

**Whooping-cough : its pathology and treatment : a prize essay, to which the Medical Society of London awarded the Fothergillian Gold Medal for 1881 / by Thomas M. Dolan.**

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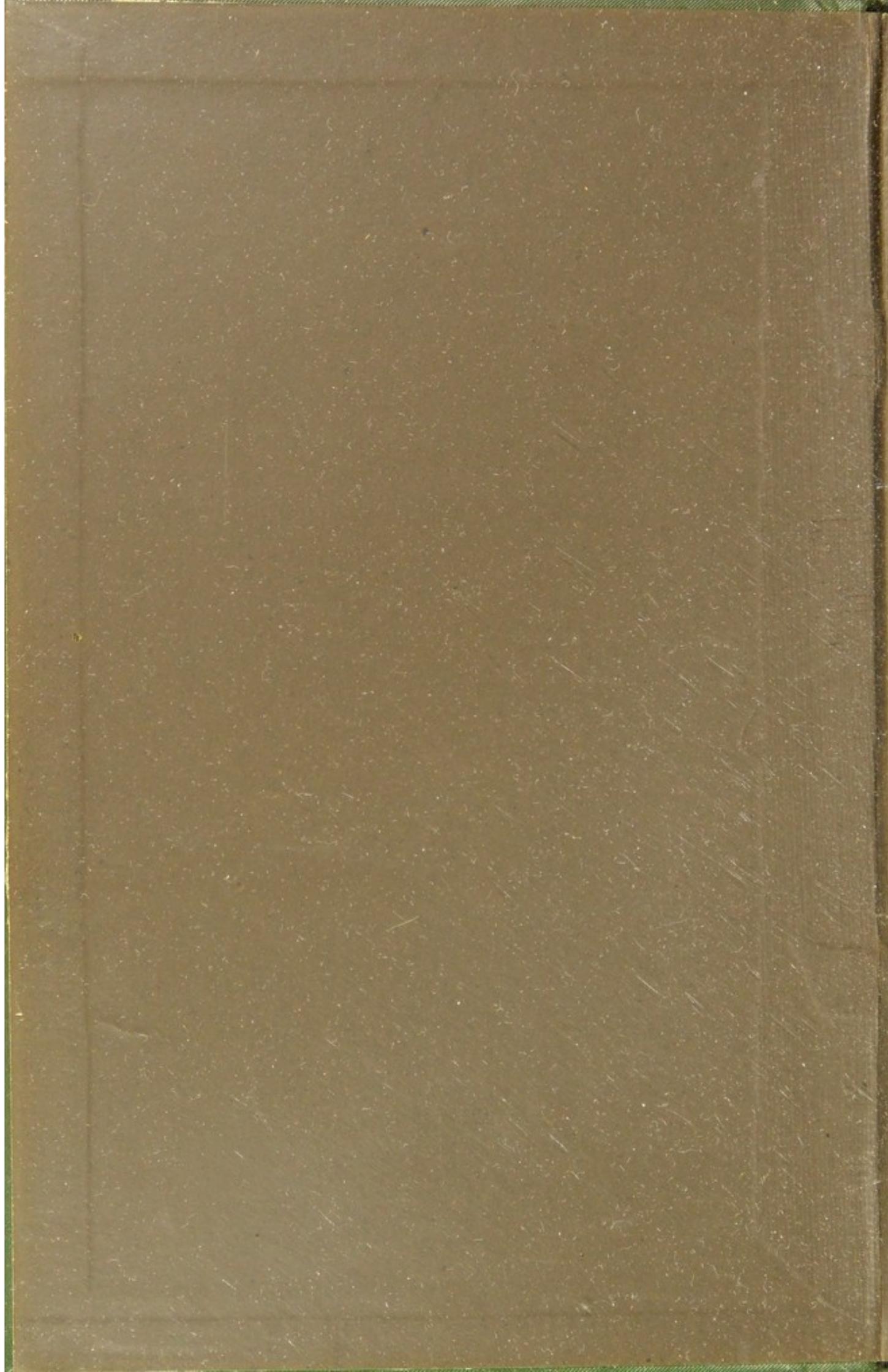
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WHOOPING-COUGH

ITS  
PATHOLOGY AND TREATMENT

THOMAS M. DOLAN.





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# WHOOPIING-COUGH:

ITS  
PATHOLOGY AND TREATMENT.

A Prize Essay,

TO WHICH THE MEDICAL SOCIETY OF LONDON  
AWARDED

THE FOTHERGILLIAN GOLD MEDAL  
FOR 1881.

BY

THOMAS M. DOLAN,

FELLOW OF THE ROYAL COLLEGE OF SURGEONS, EDINBURGH; FELLOW OF THE OBSTETRICAL  
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(BOYLSTON PRIZE ESSAY), ETC., ETC.

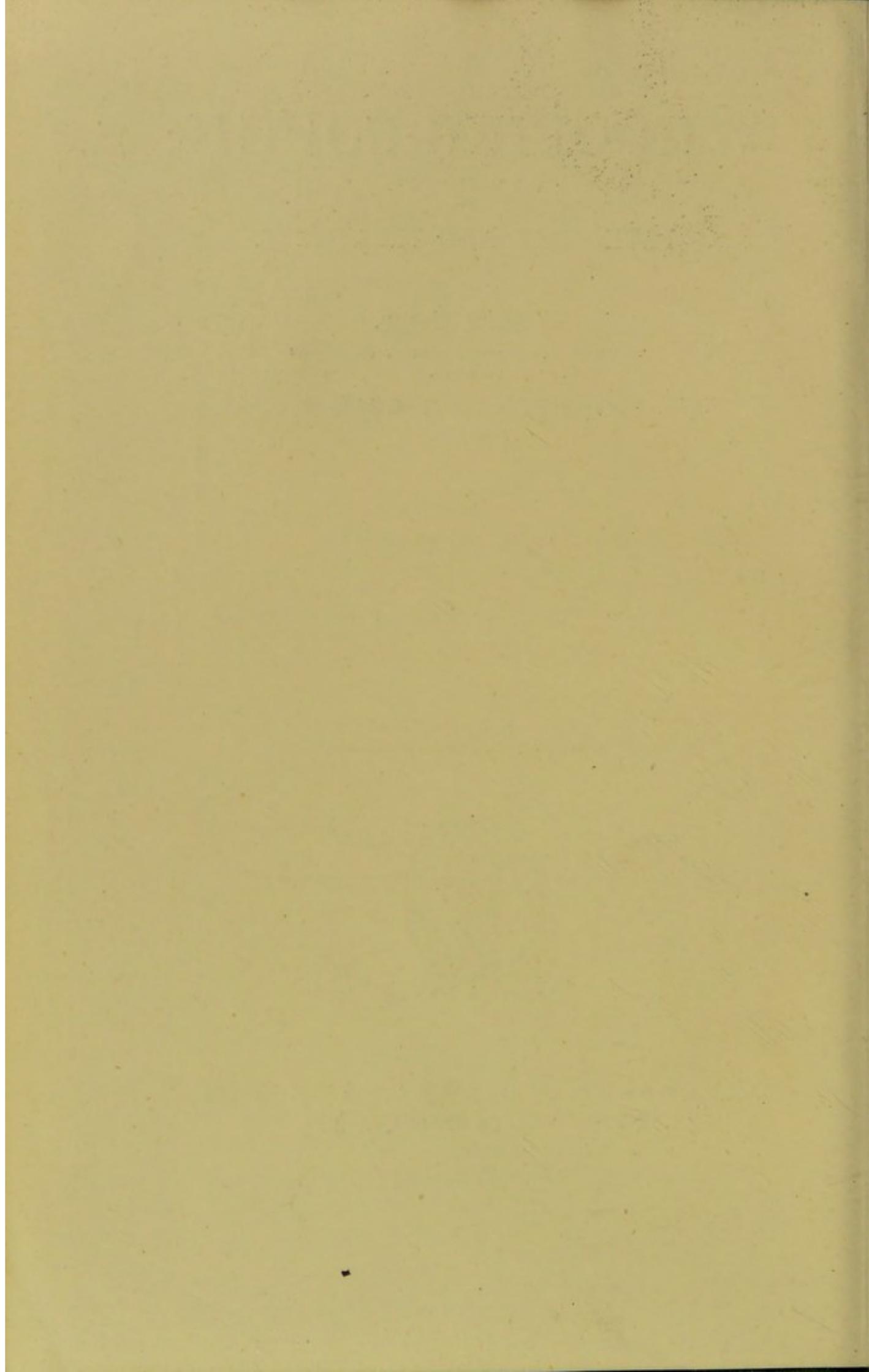
' . . . . Si quid novisti rectius istis,  
Candidus imperti, si non his utere mecum.'  
HORACE, *Lib 1. Epis. v.*



LONDON:  
BAILLIÈRE, TINDALL, AND COX,  
20, KING WILLIAM STREET, STRAND.

1882.

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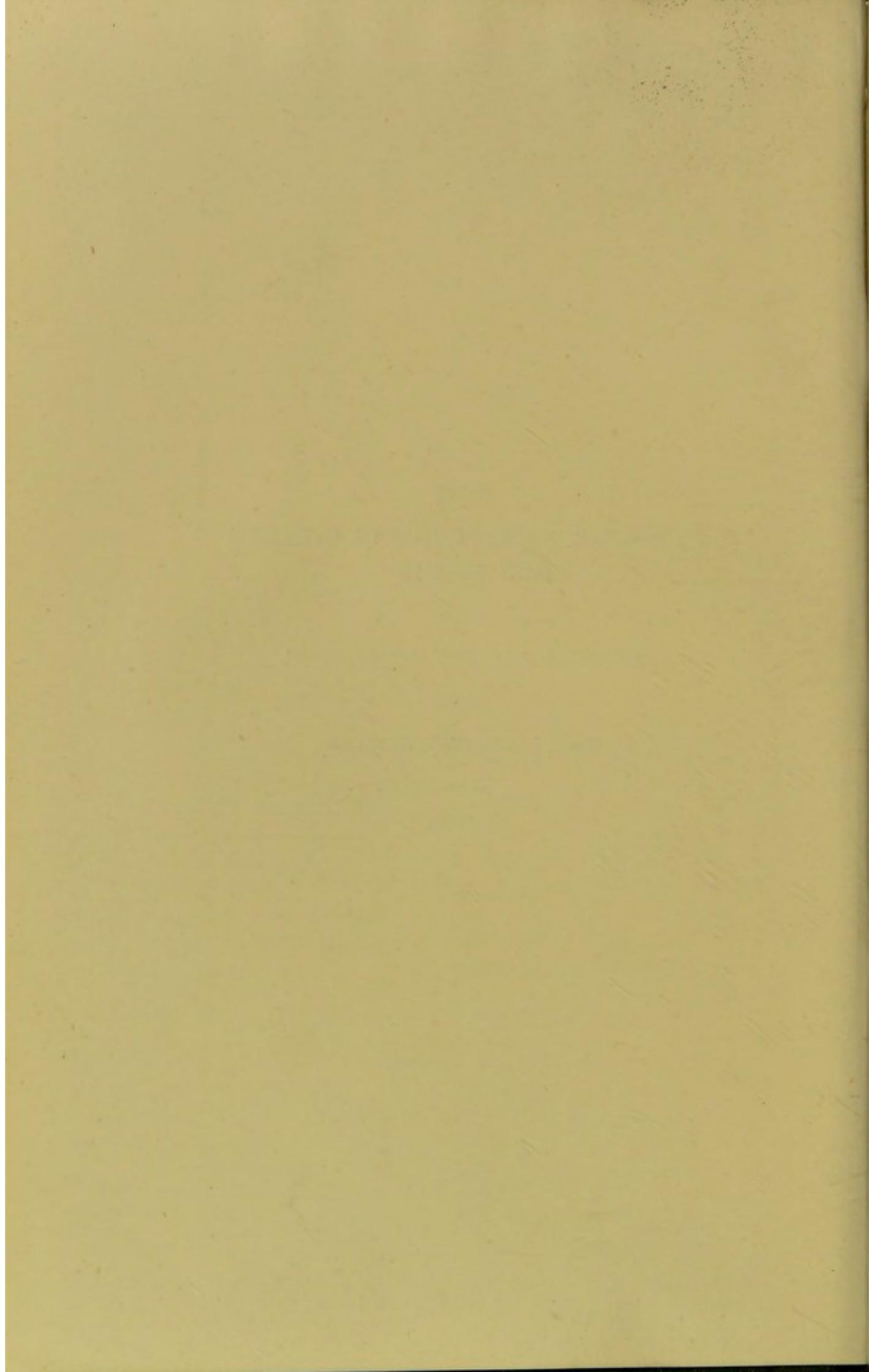


TO THE  
PRESIDENT, VICE-PRESIDENTS, OFFICERS,  
AND FELLOWS

OF THE  
MEDICAL SOCIETY OF LONDON,

THIS  
Essay is respectfully Dedicated

BY THE  
AUTHOR.



## P R E F A C E.

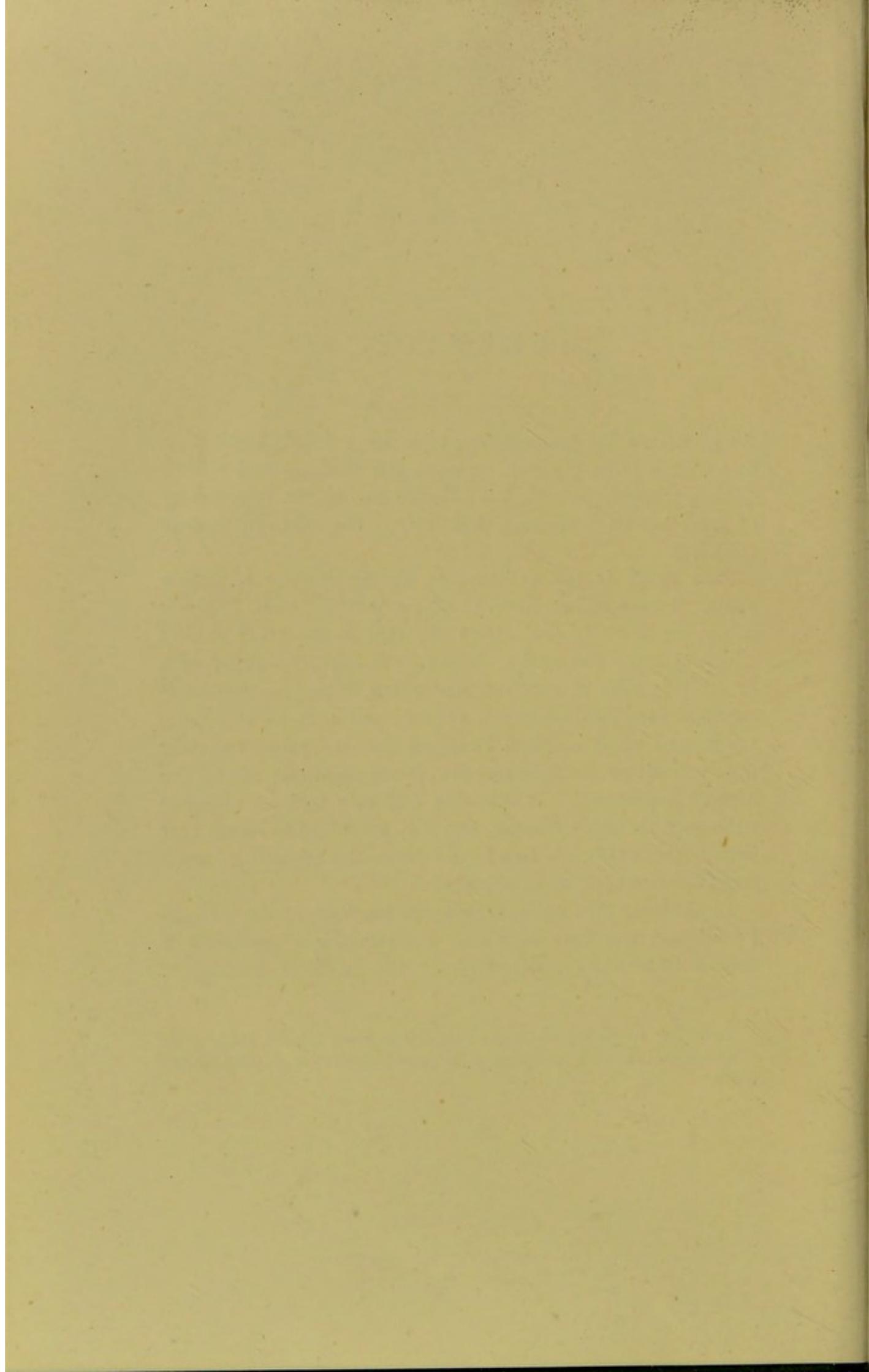
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As physician, for many years, to a large public institution, and with a large practice amongst the working and middle classes, whooping-cough has afforded me ample opportunity of studying its pathology, and testing the effect of various remedies.

This essay is the outcome of the experience of fifteen years. I have endeavoured to take a practical view of treatment; for, after all and above all, that is the great subject which concerns the public. When we remember that a fourth of the mortality of children, under five, in the metropolis is ascribed to whooping-cough (West), and that in our large towns and rural districts it causes almost a proportionately high mortality,<sup>1</sup> curative and preventive measures are of the highest importance. It is highly desirable to have a perfect pathology for every disease, but it is consoling to know, that even without this, we may have a particular method of treatment based on empirical experience.

In the hope that my essay may in some slight degree help to advance the pathology and therapeutics of pertussis, I submit it to the consideration of the Medical Society of London.

<sup>1</sup> According to the reports of the Registrar-General, 109,454 deaths were registered from whooping-cough, from the years 1860 to 1869, in England and Wales.



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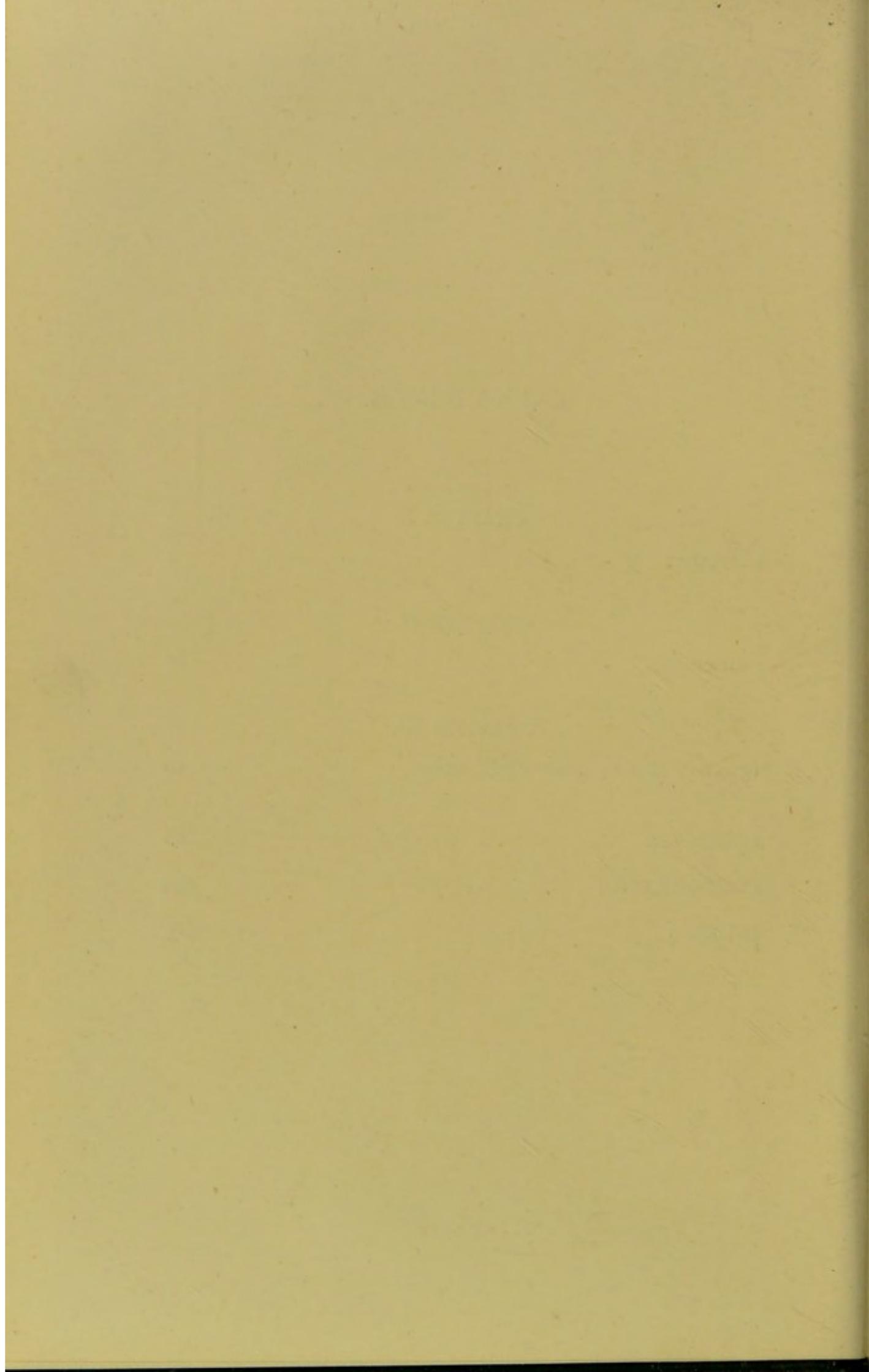
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# WHOOPING-COUGH:

ITS

## PATHOLOGY AND TREATMENT.

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### CHAPTER I.

#### PATHOLOGY.

##### § 1. *A Definition of Whooping-Cough.*

THE history and etiology of pertussis, save in their pure relation to pathology, do not fall within the scope of this essay, but a definition of the disease forms a fitting prelude to any dissertation on its pathology and treatment.

Without extracting from medical works the various definitions given by their authors, I shall frame my own definition. It is based necessarily on the teaching I have received, with my own practical observations of the disease.

Whooping-cough may be defined as a communicable disease, depending on a specific poison, prevailing epidemically and sporadically; it is characterized by fever, malaise, irritation of the respiratory tract, catarrh, and subsequently by a hard, dry, convulsive, paroxysmal cough. It attacks all ages and sexes, but especially children, rarely occurring but once; usually it runs a course varying from three weeks to three months. It may be complicated with other lesions, as ulceration of the frænum linguæ, enlargement of the tracheo-bronchial glands, capillary bronchitis, lobular collapse, emphysema, various hæmorrhages, convul-

sions, catarrhal pneumonia, tubercular meningitis, and other diseases of children. This definition is sufficiently broad and comprehensive for all practical purposes.

The next question we have to consider is its nature, and without sheltering behind a definition, to more closely examine—what is whooping-cough ?

### § 2. *Various Opinions on its Pathology.*

The above question has been frequently asked, and though many answers have been returned, yet few may be considered conclusive or satisfactory. A survey of our literature reveals to us the great divergence of opinion that has existed, and still exists, on its pathology. The favourite view seems to be to look for its seat in the nervous system,<sup>1</sup> so we have theories fixing on the cerebrum,<sup>2</sup> medulla oblongata,<sup>3</sup> pulmonic and diaphragmatic nerves, pneumogastric and phrenic nerves, as the centres of morbid change; we have theories in which it is assigned to a catarrh of the lungs and stomach,<sup>4</sup> to a form of specific inflammation of the larynx and glottis.<sup>5</sup> It has been looked upon as a form of bronchitis,<sup>6</sup> inducing directly spasm of some part of the respiratory apparatus, or cephalic irritation,<sup>7</sup> which in its turn excites the spasm, and it has been ascribed to the irritation of insects.<sup>8</sup> These are the views of the earlier writers on the disease.

If we glance at our modern text-books on medicine, we do not derive much assistance towards the solution of the problem, as they are mainly composed of a repetition of the views quoted above. Walshe<sup>9</sup> tells us that whooping-cough is a disease without any truly distinctive anatomical characters, though he admits that whooping-cough has a specific character, declaring itself by the qualities of the secreted matter, by the reflex spasm of the air-tubes, more especially manifesting itself in laryngismus.

<sup>1</sup> Hoffman, Hufeland, Lebenstein, Jahn, Pinel, Foot, Gibb.

<sup>2</sup> Webster.

<sup>3</sup> Copeland.

<sup>4</sup> Broussais.

<sup>5</sup> Dawson.

<sup>6</sup> Laënnec.

<sup>7</sup> Desruelles.

<sup>8</sup> Linnaeus.

<sup>9</sup> Walshe, 'Diseases of the Lungs,' p. 571.

Tanner<sup>1</sup> shares with him the view that the disease depends upon some peculiar poison, communicated through the atmosphere ; but he goes farther than Walshe, as he describes some of the morbid changes found in the course of the disease.

Walshe, admitting a virus, considers that the poison has a special attraction for the pneumogastric nerve, and, probably, for the connected portions of the nerve-centres, and that the saccharine state of the urine points to such localization. Tanner also states that the poison affects and irritates the pneumogastric or vagus nerve. Both writers admit a virus or contagium vivum, as the cause of the disease.

These propositions are very important.

This virus is supposed to exist in the air of expiration independently of the expectoration. This will lead us into the germ theory of disease.

Linnæus, to a certain extent, foreshadowed modern views when he endeavoured to prove that almost all diseases were produced by animalculæ, or had an insect-origin ; though his opinion was only adopted by the Linnæan school.

Many of the older writers believed that what was termed *tussis sicca*, or dry cough, was produced by the larvæ of insects, the minute eggs being exhaled into the air of respiration, and when inhaled finding a convenient nidus in the bronchial vessels.

Linnæus and the older writers were not so very far wrong. It was reserved for the present generation to prove that germs were at the root of many diseases, and that from these germs organisms were developed, which grew, reproduced, and died ; which thus manifested all the signs of vitality, so that they had to be classed as organic. Thus, classed as organic, came the question as to whether they should be assigned to the vegetable or animal kingdom. Owing to their possessing apparently voluntary motions, some considered them to belong to the Infusoria, others looked upon them as Algæ.

These organisms were known by the name of Bacteria. Linnæus may well be pardoned for considering that insects

<sup>1</sup>Tanner, 'Practice of Medicine,' vol. i. p. 566.

were instrumental in producing whooping-cough, when even so late as 1874 bacteria were looked upon as Infusoria. We now look upon them as protophytic fungi, belonging to the vegetable kingdom, and classed by Cohn as Schizomycetes.

This classification was only arrived at by slow steps. Whether Linnæus, when he referred to insects, alluded to an organism similar to, or identical with, bacteria, we have now no means of judging; but his view, read by the light of modern scientific discoveries, seems to me well worthy of consideration. Changing the term insect for fungus, as I shall presently show, there is much to be said in favour of the fungoid theory.

### § 3. *Views of Dr. Guéneau de Mussy.*

I have selected the views of Dr. Guéneau de Mussy in order to make them the basis for my objections against the majority of the theories advanced, whilst at the same time I can discuss his theory, and it is sufficiently novel and ingenious to deserve consideration.<sup>1</sup>

At a meeting of the Academy of Medicine, Paris, 1876, M. Guéneau de Mussy presented some pathological specimens collected by an old pupil, M. Parinand, who in two post-mortem examinations, which he had made on children dying from whooping-cough, had found an enlargement of the tracheo-bronchial glands, compressing the pneumogastric and its bronchial branches.

The theory of M. Guéneau de Mussy is that the malady is essentially an affection of these glands, a bronchial adenopathy. When the glands are enlarged from other causes the cough of pertussis has been noticed. By this theory he explains why the spasmodic-cough only occurs, during the second or third week, after what De Mussy calls the exanthematic period. By this theory he also explains why a catarrh or an attack of measles may provoke a recurrence of the special cough in a child convalescent from pertussis, and why the special

<sup>1</sup> A somewhat similar view was put forward by Dr. Ley, in 1876, in his work on 'Laryngismus Stridulus.' It is referred to by Sir T. Watson in his admirable article on whooping-cough in his 'Practice of Medicine.'

cough may be absent. In the latter case he supposes that the glandular enlargement was slight, or so placed as not to press upon the pneumogastric nerves. This affection of the glands he believes to be secondary to an internal eruption, and the disease to be primarily an eruptive fever with exanthematic, or rather enanthematic, manifestations, in the mucous membrane of the bronchial tubes.<sup>1</sup>

In the *British Medical Journal*, October 25th, 1879, Dr. Guéneau de Mussy has another contribution on the subject, more explanatory of his views. It was called forth by the objections raised by Dr. Barlow against his theory. In this paper he brings forward fresh evidence to support his views. He states that in all the cases of whooping-cough observed by him, since his attention has been called to this point, he had ascertained, during life, the clinical signs belonging to tracheo-bronchial adenopathy, and that in all the post-mortem examinations made in the Children's Hospital, Paris, this enlargement was found when sought for; that Dr. J. Simon, physician to the *Enfant Jésus* Hôpital, was convinced of the accuracy of the theory, and that Dr. Archambault had constantly observed the bronchial enlargement. He desired to correct an impression that compression of any part of the pneumogastric nerve must produce cough like that of pertussis, as he had never asserted such a fact. He again repeats his faith in his theory, challenging anyone to produce a case of well characterized whooping-cough without any enlargement of the bronchial lymphatic glands, ascertained by post-mortem examination or investigations during life.

#### § 4. *Objections to his Theory.*

In the discussion at the Academy of Medicine, Paris, many objections were raised against Guéneau de Mussy's views. M. Cohn pointed out that if it were true, enlargement of these glands from morbid states of the lungs should entail the cough of pertussis, but it was not found to be so; and Mr. Hardy also objected, that if glandular enlargement caused whooping-cough, it should be found in every case of the

<sup>1</sup> *Lancet*, vol. i. 1874, p. 174.

disease, whereas it was the exception to meet with it. He further instanced the occasional rapid subsidence of whooping-cough on change of residence, and the amelioration produced by compressed air, as incompatible with the theory. M. Blot said he could not understand how a permanent lesion, like glandular enlargement, could cause an intermitting cough; there must be another intermitting element in its production. M. Woillez asked the very important and pertinent question, How the contagiousness of whooping-cough could be explained on this theory?

At a meeting of the Pathological Society of London, January 21st, 1879, Dr. Barlow showed three specimens of disease of the bronchial glands, the first and second having special relation to the views of Dr. Guéneau de Mussy on whooping-cough. The first specimen showed moderate and acute enlargement of the bronchial glands, taken from a child who died, on the eighth day, of whooping-cough, contracted while the child was recovering from double empyema. Dr. Barlow believed, judging from other necropsies, that this lesion was by no means constant, or marked as an anatomical fact in whooping-cough. The second specimen was taken from a child aged seven months, the subject of tuberculosis, affecting most of the glands of the body. There was very considerable enlargement of the bronchial glands; and the vagus nerve, which was flattened, was adherent to one of them, about the size of a Spanish chestnut, situated above the root of the right lung. In this case, although the condition obtained from which Dr. Guéneau de Mussy alleged that the whoop of whooping-cough was produced, it had been noted that during life the child's cough had not the slightest resemblance to whooping-cough. The specimen was of interest also in relation to Sir William Gull's view that 'destructive pneumonia' was due to compression of the vagus nerve. In this case, although there was a cavity in the right lung, it was of the kind often found in tuberculosis of children, due to rapid breaking down of a caseous mass, and not at all of the kind described by Sir William Gull and shown in Dr. Irvin's specimens. The third specimen was taken from

a child aged eight months, the subject of general tuberculosis. Amongst other bronchial glands the one situated in the bifurcation was enlarged and caseous and beginning to ulcerate. The left bronchus, with which this gland seems to have special affinities, showed commencing tubercular ulceration on the side near the glands. Attention was drawn to cases recorded by Dr. Gee, where ulceration of the contents of the gland in this position into the left bronchus had been followed by partial gangrene of the left lung and pericarditis. This specimen was brought especially, as showing that the ulceration in such cases might proceed in both directions simultaneously; viz., from the gland to the bronchus and *vice versâ* at the same time. Dr. Burney Yeo supported the views expressed by Dr. Barlow, in opposition to those of Dr. Gueneau de Mussy. He had also, like Dr. Barlow, come to the conclusion that cough due to pressure on the vagi was very different from whooping-cough.

In the post-mortem examinations he had made in cases of whooping-cough, he had rarely met with acute enlargement of the bronchial glands. These are the obvious arguments which must be urged by all who have studied the disease even superficially, while all who have made a number of post-mortem examinations on children must reject the theory. I might accumulate evidence from sound writers against the views of De Mussy. Thus Tanner, Bristow, Roberts, tell us that the bronchial glandular enlargement is only occasionally seen. My own experience and the post-mortem evidence obtained by me are confirmatory of the observations of Drs. Barlow and Burney Yeo. Still more, the evidence of the post-mortem room is conclusive on another point; though the bronchial glands may be enlarged from various causes, yet the pertussoid cough has been absent in life. Amongst the poorer classes, amongst those whom we have an opportunity of examining in our public institutions, glandular enlargements are but too frequently seen; the cervical, mesenteric, inguinal, may be palpably felt enlarged. This arises from the unhealthy condition, unsanitary surroundings, and bad or impoverished diet of this class. As the superficial

glands are thus enlarged, we may not unreasonably infer that the deeper glands will be affected. The post-mortem room is the place to verify this, and I have found that this inference is generally correct. De Mussy's challenge has been fairly met. He asserts that he has invariably found glandular enlargement when he has looked for it. He is entitled to credence.

Others assert that they have not found this enlargement although they have looked for it, though they have sometimes noticed the morbid change. They are entitled to equal credence. If the evidence be weighed impartially, it must lean to the side on which there is the greatest weight.

Guéneau de Mussy's views are, I believe, untenable, and do not account for the phenomena of pertussis. A better title for his paper would have been 'An Attempt to Explain one of the Phenomena of Whooping-Cough.' Many of the arguments against the De Mussy theory apply to all theories which would locate the disease primarily in a nerve-centre. If we admit a pure nervous theory, then we must dismiss a theory of contagium vivum. In the face of our facts can we do so?

Against the theories which place pertussis amongst the bronchitic class, independent of the difference of symptoms, the contagious argument has equal force. I cannot find any evidence to support the view that it is primarily an inflammation of the larynx and glottis. The theory of its relation to the exanthems will admit of fuller consideration.

#### § 5. *A Comparison with the Exanthems.*

There is a singular unanimity amongst medical writers on some of the facts about pertussis. All agree in considering it contagious or infectious. It has its period of incubation, of effervescence and defervescence; it has a character peculiar to itself. It runs a regular course; it rarely occurs but once in the same individual. Though its virulence does not equal that of scarlatina or variola, yet it is sufficiently active to extend the disease, and the contagium may be carried to a distance, as the following instances prove.

Walshe states that Dr. Neil Arnott related to him the

following significant illustration of its infective nature: A lady left a port in the East for England, with two children in the whooping-cough; the vessel put in at St. Helena, where the linen of the children was sent ashore to be washed; the children of the laundress were seized with the disease, and from them it spread generally through the island, no case of the complaint having previously occurred there for a lengthened period.

Another instance derived from my own experience is equally striking. In 1877 I had several cases of pertussis under treatment, and was making some observations on the sputa, collecting it, and fertilizing it in order to inoculate some rabbits and fowls, so that I was exposed for some time to an infective media; the consequence was that through my clothes I carried it to my own house, giving it to one of my children. The child could not possibly have contracted it from any other source. By a rigorous quarantine the disease was limited to a single child. I need not say I took personal precautions at the same time so as not to propagate the disease.

The inferences from the above facts are simple. It would be premature to assert that we have found the ultimate cause at work in the production of scarlatina, measles, variola; but there is legitimate ground for asserting that as we have found the microbe causing charbon, fowl cholera, vaccinia, so we shall isolate individual varieties of microbe, on which scarlatina, measles, variola depend. Nay, more; as Pasteur has proved that by virus-culture and by attenuated cultivations he can almost stamp out fowl cholera and charbon, so we may hope that scarlatina and measles will be controlled by virus inoculations. The insect of Linnæus is the microbe of Pasteur. Two great minds thus meet at the same conclusion. Linnæus taught that whooping-cough was caused by an insect. Can we carry the microbe theory a little further, and apply it to whooping-cough?

§ 6. *The Germ Theory.*

I need only allude briefly to this theory. It is now so firmly established, daily growing in strength and securing the support of all scientific minds in the profession, that it may be regarded as having passed the theory stage.

Tyndall<sup>1</sup> virtually observes that contagious disease is of a parasitic character, and that from their respective viruses you may plant scarlet fever, typhoid fever, or small-pox; that as surely as a thistle rises from a thistle seed, as surely as the fig comes from the fig, the grape from the grape, the thorn from the thorn, so surely does the typhoid virus increase and multiply into typhoid fever, the scarlatina virus into scarlatina, the small-pox virus into small-pox; so that to all intents and purposes a virus is a seed.

On the grounds of analogy, I would extend the list of parasitic diseases by including whooping-cough in this group.

§ 7. *Some Reasons for including Whooping-Cough in this Group.*

Looking at all the phenomena and symptoms in their entirety, whooping-cough presents, as I have shown, certain resemblances to the zymotic diseases. The very absence of distinct morbid anatomical primary changes favours this view. The rash and sore throat of scarlatina, the petechiæ and Peyer patches-ulceration of typhoid fever, are pathognomonic of these diseases. Whooping-cough has its distinctive feature, the singular morbid paroxysmal cough, the '*kink or whoop*,' with the secondary ulceration of the frænum linguæ are pathognomonic of it. Admitting a contagium vivum, we fall back upon the group of Schizomycetes which are the *fons et origo malo* in other diseases, and thus we can explain satisfactorily its infective nature and all the other phenomena attending it.

Independent of scientific research and medical observation, a belief in a contagium origin has existed for ages amongst the public. Children have been taken to gas-works in order

<sup>1</sup> Tyndall, '*Floating Matter in the Air.*' London, 1880.

to cure the disease. Empirical experience proved that this form of treatment was sometimes useful, but underlying such experience we find a substratum of truth.

Lister uses carbolic acid, thymol—antiseptics, in a word, to destroy the germs which give rise to putrefactive change.

The old woman who first recommended that children should be taken to gas-works was unconsciously acting on the principles of antisepticism.

The germs or fungoid spores which cause whooping-cough do not flourish well amongst the products of gas manufacture. Science and superstition here meet on the same ground.

It is an axiom in logic and philosophy that when several explanations are offered to account for any phenomenon, it is always better to choose the simplest. In classing whooping-cough among the fungoid diseases I am acting on this sound principle.

1. It is simple.
2. It is in harmony with ascertained facts.
3. It explains many of the phenomena.
4. It has been and may be verified.

It is more than a scientific use of the imagination to ascribe whooping-cough to a germ or a microbe.

§ 8. *Previous Experiments in this Direction.*

Walshe tells us that the infective activity of the secretion in pertussis would appear from recent experiments to be scarcely questionable.

Letzerich states he has succeeded in producing whooping-cough in rabbits, by inoculating the trachea with the sputa of the human subject. These sputa, he maintains, always contain fungi.

So far back as 1867, M. Poulet<sup>1</sup> is said to have found in the moisture of patients suffering from whooping-cough what were then termed Infusoria, belonging to the class *Bacterium-bacillus*.

Binz also believed that the disease was dependent upon the reception and further development of some form of fungus,

<sup>1</sup> *Lancet*, 1868, vol. i. p. 92.

and I shall refer to his treatment, as he ordered quinine in the hope that it might act upon the spores of the fungi while circulating in the blood.

I have not been able to find any references to any English observer who believed in a fungoid origin. Since Poulet first propounded the fact that he had found some form of infusoria of sputa in the whooping-cough, we have made great strides in the study of the organisms which he misnamed. I have previously alluded to the Schizomycetes.

Poulet, Letzerich, and Binz stand almost alone in their views and experiments.

#### § 9. *New Experiments.*

I have endeavoured to find out the organism on which pertussis depends, and the following series of experiments were made in order to test the contagious influence of the blood, nasal secretion, expectoration, saliva, vomit, and other fluids thrown off from the body. The animals I selected for experimentation were rabbits. The poet is born, not made; and so I believe the experimenter has to have special gifts. It is not given to all to be a Pasteur, Koch, or Lister. Valueless though my experiments may be, yet they indicate the lines on which we must search for the intimate nature of pertussis.

#### § 10. *Is the Virus in the Blood?*

The microscopical examination of the blood in life does not afford us any assistance on this point. I have frequently examined the blood of children suffering from whooping-cough without finding any alteration in colour, consistence, constituents, relative proportion of red or white corpuscles. In order to test the action of the blood I selected two healthy rabbits, and having shaved off some of the wool, I injected into the back of both rabbits some blood from a child suffering from whooping-cough. At the same time I introduced some of the blood into the nasal passages and mucous membrane of palate of the same rabbits. For a few days they seemed uneasy, restless, and there was some slight inflammation

about the seat of puncture. This, however, speedily passed away, and the rabbits were soon well; so that from this I may form the provisional conclusion that the blood does not convey the disease. In order to compare another disease I obtained some blood from a typhoid patient, and injected it into two other rabbits. The blood of the typhoid patient certainly gave rise to more disturbance. The rabbits for a few days did not eat their food so well, and a small abscess formed at the seat of puncture. After four days they began to nibble some cabbage-leaves, and on the seventh day they were seemingly as well as ever. From this I conclude that the blood of typhoid fever does not convey the disease to rabbits, though I have evidence that fæcal and other excrementitious matter from typhoid patients will affect these animals.<sup>1</sup>

§ 11. *Action of Nasal Secretion and Sputa on Rabbits.*

Though the blood did not convey the disease, yet the sputa might have the power of doing so. Taking the two first rabbits on whom I tried the blood, I injected into the nasal passages, roof of mouth, and back of one of them a strong solution of the nasal secretion of a child with whooping-cough in the second stage. The secretion was freshly taken, mixed with a little water and well stirred up.

1st Rabbit.—This was a female, strong and active. On the first day after the injection she was lively, and ate her food well. There was no indication of her having suffered from the punctures. At the end of twenty-four hours there was a slight degree of redness of the puncture on the back. She was restless, and seemed as if she wanted to rub herself against something, though she still fed well and ran about her bin. At the end of thirty-six hours she was evidently unwell. She lay quiet in one place, and did not seem to wish to move. Her food did not tempt her. On feeling her nose it was hot and inflamed. Her breathing was quicker.

<sup>1</sup> I am aware that a French observer has obtained different results with the blood from typhoid patients. See *Journal Thérapeutique*, No. V. p. 189. Translated by me for a London journal.

At the end of forty-eight hours her condition was indicative of some serious mischief. She had not taken any food for some hours, as the bran and cabbage-leaves were untouched, and she lay quiet, and did not move when touched. Conjunctivæ and nasal membrane, and mucous membrane of mouth irritable and red; breathing very quick. At the end of fifty-two hours she was almost moribund, and she died two hours afterwards. Post-mortem examination made half-an-hour after death.

1. Seat of puncture on back very much inflamed, with a tendency to the formation of an abscess.

2. The puncture in mucous membrane of nose almost obliterated; but membrane highly congested and irritable, with some slight secretion.

3. Mucous membrane of pharynx and larynx highly congested, extending some distance down trachea.

4. On opening lungs I found them full of blood, with incipient symptoms of inflammation.

The pleuræ and other organs were almost normal. No doubt the animal had died from blood-poisoning.

Scraping away some of the nasal epithelium, and some of the pulmonary tissue, I introduced it by means of an incision into the leg, nose, and mouth of the other rabbit; the result was that the second rabbit developed almost the same symptoms, and died about the same period. Post-mortem examination revealed an almost similar state of mucous membrane of nose, fauces, etc.

The first fact worthy of note here is, that though the blood did not produce any effect on the rabbits, yet an injection of the nasal secretion killed the first rabbit, and the second rabbit was destroyed by inoculation with some of the secretions from the first rabbit. The great point of interest is to explain the difference between the two fluids, the blood and the nasal secretion. Why did the latter act so potently, whilst the former was innocuous?

On examination of the nasal secretion by the microscope I did not detect any organisms which could account for its virulency. Although this does not prove that they did not

exist; when these experiments are repeated they may be found.<sup>1</sup>

Taking some sputa from a child with pertussis, I, on another occasion, inoculated with it a healthy rabbit, introducing it into the nose and mucous membrane of mouth. I examined the sputa before using it, but did not find any specific microbe. This rabbit for nearly two days ran about its bin and exhibited its usual degree of liveliness; on the third day it was seriously unwell, the temperature was increased, breathing hurried, with loss of appetite, and other symptoms of malaise. The rabbit died on the fifth day with symptoms of pneumonia. On making an autopsy immediately after death, there was considerable arborization of the blood-vessels at the seat of the operation, with swelling of the lymphatics; and on opening the thorax the lungs were found to be in an inflammatory state, whilst the mucous membrane of the nose and buccal cavity were moist, red, irritable and swollen. The immediate cause of death of this rabbit seemed to be convulsions, and there was general turgescence of the brain and its membranes.

I inoculated another rabbit with some fluid obtained from the lungs and nose; it succumbed on the second day after the experiment, after exhibiting symptoms of general malaise, disgust of food, immobility, difficulty of breathing, convulsive movements.

The chief points of interest connected with these experiments are, that the sputa exerted a poisonous influence, whereas the blood did not do so.

The question naturally arises, is there a morbid principle attached to the sputa, intrinsically belonging to it? or is the morbid principle the result of some kind of alteration in the sputa subsequent to its ejection from the bronchial tubes of the pertussoid patient from whom it was obtained?

<sup>1</sup> Since these experiments were carried on, Koch has enriched the literature of micro-organisms by the publication of his discovery of the tubercle-bacillus. New methods of staining have been introduced, as that of Koch and Ehrlich, by which the bacilli are more easily found. It is possible and probable, by some method of staining, the micro-organism of pertussis will be revealed, and be as easily demonstrated as the tubercle-bacillus.

These suggestions or enumeration of particular questions springing from the general question of the pathology of whooping-cough, shows us what a highly complex problem we have to solve; and this complexity is not confined to whooping-cough, but is inherent to all questions on the nature of infectious and contagious diseases.

I believe that the nasal secretion and sputa thrown off by a patient with whooping-cough contain a well characterized toxic principle, which we may consider as the principal agent of the malady; that the sputa, etc., confine this morbid principle, though as the result of change, germs may be thrown off into the air, thus spreading the infection, and acting as a ferment, just as the common germs of milk fermentation or putrefactive change act. When the sputa, nasal secretion, or blood of a patient suffering from whooping-cough are allowed to stand for about eight or ten hours, we can readily find ordinary forms of bacteria, but these forms will not give rise to pertussis.

It is probable that M. Poulet mistook the bacterium termo for a bacillus, as there is little or no difference in their appearance or behaviour under the microscope, though there is a very important difference in their action, by means of which we are able to differentiate between them.

I have frequently seen in the sputa of whooping-cough an appearance of an organism, to my eye resembling the spirochæte plicatilis of Cohn; but on submitting sputa of this nature to a better microscopist than myself, I have been assured that this seeming microbe was a delusion. I make this confession, as it is so easy to make mistakes in microscopic work, and it is possible to see in the field of the microscope what we wish to see. There is a personal equation which must be allowed for. Though I believe that some form of microzeme, or microbe, is the cause of pertussis, yet I must honestly say it has not yet been found.

I have shown that rabbits die from the effects of inoculation with the nasal secretion and sputa, though not from the blood; I made one other experiment in order to try whether rabbits were susceptible to the emanations from

decomposing sputa and vomit of a sufferer from pertussis. I made them breathe an atmosphere impregnated with impure air, or the products given off by a solution made up of excrementitious matter. I placed two rabbits in a box so contrived that they were fed with the air coming from a vessel in which there was a mass of vomit. It was suggested to me by somewhat similar experiments made on dogs by Dr. Barker with foul air from a cesspool. The front of the bin was made of glass, so that I might watch the behaviour of the rabbits; and I had a small door on the top with a ventilating tube, so that I might be able to introduce food and allow the air to pass away. The vessel was placed underneath, and fed the box with air. The rabbits for four or five days remained unaffected. At the end of a week one of them showed signs of drooping; it lost its vitality, did not eat, and was evidently pining. On the tenth day it was still and quiet, its breathing was hurried, and it died on the twelfth. Post-mortem examination revealed all the symptoms of blood-poisoning.

The other rabbit suffered in a milder degree; its chief symptoms being feverishness, languidity, cough and vomiting, the latter symptoms coming on about the fourteenth day. I removed it from the bin on the fifteenth day to another one. It soon recovered, and I have this rabbit now. To all appearance it is as well as ever. These experiments suggest the lines on which other observers might proceed.

#### § 12. *The Importance of Experiments.*

Without experiments on living animals it will be impossible to clear up the pathogeny of pertussis. So many restrictions are now placed upon investigators by the mistaken zeal of hysterical women and men, that I fear research will be impeded. If well-meaning people would listen to such an instructor as Tyndall,<sup>1</sup> or had intelligence enough to appreciate his impartial evidence, the present harassing system would soon come to an end. Speaking on fermentation, he well and truly says, 'We have now reached a phase of this question when it is of the very last importance that light should once

<sup>1</sup> Tyndall, 'Floating Matter in the Air,' 1880.

for all be thrown upon the manner in which contagious and infectious diseases take root and spread. To this end the action of various ferments upon the organs and tissues of the living body must be studied; the habitat of each special organism concerned in the production of each specific disease must be determined, and the mode by which its germs are spread abroad as sources of further infection. It is only by such rigidly accurate inquiries that we can obtain final and complete mastery over these destroyers. Hence, while abhorring cruelty of all kinds, while shrinking sympathetically from all animal suffering—sufferings which my own pursuits never call upon me to inflict—an unbiassed survey of the field of research now opening out before the physiologist causes me to conclude, that no greater calamity could befall the human race than the stoppage of experimental inquiry in this direction.'

There is a sentimental wave passing over the country, which, unless checked, may put an end to animal experimentation, and which may thus impede the progress of science. It finds its advocates in ladies who are dressed in the death-work of the silkworm, in the furs and feathers of animals and birds, and who use other articles made from the skeletons of some animal, bird, or fish. They forget not only how many thousand animals are sacrificed, and how many human lives are lost, in pearl-diving, seal, whale, beaver, or lynx hunting, to gratify their vanity, or the caprice of fashion, yet they shudder at an experiment upon an animal, even though it may be beneficial to the human race. The infliction of unnecessary pain is condemned by all physicians, whilst the infliction of pain in experiment is upheld as justifiable, with the object we have in view.

§ 13. *On the Value of a Constant Lesion found in Pertussis: viz., Ulceration of the Frænum Linguae.*

This is a lesion almost constantly to be found in pertussis, though there are different opinions as to its value, frequency, and relation to the disease. Some consider the lesion as constant, initial, and anterior to the kink or cough, related to the different phases of the malady. Most observers, however,

regard these lesions as surgical, produced by mechanical action; viz., by the contact of the tongue with the lower incisors in the seizures.

Writing on this subject in 1878, anonymously, I pointed out the necessity of studying and comparing foreign contemporary literature in order to keep *au courant* with scientific advance. This observation was called forth by my reading in the *British Medical Journal*, September 21st, 1878, a paper by Dr. Maccall on 'Ulceration of the Frænum Linguae,' and in the *France Médicale*, September 21st, a report on the same subject, so that side by side we had different observers in different countries working at the same problem. Dr. Maccall's observations may be read in our English journal. *La France Médicale* is not generally seen by the profession, so that a brief abstract on the results and deductions of the French reporters will not be out of place. I translated it at the time, as the conclusions of the reporters harmonized with my own views. The report was called forth by a note 'On Diphtheroid Ulceration in Whooping-Cough,' published by M. Delthil. M. Henri Roger, in the name of a commission in which he took part with Guéneau de Mussy and Moutard Martin, reported on it at the French Academy of Medicine.

M. Roger arrived at the following conclusions:

1. The sublingual ulceration is proper to pertussis, and as it is only produced after violent 'kinks,' it becomes almost a certain sign of confirmed intense whooping-cough.

2. It is traumatic: the indispensable conditions for its occurrence being propulsion of the tongue outside the mouth during a violent attack, the repeated rubbing of the frænum on the free borders of the incisors.

3. The intensity of the cough and the ulceration are proof of the mechanical action, for it is only formed when the attacks are violent; it persists as long as they are severe, and cicatrizes when they become weaker—when the pertussis is on the wane, though not gone.

4. The physical characters of the lesion further confirm this view.

5. It is still further proved by the absence of this lesion at certain times, as in the first months of life and when the incisors are absent, so that without offensive teeth there can be no possible wound, and consequently, no sub-lingual ulceration.

6. The frænal ulceration cannot be considered a specific morbid manifestation. Far from being constant, it is only met in a moiety of cases. It does not appear at the beginning, like fever eruptions, but at variable times; it follows the 'kinks.' It cannot be regarded as an exanthem, since it does not commence as a vesicle, pustule, tache, diphtheroid plaque, or pseudo-membrane. It is at first an erosion or wound, which ulcerates, and becomes covered with white or grey matter. The microscope points out its dissimilarity from the false membrane of diphtheria.

7. It would be a grave error to believe in the relation of the sublingual lesion with the genesis of pertussis, or to compare ulcerations of the frænum 'with the chancre of syphilis, the aphthæ of enteritis, or the lyssæ of rabies.'

8. Its importance must not be looked at in a general pathological view; it is only an incidental local lesion; but as it is not met with in any other affection,<sup>1</sup> it becomes in certain cases a capital symptom, a certain sign of whooping-cough, and of great semiolic value for pertussis of an intense type.

This report would be incomplete without a brief *résumé* of the propositions of M. Delthil, on which it was based. From an observation of twenty-seven cases, M. Delthil came to the following conclusions:

1. This ulceration is the primary phenomena of a general affection, as chancre is in syphilis.

2. It has been improperly termed sublingual, as its seat is variable; sometimes at the frænum on the right or left side, the floor of the mouth, lower lips, etc.

3. It has been attributed to the irritation produced by the projection of the teeth, during the paroxysms of cough; but

<sup>1</sup> This is contradicted in *British Medical Journal*, vol. i. 1879, pp. 348, 427. Dr. W. Berry and George Browne state that they have met with ulceration apart from whooping-cough.

in two cases it was observed prior to dentition. It always disappears before the paroxysm, and is found at all ages, in children and in adults.

4. It precedes the paroxysms of cough, appearing with the fever and vomiting, and disappears with the fever in from four to eight, or sixteen days, the vomiting and paroxysms still persisting.

5. It is observed from the twelfth to the fifteenth day after the supposed contagion.

6. It leaves cicatrices behind.

7. Of more frequent occurrence than has hitherto been acknowledged, it seems to be proportionate in its extent, duration and depth to the gravity of the affection.

I look upon M. Delthil's views as an example of hasty generalization from insufficient premises. I have noticed this lesion; but as regards the cause, my views are almost in agreement with those of M. Roger.

#### § 14. *On the Phenomena of 'Kink,' or Cough.*

In no other disease do we meet with such a cough. It has a character peculiar to itself; it is known to every mother, and the diagnosis is soon made out when you once hear this 'kink.' It is unlike the cough of laryngismus stridulus. How is it caused? Coughing is a common effort, consisting in the first place of a deep and long-drawn inspiration, by means of which the lungs are well filled with air, this being followed by a complete closure of the glottis, followed again by a sudden and forcible expiration, in the midst of which the glottis suddenly opens, and a blast of air is driven through the upper respiratory passages. Coughing is a reflex act. But there is something more in the cough of pertussis. In what does the difference consist, and what are the pathological conditions, if any? There are two stages in the paroxysm.

1. We have a number of expiratory efforts made in quick succession, during which the air is driven out of the lung in jerks, of varying degrees of violence. During this stage no air is taken in to make up for what is lost. The blood is

thus imperfectly aerated, and the patient seems on the point of being suffocated.

In the second stage we have exhaustion of the paroxysm, followed by a long-drawn act of inspiration ; at this period the peculiar crow, kink, or whoop, so characteristic of the disease, is heard. The violent expiratory efforts, followed in turn by inspiratory efforts, recur again and again, under the influence of reflex irritation. The paroxysm may go on until the irritation is removed, expectoration or vomiting accomplishing this.

The question naturally arises, in what condition are the lungs during the paroxysm? If the chest be auscultated between the short intervals of expiration and inspiration, you will hear some wheezing or vesicular breathing; but if the ear be applied to the chest during the long-drawn noisy inspiration, there is nothing to be heard. How can we account for this? Several hypotheses have been put forward.

1. It has been supposed to result from the slow and niggardly manner in which the air passes towards the lungs through the chink of the glottis, which is spasmodically narrowed.

2. Laënnec believed that it depended in part upon a spasmodic condition of the muscular or contractile fibres of the bronchi and their branches. We have no post-mortem evidence to confirm Laënnec's view, but if it were possible to examine the lungs in this stage I am of opinion that Laënnec's view would be correct. We know now more about the minute anatomy of the lung than we did in the time of Laënnec. It will not be out of place to briefly cast a glance at the minute anatomy of the lung, as revealed to us by the industry of Charcot. I shall especially dwell on the intrapulmonary bronchial tubes, setting aside the upper part of the aerial tract, as the larynx, trachea, and primary divisions of the bronchi.

Charcot shows us that in dissections made perpendicularly to the axis of the bronchus, whose diameter exceeds a millimetre, the structure is as follows :

1. The wall consists of a coat, called the external or

adventitious fibrous coat, which is principally formed of dense fibrous tissues, disposed in fasciculi, some longitudinal, others transverse. In its thickness are seen numerous elastic fibres grouped in bundles, whose direction is longitudinal; it is in this coat also that there are found cartilaginous plates, as well as mucous glands.

2. Farther inward is found the muscular coat, composed of smooth fibres arranged in circular bundles. In men the thickness of this layer in a bronchus of 4 millimetres is 0.1 millimetre, and in a bronchus of 2 millimetres it is 0.05 millimetre. This layer, from a pathological point of view, is very interesting, as the destruction of the cartilaginous nuclei which it possesses plays a considerable part in the pathogenesis of certain bronchial dilatations. It is also important in connection with atrophy of the muscular coat, and the theories which ascribe spasmodic bronchitis to the action of the fibres of Reissessen.

3. Still farther inwards we meet with the internal fibrous layer.

4. In the last layer we have cylindrical epithelial cells with vibratile cilia.

If we examine the walls of bronchial canals, whose dimensions are less than 1 millimetre, we find certain modifications.

1. These modifications are principally noticed in the external fibrous coat. In the first place, this membrane becomes relatively thin; thus, in a bronchus of 0.4 millimetre in diameter it is only 0.02 millimetre. Besides, and this is an important point, the cartilaginous plates and mucous glands are absent. We must not then expect to find these anatomical elements in the walls of the intralobular bronchi, whose diameter, as we are aware, are less than 1 millimetre.

2. The muscular layer is well marked, but it is not continuous, and forms a series of small sphincters on the terminal bronchioles. According to Rindfleisch, one of these little sphincters, which sometimes is much hypertrophied on the alteration of the lung known as brown induration,

marks the point where the terminal bronchiole opens into the alveolar canals.

3. The internal or mucous layer preserves at first its folded and wavy appearance ; then it tends to become smooth, and while retaining these characteristics it is thinned in the terminal bronchioles.

4. With respect to the cells which constitute the epithelial investment, they maintain their character as far as the terminal bronchioles. At this point they become of a cuboid form, and ultimately, at the point of entry of the bronchioles into the alveolar canals, they become squamous, at the same time losing their cilia.

We must bear in mind the minute anatomy of the lungs if we desire to fully appreciate why all is silent in the chest during the inspiratory stage, the causes at work in the production of emphysema, collapse of the lung, and other secondary conditions of the pathology of whooping-cough.

When the inspiratory act takes place, the air at first does not penetrate beyond the larger bronchi, and is long before it again freely permeates the pulmonary vesicles ; and why ? because though the larger bronchi are patent, the muscular fibres of the smaller and ultimate bronchioles are closed.

In the secondary condition of carnification of the lung, often found in whooping-cough, and where opportunities offer themselves of making post-mortem examinations, Sir John Alderson has found that the lung is dense and contracted, as if the air had been expelled, and from the throwing out of adhesive matter, the sides of the air-cells had been agglutinated together. In the stage when air is taken in, we have not this agglutination, though the air-cells are primarily closed by the fine muscular fibres above described. These facts have a very important bearing upon the causation of emphysema.

Professor Gairdner (Glasgow) has clearly propounded and ably supported the inspiratory theory of emphysema ; but this theory is not applicable to whooping-cough, for as MM. Rilliet and Barthez have proved, the inspiratory efforts during whooping-cough are not violent ; there is a gentle,

regulated, slow flow of air into the lungs. We have therefore to fall back upon the expiratory theory advanced by Sir W. Jenner.

The minute anatomy is also important in connection with the part played by the pneumogastric nerve in whooping-cough.

Roughly stated, the lungs are supplied from the anterior and posterior pulmonary plexuses, formed chiefly by branches from the sympathetic and pneumogastric. The filaments from these plexi accompany the bronchial tubes, upon which they are lost. Small ganglia are found upon these nerves. Irritation of these nerves is said to have the effect of producing contraction of the bronchial canals, sufficient to expel a certain quantity of air. If this theory be true, it helps us in explaining why the larger, mediate, and smaller bronchi are closed during the expiratory stage of the pertussoid paroxysmal cough.

As I am speaking of the pneumogastric nerve I may refer to the theory of Autenreith, that inflammation of the vagus is the primary cause of whooping-cough. I have not found it so. Other observers have sought for it in vain in a large number of cases. Professor Alhers,<sup>1</sup> of Bonn, states that, having examined the bodies of forty-seven children who died of whooping-cough, he found the vagi perfectly healthy in forty-three. In three the vagus of the right side, and in one that of the left side, was slightly reddened; but this redness corresponded to the side towards which the body had been inclined, and in no respect differed from what is observed in the bodies of plethoric persons, and of patients who have died of typhoid fever. West, out of twenty-four examinations of the bodies of children who had died of whooping-cough, only once observed an alteration in the appearance of the vagus, though he always looked for it. In that instance both nerves seemed to be of a decidedly redder colour than natural; but they were not otherwise altered.

I agree with his conclusions, that an appearance so frequently absent cannot be one of much moment; that it is probably a post-mortem alteration, and that certainly it can-

<sup>1</sup> West, 'Diseases of Children.'

not be adduced in support of any particular hypothesis as to the nature of the disease. The paroxysmal characteristic cough of pertussis cannot then be ascribed purely to irritation of the vagus ; it is dependent upon a number of conditions.

§ 15. *Is there a Morbid Lesion peculiar to Whooping-Cough?*

Having had an opportunity of making post-mortem examinations on the bodies of two children who died from whooping-cough in the earlier days of the disease, the cause of death being convulsions, I am forced to agree with those who state, that in pure uncomplicated whooping-cough the scapel of the most practised anatomist fails to detect any characteristic or pathognomonic lesion. The simple disease is rarely fatal, and the appearances found in the body are the results of the complications which are almost part of the disease. If my hypothesis be true, I am not surprised that morbid anatomy should not throw any light upon the pathogenesis of whooping-cough, when the patient dies in the primary stage of the disease. In fact, the very absence of any morbid change confirms me in my belief, that whooping-cough should be classed amongst the group of diseases which have their origin in microbes or protophytic fungi ; and the presence of morbid changes in cases complicated with emphysema, pulmonary collapse, capillary bronchitis, and other secondary complications, does not invalidate my hypothesis.

§ 16. *A Comparison with other Germ Diseases.*

If we make a post-mortem examination on the body of a person who had died from scarlatina or splenic fever, in the incubatory stage of these diseases, will the scalpel of the anatomist be able to reveal the nature of the disease from which the patient died, presuming at the same time that the symptoms during life are unknown to him ? I think there are few who would assert that there are pathognomonic microscopical changes at this early stage of those diseases.

We are all now familiar with the phenomena of hay fever, and more recently the medical world has been interested in what is called 'wool-sorter's disease,' upon which a flood of

light has been thrown by the recent researches of Drs. Bell, Greenwood, and Spear. There is a period of incubation and prodromal stage in this disease. If a patient were to die in this period, when the symptoms are chiefly chilliness, weariness, with profuse perspiration, sleeplessness, disturbance of the respiratory centres, etc., would the post-mortem examination reveal the true nature of the disease? This can only be answered in the negative. When it has reached the stage of full development, with the secondary complications, certain pathological conditions are plainly to be seen, resembling those found in catarrhal pneumonia. It was for a long time believed that bronchial catarrhs, bronchitis and pneumonia, were induced, in the wool-sorters, by the mechanical irritation of the dust inspired during their occupation. We now know that a specific and effective agency is at work, and that the *Bacillus-anthraxis* is the active agent.

If we take another disease, typhoid fever, and have an opportunity of examining the body of a patient who has died from it, in the first few days our necroscopical observations will not assist us much towards the elucidation of its pathogenesis. As a rule, patients do not die from most of the zymotic diseases, as measles, typhoid; they perish from the complications—as in the former from bronchitis, pneumonia, etc.; in the latter from diarrhœa, ulceration of bowels, pneumonia, etc.

Pure uncomplicated cases of measles, typhoid fever, according to my experience of fifteen years as physician to a fever hospital, run an uninterrupted course to recovery; it is the complications which kill. Pure uncomplicated cases of whooping-cough also run their course to recovery; it is the complications which kill, and which leave their marks behind.

I have alluded to hay fever, a complaint the pathogenesis of which puzzled physicians for so many years. It was not by its morbid anatomy its nature was revealed; and I might repeat my arguments and derive another illustration from it. But it is unnecessary; I have said enough to indicate my line of argument, and to prove that whooping-

cough resembles, even more closely than we imagine, those diseases with which I have previously compared it.

I am aware that many objections may be raised not only against my hypothesis on whooping-cough, but against the general theory of *contagium vivum*; but as regards the latter objection, I think few can have followed the literature of the past few years without being convinced that living organisms of various forms and character are the cause of a large number of diseases—that is to say, if the reader be capable of appreciating the value of evidence. We may call them *microdemes*, microbes, bacilli, or any other name, but the facts remain the same. We may hold different views on *contagium vivum*, or believe that there is only one form of these organisms, which, under the influence of environment, becomes altered in character, causing a varied number of diseases, still the leading principle of the germ theory would remain.

It is unnecessary here to repeat the history of this scientific movement—it is written in the work of Lister, Koch, Pasteur. Fully accepting it, I propose, on the grounds of analogy and on some ascertained facts, to add another to the list of diseases depending on a microbe. The hypothesis of to-day may become the fact of to-morrow—I may hope it will be so.

I have endeavoured to show the reason why in whooping-cough we do not meet with pathological pathognomonic changes, when death has taken place simply from whooping-cough. I have stated that such an occurrence is rare. We almost always have complications, so that it becomes necessary to consider some of the principal ones, and to explain why we have some more frequently than others.

First I must say a few words about the mode of entry of the contagium, how it acts upon and reaches the lung, whether primarily attacking the epithelium of the bronchial tubes and air-passages, or whether it is conveyed there by the blood. I could not place a more difficult question before myself, but I shall endeavour to answer it, however imperfectly.

§ 17. *Mode of Entrance of Contagium.*

There are two views or theories which may be entertained:

1. That the contagium acts directly on the mucous membrane of the air-passages, or
2. That it affects the blood, subsequently locating itself in the lungs.

The first view is maintained in a modified form by Steffen,<sup>1</sup> though he does not attempt to explain the nature of the virus; he believes that a catarrh of the respiratory organs lies at the foundation of whooping-cough. This affects principally the mucous membrane of the larynx within the glottis, of the trachea, the bronchi and their ramifications, extending sometimes even to the alveoli. In rare cases, especially in small children, the nasal mucous membrane is also involved. This catarrh arises from infection, and consequently it, as well as its secretion, has a specific quality which may certainly be proved, but cannot at present be more closely defined. The proof of the specific character is furnished by the infection of other individuals, as a result of which the same disease is developed in them. The mode in which the infection takes place is that the contagious substance gains access to the respiratory organs during respiration, and there sets up the specific catarrh with its secretion. We do not know of what kind this infectious substance is. It is either simply of a gaseous nature, and is thus inhaled, or there may be very minute particles contained in this gas, which are the proper vehicles of the contagium, or themselves constitute it.

Even let the contagium be what it may, it is certain that after it has gained entrance into the air-passages it sets up a catarrh, which produces a secretion of specific character. The peculiarity of this latter lies not merely in the fact that it contains the infectious matter, but also that this increases with rapidity, so that this increase has a certain duration, until such time as it abates, and the contagium is gradually destroyed. If the secretion has acquired a character which

<sup>1</sup> Steffen, *loc. cit.*

renders it capable of exercising a sufficient degree of irritation upon the catarrhal mucous membrane, the characteristic attacks of coughing are determined as a reflex phenomenon by the excitation of the branches concerned of the vagus nerve, or in the larynx of the internal twig of the superior laryngeal.

The theory of Steffen does not seem to me satisfactory, although it explains part of the phenomena. It leaves us in difficulty as to the nature of the contagium. There are constitutional symptoms before the development of the pulmonary symptoms. I do not believe that the virus is primarily deposited on the mucous membrane of the air-passages. I therefore incline to the second theory, that the virus first is taken up by the blood, subsequently manifesting its influence in the lungs. That as a germ disease it follows the laws of other germ diseases. The virus absorbed by the blood multiplies and develops there, spreading through the body; its location in the lung may be compared to the location of the bacilli in splenic fever. ?

It is hardly necessary to go over the ground or to explain the germ theory. We know that the contagium of scarlatina, small-pox, measles, do not exist in a gaseous form, that the virus in each case consists not of an atom or molecule, but of a particle—I use the word ‘particle’ in the sense attributed to it by Tyndall, viz., that an atom or molecule if free is always part of a gas, whilst a particle is a bit of liquid or solid matter formed by the aggregation of atoms or molecules—that this contagium first exercises a general influence, subsequently developing the distinctive and characteristic eruptions which belong to each disease.

We have no reason to believe that the contagium of whooping-cough is different in its behaviour from the contagia above named; nay, more, we have the grounds of analogy to warrant the statement that the action of the organic agent in whooping-cough should follow the course of the active agents in those diseases with which I have compared whooping-cough. My belief in what I may call a parasitic origin simplifies the phenomena, and may be applied

to some of the views of Steffen, rendering them more intelligible.

I presume, then, that the germs of whooping-cough enter by some of the channels through which other contagia enter; that in the blood they develop, setting up what may be termed constitutional disturbance, subsequently attacking the pulmonary epithelium, and giving rise to all the phenomena which characterize whooping-cough. From the lungs spores or germs are again thrown off into the air, or the sputa contain them. We have thus the contagium carried about and extended.

§ 18. *Secondary Post-mortem Changes in Various Parts of the Body.*

Whooping-cough cannot long persist without leaving some impression upon various parts of the frame. I have alluded to one important lesion. The imperfect aëration of the blood, the disturbance of the circulation, the very concussion produced when in a severe paroxysm the child is shaken from head to foot, grasping with instinctive haste any support it can lay hold of to break the force of the concussion, the incessant, teasing, harassing cough, the vomiting, cannot occur without altering in some way the texture either of the mucous lining of the throat, bronchiæ, bowels, the structure of the lung, the heart, or the brain and its meninges. I shall consider the morbid changes found in the leading complications of whooping-cough.

§ 19. *State of the Brain and Membranes.*

When death takes place in whooping-cough and we have an opportunity of examining the brain and its membranes, in what condition do we find them?

As far as the brain is concerned the changes are very simple, and what may naturally be expected from the phenomena of whooping-cough. We never find any symptoms of softening. There are certain morbid effects, however, appreciable to the eye: the minute vessels are injected and enlarged; there is cerebral engorgement with effusion of

fluid into the ventricles. Microscopic examination does not reveal to us any lesion which would account for the symptoms of pertussis. The vessels of the membranes of the brain are overfilled with blood.

These pathological appearances can be accounted for. They are lesions observed in various other infantile diseases, and cannot be considered pathognomonic. We may find the spinal cord and its coverings in a similar state, owing to the same causes. This congested state of brain is important, as convulsions depend upon it, especially in infants under one year.

§ 20. *State of the Mucous Membrane of Eyes, Nose, Larynx, Bronchiæ, and Stomach.*

In life the conjunctivæ are frequently seen in a high state of congestion, and we may have hæmorrhage from over distension of the bloodvessels, caused by the violence of the paroxysms. We have hæmorrhage from nose, buccal mucous membrane. We must expect to find the mucous membranes in a highly injected, irritable, and red condition. The correctness of this inference is proved in the post-mortem room.

Does a laryngoscopic examination during life assist us in detecting any characteristic changes in fauces, larynx, etc. ? I believe not, though we may find the mucous membrane of these parts in an irritable, red, or swollen condition.

One observer, Dr. Rudolf Meyer, has left us the results of some auto-laryngoscopic observations he made whilst suffering from a well-marked attack of this disease. He found the mucous membrane of the under surface of the epiglottis and of the adjoining parts of the entrance into the glottis, and especially that covering the so-called arytenoid cushion, swollen and red ; whilst that of the adjoining parts of the pharynx was also distinctly inflamed. The vocal cords and the lateral and internal parts of the larynx were normal. The inflamed parts were highly sensitive to the least touch, bringing on a spasmodic cough. In another case occurring in a middle-aged woman, the same conditions were ascertained

to be present (*Swiss Correspondenzblatt*, April, 1873). If Dr. Meyer's observations were correct, the treatment of whooping-cough would be very simple, but unfortunately we do not find that this irritable condition is always present, or that it yields to his treatment.

Steffen believes that in every case of pertussis the presence of a catarrhal inflammation of the air-passages can be established, though he says this is not the rule, as sometimes the inflammatory process may begin in the larger bronchi; further up the mucous membrane is pale and not swollen. My experience is to the effect that, as a rule, the whole of the mucous membrane is in an irritable, red, and swollen condition, primarily; that the inflammatory process is a subsequent complication.

I may here briefly allude to one common appearance found towards the latter stages in the bronchi: under the influence of irritation mucus is secreted; as we have expectoration in pertussis, the mucus is expelled by the cough and by vomiting. After death we often find the bronchi filled with abundance of thick mucus, occupying the cavities of the air-tubes. In many cases when inflammatory action has followed from neglect and exposure, we have the usual signs of inflammation, and the bronchi may be found dilated. I shall presently devote some space to the consideration of some of the phenomena attendant upon bronchial dilatation.

### § 21. *Emphysema.*

We need not wonder that secondary emphysema should be associated with pertussis.

Steffen tells us that emphysema will seldom be found absent in the lungs of a child that has died from whooping-cough and its results. Its seat is generally marginal and peripheral. Less frequently it is found to have extended to the interstitial tissue of the lungs and the cellular tissue of the mediastinum. In accounting for it he adheres to the exploded theory that emphysema may be caused by inspiratory efforts. He thinks that the vesicles may be injured from their being so distended by the air spasmodically forced

into them. Emphysema results, which, as a rule, is apt to involve only the superficies of the lungs or certain peripheral sections, and then passes off without any symptoms. If the whooping-cough does not last too long, and the elasticity of the alveoli is retained, this condition may again pass into a perfectly normal one, on the subsidence of the attacks.

The English explanation is better, and that of Sir William Jenner is generally accepted as the correct explanation, viz., that emphysema is an attendant on expiration.

This emphysematous condition, West tells us, is met with, and sometimes in an extreme degree, in the lungs of children who have died of whooping-cough, unassociated with other diseases of the respiratory organs. To such cases the expiratory theory applies pre-eminently. He thus accounts for it: 'During the violent expiratory efforts with a closed glottis which characterize a paroxysm of the cough, the air is driven forcibly towards the upper parts and the circumference of the lungs; in other words, towards just those parts which are least compressed.'

Vesicular emphysema is frequently the result of pulmonary collapse, the loss of function in the airless part of the lung being compensated for by an increase of volume in the non-obstructive portions.

There is another factor we must take into account in the production of emphysema, that is, atrophy. This may arise from the pressure and strain to which the air-cavities are subjected during the constantly recurring paroxysms. The atrophy is in this case primary, and the emphysema secondary.

#### § 22. *Collapse of the Lung.*

Lobular collapse of the lung is so frequently met with in whooping-cough, that according to Alderson and Hewitt it is rarely absent.

The causes of this condition are attributed by Walshe to collapse of the air-cells; a perverted state of inspiration which allows of almost complete emptying of the lungs of air, and the consequent falling in of the chest walls; obstruction

by accumulated secretion in tubes; and lastly, general debility.

In 1830, Sir John Alderson published a paper on 'The Pathology of Whooping-cough,'<sup>1</sup> in which he described the anatomical characters of collapse. We are all really indebted to him for our knowledge of this condition. Other observers have followed in his footsteps and corroborated his observations. He differentiated between collapse and pneumonia. The following short passage embraces his views. Speaking of the appearance usually found, he says: 'In the lower and posterior portions of the lungs the structure was rendered very firm and dense; the portions which were the subjects of this change were exactly defined by the septa, of a dull red colour, devoid of air, sinking instantly in water, and thin slices undergoing no change by ablution. The individual lobules were more dense than in hepatized lungs; and the cellular membrane between them, retaining its natural structure, conveyed to the touch the same sensation that is felt on touching the pancreas. . . . I apprehend that the appearances detailed differ from those found in peripneumony. In whooping-cough the lung is always dense and contracted, as if the air had been expelled, and from the throwing out of adhesive matter the sides of the air-cells had been agglutinated together; while in hepatization the lung is less dense than in whooping-cough, and is rendered more voluminous than in its natural state.'

Pulmonary collapse is the result very frequently of bronchitis. Thus if one or more of the tubes become choked up with mucus during expiration, some air is forced out by the side of the mucus, but each inspiration draws the phlegm into a narrower part of the tube. Air is expelled, but none is taken in; the consequence is, that the air-sacs collapse.

Following on collapse we have condensation of the pulmonary tissue, as described by Sir J. Alderson. This lesion is one of the most important in connection with the secondary pathological changes in whooping-cough. It is characteristic and pathognomonic.

<sup>1</sup> Alderson, 'Medico Chir. Transactions,' pp. 90, 91.

§ 23. *Capillary Bronchitis.*

As the result of exposure to cold, or to an unequal temperature, capillary bronchitis is one of the most frequent complications in whooping-cough. As it is a very fatal disease we have frequent opportunities of observing the necroscopical condition of the lungs of children who have died from this disease. There is nothing to distinguish ordinary capillary bronchitis from the same form of disease combined with pertussis. We have the usual inflammatory state of the large and small air-tubes ; we have evidence of a high state of inflammation ; and, as a result, we find the mucous lining of the air-tubes soft, turgescient, injected, with mucus in abundance blocking up the air-vessels and interfering with the proper aëration of the blood. As the inflammatory state becomes more intense, in place of finding the bronchioles filled with mucus, we may find a copious secretion of pus.

The congestion and thickening of the lining mucous membrane of the capillary bronchia, the subsequent coating of the small bronchioles with viscid mucus, and the supervention of pus, are conditions usually found.

We may find, as the result of bronchitis, the bronchi dilated. I have previously given the minute anatomy of the lung, and bearing in mind the minute muscular fibres which exist, even in the terminal bronchioles, we can readily understand the mechanism of dilatation. With long-continued cough and expectoration, the elasticity of the bronchial tubes is likely to be impaired and their muscular activity slackened ; and hence they yield to the distending influence of cough in expiration, and to the accumulated secretions.

This dilatation is not very unfrequently met with. If the dilatation is uniform, the whole calibre of the tube is affected ; but if it be saccular, a number of bead-like dilatations will be seen, within which may be found some mucus, which, owing to the peculiar form of the dilatation, cannot be got rid of, and which may set up irritation. We have then a form of bronchiectasis. Dilatation of the minute bronchi may be especially noticed at the periphery of the lung. If we make a section

of the smaller tubes we shall find that the connective tissue and epithelium are destroyed; we shall also find that corpuscular elements abound. I have but to refer to Charcot's description of the minute anatomy of the smaller bronchioles to account for the destruction of the muscular envelope which forms such an important part of their structure.

#### § 24. *Pneumonia.*

As the result of cold and other causes we may have pneumonia. The post-mortem appearances will be found to be exactly identical with those observed when the patient has died from pneumonia uncomplicated with whooping-cough. According to the time in which the patient has died, so shall we find the morbid condition of the lungs. We may have one of the four stages :

1. The lung simply congested.
2. Engorged.
3. Hepatized, with red colouration.
4. Hepatized, with grey colouration.

It is unnecessary to describe minutely the post-mortem appearances of all these stages, as they are given in all our text-books, or to enter into the pathology of these conditions. I have previously alluded to the differences between carnification and hepatization, so ably described by Sir J. Alderson.

Inflammation of the pleuræ may be associated with pneumonia, when we shall find all the characteristics of the various stages through which pleurisy may run.

Tuberculosis may exist in a latent stage, but may be excited into activity by whooping-cough, so that we may have post-mortem signs of phthisis.

I need not dwell on the morbid conditions of tuberculosis. The foregoing complications do not afford us any characteristics by which we can distinguish them from the same diseases when they occur without whooping-cough.

#### § 25. *State of the Heart.*

We know that the circulation is disturbed, and the perfect aëration of the blood interfered with, in pertussis. We have

but to look at a child in a paroxysm of coughing to see this. As the result of this disturbance of the balance of circulation and aëration, the heart must be thrown out of gear, and its action made irregular. After a paroxysm the child pants for breath. If you place your hand over the cardiac region, in this state, you will find that the child is breathing with renewed energy. You can feel the heart palpitating, pumping away with vigorous strokes the imperfectly aërated blood.

Does this disturbance produce any permanent alteration in the heart? Are the valves affected? Have we to dread mischief in the future? Do we find whooping-cough complicated with pericarditis or endocarditis?

As a rule, we may say whooping-cough does not leave behind it any permanent cardiac lesion. We may find the coronary arteries filled with blood, distended, changes obvious to the naked eye; but we do not find under the microscope any alteration in the muscular fibres, such as degeneration, proliferation, or infiltration. We may find some slight signs of irritation in the chambers of the heart, and the small vessels in the inter-muscular connective tissue may be intensely injected. Consequent upon the irregular action of the heart, we have a corresponding irregularity in the pulse; the rhythm and force are altered, but this trouble soon passes away; and after the attack of whooping-cough has completely vanished, the pulse retains its normal character.

#### § 26. *Tubercular Meningitis.*

This complication does not so frequently accompany pertussis. When it does occur, it is usually of the inflammatory type, when we have all the characteristic morbid appearances, as excessive vascularity or true congestion of the membranes of the brain, dulness or opalescence of the arachnoid, effusion of fluid on the surface of the convolutions and in the ventricles, etc., etc.

Fluid in the ventricles has been frequently noticed as a post-mortem appearance, when there have been no symptoms of meningitis. We shall find also a number of minute flattened spherical bodies, the other element in

meningitis, and from whence we have the name 'tubercular.'

Whooping-cough may be the exciting cause of this disease, especially when the attack is very severe. As it is an insidious and fatal disease, its supervention should be guarded against.

#### § 27. *Other Neuroses.*

We may have general disturbance of the nervous system, produced by the long continuance of the cough and the paroxysms. In infants in whom the process of dentition is still going on, this disturbance may lead to formidable convulsive seizures, especially in irritable children.

In many cases of death from infantile convulsions, the scalpel does not throw much light upon the cause of death; at least we do not find any lesion sufficiently marked or pronounced so that we could fix upon that as the cause. We may find symptoms of cerebral or spinal congestion, but these conditions, we know, are frequent in childhood, and not necessarily fatal. We can, however, understand that death may occur from exhaustion, following on convulsions and disturbance of the nervous system, even though we have no pathognomonic changes to confirm our opinion.

#### § 28. *Enlargement of the Tracheo-Bronchial Glands.*

Enlargement of the tracheal and bronchial glands is very frequently met with in delicate, strumous children, in whom we have enlargement of the cervical, inguinal, and other superficial glands. We may have these glands in an inflammatory state; we may have hyperplasia, with cheesy degeneration and breaking down of the centres of these glands. Enlargement of these glands, as we have seen, plays an important part in the history of the pathology of pertussis.

I may here mention Dr. Ley's views. He suggested that mere inflammation of the mucous membrane of the air-passages might cause swelling of the absorbent glands of the bronchi of the neck. This is a circumstance which Watson thought probable from having found enlargement of the

cervical glands springing up during the existence of pulmonary irritation. If we take notice that the spasmodic fits of whooping-cough are always preceded, for some days, by mere catarrhal symptoms, and observe, further, how the parts supplied by the pneumogastric nerve are affected in these paroxysms (the larynx, the lungs, and stomach), this conjecture may be adopted—viz., that the crowing inspiration of infants and the crowing inspiration of whooping-cough, though quite distinct affections, may both depend upon irritation of the recurrent nerve, or of the pneumogastric nerve generally; and that even the irritation in both cases might arise out of the enlargement of the glands that lie in the course of that nerve. This natural conjecture had presented itself to Dr. Ley's mind. Having under his care four children suffering from whooping-cough, he found that in all, the glandulæ concatenatæ near the trachea were very considerably enlarged. 'Is this,' he says, 'merely an accidental combination? or is there any essential connection between the two? May it not be that an enlargement of these glands from a specific animal poison, similar to that of the parotid gland in mumps, is, after all, the essence of whooping-cough?'

When examining the views of Dr. Guéneau de Mussy, I exhaustively entered into the subject of the connection of these glands with pertussis, and expressed my opinion that De Mussy's theory was wrong. In addition to the evidence already accumulated to disprove his views, I may add another. If these glands set up irritation sufficient to excite the pneumogastric nerve, we would expect to meet with a pertussoid cough in the anthracocis of colliers, in whom the bronchial glands are much involved.

#### § 29. *State of the Kidneys.*

Gibb was, I believe, the first to point out that the urine was frequently in a saccharine state in pertussis. Great stress was laid upon this announcement; at the time it was believed that this condition threw light upon the pathology, and that the nervous theory was cleared up by this complication. Gibb for some time had the reputation of being able

to cure whooping-cough by means of a nitric acid mixture. This nostrum had a short-lived reputation. Bromide of ammonium in his hands achieved equally marvellous results. In the hands of other observers it was found to be not so efficacious. It is a useful medicine under certain indications. Not having so much faith in Gibb's remedies, a certain degree of scepticism creeps in about his observations.

Is the urine always saccharine? I believe it to be the exception to find it so. I have examined the urine of fifty children with confirmed whooping-cough, and could only find traces of it in thirteen. It might be possible to account for the presence of sugar in the urine of children without ascribing it to the irritation of any nerve, if we simply remember the kind of diet on which children live. This pathological indication I do not regard as of the slightest value.

In what state are the kidneys? They share in the general congestive state found in other organs, due to known causes. I have never seen hæmorrhage from the kidneys during the course of whooping-cough, or blood in the urine.

Steffen says that albumen may be contained in the urine at the time of violent seizures, or shortly after them, but that investigations are wanting as to whether admixtures of blood are also present in it. I can supply this hiatus. Under the microscope blood-corpuscles are not found. In this survey of the clinical and pathological phenomena of pertussis, I have striven to prove that they have to be divided into two great classes: 1. Those which are peculiar to this special form of zymotic disease; and 2. Those which are common to it with other diseases of children, but which still are linked to it by characteristic features.

If we consider the clinical and pathological phenomena of those diseases with which I have allied it, we shall find that my method of classification also applies to them. This is another link in the chain of evidence I am constructing.

§ 30. *Post-Mortem Notes on Seven Cases.*

West gives the following statistics of the cause of death of thirty-five children who died of whooping-cough under his care, from which it appears that seventeen perished in consequence of the supervention of bronchitis or pneumonia, eighteen from congestion of the brain, from convulsions coming on in a fit of coughing, or from tubercular meningitis.

Reckoning the commencement of the disease from the first distinct whoop, or first appearance of a well-marked paroxysmal character of the cough, it appears that of thirty-one cases in which this point was noted :

Dying through the lungs.	Dying through the brain.	Total.	Dying within
0	1	1	7 days
2	4	6	14 „
2	3	5	21 „
0	2	2	28 „
1	1	2	5 weeks
2	0	2	6 „
3	3	6	7 „
1	1	2	8 „
4	1	5	from 8 weeks
—	—	—	to 3 months.
15	16	31	

It is a matter of regret he does not mention more particularly the form of lung or brain disease from which the children died.

Having had an opportunity of making seven post-mortem examinations on children who had died during the whooping-cough, I shall briefly give the results of the more interesting cases.

The deaths may be thus roughly classified after West:—Dying through nervous system, three; dying through respiratory organs, four.

The special forms of disease were in one, spasm of the glottis; in two, infantile convulsions, depending on teething

and brain congestion; in two, capillary bronchitis; in two, pneumonia.

In the first case of spasm of the glottis, the child, a girl, was in the second stage of pertussis; she was eleven months old. She was playing on the floor of the nursery, and, as the mother told me, she was seemingly better. A severe attack of paroxysmal coughing came on. When the mother lifted her on her lap, the child was stiff. Death must have been almost instantaneous.

Post-mortem six hours after death. Child was well-nourished; post-mortem ecchymosis established. The question here arises, Where was I to seek for the cause of death in this case? In the locale of the glottis, in the lungs, or in the brain? Would there be any well-marked lesion found, or any alteration in the recurrent laryngeal nerve?

*Autopsy I. Brain.*—Membranes highly vascular, but there was no effusion over brain substance. Intense congestion of brain, with slight effusion into ventricles. Consistence normal. On subsequently examining a small section under the microscope, the injected state extended even to the minute vessels, but there was no exudation in the per-vascular spaces. There was a well-marked lesion on frænum linguæ. Fauces highly injected and swollen, and this extended some distance down trachea. Recurrent laryngeal nerve unaltered.

*Lungs.*—On opening thorax the lungs had seemingly collapsed, though they felt spongy and normal. On section it could be seen that they were congested. They floated in water. On a more minute examination the larger bronchi were found to be red, and swollen in the interior, and filled with mucus. Towards the periphery of the lung there were some collapsed lobules. Except these alterations, there was nothing else worthy of note as far as the lungs were concerned.

The seeming collapsed state of the lungs can be explained by the prolonged expiratory efforts in the paroxysm, thus emptying the lungs of air; but as spasm of the glottis and death immediately took place, there was no inspiratory effort

to make up for the air that was lost. The heart and other organs were found in a simple state of injection, consequent upon the mode of death. There was some food in the stomach, and its lining, except for a little redness, was almost normal. The liver did not present any appearance of degeneration or structural change. There was a little urine in the bladder, but it was not saccharine.

I have never met with a similar case to this one. The whooping-cough was progressing favourably, running its course to recovery. There was no marked morbid lesion to account for death, which in this case was due to spasm of the glottis, the child being suffocated by its long continuance. Though we know spasm has a nervous origin in either the trifacial, pneumogastric, and spinal nerves and acting through the medium of the spinal marrow and inferior or recurrent laryngeal, intercostal, and diaphragmatic nerves, yet the changes in these nerves are so obscure that we cannot with our present instruments fix upon or observe them.

We cannot isolate though we may measure nervous force; there are molecular changes and molecular groupings which are unappreciable, at present, by our senses: so that we may have, in connection with the nervous system, solitary torpedo-like discharges which may do an infinite amount of harm amidst the living elements, or bioplasm, without leaving a trace behind either as to the manner or the method of its discharge.

In making post-mortem examinations I have had on many occasions to wonder:

1. Why my subject should have died from the trifling lesions my scalpel revealed.

2. How my subject could have lived so long, with the serious mischief present before my eyes—brain, heart, lung, liver, and almost every organ in advanced stages of disease.

The next two cases are those of the two children who died from infantile convulsions, consequent upon teething and brain congestion.

*Autopsy II.*—The subject of this post-mortem was a male child aged thirteen months, who had been suffering from

pertussis for three weeks. The paroxysms had been very frequent and severe. Convulsions came on, and I was only called in when the child was in a moribund state. He died five minutes after my arrival.

Post-mortem eight hours after death. Rigor mortis established; the child had lost flesh. Brain and membranes highly congested. Congestion not confined to larger vessels, but permeated all the minute capillaries. Increase of fluid over convolutions. Considerable effusion into ventricles. Brain texture slightly altered.

Microscopic examination of a section revealed, besides injection of minute vessels, transudation or migratory corpuscles, the result of the intense congestion. This state must have existed for some days, consequent upon the severe paroxysms. The lungs were much collapsed and shrunken, but felt crisp and spongy to the touch; they were in a high state of congestion. A portion of the lung was completely collapsed, and did not float in water. There were several emphysematous patches. On opening some of the larger bronchi I found them tumefied, filled with a thick secretion which under the microscope was found to consist of mucus, some pus-cells in which micrococci could be seen. Slight enlargement of the bronchial glands. There was no sign of inflammation in pneumogastric nerve. Slight congestion of the heart. The mucous membrane of stomach was red, irritable, and highly injected; the mother informed me the child had suffered very much from vomiting. Liver and kidneys filled with blood.

Dentition was very backward in this child. He had only four incisors; the other teeth were just escaping from their capsules, and only required the gum-lancet to relieve them. Had a medical man been called in, probably convulsions might have been averted. This case is a very typical illustration of what we meet with in general practice.

The little patients are first treated with domestic remedies for some time; mischief is insidiously going on. When a *foudroyant* attack like convulsions comes on, the physician is summoned, but only to witness the euthanasia of his patient.

My custom is to refuse a certificate when I am called in under such circumstances, and to insist on a post-mortem. In some cases this is granted ; in others the child is buried without a certificate.

*Autopsy III.*—The next case is somewhat similar in its leading features to the previous one, though I had an opportunity of seeing the child a week before her death. She was a delicate infant of nine months old. I saw her for the first time about a fortnight after the first 'kink' had been heard. I was called in on account of convulsions. They yielded for a few days to treatment, but returned with renewed force. The child died exhausted on the seventh day of my attendance. The post-mortem appearances were very similar to those previously described, so I need not detail them in full. The principal features were the increase of fluid in the ventricles, and collapsed state of lungs due to mechanical causes. The bronchial glands were hyperplastic, but the pneumogastric nerve was unaltered. The urine was not saccharine.

It is unnecessary to give a full account of the other post-mortems, as they simply confirm our existing evidence on the state of the lungs in capillary bronchitis and pneumonia. I may add that all my post-mortems were made on children under two years of age. I have never had an opportunity of examining a child over that age, nor do I remember ever having had a death from whooping-cough in a child over two years. My experience is that the disease is milder and more amenable to treatment over that age. They are better able to stand the paroxysms. We are able to do more for them in the way of fomentations, poultices, etc., to regulate their diet and manage them, than we are during the period of infancy. We can better avoid those exciting causes, which render whooping-cough so dangerous and fatal. Five of my post-mortems were made on private patients, and two on infants who had died in a public institution. I could have made more in the latter place, but unfortunately there are restrictions and regulations which are almost prohibitive. Five of the autopsies were made on girls ; I may say I have

found the disease more prevalent amongst girls than boys. This may bear some relation to the relative proportion of boys and girls in town. I have not been able to trace any relation between pertussis and measles. Their occurrence together is a coincidence. Climatology and seasons do not seem to influence it.

In treating of the pathology of whooping-cough I have advanced a speculative theory on its origin, and I have endeavoured to support my theory by argument and by observations based partly on fact and partly on analogy. How far I may convince those who may read my essay, I am unable to say. Though I have indulged in theory, yet I have not lost sight of the great end of theoretical discussions, viz., the practical deductions which may lead us to treat pertussis rationally and scientifically. It may be true that I have not unravelled all the hidden threads which encircle whooping-cough, that I have not satisfactorily accounted for all the phenomena attendant upon the disease, yet I hope to prove, that whether my theory be right or wrong, we may derive rational measures therefrom, which may assist us in our efforts to treat what has been so long considered an *opprobrium medicorum*.

### § 31. *Summary of my Views.*

I have endeavoured to investigate thoroughly the pathogenesis of pertussis, with what results the reader will form his own opinion.

A brief summary of my views, or a recapitulation of my data, will place my provisional conclusions in perhaps a simpler light.

1. Pertussis depends on a specific poison or contagium; this is universally admitted.

2. This contagium is active—highly infective. This is also granted.

3. The contagium is analogous to the contagia which produce splenic fever, measles, scarlatina, variola, etc.

4. It has a particular determination to the lungs.

5. Like all the other contagia, it has its periods of activity and decline.

6. The period of greatest activity is in the first and second stages.

7. Pertussis runs a regular course, like measles, scarlatina, variola, etc., and rarely attacks a person but once.

8. It thus may be classed among the zymotic diseases.

9. The fact that there is no primary pathognomonic morbid change supports this view.

10. There are various secondary lesions which are characteristic, as ulceration of the frænum linguæ, carnification of the lung.

11. The mode of death harmonizes with my views.

I am aware that numerous objections will be raised against the above propositions, and that it may be said, 'You have not positively found out the special form of bacteroid, or microbe, on which it depends.' If inference and analogy be of any use, I consider that, without this positive proof, my hypothesis is tenable, and the only one which satisfactorily accounts for the phenomena, and even for the treatment.

With a theory like the one I advocate, the treatment becomes rational. Certain experiments must yet be made to substantiate my belief and place my theory amongst our facts; and I have no doubt that our increasing knowledge of the connection of organisms with disease will soon enable us to reach the stage of verification.

Steffen (*loc. cit.*) raises an objection against the views I advocate. He says: 'Just as little is whooping-cough to be regarded as a zymotic disease of the general system, in which the exciting cause of the malady is specially localized in the organs of respiration. This idea has been deduced from the observation that this disease, in common with certain infective diseases, attacks the individual but once; and, further, that it seems to show a sort of connection with measles, scarlatina, and small-pox, because it has been epidemic at the same time with these diseases, or before or after them.'

I cannot pretend, then, to any novelty in the views I advance, unless in the sense that he who proves discovers.

In 1847 Dr. Duncan published a paper, in the *Dublin Quarterly Journal*, on the propriety and practical utility of classifying whooping-cough amongst the exanthemata. He based his arguments on somewhat similar general principles to those I have advanced. Thus the regularity of the course, the universal susceptibility to the influence of whooping-cough, the occurrence but once in life, and the propagation by a specific poison of the disease, struck him as seeming links between the exanthems and whooping-cough, and suggested to him a new classification for the disease.

There is a difference between Dr. Duncan's theory and my own.

In the history of medicine the student will find that there are few theories advanced, even in modern times, which do not bear some relation to some theory advanced at a previous time; as George Meredith<sup>1</sup> says: 'The moderns live on the ancients, and not one in ten thousand can refer to the particular treasury he filches.'

Hypotheses or guesses have frequently been advanced to account for phenomena; and they are useful if we follow out the advice of Herschel about them. He tells us that hypotheses have often an eminent use; that a facility in framing them, if attended with an equal facility in laying them aside, when they have served their turn, is one of the most valuable qualities which a philosopher can possess; while, on the other hand, a bigoted adherence to them, or, indeed, too peculiar views of any kind, in opposition to the tenor of facts as they arise, is the bane of all philosophy. This is sound advice, though not adopted by our modern philosophers.

We are told that the eminent biologist Haeckel, speaking at a dinner at the Palais Royal, Paris, remarked, in reference to the discussion which is going on about spontaneous generation: 'Even though spontaneous generation be disproved in the laboratory, yet we must admit it, as it is necessary for the full comprehension and development of the evolution theory.' This method of substantiating a theory is not a scientific one.

<sup>1</sup> George Meredith, 'The Egoist,' vol. iii. p. 62.

I am not so wedded to my hypothesis as to apply, with a slight alteration in words, the dicta of the famous author of the 'History of Creation;' viz., 'that, even though the presence of microbes be disproved in pertussis, yet they are required in order to make the zymotic theory complete.' When facts are brought to dispute it, I shall bow down before the weight of evidence, and admit that I was wrong. Meantime, I hold it to be the most satisfactory theory yet propounded, from a pathological light; whilst at the same time it harmonizes with the majority of the methods of treatment advanced, and renders them intelligible. Treatment is even more valuable than hypotheses about pathogenesis; and treatment may be correct even though our pathological views may be wrong.

In all the various methods of treatment advocated—running, as it were, like the diapason or the swell of the organ, through all the supernumerary notes which complete the *môtif*—there has been one great leading idea—viz., that whooping-cough should be guided through its course, warding off inflammation, and quieting irritation. This is the key-note which has been struck by some of the best physicians, past and present. Under the zymotic theory this key-note is alone explainable.

I shall presently consider the subject of treatment; but first I must devote some space to the question of prevention.

Sanitary science has now, fortunately, become one of the most important branches of human knowledge and research. Its aim is to suppress disease entirely, especially of the zymotic class, by preventing the diffusion of the virulent elements on which their maintenance and vitality depend. Preventive measures have proved useful in checking other diseases; and preventive measures, if carried into operation with energy and wisdom, cannot but have a controlling power over whooping-cough.

The next chapter I shall devote to prophylaxis.

## CHAPTER II.

§ 1. *The Prophylaxis of Pertussis.*

THERE has been no systematic attempt made to educate the public on the preventive measures which should be adopted to limit, check, or stamp out whooping-cough. There are few diseases about which there is more lamentable ignorance and carelessness amongst the public, and the people sin in consequence of this. Though it is popularly believed to be contagious, yet no precautions are taken to prevent infection.

There is one great fallacy against which for many years I have contended, though I regret to say without much result. The public believe that every child must have whooping-cough, measles, and scarlatina, and as they must have these diseases, the sooner they contract them the better. When I have asked sensible fathers and mothers why children should have such diseases, they have fallen back upon their experience, and told me that it was one of the laws of Providence, and that there was no escape from it.

Whole hecatombs of children have been sacrificed at the Moloch of custom and superstition. We have a great work to do in the present and in the future. We must kill this false idea; we must endeavour to enlighten the public on this fallacy; for this purpose we must begin with the most numerous class, and one of the first lessons must be that it is not necessary for children to have measles, whooping-cough, or any infectious disease, if they would adopt the true great laws of Providence, if they would assist in the prevention and spread of each single case of infectious disease, if they would attend to the health of their houses, if they would only

value at their proper worth pure air, pure water, cleanliness, and light. The most numerous class is called the working class; we must begin our work on this stratum.

How necessary instruction is, all medical men must know. When scarlatina or measles invade some of the households of our working classes, there is no attempt made at isolation; sympathizing neighbours come backwards and forwards, other children are exposed to the contagium, and thus the disease is carried from one house to another, and perpetuated.

When a child has whooping-cough it is allowed to play with other children, sleep in the same bed with them; there is not even a pretence at isolation. Children play in the streets, travel by cabs, omnibuses, railways, with confirmed whooping-cough, and no notice is taken of it, and no wonder expressed that such a thing should be. We often hear it said, 'The child has only got the whooping-cough.' Yes; the child has only got a disease which causes a fourth of the annual mortality amongst children under five years of age in London—only got a disease from which thousands of children die annually in the provinces, and yet we wonder that we have a high infant mortality!

There is a great awakening at the present time to the truths of sanitary science. We require a practical Bill compelling all householders to notify to the sanitary authorities the existence of infectious or contagious diseases in their families, and at the same time we must have hospitals, so that isolation may be carried out. At first no doubt there will be many difficulties to contend with, but difficulties were made to be overcome.

Whooping-cough must not be omitted from the list of diseases requiring isolation. Contagium is what we have to contend with in whooping-cough. If it were possible on the same day to isolate all the children suffering from this disease in England, and to keep them in quarantine for a lengthened period, whooping-cough might be stamped out. This is, I know, impracticable. We may, however, do much to check and limit it. Without the assistance of the public we are powerless.

§ 2. *What are the Preventive Measures necessary to check the spread of this special Contagium? — Modified Quarantine or Isolation?*

The disease never arises spontaneously: this is a cardinal point in my faith. Spreading, then, by contagium, an efficient quarantine should be carried out, to keep the healthy from the unhealthy.

1. In public institutions where there are a large number of children, and where children are constantly coming in, quarantine is necessary and practicable.

It is painful to witness the suffering of a large number of infants and children in paroxysms of whooping-cough. An illustration from experience will show how much can be done by isolation, combined with hygiene, to limit the spread of whooping-cough amongst children. In 1869 I took charge for the first time of an institution in which there were a number of children and infants. There was a nursery, and in this nursery there was a patent cradle in which six infants could be rocked at the same time, and in this cradle might have been seen six little human waifs, struggling with the paroxysms of whooping-cough, gasping, palpitating, choking, amidst a close polluted atmosphere. The nursery was badly constructed. There was neither sufficient light nor ventilation. As all contagia become more virulent in polluted air, I had an opportunity of witnessing whooping-cough in some of its most painful forms. I need not detail all the steps taken to alter this sad condition of sanitation; it is sufficient to say that I was fortunate enough to secure the support of the managers. A new nursery, three times the size, was opened; every article of clothing was destroyed that had been used in the old nursery; only fresh admissions were allowed in the new nursery. The infants who had whooping-cough were kept in the old nursery, which I improved by new ventilators, and by the free use of disinfectants, by enforced cleanliness, so that in time the disease amongst the little infants in the old nursery came to an end. As regards admissions to the new nursery, as I saw every patient on entrance, I was able

to ascertain whether whooping-cough existed. I was thus enabled to keep the nursery clear, for when I found a case of whooping-cough I was in a position to isolate it.

Under the new conditions, whooping-cough, in the intense and aggravated form in which I first saw it, was unknown; it was of course impossible to keep out of the house children suffering from whooping-cough, under the conditions of admission to the institution, but as they were at once isolated, it rarely, if ever, occurred that a child within the house contracted it. In all public institutions, then, isolation should be practised, and hospital provision should be made for the treatment of this disease.

It would be well if we could send the children of the very poorest class to a hospital when they have pertussis; I allude to the class who live in only one room, in which father, mother, and children live and sleep.

I am aware that such a course would be impossible: it is with this class we have the greatest difficulty, not only with whooping-cough, but with all other infectious diseases. How to reach effectually this class is the puzzle of sanitarians. We may hope for much from the spread of education, and we may ultimately arrive at a solution of the best method of dealing with this stratum of society. We may do much by endeavouring to teach them the best precautions under their present conditions, we may impress upon them the evil caused by allowing their children to play with other children when in states of disease. Other simple truths may be urged, as the value of cleanliness, fresh air, light, etc.

When we come to the consideration of isolation amongst the higher and middle classes, our difficulties become less. It is possible for those who have large houses to give up a room to the infected child, to keep other children away, and to carry out a modified form of quarantine. The same may be said of the middle classes. They are in a position to carry out isolation.

It has been recommended, when whooping-cough has been epidemic in a neighbourhood, that families in a position to remove should take their children away to the country or the sea-side, and thus they effectually guard against the disease.

Removal is not always efficacious. In too many cases it simply means transferring the disease from one town to another, the children frequently breaking out on their arrival with the very disease they have run away from. If we could establish amongst all classes a belief in the value of preventive measures against whooping-cough, we would not require to advocate such a step as removal, as the disease would become rare, and when it did occur, active steps would be taken to limit it.

Isolation, then, is the first prophylactic, and each family must carry it out as fully as their circumstances and room permit.

2. Clothing and articles used by patients suffering from pertussis may carry the contagium. I have given an instance to prove this (p. 14), so that disinfectants and stoving should be employed to destroy the contagium. We have many disinfectants to select from, and we have in Ransome's apparatus a ready, cheap, and excellent method of disinfection by heat. Every town and village should possess a disinfecting apparatus. We spend now millions annually upon sanitation, upon great schemes of water-supply and drainage, so that we must not begrudge a trifling expenditure in order to more fully carry out practical hygiene. The clothing of infants is not very expensive, so that when a baby has whooping-cough, the cheapest plan in the end would be to burn the articles used.

3. I need only say a few words about the general hygienic conditions of households. We know that disease loves dirt; that foul air and sewer-gas are the favourite elements in which contagia thrive, so that the general principles of hygiene must be carried out, and children should have all the advantages of cleanliness, pure water, fresh air, light, and all those essentials to health.

4. It will naturally be asked, Do you propose to keep the child in one room during the whole period of whooping-cough? I should be far from advocating such an unwise measure, though I have seen a great deal of harm done by sending children out in all stages of the disease, without con-

sideration for the state of the child's health or the condition of the atmosphere. Undoubtedly the child must have fresh air and exercise, and in mild weather the children may with advantage be sent out to breathe pure atmospheric air, to obtain a fresh supply of that great disinfectant, oxygen. Due attention must be paid to the clothing of children suffering from whooping-cough; they must be warmly clad. It is quite possible for children to take exercise and reap all the benefits from the open air, without coming in contact with other children. It is unnecessary to send them into parks and squares where other children are playing; in the country there is, of course, not the slightest difficulty on this point; in most towns there are pleasant walks, and the suburbs are soon reached; and even in the metropolis it is possible to give children exercise without at the same time doing harm to other children.

Oxygen is a destroyer of contagium, and thanks to this power, the virulence of all the zymotic class of diseases is lessened, so that any objection which might arise on the ground that by sending children out into the air, the poison germs would be wafted away, causing a spread of the disease, is thus answered. Common-sense principles must guide mothers about sending their children out. They must remember that in pertussis the mucous membrane is in a highly irritable condition, that an east wind will convert a simple case of pertussis into a complicated one; they must take into account the individual state of the child, whether strong or delicate—thus they must use, in a word, that great gift of common-sense, which I believe, as a rule, mothers largely possess.

### § 3. *Pertussis in Public Institutions.*

In public institutions children must have exercise, but under judicious management this can be afforded without bringing the infected in contact with the uninfected; the exercising grounds should be used at times when other children are within doors. I am aware that in foundling hospitals and other similar institutions the ingenuity of the officers

will be taxed about providing for exercise and isolation; yet I think they should be capable of rising to the emergency. If they remember what an amount of trouble whooping-cough causes, a little extra trouble will not be spared to keep the healthy from the unhealthy. In those institutions wherein whooping-cough is now not a visitor, but one of the family, looked upon as a necessary condition of babies and children, I can imagine that a serious amount of trouble will be involved in any effort at isolation, and managers may stand aghast at an attempt to stamp it out, limit or check it. It is, however, possible to do so; it is work that should be done, even though it may cost time and money.

Within my own recollection it was believed that erysipelas, hospital gangrene, bed sores, were conditions necessary to surgical operations and hospitalism; I need hardly say, at the present day, we do not believe such false doctrines. Erysipelas, hospital gangrene, followed on dirt, uncleanness, foul air, bad ventilation; and bed sores were produced by bad and careless nursing, by dirt and uncleanness. They stood in the relation of cause and effect. They are now almost unknown in well-managed hospitals, and if they occur, we may take it for granted there is some defect in the hygienic arrangements, or in the nursing. Whooping-cough will flourish and thrive in a colony of infants; it will remain there, and be handed down to the next colony, unless some steps be taken to destroy it.

I shall be met by the objection, it would be impossible to provide isolation for a large number of infants; and in certain institutions there is such a large annual supply, that the accommodation required would be excessive. This objection would have great force, if preventive measures against whooping-cough were only to be taken by the managers of public institutions; but I mean prophylaxis to work all round. If we could induce the higher-class, the middle-class, the working-class, to regard whooping-cough as a serious disease, to adopt precautions against it, to practise isolation, to keep their children from school when suffering from it, to prevent contact with other children, to stop travelling by cab, omni-

bus, or railway, with children suffering from it, we should be in a fair way towards limiting or checking the disease. It would not then be so common, and the consequence would be that the pressure upon foundling institutions would not be so great; that is to say, they would not have to receive annually such a large number of children suffering from whooping-cough. Under a strict regime they should not contract whooping-cough within the walls of any institution.

§ 4. *Lesson taught by Whooping-Cough.*

Whooping-cough, like all the other zymotic diseases, teaches us one lesson, the dependence of one class upon another. If we throw a stone into a pond a very well-known phenomenon occurs. The water is disturbed, very soon circles may be seen radiating from the disturbed centre; these circles increase, grow wider and wider, until they are ultimately lost to the perception of the eye; each circle bears a geometrical relation to the preceding circle, all owing their origins to the primary point at which the stone sank out of sight. When whooping-cough or any other infectious disease occurs, from this tainted centre waves or circles may be thrown off; these waves may increase, growing wider and wider, but, different from the mimic circle on the pond, carrying with them disease, misery, and death. These waves do not respect old or young, rich or poor, the prince or the peasant—they all bear a relation to the primary case, so that each class have an interest in confining the operation of the primary disturbance.

If each one discharged his individual responsibility there would be no excessive individual sacrifice; if each one considered his neighbour, how easy it would be to check infectious disease. It all follows in a consecutive chain of duty and self-interest. By the isolation of the first case of whooping-cough in any house or street, by the observance of the general directions I have given, a limit would be put to the spread of the disease. One family would suffer a little self-denial, and it would involve a little self-sacrifice, but the

result would be a diminution in the number of children suffering from whooping-cough. Much suffering would be spared, and infant mortality would be proportionately lowered.

Unfortunately we have no specific for whooping-cough, as we have no specific for measles or scarlatina. Vaccination, belladonna, gas-tar and other drugs, have been vaunted as preventives, but they are useless in this sense. For prevention we must depend on the intelligence of the public. Let us hope that they may appreciate in time the education which medical men are now so nobly giving to them by means of health lectures. The energy put forth by the members of my profession surely cannot all be lost—some of it must be conserved, and bear good fruit in the future.

From prophylaxis I pass on to curative or palliative measures.

## CHAPTER III.

## CURATIVE AND PALLIATIVE MEASURES.

THE scientific physician does not pretend to cure scarlatina, measles, typhoid fever, small-pox, but, like the helmsman at the helm of a ship, he strives to guide their course, to pilot his patients safe to land, to recovery, avoiding the reefs and rocks, or otherwise the complications, which may arise. Great skill is required in this process, even though all the above diseases run naturally towards recovery. Like them, whooping-cough as a rule runs a regular course, and the efforts of the physician are directed to steering safely through the perils which surround it. His aid is valuable, even though he does not pretend, in the sense in which it is commonly understood, to cure it. Many specifics have been introduced, claiming the power of arresting the disease ; most of them have proved worthless.

It would not be far from truth to say that nearly all the drugs in the pharmacopœa have been tried : arsenic, alum, acetic acid, antimony, benzine, belladonna, bryony, chloral, cannabis-indica, cantharides, cochineal, croton oil, chloroform, carbolic acid, drosera, ether, hydrocyanic acid, hyosciamus, ipecacuanha, iodide of silver, lobelia, laudanum, morphia, nux-vomica, nitric acid, petroleum, potassium salts, turpentine, salicylic acid, quinine, have been recommended and praised for their efficacy by various writers. Blistering, bleeding, have had their advocates.

Looking at this long list, the student naturally must have a difficulty not only in selecting a medicine, but even in comprehending on what principle so many drugs have been used.

In olden times, when a gun called a blunderbuss was used, a large quantity of shot was placed in it; when it was discharged there was a great waste of lead, but the sportsman had the hope that some of the pellets would hit the object aimed at. We might understand the rationale of using the above-named medicines, if they were all compounded in the same mixture; the prescriber might have a hope that some of them would reach the disease, and thus do some good. Administered singly, it is not easy to understand on what theory they could be prescribed.

In the absence of any precise knowledge on pertussis, a number of plausible hypotheses were put forward, and various medicines were tried to support these guesses.

I shall devote a short space to the consideration of some of the methods and theories of treatment advanced, selecting some of the most interesting. It is well to know what has been done in the past. I shall commence with the views of that great and astute observer, Cullen; reading by the light of the advanced knowledge of the present day his description of pertussis, I am more than ever impressed with his power of observation.

There is a growing tendency to ring in the new: there is a feeling in favour of foreign medical literature, and theories supported by foreign names find favour which would be simply laughed to scorn if advanced by a plain-sounding English name, as Thompson, Jones, or Simpson. This very much arises from the desire for novelty, from a weakness of human nature so well expressed in the words, *omne ignotum pro magnifico*. I must lament over the neglect of our old medical writers. We should not ring out the old in favour of the new merely because it is new. Cullen is not sufficiently read. How terse is his definition of whooping-cough simple: 'Morbus contagiosus; tussis convulsiva, strangulans, cum inspiratione sonora, iterata, sæpe vomitus.' There is a text for half a dozen pages of descriptive word-painting.

Describing it in detail, Cullen tells us that this disease is commonly epidemic, and manifestly contagious; that it seems

to proceed from a contagium of a specific nature, and of a singular quality; that the contagium has a particular determination to the lungs; that it affects children, rarely occurring but once. He then describes more minutely the progress of an attack, entering into all those details familiar to all who have observed the disease.

Sir Thomas Watson has left us an admirable piece of word-painting, in his 'Practice of Medicine,' of a paroxysm of whooping-cough; but his diction is soft and graceful, while Cullen's is forcible, vigorous, and rough. Both were masters in their art. We have reason to be proud that we have our literature enriched by their writings.

Cullen observes, with singular modesty: 'I dare not say anything towards a theory on its pathology. I have no conception of what are the circumstances of the peculiar contagium which determines it to the lungs.' As I read these words the lines come instinctively to my mind (perhaps applicable to myself):

'Fools rush in where angels fear to tread.'

Though he has not a theory, yet he throws out hints at the treatment: suggestions sound and rational—far before most of those which have been since propounded, though based on elaborate theories. He tells us that the cure of this disease has been always considered as difficult, whether the purpose be to obviate its fatal tendency when it is violent, or merely to shorten the course when it is mild. He believes that when the contagium is recent, we neither know how to act nor how to expel it; and therefore the disease continues for some time. But he adds: 'It is probable that the contagium, in this as in other instances, ceases at length to act, and then the disease continues by the power of habit alone.'

From this point of view, Cullen maintains that the practice must be different, and treatment must be adapted to two different indications, according to the periods of this disease. At the beginning, and for some time after, the remedies employed must be such as may obviate the fatal effects; but after the disease has continued for some time, and

is without any violent symptoms, the only remedy required is that which may interrupt its course. He then details his treatment, naming his remedies, some of which, as emetics, find favour at the present day. Thus, for instance, Steffen says ('Ziemssen's Cyclopædia,' vol. vi. p. 721): 'Although this method was abandoned long ago, it may still do good service in cases where the air-passages, particularly the bronchioles and alveoli, are overwhelmed with secretion, in consequence of which the respiratory insufficiency is extreme, and we are apprehensive of secondary pneumonia. Ipecac, sulphate of copper, or subcutaneous injections of apomorphine are here the most suitable.'

West ('Diseases of Infancy and Childhood,' p. 482) also says: 'If there is much wheezing at the chest, an emetic of ipecacuanha should be given once or twice a day, in order to free the air-passages from the mucus which collects in them, often in very considerable quantity, and thus tends, by the obstruction it offers to the free admission of air, to favour the occurrence of collapse of the lung. The degree to which the child suffers from the accumulation of phlegm in the bronchi must determine whether the emetic shall be given once or oftener during the day. If it is given but once, the evening should be the time selected for its administration.'

I have selected Cullen's plan of treatment for consideration, not because I have faith in his method, or in the humeral pathology as taught by him—although the humeral pathology bears a distinct relation to the germ theory—but there are certain points in his treatise to which I desire to direct attention.

1. Cullen recognises that whooping-cough, like measles and scarlatina, runs a certain defined course.

2. That there is a particular determination of the disease to the lung, just as in measles we have a determination of the measles-poison to the skin and bronchial mucous membrane.

3. He believed in contagium.

4. He divided his treatment into two stages: (a) When the contagium is active; (b) When it has expended itself.

Here again we have an analogy with measles, scarlatina; they have their periods when the contagia is active, and when their respective poisons exhaust themselves. These views of Cullen lend a support to my hypothesis. His method of treatment, as regards division into two stages, is a very rational one. After the time of Cullen a number of theories and plans of treatment were put forward, to a few of which I shall briefly allude.

Autenrieth, believing that inflammation of the pneumogastric nerve was the cause of the disease, recommended tartar emetic. He gave no internal medicine, but applied friction with tartar-emetic ointment, one drachm and a half to the ounce of axunge, a portion the size of a nut to be rubbed over the epigastric region three times a day. In order to insure the efficiency of his treatment he was not satisfied with producing pustules. He continued the remedy for eight or twelve days, until ulceration came on. He found imitators, as, for instance, Luroth followed the same plan. Such a course of treatment is now deservedly neglected. His theory, however, did not die, for I find that Lubelski, also believing that the vagus was the primary cause of pertussis, suggested the application to the neck along the course of the pneumogastric nerve of ether pulverizations. He narrates a case. The first trial was made on his own child, aged seven years; he states it was followed by almost immediate relief. He regards these pulverizations as only palliative, especially applicable to children harassed by violent and frequent paroxysms.

It is pleasant to turn from these theories to the views of a writer whom I have mentioned in the same line as Cullen. I allude to Sir Thomas Watson. He has not any specific to offer, but he has some sound advice to give. He tells us that the object of rational treatment in whooping-cough, supposing the disease to be simple, should be to keep it simple, to keep it mere whooping-cough, to obviate serous inflammation, or mischief in the chest, or head, and if possible to mitigate the severity and shorten the duration of the fits of coughing. He did not believe that the duration of the complaint could

be abridged: it will, he says, 'in all probability run a certain course, and our business is to conduct it evenly and safely to the end of its course. You will find different persons employing and praising different plans of treatment, the object in all cases, however, being the same, viz., 'to ward off inflammation, and to quiet irritation.' I think there can be no question as to the soundness of this advice, and that Watson has struck the key-note of what treatment should be, in the few last words in the sentence I have just quoted. I must leave Sir Thomas Watson for the present and turn to a group of remedies, such as benzine, carbolic acid, petroleum, gas-tar, salicylic acid, turpentine, quinine, chlorine.

These are the outcome of the experience of later years; most of them are recommended in the form of inhalations. This method of treatment is significant of the belief in an active contagium, to be controlled by means of antiseptics.

Inhalations have been practised for years, but ever since the introduction of gas they received a new development. It was said that those who lived in the neighbourhood of gas-works did not suffer from whooping-cough, and that their children thus escaped it. The *rationale* is supposed to be, that the contagium could not live in the products given off by gas manufacture. In the hope that a remedy was at last found, physicians recommended mothers, who had children suffering from whooping-cough, to take them for exercise to the neighbourhood of gas-works. In some cases children were admitted within the works, and were allowed to pass through one of the rooms, in which they were exposed for a short time to the pungent vapour of chlorine. This system was highly praised, and it soon became a popular remedy.

When a student I was apprenticed, under the old system of instruction, to a practitioner of the old school—a shrewd, clever, but eccentric man; he had, what I may truly call, an immense practice amongst all classes: a large city being the sphere of his labours. He enjoyed a great reputation for treating diseases of women and children. The consequence was I saw a great variety of infantile disease, and whooping-cough was a leading speciality, owing to the reputation of

certain powders which he prescribed. I have seen hundreds of children with whooping-cough during this period of pupilage. In his hall we often had as many as ten or a dozen children at a time, crowing, whooping, coughing, in all states of the disease; whilst other sympathizing mothers with infants in their arms were also there, so that there was every facility for keeping up the contagium. Such a thing as isolation was not even dreamt of. His reputation was based on very slight grounds, and his was a routine form of prescribing.

As we made up our own medicines the simplicity of his prescriptions was not known. Simple though they were, he acquired both reputation and money. One of the first recommendations of this practitioner was, that the child should be taken down daily to the gas-works, the second that the child should be warmly clad, this being followed by giving the mother a dozen powders, with directions that the child should take one, night and morning, mixed with a little sugar or jam, or in any way the mother's ingenuity could suggest. The powders were composed of a quarter of a grain of ipecacuanha, one grain hyd. cum creta and two grains of aromatic confection.

This was the usual routine treatment for very simple cases, but yet it was very satisfactory, as proved by the mothers' returning, and by the continual stream of fresh patients, all of whom brought grist to the mill. If there were any graver symptoms, the recommendations and the powders were supplemented by the following mixture :

Vin. Ipecac.	.	.	.	ʒii.
Spt. Æth. Nit.	.	.	.	ʒii.
Syrup. Scillæ	.	.	.	ʒvi.
Aquæ ad	.	.	.	ʒiv.

Two teaspoonfuls to be taken every four hours. When we had more severe complications (a comparatively rare occurrence) we reached higher flights of prescribing.

I was not then old enough to properly investigate the influence of the value of the gas-works upon the duration of

the malady, but the mothers declared that the paroxysms were shortened, and that the children derived benefit from the air.

I do not pretend to give an opinion on the data of those years. Since then I have tested the remedy, and examined statistics which have been published on the subject, and my conclusions are :

1. That in the majority of cases, no amelioration in the symptoms or in the duration of the malady has resulted from it.

2. That in a minority of cases some benefit has been derived from it. It has not cut short the paroxysms, so that its specific value must be considered as non-existent. Its claims as a specific have been considered by other observers. Lochner<sup>1</sup> sent forty-three children into the purifying chambers of a gas-works, so that they could breathe the exhalations of the lime used in purifying the illuminating gas. Twenty-three boys and twenty girls were subjected to this treatment, eleven of them being less than a year old. The results are said to have been for the most part favourable.

Commenge<sup>2</sup> sent eighty-eight children to the gas-works of St. Maud. Of these fifty-four were cured, twenty-four improved, while in ten no result could be determined. Each sitting lasted about two hours, and each successful case required on an average eleven or twelve sittings. Maingault, Blanche, Bergeron, Barthez, Roger, and Bouchut have declared against making this use of the gas-works, partly from the want of results, and partly because they regard these inhalations as hazardous.

More recent investigations confirm my view. A valuable report was presented to the French Academy of Medicine by its president, M. Henry Roger, 'On the Efficacy of the Emanations from Gas-works in Checking or Moderating Whooping-Cough.' The following is an abstract of M. Roger's interesting report:<sup>3</sup>

M. Roger examined with much care the various statistics which have been published in France on the subject, coming

<sup>1</sup> Lochner, Ziemssen, *loc. cit. ante.*    <sup>2</sup> Commenge, Ziemssen, *ut supra.*

<sup>3</sup> 'Progrès Médical.'

to the conclusion that this method is far from having any therapeutical merits superior to those of other remedies in whooping-cough. He admits that it modifies in quality and quantity the bronchial secretions, that it can for a given day assuage the numerous and variable symptoms of the pyrexia, but that it has no real or abortive or specific action; nor are the emanations from gas-works a specific remedy for the disease—in fact he says there is no such remedy.

The practice of inhaling the emanations from gas-works and the alleged benefits derived therefrom, suggested to the minds of physicians the desirability of trying other forms of inhalation.

In 1850 Ebenezer Watson<sup>1</sup> recommended that the throat should be brushed with a solution of nitrate of silver. Under this form of treatment he professed to shorten the duration of the disease; this was tried by others, but failed. His plan appeared again in another form. Rehn,<sup>2</sup> in 1866, employed inhalations of a solution of nitrate of silver at the height of the second stage. He experimented on six children over four years of age and two adults. After the third inhalation, in the best case, there occurred a remission of the symptoms, and after from eight to ten inhalations there remained only a simple bronchial catarrh.

Compressed air was employed by Brunniche,<sup>3</sup> chloroform by Roger, camphor and oil of turpentine by Clar; and Kjellberg (Stockholm) advised inhalations of benzine.

In 1862 Hanke<sup>4</sup> published the results of experiments on the inhalation of various gases which he tried in St. Ann's Hospital at Vienna. Oxygen and illuminating gas never induced attacks of cough, and patients were glad to inhale them. Carbonic acid and ammonia made the attacks worse, and hydrogen and nitrogen frequently brought them on. He advises increasing the oxygen of the atmosphere, in which the patients were living, either chemically or by setting out certain plants.

<sup>1</sup> Watson, 'On the Topical Medication of the Larynx.'

<sup>2</sup> Rehn, Ziemssen's 'Cyclopædia,' p. 723.

<sup>3</sup> Brunniche, Ziemssen, *loc. cit.*

<sup>4</sup> Hanke, Ziemssen, *loc. cit.*

In 1875, Lee published in the *British Medical Journal*, vol. ii. p. 425, a paper on the treatment of whooping-cough with carbolic-acid vapour. The same remedy had been previously recommended by Burchardt<sup>1</sup> in 1874. Jefferies<sup>2</sup> followed in the same path, and recommends the inhalation of carbolic acid fumes; his method is very simple, and may be useful in purifying the room—a very important requirement in all cases of whooping-cough.

At the fever hospital which I attend, I have an apparatus for properly burning carbolic acid, which I have found very useful, especially in cases of small-pox.

Jefferies directs that the patient be placed in a room, with closed doors and windows; heat the kitchen-shovel, and place on it two drachms of common carbolic acid. He states that if the patient happen to have a fit of coughing, it will be cut short by breathing the carbolized air. This should be repeated three times a day, and the rooms frequented by the patient should be carbolized, especially the bedroom. I agree with his suggestions about purifying the air of the chambers used by the patient, but I cannot approve his plan as far as the child is concerned.

Various other disinfectants have been tried, in the hope of acting directly on the mucous membrane of the air-passages, and on the special contagium.

Lesser<sup>3</sup> employed inhalation of petroleum; and Letzerich,<sup>4</sup> believing that whooping-cough is due to the presence of fungoid spores, directed the inhalation of muriate of quinine in the form of powder, in combination with bicarbonate of soda and gum arabic.

According to his report of three cases treated in this way, the convulsive attacks are said to diminish, after about eight or ten days, and the third stage soon ceases. I have dwelt for some time on these various forms of inhalation, in order to show the tendency of modern lines of treatment. I shall presently have to refer to certain forms of inhalation and pul-

<sup>1</sup> Steffen, *loc. cit.*

<sup>2</sup> Jefferies, *British Medical Journal*, 1879, p. 965.

<sup>3</sup> Steffen, *loc. cit.*

<sup>4</sup> *Ibid.*

verizations, which I have found useful, and I shall explain their rationale. It must be borne in mind that the value of inhalations do not depend upon their power of specifically cutting short the disease, but they relieve, when judiciously employed, certain states depending on the disease. As whooping-cough occurs in very young children, it is often difficult and even injurious to employ this measure. Inhalations of various kinds are useful adjuncts to our resources against whooping-cough, but they are only adjuncts.

Whooping-cough, like measles and scarlatina, will run its course. We have no power over its incubation or its development, but we have great power over its issue. As I have previously pointed out, we can by a modified form of isolation and quarantine prevent the spread of infection. By improved hygienic arrangements we can place the patient in the most favourable circumstances towards recovery ; we can relieve certain painful and prominent sources of trouble ; we can guard against complications ; in a word, by the employment of rational measures we can assist Nature in her efforts to throw off the disease, and this is the highest power we possess in dealing with the majority of the diseases of this class.

I need not say very much about the various drugs which are said to have such curative effects, as nitric acid, cochineal, alum, etc. I have tried a few new remedies, but as a rule I have adhered to a uniform plan, as I found I secured good results ; viz., I had what I may call an average of recoveries. This arithmetical method of forming an estimate of the value of treatment might be usefully applied by practitioners.

For the treatment of the majority of diseases I presume most practitioners have some definite methods of procedure, the value of which they have tested by the results. Now if, for instance, in any one disease 90 per cent. of recoveries are afforded by the system pursued, the clearest evidence should be forthcoming that by altering the treatment 91 will recover under the new regime. But if cent. per cent. are restored to health under the old method, I think the practitioner,

having thus secured the great desideratum, would be unwise, for the sake of novelty, to try a new remedy.

This principle of numbers is illustrated in antiseptic surgery.

A. operates forty times with the best results, his dressings being after his own method. B. has an equal number of operations with a similar result. As there are cent. per cent. of recoveries, A. and B. act wisely in adhering to their own plans. But the case would be different if A. had twenty deaths, while B. had none, for then there would be a legitimate reason to test the efficacy of the system by which B. obtained such favourable results.

I might dwell longer on this subject, as it affords ample food both for suggestion and thought. Exactness in medical reasoning is a great want; there is an abuse of inductive inference both as to cause and effect, and hence for the treatment of certain diseases we have a host of remedies. The *post hoc* is *propter hoc*.

After this digression I return to the subject of treatment.

The method I have followed for years has afforded me good results, looked at from the numerical standpoint I have just mentioned. It does not pretend to be treatment of a specific nature. I have endeavoured to guide the disease scientifically to a successful issue.

In all plans of treatment certain modifications must be made, depending on the occurrence of exceptional phenomena. Every plan of treatment must be modified to suit the age, constitution and the environment of the patient; thus, for instance, we could not pretend to treat a delicate strumous infant with whooping-cough in the same way as we would treat a robust, strong, and healthy infant; nor would we use the same measures for an infant that we would employ for a child of two or four years of age.

#### *Treatment of a Simple Case in a Child under Two Years.*

The disease is more dangerous in an infant; it is not so well able to resist the depressing influence of the contagium; it is more unmanageable: for instance, it is impossible to

employ inhalations of certain forms, though we may use pulverizations. We must take into account the condition of the child, whether a puny, weak, or strong nursling, whether a good or bad feeder.

Authors have divided the disease into three stages,<sup>1</sup> but this is an artificial classification, as the stages are not always sharply defined. This division is, however, useful. Practitioners do not so frequently see the disease in the first stage, as mothers do not bring their children for treatment until the distinctive paroxysms have appeared, and they hear the whoop or kink which proclaims, in crowing accents as it were of jubilation, 'whooping-cough.' This first stage comes on unsuspectedly and insidiously; the child may have some slight fever, *malaise*, be restless, cross, with some symptoms of catarrh: the mother thinks the child has a cold, which will soon pass away under a little domestic treatment. Castor oil is given, oil or candle-grease—popular remedies—are applied to the chest, and the mother has the satisfaction of finding the child better in the morning. It is so well that it is allowed to go out without any extra precaution, or without considering the state of the atmosphere. On its return, the cough is worse, and the infant exhibits more manifest symptoms. There may be some discharge from the nose; the cough is more urgent and teasing; the child more restless, uneasy, and cries as if in pain.

This stage progresses; we have still more pronounced symptoms of catarrh; a little more care may then be taken by the mother, the supposed cold is again attended to, the child is nursed, kept in the house, and under this form of treatment there is again an improvement. But the cough persists, and the infant is not so uneasy or restless; there is a remission of watchfulness on the part of the mother or nurse. The child is taken from a warm to a cold room, or after having been warmly wrapped up, the extra clothing is taken off: again there is a change; the cough returns with intensity, occurring in repeated attacks, during the intervals

<sup>1</sup> These stages correspond to the 'stadium prodromii,' 'stadium convulsivum,' and 'stadium decrementi,' of Aberle.

of which the child pants for breath. Sometimes the paroxysms in this stage are so continuous that the conjunctivæ become injected. When the child is put to bed in a cold room, after having previously been in a warm nursery or kitchen, there is an aggravation of the symptoms and some spasmodic inspiration resembling croup.

The next stage is not far off. The whoop soon commences. The mother then knows what the disease is, and in her anxiety rushes off with the child in her arms to the nearest chemist, or perhaps to the doctor. In the second stage we most frequently meet with whooping-cough amongst the children of the working-classes. Mothers have but too frequently come to my house with their children in confirmed whooping-cough.

I have seen in chemists' shops, and particularly in that of one chemist who has a reputation for treating infantile diseases, a number of children at one time, suffering from whooping-cough, waiting for the specific in the shape of the fourpenny mixture which is to cure the disease. It is thus whooping-cough is spread; it is thus complications arise. Independent of the harm done by the mothers, the mischief caused by this class of chemist is very serious. I am glad to say that the most respectable chemists confine themselves to their legitimate duties, but the prescribing species is not uncommon. He does harm not so much with whooping-cough as with other diseases. When a child is brought to him with incipient hydrocephalus, he directs attention to one prominent symptom. He treats the cough, tells the mother that the child has bronchitis, and that his mixture will soon set the child all right. The poor mother soon finds out that it is all wrong; the child grows worse, and it is evident that a certificate of death will soon be required. A medical man is then called in, who at once recognises the disease and pronounces the fatal verdict: 'You have called me in too late.' This is only one illustration out of many I could give to prove the harm done by this species of chemist. The legislature may possibly, in time, do something to alter this sad condition of affairs, and to protect infant life.

As a rule, then, we see pertussis in the second stage. If

we are fortunate enough to be called in to a patient in the first stage we can do a great deal ; we can relieve the more urgent symptoms, and, if our directions are carried out, we can prevent complications. In the first place, we can impress upon the mother the absolute necessity of adopting the precautions I have previously spoken about ; we can advise isolation.

The treatment must proceed on the following lines : The child must be confined to the house—here we must act in proportion to the accommodation at our disposal ; if there are other children it must be, if possible, isolated from them. The room in which it is placed should be kept at an equable temperature. If there is a nursery it must be maintained at such a temperature that the child will not experience too great a change when it is removed to its cot, at night, in the bedroom. The air should be as pure as possible ; there should be good ventilation without draughts. Flannel must be employed to keep the child warm, particular attention being paid to protect the neck and chest ; the diet must consist either of breast-milk or light farinaceous foods. It is advisable to give some medicine, so as to act on liver and bowels, and for this purpose I usually employ hyd. cum creta with pulv. rhei.<sup>1</sup> If there is great irritation and the cough is troublesome, I usually give a simple mixture of ipecacuanha with syrup of scillæ.<sup>2</sup>

I have never seen any necessity for giving an emetic in this first stage. The leading indications are to allay irritation and prevent mischief ; this is done by the above simple measures, and if carried out, when the second stage commences the child will be in a position to withstand the paroxysms.

How long does the first stage last ? No definite opinion can be given on this point. I have seen the whooping-stage develop in two days ; I have seen it take fourteen ; in some cases there has been seemingly no prodromic stage. The statistics of other observers vary on this point. Berger has estimated this stage as averaging from eight to fourteen days. Lombard, from four to six weeks. Wunderlich assigns from half a week to six days ; West from two to twenty-five days.

<sup>1</sup> See Formulæ 37, 38, 39, pp. 100, 101.      <sup>2</sup> See Formulæ 34, 35, p. 100.

It must vary according to the intensity of the contagium, the particular receptivity of the infant, and the general environment. I have never seen the first stage terminate the disease, though I have not the slightest doubt that the second and third stages may be modified by care and attention to diet, warmth, hygienic surroundings. All contagia, as those of scarlatina, measles, variola, are more intense under certain conditions. When a child has whooping-cough under insanitary conditions, we may feel sure that the second stage will not only be more painful, but more dangerous. If the patient can be placed at home under ordinary favourable sanitary conditions, I do not think that removal is advisable, or that the disease will be cut short by sending the child away to another atmosphere. When there is overcrowding, defective hygienic arrangements, want of room in a household, there can be no question of removal being not only advisable but necessary.

In simple cases, and with ordinary children, by this method, the child is steered through the first stage to the second, when we meet with the paroxysmal cough, so characteristic of the disease.

Sir Thomas Watson has left us a graphic description of the phenomena. It is this paroxysmal stage which excites so much commiseration, and we need not wonder that so many remedies have been used in the hope of cutting it short, and saving so much suffering. Simple drugs which would do no harm if they did no good, poisons which might promote the euthanasia of the infant, have been tried, and praised by those who introduced them.

What can we do for this stage? There are three leading indications which we have to fulfil:

1. To palliate or cut short the paroxysm.
2. To relieve the irritability of the lung.
3. To assist expectoration.

1. Many favourite medicines may be selected for the first indication. Hydrocyanic acid<sup>1</sup> is said to be very useful by West. I have not found it so. It is a dangerous remedy for

<sup>1</sup> West, *loc. cit. ante.*

children, and especially for infants. On the evidence I have as to its utility, I have not faith in it. Nitric acid, introduced by Gibb, is said to be a specific. I believe it to be utterly worthless. When the paroxysmal stage appears to be approaching, the plan I have adopted has been to introduce, by pulverization, chlorate of potass. This can be easily done by mixing it with bicarbonate of soda and gum arabic. It is blown into the fauces by one of the small apparatus sold by all instrument-makers. It can be used with infants. This is a great advantage. Owing to their tender age, inhalations cannot be practised, as they cannot inhale. My plan does not hurt the child, and hence there is no struggling or crying; as we know that it is desirable to keep children with whooping-cough in good temper, this is an advantage. The chlorate of potass seems to relieve the intensity of the paroxysm. It has been tested on a large number of cases, and from my own personal experience I believe it is a useful palliative. I have the evidence of the mothers as to its efficacy; but this, of course, is not of much scientific value. I have employed it for years. I have said that inhalations cannot be practised in the ordinary way by making the child inhale out of a vessel, but the infant may be made to breathe an atmosphere impregnated with some form of disinfectant. I have alluded to the suggestions of Jefferies, and given my opinion of it. It is in this stage that children are taken to gas-works. As I have said that pertussis is caused by some form of microbe, allied to those forms which give rise to measles, scarlatina, variola, charbon, what is the value of medicines which have been suggested so as to act specifically on the microbe, microzemes, or the organism causing the disease? This form of treatment has been attempted by Letzerich and Binz.

To Binz belongs the credit of having introduced the use of quinine against this disease. He relied upon the theory that whooping-cough is dependent upon the reception and further development of some form of fungi. Since quinine in experiments acts injuriously upon the spores of fungi, and besides, seems to prevent the escape of the white blood cor-

puscles from the vessels, he was persuaded in advance of the favourable action of this remedy. At first he made use of comparatively small doses repeatedly; subsequently, with better effects, he gave larger doses more frequently. He advises the use of the muriate of quinine, as the more soluble. Still, the sulphate appears to be taken up by the system just as easily. In the *Jahrbuch für Kinderheilkunde*, N.S.T., p. 235, he reports the case of a girl of eight months, who had been ill for two weeks, and that of a girl, seven years, who had been ill three weeks before. The former was completely cured in forty, the latter in thirty-eight days. In the same journal, iv. p. 103, he insists that we can attain good and prompt results only when large doses of quinine are given before the disease has reached its height. Beidenbach (1869) has reported that in an extensive epidemic he has seen the best results from this treatment.

I have used quinine and bark for the treatment, but not with the hope of cutting the disease short. We do not attempt to act specifically on the contagia of typhoid, variola, measles, or scarlatina. It is true that sulphurous acid, sulphite of magnesium, salicylic acid, carbolic acid, have been put forward with this object in view, but though cases have been brought forward in support of the efficacy of these medicaments, yet we know that such a form of treatment has failed in the hands of independent observers. We may prevent, we cannot act specifically, on any zymotic disease; so this quinine treatment, in my opinion, has no scientific value. In the second stage of the simple class of case I am now describing, the child may go out when the weather is fine. Much benefit is derived from the fresh air. The infant must be warmly wrapped-up. It is needless to say that precautions must be taken against spreading the infection, and that attention must be paid to the hygienic environment of the patient, ventilation, diet, temperature, etc. All handkerchiefs used for receiving expectoration, nasal secretion, vomiting, should be destroyed.

2. Many medicines are useful in relieving the irritable state of the bronchial mucous membrane. I have used bella-

donna largely for this purpose, and have found it has given relief in a large number of cases. Infants seem to have a tolerance for it, and it may be given in larger doses than those commonly prescribed. When the cough is troublesome, at night, and when there is some dyspnoea, I have found the powders recommended by West<sup>1</sup> useful; and I have employed with useful results the common tinc. camph. co., in doses proportionate to the age of the infant.

3. The third and last indication is to assist in keeping the bronchial tubes free from the accumulations of mucus. In ordinary simple cases, the vinum ipecac. with squills will be found sufficient. I shall presently have to allude to the complications.

How long does the second stage last? This will depend upon various circumstances, somewhat similar in character to those I pointed out as having an influence on the first stage. I have seen it last five days, eight days, fourteen days, thirty days. The opinion of other observers may be compared with mine.

Gerhardt fixes it at from two to ten weeks; Steiner at from three to eight weeks. Burnier assigns from four to five weeks as the medium duration, but has also seen this stage last but two weeks, and on the other hand several months. According to Barthez and Rilliet, it varies from fifteen to sixty-five days.

After a varying time the paroxysms then become less, and we reach the third stage. Here change of air is found to be beneficial, and in some cases it seems to act with a magical influence; and in this stage syrup of phosphate of iron may be given with benefit. If the cough persists, I have found that the alum<sup>2</sup> treatment is one of the simplest and best methods of checking it. The simple case now terminates in recovery.

It may be said this sketch is very simple. When we see a yacht in a harbour, when the water is calm, and unruffled by a breath of wind, and watch it glide over the surface, like a graceful swan, we instinctively think that very little skill

<sup>1</sup> See Formula 12, p. 97.

<sup>2</sup> See Formulæ 36, 40, pp. 100, 101.

is required in sailing such a vessel. If we could witness the bearing of the same yacht in a stiff breeze, or in a stormy sea, we should form a different opinion, and recognise the great skill and ingenuity that are required to guide the vessel and even to keep her afloat amidst the elements which seem to be contending for her destruction. The yachtsman must be prepared for smooth harbours and stormy seas, and for the complications which may arise.

The physician, when he has to guide the frail infant through pertussis, does so with greater ease when the case is simple; but he must be prepared and armed for the disturbing elements which may interfere with the safe conduct to health of the little vessel he is also guiding, and for the complications which make whooping-cough so dangerous.

*Complications in Children under Two Years.*

1. We may have brain congestion, with drowsiness and other well-known symptoms, occurring in consequence of the violence of the symptoms. We may have brain symptoms of trifling and of serious moment. This first group of complications will tax the physician's power. Carrying a simile I have used before a little farther, he will have to steer the vessel through very troublesome waters. If he wrongly uses the rudder, or puts on too much canvas, he will run on a rock, capsize, or sink the craft. He will have to exercise his judgment, to decide whether mild or vigorous treatment is required. The difficulty is to diagnose the exact condition on which the symptoms depend. West gives a wise caution: 'If, mistaking the import of the nervous symptoms, we direct our treatment to some imagined mischief within the chest alone, and make free use of antimony and other depressing medicines, we will aggravate instead of relieving the difficulty of breathing, etc. The irritability of the nervous system increasing in proportion as the respiration becomes impaired, we will hasten the occurrence of convulsions and of those formidable symptoms we desire to avoid.' We may have some cases in which the symptoms of congestion may be slight, which will soon yield to mild treatment, as the

application of cold to the head. We may have graver symptoms, when leeches may be required. Especially when dentition is going on we may have disturbance of the spinal system of nerves, with carpo-pedal contractions, and attacks of spasm of the glottis, superadded to frequently recurring convulsions. When complicated with vomiting, these symptoms are much more serious, as the very succussion of the act increases the mischief.

In all these neurotic attacks the bromides will be found useful, and I have experienced great benefit both from the bromide of potassium, and the bromide of ammonium.<sup>1</sup> Attention must be paid to the state of the bowels, and here calomel will be found a serviceable medicine. If dentition is incomplete and the teeth are not through, lancing the gums may be safely adopted. I have seen carpo-pedal contractions yield, almost like magic, to the influence of the gum-lancet.

I have said that I have not found much use from hydrocyanic acid in the paroxysms, but I have found it useful to correct intense vomiting in a few severe cases. We may have graver symptoms and manifestations that there is something more than mere inflammatory irritation. We may have organic change and effusion, as the result of the irritation, calling for aid. In some delicate children, in whom hydrocephalus has been previously unsuspected, pertussis may rapidly excite the latent mischief, and we may have this formidable malady to grapple with. Lastly, tubercular meningitis may present itself, calling for special treatment and care, testing our resources to their utmost. In all the neuroses we have to fall back upon three great principles :

- (1) To quiet irritation ;
- (2) To subdue inflammation ;
- (3) Not to allow the vires vitæ to become exhausted.

The treatment of tubercular meningitis must proceed on these lines. We shall have to consider whether we shall deplete ; and here we must take into account the character of the pulse. In my opinion, actual depletion, by leeching, will be rarely necessary ; but we have in purgatives a sufficiently

<sup>1</sup> See Formula 27, p. 99.

active agent to reduce, whilst in aconite we have another controller of febrile disturbance. Half a minim may be given to an infant every four hours, mixed with some simple saline mixture. For sleeplessness, we can resort to bromide of potassium, in doses proportionate to the age of the child, and combined, if necessary, with a small dose of chloral hydrate. We must support the strength by chicken-broth, beef-tea, milk, and other nutritious foods; and when convalescence is coming on, we must have recourse to some form of strengthening syrup, or some suitable tonic.

2. We may have to deal with complications chiefly referable to the chest.

Capillary bronchitis, in which the small air-tubes are inflamed, may prove an element of peril. We shall have to diagnose it accurately from pneumonia. It is a complication fraught with peril to an infant. If we deplete by depressing medicines, under the belief that we are treating pneumonia, we shall increase the severity of the symptoms, and simply induce a fatal result. Providing we have made out our diagnosis, our treatment should be directed to soothing the inflamed bronchioles, whilst at the same time we endeavour to relieve them. For the first indication we may use poultices, warm fomentations. I have been in the habit of applying a large sponge, dipped in hot water, keeping it to the chest until the whole surface became reddened. A linseed poultice may then be applied. I know no better remedy than the hot sponge in this condition. For medicine, I place reliance on ammonia, ipecacuanha, and senega. It is unnecessary to say that particular attention must be paid to the atmosphere of the child's room, and the infant must be carefully watched. We have to guard against pulmonary collapse.

In treating capillary bronchitis, we must specially guard against reducing the child's strength by depleting treatment, as antimony. Those who practise in manufacturing towns rarely find occasion for this medicine. As a rule, more stimulating expectorants are required, as senega. I know of no better mixture for children suffering from capillary bronchitis, than one containing ammonia, ipecac., senega, and

syrup of squills.<sup>1</sup> It is useful when the child is unable to expel the mucus which is blocking up the bronchi, thus interfering with the proper aëration of the blood. This mixture is often required even at the commencement of an attack, when if we had recourse to sedatives, as tinct. camph. co., spiritus ether. chlo., tinct. hyoscyamus, they would be fatal. There are cases when we have to adopt a sedative treatment, when after giving ipecac. we shall have to resort to some medicine to soothe the nervous system and to relieve the irritation, and this we can do by small doses of bromide of potassium<sup>2</sup> or one of the medicines just mentioned. We must not forget to support the little patient's strength by beef-tea, chicken-broth, and other suitable food; brandy and water, if necessary. Attention must be paid to the bowels. In case of constipation, calomel or castor-oil will soon relieve it; and should diarrhœa exist in a severe form, without resorting to opiates, we can check it by mist. cret. co., with catechu, or by the mist. hæmatoxyli.<sup>3</sup> The diarrhœa may arise from dentition, so that the state of the teeth should therefore be looked to, and the gum-lance used to relieve the capsules.

In treating capillary bronchitis in infants, we shall have to pay the greatest attention to the hygiene of the sick-room, keeping the temperature equable, the air pure, avoiding draughts and everything which might irritate; and this care must be exercised for a considerable time, especially when the child is approaching convalescence, as relapses are likely to occur, owing to a relaxation of vigilance in these particulars. When the attack is passing off, some mild preparations of iron, as the syrup of the phosphate or the vinum ferri may be used. Some recommend cod-liver oil, but in infants I consider it is a medicine very much overrated when given by the mouth, as it is not emulsified, a necessary condition to its absorption. Change of air can be recommended when convalescence is fairly established, if the season is suitable, and

<sup>1</sup> See Formulæ 13, 14, 15.

<sup>2</sup> See Formula 27.

<sup>3</sup> See Formula 26.

especially if by removal the child can be placed under better hygienic conditions.

Pneumonia will afford us an opportunity of exercising our judgment. The first thing necessary is to diagnose it. In the pneumonia of infants, I am inclined to agree with those who adopt an expectant treatment; who rely upon the natural powers to overcome the disease, who assist in promoting recovery by attention to diet, warmth, and hygienic surroundings, in place of putting their sole reliance upon medicine. This expectant treatment does not simply consist in folding your hands, and looking on while the patient is in peril, and you simply watch and wait for nature alone to overcome the peril. It is something far different from this.

Recognising that in infancy and childhood pneumonia almost invariably runs to recovery, the physician places his patient in a favourable atmosphere. He attends to the temperature and moisture of the room, applies some soothing applications to the chest, as linseed-meal poultices; he feeds the child with milk, beef-tea, wine, and brandy; he attends to the bowels, to the process of dentition; he watches the symptoms, ready to step in at any moment; he gives some simple medicines, as bicarbonate of potass, or a saline mixture, and under this regime the patient recovers. Better results are secured in this way than by inunction with mercury, or by leeches.

In watching a case, the physician must be prepared for emergencies. There are occasions when medicines may be required—when the breathing is laboured and hurried, and nostrils expanding with painful frequency, the pulse small, thin, and almost uncountable. In this state we have a sheet-anchor in ammonia.<sup>1</sup> I have seen it act like magic. It may be given in milk, or in combination with senegæ. It does not require a theory to explain its action. The use of stimulants, as brandy, wine, may be required, and we shall have to judge each case on its individual merits. It may not be necessary to stimulate in every case, but it is better to err on the side of over-stimulation, than on that of depletion.

<sup>1</sup> See Formula 44.

In infants an antiphlogistic regimen is rarely required. They will not, if tried, take the breast in the primary stages of pneumonia, as the efforts at sucking cause pain. Some difficulty will be experienced in making them take food; there is danger that they may sink too low through their objection to be fed. It is better, therefore, to support the strength, unless there is some great indication to the contrary.

There may be some cases of pleuro-pneumonia where a few leeches may be applied with advantage, as, for instance, in full-blooded children; but such cases are rare. I have an objection also to blistering infants: it may be advisable to apply a stimulating liniment or to mix some mustard with the linseed, but this is as far as I go. West places great reliance upon small doses of antimony and calomel and antiphlogistic remedies in the first stage of pneumonia. No doubt in the cases seen by him, such a course of treatment was required. I should not pretend to argue that the exudation matter could not be removed by medicine, or that calomel and antimony are never required. I can only say our experiences do not agree, and that in cases seen by me other and simpler measures afford equally satisfactory results.

When the infant is approaching convalescence we must not relax our precautions too soon; we must guard against chills, attend to the temperature and warmth of our patient, for a relapse may easily occur, and we may have to begin *de novo*. Some form of tonic may be required, and we can fall back upon some of the excellent syrups of iron which modern pharmaciens now place at our disposal. We must be particularly careful not to let the child go out too soon.

But all this time, speaking of fresh complications, we have lost sight of the primary disease—*whooping-cough*. Does it pursue its course? Do the paroxysms occur? In all the cases of complications I have seen, the paroxysms are less frequent and less violent; the minor disease becomes merged in the major. Capillary bronchitis and pneumonia are the two principal respiratory complications I need allude to.

3. Whooping-cough may be complicated with a disordered condition of the bowels. We may have symptoms of gastric disturbance, foul tongue, offensive evacuations, loss of appetite with chronic irritation of the gastro-intestinal tract, which may give rise to febrile disturbance. The intense vomiting so frequently a concomitant of whooping-cough may set up this irritation. Speaking of these complications, Tanner tells us that if these symptoms continue for some time unrelieved, the chronic irritation of the digestive mucous membrane gives rise to a remittent fever in which the attacks of cough become more frequent, the breathing gets oppressed and hurried, the child's aspect becomes peculiar, and it is constantly picking its nose and lips. There is also increasing emaciation, and febrile exacerbations and remissions are observed twice in the twenty-four hours. Should the disorder proceed further still, serous effusion into the ventricles of the brain may take place, or disease of the mesenteric glands will very likely result.

Diarrhœa forms a serious complication in infants. It is often one of the first indications that whooping-cough is coming on. There is an excessive infant mortality registered from diarrhœa. If it were possible to arrive at the truth, it would be found that whooping-cough existed in a very large percentage of the cases. The treatment of the disordered conditions of the bowels resolves itself into correcting the primæ viæ. To regulate the secretions hyd. cum cretâ and pulv. rhei will be found very serviceable, and when the bowels are brought into a healthier state by these alteratives we can give with advantage a mixture containing bicarbonate of potash, cascarilla, and syrup of orange-peel.<sup>1</sup> The diet must be carefully regulated. Milk mixed with lime-water, potash, or soda-water will be found useful. To correct the diarrhœa, we can fall back upon the ordinary chalk mixture with catechu, or mist. hæmatoxyli.

4. Complications with various forms of hæmorrhage. Owing to the violent paroxysms hæmorrhage may occur. By the convulsive efforts of coughing we may have :

<sup>1</sup> See Formulæ 17, 18.

(1.) Sub-conjunctival and palpebral ecchymoses. These are not of serious moment, as they readily pass away.

(2.) Epistaxis may be produced directly by the convulsive efforts of coughing. Bleeding from the nose may be of great service, especially in infants of full habit; it relieves the congestion of the cerebral vessels, and may thus prevent brain mischief and convulsions. In a very delicate anæmic child, if epistaxis persisted for a considerable time it might injure the child by reducing its strength. It is rarely a dangerous complication; we can always control it should occasion require.

(3.) The next form of hæmorrhage is very frequently met with, viz. that from the mouth at the moment of fits of coughing. This form of bleeding may produce great alarm, both in the attendant and friends, as it may be mistaken for hæmorrhage from the lungs; so that an examination of the mouth should always be made, especially when at the end of a paroxysm the child expectorates some bloody froth. We may find that the gums are congested, bleeding on the slightest pressure, so that the mucus becomes stained in the mouth by the exuded blood. Another source of blood-staining may be found in the ulcer of the *frænum linguæ*, or the tongue or lips may even be bitten through in a very severe paroxysm. As the mucous membrane of the pharynx and larynx are congested, we may have some slight hæmorrhage from those lesions. We may find some small ulcers on the lips, and as the infant may pick them, a little oozing of blood may follow. It is necessary to bear in mind these sources of hæmorrhage, and not confound them with hæmoptysis or hæmatemesis. In infants we do not meet with either of the latter forms of hæmorrhage. It is true that the vomit may be found stained with blood, but this state can be satisfactorily accounted for, as the blood may flow down the posterior nares and thus colour the rejected food.

The foregoing are the principal complications generally associated with pertussis. We may expect to meet with one or other of them if we have many cases of whooping-cough to treat. On that account I have given some space to their

consideration and treatment. I shall select from my notebook one or two cases illustrative of treatment, and to render my views clearer. Though I do not believe we have any specific for whooping-cough, yet my medical scepticism does not reach so far as to say that we have no treatment for some of the conditions which intensify whooping-cough, rendering it not only painful to witness, but dangerous.

Medicine has great power when judiciously used. A good deal of opprobrium has been brought upon medicine by vaunting the value of certain drugs, declaring that they were specific in their action, and that the paroxysms of whooping-cough were not only shortened, but cured by their administration. For instance, if we take the nitric acid and bromide of ammonium plans of treatment, we have an illustration of faulty generalization from insufficient data. Gibb extolled both methods of treatment. We find in the journals of his time numerous cases of whooping-cough reported, under headings of 'cure of whooping-cough;' these drugs had a short-lived popularity. Nitric acid is not a specific, though it might be useful in the treatment of certain conditions arising in the course of whooping-cough, as when we had to deal with some disorder of the digestive functions or liver. Neither is bromide of ammonium a specific, though it may be usefully employed to allay nervous irritation and to overcome the dyspnoea of nervous irritable infants. I have used bromide of ammonium in this class of cases, and I have found that the infant derived benefit from it.

Example: Emma H., aged fourteen months, a delicate, irritable, nervous child, constantly moaning, cross, and peevish. Dating from the commencement of the 'kink' or whoop, sixteen days had passed; paroxysms severe; during the remissions the infant slept badly. Gave her three grains of bromide of ammonium in a little peppermint-water. On the third day irritability reduced; infant not so restless; continued the bromide every four hours in two-grain doses. On the sixth day some further amelioration; paroxysms still continuing, but the child slept better, the twitching disappeared. Continued the bromide in one grain every four

hours. On the ninth day dyspnœa relieved, paroxysms not so severe; the child looked better, as it had slept well, and lost its irritable, peevish manner.

In giving the bromide of ammonium, it is better to begin with a moderately large dose, and then reduce it according to the effects produced. Two grains may be safely given to an infant six months old; three or four to an infant of fourteen months; four to six to a child of two years of age. Always taking account of the child's size, state of health, etc.

I might give other examples with other medicines to prove their value in individual cases. What I desire to impress is, that the physician has no specific on which to rely; but he has several medicines, by means of which he can relieve individual urgent symptoms. To treat whooping-cough scientifically and rationally, he must grasp this as a leading truth or first principle.

#### *Treatment of Patients over Two Years of Age.*

The symptoms in children over two years of age are somewhat similar to those described in connection with the earlier periods of life, but the treatment seems to me simpler. More relief can be given during the second stage, when the distressing paroxysms, which excite so much commiseration in infancy, occur. Over two years of age children are more amenable to treatment, they can do very much to help themselves, and can assist us in a way that infants cannot, as, for example, when we desire to employ inhalations.

When whooping-cough occurs in a child over two years of age, we shall have to follow out the leading indications of treatment already sketched. We shall have to attend to the atmosphere and surroundings, to the ventilation and warmth, the diet and state of the bowels of the child. If there be a high degree of fever, we can give some simple saline mixture<sup>1</sup> to allay it. If there be a little wheezing and teasing cough, we may give a mixture of ipecac., tinct. camph. co., spirit. ether. nit. and syrup of squills. We shall have to guard

<sup>1</sup> See Formula 35.

against complications as carefully as ever, though we do not meet so frequently with them as we do in infancy.

Some disturbing elements are removed, as the process of primary dentition is nearly completed, and thus we have one element of mischief eliminated. My experience is to the effect that we may have capillary bronchitis and pneumonia caused by exposure to cold in children over two, but I have not often met with any serious symptoms indicative of brain mischief, as convulsions, etc. In the paroxysms of coughing we often have hæmorrhage from the nose, mouth, but rarely from the lungs.

In a simple case, then, in a healthy child, we may content ourselves with attending to the general details enumerated. When the first stage has passed into the second, and we have the characteristic feature of the disease, we may afford relief in certain cases by the use of a remedy which, owing to the tender nature of the infant, we are debarred from using—I allude to inhalations—while at the same time we give some medicine, as belladonna, bromide of potassium, or ammonium, to meet the requirements of each individual case. Steam inhalations can be employed by the children themselves. Owing to the persistence of the cough, the fauces are in a highly irritative condition.

As a local remedy for soothing purposes, steaming inhalations are very useful. There are various forms of inhalers supplied by instrument-makers, and any of these forms can be employed or an improvised method adopted. One great point to keep in view is to have the temperature not less than 120°. Inhalations of simple hot water may be tried, or some drug can be added, in the hope of acting topically upon the disease. I have seen the attacks alleviated, both as regards their intensity and number, by simple inhalations of hot water and carbonate of soda. We know that during the paroxysms the child cannot swallow or inhale, but after the paroxysm is the time to resort to this procedure.

Presuming that the child is intelligent, and old enough, a tablespoonful of carbonate of soda should be mixed with a pint of boiling-water, and the child directed to draw the

steam in slowly for about five minutes four or five times daily. In some cases, carbolic acid (ten grains to the pint) may be added, or conium (two drachms to pint), or the vapour of chlorine may be tried. Other disinfectants may be added, but I cannot say I have found that they cut the disease short. Spray-inhalations have been recommended.

Dr. Cardwell's method of treating pertussis is by placing a steam-atomizer in a position, on a table, before the patient, charged with the following mixture :

Extract Belladonna fluidi	.	.	gtt. vi.—xii.
Ammonii Bromidi	.	.	ʒii.
Potassi Bromidi	.	.	ʒii.
Aquæ . . . . .	.	.	ʒii.

This spray is repeatedly carried into the face and mouth of the child and applied for ten minutes, until the pupils are dilated with the belladonna mixture. The application to be made three times a day. This has, it is said, cut short the cough in two or three days. As a rule, spray-inhalations are contra-indicated in dyspnoea. I have tried this plan, but I cannot speak so favourably of it as Dr. Cardwell.

There is another form of inhalation, which I have tried on adults, that is, fuming inhalations made in accordance with the directions of Mackenzie. They can be best carried out by steeping unsized paper in a solution of nitrate of potash of definite strength, cutting the paper into strips of three inches long by half an inch broad, lighting the paper and dropping it into a cylindrical vessel, from which smoke can be inhaled. A particular character may be given to these papers by the addition of various volatile principles. One patient, a lady under my care, had whooping-cough at the age of twenty-two. She told me she experienced the greatest relief from inhaling the fumes of a paper impregnated with compound tincture of benzine.<sup>1</sup>

In other cases we may have a congested state of the pharynx, larynx, and trachea. Relief may be afforded by insufflations, and we may employ chloride of potash, or alum,

<sup>1</sup> See Formula 49.

mixed with starch and powdered acacia. I have on a few occasions tried the vapour of chloroform. It will no doubt arrest the paroxysms, but it must be given at each fresh attack, and thus the services of a surgeon would be required almost constantly in a household, so that it is an impracticable method of treatment.

In treating the second stage in patients over two years of age apart from the inhalations, our line of treatment will have to approximate to that recommended for infants.

When the third stage is reached, and the cough is persistent, I have found cod-liver oil of service. Syrup of the iodide and phosphate of iron may be given, and at certain seasons of the year sea-bathing and sea-air will be found of advantage.

Care must be taken not to spread the contagion. I have already pointed out what should be done in this respect.

As regards complications in children, they must be treated on the same general principles I have laid down for the same diseases in infancy.

Whooping-cough in the adult is a very painful affection, requiring appropriate treatment, as isolation, warmth, soothing applications, fumigations; and we must direct our efforts to the quieting of irritation and warding off inflammation. It runs a course somewhat like that in children; but I have never met with a case in which it was complicated with other diseases. Adults suffer very much from loss of sleep, but in chloral hydrate and atropia we have a means of remedying it, while we have to fall back upon expectorants, as ipecac., senega, to relieve the overloaded bronchi.

Tonics, as the various preparations of iron, Easton's syrup, may be resorted to, when the disease is passing off; and these medicines combined with change of air, especially sea-air, will soon restore the vigour which has been lost by the long-continued and exhausting process of pertussis. During late years some new remedies have been suggested, and, on good authority, their claims as curative agents have been placed before the profession; amongst others being croton-chloral, chloral hydrate, quinine, and the sulpho-carbolates.

Dr. Sigismund Sutro recommends in the *British Medical Journal*, 1880, p. 39, the following mixture :

Quiniæ Sulph. . . . .	ʒi.
Sol. Acid. Bromo. Hyd. . . . .	ʒi. ʒ
Syrup. Æth. . . . .	ʒi. ʒ
Aquæ ad . . . . .	ʒvi.

For a child two years of age, one dessert-spoonful four times a day.

I have tried this mixture, but as a specific it has the same value as all the other specifics I have used. I can say the same of croton-chloral, quinine, and the sulpho-carbolates.

I agree with Dr. Dickinson to a certain extent. In the *Lancet*, April 27, 1867, p. 513, there is a report of his views, and of the treatment adopted at St. George's Hospital ; while in the same report we have the various plans of treatment in use at St. Thomas's, King's College, and the Foundling Hospitals. Dr. Dickinson is reported as believing that a more or less persevering trial of most of the remedies, which have been urged as able to cut short the disease, has resulted in failure. It appears to be as essentially incurable as typhus, or any of the specific fevers ; but at the same time good may be done by meeting urgent symptoms as they arise, and by directing treatment to the various complications which are apt to endanger the patient. The only specific, Dr. Dickinson admits, is time.

In striking contrast with the above views are those alleged to be held by Dr. Gibb. After a full account of his nitric acid and bromide of ammonium plans of treatment, in which it is stated that the pertussial malady is cured by the nitric acid mixture, whilst at the same time it is prophylactic against intercurrent throat complications, the report concludes by announcing that when properly managed, Dr. Gibb considers pertussis a disease in every way amenable to treatment. An empiric might make a fortune by announcing that he had a cure for pertussis even at the present day ;

and if he were to make up a mixture of bromide of potassium, or ammonium, and advertise it with the same spirit of enterprise with which Holloway and Eno have pushed their pills and fruit salt, the same rich reward would almost certainly follow.

Treating the subject from a scientific standpoint, and apart from empiricism, I am forced to agree with Dr. Dickinson and those older physicians, who have taught that there is no specific, and that we must be content with guiding the disease through its course. How we may do so I have endeavoured to show, and still more, as prevention is better than cure, laid down directions on prophylaxis, which if adopted would deprive us of the necessity of having to attempt to cure it.

The latest development of the genius of Pasteur has found issue in arresting splenic fever, and fowl cholera by inoculation with the attenuated virus of the microbes upon which those diseases depend. So that I may not unreasonably hope that as whooping-cough is a bacteroid disease, we may be able by his method to add a more powerful weapon to our preventive measures, and that by inoculation with the attenuated virus of pertussis we may render infants insusceptible to the contagion.

Jenner conferred a boon on humanity by the introduction of vaccination. Following in the footsteps of the illustrious Englishman, Pasteur promises to be equally a benefactor to his race. But is not this a sad confession to make, that we have to depend upon prophylaxis—that we have no specific? I do not think so. We can control and direct the disease, just as we can control typhoid, scarlatina, variola. We have no specifics for them.

My views are, I believe, in harmony with the temper of medicine in modern times. It is not derogatory to true progress to recognise the Hippocratic *vis medicatrix naturæ*. It is something to be able to estimate the physiological disturbance going on in virus-diseases—the heat, waste, increase of heart or lung action, the altered functions of secretion and excretion; to have the power of directing or controlling

physiological action, though we may not arrest or neutralize the specific organisms which are at work. It is something to know the nature of the organisms we have to deal with; it is something to feel proud of that, by the aid of sanitary science, we can prevent such diseases, though they depend upon entities which cannot be cast out after the incubatory stage.

The true pathogenesis of pertussis may not have been pointed out by me, yet if my views be adopted they afford a wide sphere for activity. We can relieve certain symptoms as they arise; we can alleviate, we can palliate, and we can prevent. To counteract the causes of disease is the highest triumph of our art.

There is a true and false medicine—the true consists in ‘knowing how much we know,’ the false in pretending that all the arcana of disease and nature are known to us. The true is noble and honest, the false is ignoble and dishonest.

In the interest of the true it is better to unhesitatingly declare that there is no specific for pertussis, and to show the reason why. This I have endeavoured to do. In the interests of our little patients I should have been pleased, had facts allowed me, to write that there was a panacea for pertussis; and when the specific is found I shall hail its advent with joy, and gladly put it to the proof. It would be a pleasure, in this case, to be convinced of holding erroneous views.

Meantime, waiting for the panacea, I submit my own method of treatment to the consideration of my readers, and, in the words of Horace, I say:

‘ . . . Si quid novisti rectius istis  
Candidus imperti; si non his utere mecum.’

## APPENDIX OF FORMULÆ.

IN the *Lancet* and *British Medical Journal*, even at the present day, I find writers asking for information about various formulæ for pertussis, and several very old prescriptions I notice have been put forward, seemingly as original. The following *selecta e prescriptis* are examples of some of the most popular formulæ, mixed with others which may be usefully employed in certain stages of the disease:

- |                         |                   |
|-------------------------|-------------------|
| 1. Atropiæ . . . . .    | gr. $\frac{3}{4}$ |
| Sacchari puri . . . . . | ʒii ʒ             |

Give a grain and a half two or three times a day to a child of five years. BOUCHARDAT.

- |                      |                     |
|----------------------|---------------------|
| 2. Atropiæ . . . . . | gr. $\frac{1}{120}$ |
| Acid. Nit. . . . .   | ʒii.                |
| Aquæ . . . . .       |                     |

To be given three times a day. DR. H. JONES.

- |                               |                   |
|-------------------------------|-------------------|
| 3. Ext. Belladonnæ p. . . . . | gr. $\frac{1}{8}$ |
| Sulph. Zinci . . . . .        | gr. $\frac{1}{2}$ |

To be given to a child under three years of age; dose to be increased according to age. GARRAWAY.

- |                                  |         |
|----------------------------------|---------|
| 4. Rad. Belladonnæ pulv. . . . . | gr. ii. |
| Rad. Ipecac. pulv. . . . .       | gr. i.  |
| Sulphuris Loti . . . . .         |         |
| Sacchari Lactis, ana . . . . .   | ʒ ʒ     |

The powder to be divided into eight parts, one to be taken three times a day, for a child of three or four years. KAPP.

5. Potas. Bicarb.	.	.	.	gr. xv.
Cocci Cacti.	.	.	.	gr. viii.
Aquæ destil.	.	.	.	f. $\bar{z}$ vi.

Rub together, strain, and add

Acid. Hydrocyanici dil.	.	.	.	$\mathfrak{m}$ x.
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A teaspoonful to be taken when the cough is troublesome.

DR. GRANVILLE.

6. Cocci pulv.	.	.	.	$\Theta$ i.
Potas. Carb.	.	.	.	$\bar{z}$ i.
Aquæ ferventis	.	.	.	$\bar{z}$ viii.

Rub together and strain. A teaspoonful three times a day for children.

DR. ALLNATT.

7. Cocci pulv.	.	.	.	$\Theta$ $\bar{\rho}$
Sodæ Bicarb.	.	.	.	$\Theta$ $\bar{\rho}$
P. Belladonnæ rad.	.	.	.	gr. ii.
Sacchari puri.	.	.	.	$\bar{z}$ i.

Mix and divide into fifteen powders, one to be given four times a day.

M. VIRICEL.

8. Acid. Hydrocyanici dil.	.	.	.	$\mathfrak{m}$ iv.
Syrup. simplicis	.	.	.	$\bar{z}$ i.
Aquæ destil.	.	.	.	$\bar{z}$ vii.

A teaspoonful to be taken every six hours.

WEST.

9. Acid. Hydrocyanici dil.	.	.	.	$\mathfrak{m}$ iv.
Mist. Amygdalæ	.	.	.	$\bar{z}$ i.

A teaspoonful every six hours, for a child nine months old.

WEST.

10. Acetat. Ammon. sol.	.	.	.	$\bar{z}$ ii.
Spt. Æth. Nit.	.	.	.	$\bar{z}$ i.
Spt. Chloroformi	.	.	.	$\mathfrak{m}$ xl.
Syrup. Scillæ	.	.	.	$\bar{z}$ vi.
Aquæ ad	.	.	.	$\bar{z}$ iii.

Two teaspoonfuls every four hours, for a child over three years.

11. Liquor Ammon. Acet. . . . .	ʒii.
Vin. Ipecac. . . . .	℥xl.
Syrup. Tolu. . . . .	ʒiv.
Aquæ ad . . . . .	ʒiii.

Two teaspoonfuls every four hours.

12. Pulv. Ipecac. co. . . . .	gr. ʒ.
Pulv. Ext. Cinnamoni . . . . .	gr. i.
Sacchari albi . . . . .	gr. iv.

The powder to be taken at bedtime, for a child two years old. WEST.

13. Ammon. Carb. . . . .	gr. xii.
Vin. Ipecac. . . . .	℥xl.
Tinct. Senegæ . . . . .	fl. ʒii.
Syrup. Rhœados . . . . .	fl. ʒiii.
Aquæ ad . . . . .	fl. ʒiii.

A dessert-spoonful every three hours to children over two years. TANNER.

14. Ammon. Sesquicarb. . . . .	gr. xii.
Decoct. Senegæ . . . . .	ʒii. ʒv.
Tinct. Scillæ . . . . .	℥xvi.
Syrup. Tolutan . . . . .	ʒiii.

A dessert-spoonful every four hours, for a child over two years. WEST.

15. Carb. Ammon. . . . .	gr. v.
Vin. Ipecac. . . . .	ʒi.
Syrup. Scillæ . . . . .	ʒiv.
Decoct. Senegæ . . . . .	ʒvi.
Aquæ ad . . . . .	ʒii.

Two teaspoonfuls every three hours.

16. Chloral Croton. . . . .	gr. ii.
Tinct. Cardam. co. . . . .	℥xv.
Glycerini . . . . .	ʒi.
Aquæ ad . . . . .	ʒ.

A draught to be given to a child of six years. One grain may be given to a child a year old, every four hours.

WILSON ROBERTS.

17. Chlorat. Sodæ Liquor. . . . .	ʒi.
Tinct. Serpent. . . . .	ʒii.
Syrup. Aurant. . . . .	ʒiv.
Aquæ ad . . . . .	ʒiii.

Two teaspoonfuls every three hours.

18. Potas. Bicarb. . . . .	gr. xv.
Tinct. Cascarill. . . . .	ʒi.
Syrup. Aurant. . . . .	ʒii.
Aquæ ad . . . . .	ʒii.

Two teaspoonfuls every four hours.

19. Syrup (Trousseau).	
Syrup of Ether	} aa. grammes xx. (gr. ccc.).
„ Opium	
„ Belladonna	
„ Orange Flowers	

Ten to twenty grammes daily, in small teaspoonfuls, at a time.

20. Ext. Opium	} . . . . . aa. centigr. xxx.
„ Belladonnæ	
Sugar of Milk . . . . .	gram. i. (gr. xv.).

Divide into six powders. One or two in twenty-four hours.

BRACHET.

21. Nicotin . . . . .	centigr. x. ( $1\frac{2}{3}$ gr.).
Tartar Emetic . . . . .	centigr. v. ( $\frac{3}{4}$ gr.).
Powdered Sugar . . . . .	grammes x. (150 gr.).
Gum Arabic . . . . .	grammes ii. (30 gr.).

To be divided into twenty powders. One to be taken every two hours.

PITZCHEFT.

22. Sulphate of Quinine . . . . .	gramme i. (15 gr.).
Acetate of Morphia . . . . .	decigramme i. ( $1\frac{1}{2}$ gr.)
Conserve of Roses . . . . .	q.s.

To make eighteen pills ; one to three a day.

THARSTUN.

23. Acid. Sulph. dil. . . . .	℥ xxx.
Syrup. Zingiber . . . . .	ʒiv.
Decoct. Cinch. Lancifol. . . . .	ʒiii.

One tablespoonful three times a day ; as a tonic for children.

24. Potassæ Chloratis, gr. ii., iii., iv., or v., according to age.

Syrup. Aurant. . . . .	ʒi.
Aquæ ad. . . . .	ʒ ð.

A dose every two, three, or four hours.

25. Potassæ Chloratis . . . . . gr. ii.

Sodæ Sulph. . . . .	gr. iv.
Syrup. Aurant. . . . .	ʒi.
Aquæ ad. . . . .	ʒ ð.

One dose to be repeated every two, three, or four hours, if necessary.

26. Acid. Sulph. dil. . . . . ℥ i.

Tinct. Catechu . . . . .	℥ v.
Decoct. Hæmatoxyli . . . . .	ʒi.
Syrup. . . . .	ʒi.

One dose for a child, to be repeated if necessary.

27. Ammon. Bromid., gr. i., ii., iii., iv., or v., according to age.

May be given with milk, mint-water, or in any simple vehicle, and repeated every two, three, or four hours.

28. Potass. Bromid., gr. ii., iv., vi., viii., x., according to age.

Syrup. Tolu. . . . .	ʒi.
Aquæ ad. . . . .	ð ʒ.

To be repeated every four, six, or eight hours.

29. Vin. Ipecac. . . . . ℥ xx.

Mucilaginis . . . . .	℥ c.
Syrup. . . . .	℥ xl.
Aquæ ad. . . . .	ʒi.

One drachm every four hours. MIDDLESEX HOSPITAL.

30. Sodæ Bicarb. . . . . gr. xx.

Spt. Æth. Nit. . . . .	℥ xxx.
Tinct. Opii . . . . .	℥ iii.
Mist. Ipecac. ( <i>ante</i> ) ad . . . . .	ʒi. ð.

One drachm every two, three, or four hours, according to age. MIDDLESEX HOSPITAL.

31. Liq. Atrop. Sulph.	℥i.
Aquæ Anethi	ʒi.

To be repeated every sixth hour if necessary.

MILNER FOTHERGILL.

32. Quin. Sulph.	gr. i.
Acid. Hydrobrom.	℥xx.
Aquæ	ʒii.

To be given three times a day.

MILNER FOTHERGILL.

33. Acid. Salicylici	ʒi.
Olei Amygdalæ expressi.	f. ʒv.
Pulv. Acaciæ	ʒii. ʒ
Syrup. Amygdalæ	f. ʒvi.
Aquæ Aurantii Floris ad	f. ʒiii.

One drachm to be taken for a dose.

FARQUHARSON.

34. Mucilag. Tragacanthæ	ʒi.
Syrup. Papav.	ʒiii.
Vin. Ipecac.	ʒii.
Aquæ ad	ʒiii.

One teaspoonful every two or three hours.

35. Syrup. Papav.	ʒiii.
Liquor. Ammon. Acet.	ʒiv.
Spt. Æth. Nit.	ʒi.
Vin. Ipecac.	ʒii.
Aquæ	ʒii.

One teaspoonful every two or three hours.

36. Pulv. Aluminis	gr. xl.
Syrup. Papav.	ʒii.
Aquæ ad	ʒi.

A drachm to be given every three or four hours.

37. Pulv. Rhei	gr. iii.
Hyd. c. Creta	gr. ii.
Pulv. Zingiber.	gr. i.

Powder to be taken when required.

38. Pulv. Rhei . . . . .	ʒiv.
Calomel . . . . .	gr. i.
Zingiber. . . . .	gr. i.

One powder to be given when necessary.

39. Pulv. Aromatic . . . . .	gr. ii.
Hyd. c. Creta . . . . .	gr. ii.
Pulv. Rhei . . . . .	gr. iv.

One powder to be taken if necessary.

40. Alum. Sulphat. . . . .	gr. xxiv.
Acid. Sulph. dil. . . . .	℥ xii.
Syrup. Rhœados . . . . .	ʒiv.
Aquæ puræ . . . . .	ʒii. ʒ.

A dessert-spoonful every six hours.

41. Acid. Hydrochlor. dil. . . . .	℥ xxxii.
Tinct. Opii . . . . .	℥ iv.
Syrup. Mori . . . . .	ʒiv.
Aquæ puræ . . . . .	ʒii. ʒ.

A dessert-spoonful three times a day.

42. Mist. Ferri. co. . . . .	ʒiv.
Tinct. Scillæ . . . . .	℥ xvi.
Tinct. Conii . . . . .	℥ xl.
Mist. Amygdalæ . . . . .	ʒii., ʒiii.

A dessert-spoonful three times a day.

43. Acid. Hydrocyanici dil. . . . .	℥ viii.
Liq. Cinchonæ . . . . .	ʒi. ʒ.
Syrup. Aurant. . . . .	ʒi. ʒ.
Aquæ Flor. Aurant. . . . .	ʒiii.
Aquæ distil. . . . .	ʒxi.

Two teaspoonfuls three times a day.

44. Ammon. Carb., gr. i, ii., iii., iv., or v., according to age.	
Tinct. Lavand. co. . . . .	℥ x.
Syrup. Aurant. . . . .	ʒi.
Aquæ ad . . . . .	ʒi.

One drachm to be repeated when necessary.

45. Ammon. Carb.	.	.	gr. v.
Spt. Chloroformi	.	.	℥ xl.
Mucilaginis	.	.	ʒii.
Aquæ ad	.	.	ʒii.

Two drachms every one, two, or three hours.

46. Spt. Chloroformi	.	.	℥ xl.
Spt. Ammon. Aromat.	.	.	ʒi.
Syrup. Aurant.	.	.	ʒiv.
Aquæ ad	.	.	ʒii.

Two drachms three times a day.

47. Potassæ Nitratis	.	.	gr. xii.
Magnesia Sulph.	.	.	ʒi.
Syrup. Limonum	.	.	ʒiii.
Aquæ destil.	.	.	ʒix.

Two drachms three times a day. For a child a year old.

WEST.

48. Potassæ Citratis	.	.	gr. xx.
Potassi Bromidi	.	.	gr. xv.
Tinct. Aconiti	.	.	℥ iii.
Tinct. Chloroformi co.	.	.	℥ xv.
Syrup. Mori	.	.	iv.
Aquæ destil.	.	.	ʒi.

Two drachms every four hours. For a child a year old.

WEST.

49. Benzonin Cont.	} . . . . .	aa. ʒi.
Styracis Cont.	} . . . . .	

To be thrown on hot cinders in the patient's room.

Blotting-paper, soaked in a solution of nitre and dried, and afterwards brushed over with tinct. benzonin comp. and dried, is also burnt for the relief of whooping-cough. This is an old remedy. Chemists can supply paper charged with several drugs.

In the *Lancet*, Oct. 22, 1881, there is a letter from a F.R.C.S. bearing testimony to the value of the vapour of

benzole. He states that by means of Lister's apparatus he submitted some of his family, night and morning, to the spray, with the most gratifying results. It certainly checked the spasm and relieved the whoop. The old and the new here meet again.

50. Tinct. Opii . . . . .	ʒii.	
Tinct. Lyttæ . . . . .	ʒii.	
Lin. Camphoræ co. . . . .	ʒi.	
Liniment to be rubbed on the chest.		WEST.

51. Potas. Bicarb. . . . .	ʒi.
Aquæ Anethi . . . . .	ʒii.

Ten or twenty drops a dose for an infant.

52. Tinct. Assafoetidæ . . . . .	ʒi.	
Tinct. Opii . . . . .	℥x.	
Vin. Ipecac. . . . .	ʒi.	
Aquæ . . . . .	ʒii.	
A small spoonful every third hour.		RUSE.

53. Ext. Conii . . . . .	gr. v.	
Magnes. Sulph. . . . .	ʒ℥.	
Aquæ Carui . . . . .	f. ʒx.	
Syrup. Tolu. . . . .	f. ʒi.	
The draught to be taken three times a day.		D. G. GREGORY.

54. Ext. Conii. . . . .	gr. xii.	
Aluminis Pulv. . . . .	gr. xxv.	
Aquæ Anethi . . . . .	f. ʒiii.	
Syrup. Rhœados . . . . .	f. ʒii.	
A dessert-spoonful every sixth hour.		G. FIRD.

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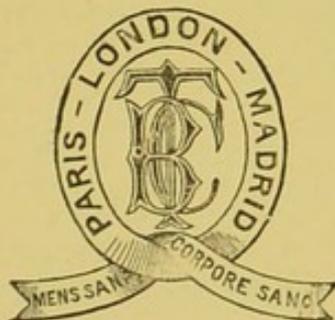
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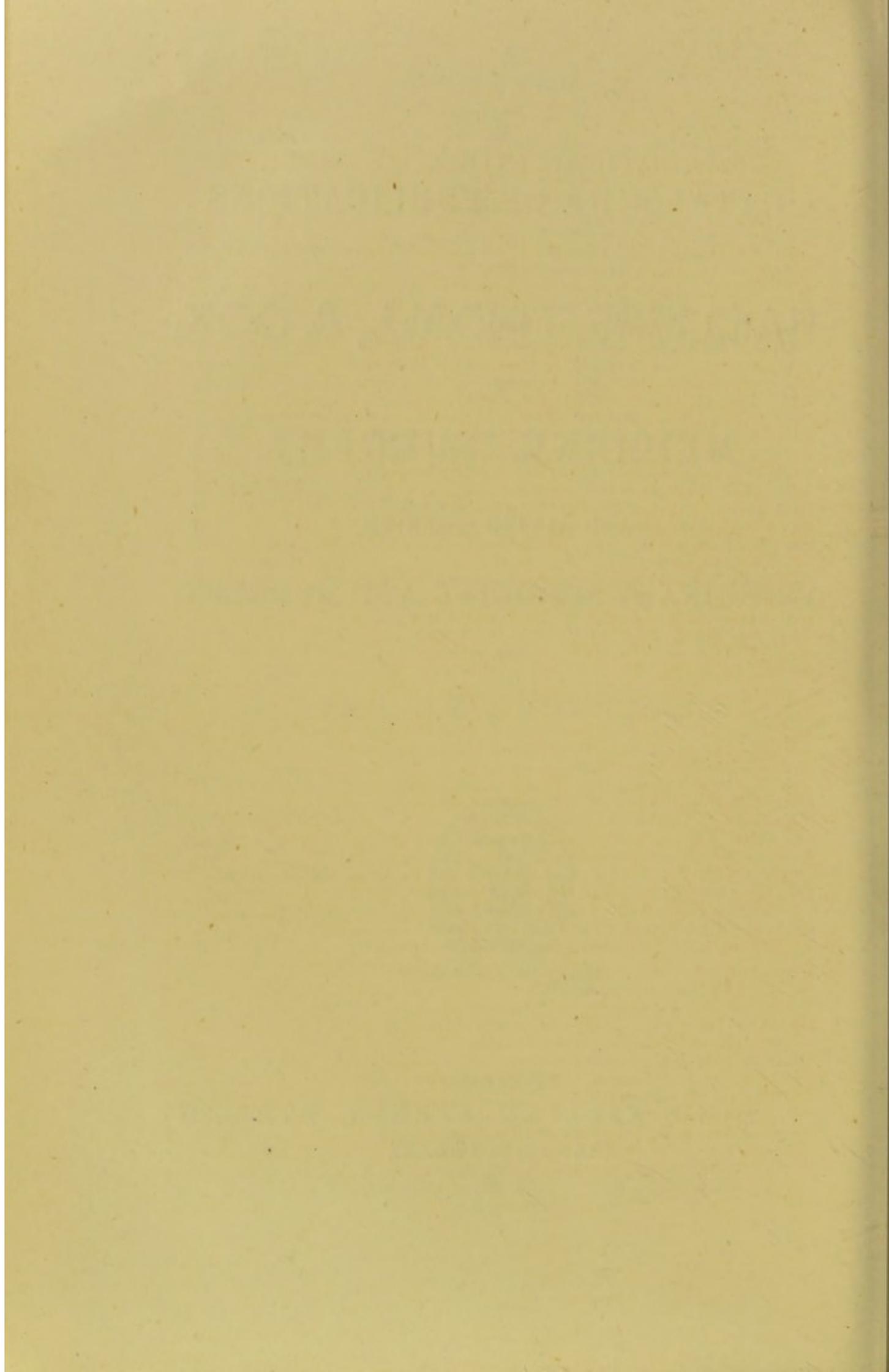
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