BIOTECHNOLOGY AS MEDIA:

A CRITICAL STUDY OF THE MOVEMENT OF MEANINGS ASSOCIATED WITH CONTEMPORARY BIOTECHNOLOGY

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Abstract

This thesis purports to make two contributions to understandings of biotechnology. First, it presents a novel framework through which to view biotechnology as a complex series of fundamentally social and politically economic mediations rather than a decontextualised collection of technical and scientific phenomena. Second, the thesis presents a method for analysing contemporary discourses about biotechnology within this framework. The framework presented in the first content chapter of the thesis identifies what I see to be the four primary mediating "movements" that are central to seeing Biotechnology as Media: Alienation, Translation, Recontextualisation, and Absorption. The next chapter explicates these movements more fully using a combination of social practice and discourse theory. Using these four movements and the mediation framework as a guide, I then critically analyse a corpus of seventy two exemplary texts (approximately 700,000 words) about contemporary biotechnology.

Mediation, in the sense I use it here, is not concerned with one particular media form or technology. Rather, it focuses on the process of mediation as the *movement* of meanings (Silverstone, 1999). I argue that seeing biotechnologies as mediations can provide a deeper and more critical understanding of how ways of seeing, being, acting, and describing (discourses) associated with contemporary biotechnology are moved from micro- and macro-biological and scientific contexts into the everyday lives of citizens and ecosystems. In particular, such a view highlights the forces and voices that currently determine the path and substance of political-economic movements in biotechnology and, consequently, how everyday perceptions of biotechnology are shaped or silenced in processes of mediation.

A core assumption of the thesis is that processes of mediation are not neutral. Rather, they are always inherently interpretive, politically economic, and ethically significant. Any mediation involves "filtering" processes via which "content" is transformed into a form that is appropriate

for a given medium by persons who have control over the medium, and by the nature of the medium itself. This applies as much in laboratory and scientific contexts as it does in the contexts of mass consumption, whether in newspapers, policy papers, movies (such as Gattaca), or consumer goods. The same is true in the mediation of biotechnology: there are technological and discursive restrictions on what and who can "contribute to" and "come out" of biotechnology and also what is construed as being a valuable and desirable outcome of biotechnology research and development.

The three central analysis chapters of the thesis outline firstly how biotechnology can function as a time-based medium for the reproduction of already powerful discourses on, for example, the role of technology in human development and the consumer market as the moral medium between generators of new technologies and their "consumers". I identify exemplars of how the history of biotechnology and mediation (movement) is expressed in the corpus. This is followed by a more concentrated analysis of the ethical and social significance of the key "official" mediations presented in the corpus. I focus in particular on how the predominant policy evaluations of biotechnological mediations expressed in state, national, and international policy documents construct a "virtuous cycle" of product development that will ostensibly "deliver the benefits" of biotechnology to all citizens who, in the corpus, are framed predominantly as "consumers".

The final chapter of the thesis reflects on the significance of biotechnology at the macro level of social practices and systems. Apart from its direct function as a technical medium for alienating hitherto inalienable aspects of life, such as configurations of DNA, and turning them into products for sale, I argue that, as a suite of mediating movements, biotechnology has the potential to effectively, and for the most part invisibly, mediate our more general understandings and experiences of ourselves, of other species, and of the world we live in. More specifically, I argue that biotechnological mediations actively, and often forcefully, promote a narrowing of the range of evaluative resources on offer to the general community, and indeed to biotechnologists themselves. Biotechnological mediations can therefore be

described as part of a broader movement away from conditions of heteroglossia or dialogue (multi language, multi voice) toward conditions of monologia (one language, one voice).

The thesis concludes with an important question: if we can identify these narrowing effects or mediations of biotechnology by using techniques such as Critical Discourse Analysis and by seeing biotechnology in a mediation framework, what can we do to interrupt them and generate movements that are more generative of heteroglossic and socially responsive ways of seeing, being, and acting? I offer a number of responses to the question in the conclusion.

The work contained in this thesis has not been previously submitted for a degree or diploma at any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

Signed:____

Date: ______________________________________

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Preface

This thesis is the culmination of many conversations, thoughts, ideas, and experiences that extend beyond the thesis period. The biotechnology focus to these ruminations began in 1999 when I undertook what seemed to be a promising position at the Brisbane Institute as Project Manager of the Institute's twelve month *Biofutures Policy and Awareness Strategy*. For readers who would not have heard of it, The Brisbane Institute refers to itself as an 'independent think tank' and 'public ideas forum' for Brisbane, Queensland, and Australia more generally. The Brisbane Institute is funded by sponsors: mostly large companies, universities, and the state government. The project I worked on, and my salary, was funded by the state government Department of State Development. A number of senior members of the Institute's Board were directly involved with local biotechnology firms and research institutions. I took on the job of designing a twelve month series of conferences and seminars that were intended to promote public awareness and policy development surrounding biotechnology research and commercialisation. The research component of the position involved a comprehensive mapping and analysis of the Queensland biotechnology research and industry sector, including a nation wide survey of the "bioindustries" labour force and the distribution of all science related public funding for 1999-2000. The purpose of that research was to determine where Queensland's 'strengths' and 'weaknesses' were in terms of a biotechnology industry 'critical mass'. This research had the potential to either validate or invalidate Premier Beattie's claims that Queensland was, or would soon be, the biotechnology ‘hub’ of Australia (cf. for example, Beattie, 1999). This included my conducting 24 interviews with local biotechnology scientists, science bureaucrats, consumer representatives, and chief executive officers and managing directors of Queensland biotechnology firms. Several of the interviewees have since given permission for their interview transcripts to be used as a resource in this thesis.

Every person I interviewed for the research identified that they were dissatisfied with the level of debate – or lack thereof – over where biotechnology was going. Only two interviewees out of the 24 interviewed said that they had participated in a forum that they felt was effective in exploring and responding to the social aspects of the technology. Consumer representatives were particularly concerned with the polarisation of debate into ‘for’ and ‘against’ camps. This sense of frustration with the current level of discussion and debate around biotechnology research and commercialisation is where my thesis essentially began.

The time I spent at the Brisbane Institute was not, as I had hoped it would be, dedicated to promoting critically informed public awareness of biotechnology. Rather, my time was primarily taken up in attempting to navigate the multiple and varied interests that were launched on the Institute in relation to the biotechnology “awareness” program. The pressure to pursue a unquestioned industry development agenda, and not to publish anything that could be seen to be critical of local developments in biotechnology, grew increasingly over the 12 months from both internal and external sources. The result was that I and my colleagues developed a sense of being vastly constrained by the politics of the situation, particularly as we became personally affected by our interactions with others in the field. Most particularly, we were confronted by the sense that commercial developments in biotechnology were, apparently, beyond critical discussion and public control.

I and my colleagues in various institutions at the time felt that the social space for informed discussion and questioning of developments in biotechnology was being controlled by a strong industry-government focus on expanding and commercialising biotechnological research. The space for ethical and social deliberation, and the voicing of concerns from persons who are directly affected by some of the new genetic technologies, was severely curtailed in an often threatening and patronizing manner. Since leaving the Brisbane Institute, some of my professional activities in biotechnology and ethics have been directed toward opening out these spaces for critical reflection and discussion in biotechnology, and in challenging the dynamics of silence and silencing that I had witnessed in many public biotechnology forums.

A significant proportion of the first year of this PhD was spent collecting and analysing the existing public "education" materials available on biotechnology. Using the methods and philosophy of Critical Discourse Analysis (CDA) in particular, I was interested in identifying the *range* of resources that we (citizens) are offered through a range of sources as we attempt to make sense of, and evaluate, the various claims surrounding the potential benefits and costs of biotechnology research and commercialisation. In addition to these textual resources, I was also interested in the kinds of public consultation mechanisms that were on offer, who controls them, and how they portray – or don't portray – the different agents who are directly or indirectly affected by new biotechnologies. What I found was that the curtailing of dissent and strict demarcation of discussion and debate I had witnessed at the Brisbane Institute was also present in the range of biotechnology education materials on offer. So, not only was there a limited range of critical works available to the public, there was also very little respected or publicly funded socio-political space within which to create alternative or contesting resources.

These initial rounds of analysis eventually transformed into a broader theoretical and conceptual examination of how biotechnology as a social practice – as opposed to a merely a technical one – influences the range of meaning resources we have on offer to us not only in understanding and evaluating biotechnology research, but also in understanding and evaluating broader societal movements, aims, and trajectories. To understand the social impacts of biotechnology more fully, I had to find some way of understanding the ways that biotechnologies and the associated ways of seeing and acting 'moved' beyond the laboratory into new and different social and ecological contexts. This is where Biotechnology as Media entered the equation.

Before delving into these discussions any further, I would like to emphasise that I have directly experienced and observed, and continue to experience and observe, many of the pressures, movements, discourses, and political interactions that are discussed in this thesis. What began as an attempt to simply make sense of these experiences, and be a participant in them, has evolved into the theoretical-conceptual rendering of biotechnology as media that you are about to read. As perhaps is the experience of many doctoral candidates, I have come to see at the end of the thesis writing period that my work has only just begun. I offer the thesis therefore as an initial 'map of the territory' with the hope that it will assist others in their attempts to comprehend, and respond to, the ever increasing detail of a modern biotechnology terrain.

Chapter 1 Introduction

Introducing biotechnology

One of the primary challenges that citizens – and this category includes academics, business people, lawyers, politicians, and scientists – encounter when attempting to understand and evaluate "biotechnology" is its broad nature and the very different range of contexts, practices, discourses, techniques, and persons it involves, uses, or affects. Official institutional definitions of biotechnology oscillate between framing biotechnology as any scientific technique that *uses* or consumes one aspect of a living organism as a tool to do something else (viz bio-technology) and technologies that produce a complete living organism or bio-product of a certain type or quality. So, for example, biotechnology can include anything from using reproductive technologies to select an embryo that does not have the genetic traits of, for example, Down's Syndrome, to using yeast to make bread or hops to brew beer.

Current examples of bio-products include do it yourself DNA screening and diagnostic kits for sale via the Internet; genetically engineered vaccines and drugs; replacement body parts harvested from genetically engineered animals for xenotransplantation[1] into humans; compounds produced in, and harvested from, genetically engineered or naturally occurring organisms;

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[1] Xenotransplantation includes 'any procedure that involves the transplantation, implantation, or infusion into a human recipient of human body fluids, cells, tissues, or organs that have had ex vivo contact with live nonhuman animal cells, tissues, or organs. The definition includes human embryos co-cultured with living nonhuman animal cellular material, such as bovine tubal cells or Vero cells, and includes feeder layer cells irradiated to render them nonproliferative' (Crawford, 2002).

human skin for sale; living bacteria that consume and convert pollutants such as diesel; reproduction technologies and services for example, donor insemination, in vitro fertilisation, and animal cloning; pre natal genetic screening for genetic diseases and conditions such as Down's Syndrome and Thalassemia; and animals, plants, and foodstuffs that are genetically engineered to display particular traits, such as taste, colour, lower levels of body fat, heat or cold resistance, insect resistance, or stress resistance.

Most of the technologies that we refer to as biotechnologies are different from the kinds of technologies of mass production we have known in the past: these are not generally the kinds of technologies that require a lot of space to be housed or fuel to run. Many of the so called biotechnologies are actually technical knowledges and associated laboratory tools and computerised techniques that sit in, and in the spaces between, a range of scientific and industry minds and computing networks in a range of scientific disciplines and industry areas. Areas of scientific inquiry involved in biotechnology include, for example, molecular biology; genomics; functional genomics; computational biology; microbiology; bioinformatics; genetics; animal husbandry; chemistry; pharmacy; biomedicine; agriculture; pharming[2]; and aquaculture. So, although we hear a lot about "biotechnology" or "gene technology" as a new area of science, it doesn't really exist in isolation from any of these branches of science, from longer term traditions of human biological intervention in physical life forms and

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[2] Pharming involves genetically engineering and growing animals and plants that produce compounds used to produce pharmaceuticals for human and veterinary purposes.

systems, from the existing and emerging bio-productive apparatus or, in fact, from public policy initiatives, industry, and government priorities upon which it is still highly dependent in OECD countries including Australia.

Further, I observe that the social practice of biotechnology is a *purposive*, and in most countries now, a *formal hybrid* of these scientific practices with industry practices and contexts. I do not assume though that the science-industry hybrid that characterises contemporary biotechnology is new to science. Rather, science has an ongoing history of collaboration and co-determination with industry that has, at different periods in history, become more or less prominent (cf. Ben-Chaim, 2001; Chen, 1992; Gaudillière, 2001; Leiss, 1994). Ravetz (1971) identifies four different conceptions of the relationship between science and industry, including the possibility that science should be free of any associations with the state or industry.

> 1. The idea of science as a technique important to industry;
> 2. The idea of industry as a technique (productive apparatus) important to science;
> 3. The idea of science as a form of knowledge valuable in itself; and
> 4. The idea of science as a vehicle of liberation from dogmatic attitudes and irrational faith (Ravetz, 1971, in Leiss, 1994, p. xi).

All of these conceptions of science and its relationship or non-relationship with industry and capital are present in contemporary discourses and definitions of biotechnology yet, obviously, some are more prominent than others. While all are present in the discourse, it is notable that contemporary biotechnology policy prescribes that commercial industry intervention in biotechnology research and development activities are vital and indisputable requirements for deriving benefits from biotechnology.

The rhetorico-economic enhancement of biotechnology

A consistent finding in the critical literature that deals with language practices surrounding biotechnology is that government and scientific institutions have primarily sought to ‘indoctrinate rather than illuminate’ (Seedhouse, 2001) the public so that they will accept and value biotechnology products and services (cf. for example Hindmarsh, 1996; Hindmarsh, Lawrence, and Norton, 1998; Fraser, 2001; Sunderland, 2000). The authors cited above analyse public education brochures on genetically modified foods, touring CSIRO science education vans, public speeches made by influential scientists, politicians, research directors, and information booklets and discussion papers circulated by “independent” think tanks, and so on.

My critical discourse analysis of a corpus of policy, education, industry, and interview texts, has confirmed these same dynamics of indoctrination across a range of textual genres in biotechnology. The highly prophetic “biotechnology is our future” discourse in particular is entrenched in the policies of all of the countries represented in the thesis corpus. The degree to which Politicians have “hedged their bets” on biotechnology is evident in a speech presented by the Queensland Premier Peter Beattie to Tokyo business leaders in 1999.

> Like you, I am obsessed with the immense potential biotechnology has to improve our quality of life and to create a future for our children. Australia is one of the 12 mega-diverse[3] countries on earth. And Queensland has more than its share of this natural wealth. Some 20 of Australia's bioregions are in Queensland. And a further 15 marine bioregions occur in Queensland waters. We have five world heritage-listed sites covering some 40 million hectares, including vast wet tropics areas, and Fraser Island - the world's largest sand mass. Our Reefs and Rainforests make Queensland not only a magnificent place to work, live or holiday - but they also present a unique opportunity to claim a future in this great industry. (Beattie, 1999, np)

This excerpt is indicative of things to come. Here, Premier Beattie not only claims biotechnology as his and his audience's 'obsession', but simultaneously construes Queensland's "biodiversity" as something to be exploited. This discourse of discovering and exploiting natural resources in the form of biodiversity is, arguably, at the base of dominant "official" representations of biotechnology research and commercialisation.

Biotechnology scientists and industrialists refer to the process of looking for exploitable "value" in natural world as "bioprospecting". Bioprospecting is very simply 'biotechnological research that looks for a useful application, process, or product in nature' (United States National Parks Service, 2002, np). Beattie's claims regarding the competitiveness of Australia and Queensland rests upon the degree to which economic value can be technologically extracted from Queensland's megadiverse ecosystems. Bio-

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[3] Approximately 12 countries in the world (Australia, Brazil, China, Colombia, Ecuador, the United States, India, Indonesia, Madagascar, Mexico, Peru and the Democratic Republic of the Congo) contain 70% of our planet's biodiversity. These countries are known as being "Megadiverse".

prospecting, as the name suggests, is ideationally consistent with traditional land mining practices and views except that it is living organisms (for example, corals, marine animals, or snakes) that are being screened and mined for things (for example, venoms, novel compounds) that can be transformed into a useful/valuable bio technology or product (for example, new drugs, anti-venoms, bioremediation organisms). A point to note here is that the object of bioprospecting is literally *anything that is living that can be mined for potential use value*. This practice of bioinformatics is central to biotechnology's mediating impact in that it expands the range of contexts and organisms that can be subjected to instrumental imperatives of capitalist production.

Bioprospecting – and biotechnology more generally – relies significantly on information and communication technologies (ICTs). This interaction with ICTs is commonly referred to as "bioinformatics". Bioinformatics is 'the science of developing computer databases and algorithms for the purpose of speeding up and enhancing biological research' (UF Interdisciplinary Bioinformatics Initiative, 2001, p. 1). Bioinformatics has been used most noticeably in the Human Genome Project where scientists worked with mathematicians, statisticians, and computational specialists to develop software programs that could be used to catalogue and analyse human DNA. Students in Bioinformatics receive training in molecular biology and in computer science, including database design and analytical approaches (UF Interdisciplinary Bioinformatics Initiative, 2001, p. 1).

Thus, while much focus is on the biological science tools and techniques, biotechnology is more accurately described as “converging” biological and information technologies (cf. Graham, Isaacs, and Sunderland, 2002, p. 20; Thacker, 2000, 2002). Eugene Thacker’s work on “biomedia” is perhaps the most specific exploration of this phenomenon of technical and biological convergence. Thacker (2002, p. 1) uses the term “biomedia” to describe the ‘technical recontextualization [sic] of biological components and processes’. Extending on Donna Haraway’s (1990) work on cyborgs, Thacker (2002, p. 1) describes ‘the way in which the body-technology relationship is transformed in biotech research, from a relative separation (human-user, machine-tool) towards a specific implosion (the biologization of technology)’. Indeed, the term *bio-technology* provides an interesting illustration of the convergence of these two spheres of the biological and the technical as manifest in language.

Perhaps most significantly, the use of ICTs in biotechnology is directly patterned in the thesis corpus with discourses of *speed* and *acceleration.* It is also interesting to note that computer screens are frequently featured in pictorial representations of all biotechnology contexts in the thesis corpus – except “third world” and “developing countries”. The focus on speeding up biological research is also indicated in the above definition of bioinformatics. The emergence of “high throughput screening”; “high throughput analysis”; and “high throughput biology” in local research institutes reaffirms the focus of ICT use in biotechnology as being on speeding up the research and development process and on being able to process large amounts of 'data' (i.e. screening genomes or the materials harvested through bioprospecting such as corals, plants, venoms, shells).

Discourses of speed in biotechnology relate interdiscursively to what Armitage and Graham (2001) refer to as "dromo-economic" imperatives for speed, efficiency, and productivity in contemporary political economy (see also Pace, 2002). Quoting Armitage and Graham (2001, p. 3): 'Virilio believes that the logic of ever-increasing acceleration lies at the heart of the political and economic organisation and transformation of the contemporary world'. As Virilio puts it:

> To me, this means that speed and riches are totally linked concepts. And that the history of the world is not only about the political economy of riches, that is, wealth, money, capital, but also about the political economy of speed. If time is money, as they say, then speed is power. (Virilio, 2000, in Armitage and Graham, 2001, 3-4)

Speed is also important in contemporary biotechnology due to the increased focus on patenting and licensing. As a reviewer of this thesis points out, you cannot patent if you are not first to develop or "discover" a particular genetic technology. As an example, the following excerpt from the United Nations' Human Development Report for 2001 presents contemporary biotechnology practices as being preferable to traditional breeding precisely because they can do it faster:

> Traditional cross-breeding takes a long time, typically 8-12 years. <u>Biotechnology speeds the process</u> of producing crops with altered traits by using a specific genetic trait from any plant and moving it into the genetic code of any other plant. More significantly, <u>the modification of plants is no longer restricted by the characteristics of that species</u>. (UN Human Development Report, 2001)

Of note as well is the fact that the authors of the UN Human Development Report also esteem the fact that plants can be engineered and produced using the genetic characteristics of other species which was not possible using traditional cross breeding techniques.

Why biotechnology is significant as media

Biotechnology is significant as media firstly because, as a practice, it produces and reproduces certain ways of seeing the world in multiple social and ecological contexts. Based on a critical discourse analysis of policy, education, industry, and interview texts, I observe that biotechnology discourses are shaped by, and in turn perpetuate, a range of historically salient discourses in western society. These include, for example, foregrounding economic capital and technological determinism in discourses of human development; using natural resources and contexts as materials and sites of capital production; focusing on speed and acceleration in technological and economic progress rather than extended contemplation of social and ecological factors; and the artificial demarcation of allegedly "rational" and "objective" physical sciences from allegedly "irrational" or "emotive" social sciences and practices of ethics, faith, or politics.

Multiple institutions and practices in Australia have been transformed in the same way that biotechnology is being transformed to accord with dominant economic imperatives at present (Bainbridge, 1997; Leiss, 1994; Marginson, 1997; Pusey, 1991; Saul, 1997; Sunderland and Graham, 1998; Yeatman, 1993, 1998). These include practices as pervasive and potentially influential as education, health care, and public service. Viewed in this socioecological, socio-historical context, biotechnology is but one development in a more pervasive social trajectory toward economic totality in social and biological life. Although it cannot be seen as a completely new phenomenon, biotechnology is a notable development in this trajectory because, since the advent of genetic technologies in the 1970s, and the ongoing "gold rush" for intellectual property rights on previously inalienable DNA, humans can not only design, commodify, and homogenise social processes and practices such as education, health care, public service delivery, *they can also more thoroughly or fundamentally redesign, commodify, and homogenise living organisms to accord with the dominant productive requirements of the day*. Hence, the sphere of assumed human control over other humans and species is increased.

Biotechnology is, thus, also significant as media because it increases the range and depth of potential sites and contexts within which dominant conceptions of progress, the good life, and so on, can operate. Bakhtin describes the tendency toward, and associated politics of, particular homogenising discourses as a "centripetal" force toward a central point. This is opposed to "centrifugal" forces which promote movements away from this central point toward heterogeneity. Both the centripetal and centrifugal forces, he argues, are played out in language.

> …there are two forces in operation whenever language is used: centripetal force and centrifugal force. Centripetal force… tends to push things toward a central point; centrifugal force tends to push things away from a central point and out in all directions. Bakhtin says that monologic language (monologia) operates according to centripetal force…The centripetal force of monologia is trying to get rid of

> differences among languages (or rhetorical modes) in order to present one unified language. Monologia is a system of norms, of one standard language, or an "official" language, a standard language that everyone would have to speak (and which would then be enforced by various mechanisms, such as Althusser's RSAs and ISAs). (Bakhtin in Klages, 2001, np)

I argue that these centripetal and centrifugal movements toward and away from heteroglossia are the broadest level of mediation associated with biotechnology. In consonance with Bakhtin, I posit that these movements are mediated by, and manifest in, language. The concepts of heteroglossia and monologia are thus central to the thesis.

Bakhtin's heteroglossia rose out of Soviet culture during, and in response to, Stalin's 'revolution from above' from 1928-32 (Brandist, 2002, p. 92). Bakhtin invokes the concept heteroglossia to argue against the idea that an artificially imposed "national language" could possibly represent the intense stratification and diversity of language that constitutes a culture.

> The internal stratification of a single national language into social dialects, group manners, professional jargons, generic languages, languages of generations and age groups, languages of trends, languages of authorities, languages of circles and passing fashions, languages of socio-political days, even hours (every day has its slogan, its vocabulary, its accent) (Bakhtin, 1981, pp. 262-3, in Brandist, 2002, p. 115)

Bakhtin emphasises that, at any given moment of its becoming, language is stratified not only into linguistic dialects in the strict sense of the word (according to formal linguistic markers, especially phonetic), but, also into 'socio-ideological languages: languages of social groups, "professional" languages,, "generic" languages, languages of generations'. (Bakhtin, 1981, p. 271-2, in Brandist, 2002, p. 113).

I argue that the rhetorical and discursive strategies involved in suppressing heteroglossia in biotechnology are not only political but have an inherent ethical significance. The natural heteroglossia that exists in a community or society incorporates multiple and varied points of view on the world which are in a constant state of becoming (Bakhtin, 1929/1986, in Lemke, 1995, p. 22). Moreover, heteroglossia 'creates the conditions for the possibility of a free consciousness' by its representation of the limits of discourse and, hence, interpretation (Morris, 1994, p. 16). By contrast, politico-rhetorical and discursive strategies that seek to impose and perpetuate monologia (even though this could never be wholly successful) not only threaten, but also devalue the natural diversity of voices and languages. Despite the rich range of contesting and marginalised voices that have responded to developments in biotechnology, proponents of biotechnology have promoted, and continue to promote, a monologic, positivistic agenda for accelerated biotechnological development. This, I argue, is of inherent ethical and political significance, a point I explicate further in the chapters that discuss critical discourse analysis (chapters 5-7).

Biotechnology proponents' attempts to overrun heteroglossic responses to biotechnology with an official, positivistic rationale and discourse are significant in a number of ways. Biotechnologies – when observed through a mediation framework – touch and transform many contexts. Their impact is not limited to the contexts in which they are directly produced or consumed.

For example, by the time a biotechnology product gets to market it will have been transformed on repeated occasions, and in multiple contexts, according to the discourses, practices, and processes of, for example, scientific research institutions and peer review processes, government policy directives, government regulations, government funding priorities, intellectual property guidelines and regulations, ethics committees, commercialisation, commodification, industrialisation, marketing, and so on. The "product" that eventuates is a complex "black box" of all of these social and technical processes and interests which perhaps no individual is able to account for (Latour, 1987).

Biotechnology can produce and consume anything from a strand of DNA, a single cell bacteria, an ovum, a sperm cell, an embryo, a species of plant, or a living person or animal. This fact is obscured in scientific discourse by the use of the term "living organism" to describe the objects and outcomes of biotechnology. The term "living organism" cannot capture the fact that persons can be, and already are, the outcome of these technologies. Moreover, there is almost nothing in the official representations of biotechnology to indicate that "potential" persons can be, and already are, prevented from being born as a result of these technologies when a foetus or fertilized egg is "discarded" because it has the genetic characteristics for, for example, Down's Syndrome. A foetus or fertilized egg may also be discarded for not displaying the genetic characteristics required for, for example, bone marrow transplantation with an older sibling.

But just as the bio-products and technologies themselves are repeatedly transformed, so too are the contexts – and the people who constitute them – that deal with them. To deal with each "new technology" mediating practices are required to generate, for instance, new laws; new ethical guidelines; new cataloguing techniques; new storage bins that keep GM from Non GM grains; and new consultation mechanisms for dealing with the public. Further, apart from being "workers" in a constantly adapting chain of vocational contexts for bio-product commercialisation development, humans, along with non human animals and plants, are also objects and "outcomes" of biotechnological research and commercialisation. By this I mean that humans are objects of scientific research and technologies used to alienate particular body parts or cells and they are also the products of these kinds of interventions.

A human baby can, for instance, be *technologically mediated into existence* through the use of IVF technologies, genetic screening, or genetic selection. Although still dependent on the presence of an ovum, sperm, and uterus, the resulting human is, within certain limits, a product of biotechnologies. The basic biological being of an adult human might also be transformed through gene therapy or other medicinal and therapeutic interventions. In a more extreme example, genetically engineered animals and plants are literally *produced* – as opposed to organically reproduced – using the techniques, technologies, and products of biotechnology: biotechnology is engineered and absorbed in the very substance of some animals' and plants' biological be-ing. In this case, processes and contexts of "animal" reproduction are superseded by “rational” processes of controlled economic production (Haraway, 1990, p. 191; Plumwood, 1993). Haraway (1990, p. 191) argues that this replacement of the “animal” with the “rational” has already permeated much of human and animal life. In her words, ‘we are all chimeras, theorized and fabricated hybrids of machine and organism; in short, we are cyborgs’. Jordan (1999, p. 4) similarly argues that science and technology have attained an ‘intimate and penetrating’ presence in our lives through surgery, dentistry, electronic devices such as pacemakers, and the constant digestion and absorption of pharmaceuticals, vitamins, and body enhancing chemicals.

Biotechnology is also significant as media because it is an inherently exclusive medium. In technologising and rationalising reproduction, practices such as biotechnology do not allow all humans to exercise “authorship” over their own, or others’, being. Rather, biotechnology – like any other specialist knowledge and practice – provides an inherently exclusive technological medium via which humans with the appropriate knowledge and position can produce and reproduce new or altered forms of human, and non human, life. As confirmed by the corpus texts, it is a reality that elite scientific, technological, and capitalist impulses predominantly define not only the *official* purpose of biotechnology practice, but also the *official* means of achieving that purpose and the nature of practitioners’ relationships with other practices, living organisms, and the natural environment. I use the term “official” here to emphasise that although there are dominant ways of representing biotechnology evident in the thesis corpus, these are not the only representations. Indeed, the interview transcripts with research scientists (as opposed to research directors or company CEOs) displayed a clear lack of these "official" ways of describing the purpose and means of biotechnology.

Key concepts and methods employed in the thesis

The methods of analysis employed in this thesis have both shaped, and been shaped by, the central conceptual and theoretical components of the thesis during all stages of its construction. It should be assumed that all conceptual and theoretical components of the thesis will act as "method" in their own right, and that the outcomes of progressive analyses have, in turn, significantly shaped the conceptual and theoretical framework developed throughout the thesis. Literatures relevant to both theory and analysis are interwoven throughout the thesis chapters rather than grouped into one literature review style chapter. This approach is consistent with the overall dialogic nature of the thesis and the research method. The key terms and concepts employed in the thesis are introduced below.

Media

Media in this thesis does not refer to particular media technologies or institutions such as television, radio, or print. I argue, rather, that contemporary biotechnology practices depend on processes of mediation: processes of shifting and politicising meanings. Seeing biotechnology through a "media lens" most importantly requires recognition that the process of mediation is fundamentally interpretive, evaluative, transformative, and perhaps most strictly, politically economic (Silverstone, 1999, p. 4).

> Mediation involves the movement of meaning from one text to another, from one discourse to another, from one event to another. It involves the constant transformation of meanings, both large scale and small, significant and insignificant, as media texts and texts about media circulate in writing, in speech and audiovisual forms, and as we, individually and collectively, directly and indirectly, contribute to their production (1999, p. 13).

In developing a framework for seeing biotechnology as media, I emphasise the various ways that any given social practice is both subject to, and initiator of, mediating practices that move both "into" and "out from" the permeable discursive "boundaries" of the social practice of biotechnology. Using critical discourse analysis (explained below) I have analysed the politico-discursive movement of biotechnology into a number of different social contexts into which core biotechnological products, ways of seeing, being, and acting are being "exported".

Based on this analysis, I observe that biotechnology as media has three primary aspects and implications: That is, biotechnology is simultaneously a technological, social, and historical medium. First, as indicated above, biotechnology is a technological medium for the production, alienation, technologisation, and commodification of living creatures and plants and other "life materials". That is, while the so called "new genetic technologies" can be used to design and produce a complete living creature that exhibits particular "desirable" characteristics, these technologies and techniques can also be used to alienate (remove from origin), commodify, and technologise (use as a tool for some other purpose) one particular aspect of a living creature or thing – such as deoxyribonucleic acid (DNA), a particular type of cell or enzyme, venom, or a derivative compound.

Second, biotechnology is a social medium for producing and reproducing particular ways of seeing, being, acting and describing over others (discourse). In highlighting biotechnology as social media, I want to emphasise that official discourses on biotechnology (i.e. those that are authorised by governments and other powerful institutions) produce and reproduce certain, identifiable evaluative and political orientations regarding what is progressive, normal, healthy, dispensable, desirable, undesirable, and so on. Throughout the thesis I maintain that governments' role in promoting biotechnology in multiple countries across the world – and in making it a basis for economic, industry, health, and science and technology policy – increases the potential power and influence of biotechnology to function as social media in multiple social contexts in and over time.

Finally, as indicated previously, I argue that biotechnology is an historical medium for the reproduction and rejuvenation of a number of historically salient discourses not only regarding what constitutes "the good life" but also who or what is included or excluded in that good life, and how we as a society or species might go about achieving that good life. I argue that, via the social practice of biotechnology, these historically powerful discourses and trajectories are being successfully reproduced, reinvigorated, and conveyed into new or expanded social and biological contexts. When viewed in this way, biotechnology can be seen literally as a medium between the past, present, and the future.

The term "context" is used in this thesis to denote a specific field of activity which may include multiple and overlapping social practices and geographical sites of activity. I may refer, for example, to "contexts of consumption"; "contexts of production"; "the laboratory context"; "the market context"; or "the body-context". I argue that contexts are significant because they set both formal and informal standards of discourse and interaction: contexts are "genres" of social engagement if you like (Bakhtin, 1986, in Eggins and Martin, 1997, p. 236; Weiss and Wodak, 2003, pp. 21-22). The contexts that are featured in the corpus and the broader thesis include:

- Spaces of abstraction prior to biotechnological intervention including, for example, ecosystems and the body context;
- Scientific research and teaching contexts in universities and schools;
- Laboratories in public and private research units;
- Computing machines and networks;
- Commercialisation, product development, and marketing contexts;
- 'The market' of exchange;
- Officially designated "public" contexts, including the supermarket, the street, the hospital, the clinic, and the workplace;
- Pharmaceutical companies;
- "The Bioindustries";
- The mass Media;
- Industry-research "clusters", "networks", and "hubs";

- "Developing" countries and "The Third World";
- "Global science and technology";
- Stock markets and finance;
- Agricultural production contexts;
- Government policy and regulatory contexts (ethics is usually included in regulation);
- Ecosystems and individual living organisms that have been or will be transformed through biotechnological intervention;
- Economies that will be transformed through the development of bioindustries.

As I explain in Chapter 2 – A Framework for Viewing Biotechnology as Media – different contexts require translation and transformation in the nature of biotechnological products, but, perhaps more significantly, the values that are attributed to them.

Through iterative phases of analysis and conceptualisation I have identified four primary mediating processes involved in *moving biotechnology discourses in and between* the contexts listed above: Alienation, Translation, Recontextualisation, and Absorption. I will henceforth refer to these as the four primary "movements" of biotechnology as media. The four movements describe in a cumulative way the discursive mediating processes via which aspects of "life" are technologically alienated from their origin; commodified and translated into, and interpreted using, existing technocratic discourses; recontextualised from living organisms and ecosystems, to the laboratory, to the computer, to markets of exchange, and once again to living organisms through consumption; and then finally absorbed into the everyday invisibility of the productive apparatus, the lives of citizens, and ecosystems.

I argue that these four movements, when combined, can be employed to understand the political, social, and ethical affects and transformations of biotechnology in a range of social contexts beyond the social practice of biotechnology itself. In illuminating the sites and contexts where apparently preordained and discursively limiting movements in meaning are promulgated and imposed, the biotechnology as media framework also highlights where counter movements can be made to open out and contest monologia.

Social practice

The conceptual framework for positioning biotechnology as media rests on a theoretical understanding of biotechnology as a social practice. Following Isaacs (1998), I define social practice as a socially constructed, socially constituted, and socially embedded[4] collection of persons, techniques, technologies, discourses, ways of seeing, being, and acting that are bound together toward the achievement (in actuality or representation) of a common purpose(s). A social practice is not an institution, although social practices do entail institutional dimensions of hierarchy and authority as indicated above. The term social practice is, rather, intended to signify practices that are characterised by shared traditions, ways of seeing, being,

[4] Social embedded nature refers to the way in which social practices 'exist within broader social settings and alongside other social practices' (Isaacs, 1998, p. 7).

acting, meaning making, and, particularly in the case of biotechnology in current times, designation of common orientation and purpose.

Diverging from Isaacs' original model, I argue that discourse and language are the primary means by which social practices are produced and reproduced over time and via which they shape, and are shaped by, surrounding social individuals, practices, and systems. In consonance with Bakhtin and Luhmann (1995), I argue, then, that language and discourse are the primary means via which social practices function as media. This argument depends on the characteristics of social practices as outlined by Isaacs:

> i. Social practices are constructed and constituted by persons;
>
> ii. Social practices are directed toward an overall purpose;
>
> iii. Social practices are shaped by tradition i.e. of what to do within the practice and how to do it;
>
> iv. Social practices depend on processes of learning and socialisation to recreate themselves;
>
> v. Social practices involve, but are not necessarily delimited by, an institutional or organisational dimension including the production and reproduction of positions and discourses of authority and power within the practice; and
>
> vi. Social practices exist within wider social and ecological systems. (Isaacs, 1998, pp. 3-8)

I posit that the notion of social practice provides a functional and effective framework for comprehending and analysing biotechnology in its social, political, historical, and discursive contexts. More generally, it allows me to foreground a socio-political and historical aspect to biotechnology, rather than a merely technical or economic aspect as is often the case in official biotechnology discourse.

Comprehending biotechnology as social practice also, and perhaps most significantly, allows me to highlight that the "boundaries" surrounding any given social practice are discursive and, hence, are permeable. This one feature of biotechnology as a social practice is perhaps the key understanding of the biotechnology as media framework. Permeable boundaries mean that discursive resources may flow both into and out from the social practice of biotechnology. Adding critical discourse analysis to the mix helps me to identify and critique the nature, content, and politico-ethical implications of these mediating interchanges.

Critical Discourse Analysis (CDA)

Critical discourse analysis is employed in the thesis to emphasise the social constitutive, political and rhetorical functions of language (cf. Gee and Lankshear, 1995; Weiss and Wodak, 2003). One of the key considerations of the thesis is to identify, through close textual and interdiscursive analysis, the way that biotechnology promotes particular voices and particular ways of seeing, being, and describing while at times actively subverting others. I understand that discourse has many meanings in academic and non academic circles, however, the term discourse will be used in this thesis to describe a specific dialogical relationship between ways of seeing, ways of being, ways of acting, and ways of describing. Unless otherwise indicated, the reader can assume that when I use the term 'discourse' I am also referring to these broader dialogic aspects of the term including ways of seeing, being, and acting.

My use of the term discourse is consistent with the CDA literature (cf. Fairclough, 2001, p. 1; Lemke, 1995, p. 24; Stillar, 1999, p. 91). As Lemke states:

> [Discourse refers to] the persistent habits of speaking and acting, characteristic of some social group, through which it constructs its worldview: its beliefs, opinions and values. It is through discourse formations that we construct the very objects of our reality, from electrons to persons, from words to 'discourse formations'. We necessarily do so from some social point of view, with some cultural system of beliefs and assumptions, and some system of values, interests and biases. We do this not as individuals alone, but as members of communities, and however we do it, whatever discourse formations we deploy to make sense of the world, our formations always have systematic sociological relations to their formations. We speak with the voices of our communities, and to the extent that we have individual voices, we fashion these out of the social voices already available to us, appropriating the words of others to speak a word of our own. (Lemke, 1995, p. 24)

In consonance with Stillar, I assume that 'discoursal and rhetorical acts [both] shape and reflect the social practices of groups in particular contexts' (Stillar, 1999, p. 91). Furthermore, I assume that this mutually constitutive relationship between discourse and social life is a feature of all social processes, relationships, and contexts. As Fairclough states, 'CDA is based upon a view of semiosis as *an irreducible element of all material social processes'* (Williams, 1977, in Fairclough, 2001, p. 1, italics added)

The rationale for using CDA in this thesis is that language acts are 'intimately connected to the social conditions out of which texts arise and to the social consequences that follow them' (Stillar, 1998, p. 90). While we may tend to see a written "text" as a static or object form of discourse, Stillar emphasises that discoursal or rhetorical texts are social and symbolic acts: 'A text is an active step in a sequence of related social goings-on. It does something in its social context…' (Stillar, 1998, pp. 1-3). A written code of ethics or a policy statement, for example, is obviously still a part of a social context(s) and is an active step in 'social-goings-on' (Stillar, 1999, pp. 1-3). Persons use a code of ethics or a policy document to express, influence, and regulate social-goings-on. These texts are officialised means by which authoritative actors and institutions, such as governments, articulate normative expectations and principles for engagement between persons.

Hence, a text is also a phenomenological manifestation of a range of different contexts, agendas, interests, and imperatives that are translated and recontextualised into [usually] written form. Although a text can be seen as being symbolic or representative, it does not originate or exist independently of the human agents who create and interpret it, their contexts and experiences, their intentions, and/or the action that the text initiates. As Stillar argues,

> …all symbolic acts articulate their participants' interests in – their orientation toward – what is being represented and who is being addressed. A symbolic act is not merely "about" something; it indexes our position with regard to that something – whether we think it desirable, possible, likely, good or bad, and so on – and with regard to that "someone" we are addressing – whether we tell, ask, or command,

> and whether we construct our addressee as “above” or “below” or “equal”. The symbolic act is the material with which we play out our motives, our interests, and our stance in relation to others and to ourselves. (Stillar, 1998, pp. 4-5)

Like Stillar, Lemke emphasises that each act of discursive interaction has an ‘orientational dimension’ (Lemke, 1995, p. 11). But while Stillar emphasises that the symbolic act is deliberative to the extent that it is the ‘material with which we play out our motives’, Lemke asserts that the orientational-political function of the symbolic act is in fact *unavoidable*. We can inadvertently through our symbolic acts commit ourselves to a particular political stance and social point of view in the eyes of others without, perhaps, even being aware that we have done so:

> We orient our meanings toward prospective audiences and we orient them within a system of different viewpoints available in the community toward our topic. These orientations involve value preferences: they commit us to a political stance and a social point of view on our subject and toward our audiences. They are inescapable, and to the extent that our viewpoint is determined by our social position, and by our social and political interests in any conflict between social positions, orientations meaning situates us in the realm of textual politics. (Lemke, 1995, p. 11-12)

Whether it is apparent or not, every text included in the thesis corpus makes claims on how its reader is to think about, and attribute value to, developments in biotechnology. There are many features of a text that can function in this way. Static object categories such as ‘the third world’, ‘the disadvantaged’, ‘the anti-biotechnology community’, ‘the disabled’, and ‘living organisms’, for example, have an objectifying function. These kinds of categories also have the added meta-function of privileging and promoting stereotypical, universal, and partial ‘sight lines’ of cognition over ones that might reveal and appreciate vulnerability, particularity, and/or difference (Steiner, 1975, p. 78).

In this thesis I have adopted Stillar’s (1998) approach of combining critical discourse analysis with functional grammar and rhetorical analysis. Close textual analysis using functional grammar is important because it highlights exactly *how* lexical and grammatical variation in a text *functions* to produce particular political, evaluative, and rhetorical ends. The everyday rendering of active processes (verbs) or persons (subjects/agents) as nouns (things) in scientific discourse is but one example of how grammar influences the evaluative orientation and epistemological impact of a text. The significance of this particular example is that, when a person is rendered as a thing or object, the necessity for others to be responsive *to the person as a person* is reduced or removed entirely.

Rhetorical analysis is important because it brings us to think about the way that we are persuaded to think about things in a certain way. Rhetoric in a very general sense is the study and practice of persuasion (Aristotle, 1991, pp. 1-2). Put very simply, the practice of rhetoric assumes that different and contending positions exist and, moreover, that someone needs to have their point of view changed. Rhetoric is employed to achieve three main functions:

1. Prosecution and defence (Forensic rhetoric);
2. Political transformation (Deliberative rhetoric); and

3. Aesthetic and artistic value (Epideictic rhetoric) (Aristotle, 1991, p. 81-2).

The subtlety of rhetorical and grammatical strategies in biotechnology discourse cannot be underestimated. In the pilot analysis for the thesis, for example, I compared two public education documents. One was produced by an Australian Government Agency Biotechnology Australia (BA), the other by the New Zealand Independent Biotechnology Advisory Council (IBAC). I chose these two documents to do a comparative analysis because, at first glance, they appeared to be very different. The BA brochure “Juggling Genes” is intended for a young audience, it is a full colour gloss publication and uses colloquial quirky language. The IBAC booklet by comparison is intended for adults and is quite a substantial A5 booklet presented with a matt cardboard cover in three colours: olive green, dusty red, and white. The major headings included in both documents are included in the table below to provide an indication of content and the style of language used:

Table 1 : Comparison of education documents

IBAC	BA
We want to know what you want to know	Fantastic farming
What is biotechnology?	Doggie diversity
Why think about biotechnology?	Getting into genes
The basics of life	How are genes juggled?
Classifying new biotechnologies	Gene technology benefits
Finding out about genes and DNA	Fancy food?
Moving genes around	Genetically modified food downunder
- GM bacteria	Is this really going to happen?
- GM plants	Who regulates gene technology and its safety?
- GM animals	Freaky, friendly or Frankenstein?
- GM humans	
Growing new tissue	
- Tissue culture	
- Cloning	
- Cross-species organ transplants	
Who is IBAC?	
- Our philosophy	

Upon analysis, I found the IBAC booklet to use largely the same strategies as Biotechnology Australia's Juggling Genes brochure. In particular, both documents used references to *new* and *newness* in relation to the benefits of biotechnology while referencing constantly to *tradition* and the *familiarity* of biotechnology development when outlining possible risks associated with future developments. Both documents also portrayed future benefits of biotechnology in a universal, positivistic and unquestioned way, whereas risks were portrayed only as potential considerations that 'might' occur in a limited number of situations. Analysing these documents ultimately showed me that even two documents I initially perceived to be quite different in their evaluative and rhetorical orientations, because of the different genres and presentation formats they were drawing on, were in fact rhetorically, grammatically, and ideationally compatible.

Corpus selection

Following this pilot analysis, I began to collect a range of texts that expressed “official” representations of biotechnology in the public sphere. As the reader will be aware, public acceptance of new technologies is mediated by a range of texts and rhetorical genres on offer to members of the public through the social medium. Resources include texts that are specifically designed to influence understanding (such as education brochures) and texts that are designed to do something else (for example establish a strategic plan for commercialising research) but which employ significant rhetorical strategies to justify and officially rationalise those plans. As indicated previously, policy and other institutionally authored texts are significant because they are official authorised statements of an organisation’s orientation toward something: the text is a ‘concrete realisation’ of abstract forms of knowledge, orientation, and evaluation (Weiss and Wodak, 2003, p. 13).

The resulting thesis corpus consists of 87 titles and 700,000 words (see Appendix for full list of corpus texts) including interview transcripts from scientists, science bureaucrats, consumer representatives, and biotechnology company managers in Queensland[5]; Australian State and Commonwealth level policy documents; international policy documents that are publicly available; policies and reports from transnational organisations such as the United Nations; public 'education' documents from a number of countries; and a number of corporate reports and media articles dealing with the biotechnology industry.

Criteria for text selection for written texts (other than interview transcripts)

i. Texts designed to influence public understanding of, and attitudes toward, biotechnology research and commercialisation (primarily policy, public awareness, and opinion pieces from select industry journals);

ii. Texts that describe the progression of biotechnology in society and methods for supporting and enhancing the practice;

iii. Texts that are designed to communicate an official rationale for, and account of, biotechnology for a particular group or institution;

Authors of the selected texts include:

- National and state government departments, agencies, and officials in Australia, Canada, Finland, Ireland, India, the Netherlands, New Zealand, the United States, South Africa, and Sweden;

[5] As indicated in the Preface, I conducted these interviews while working at the Brisbane Institute. Special permission was given from the interviewees to use the transcripts as a comparative resource in this thesis.

- Supra national policy and regulatory bodies such as the Commission for European Communities, the G8 Heads of Government, the OECD and the UN;

- Spokespersons and public relations professionals for a particular company or industry such as Abbott Laboratories, Monsanto, and Johnson & Johnson;

- Industry organisations such as Aus Biotech and the US Biotechnology Industry Organisation; and

- Government agencies responsible for promoting public awareness of biotechnology such as Biotechnology Australia, The New Zealand Independent Biotechnology Advisory Council, and the Canadian Council for Biotechnology Information (see www.whybiotech.com).

The interview transcripts have been used as a resource for comparison with other texts. The interviews are valuable because they provide accounts of biotechnology's objectives, means, and outcomes *as articulated by its practitioners*. They are also significant because they are not necessarily 'official' or 'authorised' statements regarding biotechnology. The veil of anonymity that surrounded the interview process also led to some unique statements and portrayals of different parties in the biotechnology "debate". The interviews are also special because they were delivered in the first person voice rather than the institutional voice.

Heteroglossia

As indicated above, my examination of the politics of discourse in relation to biotechnology as media is based primarily on Bakhtin's heteroglossia. Different aspects of the concept of heteroglossia have been foregrounded by different authors (cf. Beetham, 2002; Brandist, 2002; Haraway, 1992; Lemke, 1995, p. 24). There are two variations of the term that are significant for the thesis. Lemke's (1995) use of the term heteroglossia is the first variation. Lemke emphasises that aspect of heteroglossia that refers to 'the spectrum of interpretive and expressive tools from which a discourse community typically chooses in defining its world and the way the discourse community relates to heteroglossia in which it is embedded' (Bakhtin, 1929/1986, in Lemke, 1995p. 24). Used in this way, heteroglossia can highlight the range of intertextual and 'interdiscursive' (Fairclough, 2002) resources that we typically have access to in making sense of, and evaluating, a particular area of social development such as biotechnology.

Intertextuality refers to the notion that words do not relate to their "object" singularly but are located within, and related dialogically to, a range of other words that are directed toward the same object (Brandist, 2002, p. 113). What this essentially means is that meaning is not derived simply from one word or one way of representing something but, rather, is derived via the interaction between different words and different discourses pertaining to the same thing. For example, biotechnology is variously represented in the public sphere as (in rough terms):

a) A source of future wealth, health and prosperity;

b) A source of potential catastrophe and environmental damage;

c) A means by which to ease human suffering and malnourishment;

d) A source of social stratification and genetic discrimination;

e) A natural development for human kind;

f) An unnatural thing for humans to do.

In Lemke's terms, this range of representations (plus the many more that are on offer) of biotechnology constitutes an *intertextual spectrum* of meaning resources pertaining to biotechnology. The notion of intertextuality is that social agents do not simply derive their understandings of biotechnology from one of the representations, rather, they would be exposed to, and more or less responsive to, any number of representations of biotechnology in and over time.

Heteroglossia more generally refers to the range of meaning resources we have on offer in social systems: the full heterogeneity of voices, languages, and perspectives on the world that Bakhtin initially described – not merely those that pertain to a specific topic such as biotechnology.

> All the languages of heteroglossia…are specific points of view on the world, forms for conceptualising the world in words, specific worldviews, each characterized by its own objects, meanings, and values. As such they may all be juxtaposed to one another, mutually supplement one another, contradict one another, and be interrelated dialogically. (Bakhtin, 1935/1981, pp. 291-2, in Lemke, 1995, p. 24)

While Lemke emphasises intertextuality in heteroglossia, this is different from – but not inconsistent with – Bakhtin's original emphasis on the political aspects of language monologia and heteroglossia. While I will refer to intertextuality within the thesis, I posit that it is important to retain Bakhtin's original focus on the political and ethical significance of heteroglossia and monologia. Most particularly, the notion of monologia reminds us that, although a range of resources may be on offer within the social medium, some are foregrounded – or hegemonic – while others are marginal. We should neither discount the extensive range of discursive and rhetorical strategies that are at work to maintain distinct hierarchies and patterns of dominance in the politics of representation.

There is another aspect of heteroglossia that is not articulated heavily in the intertextuality version of the term: voices of the heteroglossia. In addition to the *languages* of the heteroglossia, Bakhtin describes a natural but suppressed diversity of *voices* that exist in any culture or social practice at a given point in time. The most notable uptake of/parallel to Bakhtin's notion of the heteroglossia in ethics has been feminist ethics. Haraway (1992, in Beetham, 2002, p. 178) argues that we must 'abandon the dream of a common language because it has too often been an imperialist one, in which the relatively powerful say they want a dialogue but they want it only on their terms and in their tongue'. Gilligan also argues for 'a different voice' that challenges the 'masculine' concern for justice as universal and offers in its place an ideal of care that is attentive to differences of need (Gilligan, 1982, 1995, in Beetham, 2002, p. 178). Like the feminist analysis of the masculine voice, Bakhtin, following Marr, argues that the imposition of a unitary national language is an artificial dictatorship over language and habitation in social reality: 'the dictatorship of artificial linguistic and literary standards opposes the "natural life of languages", especially those of oppressed socio-economic groups' (in Brandist, 2002, p. 112).

Hybridity

Social practices are always hybrid practices. This is because of a number of reasons. First, all of the people who *constitute* a social practice are simultaneously embedded in other practices, contexts, social groupings, and interactions. Second, the persons who constitute the social practice of biotechnology are "hybrids" of their own (and others') histories, experiences, social roles, and contexts. At the same time, each individual member of a social practice is shaped and informed by hybrid traditions that are passed on through the practice. Lemke defines hybridity as the notion that:

> particular utterances, even though the product of a single speaker, may contain within them elements of more than one dialect or discourse formation, thus producing new possibilities, which, if taken up by other speakers, can lead to linguistic and cultural change. (Lemke, 1995, p. 25)

The significant point to note in Lemke's definition is that hybridity can lead to linguistic and social change. But while hybridity is a natural state of discourses and social practices, hybridisation is not unfettered. The features of hybridisation are, on the contrary, strongly patrolled and controlled by both internal and external actors. Indeed, social practices are purposively *hybridized* to benefit particular purposes, individuals and/or groups (cf. Chouliaraki and Fairclough's notion of "inculcation", 1999, p. 13).

Hybridity between science and industry is a matter of public policy at state, national, and supranational levels. Although this government led co-optation of research and commercial interests is not new (cf. for example Ben-Chaim, 2001; Gaudillière, 2001), the science-industry merger is notable in biotechnology to the extent that Australian Governments' policy platforms for biotechnology actually *depend upon* this hybridising between science and industry. Hybridisation can be forced through public and institutional strategic policy and funding priorities. The following excerpt from an interview with a Research Scientist is indicative of the extent to which funding restrictions have actually precipitated the current convergence of biotechnology research science and industry:

> Gone are the days when you can dream up some wild idea and expect the department to fund it. You have got to really show that you are addressing real industry needs, you are addressing strategic directions set by government and those sorts of things. So I think those days are gone. I think most of us accept that. We still enjoy the work we are doing, we still get a buzz out of new discoveries and recognition for the work we do, so that is what drives us. But to do that we realise we have to get funding to do that. (Interview, Research Scientist and Team Leader, Government research institute)[6]

Apart from the use of particular terminologies and practices, deliberative hybridisation in biotechnology in response to public policy initiatives is based on creating relationships between people and contexts. These

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[6] Note: quotes from the thesis corpus will be presented in this arial narrow font throughout the thesis to aid the reader in differentiating them from other literature citations.

relationships are in turn mediated primarily through language and discourse. For example the relationship between a company and its shareholders might be fostered and developed while the relationships between a company and the public or relationships between humans and animals, nature are not acknowledged. What is significant in biotechnology policy is that policy makers a) recognise that hybridity occurs through the mixing of people from different contexts and practices; and b) they use it as a tool to create further hybridity between biotechnology, science, and industry.

Ethics

Ethics is frequently mentioned in government documents concerning biotechnology but it is a very particular discourse on/way of seeing ethics that is inscribed. In the Victorian Strategic Plan for biotechnology, for example, every reference to *ethics* is in collocate with the terms *regulation*; *committee*; *advisory*; and/or *safety*. The sheer consistency with which ethics is represented/collocated in this way in policy documents specifically relating to biotechnology suggests that is not just a tendency or coincidence but that the code/regulatory approach to ethics is in fact *a generic feature* of biotechnology policy and practice more generally. This is confirmed by the fact that the code and regulation approach to ethics is consistent across government departments dealing with biotechnology research and development in Australia and abroad. An example of the way that ethics is presented in biotechnology is provided in current debates over research on human embryonic stems cells.

In traditional orthodox ethics the ‘issue’ of stem cells is interpreted and debated within the bounds of standard bioethics concepts such as informed consent, moral agency, and utility (cf. American Society for Reproductive Medicine, 2002; Daley, 2000; Parker, 2003; Reiss, 2002). While these concepts might provide some particular insights that are useful for professional and amateur “ethicists” to kick around in relation to this particular issue, they simultaneously limit the discussion and debate to some strict parameters regarding what can be questioned and how. Moreover, they do not provide for broader ruminations on the mediating functions of particular technologies outside of the immediate context of the ‘issue’. Concepts such as autonomy, rights, and utility create both limited and particular sight lines that “ethicists” and others (including any consumer of mass media during periods when ‘issues’ such as these are debated) are encouraged to see as ‘ethical’ deliberation. Thacker observes,

> One of the primary issues in this [stem cell] debate is whether the future of stem cell research will be exclusively medical therapy or extra-medical enhancement. Much discussion has to do with whether the U.S. government should continue funding such research, knowing that one of the resources of stem cells is discarded embryos from infertility clinics (and thus intersecting issues pertaining to abortion and human experimentation into regenerative medicine). However, stem cells (and there are many different kinds of stem cells) exist in many different kinds of contexts, and it is unlikely that a single set of guidelines will be acceptable across all possible uses of stem cells in research. Beneath these ideological, ethical, and economic deliberations is a more troubling question: that, *with developing biotechnologies, the very notions of what counts as normative health may be in the process of being redefined.* (Thacker, 2002, p. 3, italics added)

Here, Thacker draws attention to the idea that, apart from standard issues of informed consent, moral agency, or utility, what constitutes a normal healthy human being is redefined by developments in biotechnology. However these issues have been hived off into academic social science disciplines rather than being incorporated in the ethics discourse. Obviously, health and wellbeing is a central aspect of what constitutes individual and collective conceptions of the good life. The redefining of the meaning of health along genetic lines is just one example of a mediating force associated with biotechnology.

Like approaches to public consultation in Australia (cf. for example Australian Law Reform Commission {ALRC}, 2001, 2002a, 2002b; Fraser, 2001) ethical "responses" have, under the directives of State and Federal Government departments, generally concentrated on one particular area of research or a specific issue relating to biotechnology research and commercialisation, for example, genetically modified (GM) crops; regulating ownership of genetic material; cloning; or stem cell research. Public "consultations'' have largely consisted of debate style interactions between an expert elite and a purportedly "lay" audience. As Fraser (2001, np) argues, the already dominant tendency in both ethics and public consultation is 'to simplify and reduce the variety and complexity of arguments to those that sit comfortably alongside scientific risk analysis'.

The prevalence of scientific risk analysis as a basis for ethical and community standards and procedures is not surprising given the dynamics of the practice of ethics more generally. "Ethics" is regularly portrayed in public discourse as an expert practice that seeks to provide solutions to particular moral questions, issues, and dilemmas. However, parallel with the intentions of CDA as expressed by Weiss and Wodak (2003), some contemporary approaches to applied ethics have emerged to devise social strategies for ‘channelling or constraining the power of persons so that all citizens may flourish, even those who are weak and vulnerable’ (Isaacs, 2002d, p. 4). Notable areas of development include feminist ethics; narrative ethics; environmental ethics; and ethics of “engagement”. Moreover, it requires persons – particularly those in positions of responsibility and power – to develop critical and interpersonal sensibilities that are not commonly promoted in modern consumer societies (cf. Marcuse, 1969/1972; Smythe, 1981, p. xv).

The focus of emerging approaches is to promote enduring social relationships – rather than one off responses or written guidelines – that contribute to the ‘ethical form of life’ (Isaacs and Massey, 1994, p. 2). In Isaacs’ and Massey’s words,

> For us, the overall point or purpose of applied ethics is practical and involves creating and sustaining relationships which mutually recognise the needs, interests and aspirations of all participants (stakeholders) as “ends in themselves”. The focus is on the continuing enhancing of the other and the self within the human social condition as it is actualised within specific situations, roles, practices, institutions and cultures. In short, applied ethics seeks to enhance the *ethical form of life*. (Isaacs and Massey, 1994, p. 2, italics added).

In consonance with Isaacs and Massey, May (1992) argues that the ethical way of life is concerned not just with an immediate or isolated *response* to given problem, issue, or dilemma, but with a general condition of responsiveness to others in our day to day relationships.

> An ethic of responsibility calls for people to be sensitive and responsive for those whom they have harmed or those whom they could help. The call for sensitivity carries with it a call for attention to the details of one's own life and the lives of those with whom one comes in contact. Rather than paying attention to what it is that we all share in common, for instance our "humanity" *an ethic of responsibility calls for us to pay attention to what is unique and even peculiar about one another. To gain this knowledge, we cannot be armchair theorists; rather, we must find out about the world, both the facts of the world that various people inhabit and the facts of how individuals respond to that changing world.* This means that *the social facts of how people in a certain situation relate to each other and affect each other, as well as how people's attitudes and desire are affected by such interaction, need to be taken quite seriously*…The concept of responsibility seems especially well suited to problems in applied ethics (such as those in professional or business ethics) because it has *an inherently social dimension*, namely, that *it is responsive to the way individuals relate to each other* (as we have seen) and to *the way individuals relate to groups*… (May, 1992, pp. 91-2, italics added)

A point to note is that this type of ethics "in the everyday" broadens not only the scope of the practice of ethics as we commonly understand it, but also the range of people who are regarded as being responsible for questions of ethics, and, moreover, *the range of socio-political experiences and relationships that are of ethical significance*.

When I refer to "ethics" in this thesis, therefore, I am not referring to ethics as a practice of formulating written codes and ethics committees. Rather, I am referring to ethics as a practice that is concerned with identifying and responding to the deeper issues of privilege, exploitation, and power that play out in biotechnology. My work in applied ethics seeks to identify the social, political, and ethical complexity of the social practice of biotechnology and, moreover, to subject that practice to critical social and ethical inquiry.

While some self labelled “ethicists” (cf. Caufield, Singer, and Flis, 2003; Savulescu, 1998) choose to practice ethics in biotechnology by championing a particular area of biotechnological research, the approach to ethics I follow is more concerned with identifying and critiquing aspects of the practice of biotechnology that may need to be sustained or transformed so as to maintain and support the health and flourishing of persons who are rendered vulnerable in relation to these new technologies (cf. Isaacs, 2002a). This approach has been informed particularly by my professional experiences as a coordinator of public discussions surrounding the ethics of biotechnology.

By using the biotechnology as media framework, I would like to offer academics, scientists, policy makers and hopefully many others a way of seeing biotechnology that helps them to comprehend biotechnology as something more than new technologies and techniques. I would like to illustrate that, through the politics and mediation of discourse, a social practice such as biotechnology has the capacity to transform and shape significant aspects of our lives both as humans embedded in social systems and as humans embedded in ecological systems. In this way, I posit that the media framework provides important understandings for the applied ethics agenda in biotechnology.

I argue that biotechnology is ethically significant at a macro societal level precisely because its proponents make stringent claims regarding not only what constitutes the good life, but how we as citizens, workers, and consumers are expected to achieve that good life. Apart from some exceptional contributions in the fields of critical anthropology (cf. Escobar, 1999), disability studies (cf. Clapton, 2002; Goggin and Newell, 2002; Newell, 2000), technology and culture studies (cf. Haraway, 1990,1999; Thacker, 2000, 2002), and select analyses of public relations and communications practices in gene technology (cf. Hindmarsh, 1996; Weaver and Motion, 2002), there has been little such in depth critical analysis of ethics and biotechnology at this macro level of social practice or social systems.

Thesis structure

A brief summary of each of the thesis chapters is provided below.

<u>Chapter Two</u> provides a fuller introduction to the biotechnology as media conceptual framework. The four movements of mediation – Alienation, Translation, Recontextualisation, and Absorption – in particular are outlined in full in this chapter using examples from the thesis corpus. The media framework is positioned early in the thesis to provide the reader with a basis of understanding for the subsequent theoretical and analysis chapters. As indicated previously, in framing biotechnology as media I am seeking to explore biotechnology as *a process of mediation*: a process of shifting and politicising meanings rather than a particular media technology such as the television or radio.

The concepts of mediation, social practice, and discourse are combined in this chapter to introduce the notion that a social practice such as biotechnology can function as media. Biotechnology, like any media form, inherits, creates, or sustains particular channels for the movement of meaning. It also has, particularly in its current form, demarcations on the officially sanctioned ‘content’ that can be carried on those channels. At present, the officially sanctioned content is that which fits within the channels and requirements of product development, commercialisation, and sale. Following work by Postman (1985) and McLuhan (1964), I also emphasise that, apart from its official and readily identifiable content, biotechnology, like any media form, also involves processes of filtering, transforming, and politicising meaning: media as epistemology. This essentially means that unintended or unofficial ‘content’ in the form of inscribed ways of seeing, being, and acting, is also ‘transmitted’ along with – and within – the official content of biotechnology mediations. The chapter also explores in more depth the role of the State as an official mediator of new technologies and technological ‘revolution’ and as the generator of official discourses on, and rationales for, biotechnology.

Chapter Three seeks to identify and explain in more detail the links between the concepts of discourse, social practice, and mediation. As such, the chapter provides a theoretical basis both for the biotechnology as media conceptual framework and for understanding the nature of biotechnology as a social practice. Discourse is highlighted in this chapter as an essential process in the production, reproduction, and mediation of ways of seeing, being, and acting both within and beyond the social practice of biotechnology over time. The inherently ethico-political nature of discourse is also highlighted. Following work by Isaacs (1998) and Luhmann (1995) I posit that the boundaries surrounding any given social practice are discursive and hence are permeable. In this way the social practice of biotechnology is highlighted as being embedded within history and in relationships with other practices. This notion of historical and social *embeddedness* is a key concept in understanding biotechnology's mediating functions because it situates biotechnology as an "open" (but not unfettered) practice that both mediates, and is mediated by other practices and particular persons in and over time.

Chapter Four provides an introduction to a range of methods and concepts used in critical discourse analysis for the thesis. This chapter is designed to function as a bridge between the introductory chapters and the analysis chapters which illustrate more fully the ways that the processes of mediation actually play out in official discourses on biotechnology. The methods and concepts identified are used as "filters" or "probes" with which to read and analyse the corpus as a whole, individual texts, and subsections of them. The key analytical filters explained in this chapter include interdiscursivity; the discourse-historical method (Wodak, 2001); mediation and context; the politics of representation (Mehan, 1993); thematic patterns (Lemke, 1995); emic instances (Pike, 1958); and moments of silence (Sheriff, 2000; Sunderland, 2002).

Chapter 5 provides important discourse-historical background to biotechnology in preparation for the corpus analysis. The notion of biotechnology as a ‘time medium’ in particular is explored in this chapter. The Chapter also explores a number of ways that history is [mis]represented in contemporary discourses on biotechnology. A central observation of this chapter is that historical discourses on biotechnology provide only limited scope for understanding history as a linear positivistic progression toward human development. This limited view of history in official biotechnology discourse inhibits heteroglossia and, hence, the range of resources on offer to citizens in understanding and evaluating contemporary biotechnological developments.

Chapter 6 seeks in the first instance to identify a number of key official representations of mediation (movement) in biotechnology policy and education texts: what or who moves where and how. Because contemporary biotechnology policy is for the most part geared toward moving the knowledges, beings, and things associated with biotechnology to commercial and consumption contexts, there is much in the thesis corpus that reflects the four movements of hybridisation and mediation. There is a significant focus on how movements toward hybridity between science and industry is produced and reproduced and how links between science and industry such as the ‘product development pipeline’ act as channels for mediating biological and discursive content into different contexts. The chapter concludes by discussing the metaphor of ‘the Virtuous Cycle’ that was used in the Australian Health and Medical Research Strategic Review (Commonwealth of Australia, 1999) to portray the movement of research into contexts of commercialisation, product development, and sale to citizens. The metaphor of the Virtuous Cycle draws on significant intertextual bases relating to, or more particularly countering, the 'vicious circle' of poverty, ignorance, and sinfulness (cf. Malthus, 1914; White, 1896/1960).

Chapter Seven explores the social and ethical implications of the mediations outlined in Chapters Five and Six. In this chapter I draw attention to the fact that official discourses on biotechnology portray the meeting point between biotechnology research and 'the community' as being located within the context of the market of commercial exchange. I also identify the significant politics of representation that surround given stakeholders in biotechnology such as 'the anti biotechnology community' and 'scientists' and the way that context is used to include and exclude persons and from ethical deliberations surrounding biotechnology mediations. The chapter features analysis and discussion of a number of voices that are missing from official biotechnology discourses.

Chapter Eight is the concluding chapter of the thesis. In this chapter I provide a summary of the main points of the thesis as well as some suggested points of transformation in ways of seeing biotechnology and in public engagements surrounding biotechnology research and commercialisation. This chapter marks the re-incorporation of my professional experiences in designing and conducting public discussion forums for biotechnology and advocates a number of changes in the way we see both biotechnology and ethics in relation to these engagements.

Conclusion

Biotechnology is increasingly defined in public policy and organisational discourses as a branch of science practice that is primarily concerned with commercial, material, and product outcomes. This is despite some scientists' claims that the primary function of the practice is to contribute to the stock of human knowledge and understanding, environmental benefit, alleviation of hunger, or the provision of new drugs and pharmaceuticals to those who suffer. Through convergent technologies of biology and information humans can use biotechnology to increase the range of human and non human living organisms that fall under the commodity logic of contemporary capitalism. In this biotechnology 'revolution' a broader range of humans, animals, and plants are rendered – in a more thorough way – both materials and sites of capital production.

Chapter 2 A framework for viewing biotechnology as media

Overview

Framing biotechnology as media allows us to analyse biotechnology not as a set of static, objective techniques or technologies but, rather, as a means of producing, reproducing, and shifting meanings. In this chapter I posit that the social practice of biotechnology extends outward into society, and in turn is shaped by the reverse, via four primary discursive mediating processes: Alienation, Translation, Recontextualisation, and Absorption. It is precisely because of biotechnology's potentially wide reaching influence, and relative political weighting at present, that we should seek, wherever possible, to identify, comprehend, and evaluate its effects in contexts beyond those in which it is readily seen to operate or function.

Media

Understanding biotechnology as media firstly requires us to step away from what we immediately think of as "media" (for example television, radio, print). Rather, in framing biotechnology as media I am seeking to explore biotechnology as a process of mediation: a process of shifting and politicising meanings (Silverstone, 1999). Viewing biotechnology as a social practice initially helps to highlight the extent to which biotechnology as media processes *can* and *do* affect wider social trends and trajectories beyond the field of biotechnology itself. This is primarily because social practices are “separated” from their social environment, by discursively[7] constituted boundaries that are produced and reproduced both within and beyond the practice itself (cf. Isaacs, 1998; Luhmann, 1995). A discursive boundary quite simply is one of meaning. Some people have access to the shared meanings, ways of seeing, terminologies, experiences, and so on within the practice, while others do not. Any given practice, including its shared meanings and boundaries, has a history and a purpose: this includes seemingly non significant technologies employed within the practice. As such, when we see biotechnology as media, we are talking not only about technological media forms or techniques, but also to the social, interpersonal, and historical aspects of the practice itself. All of these aspects of a practice can in fact mediate or shift meanings.

The highlighted biotechnology as media movements of Alienation, Translation, Recontextualisation, and Absorption work beyond the social practice of biotechnology itself. As mentioned above, the boundaries between any social practice, other practices, institutions, professions, and “society” at large are discursively constituted and hence are permeable. The boundaries that separate the social practice of science from ethics or public policy, for example, are not made of electric fences. Rather, these boundaries are the products of shared and consistently produced/reproduced ways of seeing, acting, and being that people share. Furthermore, it is not

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[7] As noted in the Introduction, I use the terms “discourse” and “discursive” in consonance with Lemke (1995) who observes that ‘discourses are the persistent habits of speaking and acting, characteristic of some social group [practice or system], through which it constructs its worldview: its [identity], beliefs, opinions, and values (p.24). When I refer to discourse in the thesis I am assuming a dialogic relationship between ways of describing in language and ways of seeing, being, and acting.

only the people within any given practice who create and sustain these boundaries. Because the boundaries are discursive and permeable, other social practices, institutions, individuals, and so on can also contribute to them, and to the practice itself. The influence that biotechnology has on the rest of society is not one way. Other practices and agendas can and most definitely do intertwine with what might be seen to be the "core" purpose or "business" of biotechnological research.

The current political and economic environment has raised significant issues regarding the importance of curiosity based or basic research in conjunction with strategic or applied research. Biotechnology is by generally accepted definition a product or "application" based, usually commercially oriented branch of science practice. Common definitions of biotechnology, as listed below, all describe a given organism or biological process as a means to producing or acquiring a given technology-based use, outcome or product.

> '[Biotechnology is] The application of scientific techniques that use living organisms, or substances from those organisms, to make or modify products, improve plants and animals, or to develop micro-organisms for specific uses' (US Office of Technology Assessment).

> 'The use of biological systems - living things - to make or change products. It has been used for centuries in traditional activities like baking bread and making cheese' (CSIRO).

> 'Development of products by a biological process. Production may be carried out by using intact organisms, such as yeasts and bacteria, or by using natural substances (e.g. enzymes) from organisms' (International Industrial Biotechnology Association).

> 'Biotechnology is a very broad term referring to any practical or commercial use of living organisms, such as using yeast to make beer or bread' (Washington Biotechnology Action Council).

Obviously though, the simple, familiar examples of beer, bread and cheese as featured in the above definitions have little to do with modern biotechnological and biomedical processes such as producing 'human ears growing on the backs of mice', 'reattached and functional hands and limbs', 'sheets of artificially produced human skin on sale from biotechnology firms' (Wildman, 1999, p. 3).

As indicated above, understanding biotechnology as media requires us to see biotechnology as a process of mediation: that is, a process of shifting meanings (Silverstone, 1999, p. 13). Silverstone defines mediation as:

> 'the movement of meaning from one text to another, from one discourse to another, from one event to another. It involves the constant transformation or meanings, both large scale and small, significant and insignificant, as media texts and texts about media circulate in writing, in speech and audiovisual forms, and as we, individually and collectively, directly and indirectly, contribute to their production (1999, p. 13).

The process of mediation and movement of biological and discursive resources for meaning making is, as Silverstone points out, 'fundamentally political or perhaps, more strictly, politically economic' (1999, p. 4). In taking on the notion of biotechnology as media, we also need to recognise that one movement and/or politicisation (for example the mapping of the human genome) precipitates and enables any number of subsequent movements (for example, codifying and privatising genetic information; selling access to knowledge and information about a particular country's gene pool; new vaccines and treatments; new services and products; new desires and expectations). As Silverstone identifies, '[m]ediation is like translation…it is never complete, always transformative, and never, perhaps, entirely satisfactory' (Silverstone, 1999, p. 14). So in this sense, it is not only our DNA that is *mediated* via the social practice of biotechnology, it is also a very broad range of social contexts, relationships, and products that are affected or directly created via biotechnology mediations, including, for example, legislation and regulation created to monitor and regulate the "use of" genetic and biological material (such as DNA and discarded foetuses), the range and purposes of drugs on the market, "geneticised" discourses concerning what constitutes a good and healthy life, new areas of investment and venture capital companies.

Within biotechnology's orientation toward application or product development, there are also a number of broader, historically salient trajectories at hand. My understanding of the political and economic orientations of biotechnology as media is particularly influenced by Marcuse's (1964) analysis of the ways that modern societies can work to dilute and devalue any form of 'antagonistic' or 'subversive' public opinion (p. 9). Marcuse argues that technological innovation in the form of media in particular has allowed antagonistic/subversive content to be recontextualised into the "everyday" operations of the productive apparatus. The point is, that in modern biotechnological processes, something so wondrous as the foundations of life somehow are translated into the form of a product to which only a select few have access. We take DNA for example, from a hitherto secret place, and move it progressively toward something that is part of our everyday existence such as vaccines, treatments, products, services, and so on. But not only is DNA moved, it is also changed, altered, politicised so as to *fit with* existing social trajectories or demands. The groundbreaking scientific discovery in effect loses its initial meaning and value by being diluted and subsumed under the commodity logic into which it is currently being recontextualised. Perhaps more correctly, the great scientific "discovery" has its meaning and value reinterpreted by different human agents, its potential evacuated and replaced with something else that is relevant to its new context for example, the 'price system' (Innis, 1942).

Steiner offers a parallel story to that offered above:

> 'art dies when we lose or ignore the conventions by which it can be read [attending the theatre, museum, or concert hall], by which its semantic statement can be carried over into our own idiom' (1975, p. 30).

The point is that when something, or someone, is subject to mediation and recontextualising movements, things change. The original values that were attributed to the thing, process, whatever, do not remain constant as the discovery or creative work is moved into new contexts. Neither do the practices or people that surround the production and/or reproduction of the thing, object, or process. I will return to this consideration in more depth in the following sections on Alienation, Translation, Recontextualisation, and Absorption.

Media as epistemology

In framing biotechnology as media, I am presupposing a certain function of mediation more generally that goes beyond the social practice of biotechnology. This function has been fully explicated in the field of media studies, in particular McLuhan's (1964) '*The Medium is the Message'* and Postman's (1985, pp. 16-30) '*Media as Epistemology'.* As such, it may be at least familiar to a range of readers. Postman explains the notion of media as epistemology as follows:

> Every medium of communication, I am claiming, has resonance, for resonance is metaphor writ large. Whatever the original and limited context of its use may have been, a medium has the power to fly far beyond that context into new and unexpected ones. Because of *the way it directs us to organize our minds and integrate our experience of the world*, it imposes itself on our consciousness and social institutions in myriad forms. It sometimes has the power to become implicated in our concepts of piety, or goodness, or beauty. And it is always implicated in *the ways we define and regulate our ideas of truth.* (Postman, 1985, p. 18, italics added)

Postman's examples of metaphor's 'writ large' include the character of Hamlet (associated with madness, jealousy, Oedipal syndrome etc) or the city of Athens (associated with Greek gods, ancient Greek civilisations etc) (1985, p. 12). The phrase, person, location, or object becomes a metaphor for certain shared meanings and attributions—a metonymic shortcut to interpretation that helps us not to have to think too much in order to get a general understanding—and, depending on the prevalence of use, a way of seeing. Biotechnology in Postman's terms can be seen as both metaphor and medium. In its metaphorical sense, biotechnology has evolved over time to *represent* for many people some very distinct orientations to the world and what is in it. Perhaps more directly, biotechnology is analogous to many of our contemporary mass media practices because, increasingly, we cannot easily evade its presence; its influence on ourselves and others; or its representations of the true, the good, the bad, the desirable, the undesirable, the normal, the abnormal, and so on (cf. Lemke, 1998).

The movements of mediation

The four mediating processes discussed in this chapter are not intended to be mechanistic or linear. Rather, at any particular moment of mediation the four mediating processes can be identified in multiple contexts and practices, in different orders of progression, and even simultaneously. Indeed, alienation, translation, recontextualisation, and absorption are closely featured in most, if not all, biotechnology mediations to be explored in the following analysis chapters. Each of the processes are integral *dimensions of* mediation in, and surrounding, the social practice of biotechnology. As the following sections illustrate, each of the four processes are in fact *required* if biotechnology is to develop according to the values, objectives, and purposes prescribed in state, national, and trans-national policy texts.

Alienation

Alienation has once again become a point of interest in discussions regarding intellectual property rights for biotechnology processes and products (cf. Andress and Nelkin, 1998; Flowers, 1998; Nelkin and Andrews, 1998; Thompson, 1995). However the main reason the term has re-emerged is not to discuss the alienation of human labour from human beings or the ultimate alienation of humans from nature, but as a precondition for commoditising bio-products (cf. Thompson, 1995). Thompson states that ‘a good or the right to enjoy a good is “alienable” to the extent that it can be *dissociated from one owner of the good and transferred to another*’ (p. 281, italics added). Rivalry on the other hand ‘refers to the situation where the use or consumption of the good by one person diminishes the amount of good available for others’ like, for example, a can of tomato soup (Thompson, 1995, p. 281). Lighting on public streets on the other hand is in most cases a non-rival good. Excludability refers to how easy or hard it is to *exclude others* from using a particular good (Thompson, 1995, p. 281). By consuming a can of soup, a person excludes the possibility of anyone else consuming it. On the other hand it would in most cases be very difficult to restrict others from accessing the light thrown off from street lamps in your neighbourhood.

The three conditions of alienability, rivalry, and excludability, according to Thompson, are the prerequisites for declaring something as property. Thompson’s explanation is particularly effective:

> One person cannot listen to the song of a dove while someone else eats the same dove roasted, because these are rival uses of the dove. However, if the dove’s song is alienated from the dove itself with a recording, previously rival uses become associated with separable goods, their rivalry diminishes, and the potential for hearing the dove’s song while feasting on its flesh becomes possible. *Alienability of a good is thus a necessary condition for regarding it as exchangeable property.* (Thompson, 1995, p. 281, italics added)

Thus, the process of *alienation* – as Thompson would describe it – in the context of this thesis is where the biotechnology as a technological medium function is most concentrated: Humans use modern genetic technologies to *dissociate biological materials from one 'owner' (plant, animal, human, or other living organism) or context to another 'owner' (in the form of "intellectual property") or context (for example, DNA shifted from the context of the body to a laboratory setting or computer database).* Recombinant DNA techniques used in contemporary biotechnology are significant in that they

> represent means to alienate goods from previous patterns of ownership and exchange and to establish new rights of ownership and exchange. Although conventional plant or animal breeding was capable of introducing substantial changes in the traits or composition of individuals, it did not permit the alienation of those goods from representative individuals themselves. (Thompson, 1995, p. 282)

Although it is a powerful and consequential movement, alienation in itself is not sufficient to explain the way in which previously inalienable aspects of life are transferred into economic goods for exchange on the commercial market. Indeed, the significance of alienated genetic 'codes', cells, DNA and so on are, in their purely technical forms, accessible only to those discourse communities versed in the discourses associated with Recombinant DNA technologies and molecular genetics. Like Postman's metaphors writ large above, for the alienated 'goods' to be taken beyond the laboratory context, they must undergo several interrelated processes of meaning production and reproduction, including translation, recontextualisation, and absorption.

Translation

> We cannot accurately conceive what it must have been like to be the first to compare the colour of the sea with the dark of wine or to see autumn in a man's face. Such figures are *new mappings of the world*, they reorganise our habitation in reality. (Steiner, 1975, p. 23, italics added)

Translation is the process of recasting a system of meaning in the form of another, often fundamentally different system of meaning and representation. Translation is the most overt discursive function of the four media movements. Translation is, of course, inherently political and interpretive. Far from being a process concerned with opening access to new spaces, alienation can be seen as a process of translation and encoding (or codifying) rather than "decoding" the human genome; it is the translation and narrowing of previously inalienable meanings and biological resources into alienable scientific discourse, applications, material, biological products, and so on (cf. for example DeCode Genetics' corporate logo "decoding the language and life", nd, np). In Steiner's words, '[t]he translator invades, extracts, and *brings home*' (1975, p. 298). Steiner's use of the word "extracts" is particularly pertinent in that it emphasises the selective and interpretive nature of translation, and its potentially minimising filtering effects on the previously inalienable, merely potential meaning system. Like Steiner, Silverstone argues that in 'translation we enter a text and claim ownership of its meaning' (1999, p. 15). Translation is 'a move which involves both meaning and value. While it might seem at times a largely technical or pragmatic activity, translation is in fact ‘both an aesthetic and an ethical activity’ (Silverstone, 1999, p. 15).

> Translation is process in which *meanings are produced*, meanings that cross boundaries, both spatial and temporal. To enquire into that process is to enquire into the instabilities and flux of meanings and into their transformations, but also into *the politics of their fixings.* (Silverstone, 1999, p. 16, italics added)

Because it is a process of *transforming* and, according to Steiner (1975), *fixing* meaning, translation, particularly in the case of previously inalienable ‘goods’ in knowledge, involves limiting potential meanings and also potential “audiences” (or discourse communities) who may access these newly translated meanings. For example, the human genome directory is expressed in a series of codes that use four letters of the alphabet. This is where the discursive boundaries around the social practice of biotechnology are perhaps most evident.

Thacker (2000) in particular has explored the translation of “the body” into data that is suitable for processing via ICTs in the human genome project. The graphic over page illustrates four different ways in which the human genome has been mapped for scientific purposes, including information sharing between scientists across the world. The diagram is taken from the information booklet titled *Mapping the Human Genome* produced by the US Department of Energy and the Humane Genome Project (1996, p. 11). It provides a graphical representation of the various ways in which the human genome has been ‘mapped’. To the non-scientist, or even a scientist not involved in molecular genetics, genomics, and related disciplines, this translation or ‘mapping of the human genome’ can be completely meaningless and inaccessible in the sense that a molecular geneticist, for example, would understand it.

Figure 1: ‘Genomic Geography’ in the Human Genome Project (Source: Department of Energy and the Humane Genome Project (1996, p. 11)

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from the QUT Library.

Another example from an article titled ‘A crystallographic map of the transition from B-DNA to A-DNA’ utilises the four letter coding system for DNA in written form:

> The transition between B- and A-DNA was first observed nearly 50 years ago. We have now mapped this transformation through a set of single-crystal structures of the sequence d(GGCGCC)$_2$, with various intermediates being trapped by methylating or brominating the cytosine bases. The resulting pathway progresses through 13 conformational steps, with a composite structure that pairs A-nucleotides with complementary B-nucleotides serving as a distinct transition intermediate. The details of each step in the conversion of B- to A-DNA are thus revealed at the atomic level, placing intermediates for this and other sequences in the context of a common pathway (Vargason, Henderson, and Shing Ho, 2001, p. 7265).

Granted, the article by Vargason et al. is not intended for general audiences –and thus is not written in a language that general audiences will understand –yet it is obvious to all that the sequencing “d(GGCGCC)$_2$” is an *encoding* translation of the human genome. As an earlier reviewer of this thesis notes, those who are able to read this language may take several years to become fluent in this language of DNA in much the same way that one might take several years to become fluent in Greek or Arabic. Vargason et al.’s use of terminologies and phrases such as ‘A-nucleotides’, ‘distinct transition intermediate’, and ‘common pathway’ is similarly mystifying to an outsider-audience, despite the fact that they still employ common English vocabulary (i.e. commonly accessible words such as distinct, transition, intermediate, common, pathway, etc).

The direct translation process from the previously inalienable “language of life” into technocratic scientific discourses and modes of representation is apparently separate from any contemplation over the ethical and moral aspects of the technologies. As we move away from the encoding of DNA itself, we see further translations and recontextualisations at play, from scientific discourse to the discourses of economic and entrepreneurial enterprise. In the 1998 *Hastings Centre Report*, Nelkin and Andrews (1998) make the following translations into the technocratic discourse of market economics:

> These expanding *markets* have increased the *value* of human tissue, and institutions with ready access to tissue find they possess a capital resource. Access to stored tissue samples is sometimes included in collaborative agreements between hospitals and biotechnology firms. (Nelkin and Andrews, 1998, p. 30, italics added)

Note here that the agents are different from those in the example from Vargason et al: here examples of agents include markets; collaborative agreements; hospitals; and biotechnology firms. Obviously, the biotechnological context Nelkin and Andrews are talking about is a different one from Vargason et al, and at a different stage of mediation and recontextualisation. Note particularly that ‘expanding markets’ are the agents that have imbued human tissue with ‘increased … value’.

All processes of mediation, just like technologies themselves, are imbued with inscribed value judgements as to which biological resources are desirable and important in any setting – not merely in the context of economic exchange (cf. Martin, 2000). In its crudest form, commercial "viability" becomes a litmus test for which products will become readily available resources for making meaning within the broader discourses to which biotechnology research and commercialisation are shifted. It is implicitly accepted, therefore, that 'free market acceptance of a good or technology [is] equivalent to an ethical endorsement' (Thompson, 1995, p. 276).

Even if members of the general community cannot access the technocratic discourses surrounding the translation and absorption processes, they are able to draw their own meanings from the everyday productive manifestations of these processes or specific programs to influence social understanding (and usually acceptance) of biotechnology practices and products. Non-scientists and non-economists can draw on the commodified version of biotechnology as media simply by buying it, selling it, using it, being aware of it, and so on. Hence *the process of translation is enacted once again at the point of capital exchange and consumption*.

General understandings of biotechnology research and development are conveyed through the everyday sale of commercial goods and services, as well as through wider media and political discourses and rhetoric surrounding biotechnology processes themselves. Biotechnology products and services, as manifestations of biotechnology as media, are literally *absorbed* via consumption into the everyday lives of members of the public. Biotechnology techniques and technologies themselves are in many cases the product of a long process of alienation, translation, recontextualisation, and absorption with imbued values, motivations, and judgements as to their viability, worthiness and so on.

The already abundant range of bio-products and services circulating in global pharmaceutical and "life" markets indicates the extent to which previously inalienable or incomprehensible aspects of human life have already been absorbed in the everyday productive apparatus:

> In recent years, biotechnology techniques have transformed a variety of human body tissue into valuable and marketable research materials and clinical products… the catalogue from the American Tissue Culture Catalogue lists thousands of people's cell lines that are available for sale. Body tissue also has commercial value beyond the medical and research contexts. Placenta is used to enrich shampoos, cosmetics, and skin care products…There is also a market for services to collect and store one's tissue outside the body. People can pay to store blood prior to surgery or embryos in the course of in vitro fertilization…There are about fifty private DNA testing centers in the United States, hundreds of university laboratories undertaking DNA research, and over 1,000 biotechnology companies developing commercial products from bodily materials. (Nelkin and Andrews, 1998, p. 30)

At each stage of translation, recontextualisation, and absorption, the discourses, and physical bio-products themselves are *produced as a result of*, certain technocratic practices and orientations (cf. Martin, 2000). Attributions of value, desirability, worthiness, ethicality and so on are specific to the particular discourse communities and social contexts. For example, where the successful cloning of a human being might be seen as a major scientific breakthrough for the scientific community and those who will directly benefit from the technology, cloning a human may be seen as an immoral practice fraught with danger and fear for other members of the general community. Individuals involved in discourse communities concerned with ethics or public policy may also *attribute* the scientific "breakthrough" with different meanings, consequences and so on. Obviously, the social embeddedness of all social practices, and the persons that constitute them, ensure that they do not operate in complete isolation from one another. But, when the practices and processes associated with biotechnology enter distinctly different social systems and settings (such as the system of commercial exchange, regulation, or politics) their meanings, significance, perceived value, desirability, degree of familiarity and so on can and do identifiably change.

All uses of the term "translate" in the corpus are consistent with the use of the term in relation to mediation. There is an acknowledgement that a movement from one context to another both precipitates and requires translation or fundamental shifts in meaning systems. For example, the following excerpt from an industry magazine article refers to a series of 'translations' that are involved in contemporary biotechnology scenarios. I have underlined the sections that specifically refer to translation.

> 'BioPLATFORM will: - extend the foundation <u>for translating excellence in research into economic benefits'</u> (NSW Govt Biofirst 2001 Strategy); 'Australia has <u>strengths in scientific discovery, which are not currently being translated into exploitable intellectual property'</u> (Victorian Strategic Plan 2000); 'It is essential to have the capacity to translate knowledge into new products, processes and services, that in turn will generate benefits to society, skilled jobs and prosperity' (A Strategy for Europe); <u>'Industry…has a key role in translating our research base into products, services and wealth'</u> (Victorian Strategic Plan 2000); California-based Genentech has made remarkable progress in

translating genetic information into tangible, practical information to change drug development (Black Art Industry magazine article)'.

The orientation of translations portrayed in this text is different from the orientations that feature in the official rationalisation of biotechnology: that it is intended to improve our standard of living, health and well being for all. This excerpt mentions the following translations:

- Excellence in research into economic benefits;
- Strengths in scientific discovery into exploitable intellectual property;
- Research base into products, services, and wealth;
- Genetic information into tangible, practical information to change drug development; and
- Genetic information into a new system of drug development.

For me, this excerpt highlights that translation is not merely a linguistic phenomenon: translation in biotechnology is coupled with movements in language, space, and substance. It also introduces a phenomenon that emerges consistently in the thesis corpus: Biotechnology transforms not only individual living organisms and things, it also transforms *practices* such as 'drug development'.

Recontextualisation

The translating of an entire, and until recently unknown, aspect of life into commodifiable products and services is also highly dependent on processes of *recontextualisation* (cf. Bernstein, 1990; Iedema, 1997a). Recontextualisation is the process by which discourses are encapsulated in 'increasingly durable materialities' as a direct result of their translation and entry into new social systems and contexts (Iedema, 1997a). The consequence of recontextualisation then is that these 'increasingly durable materialities' – such as a hospital building, a technology, or a product – are seen to encapsulate the discourses that have shaped their being and becoming: They are discourse materialities.

Sarangi (1998) extends on Iedema's work to emphasise that recontextualisation is necessarily coupled with processes of decontextualisation and entextualisation. He observes that

> …putting something into context (contextualizing it), putting something out of context (decontextualizing it), and putting something into a different context (recontextualising) are both everyday and scientific activities…In between decontextualization and recontextualization, Bauman and Briggs (1990) suggest, there is a process of '***entextualization'*** in narrative performance: an event is entextualized into a discourse with a controllable set of truth-values…Recontextualization is thus not 'representation', but 're-presentation' or re-production' which implies creativity (Sarangi, 1998, pp. 306-7, italics added).

The process of recontextualisation, then, requires concomitant processes of decontextualisation, transformation, and *entextualisation*[8]. For example, when pieces of foreskin tissue or placenta are alienated from their origin body-context and re-contextualised into other contexts such as the laboratory, clinic, or hospital, the original and typically tacit value and meaning of “foreskin” or “placenta” are replaced by other overt and functional meanings, use values, and exchange values by agents in these new contexts. A point to note also is that the range of persons who have power to entextualise the foreskin and placenta with meaning and value, and to use it for specific purposes in research or treatment contexts, are vastly different from the original and personal ‘owner’ of the tissue in its body-context.

Both Iedema and Sarangi see the creation of written texts as a significant part of the recontextualisation process. Texts in particular are significant indicators of which meanings and values get ‘left behind’ and which are foregrounded at various stages of recontextualisation (cf. Lojek, 1994, p. 84; Mehan, 1993; Sarangi, 1998, p. 308).

> An important part of this process (recontextualisation) is the transformation of discourse into texts…Such texts, generated from a particular event in the sequential process (e.g., a testing encounter), become the basis of the interaction in the next step in the sequence (e.g., a placement committee meeting), These text become divorced from the social interaction that created them as they move through the system institutionally isolated from the interactional practices that generated them in the preceding events.

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[8] In later sections of the thesis I will use the one term ‘recontextualisation’ to refer to the related processes of decontextualisation, recontextualisation, and entextualisation.

The following excerpt from the UN Human Development Report 2001 provides a detailed example of the role of texts in recontextualisation. recontextualising process from the thesis corpus. The excerpt details the steps by which the UK Government's Technology Foresight Program moves from its initial conception to being implemented in various contexts, in various forms, by various agents. I have underlined the different contexts and genres that the 'UK Technology foresight program' moves through toward its 'applications' and 'outcomes'. The contexts range from particular institutional genres, such as 'the steering committee' to more abstract discursive formations, such as 'four themes'.

> The UK technology foresight programme, announced in 1993, is forging a closer partnership between scientists and industrialists to guide publicly financed science and technology activity [hybridity]. More market oriented and less science driven than similar efforts elsewhere, the programme has had three phases. First it set up 15 panels of experts on the markets and technologies of interest to the country, each chaired by a senior industrialist. Each panel was charged with developing future scenarios for its area of focus, identifying key trends and suggesting ways to respond. In 1995 the panels reported to a steering group, which synthesized the main findings and identified national priorities. Next the steering group produced a report distilling its recommendations under six themes: social trends and impacts of new technologies; communications and computing; genes and new organisms, processes and products; new materials, synthesis and processing; precision and control in management, automation and process engineering; and environmental issues. The steering group assigned priorities to three categories: key technology areas, where further work was vital; intermediate areas, where efforts needed to be strengthened; and emerging areas, where work could be considered if market opportunities were promising and world-class capabilities could be developed. Now the recommendations from the exercise are being implemented. For example, research in the four priority areas- nanotechnology, mobile wireless communications, biomaterials and

sustainable energy-is being supported through a research award scheme. Another example is its application in Scotland. Scottish Enterprise hosts the Scottish foresight coordinator, who focuses on promoting foresight as a tool for business to think about and respond to future change in a structured way. The coordinator works with a wide range of public, private and academic actors. While a key goal is to help individual companies better manage change, this is being achieved by channelling efforts through a range of trusted business intermediaries-industry bodies, networks and local delivery organizations -that have a sustainable influence on company activities. All panels and task forces address two underpinning themes: sustainable development and education, skills and training. (UN Human Development Report, corpus text, **cwn**[9]. 54,126)

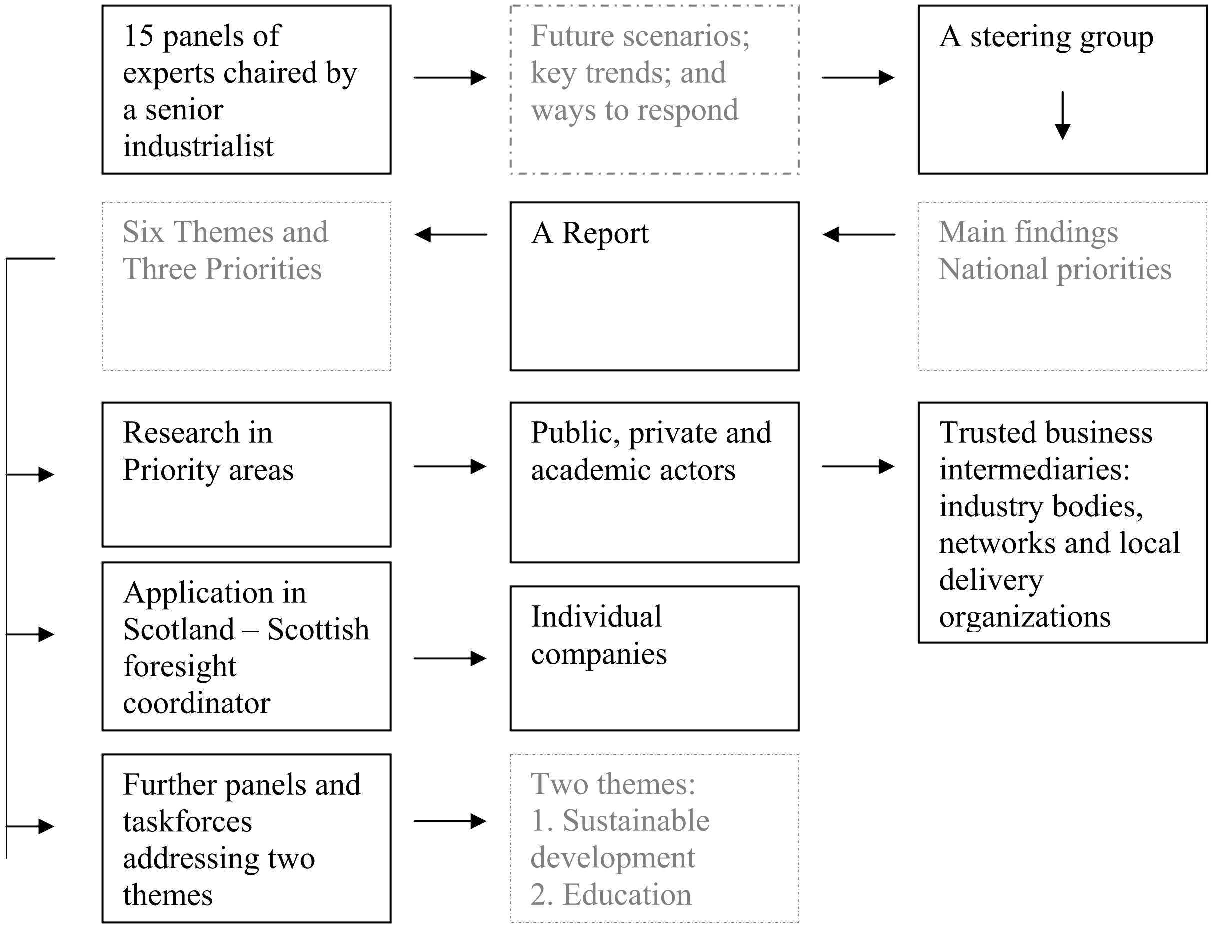
A significant point to note regarding the processes of recontextualisation illustrated above is that the point of motivation, concern, exchange, interest, or desire associated with the Technology Foresight Program underwent multiple transformations that were beyond the reach of the original program authors. The reader will note that recontextualisation in this example entails shifts not only in text types and genres (from reports to meetings, to strategies, to taskforces, to training), but also shifts between contexts and agents: who is involved, which institutions, which spaces, which practices.

I have translated the above excerpt into the diagram below in order to illustrate these movements more clearly. The boxes that feature dotted borders are intended to convey discourse formations such as "themes" or "priorities" rather than particular social contexts or texts which are presented in solid boxes. Interestingly, it is the themes or priorities that are the

[9] **cwn** refers to Corpus Word Number. This is a limitation of the wordsmith program I used to manage the corpus texts. The program requires texts to be in 'text only' format which does not allow for individual texts' page numbers to be preserved. The cwn refers to the word number of the citation within the full corpus.

currency of recontextualisation in this example: they are the links in a chain between one context and another. The themes and priorities themselves are heavily condensed summaries of all of the discussions and interests that have emerged in prior contexts. They are nominalisations.

Diagram 1: Recontextualisations in the UK technology foresight program



A final point to note in regard to the movement of recontextualisation is that recontextualised abstractions, when absorbed in objectified material culture, such as the various bio-products now on offer, themselves become 'a component in the process of communication' (Streeck, 1996, p. 366, in Iedema, 1997a): that is, a consumable *resource* for meaning making and evaluation. As intimated above, many members of the general public – i.e. those who are not members of the technocratic genetics discourse community – will, to a certain extent, draw on the objectified material culture as resources for meaning making. The material manifestations of biotechnology themselves are imbued with, and indeed ontologically produced and defined by, a set of technocratic (economic and scientific) values, judgements, and evaluations.

But, as discussed in the Introduction, the durable materialities of biotechnology recontextualisation are not merely ‘products’ such as a particular diagnostic kit or vaccine, they are also living plants, animals, humans, and other organisms such as bacteria. These outcomes of biotechnology become a component in the process of communication. We may come to understand and evaluate GM foods, for example, through their availability for sale in supermarkets. We may have a friend who aborted a child because of the results of a genetic test taken during the early stages of pregnancy. We may have a nephew who was conceived through reproductive technology. These persons are within our families, our friends, and colleagues. These persons, whose lives have been directly manipulated by biotechnological mediation, may choose to contribute their own ‘lived experience’ evaluations of these technologies to public discourse. This is where the notion of alternative voice in heteroglossia and ethics becomes perhaps most important.

Absorption

Technological innovation provides a means by which humans can move previously non-routine aspects of human cultural expression and life to into “everyday” mediated contexts. Marcuse’s (1964) description of the way that abstract cultural expressions and antagonistic or subversive cultural content are depleted and transformed (homogenised so as to fit within the media form) via mediation is particularly instructive here. Marcuse (1964, p. 61) argues that mediation affects not only how things appear, but also where they appear, and in what form (for example, the salon, the concert hall, the theatre, the market) . All of these variables, he argues, impact upon the perceived social significance, meaning, and political (non)potential of both the media form and its "content" (Marcuse, 1964, p. 62).

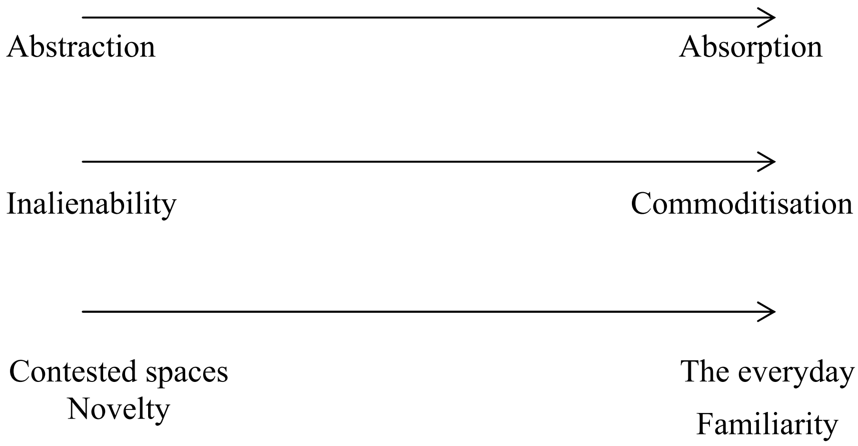
Marcuse contends that the antagonistic or subversive potential of content – that is, the potential to be other than what *is* and to effect consciousness of, or desire for, something other than the current path of mediation – is depleted by 'the absorbent power' and more or less "everyday" status of a particular media form. A particular media form, for instance, cannot help but filter and shape the content that is passed through it because of its own limitations, transmission channels, intended uses, and so on. The *context within which* an "audience" interprets content (for example, a theatre, concert hall, laboratory, supermarket), in conjunction with the filtering effects of a media form itself, is also significant to the range of possible meanings that are attributed to that content by the audience or "consumer".

> 'The absorbent power of society depletes the artistic dimension by assimilating its antagonistic contents. In the realm of culture, the new totalitarianism manifests itself precisely in a harmonizing pluralism, where the most contradictory works and truths peacefully coexist in indifference…Whether ritualised or not, art contains the rationality of negation. In its advanced positions, it is the Great Refusal – *the protest against that which is*. The modes in which man [sic] and things are

> made to appear, to sing and sound and speak, are modes of refuting, breaking, and recreating their factual existence. But these modes of negation pay tribute to the antagonistic society to which they are linked. Separated from the sphere of labour where society reproduces itself and its misery, the world of art which they create remains, with all its truth, a privilege and an illusion…The salon, the concert, opera, theatre are designed to create and invoke another dimension of reality. Their attendance requires festive-like preparation; *they cut off and transcend everyday experience* (1964, pp. 61-63, italics added).

The key aspect of absorption, as distinct from the other movements of mediation, is that it deals specifically with these processes of rendering new technologies familiar, invisible, and part of the "everyday". All of the movements of mediation discussed above are, however, intimate in this inherently political process of absorption. As the following diagram indicates, all of the movements of mediation are intimately involved in moving biotechnologies, and the living products they engender, into the everyday lives of citizens. Absorption in biotechnology requires a movement from inalienability to commoditisation; from abstraction to absorption; and from spaces and times where the technology or product is new and contested to spaces and times where is nothing more than an everyday, acceptable product or service, and familiar.

Figure 2: Abstraction, absorption, alienation, and commoditisation



An integral part of the absorption movement is, then, the process of rendering a new technology desirable, acceptable, and familiar. This movement may have to occur in an atmosphere of considerable opposition, as has been the case with some areas of biotechnology including GM foods, cloning, and stem cell research. Among other things, dissent disrupts the invisibility of a new technology and focuses, rather than deflects, critical consciousness.

The rhetorical imperative is paramount in some areas of technological absorption because the hopes that surround technological revolutions are, characteristically, not the hopes of the many – at least in their first incarnation. Rather, the nature of technological 'advance' is such that new technologies have to be "introduced" to social systems and be rendered familiar, acceptable, and desirable through strategies of influence and persuasion. In mediation, even technologies that have been hotly contested can become part of the accepted and familiar everyday by becoming familiar, available, and gradually indispensable. As such, the most crucial role of the introducers of new technology is to make others desire the new technology, and the outcomes it may accrue. In high technology industries, the most important people to convince are arguably the funding agencies which, in current climes, equals industry representatives and politicians.

New media forms and products find their way into the everyday as material objects and processes and even as further abstractions of capital and value, for example, spin off companies, stocks and bonds, currency, and "futures". These products, technologies, and their intangible abstractions become part of the everyday through rhetorico-political processes of routinisation and naturalisation. The need to 'introduce' technologies to a society, and to secure their 'place' in that society, is manifest in the imperatives of industrialists and academics who have become increasingly concerned with processes of 'technological diffusion; 'innovation infusion'; 'early adoption'; 'early adopters'; 'critical mass'; 'media saturation'; and so on (cf. Green, 2002; Hauben and Hauben, 1997; Takacs and Freiden, 1998).

The State of mediation

> The reaction of the state power upon economic development can be one of three kinds: it can run in the same direction, and then development is more rapid; it can oppose the line of development, in which case nowadays state power in every great nation will go to pieces in the long run; or it can cut off the economic development from certain paths, and impose on it certain others. (Frederick Engels, Letter to Conrad Schmidt, Oct. 27 1890, in Marx and Engels, 1947, p. 4)

The current pathways of biotechnology mediation have been officially sanctioned and promoted by governments across the globe. In Engels' terms above it seems that governments have chosen the "run with it" option. Yet, the rhetorical enhancement of technologies and common declaration of technological revolution that is evident in much public policy on biotechnology is in no way insignificant or rare. One may even argue that the declaration of technological revolution in these policy documents has become little more than a rhetorical device designed to inscribe new technologies with unquestioned overtones of social betterment and the improvement of human life. The most pervasive and uncritical claim in the discourses of technological revolution is that a technologically 'revolutionised' society is one that is more 'advanced' than others. A technologically revolutionised country is, apparently, forward looking, bold, innovative, modern, cutting edge, and leading the way. Moreover, to join the 'industrialised' world, developing countries are told that they must adopt the latest technologies, and perhaps more significantly, the dogma that accompanies their inculcation.

Like all technological 'revolutions' of our history, biotechnology is defined by profound hopes for the future. Whether these hopes match the expectations of those who initiated them or not, the outcomes of any technological revolution are of great consequence. This is because technological revolution hinges on transformation: Technological revolution happens when some thing, society, process, practice, or one, is transformed. But a revolution does not necessarily mean that the dominant modes of *valuing*, worldviews, or ideologies are transformed. The most prolific transformations, it seems, are in fact rendered upon what can be transformed: what is the object of technology. Technological revolution is deemed to be revolutionary to the extent that it opens up new or expanded spaces of physical, biological, and social life for exploitation according to the dominant means and imperative of the system from which it is borne and into which it is [re]introduced. Technological revolution does not, historically, stop exploitation from occurring but, rather, simply increases the range of natural human and non human life forms that are subject to productive exploitation.

Once a new technology has been factored significantly into a nation's policy mix it becomes authorised, rather than aberrant and strategic rather than abstract. The new technological 'innovation' is recontextualised as the stuff of enlightened public policy. As Feenberg (1999) posits, this focus on technology and scientific revolution as a precipitant of human progress is a characteristic feature of modern western societies:

> There is, however, another fateful path by which technology enters the larger conversation of modernity: the historicizing trend in the emerging biological and social sciences of the late 18th and 19th centuries. This trend was firmly rooted in the idea of progress, which found its surest guarantee in the promise of technology. By the end of the 19th century, under the influence of Marx and Darwin, progressivism had become technological determinism. Following the then common interpretation of these materialist masters, technical progress was believed to ground humanity's advance toward freedom and happiness (Feenberg, 1999, pp. 1-2).

Once advancements in a particular area of technological development becomes policy, the state moves henceforth as the primary medium of technological-ideological diffusion: that is to say as the primary force of mediation. The 'new' – rather than 'aberrant' – technology is literally 'frameshifted' to the level of national and international policy and consciousness (Waller, 2001). Through the medium of the state and productive apparatus, both the material and non material aspects of the new dogma enter schools, universities, public institutions, public spaces, homes, ecosystems, and bodies. The substantive basis of these movements from idea to the everyday involves the 'interlocking apparatus of scientific research, technological innovation, and industrial mass production' (Leiss, 1994, p. xii). Such paths of officially sanctioned mediation are difficult to contest precisely because official rationales for mediation become ensconced in representations of the (future) good life. The result is that anyone who argues against it is often rhetorically pitted against the 'future wellbeing of all of humanity', or the economic growth and prosperity of their nation and their children.

As Chapters Six and Seven discuss, these diffusion, routinisation, and naturalisation strategies are predominantly carried out via existing social media including the State, mass communication media, and markets of exchange. As new technologies emerge, the institutions of governance, law, and even ethics are invoked to regulate and patrol the development and diffusion of the technology and to advocate in the interests of public 'safety'. Programs also emerge, usually post facto the initial surge of economic activity and division of property rights, in an attempt to ensure equality of access to the materialisations and capital abstractions of the new technology.

An important part of the routinisation of new technologies is the phenomenon whereby ‘access’ to the material outcomes of a new technology becomes a basic human ‘right’: a measure of human development and the good life. When this occurs, it is assumed that all persons should have access to these technologies because they are unquestionably good, beneficial, and desirable. A person who does not have “access” to the new technology can be literally excluded from accessing some very basic social services which now depend upon that technology – the use of electronic banking over face to face and services delivered via the Internet is a classic example that has led to declarations regarding ‘the digital divide’ etcetera.

The most prominent example of this in the context of biotechnology is in relation to the severe lack of access to HIV/AIDS drugs in sub Saharan Africa. What the UN (2001, cwn. 65,919) has termed “Poor People’s Technology” programs (publicly funded technology) have been introduced to ensure that ‘disadvantaged’ communities in ‘developing’ nations have the same opportunities to access drugs and vaccines as rich people in western industrialised countries (United Nations, 2001, cwn.72,647). The function of not for profit programs and social policies run out of the United Nations and other social and environmental justice bodies are to attend to persons or ecosystems who/that may be left out of the dominant modus operandi of the large pharmaceutical companies. What these groups are responding to is the fact that some people are literally *rendered* vulnerable by the current paths of mediation and development in biotechnology. As the authors of the UN

Report state, the role of the UN's Poor People's Technology programs is to fill in gaps that are created by 'market failure'.

Examples of biotechnology as media

Example 1: Cilento turns to tourism

It was announced on 30 October 2000 that ten remote villages in southern Italy will be the subject of 'one of science's most ambitious attempts to trace the roots of inherited illnesses by spotting genetic differences between a homogenous people' (Carroll, 2000).

> The villagers agreed to become a *living laboratory* after it was explained *they possessed* a unique gene pool that could help create better drugs…Scientists chose Cilento because its inhabitants…have been undisturbed by large-scale immigration for millennia…The project is funded by Italy's national research council but private backers are being sought, a move that could be controversial if profit-making companies are given exclusive access to data…Playing a role in 21st-century medicine is gratifying but Cilento's inhabitants hope the researchers' arrival will reverse an atrophy that has left villages half-abandoned, according to Andrea Salati, mayor of Gioi Cilento. "Many of our children have gone, it's mostly old people, which means our communities are dying. This has given us hope for the future. *It is a chance to create tourism.* (Carroll, 2000, italics added)

Similarly, the Estonian Genome Foundation announced in November 2000 that it is looking for investors to fund the world's biggest database of medical and genetic data taken from a potential 1.445 million citizens of Estonia, a move supported by the Estonian Government earlier in 2000 (Gross, 2000; see also www.genomics.ee for publicity on the venture). Like the people of Cilento, the Estonian people are seen to be ‘just perfect’ for the purposes of the database: they

> have been settling in their present location for at least 5000 years, but not too isolated from the rest of the world. Their family trees can normally be traced back into the 17^{th} century…Opinion polls suggest that more than 90% of the 1.445 million Estonians are ready to part with 50ml of their blood and a detailed account of their medical history. (Gross, 2000)

In some cases the individual, tribe, or even isolated village is defined in legal and corporate discourses as a “partner” in the process of alienation and the profits arising thereof because without the medium (biotechnology) and the controllers of the medium (the technocratic scientific community) the content would be “useless”, inalienable etc. The conflict between being the owner and partner in exploiting one’s own genetic material is obvious because the processes of alienation, translation and so on require an “object” on which to work which is, inevitably, yourself.

Example 2 Moore Vs Regents

Consent – naïve or otherwise – is not always required for alienability and property rights to hold as we have seen in the case of *Moore v Regents of the University of California.* When alienation is enabled through technological innovation, the individual from whom property is alienated is not yet guaranteed any recompense, even from his/her unique genetic characteristics. The case arose when Doctor David Golde and research assistant Shirley Quan were able to patent a cell line derived from tissue extracted from Mr John Moore, a sufferer of hairy-cell leukaemia. Without consent from Mr Moore, Golde and Quan were able to develop and patent the Mo cell line with potential profits of US$3 billion (Faigus, 1993). As it was, ‘the court sided with the interests of the defendants. Its reasoning was that giving the patient a property right to his tissue would impede progress and "destroy the economic incentive to conduct important medical research"’ (Andress and Nelkin, 1998, p. 59). In this particular case, one might question the extent to which institutional hybridisation has already delivered us to a state where courts of law are making decisions overtly in the interest of commercial business outcomes (!).

Conclusion

As we have seen in this chapter, all of the primary mediations (alienation, translation, recontextualisation, and absorption) that form biotechnology research and commercialisation make the distance between the initiators of scientific discoveries, and those who ultimately are affected by or consumers of the technology, or product further and further apart. With each new context that is identified in biotechnology and its related practices, new actors are also either identified or implied. So too, with every change of context do we see new representations of biotechnology emerge.

Chapter 3 Discourse, social practice, and mediation

Overview

A key understanding of the previous chapter was that the boundaries between any given social practice, other practices, and the broader society are discursively constituted and hence are *permeable*. Social practices such as biotechnology and science more generally are interdependent, overlapping, and interwoven with other practices precisely because members of any given social practice participate in a number of social practices, traditions, and social systems in and over time. The extent to which discursive freedom arises out of the natural embeddedness of a practice and its members is, however, often strongly patrolled by both internal and external actors in various practices and social contexts.

This chapter expands upon the role of language and discourse in producing, reproducing, and revising shared ways of seeing, being, and acting within the social practice of biotechnology over time. The social practice framework used in the thesis provides a way of mapping and understanding the potential social and political implications of biotechnology research and commercialisation. Moreover, the social practice framework articulates a view of biotechnology as a socially constructed, socially constituted, and socially and historically embedded practice that is capable of functioning as media.

Discourse and social practice

As outlined in the Introduction chapter, Isaacs identifies six characteristics of social practice that are fundamental to the mediation framework and critical discourse analysis:

1. Social practices are constructed and constituted by persons;
2. Social practices are directed toward an overall purpose;
3. Social practices are shaped by tradition i.e. of what to do within the practice and how to do it;
4. Social practices depend on processes of learning and socialisation to recreate themselves;
5. Social practices have an institutional authority dimension. The production, revision, and reproduction of social practices is often closely controlled by persons in positions of formal and informal authority;
6. Social practices exist as part of a broader, fluid ecology of social and other systems (Isaacs, 1998, pp. 3-9).

The above characteristics emphasise the importance of understanding social practices, and any other conceptualisation of social interaction, in their ongoing social and historical contexts. But, perhaps more importantly they emphasise that social practices can both shape, and be shaped by these surrounding contexts, persons, and practices. Isaacs emphasises that social practices are both socially constructed and constituted. Isaacs emphasises also that social practices are produced and reproduced over time via processes of learning and socialisation. The difference between Isaacs' model of social practice and this thesis is that I have foregrounded the role of discourse and language as central to not only socialisation and learning within social practices, but also the relationship between a given social practice and other external practices and contexts. I posit that the recursive formation of individual and collective identity within the practice of biotechnology, as well as the overall conception of the practice of biotechnology in society, is a function of language and discourse (cf. also Halliday and Martin, 1993; Lemke, 1995; Massey, 1998). Language and discourse are the primary means by which members of the practice and the broader society not only come to understand and identify the practice of biotechnology, but also, and as a result, the primary means by which it is produced and reproduced over time.

Routine aspects of the practice of biotechnology – such as the use of particular terminologies, technologies, assumptions, and ways of (not) relating – reflect, at a surface symbolic level, the deep power structures, ways of seeing, being, and acting within the social practice (Frost and Egri, 1991, p. 242). Language and discourse are hence both a phenomenological representation of the epistemological, ontological, and moral resources on offer, and a contestable medium via which these resources are produced, reproduced, and revised over time. The discourses that existing members of a practice use in describing themselves, and the overall practice, is an integral element of the socialisation[10] process for new members. Through this process, new members of a practice come to identify with salient traditions,

[10] Isaacs defines socialisation as the process whereby 'shared beliefs, actions, and commitments' are learnt and thus reproduced within the social practice (Isaacs, 1998, p.6).

institutions, and their experiences in particular settings within the practice. The importance of language in processes of socialisation and identification is reflected in Gee's (1990) emphasis on discourse and social identity:

> 'A socially accepted association among ways of using language, of thinking, feeling, believing, valuing, and of acting th*at can be used to identify oneself as a member of a socially meaningful group*' (in Falk, 1994, p. 3).

Gee identifies the essential interrelatedness of ways of using language and the ways of seeing and acting that inform the collective consciousness of a social practice. Furthermore, his definition emphasises the importance of language and discourse in producing, reproducing, and revising/contesting shared ways of seeing, being, and acting in the process of identifying with the social practice.

To gain "entry" to the social practice, neophyte members must gain access not only to this system of shared meaning but to the system (discourses, genres) of ethical engagement and orientation this involves. A person's access to this system of meaning and evaluation can be as "routine" as the basic administrative knowledge required to operate within the practice, or it may be as specialised as knowledge required to execute novel gene splicing procedures in a laboratory setting. The sites and contexts within which we are embedded have distinct influence upon our individual and shared ways of seeing, being and acting: 'our embeddedness provides both the source and the contours of our be-ing and be-coming' (Isaacs, 2002a, p. 12).

Social life in all its forms is produced and reproduced via learning and education. In John Dewey's words:

> The most notable distinction between living and inanimate things is that the former maintain themselves by renewal… Education, in its broadest sense, is the means of this social continuity of life. Every one of the constituent elements of a social group, in a modern city as in a savage tribe, *is born immature, helpless, without language, beliefs, ideas, or social standards*. Each individual, each unit who is the carrier of the life-experience of his group, in time passes away. *Yet the life of the group goes on*. Society exists through a process of transmission quite as much as biological life. *This transmission occurs by means of communication* of habits of doing, thinking, and feeling from the older to the younger. Without this communication of ideals, hopes, expectations, standards, opinions, from those members of society who are passing out of the group life to those who are coming into it, social life could not survive. (Dewey, 1922, 2001, np, italics added)

Just as Dewey refers to the communication of habits from the older to the younger in societies, so too can we can talk about the communication of habits from established members of social practices and institutions to neophyte members. Dewey's notion of the renewal of life through transmission effectively captures the dynamic nature of both our social and historical embeddedness. It is also true that each 'genre' of interaction in the social medium has a rich and complex history and political economy of standards and resources for understanding, interacting, evaluating, valuing, relating, and defining among other functions. Each genre makes powerful claims upon our sense of self and our sense of, and engagement with, *others*.

The politics of discourse are ongoing but are most clearly identifiable in processes of learning and socialisation. Learning and socialisation are the means by which neophyte members of the practice come to be seen, and to see themselves, as being “a member” of the practice. Scientists for example, learn specialised terminologies that many other members of the community cannot understand. These terminologies form the basis of a corequisite *system of shared meaning* across the profession. A subgroup of scientists who specialise in molecular genetics might have another set of terminologies that ecologists or physicists are not aware of, or do not use frequently, and vice versa. In this sense we can see that discourse operates in a very much political fashion to include and/or exclude certain actors from entire systems of meaning and activity.

Apart from discursive and institutional boundaries that keep others out (for example the use of specialised terminologies or specific educational requirements) members of social practices actively define their borders through means of rhetorical demarcation and negotiation in the social medium. Taylor (1991) observes,

> "If we want to take a rhetoric of (as opposed to about) science seriously . . . we then must confront questions concerning *how science is demarcated as science*" (403). In other words, our inquiry into the rhetorical functions of scientific discourse should also lead us to explore popular texts that instruct our culture as to the "proper" place of science. It is also important to look at *how science has opposed itself to other sense-making systems in our culture, attempting to dismiss their logics and affirm its own* (Taylor, 1991, p. 1991, italics added).

Members of a particular practice or discourse community also *draw on,* and simultaneously *define,* other social practices in order to differentiate themselves, their ways of seeing, acting, and so on from the wider society.

For example, we often hear of syllogistic statements such as ethics is based on reason, religion is based on belief; you can argue with reason, but you cannot argue with belief; hence religion has no place in the practice of applied ethics (cf. Savulescu, 1998). The effect of this kind of reasoning is to demarcate between practices by stating or creating differences.

Socialisation

Social practices and systems are different from other types of systems, such as machines or organisms, in that they are constituted by the production and reproduction of *shared meanings and understandings* that are expressed primarily through language over time (Luhmann, 1995). In other words, a social system can be seen literally as a *system of shared meaning* that some or all of us have access to. Dewey's description of the regeneration of socialisation for new born members of society provides an analogy for the ways in which new members of a social practice are socialised into shared ways of seeing, being, and acting that 'characterise' the practice.

> On one hand, there is the contrast between the immaturity of the new-born members of the group -- its future sole representatives -- and the maturity of the adult members who possess the knowledge and customs of the group. On the other hand, there is the necessity that these immature members be not merely physically preserved in adequate numbers, but that they be initiated into the interests, purposes, information, skill, and practices of the mature members: otherwise the group will cease its characteristic life. Even in a savage tribe, the achievements of adults are far beyond what the immature members would be capable of if left to themselves. With the growth of civilization, the gap between the original capacities of the immature and the standards and customs of the elders increases. Mere physical growing up, mere mastery of the bare necessities of subsistence will not

> suffice to reproduce the life of the group. Deliberate effort and the taking of thoughtful pains are required. Beings who are born not only unaware of, but quite indifferent to, the aims and habits of the social group have to be rendered cognizant of them and actively interested. Education, and education alone, spans the gap. (Dewey, 1922/2001, np)

There are several points that I will emphasise here. First, neophyte members of a practice do in time become the 'sole representatives' of that group, they rise to powerful positions within the group and can influence the direction of a practice over time. This is at least one reason why it is important for members of a particular practice to be cognisant of the practice and their relative power or powerlessness to contribute to the conditions of their existence. Without formative and deliberative communication between 'generations' of practitioners, the social practice would, in Dewey's words, 'cease its characteristic life'. Second, while I do not discount the potential for members of a social practice (new or old) to *revise* or add to the shared understandings that characterise a social practice, I do recognise that it is primarily the established, powerful, and/or senior members of a social practice who 'hold' and communicate the 'interests, purposes, information, skill, and practices' of the group to new members. Third, and most importantly, while socialisation involves the transference of technical skill and specialist languages, it also involves a fostering of commitment, care for, and loyalty to the practice and its associated ways of seeing, being, and acting. Learning and socialisation are the processes whereby 'shared beliefs, actions, and commitments are learnt and thus reproduced within the social practice' (Isaacs, 1998, p.6). Neophyte members of a social practice have to be rendered cognisant of the shared beliefs, actions, and commitments of the practice, but more importantly, they have to be rendered actively interested in, and committed to, them.

While socialisation can be both formal (for example combined degrees in biotechnology and business) and informal (workplace norms, culture, language, hierarchy, peer relationships), it is always *political*, ethical, and interpretive to the extent that it actively and deliberatively shapes individual practitioners' ways of seeing, being, valuing, and acting according to dominant paradigms. The extent to which an individual member of a practice is free to voice uncharacteristic ways of seeing, being, and acting within the practice can to a large degree, determine the extent to which he or she can identify with the practice, its stated and unstated objectives, and other members of the practice.

The silencing of a marginalised group or individual in a particular context or social practice should not, however, be interpreted as a complete absence of dissenting views and ways of seeing in a practice altogether (Sherrif, 2000): while a practice may be characterised by certain ways of seeing, being, and acting, it is not limited to those ways of seeing, being, and acting. Rather, there are various ways in which individual actors within a social practice may contest and transform dominant ways of seeing, being, and acting – not least through the way they relate with other members of the social practice and *educate* new members as they enter the practice.

Ways of seeing as

Any form of socialisation, be it vocational or otherwise, requires persons to learn new terms and languages. With additional words and meanings come new or clarified concepts and understandings. Thus, socialisation “into” a social practice and its concomitant languages, literally, changes the way that practitioners “see things” both in the work context and in other personal contexts. Technological and scientific changes or innovations in a particular practice such as mechanics bring about wider changes in shared ways of seeing (cf. Kuhn 1977). Kuhn, for example, identifies a historical trend of widespread shifts in perception as shifts in science and knowledge that were then materialised in technologies.

> What my reading of Aristotle seemed therefore to disclose was a global sort of change in the way men [sic] *viewed* nature and *applied language to it*, one that could not properly be described as constituted by additions to knowledge or by the mere piecemeal correction of mistakes. That sort of change was shortly to be described by Herbert Butterfield as “putting on a different kind of thinking –cap”… (1977, p. xiii, italics added).

The following example on conceptions of the heart more fully illustrates Butterfield’s (in Kuhn 1977, p. xiii) description of ‘putting on a different kind of thinking cap’:

> ‘in primitive societies, where technical images are few and far between and very simple at that, most explanatory metaphors are drawn from nature. In the effort to understand his [*sic*] makeup, primitive man inevitably resorts to images of wind and water, breezes and tides, floods, fruits and harvests. But the development of technology created a whole new stock of metaphors—not simply extra metaphors, but ones altogether different in their logical character. Once man succeeded in

> making equipment which performed—looms, furnaces, forges, kilns, bellows, whistles and irrigation ditches—he was confronted by mechanisms whose success or failure depended on the efficiency of their working parts: things which could block or break, silt up or go out, mechanisms which were intelligibly systematic and systematically intelligible' (Miller, 1978, p. 181).

There are three important points to note here. First, discourses produce and reproduce certain *ways of seeing* the world, our relationships and responsibilities toward others, and ourselves. Second, these discourses are dynamic not static. Meanings, values, and orientations develop and change over time. Finally, Kuhn's fundamental argument that scientific and technological change can bring about broader movements in ways of "seeing as" is key in understanding the way that biotechnology can mediate broader ways of seeing, being, and acting in society.

Discourse, ethics, and practice

Both ethics and language find their primary expression, production, and reproduction in 'the social medium': the social 'spaces' of interaction, relationship, and meaning. Dewey (1922/2001, np) articulates '[t]he bare fact that language consists of sounds which are mutually intelligible is enough of itself to show that its meaning depends upon connection with a shared experience'. Ethics, like power, like language, like any form of collective social engagement, lives in *the spaces between* persons in the social medium both in the present and over time. The significance of both the broad (social systems, practices, and institutions) and narrow (interpersonal relationships) aspects of the social medium to the practice of ethics should not be underestimated, nor as language and discourse theory shows, be seen in separation from other levels of social organisation (cf. Lemke, 1995, pp. 104-106).

As Dewey (1922/2001, np) observes, our engagement in the social medium is fundamentally educative: our primary linguistic, aesthetic, moral, and political understandings and orientations are produced, shaped, and reproduced via our engagement/embeddedness in the social medium, from our environment(s), and our relationships with and for others[11]. The understandings and orientations we develop by way of our embeddedness in the social medium are more and less *unconscious* orientations precisely because they are part of the 'constant give and take of relationships with others':

> While this [the] "unconscious influence of the environment" is so subtle and pervasive that it affects every fibre of character and mind, it may be worth while to specify a few directions in which its effect is most marked. First, the *habits of language*. Fundamental modes of speech, the bulk of the vocabulary, are formed in the ordinary intercourse of life, carried on not as a set means of instruction but as a social necessity. The babe acquires, as we well say, the mother tongue… We rarely recognize the extent in which our conscious estimates of what is worth while and what is not, are due to standards of which we are not conscious at all. But in general it may be said that the things which we take for granted without inquiry or reflection are just the things which determine our conscious thinking and decide our conclusions. And these habitudes which lie below the level of reflection are just those which

[11] Note: relationships with and for other[s] includes the individual person's interactions with and for other individual persons and with and for social groupings, institutions, practices, and so on. Thus is the nature of the social medium.

> have been formed in the *constant give and take of relationship with others*. (Dewey, 1922/2001, np)

Urban-Walker (1998) also emphasises the moral significance of this daily 'give and take' in what she calls 'the moral medium':

> Any particular system of mutual moral accounting is a cultural practice already there that we learn from others. We arrive at any situation of moral assessment with moral concepts, maxims, deliberative strategies, and intuitive convictions shared, even if incompletely, with some others. So too we come with sensibilities, emotional responses, and sense of relevance and seriousness shaped by a history of interactions in some personal and political environment, and by our places in that. By accounting to each other through his moral medium, we acknowledge each other as responsible. At the same time we renew and refine the moral medium itself, keeping it alive as we keep our identities as moral persons afloat within it (Urban-Walker, 1998, p. 63)

Narrative ethics in particular has increasingly been recognised as a valid approach in applied ethics for promoting and emancipating those 'voices' and 'stories' that have been marginalised or excluded from public debate, regard, or even consciousness (cf. for example Haraway, 1999; Josselson and Lieblich, 1993; Kohler Riessman, 1993; Massey, 2001a, 2001b; Schneewind, 1982). Urban Walker (1998) also notes that there are 'shared vocabularies and grammars of moral discourse that give us things we can say, and an understanding of when to say them ("kind," "ungrateful," "fair," "wrong," "irresponsible," "promise," "honour," "lie,")' (p. 61). Urban Walker acknowledges that there are commonly recognised and widely shared examples and models that 'teach us the accepted sayings of things' in any given language (1998, p. 61).

Discourse materialities

Apart from the more intangible social aspects of social practices such as shared understandings and ways of seeing, other physical elements of the practice, such as a particular machine or product, can also act as communicative and political *media* within and over time: as discourse materialities. Fairclough states that different elements of social practice – such as objects, technologies, discourse – are 'dialectically related'. That is to say, 'they are different elements but not discrete, fully separate, elements. There is a sense in which each "internalizes" the others without being reducible to them' (Fairclough, 2001, p. 1). While I would prefer to name this relationship as 'dialogic' rather than dialectic, Fairclough's observation is an important one. Technologies – and more specifically biotechnologies – are *discourse materialities*: These technologies are designed out of particular human knowledges and understandings and are, moreover, designed for a particular range of purposes.

A full recognition of biotechnology as media is not possible if we do not comprehend the ways in which all meaningful elements of a social practice can act as media in contexts within and beyond the social practice of biotechnology itself. But, a further appreciation of the extent to which biotechnology as a social practice mediates our social identities and relationships requires us to look at the resources for meaning and evaluation that are materialised within those technologies and products which are consumed by individuals for varying reasons and with varying degrees of informed consent. As indicated in the previous chapter, I have used the concept of recontextualisation to fully explore the movement of meanings between discursive forms, genres, and contexts and, in particular, the discursive movement toward ‘increasingly durable materialities’ (Iedema, 1997a).

I frame both discourse materialities and ways of seeing, being, and acting as media forms to the extent that they can effect meaning in contexts immediately linked to biotechnology research and commercialisation and contexts that are not immediately linked to biotechnology research and commercialisation. Novel genetic technologies for example can literally function as “portals” to the future for a whole range of assumptions, ways of seeing, being and acting that have characterised science practice, and human-non-human interactions for millennia. By this I mean that technologies – and I use this term here to refer both to physical and social technologies – that are created or adopted within a given practice imbue/materialise certain functions, motives, ways, of seeing, being, and acting. *When bio-technologies and techniques are deployed in different social contexts, for different purposes, the functions, motives, ways of seeing, being, acting that are imbued within them are deployed as well*. In other words, technologies, techniques, products, people, ways of describing, new vocations as biotechnologists and bioinformaticists etcetera can function all as media, not only between and across socio-political contexts, but also over time.

Conclusion

Social practices are shaped by traditions of 'what to do within the practice and how to do it' (Isaacs, 1998, pp. 3-9). The corollary is that social practices such as science, ethics, or public policy are also shaped by traditions of what not to do and how not to do it. The production and reproduction of social practices such as biotechnology is an infinitely social, political, and discursive process. Any instance of shared culture, shared ways of seeing, being, and acting – such as the social practice of biotechnology – 'depends on the transmission of meaning across time' (Steiner, 1975, p. 31).

Yet, while we as social beings inevitably draw on the linguistic and discursive resources that are on offer to make sense of our and others' responsibilities, purpose, and place in the world, we are also capable of contesting these resources, re-evaluating them, and revising them. Imperatives for 'applied' and 'strategic' research in biotechnology and universities more generally literally currently places pressure on biotechnology practitioners to translate their research into commodities and commercial opportunities for the university or organisation they are involved in. In responding to these imperatives, biotechnology practitioners themselves function to produce and reproduce powerful discourses and trajectories that are focused on commoditisation, alienation from nature, and technological interventions. The individual practitioners of biotechnology, in learning and passing on the practice, are a vector for the production and reproduction of the practice, and for the trajectories and discourses that historically constitute it.

Chapter 4 Filters of analysis

Overview

As I have argued in the previous chapter, discourse is a central dynamic in the production and reproduction of social practices such as biotechnology over time. The following chapter outlines some ways that these understandings about the functioning of discourse in social practice can be translated into meaningful methods for critical discourse analysis (and vice versa). The intention of the chapter is to familiarise the reader with key interpretive lenses employed within chapters five, six, and seven, which deal significantly with the thesis analysis.

Introduction

Discursive resources for meaning making and evaluation emerge from numerous recognised and unrecognised sources in the social medium. Governments in Australia have attempted to shape public attitudes toward biotechnology research and commercialisation through a number of media, including public awareness and relations programs and more indirect policy and funding statements/initiatives. But our understandings of biotechnology, like the practice itself, are not influenced only by those texts or brochures that are trying to make us think of biotechnology in a certain way. Although I only analyse written texts in this thesis, I note that both textual resources such as brochures and news items, and discourse materialities, such as particular products on offer or procedures, constitute resources for meaning making within this intertextual spectrum. The different ways of seeing included in the heteroglossia are engaged in a politics of representation. Some ways of seeing are foregrounded and esteemed, ‘on sale’, officially sanctioned, while others are unavailable, marginalised, or silenced.

The corpus of texts has been developed over a three year period from July 1999 to July 2002 in an attempt to draw on a range of resources for meaning and evaluation that are available *in the public sphere*. The final analysis portrayed in this thesis has foregrounded those texts that are designed to represent, and/or are produced within, a specific context. I have chosen this approach specifically to highlight the various movements of biotechnology under the biotechnology as media framework – from alienation to absorption. Where possible I have analysed texts that are produced *within* the different social contexts that are consistently mentioned in relation to biotechnology research and commercialisation, for example, basic research contexts; commercial contexts; investment and stock market contexts; regulation and public contexts; policy contexts; education contexts. This approach is consistent with Stillar’s observation that ‘discoursal and rhetorical acts [both] *shape and reflect* the social practices of groups in particular contexts’ (1999, p. 91).

The analysis has included multiple rounds of text analyses and reconceptualisation across the duration of the thesis work, only some of which is presented in this thesis. Reiterative analysis and conceptualisation provides for an ever deepening understanding of the complex interdiscursive and intertextual thematic patterns (Lemke, 1995, p. 42) that have emerged across genres and contexts. As indicated in the Introduction, the “pilot” analysis for the thesis consisted of a comparison of two public education documents dealing with biotechnology (cf. Sunderland, 2000). The outcomes of the analysis, combined with initial content analysis of policy documents and interview data I conducted for the Brisbane Institute, were the basis of the biotechnology as media framework for the thesis. Using the concept of mediation or "movement" as a basis, I began to collect texts that were produced in, or intended to be representative of (for example, policy, ministerial statements, press releases), those contexts that were most consistently referred to in the initial corpus of public education, policy, and interview transcripts.

Key analysis filters

The analysis was conducted using a range of methods and concepts arising out of critical discourse analysis that are suitable to the biotechnology as media framework and the initial findings of the pilot study. The methods and concepts identified were used as "filters" or "probes" with which to read, interpret, and evaluate whole corpus texts, and subsections of them. I use the term "filters" here to acknowledge the selective nature of the final analysis and also to highlight the nature of corpus analysis. Analysing a large corpus of texts using the Wordsmith software program requires this filtering process due to the sheer amount of data that is available. The key filters I have used in analysing the thesis corpus are explained below.

Interdiscursivity and intertextuality

In order to track mediation across and within various social contexts the analysis had to be interdiscursive (Fairclough, 2002). This is a basic prerequisite of discourse analysis to the extent that all meanings are intertextual: 'the meaning of a utterance or event must be read against the background of other utterances and events occurring in the community' both past and present (Lemke, 1995, p. 25).

The first section of the thesis analysis is hence dedicated to discourse-historical concerns. Discourse-historical analysis is primarily employed to promote interdiscursive and intertextual analysis and to 'situate' contemporary discourses within a wider historical context (Wodak, 2001).

> In investigating historical and political topics and texts, the discourse historical approach attempts to integrate much available knowledge about the historical sources and the background of the social and political fields in which discursive 'events' are embedded. Further, it analyses the historical dimension of discursive actions by exploring the ways in which particular genres of discourse are subject to diachronic change, that is, the intertextuality and interdiscursivity.

The idea of the discourse-historical approach is that the analyst seeks to compare the current texts with historically significant discourses and trends. Understanding the social and historical bases of a given social practice is also the first step toward understanding how that social practice can act as media in broader social contexts over time. While this thesis does not provide the scope for a full discourse-historical analysis and comparison of biotechnology discourse (which is obviously a fruitful area for future research), I do provide some analysis of representations of history in biotechnology in the following chapter.

Mediation and context

As identified in previous chapters, a key aim of the thesis analysis was to identify "official" mediations or the official path of movement for biotechnology research. This includes, for example, the thematic metaphor of a 'product development pipeline' that runs from research contexts to manufacturing contexts. This metaphor appears in multiple contexts in the thesis corpus, including interview transcripts, public policy, and industry magazines. A second aim was to identify how biotechnology is represented in different contexts and texts. Does it change noticeably for example between a research laboratory context and the pharmaceutical company context.

The politics of representation

A key consideration of critical discourse analysis is to identify the political and rhetorical significance of the way that things, relationships, persons, animals, etc, are represented. Mehan (1993) identifies,

> [t]he choice of *a particular way of representing* events gives them a particular meaning. There is often a *competition* over the correct, appropriate, or preferred way of representing objects, events, or people. In fact, although there are many possible modes of representing the world and communicating them to people, the course of history can be envisioned as successive attempts to impose one mode of representation upon another. (Mehan, 1993, p. 241, italics added)

In paying attention to the politics of representation, I have sought to identify contending or uniform representations of persons, technologies, animals, and practices. I have also sought to identify who is attributed with agency in different contexts and scenarios. Through wider intertextual comparison, I have also sought to identify who or what is objectified or absent in the politics of representation played out in the corpus texts. Competition over the 'correct, appropriate, or preferred way of representing objects, event, or people', gives rise to a *politics of representation over biotechnology research and commercialisation* (Mehan, 1993). Mehan describes this below:

> Proponents of various positions in conflicts waged in and through discourse attempt to capture or dominate modes of representation. They do so in a variety of ways, including inviting or persuading others to join their side, or silencing opponents by attacking their positions. If successful, a hierarchy is formed, in which *one mode of representing the world (its objects events and people, etc.) gains primacy over other*, transforming modes of representation from an array on a horizontal plane to a ranking on a vertical plane. (Mehan, 1993, p. 241)

Even if there is no immediately noticeable difference in how things are represented in different texts and contexts, the politics of representation are still significant to the extent that one mode of representation or discourse can be seen to be repeated in multiple contexts: thematic patterns of representation and orientation.

Thematic patterns and emic instances

Thematic patterns are patterns in ways of representing and evaluating across multiple texts or within one text. In Lemke's words

> [t]ext meaning is not reducible to or recoverable from word meaning potential alone. Text meaning is made by using thematic patterns as the direct meaning making resource…*The same thematic patterns [can] recur from text to text in slightly different wordings, but recognizably the same, and each wording can be mapped onto a generic semantic pattern that is the same for all*. (Lemke, 1995, p. 42, italics added)

When thematic patterns are present, it means that there is at least some uniformity in the way that things are being represented. If the same patterns are present in multiple texts, that originate from multiple authors and contexts, it is significant in terms of the range of discursive and evaluative resources that are on offer regarding the object of representation. Some examples of thematic patterns in biotechnology follow.

> [Heading] Why biotechnology is important to Australia[] 'Australia's industrial <u>competitiveness</u>, and hence our <u>standard of living</u>, will be strongly influenced by <u>whether *we* can grasp the opportunities presented by biotechnology</u>, and underpinned by the knowledge and skill of our researchers… Biotechnology <u>promises to be</u> the <u>next great wave</u> of <u>technological change</u>, bringing changes <u>as radical and pervasive as those wrought by the IT revolution</u>. (Commonwealth of Australia, 2000,cwn. 1,587)

In truth there are a many thematic patterns included in this one excerpt. For example, a common feature of biotechnology policy documents and education documents is to establish a causal relationship between our pursuing biotechnology and achieving 'industrial competitiveness' and a high 'standard of living'. Another feature is the modalisation of these benefits: i.e. biotechnology merely has the *potential* to improve industrial competitiveness and living standards. This modality is reaffirmed in repeated phrases such as 'biotechnology promises to be'; 'biotechnology will be', etcetera. The attribution of human and transcendent agency to the non human biotechnology is also standard: 'biotechnology allows us…'; 'biotechnology delivers…'; 'biotechnology helps us to…'; 'biotechnology provides us with…' . These are just a few examples of thematic patterns of representation and orientation in the corpus.

Yet, in addition to identifying thematic patterns, I would like to highlight deviations from the patterns: I would like to highlight any contexts or discourses where a particular way of representing and evaluating biotechnology is unique or peculiar. I use the term 'emic instances' to describe these peculiarities. This is taken from Pike's discussion of the insider and outsider world views of particular communities. Pike (1958) observes that the view of a local scene through the eyes of a native participant in that scene 'is a different window' to the one that an outsider looks through (1958, p. 144). It is a reality that no one but an inhabitant of that scene can have access to that window.

Consistent with Dewey's description of the regeneration of social life through transmission, and Isaacs' account of particular social practices as being produced and reproduced through processes of learning and socialisation, Pike identifies that individuals can only gain 'access' to emic views

> …by being "born into" a system – by suddenly finding themselves in a series of events which they at first do not comprehend. Here they gradually learn to act as normal participants, as through contrastive situations (or by receiving instruction) they gradually learn to make the kind of responses to these events which elicit appropriate reactions by other members of the community. (Pike, 1958, p. 146)

I posit that in identifying peculiarities and inconsistencies in ways of representing and evaluating in the range of discursive resources on offer, we can go some way toward helping 'outsiders' to identify the emic views that characterise and constitute a particular practice or context. An example of an emic 'instance' in the corpus is the focus on stock market prices and minute-to-minute figures on multinational pharmaceutical companies' websites (cf. for example the corpus illustrations included on p. 185). These figures do not appear in any other of the contexts explored in the analysis. Likewise, the United Nations Human Development Report (2001) is the only text that highlights successful models for collaboration among researchers toward the provision of public health services in developing countries.

Steiner (1975, p. 78), acknowledges the relationship between language and particular ways of seeing in arguing that language is a) specific to cultural, social, and historical contexts and b) both opens up, and reflects, peculiar ways of seeing/knowing that persons outside of language system cannot 'access':

> …language is not the vehicle of thought but its determining medium. Thought is language internalised, and we think and feel as our particular language impels and allows us to do. But tongues differ as profoundly as do nations. They too are monads, 'perpetual living mirrors of the universe' each of which reflects or, as we would now put it, structures experience according to *its own particular sight lines* and habits of cognition. (Steiner, 1975, p. 78, italics added)

If nothing, else, the recognition that emic views exist reaffirms the importance of selecting texts that are produced within a range of different contexts and practices and that are written by a range of authors. In comparing and contrasting the different texts, the analyst can identify particularities, as well as similarities, between them.

Silences

While participating in a CDA reading group in 2000, I became interested in the possibilities not of discursive politics or obviously rhetorical forms of discourse, but of 'silences' and, in particular, the contexts, persons, processes, and events that are not represented in, or who are actively silenced by, those who perpetuate powerful discourses on biotechnology. Sheriff highlights the inherently ethico-political function of silencing in the article '*Exposing silence as cultural censorship'*. In her words,

> The kind of silence I am concerned with *does not rely upon obvious and explicit forms of coercion or enforcement*. Although there may be meaningful, even profound, psychological motivations underlying this silence, it is *socially shared*; the rules for its observance are culturally codified. Unlike the activity of speech, which does not require more than a single actor, *silence demands collaboration* and the tacit communal understandings that such collaboration presupposes. Although it is contractual in nature, a critical feature of this type of silence is that it is *both a consequence and an index of an unequal distribution of power*, if not of actual knowledge. Through it, *various forms of power may be partly, although often incompletely, concealed, denied, or naturalized*. Although the type of silence I refer to may be a more or less stable and widely shared cultural convention, *it is constituted through, and circumscribed by, the political interests of dominant groups*. While silence tends to penetrate social boundaries it is not seamless; different groups, whether constituted by class, ethnicity, racialized identities, gender, or language, have markedly *divergent interests at stake in the suppression of discourse*. Silence, like discourse, must be deconstructed in such a way that these interests are explicitly located within a range of differentiated and opposed social positions in which both linguistic and nonlinguistic form of power are distributed'. (Sheriff, 2000, pp114-15, italics added)

Silences are different from emic instances because they are meaningful in their absence rather than their peculiarity. To identify silences, an analyst requires intertextual and interdiscursive knowledge of the subject area he or she is dealing with. He or she must be aware of the different voices in a debate, the different perspectives, and the politics of a situation prior to engaging with a corpus.

As explored in previous work (cf. Sunderland 2002), some forms of engagement in biotechnology currently function specifically as 'technologies of silence and silencing': They are socio-political tools that some actors in our society use – both advertently and inadvertently – to reinforce positions of influence, power, and powerlessness; to create certain reputable or disreputable images of others; and to intimidate and/or silence others. The effect of these technologies of silence and silencing is that particular individuals and groupings of people are *silenced*.

To the extent that silence is a collective practice that contributes to shared meaning, it too can be seen as discourse. All discourse – including silence – is a collective practice which happens within shared social contexts (Fairclough,1992; Lemke, 1995). The simplest way to understand silence as contributing to shared meaning and understanding is to think about where there are "gaps" in those forms of communication we would normally think of as discourse (eg speech, text, pictures, non verbal communication, and so on). This in itself is more meaningful than it may at first appear: It is part of our common knowledge for example that something can be known or tacitly accepted without ever being overtly stated by anyone. We can for example "know" or "sense" that it is not "the done thing" to talk about X in a certain context or to discuss Y and Z with certain people. We come to learn, know, or sense these often unstated rules for communicative engagement from a range of sources. For example, we can be influenced by

- Things that we have directly experienced or seen in the various social contexts we engage in;
- Interpersonal engagements and reactions or attacks we, or others we know, have experienced in the past;
- Attitudes and opinions others in positions of power have expressed to us or to others we know;
- Formal institutional and organisational policies, strategic plans, and so on;
- Shared ways of seeing, being, and acting; and/or
- By not being aware that X, Y, or Z even exist or are of interest or concern for others.

Obviously, silence, while still meaningful and collaborative, is not readily identifiable, particularly to people who exist outside of , and hence are not witness to, the emic experiences and contexts of those who are silenced and marginalised.

The very significance of silencing and marginalisation is that voices are not readily heard, that experiences are not shared, and understanding is not easily developed by others outside of that sphere of experience. Practices of silence and silencing are hence ethically problematic because the communicative “media” of ethical engagement and mutual understanding are immobilised when silence and silencing proliferate. Apart from the ideologically limited, and limit*ing*, evaluative, socio-political, and socio-ethical orientations that are ‘inscribed’ (Martin, 2000) in publicly available biotechnology education materials, there are a number of further socio-political and institutional technologies that prevent, inhibit, and threaten – both explicitly and implicitly – informed, critical, debate in relation to developments in biotechnology research and commercialisation. In light of the often personally challenging and inherently anti-democratic effects of these technologies of silence and silencing should definitely be subject to critical analysis and, where possible, transformation.

Genre considerations

Genre is significant to the analysis in a number of ways that have been explored in previous chapters. Genre in its traditional literary sense, is also a very important consideration in textual analysis. Genre is the guiding normative system of a text or, if you like, the guidelines that authors use to produce a certain “kind” of text. We know that a policy document for example is a policy document based on a range of things which may include, for example, the content; its presentation; the style of language and diagrams used; who the authors are; patterns of evaluation; the rationality behind patterns of evaluation; the logic or function of the text; the persons who are portrayed in the text; and so on. The document can be recognised as “policy” because it has *generic* features in common with other texts of its “kind”.

Genre is also a rhetorical device to the extent that it produces, reproduces, and *normalises generic patterns or modes of evaluation and representation*. We come to "expect" certain things from certain kinds of documents, often to the point where the generic features of a text become invisible. Education and policy documents on biotechnology are a case in point because they are often presented as a source of 'information' or 'authority' and hence, through their genre alone, achieve significant rhetorical appeal (ethos).

Conclusion

This chapter has outlined the core analytical filters I have used to analyse the thesis corpus. Each of the filters presented significantly enhances my understanding of the political nature of discourse, and moreover, the degree to which official sanctioned representations of biotechnology – through government policy and education documents in particular – promote certain ways of seeing and evaluating biotechnology. The following three chapters will highlight different aspects of the thesis corpus that have been highlighted by these various analysis filters. The first of the three analysis chapters deals with the discourse-historical approach and provides an analysis of the various ways that 'history' is presented in official biotechnology discourses. The second identifies official 'mediations' in the social practice of biotechnology and, in particular, the way that hybridity between science and industry is produced and reproduced in policy. The third analysis chapter highlights some of the ethical and social implications of official biotechnology mediations. The politics of representation are particularly significant in the way that various actors in, and opponents of, biotechnology are identified (or not) within specific contexts.

Chapter 5 Discourse-historical? The bases of biotechnology

Overview

The previous chapters have outlined the way that contemporary definitions and discourses of biotechnology research and commercialisation foreground its economic and commercial private value but also make significant claims regarding the public value of biotechnology in promoting human well being, health, and prosperity more generally. This style of representing new technologies is not new. To the extent that biotechnology continues to reinvigorate and rearticulate (loudly) technocratic discourses associated with rational science and market economics, it is also a *temporal medium* that functions to reproduce historically powerful ways of seeing, being, and acting in new or expanded socio-biological contexts.

The ultimate impact of biotechnologies is thus not merely experienced in contexts of consumption, therapy, or treatment (as the authors of certain texts within the thesis corpus want to suggest) but, rather, the impact of biotechnology can also be felt in the closing down, and marginalising, of socio-political spaces, voices, and discourses that seek to offer alternative and dissenting ways of seeing, being, and acting other than those officially endorsed and propagated by the increasingly powerful and economically oriented discourses of biotechnology research and commercialisation. In order to introduce these broader movements, this chapter will outline some discourse-historical and social trajectories within which contemporary biotechnology operates. This is an important grounding to the thesis not least because one of the primary observations is that biotechnology acts as media not only between social contexts in time, but also between social contexts over time.

The traditions and trajectories highlighted in this chapter are not acknowledged in official discourses on biotechnology despite the fact that they provide important intertextual understandings of biotechnology in contemporary society. The corpus analysis shows that the dominant representations of the history of biotechnology are, rather, positivistic, linear, and misleading. As I will argue, though, a lack of historical context for biotechnology – particularly discursive context – fundamentally subverts heteroglossia in biotechnology discourses and confiscates vital resources for understanding and evaluating contemporary biotechnology.

Biotechnology as a time medium

Although it is often portrayed as being "new", "revolutionary", or "emerging" by critics and protagonists alike, our current preoccupation with genetics, improvement, and perfection is arguably not new but, rather, *re-emphasised, rearticulated,* and *reinvigorated* by recent developments in genetic technologies, the biggest one of which is the much touted "mapping of the human genome". As the corpus analysis shows, modern approaches to biotechnology have been, just like eugenics, frameshifted to the level of national policy, in fact to the level of the public interest for all Australians, all of humanity, and all future beings. Animal husbandry and farming practices have routinely sought to "optimise" desired traits, and eradicate or reduce undesired traits, of animals, crops, and plants for a range of aesthetic, commercial, agricultural, and manufacturing purposes.

The Australian national economy and technology and pharmaceuticals stock markets for example have and are being [re]geneticised. So too have race relations; interpersonal relations; property rights; social class; science degrees; public funding of research, scientific and otherwise; business ventures in the "new economy"; venture capital and investment; social behaviour, tastes, and fashion sense; agriculture; aggression; spousal choice; smoking; alcohol consumption; obesity; cancer; and intelligence. But how do the practices and objectives of modern genetics differ from genetics other than the technologies that are used? What are geneticists other than a nation of animal husbandmen – but for humans?

But, there are some *new* traditions that have entered into mainstream biotechnology practice as it moves into new contexts such as multinational markets and the stock market. Thomas Kuhn's work, as outlined in Chapter Three emphasises the role of technological and scientific innovation in creating *new* ways of seeing old things, old ways of seeing can be recast and *en*textualised in new technologies.

Rhetorical ahistoricity in contemporary biotechnology discourse

> Mr BEATTIE: That is the truth. It is important that we have an informed and educated debate about genetically modified food. I am concerned generally about a number of alarmist headlines and stories that I have seen. When talking about genetically modified food, we have to understand that humans have been eating genetically modified

> food for thousands of years. Ever since we got out of the trees, we have been modifying food. If you think about it—
>
> Ms Bligh: Some are not out of the trees!
>
> Mr BEATTIE: I know that some in this House have come out of the trees more recently than others. I accept that. For those on this side of the House, who have indeed been out of the trees for a long time, I want to make a very serious point about this. As a species we have been modifying food since we came out of the trees. If you think about it, when Adam and Eve were around, there were not the special breeds of dogs or horses or cattle or the grains of wheat or merino sheep. The list goes on and on. We need to be aware that we have modified our grain and we have modified our livestock. The wheat, sheep and cattle that we grow today bear little resemblance to the wheat, sheep and cattle of even two centuries ago.
>
> Let us not be alarmist in this debate about biotechnology. Biotechnology will be the greatest shot in the arm for primary industries in this State that we have ever seen. That is why it is absolutely essential that the media contains its normal exuberance for alarmism and has a sensible debate about this issue. As I say, there needs to be a sensible education program through the media, not headlines that cause people to worry unnecessarily. As to labelling, we should have some truth in labelling and state that every product that we eat has been, somewhere along the line, genetically modified.
>
> - Queensland State Government Premier Peter Beattie, Ministerial Statement on Biotechnology recorded in Parliamentary Hansard 19 August 1999 -

History is presented in a number of ways in discussions surrounding biotechnology research and commercialisation. A few of these are illustrated in Beattie's "Out of the Trees" Ministerial State of 1999 above. The 'out of the trees' version of biotechnology is the one where biotechnology has, allegedly, been around for 'millennia': biotechnology is part of the natural evolution of humans. Arguments related to this version of biotechnology history include: if we have accepted ‘traditional’ biotechnologies such as beer, bread, and cheese, for so long, why would we reject any of the natural post-cursors to these technologies in the form of modern genetic technologies.

Another common version of history in biotechnology is the biotechnology time line (see over page). This timeline is most common in texts that are designed to be “educational” for a “lay” audience. I have included a typical example of the biotechnology timeline over the page. To the extent that it has become the predominant way of representing a history of biotechnology in these ‘public education’ texts, the “biotechnology time line” can be regarded as a *genre* or way of *interacting* very selectively with the origins of biotechnology research and commercialisation. In both genre and content, the biotechnology time line, as it is presented in so many web sites and publications, reaffirms the dominant scientific discourse surrounding biotechnology as being positivistic in ideational and evaluative content. Although it may seem mundane, presenting history on a ‘timeline’ as a chain of “events” is significant. The Timeline, presented in logical blocks and apparently related ‘developments’, invokes the mathematical equation or *logical series* function/expectation that is common in intellectual quotient testing and high school mathematics competitions *a la*:

> Identify the next two numbers in this series:

1, 3, 5, 7, __ , __

Like the mathematical series above, the timeline format encourages us – or indeed requires us – to “see” or find links and patterns between the various plots on the line. The development from one plot to another is linear and, apparently, logical. Biotechnology time lines display none of the complexity and richness of the history of the science and biotechnology that is in fact long, interdiscursive, and multicontextual.

Table 2: Biotechnology Timeline. Source: North Carolina Biotechnology Center (accessed 2003)

**This Table is not available online.
Please consult the hardcopy thesis available
from the QUT Library.**

A third and final version of history I would like to point out is the *future history* of biotechnology. Biotechnology policy discourse features an interesting and complex rhetorical usage of future, past, and present tense to create causal relationships between a selective view of biotechnology history, current actions and policy stances, and a future bio-mediated utopia (cf. Hindmarsh and Lawrence, 2001). At the same time that biotechnology is defined as an age old – and even a instinctual – process, the benefits of biotechnology are always portrayed as being actualised in a future time and place. The example below is taken from the NSW State Government Biotechnology Policy document. I have underlined those sections of the excerpt that make specific claims on time period and tense.

> At the <u>start of a new century</u> few industries encapsulate the meaning of innovation better than biotechnology. <u>Within a few months</u> the human genome will be mapped a development which will <u>revolutionise</u> medical science and the discovery of new therapies for human disease. Other developments in agricultural biotechnology promise a <u>similar revolution</u> in food production. (NSW State government, cwn. 13725)

The emphasis on revolution and the misappropriation of historical context in biotechnology is a significant feature of the discourse. As illustrated above, biotechnology is being portrayed as the stuff of social and economic revolution: biotechnology is portrayed as the defining technology of a 'new age' and a 'new century'. The excerpt below portrays similarly grand notions of biotechnology. The policy writers are actually quoting former US President Bill Clinton in this excerpt. Once again, references to tense and time period are underlined:

> As we stand at the dawn of the new century, we recognise the enormous potential that biotechnology holds for improving the quality of life here in the United States and around the world. These technologies, which draw on our understanding of the life sciences to develop products and solve problems, are progressing at an exponential rate and promise to make unprecedented contributions to public health and safety, a cleaner environment, and economic prosperity. U.S. President Clinton January 2000. (Victorian Government, cwn. 3661)

So, although biotechnology has in Beattie's 'out of the trees' and the 'timeline' versions of history been around for millennia, biotechnology is still largely a *possibility* for Clinton, a possibility that must be nurtured and supported. The rhetorical significance of time and tense is large in policy discourses on biotechnology. The so-called Biotechnology Age or Biotechnology Revolution is historically significant because it has been promised before it has actually happened[12].

In foregrounding only these limited views of biotechnology history, biotechnology policy authors and others fail to acknowledge the extent to which biotechnology practice is produced by historically significant trajectories. Indeed, apart from the homogenized version of the linear biotechnology timeline that starts with Sumerians brewing beer and leads to the mapping of the Human Genome, discourses on contemporary biotechnology are largely devoid of historical context. The serious implication of this is that a limited appreciation of history *limits the range of resources on offer* to society in understanding and evaluating biotechnology:

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[12] I acknowledge personal communication with Peter Isaacs in 2001 where he observed that the biotechnology revolution is being declared before it has happened.

an ahistorical or mis-historical account inhibits the natural heteroglossia of understanding in biotechnology.

Biotechnology as a time machine: Reinvigorating discourse through social practice

Leiss (1972) argues that the human domination of nature through technological means enables a concomitant but hidden domination of persons by powerful scientific and technological trajectories. He argues, further, that one of the primary ways that technological innovation, and its inculcation in society, achieves ends of social control is by creating and controlling human longings, wants, needs, and desires.

> The objective of transforming all of nature (including consciousness) into the material of production becomes compulsive, blindly repetitive, and finally self-destructive. The apparatus of production expands infinitely – steady growth is its Nicene Creed – while all rational criteria for judging the human value of its fruits are subverted. The final stage is reached when the only rationale for production that can be offered is that many persons can be induced to believe that they really want and need the newest offering of commodities in the marketplace. At this stage domination over nature and men [sic], directed by the ruling social class, becomes internalised in the psychic processes of individuals; and it is self destructive because the compulsive character of consumption and behaviour destroys personal autonomy and negates the long and difficult effort to win liberation from that experience of external compulsion which marked the original relationship between human and nature. (Leiss, 1972, pp. xv-xvi)

In this way, technological innovation in biotechnology facilitates not only the alienation and commoditisation of biological life, but also the alienation and commoditisation of human characteristics and traits, social relationships, human aspirations, activities, and identity. The range of bio products and services on sale, and the official rationality behind them, are designed to inspire the imagination and desire of persons in both direct and indirect ways. They are direct in that they inspire the literal consumption of new or altered products into the imagination, lives, and bodies of individuals. They are indirect in that they are absorbed through organic and social mediation into social and organic systems: that is, into the pool of biological and meaning resources (biodiversity and heteroglossia).

Biotechnology's temporal mediating function is fed by technological development because technological development creates new products, new market places, and new consumers. The nature of both consumerism and technological development is that they are future oriented: Consumers are incessantly upgrading their products, taking advantage of the new, and discarding the old. But scientific and technological elites, via their commercial technological 'revolutions', also create new forms of dependence on technology. The notion of critical mass in particular betrays the notion that, once a technology has 'diffused' in society to the point of universal accessibility, or even partial accessibility, it becomes a necessity for persons to access that technology if they are to fulfil the requirements of everyday life. As a technology moves toward 'critical mass', and is inculcated in the productive, state, legal, and social systems, it becomes harder – and in some cases impossible – for an individual to not use the technology or be affected by it as is currently the case with information and communication technologies such as email and the Internet for many people.

Apart from creating and controlling consumer wants and desires, technological developments produce new vocations, disciplines, jobs, and practices that determine how and where we live our lives. As Marcuse (1964) notes, '[i]n this society the productive apparatus tends to become totalitarian to the extent to which it determines not only the socially needed occupations, skills and attitudes, but also individual needs and aspirations' (Marcuse, 1964, p. 13).

The degree to which technology comes to define notions of progress is evident in the UN's recently developed Technology Achievement Index (TAI) on which all countries around the world were ranked. The number of technology precincts/hubs are one of the defining criteria of a country's TAI rating along with human resources, innovation funding, and science citations.

> Human progress in the past 30 years shows what is possible. So does this year's Report. One of its main messages is that technological advance has contributed greatly to the acceleration of human progress in the past several centuries. Those contributions have the promise of even greater acceleration. Technological advance has contributed greatly to the acceleration of human progress in the past several centuries. Technological innovation is essential for human progress. From the printing press to the computer, from the first use of penicillin to the widespread use of vaccines, people have devised tools for improving health, raising productivity and facilitating learning and communication. Today technology deserves new attention. Why? Because digital, genetic and molecular breakthroughs are pushing forward the frontiers of how people can use technology to eradicate poverty. These breakthroughs are creating new possibilities for improving health and nutrition, expanding

> knowledge, stimulating economic growth and empowering people to participate in their communities. Today's technological transformations are intertwined with another transformation-globalization -and together they are creating a new paradigm: the network age. These transformations expand opportunities and increase the social and economic rewards of creating and using technology. They are also altering how-and by whom-technology is created and owned, and how it is made accessible and used. A new map of innovation and diffusion is appearing. Technology growth hubs-centres that bring together research institutes, business start-ups and venture capital-are dotted across the globe, from Silicon Valley (United States) to Bangalore (India) to El Ghazala (Tunisia), linked through technology development networks. (UN Human Development Report, 2001, cwn 19,985)

The fact that the UN discursively narrows the concept of 'human development' so as to be measurable by the number of technology precincts a country owns or operates is very significant. In effect, human development is being presented as being synonymous or contemporaneous with, not just the outcomes of, but *the mere existence of* technology in a country. At the same time as the presence of technology is assumed to engender human development, that presence is largely outward oriented: toward international "markets" and economic competitiveness.

As is the case with South Africa, for example, technology, and in particular biotechnology, is seen as a utopian path toward joining the 'industrialised world'. Just as Australia and other countries are aiming for the official utopia of the biotechnology future, 'developing' countries merely aim to use biotechnology to reach the 'first world'. The apparent global 'peer pressure' toward biotechnology industrialisation is particularly evident in the South African policy on biotechnology. The South African policy is distinctive in the corpus because it is written from the perspective of a "reintegrating" economy. The South African policy illustrates the sheer extent to which western economies dictate the direction of nations through technological 'innovation'. South Africa sees investment in biotechnology, and particular trends in research and commercialisation, as being key to their emergence into the category of 'global science and technology'.

> South Africa has a solid history of engagement with traditional biotechnology. It has produced one of the largest brewing companies in the world; it makes wines that compare with the best; it has created many new animal breeds and plant varieties, some of which are used commercially all over the world and it has competitive industries in the manufacture of dairy products such as cheese, yoghurt and maas and baker's yeast and other fermentation products. However, South Africa has failed to extract value from the more recent advances in biotechnology, particularly over the last 25 years with the emergence of genetics and genomic sciences (the so-called 3rd generation). Already many companies and public institutions elsewhere in the world are offering products and services that have arisen from the new biotechnology. In the USA alone, there are 300 public biotechnology companies with a market capitalisation of $353 billion and an annual turnover of $22 billion p.a. Moreover, the growth of biotechnology industries is not restricted to the developed countries. Developing countries such as Cuba, Brazil and China have been quick to identify the potential benefits of the technology and have established measures both to develop such industries and to extract value where possible and relevant.
>
> The strategy outlined in this document is designed to make up for lost ground and to stimulate the growth of similar activities in South Africa. Biotechnology can make an important contribution to our national priorities, particularly in the area of human health (including HIV/AIDS, malaria and TB), food security and environmental sustainability. In the pursuit of these priorities, we are fortunate in that we can be guided by the experiences of other countries. For instance, we know that to achieve success a country requires a government agency to champion biotechnology, to build human resources proactively, and to develop scientific and technological capabilities. In addition, successful commercialisation of public sector-supported research and development (R&D)

> requires strong linkages between institutions within the National System of Innovation and a vibrant culture of innovation and entrepreneurship, assisted by incubators, supply-side measures and other supporting programmes and institutions …
>
> As South Africa re-integrates into global science and technology it has to be aware of important changes in international understanding of the way in which research is undertaken and knowledge is generated. In the industrialised countries it is increasingly acknowledged that:
>
> - Knowledge is to an ever growing extent produced in the context of its applications and there are greater expectations that support for research will lead directly to economic and social benefits for the nation providing the support.
>
> - There is an inescapable trend towards larger and more interdisciplinary teams working in more transdisciplinary research activities.
>
> - There is a growing diversity of participating organisations to be found in today's research teams.
>
> - There is a continuing trend towards greater international linkages in research teams. (A National Biotechnology Strategy for South Africa, 2001, cwn 11)

For South African policy makers at least, biotechnology now *defines* the ‘developed’ and ‘industrial’ world. Moreover, the biotechnology utopia South Africa is aiming to buy into is contingent upon a range of specified government actions that have been set by countries who have been ‘successful’ in ‘extracting value’ from the ‘new biotechnologies’. The proven government actions and conditions for biotechnology include:

- ‘A government agency to champion biotechnology, to build human resources proactively, and to develop scientific and technological capabilities’;

- 'Strong linkages between institutions within the National System of Innovation and a vibrant culture of innovation and entrepreneurship, assisted by incubators, supply-side measures and other supporting programmes and institutions' to promote 'successful commercialisation of public sector-supported research and development (R&D);

South Africa is also following the lead of industrialised countries in structuring the way that 'research is undertaken and knowledge is generated'. According to the authors of the South African policy, industrialised countries that excel in extracting value from the new biotechnologies exhibit the following conditions for research:

- Knowledge is to an ever growing extent produced in the context of its applications and there are greater expectations that support for research will lead directly to economic and social benefits for the nation providing the support;

- There is an inescapable trend towards larger and more interdisciplinary teams working in more transdisciplinary research activities;

- There is a growing diversity of participating organisations to be found in today's research teams.

- There is a continuing trend towards greater international linkages in research teams. (A National Biotechnology Strategy for South Africa, 2001, cwn. 7946)

According to this catch up, mentality, any innovation can be potentially good, desirable, and valuable as long as it is seen to be innovative in the contexts of 'global science and technology'. While 'human health (including HIV/AIDS, malaria and TB, food safety), and environmental sustainability' are named as a specific priority for South Africa that can be achieved through biotechnology, these specific goods do not appear as frequently as the ideal of more general ‘extracting of value’ that is, apparently, an unquestionable good for any economy or country.

As argued previously, a technological innovation does not prosper unless it is mediated through the existing capitalist productive apparatus. But, most significantly, the productive apparatus is also by necessity the site of alienation of human labour: human labour (including ‘intellectual’ labour) is rendered as but one element in the chain of production: simultaneously a resource and tool of production. The nature of scientific, technological, and capitalist systems is to render processes into things. The consumer system relies on consumers continuing to consume: that is, in not having their wants and needs met. The system relies just as much on new productive technologies and human labour as it does on human wants, needs, and desires.

Owning the natural [and unnatural] world

The tendency toward defining genetic material in property terms links into a wider trajectory of ongoing alienation and commoditisation that Graham (2001) refers to as ‘hypercapitalism’: a period where the ‘development and diffusion of technology within capital has tended towards an emphasis on its ability to firstly appropriate and commodify, and later to replace, increasingly intricate and intimate aspects of human labour power’ (p. 135). Using biotechnology as media in direct and indirect ways, humans from a number of inter-textual and inter-temporal backgrounds, practices, professions, intentions, and persuasions continue to expand the number and range of territories, sites, and contexts within which they or other individuals and institutions can produce economic exchange value. Graham argues,

> Today, few if any aspects of human activity are now beyond the technical, conceptual, or legislative grasp of formal commodification. This appears to be a characteristic of capital. As it progresses as a system of social organisation, *increasingly intimate aspects of human experience are subsumed under its formal processes*. The very idea of a "knowledge economy" exemplifies the trend... Consequently, the complex of historically derived abstractions we have come to call "the economy" has appeared to move 'closer' to people (cf. Castells 1989: 16-17; Jessop 2000), thoroughly infusing the most fundamental levels of human existence, thought and language, while at the same time appearing to speed rapidly away from the control of human agency, and even from that of national legislatures. (Graham, 2000, p. 135)

The historical significance of biotechnology is that it allows humans to render – if only in a more thorough fashion – living organisms both as sites of economic activity and ownership and as materials of production. In the case of biotechnology, we are witnessing a distinct expansion in human ability to appropriate, commodify, and replace/transform not only human *labour*, but the very foundation of human and non human social ***and*** biological be*ing*. The *Bayh Dole Act 1980* was one of the first Acts to inscribe that patents could be held in the USA on 'non human and non naturally occurring life forms' and license these patents for private commercial use (US Council on Governmental Relations, 1999). Prior to this, the US government had 'retained title and made these inventions available through non-exclusive licenses to anyone who wanted to practice them' (US Council on Governmental Relations, 1999). Companies could not have exclusive rights under government patents to manufacture and sell resulting products.

The corpus texts include consistent references to 'intellectual capital' and 'intellectual property' with a few references to natural capital, genetic resources, natural resources. The point to note is that what humans do to, and with, animals in biotechnology is presented as 'intellectual property' that can be transferred from human mind to human mind and from context to context. In reality it is not just 'intellectual property' that is being produced by humans in biotechnology, it is *any living thing of value, or potential value, to humans*.

As an example of the degree to which biotechnology invokes old conceptions of property and ownership, the following excerpt is taken from a industry magazine called *CMA Management*. As the reader will note, the metaphor of mining the earth for materials of production have carried over to new contexts of alienation and exploitation in biotechnology: namely, in this instance, the human genome. I have italicised those sections of the excerpt that invoke the conflation between mining and contemporary genetic technologies.

> Barth [CEO of pharma company] likens *drug discovery* today to the oil and gas industry just before a number of technologies affected that sector, such as "3-D seismic…Oil drilling *used to be a real black art - a hit-and-miss exercise*," he explains. "Each find would last for about 10 years before the company would have to find a new deposit, not unlike pharma companies searching for their next blockbuster because of patent expiry." This changed in the oil and gas industry with seismic *technology, which allowed a three dimensional*

> *characterization of deposits, and greatly reduced the risk associated with deposit discovery*. On a larger scale, changes in drug discovery today parallel those of the oil and gas industry several years ago, Barth points out. "It is becoming *less of a hit-and-miss venture and more predictable* - the art has become a science." (Parker, 2002, cwn 354)

What is perhaps most interesting in this text is the way existing ways of seeing as are rendered upon current or emerging activities, such as 'mapping' and 'mining' the human genome. The emphasis on "extraction" and on moving from 'hit and miss' techniques to 'precision' techniques through the intervention of new technologies is also common to mining metaphor. This notion of precision is actually one of the more common "benefits" that are assigned to contemporary genetic technologies, particularly in reference to genetic selection for breeding purposes.

Eugenics and national policy

> Gene testing: Testing of a person's genetic material for abnormalities, defects and deficiencies, including carrier status (the possibility that a healthy person carries particular genes that may affect his/her descendants) (Commission of the European Communities, 2001, cwn. 12,198)

> Gene therapy holds great promise for treating disease by replacing or changing a very small part of the overall genetic program of carefully selected cells perhaps permanently, producing a cure. It aims to restore the healthy function of cells by replacing or correcting the defective gene. Gene therapy can be used to replace an abnormal gene with a normal one, to insert a missing gene, to switch off rogue genes that may cause cancers and to stop viruses multiplying within cells. The modified cells and genes are not passed onto children. (CSIRO, Gene Technology: How's it done? 2001, cwn. 2,373)

In his article titled '*Ideas of heredity, reproduction, and eugenics in Britain, 1800-1975*', Waller (2001) argues that popular accounts of eugenics that identify Francis Galton as the “father of eugenics” are misled in thinking that “eugenics” (as Galton named selective breeding of humans in 1883) emerged out of nowhere around 1865. Waller argues, rather, that ‘notions of mental heredity and the dangers of transmitting hereditary “taints” were already serious concerns among medical practitioners and laymen [sic] in the early nineteenth century’ (2001, p. 457). Waller’s argument is that Galton’s work on eugenics arose out of the conditions and assumptions of hereditarianism in pre-Victorian and Victorian Britain: they are not a view from nowhere. Apart from the ideational and lexical cross over between discourses on eugenics and contemporary discourses on biotechnology (viz “normality” and “abnormality”, “detecting” genetic imperfections) Waller’s argument is perhaps more significant in that it identifies the ways that practices of eugenics ‘came from’ somewhere and were recontextualised and translated into other discourses and contexts such as public policy, public health, and social science. Like biotechnology, Galton’s eugenics was presented as a strategy for developing the health and wellbeing of the British ‘race’, a matter of public health and economic policy for British governments. In Waller’s words, eugenics ‘saw traditional concerns over the quality of lineages projected onto the national stage in the form of eugenical thought and fears of biological degeneration…discourses of hybridity were “frameshifted” to the level of national health’ (2001, p. 458).

Like biotechnology today, eugenics can be seen as media to the extent that it was informed by, and reinvigorated, the hereditarian ideals of pre Victorian Britain. Eugenics as media was so successful that these traditional hereditarian ideals were elevated to the level of national governance (Waller, 2001, p. 458). Waller argues that popular accounts of eugenics in Britain have failed to identify or appraise the 'range of social, ideological and intellectual factors that rendered eugenical thought unprecedentedly credible in the mid-Victorian period'. As I have outlined above, the genre of biotechnology timelines presented in classrooms and public education programs dealing with biotechnology do not seek to provide any form of social, ideological or intellectual historical context for biotechnology.

Science as separate from society

Waller's argument that eugenics has tended to be decontextualised from its social, cultural, and political origins can be applied more generally to science and biotechnology. Indeed, the term "physical science" was originally coined to exclude certain "non-physical" or "metaphysical" activities and practices. T.H. Huxley (1893) in his essay *On the Advisableness of Improving Natural Knowledge* documents the emerging split between natural science and non-natural science at the Royal Society for the Improvement of Natural Knowledge. Huxley remarks that the 'half-dozen young men, studious of the "New Philosophy", who met in one another's lodgings in Oxford in London, in the middle of the seventeenth century' was later to become the 'Royal Society for the Improvement of Natural Knowledge' (p. 23).

The Royal Society's self defined charter was 'to discourse and consider of philosophical enquiries, and such as related thereunto:- as Physick, Anatomy, Geometry, Astronomy, Navigation, Staticks, Magneticks, Chymicks, Mechanicks, an Natural Experiments' (Huxley, 1893, p. 21). These activities, collectively referred to as 'physical science or knowledge', explicitly excluded 'matters of theology and state affairs' (Huxley, 1893, p. 21). This separation of natural science from 'matters of theology' constituted part of a wider political strategy designed to sift superstition and emotion from "fact" in the conflicts between religious positions during the period (Toulmin, 1990, p. 81). Scientific rationality, apparently characteristic of the natural sciences, emerged as a "neutral" position in these conflicts and was construed hence as an advantageous, selective, and civilised option not available to those people still locked 'in the tyrannous societies and superstitious cultures that existed before the age of modernity' (Toulmin, 1990, p. 3).

Claims to both scientific rationality and objectivity are surprisingly overt in today's debate over biotechnology, *a la*

> There is no science to support the ban of insect-resistant corn, which forced Frito-Lay's producers to revert to chemical insecticides. Two much larger grain purchasers have already reversed anti-biotechnology decisions: Archer Daniels Midland, one of the nation's largest purchasers and exporters of grain, and Cargill, the nation's largest grain merchant. Cargill declared "it's business as usual" when it followed ADM's lead and began accepting transgenic grains again. These hold-the-line decisions are extremely important in blunting the pseudo-science of the activist community and moving toward biotechnology's potential to help feed a hungry world. The anti-biotechnology community claims there are "10 reasons why biotechnology will not ensure food security, protect the environment and reduce poverty in the developing world." In stark contrast, more than 1,800 members of the scientific community have signed a statement declaring their belief that biotechnology is a powerful and safe way to enhance substantially our quality of life by improving agriculture, health care and the environment. (Prakash, 2000)

This section from a magazine article written by agricultural biotechnology advocate Channapatna Prakash uses oppositional categories of characters in the biotechnology "debate". In this case it is "The anti biotechnology community" versus "the scientific community" and, also, "science" versus "pseudo science". In invoking the 'science – pseudo science' binary, Prakash forces his debate to be carried out in the terms and evaluative orientational schema that are emic to the scientific community. Note in particular that when activists or opponents are cited, their arguments are presented as 'claims' rather than facts: 'the anti biotechnology community claims' or 'some claim' or 'opponents of biotechnology claim'. This is in contrast to scientific 'facts', 'results', and 'evidence'.

The predominance of technical scientific and fiscal modes of representation and evaluation is consistent across the corpus[13]. As the following excerpt indicates, there is a slippery conflation between knowledge that is derived through scientific experimentation and 'fact'. In entering any form of discussions regarding biotechnology, citizens are frequently asked/required to interact within the discursive perimeters of science and scientific evaluation or, depending upon the context, economic or fiscal evaluation. As the author of *'Agricultural biotechnology questions and answers'* argues,

> Meaningful debate can only be achieved if the public is accurately informed, and <u>informed opinions can only be reached when people are aware of the facts</u>. The use of gene technology in agriculture and food production raises several important matters, particularly impacts on trade and regulatory issues.

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[13] With the notable exception of the New Zealand Discussion Paper (2002) which [at least] states that 'economic, social, environmental and cultural values' should be given equal consideration

> However, <u>the most common questions asked by members of the public and special interest groups are in relation to the science itself</u>. This booklet provides <u>science-based answers</u> to the most common <u>technical questions</u> raised about gene technology in agriculture and food production. It draws upon <u>the scientific knowledge and current research findings of experts</u> in various fields, including gene technology, molecular biology, microbiology, biochemistry, plant physiology and agriculture. Scientific progress in this area is developing rapidly and, as in other fields of science and technology, there are divergent views on some issues. This publication presents the <u>current scientific thinking</u> on these matters in a balanced way. It is hoped that communicating the <u>science-based facts and current understanding of research results to date</u>, will establish a <u>basis for well-informed discussion about the broad range of issues accompanying the use of gene technology in agriculture and food production</u>. (Bureau of Rural Sciences, 2000, cwn. 777)

While I do agree that it is important to be informed of current scientific thinking and experimental results on biotechnology, and that the so-called ‘emotional’ responses to biotechnology should also be explored and, where appropriate, subject to critique, I do not think it is appropriate that discussions on biotechnology be confined to the limits of scientific ‘evidence’ or appeals to so-called scientific ‘fact’. This is for one simple reason: Biotechnology is not merely a technical or empirical practice. I posit that the above author’s delineation of questions that relate ‘to the science itself’ is not just a blind appeal to scientific ‘fact’, it is also a rhetorical demarcation upon the *kinds* of questions that can be asked of biotechnology and its proponents and, also, the kinds of answers that are appropriate and credible.

The author emphasises that the answers to any questions, and the basis of all discussion, should be provided by ‘science based answers’. The author proposes that these answers will come quite clearly from ‘scientific knowledge and current research findings of experts *in various fields*, *including* gene technology, molecular biology, microbiology, biochemistry, plant physiology and agriculture’; ‘current scientific thinking’; and ‘science-based facts and current understanding of research results to date’. As Toulmin (1953/1960) argues, physical sciences are inherently idealistic and, at least to some degree, speculative. That is

> ‘…the arguments of physics are conducted in terms of ideals, and there is always some limit to the extent to which we have found ways either of realising these ideals, or of recognising bodies or systems which can be accepted as realising them as accurately as we can measure’ (Toulmin, 1953/1960, p. 71)

Toulmin recognises that the practices of hypothesis and empirical testing is inherently guided toward realising, or of operating within, certain ‘accepted’ ideals or laws. Toulmin’s description of natural science acknowledges the limits of human consciousness in identifying and hypothesising on nature as separate from human activity. Toulmin notes that even the natural sciences operate within value-laden political economic systems. The sites of strategic and “curiosity driven” biotechnology research activity in Australia – i.e. mostly universities and a relatively small number spin off and multinational pharmaceutical and diagnostics companies – are neither separate from, or immune to, this fact.

Universities as industry partners

Universities are a major site of institutional convergence and hybridity in Australian biotechnology. Much of the Federal and State Governments’ plans for biotechnology industry development is based on the creation and nurturing of ‘innovation networks’, ‘clusters’, ‘technology precincts’, ‘hubs’, etc. This phenomenon is not limited to Australia. The Australian industry development ‘cluster model’ is in fact modelled on high profile technology clusters in North American and European cities of Boston, San Diego, Cambridge, Munich, and Austin Texas. As the authors of the UN Human Development Report 2001 note,

> Encouraging links between universities and industry can stimulate innovation. High-technology companies thrive on state-of-the-art knowledge and creativity as well as the scientific and technical expertise of universities. Hubs are created as entrepreneurs purposely establish their businesses near universities. Tampere University of Technology in Finland links Nokia, the Technical Research Centre of Finland and firms in the wood processing industry. (UN Human Development Report 2001)

This deliberative collocation of research contexts and commercialisation contexts is a feature of higher education policy more generally in Australia. In the domestic scene, those university research institutions that have high output in the form of “commercialisation of research” and “spin off”[14] companies attached to them are seen – at least in technocratic funding terms – to be the most successful and the most valuable (cf. Mahony, 1992, p. 226; Williams, 1992, p. 286). Governments, industry magazines, and science bureaucrats alike exalt those research institutions and individuals who can “sell” or “licence” their “intellectual property” to multinational pharmaceutical, agricultural, and life science companies.

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[14] Spin off companies are companies based on “intellectual property” garnered through research contexts. Their aim is to make money out of research. They are usually tied to universities and public research institutions.

The distinction between 'basic' – or pure – research, and applied research in universities has also become increasingly blurred as OECD and domestic imperatives for any basic research to be commercially oriented penetrate government and university policy (Marginson, 1997a, p. 261). Relatively recent developments in OECD policy regarding basic research in universities collapses corporate managerialist and traditional academic practices and imperatives into one: the OECD developed a practice of *strategic basic research* which requires academics involved in pure research to 'extend the underlaying capacity of innovation whilst maintaining commercial potential' (Marginson, 1997a, p. 261). Such universal pressure to be market-oriented has invoked a reworking of the discourse of academic freedom generally (Marginson, 1997a, p. 260). A primary criteria for receiving competitively allocated funding is now predominantly based on whether proposed research projects will be readily saleable to industry in an applied, or applicable, form.

These arrangements are challenging in the context of biotechnology for a number of reasons. First, publicly funded research is sold for private gain not only for individual researchers and universities but, most significantly, for those companies that are large enough to license technologies, fund product development and, where required, fund long winded rounds of clinical trial. The second, and perhaps not so readily identifiable point, is that what is sold as "intellectual property" is actually constituted of, or derived from, living organisms, or potential living organisms. This is not represented in the highly abstract and individualist claims that are made upon the ownership and discovery of “intellectual property”. Finally, despite the fact that the majority of research in Australia and other OECD countries begins with public funding, the final outcome of research, licensing, and commercialisation is only public to the extent that it can be *bought* and/or *consumed* by the public. Finally, the hybridising of science and industry in the context of biotechnology does not end with funding and research contexts. The government’s plans to merge science with industry has entered the primary education system and, specifically, the training of future biotechnologists and science bureaucrats as will be explored in more depth in the following chapter.

Defining future history

> It [biotechnology] is going to be the future, that's what it is going to be though, just write that down, going to be the future. (Interview, Research Institute Director)

The current political economic form of global capitalism (however it may be defined) cannot be overlooked in attempting to identify and assess contemporary movements in biotechnology. The degree to which Governments have positioned biotechnology as a saviour of industrial and “developing” economies alike is evident across many texts and within the interview transcripts. I have listed a number of quotes below to illustrate the extent to which this theme is featured in the corpus, primarily in policy texts but also significantly in education documents and interview transcripts. The future space of a world transformed through biotechnology has arguably, through its indoctrination in policy worldwide, become an ‘official utopia’ of our time (Graham, 2001, p. 761). According to these statements from policy and interview transcripts, biotechnology is a precondition, *and an indicator*, of innovation, progress, and economic development for all countries. I have underlined those sections of the texts that refer specifically to the imperative nature of biotechnology as an opportunity to be grasped so that we may secure our future in bio-utopia.

> Cr Lucy Turnbull Deputy Lord Mayor the City of Sydney 'The biotechnology sector is set to provide venture capital business with more exciting opportunities than the Internet ever could. Australia enjoys some clusters of world-class excellence in this sector; let's grasp the opportunity now. Policy makers should unapologetically back this sector in as a "winner" for Australia.' (quoted in the NSW Biofirst 2001 Strategy)

> [Heading] HARVESTING THE POTENTIAL [] The potential of life sciences and biotechnology is being exploited at an accelerating rate and is likely to engender a new economy with creation of wealth and skilled jobs. (Commission of the European Communities 2002)

> It is widely believed that biotechnology will be one of the most significant technologies of the early decades of the 21st century ... there is a huge opportunity for Ireland to join in, to contribute to, and to benefit from, the next phase of the biotechnology revolution ... no country with a strong food and pharmaceutical industry can afford to ignore the new biotechnology. (Ireland Modern Biotechnology Report 2000)

> … Staying out of the biotechnology revolution is not an option. (Victorian Strategic Plan 2000)

The imperative nature of these statements is a consistent and readily identifiable pattern (viz statements such as we must; we will; we are; we should; we need to). This is even extended to the point where the authors of the Victorian Strategic Plan makes claims as grand as ‘Staying out of the biotechnology is not an option’.

These exhortative claims are consistent with the genre of technology policy more generally. Graham (2001c) observes that a primary function of technology policy is ‘to create prophetic perceptions of value for new, unexplored, or unknowable spaces that exist at a time-distance from the here and now – that is to create value for some imagined future place and time’ (Graham, 2001c, p. 761). This is where the biotechnology as time medium function reaches into the future: Biotechnology policies create ‘irrealis’ or potential spaces and times (the biotechnology age) and present them as if they were reality, an *unquestionably* desirable and attainable future. All policy initiatives, laws, funding decisions, regulations, and strategies are geared to “get us to” this future space. There is, apparently, no opportunity for deviation from the path. If we deviate we will miss out or we will fail to meet up with the rest of the ‘industrialised world’ in that place.

I would like to suggest that rather than being simply beneficial or even innocuous, technological ‘innovation’ – when it is a true innovation – is also part of the biotechnology as time medium function. Innovation is repeatedly portrayed in the corpus as a movement or translation of something into some other form. Innovation implies that something that has existed previously is passed over in favour of something else that is new. As the following quotes illustrate, the assumption is that an innovative (transforming) movement toward newness is necessarily positive:

> Innovation is the process of developing an idea into a product for commercial benefit, while invention is the process of creating those ideas. Entrepreneurs are the people who turn invention into innovation. (Tasmanian State Government, 2001, cwn 1,829)

> Innovation is widely recognised as a primary driver of growth and wealth-creation. Innovation based on science and technology research is creating new industries and transforming existing ones. While Australia has an enviable world reputation for the quality of its science and technology, it has been less successful in creating a culture of innovation, in which discovery leads to the development of products and processes that generate wealth. (Tasmanian State Government, 2001, cwn 1,288)

> Decreasing arable land means that technical innovation is needed simply to sustain current levels of food production. (Monsanto Australia, 2002b, cwn 85)

> Innovation is important to us [the company], important to us is knowing that we are somehow benefiting people, indirectly people by taking care of their pets, and that is something we feature very strongly within the company. (Interview company CEO, cwn 1,951)

> Innovation is increasingly being regarded as the key factor underpinning a nation's export competitiveness, employment growth and economic well-being. Australia's future depends on investing wisely today in the foundations of economic competitiveness. (Victorian State Government, 2002, cwn 4,642)

> Innovation is not only the province of new or high tech industries, but also essential to the future of many of our traditional sectors such as agriculture, manufacturing and mining. (Commonwealth of Australia, Backing Australia's Ability, 2001, cwn 982)

> Technological innovation **is** an expression of human potential …technological innovation is a means to human development because of its impact on economic growth through the productivity gains it generates. It raises the crop yields of farmers, the output of factory workers and the efficiency of service providers and small businesses. It also creates new activities and industries-such as the information and communications technology sector-contributing to economic growth and employment creation. (UN Human Development Report, 2001, cwn 20,812)

The benefits of innovation presented in the corpus include: commercial benefit; growth and wealth creation; the development of products and processes that generate wealth; the creation of new industries and the transformation of existing ones; sustained levels of food production; indirectly taking care of humans by taking care of their pets; a nation's export competitiveness, employment growth and economic well-being; Australia's future; the future of many of our [Australia's] traditional sectors such as agriculture, manufacturing and mining; the foundation of economic competitiveness; human development; economic growth through productivity gains; higher crop yields of farmers; increased output of factory workers; increased efficiency of service providers and small businesses; the creation of new activities and industries; economic growth; and employment creation.

Innovation is, as these quotes define, a process of inventing something new that then transforms something else, for example farming practices, manufacturing processes, drug development, daily life. As the Tasmanian policy makers state, invention is the process of creating ideas, it is 'entrepreneurs' who 'turn an invention into an innovation'. Innovation is a process not just of invention but of growth, transformation, and creation. Innovation is inherently competitive and technological (i.e. used to do, to change).

Innovation, then, *requires* the movements of mediation. Yet, as we know, innovation is not a neutral process. Innovation is patrolled within the bounds of the social practice of biotechnology; by the priorities articulated in public policy and funding; by trends and traditions; by organisational dynamics and politics; by consumer demand; and the orientation of research cultures.

While a scientist interviewed from a regional research station tells that what he does depends on what he can do, mixed with what industry wants, and what the department's 'strategic priorities', a CEO of one of Brisbane's publicly listed biotechnology manufacturers says that product development does not happen without the marketing department's endorsement. He says that marketing can persuade the public that they need a particular product: innovation mixed with marketing can *create a market of the future*. Here we can see the biotechnology as time medium function reaching into the future once again. The point to note is that innovation in biotechnology in fact requires *the production of people* who are willing to manufacture, endorse, buy, consume, and become dependent upon biotechnology products, not just the creation of new products. This is yet another way we can see biotechnology – which is a specifically product oriented branch of science – functioning as media in unexpected places.

Conclusion

In this chapter I have forwarded the idea that a social practice can act as media over time or, if you like, as a time medium. The basic point I am trying to make is that biotechnology is shaped by discourses that have emerged through historical traditions and practices. Biotechnology as a social practice in turn acts as media to, reinvigorate, invest and inscribe these discourses in a range of new or expanded socio-biological contexts, discourse materialities, practices, and people. In this way the social practice of biotechnology literally functions as a time machine to deliver historically salient ways of seeing, being, and acting into present and future contexts.

While attention is given to ‘history’ in official biotechnology discourses, it is a linear, positivistic view of the history of biotechnology. Common representations of history in official biotechnology discourse have one thing in common: They all portray biotechnology as being a natural and inherently valuable postcursor to previous, inherently valuable technological developments or revolutions. Biotechnology time lines are a case in point because they portray recombinant genetic technologies along a continuum of developments and innovations that include, for example, making bread using yeast, the ‘discovery’ of penicillin, ‘mapping’ the human genome’, and cloning a sheep. The combination of everyday familiar items such as beer, bread, and cheese, with new and contested technologies is an inherently rhetorical movement. The timeline genre is also very effective in decontextualising scientific and technical ‘innovations’ from the more complex social conditions from which they emerged, or which they precipitated.

Chapter 6 Mediation and the social practice of biotechnology

Overview

The purpose of this chapter is to outline the movements, and the representations of movements, that are *manifest* in the analysis corpus. The chapter includes multiple references to the thesis corpus which includes a range of policy, industry, education, and interview texts from a range of different countries. As previous chapters have indicated, one of the key findings of the analysis was the sheer extent to which biotechnology is being defined as the basis of all *future* economic growth and prosperity. In order to reach this future biotechnology utopia, policies on biotechnology all prescribe that science must 'partner with industry' to 'deliver on the promise' of biotechnology.

Where previous chapters have identified the discursive processes via which social practices are produced and reproduced over time, this chapter explores the extent to which science is required to hybridise with industry to birth the contemporary practice of biotechnology. Hybridisation is clearly evident in the stated features of biotechnology in the thesis corpus. This includes hybridity in the defined purpose of biotechnology; its means of achieving that purpose; the people who constitute the practice; the formal processes of socialisation and accreditation required to enter the practice; and perhaps most significantly, the geographical *co-location* of science practitioners with industry groups in newly developed biotechnology "precincts".

Thematic patterns in mediation

Movements in space: Spatial convergence and hybridity

In addition to the great amount of attention given to attracting appropriately qualified and experienced 'human resources' in the bioindustries (the so-called "brain drain" and "brain gain"), biotechnology industry policy emphasises bringing different sorts of people together in spatial as well as abstract ideological contexts in order to merge the two practices of science and business or science and industry. Indeed, the dominant function of biotechnology policy is in fact to ensure mediation between these contexts, i.e. to 'industrialise', to 'commercialise', to 'commodify', to 'translate', to 'deliver ', to 'develop', to 'license', to 'export', to 'make money out of', to 'capitalise upon', to 'apply', or to 'activate'. I observe that "innovation networks" (vertical and horizontal integration between organisations) are identified as an organisational structure en par with hierarchies, flat structures, team based structures monopolies, or oligopolies: That is, the networked organisations are seen as being combined in purpose to such an extent that the innovation network is seen as a prominent *form of organisation*.

As indicated in the Introduction, the socio-spatial nature of hybridity is evident to the extent that policy makers in biotechnology, particularly those in Australia, have created or funded biotechnology "precincts" via which hybridising between specific research institutes and specific companies has, should and must occur[ed]. Examples include The Institute of Molecular Bioscience in Brisbane, Australia; Bio21in Melbourne, Australia; and the much cited clusters in Boston; San Diego; Cambridge; Munich; and Austin Texas. I have included the following quotes from the corpus as examples of what might be called "precinct hybridity". See examples below:

In New South Wales, Australia:

> Commercialisation of biotechnology requires more than the formation of start-up companies. It requires skills to enter licensing agreements and <u>strategic partnerships</u>. The NSW Government is proactively ensuring a sustainable <u>funding pipeline</u> for biotechnology to maximise benefits from the platform strategies through targeted assistance for the following initiatives… Foster <u>connections between investors and biotechnology sector</u> A broad strategic view will be taken in the design of initiatives that aim to facilitate <u>connection between investors and the biotechnology sector</u>. (NSW Biofirst, 2001, cwn. 6,243)

> 'One of the key platforms for change in the medical research sector revolves around the creation of critical mass among its scientists. Given that one of the primary objectives of science is to sponsor individual investigator-initiated, curiosity-driven fundamental research, <u>it is now critical that we garner these skills into an overall framework of infrastructure and commercialisation support</u>. <u>The concept of "clustering" will greatly enhance research interaction and, most importantly, create major costsaving efficiencies and greater effectiveness</u>.' Peter J Wills, AM (NSW Biofirst, 2001, cwn. 13,387)

In Queensland, Australia:

> … so I really think that with government backing we have a very good bio industries group within bureaucracy and a lot of people who have been working towards growing bio-tech from all different levels, we are very strong in Queensland. We have got nice weather, <u>we have got places</u> we can put technology parks if that's the way we want to go. We have got the infrastructure that can build <u>a very significant bio-technology cluster</u>… we have actually been

> clustering in Queensland for a long time. We were doing that under the development strategy, the South-East Queensland Development Strategy and we began at that point really starting to cluster the industries. At least at a sort of networking level. (Interview, Industry consultant, cwn. 1,832)

In Victoria, Australia:

> Clusters allow participants to benefit as if they were larger or as if they had joined with others formally-without being required to sacrifice flexibility. Clusters drive the direction and pace of innovation. This in turn stimulates the formation of new businesses that expand and strengthen the cluster itself, thus creating a virtuous cycle of innovation and company formation…
>
> Melbourne is home to more than 40 leading medical research institutes and organisations including The Walter & Eliza Hall Institute of Medical Research, The Baker Medical Research Institute, The Howard Florey Institute and The Murdoch Children's Research Institute… It is envisioned that all these groups and many individual research institutes will come together and operate under the Bio21 umbrella'. (Victorian Government - Capturing the Opportunity, 2000, cwn. 12,590)

Precincts, clusters, hubs, and networks in biotechnology policy include things other than persons and the relationships between them, most particularly high levels of investment capital, physical infrastructure including expensive information and communication technology and laboratory equipment, government policy, and/or particular politicians or science leaders/heroes. In biotechnology these are the things (capital, infrastructure, technology, policy, and heroes) that are presented as *facilitating* the hybridising, 'interfacing', or 'bringing together' of the practices of science and business. As the policy terms 'interfacing', or 'bringing together' imply, policy makers and science bureaucrats are holding on to the idea that science can serve economic goals and still remain intact.

The relationships between science and industry within these clusters are consistently defined as “partnership”, “networking”, “collaboration”, “strategic alliance” yet it is still to be seen whether or not these precincts can bring about the desired outcomes in terms of hybrid aims, values, and outcomes between science and industry. Official terms such as “partnership” imply that the practices, individuals, and organisations involved retain autonomy and distinctiveness in the relationship. It is interesting that the policy makers use the term ‘partnerships’ so often. Partnership implies that the two practices remain distinct. Yet, one interviewee (Research Project Leader) indicated a conflation between what scientists can do, what their technical capabilities are, what industry identifies as a need, and what the department (state government) identifies as a strategic priority. S/he ranks the technical capacity of scientists equally with strategic priorities of government and ‘market need’.

The following interview quote puts a finer point on the ways that “partnerships” and “alliances” between science and industry are in fact shifting science practitioners’ (researchers) understandings of the fundamental nature and purpose of their practice – albeit if reluctantly. In particular, this interviewee, who is Director of a Regional Research Centre for a Queensland Government Department, emphasises that government funding policies do not just encourage but, rather, necessitate institutional hybridity.

> It is almost always up to the individual researchers to do the leg work initially, and approach either the funding providers or approach industry with project ideas. It also has to be compatible with the INTERVIEWEE'S ORGANISATION sort of strategic roles and whether they have resources to put into that area or not, with the ORGANISATION they have their sort of, I suppose you could call it their preferred sort of option in terms of where they want to put their resources. You know, you just wouldn't say, look I can do something terrific and land in there when there is really no support there for you from industry. Therefore the institute would probably not provide any support for that work, so it really has to be hand in hand with what industry identifies as a need and what you can do to solve those problems as a researcher and then that ties up with some strategic directions provided by the institute or the DPI. So you always sort of trying to marry all those sort of groups together. We come at it from more the technical end, we know what we can do, we know what our technical capabilities are… (Interview, Centre Director & Research Project Leader, cwn 645)

For this research leader, a primary influence on the direction of scientific research is whatever industry identifies as 'a need' combined with the 'strategic priorities' of government, and 'what scientists technically can do'. The technical capabilities of scientists are demarcated from market and strategic priorities under the assumption that they are separate from them. It is worth noting here that the scientists' technical capabilities are presented as being *descriptive* rather than *normative*, i.e. this is simply what we can do: it *is* the case.

The same imperative to pursue hybridity with industry through collaborative arrangements is evident for this Director of a university research institute:

> … basically if we maintain the same standard of people as we have got now, we are bringing in additional principal investigators and so forth, and the big one is that we need to increase our commercial income, our industrial income from about two million a year up to about twelve million a year, and that we will do by increasing the number of alliances and the number and size of the

> alliances we form in the industry. Increasing the number of spin-out companies we generate, and basically we have to very strategically plan for the way in which we are going to develop those things. So that is what we are doing… (Interview transcript, Research Institute Director, cwn 2,731)

The emic positioning of this University Research Institute Director is interesting in comparison to the Government Research Scientist quoted above. This Research Director emphasises that his/her institution is not only concerned with raising industry "income" (as opposed to "funding") from $2 million to $12 million per year, but also in creating its own spin off companies: that is, in *becoming* (rather than just collaborating with) business.

Aristotle's functions of rhetoric – as outlined briefly in the Introduction – can apply here. There are differences in tense in the interviewees' accounts of the three different influences of science, government, and industry. The differences in tense play a rhetorical-representative function and are consistent with functions of rhetoric. First, the scientists' technical ability is portrayed as being in the present: the neutral-objective feature of the equation between science, industry, and government. Second, both the industry's identification of market need and government priority are future oriented (deliberative): they seek to direct scientific research in a direction in/for the future. Both the future and present tenses are rhetorically significant.

Strategic priorities for the Research Director are inherently deliberative and future oriented. The government research scientist sees that his/her work remains distinct from whatever industry or the department identifies; s/he defines his/her core work in terms of "what we can do" and "what our technical capabilities are"; and s/he indicates that a major and consistent requirement of his/her role is to 'marry all of those groups together'. Research Director on the other hand is looking for increased "income" from industry and direction translation of the Institute's work into becoming business. As both interviewees indicate, there are pressures coming from both inside and outside the practice of science itself that influence what they do and why. While government policy and funding mechanisms do in fact *require* hybridity between universities, businesses, government, and so on, the Research Director's interview comments indicate that corporate practices such as strategic planning have already entered the discourse of his/her emic university setting – at the very least in the form of him/her.

Hybrid selves

In keeping with dominant policy imperatives to merge science with industry, international policy documents and select interviewees emphasise the need for academics and future scientists to reflect and embrace hybridity both in their work and *in themselves*.

> [Heading] Exploitation [] A close relationship between the academic domain and the commercial or market-facing domain. In particular, academics must have ready access to business skills and financial and legal support. Such services are typically to be found in the incubators closely associated with biology departments and institutions. (South Africa Policy, 2001, cwn. 5,576)

This quote from the South African Biotechnology Policy sits neatly with global trends in higher education policy that require universities to become more entrepreneurial in seeking research funding and ensuring the strategic application of research. In relation to property rights it is the inventor and the university who benefits. Also the use of the phrase “market-facing” is very interesting and expressive because it connotes a particular responsibility and preoccupation across a whole “domain”. Once again though the academic domain is portrayed as being separate from this market facing domain which, based on the interviews taken for this research, and wider policy imperatives, appears to be patently false:

> Industrialists in science and technology spend 20% of their time at universities, giving lectures to students in their areas of expertise. The "adjunct professors" work on a challenging interface between industry and academia, and students learn the relevance of technology to industry. In China too, institutions of higher education support the technological work of enterprises. Tsinghua University established the Chemical Engineering and Applied Chemistry Institute jointly with Sino Petrochemical Engineering Company, which has given more than $3.6 million to support the university's research activities and recruited more than 100 of its graduates. The State Torch Programme encourages enterprises to strengthen their ties with research institutions, to accelerate the commercialization of research results. Chinese universities have also established science parks. The Shanghai Technology Park acts as an incubator for the rapid application of scientific and technological work in industry. In the 1990s China emphasized the development of high-technology industry through a variety of government programmes to support R&D. Now China is also using R&D to improve the productivity of traditional activities in agriculture. The Spark Programme propagates Encouraging links between universities and industry can stimulate innovation (UN Human Development Report, 2001, cwn. 55,569)

The examples from China cited in the UN Report once again herald links between universities and industry as a source of future development and ‘innovation’ in biotechnology.

As outlined in Chapter 3, biotechnology is a socially constituted practice. It is produced and reproduced over time through processes of learning and socialisation. Knowledge of what to do and how to do it, as well as broader normative orientations toward that doing and knowing, are passed on between members of the practice in formal and informal ways. Both internal and external actors and governing bodies can influence the purpose and means of the practice. The Wills Review of 1998, for instance, makes the following recommendations about scientific research:

> Students should be exposed to the excitement of science and associated industry through greater interaction with our centres of excellence. We should also extend our graduate training to produce researchers capable of relating better to industry and health care providers and developing new specialist skills such as in bioinformatics.
>
> We should better equip researchers by extending graduate training to include topics – such as management, intellectual property and regulation – which bear on research; and by building research capacity for all health practitioners, especially in under researched areas. (p. 4)

Consistent with the recommendations of the Wills Review, science bureaucrats, industry consultants, and company CEOs interviewed – as opposed to research scientists – made normative statements regarding education requirements for future biotechnologists. Consistent with current policy stances, science bureaucrats, industry consultants, and CEOs advocated that biotechnologists of the future should have skills in Intellectual Property; patenting; entrepreneurship; finance; management; and marketing. In particular, the research directors of large research institutes and industry consultants were the most adamant that science education should include a substantial "business" component. An industry consultant interviewed similarly identified that current university staff needed to develop competencies in patenting and intellectual property:

> People at the universities need to understand much broader issues around IP rather than just patenting. It is just one facet. A bit of a side track. I think it actually needs to be embodied into the courses in the university so that everybody who is undergoing the science course or engineering course, or anything where you might end up with patentable ideas or protectable ideas, should have some understanding of IP right from the first year of university… (Interview, industry consultant, cwn. 2,829)

One company CEO was also particularly interested in the role of marketing. Note in particular the CEO's delineation between "marketing language" and "technical [scientific] language" and also the argument that a market can be made to want a product it does not necessarily want at present:

> So it's a particular passion of mine that marketing is not, when the product is finished and you are going out to sell it and put the best spin on it, it is creating the product that market wants or the market will buy. It [the market] may not exactly want it now but you believe that you can persuade them because of the benefits it will bring. But that is all marketing language, it's not technical language. I would say that there is great opportunity for young people who want to be in our industry and are probably doing a science degree now that they round that off with communications or marketing. I think that there is, that that is particularly relevant to both ends of our industry, to the research end as well as to the marketing end. (Interview, Company CEO, cwn 2,955)

The emphasis on marketing in this excerpt is indicative of the extent to which biotechnology actually incorporates or involves a growing number of scientific and industry subpractices. In my experience it is also quite rare to have a company CEO in the field of biotechnology making claims that 'a market' can be made to want something it does not necessarily want at present. The interview genre in this instance has presented viewpoints that would not normally be voiced in, for example, public policy documents or public forums dealing with biotechnology. Nevertheless these viewpoints, are clearly important in unveiling the ways that public concerns or interests are perceived in relation to biotechnology commercialisation and product development.

Hybridity in science and industry is being implemented at the earliest stages of socialisation into the practice of biotechnology. A university degree in biotechnology now requires science students to undertake a significant proportion of their studies in business, including marketing, finance, commercialisation, product development, and intellectual property. There are also formal mentoring strategies that seek to shape emerging biotechnologists as entrepreneurs. The Queensland Government's recently announced *Bioenterprise* program is one example:

> Queensland's Innovation Minister Paul Lucas asked Queensland's corporate sector to help support a new student program that could create the start-up companies of the future. The "BioEnterprise" program is the first of its kind in Queensland, and allows second-year biotechnology innovation students to form their own companies with the help of industry mentors. The students run the company for the duration of their degrees, developing and marketing real products or services and keeping company records. Mr Lucas yesterday met with students from the program's first five companies and urged potential mentors in industry to get behind the initiative. "These students have come up with ideas that range from a personalised cancer diagnostic test; an information service for biotechnology investors; market research into the compound that makes some marine life glow in the dark; and an educational package promoting biotechnology in high schools," Mr Lucas said. (QUT Corporate Communication, 2002)

Secondary schools (grades 7-12) are also articulating links with biotechnology. The Cavendish Road State High School in Queensland, for example, has been commended in state, local and national newspapers, and awarded by the Queensland Government, for installing a biotechnology laboratory among other specialist programs in science and sports. The School has links with universities that have agreed to provide school students with dual accreditation towards university degrees if they take certain subjects in school.

The pipeline of value creation between science and business

A metaphor of the product development "pipeline" is also used to describe the connections between official biotechnology contexts. The pipeline metaphor is used to describe the "product development cycle" that runs *from* basic research *to* research and development to product development commercialisation, sale, and consumption (profits; market share; happy, healthy people). The pipeline metaphor is consistent across contexts and genres in the corpus but is particularly influenced by – and presumably born of – the emic contexts of large pharmaceutical companies who run their own internal organisational pipelines from Research and Development units, to product development, commercialisation, marketing, distribution, and so on.

The pipeline metaphor is not surprisingly less prominent in education documents than in industry documents in the thesis corpus. The Australian biotechnology industry organisation Aus Biotech, for instance, devoted the 2003 national conference to the theme of moving 'invention to product' (see flier below).

This image is not available online.

Please consult the hardcopy thesis available

from the QUT Library.

Interestingly, the research scientists I interviewed who were not involved directly in the generation of funding or liaison with governments *did not* refer to this pipeline even though they were cognisant of imperatives for industry oriented research (i.e. research that industry is willing to fund and identifies as a market need). Research-intensive companies and research institutes that do not have the capital required to commercialise (venture funds, clinical trial, marketing) their own research (which includes most small Australian biotechnology companies and University R&Ds) made the most references to this pipeline. Indeed, interview transcripts indicate that CEOs and Managing Directors of small spin off companies regard "feeding" this pipeline as a core purpose of their organisation:

> Fundamental research needs to be carried out in order to keep feeding the pipeline of commercial development. To date, COMPANY NAME has had to work both ends of this pipeline maintaining both fundamental and commercial activities. Investors will not fund us based on how much fundamental research we are doing. They will make their investment based primarily on where we are in the development of our commercial products. However, we cannot ignore the fundamental research because that develops the intellectual property which then in turn feeds our commercialisation activities. Added to this equation is the short term nature of start-up funds, which typically last 6 to 24 months. Thus the research program at this stage of the development of COMPANY NAME is a delicate juggling act balancing commercial and fundamental discovery activities. COMPANY NAME is in a fortunate position in that the company has been able to obtain rights to drug candidates in a reasonably advanced state of development. By quickly 'value adding'[15] further IP to these candidates the company will be in a strong position to license the ongoing drug development

[15] Note, the interviewee added in these quotation marks when offered the transcript for review. He/she is a scientist by training. At the time of interview he/she was CEO of a small spin off company established to commercialise and develop research he/she was involved in at a public research institute.

> programs. Deals of this type will support COMPANY NAME commercial and fundamental research base. (Interview, CEO, Brisbane Spin Off Company)

This pipeline metaphor is significant because it constitutes a link between the practices of scientific research in biotechnology and industry contexts of product commercialisation and sale. The pipeline metaphor is significant because, in addition to the relational paths of two way mediation that are established through precinct hybridity, the pipeline metaphor presents a normative, apparently linear channel of mediation for biotechnology's discourse materialities. *The product development pipeline is an officially sanctioned channel of mediation in biotechnology*. The pipeline is currently foregrounded in biotechnology discourses at the cost of other potential pathways of mediation, such as the collaborative not for profit research and development approaches canvassed in the UN Human Development Report. Like any medium, the product development pipeline in biotechnology is only intended to carry certain forms of "content". In this case the acceptable content consists of bio-products (things) that are deemed to be desirable to the "receiving" context of larger multinational companies. Desirable in this context generally means that they can be sold for profit within the existing price system.

The "virtuous cycle" of biotechnology research and commercialisation

In October 2000 the Australian National Health and Medical Research Council released a strategic review of Health and Medical Research in Australia titled *The Virtuous Cycle: Working together for Health and Medical Research* or what is otherwise referred to as 'the Wills Review 1998'. The authors define "Virtuous Cycle" as 'a mutually reinforcing set of actions by the research sector, industry and government' (Commonwealth of Australia, 1998, p. 2). They state that 'the outlook of health and medical research lies not only in greater government investment, but also in establishing the links between public funding, research and the commercialisation of findings through industry' (Commonwealth of Australia, 1998). The cycle is presumably 'virtuous', rather than 'vicious', because

> Commercialisation of research facilitates the delivery of new medicines and treatments to the community. If managed appropriately, it further benefits the community through employment and wealth generation. Minimising barriers between research and industry was a key element of the virtuous cycle outlined in the Review. (Commonwealth of Australia, 1998, p. 2)

'The Virtuous Cycle' of medical and health research, as it is presented in the Wills Review 1998, is synonymous with the product development pipeline discussed above. However, this time the emphasis is on the virtuosity of this pipeline as a way of sharing the 'benefits' of biotechnology around: that is, everyone benefits from the Virtuous Cycle through the products they consume. According to the Wills Review authors, value is 'created' as the technology, idea, whatever, moves *along the pipeline* toward product development, manufacturing, the market, consumption, and *profit*. Once again, there is a strict partition between this profit oriented version of value creation and the Wills Review 1998's comments on 'benefits' that accrue to the community through access to products arising from publicly funded research.

Once again, 'the community' is not included as a benefactor in the contexts where this kind of commercial 'value' is created. Rather, the community is represented in public spaces such as the clinic, the hospital, or the workplace.

> There is great opportunity to create value between the public funded fundamental research and ultimate development for market. Australia has traditionally "sold out" or given away its intellectual capital early in the process. Formation of new businesses around key researchers is the best way to capture value from Australia's intellectual capital and to generate substantial knowledge-based employment. We must develop a research culture that is positive toward commercialisation, build management skills both in the research enterprise and in related industry, and foster geographic clusters of biotechnology and research organisations. (Wills Review, 1998, p. 7)

The Wills Review's focus on commercialising publicly funded research for private commercial gain is consistent with developments in the USA two decades ago. The rationale for allowing private companies and universities to take and make life as property and gain from publicly funded research under the Bayh Doyle Act is presented as follows:

> Understandably, companies were reluctant to invest in and develop new products if competitors could also acquire licenses and then manufacture and sell the same products. Accordingly, the Government

> remained unsuccessful in attracting private industry to license government-owned patents. <u>Although taxpayers were supporting the federal research enterprise, they were not benefiting from useful products or the economic development that would have occurred with the manufacture and sale of those products</u>. (US Council of Governmental Relations, 1999, np)

The rationale behind the 1980 Bayh Dole Act is, like the Wills Review 1998, that it will deliver hitherto inaccessible benefits to taxpayers *in the form of products*. The ideal is that publicly funded research would 'deliver' tangible outcomes to 'taxpayers' via the assistance – mediation – of the bio-political economy: that is, the market is portrayed as the moral medium between research and the community.

The virtuous cycle of the Wills Review 1998 is a good example of the ways in which discourse materialities are installed into the everyday lives of citizens via the productive apparatus for private gain whilst being represented all the while as public goods within the public interest. Industry, and the productive apparatus, is coopted as the medium via which governments can act in the public interest or for the benefit of 'all Australians'. The Virtuous Cycle is presented as being circular but is, in fact, linear (apart for example from taxation health care etc). Biotechnology research is mediation with a focus on alienation and translation. Government Policy that advocates science-industry hybridity is mediation with a focus on translation and recontextualisation. The virtuous cycle is mediation with a focus on translation, recontextualisation, and absorption.

The Virtuous Cycle that leads to beneficial outcomes for communities has been presented in contexts other than Health and Medical Research. The following is taken from a speech delivered by the CEO of international data management company *Recall*.

> This cycle, *in its current form,* is *benefiting* people all over the world. This virtuous cycle of commerce benefits not only the *employees* who work in specific enterprises, but *consumer*s. It benefits those who the cycle allows to step onto the stair of opportunity, often for the first time. The cycle starts with *investment.* Investment creates *jobs,* new *opportunities* for the people who hold the jobs. These jobs in turn create more demand for *goods and services,* which itself creates *jobs*. Many of these jobs, even *entry-level* jobs, teach skills that lead to better jobs. As more people become more skilled . . . opportunity increases for creating more *better* jobs. Again, Recall is a *concrete example* of the cycle: While providing a *valuable service* for our customers, and producing a *profit* . . . we are also providing *new opportunities*. This is how the virtuous cycle of commerce works. In our time . . .. another name for the virtuous cycle of commerce is . . . *globalization*. We all know that *"globalization"* has *vocal* critics. They would stop it if they could. But the fact is . . . *no one* . . . has developed a formula that benefits people as does the virtuous cycle of commerce. Over the millennia, it has proven to be the *best way* of enabling *more people* in *more places* to escape want and move into a growing circle of *prosperity*. *Globalization* is a force for good. (Mexico Speech delivered by Al Trujillo, CEO and President, Recall Corporation, 2002, see http://www.recall.com/english/news_white.asp)

As the above excerpt indicates, the Virtuous Cycle as it is presented in biotechnology policy is an extension of wider discourses on neoliberal economics and globalisation where ‘public policy objectives couched in terms of social goods’ are replaced with ‘public policy objectives couched in terms of economic goods’ (Yeatman, 1993, p. 3). The righteous picture presented by the Recall CEO is problematic for very well established reasons including, and most specifically, the inability of ‘the market’ to attend to social and humanitarian suffering and the exploitation of human and nature at the hands of powerful scientific, technological, and economic elites (cf. Argy, 1995; Rees, Rodley, and Stilwell, 1993; Wheelright, 1993).

As Yeatman (1993) identifies, the shift toward market ideology actually *inverts* the socially responsive role of practices by replacing their social responsibilities with an overarching responsibility to promoting increased “efficiency”, “productivity”, and “growth” of their country’s economy. While proponents of the Virtuous Cycle of biotechnology claim that social goods will arise from biotechnology commercialisation, they do not specify *how* these benefits will be “delivered” through an amoral market medium given the history of inequality that erupts around the adoption of any new technology.

In assuming that the marketplace will deliver benefits to society, proponents of the virtuous cycle in biotechnology seem to have taken a step back, rather than forward, in presupposing a mode of social responsibility that relies on *market forces* to ensure an even distribution of wealth, goods and services, and well-being. Yet, when equitable outcomes do not accrue from market facing policy stances and initiatives, it is apparently “the market”, not the governments or individuals who have relied on “its” invisible hand, that is to blame. What consumers see, or are led to see, as a consumer/market need, does not always bring wellbeing, health, or 'happiness'[16]. Continuing studies conducted by the UN and individual researchers show that economic growth and prosperity does not reach through socio-economic levels by the assumed "trickle down effect" but, rather, *creates* inequality and poverty (United Nations, 1990, in Wheelwright, 1993, p. 41; cf. also Bauman, 1998).

Moreover, in the corpus, companies, not governments, are the agents who are presented as being responsible for and to the community. This is itself problematic given the sharp, but contested, societal distinction between practices that are seen to be 'for profit' and those that are 'not for profit'. The UN has, for example, identified that the monopoly of ownership of "intellectual property" in biotechnology industries already raises problems for social distribution of vital drugs, therapeutics, and diagnostics in poor countries. Gaining access to key patented inputs - often owned by private firms and universities in industrial countries - has become an obstacle to innovation and technology distribution especially in developing countries where public institutions often lack the resources for licensing and cross licensing proprietary research tools and products (UN, 2001). The authors of the UN Report state that while publicly funded research is 'still the main source of innovation for poor people's technology' it is shrinking relative to privately funded research globally (UN, 2001). Public funding for research that does exist has not been mobilised from national or international sources

[16] I'm thinking here of the often quoted examples of thalidomide, nuclear power, mad cow disease, pink fluorescent disco socks, and high heeled shoes.

to support research that provides specifically for disadvantaged developing countries (UN, 2001), apart from the international collaboration on AIDS. This is despite the fact that policies are universal in their claims that developing countries are stakeholder who will directly benefit from developments in biotechnology.

So, while government policy on biotechnology universally claims that biotechnology application and development via the Virtuous Cycle will bring untold benefits to communities and individual citizens, the policies they offer are industry policy, they do not feature mechanisms for expressly social, or not for profit, outcomes or distributing the benefits of technology other than funding for basic research in X & Y area. Apart from access to drugs, there are contradictory reports about the value of biotechnology in 'feeding the world'. While on the one hand Africa Bio, for example, states that 'Modern biotechnology cannot eliminate poverty and hunger because these problems are rooted in the socio-political realm', it also quotes a number of "experts", including the World Bank who state that 'Modern biotechnology offers many benefits for agriculture in Africa …The use of high yielding, disease-resistant, and pest-resistant crops will have a direct bearing on improved food security, poverty alleviation, and environmental conservation in Africa' (Africa Bio). The problem still remains of how socio-political institutions can/will facilitate these benefits, if indeed they eventuate, when public funding for 'poor people's technology' is decreasing and the outcomes of 'the Virtuous Cycle' are mediated by an apparently *a*moral market.

Apart from the UN whose charter is specifically to work for social justice outcomes, and supranational agreements such as the Convention on Biological Diversity, no national or state policy making body has developed strategies for dealing with issues of global disadvantage and inequality in relation to biotechnology. There are copious mentions of ‘equity’, ‘equality’, and ‘distribution’ but these are all in relation to either stock markets (equity); technology transfer and supply chain logistics (distribution); current *measurements* and abstract statistics of inequality and [under] development; and gender in/equality. While the NSW Government does attend to ‘equality of access to genetic resources through its “BIOPLATFORM” initiative’, it is for the purpose of ‘developing a competitive and sustainable biotechnology industry’ not for ensuring a balance of benefits for communities (NSW Biofirst 2001).

The UN is the only policy making organisation to offer authentic policy recommendations and strategies – as opposed to the hollow rhetoric that characterises Australian “policy” genres – on deriving ‘social’ and ‘humanitarian’ as opposed to ‘private’ and ‘commercial’ value from biotechnology. The UN’s prescribed policy stance is fundamentally collaborative rather than “strategically competitive” as is the focus of Australian biotechnology policies which even seek to compete between states…:

> No national government can single-handedly cope with global market failures… The lesson of this Report is that at the global level it is policy, not charity, that will ultimately determine whether new technologies become a tool for human development everywhere… At a time when universities, private companies and public institutions are <u>reshaping their research relationships</u>, new international

> partnerships for development can bring together the strengths of each while balancing any conflicts of interest. Many approaches to creating incentives are possible-from purchase funds and prizes to tax credits and public grants. One promising model is the International AIDS Vaccine Initiative, which brings together academics, industry, foundations and public researchers through innovative intellectual property rights agreements that enable each partner to pursue its interests while jointly pursuing a vaccine for the HIV/AIDS strain common in Africa. (UN, 2001, cwn 7,293)

While ever we are looking to the future, to the next great 'opportunity' or 'challenge', our consciousness is diverted from the suffering that sits at our doorstep day in and day out. Biotechnology's official utopia does not include an oasis for developing countries or even citizens within already industrialised countries who still rely on 'poor people's technology'. The Virtuous Cycle can deliver products, but can it deliver access to those products? And can it deliver the products that we need or will we have to be reconstituted via the productive apparatus and practices of marketing to think that we need them?

While policy makers and politicians consistently claim that 'society' in general will benefit from biotechnology commercialisation, the translations that are named in the corpus do not support these claims. Perhaps most significantly, the actual positioning of the claims re societal benefit in the texts are most often located *at the start and at the end of the document: That is, societal benefit is mentioned in the introductions and conclusions, but not predominantly in the body of the policy texts.* This is possibly because the policy writers are not writing policies to bring about explicitly social benefits but just *assume* them. Societal benefit is pervasively and consistently portrayed as a secondary, sideline benefit of economic benefits.

The representations of deliberative translations happening in the corpus are most indicative in this respect. They identify exactly 'what' is being translated into 'what' in the eyes of policy makers.

Conclusion

In order for the social practice of biotechnology to develop in the ways advocated in public policy, the traditional practice of science is required to *hybridise* with a range of technological and industry subpractices. There are various elements involved in this hybridity, including perhaps most interestingly, the concept of 'precinct' or spatial hybridity that is prevalent in biotechnology policy and industry development programs. The notion of hybridity forwarded in this chapter stresses that hybrid discourses and practices are constituted by people – hybrid people who are embedded in multiple social contexts at any given time.

Further, the science bureaucrats and industry consultants who are involved in government task forces and receive substantial government funding spoke of imperatives for commercialisation, intellectual property, and employment generation as core components of biotechnology practice. A point to note though is that the research scientists interviewed who do not frequent these government and industry contexts, did not mention any of these things. Perhaps most interestingly, scientists and science bureaucrats do not feature in the written parts of the corpus texts. They *do* feature though in the colourful and glossy *pictures* that go along with industry and government websites, education brochures, and policy documents, as the following corpus illustrations (over page) show.

To extend on the dynamics of recontextualisation in biotechnology, the following chapter will highlight that, depending on the context involved, different stakeholders are named as primary beneficiaries or agents of biotechnology mediations in the product development cycle. The category of "community", for example, is construed simultaneously as a group of customers, clients, or consumers in the corpus and are "located" only in specific market or public contexts such as "the clinic", "the street" or "the supermarket". In industry magazines, investors and shareholders are construed as the primary stakeholders and beneficiaries of biotechnology. On multinational pharmaceutical companies' websites, investors and consumers are apparently paramount. Finally, in government policy, there are more frequent claims regarding the broad utility value of biotechnology in promoting the wealth, health, and prosperity of all citizens. Yet, as one delves deeper into the logic of the texts, the benefits that ostensibly accrue to the general (non-profiting) community are almost always presented as new, enhanced, or transformed products.

Corpus Illustrations

The following illustrations (Illustrations 1-4) are taken from texts produced in, or intended to represent, five 'contexts' in the thesis corpus: Government and University Research; State Government Policy; Multi national companies; Health; and Biotechnology in 'the developing world'. The illustrations have been included to provide the reader more of a chance to build his or her own experience of the thesis corpus. The photos and illustrations are such that if a member of the public were to access one of the websites or texts, he or she would be confronted with these graphical representations in full colour.

The reader will note that with each new context presented, different persons, relationships, combinations, and ways of representing the practice of biotechnology (for example through graphs and tables) are introduced. Although I will not conduct a dedicated analysis of the illustrations, I have noted significant points following each Illustration.

Illustration1: Government and University Research Contexts

This illustration is not available online.

Please consult the hardcopy thesis available

from the QUT Library.

Notes on Illustration 1 – Government and university research contexts:

1. The only persons who remain constant throughout the five contexts are scientists yet, as noted in the following chapter, scientists are not featured in the written parts of the corpus texts;

2. Animals are only featured in the University of Melbourne's Centre for Animal Biotechnology website graphic, one (golden retriever) in a loving relationship with a woman and another (sheep) having its wool inspected;

3. The Human Genome publication *To Know Ourselves* presents both the idea of science as a form of knowledge valuable in itself and, perhaps more obtusely, the idea of science as a vehicle of liberation from dogmatic attitudes and irrational faith. This representation is emic to the research contexts and, apparently, to the Human Genome Project;

4. The Queensland Institute of Medical Research Gene Discovery and Genetic Diseases page collocates babies and 'natives' with computerised data in the context of biotechnology research;

Illustration 2: State Government

This illustration is not available online.

Please consult the hardcopy thesis available

from the QUT Library.

Notes on Illustration 2 – State government contexts:

1. The NSW Government Innovation Council combines a cool kid (future employment? Harmless technology?) with the slogan "profiting from biotechnology in NSW";

2. Graphs and tables are emic to State Government Policy and multinational pharmaceutical industry contexts;

3. The Biotechnology Strategic Development Plan for Victoria situates a range of technology industries (information technology, biotechnology, materials technology, and microtechnology) in a continual process of 'enabling technologies and technology transfer'. This implies that the four areas of technology are/should be convergent. Each area of technology is channelled into 'business opportunities'.

4. An entire mediation process is manifest in the Queensland Government graphic at the bottom of the State Government Policy page. The graphic starts on the left with trees in a forest, moves to DNA, then to a scientist studying something (presumably DNA), then to an illuminated light bulb (idea), then to a man at a computer, then to what is presumably a microchip or some part of a computer, then to a satellite, then to a blue plan map of the globe.

Illustration 3: Multi national pharmaceutical companies

This illustration is not available online.

Please consult the hardcopy thesis available

from the QUT Library.

Notes on Illustration 3 – Multinational Pharmaceutical Companies:

1. The Biogen slogan 'Delivering on the promise of biotechnology' reiterates once again the idea that human benefits from biotechnological research will be/are mediated through commercial industrial apparatus. It also dictates, in no uncertain way, what form the benefits of biotechnology will take (i.e. products including consumer drugs, pharmaceuticals, diagnostics);

2. The superlative abstraction in biotechnology as media appears only in the multi national pharmaceutical contexts with the Aventis 'Investor Centre' graphics. A photo of a stock broker is overlayed with stock price figures as they would appear on a trading floor board. The stock price table translates, technologises, and recontextualises biotechnology developments into various categories of figures that shift quickly over times and dates.

3. Another recontextualised abstraction in the form of the Sciona product range is presented on the multinational pharmaceutical page. Note that multinational contexts provide the most prolific representations of product outcomes of biotechnology. Most, if not all, multinational pharmaceutical companies include a 'products' page on their website.

4. Everyday happy and satisfied humans (a small boy, a mother and baby, and an older man) are featured most prolifically in

multinational pharmaceutical and health contexts where, apparently, the benefits of biotechnology are ‘delivered’ to the public;

Illustration 4: Health contexts

This illustration is not available online.

Please consult the hardcopy thesis available

from the QUT Library.

Notes on Illustration 4 – Health Contexts:

1. The Amgen corporate slogan ‘dramatically improving people’s lives’ makes a direct claim on the virtuous nature of the business. The picture collocates a scientist at a microscope with microscope slides, numeric figures, and a woman sitting on a beach rock;

2. Computer screens feature throughout biotechnology research contexts. The emphasis of the Johnson and Johnson picture in Illustration 4 Health Contexts, is on the *speed* of drug development and enhancing productivity. This also reflects the degree of technological convergence in contemporary biotechnology;

3. The Queensland Institute of Medical Research Health Page features an older woman in a wheelchair looking at a collection of medication bottles that are foregrounded on the bed. There is more medication on the bedside table along with some flowers. The woman is apparently in some form of hospital room. While it is unknown what the intentions of the photo may have been, the photo seems to collocate the life of an elderly woman with dependence upon medication, a state of incapacity, and apparent sadness. Is the message that genetic technologies will deliver this woman from her dependence on medication? Or will they deliver others away from a life such as hers?

Illustration 5: Biotechnology in 'the developing world'

This illustration is not available online.

Please consult the hardcopy thesis available from the QUT Library.

Notes on Illustration 5 – “Developing World” Contexts:

1. The graphics included on the biotechnology in the developing world page most consistently contrast apparently humble, ‘conventional’ farming techniques and crops with modern scientific ones.

2. The graphics used in these booklets are very different to the high technology computer and laboratory settings that feature in multinational and policy contexts.

3. These pictures show basic food being produced, not pharmaceuticals or diagnostic kits – as with Sciona for example. As a reviewer of an earlier version of this thesis points out, the high technology examples of plant biotechnology used in these pictures appear to be very *humble* precisely because they appear in the form of everyday items such as “plants” – albeit more healthy ones than non GM varieties.

4. The people in these pictures are black.

Chapter 7 The impact of mediation: Social and ethical considerations

Overview

As indicated in the previous chapter, the primary medium of benefit in biotechnology for non-profiting citizens is portrayed as being through this virtuous cycle of product development and ultimately through the market of exchange. The primary purpose of this chapter is to identify the persons who populate this virtuous cycle and the significance of their role in relation to biotechnology.

Defining embeddedness: The relationships that [are] count[ed] in biotechnology

The authors of the corpus texts are very specific in defining other practices and agents with who biotechnology practitioners should be relating. In this way policy makers are very actively defining the 'embeddedness' of the social practice of biotechnology. These relationships are significant not only because they are the media of hybridisation between science and industry, for example, but also because they are the official media of mediation in biotechnology: These relationships are the *official channels* of movements in meaning both toward and away from biotechnology. As such, these relationships stand in direct opposition to the *unofficial* relationships that the social practice of biotechnology has with other social contexts, persons, and practices. Unofficial relationships might include ones that are purely derived from profit maximisation activities or even those with persons who are rendered vulnerable in relation to the new genetic technologies. As the authors of Biotechnology Australia fact sheet state, ‘Genetic information is special: It might confirm a diagnosis, or suggest a future likelihood of disease in an apparently healthy person’ (Biotechnology Australia, accessed 2003, cwn. 373). In either case, the unofficial relationships are the ones that are not foregrounded, esteemed, or named at all.

Representations of relationships such as the science-industry-government scenario discussed above are significant precisely because they ‘marry’ people, places, and things together. The are also significant in a corpus such as this one because they identify the primary agents involved in specific ways: i.e. in relation to other people, processes, and things.

Other official relationships in the corpus include:

- Intergovernmental relations (between governments at different levels);
- Industrial relations (between employers and employees);
- Relationships of heredity, paternity (between members of the same genetic family);
- Academic – commercial or ‘market facing’ domains (between academics and industrialists);
- Australian medical Diagnostics Industry and the Commonwealth Government (between and industry association and the commonwealth government of Australia);
- DNA structure and function (a relationship of causality between DNA and its function);
- Human – mouse genome (a relationship of comparability);

- Network relationships (between multiple individuals and groups that share interests in a given location or practice);
- International relations (relationships between countries, usually the governments of those countries);
- The University and Chamber of Commerce in Austin Texas (academics and the chamber of commerce);
- Genetic make up and disease (causality);
- Public relations (relations between an organisation such as government or industry and the consuming public);
- Commonwealth – State governments (as with intergovernmental relations);
- Investor relations (relations between a for profit organisation and its investors like PR but only for a specific community of investors); and
- Related persons after a diagnosis of hereditary disease is made (relationships between genetically related persons).

The relationships that are actually *presented* in the corpus (as opposed to those that can be inferred) are all between *groups* of people (not individuals) and biological organisms/processes. The agents in the relationships include governments; the public; industry organisations; chambers of commerce; investors; genetically related persons; employers; employees; genomes; DNA; and DNA function. The only mention of the non government or non-industry public is within the particular context of 'public relations'. So, while the community and the public are presented as being ultimate benefactors of biotechnology research and commercialisation, they are not figured in any of the relationships that are venerated in the corpus, other than when they are presumed to be significant to one of the specific contexts of biotechnology research and commercialisation e.g. an investor or someone with a hereditary disease. The relationships presented above are constituted in a wider flowing trajectory that runs from research to industry to the market. This wider flow from research to industry is consistently referred to in multiple contexts and genres of the corpus, including the interview transcripts.

Defining sites of moral responsibility in biotechnology: Onward to market

One of the final considerations of this chapter is the extent to which a focus on the future, and the myriad of other silencing dynamics in official discourses on biotechnology, instil a sense of hopelessness in citizens regarding their part in perpetuating monologia. In '*Towards a Humanized Technology'* (1968/1974), Erich Fromm identifies two versions of hope: passive and active. He identifies the pervasive trend in western industrial societies where citizens consciously hope for change and progress but at the same time are unconscious of the extent to which we are resigned to certain powerful paths or trajectories of "progress". He relates Kafka's story about the old man at the gates of heaven as an example of how passive hope contributes to the reproduction of existing power dimensions and the lack of societal transformation: how citizens are disempowered and rendered impotent literally through their own sense of hope. The moral of Kafka's story is that people can hope, 'but it is not given to them to act upon their heart's impulse and as long as the bureaucrats do not give the green light, they wait and wait' (Fromm, 1968/1974, pp. 7-8). They put their hope in someone or something (technologies) else's hands.

A fixation with the agent-less, anonymous (i.e. *some*-body, *some*-thing) future defines Fromm's passive and 'generalised' form of hope. As he articulates,

> '[n]othing is expected to, or portrayed as, happen[ing] in the now, only in the next moment… [therefore] I do nothing, I remain passive, because I am nothing and impotent; but the future, the projection of time, will bring about what I cannot achieve' (Fromm, 1968/1974, p. 7).

Passive hope promotes an engagement not with others in complex socio-political contexts, but with unnamed and potential individuals and things in the future tense. While hope is intrinsically future oriented by its very nature, the passive hope Fromm identifies prescribes engagement between some unnamed others in a future time and space, not in the immediate and responsive present. Instead of focusing on something I do or become, I focus on and rely upon something that *I* will not do (Fromm, 1968/1974, p. 8). "The future" as the actor or agent will bring about something I desire without my doing anything, hence, I remain passive. This future orientation of engagement is vastly significant for discourses and public engagements surrounding biotechnology.

References to the "public" or "community" or "consumers" or "the developing world" in the corpus are strictly demarcated into contexts of 'consumption'; 'acceptance'; rejection; 'ignorance'; 'concern'; 'opposition'; 'ethics'; 'the providing of information to'; 'awareness'; 'benefit'; 'well being'; and 'uncertainty'. There is no inclusion of agents other than those directly involved in the merger and forwarding of commercial biotechnology presented in these spaces. The agents that are represented include 'scientists', 'industrialists', 'the public sector', pharmaceutical companies, and governments. The following quote provides an example of how the positioning of persons in these contexts is constructed in policy texts:

> Genetic research and its application also open significant ethical and consumer issues and there are potential risks to the environment which need to be managed. The Australian community needs to be engaged in an informed debate on the ethical and regulatory issues. A challenge for Australian biotechnology will be to work with the community and earn its confidence <u>as consumers and investors</u>. (Commonwealth of Australia, National Biotechnology Strategy, 2000, cwn, 2,094)

As with the UN Human Development Report 2001, the industry in this case labelled as "Australian Biotechnology" in relation to "the community" is portrayed as being responsible to consumers but *in a very specific context: the marketplace*. The 'community', moreover, is presented as amorphous collection of individuals who are free to pursue their personal interests, wants, needs, and wellbeing *in the marketplace* (Upton, 1987, in Peters, 1994, p. 66).

The reference to 'consumers and investors' at the end of the quote is quite overt, but very consistent with the representations and inclusion/exclusion of persons in different biotechnology contexts. Australian biotechnology is personified and active in comparison to the nominal, passive 'public'. When the government relates with the community, they are described as 'the public' or 'the community'. When companies (Australian Biotechnology) relate with the community they are ‘consumers and investors’. The context of interaction here and assumptions of social responsibility are paramount to how the community is described i.e. as citizen or consumer/investor.

Moreover, while the Commonwealth Government policy makers indicate that ‘the Australian community’ in total needs to ‘be engaged in an informed debate’, there is no mention of how this engagement in debate can and will affect policy or regulatory developments in biotechnology. Apparently then the only way a company impacts upon or interacts with everyone else in the universe is in an exchange relationship and responsibilities are governed by this relationship:

> [Heading] SHAPING CHOICES: THE ROLE OF PUBLIC OPINION In democratic systems public opinions of risk trade-offs are often key determinants of whether a technology is promoted or prohibited. <u>Public preferences matter, since it is ultimately individuals and communities that stand to gain from change or to bear its costs</u>. But views that dominate the global debate can lead to decisions that are not in the best interest of local communities. (UN Human Development Report, 2001, cwn, 2,745)

This is the kind of representation of “why public preferences matter” that underpins neoliberal industry obligations to the public i.e. ‘the consumer is the ultimate arbiter of the acceptability of products’. This view of why public perceptions matter relies upon very strict definitions of people in specific contexts and relationships and also very strict definitions of their power to create or inhibit change in those relationships. BUT the “consumer” can only be an arbiter when the “product” is indeed in the form of a product at one of the latest stages of mediation. In other contexts, such as the ones where research is funded, regulated, or marginalised, the “arbiters” are elite members of government and corporations. “Activists”, not consumers, is the term that is used to describe people who seek to enter into decision making processes in contexts when the “product” is not yet a “product”.

This is problematic in quite significant ways. First, framing consumers as powerful arbiters of whether or not a technology is “accepted” (i.e. bought and consumed) does not at all acknowledge the wider political or ecological systems within which they are produced and consumed. Second, the presentation of the market as the primary space of moral action and engagement is a very narrow representation of the company’s relationship with “the rest of society” which ignores the various ways that a company seeks to create acceptance, to create future markets for future products. A market-as-medium-for-moral-exchange view does not even come close to recognising the social and political embeddedness of a company or the people that constitute the company.

Third, the dominant presentation of industry responsibility does not acknowledge the multiple facets and political-ethical features of relationships. Rather, *corporate responsibility – and the ‘benefits’ that accrue to the general public from biotechnology in the form of products – are mediated by and through the market*. From this perspective, government policy makers apparently assume that it is, and ought to be, “the market” which constitutes the basis of moral engagement in our society and, as such, that the market can and should dictate the ethical, social, *and* economic outcomes of human interaction.

The market, marketing, and PR are hence construed as, *mediating practices* of 'engagement' or, more precisely, *ethical* engagement within the market context. Even policy makers have attributed "public opposition" and "distrust" to poor PR and marketing practice (!):

> The biotechnology industry is not unique in its corporate structures or commercial strategies. A similar process of concentration has seen the emergence of giant global corporations in many other sectors -electronics, automobiles, media, aircraft, pharmaceuticals and consumer electrical goods among others. Companies in other industries pursue market share and protect their intellectual property with the same vigour as biotechnology corporations but are seldom subject to the level of criticism directed at the latter. Where they are so criticized, the distinction between the possibly undesirable nature of some corporate practices and the beneficial character of the technology is readily appreciated. Few would suggest rolling back the revolution in information and communication technologies because of dislike of the power or policies of major electronics corporations. Nor should the advances in modern biotechnology be dismissed solely on these grounds. These points notwithstanding, the ethical issues raised by biotechnology differ in important ways from those associated with other industries. Heinz Imhof, president of Novartis Seeds, the leading Swiss biotechnology company, has acknowledged that companies had 'perhaps asked for trouble' in first introducing crops which, although beneficial to farmers, offered few benefits to consumers. A number of leading figures in the industry have since acknowledged that the introduction of GM crops and foods to the European market-place was not well handled.[22] The companies concerned lost sight of the fact that, in a market economy, the consumer is the ultimate arbiter of the acceptability of products and did not take effective steps to address public concerns or convince consumers of the benefits of their products. (Ireland Modern Biotechnology Report, 2000, cwn. 36,615)

Interviewees generally attributed more agency to "the community" and "the general public" than authors of policy and education texts. The majority of interviewees acknowledged that "the community" has rights regarding genetically modified organisms and that certain developments in biotechnology research and applications simply would not go ahead without community support. Interviewees used the terms community, public, and client/consumers interchangeably. Several scientists who displayed an interest in public awareness of biotechnology (some did not bring up the public or the community at all other than when questioned on responses to ethics) noted, though, that there needs to be a significant "information" and/or "education" campaign to inform non-scientist members of the public about what the technology involves, how it is used, what are its benefits, and what are the potential risks. One research team leader had interesting views on the non scientist community as opposed to his/her other main clients: growers.

> The growers seem to be quite accepting of GMOs. They are familiar with new plant variety, you know they have been introducing new plant varieties for years, and their Dads did, and they are just familiar with the concept of genetic *improvement*. They are a lot more familiar than the general public about the ways that you can go about modifying plants and improving plants to make them better and more productive and disease resistant. So generally the growers and people associated with the industry accept GMOs but they are also very concerned about the wider public acceptance of GMO, so now we are talking about the person we will bump into in the street or supermarket who are very ill informed about GMOs. Their concept of GMOs is what they saw in the latest X File movies, and they're concerned about things they don't understand, they are fearful maybe of things they don't understand, they don't trust scientists and they don't trust governments the way they used to and all of this I think has left a bit of a backlash in the community perceptions about GMO. (Centre Director, Research Project Leader, cwn. 2,109)

This quote is significant for at least two reasons. First, this scientist, throughout the entire interview does not refer to discourses of jobs creation, venture capital, economic growth, industry clustering as others who are involved in those contexts (e.g. research institute director, industry consultant) do. This scientist states that s/he is not involved in policy making and is not 'in the circle of government funding'. This scientist orients more toward the agricultural discourses and the traditions of farming. S/he identifies two clients for this work: growers and consumers. S/he gives an account of why growers are more familiar with genetic modification: because they are familiar with genetic improvement and because their dads were also familiar with 'genetic improvement'. Reference to the family involvement – specifically patriarchal inheritance of vocation and the family business – is a very specific formation, emic to farming.

Second, the interviewee counterposes growers with "the general public". S/he attributes "the general public" category with the following characteristics:

- They are concerned about things they don't understand;
- Their concept of GMOs is what they saw in the last X Files movie;
- They are the kind of person you would bump into in the street or the supermarket (i.e. in public spaces not in labs or restricted spheres of engagement and authority);
- They are very ill informed about GMOs;
- They are fearful maybe of things they don't understand;

- They don’t trust scientists;

- They don’t trust governments the way they used to;

As with the policy documents discussed above, this interviewee presents “the general public” as being situated within very specific social contexts that are apparently separate from the contexts in which biotechnology “happens”: the street and the supermarket. The growers by contrast are located in contexts where ‘genetic improvement’ is a family tradition. There is no recognition that the ‘everyday’ person you bump into in the street may *also be* an ecologist, hairdresser, lawyer, doctor, gardener, father, mother, sister, whatever. There is no recognition that this is the person who might frequent the court house, the council chambers, the bedroom, the stock market, the hospital, the environment, or the theatre. There is no recognition that the grower is also someone who shares these spaces, as may the scientist. The interviewee presents a stereotypical view of “the general public’s” attitudes toward GMOs. The presentation of distrust is also significant in that it taps into established discourses on social capital where the community’s lack of trust is presented as its own problem, its own fault so to speak. The historical and systemic origins of distrust are thus not acknowledged or addressed.

Representations of ‘the community’ and ‘the general public’ are more subtle in policy texts than in the confidential interviews. This is consistent with Graham’s observation that ‘the hortatory content of contemporary policy is often implied in, disguised as, rationalised by, or buried under piles of ostensibly “value-free”, “objective”, pseudo-scientific statements of fact

(Lemke, 1995, pp. 60-61; McKenna and Graham, 1999). Moreover, policy texts are usually longer, they are premeditated, edited, censored, researched; they are a public document that is written in third person and attributed an institutional author and bureaucratic anonymity. Attributions and evaluations of a particular group are usually spread across the document. The 1998 Canadian Biotechnology Policy provides an example:

> [Heading] BUILDING PUBLIC CONFIDENCE AND AWARENESS, AND COMMUNICATING ACCURATE, BALANCED, EASY-TO-UNDERSTAND INFORMATION TO CANADIANS [] <u>Public opinion surveys and focus group tests suggest that, relative to people in other industrialized countries, Canadians have a comparatively high level of interest in and acceptance of biotechnology. However, Canadians' detailed knowledge of biotechnology is limited</u>. Most important, <u>the public wants assurance</u> that biotechnology products and services are safe for humans, animals and the environment. Consultation participants stressed: <u>using credible sources</u> such as government, health care professionals, scientists, educators and NGOs to convey information recognizing the difficulties of conveying science-based information in a thoughtful, understandable manner to reduce the potential for misinformation increasing the visibility of regulatory processes, providing support for the communication of regulatory matters, including risks and benefits, to the public to <u>"de-mystify"</u> regulatory operations, and better explaining of how they function and protect the public interest explaining more proactively the issues surrounding food labelling and Canada's current policy. Possible actions: work with public and private sector partners <u>to coordinate and enhance respective information and public education functions</u> develop a comprehensive, coordinated communications strategy <u>to inform</u> Canadians about the regulatory system and other biotechnology-related activity <u>articulate and promote the CBS vision in Canada</u> and abroad encourage biotechnology companies and/ or industry associations to work with customers and stake-holders to develop voluntary codes of practice for use in Canada and abroad (Canadian Biotechnology Strategy, 1998, cwn. 5,455)

This is a complex passage. There are two hedges/qualifiers before the statement that Canadians have a ‘high level of interest and acceptance’ of biotechnology. The first hedge is ‘suggests that’ the second is ‘relative to other industrialised countries’. Further information, while seemingly adding to the quantitative validity and factual nature of the statement, actually discredits it by saying that these same Canadians, who exhibit a high level of interest in and acceptance of biotechnology, do not understand it. It is not informed interest or acceptance. While the data cited by the Canadian policy makers may or may not be correct, I would argue that the actual presentation of the data, the sequence, tonality, and grammar, change the meaning, orientation, and overall impact of the text significantly. Moreover, the phrase ‘the public wants assurance’ pacifies the ‘public’ into a meek thing merely wanting assurance from the experts that everything is going to be ok. This is also an inaccurate presentation of the range of public attitudes and orientations toward biotechnology. It assumes that biotechnology is going ahead, that all is well, and the public merely needs to be informed of this. This theme recurs later in the passage with the repeated use of one way communication process eg ‘inform’, ‘educate’ ‘convey information’, ‘the communication of’, ‘de-mystify’, ‘explain’ . It is interesting also that when the government text gets to the point of talking about industry/company interactions with the ‘public’ they again become consumers.

Magazine articles and some “public education” documents (brochures, fliers, websites, reports) are not so subtle as policy. The following quote is taken from an information brochure titled ‘Genetically Modified Foods in

Africa'. The document is co-produced by the San Diego Center for Molecular Agriculture (see www.sdcma.org for more information) and AfricaBio. AfricaBio describes itself as a "nonprofit, nonpolitical biotechnology association". AfricaBio sets a clear hierarchy of categories of people with more and less desirable attributes/attitudes toward biotechnology:

> The agricultural scientists and farmers all over the world who improve our crops are the true heroes of our time… Most of us know very little about the way our food plants are grown and are far removed from the factories where they are processed. All we care about is that our food be wholesome, nutritious, and tasty. Critics of crop biotechnology are of the opinion that potential ecological and food safety disasters are looming on the horizon because genetically improved (GI) or genetically modified (GM) crops have entered the food chain. Alarmists have introduced emotionally charged terms into the debate and speak of "frankenfoods" and "genetic pollution." The debate that rages in Europe has now reached Africa. This debate has important consequences for us in Africa where many countries have limited arable soil and extreme climates. (Foods from Genetically Improved Crops in Africa, San Diego Center for Molecular Agriculture &AfricaBio, 2001, cwn. 694)

Categories presented in this passage include the following: *'agricultural scientists and farmers'* who are the 'true heroes of our time'; *'most of us'* who know very little about the way our food plants are grown; *'all of us'* who only care about our food being wholesome, nutritious, and tasty; *'critics of crop biotechnology'* who see disasters looming on the horizon; *'alarmists'* who have introduced 'emotionally charged' terms into the debate; and *'us in Africa'* who will be affected by the critics of crop biotechnology and the alarmists and who have 'limited arable soil and extreme climates'.

This one passage, out of an educational booklet, provides not only information on who the author sees as being involved, or being ‘stakeholders’ in debates over GM foods in Africa, but also attributes very specific ideological categories and characteristics to each of the stakeholder groups without modalisation. For example the scientists and farmers ARE the true heroes of our time, just as “surely” as ‘critics of crop biotechnology’ are of the [apparently singular] opinion that disasters are “looming”. The only other instances of such blatant and unabashed stereotyping of actors in the texts comes from media articles and opinion pieces.

The rhetorical demarcation of ‘industry’ as distinct from ‘community’

Defined contexts and roles for ‘industry’

The following article excerpt taken from a pharmaceutical industry magazine illustrates a different representation of *who* benefits from biotechnology. It is produced by, and intended for, a different audience than policy. To start with, the article’s author quotes the voice of pharmaceutical company CEO Joshua Boger as a hero and expert in this context. Note, in particular, the positive focus in the article given to the increased speed of drug development. Note, also, the way that Boger attributes value:

> As Joshua Boger, CEO and founder of global biotechnology company Vertex Pharmaceuticals, surmises, the industrialization of drug discovery means "better drugs faster." Vertex Pharmaceuticals is considered an icon of industrialized drug discovery. The company recently signed one of the most lucrative drug discovery alliances in the history of biotechnology with Novartis, resulting in $800 million in research funding. This will provide eight new drugs for Novartis, and drug royalties for Vertex.

> "Too often, companies are concerned with the rate at which they screen small molecule drugs for their clinical relevance rather than focusing on the quality of the leads they generate and the validity of the biology behind the assays they use," explains Boger. He adds that the industry average for the generation of new small molecule drugs to reach the point of human testing takes about five years, but that Vertex is now able to do this in three-and-a-half years.
>
> "We have combined a variety of techniques within our own research culture, which is the actual design of drugs to fit disease targets," Boger says. Vertex departs from many of its peers by coupling high-throughput screening of large libraries of compounds with the design of such candidates prior to screening…
>
> Thanks to industrialization, chemotherapeutic and biologic drugs are now produced at much faster rates than have historically been possible. While the enabling technologies behind this transformation may differ, the implication is the same - the pace and reliability of drug discovery has accelerated fast enough to disrupt the competitive landscape of the health-care industry.
> (Parker, 2002, cwn. 691)

There are a number of insights we can gain from this passage. First, biotechnology is characterised as the positive "industrialisation" of formerly slow, conventional, and inefficient means of producing pharmaceuticals and health care products. In this way biotechnology is separated from other non-industrialised areas of scientific research. Second, the primary benefit of industrialisation according to this passage is the *speed* with which drugs and other health care products can be manufactured. Third, the primary benefactors of industrialisation of science in the form of biotechnology as represented in this passage are the companies who manufacture or own licenses for them, in this case, Novartis and Vertex. Fourth, additional benefactors, for example patients, health care professionals, "consumers" are not signified as "stakeholders" or beneficiaries of biotechnology research and commercialisation in this discourse or context.

Defined contexts and roles for 'community'

There *is* considerable mention of what is 'acceptable' to the community or the public or consumers throughout the corpus but consumers and investors or the general public *are not represented in contexts where partnerships or collaborations occur between science and business*. In a now well known two step flow, the public is informed that *we* (note global use of "we" and "our" to promote collective ownership and responsibility) need to "grasp" biotechnology to promote 'prosperity', 'well being', 'industrial competitiveness', 'economic growth', 'economic and environmental sustainability', a 'higher standard of living', 'human development', 'innovative farming, production, and manufacturing'. The research scientists I interviewed, though, were more likely to make a *direct link* between biotechnology and the general standard of living, a cure for a particular disease, crops in third world countries etc: they did not generally insert the two step flow between product development or industrial/economic competitiveness and standard of living.

The utility (citizenry) value of supporting biotechnology research is often foregrounded in Australian Government policy documents.

In New South Wales:

> Through the strategies outlined in Biofirst 2001 the benefits to the people of NSW will be maximised. (NSW Government Biofirst Strategy Statement, 2001, cwn. 127)

In Queensland:

> Like you, I am obsessed with the immense potential biotechnology has to improve our quality of life and to create a future for our children. (Beattie, 1999)

In Victoria:

> Biotechnology is regarded as one of the keys to Victoria's future prosperity with the potential to generate enormous economic, health and environmental benefits. (Department of Innovation, Industry and Regional Development, Victoria, 2002, cwn. 6).

Apart from claiming broad utility benefits for all Australians, the Commonwealth Government's 2001 strategy *Backing Australia's Ability* sets down a particular "challenge" for all Australians:

> We invite all Australians to join in this exciting era. A great challenge now exists for the community at large, and in particular those in business and the research sector, to capitalise on the opportunities created. Together, we can continue to build a nation where innovation and excellence thrives. (Commonwealth of Australia, 2001, cwn. 402)

Public private partnerships are acknowledged but in an uncritical way. It seems that the Commonwealth Government is following on from the rhetorical strategies Beattie used in the 1999 statements on Queensland the Smart State and Queensland the Biotechnology Hub of Australia. The rationale is that the scientific expertise and intellectual capital in biotechnology *already exists*, the government will merely give biotechnology scientists the support they deserve for being 'innovative'. In 2001 the Australian Commonwealth Government had proceeded to a policy rationale of supporting the *existing* bases of biotechnology expertise in the country *a la*

> Backing Australia's Ability commits substantial additional money to the significant funding my Government already provides for science, research and innovation. This is evidence of our <u>determination</u> to back innovative Australians, build on known strengths, explore new opportunities and <u>compete successfully with the best the world has to offer</u>. It recognises that through the efforts of our scientists, researchers and entrepreneurial business leaders, <u>all Australians will prosper</u>. The Government believes that the strategy marks a significant step in <u>harnessing the collective talent, energy and resources of all those dedicated to securing Australia's economic future</u>, both within and outside Government. It represents <u>a commitment to pursue excellence in research, science and technology</u>, to build an even more highly skilled workforce and increase opportunities for the commercialisation of new ideas—in essence it is about backing Australia's ability (Commonwealth Government, 2001, cwn. 203).

The authors of these policy documents do not identify exactly how the people of Australia, New South Wales, or Queensland will benefit through biotechnology. Pictures of everyday people are not really featured in the policy documents analysed. They are featured though in other contexts, specifically pharmaceutical company advertisements and health care advertisements and information.

People in the virtuous cycle: The politics of representation

To pull out some of the core aspects of biotechnology in terms of what the technologies are, who the agents are, what are the objects, processes, and outcomes of the technology, I have gathered a range of explanations of what biotechnology actually *is* from the corpus. The full list of explanations I have included in the tables below are listed in *Appendix A*. The following three analysis tables provide more clarity of the range of subjects, processes, and objects being presented at three different levels of social interaction in relation to biotechnology research and commercialisation:

- Government and politicians - public documents;
- Non government publicly funded research organisations and institutions - public documents;
- Individual scientists and practitioners' - interview transcripts.

The explanations of biotechnology are divided into five columns: Outcomes; Processes; Technologies; Agents; and Objects. *Outcomes* refer to what is produced or actualised through biotechnology (for example bread, cheese, beer). *Processes* refer to the action that is being carried out (for example using, manipulating, enhancing). *Technologies* refer to what is being used to produce the outcome (for example knowledge, genetic techniques). *Agents* are the persons or things that are presented as using the technologies or who conduct actions (Science, scientists, technology). *Objects* refer to the *object of the technology*, what is *subject to* action or transformation (for example flour, animals, embryos).

The purpose of the tables is to make explicit the categories of persons, objects, processes, and things that are routinely defined as being central to the practice of biotechnology. While I do not assume that these explanations are in and of themselves sufficient to map out the complexity of the practice of biotechnology, both the formulated and semi or un formulated explanations offered by the various institutions and individual scientists are relevant as concentrated representations of what biotechnology *is* to individual practitioners and/or what it is represented to others *as being*. The differences between the explanatory content and orientations at various levels is also a very cogent introduction to the diverse functioning, representation, and evaluation of biotechnology *in different contexts*.

Table 3 Government departments' and politicians' explanations of biotechnology				
Outcomes (The end or product)	**Processes (the action or what is done)**	**Technologies (what is used as means to…)**	**Agents (Who acts, who uses the technologies)**	**Objects (What is *acted upon* or *subjected to* technological intervention)**
▪ Industrial processes ▪ Useful organisms and their products ▪ Foods and medicines ▪ The reduction of wastes ▪ Renewable energy sources ▪ Things for humans ▪ A food product ▪ Goods and services ▪ Yoghurt ▪ Beer, bread, and cheese ▪ Medicines, foods and energy sources ▪ Animals and plants with specific characteristics ▪ Health, social, environmental or economic applications or outcomes ▪ New products and new industrial processes	▪ Using (The use of) ▪ Developing (The development of) ▪ Producing (The production of) ▪ Reducing (The reduction of) ▪ Creating (The creation of) ▪ Fermenting (to ferment) ▪ Pursuing (Pursue the understanding and use of) ▪ Understanding (Pursue the understanding of) ▪ Breeding (Animal and plant) ▪ Applying (The application of) ▪ Making (To make)	▪ Biological discoveries ▪ Yeast ▪ Active micro-organisms ▪ Living organisms ▪ Bacteria ▪ Fermentation processes ▪ Organisms and biological processes ▪ Techniques ranging from molecular and cellular biology, biochemistry and immunology through to biological applications of information technology (IT). ▪ Knowledge about living organisms and their components	▪ A group of technologies	▪ Wastes ▪ Dough

Table 4 Research Institutions' explanations of biotechnology

Outcomes **(The end or *product*)**	**Processes** **(the *action* or what is *done*)**	**Technologies** **(what is *used* as *means to…)***	**Agents** **(Who acts, who uses the technologies)**	**Objects** **(What is *acted upon* or *subjected to* technological intervention)**
▪ Products ▪ Modified Products ▪ Improved plants and animals ▪ Micro-organisms for specific use ▪ Bread ▪ Cheese ▪ Beer	▪ Applying (The application of) ▪ Making (To make or modify) ▪ Modifying (To make or modify) ▪ Developing (To develop) ▪ Changing (To make or change) ▪ Baking ▪ Making ▪ Developing (the development of) ▪ Producing (Production) ▪ Using practically (Any practical or commercial use of living organisms) ▪ Using	▪ Living organisms ▪ Substances from living organisms ▪ Biological systems ▪ Living things ▪ A biological process ▪ Intact organisms eg yeasts and bacteria ▪ Natural substances (eg. Enzymes) from organisms ▪ A biological process ▪ Yeast	**Zero representation**	**Zero representation**

Table 5 Interviewees' explanations of biotechnology

Outcomes (The end or *product*)	**Processes (the *action* or what is *done*)**	**Technologies (what is *used* as *means to achieve desired outcome)***	**Agents (Who acts, who uses the technologies)**	**Objects (What is *acted upon* or *subjected to* technological intervention)**
▪ Products ▪ A result ▪ Products and processes ▪ other organisms or mechanisms ▪ chemicals, foods, etc ▪ new organisms with different structures ▪ Genetic change for example molecular markers ▪ Human application or plant application or food ▪ Health care applications – both veterinary and human ▪ [improved] biological systems ▪ Agriculture or medicine ▪ Human endeavour	▪ *Manufacturing* 'The manufacture of' ▪ *Using* 'Using biological organisms' ▪ *Producing* 'The production of' ▪ *Creating* 'The creation of' ▪ *Changing* 'Genetic change for' ▪ *Utilising* 'Utilising biological information and biological systems' ▪ *Improving* 'Improvement of' ▪ *Manipulating* 'Manipulating genes' ▪ Relating 'Technology related to recombinant DNA' ▪ *Enabling* 'Enabling technologies' ▪ *Applying* 'The application of biological systems'	▪ Biological organisms ▪ Biological means ▪ Biologicals ▪ DNA ▪ Biological information and biological systems ▪ Natural organisms or mechanisms ▪ Genes ▪ Gene technology ▪ Biological techniques ▪ Manipulation ▪ Modern molecular tools ▪ Molecular markers ▪ Anything that is science based ▪ Enabling technologies ▪ Fermentation reactors ▪ Tissue culture ▪ Plant tissue cultures ▪ Gene technology ▪ Human endeavour	**Zero representation**	▪ Biological systems or organisms ▪ Genes ▪ Species ▪ Kingdom barriers ▪ Fields of agriculture or medicine ▪ Any sort of field of human endeavour ▪ Studies in plant physiology or applications in plant improvement ▪ Biological sciences ▪ A chemical/product

Object vs. agent: Of mice and men

> …eponymy undeniably pervades the language scientists use to talk about the history of their research organisms. Just as any chemist might refer to 'Boyle's air pump' or any engineer might speak of 'Edison's light bulb', for example, biologists typically speak of 'Morgan's flies', 'Brenner's worms', and 'Wistar rats' as kind of shorthand for the process (actually involving many people) that brought these creatures into their laboratories. (Rader, 1999, p. 319)

As the above tables indicate, persons and other living beings who are rendered vulnerable in relation to contemporary biotechnology have arguably fallen to the same fate as mice in science – at least in the official discourses. Within the history of science the 'case study' genre has traditionally 'subordinated research materials [organisms] to the careers of the individuals who developed them and their institutional settings' (Clarke, 1987, p. 323). Likewise, the *people* or other living beings who are *changed*, *mediated, or mined* by the technologies, whether they be genetic screening, genetic 'enhancement', therapeutics, diagnostics, vaccines, skin transplant, whatever, are literally *not in the picture* in this corpus. As part of the orientational or evaluative function of language, authors implicitly or explicitly attribute [moral] agency to things, persons, processes. Agency is a significant variable in biotechnology discourses as has been highlighted throughout this chapter. There are several groups that have not been represented in the corpus or have been represented but *without* agency. Their value is derived through their instrumental *use value* to humans.

Where the *object* of a technology is person or potential person with a particular genetic disease for example, that person, like the lab mice above, is rendered invisible. Likewise, where the *outcome* of the technology is a person or potential person, as in assisted reproductive technology or cloning, that living person, as both object and outcome of the technology, is also rendered invisible. The objects of biotechnology are consistently not represented across the three contexts mapped in the above tables. The outcomes of the technology though are represented, but they are only presented in a positivistic sense: that is, in terms of beneficial transformation, enhancement, or efficiency. Unlike the mice and men example in the history of science, *both the scientist and the objects and the human outcomes of the technology are portrayed as being secondary to the technology itself.*

As indicated in various sections of the thesis, these persons or other living beings are presented variously as 'living organisms'; 'research organisms'; 'production animals'; 'genetic resources'; 'natural resources'; and so on. There are only three mentions of abortion or termination of pregnancy related to genetic testing in the thesis corpus and only one of these indicates that this may be of ethical, social significance: i.e. that parents may feel pressured to terminate a pregnancy if a genetic disease or "abnormality" is detected in an unborn embryo/foetus/child. What is not being said is that prenatal genetic testing is not a 'treatment' or 'cure' for the unborn child or his or her parents. It is a method of identifying genetic traits in unborn children who may be terminated if they are found to have x, y, or z genes.

Furthermore, the representation of living with disability or inherited disease as a way of be*ing* (cf. Campbell, 2002; Clapton, 2002), or even the acknowledgement that persons currently live with disability, is zero except for the New Zealand Independent Biotechnology Advisory Council's Information Booklet. This booklet is the only document in the entire corpus of publicly available texts that refers to the basic human rights of, and potential genetic discrimination against, persons as a result of genetic "abnormalities" or hereditary diseases.

Biotechnology and non humans

As the previous section has explored, while some agents in biotechnology are simply not represented at all, others are presented as if they are not agents but objects of the technology. This is particularly the case for non human living species. The thesis corpus consistently portrays animals and the natural environment are nothing other than economic resources to be exploited for human use, benefit, or wealth creation. This is once again an example of how biotechnology functions as a time medium by reproducing historically salient ways of seeing in new times. While it is not new, the recasting of all living things as being of potential human or, more specifically, commercial use value is an *underpinning* assumption not only of the "biotechnology age". The sheer extent to which official discourses on biotechnology perpetuate an instrumental view of animals and the non human environment – despite considerable developments in animal rights and environmental sustainability discourse – is very significant.

Throughout the corpus there was only one reference to the intrinsic value of animals and the natural environment in a Swedish policy document. Other references to the potential for animal suffering were located within the broader assumption that it is still acceptable to conduct genetic experiments on animals and that we should do so precisely because it brings some form of human "benefit". The following quote from the Managing Director of a company that produces human and animal diagnostics provides an example of how human benefit presides over animal welfare:

> I will just give you an example, we have done the calculation last year 1.5 million people were touched by our blood clot diagnostic product, even though the blood samples that were tested, the results affected their outcome. We have over two and a half million dogs and cats that were tested worldwide with our products to affect their outcome, be it that they got a better treatment, that they survived or whatever other decision was made *for the benefit of the owner*. So that is a feel good for the people here and that probably motivates the people here, the 70 people that work here full time that probably motivates them more than anything else… (Interview transcript, company Managing Director, cwn 7,993, italics added)

The terms most frequently used to describe the benefits of genetically engineering 'production animals' include increased animal productivity; decreased animal wastage; increased disease resistance; and increased animal efficiency. This terminology was particularly evident in interview transcripts with research scientists in the CSIRO. Even the different categories of animals identified in the corpus send a message: that is, "production animals" versus "companion animals". This discourse on animal productivity orients toward the "primary producer" context on biotechnology where more meat and less fat are important characteristics in an animal. Likewise an animal that can be genetically engineered or selectively bred to be more heat and stress resistant is a bonus for farmers who freight their "stock" on trucks or cargo ships. There are exceptions though that should be noted. Some areas of biotechnology are designed specifically for bioremediation and environmental preservation rather than strictly human "use".

I posit that all of the implicit assumptions regarding animals and the non human environment in official discourses on biotechnology can have wider implications. This is not least due to the fact that biotechnology is being taught in schools and universities; is discussed on television and other mass media outlets almost daily; and is the focus of much of Australia's – along with most other country's – science and technology policy. With the advent and propagation of genetic technologies since the 1970s, and the ensuing "race" by multinational companies to secure the intellectual property and financial benefits arising out of the technology, we have moved into an expanded realm of commercial dominance. We have also introduced new or expanded *bio-technologised* notions of what is "natural", innovative, and desirable in human life.

We are now, arguably, witness to a time where the notion of what is "natural" itself is being redefined by the use of modern genetic technologies. Human ability to genetically engineer other species and themselves involves a fundamental ontological and epistemological challenge to standard ways of seeing and being within the now wider socio-political world of nature and society. This is not to say that discourses of nature have never been guided by socio-political phenomena. Of course our understandings of nature are regulated by discourse which is itself a social process of meaning making and sharing. But beyond that realm of our own "sense" of nature is where the changes mediated through biotechnologies are occurring: That is, the fundamental structures of living things are being altered in a more precise and invasive way to accord with human desires. As such, these technologies have fundamental implications for a range of human relationships both with the human and non human world. In Escobar's words:

> …we might be witnessing – in the wake of unprecedented intervention into nature at the molecular level – the final decline of the moderm ideology of naturalism, that is, the belief in the existence of pristine Nature outside of history and human context. (Escobar, 1999, p. 2)

As the previous analysis chapters have highlighted, current policy discourses on biotechnology function to obfuscate and remove agency from humans who are rendered vulnerable in relation to new technologies and non human living beings by making them simultaneously materials, objects, and sites of capital production.

Agency as it stands in the dominant technical and economic discourses of biotechnology today is a strictly human domain. Current discourses surrounding biotechnology research and commercialisation produce, reproduce, and *rely upon* already prevalent dualisms in modern western thought. This becomes even more interesting when we look at the discourse to see how these dualisms are invoked to allow/justify further colonisation of the natural world. In effect, these dualisms, like many other features of powerful economic and technocratic discourse, help us not to think critically or in a complex, appreciative way about human and non human others.

What is significant about recombinant gene technology, as opposed to any other historical form of human manipulation and domination, is that “nature” or more particularly what is “non-human” can now be more *fundamentally* altered, manipulated, engineered by humans toward the achievement of human wants, needs, or desires. These wants, needs, and desires driving biotechnology research, funding, and commercialisation opportunities are not being determined in an open or democratic process. The intersection of economic and political agendas obviously has a powerful voice in determining what/how these wants, needs, and desires are represented and actualised.

Dualism and colonisation

The table below combines the major dualisms of western thought (Plumwood, 1993) with the thematic results of the pilot analysis. The table shows that official biotechnology discourses rely upon and reproduce a number of dualisms constructed by Plumwood in order to make the claims it does about the value and logic of developments in bio/gene technology. As you will see, this is more complex than a mere human-nature split.

"Good" positive Subject Plus Agency	"Bad" negative Object Minus Agency	Biotechnology manifestation
Anthropocentrism	Biocentrism	Technological imperative, means to ends
Subject	Object	Use of living organisms, also humans objectifying themselves as object of study/production "we can take a look at ourselves too" "understanding of = control over"
Rationality	Animality	Controlled reproduction, or 'rational reproduction'
Culture	Nature	Defining culturally desirable attributes, eugenics
Reason	Nature	Common manifestation: "Understanding of and control over living organisms and processes" (Independent Biotechnology Advisory Council, IBAC, 2000)
Mind	Body	"…we'll be able to take a closer look at ourselves too" (Biotechnology Australia, BA, 2000)
Master	Slave	Engineering other species to be more efficient, productive etc for human benefit (CSIRO Tropical Agriculture Division); xenotransplantation, spare parts for humans Animal experimentation
Reason	Matter (physicality)	"…we'll be able to take a closer look at ourselves too" (BA) "engineering"
Reason	Emotion	"Some people fear the creation of Frankenstein-like monsters! Much of this fear comes from a lack of understanding of the science". (BA)
Mind, spirit	Nature	Control; precision; engineering; anthro-biocentrism
Freedom	Necessity	Pressure on parents to consent to genetic screening and possible termination for 'faulty' embryos; embryo selection; eugenics Narrowing of down evaluative options in public discourse GM Foods – labelling
Universal	Particular	Normality over "abnormality" for example striving to "eradicate" Down's Syndrome
Human	Non-human	Microbe world a "plague" on humanity (BA) Anthropocentrism and the technological imperative
Civilised	Primitive	"Our new knowledge of gene technology will enable us to change exact characteristics without years of complicated, *hit-and-miss* breeding programs" (BA). "catch evolution red-handed" (US National Academy of Science, 2001)
Production	Reproduction	Genetic engineering; human "spare parts" taken from organisms with pig-human genes, xenotransplantation, embryo selection "catch evolution red-handed" (US National Academy of Science, 2001)
Public	Private	DNA profile databases; intellectual property — private ownership of genetic material for plants, animals and humans
Self	Other	Parents selecting embryos based on their own preferences, rights, or desires; cloning in one's image = strict uniformity and narrowing of range of biological resources

Table 6: Dualism and colonisation

Dualism is also used as a rhetorical strategy in defining and objectifying certain groups of people in the biotechnology "debate". As the following analysis will show, stereotypes play a significant role in the politics of representation surrounding biotechnology research and commercialisation. Stereotypes are a feature of all genres of engagement surrounding biotechnology including the mass media, interpersonal, conferences, policy documents, interview transcripts, public education documents, and corporate strategy. Stereotypes are significant to dis-engagement because they are literally shortcuts to interpretation: they help us *not* to think, understand, or appreciate. Stereotypes misdirect us from a truer appreciation, or range of appreciations, of a person, process, or thing in our daily engagements with persons, living and non living 'things'. Perhaps most significantly for ethical engagement, a stereotype requires *generic* evaluations and attributions that *characterise* the stereotype over time: Stereotypes are genres of identity.

Dualistic stereotypes, like silence, language, and ethics, are a fundamentally social phenomenon (cf. Goffman, 1972). Stereotypes are closely linked to the normative expectations that surround social roles: What we do, how we do it, what we value, what we don't value in our different social roles (Goffman, 1972). A common role stereotype is the private-public distinction. There are certain ways we behave in public and certain ways we behave in private. Common ideational categories in biotechnology discourses include 'the scientist'; 'the activist'; 'the industrialist'; 'the entrepreneur'; 'the ethicist'; 'the uniformed public'. In telling us what we should be interested in, and responsible for, a stereotype or role also tells us what we should not be interested in or responsible for.

Thus stereotypes, like university disciplines, function politically to maintain a *division of labour* between various areas of social inquiry. For example, between ethics and science, science and business, economics and society, accounting and science, politics and policy, etcetera. Someone who is concerned with economic growth does not, for instance, ostensibly have to concern him or herself with the intrinsic, as opposed to commercial, value of scientific research as a social science. When stereotypical demarcations are made between areas of social inquiry such as those listed above, one or other of the two "opposites" is portrayed as being superior. This happens within specific contexts. A context such as the stock market, for example, engenders different assumptions regarding the intrinsic value of scientific research than would a university research institute.

The dominant modes of evaluation and the perceived function of the practices and contexts are significant to which of the supposed opposites is presented as being "rational", "reasonable", "desirable", "virtuous", or "correct". There are "overlays" of superordinate dichotomies over other dichotomies that function not just as shortcuts to interpretation, but as shortcuts to evaluation and ethical response or non response.

The superordinate dichotomies of evaluation of any given point in history define a social system (Lemke, 1995, p. 13). The persistent superordinate dichotomy is a classificatory good-bad distinction. The rhetorical function of creating dichotomies of good-bad is to prize one of the "opposites" over the other: That is one option is attributed with intrinsic value and superiority while the other is presented as the evil undesirable opposite (Metzner, 1988). The superordinate dichotomies of evaluation as articulated in policy discourse on western biotechnology include: for profit-not for profit; rational-emotional; industrial-non industrial; innovative-conventional;

These potent demarcations get interesting in biotechnology when we have hybrid roles such as the research director of a university centre who has agreed to work toward commercialising research, economic productivity, and goals for state employment. This is the same person who is asked to sit in the NHMRC ethics committee, speak at public discussion forums, and make statements that address public concerns surrounding biotechnology. I have directly observed that, for some people involved in biotechnology practices, multiple roles, expectations, and responsibilities make it hard for them to express their thoughts honestly in a public setting. This is because a) their thoughts may conflict with the normative assumptions that surround their official position or role; b) their thoughts may conflict with the normative assumptions of the tradition, organisation, or social practice they are a part of.

At each recontextualisation the defined benefits of biotechnology, and the agents who are benefited, are represented in different ways. This is very important not least because it shows that different contexts bring out different permutations of what seem to be the same “goods”, values, or evaluative orientations. The differences between for example what a research scientist will say, and what is presented in a policy text, reiterates that different social practices can appear to be pursuing the same values, beliefs, etc but may be acting out different value sets and propositions.

Further, policy statements are generically very different to a scientist's narrative or an activist's narrative: Governments try to present a case for the people, for *all* of the people. A functional way to do this is to appeal to generic standards such as "quality of life", "economic efficiency", or "jobs creation". But, although there are many *we's* and *our's* included in the Commonwealth excerpt, neither the Australian public (investors included) nor the scientists themselves, are the ones who are realising this *potential* promise according to the scenario portrayed in this policy text. Rather, it is the personified but simultaneously transcendent "bio *technology*" who is 'promising', 'presenting' and 'bringing' change and prosperity to "us".

The 'anti-biotechnologists' and 'scientists'

The 'anti biotechnology community'

> 'The reason why we should be concerned about the minority that espouses anti-science sentiments is that many of these individuals are often better educated, more articulate and more committed to their particular views than the average citizen. A significant number of them are university educated (though of course they tend to hold degrees in the humanities). More importantly, they frequently occupy influential positions within the social, educational and political establishments where they are able to wield a degree of political power that is out of all proportion to their number. This contemporary dissatisfaction with science finds expression in two other phenomena characteristic of the late 20^{th} Century. One is a dramatic resurgence of fundamentalist attitudes and beliefs, many of which are either self consciously anti-science or actively seek to constrain its activities in radical ways; the

other is marked by the emergence of philosophies of despair among intellectual élites within the humanities' (Dunbar, 1996, p. 5).

As an example of the extremes to which the politics of representation may flow, Vandana Shiva is used as an example of 'biotechnology opponents' in the quotation below:

> <u>The apparent willingness of biotechnology's opponents to sacrifice people for their cause disturbs scientists who are trying to help the world's poor</u>. At the annual meeting of the American Association for the Advancement of Science last February, Ismail Serageldin, the director of the Consultative Group on International Agricultural Research, posed a challenge: "I ask <u>opponents of biotechnology</u>, do you want 2 to 3 million children a year to go blind and 1 million to die of vitamin A deficiency, <u>just because you object to the way golden rice **was** created</u>?" Vandana Shiva **is** not alone in <u>her disdain for biotechnology's potential to help the poor</u>… (Why we Should Learn to Stop Worrying and Love Genetically Modified Food, By Ronald Bailey, Reason Magazine, January 2, 2001, cwn. 579)

The rhetorical strategies used in this passage are quite obvious and common in the popular media and some interpersonal exchanges at conferences and seminars I have attended. The primary rhetorical strategy is to position *categories* of actors in opposition to one another and attribute more and less favourable moral-ethical-political characteristics and motivations to those categories. Even the labels applied to categories serve a forensic rhetorical function. For example, "opponents" of biotechnology are referred to as "activists", "environmental groups", "critics", "anti-biotechnologists" and, perhaps most interestingly, "*the anti-biotechnology community*" (cf. Prakash, 2000). All of these categories imply that the persons ostensibly positioned within them display unilateral, static, attitudes and orientations toward biotechnology.

Representations of Scientists

Like the scientific 'facts' and 'thinking' explored previously, research scientists are not the subject of official discourses on biotechnology. In contrast to 'the anti biotechnologists' described in Prakash's magazine article discussed previously, scientists are not described in the noun form of "the anti biotechnologists": they are described as "scientists". But, even though they are not presented as a *thing* (viz *the* anti biotechnologists), there is little to no representation of the "voices" of scientists – in particular basic research scientists – in policy, corporate, or educational texts (apart from, for example, when a scientist contributes to a "fact sheet" on a particular biotechnology technique or application). Media sources quote directly from scientific "experts" in a certain field about a specific development, breakthrough, but they are not the voices that make claims on the future of biotechnology in country X, city Y, or practice Z. What the textual analysis cannot demonstrate is that *the primary representation of scientists happens through the pictures that accompany policy documents, and government and company websites.* In fact, *scientists and computers are the only "agents" featured pictorially at every stage of mediation toward commodity*, including policy contexts, industry contexts, and research contexts. (See the previous chapter for a selection of pictures from different contexts to explicate these dynamics of representation). "Ordinary People" who "benefit" from biotechnology (i.e. other than scientists who are consistently represented in relation to research) are most often represented pictorially in *contexts of consumption* usually to do with medicine and health and pharmaceutical products.

Conclusion

This chapter has explored the ethical significance of a number of mediations that are manifest in the thesis corpus. These mediations are accepted, and apparently acceptable, to the extent that they conform with and reproduce the limited contexts in which they are produced and upon which they impact directly. See for example the diagram taken from the Victorian Strategic Plan 2000 for biotechnology included at the end of the previous chapter. The arrows that lead out of the diagram portraying areas of research all represent “business applications”. I do not want to suggest that this is a surprising or “out of place” feature of a strategic plan – quite the contrary. I posit that this document is doing and saying what it “should” according to the genre of strategic plans. The broader indirect and less visible ethico-social and socio-political mediations of these processes are, however, rarely recognised or critiqued, as the analysis in this chapter has shown.

Chapter 8 Conclusion

Overview

This chapter revisits the primary theoretical and conceptual contributions of the biotechnology as media framework. Apart from its function as a technical medium of alienation for hitherto inalienable aspects of life such as DNA, and a time medium for reproducing historically salient discourses, I argue that biotechnology has the potential to effectively, and for the most part invisibly, mediate our more general understandings and experiences of ourselves, of other species, and the world we live in. I have argued that biotechnology as media processes – as they currently function at formal discursive levels at least – actively and often forcefully promote a vast narrowing of the range of evaluative resources on offer to the general community, and indeed to biotechnologists themselves. The important question asked in this chapter is, if we can identify these broad effects or mediations of biotechnology by using techniques such as CDA and the biotechnology as media framework, what can we do to interrupt them and generate movements that are more socially just, accepting, and generative of more democratic and socially responsive range ways of seeing, being, and acting?

Biotechnology as media – a digest

Throughout this thesis, I posit that seeing biotechnology as media allows us to more fully recognise the myriad forms and processes in which, and by which, the ways of seeing, being, and acting associated with the social practice of biotechnology oscillate outward, beyond the permeable rhetorico-discursively produced boundaries of the practice itself. The biotechnology as media framework, in particular the combination of social practice and discourse, reopens discussions about the merging or 'hybridising' (Lemke, 1995; Fairclough, 2002) of social institutions, discourses, practices, genre, function, and so on. In particular, the notion of social embeddedness renews focus on a key understanding in critical discourse analysis literature that each individual member of any given social practice or 'discourse community', is simultaneously a constituting and constituted member of *multiple* discourse communities and social contexts.

An emerging theoretical observation gained from the biotechnology as media framework is that mediating processes do not have to work in a linear, one way fashion. In being socially embedded, any given social practice is both subject to, and initiator of, any number of mediating practices that move both "into" and "out from" the permeable "boundaries" of the social practice. Through policy texts in particular, it is evident that mediating processes into and out from the social practice of biotechnology, are operating in historically familiar ways.

Using the combined resources of CDA and the media framework, I have identified a number of sites of mediation (alienation, translation, recontextualisation, and absorption) that are evident in discourses surrounding biotechnology research and commercialisation. I have summarised these sites of mediation in the following categories:

1. Ontological: transformation of human *being* and becoming through the direct intervention of genetic technologies and, indirectly, through the production and reproduction of esteemed versions of normality, abnormality, desirability, and so on. This includes, for example, notions of what constitutes a "healthy person", a "defective person", or "an embryo worth growing" amid knowledge gained via genetic technologies. Discourses of animal and productivity and instrumentality in biotechnology also obviously impact on humans' perceptions of be-ing in non humans;

2. Relational: transformation, expansion, or contraction in human be-ing *in relation to,* and as *demarcated from,* others. This includes relationships within the human species and with other species and "nature" more generally;

3. Spatial: actual geographical movement of discursive and biological resources from one place and context to another, for example, from the body context to the clinic, the ocean to a pharmaceutical manufacturing plant, or the laboratory to the stock market;

4. Temporal: This refers to the notion of biotechnology as time vector or literal median point between the past, present, and imagined futures. I argue that biotechnology reinvigorates a series of dualisms, assumptions, ways of seeing, acting, and

being featured in historical discourse, delivers them in various ways into a range of new contexts, practices, and relationships;

5. Hybridising: This movement is most evident in the social practice of biotechnology where science is purposively mixed with, or totalised by, the dominant economic and commercial imperatives of industry. This movement is also featured where recombinant DNA technologies are used to design and produce hybrid life forms. These hybrid life forms are not, as they previously were, limited to movements between members of a particular species. Rather scientists and medical practitioners use recombinant DNA technologies to transfer genes and body parts from one species to another (see for example, xenotransplantation).

6. Colonising: this movement refers to the way that the function, location, and reproductive capabilities of a living organism are colonised and reengineered so as to accord with dominant human (productive capitalist) desires, interests, and uses. The living organism is produced (rather than reproduced) to carry out a technological function that is intended to serve some human benefit. This colonising movement is also evident where animals and plants are used as living factories to produce a given hormone, enzyme, or compound for human use (referred to as "pharming"). Another way to describe this movement may be "human imperialism" over the non human world. In my mind

> this movement has parallels with the way that a virus infects a cell and takes over its functioning within the body.

As the previous chapters have highlighted, there is a great deal of thematic consistency in the ways that biotechnology is being represented and evaluated in official biotechnology discourses. The mediations involved in product development in biotechnology are specifically aimed at moving the "outcomes" of biotechnological research into social contexts of mass consumption.

These mediations are in no way neutral. They are in fact, finely tuned to using an existing productive apparatus to produce tangible things out of biotechnology research: Industry is the medium for "delivering on biotechnology's promise". There are, however, only so many forms and attributes that the medium of capital production will accept. These forms are not by and large set by scientists or governments. As the policies indicate, governments, under the label of science and technology policy, are relying on private companies and industry bodies to responsibly translate and deliver strengths in scientific research into new bio-industries, jobs, profits, health products and technologies, and economic growth.

Using biotechnology as media in direct and indirect ways, humans from a number of inter-textual and inter-temporal backgrounds, practices, professions, intentions, and persuasions have expanded the number and range of territories, sites, and contexts within which they themselves or other individuals and institutions in current or future times can produce and reproduce salient forms of power, evaluation, and meaning. One new site pronounced in discourses surrounding biotechnology research and commercialisation for example is the "the human genome". Developments in gene technology have evoked a redefinition of how "property" is being defined in both general and legal discourses. The essential elements of property and ownership themselves have been tested at a most fundamental level because recombinant DNA technology means that previously *inalienable* aspects of human life (for example DNA sequences, cell lines etc) can now be alienated from an individual, tribe or race to be patented and exchanged for profit under intellectual property rights protection (cf. Thompson, 1995). In some cases (see previous examples of "Genetic Park" in Cilento, Italy and Moore vs. Regents in Chapter 2) the individual, tribe or even isolated villages is allowed only as a "partner" in the process of alienation and the profits arising thereof because without the medium (biotechnology) and the operators of the medium (the technocratic scientific community and its funders) the content would be useless, abstract, inalienable. As Graham (2000) argues, these new definitions of genetic "sites" and "property" are equivalent to the land grabs and enclosures acts in More's Utopia in the sense that they redefine and allocate public property as private. Graham draws comparison between the enclosures act for example, and current policy and legislation that seeks to appropriate things such as "bandwidth" and radio frequencies as private property.

But, as mentioned previously, it is not only biotechnology research that is being "fenced in" and commercialised in this way. There are a range of social practices, disciplines, and persons that are subject to the same discursive trends and imperatives for productivity, speed of product development, material commercial appeal, and fiscal reward. A simple example is the *Yoga in daily life* centre that I attend. While there is potential in traditional Yogic teachings and values to promote radically different ways of seeing, being, and acting than those promoted through contemporary western institutions, the Yoga in daily life centre does not fully promote this radical, alternative aspect. Rather, the Yoga in daily life centre, as the name suggests, has adapted traditional Yogic practices to attend to the pressures and constraints of everyday life in a productive society including, for example, muscle pain associated with computer use, minimal leisure time outside of working hours, and stress. While I do not want to ridicule this practice, or deplete from its value, I do want to point out that, in as far as the adaptive yoga practice promotes only minimal interference into the working day (i.e. three minutes or so) it inversely propagates the given daily life associated with productive society. My point is that the potentially transformative content of a practice can be diluted or absorbed by the imperatives of the dominant productive apparatus and its mediation according to the so-called "way it is". In this way the heteroglossic potential of the practice can be totalised or colonised by the dominant ways of seeing, being, and acting within a social and political economic system.

Heteroglossia and monologia revisited

> 'We used to think our fate was in the stars. Now we know, in large measure, our fate is in our genes'. (James Watson)

A central dialectic underpinning this thesis has been that, while economic, political, and scientific powers to mediate the social and biological world via powerful, linear (one way), and elite scientific, political, and commercial practices increase, the citizen's power to identify, resist, and/or reverse that mediation decreases (heteroglossia and monologia). Obviously, science, biotechnology, and commercialisation do not transform only the social and biological world of a laboratory or market place. Rather, the combined practices of science and commercialisation – and all of their related practices such as public policy, health care, education, ethics, counselling, and so on – reach into multiple contexts via multiple interlaced and interlocking discourses and socio-political technologies. Indeed, biotechnology as a social practice itself has been subject to many of the powerful trajectories it reproduces and as such shares an historically salient and readily identifiable path of simultaneous expansion and contraction with many other social practices of its and other times.

In effect, although it is often portrayed as being "new", "revolutionary", or "emerging" by critics and protagonists alike, our current preoccupation with genetics and "breeding" is not new but, rather, *re-emphasised, rearticulated,* and *reinvigorated* by recent developments in genetic technologies, the biggest one of which is the much touted "mapping of the human genome". Animal husbandry and farming practices have, for example, routinely sought to "optimise" desired traits, and eradicate or reduce undesired traits, in animals, crops, and plants for a range of aesthetic, commercial, agricultural, and manufacturing purposes.

Throughout this thesis I have sought to emphasise that understandings, meanings, and in particular, socio-politico orientations enabled by modern technologies of genetics and biology move beyond the social practice of science, biotechnology, and directly related practices such as medicine to vastly different contexts, relationships, and social situations. The Australian national economy and technology and pharmaceuticals stock markets for example have and are being "biotechnologised" or, more specifically, "geneticised". If we believe what we see and hear in the Media, so too are race relations; interpersonal relations; property rights; social class; science degrees; public funding of research, scientific and otherwise; business ventures in the "new economy"; venture capital and investment; social behaviour, tastes, and fashion sense; agriculture; aggression; spousal choice; smoking; alcohol consumption; obesity; cancer; and intelligence.

In biotechnology, we are witness to a significantly expanded ability for *some* humans to alienate, appropriate, transform, and commodify not only human labour power, but the very bases of human and non human social and biological be*ing*. Developments in information, understanding, technique, and/or knowledge have facilitated an expansion in the range of technico-scientific apparatus with which humans may *alter* and *control* the natural environment, other species and themselves. In identifying and alienating certain, previously unidentified or inalienable aspects of life, biotechnology significantly *expands* the range of subjects, organisms, processes, and substances *upon and within which* scientists can act.

When a practice such as biotechnology is captured by dominant productive economic trends and discourses of the day, it becomes a powerful vehicle for transporting those discourses literally into thousands and even millions of social and biological contexts and beings (i.e. our social as well as our biological be*ing*). At the same time, the spaces for contesting such movements are being colonised or shut down entirely. In consonance with Marcuse (1964), Bourdieu (1998a, p. 19) argues that the kinds of movements from heteroglossia to monologia I have outlined in official biotechnology discourses significantly limit the availability of social and political spaces for contestation in modern society. Bourdieu posits that '[t]he social space is indeed the first and last reality, since it still commands the representations that the social agents can have of it' (1994/1998b, p. 12). He argues, further, that spaces of artistic abstraction and antagonism which were thought to "transcend" the everyday productive apparatus (some spheres of nature and art) are increasingly subjugated to, and totalised by, the ideational constraints of commercialisability, immediate profit, and exchange value (Bourdieu, 1998a, pp. 37-38).

> The autonomy of the worlds of cultural production with respect to the market, which had grown steadily through the battles and sacrifices of writers, artists and scientists, is increasingly threatened. The reign of 'commerce' and the 'commercial' bears down more strongly every day on literature, particularly through the concentration of publishing, which is more and more subject to the constraints of immediate profit; on literary and artistic criticism, which has been handed over to the most opportunistic servants of the publishers – or of their accomplices, with favour traded for favour; and especially on the cinema…Not to mention the social sciences, which are condemned either to subordinate themselves to the directly self-interested sponsorship of corporate or

> state bureaucracies or with under the censorship of power (relayed by the opportunists) or money. (Bourdieu, 1998a, pp. 37-38)

The social space for alternative ways of seeing, being, and acting, and contestation of monologia, is literally its abstraction, in spaces removed and protected from the everyday, or in the case of biological options, in unknown states of potentiality and inalienability. However with the technologisation and mediation of these antagonistic contents, '…whatever preconditions for a reversal [of the dominant productive apparatus] may exist are being used to prevent it' (Marcuse, 1964, p. 13). We have seen this in biotechnology through very limited public consultation forums and engagement strategies. It is also evident in the dynamics of silence and silencing that proliferate in university and government bureaucracies.

Re-emphasising context

Context is an important concept in the biotechnology as media framework for a number of reasons. First, different actors, beneficiaries, and stakeholders are 'located' and 'represented' in different contexts in discourses of biotechnology. The effect of this social locating is to identify who has a say in which areas, who is required to have and say, and who cannot have a say. One of the most obvious findings of the textual analysis was that members of the general community are only seen to have a role in contexts of passive consumption.

Community and the public are portrayed in only five contexts in the thesis corpus: the workplace; the clinic; the hospital; the street; and the supermarket. Correspondingly, community members are identified variously in contract to 'biotechnology' as consumers, patients, and employees. As the pictures included at the end of Chapter Six indicate, 'the general public' are portrayed pictorially most often on pharmaceutical company websites and in *health* research contexts (Such as the Queensland Institute of Medical Research's Population Health page). Although scientists are included in all contexts pictorially, they are curiously not given a voice in the thesis corpus. The focus is rather on the commercialisation and commoditisation of their work.

Second, context is very significant in biotechnology because the whole point of government intervention in the practice is to recontextualise, technologise, and commodify the objects and understandings of research into new commercial and product oriented contexts. Each movement of recontextualisation requires both decontextualisation from the practice, point, or context of origin, and *en*textualisation according to the dominant norms, values, and expectations of the receiving context. Each movement also, by a matter of course, reduces the degree of proximity between the original goals, goods, and guides of scientific research and its ultimate ends. I suggest that CDA is a valuable tool for identifying and assessing these movements. It would not be possible to identify these differences without conducting interdiscursive or intertextual analyses.

Responses

A critical question arising from the thesis, and contemporary approaches to applied ethics more generally (cf. Isaacs and Massey, 1994) is, if we can identify these broad effects or mediations of biotechnology by using techniques such as CDA and the biotechnology as media framework, what can we do to interrupt them and generate movements that are more socially just, accepting, and generative of more democratic and socially responsive range ways of seeing, being, and acting? Mediations do not need to flow in only one direction. I have outlined a number of possibilities below.

1. Towards an alternative metaphor

> Most people not only aren't interested in changing the ordinary and routine, they can't even imagine the need for doing so because of the invisibility of the habitual. In order to get them to think about it, you have to make it visible to them. (Postman and Weingartner, 1971)

Throughout the thesis I have argued that a focus on new biotechnology *technologies* or *techniques* alone – as opposed to a fuller recognition of the elements of social practice – restricts citizens' view of biotechnology to observable products or applications. Indeed, even anti-biotechnology activists' focus on, or resignation to, the *fact of* institutionalised regulatory practices such as legislation, codified ethics, and public policy does not illuminate the extent to which social, scientific, technological innovation can influence and define human society via the myriad but largely unrecognised, nonmaterial, non-physical-technological by hugely political-moral processes of mediation.

In order to comprehend its socio-political, socio-historical impacts, I argue that we need to change the way we think about and evaluate biotechnology. I have suggested the metaphor of media and mediation as the central contribution of this thesis. But when we describe biotechnology to others, it does not need to involve an entire doctoral thesis. An appropriate metaphor for biotechnology needs to be alive, it needs to "flow" in many ways and be sensitive to new additions to the story. In constructing an appropriate metaphor, we also need to recognise that even once certain ways of seeing, being, and acting have been 'absorbed' into everyday common sense and use, they are not beyond critique, question , or revision.

During various conference presentations and conversations I have often described biotechnology as media using the metaphor of a lake of water. I have turned the metaphor of the lake into a story that encourages people to imagine the different ways that one event or development can move outward to, and affect, new contexts. If we say, for example, that knowledge and understanding of the human genome is a pebble (more or less weighty according to your own experience and imagination), and the practice of biotechnology research is a lake of water, the pebble being tossed into the lake could produce any number of expected and unexpected ripples and outcomes both within the lake and beyond it. When the pebble is tossed into the lake it causes ripples in the water that move outward from the point of origin. By the time these ripples get to the edges of the lake they have become waves that take sand from the edges of the lake and smooth the pebbles on the beaches. The force of the waves on the beach returns the ripples in a reverse motion toward the centre of the lake where the pebble has since sunk to the bottom and has been ingested by a large fish named Boris.

At the far end of the lake there is a group of school students collecting insect specimens for their science class. They enjoy the feeling of the ripples running over their feet at the edge of the water. Some girls at one end of the group decide they'll start throwing in pebbles and sticks too. Their teacher, who seems to be somewhere else entirely, likes the aesthetic appeal of the way the ripples make the sun dance on the surface of the water.

At the opposite end of the lake there is a stream that runs into a river that in turn runs into the ocean. At one section of the river a small farming community has gained permission from the local council to drain an agreed amount of water out of the river each day to irrigate their crops and provide drinking water for their animals. A high-pressure pump is now syphoning the ripples into an underwater pipe that eventually leads to Farmer Bob's cows and crops. Along the river a bit further a small community has built a dam on the river to run a hydroelectric power station. Some of the ripples that came originally from the pebble, through the lake, and into the river, are now channelled into the hydroelectricity plant's catchment area, others pass on through the dam wall. Before the community can use the power generated at the hydroelectricity power station it has to be processed, converted, and channelled into an appropriate voltage for household use. Ten years ago the local council decided to raise household rates to help pay for the hydroelectric dam to be built. The state government also chipped in some funds it had raised through a longstanding petrol levy. Each household now has to pay a $150 connection fee to finally start using the power. Household power privileges are cut off if they don't pay their monthly bills after that. The price of power is set by the CEO of power company but are within state government guidelines.

At the point where the river is almost the ocean an oil freighter is in dock. Unbeknownst to the ship's crew there is a leak in the main cargo hold. Oil is gradually leaking out of the large freighter into the water. Before the oil can be treated by the local bioremediation firm, some of the ripples from the pebble that made it through the lake into the river and past the hydroelectric dam now help to carry the oil slick out to sea. A fish who has decided she doesn't like the level of water pollution so close to dock decides she will swim back toward the lake where she first learnt how to swim with her brother Boris. As she goes she carries with her images of the oil slick fresh in her mind and tiny particles of oil on her fins that she doesn't even know are there. While it may be easy for an tall observer to watch the ripples progress outward from the pebble's point of contact with the surface, it becomes increasingly more difficult to monitor or observe the progress of the pebble's ripples as they move to and from the shore and beyond the lake into the stream, the river, and finally the unknown depths of the ocean

2. Interrupting linear mediations and practices of silence and silencing

The objective of government policy on biotechnology is to move biotechnological innovation and 'life' products in a linear flow from a state of inalienability to the commercial market and consumption. This is in part why contesting voices may feel utterly overwhelmed by the historical force and political weight of the assumptions not just of biotechnology but of the whole modernity project. Biotechnology as media processes are in reality not linear. Recontextualisations, translations, alienations, absorptions occur in many directions between the groups, institutions, and individuals involved. Indeed the processes themselves are often simultaneous, for example recontextualisation via or through translation or alienation through translation and recontextualisation.

In challenging practices of silence and silencing, we need to first acknowledge that silence is a collective practice. This in itself is more meaningful than it may at first appear: It is part of our common knowledge for example that something can be known or tacitly accepted without ever being overtly stated by anyone. We can for example "know" or "sense" that it is not "the done thing" to talk about X in a certain context or to discuss Y and Z with certain people. We come to learn, know, or sense these often unstated rules for communicative engagement from a range of sources. Identifying these technologies of silence and silencing goes at least some way toward showing us WHERE and HOW silence is produced and reproduced as a socio-political process, and thus where and how it can be transformed, not just THAT it exists. Moreover, it is important for all citizens, but particularly those who shape social engagements, to recognise that, even in situations where "discussion" and "debate" does occur, processes of silence and silencing can be at work: there are many things that are not said that should be. As the critical discourse analysis included in this thesis has identified, even when we have access to "information" about biotechnology, that information can still limit, distract, confuse, and lead us to silence, either advertently or inadvertently. Indeed it is often the most obvious, powerful, and readily identifiable forms of discourse that mask and/or de-emphasise the harmful and dehumanising realities of silence, silencing, and the silenced. One way of countering practices of silence and silencing is to promote a more critical awareness of discourse and language.

3. Critical discourse awareness

> Discourses do not just function ideologically as identity kits or to obtain 'goods'. They also function to legitimate, naturalize, or disguise the *inequities* they sustain. *They function to get us thinking along particular lines, the lines of a common sense, which are not as likely to lead to subversive conclusions as using some other discourse might.* (Lemke, 1995, p. 13, italics added)

Fairclough (1992) states that discursive practice is 'constitutive in both conventional and creative ways: it contributes to reproducing society…as it is, yet also contributes to transforming society'. He makes an example of education practice:

> 'For example, the identities of teachers and pupils and the relationships between them which are at the heart of a system of education depend upon a consistency and durability of patterns of speech within and around those relationships for their reproduction. Yet they are open to transformations which may partly originate in discourse: in the speech of the classroom, the playground, the staffroom, educational debate, and so forth' (p. 65).

Most importantly, Fairclough's example reinforces that the relationship between students and their teachers in this example is influenced by *the way in which they are described*. In a similar manner, critical awareness of the language of biotechnology research and commercialisation is urgently required in order to challenge the linearity of biotechnology mediation processes toward absorption. Transformation in biotechnology and its related practices will require *critical language awareness* in order to render visible the assumptions and values that underlay, produce and reproduce the practice (Gee and Lankshear, 1995). Critical language awareness requires:

> 'teasing out the possible meanings of socially contested terms can give rise to sets of questions and issues for debate and dialogue among Discourses, as well as deeper understanding of the values and ideological loadings that are at stake' (Gee and Lankshear, 1995, p. 12).

Consonant with Gee and Lankshear's notion of critical language awareness, Isaacs (1996, p. 39) and Gilbert (1987, p. 52) advocate the need for *critical practice.* Critical practice requires a condition of *anti-hegemonic* formal and informal practice 'if it is to produce policies and political action' (Gilbert, 1987, p. 52). Essentially, anti-hegemonic practice requires that alternatives to the current conception of the purpose, means and culture of the dominant discourses are made available through the everyday lived experiences on offer. Critical *discourse* awareness, as opposed to critical language awareness, incorporates a more overt focus on the relationships between ways of using language, ways of seeing, being, valuing, and acting.

4. Enhancing the engagement

As members of an engaged community of scholars, researchers, and activists that seeks to practice and facilitate open and authentic discussion surrounding biotechnology developments, it is important that we name, discuss, critique, and seek to transform the technologies of silence at work in biotechnology related debates and other areas of social contestation. In many ways this is a personal challenge as much as it is a social or an institutional one: we ourselves may need to overcome any number of personal and institutional limitations that would in many other circumstances, and for many quite legitimate reasons, function to silence or intimidate us. I do not want to pretend that this is an easy task.

One possible solution is to create genres of engagement that support heteroglossia and contestation. As an indication of what may be possible, we can think briefly about the role of engagements that can be mediated through academic university contexts. During the thesis period, for example, I was involved in the organising committee of an international conference on biotechnology: ‘Towards Humane Technologies: Biotechnology, new media, and citizenship’. The aims of the conference were listed as follows:

- To create a space for informed discussion and debate for all interested persons;
- To illuminate the relationship between progress in biotechnology and broader technological, social, political, and economic trajectories;
- To illuminate the social and historical embeddedness of biotechnology, so that we may more adequately understand, and respond to, current and future challenges;
- To illuminate the nature of the new political economy with particular reference to biotechnology and new media, globalisation, sustainability, and global capital;

- To map out current ethical, regulatory, and legislative responses to advances in biotechnology research and commercialisation, and to evaluate the degree to which these responses match the ethical challenges at hand;
- To develop an innovative and creative template for public discussion and learning founded on a multidisciplinary approach to doing applied ethics;
- To encourage the development of an international network of scholars, professionals, and citizens who are committed to fostering broad, reflective, and informed awareness of biotechnology;
- To promote a more authentic awareness and appreciation of vulnerable persons and marginalised discourses in the debate;
- To facilitate a greater awareness of the human and non-human benefits and costs of modern biotechnology research and commercialisation.

The conference featured a number of alternative engagement forums including: "Reality Check" testimonials: A series of live and recorded testimonials from professionals and interested parties whose voices are generally not foregrounded in public discussions. For example, people with disabilities; people conceived through reproductive technologies; scientists at the coal-face; policy makers; and so on.

Following the conference, the conference organising committee produced a report that was used to circulate the outcomes of the conference to government organisations (cf. Graham, Isaacs, and Sunderland, 2002). The authors emphasised a number of practical features that people organising engagements surrounding biotechnology need to be aware of. These include: The need to recognise, value, and include multiple knowledges and lived realities without falling into dichotomies between "expert" and "lay" or "rational" and "irrational" and "emotional"; The need to move the discussion into more community-friendly spaces: eg, not on working days and in working hours and no fee for any participant; The need to promote ongoing participation from government, academic, scientific, corporate, and other communities; and the need to provide a duty of care for those who wish to speak about their personal experiences, identities, constraints and so on, regardless of their institutional affiliation, status, or lack thereof;

The report also suggested that the following passage, from Erich Fromm's *The Revolution of Hope: Toward a Humanized Technology*, remains instructive and relevant in the context of biotechnology:

1. The number of participating people must be restricted in such a way that the discussion remains direct and does not allow the rhetoric of the manipulating influence … to become effective. […].

2. Objective and relevant information which is the basis for everyone's having an approximately clear and accurate picture of the basic issues must be given to each group. ...We must ask (a) how the necessary information can be transmitted to the group for which it is relevant and (b) how our education can increase the [participant's] capacity for critical thought rather than to make of him [or her] a consumer of information.

3. Another requirement for the functioning of all face-to-face groups is debate. Through the increasing mutual knowledge of the members,

the debate will lose an acrimonious and slogan-throwing character and will become a dialogue between human beings instead of a disputation. ... In every fruitful dialogue, each participant must help the other to clarify his [or her] thought rather than to force him to defend a formulation about which he [sic] may have his own doubts. Dialogue implies mutual respect and clarification.

4. Eventually, information and debate would remain sterile and impotent if the group did not have the right to make decisions and if these decisions were not translated into the real process of that social sector to which they belong. …

5. The people involved in debate, dialogue, and decision making need to be given time to consider, reflect, and reconsider their learnings and interactions. … It follows that the area of decision making should grow while people learn how to think, to debate, and to make judgements. … Eventually, the face-to-face groups would be entitled to vote on fundamental principles of action which would require a significant process of power shifting and sharing. (Fromm, 1968: 115-116)

Every process of interaction and debate has an educational influence and changes the people who participate in it (Fromm, p. 116). People who host these events have a duty of care to make every attempt to ensure that the people who participate move away from destructive interactions toward conditions of mutual respect – even in cases of disagreement and dispute. The lack of follow through with decision making directly, and the transformation of decision making processes, has been a major limitation of public "consultation" and Consensus Conference style interactions we have experienced in Australia.

Conference organisers, managers of public awareness, and academics need to be aware of the broader climate of disinterestedness or prejudice against certain forums for including multiple voices and narratives of lived reality. In particular, we face problems of passivity, silencing, and subjection to expert and hierarchical voices when trying to encourage widespread participation in debates and dialogue, particularly when attempting to hear from scientists working at the bench.

Biotechnology is a particularly contentious area of debate and many public discussion forums end up being set up as US versus THEM. Getting a "balance" of the US and the THEM camps is then portrayed as a successful event – regardless of the quality of discussion and progress in understandings and trust between participants. Following the points above, participants can be encouraged to clarify understandings and perspectives with and for each other, rather than pursue offensive-defensive positions. Fromm's point above that individual presenters and participants may themselves have some doubt about their position is particularly important in this respect.

It is a reality that *many* people who have attempted to engage in public discussions surrounding biotechnology have been personally attacked and labelled publicly or in private forums using highly slanderous and derogatory terms. Because of this reality many people with valuable contributions and understandings feel disinclined to participate in further events. Conference organisers and participants alike should seek to remind others that bullying is unacceptable for any participant in any context, be they academic, scientist, community member, bureaucrat, politician, or activist.

5. Toward a view of ethics and language in social life

Consistent with its focus on ethics as a dimension of social life, the approach to applied ethics adopted in the thesis draws less on philosophical approaches to ethics and more on social theories of language, power, interaction, mediation, and discourse. This approach to ethics seeks to locate ethics not in the realm of select, elite, authoritarian tracts, pacts, or defined spaces, but in the social round. Just like language itself, ethics is dynamic: at all times it is multicontextual, multifaceted, and multivoiced. Ethics is not simply philosophy, neither is it a field of science. Both philosophy and science are historically powerful representations and ways of approaching ethics that carry with them – like any approach or particular way of seeing – their own incumbent assumptions, freedoms, and limitations.

Ethics is not separate from the social medium even when it is codified into a symbolic text such as ethical guidelines or laws or even stoplights at intersections. Even the most abstract text is an element in a chain of social events, understandings, interpretations, and relationships: It arises from specific social contexts and it has specific social effects.

If we see ethics as being embedded in everyday relationships, codified guidelines for ethics is not “ethics” and ethics “committees” do not constitute “ethics”. Both of these genres of ethical engagement are only normative *representations* of ethics as it occurs in every, everyday social relationships and contexts. Drawing on Bakhtin’s theory of heteroglossia and its manifestation in the novel genre, we can draw parallels between ethics and language, or, more specifically Bakhtin’s critique of the notion that there can be one national language for any given country or culture. Apart from the correlations we can draw between ethics and language as both being fundamentally shared social practices, and existing in social relationships, there are distinct functional relationships between language and ethics that have hardly been taken into account in the dominant "national language" style approaches to ethics. Although the fields of linguistics, language theory, philosophy of knowledge, discourse analysis, and some areas of narrative ethics readily acknowledge the role of language, discourse, and discourse materialities as shaping social appreciations of value, esteem, validity, identity, desirability, and more general ways of seeing, being, and acting, this is – curiously – not a feature of ethics discourse generally.

I posit that, taking Bakhtin's notion of heteroglossia as a base, we can re-emphasise the heterogeneity and literal heteroglossic nature of ethics-in-life relative to multiple layerings of time, context, identity, lived reality, and so on. The primary aspect of this is to foreground language as a primary constituting element both of understandings of ethics, and of the more and less stated value orientations of members of society. We can literally see ethics *as* heteroglossia. The linkage point between a social view of ethics and heteroglossia is that each of the "socio-ideological languages" Bakhtin identifies in the above passage serve to produce and reproduce, in and themselves, distinct ethical orientations, ways of valuing, ways of being, seeing, and acting. This social metaphysical view of ethics is not merely essential in understanding the nature and complexity of social value and ethical engagement but also in acknowledging and respecting the multiple sites and shapers of ethical engagements between persons. If we move the agenda to think not only of socio-ideological languages, but of their constitutive and recursive intersections with Beings and materialities we have yet again thickened and deepened our heteroglossic range of resources for comprehending and entering into ethical discussion and engagement.

In their role in producing and reproducing centripetal power forces, social institutions and social practices are in themselves manifestations of ethics, value, and evaluation (Bahktin). But like language also, these institutions are not static or structural in and of themselves. These manifestations and the power they and their constituents accrue through totalisation of the centripetal and centrifugal forces have immense power to shape and reshape social habitation in reality and social relationships. How are these movements primarily achieved? Through language and discourse, the substances of shared social reality. Ethics, like language itself, finds it expression, production, and reproduction only *through the social medium*, the social round of shared experience, shared understanding, and shared access to meaningful social spaces.

Ethics like biotechnology, policy making, law, medicine, business, and education, is a ‘social practice’ (Isaacs, 1998). We as social beings are inevitably tied up in practices of language and discourse via which we produce and reproduce shared understandings, relationships, meanings, identity, and so on. In approaching ethics as social practice, I have foregrounded the role of language and particular language practices such as translation and recontextualisation as being inherently interpretive, political, and ethical practices. Social materialities such as social institutions, social practices, processes of governance and law which form the objective everyday realities of our lives and the boundaries within which we interact as ethical beings are all in and of themselves expressions of ethics that are recursively shaped and reshaped via language and discourse.

As social beings we rely on language to be able to communicate with others, learn about, and understand them as well as ourselves. Language defines social realities just as it defines the value systems that shape the way we live. We are socialised as human beings via language and we gain access to various social practices, professions, and contexts by learning a common language and entering into a shared system of meaning. Our conceptions of our own identities, and the identities of others, are delineated and defined in people’s language, and that is why language provides an important, if not a vital focus for understanding ourselves as social beings. But to do so is no simple matter. Language practices cannot be understood *outside of* their historical and political contexts; neither can they be *derived* from these contexts by any simple equation.

Social institutions, social practices, and language are all living, dynamic processes. They live in the spaces [relationships] between humans, not in individual humans alone. This means the ethical response is just that, a response. Not just an *act* or *behaviour* in accordance with a codified principle of such and such but a responsiveness and awareness and consciousness of the other, of his or her particular voice, and the historical language and site he or she is speaking *from*. In life *as it is lived* ethics is a novel of voices, perspectives, experiences, and thoughts. Ethics is heteroglossic. But in ethics, as in social relationships at all levels, the voices of the heteroglossia are not equal. Each voice, each individual, each representation is regulated, privileged, and restrained by dynamics of power and the reproduction of power.

Conclusion

Throughout history developments in the biological sciences and health care such as the ones emerging in the "biotech century" have challenged widely accepted notions of the moral and ethical obligations of health professionals and the wider society (Beauchamp and Childress, 1994). But at a deeper level it is language and human relationships that make social systems different from mechanical or organic systems. Language is the basis of social-ethical engagements and of our understanding of others because of one basic fact: we cannot read someone else's mind, we can only interpret what resources for meaning they and others make available – either wittingly or unwittingly – in the social medium.

To the extent that techno-scientific and economically determined discourses on biotechnology are more powerful than others – and more effectively/invisibly produced and reproduced over time within increasing numbers of social genres – they filter out to become 'officially' synonymous with 'the ethical form of life'. The thesis corpus clearly shows that biotechnology is an 'official utopia' of our time. The mediating functions of Alienation, Translation, Recontextualisation, and Absorption currently function in largely monologic ways to perpetuate and shield this distinctly modern utopia from dissent or contestation.

Currently, biotechnology developments are forcibly recontextualised into, and thus mediated by, contexts and practices that are themselves saturated with commercial imperatives and apparently asocial imperatives of economic determinism and rationalism. These mediations occur as a matter of public policy at state, national, and international levels.

But, mediation is not a one way street. The current observable pathways of mediation associated with the so-called Virtuous Cycle of biotechnology need not necessarily define biotechnology as a practice in the years to come. The basis for social-political transformation has been located in the production and reproduction of social practices over time and, in turn, their influence on our shared ways of seeing, being, and acting in social life.

Appendices

Appendix A Definitions of biotechnology

Group 1. Government departments and politicians - formulated "official" definitions

The following explanations of biotechnology come from Australian state and commonwealth government Departments.

a) Biotechnology Australia Public Awareness division within the Commonwealth Department of Industry, Science, and Resources (DISR)

Biotechnology is a broad term covering the use of biological discoveries for the development of industrial processes and the production of useful organisms and their products. Uses include the production of foods and medicines, the reduction of wastes and the creation of renewable energy sources. (Factsheet)

b) Queensland Government Department of Primary Industries

Biotechnology is simply using biological processes to make things for humans. Bread, for example, is made using biotechnology. The biological activity of the yeast helps dough rise, creating a food product with the help of active microorganisms. (Information for Educators page)

c) Queensland Government Department of Innovation and Information Economy

Put simply, biotechnology is the science of using living organisms to produce goods and services. Technically, the use of bacteria to produce yoghurt or the use of yeast to ferment beer is biotechnology. However, modern biotechnology is more commonly associated with genomics and gene technology. (Policy Statement: 'Queensland's Ethical Approach to Biotechnology Development)

d) Parliamentary speech by Barbara Stone Member for Springwood QLD

Biotechnology is the term used for biological discovery for the development of industrial processes and the production of useful organisms and their products. It is used in the production of medicines, foods and energy sources. It can be said that biotechnology in the form of fermentation processes has been used for decades to make cheese and beer. Biotechnology has also been associated with animals and plants in the creation of animals or plants with specific characteristics. (Hansard 18 October 2001)

Group 2. Non government organisations – industry, activist, and scientific institutions and organisations – formulated definitions

The following definitions of biotechnology are taken from a range of organisations and institutions websites. These organisations and institutions may be closely linked to government but are not government departments.

a) US Office of Technology Assessment:

'The application of scientific techniques that use living organisms, or substances from those organisms, to make or modify products, improve plants and animals, or to develop micro-organisms for specific uses'.

b) CSIRO Australia:

'The use of biological systems - living things - to make or change products. It has been used for centuries in traditional activities like baking bread and making cheese'.

Group 3. Practitioners involved in biotechnology research and commercialisation – semi-formulated to informal definitions

The definitions of biotechnology listed below all come from people working within, or in direct relation to, the social practice of biotechnology in Queensland Australia. These definitions were recorded during interviews conducted between January and June 2000. While they are not intended to be representative of the complete range of understandings within the practice, these definitions provide an 'impressionistic account' (cf. Van Maanen, 1998, pp. 101-102) of the range of discursive resources on offer within the Queensland scientific research and business communities.

a) "My understanding of it [the term biotechnology] would be different from the way it is used I suspect… I think the way it is actually used is any field of technology that's applicable to biological systems or processes. In a stricter sense, biotechnology is actually using biological organisms to manufacture products - in which case we obviously wouldn't fit". (Company Managing Director)

b) "Technology based on the use of biological means to achieve a result". (Company Director)

c) "Any type of technology that uses DNA as its basic substance, I don't use it to refer to, for example, research in hormones and how to manipulate animals using hormones. For myself I see that term as restricted to DNA technology". (Research Scientist)

d) "Biotechnology is essentially, to me, the development of products and processes utilising biological information and biological systems". (Research Director)

e) "Using natural organisms or mechanisms to produce other organisms or mechanisms. Biotechnology has been around for centuries, used for bread making, whatever. Really, modern biotechnology began with the discovery of DNA and recombinant technology.” (Company Director)

f) “Any advanced technology that relates primarily to gene technology though its content may be broadened to include advanced biological technologies”. (Company CEO)

g) “Biotechnology covers a lot of traditional forms of using biological techniques to produce chemicals, foods etc so it includes fermentation and similar sorts of traditional processes. But what I think we’re really talking about now is what you might call modern biotechnology or gene technology which involves actually manipulating genes to change the structure of organisms or to create new organisms with different structures. Within traditional biotechnology you can also talk about traditional breeding and cross breeding which has been going on for millennium. Now modern DNA technologies enable the transfer of DNA between species and even across kingdom barriers between plants and animals, microbiological organisms etc”. (Consumer representative)

h) “I understand it to mean manipulation of DNA by a range of means – not just genetic engineering, but including use of modern molecular tools to assist in genetic change and that includes things like molecular markers to assist in [indiscernible] breeding for example as well as traditional (well traditional now) conventional [indiscernible] things like genetic engineering.” (Research Director)

i) “I think it’s changed a lot. It’s a bit of a catchall actually because these days it covers a lot of chemistry and physics but I suppose really it’s technology related to recombinant DNA”. (Research Institute Director)

j) “Using biological processes or organisms for human application or plant application or food”. (Company Managing Director)

k) “From a public company perspective… meaning anything that is science-based that is used in health care applications – both veterinary and human. This is not necessarily the traditional definition of using biologicals although that is certainly and important part of [company name]” (Company CEO)

l) “I believe it’s the use of, well I suppose, enabling technologies whether they be fermentation reactors or tissue culture or gene technology. It’s the use of a set of technologies for basically improvement of biological systems… Maybe it’s the application of biological systems in any of the fields of agriculture or medicine or, you know, any sort of field of human endeavour. Even in my mind it’s a fairly loose term and I never really started out thinking of myself as a biotechnologist. I started my career in plant physiology and I then widened that to use plant tissue cultures for some studies in plant physiology or applications in plant improvement. It’s only really been in the last 15 years that people have started calling it biotechnology” (Research Group Leader.)

m) “I see it as broad a term as possible. I know a lot of people would assume biotechnology is genetic engineering but no I prefer to think of it as the use of modern technologies in a biological sense”. (Senior Researcher)

n) “Creating value from biological sciences”. (Industry Consultant)

o) “Anything to do with where we use technology as part of a biological process to achieve an end result”. (Company Marketing Manager)

p) “Basically the use of biological means to achieve either the production of a chemical/product, or the degradation of a chemical/product be it naturally occurring or synthetic”. (Company Senior Scientist)

q) “Two things: biotechnology literally is the use of living organisms in some way to achieve a technological goal of one sort or another so things like genetic engineering are classic modern manifestations of it. Ancient manifestations are things like brewing and bread making and all that sort of stuff, cheese etc. I don’t think that we mean… I mean biotechnology now is a completely different word. Literally, in terms of its scientific discipline it still means the same thing: the use of living organisms for some purpose…When Bill Clinton, or John Howard or the Head of the International Biotechnology Industry Association or someone like that uses the term biotechnology they really mean the bio-industry or biologically-related industries if you like”. (Director Research Institute)

Appendix B List of Corpus Texts

Abbott Laboratories. (2002). *Press Release Abbott Laboratories to build biotechnology manufacturing plant in Puerto Rico*. Abbott Laboratories.

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