

SOME OBSERVATIONS ON WHOOPING COUGH  
WITH  
SPECIAL REFERENCE TO TREATMENT BY ETHER.

BY

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## CHAPTER ONE.

It is generally recognised that in the immediate past the science of modern medicine has been productive of much advance ; it would be futile to assert that all the problems have been solved. Many diseases, notably those of tropical origin, now lend themselves to complete cure, and against most of the remainder almost daily progress is being made.

This cannot be said of whooping cough. During the last three hundred years, little success has been encountered in the treatment of this alarming and distressing affection.

Many pages would be necessary to enumerate the drugs and other remedies which have been used in the treatment of whooping cough. They range in their application from charms and relics of saints to the present-day use of antipyretics, sedatives, and expectorants ; all of these, however, have yet to prove that they can be of even the slightest use in the treatment of this disease.

No attempt is here necessary to describe the main features of whooping cough, as all are well acquainted with its nature ; it is probable that no other disease gives rise to symptoms so distressing,

either to the young patient or to parents, whilst the recurring anxiety over so long a period is a feature almost unique in disease either of children or adults.

Schools, and particularly boarding-schools, regard whooping cough with more than usual aversion. The prolonged nature of the complaint, the almost certain liability to infection, and the extended time of quarantine alike combine to prevent both successful work and attendance at school.

It is thus felt that no apology is needed for dealing in this thesis with a common ailment which has hitherto successfully resisted all attempts at other than symptomatic treatment, and which ranks first, second, or third, according to country, in the causation of mortality of children under five years of age.

Such is the record of the direct mortality. It is almost impossible, however, to compute mortality from indirect causes such as tubercle, which is only too ready to seek its nidus in the whooping cough "convalescent". Even this does not end the morbid story, for few writers or statistics are able to take account of the many children who prolong into adolescence their childhood inheritance of the sequelae of this disease.

The author first noted in the year 1924 an account of ether therapy in an attempt to check

whooping cough and he has since treated most of his cases in practice by this means. Unfortunately he found himself confronted with a disease for which advice is not usually sought in a certain class of the community : whooping cough has come to be regarded as "something which must take its course", a melancholy belief for which medical science cannot altogether be held blameless.

Partly as a consequence of this belief, and partly because the case incidence of the disease has seemed to be in inverse ratio to one's desire to obtain clinical material, it is regretted that this thesis is formed only on the basis of forty-three cases, all of which were treated by ether after some method.

## CHAPTER TWO.

The ancient Greek and Roman physicians have left us no record of any disease characterised by such a convulsive cough, and it would appear extremely unlikely that such a well-marked complaint could have escaped their notice. It is almost safe, therefore, to assume that whooping cough was not then in existence.

Probably the earliest known reference to whooping cough occurs in an old manuscript book of prescriptions. Moulton's "This is the Mirror Glass

of Health" (1), is in the main a reproduction of the old manuscript book ; the same receipt which appears in the one "for the chyncough" is recommended "for ye kink" in the other.

Whooping cough is not mentioned in Phaer's Book of Children (2), whilst in Flyot's "Castel of Health" (3) it is unlikely that such an exhaustive description of child morbidity as is there given would not have contained some reference to whooping cough, however slight, had the disease then been known. De Baillou in Paris in the year 1578 was the first writer to draw attention to this sudden and convulsive cough. He says that he knew of no other hitherto writing of it, yet he speaks of this distinctive cough as a "familiar thing".

It is interesting to remember that just prior to this time a great deal of exploration and discovery had taken place, notably in the New World. It seems to be established beyond doubt that the sailors of Columbus and of the later voyagers were responsible for the introduction of syphilis into the countries of Europe, and it may well be that a voyage of this nature was also remarkable for the persistence on board ship of an epidemic of convulsive cough, sufficiently virulent and prolonged to infect those with whom the returned sailors came into contact.

Later, however, it would be erroneous to

assume that this epidemic of our time did not occur with equal frequency in those days. Willis (4), of Oxford, in the year 1674, remarks that whooping cough was left to "old women" and empirics, and this suggests why so little exists in the way of an earlier authoritative description. Sydenham, in the year 1670, mentions it, and first calls it pertussis, whilst he also records it as appearing in conjunction with measles and influenza.

In the year 1661 a mother writes of the "chincofe", and adds, "There is many dy out in this town", but it is not quite clear that the latter reference attributes the deaths directly to whooping cough (5).

Whooping cough is first found recorded as a separate cause of death in the City of London in the year 1701, causing six deaths. For a number of years deaths there were below the number of ten annually, with a gradual increase to 152 deaths in the year 1730, and reaching 1004 in the year 1802.

Swedish statistics give in the middle of the eighteenth century a mortality averaging 2600 annually in that country. Edinburgh during the two years 1740 and 1741 had 101 deaths from whooping cough compared with 112 from measles ; the former cause having only contributed a quarter of that number in previous years.

In May of the year 1751 Fothergill (6) writes ;  
"Great numbers of children had the whooping cough, both in  
London and several adjacent villages, to a violent degree.  
Strong, sanguine, healthy children seemed to suffer most  
from it, and to some of them it proved fatal where it  
was neglected or improperly managed".

Allowance must be made at the same time for  
the fact that, prior to 1837, when compulsory registration  
of the cause of death was first enforced, the statistics  
are not reliable, and it is more than likely that parish  
clerks were wont to rely upon such causes as "teeth",  
"convulsions" or "chrystoms" when making an entry of the  
cause of death of a child under one year of age.

Between the years 1874 and 1880 the average  
death rate from whooping cough per thousand living at  
all ages was 0.5 ; between the years 1914 and 1921 it  
was 0.16 . Parkes and Kenwood state that whooping cough  
is now the most fatal of all children's illnesses under  
the age of five years (7) .

### CHAPTER THREE .

Epidemics of whooping cough vary very greatly  
in virulence, intensity and mortality. Climatic  
variations appear to have little effect upon the disease,  
although it is known that whooping cough is more frequent  
and more severe in cold climates. Seasonal variation has



in the past merely shown that mild epidemics have occurred in winter and severe outbreaks in summer ; the course of the disease, however, would seem to be mitigated by weather which permits the sufferers to go out of doors.

Most cases of whooping cough are met with during the first quinquennium of life, and fully half of the total occurs during the first two years. Older children and adults, as in other children's diseases, do not seem to be so susceptible, although whooping cough is comparatively common in the elderly, and is not unknown in old age. The newly born may contract the disease, and apparently even the foetus in utero may be affected. It is recorded that an expectant mother had been taking care of a child suffering from whooping cough ; her own newly-born child developed whooping cough on the day upon which it was born (8). Another child showed symptoms of a developing cough on the second day of life, a well-marked cough was present on the eighth day (8).

Many writers have drawn attention to the fact that whooping cough more readily attacks girls than boys. It was at one time suggested by Vierordt that this was due to a structural difference between the larynx of the male and that of the female ; a belief which is without anatomical foundation.

Apert and Gambessedes (9) quote statistics from the whooping cough pavilion at the Hôpital des Enfants

Malades. These show that during the year 1919 one hundred and fifty girls were admitted, compared with a total of eighty-eight boys . Other authors agree upon this unexplained predilection of whooping cough for the female sex ; it is more remarkable when we consider the other infectious diseases of childhood. Diphtheria, scarlet fever, and measles are all said by Rolleston (10) to be found with greater frequency in males. The text books generally do not bear out this assertion.

Morse (11), of the Boston's Children's Hospital states that according to official statistics whooping cough has the highest mortality of the three important diseases of childhood, namely, measles, whooping cough, and scarlatina. It is only less fatal than diphtheria. Reiche (12) has quoted the Hamburg State records to show that between the years 1872 and 1912 there were reported 60,253 cases of whooping cough, of whom 7,355 died ; a mortality percentage of 12.2 . Reiche admits, however, that this figure must not be supposed to include all the mild cases of whooping cough which did not reach the stage of notification. The figure has some value in that it illustrates the heavy death rate due to whooping cough, in a hospital to which presumably only infectious cases are admitted.

In common with most of the other diseases of childhood, the death rate, parallel with the case incidence, is highest in the early months of life ; it diminishes as age progresses. Morse (11) quotes

United States statistics of 6324 deaths from pertussis in the year 1906 ; an analysis of these shows that the mortality rate is highest during the first year of life, namely 57%, in the second year 23%, falling to 8% in the third year, and to 4% in the fourth.

It is also important to examine deaths from pertussis in the light of other infections, secondary or complicating thereto. Reiche (13) quotes 66 deaths in his whooping cough department between the years 1914 and 1920 ; of these sixteen were due to tubercle lighted up by the whooping cough, inclusive of four deaths from the miliary form. Severe secondary infections of diphtheria, influenza, and pneumonia accounted for another quarter of the deaths. Fourteen per cent of deaths were also attributed to severe rickets or to the lymphatic diathesis ; it is therefore clear that of these sixty-six patients, two-thirds died from causes other than whooping cough. Such statistics serve a valuable purpose in bearing out a premise which is now generally accepted, namely, that deaths following whooping cough are always accelerated by the complications rather than by the primary symptoms of the disease. The series of statistics here quoted from Reiche may be criticised in that the period of collection covers the war years, during which in Germany individual resistance to disease must have been very low.

A description of the earlier researches into the causation of whooping cough is given by Koplik (14). The essential cause of whooping cough was believed by Deichler and Kurloff to be a protozoa-like body which they claimed to have found in the sputum. Later Affanesjew and Szezchenko isolated a bacterium from the sputum of children suffering from whooping cough ; a bacillus which was said to occur either singly, in pairs, or in chains. Its measurements were given as being from 0.6 to 2.2 micromillimetres in length ; in short, a pleomorphism which is not in accordance with the known facts of present-day bacteriology. Hensel, Kapelewski and Koplik in the year 1897 described a "pole-bacterium" which was non-motile and which resembled the influenza bacillus. About that time also, Koplik observed and described a minute finely-punctate bacillus which again bore a resemblance to the influenza bacillus. A similar bacterium was observed by Luzatto in an epidemic of whooping cough in Graz ; he also classified the organism as one of the influenza group.

Other observers during the earlier years of the present century included Sprengler, Krause, and Jochmann in Europe ; Davis and Martha Wollstein in America. Their researches all tended to describe a similar influenza-like organism, which was said not to be very abundant in the early stages of the disease, but to be very

profuse during the paroxysmal stage.

In 1906 Bordet and Gengou (15) published results of their long study of pertussis sputum. In the year 1900 one of these observers had found in the sputum of a child a small bacillus. The child was suffering from whooping cough, but the organism differed from the influenza-like bacillus of the other observers. It was very numerous, the patient was otherwise a healthy child, but the organism resisted all attempts at cultivation.

Some years later Bordet and Gengou again succeeded in isolating the same bacillus from the sputum of a two months old child with catarrhal respiratory symptoms. The child in due course developed whooping cough. On this occasion Bordet and Gengou succeeded in cultivating the organism on a medium containing human blood ; subsequent attempts at subculture resulted in their obtaining on ascites agar a growth which was quite luxuriant (15).

The bacillus described by Bordet and Gengou is less pleomorphous than the *Bacillus Influenzae* of Pfeiffer. The bacterium of whooping cough is not found in the blood except as an agonal phenomenon.

In their search for confirmation that this was the causal organism of whooping cough it was to be expected that Bordet and Gengou would have resource to their recently discovered phenomenon of complement deviation, called by them "Fixation d'alexine". By

this means they discovered that many patients in the convalescent stage of whooping cough possessed sera which caused agglutination of this new organism, and that the serum of a convalescent patient invariably gave rise to the deviation of complement : a specific immune body was thus present in each patient against this known bacillus.

Friedlander and Wagner (16) state that in no case have they found a positive complement deviation reaction to occur in a patient who was not then suffering from whooping cough, or who had not suffered from the disease during the preceding four years.

Evidence that this organism occurs in all cases of whooping cough is less convincing. Arnheim (17) isolated the bacillus in six sputa out of twenty obtained at random. He failed to demonstrate the bacillus from six cases after death. Most of the earlier observers recovered the organism from the sputum in many cases, but in many other cases were unable to recover it after the second week of the disease.

Meyer (18) claims that statistical study of a large number of cases of whooping cough shows that the bacillus is demonstrable in 75% of sputa of patients during the catarrhal stage.

Freeman (19) obtained cultures of the original strains of the bacilli from Bordet, and found that they were agglutinated by the sera of London patients, who

were suffering from whooping cough. He also observed deflection of the complement with such sera. Freeman did not find the agglutination reaction to be very strong ; a higher titre than one in sixty was not obtained. On the other hand, sera obtained from healthy persons did not cause agglutination with a greater dilution than eight-fold ; in most cases the dilution necessary was four-fold or less. Arnheim (17) isolated the bacillus from his own patients ; he then obtained agglutination of Bordet's bacillus with the serum of whooping convalescents , in each case the titre was one in fifty or more.

Klimenko (20), in collaboration with Fraenkel, recovered Bordet's bacillus from the pneumonic exudate obtained from a fatal case of pertussis. A culture of this organism was introduced into the trachea of a monkey. Klimenko claimed that this monkey subsequently showed symptoms similar to those of whooping cough in man. Another monkey was confined in the same cage as the artificially infected monkey ; infection of the former occurred three days later. Klimenko and Fraenkel also claimed to have produced similar coughs in puppies. They used intratracheal injection ; other observers are said to have produced an identical cough in dogs by the insufflation of a mechanical irritant such as sawdust.

Krumwide and his co-workers (21), having tested the agglutinating properties of the bacillus of Bordet and Gengou, also applied the agglutination

absorption test. They reported that they had isolated two distinct strains of the bacillus ; these they designated Group "A" and group "B" respectively. These two groups apparently differed serologically. Antisera to group A agglutinated not only strains of A, but to a considerable extent strains of B also. Antisera to group B, however, would agglutinate strains of B, but would only agglutinate strains of A slightly, or not at all. In a series of observations these observers found that only one patient of the series showed group A strain. All the others showed that of group B.

Kristensen (22), commenting on this, suggests that these differing strains are only found when the bacillus has been subjected to subculture in the laboratory. In Denmark he found only one type. He examined bacilli from ten different cases ; each strain of the organism was tested against all the sera available in the series of patients. All reacted equally ; the absorption tests gave confirmatory evidence.

Bordet (23) himself expressed in the year 1909 the opinion that the bacillus of whooping cough when grown on common agar loses its property of reacting with an agglutinin which is capable of influencing the same germ when grown on a medium rich in blood. He quoted experiments made by himself to show that the organism grown on a blood medium contained an antigen quite absent from the organism when grown on agar alone. Bordet further



showed that the agglutinating property thus lost by the "agar germ" is regained when the bacillus is again restored to grown on a blood medium.

It seems certain that these different strains which are said to be isolated from whooping cough patients are the outcome of this subculture in the laboratory, as Bordet and Kristensen suggest. The existence of two or more strains, however, would go far to account for the hitherto unsatisfactory results of vaccinothrapy in the treatment of whooping cough .

Hall (24) considered that the vomiting was the chief source of danger to patients suffering from whooping cough. He claimed great relief of this by the use of gastric lavage ; examination of the washings consistently revealed the presence of a penicillium mould, which Hall considered to be the cause of the disease. No other writer can be found who has published results confirming this.

Freeman (19) quotes one more instance of the specificity of Bordet's bacillus. Bordet administered prophylactic doses of a sterilised bacterial vaccine of his bacillus to some twenty children who had been exposed to whooping cough infection. These children afterwards caught whooping cough of so severe a type that it was difficult to persuade their parents that they had not been inoculated with a living organism. Although unfortunate, this result seems to suggest the production

in these children of a negative phase specifically consequent upon the injection of Bordet's bacillus ; in this stage they fell easy victims to the infection from without.

It is worthy of note that certain observers have commented on the likeness to whooping cough of illnesses caused by another bacterium. Brown found (25) *Bacillus Bronchiseptus* in the respiratory passages of a child suffering from a paroxysmal cough ; the cough was clinically indistinguishable from whooping cough. Infection had apparently occurred from the fondling by the child of a pet rabbit.

Rhea (26) has also drawn attention to the similarity of these two organisms, both morphologically and in their clinical manifestations. Both organisms have been found concealed deep among the cilia of the bronchial epithelium. Rhea is also of opinion that *Bacillus Bronchiseptus* may often be the cause of what seems to be true whooping cough. It is fortunate that there are differences between the cultural reactions of the two bacilli in litmus milk, and that *Bacillus Bronchiseptus* is motile, whilst Bordet's bacillus is not.

*Bacillus Pertussis* does not succeed in the fulfilment of the postulates of Koch. It is not constantly found in the disease, although this failure would seem rather to be the result of the different

methods of observation, or to lack of search sufficiently early in the course of the disease. There is ample proof that the organism can be cultivated outside the body in successive generations. Experimental reproduction of the disease would seem to depend upon the work of Klimenko ; upon his claims, unfortunately, some doubt has been cast. The author can find no further record of the successful inoculation of animals.

The strongest evidence would thus appear to be available in favour of Bordet's bacillus as the causal agent of whooping cough ; the evidence lacks final confirmation, but it is significant that no claim of equal strength has yet been put forward in favour of any other organism.

## CHAPTER FIVE.

The recognition of whooping cough is rarely difficult after the patient has entered upon the paroxysmal stage of the disease. A deciding factor may be the presence or proximity of other children with similar symptoms.

Isolation of the patient in such cases is delayed throughout the whole of the initial infectious stage of whooping cough. Many epidemics might be considerably reduced in severity and in length if it

were possible to recognise whooping cough in its earliest stage. It is also possible that during an outbreak many patients are for a time condemned to isolation on account of a cough which subsequently does not prove to be whooping cough. This could likewise be prevented by an earlier method of diagnosis.

It is not here intended to refer to the ordinary clinical methods of diagnosis. These rest upon the presence of a prolonged cough with whoop or with vomiting ; a recognition which rarely requires medical knowledge.

During the visit of the physician the child may not be affected with the characteristic spasm or whoop. The author has for some years found great help from the method of Guida ; the child is held as for throat examination, a spatula is introduced along the tongue to its base in such a way that the glottis comes into view. This rarely fails to induce a spasmodic and typical cough when whooping cough is present.

Ochsenius (27) describes another physical method of early diagnosis. Rectified oil of turpentine is placed in an atomiser ; to this is added 5% or 10% of eucalyptol. A spray of this is inhaled by the patient ; a typical spasm suggestive of whooping cough is only produced in those suffering from the disease. Ochsenius stresses the fact that the method is free

from harm ; he points out that one cannot always wait for the appearance of the whoop, and that a blood count is not always practicable or convenient.

Increase in the white cell count of the blood has long been noticed in patients suffering from whooping cough. This begins during the catarrhal stage, continues so long as the paroxysms last, and declines coincidentally with them. The leucocyte count varies in the average case between 20,000 and 25,000 cells per cubic millimetre. All forms are increased, but the greatest increase is found in the lymphocytic series. Usually in whooping cough these account for more than half the total number of leucocytes present.

Bourne and Scott (28) report a case of whooping cough in which the patient exhibited a leucocytosis of 176,000 cells per cubic millimetre on the sixteenth day of the disease ; of these 116,000 were lymphocytes. The authors trace by means of a graph (reproduced, Appendix, Fig. 2.) the gradual decline of the total cells, of the neuterophils, and of the lymphocytes. They do not suggest in this case the existence of a coincident infection to account for the high leucocyte count. A concurrent illness such as influenza is, however, suggested by Reiche to account for a high leucocyte count (29). He found the number of white cells to be 172,000 per cubic millimetre, a figure almost identical with that of Bourne and Scott.

Mosenthal (30) and Crombie (31) found these blood changes to be present early during the catarrhal stage of whooping cough.

Hess (32) of Frankfort came to the conclusion that the predominance of the lymphocytes was produced as a direct result of the paroxysms ; he found that each paroxysm caused an increase in the number of white cells in the blood, and he found the highest values during the occurrence of convulsions. He attributed this to the pressure exercised mechanically in these circumstances by the muscles of the thorax and abdomen on the spleen and on the thoracic ducts. Hess is thus of opinion that these organs are the central depots for lymphocytes, which are thus forced out by pressure into the systemic circulation. Zeigler does not agree with this theory (33). He also finds that the lymphocytosis is present during the catarrhal stage, but suggests that the cause is the toxic infection. He is unable to support the theory of a mechanical causation, because lymphocytosis does not occur during the spasmophilic type of pseudopertussis. It is also stated (34) that Fukushima is of opinion that the lymphocytosis is due to the lipoidal content of the bacilli.

The author has consistently found a lymphocytosis in ten cases examined before the commencement of the paroxysmal stage, and he is therefore unable to accept the theory advanced by Hess, and finds that of

Zeigler more tenable. The spleen is now known to be a reservoir of red corpuscles in states of health, but there is no evidence whatever that in whooping cough there is any proliferation of the normal lymphoid tissue there present.

It is stated that Fanton (35) has endeavoured to elaborate a haemoclastic test for the early diagnosis of pertussis ; he ascertains the leucocyte count in the fasting patient, taking the average of four estimations made from separate skin punctures. The administration of a small dose of pertussis vaccine is then made hypodermically ; half an hour later an equally careful white cell count is again made. A positive result is described as that in which the second count reveals a diminution in the number of leucocytes as compared with the former enumeration. Positive reactions are further subdivided as follows : -

- (1) Very strong Positive - diminution over 3000
- (2) Strong positive - diminution over 2000
- (3) Positive - diminution over 1000

Any diminution of less than 600 is regarded as indicative of a negative reaction. In a series of fourteen cases Fanton is said to have found that two were strongly positive. Nine others were strongly positive, two were positive and one gave a negative result. All the patients were suffering from whooping cough.

This method of diagnosis is very attractive.

It has the merit of being not too difficult of application, and it should be worthy of further trial.

The bacterial method of diagnosis of whooping cough has, in this country at least, never been stressed either by clinicians or by bacteriologists. The reason may be found in the supposed difficulty of culture in the laboratory. In Denmark and in America, however, it is easy to find observers who unite in emphasising the ease with which whooping cough infection can be verified bacteriologically. Meyer (18), Sugare and McLeod (37), Madsen (38), and Lawson and Mueller (39) are among others who have published details of their success in isolating the *Bacillus Pertussis* in the early stages of the disease.

Best (40) found difficulty in isolating and in culturing the bacillus sufficiently for diagnosis in less than several days ; other observers have not found necessary the elapse of such an interval.

Kramer (41) on the contrary reports that he was usually able to obtain colonies of the *Bacillus Pertussis* from the sputum in less than twenty-four hours, using a defibrinated human blood medium. Sugare and McLeod (37) and other writers claim that the identification of *Bacillus Pertussis* is no more difficult than that of the diphtheria bacillus.

The method now customarily used is that of the "cough-plate". Originally described by Chevitz



and Meyer (42), and first put into practical use in Denmark in the year 1916, it is rapid and simple of application. A Petri dish coated with the medium is held some four or five inches from the mouth of the patient, who coughs directly on to the surface of the medium. Care is taken to include in the exposure a cough of the "explosive" or paroxysmal type. Colonies are found usually towards the end of the second day of incubation ; the medium used is of agar with added glycerine, potato, and defibrinated blood. Sauer and Hambrecht (43) have also found diagnosis easy by this means.

Reference has already been made to serological methods of diagnosis. It is, however, doubtful whether the specific agglutinins to the bacillus are developed before the commencement of the paroxysmal stage, when the nature of the disease is apparent to everyone : information of value might be gained by the use of this method in atypical cases.

The cerebro-spinal fluid is not characteristic. Genoese (44) states that in pertussis it is limpid, at high pressure, with a normal globulin content. The chloride content is unaffected, acetone is absent , Boveri's reaction is negative ; there is a notable increase in the reducing substances present.

The sedimentation rate of the blood is affected and delayed by whooping cough. This has

been studied by Rohr and Krieger (45), who state that the delay is not negatived by such concomitants as bronchial, nasal, or aural catarrh. In doubtful cases of whooping cough the authors recommend that this method be given further trial.

Regan and Tolstounov (46) have made investigations into the chemistry of the blood in cases of whooping cough. They found a lowering of the hydrogen-ion concentration of the blood, associated with a decrease in the inorganic phosphorus content of the plasma. They class this as an uncompensated acidosis (type 6, van Slyke), and they are of the opinion that it is intimately connected with the paroxysms. They state that they have found the symptoms of whooping cough to disappear if the acidosis is corrected.

It is not surprising that diagnosis has been attempted by means of dermal and intradermal tests, after the methods of the Schick and Von Pirquet reactions. An intradermal test similar to the Schick test was elaborated by Orgel (47) in the endeavour to arrive at an early diagnosis of pertussis. Orgel used a weak vaccine of the bacillus by intradermal injection, but failed to obtain any response. A similar test using a mixed vaccine was also unsuccessful; a scarification test with a pure vaccine of the bacillus likewise failed. Finally, by means of the intradermal injection of a vaccine containing



suffered would have developed an active immunity. It is almost impossible that a disease in which second attacks are rare, and which obviously confers a lasting active immunity, would not also confer a negative result to a test of susceptibibility alone.

All the observers mentioned seem to have used sterilised bacillary cultures in these tests ; the author has not found any record of the use in this connection of diluted bacillary toxin. This toxin, to which reference will be made later, was first isolated by Bordet and Gengou.

Summarising the present state of our knowledge of the aids to the diagnosis of whooping cough, the author has come to the following conclusions.

(a) Serological methods of diagnosis do not appear to be of use before the commencement of the paroxysmal stage, and are thus applicable only to the atypical forms of the disease.

(b) Bacteriological diagnosis has been found to be easy of application, according to American and Continental observers of repute, and it is to be regretted that this method is not more widely known and used in Britain. Bacteriological service could be obtained analagous to that available in diphtheria ; it would do much to prevent the spread of whooping cough.

(c) The state of the cerebro-spinal fluid gives little diagnostic help ; no information is

gained which would justify systematic lumbar puncture as a routine measure.

(d.) The dermal tests are disappointing, although worthy of further trial, especially by the use of diluted toxin.

(e) Such tests as that of the sedimentation rate of the blood, and investigations into the the chemistry of the blood require much further corroboration.

(f) We are thus very little in advance, in Britain at least, of the time when a suspicious cough in a child together with a lymphocytosis or the presence of an epidemic, was alone necessary to justify a diagnosis of whooping cough.

## CHAPTER SIX.

Bordet (23) made experiments on guinea pigs; he injected the bacilli under the skin or into the peritoneal cavity of these animals and of rabbits. It was found that the bacterium of whooping cough was unable to invade the organism of these animals. The injection, however, of a few milligrammes of a culture of *Bacillus Pertussis* was able to cause death with all the symptoms of a profound intoxication.

Bordet concluded that the bacillus was able

to produce a virulent toxin ; this he isolated after the method of Besredka. Injected intraperitoneally into animals it was found to be highly toxic ; injected hypodermically it produced necrosis and sloughing over a wide area of skin. The presence of the toxin in the tissues appeared to indicate changes suggestive of irritation rather than of inflammation.

An analogous necrosis has been found in the lower respiratory passages of human beings who have died from pertussis. This analogy, coupled with the fact that most of the bacilli have disappeared from the bronchi during the greater and latter part of the paroxysmal stage of whooping cough, lead one to surmise that most, if not all, of the symptoms are caused by this toxæmia, whose effect is still operative after the withdrawal of the organisms.

The author has failed to observe during life any morbid changes in the upper respiratory passages ; he has not had the opportunity of observing a fatal case of pertussis, nor of seeing an autopsy thereon. The changes after death are said to consist of little more than mild catarrhal inflammation of the bronchi and of the trachea, unless death has supervened as the result of some complication. In this case the changes are characteristic of the complicating disease, usually bronchitis or bronchopneumonia.

Donally (50) quotes Variot and Esbach,

who report a simple case of pertussis, which at autopsy showed showed no morbid changes in the air passages. "Among the numerous autopsies of whooping cough which it has been permitted us to do, we have never met a case in which the bronchial apparatus, the lungs, and glands of the mediastinum, were as completely spared as in this child. Only was there a rosy tint of congestion in the lower half of the trachea, in the large bronchi, and in the bronchi of the second order; below them there was no congestion".

Donally (50) has observed that postmortem examination usually reveals bronchopneumonia, with or without tubercular alteration of the lymph glands, together with pulmonary emphysema, dilatation and hypertrophy of the heart, or complications of the central nervous system, most frequently haemorrhage.

The author has on several occasions noted the development of glandular tubercle after whooping cough ; it would seem to be more common in the lymph glands of the neck. It must, however, be supposed that its occurrence is equally common in the mediastinal glands, where its presence is more readily overlooked. In the series of cases at present under consideration, glandular tubercle in the thorax was met with on three occasions. No infection of the lung parenchyma with the human strain of *Bacillus Tuberculosis* has been met with by the author.

The presence of albumen in the urine is, in the opinion of the author, rather more common than is usually described in the text books, especially during the late stages of the prodromal period and at the time when the paroxysms are commencing ; it has a definite relationship to the febrile state.

It is doubtful if sufficient recognition is accorded to the frequency with which bronchopneumonia is met with during whooping cough. It is highly probable that many bronchopneumonic infections in children are really infections by the Bordet-Gengou bacillus ; in young children especially the characteristic whoop is often absent throughout the period of cough, and the nature of the infection is unrecognised unless an epidemic be present. In other cases the bronchopneumonia may mask the inception of the paroxysmal stage, the whoop appearing during convalescence, or during defervescence.

Bronchopneumonia has been observed by the author in four instances in the present series ; lobular collapse of the lung in two. The latter is a not uncommon complication, which is more often seen in patients who remain untreated.

Oedema of the glottis, pleurisy, and lesions of the nervous system are all known to occur in whooping cough, but have not been observed by the author. It is common to meet with convulsions

in patients who are suffering from whooping cough, especially if they are children under twelve months of age. It would seem that these are due to the asphyxia and congestion of the central nervous system resultant upon prolonged spasm of the glottis. Haemorrhages, most frequently from the nose, or under the conjunctiva, are of frequent occurrence.

## CHAPTER SEVEN.

According to Parry (51), the therapeutic measures in vogue against whooping cough fall into two categories, the effective but unbearable, and the tolerable but inefficacious. "The intramuscular injection of ether falls into the first class. Though this can sometimes abort pertussis, the physician who employs it will find that however beneficial it may be to the sufferer, its effect on his practice will prove almost lethal".

Very little indeed has been contributed to the British journals on the subject of the treatment of whooping cough by means of ether ; it is therefore to be regretted that such a statement has appeared in the medical Press. A survey of the available literature, together with some personal



experience, leads the author to think that the disadvantages of this method of treatment have been much exaggerated. Even though there are drawbacks to the intramuscular method of medication, other means of administration are readily available ; these are equally effective though perhaps not so convenient of application.

Most of the English text books do not mention the method at all ; others dismiss it in a few words, possibly concluding with the remark, "It is painful". It is the experience of the author that we have in ether a remedy for whooping cough which is much more effective than any we have yet tried ; it is rather to be deplored that the momentary pain of the injection is in any way thought to be proportionate to the distress caused by the paroxysms of cough.

The treatment of whooping cough by ether was first instituted in France, by Audrain of Caen ; he read a paper on the subject at Havre on the day before war was declared by France in 1914. Before this time Bedo(52) had noted that two children suffering from whooping cough, to whom a general anaesthetic had been given, had been cured of the whooping cough. The greater medical issues of the war decreed that this new method should fall into desuetude, but in the year 1919 Audrain (56) again published further records of his results in this new field of treatment. During

the last eleven years, these results have been endorsed by many clinicians in France, notably by Cheinisse of Paris (53), Gleyvod of Lyons (54), and by Weil and Dufourt of Lyons (55).

Subsequently this method of treatment became popular in Italy, in the United States of America, and in most of the Latin American countries. Most observers are openly and frankly enthusiastic, and claim that the use of the ether treatment has inaugurated a new era in the therapy of whooping cough. Others are more reserved in their opinion; a few are unable to record results which justify the continuance of ether therapy as a curative measure.

Previous to the year 1924 the author had no experience nor knowledge of ether therapy in whooping cough, probably because of the scant references in the medical journals of this country. Early in that year he read in a periodical published by a commercial firm the account of a small epidemic of whooping cough which had been treated by ether ; the article was anonymously contributed(57). A description was given of the results of ether therapy in patients who were all of the rather weakly "institutional" type of child ; these results were so encouraging that the author resolved to rely solely upon this measure in the treatment of the next epidemic met with. The anonymous authorship of the contribution in this periodical did much to suggest

that the claims made were not unduly optimistic.

The method used was in all cases by deep injection of ether into muscle, although the writer did not mention the precise site of injection.

Nearly twelve months passed before an opportunity was found of confirming these claims. Up to that time, the author of this thesis had found little help from the drugs and remedies usually employed in whooping cough ; it was therefore decided to institute a trial of the new remedy.

Following the lines of treatment already suggested, the intramuscular route was chosen by which to administer the ether ; the injection was made at a point about two inches below the crest of the ilium. On a former occasion the effect had been seen of a hypodermic injection of ether ; the extreme pain caused was not easily forgotten. Some discomfort was thus expected as the result of the intramuscular injection ; this was, however, found only to be of short duration, lasting possibly from one half to one minute.

This pain is sufficiently severe to induce crying or screaming in a young child, and is thus the cause of the resistance by the child of further treatment. Coupled with the sympathy evoked by the distress of the cough, such a result is apt to give rise to a request that the injections be discontinued, and oral therapy substituted. So far the author finds himself

in complete agreement with Parry (51).

On the Continent, where hypodermic medication is much used, less persuasion may be necessary ; such scruples have nevertheless been the means of losing many opportunities of making this study more comprehensive.

The ether was introduced through a hypodermic needle of about 25 millimetres in length and of fine calibre. A needle of large bore is unnecessary for the injection of ether, and it was found that even a fine needle could, if sharp, be carried through the skin and down to the required depth in one movement. The ether was deposited in the deepest layers of the muscle , almost against the bone : it was soon seen that the deeper the injection was made, the less was the resultant pain or discomfort. The amount of pain was increased unless the ether was prevented from reaching the needle tract during withdrawal of the needle. It was usually found easier to have the child with the hip flexed, supported on the knee of the mother.

In all, four cases of whooping cough were treated by this method, but after treatment of the first two, in spite of excellent results, it was felt that the pain caused was a distinct deterrent to the further use of the method. Search was accordingly made for another method of administering the ether. The author was at that time unaware that any other method had been used in the administration of ether in

whooping cough ; it was, however, thought that the use of ether enemata might be attended by equal success. The method was known to have been for some time used in the production of anaesthesia ; the ether was usually mixed with olive oil in varying proportions.

A mixture of equal parts of ether and olive oil was first used, it being thought that better retention would be effected if the bulk of the enema were as small as possible ; the mixture was introduced high into the rectum of the patient.

Ether when mixed with olive oil forms a clear oily fluid which is very mobile ; it can easily be passed through a catheter of small gauge. An English gum-elastic catheter was selected, with a termino-lateral eye to ensure against blockage by the rectal contents which might be present. The catheter was of number 6 gauge in order to ensure some rigidity during its introduction, the effect of the ether oil mixture being to make the tube unduly flexible. The catheter was marked at a distance of five inches from the tip, thus ensuring in all cases an equal distance of insertion. A Record syringe attached to the end of the catheter provided an easy means of measuring the fluid to be introduced. The capacity of the syringe was twenty cubic centimetres ; the syringe could also be used as a means of overcoming the resistance caused by straining on the part of the

patient.

McGee (58) is said to find that he is able to introduce the mixture by gravity alone; the author has not found this to be so, rather has he found that unless pressure is used, flow will be in the reverse direction to that intended by the operator.. The "gravity method" is thus unreliable. To overcome the resistance of the abdominal muscles a long tube is necessary to ensure sufficient "head", unless pressure be applied. If this tube is not filled at the commencement of introduction, a certain amount of the fluid is apt to remain in the tube after withdrawal; in the case of a long tube the consequent inaccuracy of dosage is not to be neglected. The filling of the tube previous to injection is apt to result in soiling of the clothing of the child, of the mother, or of the operator. The author has found that a short tube and injection under pressure result in a much more satisfactory, cleanly, and accurate administration.

Because of the volatility of the ether, the author thought it necessary to introduce the mixture at room temperature; it was also found inadvisable to introduce the mixture when faecal matter was present. In most patients when the rectum was empty, the entrance of less than an ounce of fluid caused no desire to defaecate, which might not be controlled by slight pressure on the anus for a few moments. If,

however, the rectum were loaded, the desire to defaecate after injection was almost irresistible. Retention was assisted by holding together the buttocks for five or ten minutes ; in spite of this, a motion was usually passed soon afterwards, and it was thus doubtful whether much of the injected fluid was absorbed.

Most of the enemata were given in the afternoon or in the evening ; in the morning one was apt to find that the child's bowels had not acted. In some instances it was deemed advisable to ask the mother to ensure a daily action, by the use of a mild saline aperient, earlier than the time of the injection.

The catheter and the anus having been liberally smeared with vaseline, it was soon found that with a little care the introduction of the catheter was not attended by any discomfort ; the operation could be performed upon a sleeping child without causing it to awaken. The catheter was gradually and gently introduced for the full five inches, using a twisting movement to avoid kinking. The mixture of ether and oil was then rapidly injected, and the catheter as rapidly withdrawn. In most children a slight sensation of discomfort was experienced, referred usually to the left iliac fossa ; this was in no way comparable with the pain attendant upon.

intramuscular injection. It was thought at the time that this was due to the low temperature of the enema. The discomfort lasted about the same length of time as that produced by intramuscular injection, but was in no way comparable with it in intensity. Provided that the child was encouraged not to admit the desire for stool, retention was apparently easy and comfortable. Of the older patients, most admitted that the injection "did not hurt much".

Some difficulty was met with in nervous or in unruly children ; resistance to treatment by screaming or struggling was apt to provoke a paroxysm of coughing. In these patients it was wise first to induce the paroxysm by an examination of the pharynx of the patient ; this evoked a paroxysm, the injection was given immediately afterwards. In most cases, however, there was little resistance to treatment after the first injection ; with gentle and careful technique, a spasm of coughing can be avoided. It was practically always elicited from mothers that retention, and, presumably, absorption took place.

In some of the later cases recorded in this series, a further modification was introduced. The ether and oil mixture was emulsified by means of scacia ; it was thought that this might obviate the slight feeling of discomfort after injection, and that it might cause the rate of absorption to be slowed.



Finally, in two cases not recorded in this series, paraldehyde was added to the emulsion. No advantage seemed to be able to be credited to its use, which was based upon its excretion through the lungs. The dose employed was up to ten minims for each completed year of the child's age ; any benefit seemed to depend upon the production of narcosis in a mild form.

It is interesting to note that Reim (59) has claimed very encouraging results from the use of camphor dissolved in ether ; it is administered by intramuscular injection.

Within a varying period after administration it is always possible to detect the characteristic odour of ether in the air exhaled from the lungs ; this is less noticeable than after the administration of a general anaesthetic. Observations made by mothers have led the author to believe that ether may persist in the breath for a much longer period than that recorded by other clinicians. Mason (60) records six hours as the usual time during which ether may be noticed in the breath ; it is stated that McGee mentions eight hours (58). The author has noted the odour in the breath thirteen hours after injection, and is of the opinion that the duration is shortest after intramuscular injection, and is longest after an enema of emulsion. The observations of others are limited to the use of a simple mixture of ether and oil. If, as will later be suggested, the

value of the method is partly dependent upon the excretion of ether through the pulmonary alveoli, it is obviously of advantage to be able to command a method which ensures slower absorption, upon which a slower rate of excretion depends.

The odour of ether becomes first noticeable in the breath very soon after an intramuscular injection. In some cases it can be detected in less than a minute; with rectal administration, half an hour or more may elapse. An oily soiling of the clothing, or the passage of a stool soon after injection is usually indicative of lack of retention. It is probable that all the ether is comparatively quickly absorbed; there is, however, no evidence that any of the olive oil is absorbed from the rectum.

## CHAPTER EIGHT.

Intramuscular injection of ether is said to give rise on occasion to necrosis of the tissues of the buttock. The author has only used this method throughout the treatment of four cases. In one other patient two intragluteal injections were given as a terminal means of treatment following several rectal administrations; in assessing the results of treatment, however, these have been disregarded. The

number of occasions upon which an intramuscular injection was made is thus raised to twenty-nine, in only one case was it found that any reaction followed, the effect was limited to an area of induration. This subsided rapidly under the influence of moist heat and disappeared in a few hours ; the same buttock received its injection in its turn, two days later, without further ill-effect.

Necrosis of the tissues at the site of injection was met with by Graeser (61) in four patients of twenty-one treated by him. The resulting slough was not very painful to the child, but took a long time to heal ; a deep scar was left in every case. Levy and Finkelstein (62), using a mixture of ether and olive oil in equal parts, treated one hundred and four cases thus ; each patient received from four to eleven injections, in no case did necrosis ensue. Mason (60), who treated twenty-six patients with intramuscular ether, found in one instance only some tenderness of the buttock ; this did not last longer than three hours. Goldblum (63) reports a series of cases totalling sixty-three injections ; one patient showed induration of the buttock for about three months afterwards.

Tow (64) treated seventy-eight patients by intragluteal injection ; of these seven developed areas of necrosis at the site of the needle track. Levy and Shapiro (65) found that necrosis followed

in twenty-five per cent of patients to whom treatment was given , an appalling proportion.

The French and Italian observers do not appear to have found the same disadvantages. In the literature consulted by the author, none of them has stressed the danger of necrosis after injection of ether. Summers (66) in America, is reported to have met with no ill effects in his treatment of a series of seventy-eight patients. Newman (67) is said to have been prepared for a strictly limited area of necrosis ; for this reason he considers that only in special cases do the results outweigh the disadvantages. Newman, however, admits that cure or improvement followed in all patients treated by him.

The author, in seeking to abandon the intramuscular route in the administration of ether, was more influenced by the resulting pain than by the risk of necrosis. As already mentioned, twenty-nine injections by him did not give rise to a single instance of this complication. An easier method was available ; it was less painful to the patient, the intramuscular method was rendered unnecessary. The author does, however, feel that the risks of necrosis have been exaggerated by certain writers ; it is suggested that a great deal of the tendency to this accident might be avoided by efficient technique . Pain and tenderness after injection may be lessened

by deeper deposition of the ether in the muscle. The incidence of necrosis in the case records of the American authors is much too high, and it is difficult to see how they justify this accident as part of the most modern treatment of whooping cough.

Bernuth and Hannemann (68) failed to obtain any good results from the intramuscular injection of ether in whooping cough. On the contrary they have noticed paralysis of the peroneal and posterior tibial nerve regions as a result of their injections. They are therefore moved to advise against the adoption of this method of treatment in whooping cough, but it would seem obvious that they have relied on a technique which is not quite in accordance with that advised by other writers, and that the injections were made in too close proximity to the sciatic notch.

In adopting the method of administration by rectal injection the author felt that these risks, though rare, would be avoided, little or no pain would be caused to the patient, and an intelligent nurse or mother could, if necessary, give the enema. The author has, in all cases in the series under consideration, administered the ether himself.

It has been suggested that rectal injections of ether are liable to give rise to proctitis or to other irritant symptoms. Thirty-nine patients have

treated by the author after this method ; proctitis has occurred in none, even when ether has formed as much as half of the total amount of the injected fluid. None of the other writers have recorded its occurrence. Most of the patients treated by the author were observed for many months after the cessation of treatment ; no symptoms suggestive of proctitis were brought to his notice.

## CHAPTER NINE.

In four patients of the series of forty-three, treatment was given by the intramuscular route ; the dose given varied with the age of the child. The method was new to the author, a cautious procedure was accordingly adopted. The first two patients received not more than one cubic centimetre upon alternate days ; the ages of the two patients were two and a half and four years respectively. In the cases of the other two patients here recorded the ages were eighteen months and two and a half years ; the greatest dose given did not exceed one and a half cubic centimetres. In all four patients the results were unqualifiedly good, although the amount of ether given is now known to be small compared with that given by other observers. Elgood (69), one of the few British workers to have reported on the

ether treatment of whooping cough, gave no more than ten minims intragluteally. The dosage of the American and Continental clinicians is greater than this, and will be made the subject of a contrast in tabular form.

Pollock (70), Bennett (71), Genoese (72), and Manicelli (73) gave only half a cubic centimetre to infants, but administered as much as two cubic centimetres to older children. Voigt (74) employed a similar dosage ; he gave no more than two cubic centimetres to adults. Tow (64), Newman (67), Giminez Guinea (77), and Audrain (78) all appear to have employed the same dose in children up to six months of age, five cubic centimetres being sometimes given to older children.

Levy and Finkelstein (62), using by intramuscular injection their mixture of ether and oil, adopted a dosage equivalent to one or two cubic centimetres of actual ether according to age.

The above-mentioned doses refer to treatment by intramuscular injection only. Before commencing therapy by means of ether and oil enemata per rectum, the dose was fixed arbitrarily at one drachm of the mixture for the nearest year of the patients age, a child of one year thus received half a drachm ( $1\frac{3}{4}$  c.c.) of actual ether; a child of eight years four drachms (14 c.c.). Only McGee (58), of other workers, would have seemed to have used this actual strength of ether, he used it

in all cases recorded by him. All other observers report the use of a weaker solution of ether in olive or other oil. The strength employed by Goldblum (63) was one part of ether to seven parts of oil, that of Mason (60) a forty per cent strength of ether, and that of Musser (79), a ten per cent solution. Magliano (80) is reported to have used as a vehicle liquid petrolatum instead of olive oil, the proportion of ether being one part in five.

The author is of opinion that the strength used should be that employed by McGee and himself. He has seen no ill-effects from its use, and considers it to be an advantage that the volume of the enema should be as small as possible ; retention is thus aided.

Certain of the cases here recorded by the author have been treated by the use of olive oil as related, but with one modification ; the mixture was emulsified by mucilage of acacia. According to the degree of pharmaceutical skill attained, the amount of water necessary for emulsification was found to vary. In all case-records, therefore, the dosages employed are quoted in terms of the ether and oil mixture alone, due allowance being made at the time of administration for the known amount of mucilage present.



## CHAPTER TEN.

It is manifestly unfair to assess the results attained by any curative measure in a given series of patients without knowing at what stage of the disease treatment was commenced. It is obvious that any form of treatment initiated during the third or fourth week of the paroxysmal stage would lead to the assumption of brilliant results in whooping cough. In the series under consideration, therefore, all case records are shown in some detail ; no case was treated which had been whooping for more than eight days, with one exception.

In an endeavour to formulate some standard whereby the degree of improvement might be computed, reference was made to three authoritative text books of medicine ; it was found that the average duration of the paroxysmal stage in whooping cough is not less than four weeks. This minimum has been accepted in assessing the progress of all patients. The average number of paroxysms appears to be about twenty in each period of twenty-four hours ; the number of paroxysms was counted by the mother in each case, and in the case records the term "daily paroxysms" means the number of these during the twenty-four hours immediately previous. There is apparently no standard by which the progress of vomiting is to be judged ; most text books seem, by implication at

least, to suggest that it is more or less present during the whole of the paroxysmal stage. As the paroxysms lessen in frequency, so does the vomiting diminish in intensity ; the author has found this to be so in patients untreated by ether.

As has been previously stated, the patients treated by ether numbered forty-three, of whom four were treated by the intragluteal route, and thirty-nine by rectal injection. Of the latter, twenty-six received per rectum the simple mixture of ether and olive oil ; thirteen received the emulsified mixture.

The initial benefit of ether in favourable cases is soon seen in the early cessation of vomiting. This is even seen in cases where ether has no apparent effect upon the duration or upon the intensity of the whoop.. In one patient vomiting ceased upon the second day of treatment. The sickness usually disappeared on the third or fourth day after ether therapy had been commenced, and only in one patient did it persist after the twelfth day. In this case treatment had been commenced so soon as the nature of the cough was evident. In two patients vomiting did not occur at all, treatment with ether having been commenced, contrary to routine, before this particular member of the family reached the paroxysmal stage of the disease.

The relief from vomiting was commonly followed, usually about the fourth or fifth day, by a distinct

improvement in the number and in the severity of the paroxysms ; each individual paroxysm began to be less severe. The average daily number of paroxysms is about twenty ; usually there is after ether first a diminution in the number of the paroxysms during the hours which would normally be devoted to sleep . It is uncommon to find a sudden and dramatic drop in the daily number of paroxysms, nor is the author able to record the occurrence of a cure in one or two days as have the Continental workers. The customary sequence of improvement is heralded by the disappearance of the sickness, followed by better nights, and finally by the decline of the whoop and the abolition of cough. A cure is considered to have been effected when nothing remains but a very mild non-paroxysmal cough. It is almost correct to say that the two most distressing features of the disease are the vomiting and the broken nights. Improvement in these is always synchronous with a great improvement in the general condition of the patient.

The whoop and the cough are in favourable cases greatly diminished ; the former is the first to go, leaving a severe cough of the type usually found in tracheitis or in bronchitis. The time of the disappearance of of the whoop is on about the eighth or tenth day in successful cases ; the cough persists for about five days longer, gradually

diminishing in intensity. Patients exhibiting this standard of improvement were considered to have been cured as a result of the treatment ; those in whom more than the slightest non-paroxysmal cough persisted after the twenty-first day were considered to rank as failures.

Other therapy was not persisted with after the tenth or eleventh day, as a general rule, unless improvement was apparent.

Results in the four cases treated by intragluteal injection were uniformly good. In two the cough disappeared within the first ten days ; in the other two patients its duration was under twelve days. The patients had been whooping for four, five, eight, and ten days respectively. The last patient here mentioned, the first of all to undergo treatment, was also suffering from bronchopneumonia, and would not have been seen by the author but for the existence of this.

The results of treatment in these four patients were more than encouraging ; in spite of the fact that no necrosis or other accident had followed injection, it was not thought wise to continue with this method of treatment in private practice. Persuasion was always necessary before the patients or their parents could be brought to consent to a second injection. On account of the reasons quoted, therefore, no more than four patients were treated in this way.

The method had actually been abandoned after the treatment of two patients, the other two were treated later at the request of their parents.

Twenty-six patients were treated by means of the rectal injection of a simple mixture of ether and olive oil in equal parts ; their ages ranged from four months to nine years. In the case of five children little or no effect was observed as a result of treatment; this group of failures contains two of the eldest children and three of the youngest. Their ages were five years, nine years, four months, fifteen months, and six months respectively. In no case was there constant rejection of the enemata. Even in these patients it was noticeable that the vomiting in four instances disappeared after the fourth or fifth day, the cough being prolonged for four or five weeks. Two of the patients in whom treatment failed were the victims of convulsions causing actual unconsciousness for about two minutes ; the convulsions did not recur.

It was considered that ten of these twenty-six patients were cured of whooping cough as a direct result of the injections of ether ; the whoop disappeared in from five to ten days, the cough in from ten to fifteen days. Four children were thought to be very much improved, their cough had disappeared by about the eighteenth day. Seven were adjudged merely to be "improved" ; at the end of three weeks

their cough was still present, but was non-paroxysmal in character.

Of this series of twenty-six patients, two were seen suffering from bronchopneumonia, one with lobular collapse of the lung, one with bronchitis, and two with convulsions. All made a good recovery ; the author agrees with the views attributed to Summers (66), and to Drake (82), who are of opinion that ether therapy is of especial value in the treatment of complicated whooping cough.

It has already been suggested that some slight pain or discomfort may arise from the injection into the bowel of a simple mixture of ether and oil ; the discomfort is always of short duration. With the intention of avoiding this discomfort, the ether and oil mixture was emulsified, as already described ; it has proved equally effective in the control of vomiting and of cough. It is not claimed that there is in this method any advantage over the simple administration of ether and oil, other than that it overcomes the pelvic discomfort which so often ensues after introduction by the older method. The author is also of opinion that the rate of absorption is somewhat slowed, and that ether is excreted through the pulmonary alveoli for a longer period than that obtainable when ether and oil alone are administered. A more prolonged effect is thus obtained ; greater

confidence is engendered in the younger patients, obviating the speedy occurrence of a paroxysm with its attendant risks of non-retention.

The "emulsion series" consisted of thirteen cases, whose ages ranged from three months to nine years ; none were complicated by any other disease. Nine patients were adjudged cured or very much improved ; one merely to be "improved"; three patients derived no obvious benefit from the treatment, their ages were three months, eleven months, and two years respectively. Of these three patients, the youngest suffered from nothing more than a slight cough, upon which the ether had no effect. The elder two children were soon relieved of the more distressing symptoms, but the cough persisted until about the thirtieth day. The eldest of these three children also suffered from phimosis

The dosage, it will be remembered, was identical with that used when ether and oil alone were given. In all cases vomiting was early in abeyance ; the results obtained were in every way comparable with those obtained by the other method of rectal administration.

A tabular comparison of the various doses used by other observers will be found at the end of the volume ( Appendix, Tables 1 and 2.)

## CHAPTER ELEVEN.

Audrain (76) holds the view that ether therapy is successful in all cases of true whooping cough ; he has never known it to fail. Apparent failure, in his opinion, is always due to the presence of some complication or to some other disease simulating whooping cough.

Most frequent among the causes of a cough similar to pertussis are adenoid growths of the nasopharynx, enlargement of the lymph glands of the mediastinum, and spasmodic pseudopertussis. The existence of adenoids, of enlarged glands, and of rickets was always enquired into. In no case was true rickets seen ; in one patient a convulsion was described which might have been of the carpo-pedal type. Adenoidal enlargement was found to be present in ten of the forty three cases described ; all ten patients undoubtedly suffered from true whooping cough , it was concurrently present in at least one other member of the family.

The author expected that the existence of adenoidal enlargement would prolong the period of cough or render ineffective the usual action of the ether. This was not found to be so ; nine of the ten patients in whom adenoids were found exemplified the highest standard of ether therapy. Enlargement



of the tonsils, together with adenoids, may produce a chronic cough, but the writer does not think that such a cough may easily be mistaken for true whooping cough ; it may, however, be confused with whooping cough in which the whoop is not present. The author has not found simple tonsillar enlargement with an adenoid mass to give rise to a cough sufficiently paroxysmal to be mistaken for true whooping cough, provided the patient is seen during a paroxysm. It is possible that acute catarrhal inflammation of the adenoids may cause a cough which is very difficult to distinguish from true pertussis ; it is in such cases as these that the author would make a plea for the earlier application of bacteriological methods of diagnosis.

Enlargement of either the cervical or of the mediastinal lymph glands has been observed in six patients. Four patients suffered from enlargement of both groups of glands, whilst in two patients the cervical chains only were affected.. Ether therapy was ineffective in three of the four cases in whom the bronchial glands were affected. During the course of the whooping cough, one patient suffered from acute follicular tonsillitis of a mild type, with associated swelling the the cervical glands, this was not regarded as a complication of the pertussis. In this instance the glands subsided in a few days.

Bronchitis was not considered to be present unless there could be heard in the lungs auscultatory signs of more significance than the rales usually found in whooping cough. A severe type of bronchitis was only met with in one patient ; recovery was satisfactory, the bronchitis was present before the ether was administered.

Bronchopneumonia occurred in four of the forty-three patients treated ; it too had developed before ether was first given. In each patient subsidence of the pyrexia took place before the end of the first week of treatment. In spite of this complication, the symptoms of vomiting, whoop, and cough responded remarkably well to the action of ether. The children themselves were bright and comfortable after the first two or three days ; the author agrees with the statements ascribed to Magliano (80), and to Vaccarezza and Inda (84), who have pointed out that ether seems to modify the bronchial secretions when respiratory complications are present, and to have a cardiac stimulant effect, which is of great service in treatment.

Case 32 is regarded as being of importance in illustrating what may happen in whooping cough in the very young. A child suffering from bronchopneumonia may be seen ; the specific nature of the infection is unsuspected until, during the period

of defervescence, a whoop is heard. In some cases the diagnosis may be aided by the fact that other members of the family are patently suffering from whooping cough. In very young children the whoop is often in abeyance, especially if bronchopneumonia be present ; the author is convinced that this cause should more frequently be suspected when bronchopneumonia is present in a young child. Dufourt (85) has observed instances of rapid defervescence occurring in patients suffering from a respiratory complication of whooping cough. He regards these as being due to bronchitic changes with the addition of small mobile foci of congestion in the lung tissue.

Drowsiness was only noted as an effect of ether therapy in three cases ; the dose was not diminished because of this, tolerance was established in two to four days. Schonfelder (86) reports that most of his patients fell asleep within half an hour after injection ; the author has not found this to be so except in the younger patients. Magliano (80) is said to administer a dose of ether sufficient to produce superficial narcosis ; the results obtained do not seem to be an improvement on those of other observers, nor does the method commend itself as other than an extreme example of purely symptomatic treatment.

Consideration has already been given to the rapid relief achieved in the reduction of vomiting.

Lobular collapse of the lung was met with in two patients ; it is described as a not uncommon complication. This was not followed by any inflammatory lesion in the affected area. Emphysema has not been met with in the series of cases under consideration.

It would appear that ether is very effective in the treatment of the complications of whooping cough ; it is particularly so in those affecting the respiratory system. McGee (58) is of the opinion that ether prevents the occurrence of bronchitis and of bronchopneumonia. Especial improvement of these complications has been noted by Graeser (61), and it is also interesting to read that Audrain and Schonfelder (86) have claimed good results in the treatment of bronchopneumonia not due to whooping cough, and its use is even reported to have been extended to the treatment of asthma (87)

Nervous complications do not appear to figure largely in the records of patients treated by ether therapy. The author met with three convulsions in the patients treated by him. One of these was thought to be of tetanic origin, the other two were probably due to the asphyxia caused by prolonged spasm of the glottis.

## CHAPTER TWELVE.

Before attempting to give any tabulated statement of the results obtained, it might be well to consider the mode of action of ether in its effect upon whooping cough.

There is every evidence that the drug is rapidly absorbed, and that it has some effect upon the symptoms of pertussis. According to Cushny (89), elimination of the ether takes place very rapidly from the body ; if, however, a tenacious sputum be present, traces of ether may be detected in the breath twenty-four hours after administration. Such a sputum is present in whooping cough. Almost all the ether present in the blood stream is excreted through the lungs ; a small amount is excreted through the kidneys, but is so small that it may be disregarded. The above description applies to the excretion of ether after anaesthesia ; there is no reason why any fundamental difference should obtain in elimination after other methods of administration.

It is thus apparent that the action of the ether depends upon its presence in the blood plasma, or upon its excretion through the respiratory passages ; it acts either before or after it has passed through the pulmonary alveoli in the process of excretion. It is unlikely that the small concen-

tration present in the plasma if of much effect in subduing this intractable cough ; it is more likely that any action takes place after the ether reaches the respiratory passages. It may be, however, that ether acts in both ways.

Audrain himself supported the view that the ether vapour has a special selective action upon the Bordet-Gengou bacillus and upon other organisms; for this reason he extended the method of treatment to other respiratory diseases. Genoese also attributes(72) any success to the direct antiseptic action of the ether vapour. This is well known to be so outside the body, and on the skin surface ; in view of the fact that ether can be inhaled for a long period without causing cell destruction it may well be that ether is able to destroy the bacteria alone by solution of their lipoidal envelope. At the time when ether is used in whooping cough, the bacilli are becoming less numerous ; the ether may thus be introduced at a very favourable stage in the changing bacterial aspect of the disease.

Apart from its narcotic properties, ether has some effect upon the peripheral nerves. This takes the form of a descending depression and paralysis which first involves the synapses of the sensory and receptive tracts (Cushny). It is well known that during the period of induction of anaesthesia ether produces an

irritant effect upon the free sensory nerve endings of the pharynx and larynx. As anaesthesia deepens, but before the stage of narcosis, sensation begins to be lost in these nerve endings, and the ether vapour may then be inhaled without discomfort.

This seems to confirm blockage of the receptive paths by ether ; the afferent reflex tract to the medulla is thus no longer open to the stimuli caused by the pellets of sputum. In this connection it is of interest that Halphen (83) has treated several cases of whooping cough in children by the production of anaesthesia of the superior laryngeal nerve, thus causing blockage of the afferent path. Alcohol is injected into the nerve on both sides of the neck ; Halphen claims success in certain cases, the paroxysms ceasing on the fourth or fifth day. He maintains that as all the sensory impulses of spasmodic cough pass through this nerve, blockage of these must produce interruption of the reflex arc. It is possible that we have an example of this in the early cessation of vomiting which takes place when whooping cough is treated with ether, even though the other symptoms persist.

It has been suggested to the author that favourable results in this form of treatment by ether are solely the consequence of the production of some degree of narcosis. It cannot be argued that there

is no degree of narcosis, but it would seem to be very slight ; the author has not found that children readily fall asleep after injection.

Whilst it would seem certain that the presence of ether in the blood stream is to some extent responsible in blocking the reflex paths, and that the ether present in the respiratory tract may be of service in lowering the sensibility of the nerve endings, it may also be that other beneficial action may result from this bathing of the respiratory mucous membrane with a weak ether vapour . Such a means of medication is but the reverse of inhalation which is of proved service in practically all forms of laryngeal inflammation or irritation ; ether vapour may possess an especial power of penetration into the intercilial spaces, where it is thought the bacteria lie.

The concentration of ether excreted through the pulmonary endothelium must necessarily be weak ; it must not cause irritation or death of the already inflamed or unduly sensitive surfaces with which it must come into intimate contact. That such a concentration, or rather dilution, is able to give rise to direct bactericidal action is somewhat speculative ; further proof is required as to the action of ether vapour on the bacilli in culture outside the body. Such an experiment will require to be conducted with



a similar strength of ether to that obtaining in the exhaled air of the patient.

A child of six years old, presuming ether excretion to last six hours, would during that time exhale about twenty thousand litres of air, in which are volatilised only two cubic centimetres of ether.

We are therefore in possession of two theories regarding the action of ether in whooping cough ; the first, that it is accounted for by a direct antiseptic action exercised by the ether ; the second, that the effect is purely transient and sedative to the nervous system. Both theories are as yet equally devoid of proof.

The bactericidal theory finds support from the experiences of those workers who claim to have cured whooping cough after one, two, or three injections of ether, or by the administration of a general anaesthetic. It is extremely improbable that a sedative effect for many weeks could rest upon a single administration.

The second theory gains some support from the experiences of those who have failed to achieve any good effect except by many injections, and that the paroxysms return if the ether is withheld before a certain number of injections have been given. This is the experience of the author.

Yet this latter premise does not explain

why the paroxysms, if ether therapy is only of transient effect, should disappear after about a fortnight, when if untreated they would persist for four or five weeks. The acceptance of this theory would postulate that the intermission of the injections must immediately be followed by a return of the symptoms ; provided that a certain number have been given, this is usually not so.

The author finds himself unable to accept either theory in its entirety ; he is attracted by the idea that ether may succeed in breaking the vicious circle of inflamed mucous membrane and reflex arc which is unduly sensitive. In the present state of our knowledge it would seem wiser to surmise that the ether is able to exercise some bactericidal action ; in the meantime the sensory impulse of cough is held up until the bacilli are less numerous or until the bactericidal action is complete.

If the ether has been administered by intramuscular injection, it is impossible to ignore the possible effect of proteotherapy from the injured muscle tissue ; in the case of rectal injection this does not occur. Proteotherapy would thus seem to play no role in the success of ether therapy in whooping cough.

The results attained by the author, when considered along with the equally, if not more favourable results claimed by other observers may well lead us to believe that we have in ether a valuable remedy against a peculiarly repulsive disease. It is a remedy which is harmless in the doses given ; it seems to stand alone in aborting the serious respiratory complications of whooping cough. Though it is by no means a certain curative agent, the author will continue to use it to the exclusion of all other remedies, save possibly an expectorant mixture ; he is convinced that no other remedy can offer comparable results. In the cases of very young infants, ether tends to be unsuccessful in aborting the disease ; it is, however, significant that the progress of such patients is singularly free from complications.

The advantages attendant upon the rectal method of administration are obvious ; they will commend themselves to a busy practitioner.

Of the forty-three patients treated by the author, eight received no benefit from the treatment, a percentage of 18.5 . 46.6 per cent were adjudged cured as a result of the treatment, whilst 16.3 per cent were thought to be very much improved. Eight further patients, or 18.5 per cent,

were classed as "improved". A tabular statement of the results achieved by the author, together with those claimed by other observers will be found in the Appendix at the end of this volume.

It would be unfair to conclude any reference to therapeutic measures such as these without some mention of the cases of failure of ether to produce improvement in whooping cough. Most observers admit a certain proportion of unsuccessful cases ; the ratio is remarkably constant. Levy and Shapiro (65) found that only in a few cases did the paroxysms decline sharply in number ; the author has usually found the decline to be gradual . Levy and Shapiro, upon whose incidence of necrosis the author has found it necessary to comment in a previous chapter, apparently did not personally administer the injections.

Kassowitz (91) endeavoured to illustrate the futility of all treatment in whooping cough. He treated twin children who had coincidentally developed the disease ; one child received no treatment whatever, the other received apparently many forms of treatment in turn. Kassowitz claimed that at the end of a given period the untreated child had made the greater progress towards recovery ; it is worthy of note that the duration of the ether treatment was two days, consisting of only two injections, the amount of ether being two cubic centimetres.

The occurrence of sciatic nerve paralysis has already been noted. Lack of a moderate degree of success, at least, has in the main been rare.

Certain observers advise restriction in selecting the type of patient to whom they would administer ether in whooping cough. Some, deterred by the fear of necrosis, would reserve the treatment for infants and severe attacks of the disease. Bedo (52) and Bennett (71) are of this opinion ; they appear to have relied solely upon the method of intragluteal injection.

Such restrictions can only apply to this method of administration ; the author entirely agrees with these dicta, but on different grounds. He will continue to use the method of enemata of ether and oil per rectum, modified by emulsification. There can be no doubt as to the efficacy of a remedy which is able often to restore to complete health in a few days a child suffering from almost continuous cough and vomiting.

Whooping cough in the United States is a more mild disease than in Britain. It is therefore all the more to be regretted that there are available in British medical literature so few records of this method of treatment.

## CHAPTER FOURTEEN.

### SUMMARY AND CONCLUSIONS.

(1) We have in ether a harmless remedy for whooping cough ; a remedy which is almost always palliative and often curative.

(2) Control of vomiting and of the whoop are early attained in favourable cases. Complications are readily prevented ; if already present, they respond most satisfactorily to treatment. Morbid sequelae are avoided.

(3) Treatment given during the prodromal stage may abort the disease.

(4) The rectal method of administration should be used in all patients other than infants, in whom retention may be difficult. For rectal injection the ether should be mixed with an equal quantity of olive oil. Emulsification of this is to be preferred.

(5) The dose for infants should be one cubic centimetre intramuscularly. For rectal injection of patients over the age of twelve months one drachm of the ether oil mixture should be given for each year of the child's age. For this purpose the nearest year of

the child's age should be taken. It is easier to remember one drachm for each year of age than it is to remember the same dosage in centimetres.

(6) Injections should be given daily.

(7) Adenoids, if present, do not seem to prevent cure by ether.

(8) The beneficial action of ether in whooping cough is partly due to direct bactericidal action on the bacilli of the disease, and partly by blockage of the sensory receptive paths.

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NOTES OF CASES.

With graph, Appendix, Fig. 4 ; temperature chart,  
Appendix, Fig 1.

Marion Booth. Aged  $2\frac{1}{2}$  years , has had measles. No tonsillar not adenoid enlargement.

First seen 23.4. 26., along with sister Jessie.

History of cough for about ten days. Temp. evg 100.4 deg, with physical signs of light bronchopneumonia over lungs, with medium and faint bubbling crepitations. Good deal of vomiting. Paroxysms every hour or more. Very frequent in night, about 40 in 24 hours. Wakes every time she or sister coughs, has always been healthy child previously, cervical glands unenlarged. Epidemic present locally. Put to bed with bronchitis kettle, etc. Ether .75 c.c. intramusc. Pulse 112.

2nd day. Temp mng. 99.2 deg., pulse rate 94. Paroxysms so far to day 20, physical signs the same as yesterday. Vomiting frequent. Temp evg 101 deg. Pulse 118. Poult. chest. Ether restd. 1 c.c. intramusc. Paroxysms daily 40

3rd day.Temp. mng. 99 deg., pulse 96. Still vomits after each meal. Restd. ether 1 c.c. intramusc. Paroxysms daily about 25.. Had better night last night. Temp evg. 100.6 deg., pulse rate 108.

4th day.Temp. mng. is 98.2 deg., pulse 86. Vomiting has been less. Physical signs in chest improving, some harsh breath sounds, but no tubular breathing. Few med. crepitations still heard on expiration and inspiration. Child had good night, stopped poultice. Gave ether .75 c.c.. Daily spasms 15 . Temp. evg 99.6 deg, pulse 108 .  
5th day.Temp. mng. 98 deg., pulse 102. Vomiting absent last 24 hours. A few crepitations only, in chest.. Rept, ether .75 c.c.Temp. evg 98.8 deg., pulse 100. Daily paroxysms approximate 8.

6th day. Paroxysms have onlt been from 6 to 8 in the last 24 hours. Ptnt. had an unbroken night last night . Faint crepitations present, no vomiting. Repeated .75 c.c. ether. Temp. evg 98.8 deg., pulse 94.

7th day. Patient not seen by me, paroxysms about 4 and temperature normal mornign and evening.

8th day.Temp. this mng. normal Cough shows absence of whoop in one paroxysm excited by looking at fauces. Paroxysms about 4 last 24 hours and no vomiting. Sleep and appetite good. Repeated ether .5 c.c.

9th day.Improvement continues, cough is very mild and now non-paroxysmal. No vomiting, temp normal, stopped ether, put bed at open window.

11th day.Cough and vomiting negligible. No pyrexia and child able to sit out. Physical signs nearly gone.

13th day.To go downstairs, cough negligible and child appears to be putting on weight.

18th day. Completely cured. Ethereal odour has been present in breath every day when ether given.

Jessie Booth. Aged 4 years. Has had measles. No tonsils nor adenoids enlarged. First seen with sister Marion, with a history of cough for about 8 days. A suspicious whoop was heard by me, and an epidemic is at present in the neighbourhood. No vomiting so far. Temperature subnormal, a few moist sounds only in lungs. Healthy child previously. Total daily paroxysms about 19 to 20, mostly in daytime, about 4 in night. Ether intramuscularly 1 c.c., painful. 2nd day. Little change in cough. Repeated ether. Paroxysms about the same.

3rd day. Repeated ether, no vomiting so far to-day, no further development of whoop. Paroxysms about the same night or day, total still about 20.

4th day. Temp subnormal still, child has only had 4 paroxysms in the last 24 hours up to this evening. Has had some other minor cough but not paroxysmal. Repeated ether .75 c.c.. No physical signs lungs.

5th day. Repeated ether. No cough last night at all but had about 15 non-severe attacks yesterday. No physical signs chest, no vomiting, some coryza. Evening temperature subnormal.

6th day. No vomiting. Gave .6 c.c. of ether. Whoop and paroxysms almost non-existent. Cough is absent at night and in daytime is of a bronchial type only. No pyrexia.

8th day. Stopped ether, cough having almost gone. No physical signs and no vomiting. Appetite good and child is well and healthy.

11th day. Mother heard slight whoop once yesterday, but actual cough is no worse. Gave ether .75 c.c.

16th day. Cough practically disappeared.

30th day. Cough has been cured for about a fortnight.

Child seen three months later when neither she nor her sister showed any evidence of sequelae.

Jessie Husband. aged 3½ years. Has not had measles, tonsils and adenoids slightly enlarged.

First day. Seen with marked whooping cough, history of cough for seven days, and has not been well for a fortnight. Vomiting is present after most meals.

Paroxysms whilst not individually very severe, are numerous, about 40 in 24 hours. Evg Temp 99.4 deg. Cough worst at night. Whoop quite definite, physical signs in chest consist almost entirely of rales with an area of prolonged expiration at right base (possibly small area of lobular collapse from coughing). Some small deep cervical glands palpable. Treated by ether and olive oil per rectum, dr. 4 to-day.

2nd day. No injection.

3rd day. Ether has persisted in breath for 24 hours, mother thinks. (Doubtful). Child has only vomited once yesterday and not so far to-day. Paroxysms are about same numerically, perhaps not so severe each individually. Physical signs same.. Temp. 97.8 deg. Daily injections from now on. Repeated ether.

4th day. Repeated ether and oil dr.4. Vomiting was absent yesterday, only four paroxysms last night, child looks better.

5th day. No physical signs chest, child slept much better. Total paroxysms in 24 hours about 20.. To go out. Vomited once after a heavier meal yestrday. Temp. 98.8 deg. evg.

6th day. No vomiting, had good night. Paroxysms 20.

7th day. Paroxysms much less, only 1 last night, two up till noon to-day. Repeated ether, physical signs chest limited to prolonged expiration (suspect some glandular tubercle chest).

8th day. Yesterday paroxysms were much diminished and whoop practically disappeared. Spasms about 5 in 24 hours. No rales chest, no vomiting during last three days.

10th day. No whoop, occasional non-paroxysmal cough only.

12th day. No whoop, cough as above still persists. Bromide given with belladonna and expectorants.

18th day. Slight cough only No physical signs chest other than the slightly prolonged expiration. No accompaniments. Weight 36 lbs 12 ozs.

30th day. Faint cough only present Glands almost impalpable, no physical signs anywhere.

42nd day. Gained a little weight.(2 ozs.).

No cough, no glands are palpable.

54th day. No cough whatever.



Baby Oates. Aged four months. Not had measles ; no tonsillar nor adenoid enlargement.. Weight at birth seven lbs?

First day. Seen with a well-developed paroxysmal cough and whoop, weight now being about  $8\frac{1}{2}$  lbs. Child is rather emaciated and has been sick for days, it is difficult to get the child to retain feeds at all. Spasms are very insistent and severe, one in my presence almost appearing as if it might prove fatal. Child was at once given per rectum dr.  $\frac{1}{2}$  of the oil and ether mixture and put on to belladonna and small feeds every hour or even half hour. Daily paroxysms about 35.

2nd day. Repeated ether. No pyrexia, no drowsiness. Paroxysms 35. Vomiting less, only twice to-day.

3rd day. Repeated ether, vomiting is improving, Paroxysms about 25, no pyrexia, no drowsiness.

4th day. Repeated ether, no vomiting, no pyrexia. Paroxysms about 25 again. No drowsiness, there have no acutely severe spasms such as before treatment.

5th day. Repeated ether and oil, but gave minims 40. Paroxysms about 25.

6th day. Repeated ether and oil, minims 40. No drowsiness, paroxysms about the same.

7th day. Repeated ether mixture, minims 40. Paroxysms rather less severe, but still about 25 daily.

8th day. Repeated same dose of ether, all conditions about the same.

9th day. Stopped ether, as improvement is not great. Paroxysms still about 25 daily.

10th day. Not seen.

12th day. No improvement is apparent thus far as a result of the ether, except perhaps, diminution of the vomiting, diminution in intensity of spasms and better nights.

21st day. Normal course of the disease is apparently being run here. Doubtful retention may be cause of the failure, and bowels have been moved frequently, many times with cough.

2 months later. Good recovery, and putting on weight.

6 months later, complete absence of sequelae.

Ted Dugdale. Aged 2½ years, has had measles and has a good deal of tonsillar enlargement, with adenoids.  
First day. Strong healthy child with definite, whoop, cough, and vomiting after almost each meal. No pyrexia in evening. Daily paroxysms about I4. Has had the cough for some days and whoop for 2 to 3 days, probably infected from other children playing in street. No tuberculous glands anywhere, appetite good. Gave ether and olive oil dr 3 per rectum.

2nd day. Apyrexial, no vomiting. Repeated ether and oil otherwise symptoms the same, paroxysms about I2 or I3.

3rd day. Apyrexial morning. Repeated ether and oil, had a better night, paroxysms aggregate about I0.

4th day. Apyrexial evening. Repeated ether, no vomiting. Paroxysms I2 approx.. No physical signs lungs otherwise symptoms much the same.

5th day. Same as yesterday, repeated ether as before.

6th day. Cough about the same, repeated ether. Paroxysms I0 to I2, otherwise symptoms as before. No vomiting, no pyrexia, no physical signs.

7th day. Repeated ether, cough better last night. Daily paroxysms I2 to I4. No pyrexia, always constipated but ether well retained.

8th day. Stopped ether, cough about the same. Paroxysms about I0 to I2 daily.

I4th day. Cough has gradually become less paroxysmal. Daily spasms 5 to 6. Child otherwise well, has vomited once or twice.

21st day. Cough negligible.

Child was quite well, a year later.

Dugdale, Ruth. Aged 4½ years. Has had measles and has now enlarged tonsils and also adenoids.

First day. This child was seen two days ago with brother who has definite whooping cough. Cough in sister's case was suspicious, but decided to wait until whoop appeared. She is a tubercular type of child with glands of small shotty discreet type, on both sides of the neck. Pyrexial, temperature evg. being 101 deg. Pulse 118. Suspicious area dulness left base with crepitations on inspiration. Expiration prolonged and rather bronchial. V.R. slightly increased. Has vomited about once daily so far, cough is mostly present in night. Gave ether and oil dr. 5 per rectum, well retained. Paroxysms about 19 to 20 daily.

2nd day. Physical signs cleared up slightly, probably small area of collapse, but there are also crepitations in right axillary region. Temp. mng 98.8 degg. Pulse 102 (doubtful, child restless). Temp. evg. 100.4 deg. Repeated ether and oil. Has vomited twice, whoop not so marked. Paroxysms 20 to 22.

3rd day. Temp. mng. 99.2 deg., physical signs now clearing up with fewer crepitations. No dulness either side now, But (?) some due to glands at left of vertebral column.. Breath sounds seem harsh at left base and in left upper lobe posteriorly. Temp. evg. 100.4 deg. Repeated ether and oil. Cough better to-day, spasms are only about 16.

4th day. Temp. mng. 98.2 deg. Chest clearing up. Moist and coarser crepitations. No vomiting, whoop still present, but not so insistent. Tongue moist. Temp. evg 99.6 deg.. Repeated ether, daily paroxysms about 14.

5th day. Apyrexial morning and evening. Cough is much improved and coughing bouts are not so long. Daily spasms about 10. No vomiting. Repeated ether and oil. A few crepitations, mainly left-sided.

6th day. Repeated ether. Apyrexial morning and evg. No vomiting, chest is clearer. Daily paroxysms 6 to 8.

7th day. Repeated ether. No pyrexia mng, evg 98.8 deg. Whoop negligible, paroxysms 6 to 8.

8th day. Repeated ether. No cough last night. Whooped only once last 24 hours, otherwise slight cough present. No pyrexia, Paroxysms 4 to 5.

9th day. Cough very much improved, no whoop present last 24 hours. Stop ether. No crepitations in chest but breath sounds still tend to harshness. Spasms 4 to 5.

11th day. Apyrexial, to get up. No whoop, no crepitations. Harsh sounds still present. "Spasms" about 4.

Cough subsequently disappeared in about a week during which it was of such a type that it was not looked upon as a "real cough" by the mother. Child a year later was much improved, but still had a few glands in neck.

Baby Higginbottom. Has not had measles. Aged  $2\frac{1}{2}$  years. Tonsils not enlarged, no adenoids.

First seen. when child had had whoop for about 4 to 5 days and had been whooping for some the whole of this time. Cough was present previous to that. Temp. 99.6 deg., pulse 128. Child has vomited about twice daily previously, and the catarrhal symptoms are very marked, eyes and lids being very suffused.. Physical signs of patch of pneumonia on right side only ; child takes food readily. Ether and oil given dr. 2 per rectum. Temp. evg. 99.2 deg., pulse 114. Paroxysms daily 12 to 14.

2nd day. Repeated ether, vomiting is about the same. One large subconjunctival haemorrhage. Breath sounds are harsh upon the right side, and a few further crepitations are present at one point. Poulticed. Temp. evg 99.8 deg., resp. 42. Daily spasms about 12.

3rd day. Apyrexial morning. Repeated ether. Physical signs chest rather improved . Resp. mng. 44, alae nasi moving slightly. Temp 99.4 deg evg.. Whoop still spasmodic, has no actual vomiting, but has retched a little without returning food. Ether noticeable in the breath. Spasms 12. Ecchymosis other eye, under lid.

4th day. Temperature not raised mng. or evg., Repeated ether. Respirations 36 and 38 respectively. Slept some hours unawakened by cough. Physical signs almost quiescent, only occasional crepitations heard.

5th day. Apyrexial. Respirations quiet, there are no physical signs in the lungs. No vomiting, only two spasms coughing last night. Repeated ether, whoop is more mild. Paroxysms about 10 daily.

6th day. Child vomited slightly twice, no physical signs chest., repeated the ether, whoop is absent from some paroxysms. Condition apyrexial.

7th day. More or less same as yesterday, has also had a severe attack of epistaxis .Repeated ether, paroxysms number about 8 to 10.

8th day. Stopped ether, whoop is very slight, but cough still apt to be paroxysmal. Chest clear of signs, condition otherwise the same.

9th day. No vomiting last three days. Gave ether 2 c.c. intramuscularly, thinking cough was paroxysmal yesterday. Spasms last 24 hours were about 5 to 6, child had a good night, no pyrexia present.

11th day. Repeated ether intramuscularly, daily spasms about 4 to 5. No whoop nor vomiting, appetite good, child allowed up ; stopped ether again.

14th day. No vomiting, daily spasms 2 to 3.

16th day. 2 to 3 paroxysms daily.

18th day. Child has not coughed for 24 hours.

Child was quite well about one year later.

Joan Tunnicliffe. Aged 9 years. Has had measles. No tonsillar nor adenoid enlargement.

First seen. Child had had a bad cough for the last seven days and has been treated medically before whoop appeared to show true nature of cough. This first whoop appeared yesterday, and it is becoming more characteristic with each coughing spasm. Paroxysms were severe last night. Child vomited twice to-day and has also complained of nausea at the time of practically all spasms of coughing. No physical signs chest. Paroxysms about 20 daily. Child is afebrile, respiration rate normal. Gave ether and oil one ounce per rectum.

2nd day. Whoop more distinct and occurs now on occasion of almost every paroxysm. Cough worst at night, there is no pyrexia. Repeated ether, constant nausea is present. Child vomited twice in last 24 hours.

3rd day. Cough has now constant whoop. Child coughed every hour last night. No pyrexia, no physical signs of importance. Paroxysms number 20. Appetite is better; vomited once only during last 24 hours.

4th day Vomiting absent so far to-day. Cough about the same, whoop also similar to yesterday. Paroxysms 15. Repeated ether. Child did not have good night.

5th day. Vomiting and nausea absent. Repeated ether, paroxysms 22, cough whoop and other symptoms are all about the same.

6th day. Whoop not quite so bad to-day. Pyrexia is absent and there is no vomiting. Paroxysms about 15. Ether repeated, no further physical signs chest.

7th day. Whoop same as before, vomiting absent. No pyrexia, paroxysms number about 22 daily. Repeated ether.

8th day. Repeated ether, cough same as yesterday. Daily spasms 20. Vomiting absent, better night, no further physical signs.

10th day. Repeated ether, cough no better, nor is the whoop. Paroxysms 22 to 24 daily. Retention of ether seems normal. Some slight epistaxis two days ago, but otherwise no complications are present.

12th day. Stopped ether, cough no better. Spasms 20.

16th day. Cough a little better, less whoop, but this seems the usual process of decline, however.

21st day. Cough rather improving

28th day. Paroxysms daily are now about 2 to 3.

37th day. Cough now negligible.

George Torkington. Aged 3 years. Some tonsillar and adenoidal enlargement, which is not marked. May have had measles. First seen with spasmodic cough and quite marked whoop. Cough is worst at night. Vomits three to four times daily. Ether and olive oil dr. 3 per rectum. Nothing else abnormal. Paroxysms about 26.

2nd day. Ether has been present in breath, child has vomited twice. No pyrexia, nothing else of note. Repeated ether. Paroxysms about 20.

3rd day. Repeated ether, which has been marked in breath. Apyrexial, no cough at all last night. Paroxysms about 18.

4th day. Apyrexial still. Repeated ether.

5th day. Cough very much improved, whoop only present on about half the number of occasions on which child coughs. Fthereal odour breath. Vomiting absent. Paroxysms about 8. Repeated ether.

6th day. Cough is very much improved. Repeated ether. Paroxysms daily 5. Otherwise symptoms same.

7th day. Cough is non-paroxysmal and comes on every hour or so, but does not now distress child much. Repeated ether. Real paroxysms absent.

8th day. Stopped ether, cough being very mild and is practically cured. Paroxysms considered absent.

12th day. Some return of whoop., gave another enema of ether.

13th day. Repeated ether again.

15th day. Cough ceasing again.

21st day. No return of cough. No enlargement cervical glands at any time..

This child was well six months afterwards.

Case 10.

Baby Torkington. Aged 15 months. No tonsillar nor adenoidal enlargement. Has not had measles. Brother has got definite whooping cough.

1st day. Has cough and some whoop, have waited until this developed. Cough worse in night, but is then not always paroxysmal. Vomits after each meal, about five times daily. Cervical glands unenlarged. Paroxysms number 16. No pyrexia, although some while waiting for whoop to develop. A few rales both lungs. Mother particularly alarmed at what was apparently a convulsion yesterday. Gave ether and olive oil dr.  $1\frac{1}{2}$  per rectum.

2nd day. Has whooped during most paroxysms. No pyrexia, no fresh signs nor symptoms. Repeated ether. Spasms 16.

3rd day. Cough not so spasmodic, no other fresh signs. Paroxysms about 14, vomiting improved, no pyrexia.

4th day. Cough less spasmodic still, and child not so cyanotic in spasms, which do not last so long. No drowsiness, otherwise nothing to note. Repeated ether. Daily paroxysms about 12.

5th day. Cough rather improved and less spasmodic, whoop is also lessening. No complications, repeated ether. Paroxysms about 12 today also.

6th day. Cough still rather better, and child is not whooping every time. No further vomiting. Appetite fair. Repeated ether. daily paroxysms about 10.

7th day. Cough less insistent; repeated ether. The paroxysms are still present, however, about 10 daily. Otherwise no change.

8th day Repeated ether; no complications thus far. Paroxysms about 10, whoop is not always present, but the number of paroxysms is about the same. Child otherwise comfortable.

9th day. Child much the same, repeated ether. Paroxysms about 10.

10th day. About the same as yesterday. Paroxysms 10. Repeated ether.

11th day. Repeated ether, no drowsiness, cough is less insistent and whoop mild. Paroxysms about 10.

12th day. Stopped ether. Paroxysms about 12, but mild.

13th day. Not seen.

14th day. Paroxysms still about 10 daily.

18th day. Paroxysms gradually declining

21st day. Paroxysms two.

28th day. Cough disappeared.

Measles followed a short time afterwards.

Kathleen Jackson. Aged 18 months. Has not had measles. Tonsils and adenoids not pathological.

First day. Seen along with brother, both having present both definite cough and whoop. This child has had whoop for 4 days. Home conditions are bad with only one living room. No pyrexia. Child is quite cheerful or sleeps in between spasms. Vomiting after most meals. Epidemic present in neighbourhood. Child well-nourished and looks healthy. Ether intramuscularly 1 c.c.; some sensitiveness afterwards. Cough worst at night. Daily paroxysms are about 10 to 12.

2nd day. Cough about the same, repeated ether. Daily paroxysms 10. Faint rhonchi heard in chest, whoop is rather insistent. Vomited twice, otherwise has retained food well. No pyrexia.

3rd day. Cough slightly improved, daily paroxysms are about 10; spasms, however, are not so prolonged and do not seem to produce so much cyanosis. Mother agrees with this. Chest shows no physical signs. No pyrexia, child has vomited only once, repeated ether.

4th day. Cough improving, complications absent, no ecchymosis, nor epistaxis. No vomiting; repeated ether. Child had excellent night. Daily paroxysms about 6.

5th day. Cough improving, repeated ether. Child had a good night. Whoop not always present, and cyanotic facies is absent from most paroxysms. These number about 6. No vomiting; repeated ether.

6th day. Child not seen.

7th day. Cough almost non-paroxysmal and no whoop is present, except occasionally. No vomiting, appetite is good. Daily paroxysms about 3, ether repeated.

9th day. Cough much improved and nearly absent.

11th day. Cough cured, no complications or sequelae so far.

Child quite well up to three months later.

10th day. Child well up to three months later, but has disappeared.

Three months later child was quite well and had gained weight.



Norman Jackson. Aged  $2\frac{1}{2}$  years, has had measles. Is a mouth-breather, but tonsils and adenoids do not seem abnormally large.

First day. Seen along with sister with quite a definite cough and whoop, the latter of 5 days duration. Both seem to have been infected together. Home conditions not good (see sister's case notes). No pyrexia and child runs about and plays quite cheerfully.. Local epidemic of whooping cough. No physical signs heard in chest to-day. Child is fairly healthy otherwise, and is well nourished. Gave ether intramuscularly 1.5 c.c., a good deal of pain afterwards. Cough is worst at night and daily paroxysms are about 15 to 16 in the 24 hours.

2nd day.. Cough is about the same, repeated ether. Few rhonchi present chest. Daily paroxysms are about 14. Cough more paroxysmal and nose has bled in one spasm. Temp. subnormal mng. and evg.. Vomited three times.

3rd day. Cough very convulsive ; after one spasm the mother described what might have been a convulsion of the carpo-pedal type ( child is not obviously ricketty). Repeated ether, 2 c.c. Paroxysms less in number, about 10 ; child vomited twice.

4th day. Cough less convulsive and no vomiting in the last 24 hours. Repeated 2 c.c. ether intramuscularly. No epistaxis, child much happier. No pyrexia and is feeding better. Paroxysms about 6 last 24 hours.

5th day. Cough is dramatically improved and child seems and looks much better (facies, etc.). Pyrexia absent, also physical signs chest. Repeated ether  $1\frac{1}{2}$  c.c. intramuscularly. Daily paroxysms about 3.

6th day. Improvement maintained, and there is now no whoop apparent. No vomiting nor convulsive cough. Repeated ether. Paroxysms nil.

7th day. Repeated ether, improvement has been maintained, all other possible symptoms are still in subjection. Paroxysms daily 3 to 4.

8th day. Stopped ether ; improvement continues. In last 24 hours paroxysms have been about 3.

10th day. Child well to outward appearance, and cough has disappeared.

Three months later child was quite well and has gained weight

Mary Shepherd. Aged  $3\frac{1}{2}$  years, has not had measles.

No obvious tonsil nor adenoid enlargement.

First seen. With cough and definite whoop, and is having about 14 paroxysms in the 24 hours. Vomiting is mostly present in the morning and evening. No pyrexia, and no physical signs of note are present in the lungs. Ether and olive oil given per rectum, dr. 4.

2nd day. Cough about the same, with whoop and both were severe last night. Vomiting is rather worse, otherwise general condition unaltered.. Paroxysms number about 16, ether repeated.

3rd day. Repeated ether, all symptoms same as yesterday. Paroxysms have been about 14 in the last 24 hours.

4th day. Repeated ether. Vomiting seems improved, only being present twice in the last 24 hours. No pyrexia, child had a better night ; paroxysms about 12 daily.

5th day. Repeated ether. Whoop is not always present. Child had a good night, nothing else of note. Spasms have numbered about 10 in the last 24 hours.

6th day. Repeated ether, whoop not always present. Child had a good night, nothing else of note. Daily paroxysms have numbered about 10.

7th day. Ether repeated, symptoms same as yesterday. Paroxysms number 8 to 10.

8th day. Whoop negligible but cough still tends to be paroxysmal, spasms numbering 8 to 10. Ether repeated. no vomiting since fifth day.

9th day. Whoop still almost absent and cough is less paroxysmal. There are about 6 or 8 paroxysms in the 24 hours, these are of short duration. No haemorrhages have so far occurred. Child otherwise well.

10th day. Ether stopped, cough still improved, no whoop present. Child otherwise well, coughs about 6 or 7 times daily, without whooping.

12th day. Cough negligible, no whoop, no further vomiting.

15th day. Cough has now disappeared .

No sequelae here, up to one year later.

Geoffrey Hart. Aged 5 years. Has had measles. Had tonsils removed with guillotine about a year ago, no adenoids remain.

First day. Good deal of cough present with whoop. Has vomited about eight times yesterday. Temp. 99.2 deg. evg.. Administered ether and oil dr. 5 per rectum, this was well retained, child is a good patient. There are moist sounds present in the right lung mainly and the breath sounds are prolonged at right apex. Child has enlarged cervical glands and is thin, bronchial glands possibly also enlarged. Daily paroxysms 23.

2nd day. Apyrexial mng. Temp 99.2 deg. evg.. Repeated ether, cough about the same. Daily paroxysms have been 20. Child vomited twice yesterday and had a bad night from effects of cough.

3rd day. Repeated ether, cough and physical signs same. Vomited twice yesterday, whoop always present with cough. Daily paroxysms are about 20 to 25.

4th day. Repeated ether, cough much the same, likewise physical signs. Vomited once yesterday. Bad night, with a good deal of coughing. Whoop troublesome.

5th day. Cough no worse, physical signs about the same. No vomiting, daily paroxysms 20.

6th day. Cough has been a little alleviated, daily paroxysms are 22, has not whooped each time of coughing. Temp. raised again to-night, 99 deg.

7th day. Cough about the same, ether repeated each day. Physical signs unchanged. No vomiting, whoop is again invariably present.. Daily spasms 22 to 25.

8th day. Temp. evg. 99.6 deg. Whoop not so insistent. Cough about the same, daily paroxysms 20. Cough is bad at night, ether repeated, no vomiting.

9th day. Repeated ether. Symptoms very much the same, but there has been no vomiting. Paroxysms more than 20.

10th day. No real improvement. No vomiting, child is taking food better, whoop still present, stopped ether. Daily paroxysms 16 to 18.

18th day. Cough is now declining a little and is much the same. It is suspected that bronchial glands may be prolonging the cough.

28th day. Cough is still paroxysmal.

Three months later, child still occasionally subject to a paroxysmal cough; he is having treatment for glandular tubercle.

Margaret Hart. Aged 7 years. Has Had measles. No palpable cervical glands. Tonsils have been removed with guillotine ; no adenoids remain.

First seen with cough and with mild, not very convulsive whoop. Vomiting about 3 or 4 times daily. Cough worst at nights, paroxysms about 14 in 24 hours. Gave ether and oil dr. 7 per rectum, this was well retained.

2nd day. Repeated ether, cough about the same. No pyrexia so far. Vomited once yesterday. Whoop is constantly present with the cough. Paroxysms are 14 to 15 in the 24 hours.

3rd day. Repeated ether, cough is about the same. Whoop, however, is rather less insistent, vomiting is absent. No pyrexia.

4th day. Cough rather improved, but whoop is still present. Better nights last two nights. Repeated ether. Vomiting absent, paroxysms number about 12.

5th day. Cough no worse, had a few paroxysms without whoop. Repeated ether. No pyrexia, no vomiting, the paroxysms number 11 or 12.

6th day. Cough seems again improved, whoop is still present. Better nights last two nights. Repeated ether. No vomiting. Paroxysms 10 to 12.

7th day. Cough still improved, no vomiting. Ether repeated. No pyrexia. Whoop is not always present now. Daily paroxysms 6 to 7.

8th day. Cough still improving, almost non-paroxysmal now. "Paroxysms" daily 4 to 5.. Other cough is still present, however, slight and unimportant.. No vomiting, child is brighter. Good nights now. Ether repeated.

9th day. Cough non-paroxysmal and no vomiting. Cough rather after type of tracheitis or bronchitis and mild. Ether stopped. Paroxysms nil.

12th day. Mild bronchial cough, no paroxysms.

Child was well six months afterwards.

Case 16.

John Ollerenshaw. Aged 5 years. No tonsillar nor adenoid enlargement. Had measles some time ago.

First seen. With cough and whoop contracted at school and baby now has prodromata developing. This child's cough is worse at night, when it is more paroxysmal. Vomiting present after breakfast, and also usually on first coughing after going to bed at night. No pyrexia. Daily paroxysms are about 15. Thin, rather anaemic, and pinched-looking child, with some small discreet shotty glands in the posterior triangle of the neck, especially on the left side. No sputum, but a few rales heard in chest. Gave ether and olive oil per rectum dr. 5.

2nd day. Repeated ether, cough rather improved perhaps but much about the same. No further physical signs chest. Daily paroxysms about 15.

3rd day. Repeated ether. Cough rather improved and whoop is not so noticeable. Symptoms otherwise as before. Daily paroxysms about 12.

4th day. Repeated ether, whoop seems to be lessening. No pyrexia, paroxysms about 11 to 12.

5th day. Repeated ether. Vomiting almost absent, and is mild. Paroxysms number about 10 daily.

6th day. Repeated ether, paroxysms are about 5 daily.

7th day. Repeated ether. Paroxysms very dramatically reduced yesterday and to-day are again only 4 to 5 in the 24 hours. Last night no cough whatsoever. Vomiting absent.

8th day. Improvement continued, repeated ether. Daily paroxysms 3 to 4.

10th day. Iss now no paroxysmal cough, nor any whoop. Stopped ether.

14th day. Cough entirely absent.

Six months later, cervical glands are still present, treatment has been rather neglected.

Case 17.

Baby Ollerenshaw. Aged 6 months. Not had measles. No tonsillar nor adenoid enlargement. Weight not accurately known.

First day. Brother in house with whooping cough, but have waited in this case for prodromata to materialise to paroxysmal stage before giving ether. Mild whoop was first heard to-day and ether and olive oil was given per rectum, dose minims 45.. Many rales and moist sounds heard in lungs, all over. Child is coughing a good deal. Temp. evg. 99.8 deg.. Breathing not hurried. Paroxysms (real) about 8 in the 24 hours. Vomited once yesterday.

2nd day. Repeated ether same dose, child has not been drowsy, but has vomited all feeds to-day.. Chest full of moist sounds and some bronchitis is present. Temp. mng. 98.8 deg., evg 100.6 deg. Respirations a little hurried (40 per minute). Paroxysms number about 16.

3rd day. Whoop not quite so insistent. Temp. mng. 99 deg., evg. 99.4 deg.. Paroxysms number 14. Ether repeated, retention is good. Chest condition seems less acute to-day. Vomiting possibly better, food is being given in small amounts.

4th day. Temp mng 98.4 deg, evg. 99.2 deg... Repeated ether, respiration rate now not abnormal, lungs are clearing. Child had a good night. Vomited twice last 24 hours.. Cough seems less convulsive to-day and paroxysms numbered about 12.

5th day. Whoop still invariably present with each paroxysm, but chest much clearer. Paroxysms were about 16 in number. Child has vomited three times.

6th day. Chest condition improved, respirations not embarrassed, whoop still present. Repeated ether, giving dr. 1. Spasms numbered 18. Temp. evg. 98.6 deg, mng. 98.2. deg..

7th day. Repeated ether dr. 1, Respiratory symptoms are quiescent. Paroxysms 15. Temp mng. 97.8 deg., evg. 98.

8th day. Vomited only once yesterday. Paroxysms are more mild, daily about 14. Child still whooping, chest condition is quiescent.. Whoop rather more mild. Temp mng. 98.2 deg., evg 98.6 deg.. Repeated ether.

9th day. Repeated ether. Both temperatures subnormal. Paroxysms 12 to 14 in number, cough much the same to-day.

10th day. No improvement in cough, stopped ether.

12th day. Child still coughing and whooping. Try benzyl benzoate.

26th day. Cough is only just clearing up, child being well, but ether seems to have made no difference, The patient is still whooping now and again ; the chest is clear of physical signs.

Kathleen Howarth. No tonsils nor adenoids. Aged  $4\frac{1}{2}$  years. Has had measles, not recently.

First seen with cough and suspicious whoop; had had prodromal catarrh for some days, and has been exposed to virulent infection at school. No pyrexia. Temp. evg 98.2 deg. Cervical glands unenlarged. Cough is worst at night. Ether and olive oil dr. 4 per rectum. Retention was bad. Daily paroxysms numbered 22.

2nd day. Whoop definitely heard, cough spasmodic and patient vomited to-day. Temp. mng. 98.6 deg., evg. 99.2 deg.. Appetite good, and has slept well but for cough. Repeated ether and oil, same dose. Odor present in breath. Daily paroxysms about 20.

3rd day. Cough developing somewhat. Temp. mng. 98 deg., evg. 99 deg.. Vomited once last night and thrice to-day. Daily paroxysms about 20. Repeated ether.

4th day. Cough about the same. Temp. 98.2 and 98.6 deg mng. and evg. respectively. Had better night. Paroxysms were not exceptionally severe, but frequent vomiting present. Ether repeated. Paroxysms about 20.

5th day. Cough rather better. Temp. mng. and evg are 98.2 and 97.8 deg. respectively. Still vomiting after meals. More paroxysms occur by night than by day. Repeated ether, daily paroxysms number 18.

6th day. Temp. mng. and evg. 97.6 and 98 deg. respectively. Vomiting is fairly constant after meals. Cough still worst at night. Repeated ether. Child is losing weight. Few rales only are present in lungs. Daily paroxysms 18 to 20.

7th day. Temp. subnormal mng. and evg.. Vomiting is improved, but still present. Repeated ether.. Daily paroxysms about 15.

8th day. Repeated ether. Cough is not so severe and whoop rather less. Apyrexial.. Daily paroxysms 15.

9th day. Cough improving further, no physical signs present in lungs. Apyrexial. Ether repeated. Daily paroxysms about 12.

10th day. Cough again improved. Vomiting less, repeated ether. Daily paroxysms 12.

11th day. Stopped ether here. Cough markedly diminished in intensity, no vomiting yesterday. Daily paroxysms about 8.

13th day. Cough about the same as two days ago, child well otherwise, paroxysms 6 to 8 daily.

17th day. Cough has disappeared except very occasionally. Slight whoop, which is not always heard. No sequelae are present. No enlarged glands neck or elsewhere.

Patient was quite well a month after first cough. No sequelae up to 2 years afterwards. Child nervous and apt to cry, retention in the earlier days was not good.

Alice Howarth. Aged  $3\frac{1}{2}$  years, Tonsillar tissues normal, no adenoids. Not had measles, and has exhibited particular resistance to a definite and recent measles infection (infected nurse in same room).

First seen with cough and prodromate of what was known to be whooping cough. Elder sister definitely diagnosed as pertussis, from whom contracted. No vomitus as yet, no pyrexia, cervical glands unenlarged. Cough worse daytime., no whoop has yet developed. Ether and oil dr.  $3\frac{1}{2}$  per rectum.

2nd day. Whoop definitely heard and cough is more spasmodic. No vomiting so far. Apyrexial. Fair appetite, child slept well but for cough. Repeated ether; odour has been present in breath markedly. Daily paroxysms about 22.

3rd day. Cough developing, temperature subnormal mng. and evg.. Appetite fair. Vomited last night 10 p.m. once only. Now whooping, repeated ether. Daily paroxysms number 20 to 25. A few rales present lungs.

4th day. Cough about the same, apyrexial. Vomited several times.. Repeated ether. Paroxysms are now about 20 daily and are severe and distressing.

5th day. Repeated ether. Temp subnormal mng. and evg.. Cough same as yesterday, no further physical signs. Daily paroxysms about 20.

6th day. Apyrexial. Cough has been very distressing and there is an area of (?) collapse in the right lung in midaxillary line over 4th rib. Repeated ether, patient kept to bed. Paroxysms daily 24.

7th day. Repeated ether. Lobular collapse appear definite in area mentioned, also in another area at base of right lung. These are causing no real symptoms.. Temp. mng. subnormal, evg. 99.2 deg..

Repeated ether dr. 5.. Vomited twice, but whoop is not so insistent. Daily paroxysms about 20 to 24.

8th day. No vomiting yesterday, appetite improved, cough less insistent. Daily paroxysms 20. Temp. mng 98.4 deg., evg. 99 deg.. Repeated ether.

9th day. Cough about same, repeated ether. Breath sounds clearer over collapsed areas, no crepitations. Daily paroxysms about 20.

10th day. Cough lessening, repeated ether.

11th day. Had one bad coughing attack last night and vomited, cough is otherwise improved. No other vomiting. Repeated ether.. Daily paroxysms 10.

12th day. Stopped ether, no vomiting. Daily spasms about 12, lung expanded at areas mentioned.

14th day. Good nights, vomiting gone, whoop almost gone. Daily paroxysms about 4.

19th day. Cough almost gone, very slight indeed. No cervical adenitis and no sequelae.

Tonsils and adenoids removed later, at age 5, owing to great enlargement.



Barbara Howarth. Aged  $3\frac{1}{2}$  years. Not had measles, and has exhibited same recent resistance as twin sister, noted in Case 19. No tonsillar nor adenoid enlargement. First seen. with cough and suspicious whoop, has had prodromal catarrh for some days. Has vomited once. No pyrexia, no cervical adenitis. Cough worse daytime. Gave ether and olive oil dr.  $3\frac{1}{2}$  per rectum.

2nd day. Temp. mng. 97.4 deg., evg. 99 deg.. No vomiting so far to-day, but appetite poor; has had a bad night. Ether odour noticeable breath, has had dose of ether repeated. Rales are present in lungs. Daily paroxysms are about 30.

3rd day. Cough still developing, vomited twice last night and is whooping badly. Repeated ether. Temp. subnormal mng., 98.8 deg. evg.. Paroxysms 25.

4th day. Cough about the same. Morning and evening temperatures subnormal.. Cervical glands swollen. Repeated ether. Cough severe and distressing. Vomited three times, cough severe and distressing. Daily paroxysms about 25.

5th day. Ether repeated. Apyrexial, cough about the same.. Vomiting absent, no further signs lungs. Paroxysms about 20.

6th day. Apyrexial. Cough distressing, no vomiting although attempts at same. Paroxysms about 20.

7th day. Ether repeated to-day and yesterday. Cough rather better last night. Temp. both subnormal. Vomiting again troublesome, whoop insistent. Daily paroxysms 20.

8th day. Vomiting is troublesome, appetite good. Not much loss of weight apparent. Repeated ether, apyrexial, paroxysms 18, whoop less insistent.

9th day. Condition roughly the same.. Temp evg. 100.4 deg.. Child complains of sore throat, right tonsil rather red. Repeated ether. Paroxysms 20

10th day. Cervical glands still present, cough about the same. Repeated ether. Temp. mng 98.2 deg., evg 98 deg.. No vomiting Yesterdays temperature rise possibly due to constipation, but some mild tonsillitis was present.

11th day Cough about the same, repeated ether, no vomiting

12th day. Stop ether, no vomiting, cough much better. Paroxysms 20, but mostly slight.

13th day. Cough gradually lessening, paroxysms about 10.

14th day. Condition about same as yesterday.

18th day. Cough still lessening. Paroxysms 10.

20th day. Cough negligible, no whoop, cervical glands almost impalpable. No vomiting; good nights.

28th day. Cured now.

Great hypertrophy tonsils and adenoids  $1\frac{1}{2}$  years afterwards - enucleated. Child otherwise well.

Teddy Holman. Aged 2½ years. Not had measles. No obviously enlarged tonsils nor adenoids.

First seen with catarrhal prodromate of pertussis, in presence of definitely suggestive cough in sister and brother, with known exposure of the two latter to infection at school. No physical signs lungs of note. Temp. 98.8 deg.. Running nose, suffused eyes, etc. Slight cough present, no enlarged cervical glands. Troubled nights, appetite unimpaired. Pertussis vaccine 100 millions. Ether and olive oil ar. 3, child confined to bed. Paroxysms nil.

2nd day. Repeated ether and oil per rectum as before. Cough no worse, still non-paroxysmal. Temp 99.8 deg. this evg. Has had restless night last night.

3rd day. Better night last night, no whoop nor vomiting. Repeated ether. no pyrexia.

4th day. Temp evg 98 deg.. No whoop, and cough is improved. Repeated ether, coryzal symptoms less.

5th day. Pertussis vaccine 300 millions. Cough as yesterday, no whoop, no vomiting. Repeated ether, child had good night last night.

6th day. Cough improving; child allowed up. Mother reports cough much less troublesome. No whoop yet developed, no vomiting. Repeated ether. Apyrexial.

7th day. Temp. normal evg. Good night last night, no whoop, no sickness so far. Repeated ether.

8th day. Cough still improving. Temp. subnormal; no whoop; repeated ether.

9th day. Cough still diminishing, child very active and cheerful, stopped ether to-day. Temp. 97.2 deg. mng.

11th day. Cough negligible; pertussis vaccine 500 mils.

15th day. Cough practically nil.

18th day. Coughed twice only to-day.

23rd day. Cough cured; child well and active.

Child constantly observed for several months afterwards and was thus known to be in good health.

Bobby Holman. Aged 5 years. Has had measles. Tonsils and adenoids somewhat enlarged, will probably want interference in future.

First day. Seen along with brother and sister as noted. Has a similar cough to sister and also a suspicious whoop. Paroxysms also few in night, daily number is about 15. No pyrexia, temp. mng. being 97.4 deg..

Thin child with poor appetite and enlarged cervical glands. Possibly tubercular infection hilum lung, or possibly only glands. Physical signs limited to prolonged expiration right apex, plus a few rales generally. No sputum. Pertussis vaccine 100 millions Ether and oil dr. 6 retained well, in emulsion form. No vomiting, complained of slight pain after enema.

2nd day. Repeated ether, no pyrexia, Physical signs as yesterday, cough about the same. Paroxysms about 20.

3rd day. Cough just about the same, no further development whoop. Temp subnormal evg., appetite poor, ether repeated.

4th day. Cough about the same, no pyrexia ; ether repeated. Appetite poor and child is losing weight.

5th day. Pertussis vaccine 400 millions, repeated ether. Has been sick once after a meal (rather forced, I think, by mother) No increase cough, child had a good night. Whoop negligible. Temp. subnormal, paroxysms about 12.

6th day. Repeated ether, otherwise no change from yesterday. Temp. subnormal Paroxysms 12.

7th day. Temp. subnormal, repeated ether. No whoop last 24 hours. Paroxysms about 10, and cough still spasmodic.

8th day. Cough same as yesterday. Temp. normal, ether repeated.

9th day. Temp. 98.8 deg. evg.. No whoop, no further vomiting. Had uninterrupted night, repeated ether.

10th day. Temp. midday subnormal, Cough about the same. Nights still good. Pertussis vaccine 600 millions. repeated ether. Cough still spasmodic, 10 in 24 hours.

13th day. Repeated ether, cough still spasmodic, but good nights, no whoop. Paroxysms 8.

15th day. Cough markedly less, mother herself says "almost cured". "Paroxysms" 2.

18th day. Cough negligible, non-paroxysmal, and harmless

23rd day. Complete absence of cough.

Seen one month later, glands less, no physical signs in lung, and gain in weight.

Improved gradually over some months.

Mary Holman. Aged 7 years. Has had measles. No tonsil nor adenoid enlargement.

First seen in company with brothers (Cases 21 and 22). All have coughs which have been contracted at school by the elder two children, who have commencing whoop, whilst youngest has a mild cough rather spasmodic.. Mary's cough has more than a suggestion of whoop, and although she complains of nausea, sickness has not commenced so far. No pyrexia present, faint moist sounds are audible in both lungs. Paroxysms number about 18 of which only about 3 are during the night. Appetite poor. Ether ar.8 with olive oil in emulsion form. Easily retained.

2nd day. Cough same as yesterday, no further development of the whoop. Ether repeated, no pyrexia, physical signs slight. Pertussis vaccine 250 millions.

3rd day. Cough as yesterday, no increase whoop. No pyrexia, repeated ether. Paroxysms about 18

4th day. Cough as before, no pyrexia, paroxysms about 18.

5th day. Cough still present but whoop has been absent during the last 24 hours and cough is also less paroxysmal. No pyrexia, nausea present with cough, but no vomiting. Coughing about the same at night as at first. Repeated ether, vaccine 400 millions. Paroxysms 18.

6th day. Repeated ether. Apyrexial. Otherwise no change. Paroxysms about 18.

7th day. Temp. subnormal. Repeated ether, no whoop, but cough is still paroxysmal.

8th day. Temp. subnormal. Repeated ether, cough about the same as yesterday.

9th day. Temp. 98.4 deg evg.. No whoop and no vomiting. Cough about the same as regards number of spasms. Ether repeated.

11th day. No whoop, no vomiting, cough much less too. Apyrexial. Paroxysms last 24 hours stated to be about 5 and mother reports undisturbed night last night. Ether repeated. Vaccine 650 millions.

13th day. Cough has practically disappeared and all attendant symptoms also. No ether since 11th day.

18th day. Cough gone ; child cured.

Baby Burridge. Aged  $1\frac{1}{2}$  years, not had measles ; no enlarged tonsils nor adenoids.

First seen. having contracted whooping cough from other members of the family. Handicap of bad and unhealthy home conditions. This child is just developing a cough becoming spasmodic, with slight and faint whoop only.. No pyrexia, has vomited once so far. No physical signs in chest. Daily coughing paroxysms are about 12. Ether and oil given dr.  $1\frac{1}{2}$ .  
2nd day. Repeated ether, same dose .Ethereal odour has been noticed in the breath. No pyrexia. Child coughed twice last night. Paroxysms number about same as yesterday.

3rd day. Cough now no worse, mother thinks "everything about the same". Faint whoop present but not constantly. No vomiting, child keeps condition well. No physical signs lungs. Paroxysms 12.

4th day. Condition about same as yesterday. Ether repeated, also yesterday. Paroxysms number 10 to 12. Violent cough so far absent.

5th day. No definite whoop so far to-day ; no vomiting; no drowsiness. No pyrexia, appetite good, and child seems well. Repeated ether. Paroxysms about 10.

6th day. Repeated ether, child coughed only once last night. Paroxysms 10. No further whoop

7th day. Cough still improving and child had a good night. Paroxysms number 8 to 10. Ether repeated.

8th day. Cough very much improved and is now no longer spasmodic. No sequelae nor complications. Spasms can now no longer be called so, ether stopped, "paroxysms" about 5.

10th day. Cough almost non-existent, child well otherwise.

15th day. Cough negligible and slight.

20th day. Cough gone.

Later there were no sequelae up to six months. No cervical glands were present in this case, and there was no sign of rickets.

Ronald Burrige. Age 8 years ; doubtful whether had measles or not. Tonsils somewhat simply enlarged with adenoids.

First seen with history of cough and whoop for three or four days. No physical signs of note in chest.

Home conditions poor, three other children affected.

No pyrexia. Owing to state of house and apathy of mother, little help can be expected in the way of taking temperatures, etc.. Child is having a spasm about every half hour in daytime, probably about 40 in the 24 hours, but mother is hazy as to actual number. Vomiting is frequent. Ether and oil given, one ounce per rectum, was well retained.

2nd day. Still vomiting, but appetite is excellent. No temperature. Ether and oil repeated. Paroxysms probably number about 35, but there is difficulty in mother remembering those of four children, and she is illiterate. Ethereal odour has been present in child's breath.

3rd day. Vomiting improved ; appetite good, and child is well in itself.. Paroxysms 30 and over. Ether was repeated.

4th day. Vomited only once last night. Child fairly well except for cough. No cervical glands palpable. No physical signs lungs of note. No drowsiness so far. Repeated ether. Paroxysms probably about 20

5th day. Vomiting ceased. Paroxysms about 15. Ether repeated.

6th day. No vomiting. Repeat ether and olive oil. Paroxysms only 4 last 24 hours plus also some minor cough without whoop. Child was free from cough all last night . Repeated ether.

7th day. No vomiting, repeated ether, paroxysms still number about 4.

8th day. Cough mostly catarrhal, no whoop, no real paroxysms.

10th day. Mild catarrhal cough only, no whoop and no vomiting. No further ether since seventh day.

15th day. All symptoms cleared up.

This child was seen again two months later. There were no sequelae, chest was normal, and no cervical glands were present.

Mary Burrige. Aged 5 years. Has had measles. Tonsils hypertrophied and adenoids present.

First seen Nov 1929. along with three other children same family ; unintelligent mother, conditions bad.

No physical signs in lungs, other than a few rhonchi. No pyrexia ; cough paroxysmal and distressing. vomited two or three times daily after heaviest meals. Cough worst at night time. Has had whoop for two days. Ether and oil given per rectum dr. 5.

2nd day. Repeated ether, all symptoms and condition about the same as yesterday.

3rd day. Vomited after each meal. Cough is bad at night but in no way worse in the aggregate, no pyrexia present. Repeated ether and oil. Chest clear of physical signs. Paroxysms about 15.

4th day. Vomiting is improved, but cough still bad at night, although no worse. Repeated ether and oil. whoop is no worse. No physical signs of note in lungs. Paroxysms about 12 .

5th day. All symptoms are about the same. Cough is mild and is not distressing. Ether repeated. Paroxysms number about 12.

7th day. Repeated ether, no further improvement. Paroxysms number about 15.

8th day. Rather better as regards intensity of cough. No vomiting last 24 hours, but paroxysms number just about the same - 15. Child well and active.

10th day. Repeated ether to-day, also two days ago. (not noted). Paroxysms number 15. Cough very much the same as before.

12th day. Repeated ether and olive oil. Paroxysms now diminished. Paroxysms number about 10. Stopped ether, after to-day.

14th day. Cough lessening very gradually. Paroxysms number 5 in the 24 hours. No whoop present.

17th day. Cough much less; there were only two paroxysms yesterday. Some cervical glands palpable ; Syrup Ferri Iod. given.

21st day. Cough negligible.

25th day. Cured.

Fortnight later child "caught cold" again and developed a respiratory catarrh with return of whoop, this lasted during five or six days . There were no sequelae present up to six months later.

Folliet Burridge. Aged 3 years, has had measles. Tonsils enlarged, adenoids present.

First seen with history of cough, and whoop for three or four days, along with three others in the same house. Home conditions bad, no pyrexia. Paroxysms probably up to 25 in the 24 hours. No notable physical signs in lungs. Vomiting is frequent, cough paroxysmal and distressing. mostly at night. Gave ether and oil per rectum dr. 4.

2nd day. Most symptoms same as yesterday, no drowsiness. Paroxysms about 30; repeated ether.

3rd day. Much the same; repeated ether, no further development. Paroxysms 25.

4th day. Vomiting is much improved last 36 hours. No physical signs chest of note. Paroxysms number about 20. Mother herself thinks cough is improving and is not so distressing.

5th day. Mother reports whoop to be very much improved. Paroxysms number about 15. Whoop as heard by me to-day was much less insistent than formerly, and paroxysm less severe. No pyrexia, no physical signs lungs. Ether repeated yesterday and to-day.

6th day. Cough and whoop are very much improved. Paroxysms number about 10. Whoop almost non-existent, but cough still spasmodic. Repeated ether.

7th day. Condition still improving; no further symptoms. No vomiting last three days. Repeated ether. Paroxysms slight, in number about 10.

8th day. Continued improvement. Paroxysms are very slight, about eight in number, and are not distressing. Repeated ether.

10th day. Cough almost gone and is not now paroxysmal. Repeated ether, stop after to-day.

15th day. Cough has cleared like that of brother, but will require tonsils and adenoids removed later.

Some months later, child healthy and well. No palpable cervical glands.



Baby Tozer. Aged 21 months, has not had measles, Nasopharynx is normal.

First day. Child has so had good health. Seen by me on account of a cough with definite whoop. Occasional rhonchi can be heard in the chest. Child has vomited once or twice ; cough is worst at night. Daily paroxysms total about 8, of which only about three only are in the daytime..First definite whoop yesterday. Gave ether and olive oil gr. 2 per rectum.

3rd day. Mother thinks cough is rather improved, child has not vomited since last seen. He was drowsy after the injection, and odour was present in breath. Repeated ether, which was well retained, also on the first occasion. Paroxysms about 8 in number.

5th day.Cough is improving and mother does not think that it is so insistent. Paroxysms number about 6. Vomiting absent. Repeated ether, which is still well retained. Ether odour is present in breath for some hours after injection, mother thinks about 12. Child still a little drowsy after injection.

7th day. Cough is much improved. Child has been drowsy, but takes food well. Paroxysms number about 6. Repeated ether, still well retained.. Odour still very noticeable in breath after injection..

9th day. Repeated ether, child is apt to be drowsy for about 10 hours after injection, but it is doubted if this is due to ether, cough is much better and there is no whoop in the daytime and only twice last night.

11th day. No drowsiness after the last injection . Cough greatly improved and is non-paroxysmal. Repeated ether and oil mixture, gr 1 only.

13th day. Cough almost absent.

16th day.Cough cured.

Year later, child well, no cervical glands palpable and no hypertrophy lymphoid tissue nasopharynx.

Winnie Tucker. Aged  $3\frac{1}{2}$  years. Had measles at about one year old. Adenoids show promise of real hypertrophy in future, tonsils are slightly enlarged.

First day. Seen with remainder of family, this case apparently being a concurrent infection with the baby and a brother. In this child cough is mild. There is no pyrexia. So far, only about 8 to 9 paroxysms in the 24 hours and whoop is barely noticeable. Convulsive cough absent. Gave usual dose of ether and oil, dr. 4 per rectum, well retained.

2nd day. Cough about the same, repeated ether.. Child has been mildly sick once. Repeated ether, paroxysms 8.

3rd day. Much the same as yesterday, repeated ether. No vomiting, paroxysms about 8.

4th day. Repeated ether, no vomiting. Whoop no worse than first day. Patient is doing well and cough is non-convulsive. Paroxysms number 6 to 8.

5th day. Repeated ether, no vomiting. Has had no physical signs in lungs so far.. Apyrexial, appetite always good. Paroxysms number about 6 to 7.

6th day. Whoop almost absent, paroxysms number about 5. Repeated ether.

7th day. Repeated ether, child is now not whooping, nor vomiting. Paroxysms 5.

8th day. No whoop, no vomiting, repeated ether. Spasms about 4 to 5.

10th day. Repeated ether, no whoop present.. No vomiting. Paroxysms 3 to 4.

12th day. No further ether given since 10th day.. No whoop present, and cough is very little.

16th day. Cough has disappeared and child is well.

No sequelae up to just over a year later.

Russell Tucker. Aged  $2\frac{1}{2}$  years, not had measles ; tonsils and nasopharynx normal. This patient is coughing and whooping and vomiting. Temp. avg. 99.4 deg. No haemorrhages. Paroxysms about 20 in the 24 hours. Nights very disturbed by the cough and especially by the other children, all sleep in one room. This child is also awakened by the others coughing and seems to have extra paroxysms due to this cause. There is vomiting of some degree at almost every paroxysm. Physical signs in the lungs show the usual scanty rales. The cough is not quite so severe as the usual convulsive cyanotic type ; gave ether and oil dr. 3 per rectum.

2nd day. Repeated ether, it has been noticeable in the breath. Paroxysms number about 20, cough is thus about the same, whoop equally so.

3rd day. Cough a little better and mother does not think individual spasms are so bad ; vomiting is not so constant. Apyrexial, repeated ether. Paroxysms 18.

4th day. Cough still improving, vomiting not so incessant. Paroxysms 14. Chest clearer. Repeated ether, no complications. Appetite is improved.

5th day. Further improvement noticeable and cough is not so spasmodic. Each paroxysm of shorter duration.. Paroxysms number 12 to 14.

6th day. Cough better than yesterday, and whoop is sometimes absent from the shorter paroxysms. Paroxysms 12. Repeated ether. No pyrexia.

7th day. Cough still improved and whoop is only present in about 75% of the paroxysms, which are not so convulsive now. Repeated ether, which has been marked in breath. Vomiting absent, no complications.

8th day. Cough still lessening as regards whoop which is absent in about half the paroxysms. No vomiting; repeated ether. No pyrexia, paroxysms 12.

9th day. Repeated ether, cough much less convulsive, but still spasmodic, although whoop is almost absent. No vomiting; repeated ether. "Paroxysms" 15.

11th day. Repeated ether, no whoop, no vomiting. Cervical glands unenlarged. "Paroxysms" 6 to 7.

13th day. Cough is still improving, cough is not convulsive, ether discontinued.

17th day. Cough has gradually continued to "tail off". Is now mild and bronchial only.

20th day. Cough very occasional only.

George Tucker Aged 5 years. Has had measles. Tonsils enlarged ; adenoids present.

First day . Seen with three other children of same family ; this child is probably the originator of the infection, from school. I would not have been able to treat him but for the more serious illness of the baby. George is whooping almost incessantly in the daytime and has bad nights. Face very suffused and two sunconjunctival haemorrhages are present. He is bright and plays in between paroxysms. Daily paroxysms about 30. Gave ether and oil dr. 5, per rectum. No temperature above normal, a few rhonchi in lungs. Vomits after each meal.

2nd day. Cough is about the same with persistent whoop, ether repeated. No pyrexia. Vomiting, etc., as yesterday.

3rd day. Cough improved, no further complications nor haemorrhages. Vomiting not quite so easily induced. Every meal is not now returned.. Paroxysms less, about 25 daily. Repeated ether, this seems well retained. Face less suffused ; patient apyrexial.

4th day. Cough still improving gradually, vomiting reduced to three times last 24 hours, repeated ether. Paroxysms 16 to 20 daily.

5th day. Further improvement noticeable; vomiting is still present but in minor degree each time compared to previously. Paroxysms about 15.. Repeated ether, there are so far no complications.

6th day. Cough still improving, whoop less persistent. Retained breakfast well, and so far has not vomited to-day. Repeated ether. Whoop less persistent.

7th day. Cough better still, each individual paroxysm is lessening in severity. Whoop still seems to be present in each paroxysm. Repeated ether. Nothing else to note.

8th day. Cough less, paroxysms do not always show whoop, and are about 12 daily. Has not vomited but has complained of a little nausea. Almost vomited, ether repeated, other symptoms negligible.

9th day. Cough much less, whoop only present on about 50% of occasions. No complications, chest clear, ether repeated . Paroxysms about 10 daily.

10th day. Cough and patient generally both improved. Paroxysms 7 to 10. Repeated ether.

12th day. Stopped ether, no whoop. Paroxysms 3 to 4.

18th day. Cough has disappeared.

No sequelae up to about one year later.

Baby Tucker. Aged 14 months, not had measles. Tonsils normal, no adenoids.

First day. Seen with three others same family, all with whooping cough. This child has a history of cough for 3 to 4 days and has vomited but no definite whoop so far. Child obviously ill, alae nasi dilated, respirations 77, pulse (?) 156. Temp. 104.2 deg. All taken in evening. Pale face, hot dry skin.. Rather dehydrated. Treated as pertussis in view of other infected children, and regarded as a case with as yet undeveloped whoop. Child takes fluids well. Chest poulticed, physical signs of bronchopneumonia both lungs. Ether and oil dr. 1 per rectum. Steam to be inhaled.

2nd day. Temp. 101 deg. R. 68, P. 148, all mng. . Still coughing with hard cough Ether, poultice, etc., repeated. Child ill in evening, with frequent incontinence. Temp. 103.6 deg., R. 84, P. 154.

3rd day. Temp. mng 102.2 deg., R. 76. P. 148. Repeated ether, other measures continued. Child taking more nourishment to-day, fluids pushed, with glucose. Temp. evg 103.2 deg., P. 142, R. 66.

4th day. Temp. mng 101 deg. P. 132, R. 74., repeated ether and other measures. Chest seems clearer of crepitations, cough fairly insistent, but no whoop yet. Temp. evg. 102.2 deg., R. 70, P. 130.

5th day. Temp. mng 100 deg., R. 48. P. 126. Child seems much better. Repeated ether and other measures. Temp. evg 100.6 deg., R. 56, P. 124. Respirations seem still embarrassed.

6th day. Temp. mng 98.6 deg., R. 40, P. 114., Evg. temp. 99.2 deg., R. 42, P. 124. Repeated ether, Cough rather more paroxysmal and a suspicion of a whoop is present but might be unsuspected if were not expected. Physical signs chest mostly rales now.

7th day. Temp. mng. normal and 98.6 deg. evg. Whooped to-day and was sick. Takes notice of surroundings and is brighter. Taken some food. Repeated ether.

8th day. Temps. both normal, whooped with some non-paroxysmal coughs.

9th day. Apyrexial, Had good night. Repeated ether. Paroxysms 5.

10th day. Still improving, stop ether.

11th day. Same as yesterday.

12th day. Not seen. 13th day. Much the same.

16th day. Whoop gradually dying away, and child is now allowed up.

21st day. Whoop and cough disappeared and child well.

George Wheatley. Aged  $2\frac{1}{2}$  years. Not had measles. Has no enlarged tonsils ; no adenoids. Requires circumcision. First day. Seen with a suspicious cough, but only an indefinite whoop. Slight sickness has been present on two occasions. Has been in contact with some other children about ten days ago ; they had a suspicious cough. Coryza has been present, and there are a few rales to be heard in the chest. Temp. afternoon is 99 deg.. No epidemic in locality. Cough negligible at night; no cervical glands are palpable. There are about 12 paroxysms in the 24 hours. Gave ether and olive oil dr.  $2\frac{1}{2}$  in emulsion form. Child was very nervous and retention of all was doubtful.

2nd day. Not seen, intended to give ether every second day.

3rd day. No further increase of paroxysmal cough, but a definite whoop has been heard. Child has vomited three times each day. Ether repeated, same dose, and this was retained for fifteen minutes in my presence, and for normal time, it was thought.. Ether odour was present for some hours in breath after first dose. Paroxysms about 12.

5th day. No increase of cough nor of vomiting. Normal temperature. Ether repeated, is now being retained, odour marked in breath ; child is now able to go out. Paroxysms about 12.

7th day. No increase of cough, no vomiting : repeated ether. Apyrexial. Ethereal odour is present in breath for about 12 hours.

9th day. Cough is remarkably constant, but child looks better. Paroxysms about 10. Repeated ether.

11th day. Some slight decrease of cough and the spasms yesterday were only about 8. To-day, however, they are about 16. Repeated ether, no vomiting, whoop is perhaps rather less noticeable.

13th day. Stopped ether here. Cough no better than two days ago. Paroxysms about 14.

15th day. Cough a little less, perhaps.

19th day. Cough may have decreased a little, paroxysms about 12.

25th day. Child still coughs and whoops though not distressingly so. Cough did not go until about six weeks after onset.

No sequelae up to six months afterwards.

George Wheatley. Aged  $2\frac{1}{2}$  years. Not had measles. Has no enlarged tonsils ; no adenoids. Requires circumcision.

First day. Seen with a suspicious cough, but only an indefinite whoop. Slight sickness has been present on two occasions. Has been in contact with some other children about ten days ago ; they had a suspicious cough. Coryza has been present, and there are a few rales to be heard in the chest. Temp. afternoon is 99 deg.. No epidemic in locality. Cough negligible at night; no cervical glands are palpable. There are about 12 paroxysms in the 24 hours. Gave ether and olive oil dr.  $2\frac{1}{2}$  in emulsion form. Child was very nervous and retention of all was doubtful.

2nd day. Not seen, intended to give ether every second day.

3rd day. No further increase of paroxysmal cough, but a definite whoop has been heard. Child has vomited three times each day. Ether repeated, same dose, and this was retained for fifteen minutes in my presence, and for normal time, it was thought.. Ether odour was present for some hours in breath after first dose. Paroxysms about 12.

5th day. No increase of cough nor of vomiting. Normal temperature. Ether repeated, is now being retained, odour marked in breath ; child is now able to go out. Paroxysms about 12.

7th day. No increase of cough, no vomiting : repeated ether. Apyrexial. Ethereal odour is present in breath for about 12 hours.

9th day. Cough is remarkably constant, but child looks better. Paroxysms about 10. Repeated ether.

11th day. Some slight decrease of cough and the spasms yesterday were only about 8. To-day, however, they are about 16. Repeated ether, no vomiting, whoop is perhaps rather less noticeable.

13th day. Stopped ether here. Cough no better than two days ago. Paroxysms about 14.

15th day. Cough a little less, perhaps.

19th day. Cough may have decreased a little, paroxysms about 12.

25th day. Child still coughs and whoops though not distressingly so. Cough did not go until about six weeks after onset.

No sequelae up to six months afterwards.

Baby Chipplin. Aged 10 months, not had measles. Tonsils normal, no adenoidal enlargement..

First seen. Child has definite whooping cough, has been whooping for 5 or 6 days. Is getting worse and paroxysms are fairly severe. Child is thin and weakly, with an inguinal hernia. Ether and olive oil given daily in emulsion form. No pyrexia, but rhonchi and a few coarse crepitations may be heard in the lungs.. Respirations rather hurried. No pyrexia. Is vomiting 4 to 5 times daily, almost every meal being returned, this is the reason for seeking advice.. Paroxysms number 15 to 16.

2nd day. Child is very much the same generally, no worse, vomiting same. No pyrexia evg.. Repeated ether, dose was dr. 1., emulsion form. Paroxysms about 14.

3rd day. Child much the same, no worse. No pyrexia evg.. Vomited twice Repeated ether. Paroxysms 12 to 14.

4th day. Cough is improving and whoop is not so spasmodic ; the inspiratory crowing is less noisy. No pyrexia. No crepitations in lungs, to-day. Ether was repeated. Paroxysms about 12.

5th day. Cough is much improved and child has only had one minor paroxysm to-day so far, excluding those last night. Repeated ether. Paroxysms about 8.

6th day. Cough still improving and ether was repeated. Vomiting absent, no pyrexia. Paroxysms 4 to 5.

8th day. Whoop is almost absent, repeated ether. No vomiting, paroxysms 3 to 4.

10th day. Cough nearly disappeared. Minor paroxysms only. No vomiting, pyrexia absent. Stopped ether.

15th day. Only an occasional minor cough. Hernia has been controlled by truss, and the opening has not been much dilated.

No complications nor sequelae.

Graph showing rate of decline of paroxysms - Appendix, Figure 3



Mary White. Aged four years, not had measles.

First seen. as a thin pinched child with discreet enlarged glands both sides neck in posterior triangles. Tonsils large, but not patently septic., adenoids possibly also present. Cough has been present for 8 to 10 days and a definite whoop has now appeared. Vomiting is not very frequent, only once or twice daily. No pyrexia, no physical signs in lungs - few rales only being present, marked nasal coryza, probably due to adenoids.. Epidemic present locally. Paroxysms are worse at night, 24 hours total about 14. 6 or 7 of these are present in the night. Gave dr. 4 of emulsified ether and oil per rectum. There was difficulty of introduction and it was only retained for a time.

2nd day. Repeated ether, the child has seemed slightly drowsy towards yesterday evening, and the ether odour was present in the breath until this morning. Cough about the same. Paroxysms total about 14.

3rd day. Ether emulsion as before, child was drowsy again yesterday, and a marked ethereal odour was observed by myself in child's breath.. Cough improved, no vomiting. Paroxysms 10, of which about 3 are in night.. A few rales still present chest.

4th day. Repeated ether, drowsiness less apparent. Cough much less spasmodic at night, total paroxysms about 3 and child practically free daytime. No vomiting, child brighter itself, and has better appetite.

5th day. Repeated ether. Child more tolerant and less drowsy. No vomiting, little night cough, daytime whoop practically gone. Physical signs absent from chest.

6th day. No cough last night, daytime cough much less also. No rales. Whoop practically absent. Repeated ether. Paroxysms about 5.

7th day. Whoop disappeared, but there are still present daily about 8 "paroxysms" cough during the day, and 2 to 3 during night. Total paroxysms 11. Repeated ether.

9th day. No whoop, no vomiting, cough paroxysms negligible in duration. Appetite good, stopped ether.

12th day. Almost no cough, glands still present and unaltered. Physical signs absent from chest.

23rd day. Child cured of whooping cough, to have tonsils and adenoids treated later. To have glandular tubercle treated also. Child has been open air every day during the whooping cough.

John White. Aged 9 years, has had measles. Good healthy boy, no tonsils, no adenoids, no cervical glands.

First seen with sister and baby. Has a well-marked cough with a definite whoop, which he has had for ten days, the whoop being present for rather less. Before that catarrhal symptoms were present. He is probably the cause of the household infection. Sickness is occasional only, after heaviest meal of day. Whoop typical. Spasms are so far on the increase in number, but are not troublesome at night, mostly being so in the daytime, every half hour or so. No pyrexia. Ether given with oil dr. 10 in emulsion form. Retained well, with complaint of slight pain afterwards.

2nd day. No pyrexia. Ether odour has been present in the breath, mother states that she noticed it come on about two hours after the injection. Paroxysms same as yesterday, on the average; about 25.

3rd day. Temp. subnormal, no drowsiness, no vomiting. No cough last night between 10 p.m. and 7 a.m. Daytime spasms now about 20. Ether repeated.

4th day. Temp. subnormal, no drowsiness, no vomiting. Cough about the same, but again no cough last night. Paroxysms about 20.

5th day. Temp. 98.8 deg. evg. following exertion. No vomiting, has had one nocturnal spasm. Whoop less insistent. Ether repeated. Appetite better, daytime cough improving.

6th day. Temp. subnormal. No vomiting, no nocturnal spasms. Paroxysms about 15 and rather better in daytime. Repeated ether.

7th day. Whoop is much less noticeable and general spasms improved. Paroxysms 12. No night cough, no vomiting, no pyrexia. Repeated ether.

8th day. Temp. subnormal, whoop lessening, no vomiting. Paroxysms about 10, all in daytime. Stopped ether.

9th day. Mother reports cough no more than an "ordinary bronchial cough".

14th day. Cough very slight and never at night. No vomiting.

21st day. Cough has been absent during the last four days.

Baby White. Aged 11 months. Not had any previous diseases. Nasopharynx normal.

First seen, along with both brother and sister ; this child has a definite cough with whoop sufficient to cause cyanosis during the spasm and squinting and some rigidity.. Paroxysms about 20 in 24 hours, 8 to 10 being during the night.. Vomiting frequent and smaller feeds advised. Coryza not marked. Temp. evg 99.4 deg.. There are a few rales at both lung bases, no cervical glands are palpable. Ether and oil given dr.1, emulsified.

2nd day. Cough and the more severe symptoms same as yesterday. Temp. 99 deg., afternoon. Repeated ether.

3rd day. Temp 99 deg., evg... Symptoms same, repeated ether.

4th day. Mother thinks cough slightly improved at night. Rales still present chest. Temp. 98.6 deg. evg., no drowsiness.. Vomiting rather less and appetite good, but all that can be said of the cough is that it is no worse. Mother thinks not quite so paroxysmal. Repeated ether.

5th day. Temp. 98.2 deg. evg.. Ethereal odour breath more marked than before. Only three paroxysms last night. Daytime cough about the same, repeated ether. No vomiting.

6th day. Nocturnal spasms two. Daytime cough is less violent but still have spasms every  $\frac{1}{2}$  hour on the average. There is no vomiting. Temp 98 deg. evg., repeated ether.

Obvious loss of weight, no physical signs in lungs at time of examination.

7th day. Cough I.S.Q. Temp. 97.6 deg. evg.. No ether given.

8th day. Cough about the same, temp. evg. 98.8 deg.. No vomiting, paroxysms are not too severe, one having occurred during injection. No convulsions so far, and no sign lung collapse.. Ether not apparently having any curative effect.

10th day. Cough rather improving, four to five spasms daily. Child well, active, and cheerful in between paroxysms. Temperature subnormal. Nocturnal spasms less.

12th day. Cough lessening and whoop becoming negligible.

14th day. Cough still improved, no further vomiting.

16th day. Whoop absent, but catarrhal cough is present.

20th day. Improving, but still coughing.

22nd day. Improving but still coughing. No whoop.

Fortnight later Mother reports occasional cough still present, but gain in weight.

Margaret Clark. Aged  $3\frac{1}{2}$  years, not had measles. Tonsils suspiciously large, some adenoids present.

First seen. Well marked cough and whoop present, with presence of other whooping cough in the house. Cough is not very severe, but occasional vomiting after a heavy meal. Paroxysms daily number 18.

2nd day. No pyrexia, paroxysms about the same, 16 to 18. Child vomited once, had a fair night. Seems well and happy between paroxysms. Repeated ether, same amount.

3rd day. No vomiting, cough rather less spasmodic, the paroxysms number the same, about 16. Appetite is good. a few rhonchi are audible chest, ether repeated.

4th day. Cough somewhat less and whoop does not occur with every paroxysm. No physical signs nor complications. Repeated ether. Paroxysms 15.

5th day. Cough is very much improved and is less paroxysmal. Paroxysms number 8. Repeated ether.

6th day. Cough still improving, repeated ether. Paroxysms number 5 ; child whooping very little.

7th day. Not seen.

8th day. Missed ether yesterday, to-day repeated ether, then stop. Very little cough, and is now only mildly paroxysmal. "Paroxysms" are daily about 5 to 6. Whoop is very mild indeed, mostly absent. No complications.

10th day. Mild catarrhal cough only.

14th day. Cough negligible.

Further condition of child could not be followed up.

With graph showing decrease of paroxysms, Appendix,  
Fig.6.

Robert Clark. Tonsils enlarged, with adenoids. Aged 5 years. Has probably had measles, mother doubtful.

First seen. With well-marked cough and whoop and other whooping cough infection in the house, but at a later stage., i.e., not so far developed... This patient's cough is fairly severe and he is having about 4 attacks of vomiting daily. No pyrexia present, cervical glands impalpable. No physical signs chest at time examined. Daily paroxysms about 22. Ether and oil given dr. 5, emulsified. Some difficulty of retention and complains of some pain, in contradistinction to sister, who retained comfortably and successfully.

2nd day. Child apyrexial. Paroxysms number about 20. These are rather worse at night, vomiting same, but child seems happy and cheerful. Repeated ether, same amount. Ether in breath, thirteen hours approximately.

3rd day. Not much change in intensity of whoop.. A few rhonchi heard chest. Vomited twice, and also slightly once more. Complains of nausea at other times. Child apyrexial, paroxysms 18.

4th day. Cough rather better, whoop only present on severe spasms. No vomiting, only one attack of cough last night. Repeated ether, paroxysms 12. Apyrexial.

5th day. Cough about the same as yesterday, also other symptoms. Repeated ether. Paroxysms 12.

6th day. Cough very much improved, has had no whoop and only four spasms in the last 24 hours. No vomiting, no complications. Repeated ether.

7th day. As yesterday, no whoop. Stop ether. Mild paroxysms present, number 4.

9th day. Cough almost gone.

11th day. No cough whatever.

Baby Clark. Aged 2 years, not had measles. Tonsils of normal size, no adenoids.

First seen with quite a well-marked cough and whoop, but not very severe. Has just commenced to whoop, and still has symptoms of the prodromal stage. Vomited so far only once. No pyrexia, no palpable cervical glands. Ether and oil given, dr. 3, emulsified. Retention good. Paroxysms number about 8.

2nd day. Child apyrexial, no physical signs in lungs. General condition about the same, repeated ether. Paroxysms about 8.

3rd day. No fresh symptoms, no vomiting. Cough mild, no pyrexia, appetite is good.. Paroxysms 6 to 8. Repeated ether.

4th day. Repeated ether. Paroxysms 6 to 8.

5th day. Repeated ether, cough is no worse. Occasional moist bronchial sounds can be heard in lungs. No vomiting, whoop not troublesome. Does not whoop every time, ethereal odour more noticeable breath. Paroxysms number about 6.

6th day. Repeated ether, no whoop since yesterday. Paroxysms 4 to 6, cough very mild.

7th day. As yesterday, stop ether. Paroxysms 4 to 6.

8th day. Repeated ether, symptoms as yesterday. Paroxysms 4 to 6.

10th day. Cough negligible and is non-paroxysmal.

15th day. Cough very mild indeed and non-paroxysmal again. No further ether.

18th day. No cough.

Ethereal odour has been marked in breath during all the time of administration.

Case 41.

Baby Tucker. ( W.J. ) Aged 14 months, not had measles. Nasopharynx is normal.

First day. Fairly healthy infant, good weight for age. Stated 27 lbs. No enlarged cervical glands. Has had prodromal signs for 8 days and now has a definite cough with whoop. Vomiting present after most feeds. Eyelids puffy and swollen and conjunctivae hyperaemic. Child is apyrexial. Spasms are severe and sufficient to check nutrition on account of the retching and vomiting. A few moist sounds and wheezing present in both lungs. Cough worse in daytime. Paroxysms 17 to 20. Ether and oil given dr. 2 per rectum, in emulsion form, this was well retained

2nd day. Repeated ether. Cough if anything worse and more sustained. No pyrexia. Vomiting present. Losing flesh. Paroxysms 20 to 22. Physical signs same.

3rd day. Repeated ether. Cough about the same as yesterday. Paroxysms about 20.

4th day. Repeated ether, cough rather less in intensity, and child does not have such marked facies of pertussis. No vomiting, paroxysms 20, otherwise condition same.

5th day. Repeated ether, cough is very much improved and several paroxysms have been without whoop, but number is not lessened. Paroxysms 18.

6th day. Repeated ether, cough still improving. Eyelids less swollen and conjunctivae less hyperaemic. No signs to be made out in lungs. Whoop not always present. Paroxysms 14.

7th day. Cough still improving, repeated ether. No vomiting, child apyrexial. Only whooped 4 times. Paroxysms 10.

8th day. Still improving, whoop is occasional only, no vomiting. Repeated ether. Paroxysms 5 to 8.

9th day. Repeated ether, whoop occasional only, no vomiting. Child looks better and seems to be putting on weight again. Stopped ether.

11th day. Bronchial cough only, no whoop, no vomiting.

14th day. Mild cough only.

17th day. Cough almost cured.

John Welsh. Aged  $3\frac{1}{4}$  years, not had measles. Has no enlarged glands, no tonsils enlarged, no adenoids.

First day. Has had a cough for about 4 days and whoop appeared yesterday. Had vomited, but not seriously, nor are the general symptoms very severe. Cough is worst at night. A few moist sounds are present in both lungs. Ether and oil given per rectum dr. 4 in emulsion form. No pyrexia. Some nasal and conjunctival symptoms of coryza. Paroxysms about 15. No difficulty with retention. Child's eyes very suffused.

2nd day. Repeated ether, cough about the same, paroxysms number 14. No further symptoms. Vomiting about the same.

3rd day. Repeated ether. Cough and vomiting same as yesterday. Paroxysms 14, no further symptoms developed.

4th day. Repeated ether. Mother reports cough is less distressing, but number of paroxysms about same.. No pyrexia, no vomiting.

5th day. Repeated ether. Cough lessening and whoop only doubtful in my presence, at least.. Paroxysms about 10.

6th day. Cough lessening in severity, repeated ether. Paroxysms about the same in number. No physical signs lungs.

7th day. Paroxysms are very much less in number in last 24 hours, about 6.. No vomiting. No complications. Repeated ether.

8th day. No whoop yesterday, no vomiting, ether stopped. Paroxysms mild about 4 to 5.

10th day. Cough is non-paroxysmal, appetite good. Child cheerful, mother very relieved. No apparent loss of weight.

15th day. Completely cured.



Case 43.

Ann Welsh. Aged 3 months. Not had measles, no enlarged cervical glands. Nasopharynx normal.

First day. Has been seen before this whilst treating brother, but as cough was only very slight, treatment was withheld until some whoop appeared. Cough is still slight and no vomiting present. No actual "chinking", but whoop is definite. No fever, and child takes feeds well. Ether emulsion given dr 1.

2nd day. Repeated ether, dr. 1. Has produced slight drowsiness but cough is no worse. Paroxysms 6 to 8.

3rd day. Repeated ether minims 40 emulsion. General condition shows little change, cough no worse. No physical signs, no pyrexia. Paroxysms 4 to 5.

4th day. Repeated ether, minims 40 emulsion, child still apt to be a little drowsy, but not markedly so

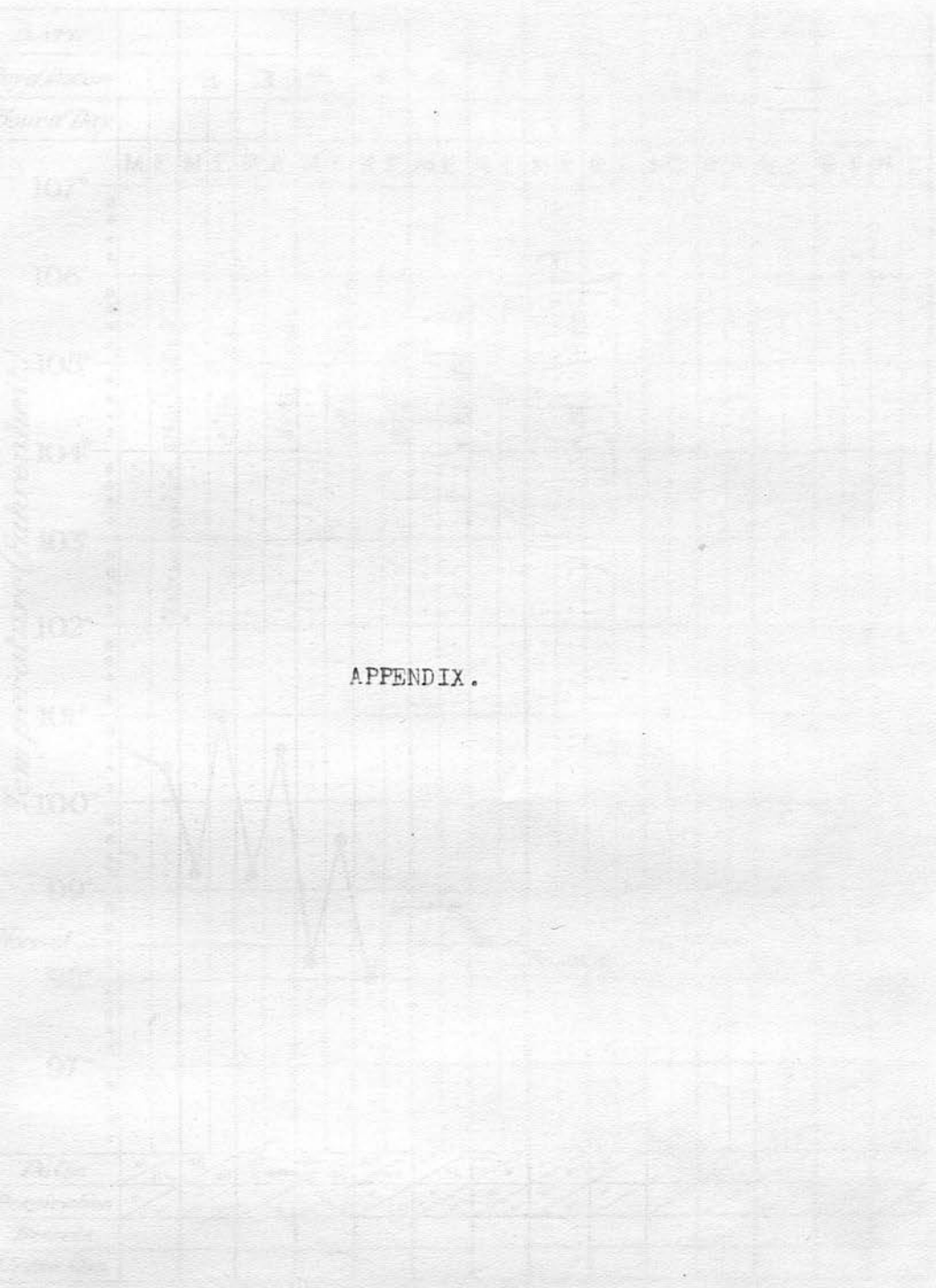
5th day. Much the same, no drowsiness.

6th day. Repeated ether yesterday and to-day. Paroxysms 4 to 5, condition much the same.

8th day. Much the same, looks well and is having no distress. Repeated ether, minims 40.

10th day. No ether, much the same generally.

16th day. Cough is gradually lessening, and is not now paroxysmal or distressing. Ether did not seem to have any effect in causing decline of the paroxysmal stage, but there was certainly no increase in the cough.



APPENDIX.

Fig. 1. Diagram of the...  
 ...  
 ...

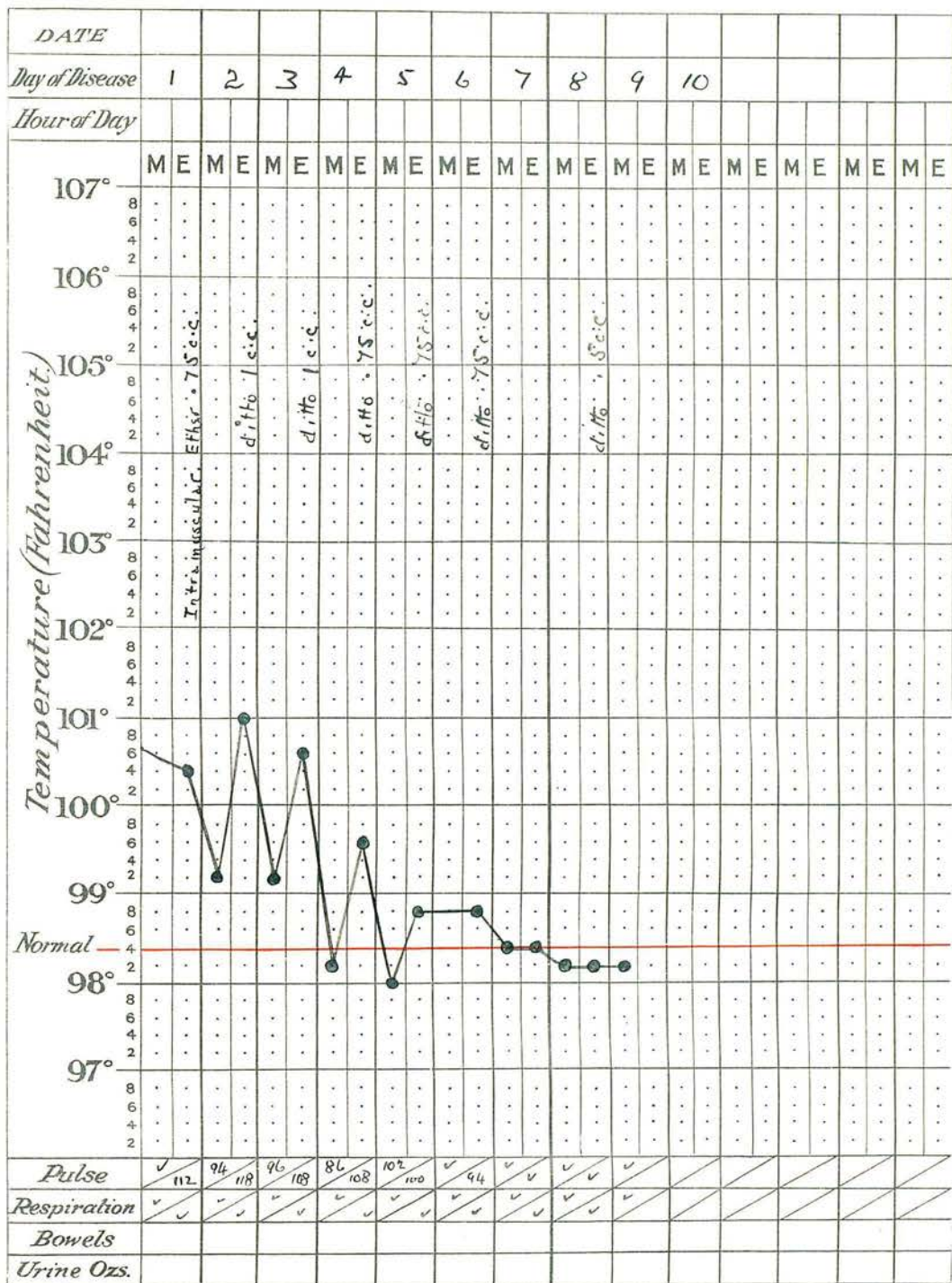


Fig. 1. Clinical temperature chart of case of whooping cough complicated by bronchopneumonia. Rapid subsidence of pyrexia under the influence of ether is shown.

Case 1. Marion Booth.

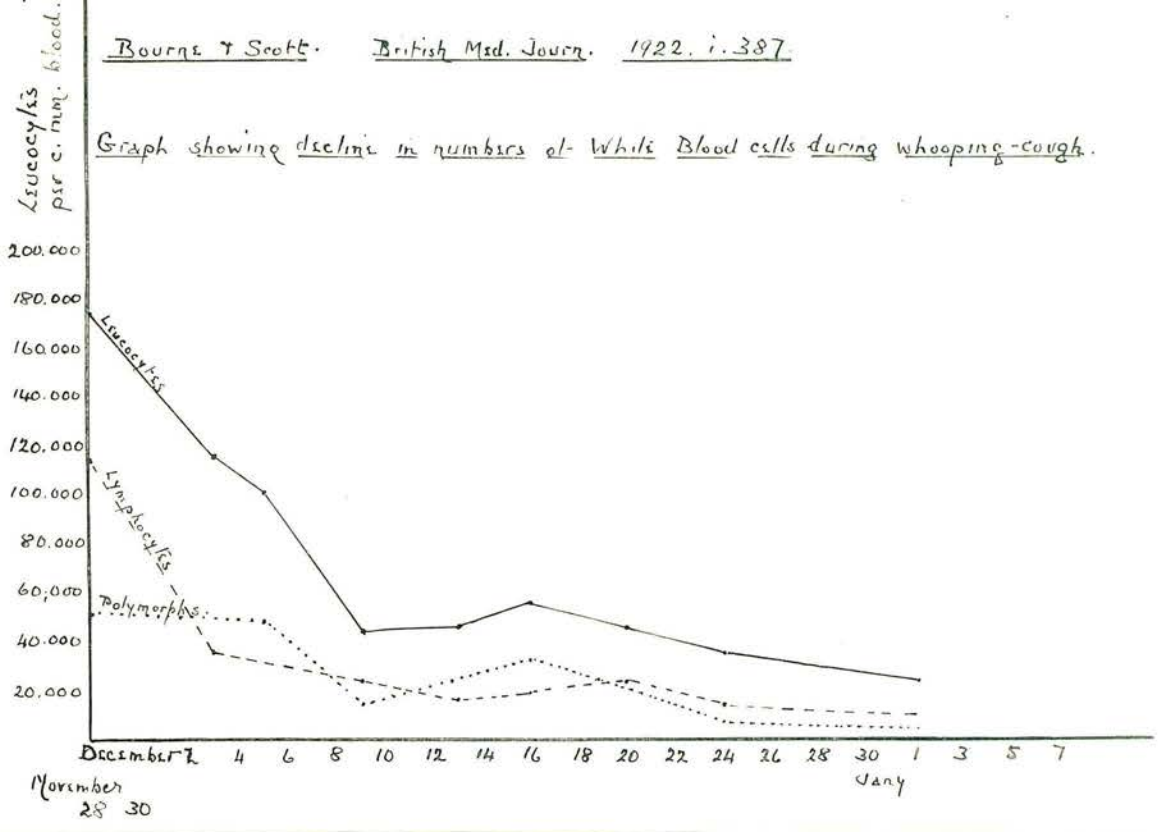
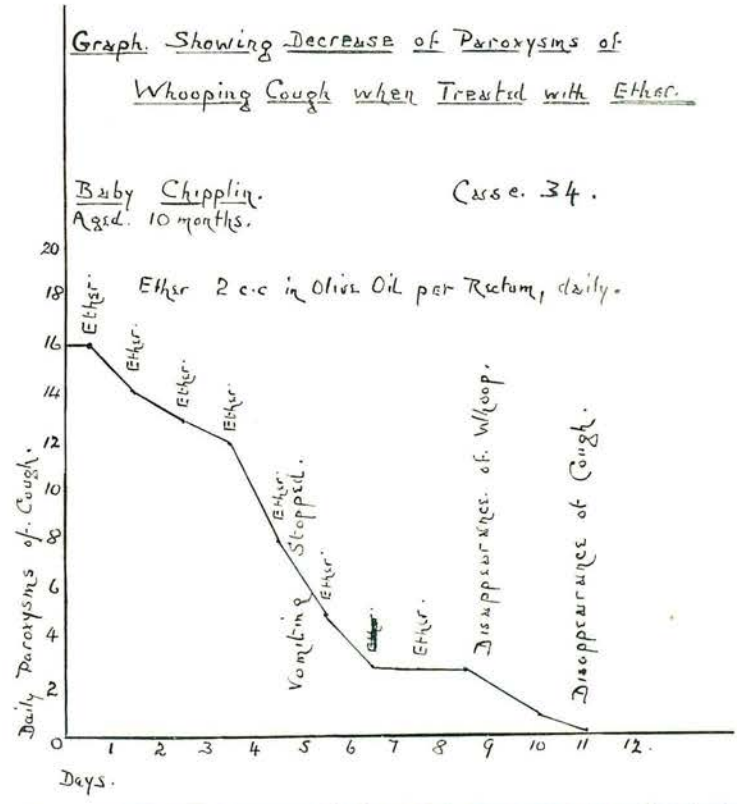


Fig 2. Graph showing rate of decline of leucocytes of the blood during whooping cough (Bourne and Scott). Reproduced from British Medical Journal 1922, 1, 387.

Fig. 3. (Below) Graph showing decline of daily number of paroxysms in a case of whooping cough under treatment by ether. Case 34. Baby Chipplin.



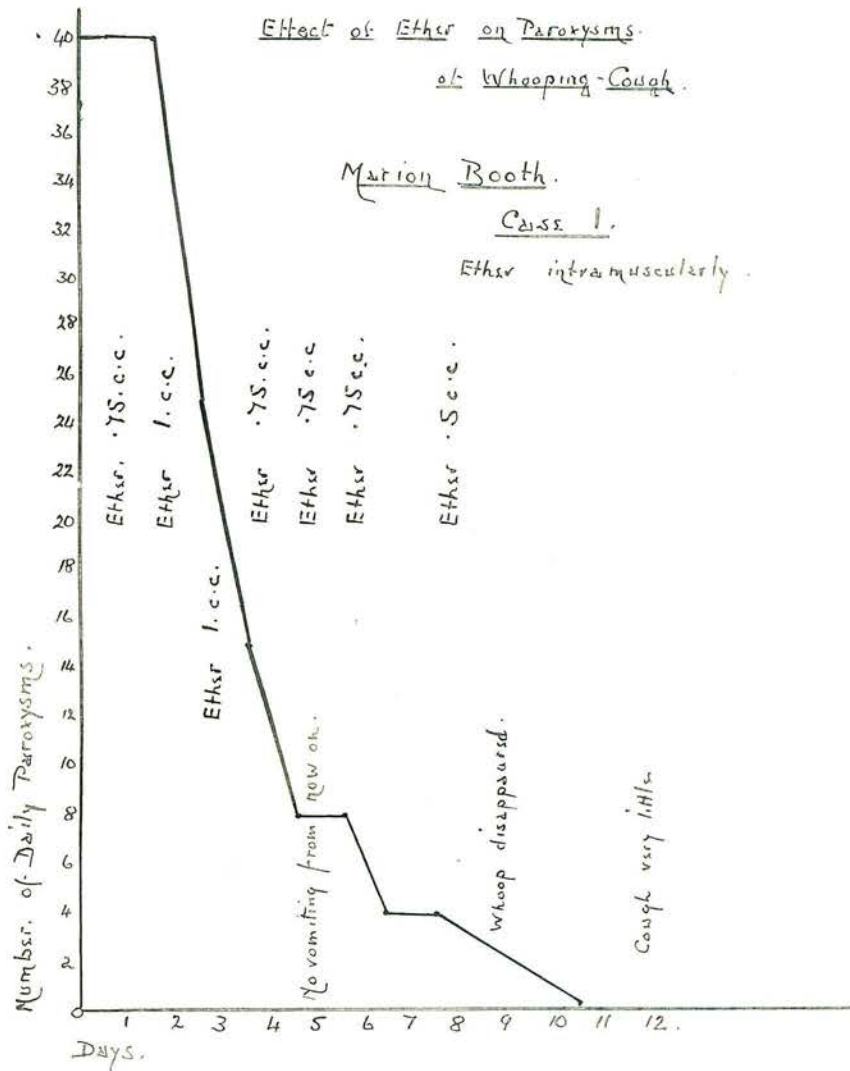


Fig. 4. Graph showing decline of daily number of paroxysms in a case of whooping cough under treatment by ether Case 1. Marion Booth.

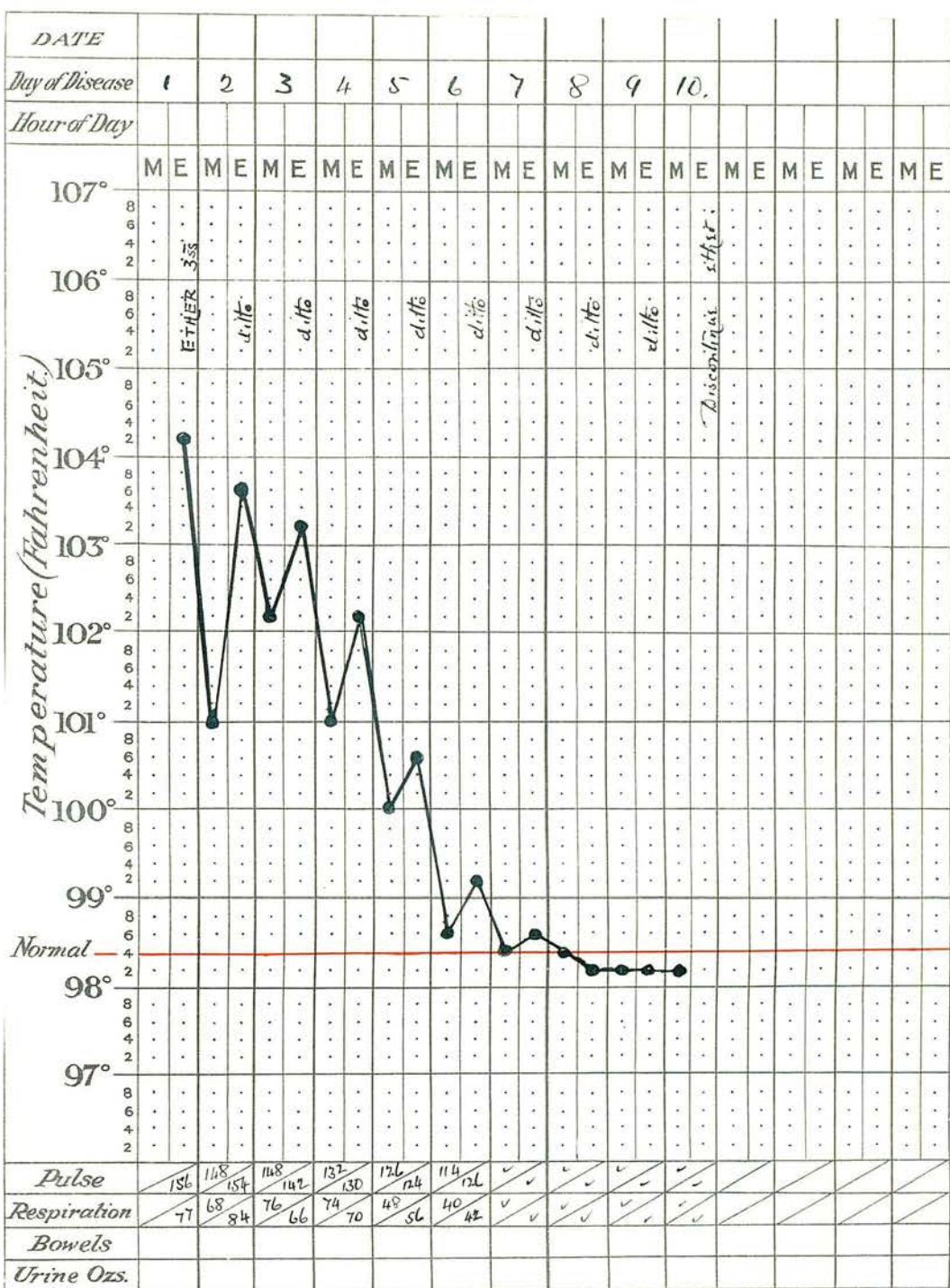


Fig. 5. Clinical temperature chart of case of whooping cough complicated by bronchopneumonia. Rapid defer-  
 rescence is again shown coincident with treatment by  
 ether Case 32. Baby Tucker.

Graph. Showing Daily Decrease of Whooping-Cough.

Paroxysms under Treatment with Ether.

Clark, Margt. Case 38.

Ether. 6 c.c. per rectum daily.

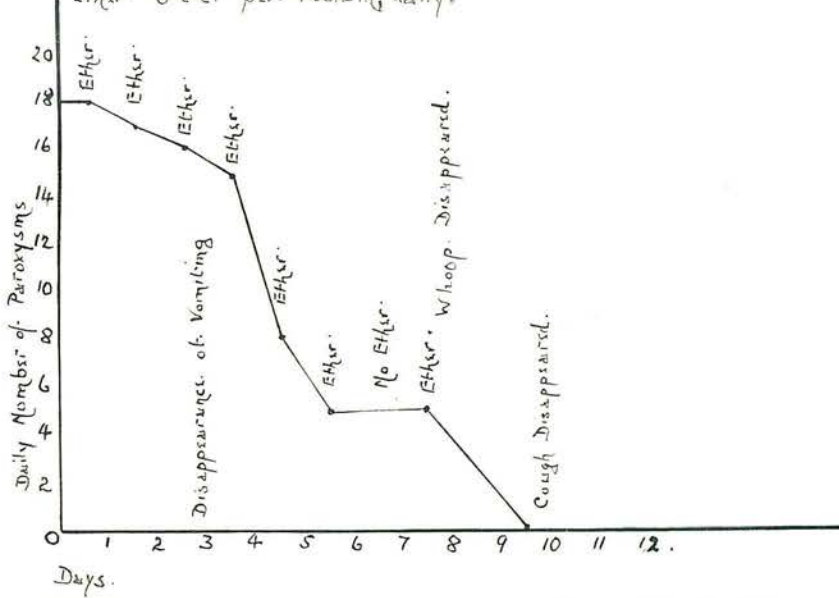


Fig. 6.

Graph showing decline of daily number of paroxysms in a case of whooping cough under treatment by ether.

Case 38. Margaret Clark.

TABULAR COMPARISON OF DOSAGE USED BY VARIOUS  
OBSERVERS.

ETHER BY INTRAMUSCULAR INJECTION.

Observer	Dosage Intervals	Amount injected, age of patient, etc..
Guinea	Alternate days	1 c.c. up to 6 months of age up to 5 c.c. for older children
Tow	1, 2, or 3 days	1 to 2 c.c. according to age
Chénisse	Alternate days	Usually 2 c.c. at all ages.
Newman		1 to 3 c.c. according to age
Vecerezza	Daily at first then alt. days	$\frac{1}{2}$ to 2 c.c. according to age.
and Indr		
Follock	Alternate days	Ditto, ditto.
Elgood	Daily	5 to 10 minims.
Rey (88)	Alternate days	Under 3 years, 2 c.c., over, 3 c.c.
Reim	Daily	1 c.c. with 0.5 gm camphor.
Bennett	Daily	$\frac{1}{2}$ to 1 c.c. for three days
Mason	Once or twice daily	$\frac{1}{2}$ to 1 c.c. according to age.
Audrain	Alternate days	1 to 2 c.c. according to age.
Gencese	Alternate days	$\frac{1}{2}$ to 2 c.c. according to age.
Manicelli	Alternate days	1 c.c. at 1 year, increased with age.
Levy and Finkelstein	Daily	1 to 2 c.c., according to age, in oil.
Goldblum	1 or 2 days	1 to 3 c.c. according to age
Milio	Alternate days	$\frac{1}{2}$ c.c. in very young infants.
Panayotolau	Alternate days	2 c.c., all older children.
Levy & Shapiro.	Daily	1 c.c. at all ages.
Schonfelder	Daily	Probably 1 to 2 c.c.
Voigt	2 or 3 days	$\frac{1}{2}$ to 1 c.c. to children. 2 c.c. adults.



## TABULAR COMPARISON OF DOSAGE USED BY VARIOUS OBSERVERS

## ETHER BY RECTAL ADMINISTRATION.

Observer	Interval	Dosage and age	Strength of solution, etc..
McGee	Daily	Dr.1 for nearest year of age	50% ether in olive oil.
McGee	Daily	dr. 2 infants	25% ether in olive oil.
Magliano	Daily	5 to 10 c.c.	20% ether in olive oil, or 20% ether in Liq.petroatum. ether in olive oil.
Musser	Thrice daily	10 c.c.	ether in olive oil.
Mason	Every six hours	6 c.c.	40% ether in olive oil.
Goldblum	Twice daily	Half an ounce	12½% ether in olive oil.
Elgood	Daily	30 minims	of actual ether, in olive oil.

RECTAL INJECTION OF ETHER :  
 TABULAR STATEMENT OF RESULTS OF 39 CASES  
 TREATED BY THE AUTHOR.

Table 3.

Case Number	Age	Total Injections	Result and remarks.
3	3½y.	5	Mild fever. Lobular collapse lung. Improved. Adenitis glands neck and mediastinum.
4	4m.	8	Unimproved, convulsions, recovery
5	2½y.	7	Much improved. Adenoids. Constipation.
6	4½y.	8	Adenoids. Adenitis. Foci lungs. Improved
7	2y.	9	Mild congest. bronchopneumonia. Much improved.
8	9y.	9	Unimproved, no adenoids, no tubercle.
9	3y.	7	Adenoids ; rapid cure
10	15m.	11	No adenoids. Only slightly improved.
13	3½y.	9	Rapid cure.
14	5y.	9	Pre-existent gland tubercle. Unimproved.
15	7y.	8	Cured.
16	5y	8	Cervical adenitis, Cured.
17	6m.	9	Unimproved. Bronchitis, with good recovery.
18	4½y.	10	Mildly pyrexial. Much improved
19	3½y.	11	Much improved. Areas lobular collapse lung.
20	3½y.	11	Improved. Tonsillitis, acute adenitis neck.
21	2½y.	8	Cured.
22x	5y.	11	Much improved. Suspected mediastinal glands.
23x	7y.	10	Cured.
24	1½y.	7	Cured
25	8y.	7	Cured. Adenoids.
26	5y.	9	Very much improved. Adenoids.
27	3y.	9	Cured. Adenoids.
28	21m.	6	Cured ; ether alternate days only.
29	3½y.	9	Cured.
30	2½y.	10	Very much improved
31	5y.	10	Ditto. Haemorrhages subconjunctivally.
32	14m.	9	Improved. Bronchopneumonia. Whoop absent.
33x	2½y.	6	Unimproved. Ether alternate days. Phimosis.
34x	10m.	7	Cured.
35x	4y.	7	Improved. Adenitis. Doubtful adenoids.
36x	9y.	7	Cured.
37x	11m.	6	Unimproved, complications absent.
38x	3½y.	7	Cured. Adenoids.
39x	5y.	6	Cured.
40x	2y	7	Very much improved.
41x	14m.	9	Very much improved.
42x	3½y.	7	Cured.
43x	3m.	7	Unimproved. Symptoms mild throughout.

Cases marked thus "x" were treated with emulsified ether and oil. Dosage constant in all cases, a mixture of ether and oil, emulsified as noted, was administered so that the patient received half a drachm of ether (2 c.c. approximately) for each year of age. Very occasionally dosage was slightly increased over this figure.

Table 4.

INTRAMUSCULAR INJECTION OF ETHER :  
 TABULAR STATEMENT OF RESULTS IN FOUR CASES  
 Treated by the author.

Case Number	Age	Total Injections	Amount in c.c.	Result and remarks.
1	2½y	7 in 8 days	.75,1,1,.75	Bronchopneumonia, scattered foci of congestion. Cured rapidly
2	4y.	Ditto	.75,.75,.5 1,1,1,.75	
11	1½y.	7 in 7 days	.75,.6,.75 1,1,1,1,1,	Cured. Uncomplicated.
12	2½y	Ditto	1,1. all 1.5 c.c.	

TABULAR STATEMENT OF RESULTS OF ETHER THERAPY  
 RECORDED BY VARIOUS OBSERVERS.

Table 5.

Observer	Cases	Method	Results.
Levy and Finkelstein	104	Intramuscular	81% cured or improved
Goldblum	18	Ditto	82.2% cured or improved
Tow	61	Ditto	82% cured or improved
Guinea	302	Ditto	94.4% cured or improved
Costello	32	Ditto	70% cured or improved
Magni (92)	35	Ditto	74% cured or improved
Mason	26	Ditto	85% benefited
Audrain	Many	Ditto	Never known method to fail.
Genoese	20	Ditto	All cured or improved
Graeser	21	Ditto	81% cured or improved
Panayotolau	25	Ditto	All cured or improved
Goldblum (8)	21	Rectal	90.5% cured or improved
McGee	--	Ditto	Most cured or improved
Magliano	10	Ditto	All cured or improved
Mason	4	Ditto	50% cured
Newman	9	Intramuscular	All cured or improved
Pollock	107	Ditto	All cured or improved
Elgood	33	Ditto	55.5% cured, 12.1% failed
Elgood	70	Rectal	55.5% cured, 22.8% failed
Voigt	12	Intramuscular	All cured.

Table 6.

TABULAR STATEMENT OF RESULTS OF ETHER THERAPY  
BY ALL METHODS  
IN THE AUTHOR'S SERIES OF CASES.

Cases Treated	Total	Cured	V.M.I.	Improved	Classed as failures.
Intramuscular	4	4	-	-	-
Simple ether and oil.	26	10	4	7	5
Emulsified ditto.	13	6	3	1	3
All methods	43	20	7	8	8
Percentage		46.6%	16.3%	18.5%	18.5%

V.M.I. . . . . "Very much improved".