THE ROLE OF SCIENCE AND TECHNOLOGY IN THE PROCESS OF MEDICAL SPECIALISATION

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D E C L A R A T I O N

I DECLARE THAT THE WORK DESCRIBED HEREIN IS MY OWN WORK AND THAT THE THESIS HAS BEEN COMPOSED BY ME

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CONTENTS

ABSTRACT OF THESIS

The practice of medicine has undergone profound changes over the past fifty years. Many aspects of this change have been dramatic and some of the techniques used in 1985 belonged to the realm of science fiction only a decade ago. The incorporation of developments in science and technology into medicine has widened the scope and range of interventions available to doctors, and this is reflected in their practice.

This thesis explores the general belief that scientific and technological developments have not only had a general influence on medicine, but that they have affected the internal division and social organisation of this profession.

The thesis begins with a section which explores the substantive areas of sociolology which have relevance to this analysis.The sociology of the professions and the sociology of medicine are studied as well as the approaches on the interaction of technology and society. The development of the analytical framework drew on the work of both the symbolic and technological interactionists as well the work connected with power and control, and incorporated the metaphors of the ecologists.The framework is based on the complex concept of territory and though this concept is not new, I have extended it and made it central to my work.

The second section of the thesis examines the developments that have influenced medical practice over the past fifty years or so. It is divided into two chapters, one being concerned with diagnosis and the other with treatment. The concept of physical ,chemical and biological manipulations is used and the imaging devices which extend the senses are described. The section ends with some details on the changes in disease theories.

The area of medicine selected for detailed analysis was that of reproductive medicine. The conflicts between obstetricians, paediatricians, medical geneticists and other groups are explored and the specific role of scientific and technological developments as resources in these battles are focused upon. The recent developments in this field are charted and contentions over the perinatal period are described. The work of the second section enabled me to set reproductive medicine within the general practice of medicine, and show a commonality of both practical and philosophical approaches.

Throught the thesis the emphasis has been very strongly on the intra- professions conflicts in medicine and on the influence of scientific and technological developments upon them. I have , however, indicated in several places that there are other factors which influence specialisation. I have also pointed, albeit it briefly ,to the conflicts with para-medicals, especially midwives.

INTRODUCTION

Medicine in modern western industrialised democracies is, by virtually any criteria, a remarkably successful sphere of activity. It is powerful and prestigious and its practitioners are well paid and relatively secure.

During the past fifty years, this activity, regarded by many not only as a profession but as the archetype of all professions, has expanded greatly, both in personnel and in the scale of economic resources it absorbs. It has also become increasingly scientific and technological in outlook and method.

Fears that it will not be possible to support the continued growth of modern medicine lie behind many of the current debates and disputes. But besides concern about the increasing cost of medicine, there is also a growing awareness of the wide and ever widening range of medical interventions in the everyday aspects of life.

Medical practice has to do with the diagnosis and treatment of currently accepted forms of injury and disease; but it is becoming increasingly involved in defining parameters of normality and hence of abnormality, in campaigns for more positive promotion of good health and, more intimately, in the basic processes of conception, birth and death.

Although the practice of medicine is of extremely ancient origin and has long had within it a considerable internal differentiation of tastes, modern medicine in its growing diversity and influence has developed an unprecedented increase of specialisation.

Many factors affect the degree and type of specialisation within the medical profession. One factor recently identified as particularly important is the impact of science and technology. This thesis sets out to examine the hypothesis that developments in science and technology have significantly influenced the dynamics of medical specialisation.

How then is one to test this hypothesis? Firstly the changes in medicine must be set within a wider societal context. Many commentators have observed that modern society is currently experiencing the very powerful effects of a technological revolution. Advances in information collection and processing, computer and robotic developments, in vitro fertilisation and organ transplants are examples of such revolutionary changes with profound social implications. Changes have been quick and dramatic; much of contemporary medicine belonged to the realm of science fiction only a decade ago.

These recent developments are perceived, in general terms, as having the capacity to alter drastically the organisation of work, of domestic and recreational activities, and of interpersonal relationships. Human beings are, however, hodiocentric and in general there is the view that this current period is unique. There is a lack of awareness that throughout history, technological developments have had profound effects on human communities.

Social scientists and historians, however, have long been interested in the role of technology in diverse cultures and societies. Developments in agricultural techniques, changes in forms of locomotion, military hardware and procedures have been examined, as well as new methods of industrial production in the 19th century. Work in these areas has traditionally been concerned to trace the impact of new technology on society at large.

Recently, however, there has been a concentration of interest by sociologists and others, not only in the effect of technology, but in the social shaping of the technology a society adopts. Studies have been made on the initiation and take up of technological innovation, and of the question, which groups have been positively or negatively affected by these innovations.

During the last four decades a considerable body of literature on the development of medicine has been built up by authors writing from different standpoints, often historical and asociological. But these workers have not always examined properly the process of interaction between medicine and technology. This thesis attempts such an examination.

No particularly strong approach to the study of this subject stands out. There is considerable diversity of theory and method and also a good deal of variation in the kinds of issues which are seen as salient.

There appears to be no single area or field of sociology into which the work of this thesis could be set. Consequently a wide trawl was made of the literature available in a search for the basis of an analytical framework to test the hypothesis. This has included the sociology of the professions, the sociology of medicine, the medical literature, the relationship of technology and society and the diffusion of innovation.

This cross-disciplinary approach has had its disadvantages, especially for the researcher; but it is hoped that the thesis which has been illuminated by this approach will have potency precisely because the framework and the subsequent analysis of the hypothesis were developed from the necessity of exploring in depth a wide and disparate body of literature and having contact with a wide variety of people.

SECTION I CONSPECTUS

INTRODUCTION

This section contains within it an account of the broad literature survey I carried out, which helped to illuminate both the topic of the thesis and the development of an analytical framework.

The first chapter explores the sociology of the professions, for medicine is regarded as one of the prototype professions. The development of the various approaches to the study of professions is charted. Their positive characteristics as well as their limitations are described.

The second chapter considers in a fair amount of detail the literature on the sociology of medicine, but as it is such a large field, there has been of necessity a certain selective process in deciding which authors to discuss in detail.

The third chapter explores the complex subject of society and its relationship to technology. It was considered necessary to explore this area for it has relevance to the broad setting in which modern medicine is found.

Finally in chapter four there is a synthesis of the themes which emerged from the previous three chapters and the concept of territoriality which leads to the development of the analytical framework of the thesis.

CHAPTER ONE SOCIOLOGY OF THE PROFESSIONS

INTRODUCTION

To start with a study of the sociology of the professions is an obvious choice, for medicine is regarded by many as the archetypal, the prototype profession. The review of the literature in this general area of professions was informed by a search for themes and ideas which could be translated more specifically into the proposed study of medicine.

Unlike many writers in this area, I did not seek an answer to the question: What is a profession? Rather I chose to ask: what have studies of professions and the process of professionalisation to say about specialisation, about changes in practice and more generally about models which can be used for more specific studies?

This chapter will look at the early work, then chart the major themes before the 1970s, i.e. the functionalist approach, the trait approach, the symbolic interactionist approach. The quite radical change in approach in the 1970s when the conflict-power model was developed will be considered. Then the more recent work on the professions will be examined.

EARLY WORK

The question "What is a profession?" is an old one, and one that has been addressed by many writers, often without a clear idea of why the question was being asked in the first place.

Many definitions have been suggested and other definitions are implicit in everyday language and verbal interchange, yet agreement on the specifics of a "profession" has not been reached, and the question is still being posed in the 1980s.

According to Becker (1970, 87), Abraham Flexner set the tone of discussion for many years to come, when in 1915 he delivered his classic paper "Is Social Work a Profession?". Flexner noted that the term profession

> strictly used, as opposed to business or handicraft, is a title of particular distinction, coveted by many activities. Thus far it has been pretty indiscriminately used. (ibid, 577)

Many groups laid claim to the title and produced degrees in support of their claim, not only doctors and lawyers, but dancing masters, equestrians and chiropodists. Flexner proposed that there should be a formulation of basic standards, asking in a narrow and 'eulogistic sense', "what are the earmarks of a profession?"

In his opinion, there were six criteria which could be used to distinguish professions from other kinds of work. Professional activity was

a. basically intellectual carrying with it great responsibility
b. learned, being based on great knowledge and not merely routine
c. practical, rather than academic or theoretical
d. its technique could be taught, this being the basis of profession education
e. it was strongly organised internally

f. it was motivated by altruism, working for some aspects of the good of society.

It is of interest to note that responsibility was not singled out as a separate criterion, and that there appears to be some tension between the concepts of intellectualism and academism.

Nevertheless, using these six criteria he classified various occupations, finding that while plumbing was not a profession, medicine, law, engineering, literature, painting and music definitely were. Social work, the original object of his enquiry, was not considered professional as it had no technique of its own and only acted as a mediator between people with problems and those who could help with these problems. The possession of a unique "technique" based on knowledge and practice is obviously of relevance when discussing medicine and this point will be expanded later on in the thesis.

Flexner ended his analysis with a drastic qualification to his original objective criteria, for he felt that he had been too rigid and too mechanical. What matters most he concluded was "professional spirit", unselfish devotion can lift occupations like social work above the distinctions he had made. So whatever else they were, professions were, in his view, real "vocations".

Becker (1970, 88) comments that though Flexner's attempt at definition did not last and a succession of refinements were made, he finds it difficult to understand why anyone should

> want to alter Flexner's original statement for the similarities between it

> and those that followed are more striking than the differences.

Flexner's paper, however, could be said to mark the early beginning of the approach to professions, where specific attributes were considered - the trait or attribute approach, but before looking at this and the other main theoretical approaches, it is useful to consider the joint work of two writers of the 1930s, Carr-Saunders and Wilson. Their work is still an important source of reference, seeming to anticipate some of the work of functionalist and trait approach writers.

The work of the authors has elicited a variety of responses. Dingwall, (1983,1) who considers that the sociology of the professions is largely founded on the works of Parsons and Hughes, recognises that there are early writings, but says that they have been treated as of "mainly antiquarian interest". In contrast, Wilding (1982,13) considers the work of Carr-Saunders and Wilson as being "pioneering and seminal".

In their analysis of the development of "professional techniques" and the rise of "professional associations", Carr-Saunders and Wilson (1933, 304) found that evolution does not always proceed smoothly especially in relation to the specialist and the general practitioner, law as well as medicine giving prime examples. They are of the opinion that only when the "true place" and relationship of these two sectors are fully understood and accepted, can the profession concerned evolve in a "clearer and calmer atmosphere".

Carr-Saunders and Wilson (1933) indicate that though hierarchy and oligarchy may have little connection with vitality and efficiency,

> it does not follow that internal organisation is of no consequence. (ibid, 338)

They see the greatest need as being for adequate machinery for the expression of sectional interests.

The importance of clearly defined and stable boundaries for a profession are emphasised by Carr-Saunders and Wilson (1933, 319) and they indicate that only during the birth of new techniques do boundary disputes become at all serious.

Within these boundaries which they consider are stable, they are, however, aware of the

> multiplication of associations within each profession, so that the number of associations involved and the bewildering variety of types to which they conform have become a characteristic of the professional world. (ibid, 320)

These 'associations' or specialisms within a profession are of great interest and though the authors are aware that the extent of this "multiplication" can be a weakness, they list certain factors which are

> specially favourable to the multiple form of organisation. (ibid, 320)

The factors they select are:

the presence of one or more distinct "sub-crafts"

differences in "professional status" among the practitioners differences of economic status

the factor of common employment

the geographical factor

the antagonism of "outsiders" and "insiders"

In considering the society of the future, Carr-Saunders and Wilson (1933) believed that as professional associations are built up round "intellectual techniques" and in most cases these techniques are scientific, in future professions will rely more on these elements. The approach they adopted which is largely atheoretical, plainly shares important characteristics of functionalism, as when they observe that professions give stablility to a society. (ibid, 497)

The next phase of the development of the sociology of the professions is regarded by some as an unproductive era. According to Johnson (1972, 10) the initial impetus for the sociology of the professions arose from two fundamental questions. The first concerned the extent to which professional ocupations could be regarded as unique products of the division of labour in society. The second posed the problem, do professions perform a special role in industrial society, economic, political or social?

The first question he felt had been transformed into

> a largely sterile attempt to define what the "special attributes " of a prefession are. (ibid, 10)

These definitional exercises he says litter the field.

The second question, in his view

> has been largely operationalised out of existence. (ibid, 11)

For as sociologists looked at the part professions play in various spheres, they tended to narrow down the original problem. They looked at particular functions of small groups and the fragmentation of studies led away from the big and important issues related to power.

FUNCTIONALIST APPROACH

In the sociological study of the professions, as elsewhere in the discipline, the functionalists approach dominated the field for a good many years. This approach postulates elements which are said to have functional relevance either for society as a whole or for the professional-client relationship.

Parsons was a major proponent of this approach, interested as he was by the basis of social integration. He studied medical practice and endeavoured to show the social foundation of its knowledge and its translation into the impersonal normative order of science (Dingwall, 1983, 3). Science provided for the medical profession a foundation for rational order, and this order took place through collegial forms of organisation. The authority of these collegiate organisations rested on the principles of functional specificity, restriction of their domain of power and application of impersonal standards on an universalistic basis. (ibid, 3)

In this model the distinction between self-interest and altruistic motivation was of only minor significance. Of more importance was the shared orientation to success whether material or non-material. (ibid, 4)

Barber (1963) was another author influential in the functionalist approach, but his work is regarded by Johnson (1972, 33) as being abstract and parsimonious. Barber believed that a sociological definition of professions should be limited to the specific differentials (<u>differentia specifica</u>) of professional behaviour. Thus he eliminated from his definitions such concepts as style of life, corporate solidarity, socialisation structures and processes.

In his view professional behaviour may be defined in terms of "four essential attributes". (1963, 671) These are

a. a high degree of generalised and systematic knowledge
b. primary orientation to the community interest rather than to self interest
c. a high degree of self-control of behaviour through codes of ethics internalised in the process of work socialisation
d. a system of rewards that is primarily a set of symbols of work achievement and thus ends in themselves.

Although as Johnson (1972, 33) remarks this approach has little initially to distinguish it from the trait model, in the succeeding analysis the functionalist orientation becomes clear. Knowledge provides a powerful control over nature and society and it is therefore important that it is used primarily in the interests of society and thus repositories of the knowledge will exhibit a community orientation. Since only practitioners fully understanding their own practice they will obviously play a dominant role in the control of its application. The emphasis on both altruism and esoteric knowledge is a feature of several functionalist writers.

Criticism of the functionalist approach in the sociology of the professions has come from a variety of sources and reflected the more general dissatisfaction with the school of thought. Freidson (1970) was a major force in developing this critique, as he considered the lack of attention or emphasis on the power of the professions to be a fatal weakness in this approach.

The functionalist approach according to Rueschmeyer (1983, 45) implies that tensions between the "goal state" of effective self-control and the actual state of affairs, lead to self corrective change. Within this model, however, this remained only an implied assumption and was rarely made explicit and was never fully speficied and investigated. This suggested to Rueschmeyer that feed-back mechanisms are present only to a limited extent and that other factors not included in the model buttress professional privilege and autonomy.

The incompleteness of the model to take into account all the situations which are known to occur, a factor which disquiets many writers, is exemplified by Johnson (1972) in his criticism of Goode's model of the relationship between a developed professional community and acceptance of professional authority by laymen.

> his "model" neglects entirely the recent history of the professions whereby technological change has produced

> conditions throwing up new occupations to challenge the hegemony of the old. (ibid, 26)

Unfortunately, Johnson does not expand on this interesting and potentially useful observation. This is unfortunately a common fault during this period when there was a lack of interest in technology as an influential force.

Thus the functionalist approach, while it did focus attention on some important issues, displayed in this area, as in others, certain general weaknesses. It did little to encourage a critial examination of power and conflict either within a profession, or between professionals and other outside groups.

It proceeded with a typically positivistic methodology and it gave little illumination on change.

TRAIT APPROACH

Searching for essential characteristics is as old as any writing on the professions. During the period when functionalism was dominant, some writers, however, took the search a lot further and built up complicated patterns of what were called attributes or traits. They could be criticised for working in an atheoretical and empiricist fashion and Dingwall (1983, 8) warned that though their roots were in functionalism, the trait approach these writers developed, should not be associated directly with Parsons.

The trait approach or model esssentially comprises of a list of attributes which are said to represent the common core of professional occupations. People like Greenwood (1957) and Millerson (1964) are perhaps the best known exponents of this approach. This latter author is worth studying in detail.

After a study of the sociological literature and a comprehensive review of 21 authors, who had tried to define the essential elements of the "professions", Millerson collected 23 attributes which were regarded as essential. He presents these results in a table, (ibid, 5) analysis of which reveals that no one element is regarded by all the authors as essential to a profession, and in the case of nine of the elements, there is only one author acting as sole advocate.

According to Millerson the essential features expressed were that:-

A profession involves a skill based on theoretical knowledge.
The skill requires training and education.
The profession must demonstrate competence by passing a test.
Integrity is maintained by adherence to a code of conduct.
The service is for the public good.
The profession is organised. (ibid, 5)

Millerson was aware, however, that one of the most difficult sociological concepts to analyse satisfactorily was that of professions. In his view three basic problems accounted for the confusion and uncertainty. Firstly, semantic confusion, resulting from wide and excessive use of the term. Secondly structural limitations enforced by attempts to devise fundamental characteristics of a profession, and finally adherence to a static model, rather than an appreciation of the dynamic process involved in professionalism. (ibid, 1)

Related to the problem of structural limitations he is of the opinion that too few outlines have

> actually contemplated the problem afresh. Many rely on the same formulae, containing slight additions. (ibid, 3)

He also states that a "mass of confusions" stems from all analyses, which attempt to determine the occupational characteristics of a profession.

One important aspect of this author's work is his stress on the fiduciary relationship - the trust relationship - between professional and client. This relationship is direct and personal, showing confidence and reliance, and is not present in all professions.

Millerson comments that

> the close, confidential, single client relationship found in legal, medical and spiritual matters has a particular quality peculiar to those professions. (ibid, 7)

The fiduciary relationship is obviously an important one and I wish to flag an interest in it now so that further discussion of it may be initiated later.

Following the spirit of Millerson's approach Green (1974, 97) listed the characteristics of a profession, expanding the main elements separated out by this author. The list seems to apply very closely to what some observers would consider to be the attributes of the profession of medicine. The characteristics he lists are: existence of a body of knowledge at scientific level; an esoteric element in that the science and technology are accepted as beyond the lay group; the profession itself must be responsible for the transmission and development of knowledge, through training and research; members must subscribe to a prime ethic of service rather than self interest, but must aim to remain independent of the value systems of the clientele, they should show detached involvement; and finally the profession controls entry and exit.

The stress on knowledge at scientific level, and the acceptance of the underpinning of esoteric knowledge by science and technology is important and will be taken up again in the next chapter on the profession of medicine.

Although the work of Jamous and Pelloille (1970) does not appear immediately to fit into the trait model, their search for dominant attributes of a profession which can be measured seems to catch the spirit of this approach. They constructed a conceptual scheme for the analysis of professional processes, postulating that there were two main types of professional knowledge; indeterminacy, which was private knowledge which defied precise or explicit formulation, and technicality, public knowledge which can be precisely formulated and codified. Then they argue that professions are occupational groups whose knowledge base shows a high degree of indeterminacy, that is, they rely heavily on implicit knowledge and rules.

The classic statement, however, of the trait approach is according to Wilding (1982, 2) the "famous" paper of Greenwood "Attributes of a Profession". Five elements were listed, systematic theory, community sanction, authority, an ethical code and a professional culture. These elements are in my opinion of such a composite nature that it would be difficult to use them adequately in any specific analysis.

The trait approach then has proved to be inadequate for a variety of reasons, criticism coming from several writers. It is not set in an explicit theoretical framework, the status of the attributes are not properly classified, nor is the relationship between them fully explained. Johnson (1972) criticises it generally because it largely ignores the importance of power, and he agrees with Wilding (1983,6) that a further defect is the failure to consider that the evolution of professions is problematic.

Wilding's main criticism of this approach is that it is unsatisfactory on two grounds:-

> it is based on an implicit order or consensus model of society and such a model does not help to iluminate social reality.
>
> it is unsatisfactory even on its own terms making assumptions which are unjustifiable and falling short of an adequately critical view of statements made by members of the profession and would-be professions. (ibid, 7)

These writers reflect a more general unwillingness to accept the trait view that there is such a thing as a true profession, an archetypal-ideal model acceptable by all as the very essence of professionalism, moreover, a model which exhibits to some degree all the essential attributes. The static nature of the model was also seen as a grave drawback.

More particularly, problems were also seen deriving from elements such as "altruistic service" where it was not clear in the literature what level of analysis was used. Johnson (1972) points out that while claiming that altruism is a characteristic of the occupational role it is

> not always clear whether altrustic motivation is also imputed to the professional man. While the service ethic may be an important part of the ideology of many professional groups, it is not so clear that practitioners are necessarily so motivated. (ibid, 25)

While I agree in general with the criticisms of these writers, I believe that this approach should not be totally rejected. It has many limitations but like the functionalist approach it did identify some very important areas. I am thinking of the professional-client relationship - the fiduciary relationship - and also of the awareness that this relationship could be threatened by technological change.

SYMBOLIC INTERACTIONISM

The Chicago school of symbolic interactionists did not believe in the idea of a profession as a goal for study, for they reasoned that the notion of an occupation would provide a richer area of research especially if this research was carried out in a comparative way.

The term profession was seen by the interactionists as being of lay formulation, a title to be claimed by certain occupations at certain times with the blessing of others within that society. Atkinson (1983, 227) points out that their view was that

> despite the wealth of connotations attached to the title, there is nothing inherent in the work, training, values or whatever which marks out the occupation so designated.

Dingwall's (1983) specific writing on the historical development of approaches to the professions, highlights the fact that Chicago school writers would often incorporate in their interactionist appraoches concepts drawn from that other great tradition for which the place was famous - from ecology. Thus terms like 'territory' and 'domain' were frequently used. The principal proponent of the school was Hughes (1958) and at the heart of his interest lay the division of labour within society. The world of work was treated as an analogue to the city of Chicago's urban ecology. As Dingwall (1983) well describes the scene

> A given terrain of demands for goods and services was divided into blocks of tasks, which might be developed, redeveloped or extinguished. These blocks had successive occupiers, competing for access and struggling to improve their status by new acquisitions or the relinquishment of less attractive properties. Some occupiers were prestigious and powerful, others disregarded. All were caught up in a constant evolutionary process as demands and technology changed, either from clients or from internal attempts to influence the market. (ibid, 4-5)

Within this model the concepts of licence and mandate are of special relevance and the formalised exchange-relationship was a feature which distinguished work from non-work activities. For professions this is important as they not only tell society what is good, they themselves are arbiters of the terms of conceptualising the problems.

The perspectives brought to the debate by the Chicago school implied that there could be no assumption of the consensus and homogeneity so prominent in the functionalist school of thought. There would be, it was postulated, differentiation and conflict within occupational groups.

This view is exemplified by Bucher and Strauss (1966), (whose work will be considered in much greater detail in the next chapter), who wrote that

> the assumptions of relative homogeneity within a profession is not entirely useful; there are many identities, many values and many interests. (ibid, 186)

They used the term 'segment' to refer to coalitions of interests and outlooks within the occupations. Like the ecologists, they focussed on the processes of differentiation and specialisation, but this time within an occupation rather than a geographical territory. For example this quote:-

> missionaries staking claims for new territory or recolonizing abandoned ecological niches. (ibid,210)

This view of conflict and differentiation replaced the static view of the functionalists and 'trait' theorists. Atkinson (1983) describes the new approach as one

> which saw occupations as - potentially at any rate - in a constant, processual state of flux. (ibid, 227)

Bucher and Stelling (1969) suggested that professional organisations could be better described not in structural mechanistic terms, but in terms of "spontaneous internal differentation" with competition and conflict for resources.

The interactionists focussed on the mundane aspects of work, aspects which they themselves observed; they did not accept (as the functionalists did), the "professionals" own claims of service and collective orientation. Atkinson's (1983, 227) description of the perspectives which led to the work of Becker and his collaborators is useful. Writers in the "Chicago vein" studied

> how members of occupations operated pragmatically and survived amid conflicting pressures in the everyday performance of their work. The moral concerns of this latter school led them to celebrate the "underdog" while rebuking the rhetoric of superordinates.

Becker's studies (1961) were specifically concerned with medical students and their day to day lives, and how they got through medical school. The approach focussed on situational learning and ways of understanding and coping with novel situations, i.e. how sub-cultures of students grew up in these circumstances. The description and analysis of these activities were considered successful. Atkinson (1983, 229), however, raises the criticism that, by directing their approach firmly towards the process of training, the interactionists could not take the goals, values, culture of the training institution on trust, and therefore it became "problematic" and searches were made for the "hidden curriculum" which informed the daily practices of teachers and students. A further criticism is that

> paradoxically, the interactionists tend to portray the socialising agency as internally homogeneous. (ibid, 231)

This failing the author points out is shared by studies under other different "theoretical auspices" (ibid, 232).

The interactionist's foreclosure of any principled exploration of the relationship of training and work, precludes, according to Atkinson, any adequate mechanism to cope with the problem of knowledge. This is obviously a great defect as far as this approach is concerned for as this author critically remarks, there has been a lack of

> an adequate treatment of cultural transmission and knowledge management in the reproduction of the professions. Yet this is odd, as all observers are moved to remark on the extent to which 'professions' are potent self-replicating collectivities. (ibid, 234)

Despite these criticisms, the review by Becker (1970) of the nature of a profession has many items of interest, for he is concerned in part with the practice of the social scientists themselves in the field. Because the idea of profession is not the sole property of the social scientists, any attempts at definitions or definitional criteria and classification should according to the author, take into account the "folk concept", the symbol of the term profession. Becker is then concerned to equate the reality of groups calling themselves professionals with the symbol.

By setting out the terms of the debate within this framework he hoped to explore areas which were new, instead of trying to improve on the earlier efforts especially those of the functionalist school, (echoing Millerson's criticism about work on the trait approach previously quoted).

Nevertheless the concept of an "ideal" is necessary to explore the symbolism of the word profession, so there is some connection albeit it tenuous, with the earlier work.

The symbolic nature of professions he recounts can be classified into three main areas; knowledge, recruitment and training, and finally, trust. The reality, he believes, must necessarily be approached critically and unsentimentally. Medicine and law are examined in detail for

> those occupations most closely approach the symbol.(ibid, 98)

The realities show, according to the author, that these professions contrary to the symbol, do not have

> monopoly over (their) esoteric knowledge or functions
>
> not all are equally competent to supply the "care service"
>
> relations of clients and professionals differ greatly to those specified in the symbol
>
> nor are professional practitioners as autonomous as expected from the symbol (ibid, 99, 101)

What then one can ask is the value of this type of approach? Symbols may be useful things, helping people and groups to organise their lives and make sense of worthwhile conceptions of good and bad, but as Becker (ibid, 102) remarks, they have their "pathologies" for they may become so divorced from reality as to be unobtainable, and this unrealistic element may have consequences not intended by its users.

Nevertheless by raising these issues and examining them, Becker extends our consciousness not only of the lay view of professions, but of the need to understand the client-professional relationship which is so much part of medical practice.

GENERAL CRITICISMS of the Sociology of the Professions to the 1970s

Several authors have made useful general critical summaries of the sociology of the professions up to the 1970s.

Dingwall (1983, 7) criticised both the functionalist and the trait approach, firstly, because both left open a series of questions.

> How were we to know a profession when we saw one? (ibid, 7)
>
> What was the relationship between values organisation and practice? (ibid, 7)

Secondly, that both traditions had neglected the role of the market place and the professions' wider contract with their society (ibid, 7). This lack of attention to exchange relationships affected the handling of the wider dimensions of the professions.

In general terms Johnson (1972) suggests that the main weakness in the drive to formulate theoretical statements about professions, is that there is confusion about the actual object of study. He asks

> Is it an occupation activity, or an institutionalised form of control over such activity? (ibid, 38).

He answers this rhetorical question himself by stating later

> A profession is not then, an occupation, but a means of controlling an occupation. (ibid, 45)

As Davies (1983, 181) remarks this message is frequently reiterated by other writers in both theoretical and empirical work.

Johnson also believes that by accepting professionals' own definition of themselves, sociologists have given primacy and essentialness to the institutionalised form of control, which in his opinion is only transitory and only specific to the historical conditions of 19th century Anglo-American culture.

He also comments that by the stress laid in the functional model on the value of professional activity for all groups and classes of society, the power dimension is excluded. (ibid, 37). Therefore he suggests that there is

> a need for a more elaborate framework for the sociology of professions, especially that which will contain changes in the distribution of power in society. (ibid, 38)

This need for a new multi-dimensional model was perceived by several writers and reflected the more general dissatisfaction with functionalism in sociology. Renewed interest in Weber and then on a much wider scale in Marx led to a much more overt examination of the hitherto neglected issue of power and specifically of power of the professions.

This movement in the late 1960s and early 1970s represented a watershed in the sociological writings and research on the profesions. One of the best statements of this change is that of Freidson (1983,19) which is well worth summarising. Earlier emphasis, he writes, on the positive functions and achievements of the professions had given way to a more critical approach. The substantive preoccupation of the literature also changed. Earlier there was a focus on the analysis of the professional norms and role relations and the interaction in work settings, and while there may have been acknowledgement of the importance of political and economic factors, these were not analysed in any detail. The more recent literature, in the early 1970s, however, focussed specifically on the political influence of professions; the relation of professions to political and economic elites; and the relation of the professions to the market and class system.

But Freidson explains that whilst there had been significant changes in the evaluative and substantive emphasis of sociological writings on the professions, they reflected changes in the "content" of theorising, while remaining unchanged in the "nature" of theorising. For this reason he proposed that

> there has not been any significant advance in developing a theory of professions over the past decade or so

> that does not have as many deficiencies
> as past theories. (ibid, 20)

Nevertheless, despite the deficiencies I might find, it is obviously necessary for me to examine these writings.

POWER-CONFLICT MODEL

The 1970s were, according to Dingwall (1983, 11)

> invigorated by a sequence of major
> theoretical contributions, most notably
> from Freidson, Johnson and Larson.

One reason for this move was he felt due to the perception that established traditions had reached the limit of their "original paradigm" and thus there was a search for a new paradigm with more exploratory utility, and more potential fields for research.

Freidson in particular, was a notable major critic of the limits of the functionalist approach, and he advanced a counterview which has a large following. Although the main thrust of his work was in connection with medicine, it is, however, appropriate to discuss his general views in this chapter, while his specific commentary on the medical scene will be examined in the next chapter.

He found it difficult to find in the literature much agreement on the definition of the word "profession" (1970,3). In his opinion this was due to the use of the term for evaluation as well as description, but he warned that it would be unwise to be dogmatic about any definition of profession, or to assume that the definition is so widely known that there is no need for further discussion.

Nevertheless he indicates that he will assume that

> if anything "is" a profession it is contemporary medicine. (ibid, 4)

and in trying to expand the discussion on the subject he said that

> by examining it (ie medicine) carefully, we can learn more about what the class "profession" includes than we can from examining less clear-cut occupational cases. (ibid, 4)

In this examination he wishes to be concerned with the analytical variables of social organisation as he considers that these are more useful "discriminants" than those of norms, attitudes or ethics. (ibid, 5)

In advancing this emphasis on social organisation Freidson introduced the concept of power into this new approach to the study of professions. He saw that the view which included factors ignored in the functionalist approach, would advance discussion on the whole question of professions and professionals. This approach was that the machinery of a professional organisation could be a tool for acquiring and maintaining privilege and autonomy and that this function was more important than an instrument of self-control.

In other words, he saw as a crucial element in the definition of a profession, the extent to which aspiring occupational groups

> have gained the organised power to control themselves, the terms, conditions and content of their work and the settings where they perform their work. (1977, 22)

Criticism of Freidson's stress on occupational control has been made by several writers. Wilding (1983, 6) argues that his isolation of one characteristic is too specific a way of classifying the key elements in so imprecise a term as profession.

Criticism has also been made that in this early model Freidson played down the importance of knowledge. (His later work changed this perspective).

Nevertheless Freidson's concepts of power and the professions are potent. His idea of the modern state

> whose notions of public good are guided largely by professions (1970, 352)

was a more important contribution, which will be explored along with his other ideas and concepts in Chapter 2.

Freidson's writings on specialisation (1975, 27), however, are of only limited value. He considers that specialisation leads to deprofessionalisation, in that increasingly narrow specialists can be expected to do the same work repeatedly without knowledge of the whole process of which each specialty is a part. This reasoning, it is suggested by Parry and Parry (1976), is based on confusing two profoundly different processes of developing and organising specialisation. In one process the workers themselves specialise and negotiate with their fellow workers for the niche within the organisation and they do not lose control of their work. In the other mode, a superior authority organises control of work, breaking down the task into the simplest units requiring the least possible skill to perform. For the latter, the authority hires, trains and supervises workers to perform in these divisions of labour. Evidence of managerial creation and control of work would have to be demonstrated before claims of deprofessionalisation through specialisation could be made. Freidson, however, does admit that in the increasingly complex division of labour in the "health care field" he can find little or no evidence to show that physicians have been losing significant elements of their monopoly over the ordering and supervising of work provided by other occupations in the division of labour. (1975; 28)

Although he expresses concern about the control that professional associations develop over professional colleagues who are "formally equal" he does not explore further the area of intra-professional divisions of labour.

Larson (1977) who was also influential in the sociology of the professions, takes issue with the professional-bureaucratic literature. She believes that professions and bureaucracy show common historical origins and both must be analysed with reference to the emergence of monopoly capitalism. According to Davies (1983, 193) although her specific material on conflict is disappointing, relying as it does on managerial and professional orientation, her concepts of techno-bureaucratic and public service modes of integration into capitalism deserve more attention.

After rejecting the trait/characteristic approach, Johnson (1972) looked outside the professions and attempted to understand them in terms of their sources and use of power and authority. He takes issue explicitly with the ideologically determined empiricist and commonsense definitions of professionals in terms of the "traits" they possess.(ibid, 89) For him the basis for the differentiation or classification of occupations is control over the producer-consumer relationships. Thus he defines professional jobs as those where there is control of both definition of needs of the consumer and how those needs should be met.

Although he has been regarded by some as still within the existing (i.e. earlier) conventions in the field of the sociology of the professions, his views represent a shift towards new ways of framing the problems which are inherent in the unilinear concept of professionalisation. Recognising that other forms of occupational control were important, Johnson (ibid, 89) describes those related to the growing strength of the consumer movement which resulted in the emergence of "communalism" as a form of client control. He postulates that this position of control results from the fact that whilst the clientele is large and heterogeneous, the producers tend to be a relatively homogeneous group, collegially organised. Control is exercised in terms of the rhetoric of a diagnostic relationship.

In the view of Cain (1983, 108) Johnson's approach represented an advance on the classic statements on the professions (e.g. Carr-Saunders and Wilson (1933)) in that his approach is firstly relational; secondly it questions the taken-for-granted desirability of professionalism and thirdly it departs from "empiricist nominalism" (that is he considers, rather eccentrically I feel, that neither a lawyer working for a company or one working out of a neighbourhood centre would be a professional). Finally in her opinion his approach allows for mobility of jobs betwen categories.

There are, however, according to Cain (1983) crucial difficulties with this approach and these are well worthwhile outlining. Johnson assumes the need, the theoretical need, for a concept of profession yet does not indicate the body of theory which requires and situates this concept. (1972, 108)

His formulation is reactive, that is the control of clients is the characteristic of professionals. He also posits certain types of relationships as permanent; the ideal definition remaining, while different occupational groups move in and out of the category.

It could be said, therefore, that he falls victim to the same snares which trapped his predecessors. Cain sums it succinctly

> People doing certain jobs have characterised themselves - and been characterised - as professions: this concept with all its ideological trappings has been incorporated into sociological analysis so that even its harshest critics are incapable of transcending it and conduct their discourse in its terms. Thus Johnson replicates these occupations' concern with their own organisation and their rhetoric of the ignorance (vulnerability) of the client. His analysis reinforces the notion that there really 'are' professions, and by claiming the mantle of radicalism for a perspective which emphasises professional control over the client, (he) inhibits the development of an adequately theorised alternative to the conventional view. (ibid, 109)

Despite this critical attitude to his work, Johnson was an influential figure in this field; he also commented on the consequences of division of labour within occupations and professions.

He considered that

> high levels of specialisation may expose an occupation to fragmentation and routinisation as a result of which it is more easily understood and controlled by non-practitioners. (1972, 42)

This reflects the views of Hughes (1971) who wrote about the offloading of undesired tasks by dominant members of a field, to subordinate groups - the process of routinisation. He termed this procedure as "dirty work", but despite the connotation of the phrase, he was aware that it could as Johnson remarks, have unfavourable consequences for the off-loaders. Larkin (1978, i) stressed this when he warned of the dangers of routinisation in dentistry where subordinates may challenge the position of the professional.

Johnson was aware, however, that there were conditions where control would not pass to the subordinates, i.e.

> technological conditions for routinisation within a given occupation will not necessarily lead to fragmentation where practitioners already control and define the extent of the practice. (1972 42)

This control of the extent of practice is most important and is part of the professional's dominance in the definition of the needs of the client group. Subordinates do not have this role and are therefore less powerful.

The emphasis placed by both Johnson and Freidson on power within professions was reflected in the work of other writers of this period.

Foucault, and the school of thought which developed round him in the late 1960s, was part of this general concern to look at power. Although his views are regarded by many as idiosyncratic, they derive from Marxist visions of the world, and they contain concerns which have been considered amongst other Marxist writers. His interest was not power in a narrowly positivistic perspective, but examination of the processes of interaction to determine how domination develops. The following quote from his writings gives the flavour:

> the analysis should not concern itself with power at the level of conscious intention or decision; it should not attempt to consider power from its internal point of view and should refrain from posing the the labyrinthine and unanswerable questions 'Who then has power and what has he in mind? What is the aim of someone who possesses power?' Instead it is a case of studying power at the point where its intention, if it has one, is completely invested in its real and effective practices. What is needed is a study of power in its external visage, at the point where it is in direct and immediate relationship with that which we can provisionally call its object, its target, its field of application, there - where it installs itself and produces its real effect. (Foucault, 1983; 306)

There has been a certain failure within sociology both to develop and utilise his insights with reference to internal struggles for superiority, and particularly in the area of medical practice. One author, of importance in relation to the substantive part of this thesis, who tried to utilise the approach of Foucault was Arney (1982a). He was concerned with the power relationship between the obstetrician and the mother and also with the "panopticon" metaphor for surveillance, which was part of Foucault's earlier work.

Brown (1978, 435) was interested in specialisation in the American Health Care field and she makes useful comments about the theoretical basis of studies of the division of labour - which she considers a subject neglected by her country's sociologists. Most studies have in her opinion either assumed a voluntaristic consensus model in which people decide to specialise for the sake of efficiency or market expansion or one which recognised the importance of power, conflict and exploitation.

Although more logically placed in the recent work on professions, or even within the piece on medical specialisation, the comments of Searle (1984) have value here, for she is critical of the attention given to the autonomy/power element of this period. This has led, she believes, to a playing down of the importance of the knowledge base and service ideal.

> Autonomy/power, while an indispensable feature of professional status is a contingent variable, which is to say that the antecedent variables of knowledge base and service ideal are equally important. To put it as forcibly as possible, there can be no autonomy/power in the professional sense if the knowledge base and service ideal do not have credibility of a very high order. (ibid, 323)

The emphasis of this period on power and conflict led mainly to analyses of the relationship between professions and society. There was still comparatively little work on the internal dynamics of professions, and as Searle reminds us, inadequate attention to the role of knowledge.

RECENT WORK

In 1983 Davies said that the writing of a paper ten years ago on professional work would have been

> a secure, but possibly slightly tedious exercise. (ibid, 177)

Now it was different and in her opinion after reviewing the developments of the last ten years

> conventional sociological perspectives on the organisation of professional work are very narrow ones. They concentrate on the point of delivery of service, the immediate setting of work practices and the daily routines in it. Such perspectives play down and sometimees totally obscure the material and ideological conditions for different kinds of work organisation. (ibid, 184)

Dingwall, also writing in 1983, was of the opinion that once again the sociology of the profession stood at some kind of turning point. No coherent theory had developed, even after the invigoration of the contributions by Freidson and Johnson.

Dingwall explains that there is now in the early 1980s a "plurality of theoretical positions". (ibid, 11) Thus it is not surprising that within this thesis, it was difficult to develop a theoretical stance based on the work in this area of sociology. Having said this, however, the work of this latest period has much in it of interest and utility. Several authors emerge as viable commentators of this period, namely Wilding, Dingwall, Rueschmeyer and Freidson.

Wilding's (1982) important work is epitomised in his book concerned with the exercise of power by certain occupational groups in the field of social welfare, and their expectations or aspirations to be recognised as professionals. As a background to this study, he explores, as have authors before him, the key questions.

> Firstly, what is a profession? Secondly how is professional status achieved? Thirdly, what is the significance of the professions? (ibid, 1)

He does not, however, ask significant to whom, and thus does not set the scene for the implications of the professions to society.

In his chapter on the basis of professional power he explores five areas, which have also been present either implicitly or explicitly in the work of other writers. These areas are: alliance with the state, nature of the state welfare system, the service ethic legitimated by colleague control, assumed expertise, and finally the public's acceptance of the validity of the professionals' activity with the concomitant powerlessness of the clients. (ibid, 59-60).

The last two areas are most important, are intimately related and are, according to the author, based on the possession of power through knowledge. The author describes several ways in which expertise - knowledge - contributes to professional power. Societal belief in the value and importance of expertise, allows professionals to justify their classic claims like monopoly, control of entry, prouncement over major areas of public policy. This belief also allows claims of individual and social importance in the areas of life-death, mental, physical and social well-being, healing of individual and social ills and preservation of economic and social order. (ibid, 71-75)

What is missing from this section of his writing is any detailed view of the basis of this expertise, knowledge necessary to claim the expertise. He does say, however, that

> scientific knowledge and a theory of human behaviour is a far more effective prop to authority than a reliance on simple moral categories. (ibid, 73)

Finally, one of his most potentially useful observations, reflecting the influence of both Freidson and Johnson, is that power for the professional comes from the right to define needs and problems. This right

> underpins their power and provides a necessary legitimation for its exercise. (ibid, 29)

It is a "crucial element" in that they have the power to give the clients what they "need" rather than what they want.

This ability to define needs has a powerful influence on policy. Freidson (1970), as previously indicated, expressed it thus, when writing on the modern state

> whose notions of public good are guided largely by professions. (ibid, 352)

If the power over resource allocation is coupled with this power over definition of needs, the resultant power is, of course, power over people, these people being clients of the professionals concerned. The relationship of professional and client will be discussed later in the thesis, but it is important to flag it here with this section on power.

As I have already said, Dingwall (1983,11) was aware of the plurality of theoretical positions in the current sociology of the professions, but despite this he is sure that there is broad consensus on the key issues. These issues are in his opinion:-

> - the need to take a very much wider perspective in attending to the historical setting of both individuals and collectives. Professional work must be studied not just in the context of a division of labour, but as part of a network of social and economic relationships.
>
> - the importance of knowledge is reaffirmed. The division of labour is also a division of knowledge with consequential implications of reciprocal dependence and vulnerability between participants. That knowledge is moreover a social product, reproducing and constituting a particular order.
>
> - that stress should be placed on comparative empirical work. (ibid, 11-12)

The reaffirmation of the importance of knowledge is an important issue. Freidson's perception of the role of knowledge in professions has sharpened since his earlier writings. Even though he recognised then that knowledge was a basis of power, according to Rueschmeyer (1983)

> its role was played down in his initial central arguments though later he moved it to the front stage again. (ibid, 54)

Freidson did warn readers even in his early work of the dangers of looking at knowledge in general, for as he so succinctly indicated

> knowledge itself does not give special power, only exclusive knowledge gives power to its possessors (Wilding, 1982, 66)

Despite the broad consensus on these three key issues outlined by Dingwall, the turmoil apparent in the sociology of the professions is highlighted again by Rueschmeyer (1983), but at least he is optimistic about the possibility of a "prospective ferment for significant developments". The areas he is concerned with have direct relevance to this thesis. Knowledge is of paramount interest to him for he emphasises the remark of Freidson, that it is the special knowledge of the profession which justifies its autonomy. (1970, 343) Thus he is not surprised when

> enterprising occupational groups claim "scientific knowledge" and succeed in gaining acceptance for such assertions even though this claim to scientific status for their expertise should be viewed as marginal or even wholly unacceptable by those in a position to judge. (Rueschmeyer, 1983, 50)

Yet, he warns of the dangers of being ahistorical, for there is enough evidence to show that early forms of modern professional autonomy developed prior to the establishment of science as "culturally dominant and pragmatically useful".

The knowledge base he sees as of importance to occupational groups, is, he suggests, composed of different components. He stresses that there is a need to know much more than we do now about the consequences different forms of knowledge have for the control dilemma of expert services and for its various possible solutions. (ibid, 52)

This thesis aims to explore different types of knowledge in relation to the specialisation in the medical profession and so this acknowledgement of the importance of this type of analysis is encouraging. For as Wrong (1979, 52) has indicated there has been little or no discussion of authority based on specialised knowledge or skill in most analysis of the various forms of influence, power and authority.

It is perhaps appropriate to end this chapter on the sociology of the professions with the latest views of Freidson (1983), for he has been a major figure for the past 30 years in this field, and as will be shown in the next chapter, his impact on the sociology of medicine has been equally influential.

The current problem he suggests lies deep and is created by attempting to treat 'profession' as if it were a generic concept rather than a changing historic concept with particular roots in an industrial nation strongly influenced by Anglo-American institutions. (ibid, 22)

The concrete historical nature of the concept and the multiple perspectives from which it can be viewed, preclude in his opinion, the hope of any widely accepted definition of profession which would have a general analytic value.

Because of this he feels that any serious writers on the topic should be obliged to display to their readers the definition which their exposition is predicated. There is no doubt that Freidson did precisely this when he wrote about medicine. It fell into his description of one of

> those few occupations recognised by almost everyone as professions, possessing very high prestige and a genuine monopoly over a set of widely demanded tasks. (ibid, 35)

SUMMARY

The sociology of the professions has passed through various stages in the past fifty years and whilst the developments in these stages have been of interest, no one approach can be seen initially to have the efficacy to form an analytical framework for this study.

The interactionist approach, however, had possible utility for it was not static, but stressed process, and the ecological terms used within it had a potency and explanatory power which was appealing. The emphasis on the processes of social organisation rather than those in the division of labour was a disadvantage, and the apparent lack of incorporation of notions of power was similary disadvantageous. Therefore this approach could not be adopted in its entirety, but could serve as a useful partial model on which to build.

These criticisms were of course perceived by writers in the early 1970s and therefore many of them are answered by the conflict-power model which emerged at that time. The destruction of concept of the homogeneity of professions and the internal conflicts within was opportune. This approach, however, lacked any detailed construction for the analysis of the processes of specialisation and therefore again could only serve as a partial model. It was thus obvious that a detailed study of the sociology of medicine was now necessary.

Nevertheless within the literature on the sociology of the professions, several useful themes can be teased out. These are the importance of knowledge to the professions; the fiduciary relationship between professional and client; the power given to the professions by their control of the definition of the needs of their clients; the vested interests apparent in various professional manoeuvres.

The theme of the importance of knowledge to the professions is a complex one containing with it perceptions of the types or components of knowledge; esoteric, special, contained with special techniques and most tellingly, scientific. The utilisation of this knowledge and the reasons for use are not so clearly spelt out within this chapter and I hope in the next chapter to be able to look at the development of these factors, as well as looking in more detail into the components of medical knowledge.

The professions known as consulting professions have deep and individual contact with the clients - this trust relationship is of consequence to both parts of the relationship and changes in it may have disproportionate good and bad effects for each part. Medicine is a profession which has a fiduciary relationship with the patients it serves, and this theme will be examined in more detail in the next chapter.

Clients of a profession do not on the whole have a great deal of power to define their needs. Instead it is a legitimate and accepted part of a profession to define what it sees as the needs of its clients, not only the needs but how the needs will be met. Within medicine this is obviously concerned with selection of sufferings to be categorised as diseases, with consequent definitions of the parameters of normality and thus of abnormality. A theme then with great potential for further exploration.

Much of the work reviewed in this chapter has included a degree of scepticism about the altruistic aims of the professions. This was seen especially in the writings of the 1970s when ideas about control and power were brought more firmly to the foregound of the models proposed. The theme of vested interests is an important one and it will be investigated further.

CHAPTER TWO SOCIOLOGY OF MEDICINE

INTRODUCTION

From the sociology of the professions several useful themes have emerged which could be usefully incorporated into this study of modern medicine. It is now important to discover if these themes are either present or extended in the sociology of medicine, and if any new insights emerge from the review of the literature of this field.

The sociology of medicine is concerned with a wide range of topics, covering not only doctors and other workers in the health care field in a variety of countries, but also with definitions of disease, exploration of illness behaviour and the role of institutions. Consequently, one would expect to find an array of different perspectives, methods of study and theoretical positions. This is so, although one aspect which is rarely challenged is the status of medicine as a profession. As Freidson declares, it is prestigious, powerful, with monopoly over the tasks it perfoms.

It is therefore appropriate in this context to begin this chapter with Freidson's guide to the literature on the subject up to 1962. This trend paper is organised around traditional sociological concepts rather than substantive topics, as he attempts to clarify the status of the field. For although a significant number of sociologists have become preoccupied with the study of medical phenomena, according to Freidson, there is as yet no sustained discussion which integrates it conceptually.

FREIDSON'S TREND PAPER

Freidson uses four sections for the review, they are (a) medicine and the sociology of knowledge, (b) the sociology of illness, (c) the sociology of the healing occupations, (d) sociology of hospitals.

Within the sociology of knowledge, he indicates that

> the most general question sociology may ask about medicine, concerns the knowledge and ideas which surround it. (ibid, 124)

He also acknowledges in this section that a good deal of material about medicine has not been concerned with specifically sociological questions, which he considers unfortunate considering the wealth of primary and secondary sources available for the studies.

The concept of disease as both objective and evaluative, is stressed by this author, for only then can the sociologist examine the social consequences of imputing disease and more generally what kind of a social concept disease is. States recognised as "natural" may or may not be treated as a disease, he writes that

> pregnancy ... can be perceived as a natural and normal state or as an illness to be rejected. (ibid, 124)

Parsons' view of disease as the type of deviance requiring control by society is also reviewed.

In discussing disease as an ideology, Freidson remarks that

> Modern times are witness to the inclusion of more behaviour under the concept of

> disease than has ever been done before. (ibid, 125)

and indicates that medicine is moving into psychological and social states with definitions of disease which are legitimated for use in these areas. By ascribing disease to areas of human behaviour which were not formerly regarded as such, Freidson shows that this course

> designates as pathological and amenable to scientific treatment, what once was regarded as a consequence of personal choice or of an irrevocable state of sin or genetic inferiority. (ibid, 125)

Implicit throughout this section is the notion that doctors have control of the definition of disease which they wish to explain in rational, scientific tems, but there is also the idea that there is a response to societal pressures for example from the "liberal bourgeoisie".

Within the second section on the sociology of illness, there is the idea that the sociologist can make a contribution to the medical task by indicating some of the social correlates of disease and thereby suggesting possible elements in its etiology. The role of the professions in relation to those seeking cure of illness is of importance and he uses the term healer-client relationship to indicate that there are many types of healers of which the doctor-patient relationship, although considered by many as "prototypical", is but one example.

From this consideration of the sick role and the relationships which develop around it, one is led to the third section on the sociology of the healing occupations. The main question to be answered here is according to Freidson

> how are men moulded into physicians, so as to be able to perform the healing role and what influences their performance? (ibid, 130)

The notion of the highly prestigious medical profession; the authoritative symbol of healing taking precedence over all others; the prototype of profession upon which all would-be healing professions model themselves - these are all stressed, but recent work on the divisions within medicine is also reviewed. Freidson writes that

> as has been pointed out rather trenchantly recently, medicine is seen as a single profession at considerable expense of the facts. Within it are warring factions, each struggling for jurisdiction and control over various areas of work. (ibid, 130)

Bucher and Strauss, the authors referred to, are reviewed later in this chapter of the thesis and their concept of "segments" examined in greater detail, but it is of interest to chart Freidson's response. He asks

> how, in spite of this variety of struggling "segments" within the ranks of those holding the M.D. degree, and in the face of non-medical occupations struggling for access to the task of healing, the profession still preserves a common identity and sustains a superordinate position? (ibid, 139)

This is indeed an important question to ask, the answer lies according to many writers whose common view Freidson expresses, in the medical training and professionalisation inherent in it and secondly, in the exigencies of practice. Freidson's (1970) substantive work about the practice of medicine filled an important gap which he himself identified for he points out that

> unfortunately, rather few sociological studies of medical practice have been carried out, though much has been written on the topic. (ibid, 131)

This review by Freidson of the state of the sociology of medicine is instructive for a variety of reasons. Identified within it are:- the importance of knowledge in medicine, medical control of the concept of disease, the increasing incursion of medicine into all areas of life, and the importance of training for professional solidarity. These are all major themes of interest.

Although divisions within the profession are mentioned, this topic is not expanded upon, in fact Freidson is more concerned with the literature on solidarity, than with specialisation or segmentation. Medical specialisation is not reviewed nor is the influece of science and technology on medicine. One could justifiably be critical over these latter omissions for Titmus in 1958 was expressing concern over the neglect by sociologists, of science as a determining factor in modern medicine.

Apart from these criticisms, it could be said that in light of this review, the sociology of medicine was poised in the middle 1960s to expand and develop both analytical work and theoretical structure. Yet Johnson in 1975 (ibid, 229) contends that medical sociology is theoretically impoverished and has not contributed either theoretical constructs or new concepts. It has tended to be descriptive rather than analytical and current workers in the field have more in coommon with health care researchers in different disciplines than they have with fellow sociologists. It would be instructive to determine what inhibited the development. Maybe a lack of breadth of study was responsible, for this was apparent even in 1983, when Armstrong's otherwise excellent book "An Outline of Sociology as Applied to Medicine" had no section specifically on specialisation or on the influences of science and technology.

FREIDSON

After 1962, there was a variety of writers in the field, but Freidson remained a dominant influence. His book the "Profession of Medicine", first published in 1970, is regarded as a seminal work. In it, he endeavoured to counter his own criticism of 1963, that few sociological studies of medical practice had been carried out.

The main theme of his book is "men at work", only secondarily was he concerned with knowledge. In the development of his power model he states that control over work by the doctor is explainable, not in terms of the contents of formal education or some intrinsic character or skill, but in the possession of a skilful political organisation which can gain power to negotiate and establish favourable jurisdiction in an organised division of labour. With reference to knowledge specifically, though it is implied in the above reference to formal education and skill he states that for medicine

> the social value of its work is as much a function of its organisation as it is of the knowledge and skill it is said to possess. (ibid, xi)

He could be criticised for showing an ambiguous attitude to knowledge during this period of his work, for although the book is sub-titled "A Study of the Sociology of Applied Knowledge", this theme is not expanded or developed to any great extent in the book. He freely acknowledges this defect and by 1983, his later writings show a belief in the primacy of knowledge in relation to the dominance and control of the medical profession.

Typical of his attitude in 1970 however, are the following contrasting statements:-

> medicine is of all the established professions based on fairly precise and detailed scientific knowledge. (ibid, 162)

but his idea of the place of this knowledge in the profession appears less sure for he writes

> individualism minimizes the value of basic scientific knowledge and the methods by which it is established. (ibid, 191)

The role of technology in medicine though not explored in the book is indicated in almost throw-away remarks. For instance, the continuation of the first quote on scientific knowledges is that medicine

> contains less uncertainty than many other technical occupations. (ibid, 162)

Is he saying that doctors are technologists? Again he implies the importance of technology in medicine by remarking that

> in widely diverse political contexts, the state uniformly leaves in the hands of the profession control over the technological side of its work, what varies is control over social and economic organisation of work. (ibid, 24)

But again this is not developed and in that undeveloped state shows a remarkable lack of awareness of the close relationship of economic and social considerations to the control of medical technology.

Thus this work can be seen to be set very firmly within the sociology of the professions and the concepts of dominance and autonomy. Nevertheless he does give a very useful account of the characteristics of a profession when writing about medicine. It is an occupation which has assumed a dominant position in the division of labour, and therefore has gained control over the determination of the substance of its own work, becoming autonomous and self-directing. It has become the most reliable authority on the nature of the reality it deals with, and the autonomous position of the profession in society permits it to recreate the layman's world. That is when it deals with problems people bring to it, the profession develops its own independent conception of these problems. It changes the definition and shape of problems experienced and interpreted by the layman. (ibid, xviii)

This aspect of professional autonomy, which he developed further than anyone else, was for him a central issue, for it

> bears on who may determine what the problem is, how the problem is to be dealt with and what price is to be paid for dealing with it. (ibid, 369)

Within medicine, the "organised autonomy" of the profession gives freedom not only to regulate its own work but also the work of other occupations. Thus he regards it as a dominant profession, and much of his work is about power and conflict in relation to subordinate groups, to paramedicals, rather than other medical professionals, which from my point of view was regrettable, for it would have been interesting to see how he might have developed the theme of intra-professional conflict.

There is little in his work on specialisation within medicine. He refers to

> medicine's own concept of its mission
> (ibid, xviii)

surely a consensus model rather than a conflictual one, yet he also writes of a "split and fragmented" structure underlying the serene facade of medicine. Very little attention, however, is given to fragmentation and there is only one brief reference to the concept of segments (ibid, 364) and no specific reference to the work of Bucher and Strauss in this field.

He emphasises the role of individual clients of the profession and yet conflict between professionals for these clients is not charted in his sections on the detailed work of the profession. The importance of a client group to ambitious medical practitioners, would have been of interest.

His attitude to the work of the medical profession is interesting for he makes classificating statements about areas of work. He says that he will not attempt to deal with

> the "causes" of the sets of measurable and empirically verifiable signs which the physician sometimes calls disease. That is essesntially a medical question. (ibid, 200)

He appears to be willing to give complete control to doctors over the parameters for and definitions of disease. Yet he is willing to deal with

> the "causes" of labelling one set of attributes illness, and not another (ibid, 207)

for this is essentially in his view a sociolo̲gical question.

This to me represents a weakness in his argument of the autonomy which he claims doctors have, for this autonomy incorporates within it control of the social structuring of illness. Another related weakness is that although he is amongst those who regard illness as a deviance from normal, and indicates that there is debate around the definition of these norms, he does not discuss in any detail the basis of control of the definitions of normality laid down by the medical profession. Again autonomy must incorporate mechanisms for control over definitions of normal and thus of abnormality, for not only can these mechanisms strengthen the role of the professionals, they can extend their domain. Freidson had already referred previously to the incursion of medicine into many areas of life and I was surprised that he did not develop further his view of this extension of power.

A critical element enters his own view of medicine and the work of doctors, for he writes that

> while the profession's autonomy seems to have facilitated the improvement of scientific knowledge of disease and its treatment, it seems to have impeded the improvement of the social modes of applying that knowledge. (ibid, 371)

In the late 1960s and early 1970s misgivings were being expressed about professions in general and medicine in particular - the editor of Freidson's book reflects this when he quotes G.B. Shaw

> every profession is a conspiracy against the laity (ibid, viii)

Freidson himself took the view even further by stating that

> expertise is more and more in danger of being used as a mask for privilege and power rather than advancing public interest. (ibid, 337)

Thus the concept of the trust relationship - the fiduciary relationship - between professional and client is seen to be under attack.

Criticism of Freidson's work came from a variety of sources. Johnson (1972, 227) was prominent in his argument that this author had not presented a watertight case for his thesis that the profession is able to mould the whole system of care to its own design via the status and power accorded to doctors. Johnson believes that there is not enought hard evidence about the nature and execution of power within medicine to justify so broad a statement.

Goldie (1977) suggested a different approach to Freidson's conception of autonomy and power, maintaining that doctors have to work continually to maintain their autonomy, adapting various routines and strategies, and continually negotiating. Their power he believed was restricted by challenges at both macro-level by the state, and at micro-level by other staff as well as patients and their relatives. This author does not, however, indicate what framework could be used for the study of these routines, strategies and negotiations.

My own criticisms of Freidson's work are several. Firstly, he has an uneasy relationship with the idea of the primacy of knowledge, not being able to find a position for it within his power model, with which he is comfortable. Secondly, although he admits the part played within medicine by science and technology, they do not figure in his power model. Thirdly, this model which I see as inadequate for the above reasons, is further weakened by the emphasis on the relationship between the doctors and their subordinates, and the consequent playing down of the intra-professional conflicts between specialties. Finally, his emphasis on social organisation has the effect of playing down other factors of change, namely those connected with science and technology.

TITMUS

The dangers of this emphasis on social organisation was highlighted by Titmus as early as 1958. In his analysis of the development in Britain, and the effect of the formation of the National Health Service he warned that

> the public, and to a substantial extent the professional view of medicine and its problems in Britain during the past decade or so has been largely dominated by considerations of social organisation and political form ...

In consequence, other factors of change, among which the growth of science in medicine is one of the more powerful, have been neglected by those seeking to understand the role of the doctor in modern society (ibid, 183)

Titmus had no doubts that science was a powerful influence in the development of medicine, but he was also aware of the various elements contained within the term science. For instance in the following quote, the effect of the expense of science in medicine is clearly shown.

> The scientific revolution in medicine beginning in the late 1930s represented to most of the voluntary hospitals in Britain a sentence of death (due to expense) (ibid, 153)

He identified both science and technology as having an effect, by 1948 he states that

> the tide of scientific and technological change was in full flood. (ibid, 170)

He also predicted very acutely that one great factor of change was the

> invasion of medicine by the natural sciences. (ibid, 183)

This invasion he found was impressive both in scale and speed.

> The total effect of this irruption of science into medicine is impressive, not only because of the scale on which it is taking place but because of the speed at which advance succeeds and proliferates further advance. ...
>
> Once the medical significance of new knowledge in the biological and natural

> sciences has been grasped, the floodgates between theory and practice in medical care burst wide open. (ibid,. 186)

The emphasis laid by Titmus on the speed of change was most telling and his predictions that the biological sciences would be instrumental in major developments have been more than justified now, in the early 1980s.

Titmus suggested that the effects of this new knowledge in medicine can be studied under three headings. Firstly the effect on the division of labour, secondly on the content and practice of particular medical skills and thirdly on the relationships between doctors and patients. (ibid, 187)

It is remarkable that this writer was able to grasp, what had eluded and still eludes many researchers, the basic idea that any study or analysis of the medical profession and related occupations must incorporate the influence of knowledge from science and technology as important elements. The areas of likely influence of this knowledge were also of great importance, division of labour, medical practice, and the doctor-client relationship - all very closely related.

With reference to the division of labour, Titmus treats science and specialisation in medicine as two separate factors which

> in combination have had a profound influence. (ibid, 188)

Godber (1961, 1) presents the same view, not causally relating medical specialisation with what he terms "increasingly rapid" scientific developments in medicine, but yet willing to say these developments are often accompanied by the "increasing extent" of specialisation.

To return to Titmus, he is certain that these two factors of science and specialisation have had great influence on

> established patterns of relationships and behaviour within the profession itself (1958, 188)

by increasing

> misunderstanding and conflict within the profession. (ibid, 189)

Not only does this writer implicate science and specialisation in changes within the profession, he also sees the relationship between doctor and patient as being vulnerable to change by these same factors. The incorporation of science into medicine he expected would mean that

> more knowledge and more certainty are now expected by patients (ibid, 192)

and that there would be a growing faith in specialists.

Titmus was of course writing in the period of high expectancy and optimism which followed the formation of the National Health Service, when many problems were seen as eminently solvable. Nevertheless he sees the double edged nature of the developments described above for he suggests that doctors may become more authoritarian. To maintain their position they would use, as he describes it, "the authority of science".

This autocratic behaviour was, he thought, strengthened by the invasion of scientific techniques, by increasing specialisation, and by the growth of professional solidarities. Thus he was aware not only of the potential for progress in more effective treatment and relief of suffering, but in the erosion of trust between doctor and patient, leading to an objectification of the patient in the interests of the doctor.

As a commentator on the scene in the late 1950s and as a prophet of what was likely to develop, Titmus's work has great potency and utility. Although he suggested three separate headings for study of the effect of new knowledge available to medicine, I would suggest that because they are so intimately related I have not used these separate categories, but have tried to incorporate them into one general overall framework.

OTHER WRITERS

The importance of new sources of knowledge and the effect on medical organisation is stressed by a variety of other writers.

Rogers (1977) describes it thus

> the trend away from the general, all purpose physician and towards the more narrowly oriented, highly trained specialist was, at the outset, a logical response to advancing knowledge about the causes of disease and increased understanding of the biological workings of the human body.

Honingsbaum (1979) examines the split between general practice and specialist hospital medicine, but he does have a wider view in that he proposes that the "advance of knowledge" leads to the situation where

> no one can hope to master the whole of medicine, and new specialties and sub-specialties appear as soon as new techniques develop (ibid, 1)

The great financial support for medical research in the 1960s, with the rapid increase of "medical knowledge and scientific technology" led, in the opininon of Cole (1976, 1) to an increase in specialisation. Hall (1948, 327) considers that the concept of specialisation is concerned with "manageable segments" of present day medicine.

Stevens (1966) made a very detailed study of medical practice in England. She saw the "acceleration of specialisation" as a product of 20th century science and technology (ibid, 3). Later she describes specialisation as an inevitable accompaniment of "scientific advance" and she was certain it would continue to accelerate. (ibid, 50)

One writer, Magraw (1966) believed that "scientific progress" and "specialisation in knowledge" were virtually synonymous and though writing within a medical context the inevitability expressed by the last writer is emphasised and generalised in his statement that

> the continuing process of diversification in the special fields of expertness throughout society is necessary and desirable as much as it is inevitable. (ibid, 157)

Forsyth (1960, 46) used more colourful language to express his view, which was that the emphasis in medical schools on research led to the advancement of specialisation. For those who relate to the "technological tide" he forecast would see their "status advance with their science". A very muddled and unhelpful mix of metaphors.

It is perhaps Hughes (1971) who expresses the relationship most elegantly. He foresaw that an increase in medical knowledge would have two possible consequences for doctors. Firstly, those without special training are relatively further from the professional in relevant knowledge and skill; secondly, as only some small portion of medical knowledge and skill can be mastered by each member of the profession, sub-cultures will increasingly develop within the greater professional medical culture. This author summarises these movements when writing about professions. Using medicine as an example, he writes

> the occupations historically known as professions are undergoing great changes in the organisation of their work. Medicine, in responses to changes in both medical technology and philosophy, has been broken up into many specialties. (ibid, 131)

Thus some writers see new knowledge from science and technology and medical specialisation as being important in combination, others infer a direct causal relationship. It is therefore instructive initially to look separately at the two elements of the relationship; science and technology in medicine, and specialisation.

<u>SCIENTIFIC/TECHNOLOGICAL MEDICINE</u>

There is a certain amount of disagreement about the specific period when medicine could be said to have become scientific - in fact there is disagreement in contemporary literature about the use of the term scientific and whether the perjorative phrase "scientised medicine" should be used instead.

Although Freidson (1970) regarded medicine as unique for

> among the traditional professions established in the European Universities of the middle ages, it also developed a systematic connection with science and technology (ibid, xviii)

he regarded the period in the 1860s of crucial importance. The development of Koch's postulates and the beginning of the germ theory, combined with the developments in anaesthesia and asepsis, created

> a qualitative break with the past, making possible for the first time, the predictable and reliable control of a wide spectrum of human ills by virtually any well-trained practitioner, not solely by a great clinician. (ibid, 16)

For many people, however, it was the report of the lawyer, Flexner, in 1911 which marked the dawn of scientific medicine in America and Europe. This report made various suggestions for the reorganisation of medical education, and consequently medical practice, in the USA, and later in Europe. In his report Flexner outlined his appraisal not only on recognition of superstition in medicine, but on the differences between empirical and scientific observation. For he was firmly of the opinion that medicine should not see itself as an art, but as a science, with all that entails of observation, inference, verification and generalisation. He was concerned with the rigour of scientific observation and a departure from empiricism, a move towards rationality and definiteness. He believed that if medicine was classed as an art, the practitioners would happily proceed on superficial and empirical lines, but if it was thought of as a science the doctor would endeavour to

> clarify his conceptions and proceed more systematically in the accumulation of data, the framing of hypotheses and the checking up of results. (1925, 5)

In these endeavours Flexner saw a commonality of approach between doctors and scientists and thought that Sydenham when treating a sick child functioned in a very similar way to Galileo, both alike observed, reflected, verified and generalised.

This author's comments on the effect that science and technology would have on medicine, and the dangers inherent in their use are most illuminating. He saw that the "paraphernalia of science" extended the senses, sharpening the physician's natural powers by either exaggerating the data or translating from one sense to another, especially to the "more delicate sense of vision". But he warned that care must be taken in the progression from observation and interrogation of the patient, use of stethoscope and thermometer, laboratory examination of specimens, to the last resort of animal experimentation. One line of enquiry should not take precedence over another.

He also made very pertinent observations about the extension of the scope of the senses by use of the "complicated experimental paraphernalis of science" like the x-ray plate, the fluoscope, the electrocardiograph. For he warned of the dangers of reliance on instruments saying that "science resides in the intellect not in the instrument".(Flexner, 1925, 7)

Since the implementation of the suggestions contained in the Flexner report, a great range of authors have written about the scientific and technological aspects of medicine, often calling it "Flexnerian medicine".

The Flexner report was described by Berliner (1975, 573) as part of a "general societal push for scientism" and he describes three main changes in the overall view of the body which resulted from this move. Firstly the immage of the human body as a single integrated organism was eliminated from the mainstream of medical thought, as the concept of unrelated systems became dominant. Secondly the growth of a widespread and somewhat uncritical enthusiasm for the more accessible and primitive modes of scientific thought at that time led to a rejection of theories of the social causality of disease, since the social basis of humanity was placed outside the realm of what was considered scientific. The predominant focus for research became pathology and pathological anatomy, in the tradition of that initiated in Vienna in the 1840s. Therapeutics, hygiene and symptomatology, all mainstream subjects of attention in holistic medicine, were largely ignored. Thirdly, and probably most importantly, the body was considered to be analagous to a machine, where individual parts could be examined and treated without the rest of the body being affected. This development of the mechanistic model of disease had for some time increasingly led to the concept of diseases as universal entities, not individual afflictions.

Substantive efforts to introduce (in the late 30s) the techniques of physical science into medicine are described by Reiser (1978, 218) and by Compton (1938, 870) who reports the address to the American College of Physicians by the president of M.I.T. when he proposed that

> a knowledge of physics, chemisty, and electrical engineering be systematically applied to biology to create the useful art of biological engineering.

This art, he indicated, would have great value in the advancement of the American medical profession.

Since Titmuss, many observers have recognised the critical role played by the impact of science and technology. Strong (1979, 37) thinks that the achievements of high technology medicine dominate training and shape prestige hierarchy, whilst Towers (1971, 164) found that medical students were increasingly impressed by the sheer cleverness of modern technology.' His observations are worth quoting in detail for they encapsulate what many see as important current trends in the medical profession.

> Many of the techniques employed seem particularly 'sound' to our scientifically trained students, because they are often so uncompromisingly numerical in nature. In the modern world a number carries with it an aura of objectivity that a mere word cannot hope to match. Also, modern medical techniques tend to isolate just a few variables at a time, so that the numerical printouts that come back from the laboratory ... acquire a validity that we associate more with the 'exact' sciences of physics and chemistry than with the inexact science of medicine. Indeed the emphasis on 'number' ... is an indication of the extent to which physics ... has been adopted by medicine as the

> paradign of good science. But let us also remember that biology has been called 'the science of the infinitely complex' and that medicine constitutes the most complex part of biology.

Titmuss(1963, 202) quoting Pulvertaft, warns that medicine can never become fully scientific unless it becomes completely inhuman. This is reflected to some extent by Leach (1970,63) who thinks that modern medicine is being pushed by modern biology from its role of dealing with sickness and disability, towards a role of control over human machinery. This has the effect, he believes, of changing the main concern of medical ethics from its traditional role of putting the welfare of the individual patient first, to one where the escalating power of medical technology forces medicine to consider not only the wishes of the patient and family but of society as well. Yet there is a paradox here, for much of modern medicine, especially that concerned with genetic handicap, is individually-based and individually-beneficial, but of harm to the species as a whole.

Recent writings contain a variety of descriptions of contemporary medicine - i.e. "Flexnerian", "Western", "Technological", but often there is a failure to present a deeper study of these terms and their implications. In particular some of the papers in Wright and Treacher's book "The Problem of Medical Knowledge" (1982) could be criticised for this failure. Although the terms are used by several authors and although Wright and Treacher indicated a move by workers in the health service to examine how certain forms of expertise and knowledge are fostered at the expense of others, they explain that this idea is frequently explored by "self-critical doctors" in relation to high technology medicine, (quoting thoracic surgery as an example). The implication is that social scientists have not done this.

The idea of medical knowledge as a social construct is a theme which is important and pervasive, yet the above work does not explore prestigious, powerful or highly technological areas of medicine, the studies of asthma, miner's nystagmus and anticontagion, are mainly of historical interest. The paper by Yoxen (1982) on constructing genetic disease is of sociological value, however, for he is concerned to look at

> the exploitation of a new niche by a group of innovators within the professional structure that specified roles for them to adopt and placed limits on the claims they could make. (ibid, 147)

Despite this ecological, interactionist approach of one of their contributors, Wright and Teacher express the general view that

> there is no established sociology nor social history of medical knowledge based on shared assumptions and a clearly defined body of literature. (ibid, 2)

Thus it has been shown that sociological interest in the role of knowledge in medicine is strong, thought not necessarily structured. Of the writers quoted Freidson and Titmuss emerge, in my view, as the most salient. Both see the development of specifically scientific and technological knowledge as a source of power and as a factor leading to change, and not always desirable change, in the relationship of medicine to individual clients and the public at large.

Titmus acknowledges and begins to develop the importance of studying the relationship between scientific and technological knowledge and the internal divisions of labour within medicine.

All too often studies of the medical profession treat it as a united body. Certainly there are powerful institutional features working for medical solidarity but beneath the facade there is a very considerable internal process of differentiation. Thus it is important to consider this differentiaion.

<u>SPECIALISATION IN MEDICINE</u>

Although there is a body of literature especially of the structural-functionalist approach, which views the medical profession as a homogeneous one, having common interests and free from internal conflict, there is another body of writing which takes a different view.

Freidson (1962) suggests that to see medicine as a single profession is considerably at variance with the facts for within it he says

> are warring factors each struggling for jurisdiction and control over various areas of work. (ibid, 139)

In a critical appraisal of Berlant's book on professions and monopoly Sadler (1978) suggests that

> the medical profession has rarely possessed 'collective interests', but has been rent with divisions in which the different sections have been competing for access to the medical market. Any 'monopolisation strategies' would therefore have to be seen in relation to

> authority struggles <u>within</u> the profession. (ibid, 219)

Searle (1984) in her paper on anaesthesiology states that

> medicine is often thought of monolithically as one profession, when in reality it is several, organised along specialty lines. (ibid, 323)

From the literature on the effect of scientific knowledge and specialisation in modern medicine, one might reasonably expect to find that medical specialisation is of recent origin. It may therefore come as a surprise to some readers to learn that it is of ancient origin.

The medical historian Sigerist (described by Freidson (1968, 124) as foremost among these who have been concerned with specified sociological aspects), said that

> specialisation in medicine is by no means a late phenonenon of civilisation but is frequently encountered among primitives. (1967, 171)

Fraser (1904,169) indicates that there is evidence for it in archeological records of ancient civilisations and in primitive societies of isolated tribes on several continents, leading him to opine, rather sweepingly, that medical specialisation is "inherent in the human race".

The earliest divisions were relatively simple and were essentially spatially based, being informed by religious or cosmological ideas, or related to specific diseases in specific organs. Early Sumerian myths illustrate these early divisions, based on religious ideas, where various gods protected separate parts of the body against sickness. In their myth of Enki and Ninhursay, wrongdoing created sickness in eight different parts of the body, then eight different deities were created for each part of the body where the sickness was located (Hooke 1963, 21). This myth highlights two points prevalent in that society, one that the classification of disease was spatially oriented and secondly that the cause of disease was related to wrongdoing, which of course, has a variety of meaning.

The division of the body into separate parts for the treatment of sickness was not a feature of Greek medicine, but it was reflected in the branch of Greek astrology called Melothesia, where each organ of the body and each function was under the domination of a planet or zodiac sign. This cosmological aspect persisted well into the 17th century when beautiful illustrations were made of astrological man.

These notions of medical specialisation were dependent on, and in part derived from, broader, quite fundamental, conceptual frameworks existing in particular societies at given points in their history.

Reasonably objective medicine, with specialties based on the recognition of specific diseases in specific organs, was prominent in ancient Egypt. Herodotus visited Egypt in 5 BC and reported that medicine there was practised on a plan of separation, each physician treating a single disorder and no more. He found the country swarming with medical practitioners undertaking to treat diseases of the eye, the head, the intestine - all spatially based - and 'diseases which were not local'.

This far-reaching specialisation was for Sigerist (1967, 171) interesting, particularly as he suggests that it was not new, but had been in existence since the pyramid age. Ghalioungui (1969, 383) who described Herodotus's visit suggested that the spatial division appeared "natural" as man originally looked at each part of the body as a separate entity. This later became known as the Balkanised Body Image.

Even in more recent times, the division of labour within medicine gave rise to wonder. The German physician Wunderlich when visiting Paris in 1841 exclaimed that

> each organ had its priest and, for some, special clincs exist (ibid,384)

The concept of spatial criteria as bases for specialisation was further enhanced by developments in Vienna in the 1840s when pathological anatomy was raised to the status of a separate discipline. Robitansky had available to him thousands of post-mortem results and was thus able to lay "the foundation of a realistic pathology free from all speculation" (Venzmer 1972,254). This was very important for when future specialties were formed they developed within this anatomical background and tended to have spatially oriented defining criteria. A good example is the reformation of dermatology by Hebra, who arranged skin diseases according to a pathological-anatomical viewpoint which formed the basis of "modern scientific dermatology" (ibid,255).

Thus from early periods of human life to modern times there has been a division of medicine, no matter how primitive, into specialties. It is however, instructive to pay heed to Sigerist (1963) who warns that in his opinion primitive specialisation was not the same as modern specialisation.

> primitive specialization, a stage in which every doctor knows one disease or the diseases of one part of the body, or one treatment and nothing else.
>
> Our present specialisation is the result of accumulated knowledge and of a highly complex technology. (ibid, 319)

Clearly modern specialisation of medicine is viewed by many as a highly complex affair, with many factors affecting it. Sigerist (ibid, 171) felt that it was concerned with power and function, other writers have suggested more tangible factors, so it will prove valuable to explore further the area of influences on specialisation.

The rational bureaucratic model in Europe affected the organisation of many areas of life and the development of hospitals as centres of medical practice, outwith primary care, was part of the adoption of this model. This development did not clash with the ideals and aspirations of specialists or potential specialists, though it did give rise to unrest on the part of general practitioners.

Political and economic factors are obviously closely related. The initiation and subsequent growth of the concept of socialised medicine in the UK in the form of the National Health Service was basically political, but economics now play a major role in its organisation and in its direction of health care. Nevertheless, how much money is spent on health services and in what specific area of practice is basically political, which is not to say that there is no influence here from social pressure. At the end of World War II it is said that there was a specific political move especially in the USA, but also in the UK, to move drastically from the destructive aspect of nuclear energy, towards constructive use and nuclear medicine was actively encouraged.

Changes in specific sections of the population, which may result from political decisions are important. If more doctors are produced as the result of the decision several years back to increase the number of medical students, there will be a pressure towards specialisation. Similar pressures can be seen, and will be charted in Chapters 4 and 5, from the release of technicians after World War II coupled with volumes of equipment no longer needed for the war effort. In the 1970s after the rundown of the American space-probe program there were many scientists and technicians skilled in physiological methods who were suddenly in the market place.

Government financial support for medical research created, according to Cole (1976, 1) a climate where "research reigned supreme" and so more available knowledge was produced. Sklair (1977) emphasises the consequences of new knowledge when he says that political decisions about science policy lead to changes in knowledge output.

> if vast sums of money are devoted to a particular branch of science then the likelihood of advances there are greater than if it is neglected; if large numbers of mathematically trained researchers are attracted to biology rather than physics, then we can expect certain types of developments in the biomedical sciences. (ibid, 179)

The use of new biological knowledge can be seen most dramatically in current infertility treatments.

Changes in patterns of disease due to public health and environmental measures also are factors. On a broader though related front, changes in population structure are very influential. This can be seen most dramatically in the formation of geriatrics as a larger proportion of the popoulation lived for a much longer time. Not only was there pressure of numbers, but there was also a public awareness of the problem. Amulree (1977, per) described in detail the shock of ordinary people using the Underground in London as shelter during the early days of World War II, when suddenly there appeared an otherwise neglected and invisible group of sick old people. So great was the concern and so demoralising was thought to be the presence of these people that they were evacuated into the country into hospitals set aside for the expected rush of wounded soldiers, who because of the "false start" to the war did not come till later.

Reiser (1978, 146) identified the move towards specialisation in the USA also with population movements, i.e. the concentration of people into urban areas, who could then support specialist doctors.

General social pressures are hard to chart, but the cultural perception of the primacy of the expert could be of importance. Forsyth (1966 46) writes that for an increasingly well-educated and informed society, medical specialists fulfil the role scientist-technician.

Specific pressure groups also affect the process of specialisation, as they can often press their concern by forceful means. The desire for a holistic approach to the body, for a relationship with a doctor and not a machine, for the advancement of a paramedical group, for an end to the concept of pregnancy as a disease - these are all areas of concern expressed by lay people.

Demand of new occupational groups as well as older ones can affect specialisation. Kenan (1984) says that in connection with the master's degree for genetic counsellors - a new grouping - changes were made within this field.

The desires, wishes, demands of doctors are also powerful factors. They seek through specialisation the following advantages. Possibility of greater salary and better working hours and conditions, with the choice of patients, plus a manageable section of problems; prestige, both with the public and the medical profession; good career ladder; peer group becomes the prime reference group and this group has more power to get resources, plan research and produce leaders who act as official spokesman. For the majority of doctors, specialisation is good, though there are some disadvantages in connection with the hierarchy of specialties.

STUDIES OF MEDICAL SPECIALISATION

There has been a number of writers who have carried out substantial work on the medical profession and the specialisation within it.

Stevens' book "Medicine in Modern England" (1966) is regarded by some as a classic in this field. She gives a broad account of developments from 1700 to the mid 1960s, but of particular interest here is her account of the stages of specialty development. She experienced difficulties in constructing this, however, for without American-style specialty boards, the definition of specialist remains for her ambiguous. These developmental stages include the formation of a special hospital or society, the foundation of a specialist section of the RSM and the BMA, with academic respectablility being added with the naming of a university chair (ibid, 39). Future developments would be the formation of a professional sub-group which begins to practise exclusively in a well defined field (ibid, 336). In the 1950s and early 1960s Stevens found that there had been a "compulsion" for relatively large groups of specialists to become self-regulating with their own postgraduate examinations and "power and interest to advance the stated specialty" (ibid, 336). This most interesting observation is not expanded, which is regrettable, for it offers a tantalising glimpse of a main theme of the enquiry of this thesis.

Her work is historical and asociological, and this criticism could also be levelled at the work of Honingsbaum (1979) on the division of medicine into general practice and hospital care. Although this division is politically important, the area of most interest for me is the divisions within hospital care. Nevertheless, this author does discuss the divisions of the medical task and the importance of "strongly defined and certain areas". (ibid, 303)

The examination of French medicine by Jamous and Pelloille (1970) used not only the concepts of indeterminancy and technicality (already described in Chapter 1 of this thesis) but three phases of development of a profession. These authors suggested that the following phases be utilised, and though they refer to a profession, I felt that implicit in their work was the notion that these phases could also refer to a speciality.

First, a professional ideology is accepted, characteristic of the dominant group, then transferable techniques become the centre of the ideology, followed by the take-over of scientific rationality. Their emphasis on the progression of ideology, techniques, and scientific concepts is informative and this will be considered in the substantive part of the thesis especially with reference to paediatrics.

Although recognised as an overall useful conceptual scheme, Atkinson et al (1973) criticised both it and the application to French medicine. Their main criticism is that because the definition of indeterminacy is unsatisfactory, Jamous and Pelloille "reified a concept" which limited its interpretive value. Atkinson et al do, however, use with some success the phases of development in their own analysis of reaction to the Todd report.

Bucher and Strauss (1966) presented a model for studying professions which was different from that of the structural functionalist approach, for they were focusing more sharply on conflicting interests and upon change, - a "process model". They did not believe in the view that professions were homogeneous, for there are, they suggest, many identities, many values and many interests and these do not fall within the range of simple variation. They tend to become patterned and shared, coalitions developing in opposition to other groups. The authors called these groupings - segments - and developed the idea that professions were loose amalgamations of segments pursuing different objectives in different manners, and more or less delicately held together under a common name at a particular period of history. (ibid, 186)

Most of the work they carried out was in medicine, and for this reason their work is explored in detail in this chapter rather than the previous one.

The concept of segments developed by these authors is a useful one, but some of the utility is lost by its very generality. Segments are postulated as existing in a wide variety of situations, namely$ within a formal medical specialty and therefore classed as sub-specialties; conversely a segment may include several specialties or parts of several specialties. Segments may also lack association with any reasonably defined group of specialties, and they may spread outwith the formal boundary of medicine into other related professions and occupations.

One would wish to suggest an almost hierarchical classification to clarify this complexity; for segments within formal specialties will be markedly different both in potential and development from those which straddle professional boundaries.

Nevertheless the concept of segments and more importantly the processual nature of their development is relevant to this thesis, for the authors comment that

> segments are not fixed, perpetually defined parts of the body professional. They tend to be more or less continually undergoing change. They take form and develop, they are modified, they disappear. (ibid, 193)

In a comparative analysis of specialties and segments, Bucher and Strauss suggest that early in their development specialties carve out and proclaim for themselves "unique missions".

> they issue a statement of the contribution that the specialty and it alone, can make in a total scheme of values and, frequently with it an argument to show why it is particularly fitted for this task. The statement of mission tends to take a rhetorical form, probably because it arises in the context of the battle for recognition and institutional status. (ibid, 187)

While specialties organise around unique missions "segmental missions" may develop within the specialty area, and this may cause conflict because the segmental mission may be so totally and fundamentally different from the other parts of the specialty.

Continuing with the concept of missions, the authors then look at the work activities of various groups of doctors comparing broad specialties like general medicine with single specialties and asking what constitutes the "core" of these specialties. What is the most characteristic professional act of their professional lives? Asking this question is very instructive for it reveals that the "core" is often segmentally rather than specialty based, though they do admit that not all segments can be said to have this type of core. (ibid, 189)

Whilst there may be differing types of cores between segments within specialties, there may also be differences in methods and techniques which in turn can be held in common with segments of other specialties, so cutting across formal boundaries. The whole idea of boundary setting, shifting and maintenance developed by these authors has great relevance for this thesis. (ibid, 193)

Colleagueship, in the opinion of the authors, can be one of the most sensitive indicators of segmentation within a profession. Identification with segments not only directs relationships within a profession, but also with neighbouring and allied occupations.

> We might use the term "alliances" to distinguish this phenomenon from colleagueship within a profession. Alliances frequently dramatize the fact that one branch of a profession may have more in common with elements of a neighbouring occupation than with their own fellow professionals. (ibid, 191)

Another complex term which is examined in the work of these innovative authors is that of "interests and associations". Sociologists should not presume that there is "unity of interest" among professionals (ibid, 191). These interests, however, are thought to be different from missions and core work and are mainly concerned with structure, institutionalisation, training and relationships with the outside world. In their opinion, many a professional association has arisen out of conflicts in these areas.

In a general section on segments as social movements the authors stress their developmental nature and they make the interesting comment that

> movement is forced upon them by changes in their conceptual and technical apparatus, in the institutional conditions of work and in their relationship to other segments and occupations. (ibid, 193)

This, as they remark about their work, earlier in this paper

> bears a considerable resemblance to a commonsense point of view (ibid, 186)

and I would agree with this, but of course I find the remarks about "technical apparatus" most interesting.

In discussing how the diversity and movement of segments can be analysed, several important issues are raised which have relevance to the major interests of this thesis, for example

> At any one time the segments within a profession are likely to be in different phases of development and engaging in tactics appropriate to their position. (ibid, 193)

and also

> Possibly the acme for some expanding segments is the recognised status of specialty or sub-specialty. Certainly this is the way specialties seem to develop. But the conditions under which segments will become formal specialties is in itself a fascinating research problem. (ibid, 193)

Although they suggest that this type of research problem is related to the broader questions of relative development, degree of change, influence and power, they do not suggest either a methodological or theoretical basis for the pursuit of such research.

The wider aspects of segmentation are discussed by Bucher and Strauss in relation to power, both within and outwith the profession of medicine. They use terms of conflict and battle, for example

> Pockets of resistance and embattled minorities may turn out to be soldiers of former generations, digging in along new battle lines. They may spearhead new movements which sweep back into power. What looks like a backwash or just plain deviancy may be the beginning of a new segment which will acquire an institutional place and considerable prestige and power. (ibid, 194).

For some workers their concept of power was not strong enough. Carboni (1977, 105) suggest that Bucher and Strauss had ignored the political struggles which have occurred and continue to occur among the "vested interests" in the medical profession.

The work of Bucher and Strauss contained many imaginative and innovative ideas, but although they were clearly within the interactionist school, there was no basic substantial structure or methodology to carry the work forward. Although various authors have used their ideas there has not been, as far as I can judge, any major substantive work within the sociology of medicine based on their work. Workers outside this field have possibly used it more, people like Pettigrew in organisational theory and analysis, whose work will be reviewed shortly.

According to some observers the work of Bucher and Strauss was almost a diversion of interest away from the sociology of the professions and as at the time of their writings, there did not seem to be a great deal of interest in medical specialisation from a sociological point of view, the bulk of their work was bypassed as other interests, e.g. Freidson and the power model, were taken up.

The value of the focus by Bucher and Strauss on the processual nature of specialisation and the concept of segments is reflected and expanded in the work of Pettigrew (1973a) - an analyst of the industrial scene, though his work I suggest has relevance for medicine. He suggests that one should look at

> how a specialist group defines its task; how a specialist group protects its identity by a system of values; how it links itself with the activities of the interdependent specialties (ibid, 257)

Focus for analysis should be, he writes, on the

> development of interdependencies within a specialty and across specialties, sharing a common task environment. (ibid, 257)

and he stresses the fact already made by Bucher and Strauss that

> at any point in time each of the linked specialties is likely to be in a different phase of development and engaging in tactics appropriate to its position (ibid, 257)

Pettigrew also considers the problems of both new and established specialties. For a new specialty the problems are those associated with power and status. New specialist groups are likely to be seeking "social accreditation". He considers that as they are often deprived of their accepted status and function, they may take on expansionist policies. Since these expansionist policies in one area may lead to the diminution of another group, this method of increasing status often produces conflict.(ibid, 257)

An established specialty, when challenged, could manifest a series of defensive reactions. The author considers that these might be, firstly, accusing the expansionist group of incompetence and encroachment; and secondly, attempting to invoke sets of fictions about itself to protect the core of its expertise. These fictions, if supported by intra-group solidarity, can help the established and embattled group to devise a "comforting self image" to help to meet and adapt to pressures from outside. Conflict between rival groups could, he suggested, take the form of "boundary testing activities". (ibid, 258), a concept already suggested by Bucher and Strauss.

Pettigrew (1973a) analysed conflict within the industrial scene between two specific groups who were affected by technological change. He regarded it as a necessary study, for in his opinion, the literature dealing with active and reactive strategies under conditions of technological change is practically non-existent (ibid, 270). The groups studied were the computer programmers, whose status was declining due to technological change, and the new grouping of systems analysts. His emphasis was on power, and he states that

> power was operationalised through identification of power resources, together with individual perceptions of how those resources were used. (ibid, 259)

He also stressed the importance of access and control of resources and more revealingly states that

> power requires skill, not just possession. (ibid, 260)

His analysis revealed that to protect their power base and maintain their occupational identity, the programmers adopted four main strategies, which have relevance for the analysis of medical specialties. These were norms which denied outsiders competence, protective myths, norms of secrecy, protection of knowledge base through control over training and recruitment policies.

In another paper this author highlights the importance of knowledge in relation to power. He (1973b, 229) mentions that several authors also consider that control of information (i.e. knowledge) can be a power resource. This has obvious parallels in medicine, as has another observation he made, namely that under "uncertainty" conditions, the range of a set of variables cannot be reduced below a certain size; the greater the uncertainty the wider the range. In these circumstances, officials have more latitude in emphasising one part without being proved wrong. This observation will be taken up in the part of the thesis on monitoring.

Other work on specialisation, emphasised both the processual nature of the division of medical labour and the presence of developing or informal specialties or segments. Magraw (1966) writes that

> The list of official and fully certified specialties is not static. More specialties are continually evolving and are gradually added. This process is natural, irresistible, and shows no sign of slackening. Informal and de facto subspecialization within these fields constantly develops as a natural extension of new knowledge and new techniques. There are at least as many more existing but not officially sanctioned specialties as there are those now certified. The continual formation of new specialties threatens the preserve

of the established, broader specialties.
(ibid, 149)

Sadler (1978, 212 note 53) develops the idea that the notion of a 'necessary' technical division of labour refers to the view that a development of knowledge may necessitate a division of labour based on scientific specialisms. Such a concept is suspect she believes, if it is seen as 'necessary' simply because a division of labour has occurred: other factors apart from the development of knowledge and technique may have been responsible. However, she does admit that there is evidence that the development of knowledge in the 19th and 20th century did not necessarily produce a technical division of labour within the medical profession, for no one could retain all the knowledge necessary to practise non-specialised medicine.

This approach is also accepted by De Santis (1980); her researches have led her to believe that the expanding medical division of labour (in the USA) is the mechanism by which the profession accommodates the increase in its body of knowledge (which is mainly scientific and technical). Although she could find no existing mechanism to guide the allocation of the new discoveries of "medical science" to the appropriate group of specialists, she is sure that some form of process must exist (the invisible colleges described by Crane (1972) perhaps). Her conclusion is that this complex task is not accomplished by a "highly rationalised structure", but by a "loosely organised process" which appears to be concerned with monetary as well as symbolic resources.

Specifically Forwell (1976) gives examples of the changes occurring

> Although, in general, the number of consultant specialties is increasing, since specialisation is a dynamic process, some specialties may diminish in appropriateness. For example, with changes in disease prevalence, the consultant specialties of chest medicine (Crofton Report, 1973), and infectious diseases (McGirr Report, 1976) are changing and, in part, becoming absorbed into general medicine and paediatrics. (ibid, 7)

His comments are set within his view that specialisation does have disadvantages, for scientific advance does not necessarily fit the boundaries of existing specialties and effort may be wasted because of boundary disputes and vested interests. A coming together of ideas from a variety of sources, yet I would suggest with no specific framework.

Birenbaum (1982) highlighted what he saw as a lack of a comprehensive framework for study in the health care field, for he states that

> Whether structural-functional or processual the available theoretical framework fails to recognise the interactive and contextual nature of the development of the professions. (ibid, 871).

He also indicates more generally that the changing divisions in labour, technology, social organisation and economic support within the health professions have received little investigation.

Although mainly interested in the "emerging area of bioethics", Aiken and Freeman (1980, 527) suggest that the role of science and technology in medicine has received only "sporadic and limited" sociological analysis, emphasising once again the concern felt by Titmus about the neglect of this subject.

<u>SUMMARY</u>

Although I am well aware that this chapter contains a highly selective review of the literature, I felt that there must be some selectivity for the field is so very large. My presentation was informed by the need to examine the approaches and models used and by a desire to explore in more detail the themes revealed in the previous chapter.

Throughout the literature in general the ecological-interactionist approach seemed to me to be stronger than any other approach, many writers using terms like domain, boundaries etc. This approach could be said to have culminated in the work of Bucher and Strauss with their concepts of segments, unique missions, core activities and their emphasis on the processual nature of changes within the profession of medicine.

Again as with the main interactionist approach described previously, there were deficiencies in their approach, mainly the playing down of power and control and vested interests of the practitioners. But the work of these authors did inform the eventual development of an analytical framework and so their importance should be stressed.

Freidson's work was also of importance though he was not primarily concerned with specialty divisions. His work on the primacy of knowledge and of the definition of patient needs was influential and stressed how important were those themes which had been flagged in Chapter 1.

Specialised knowledge, especially that available from developments in science and technology, is seen as vital not only to the advancement of medicine, but for the specialised division of labour within it. Thus the components of knowledge, highlighted by Rueschmeyer in Chapter 1 are important and worthy of further detailed study.

References to the fiduciary relationship are scattered within the literature, some implicit rather than explicit. Titmus was well aware of the dangers to this relationship and for him as for other writers, it was a theme of potency for the understanding of the developments in modern medicine.

The theme of control of client needs by professionals was developed further in this chapter by exploring the definition of patient needs by doctors. Also the notion of 'altruistic motivation' and the opposing idea of 'vested interests' was developed.

Within this chapter, another interesting theme emerged, that concerned with the desirability for the doctors of an extension of their senses through technological artefacts and through techniques developed for their use.

It is therefore desirable now to look more closely at technology, both in the wider societal field and in the special medical one.

CHAPTER THREE SOCIETY AND TECHNOLOGY

INTRODUCTION

The previous chapter makes the point that medicine has become more and more based on science. As a substantial element in the search for knowledge, as a method of investigation, science plays a vital role, not only in the formal training of doctors, but in their day to day activities. This incursion into activities and practice is not only through the grasp of refined and esoteric theories or research findings, but in the form of technology, in what could be called the practical application of science. This application and the artefacts produced by it are the most immediately visible when one looks at the profession and its work.

The development of medical technology has to be set within a broader discussion of technology, and so this chapter will deal with not only general definitions and perspectives, but with models of the interaction of society and technology, as well as with ideas presented by a variety of writers, about the way technologies are initiated and developed.

Most modern technology has as its basis an input from science and therefore within this chapter I will be concerned primarily with technology. Nevertheless the notion of science as a search for knowledge by the process of observation, inference, verification and generalisation must not be ignored. Nor should it be forgotten that science is, in the words of Rahman (1980, 4)

> judged successful and acceptable on the
> basis of observation, deduction and

prediction and not on the use made of the results.

This is of course in sharp contrast to technology which is judged successful by its use.

The term "technology" was coined by a Harvard professor, Jacob Bigelow, in 1816, after he had been asked to teach a course in the application of science to the useful arts, and he wished to have a word which would symbolise this field of endeavour (Westrum, 1977, 480).

Technology, of course, did not suddenly erupt into social life in 1816, human societies have always had some form of "technology", in the use of tools, though the very fact that their development may have been guided by empiricism rather than scientific logic indicates the problems inherent in trying to define and describe technology.

It is instructive therefore, to look at a number of definitions of technology and its relationship with society before analysing its importance in medicine.

DEFINITIONS AND PERSPECTIVES

A review of the literature on technology and society reveals not only definitions which stress different aspects of the complex topic, but also conflicting opinions both about the value of technology and its relationship to society, to cultures, institutions and practice.

The view of technology as being present in all aspects of life is expressed by Hetman (1977, 3)

> technology is fully involved in human activities, it is a permanent component of the socio-economic pattern of modern societies.

But what is technology? Is it the machines used by certain groups of people? Dickson (1974) used the term as a collective concept for the "tools and machines" used by society and the relations implied by their use. Teich (1981, 1), however, expands this idea, for in his view:

> technology is more than just machines. It is a pervasive, complex system whose cultural social, political and intellectual elements are manifest in virtually every aspect of our lives.

The importance of knowledge (the intellectual element) is highlighted by many authors. Westrum (1977, 680) writes that

> technology is that part of culture that involves the use of techniques to affect the social and physical world ... technology is knowledge of how to change the world around us.

Not only is technology regarded as knowledge, but as the systematic application of knowledge. Galbraith (1972), an economist, expressed this view stressing that the knowledge was from science and other organised areas, and its application was to practical tasks. Macleod (1977, per) an inventor and engineer, takes this precept further. In his view technology

> is a systematic application of scientific principles and other organised knowledge to the synthesis as well as the analysis of novel processes or procedures.

The notion that technology has an analytical as well as a synthetical role is important, for in this way the ideas, the philosophy of technology and technologists can be incorporated. This importance is stressed by Hughes (1971, 131), when describing the development of sub-cultures in medicine in response to changes in medical technology and philosophy, he interpreted the latter to be "ideas and assumptions".

Within much of the writing about technology, the notion of systems is also crucial. Although it is such a basic concept to the engineer and the technologist that they tend to ignore it in their writings, or presume the reader has already a grasp of the concept, the sociological significance has not been adequately studied. In this respect the sociological analysis of T. P. Hughes (1976) stands out in its observations of this concept with its ideological and yet practical significance.

This author shows in his study of high voltage power transmission systems the relationship between the elements within this complex is important. There is inter-relationship not only between the artefacts but also inter-related ideas.

The inter-relationship of artefacts has implications for change for replacement of one piece of equipment could affect the whole system. Collingridge (1980, 47) takes this idea further and shows that there has to be adjustment of other technologies to one that is developing, it does not develop without influencing those around it. Control of this developing technology only becomes possible at the cost of adjusting these surrounding technologies. He called this the entrenchment of technology and postulates that it leads to control being difficult and slow, and change expensive. One method of avoiding entrenchment is to have several technologies which perform the same function, e.g. several energy technologies. One could also postulate that entrenchment could occur in a system of ideas and philosophy. This important concept of systems with the notion of entrenchment will be discussed later.

Thus, it can been shown that from a variety of sources, there is an equal variety of perspectives about what constitutes technology, and about the general relationships of technology to society.

Perspectives on the specific relationship between technology and machine are similarly various. Knowles (1978, 142) thinks that medical technology

> embraces everything based on science that a physician does - the learned acts he performs on the patient, the diagnostic aids, the drugs and the vaccines.

Banta (1983, 1363) closely involved in technological assessment in the USA, sees medical technology as drugs, devices and procedures as well as the "organisational and support systems" within which medical care takes place.

In a definitive book called "Medicine and the Reign of Technology" Reiser (1979, ix) does not specifically define what he considers to be technology, but by his description of what he calls "major technological advances" his attitude is obvious and it is a reversion to the tools and machines approach. The list contains the microscope, stethoscope, x-ray devices, electrocardiographs, automated bacteriology and biochemistry.

More explanatory views which have relevance for medicine are expressed by Jennett(1983, 1); the tools are used in his opinion to extend powers of observation; and by Schon (1967) whose description of technology is:

> any tool or technique, any product or process, any physical equipment or method of doing or making by which human capacity is extended

The concept of the extension of human capacity is a most important one and will be taken up again in Chapter 8, where the demand from doctors to be able to do this is discussed.

By extending human senses to aid in the diagnosis and treatment of disease, doctors could be said to be trying to reduce uncertainty - this concept is incorporated in a broad definition of technology by Rogers (1983, 12)

> technology is a design for instrumental action that reduces uncertainty in the cause-effect relationship involved in achieving a desired outcome.

This author goes on to say that

> a technology usually has two components, the hardware aspect, consisting of the tool that embodies the technology as material or physical objects; and the aspect consisting of the information base of the tool.

The duality of technology expressed here, the hardware aspect and the knowledge aspect, brings us almost back a full circle to tools, machines and knowledge.

The definitions and perspectives reviewed so far have been either broad and bland, or specific with reference to tools, knowledge, systms, extension of human capacities and reduction of uncertainty. It is now expedient to look at a wider perspective which incorporates larger societal views and influences.

There is no doubt that technology and technical change is viewed by the culture of western industrialised nations as desirable. From the point of view of elite groups it is perceived as vital. In the United Kingdom politicians of all parties have promoted the production and use of developments in technology as a way forward for the nation. Similarly from the elite group of medical professionals we see similar exhortations.

Within the literature on technology we also find statements that portray technical advance as progress. There is a triumphalist, celebratory strand, powerful since Victorian times. King (1972) (quoted by Hetman 1977, 4) expressed it so:

> Science and technology have been immensely successful and have made possible the rise of man from subsistence level, have created the resources for the building of prosperous societies, have through medicine contributed greatly to health and longer life, and the promise they hold for the creation of better societies and the abolition of poverty is enormous.

Although Thomas (1974, 99) warned of the dangers of taking technology, and medical technology in particular, as a "given", as something there for better or worse, he nevertheless summarised his feelings by saying in an equally celebratory way that

> The underlying mechanisms of human disease represent approachable and soluble problems for biomedical science. For the future, the capacity of medicine to provide effective and economically feasible technologies for the prevention and cure of disease will be largely dependent, as has been the case from the past, on new information to be gained from basic research.

The certainty of the correctness of approach - that of utilising the available developments of science and technology stressed by Thomas was also stressed by Edward Kennedy, who said

> We want a society that has the wisdom to invest its best minds and its scarcest resources in the things that do most to enhance the dignity of our human condition. Medical science and health care are among the best investments we know how to make (quoted by Ebling, 1982, 4)

Magraw (1966, 157) writing on scientific developments and specialisation in medicine made the general comment that

> The continuing process of diversification in the special fields of expertness through society is necesary and desirable as much as it is inevitable.

Thomas (1974, 99) however, was aware of the critical climate in the USA which, he felt, was part of a broader criticism or what he termed

> an unmistakable loss of confidence in the value and effectiveness of science.

To counteract this he called for better assessment of technology in medicine, a call echoed by many other writers.

Jennett (1983, 230) amplifies the celebratory aspect:-

> Some technologies are full of promise - they can remove the threat of death, reduce disability and dependence, and offer the possibility of years of life of quality.

But he does warn that whilst society may gain from these developments

> Most technologies also have some potential for harming the individuals exposed to them.

So the triumphalist approach must be modified because it is peceived that there can be good and bad effects from the use of technology. What influences these effects? Jennett (1983, 230) believes that

> there are no good or bad technologies - their potential for benefit and burden depends on a balance of many factors.

The President's (USA) Task Force (quoted by Westrum, 1977, 480) is quite certain about this neutrality, its statement reflecting the view of the establishment in that country is revealing, technology they say is

> a collection of ideas and techniques that are ethically neutral, that is, technology can result in good or evil depending on who uses it.

This perspective of use determining value is present in the work of Goodman (1969) (quoted by Westrum, 1977, 480) who views technology as

> an integral part of a complex of corporate and intellectual elites whose power and profit depend on the maintenance of a belief in the value of technology and its application to solve a wide range of societal problems.

We have thus returned to the idea of vested interests, a theme running through the previous chapters, and also to the control of societal problems, which of course include problems of suffering.

Power and profit are two driving elements within a society and Ellul (quoted by Teich, 1981, 3) is quite certain of their domination by technology. He sees technology as the central factor in modern society, as a self-enclosed totalitarian system where true human values are lost and technology becomes an autonomous force guided by internal values that bear no necessary relation to the needs of humanity. Means, according to the writer, become ends - all aspects of society become subservient to the system - domination by technology is complete and inevitable.

A very powerful statement of technological determinism. How can one believe that Fuller (1969) (quoted by Teich, 1981, 3), inhabits the same world as Ellul, for this writer, builder, inventor, believes that whilst all is not necessarily well in modern society, humankind has the capacity to solve its present dilemmas and create a technology that would truly serve its needs, a concept of social shaping in contrast to the deterministic approach of Ellul.

A final view of the general approach that technology shapes society comes from Mestheme (quoted by Teich, 1981, 5) who sees two mechanisms by which technology appears to relate to social change. It creates new opportunities and also generates new problems for individuals and societies. It has, he suggests, both positive and negative effects and usually the two at the same time and in virtue of each other.

The generation of problems for both individuals and societies has given rise to a general movement which is critical of modern technology and thus of medical technology. This will be discussed after the ideas about the relationships between society and technology have been more formally explored.

RELATIONSHIPS BETWEEN SOCIETY AND TECHNOLOGY

In a more specific and indeed more interesting way, may authors, particularly in the last decade, have begun to explore the relationship between society and technology. Probably the largest number have sought to trace the impact of technology on society, either in general terms or with specific technologies in mind. There is, however, a growing literature which reverses the question and asks not how does technology afect society but how do social processes, social arrangements, socially generated values and beliefs affect technology.

Westrum (1977, 488) suggests that to begin analysing these relationships it is instructive to examine three oversimplified models, namely, technological determinism, social shaping of technology and technological interactionism.

Technological determinists see technology as the sole result of an internal dynamic, which unmediated by other influences, moulds society to fit its patterns. Technology becomes reified, one can find many statements of this, e.g.

> Technology has even caused a redefinition of death. (Banta, 1983, 1363)

One should be warned, however, to look at these statements closely and of course in context; for many of them are shorthand or simplified expressions of complex issues. The one quoted above is really saying that for certain powerful groups i.e. transplant surgeons, the definition of death generally used, is not appropriate for their task of using organs from one human being for transplantation into another human body as quickly as possible to prevent damage. Thus the technical ability to do this has made it desirable for a new definition of death more suited to the technical circumstances of contemporary transplant surgery. And most tellingly, this definition has been legitimated by most other workers in the health care field.

Most determinist writing views the scene in a stark, binary fashion, either fulsome in their praise of technological developments - the triumphalist approach, or full of gloom and foreboding about the extreme problems technology is perceived to have brought.

Marx is regarded by many as a technological determinist, in light of his oft-quoted comment that

> the handmill gives you society with the feudal lord: the steam mill with the industrial capitalist.

The aphorism, comments McKenzie (1984, 473) has stuck; as a "succinct precis" of technological determinism it has few rivals. Yet he suggests that it is misleading and Marx agreed that social relations moulded technology and not vice versa.

The corrective to technological determinism is the approach that what matters is not the technology but the social or economic system in which it is embedded. But as Winner (1977, 488) points out when taken literally, this approach has its shortcomings by its implication that technical things do not matter at all, once the detective work has been done and the social origin of the technology has been revealed, (i.e. the power behind the technical change), then everything of importance is unveiled.

This social determinism, or social shaping, he believes is comforting to social scientists for it validates their belief that the study of technology is not distinctive or different from social determination of welfare policy or taxation. For example the remark of Daniels (1970, 199) that

> the direction of the society determines
> the nature of its technological innovation

or from Hetman (1977, 3)

> technology like other sub-systems can be
> geared to certain social ends.

But as Winner (1977) points out, the thing, the technique, the system changes social life after its introduction and there is need for feedback.

One disadvantage of this model, is that it concentrates on the effects that social shaping has on an introduced technology and as far as I can determine has little impact on research into the formation and the initiation of the technology, though some groups are redressing the balance by their studies of innovation. (McKenzie 1985, per) In this model society tends to be reified and sub-groups and their status, with regard to control, are not fully explored. One stark but telling example of the dangers of the approach concerns the storage of electricity. Many groups in society would greatly benefit from a more efficient storage device and much research work has been done under social pressure, but as yet no new piece of technology has been developed which can successfully replace the present battery storage.

Winner (1977) considers that the standard model of social shaping only goes so far in accounting for what is most interesting and most troublesome about the subject and suggests the idea of technological politics, not as a replacement for the social shaping of technology but rather as a complement to it. This extension he believes would have advantages in that it would draw attention to the momentum of large scale socio-technical systems, the response of modern societies to certain technological imperatives, and the adaption of human ends to technological means.

Whilst I agree with Winner that another model is needed, I see the further extension of his ideas in that model suggested by Westrum, of technological interactionism. The idea of a complex interaction between society and technology is appealing for one cannot separate technical changes from their social context. Inventions, innovations lead to choices for change in society, but they can be shown to be generated and developed as a response, at least in part, to social demand. The social demand, however may be from a small sector of society and I feel that this third model helps to tease out the various elements in this complex interaction and explore their relationships especially those connected to the power of the professionals.

Winner goes some way, in fact a very long way, towards this view when he asks "Do artefacts have politics?" He puts forward the controversial notion that technical things have political qualities. Expanding his notion, he suggests that we look at the proposition that machines, structures, systems, of modern material culture should be judged not only for their contribution to efficiency and productivity, and positive and negative environmental side effects but for ways in which they can embody specific forms of power and authority.

His strongest example is of physical structures - low underpasses on a road preventing buses from using it, thereby limiting the type of people who could gain access to the desirable facilities at the end of the road. The underpasses were deliberately designed to achieve a particular social effect. But surely it is the power held by the designer or proponent of the scheme that should be studied as well as the social milieu which allowed the power to be used in this socially divisive way.

One important aspect of the technological interactionist model is the idea of "culture lag". Ogburn (1946 quoted by Westrum, 1977, 493) suggested long ago that material culture, i.e. technology, may change before other parts of the culture change, and that there would be a time gap - an out-of-adjustment period, which he called "culture lag". This idea has a bearing on technology uptake by professionals for their social organisation may not be out of adjustment, but those of their clients may well be.

The relationship of technology to society is frequently treated in ways which make little distinction between technology and the underpinning of science. Nevertheless it is interesting to tease out the relationships between science and society which, though they are complex, are possibly easier to analyse, as there is an acceptable definition of science. The notions of scientific determinism, social shaping of science are present, but because there is such a close relationship between science and contemporary technology, statements about science have to be untangled to see their real import.

Consider the following logic from the introduction to a book produced by the Council for Science and Society on human procreation. Ziman (1984, ix) writes that:-

> a society is held together by rules that people are bound to obey - human behaviour always follows the constraints of biological reality - science changes biological reality - boundary conditions on rules of social behaviour are suddenly altered and people become frightened.

I would suggest that it is the translation of scientific findings into technological possibilities that produces fear. Technology could be said to be at the sharp end of interactions, at a greater number of interfaces with groups in society and thus it is more interesting if more complicated to study.

CRITICISM OF MODERN TECHNOLOGY

As suggested earlier, there is a body of opinion, well represented in the literature, which is critical of modern technology and the criticism of modern medicine must be placed firmly within this general critical field and not seen as an isolated example in society. Hetman (1977, 6) writes that

> the technologies that have been made possible by modern science are tainted.

In the late 1960s and early 1970s long established assumptions about the social benefits of scientific and technological developments were questioned. A good description is given by Boyle et al (1977, xi) though the term "uncontrolled technology" is used in a spurious way. This technology

> became associated with a variety of contemporary problems, among them hazards to health and safety; pollution and the depletion of resources; structural unemployment and the deskilling of labour; conflicts between amenity and commerce; mismatches between innovation and social need.

There is a good deal of writing in similar vein, but no purpose will be served by looking at it in detail. It is the general flavour which is important, i.e. technology is bad and has led to immense problems and has been the cause of much anger.

Mo rison (1981, 21) gives illumination on the anger felt about technical change when he says that

> our large technological capability forces us almost to the brink or realising that

> the causes of most of our problems are social. We are the enemy. And who can face that?

Weinberg (1966) (quoted by Teich, 1981, 2) highlighted this idea by arguing that technology is capable of finding short cuts to the solution of many pressing social problems. He called these short cuts "technological fixes" and since he thinks that technological problems are intrinsically easier to solve than social problems, he sees moves to transform social problems into technological ones. The difficulty of course is that the solving of one group's problem by a "technological fix" can create great problems for other groups. This is one basis for the criticism of modern medicine.

Criticism of modern medicine must, as I have already indicated, be seen as part of the general attitude and not separate from it, though it is perhaps more acute, because medicine touches everyone's life at some time and in intimate and often stressful ways.

To get a flavour of the criticism, a brief trawl of the literature, reveals a variety of concerns.

Towers (1971,165) was sure that many patients resented the "current obsession with technical procedures" and a recent report on the resignation of a professor of obstetrics and gynaecology in a premier London teaching hospital indicated that he considered medical education had taken the wrong turn and was now "beguiled and obsessed with technology" (World Medicine, 1981, 97).

Burns-Cox, (1979,79), commented on doctors from institutions where "measurements are worshipped at the expense of common-sense" and described the situation after the opening of a laboratory offering pulmonary function tests

> suddenly anaesthetists and other clinicians find themselves unable to carry on without the reassurance of these tests.

Bradley et al (1981; 53) considers that the impact of technology in obstetrics has been so profound that pupil midwives were now

> so dependent on modern technology that they were not developing their practical skills and clinical judgement in the management of labour.

More sustained and structured criticism has come from numerous authors concerned with the overall view of the medical scene. Powles (1973) is widely regarded as one of the main critics of technological medicine. His criticism is that claims by doctors of the value of recent scientific and technological developments are spurious and that there are great dangers to health in the "engineering strategies of modern medicine". He classes as a major technical failure the inability to reduce premature death in men, and uses terms like "technical over-reach" in reference to treatment for heart disease.

The theme of dangers to health was stressed by Illich (1977). New illnesses and dissorders he believed had resulted from the transfer of responsibility for health from the individual to the health care professional. Under the general heading of clinical iatrogenesis he saw drug induced iatrogenesis as being important; but social iatrogenesis - the medicalisation of life - was the basis of his major criticism. He also criticised the lack of a holistic approach to the body by the medical profession and like Powles deplored the mechanistic model adopted by them.

This criticism of the mechanistic nature of medical disease theories is also stressed by KcKeown (1979) who saw that the use of the physico-chemical model stifled any change in perspective. More basically he questions, as Powles does, the role played by science and technology in what are claimed to be medical advances (e.g. Reduction of tuberculosis). But he is also very disturbed by the elevation, by high technology medicine, of the expert, the specialist, to a central position in the achievement of health.

In the opinion of Taylor (1979) although medicine is singled out as

> one of the great gifts of modern science and used an exemplar of how technology helps mankind

what is ignored is that the use of science and technology has

> just as many, if not more, disadvantages and adverse effects as their use in any other forms of human endeavour.(ibid, 1)

The highly charged subtitle of his book - "The anatomy of a malignant technology", could be said to be indicative of the flavour of his criticisms, nevertheless many of these are reflected both in previous writings and in more recent ones. His concern is that not only has the value of medical science been "vastly over-sold" but that high technology treatment is used without proper evaluation (i.e. randomised controlled trials) and on patients who do not need that type of diagnosis or treatment. The cost of this type of medicine and the role it plays in increasing the number of patients as people are screened and have "checkings", are also included in his critical review.

These points are stressed by other writers and groups. The increasing costs were charted by Petersdorf (1976, 2) who saw that technology had caused splits in medicine in the USA and sub-specialists had become the "surgeons of internal medicine". Containment of the dramatically increasing costs were, he thought one of the most difficult problems facing the nation and he called for control of sub-specialisation and a "rational containment of technological advances".

Attempts to contain and monitor these technological advances can be seen in the move towards technological assessment. Banta and Russell (1981) and Banta (1983,) have been actively involved in this in the USA, because as they say - rapidly rising medical care costs have become an important political issue in industrialised countries in the past decade. Attempts to control these costs have focussed on the contribution to them by medical technology. The role of indiscriminate funding by government sources without any effort being made to judge benefits was criticised by them.

This criticism of lack of judgment about the benefits of medical technology is prominent in the Council for Science and Society's 1982 report on "Expensive Medical Techniques". They consider there is overuse of these techniques, the benefits are either too small or too costly, they have not been properly evaluated and acceptability has been derived from a professional viewpoint and the views of the patients left out.

Banta (1983, 1367) goes further with the latter criticism when he says that patient-need is not a powerful determinant. This brings us back to the concept outlined earlier that the professional defines the needs of the client. If this is so, then who determines who will be treated by these expensive techniques? The dilemma of choosing suitable patients for treatment by scarce resources is an ethical one, and is graphically illustrated by the work of Larber in treating spina bifida infants, where he had to decide if the possible quality of life for babies so treated was commensurate both with the suffering and the expense. As Mesthene said previously, technology creates new opportunities and also generates problems usually at the same time, and in virtue of each other.

CONTROL

Within the criticism of modern medicine and more generally in critical writings on technology, there is a strong theme of the power of the professions to control the lives and needs of clients. There is an awareness that it is not just control over immediate tasks, but that the impetus for technological innovation stems from a desire for various kinds of power and control. Even when there is no indication of a conscious or explicit motive, covert vested interests can be observed.

Ross noted in 1901 that in every period of human history, social control has been pursued through a variety of means, the techniques varying from outright coercion to the ecstatics of religious fervour. Westrum (1977, 498) believes that in the 20th century, new touches have been added to extend the ability of individuals in power to control those they govern. He sees three areas of increased control - all in relation to technology. Firstly, increased ability to acquire, store and process information about individuals, secondly, increased medical knowledge which allows great control over the make-up and physical functioning of peoples' bodies and thirdly, greater knowledge of techniques of psychological control which allows manipulation through unconscious means.

The power element in the use of technology came as no surprise to Benn (1973) but he remarked that

> Now, all of a sudden, people have awakened to the fact that science and technology are just the latest expression of power.

This idea that technology is another expression of power is reinforced by Navarro (1976, 446). Writing from a specifically Marxist viewpoint and about the health sector, he says that the distribution of skills and knowledge and the control of technology are aimed at polarising class differences. He criticises Illich and others for assuming that control of technology gives the doctors their power, the hierarchy was already there, he postulates; technology strengthened it. Johnson (1972, 12) suggested that while professionlism could be seen on one hand as a positive force for social development, it could also be an instrument of

> harmful monopolistic oligarchies whose rational control of technology would lead to some form of meritocracy

Despite this view, or perhaps because of it, there is a demand that something should be done. Hetman (1977, 6) expresses it when he writes

> technology must be brought under control
> if serious perils are to be avoided.

But one may ask under the control of whom?

Collingridge (1980) writes in his book on the social control of technology that it is one of the most pressing problems of our time. He asks the questions

> can we control our technology?
>
> can we get it to do what we want it to do?
>
> and can we avoid its unwelcome consequences? (ibid, 11)

He points out that the dilemma is basically that the social consequences of a technology cannot be predicted early in the "life of a technology". By the time unfavourable consequences appear, the technology is so often a part of the whole economic and social fabric that control is difficult.

Using specific examples, Collingridge describes the range and types of difficulties which can be experienced, from entrenchment in the case of lead additives in petrol, to those of competition in MIRV technology and energy research control in the UK. His analyses of these topics are instructive for they show that blanket criticism of technology is not enough, there must be a study of specific examples to show who gains and who loses in a particular situation and who has the power to control what steps are taken.

He suggests that there is a need to learn what obstacles exist to the maintenance of control of a technology, which will allow change, so that unwanted social consequences can be eliminated or ameliorated. The essence of this control he says is not in forecasting these conseqences, but in retaining the ability to change the technology. But again the question can be asked social control by whom, by which groups within society, and for what purpose?

The rise of the consumer movement in general, and of specific lay pressure groups in particular was seen in the late 60s and early 70s. One reason was, according to Boyle (1977, xi) a response to the awareness that

> the number of obstacles to the democratic participation of ordinary people in decision-making increased in the face of technical experts and powerful and industrial and government bureaucracies.

Criticism of the power resulting from the control of technology has come from the women's movement. The history of technological and scientific development is male dominated, men writing about men, either as inventors, innovators or as controllers of technology. Cockburn (1983) writes that

> Technology is both the social property and one of the formative processes of man.

As McKenzie &WAJCMAN (1985) point out in this perspective, the often remarked absence or gross under-representation of women in engineering and technological work (and I would say, in the more technologically sophisticated medical specialties) and the lack of confidence often felt by women faced with technology, become symptoms of a deeper problem. To say that technology is the 'social property' of men is to say according to McKenzie & WAJCMAN that

> it represents the strongest form of male dominance of the public sphere. (ibid,51)

Though there are moves to improve women's confidence, the problems are deeper than that, for male dominance of technology has been achieved by active exclusion of women from large areas. During the two world wars, women played an active part in technological work in many parts of the world. Afterwards they were deliberately excluded by a variety of devices - one of which was the reconceptualisation of the importance of motherhood and increased surveillance in the antenatal period of pregnancy. (Arney, 1982)

Part of the socialisation of children is the differing exposure to things technological depending on gender. Cockburn (1983) describes the different forms of schooling, the prevalence of different role models and the extreme gender segregation of the job market as well as the different childhood exposure to technology. All these factors she insists describe

> the construction of men as strong, manually able and technologically endowed, and woman as physically and technically incompetent. (ibid, 203)

The use of technology by specialists to control challenges from women, especially in the area of pregnancy and childbirth, where technologically-skilled specialists, mostly male, control many aspects of the lives of technologically innocent women, will be explored in Section III of the thesis.

STUDIES OF TECHNOLOGICAL DEVELOPMENT

The question now arises, how does one study technological change? The broad general model of technological interactionism is useful, ideas of control are helpful and much can be gained from the critical literature. It is instructive, however, to look at the literature specifically related to methods or ideas for the study of change, including the take-up of innovation.

There is a very large body of writing on the diffusion of innovation, which has been delved into quite deeply for this thesis. It would not be appropriate, however, to conduct a major review; a summary of the ideas which proved useful for the proposed analystic framework of the thesis would have more utility.

The first task is to ask, what is innovation? This term is used to denote technical change, change in ideas, and often interchangeably with the term invention. The separation of the concepts of invention and innovation, however, is important.

Westrum (1977, 482) describes invention as the creation of a technology, the development of new knowledge by recombining elements of existing knowledge; innovation as the introduction of a new technology into a group, an organistion or a society. He suggests that while invention is necessary for innovation, it does not necessarily follow that an invention is automatically and immediately adopted by a society.

The description of innovation by Rogers (1983, 11) is most useful especially in relation to medicine, though he suggested it for more general use.

> An innovation is an idea, practice or object that is perceived as new by an individual or other unit of adoption. It matters little ... whether it is "objectively" new as measured by lapse of time since its first use or discovery ... Newness in an innovation need not just involve new knowledge. Someone may have known about it for some time, but not yet developed a favourable or unfavourable attitude towards it, nor have adopted or rejected it. The "newness" aspect may be expressed in terms of knowledge, persuasion or a decision to adopt.

How does an innovation become adopted by a particular society or section of society? What processes are involved? A variety of authors have suggested various schemes of complexity. These authors include Whitted (1981), McKinley (1983), Banta (1983) and Rogers (1983). Instead of giving a catalogue of their schemes it is perhaps more instructive to distill from them the common elements and where they differ, then to suggest where I think there are deficiencies.

All start with the notion of an innovation: an idea, new knowledge, promising report; which is then developed and adopted by certain groups with some experimental stages. After this there is either an uptake by a broader section of society or an acceptance by society at large of the innovation often with state endorsement. Decisions at a variety of levels are implicit within all these stages.

After this general adoption a variety of possible stages can take place according to the authors quoted. There may be properly conducted trials, or there may not. The innovation may not last, it may be found to be undesirable, or th ough desirable it may be replaced by a more desirable newer innovation. It may, however, have a stable place within a group and continue in use for a long period of time. An excellent example of this is the stethoscope.

None of the authors above suggest that all innovations go through all stages, in fact they are at pains to make this clear.

My criticism of the schemes is the general view of a continuum from idea to incorporation within the practice of a special group. I would suggest that there should be more acceptance of the separateness of the original idea. It may come from a variety of sources quite outwith the remit or experience of the group which then takes it up, and I feel that more attention should be paid to the question of why this innovation and not another. What is the motive of the group which does the uptaking?

Rogers (1983, 15) does explore the idea by asking what are the characteristics of an innovation which determines its adaption. In his view it should have, or be perceived to have, a relative advantage over previous innovation, it should have compatability with the existing values, past experiences and needs of potential adopters. If it is complex it may be adopted more slowly but of course this will depend on the expertise or lack of it among the adopters. The concept of trialability is introduced by Rogers to indicate that if innovations can be tried on a limited basis they are more likely to succeed as that trial represents less uncertainty and it is possible to learn by doing. Finally there is the characteristic of observability - i.e. visibility to others, which stimulated peer discussion and helps in the adoption of innovation. Once is is decided that an innovation is adopted, then there is more of a continuum.

In connection with the uptake of ideas, of innovations, Rogers (1983, 18) also suggests that the nature of the uptakers is important. He suggests that individuals who are alike in beliefs, education, social states, and share common meanings, a mutual sub-culture and common language, are homophilous. These who are not alike are heterophilous. He then postulates that heterophily or heterophilous communication is more likely to encourage the initial diffusion of innovation but that this communication will act as a barrier to further diffusion, which is more likely to occur among homophils.

This work could be said to relate to Kuhn's (1970) work on science and the revolutions that take place within it. Within a scientific community (i.e. homophils), members share a paradigm which allows normal science to proceed where problems are solved within the limits of the paradigm. When there is a paradigmatic shift, (possibly due to heterophic liaison), the whole framework of planning experiments and interpretation of results etc is changed. Critics of his work have suggested that the meaning of the term paradigm is not made clear - many definitions being used in the same work. But in essence there are two meanings which are inter-related but distinguishable. Firstly a paradigm is an exemplar, a model, a particular scientific problem solution, accepted as successful and becoming the basis for future work. Secondly, paradigm is used to denote the entire constellation of beliefs, values, techniques shared by the members of a given scientific community.

Discussion of technological paradigms have been less profound according to McKenzie (1985) because attention has been focussed on the second definition. But as he explains, particular technical achievements have acted as exemplars, as models for further developments. Within medicine there may be exemplars, both scientific and technological, and the concepts of homophily and heterophily are important because of the complexity of medical practice where both scientific and technological ideas and philosophies are present.

MAJOR INFLUENCES

This review of literature has been necessarily selective and one major fault is that the major overarching influences, although sometimes hinted at or briefly referred to, are not strongly represented. These influences are war, profit and vested interests.

Heraclitus said that war is the father of all things, and the effects of wars are far reaching, both during their course and after they have finished. In Section II some examples will be given of the influence of war on the initiation and uptake of innovation.

Within capitalist societies, profit is a great driving force, and during times of conflict or perceived potential conflict it does not lose its potency. Although this aspect will only be referred to briefly in Section II it is an important aspect of medicine in relation both to drugs and high technology.

Of more immediate concern is the influence of vested interests, for doctors these interests are generally in the advancement of their profession, but within the hospital more particularly with the advancement of their specialty (or sub-group) and of themselves. Forsyth (1966, 76) thought that these doctors who related to what he called the "technological tide" would see their "status advance with their science".

Powles (1973) remarked that medical technology serves non-technical purposes. It is a sentiment expressed in other writings as well, either explicitly or by implication. What are these non-technical purposes of doctors apart from the immediately visible ones of control over their professional work? Stevens (1971, 9) said that

> Historically and at present the developments of specialization and sub-specialization follows economic and status needs of the dominant profession as much as the requirements of technology and knowledge or the need for effective performance.

McKinley (1983, 375) was at pains to point out initially in his paper that in his work

> every effort is made to avoid the suggestion that the medical establishment is only self-interested and involved in the diffusion of innovations.

He explains that this is a countermeasure to much recent research on medical technology which has required a villain and doctors have presented such easy targets.

Nevertheless he does write of the importance to the prestige of doctors

> to be seen to be up-to-date, scientific and more professional (ibid, 381)

and that their uptake of technology may be for financial interest, especially for specialists

> trained to be dependent on certain practices and technologies; hence their continuing livelihood is to some extent contingent on the perpetuation of them. (ibid, 383)

Jennett (1983) sees that the uptake of certain technologies may be for both altruistic and selfish reasons, that is

> scientific interest or to improve patient care; but sometimes for the less worthy ones of maintaining prestige or keeping up with rival doctors or hospitals. (ibid, 196)

In his view conspicuous private consumption - like possessing a Rolls-Royce car is now replaced for doctors as a status symbol, by conspicuous public consumption. So to be seen to be developing and expanding high technology procedures

> signals success in the competition for scarce resources - between specialists, hospitals and individuals. (ibid, 27)

The importance of technological and scientific developments to the intra-professional conflicts and competitions - the vested interests of medicine - is thus a factor well worth studying in an effort to understand modern medical practice.

Mechanic (1975, 61), while accepting that medical technology has let to more specialised division of labour, warns that examination of specialties will reveal that

> their shape is as much a product of self interest as it is of the scientific elaboration of medicine.

It will be interesting to see if this statement can be verified.

SUMMARY

Once again the approach which appears to have the most relevance and the most explanatory power is the one which stresses interactionism. It is also the common-sense approach for the dual nature of technology as it changes society and is changed by society is apparent to all who are observant.

But there are dangers in this approach if one reifies either society or technology, for then the potent explanatory powers are lost. Detailed analysis is needed to determine which groups in society are involved and what ideas, assumptions, philosophies are behind the technologies. Nor is it enough to think of technologies as they are developed, the initiation of the innovation is also of importance.

In this respect, a minor theme of both Chapters 1 and 2 was the notion of heterogeneous and homogeneous groups. This theme I suggest has been developed in this chapter in reference to innovation and should therefore be developed within the substantive sections of the thesis. Other themes which will also be examined in these sections are those of the systems concept of technology and the importance of scientific and technological paradigms or exemplars.

The original hypothesis was that developments in science and technology have influenced the dynamics of medical specialisation. In light of the strong themes of fiduciary relationship, definition of patient-need and the vested interests of the doctors, I suggest that my concern should be to examine in detail how these developments have aided specific sets of practitioners in their intra-professional pursuits of both altruistic and selfish goals.

CHAPTER FOUR SYNTHESIS

INTRODUCTION

The review and analysis of the literature in the last three chapters had a two-fold purpose. Firstly, to become acquainted with the wide range and diversity of the work related to this complex topic and secondly to discover if there was a framework which could be used directly.

Though no immediately usable framework emerged, several themes of utility did, and these themes formed the basis for the analytic elements of the thesis which are described in this chapter.

Firstly the theme of the complex inter-relationship of society and technology stimulated me to develop maps to show not only the general relationship but more specifically the relationship between medicine, medical technology and society.

Secondly, the pervasiveness of the theme of the use of special knowledge for power and control caused me to search for details of this type of knowledge used by the medical profession. In general terms, we know, it has a high input from science and technology. But more specific details were needed, and thus I attempted to chart the recent developments in these fields. A chronological account was considered not to be of sociological use, and so I utilised the concept of manipulations as a basis for this charting.

Thirdly, from each of the first three chapters of the thesis, the potency of the ecological-interactionist approach was apparent, and though I was aware of the criticisms of this approach, i.e. the lack of attention to power and vested interests, I felt that it could form the basis of an analytical framework if I extended it and made the concept of territory central to it.

Finally a choice had to be made about the area to which this framework would be utilised for analysis. For a variety of reasons, which will be outlined later, I chose the area of reproductive medicine in which to examine the use of manipulations as resources in intra-professional conflicts - in specialisation.

Thus I could be said to be using within the general field of relationships between medicine, technology and society a complex two -dimensional matrix, the elements being:-

manipulations from scientific and technological developments and

the conceptual framework of territory used on the

specific area of reproductive medicine.

This matrix will enable me to analyse in detail an area of medicine and to explore the hypothesis that science and technology influences medical specialisation.

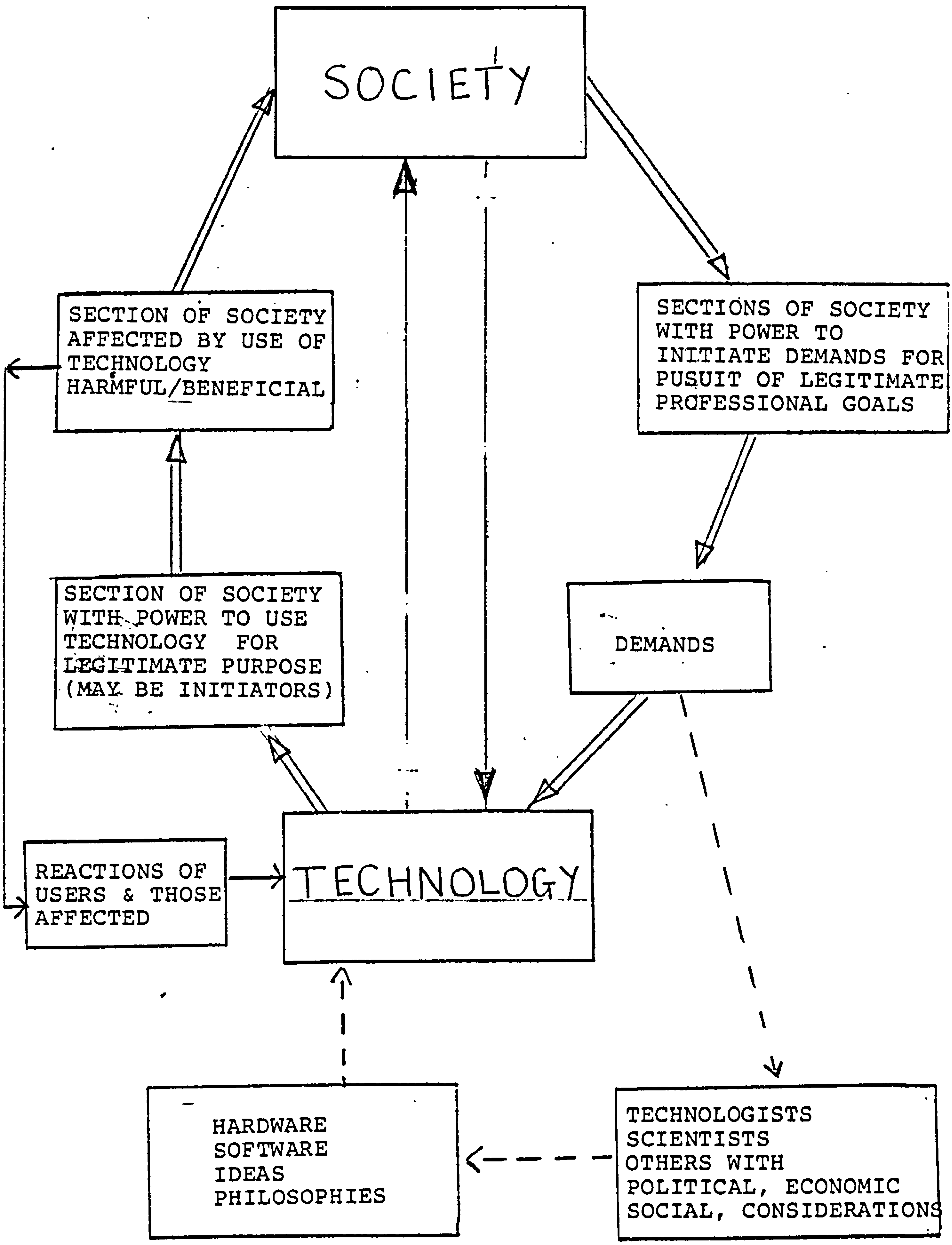
MAPS

Society shapes technology, and technology affects society. This technological interactionist approach I found most useful especially as it encouraged more detailing of meaning.

Sections of society with power - political, economic, professional, bureaucratic - I postulated could initiate demands for certain technologies in pursuit of their professional goals. The technology produced in response to these demands is of course shaped by earlier technologies, by technologists and scientists and by other social considerations, but the demand-led technology is there, with the hardware-software elements and the ideas and philosophies which encompass it. These powerful sections of society I also postulate, may initiate demands for vested interests which may be of a covert nature.

Technology may or may not be developed as a result of the demands above, but once developed it is then taken up by certain sections of society with power and mandate to use it for a legitimate purpose or for a covert goal. This use affects other sections of society on whom it may be used directly, or who are affected at second- hand, by its use which may be beneficial or harmful or both at the same time to different sections. The reaction of these less powerful people to the use by others of technology will also shape that technology, as will the reactions of the powerful users.

This rather complex description is clearer in map form - Map 1. The system it represents could be interpreted as a positive feedback or, more dynamically, as 'self-exciting'. 'Self-exciting' systems are divisible into 2 parts, which react on one another in such a way that changes to A cause changes to occur in B which then affects A and so on.


SOCIETY
SECTION OF SOCIETY AFFECTED BY USE OF TECHNOLOGY HARMFUL/BENEFICIAL
SECTIONS OF SOCIETY WITH POWER TO INITIATE DEMANDS FOR PUSUIT OF LEGITIMATE PROFESSIONAL GOALS
SECTION OF SOCIETY WITH POWER TO USE TECHNOLOGY FOR LEGITIMATE PURPOSE (MAY BE INITIATORS)
DEMANDS
REACTIONS OF USERS & THOSE AFFECTED
TECHNOLOGY
HARDWARE
SOFTWARE
IDEAS
PHILOSOPHIES
TECHNOLOGISTS
SCIENTISTS
OTHERS WITH
POLITICAL, ECONOMIC
SOCIAL, CONSIDERATIONS

This self-exciting system can perhaps be seen more clearly in the case of the medical profession.

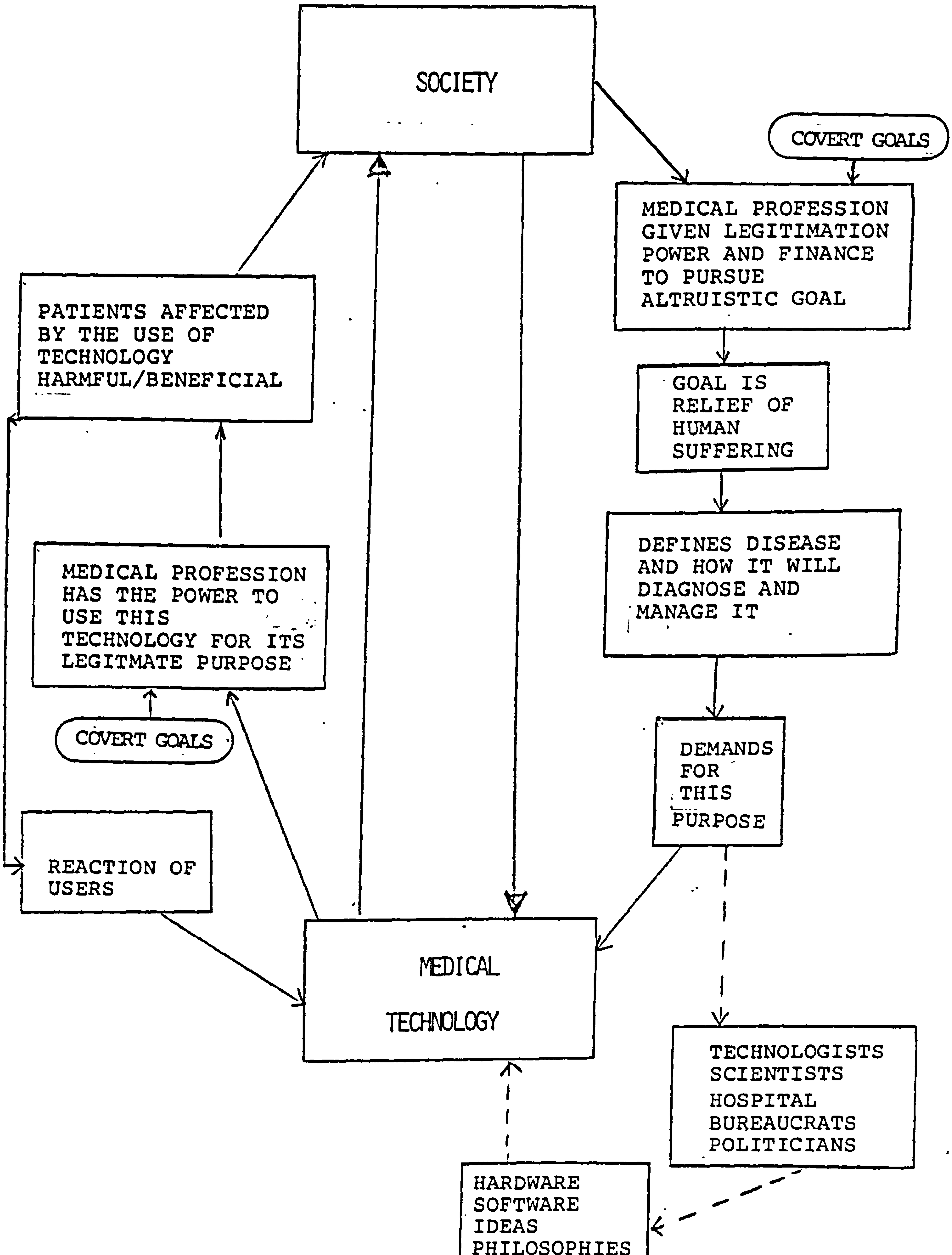
The medical profession's legitimate goal is the relief of suffering. In pursuit of this goal the profession may initiate technology or appropriate it from elsewhere and develop it for their use. Vested interest may also initiate, develop and use technology, but because of the autonomy and power of the profession, these manoeuvres may be difficult to challenge by other less powerful sections of society. A more detailed map, Map 2, shows these relationships.

MANIPULATIONS

Manipulations, I proposed, are essentially the things doctors do in their practice, like removing gall-bladders, implanting fertilised eggs, setting bones and using x-rays to diagnose tuberculosis. These manipulations may have their basis in physical, chemical or biological knowledge, ideas and techniques, and though initially these three areas were considered as possible themes for separate chapters, this idea was discarded as the following potentially more potent scheme was developed, which divided medical practice into two areas, diagnosis and treatment.

To elaborate on this framework one needs to ask, in detail what do doctors do, or say they do, and who sanctions it. The medical profession is given the mandate to determine entry into the profession, training of the entrants, and deciding what the current practice of medicine should be. They have autonomy, and authority

SOCIETY AND MEDICAL TECHNOLOGY MAP



not only over their own work, but also the work of other subordinate groups.

Their altruistic and more publicly visible goal is the relief of suffering in their clients, but other goals are advancement of their profession as a whole and more specifically with the advancement of their specialty. Finally individual doctors are concerned with their own position, career prospects and material and social status. Harmonising these goals is likely to produce conflicts. Some of these conflicts are to be explored later, but firstly the pursuit of the declared altruistic goals must be charted.

Members of the medical profession have the power to determine which manifestations of human suffering they will include, at any one time, within their practice, and to define and label them as diseases. They also have control of the diagnosis of these diseases and of the way they will be managed once diagnosed by themselves and by subordinates.

Diagnosis is very firmly under their control, as Carr-Saunders (1933, 105) expresses it

> the primary, most important and perhaps most difficult duty of the doctor is to diagnose.

In other professions, they point out there is relatively little diagnosis, the client takes the preliminary steps and decides what he wants and then comes to the professional for help, e.g.to a lawyer (in Scotland) if buying a house. Within the field of health care where doctors are dominant, part of their domination lies in their complete autonomy over diagnosis and therefore the development of better diagnostic techniques and philosophies is vital to them, in respect to their control of other workers, and in intra-professional rivalry.

What are the important elements in diagnosis and how do science and technology affect them? This question will be considered in detail in Section II Chapter 5.

After diagnosis, decisions about prognosis and management must be made. Management is the current term for what had been known previously as treatment. Its use is an efort to incorporate both care and cure and also, and perhaps more importantly, to indicate that others, i.e. not doctors, are concerned in this procedure and have within it a limited amount of control.

In what may be seen as a retrograde step, I prefer to use the term treatment for I am concerned primarily with the medical profession and wish to highlight this. Thus, Chapter 6 will chart the influence of science and technology on treatment,

Within Section II, I will in essence chart in a broad general, though not just chronological, way the major developments in science and technology which have affected medicine over the last fifty or so years. According to Norton writing in 1969, this was seen as a "herculean task", how much more so now in the 1980s.

Although I am well aware of the possibility, indeed the desirability, of approaching this task with the stages of the diffusion of innovation in mind, I have not structured this section around this topic. I will, however, be concerned to highlight certain obvious stages in a development, but will use my own scheme which is a distillation of the large body of literature already reviewed in Chapter 3. One of my criticisms of the work in this area, as I have previously detailed, is the lack of emphasis on the initial idea, invention or innovation. In the scheme for medicine outlined in Map 3, based on my review of the relevant literature, I have attempted to redress this lack by separating out the initial innovation from its subsequent development.

SPECIALTIES

Before describing in detail the development of the analytical framework used in Section III of the thesis, it is useful to look in a little more detail into the idea of medical specialties. The medical profession is a consulting profession; it has clients who consult it for the relief of suffering. Therefore it is feasible to postulate that clients are very important, even vital, to the profession. Within the institutionalised setting of the hospital, not only are patients important, but patient-beds have paramountcy in the status of the groups of doctors who have control over certain areas of medicine.

The particular areas into which medicine is formally divided are known as specialties, but these are rather difficult to define in medical practice. Stevens (1966, 39) found that without the formal specialty boards of the USA, it was difficult to define specialties in England, "the definition of specialist remained ambiguous". For the purpose of this thesis I have included specialties formally used in the official literature, i.e. for Scotland, Scottish Health Statistics HMSO: for England, Health & Personal Social Services Statistics for


GENERATION WITHIN MEDICINE
APPROPRIATION FROM ELSEWHERE
SCIENCE
TECHNOLOGY
OTHER
DEMAND FROM PROFESSION
INNOVATION IN MEDICINE
DEMAND FROM PROFESSION
DEVELOPMENT OF INNOVATION
STABILITY
REPLACEMENT BY SOMETHING BETTER
REJECTION
DECLINE
TRANSLATION INTO MEDICAL SETTING
USED IN SMALL EXPERIMENTAL WAY
ADMINISTRATIVE INPUT
ADOPTED BY SPECIALTY
ASSESSMENT OF INNOVATION

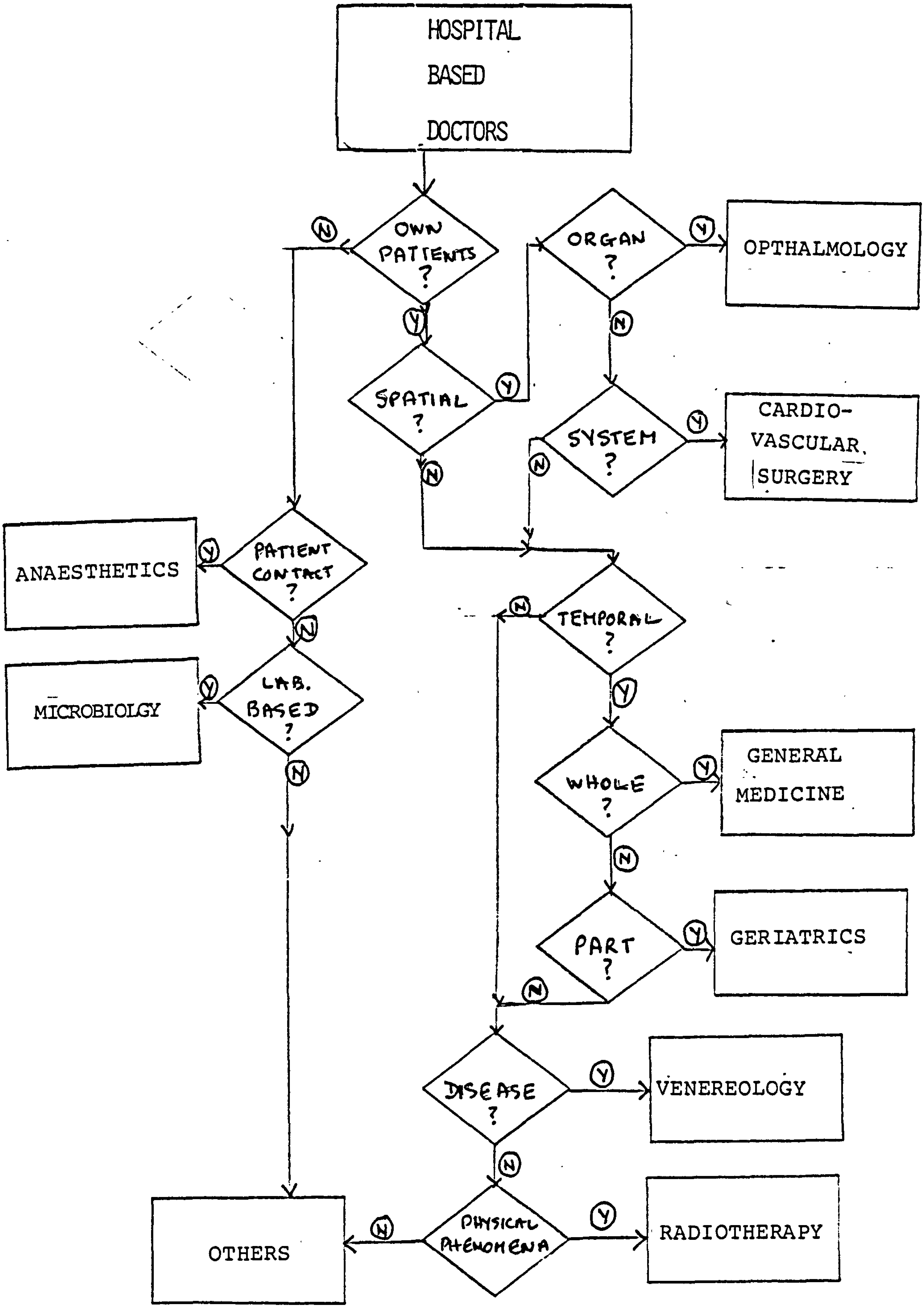
England HMSO. Sub-specialties cause a problem for they are nowhere explicitly defined. I have in the main used the names I have found in the formal literature.

As indicated in Chapter 2, specialisation in medicine is not new, what is thought to be different from more distant times is the input, into this division of labour, of developments in science and technology. Specialisation has increased and is increasing and it is instructive to ask are there criteria for differentiation which would help to produce, not a classification of specialties, but a map to act as a guide?

Map 4 is suggested as having possible utility. What it cannot show, ever, is the changes which take place over time, for specialties are not static, they flourish and die, or undergo drastic change. There is not a static view of organs or systems, or development or function; technology changes as does disease formulation. Nevertheless, despite this processual aspect, it is useful as a heuristic device to postulate that there are these defining criteria.

Classification of Specialties

Defining Criteria	Example
A. OWN PATIENTS	
1. Spatial	
a. Organ	Ophthalmology
b. System	Obstetrics & Gynaecology
2. Temporal	
a. Whole Development	General Medicine
b. Part of Development	Paediatrics


HOSPITAL BASED DOCTORS
OWN PATIENTS ?
N
Y
SPATIAL ?
Y
N
ORGAN ?
Y
OPTHALMOLOGY
N
SYSTEM ?
Y
CARDIO-VASCULAR SURGERY
N
PATIENT CONTACT ?
Y
ANAESTHETICS
N
LAB. BASED ?
Y
MICROBIOLGY
N
TEMPORAL ?
N
Y
WHOLE ?
Y
GENERAL MEDICINE
N
PART ?
Y
GERIATRICS
N
DISEASE ?
Y
VENEREOLOGY
N
PHYSICAL PHENOMENA
Y
RADIOTHERAPY
N
OTHERS

	Defining Criteria	Example
3.	Disease	Venereology
4.	Physical Phenomena	Radiotherapy
	B. SERVICE (NOT OWN PATIENT)	
1.	Function (PATIENT CONTACT)	Anaesthetics
2.	Laboratory based (NO PATIENT CONTACT)	Microbiology

ANALYTICAL FRAMEWORK

Although there are many factors which influence the development of medical specialisation, I am concerned to isolate for the purpose of analysis one factor - or one set of factors. This is not to say that I do not recognise the importance of the other factors - I do, and have already discussed them in Chapter 2. But by studying the influences of science and technology I am responding both to my own interests and skills, and to what can be seen as a growing interest in this area.

To explore these influences on specialties, I needed another framework. The ecological-interactionist approach was a useful base, as was the work of Bucher and Strauss and their concept of segments. I did not use the term segment, however, as I felt it was used by them in a very broad sense in large areas with several specialties, and yet concurrently in a very narrow sense i.e. sub-specialties. I preferred to use the concept of territory as the area over which individual specialties have control. The richness of metaphor which surrounds this territorial concept was also seen as important and some of it was incorporated into the framework.

The term - territory - has appeared in sociological papers and it is sometimes used by medical practitioners when describing their specialties. A far as I can determine, however, it has not been intensively or systematically utilised in medical sociology.

Writers who have used the terms of territory and other related terms have come from a wide variety of interests. Brown (1973;435) used the term when stating that medicine for profit inevitably leads to conflict over occupational territories, but she does not develop this idea. Carboni (1979,107) writes that by the very nature of a newly developing specialty, its task environment is "disputed territory" - this he goes on to describe as a dispute with an established group which has traditionally claimed this task environment as its "domain". Lennon (1952,679), an obstetrician, warned in forceful language against invasion of the specialty by paediatricians and against further "loss of territory", whilst Gaisford (1952,665) a paediatrician, claimed that the mother is in a "no-man's land" between the obstetrician and the health visitor.

Other workers have also used territorial terms like invasion, boundaries, colonisation etc. Forwell (1976,7) warns of effort wasted on boundary disputes, while Minuchin, (1974,53) a family therapist, writes that the function of boundaries is to protect the differentiation of the system and define the rules of participation. Bucher and Strauss use many terms which imply territory, but do not use the term specifically. They do, however, use the term boundary when writing about segments with unique missions. Strong (1978,24) uses the term colonisation with reference to the failed medicalisation of masturbation and neurasthenia. Finally Pettigrew (1973), writing not about medicine but industrial specialisation, has a rich flow of territorial metaphor, boundary testing activities, defensive reactions, expansionist groups; all most useful and thought provoking concepts.

The use of the concept of territory is not new in sociology, nor are the biological terms which follow its use. Park, (1967) and his students in Chicago in the 1920s deliberately took from biology, key terms of invasion, succession, natural areas, symbiosis, competition equilibria and tried to build a basic distinction between "biotic" and "cultural" levels of analysis when trying to explain the various developmental patterns of a modern city.

The precedent of using non-sociological concepts may be attributable to other workers, but it was a characteristic feature of the writings of Durkheim.

Writing about Durkheim's insistence on the ultimate priority of functions over structure, Traugott (1978,3) quotes passages from Durkheim's text to show his "ecological" perceptions of society. These passages are well worth quoting for they indicate that by using biological analogies new ideas are formed. Durkheim said that the

> mind cannot create a new idea out of nothing; analogy is a precious instrument for knowledge;

Most importantly he said that

> for the sociologist, biology has become a veritable treasure trove of perspectives and hypotheses which, whilst he has no right to PILLAGE, he may wisely exploit. (Traugoff 1978, 56)

Durkheim agreed with Schaeffle that sociology could learn from the more mature natural sciences without yielding to the temptation to appropriate their models wholesale. In criticism of Spencer's concept of society as an organism, he warns that an idea loses some of its value if taken too literally, but can be very fertile in judicious application.

Apart from a brief resurgence in the 1960s, human ecology, for such it can be called, lay moribund until the works of Wilson, Tinbergen and others revived it, with an input from ethological writings. The ideas from these writers helped to stimulate the use of territory as a useful tool and therefore it is worthwhile presenting some of them at this point. Wilson (1978,294) states quite categorically that most human societies most of the time are territorial, while Tinbergen (1978,84) writes of the division of space and opportunity amongst species and the defence of territory against invaders, members of the group uniting when there is hostile confrontation. Van de Berge (1978,50-55) looks at "man" in society from a biosocial view, and believes that social scientists have paid scant attention to territoriality, which he says is not limited to the national level, but appears in all levels of social organisation; without the concept much of human behaviour becomes incomprehensible. Further he believes that territoriality is a method of establishing rights to resources, so that there is a compulsion upon the occupants to defend their territory when attacked, and to maintain boundaries between competing groups.

Similarly ideas from the part of catastrophe theory concerned with territory have been useful. Woodcock and Davis (1978,107,110) describe territorial behaviour as a determinant of geographical (ie spatial) distribution of different species and write that no two species can co-exist if they make the same demands on the environment. They also show that patterns of territoriality depend both on resources available and on the cost of defending these resources in terms of energy to deter or fight off competitors. Finally they use the term "pendulum fighting" where there is competition between "owners" of adjacent territory, when the transitions from attack to defence do not take place at the boundary, but in a band of territory extending to some distance at either side.

The Territorial Model as a Conceptual Framework

Stimulated not only by the use of these ideas, but by the sociological tradition of their use, and also because my own biological background gave me an understanding of their potential, I developed the following territorial framework for the analysis of medical specialties. Though I was well aware that this is not an original move, I believe that I have extended its application further and made it more central to my analysis than have any previous workers known to me. More than a heuristic device, it has proved very satisfactory interpretatively; and it has been especially valuable as I have failed to find elsewhere any other suitable and consistent framework of analysis. This framework had the advantage of allowing the dynamics of power relationships to be studied. Arguments which balance power and technical reasons for control are powerful and worthy of study. Of particular influence was the three dimensional power model of Lukes (1974,21) which was designed to look at latent conflict where there was a contradiction between interests of those exercising power and the real interest of those they excluded.

An area over which practitioners of a given medical specialism have control will be defined as their territory, with more or less definite boundaries. The territory will be organised around the criteria already mentioned in the map of specialties, ie own patients, spatial, developmental, disease, physical phenomena, service with laboratory or function base with patient contact. Metaphors associated with territory will be used with their ordinary meanings, eg gain or loss of territory, consolidation, fragmentation, invasion, defence, colonisation of new territory, amalgamation, challenge to boundaries, redefinition of boundaries and the like.

Organising these ideas into a formalised structure proved stimulating and the following provisional framework was derived for the analysis of specialisation.

Gain of Territory

Territory can be gained by various strategies to form a new specialty or expand a previously formed one. The strategies - all expansionist are

1) Breaking away from another specialty - a larger specialty for which there is difficulty in formulating precise and defendable boundaries.

2) Invasion of another specialty, using manoeuvres that show superior claim to the territory.

3) Colonisation of a new area previously claimed by no established

specialty.

4) <u>Amalgamation</u> by the coming together of two already established specialties, giving more control and surety to each area held.

<u>Consolidation of Territory</u>

Once a specialty is formed, or an established specialty has gained new territory, it is unlikely that the pressures by others will lessen and thus it is postulated that measures must be taken to consolidate this territory. These measures are

1) <u>Definition</u>

Definition of the actual territory claimed, what it is and why do claiming specialists feel they have legitimate right to control. The defining criteria of specialisation as shown in Map 4 are important here. Is the territory spatially based (i.e. around a part of the body) or temporally based (i.e. around stages of the life cycle)? These criteria have import with reference to the defendability of a territory.

2) <u>Increase in Knowledge Base</u>

Specialised knowledge - unique knowledge must be held by the practitioners who wish to consolidate their claim to the territory. This knowledge comes from a variety of sources, these include research, use of specific techniques, design of new hardware, new disease formulation. The exclusivity of these measures is important and is connected with the third strategy described next.

3) Definition of Boundaries

Strong and firm boundaries to a territory prevent encroachment by others. The way the boundaries are defined are dependent on the defining criterion of the specialty. If spatial, the boundaries are easier to define (eg the eye for ophthalmology, the cardio-vascular system for cardiology). A temporal criterion makes problems of boundary definition, eg when does a person become old and the concern of the territory of geriatrics?

4) Control of Patients

It is important for clinical specialists to have patients directly under their control, and with patient beds in hospital. Specialties which do not have their own patients, but act in a service capacity, will continually negotiate to gain patients from other specialties or to create new patients by problematisation and medicalisation.

5) Formulation of Disease Concepts

Strategies to increase control of present patients or to create new patients are very important. Within the control of the profession are the strategies of disease formulation, which includes medicalisation. The input of science and technology will be more clearly seen here.

Response to Challenge

The response to challenge will be varied depending on the stage of development of the specialty, and will include these strategies already described. If territory is lost in one direction, moves to gain other territory will be set in motion and boundary definitions will change.

Fragmentation

When a specialty has a defining criterion which is not spatial, there is an instability inherent within it, for it is less easily defended from encroachment. Sub-specialties may form, or the specialty may disappear altogether.

Redefinition

Certain parts of a territory may become less interesting or attractive to the specialists and whilst they do not wish to lose this part to other specialties they utilise a manoeuvre which still gives them control. By routinisation the para-medicals will look after the particular piece though overall the final control is held by the specialist.

SPECIFIC AREA OF STUDY

The first stage of the substantive part of this thesis, (Section II), which will look at medical developments in diagnosis and treatment, provides a broad view of all specialties. To focus on a smaller area was thought desirable when studying the use of these developments in an intra-professional setting, for as Freidson (1970; xi) explained, sociological analysis of occupational organisation should, in his view, attend as closely to empirical data as to conceptual clarity. Most of the copious literature he said, was unfortunately very general.

The area chosen for analysis was that of reproductive medicine. A variety of reasons guided this choice.

Firstly, it is of contemporary interest to many groups, both professional and public. Pregnant women, infertile women and men, administrators, politicians, scientists, technologist, churchpeople and a variety of special interest groups all have strong views about the recent developments in this area.

Secondly, the medical practitioners within it appear to utilise the whole range of manipulations available, physical, chemical and biological. Bonner (1982, i) makes the following remarks about obstetricians.

> These doctors seek not only the most up-to-date scientific knowledge but also its application in their individual clinical practice. The 1970s witnessed an explosion of applied technology in obstetrics and gynaecology.

Titmus had earlier predicted the impact the biological sciences would have on developments within medicine; and within reproductive medicine, biological manipulations play a very important part. As a person with biological training I was particularly interested in this aspect, especially as I could see that the pace of innovations was very fast indeed, with science fiction dreams becoming reality in too short a time for general public awareness of their implications. Medicine, indeed in this area did touch all aspects of life, birth, reproduction and death.

There is a variation in the uptake of innovations in medicine, some specialties being more inclined than others. There is also a variation in the willingness of specialties to undergo proper evaluation according to McKinlay (1981, 376). He describes the awarding by Cochrane of the metaphorical "wooden spoon" to obstetrics and gynaecology because of that specialty's lack of use of random controlled trials. This criticism was of great interest and I was anxious to explore and possibly suggest explanations for this apparent state of affairs.

The third reason is that a preliminary investigation, subsequently confirmed by more detailed analysis, revealed a great deal of conflict, controversy and changing of groupings, with obstetrics as a dominant specialty. Obstetricians, according to Donnison (1977) had long been involved in battles over their practice, and she comments that their espousal of certain techniques were regarded by some observers as

> efforts by the obstetrician to elevate and widen his role. (ibid, 196)

Chalmers (1977, 44) suggests that the active incorporation of biochemistry and electronics into their specialty achieved for the obstetricians the "scientific respectability" previously denied them. Oakley (1982a, 669) believes that certain developments in antenatal care

> provided a platform for professional aggrandisement on the part of the obstetricians (and aggrandisement provided a motive for research and technical development).

In such a changing area, one group of specialists cannot expand without causing conflict with related specialists. Within this area there is one process of great import - that of birth. Manoeuvres to control birth, decisions about the importance of it as a boundary, positive control of the developmental area on either side of it, were all bound to bring additional conflict between competing practitioners. I could detect moves to form new specialties or sub-specialties utilising the resources of recent scientific and technological developments which would challenge older more established ones. These recent developments, especially those connected with infertility and with genetic handicap, might, I believe, have implications for the molecular concept of medicine.

I was also aware, fourthly, that challenges were coming not only from the subordinate occupations like midwifery, but from lay groups, especially those connected with women. For women are the main clients of this area, either as patients, mothers of patients, partners of infertile men, potential mothers, bearers of defective children. Although women make up about 52% of the adult population, it is still suggested that doctors should view their illnesses as mediated by their state of being a woman. Medicine is male oriented in many ways, and the model of the human being, for what might be called normal medicine, is definitely male.

Specifically, I was interested in the conflict about the medicalisation of pregnancy and of childbirth and in the concepts of normality and abnormality laid down by the doctors with reference to these processes.

My fifth reason was that at least two of the specialties involved, obstetrics and paediatrics, had not one, but two patients;

the mother and her unborn baby in one case and the child and the family in the other. I was interested in the position of these patients as central objects of concern.

My final reason was that for over three years I was a member of a committee looking into the ethics of reproductive medicine, and thus became very involved in discussion of the issues involved.

In this study I have used a broad interpretation of reproductive medicine. The immediate product of reproduction, the neonate and also the child are included, for I felt that the topic could not be fully understood unless they were considered.

In practical terms, the specialty of obstetrics and gynaecology, which features very prominently in this section, presented problems; for its practice is very wide, embracing as it does so many aspects of women's reproductive system. Because I have been principally, though not exclusively, concerned with the obstetrical side of this specialty, I have used in the main the terms "obstetricians" and "obstetrics" even when discussing infertility and pre-conceptual care (more correctly preconceptional care - Oakley, 1984; 291).

The main established specialties in reproductive medicine I considered to be obstetrics (and gynaecology), paediatrics and medical genetics. This section is not, however, divided up into chapters specifically along specialty divisions, but along territorial conflicts.

METHODOLOGY

My exploration of the influence of science and technology on the dynamics of medical specialisation used three main sources of knowledge, which included medical and non-medical material.

a) Formal professional literature and documents.

b) Semi-structured interviews.

c) Seminars, lectures, conferences, discussion groups.

The reasons for the reliance on these three sources and their usefulness to the research are as follows.

A pilot study indicated that the type of access to the medical profession, which I required, would be problematic. Even with my scientific background it was difficult to establish the necessary contacts with powerful groups of specialists, and when contacts were established there was a reluctance to speak of the rivalries between, and encroachment of, other specialties. Because of these difficulties, it was decided not to attempt either an extensive personally conducted survey or a postal questionnaire, for it would have been almost impossible to explore the areas of conflict with a structured fixed format technique.

Having considered these possibilities, I was driven back to the three main sources described, which had the following advantages:

Formal Professional Literature and Documents

This is the medium where people argue out professional issues, and enable one to identify and to get a view of their central objects of concern. The structure and form gives an indication of what counts as knowledge for professional viability, and the contents are central to the expressed formalised concern of the professionals.

Semi-structured Interviews

These were conducted over a period of eight years and were with people who were interested in my research. They came from a wide variety of backgrounds and were in the main frank and forthcoming, and their comments were very helpful to the overall structure of the thesis. There were problems, however, and a certain unwillingness to talk about controversial issues. Because of this, these interviews - with about 35 people listed separately at the end of the bibliography as well as within it - were only of limited use for the substantive part of the thesis. Four people were willing to be more frank if I did not quote them specifically; they were 2 obstetricians and 2 senior midwives.

Seminars, Lectures, Conferences, Discussion Groups

These were most useful, extending as they did the professional knowledge and concerns. Especially valuable was the opportunity not only to ask specific questions, but to hear the other questions asked and the answers given, and also because of my scientific training to have brief discussions afterwards with the speakers and contributors.

As with any exploratory study that does not follow an established tradition of research, it is very difficult to produce a highly refined and sophisticated methodology. This thesis is designed to explore a broadproposition rather than test in any rigorous way highly specified relationships.

As the work progressed and I focussed on reproductive medicine, I became centrally concerned with the processes of differentiation, and this led to the development of a study, which was partly historical in style, as I sought to examine the recent history of medical practice and the developments of technology within it.

This thesis combines an analytical approach with a descriptive base.

SECTION II MANIPULATIONS

INTRODUCTION

The practice of the professions is based on specialised knowledge and that of medicine is no exception. Medical knowledge comes from a wide variety of sources and has a multiplicity of forms. This section is concerned to trace the way medical knowledge, and the practice dependent on it, have been affected by developments in science and technology.

It is therefore about the public face of medicine, the open and chartable face, the altruistic side of the profession. Doctors see as their legitimate goal, the relief of suffering in their patients. In pursuit of this and in seeking to determine what suffering is appropriate to their ministrations, doctors are continually seeking new tools and techniques. These come from a variety of sources; they may be demand-led, serendipitous, taken with adaption from other disciplines, or the result of a long formal search.

Medicine is an ancient profession and retains many aspects from a previous age. But in the last 50 years there has been a great and unprecedented increase in sophisticated, complex, costly technology introduced into, and widely used by, medical practice.

Accompanying this increase in technology there has been the continuation of a distinct change in disease patterns as chronic diseases have in the main replaced infectious diseases. This change is of course reflected not only in the practice of medicine but in the demands doctors make for increased means to cope with the change.

Changes have also taken place in people's expectations and this has affected medical practice also. On the one hand doctors have been able to become increasingly and intimately involved in the basic aspects of life, like conception, in response to the demands, the needs of certain groups of people. Yet on the other hand they have been challenged over aspects of their practice by individuals and groups who are unwilling to accept their dominant view of the body and its functions. So paradoxically, as doctors become more and more involved in defining normality and hence abnormality, they are increasingly challenged on their definitions.

Detection of departures from defined states of normality, i.e. diagnosis, has always been a central and paramount part of medical practice and the changing patterns of disease highlighted above have further increased this paramountcy. Chapter 5, the first chapter of this section, is concerned with diagnosis and the elements contained within it.

Treatment to restore as near normality as possible,has a long tradition in human culture and it is one that has not always been dominated by the medical profession. Increasingly, however, doctors have gained control not only of treatment but of others - who are now mainly subordinates - concerned with treatment. Chapter 6 describes the changes in treatment mediated by developments in science and technology.

The extension of the human senses and functions by various technical means is an important part of human culture. Many of these extensions in modern times are either hidden from ordinary view or are so commonplace as to be accepted as normal and unproblematic. But within the medical practice these extensions are clearly visible. Lately, as the technical means have become increasingly complex and intrusive they are increasingly and patently visible to patients and public alike. Examples of extension of senses and their role in diagnosis and treatment will be given in the two chapters of this section.

In essence this section, though basically descriptive in nature, forms the baseline for Section III. For prior to looking at the part played in the interaction of medical specialists, it is desirable to have an idea of the general background of change; to know about the tools, the techniques and indeed the philosophies which have shaped the profession in the last 50 years.

Philosophies and ideas are critically important in this shaping and at the end of this section some comments will be made about the formation of disease categories and the role of the medical profession in the interpretation of the needs of the public, for in essence all the members of the public are potential, if not actual, clients.

Throughout I have endeavoured to look at the altruistic goals and have not considered the notions of vested interests of doctors or their intra-professional rivalry. Though there are hints and intimations of hidden battles, these are not the subject of this section. Their significance, however, will be one of the main themes in Section III.

CHAPTER FIVE DIAGNOSIS

DETECTION OF DEPARTURE FROM NORMALITY

INTRODUCTION

Diagnosis, the detection of departure from normality, is one of the most basic functions of medical practice. In fact it could be said to be the initiator of the doctors' professional life - the starting point of the system - for without control over diagnosis there would be no dominant medical profession.

Within the procedures of diagnosis, the extension of the senses is very important indeed. All the senses are involved in this extension process, though some are more involved than others. Extension of the sense of sight is paramount for the the process of imaging is vital. The phenomenon which represents a departure from normal must be imaged, i.e. it must be "seen", and this generally and preferentially involves sight or its extension.

After the phenomenon is imaged it can then be measured, and within this process concepts of normality and hence of abnormality can be developed. Measurements can then be turned into monitoring with the setting of parameters to determine points of intervention. Finally in this system of inter-related manipulations and concepts, evaluation will determine prognosis and the course of treatment thought to be appropriate.

This chapter describes this system and the growth in the elements of it as they have been affected by scientific and technological developments.

Introduction

Whilst it is not intended that this chapter should deal at all extensively with developments prior to the 1930s it is worthwhile indicating some of the developments of earlier days where the pattern was set for the extension of the human senses.

The invention of the stethoscope by the French physician, Laennec in 1816 was dramatic in that it allowed the physician to "view" inside the chest of a living patient. The very name derives from the Greek words for "chest" and "I view". The possible detection of pathological lesions by sound is extended in modern medicine by the development of phonocardiology and ultrasonic echo-recording in obstetrics. The stethoscope also had the advantage for the doctors, in that they could adopt a more dignified position during examination, and that they were physically distant from the patient and therefore more in control.

In 1850 the German physician and scientist, von Helmholtz, invented the ophthalmoscope, a device for seeing inside the eye. The larynx was the next internal organ to be examined due to the development in 1857 of the laryngoscope by the Polish physiologist Czermak. These three instruments are still in regular diagnostic use in contemporary medical practice, and represent the stage of stability outlined in the introduction.

The benefits the laryngoscope and the ophthalmoscope conferred on the medical practice of the middle 19th century, stimulated the development of devices to explore the body cavities visually through natural anatomical channels. "Seeing was believing" was the cry of the day at that time. (Reiser, 1978, 56)

Although photography was not widely used in clinical medicine in the 1890s, the experience which many physicians had of the process, as well as the value placed on the visual representation of pathology, made possible the acceptance of that "transcendent instrument of visualisation in medicine", i.e. x-rays. (ibid, 58)

The development of the use of x-rays for diagnostic purposes via the specialty of radiodiagnosis and for the treatment of disease via radiotherapy will be discussed later. It is, however, important to note that the acceptance of these powerful and dangerous physical forces made it possible for the later introduction of other physical and potentially dangerous forces of ultrasonics, laser beams and nuclear radiation.

X-rays

In 1895 Roentgen, the physicist, discovered that by using a Crookes tube (an easily available piece of research equipment) and a fluorescent screen, he was able to detect rays which would pass through solid objects. He was able to take photographs of his wife's hand showing the bone structure strongly contrasted with the feeble shadow of the surrounding soft tissues.

This discovery was sensational, the public was fascinated by it. Society women in New York had x-rays taken of their hands covered in their favourite jewellery to show "that beauty is of the bone and not altogether of the flesh". (ibid, 60)

It was immediately recognised by the medical and scientific communities, however, that x-rays were an important discovery, for they obliterated distinction between the outer and inner spaces of the body - both were now susceptible to visual examination. Images of broken bones, foreign objects within the body and kidney stones could be produced, as well as organs in motion.

Edison, describing his role in x-ray technology as he sought to take the innovation into the next stages of development, said

> (Roentgen) needs men like myself, whose chief aim is to turn the great discoveries of science to practical use, and adapt them so that the world will receive the benefit of them. (Reiser, 1978, 60)

He attempted to photograph the human brain but was not successful, for the skull bones were too thick for the weak rays generated by the tube of the day. Subsequent history of the development of x-rays was concerned with improving the quality of the image, by stronger sources of the rays and better screens for imaging, and stimulated by the awareness of their potentially dangerous nature, a move to reduce the dosage.

During the Second World War detailed reconnaissance photographs were needed, and research in this field led to the development of image intensifiers. Using this development, screens could be used in an ordinary room at ordinary light level, no adaption was necessary for the observer and the patient was more comfortable. This ability to intensify the image produced by x-rays led to reduction in patient dosage. As screening programs for tuberculosis had until this development required high dosages, image intensification was a great advance and made regular screening more possible and less hazardous (Rapson 1977, per).

A bonus from the US space probe project was the development of rare-earth screens. These screens gave increased definition with the subsequent further reduction in patient dosage. The screens are good though costly, but nevertheless are finding their way into medical practice. Another recent development is an image storer, where the x-ray equipment can be switched off, but the image is retained for the physician to examine.

X-ray techniques made it possible to determine not only the construction of the body, but to image devices or radioopaque substances deliberately introduced into the body. Prominent amongst these devices was the catheter and this was especially so in the study of the heart.

The early history of cardiac catheterisation, and the conservative attitudes which greeted this technique is worth recording in detail as described by Forssmann (1972) and McMichael, (1978, foreword) for it shows the early stages of the diffusion of an innovation.

Dr Werner Forssmann, a hospital resident in Ekersward near Berlin, was concerned that the standard methods of the time for cardiac diagnosis were unreliable, dependent as they were on the sensory organs of the examiner. Time and time again, he reported, clinical diagnosis differed inexcusably from the post-mortem findings.

This was, he wrote, (1972, 81) frustrating for all who dreamed of efficient heart surgery. One way of meeting this need which was expressed by himself and his colleagues, was to find a non-surgical way into the heart to "see" its workings. He conceived the idea in 1919 that it would be safer to inject adrenalin through a catheter passed via an arm vein into the heart, instead of attempting heroic intracardial injections during anaesthetic emergencies, and that this procedure would allow the view he sought. In an effort to prove its safety to sceptical colleagues he asked a fellow resident to undertake this procedure on himself, ie on Dr Forssmann. The catheter was passed as far as the axilla when the associate took fright, but Forssmann himself walked to the radiological department and with the radiographer holding a mirror in front of the screen he completed the procedure and took pictures of the catheter in his own right atrium. No harm resulted from this experiment so he made several further efforts, including the injection of concentrated sodium iodide to obtain rather faint angiograms of the right heart and pulmonary vessels.

He catheterised his own heart, nine times, but by then he had "used up" all his available superficial veins. When he contacted Professor Sauerbruch, a leading surgeon in Berlin, to ascertain if his technique of cardiac catheterisation could be used in the cardiac surgical clinic, he was told that they "ran a clinic not a circus". The innovation was not acceptable to the establishment of German surgery.

By the outbreak of war in 1939 there were on record no less than 110 occasions in which intracardiac catheterisation had been done "without trouble to the patient or any recognisable harm" (McMichael, 1978, foreword). As the war progressed it became obvious that it was vital to investigate the nature of cardiac wound shock. The study of cardiac output and the use of cardiac catheters became necessary, and whilst it is not appropriate here to detail the development of cardiac catheterisation it is worth noting three events.

Firstly, that there was a reluctance by the radiologists to be involved in this work - it took a little while to persuade them to co-operate. Secondly, although the Wound Shock Committee considered that the investigation was important, when asked for their blessing to recruit volunteers their reaction was that no committee could give permission for such an unorthodox procedure. But they had no objection to a personal approach by the investigators to the Friends Ambulance Unit seeking volunteers from their number. The approach was successful, volunteers were found, and as the war continued, little persuasion was needed to convince them as they felt that they were contributing to the war effort by helping in this research,

Introduction into the body of radio-opaque substances like barium sulphate made it possible not only to image defects in, and intrusions into, the digestive system, eg placid ulcers and carcinomata, but suitable intravascular materials could also image the circulation of blood in the brain; in the placenta by aminography, localisation of clots in the heart; intravenous pylography is a recent introduction to diagnostic radiology.

The ultimate in imaging by x-rays, was the development of the computerised tomography scanner in which the computer reconstructs for display a cross-section of the human body scanned by x-rays, called "The greatest advance in clinical radiology since the discovery of x-rays" (Pocock 1977, 20) it represents for many the ultimate in medical technology for its sophistication and its expense. The inventor, Dr G Hamsfield, a mathematician, used complex and sophisticated mathematics in the development of the tomoscanner, it was not a piece of serendipity. The value in diagnosis of this imaging device has been doubted by some and the expense of this often-quoted example of high technology has been criticised. The medical profession, however, has been able to persuade sections of the public that it is vital for the community, and fund-raising for purchase is a common occurrence.

Other Devices

Remote signal transmission is another highly 'physical' approach to medical investigation, when using techniques from radio telemetry, small radio "pills" were developed. These pills contain a small transmitter, when swallowed information can be relayed about changes in pressure of pH from the gastro-intestinal tract.

The stimulus of World War II and its aftermath led to the utilisation of another physical phenomenon, in both diagnosis and treatment. In atomic physics and nuclear fusion, sophisticated measuring devices were developed and many scientists and technologists worked in these fields supported by a large input of money. The increased knowledge of nuclear physics was felt by many not to be wholly destructive, but to offer new possibilities to apply physical methods to the treatment of disease. Consequently research in this field became one of the Medical Research Council's most important preoccupations in the immediate post war period. This was part of a very definite move after World War II and the nuclear bombing of Japan, to involve nuclear physicists in Britain and the USA in development of peaceful uses of atomic energy. It also recognised that there was a large number of scientists and technologists available with their equipment and knowledge.

The most important aspect of this thrust, as far as imaging was concerned, was the use of radio-active isotopes of various chemical elements in the elucidation of biological function and the detection of tumours. The development of the cyclotron was, of course, invaluable in the production of artificial radio-active isotopes. The introduction of liquid isotopes has eased the work of the clinician but has increased the problems of the hospital physicist according to Sayers (1975, 12), who also indicates the rapid rise in the use of radio-active materials has meant that there are now departments of nuclear medicine in which consultants trained in the procedures work alongside physicists in multi-disciplinary teams, very reminiscent of Bucher and Strauss's concept of segments crossing professional boundaries, The replacement of the Geiger counter by the more sensitive scintillation counter led to the rapid development of isotope techniques, as smaller amounts of isotope could be used and samples investigated containing more than one isotope.

Many of the techniques described above are invasive techniques and therefore potentially dangerous, other imaging techniques were sought which were not invasive. Two excellent examples of non-invasive techniques (not necessarily, however, non-harmful to the patient) are those using ultrasound and those using thermography.

Ultrasound

The concept of ultrasonic vibrations, ie very high frequency sound, was used to develop under water scanning devices to detect the hulls of sunken ships and other submerged items, shortly after the loss of the "Titanic" in 1912. Further development took place during World War II, especially in relation to submarine detection, and the expertise gained and the equipment made during this time was invaluable to the application of pulse-echo ultrasound to biology and to medicine. In 1949 Wild showed that different echoes could be obtained from normal biological tissues and from cancerous tissue. From this early beginning a new technology has developed which is thought by modern doctors to be the most promising and non-invasive of the visualisation aids available. An indication of the usefulness of the techniques developed from this application of physical forces to medical procedures can be seen by the following application by different specialities.

Cardiac ultrasound or echocardiography has gained wide acceptance as a diagnostic technique since its introduction in 1954, as it has the advantage of being non-invasive. The examination of the patient by this technique is rapid, does not require hospitalisation and it is thought to be repeatable without hazard.

Although the results need careful interpretation, the potential range of imaging is impressive. The movement of the leaflets of the mitral valve can be seen and the degree of stenosis assessed; the movement of the ventricular chambers of the heart during the cardiac cycle can be viewed. (Julian, 1981,per)

This technique is, of course, valuable in diagnosing heart defects in infants and neonates, making early surgery feasible.

Neurologists have used ultrasound to detect displacement of the mid-line of the brain, by haemorrhage or tumour, the main application being in neurosurgery and traumatology (accident surgery).

It is, however, the specialty of obstetrics and gynaecology which has used ultrasound in a major way. The uptake and development of this physical innovation by the specialty has been charted by a variety of writers, notably Oakley (1984) and Yoxen and Hyde (1985). The following is a brief account from their writings.

Donald - an obstetrician - had heard Wild speak in the early 1950s about the use of ultrasound to detect abnormal tissues. After he became Professor in Glasgow he started to explore this area. A patient of his, had contact via her husband with a firm producing ultrasound flaw detectors for metal flaw detection, and Donald was able to use this apparatus first on pieces of tissue outwith the body and then on living patients. His primary goal or need at this time (the mid 1950s) was as Yoxen and Hyde (1985, 25) remark

> the differential diagnosis of abdominal distension and the exclusion of malignant disease.

Pregnancy and fetal abnormality became major interests only as the other work progressed, and this interest coincided with the concern expressed about the dangers of x-rays as fetal imaging devices - the paper by Stewart was published in 1955. Ultrasound was seen then as a safe non-invasive imaging technique of great potential.

This potential, however, was not realised for some years - the original paper by Donald and his co-workers was published in 1958, and in 1964 they published accounts of the potential diagnosing, via ultrasound measurements, of abnormality in the fetal head.

Oakley (1984) has described the routine use of ultrasound first in Glasgow in the middle 60s and then elsewhere in the early 1970s. The adoption of the technology, though slow to start, reached a peak about 1976 and became standard in 1978.

The images of the fetus became not only more detailed, but also were necessary to the professional life of the obstetrician. This will be described in Chapter 8, but it is important here to indicate that doubts are now being raised about the safety of these physical rays. As Yoxen and Hyde (1985) point out, it was only in 1982 that random-controlled trials were started.

Thermography

Thermography is the other example of a non-invasive procedure for imaging. Infra-red radiation from the patient's vasculature can be charted using a complex system of colour coding and photographic techniques. Thus 'hot-spots' over superficial carcinomas can be detected, (eg in breast), placental location determined, and decreased blood flow indicated eg in peripheral vascular disease.

The use of lasers for imaging is fairly recent but according to Tyrer (1985, per) it is developing quickly. Using an endoscope it is possible to measure vibrations of the ear-drum, take holograms and immediately get visible information about vibration patterns which are distorted in diseased states - though of course the parameters of normality and abnormality will need to be built up.

Acoustic holography is in the experimental stage, but there are reports (Tyrer, 1985, per) of 3-D images being built up of the brains of patients with tumours, enabling the neuro-surgeon to plan and execute the operation with greater skill and success.

The advantages of non-invasive imaging devices are obvious, but invasive devices introduced into the body through the natural orifices have also a role to play. Endoscopes are devices, initially using mirrors, which could be inserted into the natural orifices of the body to view the inside tissues. The use of fibre optics marked a significant breakthrough as was the use of endoscopes to sample tissue from possible tumours.

The fetoscope inserted into the womb via the cervix enables obstetricians not only to view the fetus directly but also allows them to obtain samples of tissue from the chorionic villi of the placenta, and even samples of fetal blood and other fetal material for examination of abnormality. The results from these tests have the advantage of being obtainable at very early stages of fetal development.

The concept of chemical imaging is very similar to that of physical imaging. Examination of body fluids for specific substances can be carried out; those present in health can be measured; and normal levels determined. This of course introduces the concept of normality which will be expanded later in this chapter. Departure from these normal levels, either depression or elevation can be regarded as signals of disease. Chemical imaging can also be exemplified by the detection of abnormal substances in the body; specific examples are given below.

It is a complex and difficult area, but an in-depth study is not necessary once the initial concept is realised. The following examples provide an excellent resource towards this conceptualisation.

Cholesterol is an essential component of all cells as well as being the basis for several important hormones. It is combined with protein when transported by the blood stream - low density lipoprotein. High levels of this low density protein (LDP) in the blood have been associated with an increased risk of atherosclerosis. Thus chemical disturbance can be imaged.

It is often necessary in patients suffering from various types of immunodeficiencies to be able to determine what these deficiencies consist of. This can be done by laser nephelometry, a new and sophisticated method for imaging immunoglobulins.

Increased plasma enzyme activity occurs when large organs rich in enzymes are damaged and thus detection of these raised levels is useful when considering possible damage to liver, heart, pancreas, bone, prostate and blood cells. This enzyme determination can be carried out by a variety of methods including spectrophotometry in visible and ultraviolet ranges.

The above examples are concerned with normal constituents of the body; abnormal or foreign chemicals can also be imaged. Two examples are given.

Urinary-tract infections rank second after infections of the respiratory tract in the list of the most frequent bacterial diseases of man. Nitrituria is one of the most important clinicochemical indications of this type of infection. Nitrite in the urine can be produced only by bacterial reduction of nitrate. Testing first morning urine can detect this nitrite and so image the infection.

The chemical imaging of the fetus has developed from the early detection by the naked eye of bilirubin in the amniotic fluid of "rhesus" babies, to the sophisticated detection of fetal abnormality by chemical analysis of the fluid. Useful examples are the detection of spina bifida and anencephaly by measuring α-fetal protein (AFP) (1972 Brock and Sutcliffe); the detection of hyaline lung disease via chemicals in the amniotic fluid (Gluck et al 1971).

IMAGING — Biological

The combination of microscopy and cell-culture have greatly extended the role of biological imaging. The growth of human cells *in* *vitro* had been a goal for many years but prior to 1959 there was little success in growing normal cells, (cancer cells had of course been grown successfully before that time). The use of phytohaemagglutinin in 1959 to trigger the division of human white blood cells was a major breakthrough. During cell division, the genetic material can be viewed as chromosomes, and thus chromosomal abnormalities can be detected.

Detection of the chromosomal abnormalities can be made at the fetal stage of human development by a process called exfoliate cytology. Fetal cells are obtained by the process of amniocentesis, then grown in the laboratory and chromosomal analysis carried out. (the biochemical products of this growth can also be analysed)

Exfoliate cytology became a dependable technique in the late 1960s and its development since then has been rapid. Ultrasound scanning which imaged the fetus enabled the safer use of amniocentesis. A good example of the conditions detectable is that of Down's Syndrome where trisomy 21 exists; the extra chromosome can be readily spotted and the parents offered therapeutic abortion. The sex of the fetus can be determined and also chromosome abnormalities can be detected.

There are known to be 130 diseases associated with genetic defects. At present however, it is only possible to screen for 30 conditions with reliability (OHE, 1978, 42).

Other important procedures have resulted from cytological techniques. These are mainly concerned with detection of potential cancer in children and adults by pre-cancerous changes in cells.

Monitoring for the disease then becomes possible. Two good examples are the cervical smear for cancer of the cervix and rectal smear in cases of the genetic disease, polyposis coli. (Wilkie, 1979, per)

Sophisticated techniques for "seeing" genetic disease have been developed recently, and the ability to utilise this "seeing" is highlighted by the following illustration.

During the past ten years it has become possible by the technique of recombinant DNA to isolate single human genes and to study their structure and function. Several genetic diseases have been studied using this technique and include thalassemia, sickle cell anaemia, Lesch-Hyhan syndrome and pituitary dwarfism (CSS, 1984, 32).

The disease of sickle cell anaemia is an important disease in many respects, as it is a very common disease amongst black Americans, and can easily be detected by screening techniques. There was a time when many black Americans had mandatory screening, but there was said to be widespread misuse of the screening results and there was virtually no follow-up with suitable counselling. The disease is due to a recessive gene. When two of these are present, the disease develops; if only one recessive gene is present a condition known as the sickling trait develops which cause only a few minor discomforts especially during air flights. The single gene does, however, confer resistance to malaria and this is the reason why the gene has not disappeared, as it represents a successful mutation for the conditions in Africa, and hence the high incidence of single gene carriers. Laboratory analysis can determine if the fetus has inherited one or two genes by a sophisticated technique using restriction enzymes of bacteria to cleave the DNA at specific sites. (Kan & Dozy,1978,910)

Because the defect is due to changes in a single pair of nucleotides, it is thought to be a suitable target for "gene therapy" - ie replacement of the defective nucleotides with normal nucleotides at an early stage of fetal development - the potential discipline of euphenics (see Chapter 10).

MEASURING Physical

Measurement plays an important part in contemporary medical practice for one of the pressures in that discipline is the movement towards quantification and quantitative insight into medical problems. Medicine is becoming an exact science, says Sayers (1975,1) with accurate data obtained in paraclinical laboratories providing objective criteria on which the treatment of the patient is based. Once an object of a phenomenon can be imaged, it can be measured, the measuring devices varying from the unaided human senses to very sophisticated automatic measuring equipment made possible now by the introduction of computer technology. This last sentence contains such a wealth of compressed information that it is important that it should be expanded.

Firstly what is meant by an imaged object or phenomenon and its measurement. The following examples are from physical measurement. The leaflets in the mitral valve of the heart can be imaged using ultrasound, and their movements can be used by an expert cardiologist to assess the degree of stenosis. Sophisticated photography can pick up 'hot spots' on an arthritic knee via thermography and by comparative study of these photographs the value of treatment can be judged. A light patch on an x-ray plate can reveal to the chest specialist the extent of tubercular infection while x-rays of the brain after the injection into the blood of radio-opaque material may show the size and location of a blood clot in an accident victim. These are all examples of apparently simple measurements, (though not necessarily simple imaging), but it is deceptive for what is not apparent is that decisions are made on the interpretation of these measurements by doctors, and the interpretation is dependent on their experience and expertise.

An imaged object can also mean something that is viewed secondhand via an intermediary, ie a transducer. The introduction of the use of transducers has had an important effect on the practice of medicine. In cardiology the pressure measured by an inserted catheter can be changed via a transducer into an electrical signal which is a more usual and known form of measurement and adapts very well to the idea of monitoring.

Developments in nuclear medicine have made an important contribution to the diagnostic imaging and measurement, enabling organ functions to be imaged, measured and monitored by adaption of physical forces. Data processing has been the main "tool" which has led to this achievement, making it possible to utilise the potential qualities of the gamma camera by connecting it to a computer. Special programs for cardiology, measurement for blood flow in brain and liver or renal function studies reduce complicated procedures to the level of routine (Recourt 1977, 9).

Obstetrics

Specific instances of measuring abound in medical practice, but some examples might form a useful guide. As obstetricians became less worried by maternal death they were able to focus attention on the fetus and many new measurement techniques have been introduced in the last ten years. Although initially there was scepticism about the value of fetal heart rate (FHR) measurements, it is now accepted that instantaneous changes in FHR can indicate something of the well-being or otherwise of the fetus (Sayers 1975,32). Measurement of intrauterine pressure (IUP) using a transducer can also determine the well-being of the mother, as well as the child, and combination of the
electro-fetal monitoring EFM.*
two measurements IUP and FHR can be combined into a monitoring system. Control of the infusion of drugs to induce and control labour can be measured by this probe. Recordings of the brain waves of babies about to be born can be made, once it is possible to attach electrodes to the fetal head. This is a particularly sensitive area as it represents to some, aggressive use of technology. Research being carried out in Holland on the relationship between EEG on the new born and subsequent performance at school is an excellent example of technological assessment.

Cardiology

Cardiologists are concerned with precise and exact measurements of a variety of parameters, the timing of the beating of the heart, venous pressure, arterial pressure, blood flow, pressure of carbon dioxide and oxygen saturation of the blood. Cardiac catheterisation, previously described, has been used for diagnosis of disease of the heart for a quarter of a century. During this time the techniques have remained virtually the same; namely the imaging of the heart chambers, the identification of shunts, and the measurement of pressure in the heart chambers and blood vessels. Advances in technique have included an increasing refinement of apparatus and a multiplication of the methods available for the demonstration of the three parameters measured. Cardiac surgery has been established as the result of the diagnostic precision achieved by cardiac catheterisation. As Sayers (1975, 80) has emphasised, the engineer and the scientist are accepted by the cardiologist who is already aware of the value of accurate measurement. Not surprisingly we see in the field of cardiology some of the most advanced endeavours of modern medicine based on extensive research into human biochemical and physiological mechanisms as well as studies of cellular mechanisms at the microscopic level.

As soon as the human body is linked to a life support system, ie heart-lung machine, it becomes necessary to measure the physiological variables affected by the machine - many of which need to be constantly monitored. During open heart surgery the following must be kept under constant surveillance: venous pressure, arterial pressure, blood flow, partial pressure of CO_2 + O_2 saturation of the blood.

Nuclear Medicine

In the past twenty years there has been a rapid rise in the use of radioactive techniques for measurement purposes. Some examples are determination of the life of red blood cells, determination of the rate of absorption of Vit B_{12}, especially valuable in cases of pernicious anaemia, estimation of internal haemorrhaging. In the last decade the C_{14} and tritium tagging of hormones and other important biochemicals has led to increased knowledge of their production and transport etc. These substances are of course potentially dangerous and continuous measurement is desirable. A good example of the care necessary when dealing with powerful physical forces: measurements of their use have to be accompanied by measurements to determine their misuse or overuse. Research has been developed to study the toxic and lethal effect of radioactive substances and to devise methods to protect the body from them. Thus the same measuring techniques might well be used in a department of nuclear medicine, a nuclear power plant, a nuclear submarine and in a silo containing a missile armed with a nuclear warhead.

Neonatology

Although the French physician Tarnier first employed incubators for the rearing of small and sick newborn infants in 1880, modern neonatology could perhaps be dated from the time when the special skill of umbilical catheterisation was introduced into neonatal nurseries as the rational approach to the safe management of oxygen therapy. This occurred about the middle 1960s, since then neonatology as a specialty has found its place in paediatrics with the appointment of full time neonatal specialists in most centres in the United States (Baum et al 1977,126). A complex technology has now developed for the assessment and treatment of ill neonates.

MEASURING Chemical

It is in this area of chemical measurement that one of the greatest developments in medicine has taken place. A veritable explosion has taken place in the number of body substances, both normal and abnormal, which can be measured and there is also a similar explosion in the sophisticated, automated, computer controlled methods available for measurement (Fletcher, 1979, per).

In the early 1950's photo-electric colorimetry made possible the use of micromethods of analysis, followed later by flame photometry which simplified the measurement of cations eg Na^+, K^+, Ca^{++}, and led to a better clinical management of body fluid imbalance.

A major advance took place in 1956, when Skeggs invented the automatic analyser which allowed ten separate procedures on one substance and could test five thousand single substances a day, on a continuous flow system. The development of a discrete autoanalyser was especially suited to radioimmunoassay techniques.

Specific examples of the measurement of chemicals are now given. The diagnosis of myocardial infarction requires joint evaluation of the clinical aspect, the ECG and the serum enzyme activities. As 20% of infarctions may be asymptomatic and as direct diagnosis via ECG may be difficult, measurement of serum enzymes is often critical (creatine kinose and its isoenzyme being particularly important) (Julian, 1979, per).

Injury to skeletal or cardiac muscle results in the release of myoglobulin which can be detected in the urine, and accurate and rapid measurements can be made giving an indication of the degree of damage. The latest method of measurement is by nephelometric assay. Other methods which have been used, but which have been discarded because of various disadvantages, have been radial immunodiffusion, complement fixation, counterimmunoelectrophoresis. The search for a rapid and reliable method of measuring myoglobin in urine reveals the variety of methods which can be used and this is true of other chemicals and their measurements.

Detection of monocytic leukemia can be made by measurement of lysozyme in urine. Again various methods have been used including spectrophotometric, turbidometric, agar gels, immunoelectrophoresis. The latest mehod which avoids many of the problems of the other methods is determination by laser nephelometry.

It is of interest to note the inclusion of lasers in this area for apart from some repair work especially in ophthalmology, this very potent physical force has not yet been utilised as much as it had been hoped, though the protagonists are on the whole unsure of where its power could best be used (Fletcher,1979,per).

The ability to make such detailed and rapid analyses of body fluids has created many problems. The large scale nature of the work needing vast amounts of space and money both for capital outlay and running costs has caused problems of financing. Recently a new clinical chemistry unit was opened in Glasgow at an initial cost of two million pounds. There were many, both medical and non-medical, who said the money would have been better spent elsewhere.(ibid)

Disadvantages of the automated system of analysis include the large amounts of data produced daily. To process this data, substantial data processing facilities are needed and larger laboratories have computers to help with this. The main aim is to present the results of the tests in a "meaningful form", ie in words and format that the clinician understands.(ibid)

Concern has been expressed by clinicians that they were losing their status and control of the patient by using these tests, and the strictures about quantification of results outlined in the appropriate section on physical measurement is valid here. Increasingly, however, there is a return of this analysis of body fluids "back to the bedside". Small instruments are being made and Sayers (1975, 84) sees this development as

> an attempt to return some of the chemical analysis to the direct control of the clinician dealing with the patient

A sentiment heartily endorsed by Knill-Jones (1977, sem) in a medical computing conference.(BCS, 1977)

CONCEPT OF NORMALITY

Once the concept of measurement of patients is introduced, another, and very important concept which must be considered is that of normality. What is the normal and what is a departure from the normal? In many instances the parameters of abnormality are based on the experience of the doctor and often it has not been previously possible to express these parameters in quantitative terms.

A good example of this is the use by paediatricians of the abbreviation FLK when describing a child patient. Contrary to the expectation of the layman these are not the initials of a specific condition, but they express the unspecified disquiet of the doctors for they stand for "funny looking kid". There is evidence now that these letters were probably used to describe the fetal alcohol syndrome, which can now be clearly defined both by physical description short faces, thick necks, receding chins (visual measurements), low intelligence measured by simple tests.

Parameters of measurement can be found, and normality and abnormality expressed by them. Schmidt & Schmidt (1976,14) describe the situation so expertly that no apologies are made for this very long quote.

> The practical interpretation of every result relies on comparison with a 'normal' value. It is therefore surprising and confusing that markedly different normal ranges are reported for this key value even when the same analytical method is used. Part of this discrepancy is caused by the varying amount of care taken during the analysis. More important, however, are the different concepts of 'normality' and what criteria should be used to evaluate this condition.
>
> In medicine, the term 'normal' is used to describe findings commonly obtained in healthy individuals. Therefore, a normal value does not represent a true cross-section of the population. From the results of screening programmes and statistical surveys correlating body-weight and duration of life etc., it becomes apparent that a subject who feels well and is capable of work cannot definitely be pronounced healthy, but that objective criteria must be use for evaluation.
>
> The greater the number of test results available for any one individual, the greater the probability of being able to pronounce that person healthy, and therefore those results to be 'normal

values'. Hence, it is not the overall number of samples investigated and the sophistication of their statistical analysis that is decisive in ensuring the reliability of a normal value, but the care which is taken in selecting the normal population.

However, despite all care it is not possible to reliably exclude within the normal range. This factor of uncertainty increases with advancing age and the consequently greater frequency of illness.

The prima facie conclusion would be to use 'ideal values' as a standard on which to base the evaluation and to leave the assessment of varying results to the judgment of the physician; but this procedure is not compatible with the desire to differentiate between physiological and pathological conditions with a wide margin of safety.

Such differentiation can be forcibly attained by displacing the limits of normality, for example, towards the average or even further. Clearly, such resource would entail a loss of sensitivity, thus missing minor lesions and the onset or subsidence of disease.

This concept of normality raises many problems for as in all human affairs, in all biological systems there is a spread on either side of the norm, so what is normal for one person is too high or too low for another. McKinley (1951,275) is of the opinion that there is no uniformly acceptable interpretation of the term "normal". It has a wide diversity of meaning and many synonyms (average, typical, modal, healthy, ideal). He said that a person is often regarded as normal if no clinical abnormality is detected. Knowles (1977,6) cynically expresses the view that the only normal person is one who has not been submitted to measurement. He also affirms his view that sophisticated measurement techniques are mainly for reassurance of the "worried well" described by Knauss (1977, 533). Nevertheless normal standards have to be set, and this objective has led to the increase in paraclinical laboratories where 'normal' and 'abnormal' people are studied. The type of accurate data produced in them providing objective criteria upon which the pathological state can be judged.

Yet the practice of measurement in medicine has been developing since the early seventeenth century when Sanctorius of Padua made the first systematic measurements of pulse rate (using fingers and a clock) and body temperature (using a thermometer). In recent years the ancient craft of clinical measurement (Lenihan 1976, 2) has been transformed by the application of techniques derived from electronics, nuclear science and computing.

MONITORING Physical

Once it is possible to make accurate measurements of a phenomenon, the way is opened up to develop a system of monitoring. This is not to say that monitoring has not been an integral part of medicine, for before the advent of sophisticated machines, doctors and nurses were able to monitor the patients by unsophisticated and simple devices, thermometer for temperature plus graph paper, fingers for pulse rate plus record chart etc. But this system, whilst of comfort to the patient, relied on large numbers of skilled nurses, working on a 'round the clock' basis.

The shortage of nurses in the USA led hospitals to investigate patient-monitoring devices, and other forms of automation in patient care. Monitoring equipment was developed which did not need technical personnel to operate them, this meant that these devices could be handled by nurses. Integral to the concept of monitoring is the idea of visual display and many nurses were unused initially to this form of visual aid, but after the increase from 1952 of television sets, they became used to the idea of information being shown on screens, and although initially hostile to the introduction of this type of instrumentation, nurses did become enthusiastic in a comparatively short time. (Simpson 1977,per)

There could be said to be two important non-medical 'events' which led to extraordinary spurts of growth in patient monitoring. After the Second World War in Britain there was not only surplus electronic equipment, especially that connected with radar development, but more importantly there were surplus specialists in this field. Many of these men had been trained by REME and were used to the concept of innovation, and were subsequently employed in the National Health Service and its immediate predecessor. This large influx of both men and materials made possible big developments in physical measurement and monitoring. In some cases they used surplus army equipment bought at low cost. Simpson (1977,per) described the construction of complex recording equipment, for a surgical department, from second hand material from dump yards.

The second event was the space exploration program in the USA. Both the development of the program and its subsequent rundown were important to the development of medical monitoring.

The space exploration program in the United States during the 1960s, with the necessary monitoring, (ie continuous measurements, of the physiological functions of man and monkeys) was an important watershed in the concept of impersonal monitoring. If a monkey a hundred miles away in space could be monitored, there was no reason why patients could not also be examined remotely. Until this time physicians had relied on random observations of body function, mainly by nurses, to both diagnose disease, to follow its course and to evaluate the treatment recommended. The disadvantages of this type of procedure was evident to many doctors. Reliance on overburdened nurses to chart physiological changes in the patient via pulse rate, temperature and respiration, could lead to many errors. Minute changes, which might be important could be overlooked. Finally as body functions hover around certain normal points, they exhibit sufficient departures from normal during different times of the day and hence random samples often failed to detect rhythmic changes in body physiology. This was a very important precept.

The placing of man in a hostile environment, ie outer space, with the need to monitor physiological function demanded novel and highly reliable instrumentation. A large team of workers was built up by Nasa (National Aeronautical and Space Administration) and numerous contracts were placed by them. Then as space budget decreased, and workers were made redundant, these teams set up by Nasa turned to life sciences to provide markets for their accomplishments, experience and products. There appears to be one major flaw in the usefulness of this type of approach to patient care. Even if clinically applicable machines are perfected, able to perform continuous readings of body function, where would the busy doctor find time to evaluate the mass of data produced? A solution was to link the physiological measuring devices to a computer which analysed and stored the data, the analytic program devised by programmers on the recommendation of the appropriate specialists. Even further sophistication became possible when limits of danger could be set and either alarms would sound or in very sophisticated machines steps could be taken to limit the danger, eg in chemical induction of labour.

Increased use of monitoring devices compounded the problem of the complex medical record, and many doctors, especially in the US, turned to storage information specialists for assistance with this problem. Computers with their capacity not only for almost unlimited data storage, but for their capacity to correlate data, seemed to be the answer. The incursion of computers in the field of medicine raised fears that other medical functions performed by doctors would also be infringed upon. The most important of these being diagnosis of disease. This is a field of contemporary study and is divided at present into two modes of thought. One attmepts to duplicate with a computer program the mental steps physicians take to reach a diagnosis. The other has developed diagnostic strategies particularly suited to the strengths of the computer, without the requirement that they mimic human logic.

A further complication into the concept of patient monitoring is described by Crul (1970,10). He points out that as all monitoring equipment can give only indirect indications of actual organ function, the choice of parameters becomes the decisive factor in determining usefulness (a point already highlighted by Pettigrew in Chapter 2 when describing "uncertainty" conditions. So far this is the weakest point in patient monitoring since most systems select parameters easy to measure rather than those most likely to provide essential information about body and specific organ functions. This implies a need on the part of the clinician to define clearly what he would like to monitor and for the design engineer to keep the clinician informed of developments and possibilities in the field of electronics. This in turn demands better communication between the two different disciplines. Sayers (1975,81) remarks that in coronary care and intensive care, where patients need intensive nursing procedures, monitoring instrumentation is more readily acceptable, and reflects the most obvious and effective application of electrical engineering in medicine. The patient can be on respirators, can be monitored for ECG changes and pressure gauges can monitor intravascular pressure in veins and arteries.

Cardiology gained from developments in cineradiography, as the cardiological table was freed from all equipment which was placed underneath, giving the doctor free access to the patient. Monitoring became less risky and more sophisticated examinations could be made. It was possible to have a television monitor, with facilities for videotape recordings on 35 mm film with the advantage of immediate backplay, re-runs and stoppage at specific events. Capital costs for this equipment was, however, high (two high output generators were necessary), as was maintenance and running costs. The subsequent development of electronics for defence purposes has had the spin-off of smaller, more reliable, less costly equipment.

Casualties and post-operative neurosurgical patients have been found to be subject to increased risk of developing high intracranial pressure. The usual method monitoring was to measure the intraventricular pressure. There are disadvantages to this technique, particularly the increased risk of infection and this has limited its use to highly specialised clinics. These drawbacks have been overcome by a newly developed method whereby a transducer has been specially developed for intracranial application. It has the advantage over the previous method in that not only is it simple to use, but its electrical stability ensures correct measurements over an implantation period lasting up to several weeks.

A recent introduction has been the concept of SAMIS - socially acceptable monitoring instruments, indicating the demand that the technological imperative to investigate has at times to be tempered with a consideration of what is acceptable to the patient. Some devices for monitoring are so distressing to the patients that they should not be used. Social acceptance has of course not be confused with medical or administrative acceptance, and the strength of the social demand depends on the power of the pressure group responsible.

Although caesarian section (one of the oldest of operations) should perhaps be considered under removal it is worthwhile including it in this section of monitoring as the following will show. Now an increasingly popular operation both in Britain and the USA, it has its critics who consider that it is more dangerous for the mother. But it is the lack of control which the mother has over the course and management of her labour which is worrying to some observers. As Francome & Huntingford, (1980,353) indicate it is an unusual woman who in the middle of her labour

> challenges medical advice, especially when it is apparently based on objective evidence and accurate electronic observation.

Once a substance can be measured, it can be monitored and sophisticated devices can be used for the monitoring. What can also be measured is the effect that the chemical substance may have. Nowhere is this more clearly seen than in the chemical induction and subsequent control of labour. This has led to protest that childbirth has now become "technologised" and part of the movement towards "uncontrolled and escalating technological innovation" described by Oakley (1982b,672) in her paper on antenatal care. Other areas where monitoring is important include cardiovascular disease and screening for hypotension.

In discussing laboratory tests, the "Health Service in Scotland(1976)" document suggests that they will play an ever growing part in the diagnosis of disease and the monitoring of subsequent therapy. This is in part due to the increasing knowledge of factors such as the metabolic disturbances, the infecting agents and the genetic predispositions which lead to the development of clinical disease. Also important is the increasing expertise developed within the field itself in association with technological progress.

Words of caution come from various sources about the increasing emphasis on chemical monitoring and control. Miller (1966, 648) expresses the view that

> after fifty years of passionate concentration on laboratory medicine, the psychiatrist is often the only person who can spare time to take the patient's history.

Many physicians feel that history taking is a waste of time; with its subjective overtones and interactional complications; it is far easier and less trouble to send away body fluids for analysis; and to monitor the changes.

As mentioned previously the use of computers and sophisticated monitoring techniques and the range of biochemical tests on body fluids and tissue; has increased greatly over the past 20 years. Indeed there are now many tests where the clinical specialist does not know the implication of the result (often neither does the clinical chemist). Increasingly the clinicians resent the apparent poaching of or intrusion into the diagnostic area of medicine and they have taken positive steps to preserve their control (Fletcher,1983;per).

EVALUATION AND CONTROL

As Reiser (1978;171) has pointed out, many modern physicians appear to order the value of medical evidence in the following hierarchical way. Facts obtained through complex scientific procedures are regarded as more accurate and germane to diagnosis than facts detected by the doctor's own senses and experience; and even more so than the facts disclosed by the patient's statements. This state of affairs may erode the confidence of the doctor in his own ability to make independent judgments. There is evidence; however; that this state is reversing especially in obstetrics (Templeton 1979; per).

The emphasis on the value of evidence from complex scientific procedures and the down-grading of the doctor's own senses together with the statement of patients, is in conflict with the views of

Mackenzie (1920), who argued that after a mechanical device had proven its value in clinical medicine, the physicians should stop using it. They should, he said, try to obtain the same information from the symptoms recognised by the doctor himself. He applied these strictures to his own ink polygraph (a variation of the sphygmograph) for as soon as he found out what information the instrument could convey, he set about discovering means by which the information could be obtained by the unaided senses.

The whole question of evaluation is a fascinating one and the role it plays in the professional life of doctors will be a major concern of the substantive part of this thesis. It is important to note here, however, that increasingly sophisticated technology has made the problem more complex, and has made it necessary for the medical profession to discuss the effect that this technology has produced. Often it is seen as a means in itself and not a tool to improved care, but as Hellegers (1978,357) reminds his readers, it is not the monitoring that actually saves childrens' lives, it is the measures taken when monitored findings suggest that action may be needed.

An interesting example of the complexity of evaluation of monitoring techniques is the effort to find out if computer interpretation of ECG's are more accurate diagnoses of disease than experienced cardiologists. For many, this question has not been fully resolved, but it does raise the more interesting question of who writes the software for the computerised interpretation of the ECG's. Are specialists not only willing to share their expertise, but more importantly are they willing to examine their diagnostic methods to see how precisely they can express their expertise in a manner which is capable of logical processing? The importance of the computer in monitoring and thus in evaluation, which is the extension of the monitoring principle, cannot be sufficiently stressed. Computer technology has made it possible to monitor and evaluate techniques using the sophisticated adaptations of physical forces, such as x-rays, ultrasonics and radioisotopes.

Although this may not be the place for a full discussion of the social implication of these advances, it is worthwhile considering the case of fetal monitoring already mentioned. In the USA where resource to litigation is a common practice, obstetricians have encouraged this monitoring and the evaluation of the monitoring for at least two main reasons. Firstly, if the evaluatory computer program was written in conjunction with a panel of other obstetricians, there could be said to be a consensus of opinion of when intervention should occur, eg if the fetal heart rate is too high or too low according to the panel, or if uterine pressure is too great, a caesarian section should be carried out. Secondly, in litigation the computer printout would show clearly the parameters for intervention and the time that these parameters were reached.

Another area where computers have value is in patient interviewing especially in sensitive areas. It is said that alcoholics will give more information to a morally-neutral computer than to a physician, and that women prefer to talk to a computer when giving details of gynaecological problems or when seeking advice for psycho-sexual problems. One interesting sideline in research into this role for computers is that patients "lost all track of time" for the computer did not tire, did not look at its watch and the patients knew it was there until <u>they</u> were finished.

Finally, the use of computers in medical record keeping can lead to new models of disease (Anderson 1977,15). Until it was possible to have written retrievable medical records for large numbers of patients, it was not possible to create good general models of disease. Large scale analysis of this kind is now acceptable. To progress in medicine there has to be a "change in theoretical models of health and disease" (ibid,16). The complexity of the functioning body's sub-systems ranging from molecular, cell organelle, cell and tissue levels, to the integrated levels of the whole man, his family and societal groups cannot be envisaged in its totality without the use of the complex data gathering, data analysis, and data linkage facilities of the computer.

STATISTICAL ANALYSIS

It was largely out of the interest in new biological developments that a variety of statistical schemes were evolved. Biological and other manipulations gave rise to the need for sophisticated means of analysis. Large scale surveys were necessary to enable parameters of normality and abnormality to be set. A good example of this is the following quote by Hill et al (1978,25)

> Mass screening for cancer by ultrasound can only be cost effective if the technique is used to systematically interrogate large volumes of normal tissue objectively.

Some examples of the types of statistical analyses are now given.

Causality

Using sophisticated statistical techniques, Doll & Hill (1950,739) showed that cancer of the lung and cigarette smoking were closely correlated. They were not able to show direct or agent-causality, but neither had other methods. Linkage was thought to be so strong that it forms part of medical thinking, though the simple linkage has been challenged by various workers.

Large scale studies have been made to find causal links in coronary heart disease. From the evidence accumulated about life styles etc the following has emerged. The men and women most unlikely to develop atherosclerosis are

Man: an ectomorphic Bantu, who works as a bus conductor in London, spent the war in a Norwegian prison camp, never eats refined sugar, never drinks coffee, eats five small meals a day. He is taking vast amounts of oestrogens to check his cancer of the prostate.(quoted by Norton 1969,205 from work of Howard, 1966)

Woman: a hypotensive, bicycling, unemployed hypo lipoproteinal, hypolipaemic, underweight, premenopausal dwarf living in a crowded room on the Island of Crete before 1920, and subsisting on a diet of uncoated cereals, safflower oil and water. (Norton 1969, 205)

These humorous descriptions indicate that large scale studies into the causes of arterial disease has so far been disappointing.

There are probably too many factors involved for a simple answer to be possible.

Double blind trial

The alternative to treatment based on inadequate knowledge, as Norton (1969,35) points out, is a proper clinical trial, designed specifically to give once and for all the answer to the question of whether a newly introduced remedy is effective or not. Double blind trials represent the high point of this approach and consequently these trials have come in for very severe crticism especially those used to evaluate drugs used in psychiatry.

The ethics of these types of trials have been under strong attack and there are reports of trials being abandoned by doctors who felt that they could not tolerate any longer patients who were not receiving treatment, when the doctor became increasingly convinced that the treatment under evaluation would be helpful to his patient. (Kendal 1978, sem)

An example of a trial going wrong can be seen in the testing of a drug (clofiterate) to lower cholesterol in volunteers, who may have been in danger of developing heart disease. The drug seemed to cause more deaths than lives saved. (Julian 1979.per)

Computers and Genetic Registers

The use of computers for medical data analysis is well charted. Criticisms of this type of manipulation has been made by various writers. Hewitt (1971,10) argues that compulsive manipulation of data by medical researchers had led to the neglect of more fundamental issues. He is especially concerned with cancer research and asks if this technological "voyeurism" is good medicine.

The use of computers to store and correlate data about genetic diseases has also been criticised. "Rapid" (Register for the Ascertainment and Prevention of Inherited Disease) developed in Edinburgh (Emery,1979,219) has been criticised because once a child is placed on the register it can not be taken off even if it requests it on reaching adulthood. (Wilkie, 1979,per)

<u>Screening</u>

In the 1960s a new concept of medical care became widespread (Teeling-Smith 1977,43). This was the concept of widespread (and indiscriminate, according to some) screening to detect pre-symptomatic disease. One rationale for this was the need to identify health problems and institute research well in advance of likely service demands. Sophisticated treatment of results can help the development of a particular type of need becoming predominant.

One example of screening, not well thought out, was the use of x-rays for breast cancer screening, when it was found that the screening x-rays could be the causal agent of the cancer. New technology - thermography and ultrascan are now being introduced, as non-problematic imaging devices.

CHAPTER SIX TREATMENT

RESTORATION OF NORMALITY

INTRODUCTION

This chapter describes the changes in practice which have occurred in the treatment of patients by doctors. Their declared aim is the restoration of normality or as near normality as possible and they achieve this by a variety of measures. They are guided, of course, by their own perceptions of normality, which may not be consonant with those either of their patients or of groups of people outwith the medical profession.

The ways of building up ideas of normality and hence of abnormality have been described in the last chapter; in this chapter I will concentrate on the practical aspects of treatment, the manipulations doctors carry out as they remove, repair and replace affected parts or functions.

These manipulations may be physical, chemical or biological, but as the majority of them are based in the physical realm it is appropriate to commence this chapter with some general comments on surgical techniques and developments. Many observers consider that it is the peripherals of surgery which have changed, rather than the technique of surgery (which is based primarily on the skills of the surgeons). In the surgery of the early 1920s, the skill of craftsmanship in the production of surgical operating instruments had achieved results that have not been surpassed although the designs of surgical instruments have been modified as new needs become apparent, and as old needs disappeared. Progressively, surgeons ceased to be itinerants and tended to concentrate their work in institutions specially equipped for the advancing state of surgery and of sterile conditions, also instruments were improved in design to conform more accurately with the anatomical and physiological needs of the surgeon's own hands. Sterilisation of sutures by gamma radiation, a modification of a technique used in the food industry, made packaging easier - glass tubes no longer being used. Although catgut predominates, synthetic polyester yarn can be used in some situations. More sophisticated needles have been developed and eyeless needle sutures are being produced. Most surgery, however, except for microsurgery in ophthalmology for instance, could continue even if factories like Ethicon were to close or go on strike

> as long as Woolworths were open to provide needle and thread, the surgeon could still operate. (Blyde, 1977, per)

This rather sweeping statement is to some extent confirmed by the experiences in prisoner of war camps in World War II. One of the most important lessons taught by the war was that good major surgery could be done successfully under the most disadvantageous circumstances, provided that a skilful surgeon was in control of the procedures. An excellent example of this can be seen in the records of the complex surgical procedures carried out in the hospital of Changi Prisoner of War Camp in Malaysia during 1942-1945. Out of a total of 802 operations performed, only 47 deaths were recorded. These operations were carried out under conditions of extreme hardship. Asepsis was maintained by the thorough use of soap and water, despite a damaged roof full of rat droppings. The patients were virtually free of bed sores despite tropical temperatures and humidity, lack of bed linen, rubber rings or even pillowcases, a remarkable feat of superb nursing, ocnsidering that due to malnutrition, the patients were extremely thin (MacNaulty 1968, 463).

Another example of the developments of the peripheral area of surgery is in the area of anaesthetics. Hellegers (1978, 357) says that the development of safer caesarian sections was due to better anaesthetics, blood transfusion and antibiotics. But it is important to realise two things. Firstly, Cartwright (1968, 749) considers that the unquestioning acceptance of the pain of surgery did, more than anything else, delay the introduction of anaestheis, an excellent example of social control of technical innovation. Secondly, even when anaesthetics were introduced they brought about no dramatic changes in surgical techniques. The greatest change apart from the considerable decrease in patient suffering was the increase in potential operating time, and thus the potential for more complex operations.

One very important advance was the possibility of monitoring patients who were not likely to be under anaesthesia for considerably longer periods of time, sometimes as long as nine or ten hours. A continuous monitoring system was most necessary, for example, when using the heart-lung machine. Another example is the use of a computer to predict the chances of a patient surviving surgery. An experimental program in the USA has been able to predict recovery patterns with a reliability of 72% It can pinpoint three main types of patient, rapid recoverers, those who need heavy drug support and those with a marginal prospect for recovery.

Lenihan (1976), considers that many of the spectacular successes of modern surgery would not be possible without the sensitive and accurate instrumental techniques now available as aids to diagnosis, monitoring under anaesthesia and post-operative management. These procedures which were once interesting studies for the physiological laboratory have now been brought to the operating theatre and to the bedside of the patient.

In the 1970s, however, there was a major improvement in surgical techniques when microsurgery was introduced in Moorfield's Eye Hospital for the removal of cataracts. Not only was the operation more successful, the 'turn-round' time of patients was considerably reduced. It is interesting to note that although at the beginning the ENT surgeons were very enthusiastic about these new techniques, they did not take them up to any great extent (Blyde 1977, per). This, coupled with the fact that the MRC finds it very difficult to get research projects from ENT specialists (also from venereologists) has led to the suggestion that lucrative private practice stifles both research and the introduction of innovation, social structuring of a highly visible form! (Dunlop,1977,per) Recently microvascular plastic surgery has made great strides, not only in its technique but in its success rate, especially in relation to soldiers burned in the Falklands conflict of 1982.

Finally in this introduction, it is important to point out that easier access to surgery through the formation of the NHS has meant that conditions are treated earlier. The surgical repair of a hernia or a prolapsed uterus is now a simple routine, with little risk. Because surgery has become so much safer and because it is available without cost it is often performed at much earlier stages than would have been considered justified in the past. The result is that many severe complications such as the ulceration of varicose veins which were common in the 1930s are now avoided by earlier surgical intervention. In addition, the scope for surgery has been extended enormously.

REMOVAL

The removal of diseased tissues or diseased organs by surgical techniques has been very well charted. Some new surgical developments are provided by adaptation of principles of cryobiology (merging of the physics of low temperatures and biology). Not only is it possible to use cryosurgery, ie "the cold knife" for removal procedures (gynaecological and oncological applications) but patients can be chilled to slow down their metabolic processes. This has the advantage that they can remain longer under anaesthesia and that some new operations could be performed. The principles of cryobiology have also been used in the development of methods for the successful cold storage of blood and blood products and for sperm, mainly used for artifical insemination.

The use of other physical forces have led in some cases to a reduction in ablative surgery. One example is the use of I^{131} for thyroid removal in thyrotoxicosis, which has considerably reduced the need for surgery for this condition. The same is true for carcinoma-in-situ of the cervix uteri formerly treated by removing the cervical canal and the surrounding "cone" of cervix and ecto cervix but now treated by laser destruction. This operation is under the control, not of the gynaecologist, but of pathologists within the setting of one hospital in Edinburgh. (Fletcher, 1983, per)

Stone used neutron beam therapy for the treatment of advanced cancer, and many tumours regressed and in some cases disappeared completely, but the neutron beams did severe damage to the skin and normal (ie non-cancerous) tissue, and some patients died due to radiation damage. So serious were the side effects that the therapy was discontinued. But experiments with pigs showed that it was possible to destroy malignant tissue and leave normal tissue comparatively unharmed (Gale 1974,249).

A new technique, colonoscopy, utilising optic fibres enables wire loops (snares) to be guided to the point where the growth could be sampled for histopathological confirmation before removal. The difference in cost between major surgery and the use of this technique was £1,500 compared with £100. The technique, however, was difficult to learn and so the equipment was rarely used: in this case, then, specialised knowledge and technique has not been used to advance a medical specialty.

Finally, in considering surgical removal, it is useful to consider the change in perception of the body areas as expounded by a leading thoracic surgeon when talking about his replacement (Wade 1977,per). In the process of replacing him as senior thoracic surgeon, the hospital could not find a man sufficient in stature and experience. The chest was difficult to get into required considerable manual strength on the part of the surgeon, so the area approach was paramount. All the applicants were young, and the authorities may have to advertise for a cardiovascular surgeon as medicine is now using the SYSTEMS APPROACH to surgery, and not the AREA APPROACH.

Ablative surgery varies in popularity, sometimes chemical manipulation of disease is preferred, or there may be a combination of both approaches, surgical followed by chemotherapy, eg breast cancer treatment, though the combined approach is fraught with controversy.

A controversial area of ablative surgery is that of psychosurgery in the removal of the function of areas of the brain. As the first experiments were carried out using an ice axe the delicacy of the procedures can be imagined. According to Kendal (1977, sem) the decrease in the numbers of this type of operation are because the "public want it that way". Cynics say that the reason is more that the results were not good and therefore the surgeons did not want to continue, and therefore were able to use the excuse of lay fears for their own social control of a technology. Despite this view it is known that the organisation MIND is very much against this sort of drastic irreversible surgery.

The early removal of the eye or eyes of children affected by the genetically transmitted disease of retinoblastoma has led to a 90% survival rate of these patients (cf 10% before the operation was introduced). This operation does not "cure" the disease, in that the children, now living to reproductive age are transmitting the disease to their progeny, individual medicine as opposed to species medicine.

REPAIR

The differentiation between this section and the next one on replacement is difficult and therefore there may be some overlap.

A bizarre input into the working knowledge of repair surgery came from the tests which were carried out by the Ordnance department of the US Army (Callendar 1943, 5). A large series of experiments were carried out to determine the relative effectiveness of the bullets used by the different powers. Both animate and inanimate targets were used, velocities measured, and the rate of kinetic energy dissipation worked out by the physicists and mathematicians involved. As a result of this work it became possible to predict with a fair degree of accuracy the damage which could be done to specific tissues hit by bullets of known weight, shape and velocity. This knowledge was, of course, of great value not only to the military surgeons during the war, but afterwards in the minor wars which occur.

A similar input from the experiences of war is the development of "disaster surgery" in Ulster during the late sixties and early seventies. The knowledge gained in Ulster about the results of violence, the differences in wounds caused by low and high velocity weapons, between those victims of bomb blast compared with injuries in motor-cycle accidents is unparalleled in peacetime. Between 1970 and 1975, 30 papers on traumatic surgery were written by 17 Ulster doctors and published in medical journals. Disaster planning with all the overtones for nuclear warfare is a concomitant of disaster surgery and has also been developed as the result of the Ulster experience.

Paediatric cardiology deals mainly with the repair of congenital heart defects, the causes being multifactorial. There are, however, genetic implications as previously these children would not have lived to reproductive age. Will they now pass on the heart defect to their children? This possibility is according to Goodman (1979, sem) a serious problem. Cardiac repair <u>in utero</u> for humans is not yet a possibility, although it has been reported to have taken place in dogs. As Goodman (1979, sem,) points out, there is no simple blood test as a marker for this type of abnormality, nor is there a biochemical test. However, ultrasonic techniques to image the fetal heart in detail and its possible defects are being developed.

Innovation may come into the medical field from various sources. A remarkable example of a laymen's contribution (a heterophilous contribution) is the development of the Wade-Dahl-Till valve, a non-blocking implant valve to drain fluid from the ventricles of the brain in hydrocephalus. Roal Dahl (1976) better known for books like "Charlie and the Chocolate Factory" had already lost one 8 year old daughter from complications with the measles virus, then his four month old son was hit by a New York taxi, necessary operations leaving him with hydrocephalus. Dahl was instrumental in developing, with the aid of experts, this particular type of valve, primarily for use by his son. It allowed alleviation of the distressing condition and has proved of great use to other sufferers.

Ultrasound is being used to produce localised lesions in a desired small region of brain tissue, and there have also been reports of the use of narrow beams of penetrating radiation for steriotaxic surgery (ie destruction of tissue in diseases such as multiple sclerosis and epilepsy).

Intractable pain may also be removed by this type of surgery. Lasers can be used for "spot welds" of tissue and are especially used in this function in ophthalmology to repair retinal tissue.

One of the most successful areas of surgery is the coronary bypass operation. Here damaged arteries, which cannot supply all the oxygenated blood the heart requires for its pumping function are replaced with arteries which can provide the necessary blood. This is a good example of the difficulties of categorisation as this piece could equally be placed in the replacement part of this chapter.

Microsurgery has been mentioned previously, but its importance cannot be overstressed. It has revolutionised ophthalmology enabling many new operations to be developed. One example is restoration of sight by the procedure of drilling fine holes into the eye, removing the diseased aqueous humour and refilling the area with a replacement fluid and then sealing the holes. The delicacy of the instruments and the techniques enables the surgeon to operate without disturbing the eye. Because of this miniaturisation, operations can only be watched by others via the TV screen. Plastic surgeons are now using microsurgery not only for repair of burn tissue but for the repair of severed limbs and organs. The newspapers are a mine of information about these operations and pictures of severed limbs being transported in plastic bags with their owners can be seen regularly.

REPLACEMENT

It is in the area of replacement surgery that most of the attention, not only of medicine, but of the public, has been directed in the last decade. Sensational reports in the media of miracle-type replacement operations have led to increased expectations for patients with diseased organs. The main change, is that now it is possible to replace internal organs or parts of organs, whereas before only external organs could be replaced. Artificial legs made of wood have been used for centuries to replace a missing limb and various devices of varying complication have been developed to replace the function of the hand. It is worthwile quoting Emmerson (Rorvik 1973, int) who in 1870 said

> The human body is the magazine of inventions, the patent office, where are the models from which every hint was taken. All the tools and engines on earth are only extensions of its links and senses.

Automation in the automobile and other industries has led to an extensive study of the function of the arm and hand and though the designers were concerned only with function and not appearance, it is amazing how anthropomorphic their devices often are. Input from industry has played some part in human replacement links.

The thalidomide tragedy and subsequent social pressures did stimulate research into replacement links of a more socially acceptable form, and though many people were involved in this research at the beginning, many dropped out when it became apparent that there was not an immediately wide application for the results of the research. Over the years, however, the results have been expanded into general aids for the disabled. The setting up of workshops and skilled staff to cope initially with the thalidomide victims, meant that it was easier to adapt these units into more general units than to set them up from scratch. Because staff in these units work directly with patients and because the immediate effect on the improvement of the patient's way of life can be clearly seen, there appears to be no difficulty in recruiting staff to this particular area of physical medicine (Simpson, 1977,per). Replacement of hip joints and elbow joints are fairly common practice now especially among the elderly.

An example of replacement of function but not of structure is the cardiac pacemaker. This is a device which can be implanted in the body to control the electrical stimulation to the heart muscle when this function is affected adversely. Although of vital importance to some patients the pacemaker is small, unobtrusive and considered "low" medical technology. Other examples of function replacement are life support systems - good examples of "high" medical technology, ie expensive and complex.

The area of organ replacement can be divided conveniently into two sections, that dealing with transplanted organs and that dealing with artificial organs. Although many of the problems encountered in these two types of replacement surgery are similar, the main differentiating feature is the increased problem of rejection with biological material with its complex antigenic structure.

Artifical Organs

The two main areas of development in artificial organ transplant have been with the artificial heart and the artificial kidney. In 1941 in Holland, Koeff developed an artificial kidney using cellophane sausage casing to cleanse the blood of patients with kidney failure (the biological phenomenon of osmosis). The tiny pores of the casing simulated the action of the millions of nephrons in the kidney. In acute renal failure and in the rapid removal of poisons from the circulation, eg in a barbiturate coma, its use is uncontroversial. It was designed primarily as a stop-gap technology and not for the treatment of chronic renal failure. Today this is its main use and in the USA the cost of this approach is large. But it was not until the Scribner shunt was invented that renal dialysis became practical as a long term measure. For until there was a regular access point to the blood supply, the technique was limited by the availability of sound veins.

Although the principle remains the same, there have been many refinements, mainly towards home dialysis and towards miniaturisation for portability. Problems of cost are always present and recently an innovation has been introduced, that of peritoneal dialysis. In this technique the peritoneal area is filled with cleansing fluid and the blood cleared via the rich peritoneal network of vessels. This has been successful because of the mobility it confers. The artificial pancreas is based on more complex biological principles and so is treated in that section.

The second area of development, that of artificial hearts (and valves) is a complex one. To many people the ultimate in organ replacement medicine is the successful implantation of a mechanical heart. Not only does the timing of this event appear to be far into the future, but the medical imperative appears to be very weak (Macleod 1980,per). Many problems have not yet been satisfactorily resolved, chamber and valve design; biomaterials of appropriate strength, flexibility and acceptability; output control and response to body needs; power source. Attempts to solve this problem however are contributing basic data, much that is of immediate clinical value, eg Macleod mitral heart valve (ibid). It is important to note that unlike other heart replacement valves, this valve was designed from the beginning on engineering principles of fluid flow and aerodynamic parameters. It is made from vitreous carbon, one of the most biologically inert substances known.

Organ Transplant

It is, however, in the area of transplant surgery that some of the greatest advances have been made, using the term transplant to mean an organ or tissue removed from one area of the body and transferred to another area. Also from one person to another or even from an animal to a human as in the case of pig heart valves and Barnard's "piggy-back" experiments with baboon hearts to replace temporarily a human one. This area of transplant surgery is so tied up with the development of knowledge about the human immune system that it is difficult to untangle the two areas. Nevertheless it is useful first to examine the problems of immunity, for recognition of the problem of rejection, by the immune system, (unless action such as whole body irradiation, is taken to suppress it) is important in describing developments in transplant surgery. Heterografts, ie material taken from another person (donor) causes the host system to respond, to reject it. The lack of success in adequately controlling this response, without injurious side-effects has led to a slow down in work on transplantation in recent years, which has led to an increased emphasis on the use of synthetic materials for the construction of organs, which have a minimal stimulatory action. It is, however, a mistaken belief that transplant surgery is essentially a contemporary phenomenon. This is not so, for when reports of Indian methods of restoring noses reached Professor Tagliaconzzi at Bologna, Italy, at the beginning of the seventeenth century he established a successful practice in this technique. The demand for such an operation was great for not only did the ravages of syphilis disfigure thousands every year, but the current procedure of removing the noses of faithless wives and petty criminals disfigured many more. Before attempting the operation on live subjects, Tagliaconzzi did a considerable amount of research on cadavers. The operation was not painless but it had a high percentage of success. He only did homotransplants, recognising even then that there was a barrier to heterografts. (Warshofsky, 1965)

Transplantation of skin for the treatment of burn victims of World War 2, both military and civilian, was plagued by the rejection of tissue. Because of the pressures of war heterografts were being attempted. In 1942 the MRC called in several scientists to investigate this important phenomenon.

One of the investigators was a young zoologist, Medawar, who was acquainted with the problems of skin grafts by contact with the plastic surgeon, Gibson. Medawar reviewed the literature on this subject and learned that what the British surgeons were attempting, (i.e. heterografts), could not be done at the present state of science. His important and seminal paper appeared in 1943 in the Bulletin of War Medicine, a vital part of the developments in science and medicine during the forcing hothouse atmosphere of the war).

> in spite of widespread belief to the contrary, skin from one human being cannot be used to form a permanent graft on the body of another.

He was restating what other earlier workers had already learnt.

Continuing his own work, using rabbits, he investigated the process of rejection and concluded it was an immune mechanism reaction and that this reaction was an actively acquired immune reaction. The concepts of "self" and "non-self" when dealing with the immune system and its response was of paramount importance.

This work is considered to be the start of the study of modern transplant immunology. By controlling the immune response of the body to the foreign protein of the transplant, it becomes possible to transplant kidneys, hearts, skin, parts of arteries and even bone marrow.

The main organs which have been transplanted are the kidney and the heart with varying degrees of success which are dependent to a large extent on the centre in which the operations are carried out. The heart is from a cadaver donor, but the kidney may be either cadaver or living donor. The question of ethics has been raised not only about brain death for cadaver donors, but also with living donors, as essentially the person who donates one of his two kidneys is not only putting himself at risk during the removal operation, but by not leaving a fail safe device, ie the other kidney, there is a risk for the future. This is especially so when the donor and host are homozygous twins for there may be a genetic component in the original kidney disease of the host which may later be important in the twin.

It is interesting to note that the rate of success with live donors is twice that of cadaver donors and the rate of success with homozygous twins is highest of all - as would be expected because of the absent or insignificant immune reaction.

Examples of successful tissue transplants are the cornea, and also pieces of the fallopian tube. In this latter situation there is almost a domino effect in that the donor is a woman undergoing sterilisation by tubal ligation and the host is often a woman who had been sterilised and wishes to reverse the procedure. With changing marriage patterns, some criticism has been voiced about the counselling of women before sterilisation, if they are young, other forms of contraception, it is suggested, should be advised.

Heart valve transplant either from humans or pigs as donor has received a great deal of attention but because of the short life of these biological structures the research thrust is towards the artificial variety.

Other organ transplants which are in a more experimental stage are with the liver and the pancreas. With the liver transplant recent improvements of technique have led to an increased success rate, one improvement is the use of "beating-heart donors", ie patients certified as brain dead but with beating hearts.

The latter procedure, of bone marrow transplant, is of interest for it can be useful as a temporary measure when the recipient's cells are damaged, for the tissue producing them can be restored in function. In the spectacular and headline catching cases this procedure tends to be concerned with life and death situations, where a child is born with no cells capable of producing a body defence mechanism and cells from a near relative, usually a sibling are injected in the hope that they may "take" and start to produce antibodies.

Transplantation has led to the whole new field of tissue matching, and consequently an intense study of antigenic structures. This tissue matching is very important especially in kidney transplant where because of the high success rate of related donor transplants compared with non-related donor transplant, the pressure on close relatives to donate a kidney is very strong. Certain authors have expressed the feeling that the question of ethics should be more strenuously investigated in this area rather than in the area of corpse donors.

The suppression of the immune response of the body is extremely complex and several very powerful drugs can be used. As a corollary to the suppression, it is necessary to give the recipient a continuous protective blanket of antibiotics to prevent infection. Because of the heavy drug and antibiotic load the patient may undergo quite extreme personality changes (ie Blaiberg, one of the first heart transplant patients of Christian Barnard showed these changes - Wheatley 1979, per).

Recent work on the reasons for the non-rejection of the fetus by the mother's body has revealed a new kind of lymphocyte. These cells, called suppressor cells, have been found in cord blood and act in an indirect and complex way. They do not suppress antibody-producing cells in the mother, but they act by suppressing 'helper' cells which promote antibody production by other cells.

Although the fetus is not rejected, immune responses against it are mounted and prevent the invasion of the mother by the naturally invasive trophoblast of the placental villi. A degree of immunity to the fetus is therefore necessary to prevent the fetus acting as an invasive tumour. Mechanisms do exist to diminish the power of the immune attack to levels which allow the fine balance needed for successful placentation and maturation of the fetus. These are important considerations when dealing with infertile couples. (Fletcher, 1971, per)

The possibility of a reasonable explanation of why the mother's immune system does not reject the developing fetus, makes the excursion into the ultimate in surrogate motherhood a feasible proposition. That is the implantation of a fertilised egg which has no connection genetically to the surrogate mother, ie she is not a genetic mother but a "placental" mother only.

The existence of such suppressor cells may prove to have important implications for the control of the immune response in transplant rejections and also in allergies and auto-immune diseases. In a specialty as narrow as transplant immunology Hamburger (1974) reports that his laboratory subscribes to thirty-one journals and in 1973 more than five thousand articles were extracted from these journals, catalogued and filed.

The specialty of Rheumatology which is, in the opinion of many, a neglected one, has close links with immunology and it is gaining from advances in this subject (radioassay and automation). Now a new set of diseases associated with specific antigens have been labelled seronegative spondyloarthropathies. The whole emphasis here is toward disease orientation and the disease focus requires more hospital planning (Fletcher,1979,per).

An interesting financial input into the field of immunology has been the gift of nearly one million pounds from the United Arab Emirate for a unit to study diseases of the liver, ie cancer and hepatitis, with most of the work being concentrated on immunological factors.

Although it is not intended in this section to mention the purely theoretical research side of immunology, it is worth recording the comments of Calne (1977,sem), (a leading transplant surgeon) about the present state of immunological theory. He describes the developments in immunology and the subsequent theoretical model proposed as being quite inadequate to explain the results he and many of his colleagues have had in the area of renal transplantation. He suggests a new theoretical approach is urgently needed and it may well come from the practitioners rather than the laboratory specialists.

In Vitro Fertilisation

The technique of *in vitro* fertilisation (IVF) was developed mainly for treating women with blocked fallopian tubes, but the ramifications of the technique and the potential developments from these are enormous.

Technically IVF consists of the removal of an egg or eggs (ovulation is stimulated by chemicals to give several eggs) from the woman, fertilisation of that egg in a glass container by the sperm of her partner, growth of the fertilised egg to a certain stage, when it is implanted back into the woman from where it came, and whom, hopefully, will have a normal pregnancy. The birth in 1978 of a "test-tube baby" (or more correctly a "petri-dish baby") and in 1984 of a baby which developed from a frozen embryo are dramatic indications of the successes of the doctors concerned in these biological manipulations.

The potential combinations are great and will not be explored in detail here, but it is worthwhile noting a few of them. A genetic mother may choose to use a surrogate placental mother, the genetic father may not be the woman's partner but a sperm donor. Couples facing problems of inherited genetic disease may use donated eggs and sperm from non-affected people. Women who cannot produce their own eggs may accept a donation of an egg (unfertilised or fertilised depending on the situation) from a fertile woman. Spare eggs may be frozen for future use and so may embryos. Stimulation of fertilised eggs can result in identical twins or quadruplets each of whom could develop in a different surrogate mother.

The unease and disquiet felt about the developments and potential developments by many lay people as well as members of the medical profession gave rise to the formation of a committee, chaired by Dame Mary Warnock, the brief was to

> examine the social, ethical and legal implications of recent and potential developments in the field of human assisted reproduction. (Warnock Report 1984, iv)

It is of interest to note that the description is not correct for the purpose for which it was designed, for "human assisted reproduction" could be interpreted as animal reproduction assisted by humans. A more correct and less ambiguous term would be "assisted human reproduction".

The use of fetal material for research has raised many objections, mainly on ethical grounds, but some very interesting experiments with future potential have been carried out. One concerns the implantation of fetal pancreatic material into a diabetic, enabling the patient to discontinue his daily injected insulin dose for ten months. The fetal material produced the necessary insulin and because the material was of an embryonic nature and therefore not mature antigenically, the rate of rejection of the tissue was very slow.

The doctor who performed this transplant was severely censured by his peers, who felt it was wrong to use fetal material. The use of donor cells from adults is considered more ethical and there has been some success using glass tubes filled with these cells implanted in the blood stream.

The possibility of experimentation on spare eggs and spare embryos has been suggested, questions arising not of the value of this type of research, but the cut-off point of the age of the embryo. Warnock (1984,81) suggest it should be allowed before 14 days. They use anatomical criteria for this judgment, ie the primitive streak.

Life Support Systems

Although an early life support system, the iron lung, for victims of poliomyelitis, is now obsolete due to the preventive nature of the polio vaccine, it formed the basis for the present generation of life support systems (ie replacement of vital functions). The use of these systems can be seen in four main areas:

Firstly, in neo-natology where very sophisticated machines have been developed, often with miniaturisation for the care of the sick baby. Requiring constant monitoring both by automatic means and by skilled nursing staff, these machines are expensive to buy and expensive to run and maintain. The social implication in the USA of spending $30,000 for a six week stay of a premature baby in neo-natal unit is now being discussed, especially when the child may have been born of a heroin-addicted mother and may itself be addicted for some time after birth (Moosa, 1979,per). Yet the technological imperative for the increasing complexity and sophistication of these machines can be detected in biomedical manufacturing literature for these incubators.

Secondly, life support systems are also used at the other end of life, in geriatric units where old people are said to be kept alive by machines. The development of antibiotics against the causal organism of pneumonia once called the old person's friend has meant that more old people are living longer. This is not the place to debate the ethics of using these machines, but the movement in the USA towards the Living Will and the concept of "death with dignity" is surely an indictment of the medical profession.

Life support systems are also used in another controversial area of medicine, that of transplant donors. The success of an organ cadaver transplant depends on the freshness of the organ, ie that it should be removed from the body as soon after death as possible. This raises questions about the definition of death - the present British medical stance is of brain death according to certain criteria which are based on the expertise of the treating physician. Other countries rely on more technically based criteria, ie EEC patterning - "technologically determined death". It is feasible to keep functionally alive a body purely so that the organ to be donated will be in as perfect condition as possible. The fourth area where life support systems are used is in complex and long surgical procedures, eg heart-lung machine.

INTRODUCTION

An anonymous wit once described a drug as a substance, which when administered to two or three animals, produces a scientific paper. As with most jokes there is an element of truth in this remark.

A workable definition of a drug is rather harder to find for as Fisher and Christie (1973) make clear not only must the definition say what drugs are, it must also say what they do. Drugs are very powerful chemicals, that is they act in very small amounts and they act to produce changes in other chemicals which are part of living processes. The authors stress that a drug can be considered as a tool, a device, which can be used to eliminate disturbance and restore proper order and function, i.e. "normality", to chemicals which make up living matter.

Drugs are essentially the product of the pharmaceutical industry and must be viewed in this light. Those used in medicine are the prescriptive or ethical drugs. These are different from patent or proprietary medicines in that they are not for sale over the counter, they are available to registered medical practitioners and available only to the public by doctor's prescription; some may have a short shelf life and they are usually products of a comparatively high degree of research effort. (Proprietary medicines by comparison have a long shelf life for reasons of profitability, and have little research content).

Classification of Drugs

Drugs are classified either as chemotherapeutic agents or pharmacodynamic agents (Fisher and Christie 1973,). Chemotherapeutic agents or drugs are those which prevent or cure diseases caused by microbes and thereby restore "normality". They do this by destroying the disease-causing organism but they should have no effect, or a minimal effect, on the body's organs and tissues. A good example is that of penicillin which prevents the formation of the rigid cell wall which surrounds bacteria. The failure of the cell wall to form prevents the bacteria from reproducing normally and the population dies. Human cells have no cell walls and are not affected. The action of chemotherapeutic drugs is preferably irreversible, and they usually give an all-or-nothing response, either they prevent the pathogenic action of the micro-organism or they do not. They have the added advantage that their effectiveness can be tested in the laboratory directly against the organisms causing the disease. This has a further advantage in that chemotherapeutic measures can be taken before the causal organism is isolated or identified, and therefore the patient can be treated quickly.

Many anti-cancer drugs are considered as chemotherapeutic for the cancerous cells are considered as "foreign" to the body, and the term cancer chemotherapy is a commonly used one, whether it is used on its own or in conjunction with physical removal and radiation treatment by x-rays or isotopes etc. Contrary to the scheme of Fisher and Christie I prefer to place cancer drugs in the chemotherapeutic section, though their action is infinitely more complex than mere destruction of the cancer cells.

Pharmacodynamic agents or drugs can be thought of as those which restore function to as near "normality" as possible as they reproduce, stimulate, or depress physiological or biochemical human functions, and by their action can provide relief of symptoms or more positively, affect favourably the course of a disease. These drugs act not on foreign organisms in the body but on the cells of the body, and are preferably reversible. A graded response is general depending on the dosage. A good example is anaesthesia where more of a general anaesthetic can either deepen the level of unconsciousness or lengthen the period of this state.

In comparison with chemotherapeutic drugs, pharmacodynamic drugs cannot be tested directly in the laboratory against the disease-causing agent. It is often very difficult to pinpoint where their power could best be used (Fletcher,1979,per).

The majority of drugs fall into this category for three main reasons. Firstly, because microbes do not cause the majority of diseases, they may be responsible for widespread and important diseases, especially in the Third World, but they are not the causal agents of a large number of diseases. Secondly because chemotherapeutic drugs are precise in their action and consequently not so many are necessary. The third reason is that, while all drugs exhibit side-effects, drugs which manipulate biochemical processes in living cells are more likely to produce side-effects and thus there is a constant search for newer pharmacogenic drugs with less side-effects. A consideration of side-effects of drugs and also iatrogenic diseases will be outlined later.

History of Development

The physician and surgeon had an extremely limited list of effective drugs at the end of the nineteenth century. Nitrous oxide, ether and chloroform for surgical anaesthesia, opium and morphine for the relief of pain, digitalis for use in heart failure and quinine for treatment of malaria. Phytotherapy, the treatment of illnesses by pharmaceutical preparations based on vegetable drugs was the mainstay of the therapeutic arsenal until this time. There are signs that Phytotherapy is making a comeback especially in developing countries (Pelt, 1979, 8).

In its present form the international research-based pharmaceutical industry was virtually non-existent in the 1940s. Wholesale chemists and druggists were concerned with the production of "galenical medicines" derived from naturally occurring animal and vegetable ingredients. Typical of the raw materials still used at that time were bitter aloes, belladonna, cascara, digitalis, ergot and fennel. It was only from the late 1940s onward that the specific-active chemicals began to emerge from the industrial laboratories (Reekie and Weber 1979). An approach to understanding phenomena at molecular level.

Until this point, although there had been some important discoveries, their number was limited. The introduction in 1899 by Dreser in Germany of asprin could be said to be the starting point of the pharmaceutical era which still persists (Norton, 1969, 42). Ehrlich is often called the founding father of the therapeutic revolution. When building on the observations of Koch, who showed that aniline dyes could kill bacteria, Ehrlich began his search for the "magic bullet" - a drug that would seek out its own target and destroy it. In 1904 his researches produced 'Salvarsan' which was effective in syphilis (Lloyd,1971,131).

Over twenty five years passed before the next major discovery in 1935 when Domagk discovered the antimicrobial properties of 'Prontosil' - a red dye - by injecting it into his dying daughter, who recovered. Attempts to improve its efficacy led to production by May and Baker of the suphonilamide M & B 693 in 1938 (ibid,132).

Although Fleming discovered penicillin in 1928, it was certain needs during World War 2 (these are discussed later) which led to it becoming available for practical purposes in 1941. Waksman discovered streptomycin, effective against tuberculosis in 1943. The broad spectrum antibiotics were introduced in 1949 and tetracycline was produced in 1953, the first antibiotic where its chemical formula was known prior to the drug itself (ibid,132).

By 1950 the 'drug revolution' or the 'golden age of therapeutics' was under way. The lists produced by the pharmaceutical houses became larger and larger and consequently their profits became larger. They included the barbiturates; the local anaesthetics; vitamins including Vitamin B^{12} for pernicious anaemia; vaccines against typhoid, whooping cough, poliomyelitis and measles; antitoxins; toxoids against diphtheria and tetanus; the hormones beginning with insulin and continuing with thyroid, pituitary, adrenal cortical, and sex hormones; the synthetic antimalarials, new general anaesthetics; sulphonamides; antibiotics, antihypertensives;

antihistamines; anticoagulants; the new diuretics; antipsycholic drugs and the antidepressants (Norton 1969,42).

Many observers think that the 'golden age' has come to an end. In the 1960s new drugs were coming from the pharmaceutical firms at a rate of about 250 a year, in 1976-80 this number was down to 100 a year. Many of these were unsurprising additions and modifications to therapeutic groupings already well established and supplied (Dunlop, 1977, per).

There are numerous reasons advanced for this decrease. The industry has become dominated by a few large companies. These companies are unwilling to launch new products unless they can be sure they would be profitable because they are for a large potential market like peptic ulcers, hypertension and heart failure. The increase in time and money needed to get a new drug from the laboratory to commercial use is said to be stifling innovation. Couple this with the new and stringent laws on drug testing and the recent spate of litigation against the companies and you have a very conservative mood in the pharmaceutical industry. (ibid)

New Drug Development

New drug development generally follows one of the following directions; purification of natural substances, modification of the chemical structure of existing drugs, new syntheses (Fisher and Christie 1973). Examples of each mode are now given. Most of the early drugs like digitalis and atropine were derived from plants. Antibiotics are obtained from fungi (though semi-synthetic ones have been derived by laboratory techniques). New or improved antibiotics have been the result of extensive and costly screening of thousands of fungi growing on a variety of organic material (a new strain of penicillium was discovered growing on a rotten cantaloupe melon).

The world price of progesterone, the female hormone previously extracted from animal ovaries, fell from $80 gm to $1.75 gm when it was found that a naturally occurring chemical, obtainable from dioagenin, could be converted easily to progesterone. The way was now open for the production of a cheap effective method of contraception using this new supply of the hormone. This type of chemical development can also be seen in the production of new penicillins. Generally the cost of the drug is greatly reduced, eg chloramphenical, the preferred treatment for typhoid fever, was very expensive until a way was developed to synthesise it from its naturally-found precursors.

The third direction, that of new synthesis, does not begin without a well established starting point. It may be that a body substance is known to perform a certain desirable function, an attempt is then made to develop a chemical which will mimic this function without any undesirable side-effects. Experience with similar chemicals may help in the development of the new one. Fisher and Christie (1973) outline an example of this type of approach.

A drug called salbutamol was released in 1969 for use against acute asthmatic attacks. This compound was synthesised during a planned and rational research program where knowledge of the normal neuromuscular control of the lungs was coupled with the knowledge of the action of older drugs such as isoprenaline. This latter drug was effective in asthmatic attacks but there was the risk that it would disturb normal heart function as well. Salbutamol in an aerosol form was well designed to go directly to the assumed seat of difficulty in the lungs, and because it affected the heart to a much lesser degree, it could be used not only by the young with strong hearts, but by those whose hearts were weak and who therefore had been unable to obtain relief by using older, dangerous drugs.

The in vitro cultivation of plant cells has given rise to the possibility of large scale production of drugs and other chemicals, previously extracted from plant material. Examples of substances which may be produced by this method are diosgenin (starting chemical of the contraceptive pill), digitalis, morphine.

Doctors, Scientists and the Drug Industry

One cannot end this introduction about drugs without mentioning two important developments. Firstly, there is the reaction of the pharmaceutical firms towards doctors which has taken place over the last thirty years. As Reekie and Weber (1979, 56) indicate, before the late 1940s the medical profession had only experienced the

> restrained commercial atmosphere created by modest sales promotion activities of the small 'ethical galenical houses'

Then at the end of the 1940s it was suddenly subjected to

> the full force of the professional marketing activities of the new large-scale international pharmaceutical manufacturers.

This development is an important one, with potential dangers.

Secondly, there is the role of scientists in medical developments. Kornberg (1978), believed that the key discoveries which made x-rays, penicillin and polio vaccine possible were not related to medical research on disease. These medical miracles came from the curiosity of physicists, bacteriologists, biochemists and cell biologists about basic scientific questions unrelated to medicine. He does, however, make the comment that

> once the insights and techniques were discovered, the applications to medicine were rapid and dramatic (ibid, 22)

CHEMOTHERAPEUTIC AGENTS

The raison d'etre behind the development of chemotherapeutic agents was very well expressed by Ehrlich at the end of the 19th century, when he indicated that it was necessary to search for chemical compounds which will have a strong destructive effect on the parasite but which will not, or only to a minimal extent, attack or damage the organs or tissues of the body. It was important to find "magic bullets" which find their targets for themselves.

The main success story is of course the development of antibiotics. This term was derived by Waksman to mean substances derived from living organisms which are toxic to other living organisms. This distinction is important, for the era of the antibiotics began with the production of penicillin in the 1940s. Ehrlich's salvarsan, and M & B 693 are not classified as antibiotics by this definition.

The term antibiotic is now, however, used in a more general sense, for the ability to make synthetic penicillin and modification of the original molecule with added side chains, is indicative of the chemical ingenuity of the organic chemist.

This section is divided up into five sections: antibacterials, antiparasites, antivirals, antimycotics and finally anticancer drugs.

Antibacterial drugs

The development of penicillin and perception of its potential use, is one of the most dramatic examples of the diffusion of innovation. The subsequent synthesis of synthetic penicillin with various side chains depending on the action required of the drug, is often quoted in a celebratory manner as an example of the chemist's discipline. The success of these two projects gave a great impetus to the whole drug scene and could be said to have led directly to the "Golden Age of Drugs". The double edged nature of this age can also be seen, with penicillin as a prime example, for there are advantages and disadvantages to these products of technical advance.

Much is made of the serendipitous nature of Fleming's original discovery, but Pasteur's concept of the "prepared mind" is of more importance here. Fleming, who had worked with Sir Almoth Wright in World War I on antiseptic treatment of war wounds, was working on the bacteriolytic effect of lysozyne when he saw the action of the penicillin-producing fungus on S. aureus and therefore he was able to perceive, what others had not, that this was a significant event. This was in 1928 and though he thought that it would be a useful antiseptic, ie external application of the filtrate to external wounds showed some success, he did not develop this further.

It was not until 1938 when Chain was testing many chemicals for their antibacterial properties that through his interest in Fleming's work on lysozyne he came upon his work with penicillin. It was Chain and Florey who perceived its great potential for internal use and it was the pressures of World War 2 and the necessary treatment of war wounds that gave the impetus to its quick industrial development (Lloyd, 1971, 133).

> The urgent demands of war led to a quicker exploitation of the clinical possibilities of penicillin than would have been likely under normal conditions (McNaulty 1968, 10).

It was Florey, realising that large scale production of penicillin was not possible in war-torn Britain, persuaded the American government to produce it on an industrial scale. This valuable piece of inter-Allied collaboration brought the antibiotic into widespread use at a crucial period of the war and saved many lives.

Clinical trials were carried out in 1942 but the first large scale treatment was to the casualties of D Day landing in 1944. It was especially good and efficiacious in burns and "dirty" accident cases. Ethical problems concerned with human worth were experienced when the drug was in short supply. The same quantity could cure one staphylococcal septicaemia, twenty cases of gonorrhoea, or four hundred septic infections of the hand. If the septicaemic case was a civilian and the gonorrheal cases were fighter pilots, the decision was thought to be easy, but essential industrial workers with septic infections were also important.

Its efficiency, however, had one serious consequence which quickly became evident after the introduction of the drug. It became common knowledge among service personnel that it

> was a panacea for venereal disease and this engendered an attitude of carelessness among some who would otherwise have refrained from exposure because of fear of venereal diseases and the difficulty and uncertainty of effective treatment (McNaulty 1968,11).

By the end of the war there was enough penicillin available for all military purposes and a little left over for civilians. It was not until 1948 that it was produced in a form where treatment could be by injection every 24 hours, and not until 1955 that a gastric-juice-stable product was produced for oral use. Synthetic penicillin (Broxil) was produced in 1959 by the Beecham group, previously patent medicine manufacturers, who had entered the ethical pharmaceutical field in 1955 on the advice of Chain, who later joined them as scientific consultant and was responsible for this breakthrough (Dunlop, 1978, per).

Many workers were stimulated by the success of penicillin and research into other possible sources of similar chemicals was undertaken. It was Waksman in 1943 who discovered streptomycin. This antibiotic was extremely successful for the treatment of tuberculosis. Over a four year period he tested 10,000 soil cultures, 1,000 were bactericidal, 100 were followed up, 10 compounds were isolated and 1, streptomycin was effective.

In the immediate post-war period there was a definite shift of emphasis in the search for new antibiotics. Most of the early discoveries (with some notable exceptions) were made and developed by scientists working in university or medical school laboratories. But the shift was now to the research departments of commercially motivated firms. It was only those firms who were able to afford to do this type of work. This point is emphasised by the following developments. Chloramphenicol was developed as the first broad spectrum antibiotic, very effective against typhoid fever, by an American drug firm. Another firm developed the tetracyclines in 1953.

Another important development in antibiotics which again had special reference to penicillin, was in the early sixties when chemists were able to manipulate the addition of specific side chains on to a basic penicillin molecule which led to an increase in the number of penicillins available, and enabled the problem of drug resistance to be eased. The problem of drug resistant bacteria is a large one and a constant threat to the control of infectious diseases (eg outbreak of antibiotic resistant meningitis in Brazil has led to many infant and child deaths). It is in this problem that the skill of the chemist is of prime value. (Harper, 1979 per)

Penicillin should also be regarded in broader terms, for its discovery, development and subsequent wide, use acted as a great stimulant to other projects.

The dramatic effect that an antibiotic can have on a specific specialty can be seen in the case of streptomycin treatment of tuberculosis and the specialty of chest diseases. Although the incidence of tuberculosis was on the decline before the introduction of streptomycin, the use of the antibiotic plus detection of the disease by mass radiography (and to some extent by BCG vaccinations) brought about a dramatic reduction in the incidence of the disease. This decline put chest disease specialists out of work, for this specialty was at that time dominated by tuberculosis. Some concentrated on other respiratory diseases whilst others went into geriatric medicine - in many cases only a change of use of their hospitals was needed (Forsyth and Logan 1960,15).

The dangers inherent in the use of antibiotics can be judged by various indicators. Many people especially in the USA are highly allergic to these substances, especially to penicillin. So dangerous is allergy for the individual that societies exist which keep records of these people, who are encouraged to wear at all times a bracelet giving details of their allergy and a 'phone number where doctors and other medical staff can get immediate details of the problem. This also represents an increasing degree of surveillance of non-ill people.

The 'blanket' use of penicillin for the treatment of gonorrhoea has recently been placed in serious doubt for it has been discovered that the gene which provides resistance can easily be transferred. This transference could be to a drug-sensitive strain, but one danger is that it could be transferred to a related species which is responsible for epidemic meningitis (Harper,1983,per)

Antiparasites

Parasitic infestations are not a special problem in Western industrialised nations, but they are a great problem in 'developing' and 'underdeveloped countries'. As Candau,(1977,sem) has forcibly pointed out, as far as Brazil is concerned all her problems are problems of Tropical Medicine, ie largely parasitic (which makes any reduction in research in this area by 'developed' nations hard to accept, when their policies are officially towards aid to these nations).

Research in this area always receives a great boost when it is necessary for foreigners to go into areas of infestation. This can be very clearly seen during World War 2 when both British and American troops were fighting in Asia and Africa, and in subsequent areas of conflict like Malaysia and Korea. Of special interest to them was the causal organism of malaria. Developed in the USA during the war by an intensive random screening process, the antimalarial drug proguanil supplanted other less effective drugs and greatly affected the war in the Pacific, and in 1951 a joint Anglo-American team developed pyrimathamine. Unfortunately all these drugs have considerable side-effects especially amongst people of Middle East and African origin because of some genetic susceptibility, showing the disadvantages to some from manipulations that are advantageous to others.

Control of malaria and other parasitic infestations are best carried out at source by chemicals such as DDT, though resistance to this measure is now an important factor. Poor sanitation and poor nutrition with lack of medication and control of infected people are considerable factors in these diseases and the emergence of bodies like WHO who can take a global look at these problems is one important feature of medicine that has arisen in the last thirty years.

The fragility of chemotherapeutic control of malaria can be judged by the resurgence of this disease in Asia. Of particular concern is the problem with the deadly <u>falciparum</u> strain which is associated in the lethal cerebral malaria if not treated adequately.

In the main it is instability of population groupings which has led to this dangerous situation, especially in Indo-China where large groups of people have been kept constantly on the move because of local wars and upheavals. This movement has two effects, as carriers mingle with unaffected people it is difficult to have any control over the disease, and as local populations who have a resistance to their area strain, move to other areas, they succumb to a different strain. These situations make it easy for the parasite to develop drug resistance to chloroquine, which has none of the side effects associated with quinine. This drug, however, is being used increasingly to combat the chloroquine resistant strains.

<u>Antivirals</u>

A significant gap in the drug armoury against infectious disease, is the lack of any potent chemotherapeutic agents against viruses. The most effective measures in viral diseases are still preventative via vaccines. In 1970 an antiviral drug called amantadine was released after a decade of clinical trials. It was used to treat flu during an epidemic and was of limited success but its usefulness is restricted to only a third of known flu viruses. Other agents have been produced, methisazone against smallpox and idoxuridine for some forms of encephalitis. A recent drug, adenine arabinoride (Ara-A) has been used successfully in the treatment of previously fatal encephalitis. But the numbers are small and the effects in some cases problematical. The main drive of the pharmaceutical industry has been either in vaccine production or in stimulants of natural body defences (see Vitamin C).

Antimycotic agents

Griseofulvin, one of the most successful oral antifungal agents was discovered in 1939, but its therapeutic potential was not recognised until many years later and it did not go into production until the 1970s. It is very successful against ringworm.

Other agents have been developed but there are not many, eg Amphotericin for candidiasis (thrush), Nystatin also for thrush especially of the mouth and Griseofulvin for external treatment of ringworm.

Anticancer drugs

The development of drugs against cancer had its inception during World War 2. At the beginning of the war research into the possible use of gas in warfare was being carried out in the USA, concentrating on the effect of sulphur mustard gas - the gas used in the first World War and because it was suspected that it might used again. The toxicity of nitrogen mustard, an improved military gas, was examined and found to be especially toxic to lymph and bone marrow. A junior in the research team suggested that because of this toxicity this substance should be tried on a tumour of mice. An excellent example of the appropriation of knowledge from a heterophilous source. This treatment was so successful that in 1943 a patient with lymphosarcoma was treated with the chemical. A spectacular, though short lived remission followed, not reported until 1944 because of the need for secrecy. This approach, using cytotoxic chemicals for the treatment of cancer became very popular and a search for more chemicals began. Chemists became very involved in this search producing from 1946 a series of analogies of nitrogen mustards.

Faber was the first to approach the search for cancer drugs, in a scientific manner. Looking at the effect of folic acid deficiency on bone marrow he was surprised when addition of folic acid stimulated lymphomas. The use of an antimetabolite of folic acid, ie methatrexate, gave success in the treatment of leukaemia in children. The 1960s period was the time of expansion in all areas of drug development and anticancer drugs were no exception. By 1969 there were 20 compounds available from various sources. (Dunlop,1977,per)

One area of failure is worth noting. Because they had been successful during World War 2 in developing an antimalarial drug which altered the course of the war in the Pacific area by a system of random testing of large numbers of chemicals, the Cancer Institute of Bethesda tried the same method for anticancer drugs. As Smyth (1980, sem) indicates, it was probably the largest scientific experiment ever carried out (and thus the biggest failure). From 1950 in a very expensive project 400,000 substances were tested. No successful drug emerged from this project.

This lack of success, coupled with the later lack of success of the Nixon generated multifactorial (very expensive and extensive) attack on cancer in the 1960s, made it obvious that money was not the prime problem of cancer research. It was thought to be not only a lack of good research workers, but the lack of a paradigm shift with the revolution in method and theory that shift would produce.

The role of serendipity in cancer research has been stressed by Smyth, but it must be stressed again that the concept of Pasteur's "prepared mind" is important here.In 1965 Rosenberg when examining the effect of electricity on bacteria noticed strange effects when he used platinum electrodes. A junior suggested using platinum in experiments with mouse sarcoma and a very useful baseline chemical for cancer chemotherapy was discovered. At the present moment 300 platinum compounds are going into chemical trials.

In cancer chemotherapy one of the most important concepts is that of polypharmacy, introduced by Hamilton Fairlie. Polypharmacy is the use of more than one drug in treatment of patients and long remission times have been obtained, especially in the lymphoma of Hodgkins disease. It is in the field of childhood leukaemia that this approach has been most successful.

In 1980 it can be said that 56 disseminated cancers are susceptible to cytotoxic drugs and can be said to be capable of being cured, another 8 are highly sensitive and prolonged survival is possible, others are sensitive but only a short survival is possible and still others are refractory.

Smyth (1980, sem) indicates the need to approach the subject of cytotoxic drugs scientifically and stresses the need to know more basic facts about cell metabolism especially that connected with DNA. Once normal pathways can be established, the cancer cell can be cheated of metabolites. The next generation of drugs should be arrived at by scientific logic and the role of the molecular biologist, the biochemist cannot be overstressed if this approach is to be successful.

One potential breakthrough in the treatment of cancer is the use of interferon. This is a defensive protein produced by mammalian cells in the body when they are attacked by a virus. Production of this protein was complex and costly but recently by genetic manipulation of the bacterial genome it is now possible to produce large quantities comparatively cheaply. Spectacular remissions of cancer have been reported after the use of interferon.

PHARMACODYNAMIC DRUGS

A suitable schema for the division of this section is not easy to derive, but the present division is suggested as a working basis. Some areas are treated in depth, others only cursorily. The divisions are blood and blood products; control of pain - analgesics and anaesthetics; functions of the mind; vitamins and other nutrients; hormones; other drugs; vaccines; general conclusions.

Blood and blood products

Although Landsteiner introduced the procedure of blood transfusion, this was, and remained for a long time a direct transfusion from donor to recipient. Technical advances in the storage of whole blood and blood products gave the biggest breakthrough enabling complicated surgical procedures to be carried out. The impetus of World War 2 and the treatment of the wounded was instrumental in this.

Blood products are of especial interest as there have been many recent developments in this field. Antitoxins were used before the war, especially in diphtheria, but antibody treatment of pregnant women who are infected with German measles virus is comparatively new - not because of the problems in the production of antibody, but because it is now known that the virus has recently proved to be teratogenic and a proven immunological strategy has been recruited to deal with it.

A procedure introduced in the 1970s is now routine in the desensitisation of pregnant Rh negative women so that they will not damage their babies. (see chapter 7)

The development of an antihaemophilic preparation, factor VIII, has been of great benefit to haemophiliacs. This preparation which needs to be kept frozen, will prevent internal bleeding after injury. The storage can be in the home of the haemophiliac due to the development of cryotechnology and the patient can treat himself. Although this seems a straightforward development without any particular problems, when it is examined closely it is a Pandora's box of problems. Firstly because this treatment is effective, the expectation of the haemophiliac is raised. Remembering that this is a sex linked disease, women being carriers only, the young men and boys who up till now have led only a sheltered life, are now atttempting normal pursuits like skateboarding, ski-ing, mountaineering. By using the preparation before they take part in these sports any internal injuries they suffered are dealt with. This has meant that any original estimate about supply and cost of factor VIII was far too low. As it is a very costly item, questions about its increased use are being asked. In 1978 it was estimated that one haemophiliac cost the country via the NHS £8,000. Any operation performed cost £1,800 for the factor alone and because of the increased freedom more accidents were taking place.

This freedom has also led women who are carriers of the defective gene, to reconsider their attitude to children. Some had, because of the poor life the haemophiliac was forced to lead, previously either refused to have children at all or had chosen to have only girls (amniocentesis, sex determination and therapeutic abortion). Now that they see the type of life possible for young haemophiliacs they are more willing to allow a male fetus to develop. It does emphasise the way in which medical treatment now is often very much for the individual. Not only is it not species-based medicine but in this case it is almost antispecies based (Wilkie,1979,per) and shows the complexities of the doctor-patient interaction where in some instances there is a one-to-one relationship, and in others it is more general, i.e. in pregnancy.

The final problem that this kind of treatment raises, is the raw material used for the production of the factor, for it is a human extracted from human blood. Until recently this blood was readily and cheaply available from third world countries. But now, because of their own expanding medical services and increased surgical commitments, they need their blood. Also they have realised what a valuable property it is, and higher prices are being asked. These developments place the pharmaceutical industry in a quandary. Will the NHS stand for substantial increases in the price of factor VIII or will it keep to its original budget, meaning less treatment available for haemaphiliacs? Have they a strong lobby in parliament - after all it is a 'Royal' disease? Will the industry feel justified in spending money and time on the development of a cheaper method of production when the number of haemophiliacs is so small, though increasing? It is at this point that scientists will draw attention to the tremendous potential of genetic engineering in a search for this type of product. With the examples of growth hormones and interferon as models, this must be the avenue of approach the pharmaceutical industry will consider - if society gives them the mandate.

Control of pain

This area can be divided into two sections, loss of pain with no loss of sensation - analgesics, and loss of pain and loss of sensation either locally or generally - anaesthetics.

Several advances in anaesthesia were made during World War 2 especially in entubation, and the introduction of "light sleep" by the use of curare in 1946 was a very important development, as was the "pre-med" advances of the 1950s. Although the introduction of ventilators by anaesthetists could be considered under physical manipulation, it had one very important consequence, it left the hands of the anaesthetist free. This meant that it was possible to develop new techniques and use new substances. Suitable monitoring equipment greatly helped in these procedures, making open-heart surgery and transplant surgery possible. (Milne, 1979, per) These developments can be viewed as incorporating the system approach of interdependencies.

Lowering blood pressure of surgical patients by drugs, a "physiological trespass" enabled new operations to be performed, or old ones to be carried out with greater success. Another innovation was the lowering of temperatures of surgical patients - hypothermia - which necessitated very careful control by the anaesthetist especially of oxygen levels.

According to Milne (1979, per) ICI have hundreds of pharmacologists working on new drugs, 3,000 compounds a year are made and tested, ten of which may go into clinical trials. Probably only two a year will be suitable products for anaesthesia. Nevertheless the profit to be made from these compounds is considerable as operations become longer and more complex.

The life of an anaesthetist is not without grave hazard. Recent reports indicate that children of these doctors are sixty times more likely to have cancer; breast cancer among women anaesthetists is fifty times higher than normal, and they are more likely to have miscarriages.

The analgesics are numerous from naturally occurring substances like morphine, synthetic substances like methadene paracetamol, phenacetin (now not prescribed because of its serious effect on the kidney, which can lead to kidney failure - and the need for transplant or artificial kidney). Relief of pain in labour is described in Chapter 9.

The concept of a pain unit is a new one, and it is one which concerns anaesthetists and their drive for their own patients. These are units where patients with intractable pain can be treated both by chemical and physical manipulation - often a combination of both. Two examples are worth mentioning. The first is <u>cryoanalgesia</u> where narrow probes are inserted into the brain and gas at low temperatures is injected into the nerve centres which control pain. Patients are said to prefer this method as there appear to be no side effects.

The second example concerns the opiates which if prescribed properly would not lead to addiction. This is especially true for morphine and cancer pain.

In 1963 an Intractable Pain Unit was set up in the Royal Infirmary Edinburgh in the neurosurgical unit, but run by anaesthetists. Following on from this has been the involvement of the anaesthetist in the hospice movement where opiates and mood drugs like marijuana have been used to improve the life of dying patients. An area where they have considerably more control and autonomy. This represents a change from the inter-war period which Stevens (1966; 113) saw as a time when scientific advances in anaesthetics had not led to the increase in status of the anaesthesiologist. Recent comments by Searle (1984; 328) indicate that

> in recent years anaesthesiology has been able to use its technology to advance itself.

<u>Functions of the mind</u>

Drugs in this area range from mood modifiers, those used to relieve symptoms of incurable diseases, to those used to control violent mental patients.

Psychotropic drugs have been according to Miller (1966; 649) one of the greatest advances since penicillin. But there is an awareness that they are overused. Cynics in the USA have said that one reason is that patients who are restrained by drug control, cannot commit suicide and thus the psychiatrist cannot be sued by relatives. These drugs have made a great difference to the management of mental hospitals with less need for restraint and shorter hospitalisation. It has changed the direction of the specialty of psychiatry (Kendall, 1978, sem).

Increased use of chemical manipulations in general for psychiatric treatment has been reported, this ranges from used vitamins, trace elements to complex biochemicals. Recent work with a posterior pituitary hormone, vasopressin, given as a nasal spray has shown its effectiveness as a memory restoring drug - previously only envisaged in science fiction.

Drugs for the treatment of Parkinson's disease, epilepsy, schizophrenia, have been developed and have been successful to some extent. Mood modifying drugs are legion from antidepressants, sedatives like barbiturates, stimulants, and tranquillisers like librium and valium. It was the tranquilliser, thalidomide, developed in Germany in 1954 and released after apparently exhaustive testing which focused the attention of everyone (doctors, scientists, manufacturers, government and members of society) to the dangerous side effects of drugs. It was a powerfully effective tranquilliser with no apparent side effects, but it was discovered to be teratogenic to the fetus, a tragic reminder of the concept of the "poisoned womb" (Elkington (1985), discussed later in Chapter - S The subsequent consequences of this discovery are well known including the long litigation procedures, but the main effect was the tightening up of drug testing and release of drugs to the public. This was a very important watershed, and led to the formation in Britain of the Committee on Safety of Drugs in 1963, with Sir Derek Dunlop as its first chairman. (Dunlop, 1977, per)

Vitamins and other Nutrients

The importance of vitamins and nutrients has been well charted and no attempt will be made to amplify this, except to draw attention to what is seen as the apparent lack of willingness of the medical profession to utilise or teach students about the knowledge available, though new developments in this area are discussed later.

Recent developments have included the use of mega-doses of Vitamin C for treatment of cancer patients; the report that many cases of retinal degeneration in man are due to ineffective absorption of Vitamin A; the whole concept of bioavailability; the possibility that zinc deficiency may lead to cancer formation as well as male sterility and be a factor in anorexia nervosa; and the need for oral contraceptive users to take extra vitamins and minerals. These few examples from the many available indicate the growing concern with benefits of vitamin and other nutrient therapy.

This area is one of particular interest for many reasons. Firstly manipulation of nutrients can still be carried out by lay members of society without the intervention of the medical profession. This is an important consideration. Secondly two moves by the medical profession in the USA can be seen to bring control of nutrient manipulation within the context of medicine. These are the Clinical Ecology movement concerned with the toxic and allergic effects of food and other environmental substances and the Society for Ortho-molecular Medicine which is concerned with correct dosages of normal body nutrients both in cure, amelioration and prevention of disease. They are also concerned with the removal by replacement of toxic substances like lead, mercury and cadmium.

With reference to Clinical Ecology, dramatic cases of cure have been reported when normal foods have been taken out of the diet. Some of the symptoms of sensitivity to tea mimic those of heart disease. Many nervous complaints where the patients had been referred to psychiatrists, have been cured by the deletion of caffeine.

With reference to Ortho-molecular specialists they have been instrumental in opening up the whole field of trace elements and their importance in modern disease patterns. Special emphasis has been placed on the antioxidant properties of selenium in conjunction with Vitamin E, the possible connection of this substance (or lack of it) in heart disease and cancers of various kinds. The dangers of interaction of non-cancer causing chemicals to produce cancer-causing agents has also been stressed, eg chlorine and fluoride in drinking water and increase of free radicals.

Williams (1971) has suggested two theoretical ideas of importance; firstly that individuals are biochemiclly unique, i.e. each individual has nutritional needs which differ both qualitatively and quantitatively from his/her neighbour; secondly the concept of genetropic condition, i.e. a condition that is predisposed by heredity and precipitated by nutritional factors. These ideas have import generally in the doctor-patient relationship but specifically in the area of handicap.

Hormones

The main development in this area is that of the sex hormones. (Insulin and diabetes will not be described, nor will the corticosteroids, the anti-inflammatory hormones so important in asthma).

The production of oral contraceptives, their low failure rate, their possible dangerous side effects, and the moral problems involved present a fascinating aspect not only of drug development but of its impact on society. Non-barrier contraception especially in young women is said to be responsible for increasing cases of carcinoma of the cervix. Demands for an injectable contraceptive have been strong and depo-prova has been used with success. The use of hormones in HRT in menopausal and post-menopausal women has been criticised because of the potential cancer causing effects, but many women have been helped by the measure. Induction of labour and production of abortions are possible under hormonal control. The recent introduction of chemical abortion by oxytocin has led to many problems for the nursing profession, because they are often in charge of this process after the initial injection. Treatment of menstrual problems, especially in teenage girls, has also been treated hormonally. Not only can fertility be depressed, as with the use of the contraceptive pill, it can also be stimulated by hormones.

Growth regulation by hormones, especially the testosterones has received a great impetus with the production of cheap hormones. These hormones are the product of genetic engineering and in one week it is possible to produce the same amount of hormone as was produced in a year by the Chilean industry by other methods. Hormones used for pregnancy testing (Primadea) have been discontinued when children with gross abnormalities were born after the mother had been tested in this way. Other hormone treatment (stilbesterol) to prevent miscarriages has led not only to the female children developing vagina carcinoma, but a suggestion that the grandchildren will also develop this form of cancer.

As Greep (1976,2) stressed, that even if all reproductive research were to be brought to an immediate halt, out of

> our accumulated knowledge and experience, normal reproductive function including every step from mating behaviour to birth of live young could be carried out solely by the action of exogenous hormones of known structure, function and potency.

Hormonal control of sex offenders has been controversial but there have been instances where men have opted for this chemical control of pathological sexual impulses rather than serve a gaol sentence. In one instance an offender consented to have a thigh implant of the drug Oestradial, to reduce his libido. The only side effect was said to be enlargement of the breasts but said the prescribing doctor, they could be removed later by surgery. An example not only of the incursion of medicine into all aspects of life, but also an illustration of a "technological fix" described by Weinberg in Chapter 3

Other drugs

The last division of drugs is a general one. It contains many of the important drugs used today, but rather than give specific names an indication is given of the areas in which they are used (details are from Trounce 1970).

Neurological Disease - epilepsy, migraine, Parkinson's disease, neuralgia

Autonomic Nervous System - asthma, stoppage of bleeding, hypotension (amphetamines have a marked stimulating effect) glaucoma relief. This list is long and complex.

Cardiac dissease - many drugs with various uses are available

Hypertensive disease - again many drugs available.

Diuretics and drugs used in haematology can also be listed.

The use of drugs in areas other than those they were developed, for is highlighted by the use of a cancer drug - methotrexate - in severe cases of psoriatic arthropathy, although the drug is specifically proscribed for this condition. The quality of life is so enhanced that patients seem willing to take the not inconsiderable risk, and their doctors support them.

Vaccines

The concept of immunological protection from disease by the use of vaccines was well established before World War 2 and various vaccination programmes were mounted. Paramount among these was diphtheria vaccination. In 1940 a systematic immunisation began on a national scale, the Ministry of Health providing the vaccine free (previously the cost had been borne by the local authorities). The impetus of war and a very strong publicity campaign coupled with education of the patents of the value of this type of approach, had the result that in 1944 60% of children in England and Wales were inoculated. In 1940, 46,281 cases were noted - with 2,480 deaths; in 1944, 29,949 with 934 deaths. (Norton, 1969, 44) As a disease diphtheria is now rarely seen in Great Britain except in recent immigrants. Due to this rarity and some unfortunate experiences with whooping cough vaccine, parents have been less willing to bring children forward for other vaccinations. Fear has been expressed that an outbreak of diphtheria might result as there was now a substantial non-protected population of children.

BCG, the vaccine against tuberculosis, was introduced in 1943 and is now given routinely to schoolchildren. Undoubtedly the success story of the decade was the production of polio vaccines of the Salk and the Sabin types, the latter is used for large scale immunisation. (ibid, 63) Tissue culture (or cell culture) a biological breakthough, played an important part in the development of this vaccine, and German measles and measles vaccines.

Eisenberg (1977, 244) reflects the views of Titmuss on the importance of biological developments, and comments that

> when fundamental biological knowledge of disease is acquired and applied as a preventative measure striking changes do occur.

He gives the following figures for poliomyelitis for the USA (where the vaccine was developed). Total outlay on basic research on polio virus $40 million; lives saved by vaccine 2,000; severe paralysis avoided 3,000; cost to service $1 billion. In a recent outbreak of polio in Holland, 109 cases were reported with mainly relatively slight symptoms, though there was one death and 75 cases of varying degrees of paralysis. None of the victims had been vaccinated as they were from a fundamental religious sect which considers vaccination to interfere with the will of God. (Harper,1983,per)

The production of German measles vaccine has been important because of the virus's known teratogenic effect on the fetus. Vaccination programmes for teenage girls have been set up. A recent report has indicated an element of social control in this area for, girls at private schools are less likely to be vaccinated than those from state schools. Vaccination against flu is a controversial issue, especially in relation to the elderly, for the flu virus is so unstable that the efficacy of the vaccine varies depending on the strain of the current flu virus. Much money has been spent on a vaccine for the common cold, so far with little apparent success. Utilisation of smallpox vaccine as well as other controls has resulted in the virtual elimination of smallpox from the world according to WHO releases. Measles vaccine is also available but not yet in routine use, mainly given to contacts especially those in ill health.

The potential threat of a widespread epidemic of AIDS virus, has increased the public awareness of both the lack of antiviral substances and the need for efficient vaccines. This particular disease presents problems for there has been a moral element attached to its spread, when it was thought to be restricted to homosexuals and illegal drug-taking. Now is 1985 when it is known to be a blood-transmitted disease which can infect heterosexuals as well, demands from the public for an efficient vaccine or other form of treatment have grown increasingly strong. The medical profession, which was slow to respond to the needs of the homosexual population, appear to be reacting more readily to the current more general appeal.

It is worth recording here some comments by Sir Derek Dunlop (1977, per), the doyen of Edinburgh therapeutics and for many years chairman of the Drug Safety Committee which bore his name.

He was of the firm opinion that drugs were not developed as the result of devoted, logical, scientific research (except perhaps Dale's antihistamine and Peter's British anti-lewesite). Most were the result of sheer serendipity. Often a treatment was correct but had been given for the wrong reasons, i.e. bromide was useful in epilepsy but it was given as an anaphrodisiac against masturbation, liver was given for pernicious anaemia for its iron content in ignorance of the true active principle (vit B^{12}). If a drug is active, i.e. fulfilling its function, it will have side-effects. This fact is not commonly realised, nor will the side-effects be immediately apparent. Prolactol, introduced by ICI in 1967, was very good for angina, is now known to have most adverse reactions on the eyes and thus is not used. This drug-taking risk must be accepted by the public. Dunlop feels a valuable drug may have a 1:50,000 death rate, odds which a surgeon would be happy with.

In connection with the Drug Safety Committee, he pointed out that the members were part-time and their careers did not depend on it, in marked contrast to the situation in the USA. Because of this, decisions about drugs tend to be much slower in the USA and more extensive tests are done, though recent scandals in the USA in the testing of drugs by official organisations have shown the dangers of giving this work to outside firms over which there seemed to be no control.

Dunlop was also of the opinion that though psychotropic drugs had helped to reduce the stay of patients, they were now grossly overused. He also mentioned that in the 15-30 year group, self poisoning was the second most common form of death after motor accidents.

Recently interest shown by the pharmaceutical industry in old wives' tales of medical cures was, he thought, a productive line of enquiry. There is a good precedent for this as the following examples show:

burnt sponge for goitre - liberation of iodine; boiled toad for dropsy - skin has alkaloid with diuretic properties; spider's webs for asthma - arachnidin, a remarkable febrifuge isolated from webs.

These unlikely sources emphasise the old adage of Arabian medicine still common in Western medical ethics, that there is a cure for everything - all man has to do is find it. This guiding principle has been the activating faith of many researchers and can be seen in the present emphasis on cure rather than prevention, e.g. cancer treatment and search for cure.

SECTION II ENDPIECE

The purpose of this section was to describe in a fair amount of detail some of the changes in medical practice that have taken place over the last 50 years or so. My main aim was to show the influences of developments in science and technology, and whilst these are prominent and will be discussed later, it is obvious that other factors are also at work. These factors are, I propose, war, profit, state intervention and vested interests of the medical profession, but of course they are intimately bound up with science and technology and it is difficult to separate them out. Nevertheless it is instructive to attempt this exercise.

Metaphors and aphorisms abound about the milieu which favours innovation. Necessity is said to be the mother of invention and Heraclites said war is the father of all things. There is no doubt that during periods of conflict either major or minor, there is a desire to try things that in normal times would not be considered or would take ten times as long. Restrictions are lifted, money and personnel are made available. War is a catalyst, a forcing house to solve problems which are holding back the progress of the fight against the enemy.

Examples of the accelerated pace of innovations and their development during World War II are the isolation and production of the antibiotic penicillin for the treatment of wounds, amputations and some venereal diseases; the research into skin transplants for burn victims; cardiac shock treatment and bullet and wound surgery.

Another effect on medical practice was the contacts built up during this war between scientists, technologists and doctors. These contacts continued after the war and influenced both practice and ideology.

The state, of course, played a large role in stimulating and co-ordinating scientific and technology developments, first in conditions of war-time emergency, and later in the post-war reconstruction period. During these periods the conditions of scale are changed and pressure is applied to governments from powerful forces military, medical and political.

After the end of World War II, the USA and several European nations including the UK, steered a definite and positive course to encourage the development of peaceful uses of nuclear physics. I suggest, as have many others, that it was hoped that these moves would help to remove the revulsion against the destructive power of this force as it was used in the atomic bomb. The formation of nuclear medicine as a specialty was a direct result of these moves rather than the existence of the technical hardware. The employment of personnel, who had been involved in the war-time efforts, for these peaceful uses, was also a strong element in this sanitisation of nuclear energy.

Movement of personnel due to government decisions are also influential in changes in medical practice as illustrated by the above example, and was also seen in the important field of medical physiology, when large numbers of technicians and much cheap surplus equipment were released in the UK after World War II. Similarly in the USA space technicians flooded on to the civilian market after the reduction of the space programme.

In the UK, the state learned a great many things under the conditions of war and these were applied in the late 1940s and early 1950s. There was of course the founding of the NHS and a period of sophisticated and interventionist moves to promote technology, and this included medical technology, as powerful forces for the building up of a new world expected by so many after the cessation of hostilities. The influence of the medical profession was, I suggest, particularly strong at this point, for they seemed to judge correctly the mood of the nation and the mood of the Labour government as they pushed for the development of medicine with a strong scientific input.

Implicit through all these periods of change there is another factor to consider: the response of manufacturers. The demands of government and the needs of powerful professionals, lead manufacturers to seek innovation for which there will be a market. Profit is a very strong force and entrepreneurs can greatly increase in number during periods of change when there is a willingness to try something new, whether it be hardware or drugs. This is an area of great interest, but whilst I can highlight it as a definite influence on scientific and technological developments, I do not have enough evidence, nor was it ever my purpose, to make definite and positive statements about it.

The vested interests of medical practitioners both in material terms and in professional advancement of prestige and status are very hard to trace and only rarely surface in print. In the type of research I undertook it was unlikely that I would encounter this directly, for the doctors I interviewed were generally not mavericks or dissidents, and professional solidarity was strong. In principle it would have been very difficult to pick it up in this section, for how could one disentangle altruistic interest from personal or specialty ambition. I hope, however, in Section III to develop this aspect of specialty development.

These factors of war, profit, state intervention and vested interest have all played a part in the changes in medical practice and the social structuring of the profession which accompanies these changes. Scientific and technological developments are not the only ones that matter when we try to understand how medical specialisation has proceeded, but they are very important.

One clear message which comes over from this section, is that the special knowledge which was built up over the period due to these scientific and technological developments was most vital in the division of medicine into specialties. This knowledge is constantly changing and progressing and it is the dynamic nature of it which influenced the practice of medicine in relation to the hardware it uses as well as its theories.

The changing aspect of the hardware, the tools of medical technology, has been illustrated throughout this section, one good example being that of x-ray technology - an important imaging system. There were advantages and disadvantages in these developments to the medical specialty of radiology. The disadvantages were that as the x-ray pictures became better and better the clinical consultants who used the services of radiology were concerned with the actual pictures and not with the radiologists' interpretations, so this reduced the role and the standing of the radiologists. Their role was further reduced by the skill of the technicians, the radiographers, and at one point it appeared that the specialty of radiology might disappear. But the specialists fought back and the introduction of the innovation of computerised tomography - very sophisticated and expensive medical technology - saved the specialty. Thus the development of an innovation had great salience for the continued health of this particular specialty.

One notable effect of technology is the build-up of specific systems with their inter-related, and more importantly inter-dependent, elements. This can be seen in cardiological and cardiovascular surgery and also in obstetrics. This later specialty and the systems within it will be described in Section III.

The public face of a profession is very important and the image which the medical profession presented to the world also changed. Before World War II doctors would be photographed wearing formal dress in their book-lined study, but this changed after the war and the favoured garb became the white coat and the favourite place either the laboratory or the ward, but with technical equipment in the hand or by the side. (Nicolson, 1985, per)

Use of the new technologies allowed the doctors to continue in their pursuit of increased authority over the patients, which involved distancing themselves physically from their patients. As the hardware of medical practice increased and was concentrated in workshops, i.e. hospitals, the distance between the doctor and patient became greater. (Nicolson, 1985, per) This institutionalisation had substantial and mainly negative effects and led to a reduction in the fiduciary relationship between the professionals and their clients.

The importance of having a "scientific" image was apparent as doctors and scientists alike sought to emulate the premier discipline of physics and to a lesser extent chemistry and later biochemistry. This led to more and more desire and pursuit of explanations in terms of physical and chemical principles and this did make a change in medicine, not only in hardware, but in philosophy, and this affected disease formulation. Following the Watson and Crick model of DNA in the 1950s, the pursuit of ideas couched in terms of biochemical genetics developed.

The increasing availability of biological manipulations coupled with the absorption of scientific philosophies affected the disease theories held by the medical profession. Increasingly they sought explanations of disease couched in fundamental terms at molecular level if possible.

The medical profession is able to appropriate from science and technology, powerful systems of ideas on which to base models both of the body and of disease. Models are needed by the profession to interpret reality; they are ways of imposing meaning on the "chaos of the phenomenal world". (Eisenberg 1976, 4) This author considers that models of disease have a decisive effect on medical practice and on every aspect of disease management, determining what data should be gathered and what treatment planned. Once they are in place and accepted

> models act to generate their own verification by excluding phenomena outside the frame of reference the users employ (ibid, 4)

Although the use of models is claimed to be indispensable, Eisenberg warns that their use can be hazardous because they may be taken for reality rather than ways of organising reality. Scientific assessment, in his view, has greatly influenced the change in use of disease models. (ibid, 5)

Disease theories have varied throughout the history of medicine and are contingent on the philosophy of the profession, the available hardware, and the view the profession has of the needs of the patients. Shaw was very critical of the profession of medicine and said in the introduction to his play 'Doctor's Dilemma" (1906)

> Medical theories are so much a matter of fashion, and the most fertile of them are modified so rapidly by medical practice and biological research ... that the play ... is already outmoded.

Whether his criticisms are valid or not, there has been for a variety of reasons a change in disease theory over the past fifty years.

Diseases have been historically seen, according to Cambell + Scadding (1967, 877) as entities with "shadowy metaphysical existence of their own", responsible for the symptoms of the people they afflict. This essentialist model, which is a static one, is still common among lay people and it is a very useful one for doctors when dealing with patients, for then disease can be seen as the enemy, the third party, against which the doctor-patient duo do battle, with victory over the enemy always perceived as the ideal result of the conflict. In many cases this alignment of doctor and patient is powerful in the recovery of the patient; even if the doctor does not believe in the entity of the disease, he can use the analogies of battle to cope with the uncertainty of treatment and cure.

Patterns of diseases in the Western world have changed over the past fifty years. Epidemic and bacterial diseases are largely controlled, the major problems are now the degenerative, metabolic diseases and emotional disorders, diseases whose courses are subtle and chronic, associated with progressive disability rather than acute dramatic, dangerous episodes. This change in major disease problems has led to other models of disease being formulated to incorporate the complex etiology and multigenic causes.

One of these models, the nominalist one, regards disease as an arbitrary concept, - a group of phenomena given a temporary name which is likely to be changed or discarded as more is discovered about causes and treatment. It is not a static view like that of the essentialist model.

A good example of the two different models can be seen in defects of the thyroid gland. The essentialists used the term myxoedema (i.e. the symptom) and this term was prevalent for 80 years for it helped to make sense of clinical observation. But as more was known about the phenomenon, the term describing the symptoms was discarded for a term that described the malfunction of the gland - hypothyroidism. This fitted into the nominalist model for the name would be changed as more was known about why the thyroid malfunctions.

The recent developments to explain disease in terms of physical and biochemical principles has been called the reductionist model. It is somewhat an extrapolation of the nominalist model as it is dependent on change as new discoveries take place, but it has also some precedent in the mechanistic model of the body.

The mechanistic model postulates that the body is composed of a series of functions and parts which like a machine can be isolated and treated separately. There is no need to look at the body as a whole. This is in contrast to the holist model which views the body in its totality and postulates that one part cannot be treated without reference to the other parts.

The reductionist model, I would suggest, does not necessarily need to be mechanistic, in that discovering malfunction at molecular level can be incorporated into the understanding of the whole body function.

Finally I would like to highlight three observations which have, I suggest, especial relevance to the next section on reproductive medicine.

Firstly, the speed of developments, the opening of the "floodgates" as Titmuss remarked, has been dramatic, especially in the area of reproductive biology.

Secondly, that although doctors are increasingly dealing with objective ways of imaging and measuring phenomena, it is still their subjective interpretation which is paramount. We can observe the paradox that in highly scientific medicine there remains a great deal of subjective judgement. Indeed the diagnostic tools actually increase the scope for this type of interpretation.

Thirdly, developments in science and technology can act as resources for specialists and other groups, both in their dealings with patients and in their conflict with other specialists. These resources are, I suggest, being used increasingly in the area of diagnosis as more chronic conditions are seen in the population, but also as more people are coming into the domain of the doctors for conditions not thought of originally as pathological.

INTRODUCTION

The reasons for the choice of reproductive medicine as a field for detailed study have been given in Chapter 4.

Not only is it a field of great contemporary interest to many groups both professional and public, but the medical practitioners within it appear to utilise a great range of manipulations, with those based on biology having especial potency in recent years.

This field has a long history of conflict, involving medical professionals, para-medics, especially midwives, and lay groups. The majority of authors in recent years have concentrated their enquiry on conflicts between these groups rather than within the groups.

Donnison (1977) in her book "Midwives and Medical Men" describes in detail the history of the struggle for control of childbirth, with the main conflict as she saw it being between midwives and obstetricians. Arney (1982) ,entitles his book "Profession of Obstetrics" and suggests that his work is an impartial history in contrast to other works which have been either pro-obstetricians or antagonistic to them.

This author uses the language of conflict and territoriality - defensive moves, boundary work, etc. and much of his book involved the conflict and the alliances between women and obstetricians in the UK and the USA. He traces the impact of many technological innovations and their use in the conflict.

Similarly Oakley (1984) in her latest book "The Captured Womb" is concerned in part with the development of technological interventions in the relationships and conflicts between women and obstetricians, as she charts the history of the medical care of pregnant women.

The work of this section, however, is about intra-professional* conflict within the broader field of reproductive medicine and it is set within the overall picture of medical practice, including not just the technology available, but basic philosophies and ideas about disease, diagnosis and treatment.

*One way of looking at the changing profiles of medical specialities, is to look at the number of consultants.Another is to devise simple measures of status and economic reward,eg, in relation to distinction awards(see appendix B)

CHAPTER SEVEN   CLAIMING THE CHILD

INTRODUCTION

In the 1980s the specialty of paediatrics is well established, and within it are sub-specialties of considerable importance. The paediatricians successfully claim the child as their territory from birth to puberty. The development of this specialty, its emergence, its consolidation and the role of science and technology in these processes is complex with several inter-woven strands concerned not only with different parts of the specialty, but with the associated specialties of obstetrics and gynaecology and medical genetics.

Paediatrics developed out of its parent specialty of general medicine at a time when other interests within this broad field were also attempting to gain independent specialty status. Prominent among these were cardiology, neurology, psychiatry and pathology (Stevens, 1966, 116-117). Thus the pursuit of independent status for paediatrics did not take place in isolation, though for the purpose of this thesis it is considered separately.

It took place during a period of instability in a large specialty, when other groups or segments were commencing the pursuit of their own independent specialty status. Members of these segments were attempting to carve out the "unique missions" referred to by Bucher and Strauss (p.82) and those doctors interested in children were no exception.

EARLY DEVELOPMENTS

The prevalent view of children in the 1920s from a medical point of view, was that they were "little adults". The child was regarded as

> smaller edition of his parents showing the same morbidity to a lesser degree (Lancet Editorial 1942,190).

Consequently they were treated as part of the General Medicine specialty, or by GP via the referral system (Stevens 1966,48).

It was not that there was no interest in the illnesses of children, but various circumstances, including financial, made it difficult for an interested doctor to specialise exclusively in this area. It was difficult for a doctor to establish himself when

> paediatric specialists were expected to be unpaid consultants to the voluntary hospitals (ibid, 48).

It was unusual for a physician to a large general hospital who had a special interest in children, to resign all his other work and "concentrate on paediatrics alone" (ibid, 48).

A large number of general physicians did treat children in their adult wards, but there were very few consultant paediatricians in the 1920s. In this respect Britain lagged behind the United States and various European countries, especially Germany.

In 1926 and 1928 came two significant events, indicating a changing situation. Firstly, in 1926 the journal "Archives of Diseases of Children" was established by the British Medical Association, and secondly in 1928 the British Paediatric Association was formed (BPA). Until this formation there had been five paediatric clubs in Britain, but no national body. One of the clubs was called the Preposterous club as it was a combination of obstetricians (Pre) and paediatricians (post) (Cameron, 1955, 4) -a very interesting combination in light of subsequent events involving conflict between these two groups.

According to Jolly (1978) the driving force behind the formation of the BPA was a Canadian, Donald Paterson, who was familiar with the different situation in the USA where new schools of paediatrics were being developed and where there was a well established and thriving American Paediatric Society. Paterson brought specialised knowledge and experience from abroad and could be considered to be the initiator of innovative ideas and practices. Of the 56 founder members of the British Paediatric Association only 10 were involved full-time with child medicine. The Association started as an academic club but it did develop into an advisory and executive body "willing to bear the increasing reponsibilities facing it". (Editorial Lancet 1942, 191).

This medical interest in the illnesses of children reflected a more general movement towards a particular concern for the young as the guardians of the future of society. Fleming (1942, 631) expressed this view when discussing paediatrics. Children were the "section of the population on which the future of the nation depends". Other writers had also implied this sentiment, for example Davin (1978) in her critical article on "Imperialism and Motherhood".

Stevens (1966,48) writes of the increased social interest in the health and welfare of children, whilst Hutchinson (1940, 800) thought that the stimulus came in response to public demand, this demand being a consequence of the cult of the child which in his opinion has been so remarkable a feature of social development in recent years. Capon (1927,347) felt that out of the "Great War" with its "terrific wastage of life" had come

> a new impulse to try to preserve it by science at its beginning.

The struggle for paediatrics to develop into a separate and legitimate specialty was fraught with difficulties, particularly before the formation of the NHS in 1948. These primary obstacles are reviewed below. Even after this period there were many problems and these will be discussed later.

Two closely associated questions emerged in the pre-1948 period: What was the basis of paediatric separateness? Was paediatrics, separate though it might be, too general in its practice to be able to be called a specialty? Parsons,(1942, 370) thought that paediatrics was not a specialist subject,

> ..it was a general study of children in health and disease and not limited by one aspect of disease or of one organ.

Fleming (1942,631) indicated that paediatricians treat all forms of disease; the only limitation is that of age. Barlow (1926, i) felt that study of childhood diseases differed from other specialties in its "intimate and continuous" association with general medicine, but he did suggest a quite definite and desirable classification of the different periods of a child's life.

Hutchinson (1940,799) said objections had been raised to paediatrics as a specialty and that

> a horizontal division of patients into those below the age of puberty who fall within the sphere of a paediatrist and those above it who do not, is arbitrary and unnatural.

He was, however, of the opinion that the public now demanded a pure specialist quoting the following couplet from Pope.

> One science only will one genius fit
> So vast is art, so narrow human wit

Stevens (1966,116) suggests that paediatrics was regarded not so much a specialty as general medicine applied to a limited section of the population.

The advantages and disadvantages of making a separate specialty of paediatrics is reviewed in a BMJ editorial of 1931 (Horner) Two advantages were clear; firstly, increase in research into disease of children with support of the Archives of Disease in Childhood, secondly stimulation of work on the diseases and feeding problems of infancy which was seen by the editor as a "natural" specialty quite "unavoidably" separate from the medicine of older children and adults. The disadvantages were thought to be, firstly that diseases in childhood supplies a restricted field for the interest of a "first-class intelligence", secondly that the separation of paediatrics from general medicine is too artificial, and finally, that the cleavage would lead to the loss by each subject of the "illumination" obtained from the other.

In 1931, the chairman of the children's section of the AMA had asked questions about the survival of paediatrics now that it had fulfilled its purpose (ie drawn attention to the special problems of children). In answering these questions, Horner was certain that paediatrics in Britain was well established, flourishing and full of promise, though the question was posed about the reasons for development.

> Does the development in paediatrics which we are now witnessing proceed from the pressure of the growth and expansion of medical science, or does it result merely from economic pressure in the strictly honourable business of earning a living? (ibid, 977).

One of the best statements of vested interest I have come across.

Armstrong (1966) and Jolly (1978) who have charted developments in the last few years before the formation of the NHS, saw the following as being of importance. A rudimentary paediatric service developed during World War II and members of BPA were consulted, though their advice on the possible psychological problems to children caused by evacuation was not heeded. In 1942 the term paediatric was accepted without comment by "The Times", a chair of paediatrics was founded in Newcastle, and in 1944 the Goodenough Committee recognised the need for a specific examination for paediatrics. The upset of war, the movements of populations, whether to communal air shelters or evacuation from cities to the country, revealed many previously hidden problems. One was the poor state of health of many of the children from large cities.

LAYING CLAIM TO THE TERRITORY OF THE CHILD

The strategy which enabled paediatricians to claim the child as their territory was to lay stress not on the diseases of children, but on the development of children and on their health. To separate child medicine from adult medicine it was necessary for the specialty to develop as Apley says (1965,633)

> a philosophy ... and identity of its own, childhood can be neither understood nor taught simply by extrapolating back from adults.

A forceful, unusual argument was needed to counteract the claim of the general medicine specialist that the child was but a miniature adult and that diagnosis and treatment of childhood diseases could be managed by extrapolation back from adult practice.

Instead of arguing about this on conventional grounds, the paediatricians made a fundamental shift and reconceptualised the medical task. The basis of the argument they used was the concept of child development. They claimed as their special territory the study of the development of children and the setting of parameters of normality. This normality for certain stages was very important for it represented a notable shift, according to Armstrong (1977,6), from the prevailing medical model of "static clinico-pathological medicine".

Thus in claiming their "unique mission" they set about changing the very conceptual framework of their knowledge base in their pursuit of distinctiveness.

The paediatricians, qua child-specialists, chose to ask the following type of question: Is this child developing normally? They did not, in their specialist role, ask the question, has this patient a disease? This reconceptualisation was an excellent strategy for claiming the territory of the child, for the first question could not be answered by the general medicine specialist, who would not only lack the necessary knowledge about the measurement of these developments, but would not be at home with this radically different medical model.

Charting the normal, and consequently the abnormal development of children required the measurement of a variety of physical dimensions and functions. Consequently the paediatricians took up at a very early stage the principles of the exact sciences. The idea of understanding through measurement is one of the fundamental tenets of science and thus the focus by the paediatrician was within the scientific philosophy and therefore pretigious and helpful to their pursuit of separateness. To expand these points further:- Capon (1950, 859) considered that the two basic criteria of a child's health were first "his growth and development" and secondly "his behaviour as a separate though immature member of society". Armstrong (1977, 5-7) summarises the literature which stressed that any illness or disease of children had to be considered in light of their individual stage of development. Diseases could not be based on static models of normality; signs and symptoms had to be interpreted with reference to the patient's age and maturity.

Typical of the questions appropriate to this new concept of child care are the following, with their implicit background of scientific measurement and investigation, and possibility of manipulation.

> Why is this boy below average height and should he be given testosterone?
>
> Is the governing factor in this girl's obesity constitutional, endocrinal or emotional?
>
> Is this child's failure to gain weight due to infection, fatigue or emotion? (Armstrong, 1977, 6)

This "fundamental reconceptualisation of the medical task" (ibid, 6) gave paediatrics a distinctiveness and a separateness it has not lost. As Stevens (1966, 117) remarks paediatrics was able to develop as an "alternative" to general medicine rather than a sub-specialty.

SPECIALISED KNOWLEDGE

The separation of the child from adult medicine progressed during the decade before 1939, and though by the end of World War II paediatrics was still a relatively insignificant subject in university circles, chairs were just beginning to be created (Jolly 1978). The formation of the NHS in 1948 gave a tremendous boost to paediatrics for the new organisational arrangements allowed paediatricians to earn a living wage, independent of private practice. A bureaucratic move which had far-reaching effects on the specialty. New posts were created in all the major cities. But the resulting institutionalisation of this speciality revealed problems associated to a large degree with the reconceptualisation of the medical task using the concept of child development. Developmental paediatrics as it became known was the foundation of the whole specialty; but many paediatricians saw this foundation as dangerous, perceiving that this emphasis was leading the specialty towards a dead end in terms of patients and hospital beds, and a confusion of purpose. As Meadows (1971,1430) expressed it, the paediatricians

> were lost in a confusion of neonatal neurological examinations, developmental assessments, primitive reflexes and developmental screening tests.
>
> Developmental paediatricians must stop entertaining us with 6-year-old children showing a positive Fogg's second test.

Many children who were not "sick" were attending children's hospitals for special investigations, for studies of growth and development. As Farquar (1979,sem) remarks, in the early 1950s there were more paediatricians concerned with normal children than with sick children, echoing the view that doctors, in the extension of their role, were more and more concerned with areas previously thought to be outwith medicine. Tanner (1952,10) confirmed that over the last decade as part of a general application of preventive medicine paediatricians were increasingly interested in the growth of children and that this meant that they developed tables of measurements of normal children so that they could define abnormality.

In 1958 the National Child Development Study was started. Regular examinations were made of children born between March 3 - 9 1958. The study is still current, great volumes of developmental statistics have been collected, and through the years used in other studies. This work and a previous National Survey of Health and

Development (1946), carried out by paediatricians, could be seen as actually diverting the thrust of the specialty away from the care of the sick child.

These attempts to build up what Bucher and Strauss (p.82) describe as a "core" of specialised knowledge in the claim for territorial separateness, by emphasis on developmental paediatrics, and excessive attention to measurements and the formulation of tests and standards of normality, led the paediatrician into a strange situation. The developing specialty was losing patients because of the decreasing incidence of child disease and the pursuit of measures of normal development only served to emphasise that the medical territory was decreasing. For clinical medicine is about the treatment of patients; and the prestigious specialities are judged, amongst other criteria by the number of patient hospital beds they can legitimately claim.

The success of developments in science and technology in reducing, and even eliminating, childhood diseases with their consequential morbidity and mortality has already been mentioned in Section II. In the post-war period, antibiotics, vaccines, antibody treatment, x-ray screening for tuberculosis, eradication of bovine tuberculosis and the pasteurisation of milk, together with social and nutritional reforms, had all contributed to the diminution of the paediatrician's territory, i.e. the diseased child. There were more healthy children and fewer diseased children. Until the 1940s the paediatrician was concerned with a wide range of diseases, which resulted in high mortality and morbidity; tuberculosis, mastoids, pneumonia, haemolytic streptococcal infection, diphtheria, whooping cough, measles, poliomyelitis. As these childhood diseases became less prevalent, not only did much previous core knowledge become redundant, but techniques based on this knowledge also were of little practical value. This emphasises the notion that it is not only special knowledge which is important for doctors, but the use of that knowledge. Obvious instances are the long-term management of diphtheria, the treatment and isolation of scarlet fever infection and subsequent heart problems.

The inaugural lecture of Mitchell (1964) summarised very succinctly the situation prevailing then in paediatrics, showing the shift that had taken place in the paediatric population. Major acute diseases of early life, though still important, were less prominent than before. This diminution in the sheer volume of "manifest disease" allowed the recognition and study of submerged, broadly described conditions, like "failure to thrive", malabsorption and mental defect. Elucidation of these conditions required input from other disciplines as well as technological intervention - "expensive and time-consuming" though they were. The sufferers from these obscure metabolic and other disorders were now a substantial proportion of the patients in childrens' hospitals, making a disproportionately large demand on paediatric resources. (ibid, 181)

The area, however, where the greatest core knowledge build up is possible is the area of the handicapped child. Although the level of handicap at birth had not apparently increased significantly, (though there was some increase due to the technological successes in saving the lives of sick neonates), it became more obvious as children generally became more healthy.

Court & Jackson (1972, 5) describe this graphically when they say

> As the tide of infectious illness recedes, the rocks of handicap are clearly seen.

They also comment that

> Increased survival of babies was associated with an increasing number of handicapped children. Emphasis on survival is changing to emphasis on the quality of life for the survivors (ibid, 2)

It is this latter comment which highlights a new problem for the paediatrician which is described later.

Before that description it is worthwhile noting yet again comments about the importance of knowledge of the normal development of children, in relation to handicap.

Court & Jackson (1972, 47) comment

> During the last ten years, the importance of a more detailed understanding of normal development and its application to the early detection of a range of developmental handicaps has been increasingly realised by the paediatrician.

<u>DEFINITION OF BOUNDARIES OF TERRITORY</u>

An important part of any claim to medical territory is to have strong confirmed boundaries, boundaries which cannot be crossed by other specialists, especially closely related ones.

Armstrong comments that

> The boundary between paediatrics and adult medicine was based on the age of their patients, but so long as the knowledge either side of the dividing line remained similar, it was possible for the practitioners if not the patients to cross. The strength of the boundary therefore, which would legitimate the command of paediatrics over symbolic and material resources depended on the essential differences of content. (1977,8)

But what is the definition of a child - for if paediatrics is about child medicine, there must be a general agreement on the boundaries. As with all divisions of labour, the boundaries are flexible and open to expansion and contraction, to strengthening and weakening, to negotation and re-negotiation. Proposed definitions of the beginning of childhood and the end of childhood are areas of conflict. The former has been the more controversial and therefore will be studied in greater detail. The latter seems to be amenable to local and non-formalised negotiation. The role played by the use of developments in science and technology in establishing the former boundary will also be considered and highlighted.

End of Childhood

The grey area of boundary definition between child and adult medicine is an interesting one for the paediatrician can make various claims to this territory.

Seemingly simple legislative devices, such as raising the school age from 14 to 15, then to 16, give the paediatricians two extra years of "childhood". Thus their territory is increased by a bureaucratic move, a social definition of childhood, a change in social perception, or perhaps a political decision.

Claims to specialised knowledge of the period have been mentioned but as Court & Jackson (1972) agree

> there is as yet, no clear indication to divorce adolescent medicine from paediatrics on one hand and adult medicine on the other (ibid, 58)

though they do suggest that

> older children and adolescents receive medical care from physicians and surgeons who understand their special needs, and are accommodated and nursed in an environment which does not embarrass or distress them (ibid, 58)

Specific proposals were put forward by these authors and it is worthwhile quoting these for they indicate the claims the paediatricians wish to make and also indicate the areas of negotiation with adult specialties.

> 1) Older children and adolescents (12-17 years of age) in hospital should be grouped in multispecialty accommodation designed for the purpose and forming an integral part of the comprehensive children's department
>
> 2) No rigid rules should be applied regarding the age at which children cease to be the responsibility of the paediatrician or paediatric surgeon, but decisions should be made with special concern for the wishes of the child (ibid, 60)

Beginning of Childhood

The paediatricians wished to claim the territory of the child, and therefore they were claiming childhood. But where does childhood begin? Up to the 1940s the accepted boundary was the infant of between 7-10 days. Before that time, the infant, the baby, the neo-nate, (which is the term I will use) was the territory of the obstetricians. This boundary was obviously an unsatisfactory one for the paediatricians for many reasons. It was not clearly defined and could vary with the age of the neonate. At the boundary for the end of childhood there was not a great deal of competition for the territory, but at this end there was a great deal of competition from obstetricians.

The loss of territory previously described due to successful manipulations of the developments in science and technology meant that paediatricians were concerned to gain more territory to replace the lost areas. What more fertile territory could there be than the ill neo-nate? It was thus an advantage to the paediatricians to push the boundary to the point of birth, allowing them to claim both the ill neonate and eventually the healthy one.

This push by the paediatricians to take the boundary of their specialty to the birth of the child brought them, quite predictably, into conflict with the obstetricians. The success of this manoeuvre can be judged by the following remark of a young obstetrician.

> Once I cut the cord, I will not see the baby again, unless she comes back twenty years later when she herself is pregnant (Anon A, 1980)

In extending their boundaries, the paediatricians made use of many developments in science and technology. Paradoxically, use of other developments had reduced their territory, but they were able to use different developments to extend it. The role of science and technology in the development of medical specialties is indeed an important one.

The diagnosis and treatment of one particular disease Erythroblastosis foetalis (haemolytic anaemia of the new born) was of extreme importance in redrawing the boundary between paediatrics and obstetrics. Charting the progress of treatment of this disease is covered in Chapter 8. It will not be repeated here except briefly to say that their knowledge of infant development, and their use of miniaturised instruments enabled the paediatricians first to claim the neonate suffering from this disease, then other ill neonates and then finally the healthy neonate. A progression of claims, each built on claimed expertise in the previous area.

The skill of the paediatrician handling the miniaturised instruments in the small bodies of the ill neonate brought home to some obstetricians their own lack of skill in this field. Myerscough (1977,per) describes his shock when he looked at the large instruments he used on the grown female body and compared them with the small ones used on the babies by the paediatrician. He said he realised then that he did not have the skills required for neonatal intervention. Although it seems dramatic to suggest that it was this realisation which crumbled the resistance of the obstetricians to the territorial moves of the paediatricians, other obstetricians themselves have pinpointed this treatment as a definite turning point. Myerscough (1977,per) described this situation of the movement of the boundary as being informal, not guided by obvious official negotiations and appearing almost at random over the country over several years. He records spotty resistance with some obstetricians holding out, refusing to allow paediatricians into their ward and only after their retirement or death did the situation become regular over the whole country. This view is very reminiscent of the general one described by Bucher and Strauss (p.85) where they use terms like "pockets of resistance" and "embattled minorities". This view of the change is also confirmed by Cape (1952,673) who called it a "bloodless revolution" which he had observed at various "stages of the battle" in various centres and at various levels of obstetrical hierarchy. Some observers have expressed surprise that the obstetricians allowed this move by the paediatricians without mounting countermoves and whilst there was concern at what was happening, no countermoves seem to have been made. At a conference in 1951 to consider "The Place of the Paediatrician in a Maternity Unit" (from which the above quotes come) Lennon (1952,679) an obstetrician, was quite clear that his specialty had been invaded by paediatricians and he warned his fellow specialists about further loss of territory, and urged them to protect "our specialty". He did comment, nevertheless, that

> obstetricians are much to blame for their lack of interest in the baby and must shoulder responsibility for the invasion (ibid,679).

This lack of interest, which led to a lack of research, and more importantly to a dearth of specific knowledge which would follow from that interest, is borne out by a survey of both the paediatric and obstetrical literature of the period. There are no original papers on the neonate in the obstetrical journals, only reviews of other sources (eg Brit.J.Obs & Gynaecol 1939 & 1952). In the comparable paediatric journals there are many original papers (eg Arch.Dis.Children 1939 & 1952).

Other developments followed which enabled the paediatricians to support their claim to the territory of the neonate. For example, one particular scientific input confirmed yet again for the obstetrician the vast differences between the large adult body of his patient and the small body of the neonate claimed by the paediatrician. Chemical sensitivity of laboratory tests had improved greatly and it became possible for a battery of tests to be carried out on 0.2 ml of babies' blood (5 ml was regarded as normal for adults, ie 25 times greater). Thus it became possible for paediatricians to take blood at regular intervals without causing distress to the baby, so that measures of normality and abnormality could be charted, over which paediatricians have control. Thus they are repeating, and repeating successfully, the ploys they had used earlier.

Claims for the neonate by the paediatrician were thus very strong.

By the 1950s the paediatricians could relieve the obstetricians in the following ways (Gaisford (1952, 665)

They could:-

> resuscitate anoxic infants
>
> diagnose and arrange for the surgical treatment of all congenital anomalies amenable to surgery in the neonatal period
>
> help in the prevention of infection
>
> decrease the mortality rate among premature infants and those suffering from haemolytic disease
>
> take care of infant feeding after the obstetrician has ordered the suppression of lactation

Finally and most importantly Gaisford says that because the paediatrician is

> caring for all the infants, well and ill, normal and abnormal alike - the obstetrician can rely on the paediatrician's experience of normal infants to enable him to detect the earliest signs of abnormality, disease or infection and to start treatment either prophylactic or therapeutic, at the first possible moment.(ibid, 656)

A striking assertion of the paediatric principle.

Further claims not only to the territory of the neonate but to specific parts of the mother, and the pre-conception period are made by Stabler (1952, 667). Firstly, in talking about the paediatrician's desire to know why this baby has some cerebral trauma; why was labour induced and produced a premature infant; why the liquor amni became infected and so infected the baby; the very significant point is made by Stabler that the paediatrician is "therefore concerned with his patient during labour". His patient during labour - surely a most alarming statement, for obstetricians feel that the mother and her child are their territory during labour.

The physical act of birth has become increasingly a positive dividing barrier in territorial claims. The view of Draper in 1928 (quoted by Evans 1978, 3) is instructive, for it highlights the physiological change at birth.

> The moment of childbirth is remarkable because of the amazing circumstance of a new presence in the room, a new complete individual, with moving arms and legs and of perfectly well-defined and unique individuality. From the purely mechanistic stand-point the complex machine works, and works in a fashion which, in the twinkling of an eye, has changed from that of a submerged aquatic parasitic organism to that of a free-living terrestrial form.

The paediatricians used this physiological change as an argument for taking their boundaries right up to birth. But in ever increasingly expansionist moves they are willing to say that in general they are also concerned with the fetus.

Gaisford (1952, 663) at the conference already mentioned, asks the question:- When does an infant become paediatric? Then he gives four answers - the last of which is of great interest. Birth could be considered only to be "an incident" in a baby's life and the preceding nine months are of the "greatest paediatric interest and concern". He is claiming the fetus for the paediatrician and confirming the views of Parsons (1946, 1), who considered that the paediatrician of the future must be concerned with the well being of the "child from the moment of conception".

Couple these views with those of obstetrician Cape (1952, 673) who feared that before long the paediatrician

> insist on caring for the baby before it is born, and we will nerely be employed for the mechanical act of separating his patient from the mother

and conflict and change are bound to follow. The proposed extension of territory and dramatic change of boundaries are considered in Chapters 8 and 10.

CONTROL OF PATIENT

The sub-specialty of neonatal paediatrics is one area of control which has been particularly strongly affected by technological developments.

The technology associated with the ill neonate has become so complex and sophisticated that not only are obstetricians aware of their lack of expertise, but so also are general paediatricians. The sub-specialty has emerged in response to the possibilities of utilising complex scientific and technological manipulations.

Baum et al (1979,126) comments that

> a new technology has developed in parallel with the growth of the specialty, adding precision to the assessment and treatment of sick newborn infants.

Moosa (1979,per) claimed that paediatricians cannot cope with the problems of the neonate for two main reasons. Firstly they are aware of their lack of expertise about the elaborate technology necessary to treat the ill neonate. Secondly, they either do not have, or do not choose to make, the time available for the detailed examinations necessary. He said that for a neo-natal patient

> it takes an expert at least 30 minutes to make a good neurological and development examination, it cannot be done in 5 minutes which is all the time allowed to the paediatrician.

The range of manipulations available to the neo-natologist is very large and expensive. Silverman (1980) (who could be described as a disillusioned paediatrician) considers that the sub-specialty could be said to have started in the USA after World War II, when the enthusiasm to solve social problems led to an attack on neonatal mortality. This enthusiasm was helped by a bureaucratic move when in 1949 new additions to the Live Birth Certificate allowed more detail to be added ie length of pregnancy and birth weight. Suddenly statistics about the new-born infant were available and problems were apparent. Infants weighing less than 2.5 kg accounted for a major proportion of deaths and the underdeveloped newborn infant became numerically prominent. Money, technology and social drive were all available and as doctors were aware that neonatology was the weakest point of medical school paediatrics, a definite movement was started which of course influenced practice in the United Kingdom. Silvermann describes this response to the problems of the newborn as being similar to the "all out strategem" which was so decisive in World War II,

> mobilisation of enormous material assets and rapid increase in technological developments. (ibid, 617)

The beginning of the effect of the introduction of new technology can be illustrated by the following dramatic example. In the late 1940s, transparent plexiglass walls were introduced into American incubators. This coupled with the removal of heavy swaddling clothes no longer needed in the controlled warmth of the incubator, meant that for the first time small infants were visible naked to the eye of the doctor and the nurse. The result of this unwrapping and increased visibility was dramatic. As Silvermann indicates

> The innocent measure of unwrapping babies exposed them as targets for increased medical action (ibid, 619)

This "increased medical action" was a battery of physical, chemical and biological manipulations, charted by this author in his critical paper "Medical Inflation" (1980).

In the late forties, early fifties, plexiglass heated incubators revealed breathing problems and the distress of hyaline membrane disease, which was then treated by various clinical means including detergents with a mist nebuliser. Inevitably, some of these means were applied with more enthusiasm than discrimination. Oxygen was piped to a wall outlet and easily available, and its use helped in respiratory distress, but it became routinised for use before the symptoms appeared. Blindness was later found to have resulted from this uninhibited use. Antibiotics were used extensively for infections, but again, as early signs and symptoms of disease were difficult to detect in the neonate, pre-symptomatic treatment was undertaken with all babies, often with disastrous results.

He argues that the influence of the scientific method is strong, but that problems and even tragedies can result when its principles are abandoned

> In preclinical investigations involving animals or in pilot observations in infants the rules of scientific evidence were carefully observed. At the next step in investigation, the first application of new treatment in the field, the cautious rules were abandoned. (ibid, 629)

This he regards as "unrestrained medical behaviour" with a "double standard of evidence" used to guide actions. This is also a useful illustration of some of the early stages of the adoption of innovations.

One important advance in the 1950s was the monitoring of oxygen by an umbilical catheter, which allowed properly controlled safe oxygen therapy.

In the 1970s and early 1980s there has been an increasing miniaturisation of adult life support and monitoring systems specially adapted to the neonate. Very sophisticated and costly incubators are now available with computer analysis and control. Parameters for breathing, heart rate and oxygen uptake can be set and alarms ring when pre-set limits are overstepped. This has led to an increase in the ratio of neonatal nurse to baby often of 1:1.

The babies treated in these incubators tend, in the USA especially, to be from high risk mothers, alcoholics and drug takers often themselves poor and badly nourished (Moosa,1979,per). This raises ethical problems of resource allocation. Concern has been expressed that the money spent here could be spent to more effect in other ways, such as helping in nutritional education and in improving housing conditions. Other ethical problems arise when badly deformed babies are kept alive by these extreme measures, eg those with Spina bifida. The success of these measures has also led to further technical developments, as techniques have been devised to operate on these defective babies, multiplying and intensifying ethical dilemmas. The increasing potential for medical intervention highlights the interconnectedness of techniques, almost a system for the production of as near normal a baby as possible in the circumstance of the handicap.

Increasing miniaturisation of surgical instruments and operating devices have made complex operations possible on these children, eg repair of heart defects, pace maker implantation, repair of spina bifida lesions. These manipulations have led to the possibility of new segments or sub-specialties eg, not only paediatric cardiology but neonatal cardiology and of course fetal cardiology. The correspondingly highly specialised techniques of treatment are very demanding of resources. The resource and consequential ethical problems associated with heroic surgery for defective babies, especially for those with spina bifida, has led to at least one practitioner, Lorber (1971,279) defining certain scientific parameters of disability, constituting a formal system of deciding which baby should have the operation and which should not. As denial of the operation must result in certain death, this is a very stark example of the use of science to handle reality. Or more starkly, a scientific method to resolve an ethical dilemma due to resource allocation.

THE HANDICAPPED CHILD AND FRAGMENTATION OF THE SPECIALTY

An important change in the type of patients in paediatrics since its inception has already been described. The number of children with birth defects rose in relation to those without. As Mitchell remarks (1964, 181) their treatment and the diagnosis of their conditions were different.

Changes in the type of patient, changes in the treatment and diagnostic skills necessary, caused changes in paediatric practice. Sub-specialties emerged and the general paediatrician was pushed more and more to the back. This situation is similar to that of the rise of the neo-natal paediatrics.

Paediatrics in this changed state was particularly susceptible to the claims of outside specialists having special knowledge of certain organs or systems and thus claiming special bits of the territory of the child. The paediatrician still acted as the overall "gate-keeper" but the dangers of fragmentation of a broad holistic specialty became apparent.

The sub-specialties had a spatial orientation whereas the inspiration and guiding principle of the development of paediatrics had been temporal. Thus the cardiologist working with children had the choice of a temporal orientation or a spatial one.

Stevens (1966,337) summarised the situation in the 1960s.

> The paediatric physician has been joined by sub-specialties from a number of different disciplines, there are now paediatric surgeons, child psychiatrists and paediatric radiologists. As a result the scope of general paediatrics has become so wide that its future development is in doubt.

She further comments that although the new specialties (ie sub-specialties) facilitated teamwork they did so in areas that were regarded as specialties themselves.

> They cut across the traditional organisation structure of medicine, thus creating further fragmentation (ibid 377)

The development of the sub-specialties within paediatrics is a complex one, but as they developed they were grouped around the handicapped child. This move was in line with the general movement of sub-specialties.

> The sub-specialties, like the specialties before them, were focussed primarily on disease. The more esoteric they became, the more clearly disease-oriented they tended to be .... Technologically the disease focus required more rational hospital planning .... As medicine concentrated on advanced techniques and the use of inter-related skills, the specialist was moving farther away from the healthy person in society (ibid, 378)

Thus the move in paediatrics towards the handicapped, and the complex technological back-up, was within a general mainstream movement and was, therefore, completely legitimated by the other members of the medical fraternity.

Not only was this fragmentation of paediatrics considered legitimate, but it was considered a necessity, as the skills of paediatricians and technological back-up of other specialists had produced this interesting paradox. There was a continued reduction in perinatal deaths, so that the handicapped child became a larger proportion of the survivors; and this was coupled with an increase in the number of handicapped children who survived due to technological intervention as already indicated. The situation is increasingly one in which there were more children needing help, and more specialists asking other groups for help to rescue once again the lives they had already saved.

The field of sub-specialisation was inevitably a fruitful one. Two areas of sub-specialisation will be considered, to show the processes of territorial claims. These will be paediatric cardiology and paediatric gastroenterology.

Paediatric cardiology

The success of the neonatal paediatrician in saving the lives of handicapped children meant the increase in patients for this sub-specialty. Jordan (1977, 5) said that paediatric cardiology was concerned in the Western world almost exclusively with the treatment of congenital heart disease. The success rate for treatment has increased in the last 30 years, according to Goodman (1979, sem), due largely to better surgical techniques with miniature instruments and to the use of surface cooling techniques. The "potentially correctable group" was now about 35%.

Thus the territory existed, the manipulations were available and so the sub-specialty could be successful. Yet problems arise, for some doctors are now doubting the wisdom of what they are doing. Often there are other defects in the patient and by saving the life of the child, there is realised the potential of transmitting the defects to the next generation. This could be said to be an ethical problem. It also highlights the complexity of the impact of technology and the development of elements within a system which are so dependent on each other; for the paediatric cardiology sub-specialists are dependent on the technology of other sub-specialists, the neurologists one down the line so to speak, where any changes in their practice will make a difference to the number of patients available to the paediatric cardiologist.

Paediatric Gastroenterology

To lay exclusive claim to this piece of territory the sub-specialists used their skill in the various types of manipulation, , eg miniature instruments, anaesthetics, antibiotics etc, but also reiterated the concept that the child was very different from the adult. Quotations from a textbook amplify this (Harries 1978).

> The clinical conditions ... pose fundamentally different problems from those encountered in adult life
>
> The problems of children are not only different, but fundamentally different from the problems of the adult
>
> During the first year of life a variety of biological processes are immature (ibid,viii)

Further claims to the territory involved stressing the preventative aspect; the aim was to restore normality to children with potential handicap

> Disease may have an irreversible and permanent effect because biological processes are immature
> Interference with brain cell replication results in permanent intellectual defects (ibid vii)

Also involved was a widening of the definition of the "patient" - to include the family

> Acute infectious diarrhoea and vomiting and their complications may be a devastating event in the life of a young child and his family
>
> The relationship between gastro-intestinal symptoms and psychological disturbances in the child and its family .... emphasise some of the differences between paediatrics and adult gastro enterology (ibid, vii)

Similar strategies have been employed in other sub-specialties studied such as paediatric neurology (so complex and so different from the adult neurology) paediatric nephrology (new technology expertly used) paediatric endocrinology (not satisfactorily practised by the adult endocrinologist) paediatric haematology (special expertise outside the scope of general haematologist) paediatric radiology (patients wth erroneous diagnosis of disease based upon misinterpretation of a normal variation).

EXPANSIONARY TACTICS

Throughout this account of the sub-specialties which are developing within the territory of paediatrics, two concepts are repeatedly encountered, children are fundamentally different from adults, and the development of children has to be taken into consideration in assessing clinical symptoms. Strategies used by sub-specialists to increase the extent of their professional involvement, based on these concepts, reflect the manoeuvres of the earlier phase of paediatrics for access to the territory of the child. Phrases indicating the very specialised nature of the tasks are also prevalent, intended to persuade others that those tasks cannot be carried out by doctors in the comparable adult specialties.

The specialised knowledge contained in the paediatrics of the 70s and 80s is extensive, mainly scientifically or technologically based, and is increasing at a rapid pace. A brief review is of interest here (Macleod, M. 1983)

> Use of anticancer drugs in the treatment of leukaemia in children (the first area of success for anti-cancer drugs);
>
> Use of drugs to control hyperactive children;
>
> Examination of chromosomes to determine sex abnormalities;
>
> Treatment of genetic defects like P.K.U. and the dramatic effect seen on unhealthy, unthriving children;
>
> Use of growth hormones especially when they became cheap and easy to obtain;
>
> Effects of the teratogenic drugs like thalidamide and teratogenic viruses like rubella and the developments to ameliorate their harmful permanent effects;
>
> Use of tomoscanner to detect childhood cancers;

Miniaturisation of instruments so that small children and infants could be operated upon;
Large scale longitudinal studies of cohort groups and computerisation of results

Miniaturisation of chemical tests so that increased monitoring is possible, using 0.2 ml of blood instead of 5.0ml (25x less).

A common argument supporting the development of sub-specialties is the importance of paediatric knowledge to the adult part of the sub-specialty and to medicine in general. Whether this be true or not, or even testable, it is reminiscent of Pettigrew's remarks (p.87). Of paediatric gastro-enterology Harries (1978 viii) says that

> alternative transport systems of nutrients can be studied most profitably at an early stage, but have relevance for later life.

This is a special ploy, a special pleading almost, which paediatricians seem to be allowed to use with success, for I have not seen this pleading rebutted by other specialists. This being accepted, it follows that any reduction of paediatric territory would result in the diminution of useful knowledge for other specialties.

This pleading has been used throughout the history of the formation and consolidation of the specialty of paediatrics. A BMJ editorial of 1931 states that benefit

> has accrued to general medicine by the special study of disease in children. Paediatric research has not only been of value in the study of diseases peculiar to children, but it has often thrown light on diseases of adults by exhibiting in their purest forms the same morbid

> processes as these occur in early life. (ibid 997)

The editorial continues in this vein with the comment that

> It is surely true to say that the special study of diseases of children forms one of the most interesting branches of medicine, because of the light it throws on the diseases of adult life, and not seldom on the personalities of adult patients; and if this is so, paediatrics could hardly put forward a more acceptable defence of its popularity. (ibid, 997)

Further substantiation of this point often have a basis in biological science. Benzer (1976,36) in an article about Behavioural Genetics suggests that in studying the interaction of genes and environment, it is necessary to study the development of the species so studied; for, he states,

> it is easier to see influences of genetic predispositions during the development of an organism that at any other period.

This idea is extended by Brumer (1980,534) in the justification of a new series on books on the child, written for the lay person

> The nature of man, is to a great extent shaped by early experience. A study of childhood, therefore, helps us to know our capabilities as a species.

<u>SUMMARY</u>

This chapter is essentially a detailed account of the formation and development of a new specialty. It charts the processes involved when a group or segment of doctors, who have a common interest in the child, break away from the established and broad based specialty of general medicine. It illustrates very cogently the saliency of the interactionist approach.

There are various stages apparent in the development of the specialty; the first, and perhaps the most important, is the claim for separateness. Initially, this claim was that children were different from adults. They should, it was postulated, be thought of not as small adults whose problems and diseases could be understood by extrapolation from adult medicine, but as a special group of individuals requiring their own medical practitioners.

The doctors, who were negotiating that they were fitted to be these special practitioners, pursued their claim for separateness by claiming that a new model was needed to understand the child. The statico-pathological model of adult medicine no longer had saliency and should be replaced by one which included the processual concept of development.

Thus they developed their "unique mission" by asserting that any assessment of health and illness were dependent on the understanding of developmental processes of the child. This understanding must of necessity, therefore, include the development of healthy children and so the territory of the nascent specialty was enlarged considerably by this reconceptualisation of the medical task of paediatrics.

From the study of both healthy and unhealthy children came the concepts of normality and abnormality, and the uniqueness of the specialty was emphasised and confirmed. This was a very important step, for any claim to uniqueness must be backed up by the substantiation of that claim.

This early stage was dominated by the emphasis on developmental criteria as the paediatricians sought by the study of normal development to define the subject area of their discipline. The study of abnormal development could be seen as diagnostic and concerned with specific clinical tasks and without the potency necessary to back up the claim to the subject area.

The emphasis on measurement as developmental paediatrics progressed could be construed in part to the absorption of the tenets of science, reflecting the importance in the hard sciences of understanding phenomena through the special knowledge gained by measurement.

This period coincided with a decrease in acute childhood diseases and consequently a decrease in patients. The special core knowledge of the paediatricians changed because of this decrease and much became redundant. This period represented a paradoxical situation for as they lost patients the paediatricians were increasingly involved with healthy children i.e. non-patients, and thus their role as a medical specialty was declining.

In a major strategical change of tack using the special knowledge gained from their development studies, they became focussed both on the ill neonate and on the handicapped child.

Their claim to special knowledge and to specialised techniques, e.g. use of miniaturised instruments appropriate to the treatment of the ill neonate, led to a second phase of progress in the specialty. This included crossing the boundary between it and the neighbouring specialty of obstetrics. By a variety of moves the paediatricians gained as their territory not only the ill neonate but also the healthy neonate. In this process they pushed the boundary between the two specialties to that of childbirth.

Further progress took place as they propounded the idea that proper appraisal of handicapped children depended on expertise gained with normal children. So by repeating the manoeuvre of using what at one point in their development looked as though it would cause a rejection of their claim to separate status, i.e. their knowledge of normality, they expanded into another area. This shows how important it has been in this chapter to delve in as much detail as possible into the basis for claims to uniqueness.

In many cases it could be argued that the paediatricians had not one, but two patient, the mother of the neonate, or the parents of a handicapped child, and in the practice they concentrated on the needs of the patient most salient to their cause.

The diagnosis and treatment of handicap became predominant in the third phase as this group of children became more visible. But problems developed for the general paediatricians as the holistic nature of the specialty based on the temporal defining criterion was challenged by the rise of sub-specialties. These sub-specialties, which were grouped around handicap, were spatially defined, and in the main were under the control of doctors who had been trained in other specialties. The specialty of paediatrics appeared at this point to be in danger of disappearing due to this fragmentation.

The response to this danger was a shift of emphasis to concentrate more generally on the diagnosis, assessment and prevention of handicap. This move, which is only briefly mentioned in this chapter, brought paediatricians into conflict with medical geneticists as they moved into genetic counselling, and with obstetricians as they mounted a claim to some control of the fetus and the mother. These challenges will be expanded in Chapter 10.

Because of the reconceptualisation of the child as distinct from the adult, there was bound to be conflict with other medical groups and specialties. This chapter has charted these conflicts and attempts to explain how they were solved in a variety of ways. What is of interest is that though the developments in science and technology were used in powerful and successful moves by the paediatricians, there were other significant moves which were quite outwith their control.

Various bureaucratic moves, which in the main could not have been forecast, made a great deal of difference. The formation of the NHS gave the freedom to the child doctor to practise in this area free from worries of finance. The raising of the school leaving age gave first one year of childhood and then two years, not only to the children, but to the paediatricians, who could now legitimately claim them as their territory. The move in the USA to put the various statistics on the newly designed birth certificate exposed to public view a problem which it bacame incumbent on the paediatricians to try to solve.

The paediatricians were also influenced by the prevailing social mood of the lay population in that there were two concerns, one about the perceived health of the nation as seen in the young. This was especially so after World War II; also there was a heady feeling in the aftermath of this conflict that much was possible given the right attitude and strategies. In these areas the paediatricians could be said to be responding not only to the needs as they saw them of their primary client, but also to the needs of a wider group of clients which in this case included the whole population.

Paediatrics, although not one of the most secure medical specialties, based as it is on a temporal criterion, is now fully institutionalised and certainly not a Cinderella specialty. There is within it diverse technological sophistication and the influence of distinctiveness.

Much of the territory of this specialty was gained from obstetrics, apparently without any strong countermoves. The reaction of the obstetricians to this loss of terrritory and the moves they took to maintain their position and status within the profession are described in the next chapter.

CHAPTER EIGHT — COLONISATION OF THE FETUS

INTRODUCTION

The obstetricians had gradually lost to the paediatricians, not only the ill neonate, but also the well neonate. The process of claiming this territory had allowed the paediatrician to come right up to the birth of the child, and this act defined the boundary between these two specialties. This negotiated boundary was accepted by both sides and in this chapter it will not be regarded as problematic, though conflict over it did and does occur and will be described in Chapter 10.

Some reports of the reactions of obstetricians to the invasion of their territory of the neonate by the paediatricians have been previously outlined, and in general it can be said that they did not mount a strong challenge to the paediatricians.

The specialty of obstetrics and gynaecology still had legitimate claims to four areas; the pregnant mother, her unborn child, the process of childbirth and the female reproductive system outwith pregnancy.

This chapter is primarily concerned with the unborn child, the fetus. No apologies are made about the isolation of the fetus from the mother in this chapter, as this is what the specialists attempted to do in pursuit of this new piece of territory. In the parlance of territoriality, the claim to the fetus could be described as colonisation of new, unexplored territory, and a very definite expansionist manoeuvre. Bucher and Strauss (p.22) describe these moves as "missionaries staking claim for new territory".

In attempting to ensure their claim, it was important for the obstetricians to define the territory which they were claiming. Part of this process entailed having core knowledge about the fetus.

As Oakley (1984, 157) points out, in the 1940s knowledge of the fetus could only be acquired via an intermediary - the mother. By asking her questions, by examination of her abdomen and laboratory examination of her metabolic products, some information about the fetus could be gained. But this was obviously unsatisfactory from the obstetricians' point of view, for the mother had major control of the knowledge of fetus.

Their attempts to find alternative, more "scientific", more "reliable" information had the effect of wresting control from the mother. Here as elsewhere the growth of scientific, technological medicine served to reduce the autonomy and the active involvement of patients and enhance the doctors' authority. Introducing the concept of "medical problems" was important throughout the whole process as was the use of current models of disease, especially the reductionist model. It is hoped to show in this chapter how developments in science and technology are used by the "colonising" specialists.

DEFINITION OF THE TERRITORY

In the strategically important step of defining the new territory they wished to control, the obstetricians were concerned, in the course of time, with the following concepts; the unborn child, the pregnant uterus, the feto-placental unit (see appendix A), and the fetus as a separate unit. This decoupling of the fetus from the mother led to the idea of the obstetrician having a second patient - the fetus. (I will later contend, however, that the fetus has become the primary patient.

Malvern (1980,215) has described this as a second concern when defining the two main roles of the obstetrician in "pregnancy, labour and delivery".

> He or she owes allegiance first to the mother to ensure that her health, nourishment and psychological state are fully prepared for childbirth and that her labour and delivery are conducted with maximum safety and minimum discomfort.

He considered that the second concern is the fetus which

> should be screened for certain identificable congenital abnormalities and have satisfactory monitored intra uterine growth so at birth it is delivered in a mature, well oxygenated state.

The fetus is regarded as a concern but not a second or primary patient.

Oakley (1982,4) describes the interests of Ballantyne (1862-1923) "usually reputed to be the founding father of antenatal care" whose main concern in his clinic was

> the prevention of monstrosities and generally the advancement of the fetus's interests; he was not particularly interested in the welfare of the mother

In this he was perhaps unusual in his time for the "discovery of the foetus" as a patient, albeit the second patient, of the obstetrician in the 1940s is described by Arney and Neill (1982, 9) in their study of the location of pain in childbirth. In 1945 texts for the first time registered concern for the effect of relief of pain on the environment of the fetus and on fetal outcome. For the first time, obstetrics used the term "foetal distress", and obstetricians became "foetal advocates" and the "field of foetal ecology" took shape (ibid, 21 footnote 31).

Arney and Neill consider that this move towards the second patient - the fetus - was due to the challenge of natural childbirth and was part of obstetricians' move to meet

> the demands of women while still preserving the obstetrical project for obstetricians.

The authors present a coherent and plausible argument; but I consider that there is an alternative interpretation which is more compelling. The loss of the neonate by the obstetricians gave them an impetus to search for new territory to replace this loss. The fetus was a possible area for exploration. Threats to their practice of looking after mothers in childbirth were countered by controlling pain for the mother using new anaesthetics and epidural administrations. The claim of the obstetrician to the territory of their bodies and functions was thus consolidated. This idea, which will be expanded in Chapter 9 in the childbirth section, has relevance here as well.

To define the territory, it was necessary to know more about the unborn child, the contents of the pregnant uterus. An excellent example of the gaining of core knowledge is that of the diagnosis and treatment of Erythroblastosis foetalis, which marked the beginning of a definite phase of scientific input into this branch of medicine.

THE PROCESS OF BUILDING UP CORE KNOWLEDGE OF THE FETUS

The effect of the diagnosis and treatment of Erythroblastosis foetalis on the struggle between the paediatricians and the obstetricians for the territory of the neonate has been mentioned briefly in Chapter 7.

In the short term it was disastrous for the obstetrician, for it allowed the paediatrician access to the ill neonate. Yet in the long term the implications of the episode were of great benefit to obstetricians for a variety of reasons. They were stimulated to develop the idea of the chemical imaging of the fetus, the "black-box" of the womb was breached, and many other developments followed from this.

The diagnosis and treatment of E. foetalis was regarded as a watershed by many observers. Turnbull (1977,1) called it a "truly major advance in obstetrics", while Stahlman (1979,516) marvelled at the "cascade of knowledge" which could not have been "estimated before its inception". It is also regarded as a very important exemplar of disease formulation and treatment.

The disease was recognised in 1931, though its cause was not then known. Babies were being born with haemolytic anaemia often leading to death or severe brain damage. There were also interuterine deaths leading to still-births.

At this period the obstetrician was in charge of both mother and baby and the visibility of consequences of baby deaths, baby abnormality and still-births were not good for the image of the specialty, especially as maternal deaths had not yet been reduced by the use of antibiotics, anaesthetics, blood transfusions, etc. As there was no accepted cause these 'failures' could be attributed to bad obstetrical practice. For this and other reasons the specialty did not have a prestigious rating, though no attempt had yet been made at this time to deny their claim on the territory of the mother and child.

In 1941 due to scientific advances in the fields of blood antigens and immunology the mechanism of the disease process was recognised. This was a striking example of the success of the reductionist approach of medical science, in that the process could be reduced to biochemical concepts. Briefly the mother was producing antibodies to the Rh antigen in her unborn baby's blood and these antibodies were destroying the baby's red blood cells with the subsequent dramatic effects.

Scientists had found an explanation for the disease and it was established also that the mother was not ill in the conventional sense; she was genetically different from her baby. This genetic incompatability could then become medicalised, - a two step process of problematisation and medicalisation seen repeatedly in the area of genetic differences. The unravelling of the mechanism of this disease brought a close involvement of the obstetrician with the basic sciences, leading to a belief that other diseases might be similarly explained in basic scientific terms, with the possibility that this might lead to more control of territory.

Because the cause of the disease was known, treatment could be devised. At first the idea was to replace the blood of the newborn baby with fresh blood so that the damaging antibodies of the mother would be removed. After the baby was born there would be no further danger from the mother. This technique of exchange transfusion was started in 1945, not by obstetricians but by paediatricians. As has already been described in chapter 6, the paediatricians were losing patients, and therefore territory, for various reasons, and they were therefore pleased to move into the area of the ill neonate. They had the requisite knowledge of infant physiology and development and the technology and the skill to lay claim to the ill neonate, whereas the obstetricians did not.

In an attempt to stop inter-uterine deaths, exchange transfusion was then attempted in utero. This was an even more delicate operation, and though carried out initially by an obstetrician, Lily (1963,1107) he used the techniques and instruments of the paediatrician, and paediatricians later followed his procedures. It was to some extent a success, but like the exchange transfusion of the neonate, it was a dangerous procedure, justified only because the outcome of the condition was high in morbidity and mortality.

This excursion of the paediatrician via exchange transfusion into the core of the obstetrician's specialty, the pregnant mother and her new born child, was tolerated by the obstetrician in the case of this particular disease. The mother may have needed care just after birth, and because traditionally the duty of care of the obstetrician was towards the mother, he was relieved at these times to have the ill baby properly looked after - thereby increasing the survival rate of both and thus increasing his prestige. (Myerscough, 1979, per)

The obstetricians were aware that control of an ill neonate had passed from them to the paediatricians and though the more general conflict has been described, it is very interesting to see in detail what happened next in the treatment in this disease.

The exchange transfusion technique was expensive and could not be used in all cases. The concern of the obstetrician now was to get some indicator of fetal distress so that judgments could be made about early delivery via induction or caesarian section. This was an important step in the beginning of the conceptual separation of mother and unborn. The fetus as a separate entity was now becoming accepted and its role as a patient was emerging as a practical possibility. This change of emphasis was the start of the conceptualisation of the mother as a vessel, in this particular case a dangerous, unclean vessel. Here again the scientists provided a possible answer, arrived at by typically reductionist arguments. They reasoned that the fetus would excrete into the amniotic fluid the breakdown products of the damaged red blood cells, such as bilirubin. If amniotic fluid could be obtained and the amount of bilirubin estimated, a method of developing an indicator of fetal damage could be formulated. Again there was an emphasis and focus on the fetus.

In 1892 a clinical procedure to treat polyhydramnios (excess fluid in the uterus) had been described. Although the procedure was hazardous; the condition it treated was even more dangerous to mother and unborn child and thus amniocentesis, the aspiration of amniotic fluid via a hollow needle, was developed for this condition. Apart from this and the inter-uterine exchange transfusions, the womb had not been breached.

In 1956 the procedure of amniocentesis (note it is a procedure not a test, a mistake often made in non-medical literature) was used to obtain amniotic fluid for bilirubin estimation. This was a very important step for it represented a move by the obstetricians into new territory - inside the womb itself - and they were careful to keep out the neonatal paediatrician.

Exploration of the new territory would have proved useless had it led either to damage of the fetus or to the induction of the miscarriage of a normal fetus. In an attempt to make the procedure safer, a new developing technology, ultrasound, used during World War II and not yet formally connected with medicine was employed (Donald et al 1958,1188). The desire to make the fetus visible sprang from the need to guide the needle into the amniotic sac without harming the fetus.

Again this was an important milestone in obstetrical development, for the fetus could now be imaged physically (this is described in more detail, later in this chapter).

Detailed study of the fetus started at this point and contributed greatly to the determination of normality and abnormality.

The possibility of the use of biochemical indicators of normality and abnormality was also realised, especially as important new developments in biochemical analysis and cytogenetics were also taking place.

The ability of the obstetrician to detect fetal distress via bilirubin estimation, enabled him to remove the fetus from the damaging environment (a concept which has gained popularity for other conditions) thus saving some lives and preventing some morbidity. But estimations in the USA that 12% of the parent population were at risk, meaning that 24,000 babies a year could be affected in that country alone, led scientists with the help and guidance of obstetricians to develop other forms of treatment.

Developments in immunology made it possible to produce substance which would desensitise the mother to the Rh antigen of the child. It is characteristic of the disease that the first child is not affected, but sensitises the mother to the antigen. If a second child is Rh positive the mother will react against it. Immediate treatment of the mother after the birth of the first child will mean that she will not react to the second child. The substance RhoGam was produced and used in 1968 after testing on prisoners.

This is another example of the reductionist method of approach to a problem.It also illustrates the development of treatment from complicated and expensive procedures to cheaper and simpler methods which can be routinised into normal maternal care and carried out by paramedical personnel.

It is also a good example of a problem which will not go away under a democratic system, for Rh negative women will still marry Rh positive men and there will therefore be possible danger to children of the union if they are Rh positive. Antigenic variation is a fact of nature and only repressive legislation would control the combinations which cause these problems. There are indeed some agencies which believe that genetic registers should be kept on the population and "bad" combinations be either discouraged or forbidden.

The development of treatment for Erythyroblastosis foetalis had a profound effect on many areas of medicine and it has been used as a model to indicate the success of modern medicine.

As already indicated in Chapter 7, two specialties were greatly affected, paediatrics and obstetrics and the effects can be described in territorial terms. A major shift took place in the position of the boundary between the two, as the paediatricians were able to push up to the boundary of birth. This loss of the territory of the neonate induced the obstetrician to explore the new territory of the fetus, the potential of which was graphically illustrated by the model.

Specific parts of the model had relevance for other specialties and for the medical profession as a whole. A new technology devised outwith medicine, ultrasound, was utilised with great success for territorial gain, biochemical parameters for abnormality and consequently for normality could become an integral part of specialty control, change in the size of instruments, ie miniaturisation, could lead to unique expertise for an expansionist specialty. The change from expensive, complex invasive techniques to cheap, simple, non-invasive diagnosis and treatment could act as a role model for other parts of medicine provided the practitioners were aware of the dangers, ie the later types of procedure can more easily be taken over by a para-medical group.

The problematisation and subsequent medicalisation of a particular genetic combination could similarly act as a role model for the takeover of other genetic conditions, especially as the success of this model was so easily seen by the public as well as by other doctors. The ethical problem associated with treatment of genetic conditions are also focused here for there can be no elimination or reduction of the initial genetic combination, unless coercive control is used.

Finally the diagnosis and treatment was a good example of the success of the reductionist concept of medicine - explanation of disease in terms of chemical and physical principles.

Invasion of the womb

The pregnant womb had now been breached - new territory had been invaded and very fertile territory it proved to be, for little was previously known about the fetus. In the Index Medicus of 1954 there are 64 references to the fetus, in 1962, 448, 1967, 960 1972, 1536 and in 1981, 2208, showing the progression of knowledge.

The obstetricians used the techniques of science and technology to build up a core of specialised knowledge of fetal development, mirroring the devices used by the paediatricians for their territorial control of the child.

A magazine article (Gould 1979; 22) expresses this feeling in slightly more emotive language when discussing the work of the obstetrician Liley.

> he had demonstrated the possibility of breaching the secret citadel of the womb in order to diagnose and possibly treat foetal disease.

Sandler (1981- vi) writing the preface to a book entitled Amniotic fluid and its clinical significance indicates very graphically the change that has taken place

> medically speaking; the human fetus in utero has always been relatively inaccessible; any information about its well being was inevitably indirect and exiguous and the methods by which it was obtained crude and limited. The situation has recently changed dramatically. Once again it is the old story of a technical advance leading to a sudden surge of new knowledge.

He continues in more expansive vein

> From being one of the last strongholds of medical ignorance; the "black box" of the pregnant uterus and its contents has now emerged into the light of recent scientific advance. And already the clinical spin-off is immense.

Note that there is no mention here of the mother; already she is detached as a "pregnant uterus". This uncoupling, this detachment; is considered later in more detail.

The idea of the uncoupling is further emphasised by Kaback (1976) quoted by Oakley (1982,17).

> for many years the human fetus has been considered off-limits to investigation. With the scientific and cultural revolution of the past decade it now becomes possible to envision this organism as a potential patient who may be approachable and amenable to scientific evaluation and to medical management.

A very good example of a claim for the new territory of the fetus, developing a potential patient with no suggestion of the role of the mother.

The importance of the fetus is also stressed by Reid (1959, 709) who after commenting that until recent times medicine had devoted most of its energies to the study of the extra-uterine existence and very little to the interuterine development says

> An analysis of trends in research during the past decade indicates an awakening of interest in this process (ie interuterine development) upon which the future of mankind depends.

The latter part of the statement employs a tactic used by paediatricians to bolster their claim for the territory of the child ie the future of mankind dependent on the study of development of the child. Here is an obstetrician using the same tactic, using earlier development - that of the fetus.

The chemical imaging of the fetus by the test for bilirubin, just described, was a most important step for the obstetrician. The physiological state of the fetus had been determined in one important situation, and this indicated that other physiological states could also be measured once the tests were derived. Not only was there imaging, of a chemical nature, but there were measurements and from these measurements came monitoring and control.

It is worthwhile quoting here a passage from a book on "Foetal & Neonatal Physiological Measurement" edited by Rolfe (1980, foreword)

> The ability to measure is a prerequisite for the advance of any branch of science. Medicine, although frequently denied the title of 'science' by its own practitioners, has grown to become increasingly reliant upon all that the physical sciences can offer in the field of measurement. The problems of quantifying physiological events and processes have attracted considerable interest and effort among clinicians, physiologists, engineers, physicists and mathematicians and <u>physiological measurement</u> has now developed into a speciality in its own right. The extension of this description to <u>clinical measurement</u> is clearly appropriate in some circumstances, but why the specialisation in <u>fetal</u> <u>and</u> <u>neonatal</u> <u>medicine</u>? Quite simply because of the existence of overwhelming clinical needs requiring measurement techniques which were not available amongst those used in adult medicine.

The obstetricians have developed similar strategies to those of the paediatricians, namely by insisting that adult medicine does not supply the necessary techniques for fetal and neonatal measurement. Measurement is seen, however, as it is in adult medicine, as being of prime importance. This book links fetal and neonatal medicine, and though this chapter is concerned only with the fetus, this link will be considered in Chapter 10.

Physical Imaging of the Fetus

Knowledge of the developing fetus was gained by the use of imaging technologies, by the extension of the senses, especially the one concerned with sight. There were problems, however for X-rays had come under suspicion as the cause of childhood leukaemias and other malignancies and their use in this developing field was not encouraged. (Stewart 1956, 447)

The development of clinical ultrasonography by Donald and his followers is regarded by Ferguson-Smith (1983,301) as having a major role in bringing

> the fetus into sight, so that in the past ten years we have learnt much about its growth, its behaviour and its response to stimuli.

Although the use of ultrasound techniques was not new either in industry or more pertinently in medical practice (as shown in Chapter 5) it was innovative to use it in obstetrics. As Rogers (p.120) suggests, an innovation can be a practice which is perceived of as new by the adopters, and it matters little whether it is objectively new or not.

The imaging of the fetus is an important part of the claiming strategy of the obstetrician. Gross imaging by ultrasonic techniques can give much information, sex, neural tube and other defects, placental abnormalities and defects etc. Once imaged, the fetus can be measured; once measurement is possible, concepts of normality and abnormality can be devised. Biparietal diameter and rump length are measurements possible with ultrasound and increase the obstetrician's claim to specialised knowledge of development.

The sophisticated technology of real-time ultrasound scanning devices has made it easier to obtain accurate measurements and according to Cambell & Pearce (1983,322) the improvement of resolution which has made the real-time scanners as good as the staticscan apparatus enables the obstetricians to detect congenital malformations with even greater accuracy. This accuracy has led to the diagnosis not just of neural tube defects and cranial abnormalities, but other defects like tumours, congenital heart disorders, gastro-intestinal anomalies, renal and urinary disorders, and shortening of the limbs. These new real time scanners also allow the study of organs and structures during movement and enable developmental parameters to be measured more accurately.

These developments are a very good example of demand-led technology. Obstetricians expressed the need to have better pictures, to have the equipment under their control within their wards and not to be dependent on radiologists, to have real-time pictures. The industry responded to these needs, these demands, for it was a profitable development for them, as each new and more sophisticated piece of equipment was quickly bought because of the added facilities it afforded.

Thus the obstetricians are increasing their core knowledge of the fetus, much of which is the development of the fetus - normal or abnormal. As with the paediatricians, and maybe by following their example, they are concerned with development of the fetus and could therefore ask similar questions, ie Is this fetus developing normally?

Ultrasound in its various forms is now used extensively and routinely by obstetricians, who claim that it is not harmful to the fetus. Doubts have been raised about this claim and although obstetricians are concerned, a working party set up to consider methods of analysis of risks involved came to the conclusion that there were too many variables to allow definite study at this time (Howie 1981,sem) This failure to attempt an assessment, coupled with the fact that exposure in the fetal state to ultrasound will not be entered on a child's record, is regarded by some as a dereliction of duty by the obstetricians and confirmation of the belief that the technological imperative is paramount for them. It will be recalled that x-rays were similarly regarded as completely safe and widely used. The suggestion that ultrasound has now become embedded or entrenched in obstetrical practice wil be examined in the next chapter.

The control of ultrasound examination and the interpretation of results is increasingly in the hands of the obstetrician and not the radiologists.(ibid) This is to some extent due to the now portable nature of ultrasound equipment and the desire of the obstetrician to have it directly under their control, exemplified by the statement of Campbell (1984).

> I think really one of the big steps forward in the future will be to have ultrasound departments in the charge of obstetrics, ultrasound equipment given directly to obstetric departments.

Thus they are seen as high technology specialists, discovering new facts about a new territory.

Measurement of development of fetus and detection of abnormality

The importance of normal fetal growth, the importance of knowing the correct age of the fetus in case induction of labour is necessary and the detection of an abnormal fetus or abnormal fetal development, all contribute to the desire of the obstetrician to have safe but comprehensive techniques for monitoring fetal development, as a major part of antenatal care.

To confirm a claim on the new territory of the womb and the fetus it is necessary to claim special expertise and knowledge, to transmit this only to members of the specialty and to erect barriers to other specialties. If necessary, information, skill etc can be appropriated from a rival specialty so that potentially competing specialists are excluded, (e.g. ultrasound from radiologists and antenatal diagnosis of handicap from medical genetics).

Amniocentesis is a comparatively simple procedure which provides the amniotic fluid for biochemical and cell analysis. After estimations of bilirubin in Rh-incompatability in 1956 and the use of ultrasound to make the technique safer, as explained above, it became possible to detect many genetic diseases and dangerous interuterine conditions. Not all of these will be charted (at present they number over 300, Wilkie 1984), but some examples will be given.

Spina bifida is an abnormality of neural tube development and it varies in the severity of symptoms. Babies affected may be born dead, may die at birth, may die within the month, or if operated upon may live, but in a very disabled state. It does not appear to affect mental development. This type of baby does not represent a satisfactory obstetrical outcome, leading as it does to problems for the neonatal paediatrician and to ethical problems for the medical profession and for society. The scientific discovery that this condition led to an increase in a substance called α-fetal protein in the amniotic fluid, offered a method of determining the condition in utero with the possibility of theraputic abortion of the defective fetus.

Boon (1981,1661) following up 1200 cases of amniocentesis stated that antenatal diagnosis of fetal defects is perhaps the greatest advance in perinatal medicine for a generation.

Amniocentesis is an invasive procedure with a danger of inducing a spontaneous abortion, so the discovery that α-fetal protein could be detected in maternal serum was important. Thus the obstetrician could be seen to be following the current medical fashion of substituting non-invasive procedures for invasive ones (like the cardiologists(Julian,1981,per). But this method was only 60% successful, for some other conditions cause a rise in α-fetal protein. Using ultrasound, however, these conditions (wrong age of fetus, twins etc.) can be determined and the method then becomes 85-94% efficient. Thus it is possible to screen women for an abnormal fetus. A recent report (Robinson et al,1980,710) indicates that one ultrasound examination diagnosed 79% of spina bifida cases and a second ultrasound examination diagnosed 95%. This was without amniocentesis. This paper contains an excellent example of technology enabling the obstetricians to practise what has been termed "the relief of the "worried well" (Knaus 1977,533)

> ultrasound examination has the additional role.... of demonstrating to the mother the apparent normality of the fetus

That is the doctors have control of the technical apparatus and indicate their belief in this normality. The mother does not have the knowledge or the experience to challenge the doctors' interpretation and is thus dominated by the use of technolocy. This is also an example of the development of diagnostic techniques that return control to the clinical specialist. Chemical examination may no longer be necessary, for the physical imaging of the fetus by ultrasound and the diagnostic experience of the obstetrician will be sufficient to reveal abnormality. It is this experience and special knowledge which allows them to erect barriers around their territory.

The difference between the old and new methods of examination of the fetus are worth elaborating for they show how positively the obstetricians have embraced the concepts of medical science. The hands of a skilled obstetrician could make judgments about the development of the fetus by indirect contact with fetal limbs during external examination of the abdomen. Moore (1978,1) has described the types of feelings he associated with health

> when the foetal head or a limb is palpated between two fingertips, in the presence of a normal volume of amniotic fluid a characteristic sensation is imparted to the examining fingers.

This is a good example of tacit knowledge as described by Polanyi

(1962, 601). He states that medical men will say

> there are things we know but cannot tell, we know how to distinguish a complex pattern of things without being able to specify by what features we discriminate it.

It can only be transmitted from expert to novice under the guidance of the expert on a one-to-one basis and with the direct involvement of the mother. It cannot be taught in the classroom with photographic slides. I believe that this is what is meant when medicine is said to be an art. It is also static knowledge as well as being esoteric. By contrast, ultrasound pictures can be transmitted from the bedside and interpretations discussed in the classroom; one expert can teach many novices at once, and the mother is not directly involved.

I am not saying that machines render these types of intuitive skills redundant, for if palpation is seen as a diagnostically valuable procedure it will be retained, still taught to students, but possibly used in a different way or on different subjects. The laying on of hands is an important element in the one-to-one relationship of doctor and patient, and one way of building up trust, so that its use can be selective and not made redundant. But the alternative procedure of imaging, the technological aspect of medicine, does necessitate a change in the social organisation of medicine and the way students are trained.

The knowledge which comes from this technical source is also dynamic, for the machines are becoming increasingly more complex and more sophisticated and new knowledge and facts are constantly coming into the exclusive knowledge base of the obstetrician. One example is the discovery that in the initial stages more twin embryos are present than twins born. The second embryo dies and is absorbed. Only a particular configuration in the placenta revealed by ultrascan reveals this phenomenon. This can now be linked with previously unexplained structures noticed in PM examinations of the placenta and with unexplained bleeding in the mother. This provides more useful core knowledge for the obstetrician.

Other techniques used to gain information about the fetus are fetoscopy and fetal tissue sampling. These are comparatively new - a good review of them is by Rodeck & Nicolardes (1983). With fetoscopy the fetus (2nd trimester) can be viewed directly using fibre optics in a needle inserted into the uterus. Tissue samples can be obtained for genetic analysis. The authors maintain that over the last decade fetoscopy has evolved from an experimental procedure to a major diagnostic tool of proven safety and efficiency, enabling the diagnosis of at lease 50 congenital abnormalities not identifiable by other means.

Nevertheless doubts have been expressed about the safety of fetoscopy as the following example will show, highlighting problems for the obstetricians concerned with antenatal diagnosis. Beta-thalassemia can be diagnosed in this way, but two problems arise (EMG, 1979).

The first problem is that the technique is grossly invasive and both the risks of haemorrhage from the sampling site and the induction of premature labour are high. But, it is possible to diagnose this recessive genetic disease of thalassaemia and suggest therapeutic abortion when the diagnosis is positive. A negative diagnosis of course would give great relief to the parents at risk.

The second problem is that, with other tests as examples the obstetrician may decide to abandon this invasive technique and wait for the scientists to develop a testing procedure which does not need fetal blood. Such a procedure would be carried out on amniotic fluid or fetal cells procured by amniocentesis or preferably a test which could be carried out on maternal blood, as fetal cells do pass via the placenta into the maternal circulation. As no such procedures are yet available, obstetricians have to choose between ignorance and the risks of diagnosis.

PLACENTA

The rise of investigative work on the placenta is important for various reasons. Firstly there is the concept from the hormonal and chemical side of the "feto-placental unit" and thus the placenta gains increasing importance because of its relationship with the fetus. Secondly tests of placental efficiency can be made by testing for chemical indicators (oestriol etc). These tests can be correlated with other tests of fetal development and may be of vital importance in decisions about induction because of placental insufficiency. Thirdly correlated studies are being carried out on the pathology of expulsed placenta and the appearance of the *in vivo* placenta by ultrasonic scanning techniques. These studies are intended to enable the obstetrician to recognise placental problems at the time of occurrence and not after the birth. Finally it is possible to treat placental insufficiency, especially in the cases of twins, by chemical manipulation. Thus, the greater the knowledge of the placenta, the greater the ability to intervene in problem cases.

Here is another example of the obstetricians claiming a piece of territory by increased knowledge of a specialised nature. It has always been their job to ensure that the placenta was removed completely from the uterus and they had some knowledge by palpation. But by using scientific and technological procedures they can image it, detect insufficiency and correct the problem.

THE MOTHER

Before the colonisation of the fetus, the pregnant woman was regarded as at least as important a patient as her developing baby. The relationship between mother and baby was regarded as so close that in 1952, an obstetrician said that

> the patient we have been discussing belongs neither to the obstetrician or the paediatrician - it belongs to the mother (Stabler,1952,670)

During the period of colonisation, the fetus became the important or first patient and the role of the mother reduced to that of a "passive container" (Katona, 1981,26), a "passive vessel" (Anon,A,1981) or a"space capsule for the development of the baby" (Glover, 1982,sem). She has become decoupled from her baby and even from her placenta, as can be seen in the term "feto-placental unit" (appendix A). This concept is also taken up by the paediatricians, who see the mother as a container, for they desire the safe transport of a possibly problem neonate _in utero,_ no mention of the mother as such, just the function of a good transporter or passive container. (Walker 1980;42)

The concepts of separateness and passivity of the mother in pregnancy is important to the control of the territory of the fetus by the obstetrician and has little relation to the (albeit rather eccentric) 1919 description of pregnancy by Bonney (Lewis 1982;126).

> Pregnancy is a state induced by the growth of a neoplasm, labour is a process accompanied by self-inflicted wounds, and the puerperium is the period of healing ... midwifery concerns itself with the treatment of these three and is a purely surgical act.

As already indicated there has until recently been no serious challenge to the obstetricians' right to the territory of the pregnant woman; but as her treatment during pregnancy and as her role in that phenomenon changed and reconceptualised, other specialties have shown interest, as will be described later, once this reconceptualisation has been charted.

The possibility of estimation of fetal distress was realised chemically in the treatment of Rh-disease. The fetus was being killed by the reaction of its mother's body. The idea of a dangerous interuterine environment for the fetus was thus developed - not a safe, protective environment as had been thought, but sometimes a dangerous place for the fetus, a dangerous container. More recently there has come the shock of discovery of the teratogenic effect of thalidomide and german measles virus and a recent book by Elkington (1985) about reproductive toxicology entitled "The Poisoned Womb" presents evidence to show that chemical damage to the fetus is increasing at an alarming rate. Considerable evidence is also accumulating which shows that alcohol consumption by the mother, as well as bad dietary habits, could damage the fetus. Thus, the role of the mother is now under scrutiny. This patient is a potential source of danger to the fetus which, as I postulate in the discussion of this chapter has increasingly become the prime patient of the obstetrician and thus control of the mother's physiological processes is necessary to decrease or eliminate the danger.

Even medical treatment of the mother during pregnancy can cause fetal problems as indicated by Moosa (1979 per). Pre-eclampsic toxaemia is much rarer than it used to be and treatment is bed-rest and magnesium sulphate, but the chemical creates a toxic state in the fetus which when born will require exchange blood transfusion.

Reid (1959,719) expresses the danger elegantly when describing the effect of pain relief for the mother on the fetus

> the milieu rather than the foetus *per se* is largely at fault

Expressed in functional terms and embraced by many obstetricians is the concept of the mother as a "vessel" (Anon,A,1980;Anon,B,1981) which must be kept as pure as possible so that the fetus will develop normally within it.

Katona (1981,25) has described the dramatic growth of antenatal literature in the past 50 years. He records that the emphasis in the late 19th century was on the responsibility of the mothers towards themselves and their children and gives the following quotation.

> Whenyou neglect, risk or injure your own health during pregnancy you do a direct injustice to, and commit a real crime against your unborn baby (Stacpoole, 1892,16)

In the 1920s Truby-King (1924) told mothers that they held the destiny of the race in their bellies and Liddiard (1928,1) said that

> Upon the parent of today depends the health of the next generation and not only the health, because it is well known that physical, mental and moral development go hand in hand.

The change of emphasis from the 1950s is seen by Katona in the way ante-natal literature given out by doctors treats pregnancy as a process in which women are, or should be, passive containers. (ibid, 20) The implication is that the doctor is in charge and in control and knows best how to interpret not only the needs, but how these needs should be met, of the pregnant mother and her child.

The concept of a pure vessel, the passive container, has been re-inforced by the use of surrogate mothers, when there is female infertility in a couple. The prospective parents in the USA have legal rights over the life style of the surrogate mother during her pregnancy and the conditions for her daily living are generally rigorous - no alcohol, no drugs, no tobacco, no sex, proper diet, vitamin supplement, exercise but no excessive activity etc. This implies acceptance of a pure vessel concept.

The general increase in health of women likely to be mothers has aided the re-conceptualisation of the mother. The decrease of maternal deaths has enabled the obstetrician to concentrate on the fetus, both at birth and then progressively backwards towards conception.

Sayers (1975, 32) points out that the obstetrician is now

> less worried by maternal death as a major problem; he has been thus able to turn more of his attention to the well being of the foetus and as a result many new measurement techniques have been introduced into clinical practice during the past 10 years.

This decrease in maternal death has been due in part to the use of antibiotics, blood transfusion and safe anaesthetics and other inputs from science and technology.

This reconceptualisation of the role of the mother gives the obstetrician control over her - for mothers will undergo restrictions and painful examinations and tests for the sake of their developing babies. They hand control of their bodies and their way of life to the obstetrician.

The successful use of chemical manipulation to prevent miscarriages, has further increased the control of lifestyle of the pregnant woman. Previously the methods adopted were mainly physical, the vagina being packed with hydrostatic bags. Although there are side-effects from chemical manipulation eg progesterone, the mother tolerates these for the continued pregnancy.

> I had to have progesterone injections to hold her for the first five months, and I managed to convince myself that being sick six times a day - a side effect of the drug - was normal. (Porter, 1978).

The attempts of a woman to carry her fetus to viability is described in a paper (Lind, 1981). Only after four miscarriages and much chemical and physical manipulation was a live baby born. Reports are available of women who are willing to spend the whole nine months of pregnancy under the complete hospitalised control of their obstetrician.

This area has been emphasised for it epitomises two important aspects of the practice of obstetrics. Firstly, that to have a child is for some women an absolute necessity and therefore they will not have complaints against their obstetrician no matter how much manipulation there is. Secondly the obstetricians who are interpreting the needs of these women have complete control over their life style, and these considerations can permeate the rest of obstetrical practice; for this control objectifies the woman and the end justifies the means, since a baby at the end of a pregnancy is vital to both parties, the mother and the obstetrician. It is the outcome which has paramount importance, not the process.

Coupled with this control by reconceptualisation is the control by the use of science and technology. As indicated previously, there are many tests which can be carried out on the fetus and now on the placenta. These tests can establish normal development and thus departure from normality, they can also detect genetic and other abnormalities. The development of the fetus can be continually monitored. Because sophisticated devices are needed, the mothers attend hospital for these examinations. Increasingly because of this hospital based emphasis, pregnancy has been increasingly seen as an illness.

In considering the general movement of the medical professional towards intervention in states recognised as "natural", Freidson (p.48) used pregnancy as an example - it could be regarded as a natural or normal state or as an illness. Oakley (1984, 12) describes the gradual redefinition of pregnancy as pathological, which has become marked since 1950, and Arney (1982,8) sees this movement as part of the "body as a machine" concept in that all births, like machines, carry in them the potential for brekdown, i.e. the potential for pathology.

Again, this medicalisation puts the pregnant woman in the control of the obstetrician and gives the obstetrician consolidation of his rights to the territory of the pregnant woman.

SUMMARY

When the obstetricians lost the neonate to the paediatricians they were faced with a distinct loss of territory. Their practice was further decreased by the fact that for a variety of reasons their prime, their first patient, the mother, was becoming increasingly healthy and required less and less of their administrations.

Unlike the paediatricians, who had a similar experience with their prime patient, the child, the obstetricians did not go into a period of partial redundancy for they had in essence two patients, and as they lost interest in one, as the mother became less medically vital, they turned, not unexpectedly, to the unborn child, their second patient. It was an area they did in fact control, but about which they knew very little.

The territory of the fetus had only been lightly explored by simple and indirect ways which made it impossible to separate the mother and her unborn child, for the obstetricians had to involve the mother in their pursuit of knowledge about the child. This gave precedence to the mother and gave her the status of first patient even after she became unproblematic healthwise.

To be successful in their claim to the fetus, the obstetricians needed special knowledge of its development, and from this to build up parameters of normality and abnormality. For like the paediatricians, they realised that the study of normal development greatly helped to define the subject area of their proposed discipline. And like the paediatricians, the obstetricians were successful in this ploy.

In their pursuit of the specialised knowledge they needed, the obstetricians used a variety of techniques with appropriate hardware to extend their senses. The use of imaging devices was not novel to this specialty, other specialties within the profession of medicine were also using them. What appears to be special to the obstetricians was the variety and the concentration of use of these devices.

The obstetricians did not have any professional competition during this exploratory period when they were focussing in such a concentrated way. Competition from the mother was dealt with by reconceptualising her as a passive vessel and decoupling her not only from the fetus but even from her placenta as the concept of the feto-placental unit came into use.

It is interesting to note that though the obstetricians were searching for more and more ways to collect what could be called objective and scientific knowledge, it was their interpretation of the special knowledge which counted. The mother was not allowed to make her own interpretation of this objective knowledge.

Having the fetus as a patient, as Arney (1982 ,135) points out, changed the orientation of obstetrics, for it gave legitimate reasons for increased control of pregnancy and of intervention in this process when the life of the fetus was thought to be becoming compromised.

The fetus, I believe, became the prime patient of the obstetrician, and it was an ideal patient, for it was completely under their control, there was no interchange with it about desirability of certain treatments or procedures, and as the obstetricians became absorbed in this mode of practice it must have made the demands of the mothers for explanations etc very tedious.

This compliant first patient also had the great advantage that the information which could be collected about it seemed limitless. Because of the wealth of knowledge already available and because of the potential knowledge yet to be gathered, other specialties could be predicted to become interested in exploring this fertile territory.

To consolidate their colonisation of the fetus the obstetricians needed to have firm control of the boundaries of the fetus.

The next chapter describes how they did this by taking control of conception and increasing their control of childbirth, for in doing this, I would like to postulate, they can be said to be responding to the needs of parents for a perfect new baby at the end of what is increasingly being thought of as a system of production.

INTRODUCTION

The obstetricians have been successful in colonising the new territory of the fetus; they built up a core of special knowledge and from this developed specific skills and techniques, thus consolidating their claim to this territory. To strengthen this claim even further it is necessary for them to define the boundaries of the territory. The first part of this chapter will deal with the setting of one boundary of the territory of the fetus, that of conception, the other boundary, that of childbirth, will be dealt with in the second part.

BOUNDARIES - CONCEPTION

The fertilisation of an egg and its subsequent implantation in the wall of the uterus is the starting point of the development of the fetus, and therefore very important to any specialty wishing to control the territory of the fetus. Although negative control of conception via contraception for women who do not wish to be pregnant is part of the boundary, it will not be included here (though it is an instructive example of the medicalisation of a problem, i.e. the fertile wishing to be temporarily infertile).

The desire of couples to have children brings both of them into contact with the obstetrician if they experience problems of fertility, ie if one or both are either sub-fertile or infertile.

Infertility may be due to various causes and can be associated with both male and female reproductive systems. It is estimated

(Templeton, 1978, sem) that 10% of married couples seek advice about infertility from their GP and many of these are referred to special clinics run by obstetricians. Previously couples accepted the problem of childlessness because there were very few treatments available. Now that there exists a great range of treatments, the perception of this as a problem has become more acute and the concept of the "illness or disease of infertility" is emerging. Medicalisation of this human functional defect has become very popular and it embraces both male and female infertility.

Freidson (p. 49) in his discussion of disease as ideology, describes these developments where personal choice, state of sin or genetic problems (he uses the perjorative term "inferiority") are "designated as pathological and amenable to scientific treatment".

Male infertility

Bender (1979, 1117) describes his experience with impotent returning prisoners of war in the late 1940s. Their wives were anxious for children and the problem came to the obstetrician via this route, thus establishing at a very early date their interest in male infertility. Bender describes his treatment of this problem when he instructed wives how to artificially inseminate themselves with their husband's sperm using an eye-dropper. Once pregnancy was confirmed potency quickly followed. This method was artificial insemination by the husband (AIH) and was concerned with temporary impotence rather than permanent male sterility, but it had the effect of introducing a new type of patient to obstetrical practice- namely men.

The problem of male sterility can be circumvented in various ways, the most common of which is artifical insemination by donor. This procedure is carried out in general by obstetricians because they have control over the territory of the potential pregnant mother and therefore have control over the male sperm and therefore the male. This aspect will be discussed in more detail later in this chapter.

The problem has been medicalised and the application of science from outwith human biology has been used. Developments in the field of cattle breeding can be easily adapted to male infertility, especially in the transport and freezing of sperm, using the new technology of cryobiology. The use of developments from other fields is not new, but in this case and within the whole field of human reproduction the uptake of innovative technology which was appropriate to their need was a powerful weapon for the doctors.A growing public demand has led to the establishment of several hospital-based AID clinics run within the NHS. Scientific evaluations of the success of cryo-preserved sperm and fresh semen have been carried out in some of these clincs and currently the RCOG is carrying out a survey of the practice of AID in Britain.

These cryobiological techniques of sperm storage can be used for family planning. A man may choose permanent sterility by vasectomy, but to ensure his choice to have more children he can store his sperm. With changing marriage patterns and the smaller family (with possible deaths) this seems to some a prudent step. More bizarre is the setting up of sperm banks where the woman may choose the father of the proposed child from dossiers on the sperm's donor.

The cause celebre relating to the use of frozen sperm, is the case of the French woman who wishes to use her dead husband's frozen sperm for fertilisation. His sperm was frozen some years ago when cancer of the testicles was diagnosed. Any child born of this procedure will be illegitimate according to French law for the father will then have been dead for more than 300 days. (Times,1984)

Many questions regarding medical practice have arisen over this procedure of artificial insemination and the specialty of obstetrics is very much concerned with these. Firstly there are very few follow-up programmes which review patients after successful insemination. This would be a very difficult and complex area to explore for various reasons. Should the obstetrician involved in the insemination initiate a follow-up scheme? Do obstetricians regard it as their duty to review their work and its effect, allowing improvements to be made to their counselling procedures and facilitating the identification of individuals or couples who are likely to suffer adverse after-effects? Such a scientific approach to the evaluation of a particular procedure would be consistent with the general drive towards relevance in medical practice. The complication arises from the fact that AID is not only a biomedical procedure, but an example of a biological manipulation which has become medicalised. Reports of the increasing use of AID amongst lesbians in San Francisco indicate clearly, however, that medical intervention is not necessary in AID. (New Society,1977,490)

Having medicalised the procedure, and having previously conceptualised the sterility of the male as a medical problem, the obstetrician is left with the dilemma of follow-up. Should it be done? If so, who should do it? Health professionals are already employed in the counselling work - should they be used in follow-up?

Some practitioners have advocated that AID should be notifiable ie indication of successful insemination but with neither the name of the recipient nor the donor included. Thus there would be no breach of confidence and hopefully no ethical problems. Other practitioners, however, have indicated that attempts should be made to form a central register of AID pregnancies including the name of the donor, the recipient mother and the child.

Many of the reasons for this suggestion have a biomedical basis, but they highlight the dilemma of the obstetrician with reference to the role of the scientific research worker.

It would be helpful to know the identity of a donor who has passed on a hereditary illness or abnormality in a child, who may need to be studied for several years before the condition declared itself and this would involve paediatricians. Genetically this would be most rewarding but the ethical problems with regard to potential suffering and distress is thought by many to outweigh the scientific imperative.

This example of AID shows how scientific development has led to medicalisation of a problem and to a procedure adopted to cure the problem. It also shows how assessment of the new procedure cannot be scientifially evaluated because of the ethical problems it raises. It also provides an unusual instance of a situation where the natural desire of the obstetrician to expand the legitimate territory of the specialty is inhibited by ethical considerations - a dilemma which highlights the difficulty of resolving the dichotomy between the "art and science" of medicine.

The most powerful argument against a central register is the effect it would have on donor recruitment. Donors and potential donors are reassured by the anonymity which is guaranteed by the recruiting practitioner. Under the present laws the donor would be responsible for his AID children and they could have a claim on his estate. Thus a donor needs the reassurance of anonymity and if this is not secure donor recruitment would fall and current practice of AID would be severely curtailed. Thus patients would be lost and the control of the boundary of territory would be lost.

Male infertility can also be treated by physical and chemical manipulation. Operations ie variocoele, and hormonal treatment can help the problem and often the obstetrician has control over these procedures and thus control over the male.

Recent advances in biological manipulation and the success of <u>in vitro</u> fertilisation have greatly helped potential fathers who were thought to be sterile when judged by normal conceptive procedures. The joy resulting for both parents from a successful application of this procedure has greatly increased the public acclaim of the obstetrician and his manipulative skill, and thus his territorial claim over the male reproductive system.

Nevertheless, this claim to the territory of the male reproductive system is being challenged by the urologists. In two recent urological journals there is original research into male fertility and infertility. Urologe A 1980 contained papers on fertility in patients with testicular seminoma; fertility after torsion in the testicles; dissection of spermatoceles and fertility. The Journal of Urology (1982) contained papers on urological effects of vasectomy; microsurgical reversal of vasectomy; studies of human spermatozoa; treatment of subfertile men.

In what could be considered to be a consolidation of their claim there is original research on very similar topics in the journal, Surgery: Obstetrics & Gynaecology (1982). The papers are on surgery of the male reproductive system; treatment of recurrent testicular torsion; fertility after testicular cancer treatment.

These endeavours raise again the whole question of why there is no specialty of andrology to co-exist with gynaecology. Barker-Benfield (1975,280) describes how the editor of the Journal of the American Medical Association correctly predicted the abortive future of those urologists who in 1891 attempted to form the specialty of andrology. Are they trying yet again? Have the attempts to establish this specialty any connection with the change in defining criterion of the venereologists? These specialists no longer use disease as the criterion but spatially define their specialty around the anatomical areas of the genito-urinary system. The whole field is in flux and whilst I do not wish to develop these observations now, it is important to note that there are some recent indications of a specialty emerging as andrology. In 1978 a complete volume entitled "Andrology" was produced in the USA as part of a series in reproductive biology, covering "clinical problems in andrology" by various manipulations, echography (physical) and pharmacology and endocrinology (chemical) and genetic (biological).

Despite these indications, the lack of a definite specialty of andrology underlines once again that normal medicine is male medicine, and that women are separated from it and are considered by doctors to need a separate specialty. The profession is patently able to have control over the definition of needs of their clients.

Female infertility

This can be due to many causes, but it is firmly within the remit of obstetricians. Many spectacular advances have been made in this field in recent years, mainly because of the input into the specialty of biomedical scientific research and technological advances. The visibility of consequences of these advances are seen on TV programs, magazines etc. all over the world. The general population can understand the problems and can applaud the success of the specialist in overcoming them. Medicalisation of the problem is acceptable.

The two causes of infertility in women which have received the most attention have been anovulation and blocked or damaged fallopian tubes. Regarding the first, there was, until 1958, no satisfactory treatment for a woman who was not ovulating; in that year when Gemzell reported the use of extracts of human pituitary glands. A cheaper and easier method was to recover gonadotrophins from menopausal women and couple them with chorionic gonadotrophins from pregnant women, both sets of women being under the control of the obstetrician. The introduction by Greenblatt in 1961 of the drug clomiphene which induced ovulation by a different pathway was a breakthrough, although it did take time to get the dose right and many multiple births were reported, often with the death of all babies.

Research into the process of ovulation, often under the direct control of obstetricians, has made great progress in recent years. Input from research into the problem of anovulation was speedy, especially with the LH-RH hormones and the chemical manipulation of anovulation is seen as a major triumph for the obstetrician.

The opening up of a new territory is suggested by Bender (1979) who noted in 1951 that spontaneous abortion rates in women previously infertile was above average, but that congenital malformation rates in their viable babies was not raised. He suggests that an increased rate of developmental abnormalities accounted for the high abortion rate. Then he makes a most interesting comment:

> Chromosomal analyses were not then available to us, but today the chromosomes of both partners should be checked in cases of unexplained infertility and of repeated abortion - especially if early.(ibid,1117).

An invitation to open up this new territory? To whom should it belong? Who should claim it, the obstetrician or the medical geneticist? This is a most notable example of the possible use of scientific analysis to extend the scope of medical work.

Blockage or damage to the fallopian tubes is the second of the two best investigated causes of female infertility. Physical manipulation using microsurgery has been used by obstetricians to repair damage and has had some success. The drive towards helping infertile women with blocked fallopian tubes is strong, and several experimental procedures are being tested. One such procedure is the use of lasers and although only in a preliminary phase it has use for the laser, which though seen as a potentially useful tool of medical technology has as yet found very few applications. By using these sophisticated tools and by adapting them to the demands of their own specialty, obstetricians are seen as innovators and thus gain prestige from this use.

The biological manipulation or transplantation of live tissue has also been used in treating defects of the fallopian tubes. Parts of the fallopian tube of one woman about to be sterilised can be used to replace the damaged tubes of another woman who wishes to be pregnant. This has been effective within the concepts of success of transplanted tissue. Reports that this method was used to restore the tubes of a woman who had previously been sterilised at her own request have raised comments about inadequate counselling in the first place. They have also led to a directive that obstetricians should be aware of the increase in change of marriage partners, and this should cause them to reassess their attitude to the sterilisation of young women by tubal surgery.

In vitro fertilisation

In some women, because of irreparably damaged fallopian tubes it is impossible for the sperm to come in contact with the ripe ovum so that it may be fertilised in vivo. The obvious treatment for this condition is to fertilise in vitro and then implant the developing fetus back into the mother.

A normal baby conceived in vitro but developed in utero was born in 1979 to worldwide fame.

It would be difficult adequately to chart in a small space the contributions of science and technology to this achievement, but the important inputs are these: improved methods of cell culture _in vitro_, (mainly stemming from virological research and then from cytogenetics); research into process of ovulation, allowing correct timing of removal of the ripe ovum and the timing of the menstrual cycle for the implantation of the fertilised ovum; cytogenetic research, enabling any abnormalities in the manipulated fetus to be detected, with abortion if necessary; increased surgical skill for removal and implantation. The use of the laparoscope by Steptoe was further seen as major development.

What was also important was the idea not only that it could be done, but that it should be done. The social milieu was obviously of great importance here, and if it had not been favourable, there would have been considerable brakes placed on the technological imperative.The work of Steptoe and Edwards in this field of _in vitro_ (or extra corporeal) fertilisation has according to Bender (1979, 1118) illuminated many other facets of normal and abnormal conception and implantation. He raises the point that their work seems to refute the belief that spermatozoa have to be "capacitated" by a woman's fallopian tube before they are capable of fertilising an ovum.

The possible social consequences of _in vitro_ fertilisation, together with the range of research possibilities, the range of problems to be looked at and the range of scientific and technological methods associated with it, are almost unlimited. Thus the increase in territory could also be seen as unlimited.

An example of the direct input of technology into the field of infertility is the use of ultrasound. Bender (1979,1118) describes Kurjac and his use of ultrasound scanning. Kurjac demonstrated ultrasound scanning of ripe ovarian follicles produced in response to menopausal gonadotrophins. If these numbered more than one, then withholding human chorionic gonadotrophin can prevent multiple ovulation and the possibility of multiple pregnancy. This is an easier and more direct alternative to measuring urinary or plasma oestrogens. Kurjac had also found that serial scans sometimes showed a twin pregnancy at 7-10 weeks, but only one normal sac at 12-14 weeks, and Bender postulated the early death and absorption of one sac account for most episodes of so-called decidual bleeding, hitherto never convincingly explained, as well as probably many of threatened abortion which continue normally which made it wise to defer until after the first trimester telling a woman that a scan has shown a multiple pregnancy. Bender comments generally on the value of ultrasound.

> Whatever the value of ultrasound scanning in later pregnancy, it is going to teach us more about early pregnancy, normal or abnormal. The knowledge gained in a scientific advance may be more important than the advance itself. (ibid,1118)

This quote clearly illustrates that it is often the use of the technology to gain special knowledge rather than the technology itself which is vital to the development of a specialty. This, of course, does not rule out the benefit in prestige terms alone that the technology can bring to the specialists.

The impact of chemical manipulation on the development of routine in vitro fertilisation has been reported in Australia (Lee 1980, 758). Two particular achievements have led to progress towards this aim. The first is the administration of fertility drugs (eg chomiphene citrate) to induce the ovulation which produces the oocytes for test-tube fertilisation. The second is the use of hormones to control ovulation. Thus Wood and Trouson of the Department of Obstetrics and Gynaecology, Monash University, were able to induce the production of oocytes to a timetable allowing the time of ovulation and fertilisation to be arranged in advance. Such predictability make it easier for clinics with limited resources to offer "routine test-tube fertilisations". With the consent of the mothers, Wood and colleagues have implanted two embryos to improve the chances of a successful pregnancy. In recent reports of nine successfully progressing pregnancies, there are two sets of non-identical twins, that is, both embryos developed.

The visibility of consequences in these cases would be very high. In general terms, a woman previously diagnosed as infertile - with all the attendant trauma that this medical decision would bring - has brought forth a perfect baby. This has been made possible because of the skill and expertise of the obstetricians not only in their traditional role, but in the role of innovators, in that they were able to utilise the developments of science and technology in a meaningful way. The fact that it is now proving possible to produce twins means that the infertile mother need not go through the process twice so that she may have two children and the children can be the sex of her choice.

Experiments are also under way in this Australian unit to implant embryos which have been kept frozen for a period of time and there have been recent reports of a successful outcome to the procedure. These cryobiological manipulations of the embryos mean that the chances of successful implantation would be increased, for the woman would have recovered from the after effects of the surgical techniques used to obtain the oocytes before the implantation.

Deep freezing spare embryos would provide further embryos for transplantation if the first implantation failed. One feature of these techniques is that by the control of ovulation and the selection of the most appropriate time for implantation less distress is caused to the mother. Thus in keeping with the concept about to be described, that the mother is a passive vessel in which the fetus grows, the mother is more likely to be successful in producing a 'perfect' baby.

These examples have shown that the obstetricians are innovative and well able to use scientific and technological developments; that they have problematised and medicalised an increasingly common problem; that they have not only added to their own knowledge base, but by selected use of the added knowledge they have increased their physical skills; they have been able to establish procedures which will enable the development of routinisation of <u>in vitro</u> fertilisation problems.

There is as yet no specialty which could challenge the obstetrician in these fields of conception by chemical manipulation of ovulation, in vitro fertilisation and implantation of the fetus by a variety of manipulations, physical, chemical and biological.

They have very successfully consolidated their control of their territory, and confirmed the present boundaries of that territory as well as giving notice to other specialties or developing specialties that they have control of the expansion of their territorial limits.

This charting of the spectacular success of the obstetrician to control the territory of conception indicates the use made of developments in science and technology to secure the control of territory and territorial boundaries.

BOUNDARIES - CHILDBIRTH

The process of childbirth is the other boundary of the fetus and therefore it is important for the obstetricians to show that they have control of this boundary as well. They were pushed to this boundary by the expansionist development of paediatrics, when that specialty claimed the territory of the neonate; obstetricians therefore feel the need to strengthen it to any further attack. Their aim is to hand over to the paediatrician a "functionally alive baby" (EMG 1981). Other challenges can be perceived as coming from the mother, from other specialties and from para medics, especially midwives. Challenges to the whole territory of the fetus by other specialties is discussed in the next chapter, and although the challenge by midwives is a fascinating one it is not analysed here except by implication. I accept that it would have been desirable to have examined this challenge, but within the remit I had placed on myself to look mainly at intra-professional conflicts, it was not considered appropriate. The challenge by the mother, either acting in an individual capacity or as part of a pressure group is also a distinct threat and because of the intimate relationship of the mother and unborn baby, I have considered the obstetricians' response to this challenge.

The obstetricians have control over all the important aspects of childbirth, the place, the time and the type of birth; they have control of information about the condition of the fetus, the placenta and the mother, and patterns of normality and abnormality in these areas have been set by the specialty.

In this connection, it is a paradox that, to be classed as normal, it is necessary to be measured and monitored by sophisticated devices. For a mother and her unborn child to be classed as normal they have to be examined by technically advanced systems, the measurements must then fit into the parameters of normality already laid down and all this takes place within the hospital setting. Control via technology is very strong.

What is the actual process of control of childbirth? The mother, during the antenatal period, will have been extensively checked for:- general health, detection and control of medical problems eg diabetes, venereal disease, psychological state, socio-economic grouping, problems with previous children, and factors that put her at risk.

The unborn child, during the antenatal period, will have been monitored for development eg ultrascan measurements, amniotic fluid and cell examination. Abnormal fetuses may have been detected and selective abortion encouraged. Problems expected immediately after may be known eg L-H ratio indicating hyaline lung problems, low birth weight and drug addiction from the dependency of the mother on hard drugs.

The obstetricians have control over the place of birth, the time of birth (in many cases) and the style of management of birth, and these will be considered under separate headings.

Place of birth

The place of birth is no longer in doubt in the UK, for the vast majority of women, it is in hospital.(footnote) Obstetricians by various strategies have convinced other medical specialists and the public that it is necessary for the safety of both mother and infant to have a range of technological measures at hand in case they are needed, and that the place for this equipment is in hospital.

This is a simplistic statement and it ignores the various areas of conflict between obstetricians and midwives and between obstetricians and mothers, either singly or organised in pressure groups. But once again it is necessary for the present to concentrate on the strategies of cnsolidation of boundaries of territory from the obstetricians' point of view.

Davies (1981,319) has expressed the dilemma of the obstetrician and what he sees as the unpredictable nature of events controlled by his specialty.

Prediction he feels is so inaccurate that routines must often be

*Hospital births in England & Wales were:1957,64%:1969,84%: 1974,96% (DHSS,1977) applied to many mothers and infants who do not, as it turns out, benefit from them. In hindsight, he says 80% of confinements could proceed uneventfully by "natural means",

> but so rapidly may damaging changes proceed that crucial decisions and intervention often have to be taken hurriedly with less opportunity for consultation and analysis than is available to other specialties.

It is because of this latter possibility of change - and rapid damaging change - that the obstetrician can consolidate the need to have all deliveries in hospital, even though the parameters they themselves use indicate the delivery to be normal.

As the condition of pregnancy is a time limited one, the mothers will not be hospitalised for ever. This fact is a key to the control the obstetricians have over the wholesale hospitalisation of their patients, and why this is accepted by other specialties. If cardiologists were to hospitalise all their patients the NHS would be overwhelmed.

The complex relationship between the mother and the fetal-placental unit, and the development of this relationship during the separation, is as yet only barely understood. It is because of this indeterminacy that the obstetrician can take control and state the preferred place of delivery of the child.

This choice, however, is under attack. Although the working party on perinatal care (Walker 1980, 23:3) agreed that hitherto the choice of place of confinement had been based mainly on obstetrical considerations, they indicate that account must increasingly be taken of the quality of paediatric care likely to be required. This emphasises yet again that it is the interpretation of the needs of the fetus and of the new born which have come to dominate the organisation of childbirth..

Time of birth

The actual time of birth is most important for the control of the territory. The initiation of physiological processes of birth is not fully understood, nor is the role of the fetus in the initiation, although there is some evidence to indicate that the fetus normally gives chemical signals to the mother when it is ready developmentally to be born. Research which is proceeding in this area may be able to produce chemicals which can mimic these signals and of course if this happened it would increase the control of the obstetrician via more chemical manipulation. Chard (1977, 72) considers that the onset and maintenance of labour is a normal physiological event, occasionally showing abnormal variations. He also considers a basic tenet of medical practice is that

> the nearer a therapeutic manoeuvre approximates to a natural physiological event the more effective and safer it will be.

This then poses a dilemma for the obstetrician for control of the time of the onset of labour is important and though chemical methods of inducing birth are highly efficient, they reflect only very distantly the natural process. Nevertheless, Chalmers (1978,44) supports the interventionist approach in certain cases for he considers that it is important to "remove the uncertainty of spontaneous labour" by the "certainty of chemically induced labour". There are various scientific methods of chemically inducing labour. Administration of oxytocin by intravenous drip is most commonly used, while prostaglandin treatment has more side effects and is therefore less popular. The method of amniotomy - physical manipulation of breaching the amniotic sac - is an old but still used method. If the cervix is "unripe" there may be considerable pain, both at the rupture and during birth; but chemical manipulation of the pain is possible by epidural anaesthesia and so control by the obstetrician is maintained.

A good account of the development of induction policies given by Turnbull (1977) is described below and shows how a method used initially for abnormality has become, in some units, routine practice for normal patients. The desire to control the uncertainty of spontaneous labour already referred to became paramount, despite contra-indication of its potential dangers.

In the period 1948-1952, Sir D. Baird showed incidence of inter-uterine death from hypoxia in normal infants increased in primapara over 35 if pregnancy was prolonged longer than 2 weeks beyond full term. As a result of prophylactic induction of labour in this small group of women, stillbirths were reduced. Induction remained low however because of fear of induction failure.

Turnbull and Anderson (1962-1964) used a more effective means of using oxytocin for inducing or accelerating dysfunctional labour. In 1962-66 they showed that induction of labour need rarely fail and that prolonged dysfunctional labour could largely be prevented.

As soon as results were published in 1967 the induction of labour began to increase. Many women in late pregnancy do exhibit clinical features which might be associated with increased fetal risk and induction can seem a safer alternative than awaiting the onset of labour. The fear of unexpected and avoidable inter-uterine death led to the widening use of induction of young multiparous women. In many centres "prophylactic induction" now began as early as the 38th week.

The use of a new type of prostaglandin pessary to successfully bring about a ripening of the cervix during labour, has been described in a recent paper (Embrey et al 1980). Use of this type of pessary would be less invasive than an intravenous drip for labour induction and thus would not only be more acceptable to the mother, but would enable the routine use of this method by non-medically qualified staff.

Rates of chemical induction vary from unit to unit, but some obstetricians point out that if chemical induction takes place it is most likely to be followed by active chemical management of labour (Chalmers 1978). This is a most important observation, which will be considered in more depth at the end of the chapter when the system approach of technologies is implicated in these processes.

Criticisms of induction policies and their possible hazards will not be considered here, but it is worth pointing out that the concept of 'social' induction as compared to 'medical' induction has emerged as a possibility. A recent edition of a nurses' guide to obstetrics and gynaecology written in part by Hector & Bourne 1974 suggests that "increasingly social reasons are acceptable", for chemical induction.

For instance, the patient may be moving house and may not want to change obstetricians and the nurses she knows. A comment on this by a midwife indicates that staff changes in a large department would make it unlikely that the patient would know the staff - but that they would "know" her by her record sheet. (Mander 1981,per)

Type of birth

The type of birth is under the control of the obstetrician. Interventions of a technological kind are possible at various stages, and are in many cases utilised to "reduce uncertainty" as Rogers (p.98) so clearly describes.. The possibilities which exist for the interventionist policy of labour management are great. Each procedure has been devised to some extent to counter an important medical problem, but two points must be stressed.

Firstly, these procedures, because the equipment and the chemicals are available, are increasingly being used in 'normal' cases and sometimes routinised. Secondly the procedures are being used together as a "battery" of intervention, as a complex system, and disquiet is expressed not only about this but about the fact that the use of one procedure may make the use of another procedure more necessary than if the first procedure had not been used. A good example of such effects is associated with the introduction of the contraceptive pill, which led to complications when women became pregnant. As many of them did not wait for the normal menstrual cycle to begin pregnancy they could not be sure of their dates. Because it is now possible to check fetal development using parameters of normality, it became increasingly important in these cases to do more checking. Coupled with the fact already mentioned that induction requires information about fetal maturity, it is easy to understand the present drive towards increased use of ultrasound and chemical tests for pregnant women (Alberman 1977).

What procedures can be used in childbirth? A short list would include:

Ultrasonic scanning of the fetus and the placenta
Chemical management of labour (induction and control of contractions etc)
Pain relief including epidural anaesthesia
Fetal monitoring - heart (continuous)
Inter-uterine pressure monitoring (continuous)
Fetal blood analysis (scalp ph, continuous) (first introduced 1962 for O_2 starvation and brain damage especially in diabetic women ie abnormal)

Active management of labour (ie induction and acceleration generally with oxytocic drugs) produces stronger and more painful contractions of the uterus, so higher levels of pain-killing drugs tend to be used (eg pethidine). All drugs to relieve pain pass via the placenta to the fetus, where most have the effect of depressing the breathing of the newly born baby and of inhibiting sucking during the first week of life (and therefore inhibit the satisfactory adaptation to breast feeding especially in prima para). Drugs are known to persist for longer periods in the fetal and neonate circulation because of immature enzyme systems and inefficient detoxification.

It appears to be somewhat paradoxical that at this stage in the obstetricians' pursuit of a perfect baby, the needs of the mother are allowed to become dominant, even though these needs may result in harm to the fetus.

Because of the potential fetal hazards of induction and acceleration techniques, there are some obstetricians who consider that unless fetal monitoring is also used, active management of labour should not be undertaken.

Fetal monitoring is not without its hazards. The mother must be relatively immobile and attaching electrodes to the baby's head can give rise to complications. It has been suggested, rather unfeelingly, that as a blood sample is taken from the fetal head as soon as possible, the attaching of the electrodes presents no problems.

In a recent discussion (Ciba 1980,274) on the risks and benefits of monitoring the fetus, there was the following exchange between an obstetrician - Malvern, and a paediatrician - Klaus. Malvern was anxious to state in connection with infection and monitoring devices that

> if you monitor the fetal heart throughout labour and identify abnormalities, then morbidity and mortality should inevitably be improved.

Klaus, the paediatrician, wished to challenge this logic and made the following statement

> We should not talk about ascending infections, but instead ask whether we have evidence that the procedures we use for high-risk patients significantly reduce morbidity over a broad spectrum of patients. Our maternity services seem to be based on the premise that the birth of a baby is a disease. A mother with toxaemia, a slowly growing fetus or diabetes certainly needs these services,

> but for most women birth is not a disease.

A closely related specialty is challenging the practice of the obstetricians in their medicalisation of birth.

In recent years jaundiced infants have become much more common. Although the reasons for this rise are as yet uncertain it does seem to be associated with several aspects of obstetrical practice in childbirth, i.e. the use of oxytocin for induction and acceleration, epidurals and forceps delivery. Although jaundice is treatable, it can require intensive paediatric intervention, including exchange blood transfusions for serious cases and it is a frequent cause of "special care" unit admission for the sick infant. Rates of admission to "special care" baby units are rising rapidly (1970- 12% in England and Wales; 1975 - 18.4%). Whilst not all the rise can be explained by problems associated with induction, Richards (1978) is of the opinion that the obstetrically created hazards of induction and acceleration create problems that require specialised paediatric care.

Fetal monitoring has already been mentioned, but the following passages from Walker (1980) are interesting for they pinpoint three important elements in this area of monitoring. Firstly that monitoring is for obstetricians "an extension of their traditional role"; and secondly that "true monitors" will come into general use "if clinicians agree as to when a fetus is becoming compromised". Thirdly that they are aids which will allow the clinician to improve the quality of his decision.

> The monitoring is done by the attending midwives and obstetricians as an extension of their traditional role. The use of the term "fetal monitor" as it is applied to the familiar instruments in the labour ward is inappropriate, since most are simply continuous recorders. Instruments which are capable of interpreting variations in fetal heart rate and intra-uterine pressure and which incorporate alarm systems are now being developed. If clinicians could agree as to when a fetus is becoming compromised, it is possible that true monitors will in time come into general use. Even then they will still be merely aids with which the clinician can improve the quality of his decisions.(ibid,31)

According to Russell (1982,306) the Short Committee were convinced that

> obstetric intervention can largely compensate for adverse social circumstances

and advocated fetal monitoring for all deliveries. More control via more measurement is being advocated.

Relief of pain in childbirth has received much attention and it is the contention of Arney & Neill (1982,1) that the obstetricians reacted to the challenge from natural childbirth interest which gave control of pain back to the mother. This reaction was to control not only pain, but the subjective part of woman's perception of the phenomenon.

Nevertheless there has been a marked increase in the number of women electing to have epidural anaesthesia during labour. This trend has brought the anaesthetist into the management team responsible for the woman in labour. But as the following quote indicates, there can be variation in which medical specialty is responsible for this chemical manipulation.

> The staff of the Anaesthetic Department should be able to provide epidural analgesia for those patients for whom it is medically indicated and for the increasing number who request it. Such a commitment is considerable because, apart from initiating the procedure, the anaesthetist must remain available for consultation throughout labour and delivery. In Scotland epidural "topping-up" is still mainly the doctor's responsibility though midwives have now been authorised by the Central Midwives Board (Scotland) to do this in clearly defined circumstances.
>
> Suitably trained obstetricians may provide an epidural service but this would imply higher staffing levels than exist at present since it would be unacceptable for the obstetrician to be responsible for epidural supervision at the same time as carrying out an operative procedure. (Walker,1980,32)

The fact that "in clearly defined circumstances" midwives are authorised to carry out epidural "topping-up" indicates an attempt by the anaesthetist to "routinise" this procedure. Thus, after the initiation of the procedure the specialist will be relieved of the possibly time consuming watch while labour proceeds. The midwife, on the other hand, may feel that this is a perfectly legitimate extension of her territory - or a consolidation of the territorial claim she has over pain relief of the patients.

The ultimate in control of childbirth is the Caesarian section. Caesarian section has become safer in recent years, due in part to better anaesthesia, availability of blood transfusions and better antibiotics, and there is a tendency to resort to earlier section.

Decreasing family size, which places less frequent stress of subsequent pregnancies on the caesarian scar, has accelerated the trend.

Many observers see the increase in sections in the USA as being due to increased litigation. The obstetrician canclaim that by carrying out this procedure he has ensured that there was no more that he could have done.

Different types of approach to procedures during the first few minutes of independent life are possible. The obstetricians have control over this area. They may allow various procedures provided the medical indications are suitable, eg they may sanction placing the child on the mother's breast before the cord is cut only if drainage of blood back into the placenta would not affect the baby. They are still in charge; but very soon the neonate becomes the territory of the neonatal paediatrician (Anon A,1980, per).

There have, of course, been many criticisms from a wide variety of people, of this control of childbirth. Fellow professionals, para-medicals, midwives, mothers, fathers, sociologists and pressure groups have all produced critical comments.

It is not the remit of this thesis to chart these comments though the next chapter does contain an account of the challenges to the territory of the obstetrician, but it is worthwhile mentioning some criticisms.

Oakley (1982a, 669) considers that "being able to see inside the uterus" and "control the onset of labour" constitute "important strategies in the obstetrical claim to expertise". They provide a basis on which the obstetricians are able to argue that they have a "more direct knowledge of the fetus's welfare than the mother herself" and that determination of the time of birth is no longer the mother's prerogative, but a matter of "obstetrical technology and clinical policy".

Thus, not only are obstetricians controlling women by their claim to superior and special knowledge of the fetus - the increase in their authority which has previously been suggested, their clinical policy, but they are controlling by their use of technology. Control by artefacts has already been outlined (p.107) in the review of Winner's idea that technical things have politics and that they can embody specific forms of power and authority. Cockburn (p.118) develops the control by technology when she writes of the social perception of man as technologically skilled and women as technically incompetent.

SUMMARY

The obstetricians made two distinct moves to consolidate their successful early colonisation of the fetus by strengthening the boundaries at the beginning and end of inter-uterine life. They became strong fetal advocates, both facilitating conception, and generally giving to the fetus primacy of consideration in the actual process of childbirth. Because the needs of the fetus were seen as paramount, the obstetricians considered themselves justified in directing the behaviour of pregnant women towards that which would produce the perfect baby.

This extension of their practice into the life-styles of women can be clearly seen in the medicalisation of the problem of infertility, as the obstetricians increased their control over the reproductive system of women. The extension of the medical profession into an increasing area of what had been considered normal life, or at least not diseased life, is highlighted by their attempt to have some control of the male reproductive system. Throughout these extensions of practice into infertility they used developments in biological manipulations as powerful resources.

In the area of male reproductive organs they are being challenged by the urologists. It will be interesting to see how the battle develops in the next few years, and also if other specialties will join in, for there is no reason why endocrinology has not made as much progress in developing as a specialty; but as has been indicated already, normal medicine is male medicine and women have already been segregated into female medicine, when in sheer volume of numbers it should be the other way around.

Increased control of childbirth was facilitated not only by the use of a wide variety of manipulations, physical, chemical and biological, but by the adoption of the system, the linked, approach to the process. Within this system various elements in it have become entrenched and removal of them, or modification of their use, would upset the functioning of the whole process. This is especially true of ultrasound for imaging the fetus, for it has not been proven that these physical forces are completely safe, yet the removal of, or reduction in, its use would be disastrous for the obstetricians.

The technological control of childbirth has been criticised by various groups and some concessions have been made, but obstetricians are never far away from their own vested interests and I suggest make concessions when it is advantageous for them to do so. The use of technology to dominate women is a factor which many find distasteful, but they are also aware that this has to be set within a more general context. It does not just happen in obstetrics, though it is very prominent in this specialty.

Other groups, especially midwives, are in competition with the obstetricians for control over normal childbirth, but as the midwives do not control the definitions of the parameters of normality they are in a weak position.

The manoeuvres carried out by the obstetricians described in this chapter brought them into areas of ethical importance, for they were exploring new ground which was not obviously medical, but concerned some of the most basic functions of human beings.

The obstetricians had control over the fetus from conception to birth; the mother was reduced to a passive vessel. This must have seemed a satisfactory state of affairs, but other specialties and groups of doctors were showing signs of wishing to have some part of the territory, not only of the detached fetus, but of the vessel in which it grows. As the obstetrician Lennon remarked in 1952

> the wealth of interest in our specialty
> is becoming an attraction apparent to all
> (ibid, 679).

In the 1980s this is proving to be so true, as the next chapter will show.

CHAPTER TEN CONFLICT AND CHALLENGE

INTRODUCTION

The obstetricians' claim to the terrritory of the fetus, the pregnant woman and their separation in childbirth, is, in the 1970s and 1980s, under attack. The main threat from within the profession is posed by two specialties, paediatrics and medical genetics, but new groupings now developing, such as fetology, embryatics and fetal medicine also pose threats.

As described in Chapter 7, the territory of the paediatrician has decreased due to control of childhood illnesses, and it is also being increasingly dominated by handicapped children. Thus the paediatricians wish not only to have more territory, but to have more control over the prevention of handicap. They are treating the results of handicap, but they would wish to have some control of the elimination of the causes of handicap. That means invading the area of the fetus and the pregnant woman, the territory claimed by the obstetrician.

Medical geneticists are concerned with all ages of patient, but they do not, except in certain minor instances, have their own patients, in their own hospital beds. The search for these prestige items has led to a concentration on the fetus which might be genetically abnormal and on the pregnant woman who has previously given birth to a handicapped child, or is thought to be about to do so for the first time. Can the medical geneticists and the paediatricians use the various manipulations made available by developments in science and technology, or the associated concepts to support their claim to this territory? This chapter will consider some of the developments which have taken place and it will look at the reactions of the obstetricians.

EXPANSIONIST MOVES BY PAEDIATRICIANS

There are within the medical literature well documented indications that paediatricians wish to expand their practice into the antenatal period, in their concern to prevent handicap.

As early as 1926 Barlow was asking "if rickets began in the prenatal period?"(1926,i) Parsons (1946,1) in a somewhat provocatively entitled lecture, "Antenatal Paediatrics" suggested that

> the paediatrician of the future must be concerned with the well being of the child from the moment of conception.

This was a definitive suggestion that the specialty should be involved with the territory of another. This desire was explained by Gaisford, a paediatrician, in the conference on "The Place of the Paediatrician in the Maternity Unit" - parts of which have already been quoted.

Gaisford (1952, 664) comments that

> At first sight it might seem strange that paediatricians should be interested in the first trimester of pregnancy, particularly with regard to the mother's diet and her exposure to various infections

but he goes on to explain that the interest is because

> a fuller knowledge of the happening at this vital period of foetal development offers the best hope of reducing the incidence of environmentally determined congenital abnormalities.

The paediatricians, who were already claiming knowledge of the development of the child including the neonate, now wished to extrapolate their expertise to knowledge of fetal development, repeating the manoeuvre they had used to gain the neonate.

The reaction of at least one obstetrician is of great interest for at the same conference, Stabler (1952) indicated that he 'is willing' to go further, and say that the paediatrician is

> concerned with health of the foetus <u>in utero</u> ... and concerned with the health of the married couple before conception. (1952,661).

It seems unusual that Stabler - an obstetrician - was willing to give away practically every bit of the territory of that specialty. Nothing seems to be left in undisputed and unshared areas. He was evidently aware of this, and of the criticisms of his colleagues, for he states that

> you may say that this is handing over with a vengeance that all except the mere mechanical removal of the child from its mother has been transferred to the paediatrician ... but I have never handed over a patient in my life. (ibid,668).

He warns that obstetricians

> must avoid any question of "taking over" of our patient or our responsibility ... there is only one way to avoid the difficulties of dual control and the

> accusations of one interfering with the province of another ... (ibid, 668)

and that is by not laying down rules and restrictive regulations, but by close personal contact at all phases. This type of close personal contact, however, failed to protect the territory of the neonate from the paediatrician.

Later, in 1971, the Sheldon report indicated (section 9.7) that the consultant paediatrician should have primary responsibility for the special care service of babies and that it should comprise anticipation and prevention of damage to the baby <u>before</u> and <u>during</u> birth. This proposed move by the paediatrician to prevent damage to the baby before and during birth indicates very strongly their expansionist ideas.

This expansion can be seen in practice in the study carried out by Laurence et al (1980), who looked at the effect of dietary counselling on the subsequent pregnancy of women who had previously given birth to a child with neural tube defects. The women were studied retrospectively for dietary quality during the abnormal pregnancy and also during the current pregnancy, dietary advice was given and the outcome of the pregnancies recorded. This appears to be innovative and good reductionist medicine, but the important point to make is that it was carried out by a team headed by the Professor of Paediatric research in a Department of Child Health. The paediatricians had invaded the territory of the obstetrician and were treating the fetus via the mother's diet, re-inforcing the obstetricians' concept of the pure perfect vessel for fetal development. They claimed that they wished to prevent abnormality in the fetal period (ibid,1592) and thus to decrease the number of handicapped children, and so were also claiming that they were responding to the social need for perfect children.

Not only were the paediatricians interested in the fetus and the mother and actively pursuing their interest, they were also concerned, in their desire to prevent handicap, with the process of childbirth. Already in 1927 Capon, when describing the knowledge needed by the paediatrician, said the following

> The paediatrician must have a good knowledge not only of antenatal and neonatal anatomy, physiology and pathology, but also of the physiology and pathology of pregnancy, and of the effects of various forms of labour and of the different obstetrical procedures upon the infant. He must keep in touch with changes in obstetrical teaching and he should be able to offer a constructive criticism of these innovations judged from the standpoint of the infant (1927,347)

The idea of one specialty criticising, however constructively, the practice of another seems unusual and yet it was propounded again by Gaisford (1952,664), who proposed

> paediatricians should participate in antenatal research and in assessing the effects of various obstetrical manoeuvres (such as Caesarian section, forceps delivery, length of time between rupture of membranes and delivery, and the relation of time to the incidence of infections; and to the reduction of haemolysis in infants with congenital haemolytic disease; and the effects for the foetus of maternal anaesthesia and narcoses) may help in shedding light on new methods of lessening this loss of fetal and neonatal life.

Again a direct suggestion to assess the effects of obstetrical practice by another specialty. No wonder the obstetricians took a firm control of childbirth, in light of these statements.

These moves by paediatricians to have some control over the fetus, its development and its delivery, as part of their practice, indicate that they do not regard birth either as a barrier in the developmental process of the child or as a boundary of their specialty. These notions bring them into direct conflict with obstetricians. Much of this conflict is concentrated in the perinatal period - ie the period around birth - for within this period there have been many inputs from scientific and technological developments and therefore there is much knowledge to be controlled and legitimated.

THE CONCEPT OF PERINATAL CARE

The period of development to which the term perinatal (or perinatology) refers has had a number of definitions and these will be described later; in essence it is the later stages of fetal development, through birth, to the neonatal and even the infant stage of childhood. Administratively, it is a well-used term especially in connection with the statistics for perinatal mortality and morbidity, and perinatal care is a major element of the practice of midwifery. But my concern is with doctors, and the concept of a continuum of care inherent in the practice of perinatal care has been out of favour with them in recent years, as the territory of the obstetrician was pushed back to the boundary of birth. Perinatal care, however, is an idea of long standing.The foundations of perinatal care in Britain were laid, according to a Lancet editorial (1975) by the man-midwives of the 17th and 18th century and continued in the 19th century by the "physician accoucheurs". One of the most famous of these was Budin who could be regarded as the father of perinatology. His statement of 1907 is still pertinent today.

> Nowadays, thanks to antisepsis, death has practically been banished from our maternity hospitals and morbidity reduced almost to its minimum. Further, through the perfection of instruments and the advancement of operative technique, obstetrical interference has become much simpler and safer, so that the accoucheur, freed from anxiety as to the fate of the mother, can now devote his attention to the needs of the infant. Before parturition, he supervises the hygiene of the expectant mother so that she may arrive at term in a healthy condition; during delivery, he takes every precaution to ensure that the child will be born sound and viable; and throughout the first two years of life, he directs its feeding with the utmost interest. (quoted by the Lancet 1975,1227).

The difference between Budin's perinatal concept and that now current, was that the care of the infant continued in Budin's time for the first two years; but it should be remembered that at the turn of the century these two years were very hazardous for the infant and small child.

The advances in anaesthesia and asepsis which enabled Budin and his colleagues to concentrate on the welfare of the fetus and the new born child were also responsible for drawing the majority of his colleagues towards surgery and gynaecology. Obstetricians in Britain took the FRCS in preference to the MRCP and the newborn infant was left increasingly in the care of the nursery nurse. For over fifty years there was little attention given to perinatal care and "much that had been known slipped from men's minds". (ibid, 1227)

It was the recognition of the rheusus haemolytic disease E. foetalis, and its treatment by exchange transfusion which gave a great boost to the concept of perinatal care just after World War II. Surely it is remarkable that this research and treatment already documented in this thesis should again be singled out as being of prime importance in a very different context (ibid, 1227)

The creation of the NHS in 1948 made it easier for inter-specialty barriers to be crossed and permitted the paediatrician to "put his services at the disposal of obstetrician and new born baby" (ibid, 1227); but since that time the situation has not improved greatly.

Perinatal deaths and perinatal morbidity are still thought to be too high in the UK. The Lancet editorial considers that perinatal care in 1975 as envisaged by Budin in 1907 "hardly exists" and suggests that there is an urgent need for obstetricians and paediatricians to train and work together as a perinatal team.

This approach had not been adopted by 1975 and while the editorial considers that it will not be accepted until suitable career structures and training programs are devised by each discipline on a sufficient scale to meet the demands of more than 600,000 deliveries, there could be other, more probable sociological explanations.

Although stress has been laid in recent years on the concept of the medical team, and in practical terms it has led to many successful treatments such as kidney transplantation, major heart surgery and cardiac valve replacement, in most cases a representative of one specialty has always been dominant. In the examples cited, for instance, the renal surgeon or the cardiovascular surgeon has without question led the team. The claim to the territory held by the specialty in charge is rarely in doubt, and by their expertise and innovation these specialists consolidate their territory. In a perinatal team, there would not be one dominant specialty, and this would cause conflict.

The idea of a perinatal team was to some extent pushed into the background (though revived in 1984 as detailed later) by the following moves of paediatricians to gain formal control of part of the perinatal period. Terms like "antenatal paediatrics" and "prenatal paediatrics" had been used previously in the literature, but a more formal move in this direction took place when in 1976 the Court Report on child health services recommended that

> The paediatric specialties which have developed to the stage where consultant posts should be established, maintained and increased and the necessary senior training posts provided are: Perinatal paediatrics ... (ibid, 310, 18:13)

Not only had the concept of perinatality been formalised by this recommendation, but the claims of the paediatricians for some control of the fetus were recognised.

I feel, however, that the proposers were not aware of the full significance of the formation of this new specialty. However that may be, the proposal was taken up by a liaison committee of the BPA and RCOG who in 1978 made several recommendations for the improvement of infant care during the perinatal period. One of these was that

> perinatal paediatrics should be accepted as a sub-specialty as recommended by the Court Report (ibid, 80)

and that

> there is an urgent need for a career structure in this new specialty (ibid,80)

Apart from the confusion as to whether it should be a specialty of sub-specialty, there is yet again a naivete about the recommendation. Did the committee really understand the implication of what they proposed?

They continue with proposals for the integrated perinatal care and say that

> The BPA might like to consider whether paediatricians intending to specialise in perinatal paediatrics or to have a special interest in newborn care should not spend at least six months training in obstetrics (ibid,80)

Thus they appear to be unclear about the exact remit of the perinatal paediatric specialist for they later draw attention to the *need for a combined study by the RCOG and BPA regarding

> the career structure and training programmes of those 'perinatal' obstetricians and paediatricians who in the future are likely to be working increasingly closely together at the

> interface between the two disciplines (ibid, 81)

What is this interface - where is it drawn? Confusion still reigns, for previously the following suggestion had been made with reference to the obstetricians' role in the perinatal period.

> With the introduction of fetal monitoring and intensive care during labour, obstetricians are focussing more attention on the fetus and it is hoped that in the future they will extend this interest into the whole of the perinatal period (ibid, 79)

Surely confusion and conflict must result if obstetricians and paediatricians are both encouraged by their respective organisations to be interested in and have knowledge of this perinatal period.

This encouragement is seen even more strongly by the comment that

> only by studying the fetus will the paediatrician fully appreciate the problems of the new born infants; and, conversely, obstetricians need to study the new born infant if they are to assess properly the results of their own management of pregnancy and labour (ibid, 81)

Each specialty, it is suggested, will improve its own practice if it has detailed knowledge of the territory at present held by the co-existing and rival specialty. But this is surely a recipe for instability; for the more knowledge a specialty holds, the more control it expects to have over that area, and specialists wish to have exclusive knowledge to enable them to fight off incursions by rival specialists.

The Walker Report in 1980, on the standards of perinatal care in Scotland, gives an up-to-date definition of perinatal care and thus of the perinatal period.

> Perinatal care is a continuous process of care directed towards the survival, health and welfare of the fetus from the 28th week of pregnancy onwards until birth and of the newborn up to the end of the first week of life. (ibid, 62)

This period of 28 weeks is used for international comparisons, but for national statistics 22 weeks is used, showing the fragility of that boundary and the difficulty of a precise definition; for the time is based on the viability of the fetus out of the uterus and must therefore change as increasingly sophisticated technology allows pre-term infants to survive. (Recently a 23 week baby, weight 1 lb 8 ozs has survived and is now developing normally).

This report contains endorsement of the recommendation of the Court report that

> Perinatal paediatrics should be recognised as a sub-specialty (ibid, 40)

but the endorsers also continue the confusion as they appear not to know if they are recommending "perinatology" or "neonatology" (ibid, 59). As most of their suggestions in this area are concerned with "new born babies" and "intensive care facilities" it is likely that they do not see paediatricians invading the territory of the obstetrician. However there are proposals that vulnerable babies be transported in utero (ibid, 42) and the implication is that this will be under paediatric control; and also that paediatricians should have the opportunity and the training to co-operate with obstetrical colleagues in the "investigation and care of the fetus" (ibid, 52). These proposals take the paediatrician through the boundary of birth and into the care of the fetus.

It is proposed in this report that, because of the high research content of paediatrics, work leading to a qualification such as the PhD would be particularly appropriate. This proposal is significant for two reasons.

The first is that great emphasis is now placed on the scientific content of paediatric medicine - thus once again the strong effect of scientific research on a vocational profession is apparent. Secondly the proposal makes it clear by implication that whilst the areas described, i.e. fetus and vulnerable newborn, are areas where at the moment there is comparatively little knowledge, they have great potential for expansion. The knowledge gained by research into a particular area gives the researcher a propriety right over that area. Specialised knowledge can be a territorial claiming device and a very powerful one.

PERINATAL MEDICINE

Confusion was engendered by the original recommendation in the Court report, and its endorsement, for the establishment of perinatal paediatrics as a specialty or a sub-specialty. The Short Committee 2nd report on perinatal and neonatal mortality (1980) endeavoured to untangle the situation by looking at the concept of perinatal medicine, which is essentially what perinatal paediatrics would be if the term were correctly interpreted and implemented.

In response to a question about the concept of perinatal medicine, Mr Nodder of the DHSS replied

> I think perinatal medicine is probably an expression used to denote the possibility of a specialty emerging, rather like neonatal paediatrics.

Expanding this reply he remarked

> We have at the moment the obstetrician and the paediatrician proper, and the neonatal paediatrician is already emerging as a specially trained person to deal with very difficult cases of young babies. We would feel that inserting into this yet another specialism somewhere in the middle to look after the mother and baby for a few weeks might be a mistake in that it would overcomplicate an already fairly difficult situation (ibid, 58)

Dr Shore indicated that there had been no formal requests from the profession that perinatal medicine should be recognised as a specialty, though he knew it was happening in the USA. He agreed with Mr Nodder that recognition would make things

> a good deal more complicated than they are already (ibid, 58)

In light of this and other evidence the committee concluded that

> None of our witnesses thought that the development of a new speciality of perinatal medicine should be encouraged, in which a single specialist cared for the mother and fetus for the final days or weeks of pregnancy, was responsible for supervising labour and delivery, and then looked after the baby. We do not consider that the development of a defined speciality of perinatal medicine, with specialists practising both the

> obstetric and paediatric management of the mother and baby in the perinatal period is a practical possibility. (ibid, 58)

Although the desire for the specialty of perinatal medicine as such was not evident, interest in that developmental stage still exists and in an efort to formalise the interest the Short Committee (3rd Report 1984) revived the idea of a perinatal team. This time, however, the suggestion was not for a team as such but for "perinatal centres" at both regional and sub-regional level with the perinatal team teased out into its respective specialties ie at these centres there would be

> a system of obstetric and neonatal care (ibid, 59)

The centres would be staffed and equipped to provide the best possible intensive care for mother, fetus and new born infant. The members were aware that the idea of perinatal centres had received less attention than they had hoped for. This may be due to the lack of positive reports on the efficacy of these perinatal centres in reducing perinatal mortality. One report by Borkowf (1979) concerned a multidisciplinary team and their methods. The team consisted of obstetricians, neonatologists, anaesthetists, pathologists, nurses, social workers, nutritionists, sonographers, radiologists and others, but he remarks that as yet there is

> still a lack of satisfactory information about these methods. (ibid,633)

It may also be due to the opinions of some workers in the field that

> perinatal medicine suffers from a dearth of experimentally derived knowledge upon which rational practice can be based (Chalmers, 1978,44)

and thus there must be a race among interested groups to build up their esoteric knowledge.

For a formal specialty to be established there must be a core of specialised knowledge held by the practitioners, as well as an accepted definition of the territory and strong enclosing boundaries. In the 1980s these prerequisites do not appear to exist although the impression is that the paediatricians have made more moves in this direction than the obstetricians.

What is the reaction of the obstetricians to these proposals of perinatal paediatrics and perinatal medicine? Are they aware of the potential danger to their specialty? They appeared not to fight for the territory of the neonate when it was invaded by the paediatricians, as has been described earlier; will the same attitude be adopted again? Indications are that, on the contrary, they are manoeuvring via the concept of perinatality to get back some part of the neonate. This is a move of considerable importance with considerable implications for the structuring of medicine. An indication of this fight back by the obstetricians has already been revealed in the following statement by the BPA/RCOG Committee (1978) that

> With the introduction of fetal monitoring

> and intensive care during labour, obstetricians are focusing more attention on the fetus, and it is hoped that in the future they will extend this interest into the whole of the perinatal period.

The "whole of the perinatal period"- a move by obstetricians to regain the territory of the neonate?

The desire for this move was reflected in talks with obstetricians (Myerscough 1979, per;Anon A 1980,per; Anon B 1981,per) who regretted the loss of the new born child to the paediatrician. They saw birth less and less of a barrier and wished to embrace the continuum of child development from conception, (of which they now have greater control via biological manipulations) through the fetal stage, the separation of the baby from mother, to the neonate.

Myerscough (1979,per) indicated that many obstetricians felt inadequate because they are not able to tell the mother how the child is, even though they have been the expert until and during the birth. Their "first patient" is theirs no longer. Not only do they perceive this lack of control over territory definitely theirs on the other side of the boundary of birth, but, the parents, especially the mothers, are also aware of this and are disturbed by it as indicated by the comments to obstetricians. These comments include references to celebrities whose obstetricians take care of the baby (Anon B,1981). The paediatrician who has control of the baby rarely sees the mother. She is not his patient, yet recent moves outlined in a television programme (TV,1984) show the paediatricians helping the mother to understand the developmental stages of her newborn baby. These moves are further confirmed by the evidence from the BPA to the Short

Committee (3rd Report, 1984, xxvii) which indicated that

> A great deal of the special care that in the past we used to do in special care baby units is now done at the mother's bedside to avoid separating mother and baby.

The interest in the perinatal period by obstetricians is indicated by the research with ultrasound of Donald (1963) into birth which he sees as the adaptation from the interuterine to the extra-uterine life. He is interested in both sides of the boundary.

This represents quite a change from the situation described by Capon (1927, 347) who remarked that

> the obstetrician must cease to regard the newborn as the unavoidable by-product of his essential function of separating the mother from the foetus.

Further confirmation of the interest of obstetricians not only in the fetal development and birth can be seen in the grants for research given in 1981 by "Birthright". This charity, set up by the Royal College of Obstetrics & Gynaecology is dedicated to research into

> all aspects of childbearing with particular emphasis on increasing the safety of childbirth for mother and baby, on prevention of handicap and the improvement of the welfare of women by advances in gynaecology and related subjects. (Birthright Report 1981).

The grants in 1981 are worth detailing, for they reveal nothing innovative or new obstetrically, but of the last four, three are directly related to neonates and the fourth to pregnant women who wish to adopt an ambulatory mode for birth (not the usual recommended obstetrical position).

The grants were for research into:

Validation of a test for Hypercoagulability; Trophoblast sampling in first trimester pregnancies for earlier antenatal diagnosis; Evaluation of usefulness of uterine volume and the umbilical blood flow measurements by ultrasound; Fetal electro-encephalography; The development and application of a non-invasive technique for the continuous monitoring of cerebral blood flow in preterm babies; Surfactant and early onset of respiratory failure; The evaluation of a fully objective audiological screening technique in neonates at risk of hearing impairment; Investigations into the physiological process of labour in ambulant women.

Other moves the obstetricians have made to consolidate their hold on the territory of the fetus via Birthright are discussed later under fetal medicine.

According to Russell (1982, 301) the 1970s saw a considerable upsurge of interest in issues of social policies relating to the perinatal health services. At the same time debate grew inside the medical profession as illustrated by the number and breadth of general and leading articles (she gives several references). In 1977 a National Perinatal Epidemiological Unit was established with DHSS funding and in 1980 the Short Report on perinatal and neonatal mortality was published.

Russell asks why there should be this upsurge of interest amongst politicians and the medical profession. The Short Committee suggests they were led to their enquiry

> because of mounting concern that babies were unnecessarily dying or suffering permanent damage during the latter part of pregnancy and the earliest part of infancy (ibid, 303)

Russell does not think that these reasons can fully explain the intense interest and suggests that another explanation is a concern to restate the "ideology of motherhood" as part of a socio-political movement. I believe, however, that a more plausible interpretation of general explanatory power is that the interest stemmed primarily from the territorial conflict between the obstetricians and paediatricians, intent on claiming the continuum of the child from conception to infancy.

The whole area around the developmental period called the perinatal period is in a state of flux. No formal specialty has arisen in the UK, (though according to Arney (1982, 152) a new specialty has been created in the USA), yet the interest in the period is intense and in contrast to the view of Chalmers (1978, 44) already quoted, that there is little "experimentally desired knowledge", there is reported in the literature a great deal of research into the period of perinatality.

Introducing the third number of the British Medical Bulletin to be devoted to research on the fetus and the newborn - though the first to be labelled as Perinatal Research - Cross (1975,1) comments on the impressive contribution to knowledge represented in these three numbers. He predicts that before the publication of the 4th number the remarkable observations that in the sheep, the fetus determines the onset of labour, will have repercussions in practical human obstetrics. A further example of the potential use of scientific developments from other areas of mammalian physiology.

The publication "Clinics in Perinatology" reports a seminar in 1983 on perinatal endocrinology and in 1984 one on perinatal haematology, and the 3rd Short report advises the urgent appointment of perinatal pathologists so that proper perinatal audit may be carried out (1984, xxxii). Already it would appear that fragmentation is taking place on similar lines to the process in paediatrics.

An interesting coda to end this part is the efforts of the neonatologists to emulate the obstetricians by imaging with ultrasound, and ultrasound under their control. Work by Chiswick (1984,337) has exploited the "soft spot" on the infant as a "window on the brain" and has carried out ultrasound scans on pre-term babies. These scans showed a level of haemorrhaging not detected by other means and it has been suggested that they should be introduced in a sceeening capacity in special baby care units. If this were implemented, portable machines would be required for daily scanning.

Thus the neonatal paediatricians are using, and wish to expand the use of, the sophisticated technology used already by their rivals the obstetricians. As they build up core knowledge about the brain of the neonate, and the damage they can now determine, the paediatrician could, under the legitimate desire to prevent this damage, require access to the fetus to determine the cause of the damage and its possible prevention. Once again, this represents a challenge to the territory of the obstetricians.

THREATS FROM MEDICAL GENETICS TO OBSTETRICIANS AND PAEDIATRICIANS

Developments in antenatal diagnosis made it possible in 1979 to identify some 75 metabolic disorders in utero, as well as detecting a large range of chromosome abnormalities (Culliton and Waterfall 1979, 723). In 1984 the numbers are even greater (Wilkie, 1984,per). These identifications have been made possible by development in tissue culture techniques, the successful cultivation of fetal cells from amniotic fluid, metabolic studies of human somatic cell systems and the introduction of chromosome banding techniques. These are all scientifically based laboratory developments. But their availability to the practitioner prompts the questions: Who is to utilise the knowledge? Can different specialties use the knowledge to fulfil their territorial ambitions? The knowledge is initially under the control of the medical geneticists who have clinical as well as diagnostic laboratory and research commitments. But the knowledge is also used by the obstetricians to decide, with the parents, on the possible termination of an abnormal fetus, and the paediatricians concerned with the prevention of handicap. It is therefore instructive to ask a series of questions. What relationship does the obstetrician have with the medical geneticist? What is the role of the paediatricians? As they are concerned with the prevention of handicap they could claim as their second patient the mother of the abnormal child, their first patient, and they could advise about the possible outcome of future pregnancies. How does the concept of a perinatal team fit into this complex situation?

These are complex and difficult questions to answer. The area itself is complicated, needing more research into claim and counterclaim, offensive and counter offensive, invasion of territory of other specialties, claim back of previously held territory. My contribution is to attempt briefly to identify the problems involved.

The significance of genetic disorders in terms of mortality and morbidity, as well as in demands on the facilities and funding of the NHS is, according to Wenlock (1980, 83), considerable. Who then should have control over this large piece of territory? The situation is complex and to some extent confused. Walker's report on perinatal care in Scotland offered the following directive (1980, 24)

> Fetal abnormalities still contribute substantially to perinatal mortality in Scotland and patients who have a family history of genetic disorder, who have had an abnormal child or in whom there is thought to be an increased risk of fetal abnormality should have access to special counselling after delivery or when another pregnancy is contemplated. Depending on local facilities this may be provided by the obstetrician, paediatrician or geneticist or by a combination of these.

The latter remark is rather like declaring a free-for-all, and therefore this area can justifiably be seen as one of conflict, where existing territory can be gained from other specialties and new territory colonised.

Although the wider field of genetic abnormalities not at present detectable <u>in utero</u>, does not appear to be in such an unstable state, there are also territorial conflicts between the paediatricians and the medical geneticists. Emery, (1979, 221) a prominent member of this latter group, views their role as primarily one of prevention; in his opinion, medical genetics is the preventative medicine of the future. Paediatricians share this view of the paramountcy of prevention. It emerges as the cornerstone of their practice, and they are therefore concerned to be involved in this piece of territory.

The importance of genetics to paediatrics is outlined by Barltop (1976) in his introductory remarks on a conference on the subject. He believed that fewer disciplines had had as much impact on paediatrics. But there were problems, for recent advances in the subject had been so swift that

> few practising paediatricians are fully aware of either their scope or their practical applications (ibid, vii)

Another problem was that the geneticists used different models from the paediatrician

> Geneticists working with animal models, or at molecular level are seldom confronted with the implications of their discoveries in human terms. (ibid, vii)

The implication of these remarks could be that while paediatricians should be made aware of the value and scope of genetics in their practice, the geneticist is too remote from the patients and therefore should not have control of the territory. This argument is to some extent confirmed by Yoxen (1982, 148) who thought that the intensification of training of the geneticist led to their being more likely to consider "highly technical models of pathological conditions".

A further strengthening of the paediatric claim to this territory is made by Polyani (1976,3) who stresses the "naturalness" of paediatricians as genetic counsellors, when he described aspects of their practice. They had daily confrontation with congenital disease and development anomaly, they had close contact with parents of these children and this encouraged the parents to express their anxieties not only abut existing children, but those who are about to be born

> The paediatrician is a natural counsellor and this of necessity generates in him a practical interest in medical genetics

A "practical interest" in medical genetics - no suggestion that the practitioners of medical genetics should be involved clinically, but that the paediatrician should have the knowledge to be practically involved in their own clinical role.

According to Wilkie (1980, 1981, 1982, per) medical genetics is considered primarily as a laboratory-based service specialty (i.e. one with no patient contact) and until there are specific beds in hospital, it will not be seriously considered as a clinical specialty. That is, the geneticists need to expand or move their territory from the laboratory to the patients. Are these patients to be gained from other specialties or will they be new patients? If new patients, will other specialties not legitimately consider them their territory and challenge the medical geneticist? Yoxen (1982,147) considered that the specialty was the

> exploitation of a new niche by a group of innovators within the professional structure that specified roles for them

> to adopt and placed limits on the claims they could make.

Three areas of tension are seen by Wilkie (1981,per): antenatal diagnosis; diagnosis, assessment and treatment of genetic and polygenetic handicap; and genetic counselling.

a) Antenatal diagnosis, as previously indicated, has developed over the last decade due to the use of scientific and technological developments. Though medical geneticists provide scientific information about materials removed from the obstetricians' patients, they have no territorial claim to these patients who are firmly under the control of the obstetrician. In a move to increase this control, one unit is training obstetricians to interpret the results of the laboratory tests so that they do not need to rely on the medical geneticist. The aim is to push medical geneticists back into their laboratory base and away from the clinical side of antenatal diagnosis (Anon B 1981).

A MRC/DHSS working party on genetic disorders (Wenlock, 1980) made the following recommendations.

> Firstly that intensive 'in service' training in clinical genetics should be provided for obstetricians with an interest in the field. Secondly that all obstetricians engaged in the prenatal diagnosis of genetic disease should be expert in the techniques of early amniocentesis and ultrasound scanning and in the interpretation of genetic laboratory results.(ibid,83)

b) The diagnosis, assessment and treatment and even prevention of genetic and polygenic disease in children and adults is another area where the medical geneticist is mounting a challenge for new territory. Diagnosis is already under their control in the laboratory, but the other functions are ripe for colonisation. For example, the setting up of computerised genetic registers like RAPID (see Chapter 5) helps give the power of specific knowledge via sophisticated data linkage, for use in assessment. The medical geneticist has control here.

Emery (1979,216) points out that it is fallacious to assume that once diagnosis of genetic disease has been made, nothing, or very little can be done. He describes various treatments presently available; physical manipulation in removal of diseased tissue, transplantation of normal tissue; chemical manipulation such as penicillamine injections for Wilson's disease and hopefully in the not too distant future, biological manipulations for the replacement of mutant genes.

Nadler and Booth (1980,449) report that concepts of treatment of genetic disease have been greatly modified and extended in the past few years. Therapy used to be confined to alleviation of symptoms and prevention of complications, but now attempts are made to

> reconstitute the 'normal biochemical and physical milieu.'

This is made possible by

> advances in technology, increased understanding of intermediate metabolism and basic protein chemistry ... accurate elucidation of basic biochemical defects

They then review a number of methods used to treat genetic disorders by correcting biochemical abnormalities.

Projection of these concepts of biological manipulation takes interested parties into the field of in utero treatments for genetic disorders. Emery (1979, 220) is aware of the potential new territory and makes a claim for the medical geneticists to treat the fetus because of their expertise, both in knowledge and techniques, gained on animals. He describes work with mice, where the use of cortisone in the fetal stage prevents expected eye defects, where thyroxine similarly used reduces the incidence of hare lip, and manganese in other strains of mice prevents hereditory ataxia.

Further claims to the territory of diagnosis, assessment and possibly treatment of genetic handicap, are set out by Murphy (1980, 372), who describes clinical (ie medical) geneticists in glowing terms. This description repays examination in detail, for who could deny the worth of the practitioner? Among the many benefits the medical geneticists confers on his clientele are advice and guidance about prospective families. This counselling

> is a delicate clinical art compounded of insight, compassion and the capacity to communicate fact, perspective and judicious confidence. It presupposes extra-ordinary skill in diagnosis ... draws heavily on elaborate and highly specialized techniques and the services of those skilled in the management of particular problems. The wise genetic counsellor sees himself not as an oracle, but as a spokesman for a team of experts.

c) What are the claims of medical geneticists to the territory of genetic counselling? Roberts and Pembrey (1980, 228) suggest that they have strong reasons for such claims.

First they describe the territory; a considerable proportion of the population can profit from receiving genetic advice. Then they mention that one of them set up the first clinic in the UK for genetic advice in 1946. There has since been a great advance in genetic knowledge; not only are the medical professionals aware of this but in their opinion so are members of the general public, who have expressed their needs and are said to be aware of the benefits of genetic counselling. The importance of the medical geneticist is implied by the authors' remarks on the complexity of the field. For those giving advice

> extensive knowledge of the literature is needed. The vast number of inherited or partially inherited conditions make this a formidable undertaking (ibid,271)

Rare conditions, far from negligible in aggregate, may not have been diagnosed by the family doctor or other specialists. These specialists - paediatricians, opthalmologists, dermatologists who often deal with genetic conditions and do give genetic advice would, in the authors' view, operate more effectively in co-operation with a genetic clinic, ie one run by medical geneticists. In fact the authors say that they

> thoroughly agree with the general opinion that whenever possible patients should be seen at clinics for genetic advice (ibid,289)

CHALLENGE OF OTHER POTENTIAL SPECIALTIES

Potential specialties are emerging in the field of reproductive medicine and they challenge the role of the established specialties in a variety of ways. These potential specialties are concerned with different definitions of territorial area, and with different definitions of boundaries. They represent a threat because their formation would fragment established specialties and cause a complete reshuffle of the whole field.

The potential specialties are fetology, fetal medicine, embryatics and euphenics (the discipline of prenatal diagnosis suggested by Sandler (1981,vi) is considered under fetal medicine). Fetology is the study of the fetus, normal and abnormal, mainly *in vivo*, though very closely related to scientifically-based human embryology, the latter has been mainly based on *in vitro* studies. Embryatics is the manipulation of the fetus *in vivo* (ie *in utero*) to repair faults before birth whether physical , chemical or biological. Thus fetology and embryatics can be seen as aspects of the broader specialty of fetal medicine. Euphenics is concerned with the deliberate manipulation of the human genome at cellular level and should not be confused with eugenics, which is selective breeding ie choosing the partners for the mating because of the possession of some desirable characteristic, which will be transmitted.

Another less established grouping is that concerned with the use of embryonic material, both cellular and at the organised level of organs, to repair or replace faulty material in other embryos, children and adults. At present this function could be easily taken on by other specialties or potential specialties - fetology, fetal medicine, obstetrics - especially in its research aspect.

Fetal Medicine

A department of fetal medicine has recently been established in King's College Hospital, London by the charity Birthright (already mentioned). This charity has royal patronage, as its president is Princess Diana, and is part of the Royal College of Obstetricians and Gynaecologists.

The concept of a territorial grouping of fetal medicine is not new. It was said by Gairdner (1979, 710) to have been a product of the amniotic fluid sampling first carried out in the diagnosis of *E. foetalis*. In retrospect he says

> we can see that the use of diagnostic amniocentesis opened the way to a whole host of other diagnostic procedures depending on the sampling of amniotic fluid and this was the beginning of the new science of fetal medicine.

An interesting turn of phrase - the science of fetal medicine. In 1966 an editorial in the BMJ concerned with the fetus and the newborn expressed the belief that

> the time will come when medicine of the unborn foetus will occupy doctors almost as much as the medicine of postnatal life (BMJ 1966, 311)

The editorial continued by pointing out that now congenital malformations or early neonatal death are not regarded as acts of God, but due to adverse factors which can be studied and circumvented, the way is open for a rigorous study of the fetus and the newborn, and by implication, the needs of the public are being met by this section of the medical profession. The type of work reported in 1966 contained the following topics: physiology, pharmacology, morbid anatomy, biochemistry, immunology of the fetus, placental function in relation to fetal nutrition, placental morphometry, placental transfer, requirement of an artificial placenta, vascular and pulmonary adjustments at birth, induction of enzyme pathways and the development of certain metabolic pathways. In those aspects of biomedical research the neonatal stage is considered as an extension of the fetal stage, especially in metabolic pathway research. This again emphasises the continuum from one side of birth to the other as reflected in the concept of the perinatal period.

Sandler (1981, vi) suggested that a whole new discipline, prenatal diagnosis, had been born, where the wealth of data available attested to the ferment of activity.

> The field has become a meeting ground for clinicians, cytologists, cytogeneticists, biochemists and pharmacologists.

But he does not make it clear who will control this new territory which I consider could be part of fetal medicine.

Embryatics

The treatment of abnormality of a fetus in vivo was predicted very early when similar procedures were carried out in dogs.

Harrison (1982,TV) illustrated very graphically the temporary removal of a monkey fetus from the womb to repair an abnormality of the bladder. He had carried out this procedure successfully with a human fetus. He is a paediatric surgeon. It is also possible to put drainage coils into the bladder of a fetus within the womb using the fetoscope to relieve a blockage, thus enabling the fetus to develop normally. (Ferguson-Smith, 1981, 301)

Increasingly there is a move towards treatment before birth so that less damage is done to the fetus because of the abnormality. Repairs to the fetal heart are possible and lead to the speculation that fetal cardiology may develop as a sub-specialty of fetal medicine or of paediatric cardiology. Examples of chemical manipulation include treatment for methaemalonic acidaemia and for closure of ductus arteriosus by anti-inflammatory drugs. Further developments in chemical manipulation concerned with enzyme stability can provide a filter to clear blood of potentially harmful substances in an _in vivo_ not _in vitro_ situation. At present used successfully in dogs, it can be predicted that in cases of the genetic disease phenylketonuria it could be used to clear the blood of the fetus and prevent developmental abnormalities. The potential is enormous.

Euphenics

The potential of changing the human genome by biological manipulation presents many challenges to the medical profession, as well as raising ethical issues. Etzioni (Coleman 1977, 64) considers the possibilities are great, but may be socially disruptive

> Genetic technology has the potential to take human heredity out of the realm of blind fate or chance into the realm of free will and choice

whilst Kass (1977, 152) informs us that

> We must get used to the idea that biomedical technology makes possible many things we should not do ... there may be a technological imperative but society is not powerless to say no.

Wald (1977, 151) is convinced that the human genome should be declared inviolable. General acceptance of this is unlikely, as euphenics could be represented as an extrapolation of the manipulations already being carried out in embryatics and in neonatal surgery; its justification can be regarded as part of the continuum of the ideology of the prevention of handicap. This, of course, is territory ripe for colonisation, and a preliminary survey indicates that as yet no established specialty has made concerted efforts to colonise it. This may be due to perceptions that the culture gap described by Ogburn (p. 107) is too large and that control of this potential specialty would lie outwith the province of the medical profession. Lederberg (1972,241) summarises the situation when he writes

> Advances in molecular biology promise to enlarge our technical capacity to intervene in genetic problems. Social and ethical factors are therefore likely to play an increasingly important role in determining the application of new scientific advances in man.

Control of the Use of the fetus and fetal material

The use in research of aborted fetuses, and fetuses prior to abortion, is not documented but is known to take place. (Anon C,1981,per) According to Stahlman (1979, 516) there is a compelling need for biomedical research on children, infants and fetuses. She emphasises that human research on these categories must be allowable, although rights must be preserved. The recent guidelines of the Warnock committee (1984) about the age of test tube embryos at which experimentation should stop served to highlight the fact that these experiments were taking place. Interestingly the barrier for experimentation is based on a developmental indicator (the primitive streak).

Who has control of these experimental procedures at present? Will the control shift in the near future? Obstetricians appear to have control with their scientific counterparts (e.g. the team of Steptoe & Roberts), but it may be that with the strengthening of the claims of newly formed fetal medicine groupings there will be a move by these doctors to have control over the unwanted fetus. This would enable them to build up a core knowledge of normality and abnormality; they therefore have the basis of a strong claim to the territory of the fetus.

The use of fetal parts for other areas of research have been documented, eg pancreatic transplants, fetal tissue in vaccine development (Stahlman, 1979, 516) biological warfare research ; fetal tissue in brain transplants. The proceedings of a recent seminar, reported by Schmeck (1983), were concerned with the possible treatment of diseases of the brain and central nervous system in adults by implanted fetal tissue. Specific examples of where this tissue could be used were suggested; spinal cord of paraplegics, degenerated brain cells in Parkinson's disease and Huntington's chorea. Experiments with animal fetal tissue indicate that these sugggestions were well within the bounds of possibility. Again similar questions can be asked about control of this material. At present the obstetrician appears to be the gatekeeper, but control may pass to fetologists or fetal medicine professionals. The whole situation is unstable and fragile.

SUMMARY

The prediction by Lennon quoted at the end of Chapter 9, that the specialty of obstetrics contained a wealth of "interest" that was becoming apparent to others outwith the specialty, has been shown in this chapter to have become a reality. Various other specialties, and potential specialties, are very concerned to gain control over parts of the territory of the obstetrician.

The build-up of special knowledge has been great, and there have been considerable developments of new techniques. Conflict at and around the boundary of birth has continued between the two major specialties practising within that area. Potential new specialties and sub-specialties are emerging and the whole field is in a state of flux.

The obstetricians have dominance in the field; they appear to have the system of conception, pregnancy and childbirth under their control; they are the main fetal advocates and have gained much special, esoteric, knowledge about their prime patient. Two developments appear to be taking place in their pursuit of both expansion and consolidation of their territory.

They did not put up a fight over the sick neonate which they lost to the paediatricians and this led to the loss of the healthy neonate. But it was not only a loss of the neonate, it was a loss of a relationship with the mother, who after the birth became once again the obstetricians' first patient.

Now expansionist moves via the idea of the perinatal period, and the extrapolation of fetal development to the neonate, may give this specialty some claims not only to the neonate but to renewing their relationship with the mother, joining again with her in concern for the child. This would be a one-to-one relationship, one of trust, a true fiduciary relationship.

But it could be postulated that the paediatricians are aware of this ploy, and are counterbalancing it by moving from their isolation in the nursery to a visible position by the bedside. There they are setting up a very similar relationship with the mother with reference to her baby, but using their special knowledge of the neonate and also of the infant. Which special knowledge will be the most potent in this competitive situation?

The obstetricians are thus crossing over the boundary of birth in a search for the continuum of the baby. In what could be construed as a further countermove, the paediatricians are seeking again by possession of special knowledge, to cross over this boundary the other way. Knowledge gained from ultrasound imaging in the very early neonate can be vital to claims of knowing the development and the problems of the fetus just before birth. Also, and this is crucial, these claims can lead to justifiable concerns with obstetrical practices in childbirth.

In their continued concern over handicap the paediatricians are setting up claims to more control in pregnancy. They wish to be able to influence the development of their potential patient, the fetus, via the vessel in which it develops, i.e. the mother. The detachment of the mother and her reconceptualisaition as a passive vessel has brought advantages to the obstetricians, but it does provide a means whereby other specialties can poach some of their territory.

The main area of conflict and territorial activity is centred around control of the fetus in the period just before birth, and control of the neonate. Gause's principle (explained in Chapter 4) that no two species can co-exist for very long in a given region if they make the same demands on the environment, can be adapted to say that no two medical specialities, i.e. obstetrics and paediatrics, can co-exist peaceably if they are making the same demands on a piece of territory, i.e. the perinate. Similarly useful is the concept of pendulum fighting propounded by Woodcock & Davis (also explained in Chapter 4), that when there is competition between claimants of adjacent territory, pendulum fighting occurs, each having probing excursions into the other's territory. Fighting takes place not at the agreed boundary but at some distance at either side.

This can illuminate the manoeuvres of the obstetricians and paediatricians over the boundary of birth and the apparent fighting taking place over the perinatal period which is at each side of birth.

Administrators are propounding the idea of the team approach to the problems of perinatal mortality and morbidity, but the sociological naivete in suggesting the formation of perinatal paediatrics is surprising, considering the history of the fiercely competing specialties. In light of the jealous and conflictual model I have proposed, it seems that it will be very difficult to get a team approach _de novo_. Studies on the team approach in geriatrics by the author (Macleod, M, 1979) indicate that success there may be dependent on a complete reconceptualisation of the medical task in that the main aim of a geriatric team is to keep the patients out of hospital. The whole ethos of the specialists who would be concerned in a perinatal team is to bring the patients - both of them - into hospital.

The most significant move of the obstetricians to consolidate their control and "possession" of the fetus is, I suggest, the formation of fetal medicine. Not yet a specialty in the UK, but having great prestige and royal patronage, it is a very successful move, or so it would appear. But the paediatricians are interested in the fetus and via the idea of embryatics are using the same ploys they used for the claim to the neonate, specialised micro-techniques and equipment, special knowledge of the development, not this time of the normal infant, but of the handicapped neonate, to gain more control.

In general, both specialties are being challenged by medical geneticists who claim expert scientific knowledge and specialised techniques. The obstetricians counter these claims by attracting to the specialty high calibre recruits who can encompass the scientific complexity of genetics. The paediatricians react by highlighting their contact with the parents of handicapped children and the extension of their role to include the family as objects for their concern as seen in the sub-specialties described in Chapter 7.

This chapter has shown the fragility of the boundaries in the field of reproductive medicine. The whole area is in a state of flux and one can justifiably ask: what will be the next steps of development?

Will some new grouping emerge to dominate the field, will alliances be formed and between whom, will the perinatal team approach gain widespread acceptance, or will one established specialty become dominant and absorb the weaker ones?

SECTION III

SUMMARY

This section on reproductive medicine started with a description of paediatrics from general medicine, and it has ended with an account of the conflicts for the territory of the fetus and the boundary of birth.

Throughout the section I have attempted to show the importance of scientific and technological developments in the territorial conflicts, but I have not ignored other influences such as political and bureaucratic decisions.

Practitioners in this field have used a wide variety of physical, chemical, and biological manipulations. The ability to extend the senses, especially that of sight, plays a vital role in claiming or consolidating control over territory, and within reproductive medicine use of this ability has been particularly prominent.

This must, however, be placed in perspective for it is part of the general practice of medicine to seek out and use imaging devices. These devices are becoming increasingly sophisticated and costly. Oakley (1984, 279) describes the technique of nuclear magnetic resonance (NMR) for fetal imaging, and the technique has recently been proposed as potentially useful for screening for breast cancer.

The importance to the specialists of the imaging technology as part of the system of seeing-measuring-monitoring-controlling has been highlighted in this section. The possible removal of any

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Thacker (1985) has analysed four recent clinical trials designed to assess the value of routine use of ultrasound in pregnancy. One of these trials was conducted in London (Bennett et al, 1982), two in Norway (Eik-Nes et al, 1984,& Bakketeig et al, 1984), and one in Glasgow (Neilson et al,1984). Three of the trials reported no evidence of benefit to the women undergoing the procedures, whereas Eik-Nes et al (1984) concluded that there was a decrease in unnecessary induction as well as reduction in perinatal mortality and morbidity.

The quality of the trials was assessed by Thacker,and in addition he pooled the data from the four trials for analysis. Though the researchers in the studies reached different conclusions as to the effectiveness of routine ultrasound, Thacker is of the opinion that taken together,the four trials provided valuable information about this type of screening,but fail to demonstrate its usefulness for all pregnant women.

He suggests that in view of the uncertainty of the results from the four trials ,it is now appropriate to conduct further, larger radomised controlled trials to determine three things. Does ultrasound screening reduce 1) perinatal mortality, 2) rate of unnecessary induction for improperly classified postdate pregnancies, 3) neonatal morbidity (using specified criteria)?

imaging techniques which are entrenched within such systems is regarded with alarm by the doctors who rely on them. This is so with ultrasound, a technique which has not been properly tested for harmful effects or been assessed for its efficiency of use.

A recent NIH (1984) report on the use of diagnostic ultrasound imaging in pregnancy indicates that the evidence received with reference to clinical efficacy and to safety "does not allow a recommendation for routine screening at this time" (ibid, 9). The consensus was that it should be used only when there was a "specific medical indication".

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Any moves to remove routine screening by ultrasound will, I suggest, be resisted by most obstetricians, for it has become so embedded within their practice that its removal would cause major problems. As Collingridge (p.116) points out, by the time unfavourable consequences appear, the technology is so often part of the whole fabric of a practice that control is difficult. Obstetricians have come to depend on this technology not only in their altruistic endeavours but, I would suggest, in their control of both mothers and midwives by the setting of parameters of normality and abnormality. They will fight hard for the continued use of ultrasound screening, but will I am sure be looking for other imaging techniques which will give them the same or even increased control, NMR perhaps.

Within reproductive medicine, as within other parts of medicine, the search for measurement, for objectification of observations, has led, not to the increasing involvement or patients or relatives of patients in the doctor's decision-making, but to the extension of the domination of the medical professional. Interpreting evidence and deciding its clinical implications is still under the control of the specialist. Flexner (p.67) remarked that "science resides in the intellect not the instrument"; what this means in contemporary medicine is that interpretation of the results from instruments, and the action then taken, is part of the intellectual apparatus of the specialist. For in this way not only are patients excluded but so are competing groups of doctors.

The importance of the right kind of patients has been highlighted in this section. The moves of the obstetricians away from the mother as a first patient, to the promotion of the fetus to this position, indicates the importance to the specialists of having patients salient to the particular developmental phase of the specialty. Although it may seem to be paradoxical for the paediatricians to embrace, as a central object of concern, the family of the handicapped child rather than the child itself, I would suggest that they are carrying out the same type of manoeuvre as the obstetricians. These specialsts are claiming patients most salient to their current position.

Reproductive medicine and the specialties and groups within it, have much in common with other fields of medicine. One aspect which I suggest is different, or almost different in scale, is that of the ethical problems associated with recent developments.

In vitro fertilisation, experiments on the human embryo, surrogate mothers, adaption of animal breeding techniques, have all posed ethical dilemmas for society and for particular sections within it. A whole new vocabulary has been invented to deal with these developments - "placental mothers," "commissioning parents" etc (Macleod, M., 1979a). I would suggest, however, that these dilemmas result not from new ideologies or theories, but from the fact that medical technology has caught up with Darwin's "Origin of Species". In this respect the work of Haynes (1976) is important, for he proposes that understanding of the direction of modern medicine can be gained by going back to this major paradigm shift in 1859.

There was at that time a dramatic shift from natural theology to evolutionary materialism, Humans, it was postulated by the theologians, had dominance, immutability, and uniquely possess immortal souls. Evolutionary disciples claimed that humans were part of mutable phylogenetically related species, and possess no ineffable substances which would distinguish them qualitatively from other species.

Post-darwinans are aware of two strands which must follow from this altered view. Firstly, the existence of similarities and interdependencies amongst all living creatures; of evolutionary and ecological relationships of analogous patterns of cellular architecture and biochemical pathways, and most dramatically of the universality of the genetic code. Humans, it is postulated, are part of nature, not separate from it and can be increasingly well understood in physical and chemical terms.

It is the acceptance of this integration with other species which has made many medical developments feasible. The technology which led to the first test-tube baby was first utilised with small animals and then developed with great success in the economic field of cattle production.

Pre-darwinians would not have considered this type of extrapolation, for how, they would ask, could you put a soul into a child conceived in a test tube? Current criticisms of reproductive technology are couched in pre-darwinian terms, and thus conflict is bound to result, for doctors are essentially post-darwinians as indicated by their reductionist (or molecular) model of disease and abnormaltity.

The second strand is that there has been the evolution of a culture that is uniquely human, and any technology developed from the theories of the first proposition, must be set within the culture of the community where it will be used. For increasingly these technologies are confronting society with ethical dilemmas of considerable proportions. Prenatal diagnosis, based on successful cattle work, at first seemed no different from other diagnostic tests; in fact however, they face us with the problem of assigning values to individuals and designing programmes directed against those who score badly.

This assigning of values to individuals once they have emerged from the womb can be seen in the selection of certain babies for treatment for spina bifida; for removal of the cancerous tissue in retinoblastoma; the selective use of dialysis machines or kidney transplantation for genetic kidney failure. These are illustrative of the move towards individual-based medicine and away from species-based medicine.

I have talked about paradoxes and inconsistencies within medicine, but I would suggest that one of the biggest ethical problems for both society and the practitioners in the field of reproductive medicine is the paradox that the fetus is the recipient of species-based medicine, and yet the neonate and the child are the recipients of individual-based medicine.

As there is so much conflict over the boundary of birth, will there also be conflict over the ethical problems brought about by the differing views of the developmental stages at which handicapped individuals are destroyed, and at which stages they are encouraged to survive?

Benzer (1976) is sure that genetic patterns wil continue to shift under the shelter or umbrella of modern medicine and he makes the chilling comment that

> It may well be, however, that the social cost of maintaining some genetic variant will be so great, that artificial selection against them is ethically as well as economically the most acceptable and wisest solution. (ibid, 36)

Dobzhansky (1976), in a similar vein, postulates that some control of the evolution of the human species may be the only alternative to its extinction.

Which part of the medical profession would have this control if society decided that this warning should be taken seriously and acted upon? Fetal medicine specialists, embryaticicists, or a new alliance of ambitious, entrepreneurial medical professionals?

SUMMARY AND CONCLUSIONS

INTRODUCTION

This thesis set out to analyse the influence of developments in science and technology on the dynamics of medical specialisation. This was not a strange or unusual thing to do, for the suggestion that these factors had had an influence can be found in a variety of literature as I have shown in Chapter 2. It could be argued, however, that it was too broad and too general a proposition, and that refinement of it would have led to a tighter and more coherent thesis. Whilst I accept that there is some justice in this remark, I would like to argue that the breadth of the topic has given scope for the setting of reproductive medicine within medicine in general, and likewise the setting of modern medicine within contemporary technological society.

The framework drew on the approach of the symbolic interactionists, but I also attempted to incorporate within that perspective, some of the insights from those writers who had stressed the need to explore more deliberately the issues of power and conflict. From a different area, I utilised the work on the relationships of society and technology, particularly that which emphasised the interactive nature of the relationship between the two. The broad approach of the ecological school gave me my basic descriptive and analytic concepts - metaphors of domain, boundaries, colonisation - all part of the general concept of territory.

In this last chapter two questions should be answered. Firstly, to what extent have the common understandings of the relat -ionship between science and technology and specialisation been refined in my analysis? Secondly, how successful was the mode of analysis?

ASSESSMENT OF THE HYPOTHESIS

Both in terms of general description and in the details from the section on reproductive medicine, it is clear that developments in science and technology are intimately bound up with the processes of specialisation. New forms of social organisation within medicine are frequently contingent upon the development of new knowledge and new techniques.

This is not to deny that the process of division of labour in this area, as in other areas, is affected by other factors. Factors which appear to be very influential are those connected with political or bureaucratic decisions, such as the re-organisation of the medical services, the deliberate encouragement of biomedical sciences, and even changes on birth certificates.

Periods of war and conflict affect the whole way a nation thinks about medicine, and the resources, both financial as well as personnel, it wishes to allocate to support this profession and the demands made on it during these conflicts. Many developments under these conditions have led to increased specialisation in medicine.

There are changes too in the pattern of diseases within a nation. Some of these changes are connected with the practice of medicine itself, whilst others are more associated with housing and environmental conditions and economic movements. These changing patterns do however affect the practice of medicine and its social structure.

Population changes and movements are yet other factors which influence the process of specialisation in medicine. An excellent example of this is the formation of geriatrics in the UK during the second world war, and its continued development as the age structure and family structure of our society changes.

Exogenous factors are important influences on the social structure of medicine, but events like war and other large scale upheavals are unpredictable and outwith the control of medicine. In their professional careers doctors seek to reduce uncertainty, and as Rogers (p.98) points out, this is seen as one of the main functions of technology. Their increasingly institutionalised relationships with science and technology have enabled hospital doctors not only to capture appropriate developments in war and in crisis, but also in normal times as well. They are able to take advantage and appropriate developments from other areas for the advancement of their profession, their specialty or group, or themselves.

The medical profession is part of society within which science and technology are seen as vitally important. The philosophy, ideology and practical applications are all-pervasive and thus doctors take over aspects of technologised and scientised culture in their everyday lives as they practise medicine. They, like other members of society, may translate social problems into technological ones, and the concept of "technological fixes" has a certain resonance within medicine.

Within this profession there could be said to be an endemic state of rivalry and conflict which has expressed itself in many forms. In the last fifty years or so I would suggest that these rivalries have been fuelled, not only by the increasingly scientific basis of doctors' training or their contacts with medical technologists, but by the availability out in the community of resources which are scientific and technologically based. Adaption of these resources to their own particular interest has enabled groups of doctors to claim special areas for themselves, which they have then in many cases been able to elevate into formal specialties. Successful examples of adaption abound, and these manipulations are used as models or exemplars for other groups of aspiring hopefuls.

Ultrasound has been adapted from its military purpose of seeking out the position and type of enemy submarine; now obstetricians can learn about the fetus and its development, and thus use this special knowledge to gain control over a piece of territory. Molecular biology, so important in plant breeding, can be used to advance knowledge of genetic handicap in the neonate and thus enable interested doctors to claim special expertise about treatment and the counselling of the parents. Adaption of animal breeding techniques make it possible to freeze human embryos for later use if there is a failure of the original implantation, thus giving infertile women more chance of having a baby, and also increase the prestige of the obstetricians concerned. There are many more examples in the text of this thesis, especially in Section III.

Doctors mediate between their profession and the outside world and have been very successful in their trawl of scientific and technological developments. They can absorb into their profession scientific concepts and philosophies as well as technical hardware. They are able to adapt the technological ideas of design and agree with Metchnikoff (Todd, 1981, 299) that humans are poorly designed machines and that "medicine can correct nature's imperfections". Paediatric cardiologists with their miniaturised instruments invoked this philosophy when bidding for the territory of the handicapped neonate and will surely use it again when trying to develop embryatics as a sub-specialty or even a specialty.

I believe that the central argument of the thesis has stood up to this analysis. Developments in science and technology are used by groups of doctors as resources in their intra-professional struggles. But it is not enough to say that there has been this influence on the dynamics of medical specialisation, for the processes are obviously much more complex than previously suggested. The work of the thesis has pointed to some areas which are important, for I can extend the hypothesis and ask, what have been the consequences of these developments on the relationships with people other than fellow doctors?

Relationships with other members of the hospital staff are obviously very important. Though I have only mentioned briefly the conflict between obstetrician and midwives over the control of the parameters of 'normal' birth and consequently of 'normal' deliveries, I am certainly not unaware of the role this conflict, and others like it, play in the social organisation of medicine and the domination of para-medics. But as this thesis was about intra-professional divisions I did not extend my research in this direction.

Patients are a most important and necessary part of medical practice, and the increasingly technologised and specialised medicine does change relationships with doctors. Prestige for doctors is related to many things, amongst which I suggest are the physical and "mental" distance from patients. The greater the distance doctors can get from the undifferentiated mass of patients, the more prestigious is their practice. Compare for example venereologists (now genito-urinary specialists) with neurologists or paediatric cardiologists. The more control the doctor has over the physical examination of patients, the more sophisticated the technological devices used, the more prestigious is the specialty. Finally the more authority the doctors have in relationship to their own autonomous interpretation of symptoms, the more prestigious is the practice.

Use of technology, especially sophisticated technology, which greatly extends the senses, has increasingly gained for doctors considerable prestige, but it has meant that as doctors become more authoritative and in control, patients are reduced to a very passive role. Winner (p. 107) asked the question "do artefacts have politics?" and it could be argued that the technological artefacts of medicine are political, in that they give increasing control and authority to doctors. Nowhere is this more clearly seen than in pregnancy and childbirth where there is a great deal of control of patients, many of whom do not consider themselves to be in any sort of pathological condition.

These patients - the mothers - are included in the medical net, however, because of the use of technology in determining for the doctor the parameters of normality and abnormality. Doctors have control over these definitions and the more knowledge specialists have of normal development, the more claim they have over the area they wish to appropriate. This can be seen in neonatology and in obstetrics in relation to both the fetus and the mother.

Abnormality is not necessarily pathological in the strictest sense, but as a concept brings into the orbit of many specialties and potential specialties, people who can be claimed as patients. Is a sterile woman diseased or abnormal? Questions like this one, take doctors into areas of life not previously regarded as their domain, and specialty development and conflict takes place in the new areas, possibly with greater ferocity than in more established areas.

What is the legitimate area of medical practice for the profession? No-one can describe it adequately for it changes constantly, and is connected not only with the patterns of problems presented to it, the socio-economic environment, but with the current theory of disease formulation.

The formulation of disease theories is not a static process but it is dynamic and interactive. Control over formulation is important to the medical profession as a whole, and to groups of competing specialists, for it has implications for the patients they may gain or lose and the control they may have over them.

There is a pervasive cultural image within medicine of what is good science, which is modelled on physics and chemistry. Biologists are influenced by this image and there is a distinct move towards explanation and theories with a physical and chemical basis. Biology is the nearest science to medicine and this has influenced medical practice. Doctors have attempted to change their own discipline to make it similar to the culturally-given image of what good science is. This has been at both practical and philosophical levels and it has led to an increase in status and prestige by making the image of the profession closer in character to what is a culturally-given desirableness which greatly helps in funding and peer status.

Thus the specialty which can work most successfully within the current paradigm of scientific explanation of disease process, i.e. the reductionist model, will have greater success and prestige.

But where do these formulations of disease, whatever model is used, leave the patients? Again I would suggest that it leaves them increasingly dependent, for one legitimate role which professions carry out is to interpret the needs of their clients. In medicine this has great potency for not only do doctors define the needs of the patients, they are able to say how these needs should be met. Using sophisticated measuring or detecting devices, specialists or those aspiring to that status can define the needs of groups of people and so bring them into their orbit of control. Infertile men are brought within the control of obstetricians, who form an alliance with the men on the definition of need, but the obstetricians have control over how the needs are to be met. Handicapped children and their parents are brought within the control of the paediatric cardiologists where often the alliance is with the parents and not the child, but the specialist defines how the needs are met.

Control of patients, whether by use of technology, by disease theories or by need-formulation, greatly increases the power of the specialists and give them greater opportunities to control their own territory or challenge the territory of others.

In all this it is important to point out that the doctors' use of science and technology is generally viewed as legitimate. There are many patients and many members of society who admire and approve of the recent developments in modern medicine. Support and fund-raising activities for tomoscanners, for example, testify to the public's belief (mistaken perhaps) in the efficacy of modern medical technology. In this way many patients and members of the public encourage the growth of scientised, technologised, specialised medicine. There is in fact a complex interaction between doctors and the technology they use and the public or the sub-set of the public - the patients. This type of self-exciting system I have already referred to, and it is a useful model for further analysis.

It would be idle to pretend, however, that there are not aspects of modern medicine which cause alarm and disquiet. One aspect, I suggest, which is important, is the weakening of the fiduciary relationship - the trust relationship - between patients and doctors. This relationship, which is on a one-to-one basis, is for many patients a basic part of the process of recovery from illness, and it is reflected in the unfashionable disease theory of the essentialists (p.261) where the doctor-patient duo do battle against the enemy.

For many patients, the experience of modern specialised medicine is disquieting. They are often confronted not with one trusted medical adviser, but with a whole series of different individuals.

Patients rapidly lose any sense of their own identity as they are passed from person to person, each time having to re-tell their story.

Doctors as they specialise become increasingly distant, institutionally, physically and technologically from their patients, becoming almost extensions of the machines they use. The felt need to use technology, the technological imperative as it has been called, is strong, especially in situations where there is conflict or competition with competing groups of doctors. Sometimes the method or technique becomes more important than the patient, and there is a break in the trust, for patients are aware that their needs are not necessarily paramount. As Banta (p.114) remarks "patient-need is not a powerful determinant".

This breakdown of the fiduciary relationship, this lack of one-to-one encounters, plus the awareness of increasing vested interests of doctors, means that it is not possible to take on trust that doctors have at all times the welfare of their clients at heart. Money, prestige, innovation and technological imperative are all strong determinants for the type of medicine practised today.

Out of this awareness has come a variety of pressure groups and self-help groups who are challenging the basic tenets of modern medical practice. Women who want to be treated as normal people who are having a baby, not as pathological cases who need extensive monitoring and surveillance, are making their desires known to obstetricians. Other groups who find no help in the reductionist model of disease are pressing for a holist approach which they feel will help them in their suffering.

Analysing the response of doctors to these pressures, I detect that they are willing to go a little way in accommodating these wishes, for dissatisfied patients in pressure groups not only challenge the control of the specialists, but also may be perceived as being dangerous if in alliance with other competing specialists. If pregnant women become increasingly the concern of paediatricians in this specialty's concern to prevent handicap, in combination they present a threat to the obstetrician.

So pieces of practice are allowed to change or are modified to suit the expressed desires of the patients, but I would suggest that the basic core of technological reductionist medicine is not altered. Behind every birthing room there is usually a highly equipped delivery theatre, and for every middle class healthy mum who is allowed the benefit of a holist, intuitive approach in pregnancy and childbirth, there are many other women who have no say over the manner of pregnancy or the type of birth they and their baby undergo.

The medical profession is flexible and opportunist, but very firmly in control of the techniques used and the special knowledge they possess.

The importance to a profession of special, esoteric knowledge was highlighted by several writers in the first section of this thesis. Within the two substantive parts, the importance of knowledge has been pervasive and crucial, but very hard to pin down, to catch the moment when the possession of it was vital in the intra-professional struggles.

As Pettigrew (p.88) remarked, control of knowledge is power, and in my analysis I have tried to show that the control of different types of knowledge has been an important element in specialised medical practice. Developmental knowledge played a crucial role in the process of specialisation for paediatricians, and I predict that developmental knowledge will play an equally vital role in the control of fetal medicine and the sub-groups which will flourish around it. Knowledge of pathological lesions "seen" by ultrasound is encouraging paediatricians to ask questions of obstetricians about their practices in childbirth. Use of exclusive knowledge really gives power to its possessor, as Freidson so succinctly remarked (p.42).

It is thus a reasonable question to ask "where do these vital, these crucial pieces of knowledge come from?" My answer would be, from developments in science and technology and from the philosophies and attitudes associated with these disciplines. This thesis has attempted to chart these within medicine in general and reproductive medicine in particular.

The examination of the argument led to the teasing out of several issues connected with medical technology and the general relationships between society and technology. It is not necessary to take either a wholly adulatory stance, or to view all technologies as tainted.

Some technologies, including medical ones, have been of great value to some people, whilst others have caused great harm. Some people do lose out, while others gain. The effects may be directly related. For example, mothers who have already given birth to a spina bifida baby can gain from amniocentesis and the subsequent analysis of fluids, but another mother who has amniocentesis may lose a perfectly normal fetus because of the trauma of the procedure. In other cases it may be that whilst people may not be harmed directly, the funding which goes into, say, eleborate fetal monitoring equipment, could be better spent on improving housing and living conditions for pregnant women thought to be at risk.

The spending on technology within medicine, without proper assessment of its value not only to those who benefit, but to those who are adveresly affected by it, is regarded by some as a national scandal. Towers (1971, 165) asks us to pause in our current blind admiration of technology when the use of these powerful tools can lead to iatrogenic disease or death.

Collingridge (p.116) makes a case for both flexibility and caution in the use of technology and Banta (p.113) stresses the need for proper testing, but as I have suggested, many of the pieces of technical hardware are so embedded or entrenched within a system of technologies that their assessment, let alone removal, would cause major problems.

Throughout the analysis of reproductive medicine I could detect no concerted move to test technologies, to look, as Rogers (p.121) suggested, at preliminary trials before they were introduced and developed quickly for overall blanket use.

The widely held belief I examined, though initially a very general one, was useful, for it allowed for refinement where necessary, a focussing on detail, but it also aided the taking of a broad general view which helped to place things in perspective in relation to societal interaction.

ASSESSMENT OF THE ANALYTICAL FRAMEWORK

In general the thesis could be criticised for trying to cover too large an area of enquiry, and therefore there were bound to be difficulties with any mode of analysis. There were also problems due to the difficulty of trying to locate what I wanted to study within a sub-field of sociology. Thus the composite nature of the analytical framework I did develop necessarily appears to be incomplete in several respects, and these will be commented on later. Nevertheless it is heartening to learn that Fox (1985, 6) considers that one should not be afraid to work on a topic that does not sit comfortably within a legitimate field, but should go where the work carries you.

Any attempted analysis of this kind, however, does lead to the development of tensions within it. For instance, the detailed study of specialisation demands a good deal of historical and descriptive work in order to situate the actual struggles, and this does not always sit happily with the analytical side of the work.

The analytical framework used in this thesis has laid stress on interaction and has therefore drawn heavily on the work of both symbolic and technological interactionists. Throughout the thesis, the use of the framework has been not only to stress the concepts of change and process, but to marry these concepts in a consistent way with the acquisition and use of power by the medical profession in general and in specific areas of their practice.

My linkage of the interactionist focus on social processes with concerns of power and control is not novel, but the detailed study made of reproductive medicine has revealed the complex nature of medical power dynamics. The untangling of processes of change in this field has shown the kinds of conflicts, struggles for supremacy, boundary conflicts that have taken place, especially in recent years and in connection with technology.

The importance of the initiation and uptake of technology by groups or segments of doctors has been a theme within this thesis, but I have not traced it as rigorously as its importance demands. It might have been appropriate at some point to examine the utility of network analysis and to have paid more attention to the concept of invisible colleges or, as De Santis (p. 89) suggested, to those "loosely organised processes" which, she concluded at the end of her study of specialisation, must exist.

The nearer one gets to details of specialisation in medicine, the more one is aware of the inadequacies of existing modes of analysis, and this thesis is no exception to this generalisation. The importance of knowledge has been highlighted several times and it may be that more concern with the sociology of knowledge would have been helpful. I would suggest that future work should give prominence to it, as well as to the sociology of science. Here again network analysis might prove valuable, for as I have shown, the boundary between science and medicine is an important one. What are the mechanisms for transmission of knowledge across it? Individuals and small groups are important here and therefore should be studied in detail.

Future work should concentrate on exploring these ideas further, possibly paying less attention to the warring factions and more to the factors and processes which allow some measure of integration, some fragile stability within areas of medicine.

Technological change upsets equilibrium and there appears to be a constant search for temporary arrangements, but as stability seems to be more difficult to keep, and change easier to bring about, it will be important to search for reasons and explanation of these observations.

Despite these criticisms, however, the framework of the thesis did form a good basis for the work that I carried out. It allowed me to cover a wide range of issues, and enabled me to look at broad generalities as well as fine detail. The concepts drawn from the 'ecological approach' were useful, especially those connected with territoriality. Terms like colonisation helped to focus on expansionist manoeuvres, and the complex of notions about boundaries were invaluable, especially in connection with the perinatal period and the conflicts inherent in that area.

It was while looking at the fine detail of these conflicts that I had confirmed for me, the correctness of the decision I made not to use the term segment from the work of Bucher and Strauss. It was too vague a term, sometimes used for very small well-defined groups, at other times forlarge rather amorphous alliances with weak ties. No doubt the term had utility in the 1960s for the application of the interactionist approach, but I suggest that we now need concepts which capture the "nested" or hierarchical structure of the groupings observed. My work has, I believe, pointed in a direction which future studies may profitably develop.

Whatever the shortcomings of the framework of analysis, it has shown, as other studies have shown, the powerful position of doctors. They are entrenched within the paraphernalia of the state and function well within its bureaucracy. I would suggest, however, that a major reason for their success is their adaptability and entrepreneurial skills.

Of course I am aware that when talking about a profession one is not talking about all doctors, for what Kuhn (1970) said about science also applies to medicine. Not all doctors will find a place at the "sharp end", they will practise normal medicine as scientists practise normal science. They will work within the current paradigm using the hardware and disease formulation which follows from it.

But there are members of the medical profession who are able to seek out innovations, and adapt them to their own particular field; there are others who are in a position to demand certain things because of their perceived need for themselves or their clients. As I have shown, these moves often take place within a specialty or sub-specialty and lead to a gaining of position or territory.

Medicine is about the diagnosis and treatment of currently accepted diseases and conditions within the resources society perceives it has for this purpose, and therefore the more prestige a group has, and the more progressive and scientific it can appear, the more likely it is to have more influence over funding.

The paradox is that medicine as a whole is seen by the majority of the public as a united, immensely powerful and prestigious profession, and not as a series of contestatory tribes. Freidson makes reference to this paradox (p.50), when he asks how, despite the variety of struggling segments, the profession still preserves a common identity and sustains a superordinate position. But I would suggest that the paradox is heightened in that the very resources used in the internal conflicts within medicine are those which are also used to promote the image of a coherent progressive profession, namely science and technology.

It could be argued that the borrowing from and alliances with prestigious scientific disciplines may be due less to expressions of increased intellectual conviction about the reliance on the scientific method but rather be validating ploys designed to exalt the standing of the profession, but I am talking about image and not reality.

Doctors are powerful because they are adaptable and are able to present to the public the image of an up-to-date caring professsion with the needs of the client at their fulcrum, whilst concealing that there are many internal divisions and conflicts, which concern not patient interests but the vested interests of the specialist or potential specialists. Within the intra-professional conflicts, developments in science and technology act, as I have demonstrated, as potent resources.

ABBREVIATIONS

per.	=	Personal Interview
sem.	=	Seminar, lecture, conference, etc
TV	=	Television program
ed.	=	editor
eds.	=	editors
Ed.	=	Editorial
B.E.	=	British Empire
B.M.J.	=	British Medical Journal

Definitions

Fetus:	Used for all stages of development from conception to birth, (the term embryo is not used for the first few weeks of life).
Medical Genetics:	The medical specialty, often referred to as Human Genetics (in Scotland) or Clinical Genetics (in England).
Neonate:	The baby from birth to approximately one week afterwards, though this may be extended if baby kept in hospital beyond that time.
Perinatal:	The period around birth, ie before, during and after birth. Specific official definitions are mentioned in the text.
Reproductive Medicine:	Used in this thesis to include Paediatrics, Obstetrics and Gynaecology and Medical Genetics.

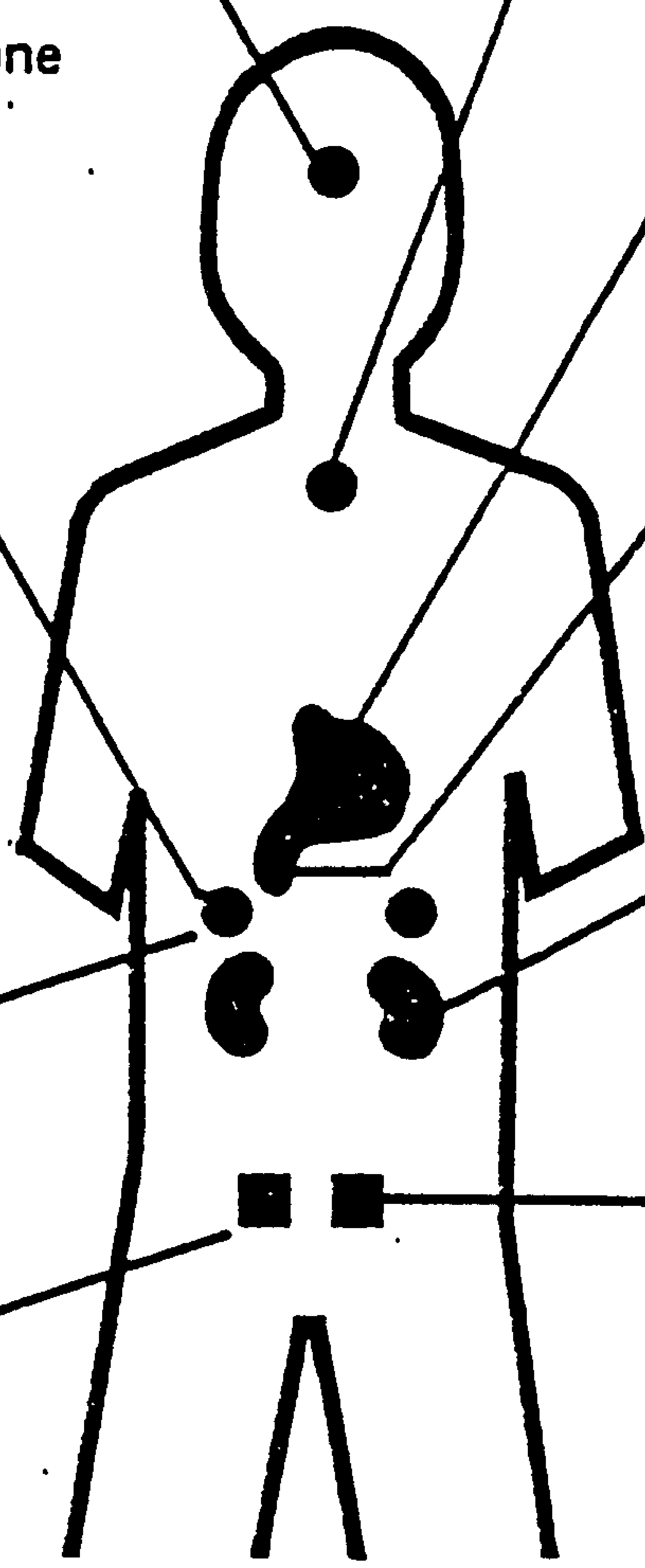
*** (p,xx) refers to the page number of the thesis

Hormone Assays (Searle)

PITUITARY
Plasma
- Prolactin
- Growth Hormone
- Luteinising Hormone
- Follicle Stimulating Hormone
- Thyroid Stimulating Hormone

Urine
- Luteinising Hormone
- Follicle Stimulating Hormone

THYROID
Plasma
- Thyroxine
- Triiodothyronine
- T3 Binding Index
- P.B.I.



STOMACH
Plasma
- Gastrin

ADRENAL CORTEX
Plasma
- Cortisol

Urine
- Pregnanetriol
- 17 Oxosteroids
- 17 Hydroxycorticosteroids
- 17 α Hydroxyprogesterone

PANCREAS
Plasma
- Insulin

KIDNEY
Plasma
- Aldosterone
- Renin

ADRENAL MEDULLA
Urine
- Catecholamines
- Vanilyl Mandelic Acid

OVARY
Plasma
- 17β Oestradiol
- Progesterone

Urine
- Total Oestrogens
- Pregnanediol

TESTES
Plasma
- Testosterone

Urine
- Testosterone

FETO-PLACENTAL UNIT
Plasma
- Oestriol
- α Fetoprotein
- H.P.L.

Urine
- H.C.G.
- Oestrogens

(from SCOTTISH HEALTH STATISTICS, HMSO)

SCOTLAND APPENDIX B

NUMBER OF CONSULTANTS
(%OF TOTAL CONSULTANTS)

	1950	1962	1964	1966	1968	1970	1972	1974	1976	1978	1980
Paediatrics	19	39	39	35	38	43	50	58	64	64	67
	(2.7)	(3.6)	(3.1)	(2.5)	(2.6)	(2.7)	(3.0)	(3.1)	(3.1)	(3.0)	(3.2)
Obstetrics	58	81	93	100	103	112	113	113	119	113	117
	(8.4)	(7.6)	(7.4)	(7.1)	(6.9)	(7.1)	(6.7)	(6.0)	(5.8)	(5.3)	(5.5)
Total nos	692	1070	1252	1401	1490	1570	1674	1886	2061	2109	2116

The total number of consultants in hospital practice in Scotland rose from 1950 to 1980(though the population remained fairly static). Both medical paediatrics and obstetrics also saw a rise in the number of consultants. But whilst paediatrics showed an overall increase in the % of consultants to the total number during that period-from 2.7% to 3.2%,obstetrics showed an overall decrease-from 8.4% to 5.5%. Although this thesis has not attempted to specifically relate these figures to processes within the two specialties,it would obviously be a field worth studying.

% DISTINCTION AWARDS AND RANKING PLACE

	1962	1964	1966	1968	1970	1972	1974
Paediatrics	43.6	35.9	45.7	50.0	53.5	46.0	44.8
	6	6	3	4	7	7	8
Obstetrics	29.6	28.0	30.0	33.0	32.1	34.5	33.7
	18	12	12	11	13	15	17

The number of distinction awards held by a specialty can be regarded as a prestige indicator. But because there is a wide range of actual numbers a better measure is relationship of those holding awards in the specialties, to the total number of awards. This % was used in the above table to show the change over time. Paediatrics returning in 1974 to its 1962 figure, whilst obstetrics show a slight rise. The ranking of these % are also shown, and though there may be some significance in these, the picture is complicated by the fact that there were 23 specialities until 1970, then there were 27 from that date.

*Surgical paediatrics has not been charted for it was not listed as a separate specialty until 1970, and the numbers are small, about 12. Similarly human genetics is also not listed for it was not separate till 1970 and the numbers are between 3 and 4.

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PERSONAL INTERVIEWS

Name	Date	Position at Time
AMULREE, Lord	(1977)	Retired Consultant Geriatrician, London
ANDERSON, Sir F.A.	(1977)	Professor of Geriatric Medicine, Glasgow
BLYDE, J.	(1977)	Sales Manager, Ethicon, Edinburgh
DUNCAN, A.S.	(1977)	Retired Professor of Obstetrics and Gynaecology, Edinburgh.
DUNLOP, Sir D.	(1977)	Retired Professor of Therapeutics, Edinburgh.
EAVES-WALTON, P.	(1977-79)	Archivist, Royal Infirmary, Edinburgh.
FARVIS, E.	(1977)	Professor of Electrical Engineering, Edinburgh.
FLETCHER, S.F.	(1977-83)	Senior Lecturer in Pathology, Edinburgh.
HARPER, E.M.	(1979-83)	Senior Lecturer in Microbiology, Glasgow.
JULIAN, D.G.	(1979-81)	Professor of Cardiology, Newcastle.
KENNEDI, R.M.	(1977)	Professor of Biotechnology, Glasgow.
LEASK, E.	(1977)	Administrator, C.S.A., Edinburgh.
MACKENZIE, D.	(1985)	Lecturer, Sociology, Edinburgh.
MACLEOD, N.	(1977-84)	Senior Lecturer, Chemical Engineering, Edinburgh.
McWHIRTER, R.	(1979)	Retired Professor of Radiotherapy, Edinburgh.
MANDERS, R.	(1981)	Lecturer in Nursing Studies, Edinburgh.
MATHESON, Major-Gen.	(1977)	Dean of Postgraduate Medical Education, Edinburgh.

MILNE, A.	(1979)	Consultant Anaesthetist, Edinburgh.
MOOSA, A.	(1979)	Neonatologist, Los Angeles, U.S.A.
MYERSCOUGH, P.	(1979)	Consultant Obstetrician, Edinburgh.
NICOLSON, M.	(1985)	Lecturer, History of Medicine, Edinburgh
PATTERSON, F.	(1979-83)	Sociologist, Edinburgh,
PHILLIPS, C.I.	(1977)	Professor of Ophthalmology, Edinburgh.
RAPSON, J.	(1977)	Sales Manager, G.E.C., Edinburgh.
SIMPSON, D.	(1977)	Professor of Orthopaedic Bioengineering, Edinburgh.
SCHULTZ, P.	(1977)	Sociologist, Denver, U.S.A.
TAYLOR, D.	(1977)	Senior Lecturer, Physiology, Edinburgh.
TEMPLETON, A.	(1979)	Senior Lecturer, Obstetrics and Gynaecology, Edinburgh.
TYRER, J.	(1985)	Lecturer, Mechanical Engineering, Loughborough.
WADE, D.	(1977)	Chest Surgeon, Edinburgh.
WHEATLEY, D.	(1979)	Cardiovascular Surgeon, Edinburgh.
WILKIE, P.	(1978-84)	Research Fellow (Genetics), Glasgow.
WILLIAMSON, J.	(1977)	Professor of Geriatric Medicine, Edinburgh.
Anon A	1980	Obstetrician
Anon B	1981	Senior Obstetrician
Anon C	1981	Senior Midwife
Anon D	1981	Senior Midwife