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INGLEBY LECTURES, 1882.

INFECTIOUS DISEASE.

BY

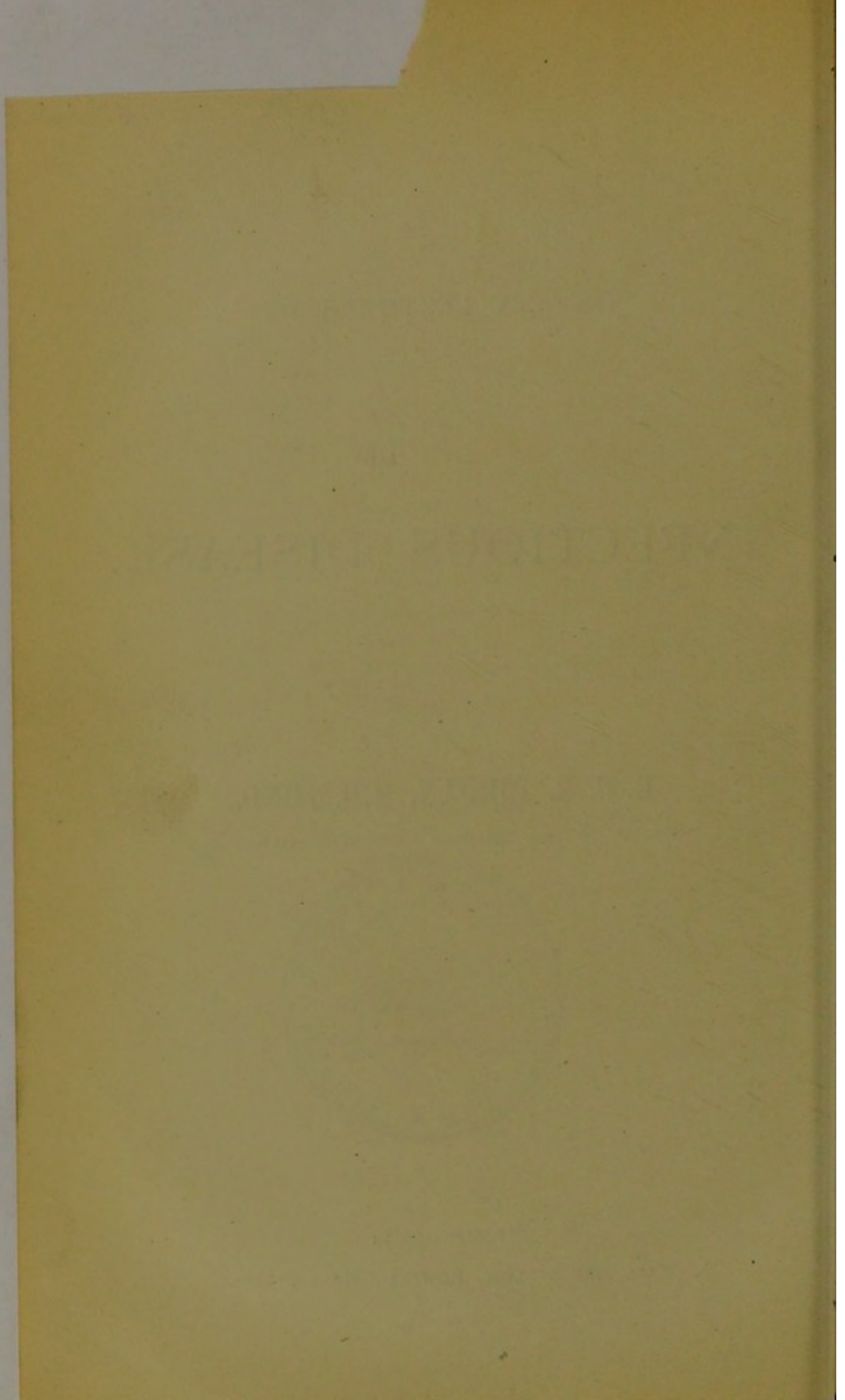
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THE INGLEBY LECTURES.

LECTURE I.

THE HYPOTHESIS OF ZYMOTIC DISEASE.

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MY first duty in beginning these lectures is to thank the Trustees of this Ingleby endowment for the honour conferred upon me in asking me to deliver them, and to thank such of my medical brethren as are here present for their kindness in listening to me. It has been my wish in preparing the work ever to bear in mind that these were lectures not to be delivered to students, using the word in its common sense, but to men, my fellow workers, to many of whom the daily increasing store of medical literature is more familiar than to myself. The task has been to me both pleasing and instructive, for in striving to teach others, I have at least added to my own knowledge.

The subject chosen by me is "Infectious Disease," and I propose to devote this first lecture to *Hypothesis*, or, in other words, the consideration of those parts of the natural history of Zymotic Disease about which we know nothing,

or less than nothing, deeming that to feel our ignorance is a most important path to truth ; the second lecture to facts which form an integral part of our medical knowledge, in this confining myself almost entirely to Scarlet Fever.

When we look at man physiologically, there does not seem any *primâ facie* reason why the balance of nutrition and of waste should not remain fixed eternally ; why the body should not be a machine renewing itself, all the daily waste repaired by the daily nutrition, so that the wheels of life might run on for ever. But we know this not to be true in fact, we know that every living organism has its period of growth, of vigour, and of decay implanted in it as a part of the natural history of its existence, by laws of which it may be said we have no knowledge. We may even dimly guess that what is true of the individual is true also of the species ; decay is a necessary stage of life, and the time of this decay is nearly as fixed as the time of growth, or the time of gestation.

So constant is this that the words written of our life nearly three thousand years ago are as true as if only written yesterday :—“ The days of our years are threescore years and ten, and if by reason of strength they be fourscore years, yet is their strength labour and sorrow, for it is soon cut off and we fly away.” So constant and yet so gradual ! for it would be hard indeed to say when such decay begins, even in middle life. In the height of matured strength there are few who cannot in their inmost hearts echo the cry made of old by Horace, and say “ non sum qualis eram ;” * even then, there are signs, which though not outwardly shewn, are yet felt by ourselves within ourselves, telling us that the outposts are secured by the enemy, and that the side of victory is no longer doubtful.

* These four words express the whole condition so fully and tersely, that I have ventured to use them, quite regardless of their Horatian context.

A law so sure and fixed is clearly part of the natural history of the individual: decay and death from these gradual changes form therefore only a phase of life, and these slow degenerations are only its natural end. They, therefore, however complicated the processes may really be, become, speaking physiologically, the simplest form of disease: the chemistry of the body somehow fails, the waste of tissue is not repaired fully and completely, little by little processes of degeneration occur, each degeneration helping to produce another, and this probably to a much greater extent than we can actually prove, until surely, though slowly, the time comes when repair is no longer needed.

Seldom, however, does the end come with so stealthy a step; slight impairment of the elasticity of an artery may impede the nutrition of some important organ, a brittle vessel may give way and fatal apoplexy follow; nay, more than this, it is rare indeed when the decay can be called perfectly natural; we hasten it by a thousand imprudences—the hard contracted kidney, the cirrlosed liver at once rise to the mind as examples of such self-induced degeneration. Nor may it be always the fault of the victim, the influence of heredity is so strong that the tendency to disease may be implanted even at birth, of which gout gives us an undoubted instance. Perhaps even more strange is the fact that, as in rickets, the balance, though true at birth may be destroyed in infancy, and injudicious food with its consequent imperfect nutrition may induce a series of changes which too often blight the bud of life before it well begins to open.

Perhaps again the balance may be rudely shaken even in the midst of health. A man lies down upon the wet grass, he feels cold and shivering, and in some way, probably through the sentient nerves, a shock is given

to his system, and its whole chemistry is changed, an acid state of blood is engendered, the fibrine again is either increased or retained, the patient has a rigor, his temperature rises, serous effusion takes place into one or more of his joints, and he has an attack of acute rheumatism; fibrinous deposits may take place on the valves of the heart, and from these a thousand after-ills may flow; another man may undergo the same exposure and escape with a simple catarrh. We cannot tell the reason of this, but we vaguely talk of a rheumatic diathesis; vaguely enough, and at first sight the term seems only to cover our ignorance; but if we look more deeply we find the term has a real meaning, for this rheumatic tendency or diathesis is a living entity. It can be acquired, and it can even be transmitted to our offspring; it becomes hereditary, the victims of this hereditary tendency may never have rheumatic fever, but they may suffer from other diseases evidently related to it in their origin, such are chorea, erythema nodosum, or even fibrinous deposits on the valves of the heart without any joint affection; but enough now has been said to show how one link of disease may depend upon another, and how varied are the ills which undoubtedly spring from changes in the chemistry of the body, or in other words from imperfect or perverted nutrition.

There is, however, a group of diseases so different in their whole history from these sequences of degeneration, that it is utterly impossible to refer them to the same cause; these are the epidemics. Their history may almost be termed the romance of medicine, and there is nothing stranger in fiction than the old chronicles of their occurrence—coming on suddenly, almost without warning, desolating populous cities, it is little wonder that in early ages they were generally supposed to be

due to the direct anger of the Gods. Most of those before me will recal to their memories that wondrously vivid picture which Homer* draws of such a visitation; Few pictures in poetry are more striking—the Sun-God sitting apart like night in his wrath; the clang of the bowstring; the death, first of the beasts, then of the Greeks themselves; and the ever burning funeral pyres of the dead; the whole scene and story is brought so vividly to our eyes that we seem to see it clearly before us. But it was not in the poet's dreams alone that such ideas of a cause existed; even down to the middle ages epidemics were looked upon with strong feelings of superstition; the judgment of an offended Deity, the evil influences of planets, witchcraft, national crimes, all were assigned as causes; then after-observers, with praiseworthy accuracy, noted all the concomitant phenomena; thus, showers of meteors, swarms of insects, earthquakes, unusual conditions of the atmosphere, are all often recorded. Little by little these observations became more rational; as for example, in the well-known letter†

* Homer's Iliad. Book I, lines 43, et seq. :

τοῦ δ' ἔκλυε Φοῖβος Ἀπόλλων.
 Βῆ δὲ κατ' Οὐλύμποιο καρῆνων χωόμενος κῆρ,
 Τόξ' ὤμοισιν εχων, ἀμφηρεφέα τε φαρετρην.
 Ἐκλαγξαν δ' ἄρ' οἴστοι ἐπ' ὤμων χωομένοιο
 Αὐτοῦ κινηθέντος· ὁ δ' ἦϊε νυκτὶ εἰοκῶς.
 Ἐξετ' ἔπειτ' ἀπάνευθε νεῶν, μετὰ δ' ἰὸν ἔηκε.
 Δεινὴ δὲ κλαγγὴ γένετ' ἀργυρέοιο βιοῖο.
 Οὐρῆας μὲν πρῶτον ἐπῶχετο, καὶ κύνας ἀργούς.
 Αὐτὰρ ἔπειτ' αὐτοῖσι βέλος ἐχεπευκὲς ἐφίεις,
 Βάλλ'· αἰεὶ δὲ πυραὶ νεκύων καίοντο θαμειαί.

† Erasmus' letters. Transl., Retrospective Review, Vol. 5, p. 24.

of Erasmus to the Physician of Cardinal Wolsey, extracts from which are here given :—

“I often grieve, and wonder how it happens, that Britain has now for so many years been afflicted with a continual plague, and chiefly with the sweating sickness, which is a malady that seems almost peculiar to the country. * * * The streets are so generally covered with clay and rushes, which are so seldom renewed that the covering sometimes remains twenty years, concealing beneath a mass of all descriptions of filth not fit to mention. Hence upon a change in the atmosphere a certain vapour is exhaled, in my opinion, not at all wholesome for the human body. Added to this, England is not only surrounded by the sea on every side, but it is also, in many places, marshy, and intersected by salt streams, to say nothing at present of the salt food, of which the common people are amazingly fond. It is my firm opinion that the island would become much more wholesome if the spreading of rushes on the ground were not used, and if the chambers were so built as to be exposed to the heavens on two or three sides ; the windows of glass being so made as to open altogether, and close in the same way, and to shut, so as not to admit noxious winds through the crevices. Since, as it is sometimes wholesome to admit the air, so it is sometimes as much so to keep it out. * * * You will laugh at my having time to trouble myself about these matters : I love the country which has for so long a time given me a hospitable abode, and in it, should circumstances allow, I would willingly spend what remains of life.”

In the *Midsummer Night's Dream*,* Shakespeare puts these words into the mouth of Titania—

“Therefore the winds, piping to us in vain,
As in revenge, have sucked up from the sea
Contagious fogs, which falling in the land
Have every pelting river made so proud
That they have overborne their continents ;
The ox hath therefore stretched his yoke in vain,
The ploughman lost his sweat ; and the green corn
Hath rotted ere his youth attained a beard ;
The fold stands empty in the drownéd field,
And crows are fatted with the murrain flock.”

The dirt, the “contagious fogs” have by this time clearly established themselves as causes in the minds of thinking men. It is strange to find the following entry in *Evelyn's Diary* shortly after the time of the great plague in the reign of Charles the Second :—

† Aug. 16.—“At the elegant villa and gardens of Mr. Bohun's at Lee. He shewed me the Zinnar tree, or Platanus, and told me that since they had planted this kind of tree about the city of Ispahan, in Persia, the plague, which formerly much infested the place had exceedingly abated of its mortal effects, and it was rendered very healthy.”

* Shakespeare. *Midsummer Night's Dream*. Act ii. Scene 2.

† *Evelyn's Diary*. Aug. 16, 1683.

History repeats itself in our tales of the Eucalyptus at the present day. Fortunately our English physician, Sydenham, was alive at the time of this terrible scourge, and has left us his record of it;* of its origin, he says: "but indeed, what, and of what character the alteration of the air may be, from which this deadly mischief arises, as well as of many other things about which would-be philosophers squabble, we are clearly ignorant." He believed the poison to be without doubt in the air, and he says in another place† that the constitution of different seasons is affected, not so much by heat or cold, moisture or dryness, as by some inexplicable change in the very bowels of the earth, by which the air is contaminated, and so disposes to this or that disease. Yet even Sydenham could not in that age quite divest himself of the trammels of astrology, for in his first tractate‡ after giving much the same causes as in his observations, he adds; "Sive inficiatur atmosphæra omnis ab alteratione quam eidem inducit peculiaris aliqua corporum cœlestium quorumlibet conjunctio;" as if the planets might possibly have some share in the evil work.

In after years guesses were made as to the probable chemical agents in the air which might cause epidemics; thus the products of decaying organic matter, whether animal or vegetable, were credited as the sources of mischief; sulphuretted hydrogen was accused from its

* "At vero quæ, qualisque sit illa aeris dispositio, a quâ morbificus hic apparatus promanat, nos pariter ac complura alia, circa quæ vecors ac arrogans philosophantium turba nugatur, plane ignoramus."

Syd: Observ: Medic. II., 2.

† "Variæ sunt nempe annorum constitutiones, quæ neque calori, neque frigori, non sicco, humido ve ortum suum debent, sed ab occultâ potius et inexplicabili quâdam alteratione in ipsis terræ visceribus pendent, unde aër ejusmodi effluviis contaminatur, quæ humana corpora huic aut illi addicunt, determinantque.—*Syd: Observ: I., 2.*

‡ *Syd: Tractate I., 35.*

smell; in the case of epidemic catarrhs seleniuretted hydrogen was named as a likely contamination, and in much later years, the danger was for a time believed even to depend on ozone.

The word fermentation was applied to the blood before the time of Sydenham. He notices it to remark that there was a logomachia between many, as to whether the word fermentatio or ebullitio should be applied to the condition of the blood in fever. He prudently changes it to commotio. It need scarcely be said that the meaning attached to the word fermentation was very different from the sense which it now bears; indeed, when the theory was revived to account for the diseases occurring only once in life, its true import was little suspected, and the word "zymotic" conveyed but little to the mind except that there was a distant analogy between the two processes. In the few last years, however, the microphytes of the fermentation have risen into the rank of a cause, and their germs are now widely regarded as the very materies morbi itself. Such in all probability will be the future of the zymotic theory. If this be the case, all diseases may be ranked under two broad divisions:—

- 1.—Faulty chemical action in part or parts of the body, however induced, causing errors in its nutrition.
- 2.—The introduction of organic germs into the system.

It should, however, be borne in mind that this last source of mischief must also of necessity always produce the first, for the germs not only pervert the chemistry when present, but often leave many a source of danger behind them when they are gone.

That any epidemic should spring from some noxious element in the air seems negatived on the following grounds:—

1.—We know of no agent capable of producing effects at all resembling any one of the epidemics. 2.—Such element, if it existed in any appreciable quantity, could be isolated, and determined chemically. 3.—The effects could not be communicated from one person to another. 4.—Such element would not be capable of indefinite multiplication.

Let us take some few of the distant analogies which do exist, and bear a resemblance, though only outwardly, to epidemic catarrh. If veratrine in powder be diffused through a room the sneezing excited ceases almost immediately if the person affected goes into the open air; the same happens with those on whose idiosyncrasies ipecacuanha causes coryza. In some constitutions again the odorous particles of anthoxanthum produce a more permanent catarrh; but here also the symptom ends if the patient goes to some sandy sea coast where there is no hay; and in none of these cases can the coryza or catarrh be given to any one else: it has no power of increase. The same, however, may be said, it must be confessed, of ague, which bears so great and evident an affinity with zymotic diseases that it can scarcely be separated from them. Of course the inhalation, or other introduction into the blood of phosphorus, of arsenic, of lead, or of mercury, would poison the system; such causes and their consequences are clear to our experience. So would be the effects of the inhalation of carburetted or of sulphuretted hydrogen; we know the symptoms of such inhalation; to suppose that these last could produce fever is a self-evident absurdity; it involves that a poison should produce an effect theoretically endless; that its effects may be multiplied in the dejections, infect well-water, and through its agency be conveyed along a whole

milk-walk. It is clear that such an indefinite increase has no parallel in any case of poisoning known to science.

A better idea of the nature of different contagia will be gained if some classification of them be made according to their different modes of action. In the following table they are arranged according to their power of infection : 1.—By direct inoculation only. Exs. : Syphilis, Vaccinia. 2.—By contagion only—of course including inoculation. Exs. : Scarlet Fever, Measles, Variola. 3.—Contagious through the excreta only. Ex. : Typhoid. 4.—Contagious and endemic. Exs. : Cholera, Anthrax. 5.—Endemic only. Ex. : Intermittent Fever. It must be remembered that this subject of infection is one of which we do not as yet even know the alphabet correctly ; and some of these anomalies may hereafter be explained, and one or more of these divisions merged into some other. For example, the natural nidus for the germs of smallpox and anthrax both may be the blood, but those of anthrax may have the power of preserving their vitality in a damp soil, whereas those of small pox may have less power of resisting death and decay ; so that anthrax may be only endemic in the same sense that scarlet fever may be said to be endemic, in a bed or mattress, or even in a room. Once for all be it understood that bacilli cannot be generated from nothing, they are always self producing ; if, therefore, a fresh origin be mentioned, all that is intended by the expression is, have the germs any natural existence in the soil, water, or elsewhere, apart from the human body ? It would seem that such must be the case in ague, if it be truly classed in the same category.

Anthrax is the most thoroughly investigated of all this group of diseases, it therefore best serves our present need as an illustrative example.

Dr. Lionel Beale was perhaps the earliest, certainly

amongst the very earliest of English workers at this subject, with the full idea that it was something which could be known, and which the microscope might reveal. He thus sums up the conclusions at which he arrived :—

1st.—The contagious virus is living and growing matter.

2ndly.—That the particles are not directly descended from any form of germinal matter, or bioplasm of the organism of the infected animal, but that they have resulted from the multiplication of particles introduced from without.

3rdly.—That it is capable of growing and multiplying in the blood.

4thly.—That the particles are so minute that they readily pass through the walls of the capillaries, and multiply freely in the interstices between the tissue elements and epithelial cells.

5thly, and lastly.—That these particles are capable of living under many different conditions ; that they live and grow at the expense of various tissue elements, and retain their vitality, although the germinal matter of the normal textures, after growing and multiplying to a great extent, has ceased to exist.

The view here held is, therefore, that the contagium is virulent living matter, at first introduced from without by the agency of infection, then multiplying by means of the ordinary living matter of the body, just as pus cells may spring from the healthy living matter of an epithelial cell ; but he adds, that this matter has a separate and specific existence of its own, and is capable of living under adverse circumstances which would destroy the life of the healthy living matter from which it sprang.

Whether the poison germs are merely the changed

descendants of healthy living matter, or whether they be germs of bacteria, may be thought, at first sight, to be a slight difference, but in reality it is a very wide one. To illustrate it by a coarser example, cancer may be as much a true parasite as the panhistophyton on a silkworm. The general view is, however, that the cells of the affected tissue have become the cancer cells, yet they are to a certain extent capable of transplantation and of growth in their new soil. Certainly the weak side of Beale's view is the difficulty of supposing this changed organic matter to have a prolonged inherent life of its own apart from the body; on the other hand, that there is a great increase of bioplasm at the expense of the ordinary tissues of the body in fever can be demonstrated, and in this sense it is true that "inflammation is a local or circumscribed fever, fever is a general inflammation." But this is not more true of specific fevers than of other highly febrile states. He sums up his views by saying,* "many facts favour the doctrine that the contagious particles concerned in propagating many of our most serious specific fevers have been derived from the living matter of man's body, and that they are not germs of fungi or bacteria of any kind whatever; indeed, in certain instances, they may be seen in far greater multitudes in the tissues of the diseased organism than bacteria, which latter, as is well known, are found often enough in countless multitudes in cases in which there is no specific disease of any kind."

It is obvious that purely endemic diseases, such as ague, could not belong possibly to the group as defined by Beale, but that they must be either regarded as examples of direct poisoning from, for example, some vegetable matter in a state of decay, or else quite classed by them-

* Beale.—"Vital action in health and disease."

selves as alone arising from germs of extraneous origin. Having premised this, let us now turn to the conclusions arrived at with regard to this same disease by other workers. As long ago as the year 1855, Pollender found rod-like bodies in the blood of infected animals; Brauell found them again in 1857; but neither of these observers regarded these as the infective material. Davaine, in 1863, found these rod-like bodies again, and classed them as bacteridia; he found them present in every case of anthrax, and proved, moreover, that infection ceases as soon as they are destroyed by decomposition. They are* “minute vegetable organisms, straight, less often bent or with obtuse angles, cylindrical, never branched, $\frac{7}{1000}$ to $\frac{12}{1000}$ ths of a millimetre in length; by a very high power they seem to consist of round or short cylindrical cells, joined together. These isolated spheres may also be met with alone. The bacteria of anthrax seem distinguished from the bacteria of decomposing fluids by the fact that they are devoid of motion.” In these words, “the bacteria of decomposing fluids,” lies the weakness of the hypothesis before us, for bacteria are to be found in every place where decay and decomposition are at work. They are not the causes of this decay; but the germs floating about everywhere find there a fitting soil for their germination. If the distinction above quoted be true, and if every contagious disease is proved to have its own distinct species of bacterium or allied microphyte, then, but not till then, the question of contagion will pass from hypothesis to demonstrable fact.

Anthrax is eminently endemic as well as infectious, so much so that some pastures in Switzerland are known as

* For this description, as well as many other facts on anthrax, the writer is largely indebted to the excellent article on anthrax by Bollinger, in Ziemssen's Cyclopædia.

Anthrax Alps. Peaty, damp moors, rich in decaying organic matters, are very favourable to its production, or more probably to its retention, since if dead bodies of infected animals are buried in these soils, the power of infection is preserved for a long time; indeed Davaine succeeded in inoculating the disease with dried blood, twenty-two months old. It would seem as if the vitality of the germs could be preserved under certain circumstances almost indefinitely. The usual materials of contagion are the diseased and dead animals, the blood, the excrements, and it can be carried away by healthy animals, as men or dogs, and given to other cattle or sheep apart from the infected creatures. It is now clearly proved, practically enough to Bradford artisans, that it may be conveyed by wool to men engaged in packing it. All these facts of contagion are so exactly parallel to those of the scarlatinal poison that the analogy at least must strike every one. It is interesting to note that Davaine obtained positive results from inoculation by the proboscis and feet of flies caught feeding on diseased beasts, and he detected the bacilli on them. It must be remembered that the minuteness of these organisms is such that he estimates the number which may be contained in a drop of infected blood at from eight to ten millions. The following instance of infection retained out of the body reads rather like a fabulous tale than sober reality, yet there seems no reason to doubt its truth. Einike relates that the skin of an ox, from whose flesh two persons got carbuncle, which died of anthrax in the fall of 1852, was soaked in the following spring in the water of a pond, and then made up by a saddler into harness; the saddler got carbuncle. From a flock of sheep, which were washed in the pond four weeks later, twenty perished in a few days of anthrax, and both of the horses (for whom the harness was made), after they had worn it

for four days, died of the disease in forty-eight hours." The following cases of scarlet fever, recorded by Dr. Richardson, form almost a parallel to it. Near Saffron-Walden was a clump of labourers' cottages, with the bare thatch over the heads of the sleepers. In one of these lived a labourer with four children; one of these was taken ill with scarlet fever and died; the other three were sent away to a grandmother some miles off. After some weeks one was allowed to return; within twenty-four hours it was seized with scarlet fever and died also. Double care was now used; the cottage was cleansed and lime-washed, every article of linen and such like was either thoroughly purified or destroyed, and four months was allowed to elapse. Then another was permitted to return. He also sickened in twenty-four hours, and this third child died.* The great marvel in both these instances, is how the bacilli or their germs retained their life for so long a period apart from what seems to us their natural home; yet much higher organisms it may be answered keep their vitality for months after the drying up of their native pond. In the case of anthrax at least it seems probable that the bacilli may not only live, but multiply in water, when we remember that the disease is endemic in some wet pasture. It is probable that the usual way in which the infection is received is either by the breath or with the food. The period of incubation varies in different animals, but in cattle or horses seems about four days, in rabbits it is only about twenty-four or thirty six hours. As in small-pox or scarlatina, so in anthrax, a fatal result sometimes happens at the very on-set of the attack, with symptoms like those of poisoning by carbonic acid; in these apoplectiform cases death often occurs very suddenly. The description of this

* Much condensed from Dr. Richardson's account in *Asclepiad*.

form in the third *Georgic** is so admirable, that I shall make no apology for quoting it:—

“Hic quondam morbo cœli miseranda coorta est
 Tempestas, totoque autumnî incanduit œstu,
 Et genus omne neci pecudum dedit, omne ferarum,
 Corruptique lacus, infecit pabula tabo.”

* * * * *

“Ecce autem duro fumans sub vomere taurus
 Concidit, et mixtum spumis vomit ore cruorem,
 Extremosque ciet gemitus; it tristis arator
 Mœrentem abjungens fraternâ morte juvençum;
 Atque opere in medio defixa relinquit aratra.”

In spite of the non-poetical character of the subject, the hand of the master has well and graphically drawn his picture, the victim in the agony of instant death, the ploughman loosing the remaining ox (the words *mœrentem* and *fraternâ* giving almost a human sympathy to the scene), and the plough left with the work unfinished, unharnessed in the furrow! The origin of the disease here is not as in our old Homeric quotation, the anger of the Gods, but the “*miseranda tempestas.*” Here again, the wild beasts suffer as well as the tame. The whole passage merits a careful perusal.

Although anthrax may be communicated to man by every agency through which it is given to animals, he seems, as a rule, much less readily affected than they are, and the most frequent source is direct inoculation by diseased matter coming in contact with an abraded surface of skin, and therefore the commonest form in which it is met with is the carbuncular. The inoculated spot is first seen as a red point, this soon increases to a papule with a dark vesicular head which soon bursts, and forms an eschar; a group of secondary vesicles rise around the base, which becomes more and more inflamed; the tissue round grows swollen and indurated, and the

* *Virg: Georg: lib. iii. 478 et 515.*

whole arm may become œdematous; the course of the veins and lymphatics is indicated by red discoloured lines; this may be accompanied with high fever and delirium, and end by collapse. On the other hand, as in a dissection wound, the symptoms may yield to treatment and end in gradual resolution. If diseased meat be taken as food, the carbuncle may be formed in the intestinal tract, and the malady known as mycosis intestinalis, always of a grave nature, is the consequence.

Dr. Bell,* of Bradford, who seems to have studied wool-sorter's disease, as it there occurs, with great care classes the cases met with under four heads:—

1.—Splenic fever. 2.—Malignant pustule. 3.—Splenic fever (not severe) with secondary malignant pustule. 4.—Malignant pustule (severe) with secondary splenic fever.

As in the case of woolsorters all the examples probably spring from direct inoculation, the intestinal form is not likely to be seen. He gives a short summary of many cases of rapid collapse, answering to the apoplectiform variety described in cattle. The first of these noted was working at his board sorting wool, at ten in the morning on the 26th of June, and he died at half-past two in the morning of the following day: the whole duration of the attack being, therefore, about seventeen hours. He felt no pain, there was no marked increase of temperature, the face was pale, with a slight leaden hue, the expression very anxious, the mind clear; the pulse very rapid, the breathings forty. The symptoms, therefore, were simply those of collapse. The examination after death showed little but a darker hue than usual of the blood, and congestion of the internal viscera, with considerable enlargement of the spleen. Dr. Bell inoculated rabbits

* Dr. Bell.—Articles in *Lancet*, June 5 and 12, 1880.

with the blood of one case, and found them die with the usual symptoms of anthrax.

Such is a very condensed account of some of the researches on the cattle plague, an epidemic that, in the Russian province of Novgorod alone, killed between the year 1867 and 1870, five hundred and twenty-eight men, besides fifty-six thousand horses, cows, and sheep. Anthrax has been chosen as our example because no other disease of the type has been so well worked out. If it be supposed to be proved that bacilli and their germs are here the cause, analogy would certainly lead us to infer that a similar cause exists in all similar diseases; but it must be borne in mind that analogy is not always a safe guide, and arguments from it can only lead to probabilities. It would be easy for example, to make out a plausible analogy between scarlet fever and urticaria; both are accompanied with febrile symptoms, both have an eruption on the skin. Now, up to a certain point, the causes of nettle rash are well known; it is obviously a morbid product in the blood; thus, the sting of a nettle always succeeds in making it come locally, and, in some idiosyncrasies, a crab or lobster taken into the stomach produces it generally. It is clear that in the one case the poison from the sting of the nettle, in the other, a noxious material from the malassimilation of unhealthy food, have brought the mischief. Therefore, it may be argued, a morbid agent of somewhat similar kind introduced into the blood might produce the scarlatinal rash, which, therefore, may well be the effect of some noxious matter from without; it may even be said, surely, the analogy between acute urticaria and scarlet fever is greater than between scarlet fever and whooping cough. But there is here one great omission in the chain of reasoning: the poison of urticaria stops with the individual, that of scarlet fever

passes on to another and another, in a never ending series. There is a likeness of distant analogy between scarlatina and urticaria, but the resemblance must be one of true homology, before we can reason from it. Now, it is probable, that the homological relation is true between all the diseases which we group together under the term zymotic; but, as before said, it is only the mere alphabet of this knowledge which is at all certain. The probability, however, of this generic resemblance is so strong, that it is more than sufficient to supply the most powerful motives for urging on work in the same direction until all is clear. There may be many mistakes in our present grouping, there is much that wants investigation. For example, the history of bovine tuberculosis makes it probable that some forms of phthisis will have to be added to the list; but it is not at all unlikely that the term phthisis is at present used too vaguely. It seems to me, that modern researches on this malady have not as yet cleared up all its difficulties. It is possible that more than one disease is confounded together, and that whilst one form may spring from malassimilation, which leads to deposit of tubercle, whatever this may be, in the lymphatic system, another may be a genuine germ disease. It must be borne in mind also, that every germ disease does not necessarily imply any fermentation; thus, the coarser forms of trichinosis and hydatids (of animal origin), favus, tinea, and pityriasis versicolor (of undoubted fungoid growth), are all truly parasitic, but not zymotic; so if cancer be eventually relegated to the same class, it would be in no sense zymotic.

The question will arise to our minds, if bacilli are found in the blood and eventually proved to be the cause of all these diseases, how will it affect their treatment? It is

most improbable that any medicine could be taken in sufficient quantity to stop the fermentation process, or to lessen the vitality of these minute organisms. These diseases will have to be treated as they are now, upon the general principles of medicine, and untoward circumstances will have to be combated as they arise ; in other words, to use the phrase of a deep thinker* and an elegant lecturer familiar to us all, it will be necessary as ever to watch, and "obviate the tendencies to death." There is, perhaps, a dim hope of a specific in this, that two different bacilli may produce a similar fermentation and the same change in the blood. For example, vaccinia need not be identical with small-pox, but if the same blood-change takes place in each case the protection would be the same ; the second fermentation could not happen, since the system would be under protection. It is possible, hardly probable, that in the future this inoculating process may extend to other diseases of the group.

Surgical scarlet fever again is always light, and, in cases where from circumstances it becomes quite impossible for children to escape from infection, it might be lawful to try a true inoculation with the poison, as was formerly done in the case of variola ; but in our present knowledge this can be only mentioned, not recommended.

It must be borne in mind that the title of this lecture was not fact, but hypothesis ; yet, granting that the facts were proven, there is still much to learn. How and where the germs usually enter the body ; what is going on during that mysterious period which we term incubation ; why this time should vary so much in different diseases ; why, for example, it should be only two or three days in scarlet fever, and two or three weeks in measles ? Here, to add to the marvel, it is certain, from many well-attested

* The phrase is Cullen's, quoted and adopted by Sir Thos. Watson. Lect. 5.

cases, that two incubations can be going on at the same time; for example, a patient of my own was removed from school because measles had broken out in it. There was scarlet fever near his house; he took it, having it mildly; the eruption lasted its usual time and disappeared; but at the end of about sixteen days from his leaving school he broke out with a genuine well-marked eruption of measles, with all its concomitant symptoms; after this his skin peeled very completely. There could be no doubt here that the two incubations had been going on at one and the same period.

How marvellous again is the long incubation in hydrophobia! If there be a real fermentation the chemical changes will, as science advances, eventually be known in each case. To be protective the changes must be transmitted to each particle of blood as it is formed—perhaps even heredity may exercise some power in mitigating these diseases, since, as in the case of measles in the Fiji Islands, when an epidemic attacks a people whose ancestors have not had the disease it seems to rage with unwonted virulence—when infection commences and when it ends is also unknown; what also may be the varying area of infection around the sick person, if germs of bacilli are the source, and wafted through the air; it would seem that they must infect a whole room, yet in the case of whooping cough, if, as in our quarantine ward in the Children's Hospital, the little patients are confined to their beds, the infection does not seem to spread; and yet when the breath is inhaled directly, no disease is more decidedly infectious. So again with typhoid fever, there is very little, if any danger, except from the dejections, and even then the poison seems much more readily taken in by the stomach than by the lungs. It would seem that there must be a time when a person is either, so to speak, more receptive of the

germ influence than at other times, or else there must be some particular condition such as an abrasion of mouth, or tissue not always present. It has twice happened in the cases of our resident House Surgeons at the Children's Hospital, that after more than a year's daily attendance in the scarlet fever wards with impunity, they have at last taken the disease: what protected them before, and what gave it to them then, are alike unknown. That some epidemics have an unusual number of severe cases, whilst others are comparatively mild, is no doubt true, as Dr. Graves well points out in his clinical lectures; there seems also, often a character peculiar to each epidemic; thus, in some outbreaks of scarlet fever, a swelling of the tissue around the glands of the neck with frequent sloughing of the integument is remarkably common; in another, kidney symptoms are more than usually abundant, but the secondary affections of the neck are rare. Sydenham's expression, quoted previously, the epidemic constitution of some particular years, has apparently some truth in it, why we know not, but the wave of fatality in different years seems almost to follow a definite law. Perhaps it never will be discovered why measles should attack the mucous membrane of the eyes and nose, afterwards extending into the lungs, whilst scarlatina affects the throat, and mumps spends its violence on the salivary glands. Many of the unknown factors in these diseases will be changed in the process of time into definite and known causes, but we gain nothing by assuming things to be truths that have no proofs; for example, that the infection of scarlet fever resides in the skin scales shed may be true, but it is, to use the words of a Scotch verdict, not proven; yet it is so constantly handed down from lecturer to lecturer that it has become one of the *eidola fori*, and has gained almost universal belief—a belief that

it is perhaps mischievous to shake because it leads to extra care, and even a patient does not believe that infection is over until "the peeling" is past. Many cases have taught me that it does not necessarily stop even then; one specially rises to my mind where unusual caution was taken at the Children's Hospital, desquamation was long and completely over, and the little patient went home, of course bathed well, and the hair well washed with carbolic acid in solution, and carrying nothing that she had used or worn in the scarlet fever ward, yet she gave the disease; there was a discharge from the ear, and in my belief the infection resided in this: on any germ theory this is of course easily explained.

The phrase that these zymotic diseases ought to be stamped out is a very common one, both in the profession and out of it; but it rarely suggests itself to the mind that it is first absolutely necessary to know on what we are to stamp. Scabies and its origin are well known, the natural history of the acarid causing it is known; does any one think it would be easy to stamp out scabies? How impossible then to stamp out germs of which we really know nothing, an ens whose existence and multiplication both in and out of the body is a mystery, and which seems in some cases to have an indefinite power of increase, even in the soil. Nay, if the bacillus theory be adopted, it is quite possible that though the germs live and multiply in the blood, that there may be an equally fitting home for the growth of the same germ in some other azotized or decomposing fluid, even perhaps in stagnant water containing much organic matter, so that in this sense the infection may arise afresh. The fact that cholera seems always endemic in the swampy districts about the mouths of the Ganges and Brahmaputra, may, perhaps, be accounted for in this way. Far, far easier would it be

then to stamp out rickets, a disease arising from faulty nutrition alone, and which indeed ought not to exist in any civilized and educated community. Yet, the day is far distant when even this can be done. Science has done much, and will do more, but the body will ever be assailed by traitors within the camp, and open foes without, and the fortress will yield after a siege of three score years and ten as long as man exists as a species.

Can then nothing be done? Are our sanitary measures of no use? We have the answer clearly written in history. The old English epidemic, the sweating sickness which Erasmus says was unknown in any other land is gone, or so far modified that we do not recognize it, an epidemic such as that of the black death in Edward the Third's time, or the plague in Charles the Second's reign is unknown in later years. There is every hope in sanitary measures, every hope, not of stamping out, but of mitigating the severity of these scourges of humanity. The history of some of the old epidemics of small-pox speak very plainly on this point. If bacilli be the cause, all low vegetable organisms thrive best in the decomposition of nitrogenous matter. The improvement is not an hypothesis, but a fact. It is a fact that even now, other things being equal, an epidemic certainly rages far more fatally in densely crowded squalid parts of a town than in purer localities; it is a fact that the poison of typhoid can infect wells by drain agency, and that the germs can and do multiply in the water so infected; it is a fact that rigid cleanliness and good ventilation in a Hospital will stop pyæmia; it is a fact that diphtheria is almost endemic where the drainage is impure. Sanitary measures cannot be carried out too strictly, the isolation of an infected patient cannot be too rigidly enforced. Preventive medicine has a grand future before it, but to be useful it

must be carried out firmly, boldly, and unflinchingly. There is a trite but true aphorism "salus populi, suprema lex." We ought not to care about a little abridgment of liberty—liberty to do ill is not liberty but license, and giving infection to others is doing ill. Isolation, purification, and free ventilation are the three cardinal points of sanitary reform.

Let me in conclusion sum up some of the more salient points brought before you this day. It has been shown that disease admits of division into two large classes; the one arising from faulty chemistry and perverted nutrition, the other from the introduction of organic germs into the system, and their multiplication therein. It has been shown that there are two theories which explain these germ diseases; the one advocated by Dr. Beale, who regards the contagium not as parasitic microphytes, but as organic matter endowed with virulent and specific qualities, changed as pus cells may be said to be when arising from altered epithelium, and therefore "having nothing to do with fungi, bacteria, or any other living thing in nature, but coming direct from the bioplasm of man's body." Although, whatever Dr. Beale says must be viewed with great respect and examined carefully, remembering that to him we owe one of the greatest physiological truths discovered in our own times—the clear distinction between living and formed material, between the active living contents of the cell and the effete dead wall surrounding it, a discovery the full importance of which cannot be ranked too highly—yet, in this view of contagion, many of the important phenomena are left unexplained, and this makes us feel that we need some other cause than the facts of an increased bioplasm to meet all the necessities of the case. The other, or bacillus theory, on the contrary, seems to meet the necessities of

the case too well ; and in the face of the evident fact that bacilli are to be found in every place where decay and decomposition are going on, it must be felt that more proof is needed before we can unhesitatingly state that their presence is the clear cause of the disease. There is plenty of work yet to be done before what is now plausible hypothesis becomes uncontrovertible fact.

Some may think that this, my first lecture, is too theoretical ; to my own mind it is far more practical to show what we do not know than to go over old and beaten tracks. There seems to me of late years a heresy gaining ground in the minds of some that physiological and pathological knowledge are something distinct from medicine. Depend upon it there is nothing more dangerous than such an error. Genuine and honest work such as that of Jno. Reid on the eighth pair of nerves, or of Bowman on the structure of the kidney, has done far more for medicine than all the modern researches on pharmacy. Remember you are the countrymen of Harvey and of John Hunter ; let such as can do so follow in their steps. Here is a wide field pointed out for investigation, and if what has been said to-day brings one fresh labourer into that field, so that a single iota of what has here been classed as hypothesis shall be turned over to the dominion of fact ; or if false, shall be conclusively proved untrue, then this lecture will not have been given in vain.

LECTURE II.

SCARLATINA—FACTS.

TO-DAY we pass from hypothesis to the more strict domain of fact, and there can be no greater proof of the increase of medical knowledge than the immense and almost bewildering number of *facts* that are now collected upon this scarlet fever, or indeed on any other disease of similar import. What is known of it now might fill a large volume, what was known in Sydenham's time could be condensed into a very small chapter. Let any one contrast, for example's sake, the lectures of Cullen on the subject, with the elaborate descriptions of even the manuals of the present day,* and he will feel what a century has done for medicine! We are now in a different age with different means of investigation in our power—the stethoscope, the test tube, the microscope, wide statistical information, these have been to medicine what the steam engine and the telegraph have been to the world around. This is not spoken to depreciate the labours of the past; far be it from me to do this. Our fathers have laid the foundation, and in most cases have laid it firmly and well; but, going on slowly, nay almost ploddingly, from day to day, all of us are apt to fancy in our desponding moments that medicine has not advanced with the age. There is no reason for this despair, the very contrary is the case, all praise to the self-denying army of labourers who have so patiently and unweariedly toiled at the work!

Scarlet fever, now so well known to us, and dreaded as a fearful scourge, has yet only been clearly distinguished

* It must be confessed that he will not find Cullen's vigorous English, or his graphic power of picturing disease.

from measles in comparatively modern times; indeed our own Birmingham physician, Withering, who was undoubtedly the first to prove that scarlet fever was the same disease as the malignant sore throat of Fothergill and the *Cynanche Maligna* of Cullen, adds also much to the clearness of the distinctions between it and measles. He says* :—"The measles are so nearly allied to the scarlet fever that we find some of the best medical writers have considered them as no way differing, but in the mode of the eruption; the former rising above the skin, and limited in their extent, the latter smooth and universally diffused. But not to mention that the patients who had gone through the measles were equally subject with others to the scarlatina, we may observe that the teasing cough, the running at the nose, the sneezing, the watery eye, symptoms so predominant in the early state of the former, were never observed to exist in the latter, at least with us." Sydenham is, however, undoubtedly the first English physician who clearly recognised its distinctness; yet curiously, in his short account of it, which is very good as far as it goes, he makes no mention of it as a fresh disease, nor does he take any credit to himself for the discovery. He especially notes that the whole skin is covered with small red spots, more abundant, more widely spread, and more scarlet than the eruption of measles, and he especially also takes note of the desquamation in small bran like scales, yet he seems only to have seen the mildest cases, for he says of it, "*Hoc morbi nomen, vix enim altius assurgit,*" and he sums up the sequelæ by saying that too active a treatment prolongs the disease, "*et æger non raro, nullâ aliâ de causâ, quam nimiâ medici diligentîâ ad plures migrat;*" yet, curiously, convulsions and even coma are noted as sometimes

* Withering. An account of the scarlet fever and sore throat. 1793.

occurring at the commencement of the eruption. This was in 1676, for in the earlier editions of his works this chapter is said to be wanting. A very few years after, Morton describes a severe epidemic of scarlet fever, recording its symptoms most accurately, and in most graphic language, yet he adds:—"Hunc morbum (ut ut universali medicorum consensu, titulo peculiari donetur) prorsus eundem esse cum morbillis censeo, et solo efflorescentiæ modo ab illis distare." So Sennertus, who describes it well, adds:—"Malo, ergo ad morbillos referre." There was an evident unwillingness to admit a new disease. Now, indeed, we have abundant reason to recognise it, since it causes more deaths in our island than any other single malady, and Continental writers lay particular stress upon its frequency as an English epidemic. In the year 1879 alone, 17,613 deaths occurred from it in England, nor was this by any means a scarlet fever year. In 1870, which had the largest mortality from this disease registered during the last twenty years, the number of deaths was 32,543, or at the rate of one person in every 685 of our then population, a fatality which indeed assumes alarming proportions.

On examining the statistics of death from scarlet fever in England, the first point that strikes us is the great variation in the degree of mortality in different years.

TABLE A.

DEATHS FROM SCARLATINA IN ALL ENGLAND FROM 1855 TO 1879.

1855	1856	1857	1858	1859	1860	1861
16,929	13,557	12,646	23,711	19,310	9,305	9,077
1862	1863	1864	1865	1866	1867	1868
14,834	30,475	29,700	17,700	11,685	12,300	21,912
1869	1870	1871	1872	1873	1874	1875
27,641	32,543	18,567	11,922	13,144	24,922	20,469
1876	1877	1878	1879			
16,893	14,456	18,842	17,613			

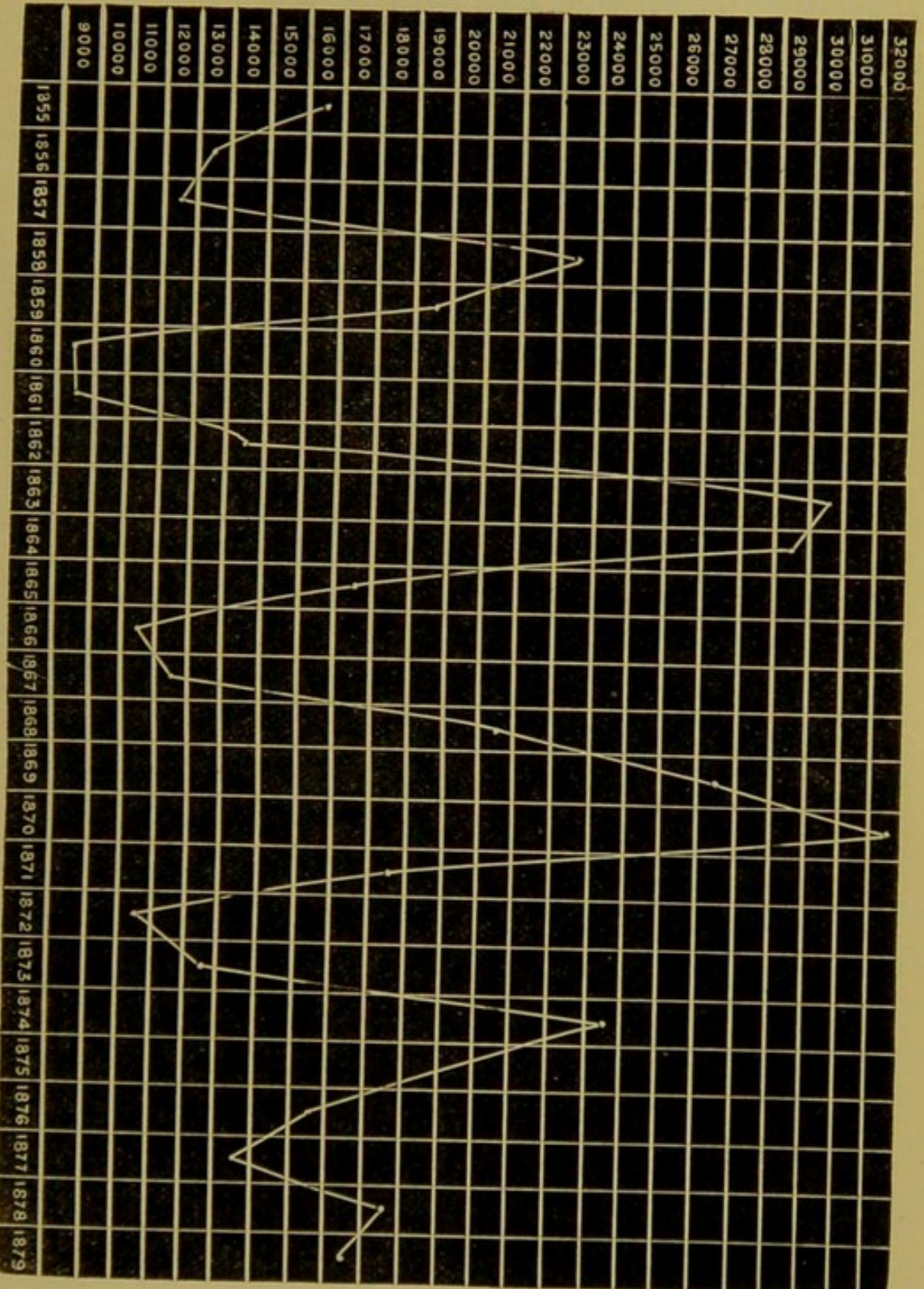
This table gives us the number of deaths in each successive year from 1855 to 1879, that is, during twenty-five years. The fatal cases will be seen to vary from 32,543, the highest number, to 9,077, the lowest, the first being the number in 1870, the last in 1861. But on looking at the tables more closely there will be found a degree of regularity in this variation, and five distinct waves will be seen in the list of mortality, the highest points being reached in 1858, 1863, 1870, 1874, and 1878. This will be better seen in the accompanying chart, where the deaths are given diagrammatically, each space representing one thousand: this records the deaths for all England; if we examine them for Birmingham we shall find a general agreement; but, as might have been expected, not a perfectly complete one. Dr. Hill has kindly given me the numbers of the fatal cases which have occurred in the town, during the twelve years from 1870 to 1881.

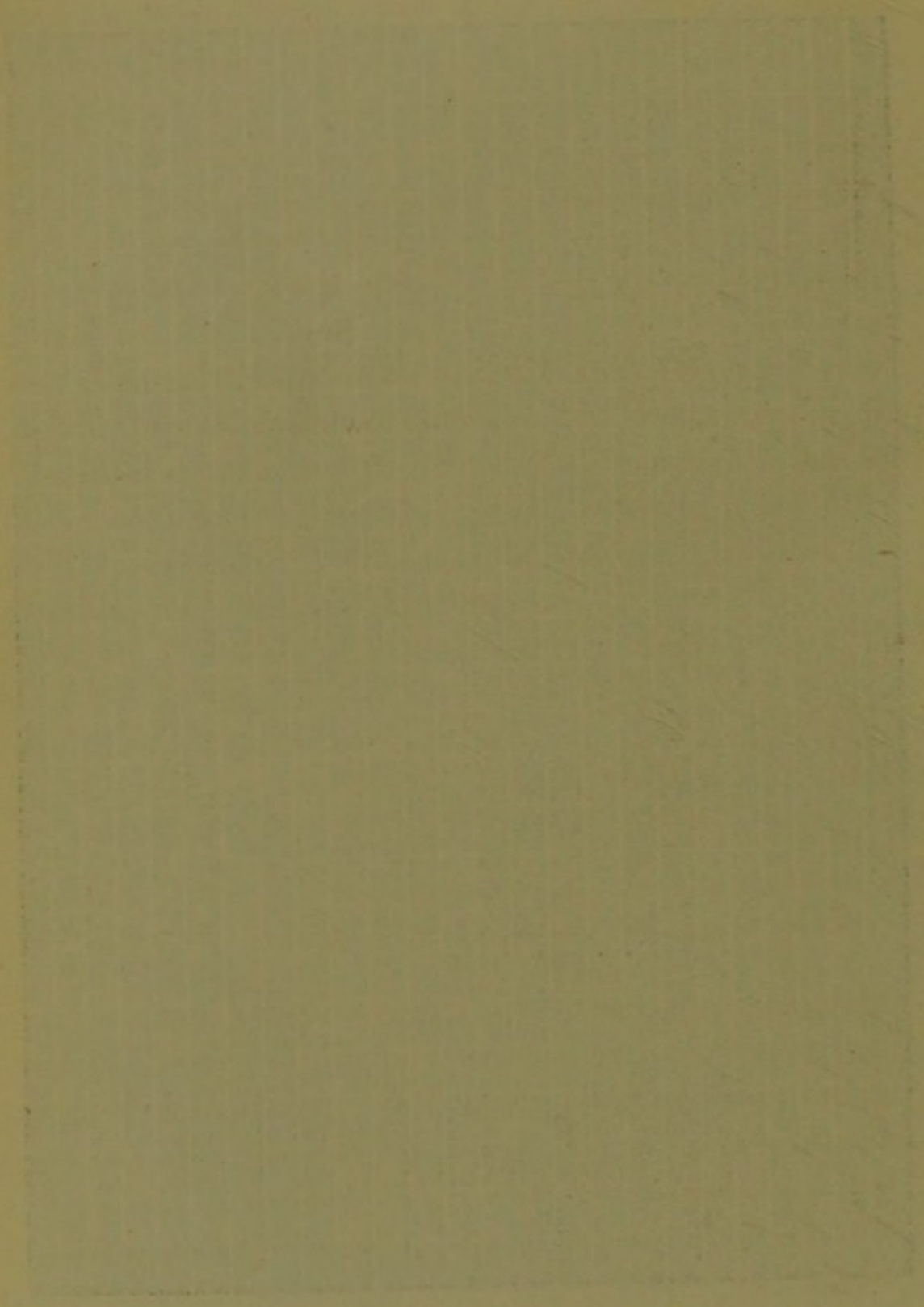
TABLE B.

DEATHS FROM SCARLET FEVER IN BIRMINGHAM, FROM 1870 TO 1881.

1870	1871	1872	1873	1874	1875	1876
324	127	409	587	737	265	204
1877	1878	1879	1880	1881		
237	995	306	123	164		

Now the highest points are reached in 1870, 1874, and 1878, so far agreeing perfectly with the general chart; but there the resemblance ceases; for example, the greatest mortality in England was during 1870, whereas this is exceeded in the local mortality of Birmingham by 1872, a year in which there was a very low general death-rate, and also by 1873, 1874, and 1878, in which last year the largest number of deaths occurred in Birmingham, more indeed than three times as much as in 1870. In 1878 the deaths in Birmingham from scarlet fever were more





than $\frac{1}{20}$ th of the number from the same cause in all England, whereas in 1870 they only reached one hundredth.

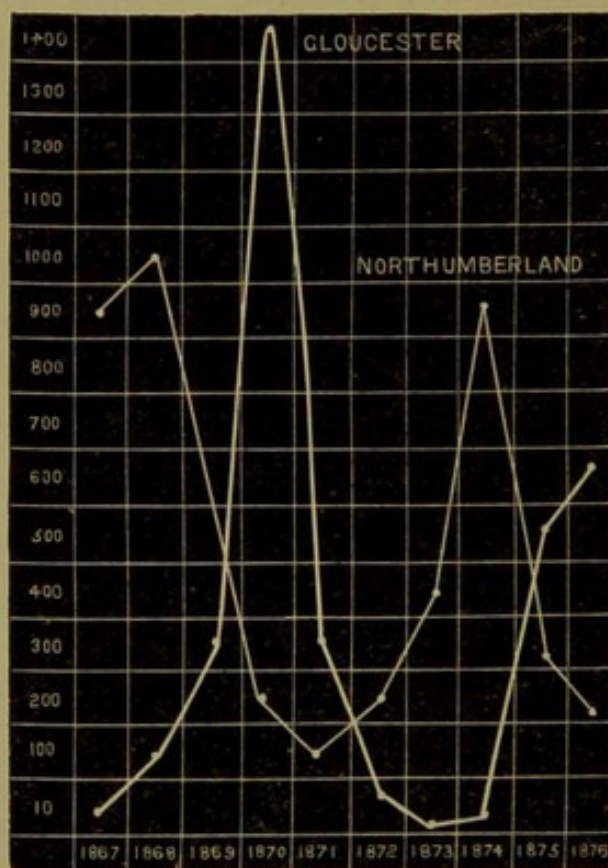
The correspondence in the county death rates is also very striking, though the same remark applies to them as was made with regard to the Birmingham bills of mortality; out of nine southern counties taken together, not for any reason except that they occurred together in the tables of the Registrar-General, Suffolk was the only county that did not reach its culminating point in the great epidemic of 1870; the following year, 1871, giving in this county a much higher death rate from this disease.

TABLE C.

	1867	1868	1869	1870	1871	1872	1873	1874	1875	1876
Essex ...	67	162	322	679	444	126	38	120	337	135
Suffolk ...	206	140	79	167	337	96	31	114	145	81
Norfolk ...	155	360	242	520	356	47	100	364	179	139
Wilts ...	56	53	85	234	183	143	79	19	67	129
Dorset ...	81	114	86	284	137	55	28	165	80	32
Devon ...	36	60	155	646	415	106	76	73	279	199
Cornwall...	33	254	161	587	392	161	45	50	164	416
Somerset...	20	55	154	534	420	172	104	173	269	569
Gloucester	54	113	399	1456	320	85	50	75	530	684

Many of these minor discrepancies will be noticed, but the general parallel character of the lines in these diagrams showing the mortality in the southern counties is certainly most striking. The height of the wave in 1874 was by no means so general as the height in 1870, and the return of the lustrum is by no means so regularly kept in the country as it is in such a town as Birmingham. Thus in the comparatively isolated county of Devon five years pass away between the crest of the waves in 1870 and 1875, and in Cornwall one more year passed before the highest point was reached in 1876; as

might be thought probable, when remote counties are examined together the result is not so uniform as when the counties are contiguous, and indeed it may be suspected that if reliable statistics could be obtained of the periods before railroads were in use, there would not be so much similarity in the wave lines of distant places as at present exists. Thus, if we compare the two distant counties of Northumberland and Gloucester together the



lines are by no means parallel; the height of the epidemic wave in Northumberland was not in 1870, but in 1868, the deaths in the former year being only about a tenth of those in the latter. The great rise of the epidemic in Lancashire was in 1869, the north taking slight precedence of the south in this wave of mortality. Yet it is plain that, even if the scarlatina years may vary slightly in different parts of the kingdom, that scarlet fever is not a mere wandering epidemic, but is subject to laws,

and has its regular periods of recurrence and decline. No satisfactory reason can be given for these risings and fallings. Two are assigned, in each of which there may be perhaps a partial element of truth. The first is dependent upon the fact, which will be seen hereafter, that there is a very great difference in the fatality of the disease at different periods of a child's life, so that the years between two and four may be looked on as scarlatina years ; thus a district may, in a great epidemic, be as it were worked out, so that all have had the disease who were in a fit state for its reception : if such were the case the next year should always show a very rapid descent ; this is sometimes the case, as in the extraordinary rise in Gloucestershire in 1870 to about 1400 deaths, followed in 1871 by a fall to a little above 300 : in such a sudden rise this cause might act, but a subsequent large fall is far from being universally the case ; thus, in Devon, the rise to 600 in 1870 is followed by a mortality of 400 during the next year, and sometimes, as in the case of Cornwall, at the same time both the ascent and the descent are gradual. Thus in 1868 the mortality was above 200, and in 1870 above 500, sinking to a little below 300 in the next year. If there be an element of truth in what may be termed the hypothesis of age, it probably acts more in closely populated towns than in a wide-spread district ; evidently it is not the whole cause, it does not account for the general mortality in 1870 being so much higher than in the next culminating points of 1874 and 1878. The second reason given is that our statistics unfortunately deal only with the number of deaths, not with the numbers affected by the disease. Now one epidemic is, as most authors testify, and as my own experience would abundantly corroborate, much more fatal than another. Graves, in his clinical lectures, speaks most

plainly on this point. In the years 1801 and 1802 scarlet fever raged most destructively in Dublin, from that time to 1834 and 1835 the disease was so mild that the physicians congratulated themselves on their different method of treatment, and thought this was the cause of the improvement. "This," says Dr. Graves, "I myself learned, this I taught, how erroneously will appear in the sequel." The epidemic of 1834 and 1835 completely dispelled these views; it was as virulent as in the old days of 1801 and 1802. According to Trousseau, Bretonneau fell into exactly a similar error; from 1799 to 1822 he did not see a single fatal case of the disease, and he was satisfied that the scarlatina was the mildest of all the exanthemata, but in 1824 a severe epidemic broke out at Tours, and he was at first disposed to think the treatment caused the fatality, but he found it the same under his own care, and it so entirely changed his views as to scarlet fever being only a slight malady, that he henceforth looked upon it as one of the most dangerous.

The statistics since the establishment of the Children's Hospital show the varying fatality of different epidemics very clearly, though of course on a small scale:—

1864	...	No. of cases,	44	Deaths,	3
1865	...	" "	80	" "	13
1866	...	" "	41	" "	5
1867	...	" "	78	" "	7
1868	...	" "	107	" "	10
1869	...	" "	87	" "	8
1870	...	" "	119	" "	13
1871	...	" "	57	" "	7
1872	...	" "	63	" "	13
1873	...	" "	69	" "	17
1874	...	" "	65	" "	17
1875	...	" "	66	" "	5
1876	...	" "	59	" "	5
1877	...	" "	64	" "	8
1878	...	" "	187	" "	37
1879	...	" "	99	" "	13
1880	...	" "	67	" "	6
1881	...	" "	101	" "	7

This gives an average of 13·2 deaths for every 100 of the whole admissions, but if the different years are examined by themselves, it will be found that in 1874 the fatal cases reached 26·15 for the 100, or more than double the average mortality; again, in 1878, the mortality was 19·8. Both of these were fatal years in Birmingham. Now in 1881, the past year, when the disease was plentiful enough, but of a very mild character, the fatal cases only amounted to 6·9 per cent., one half the average. In the epidemic of 1873-1874, four cases are noted as deaths from sloughing of the cellular tissue of the neck, and one from noma accompanying the disease. This points to the dangerous nature of the cases. The three years mentioned stand in the list as follows:—

1874	...	Admissions, 65	Deaths, 17	Per cent., 26·15
1878	...	„ 187	„ 37	„ 19·8
1881	...	„ 101	„ 7	„ 6·9

The number of admissions is of no importance, since the beds at disposal varied, but there was no selection, as every case of scarlet fever is admitted whenever there is a vacancy.

Epidemics are, then, of varying fatality, and our statistics are of mortality alone, and do not therefore embrace the cases of recovery, only the deaths; so that a widely-spread epidemic may yet look slight in the Registrar-General's reports. But if this be one cause, we are yet no nearer the explanation; for why should epidemics recur with unwonted severity at somewhat regular periods? Depend upon it there is a law and a reason in their return, though we know it not. It may be in the weather, it may be in the temperature. If there be germs in the question, some state of atmosphere may suit their propagation best. There must be a reason why cholera, always sporadic in India, visits us so rarely. There is ever the same traffic, the same opportunity of transfer. There

must be something wanting. What it is we do not know.

It was said that age exercised a great influence in determining the mortality of scarlet fever. This table

EXTRACT FROM THE REGISTRAR-GENERAL'S REPORTS.

	All ages	Under 1 year	Betwn. 1 & 2 years	Betwn. 2 & 3 years	Betwn. 3 & 4 years	Betwn. 4 & 5 years	TOTAL under 5 years	Betwn. 5 & 10 years	Betwn. 10 & 15 years	Betwn. 15 & 25 years	Betwn. 25 & 35 years
1855	16,929	1,131	2,306	2,700	2,537	1,957	10,631	4,523	1,078	438	128
1856	13,557	985	1,930	2,161	2,085	1,669	8,830	3,419	800	332	88
1857	12,646	855	1,790	2,032	1,988	1,462	8,127	3,252	766	321	104
1858	23,711	1,444	3,468	3,980	3,638	2,860	15,390	6,160	1,325	557	159
1859	19,310	1,294	2,824	3,062	2,992	2,379	12,551	4,937	1,050	469	174
1860	9,305	636	1,378	1,499	1,409	1,146	6,068	2,329	477	287	77
1861	9,077	572	1,288	1,490	1,423	1,119	5,892	2,317	447	264	91
1862	14,834	903	2,158	2,454	2,268	1,786	9,569	3,893	818	364	117
1863	30,475	1,761	4,050	4,886	4,683	3,842	19,222	8,192	1,820	805	267
1864	29,700	1,778	3,915	4,682	4,571	3,763	18,709	8,027	1,711	796	280
1865	17,700	1,118	2,497	2,914	2,613	2,140	11,282	4,759	953	448	158
1866	11,685	690	1,741	2,038	1,835	1,415	7,719	2,964	571	267	109
1867	12,300	805	1,806	2,064	1,961	1,457	8,093	3,269	551	251	97
1868	21,912	1,390	3,209	3,533	3,368	2,695	14,195	5,939	1,099	408	179
1869	27,641	1,792	4,073	4,698	4,110	3,405	18,078	7,194	1,419	538	206
1870	32,543	2,164	4,667	5,212	4,809	3,853	20,705	8,540	1,959	789	348
Total	303,325	19,318	43,100	49,403	46,290	36,948	195,061	79,714	16,844	7,334	2,642

After 35 years the decrease is even more rapid of course, and the remainder of the Table is omitted.

shows that the most fatal age is between two and three years. The deaths steadily increase up to that time, and as steadily decrease afterwards. There are here summed up the results of the Registrar-General's reports on this point from the year 1855 to 1870, including, therefore, a period of sixteen years. In round numbers, the total results give the number of deaths in England from scarlet fever, arranged according to age, as follows:—Under one year, 19,000; between one and two, 43,000; between two and three, 49,000, when the highest point is reached, and between three and four becomes 46,000; between four and five becomes 36,000. After this the descent is still more rapid. Thus, the deaths for these same sixteen years, under five, are 195,000; between five and ten,

79,000; between ten and fifteen, 16,000; and between fifteen and twenty-five (ten years), only 7,000.

If the table is examined, the details of each year taken alone will be found to bear out the same statement in every case. The total number of deaths in the sixteen years is 303,000. About one-sixth of these occur, therefore, between three and four.

As the deaths are chiefly amongst the very young, it might be expected that sex would have very little influence on mortality, and the slight excess of male over female deaths is easily explained by the greater risks which boys run at schools and other places, and moreover by the probable truth that they incur more danger from after exposure.

A year fatal from scarlet fever is not by any means necessarily fatal from other zymotics. Thus, if the same twenty-five years that have previously been examined as to their fatality from this disease be now examined as to the deaths occurring in them from measles, no definite relationship can be traced between the two, for though the years 1863 and 1874, both fatal for scarlet fever, were equally so for measles, the last year, 1874, being the most fatal from measles during that whole quarter of a century, on the other hand 1870, the most fatal year of the whole from scarlet fever, is an unusually low year for measles. The mortality from this latter disease does not exhibit the periodic recurrence which is so striking a feature in the epidemics of scarlet fever. This is shown in the diagram, where the mortalities from the two diseases are drawn in the same page. Measles is, of course, far the least fatal of the two. The time of its greatest mortality is between one and two years, one year earlier than that of scarlet fever. Of course, on the hypothesis of age, even here there should be regular intervals,

though they should be of shorter duration. The want of due regularity in its return helps to weaken the arguments from age as applied to scarlet fever:

Difference in locality is scarcely likely to affect a disease so infectious in its character; yet, as is natural, it spreads in crowded cities more than in country places where the inhabitants are more widely scattered, and the means of communication less.

The time of year certainly exercises some degree of influence in England, as is evidenced by the accounts of those registration reports in which the quarters are kept separate; here the last quarter of the year is always the most fatal, though Picot expressly states that English statistics on this point are not borne out by those of other countries.

Very difficult is it to get information as to the effect of outward circumstances on the fatality of scarlet fever; our general experience certainly seems to prove that the worst cases are most abundant in densely crowded and squalid neighbourhoods, but of course cases of all kinds are here most numerous also, and it is the percentage of severity which we want. Experience certainly proves that it is fatal alike to rich and to poor; the same remark will apply to age, it is only the actual number of deaths at each year of life which are recorded, and not the percentage of fatal cases. Scarlet fever of a sloughing and gangrenous type has come more frequently under my notice amongst the dirty and neglected than amongst children who were well cared for and well nourished, yet most of us must remember cases even of this kind amongst children surrounded with every luxury and comfort.

No doubt the deaths from zymotic disease being more numerous in one year than another do affect the annual returns of mortality, and this is more shown in the

weekly bills of large towns, but as one zymotic is more prevalent in one year, and another in a different year, it is only in a very wide-spread and fatal epidemic such as 1870 that scarlet fever can be clearly seen to have an influence amongst such a large number of other causes.

Of the means by which the infection of scarlet fever is spread, little is known with certainty; there is no proof that it can be disseminated through water, or by milk walks, except by the agency of the milk-man or his clothes, as in the case of typhoid fever, no evidence that the dejections can contaminate wells, or that the poison can be conveyed by drainage: there is no proof that it can be taken into the stomach by the agency of food or drink. The popular fallacy of its being carried by the desquamating epidermic scales has no evidence in its favour. There is a strong probability, amounting almost to certainty, that it can be taken in by the breath, and probably from the breath when there is sore throat, long before the period of desquamation. Surgical cases in the vicinity of the epidemic give every proof that it can be absorbed by wounds, or raw surfaces, as in direct inoculation, though this last process seems not to be often effectual when intentionally tried. Surgical scarlet fever is curiously almost always mild in character. The tendency to infection seems equally strong in puerperal cases, where the disease on the contrary generally assumes a very malignant type. The virus can plainly be carried by means of clothes, or even by less probable agents—as books, or papers. There is every proof short of absolute demonstration that it may be conveyed by a laundress from the mingling of healthy with infected clothes; it can contaminate cabs, or railway carriages; and it has a great power of inherent vitality.

Our present disinfecting agents of course only afford

negative evidence as to their utility, since what the germs may be, and what will destroy them, are alike unknown. There can be no doubt that some of the surgical cases at the Children's Hospital, that have occurred lately, have been under strict antiseptic treatment. The following case, proving how difficult it is to eradicate the poison, fell under my own knowledge:—A boy in a large family took scarlet fever. He was put into an attic which was made as bare as possible, and he and his nurse were completely isolated. The food, even, was left on a table outside the door, and the disease did not spread to any member of the house. He ended his desquamation, perfectly recovered, and after a necessary purification mixed with the other members of the family as usual, still no mischief occurred. The room and every thing which it contained were completely disinfected, the room was fumigated, whitewashed, freshly papered—everything, indeed, was done which ingenuity could suggest to purify it. Two months had now passed since the end of the illness, and all had gone right. Some visitors were coming to the house, and space was wanted. I was consulted as to whether two boys might be put into this room for a few nights, consent was given, and within forty-eight hours both had begun with scarlet fever, fortunately as mildly as possible. Of course they caught it in the room. The where was an easy question to answer, the how was far more difficult. The only practical reflection that occurred to my mind was that if men could breathe an atmosphere of 300 degrees with impunity, it would take a very great amount of stoving to destroy the germs of bacilli which might linger in a feather bed. When we know what the infective matter is, then it may be possible to destroy it. However, the following general rules must be carried out carefully:—Firstly.—The

strictest isolation. A nurse or mother going from the patient into another room, or another part of the house, is enough to make all precautions useless. The dress of a woman carries the poison more easily than that of a man does. Secondly.—Let nothing be in the room or come into the room which can by any possibility be left out. Thirdly.—Everything in the room must be either burnt, boiled, or stoved. Fourthly.—The room itself should be fumigated with sulphur, scrubbed out well with carbolic acid in solution, re-papered, and white-washed. Even then it should be aired by a fire and by open windows for many days before it is used.

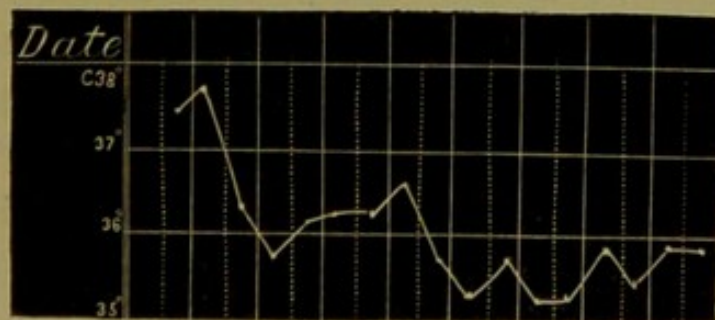
To give a rigid definition of scarlet fever is difficult, on account of abnormalities in exceptional cases, but it may be said to be an acute infectious febrile disease, occurring for the most part only once in life, usually characterised by a scarlet rash, more or less diffused over the body, generally commencing on the trunk, and accompanied by a varying amount of tonsillar or faucial inflammation. If the eruption be in patches, these have not the crescentic form seen in measles, and though the conjunctiva be injected, there is no marked coryza at the outset of the disease. The time of its incubation is undoubtedly very brief; my own impression, from the observation of many cases would be that it rarely exceeded forty-eight hours, but there is so much difficulty in fixing the exact period of infection that it is not easy to speak with certainty. Trousseau records a decisive case. Two sisters started, the one from Pau, the other from London, to meet in Paris. The sister from London commenced with scarlet fever on her journey. Now there was no scarlet fever at Pau, but the second sister showed signs of having taken the infection twenty-four hours after their meeting. Numerous instances are recorded of the occurrence of

scarlet fever after a long separation from any possible infectious case, as, for example, after a sojourn of some weeks at sea. The disease is here really taken from contact with some infected article, and, as before said, the evidence of the prolonged vitality of the germs is unquestioned.

The first characteristic symptom is usually sickness, with high temperature, and often a feeling of soreness of the throat. The following analysis of the precursory symptoms in sixty-six cases occurring at the Children's Hospital gives some idea of their relative frequency:— In forty-four out of the sixty-six, sickness was present, sometimes accompanied by a feeling of sore throat, sometimes not, but sickness always. A general feeling of illness, high temperature and headache, but no sickness, was noted in ten cases. The rash was the first symptom noticed in four instances, and one was ushered in by convulsions. Two-thirds of the cases were therefore sick. It is impossible always to predicate the future of the attack from the nature and intensity of the prodromata; thus, the single example of convulsions here recorded ushered in a very mild case; the violence of the sickness and the height of the temperature is a much safer guide. The sign, however, most to be relied upon, is the character of the rash; if the red points be few, surrounded by a pale rose-coloured eruption in wavy patches, showing, well and plainly, portions of healthy skin between them, it is ever a good symptom; if, on the contrary, the rash be confluent, of a deep purplish red hue, with the conjunctiva strongly injected, it is always premonitory of a severe attack, and especially if there are many puncta of a deeper scarlet, or of a purpuric character, visible amongst the general red ground colour.

As a rule, also, the more evanescent the eruption the milder the case, and in mild cases the rash is often only

visible for two days. The history of the cases in which scarlet fever is only the name of a disease (and which in some epidemics are fortunately frequent) may be summed up thus:—The attack is ushered in by a high temperature, slight sickness, and general malaise, with a pale rose-coloured rash coming out first at the root of the neck, then spreading to the chest and bowels, and from thence to the face and limbs, the rash being most marked in the warmest and most dependent parts. At the same time with the rash, or perhaps preceding it, is a redness of the posterior portion of the palate, and a swelling with or without slight follicular ulceration of the tonsils. Sometimes the anterior pillars seem to stand out with a sharp, clear edge in front of them, so as to hide them from view. After two days the temperature falls, the symptoms slowly subside, the eruption fades, and a slight bran-like desquamation of the skin takes place—perhaps in flakes on the hands and feet, and if no sequelæ follow, the case is over and the child is well, though care will be needed for two months at least; such is the mildest form in which this disease can occur.



Here is the whole history of a typical case of this kind. A. H., æt. 6, admitted November 2nd to Children's Hospital, felt poorly on the 1st; rash appeared on the 3rd; only lasted forty-eight hours, the primary sore throat was very slight; his highest temperature was on the morning of the 4th, 37.8°, or below 100° Fahr. After this

it never reached even the normal point. Desquamation, which was very copious, began on November 10th, and was ended apparently on December 12th. After about a week such a child would feel well, and if left to himself would run about, infect plenty of other people, and very likely get secondary kidney mischief with dropsy, and die. In strong contrast with such mild cases are those in which the disease ends even more rapidly, but not in recovery. Trousseau records two, one of which died in twenty-four hours, and the other in eleven hours from the commencement; in both there was a very rapid pulse, great heat of skin, vomiting, and intense delirium. The eruption had not time to appear, but other cases around made the diagnosis clear. Picot says the patient may be carried off before the eruption is evident. The malady commences with fever of extreme intensity, sometimes reaching or even surpassing 43° Cent. At the same time tremors, delirium, and convulsions are present, and, in children especially, subsullus or trismus. Often, besides these symptoms, there is an extreme dyspnoea unaccounted for by any condition of the thoracic organs; at last the patient falls into a deep stupor, and soon death happens. Sometimes this takes place on the first day, and it is rare for life to last beyond the second. Two such cases have fallen under my own notice. One was a strong young lad of about seventeen years of age. In his case there was a burning skin, a very rapid pulse, vomiting, and delirium, rapidly terminating in coma, the conjunctivæ were red and glassy, and a dark purple rash appeared in patches about the chest. The urine was collected, and contained the elements of bile in abundance. He died comatose in less than forty-eight hours. Other instances occur in which, though they are not so rapidly fatal as these,

there is considerable danger from the very commencement; in fact, every link may be met with between the mildest and severest forms. Cullen, when labouring (as it would appear to the reader, against his own inward convictions) to prove his scarlatina anginosa and his cynanche maligna to be distinct diseases, yet allows that the extremes of each meet. His third and fourth reasons for regarding the two as separate give such strong evidence as to the varying severity of different epidemics, that they are worth our quoting.

“Thirdly, though in all the epidemics that I could allege to be those of the scarlatina anginosa, there have been some cases which, in the nature of the ulcers, and in other circumstances, exactly resembled the cases of the cynanche maligna, yet I have as constantly remarked that these cases have not been above one or two in a hundred, while the rest have all of them been with ulcers of a benign kind, and with circumstances, hereafter to be described, somewhat different from those of the cynanche maligna.”

“Fourthly.—On the other hand, as I have two or three times seen the cynanche maligna epidemically prevailing, so, among the persons affected, I have seen instances of cases as mild as those of the scarlatina anginosa usually are, but here the proportion was reversed, and these mild cases were not one-fifth of the whole, while the rest were of the putrid and malignant kind.”

In young children death sometimes takes place on the third or fourth day, not from the violence of the first poison, as in the cases recorded, but with every symptom of scarlet fever well marked, and well developed. The eruption in such cases is dark purple red, the face engorged, the glands of the neck swollen, the throat with an ashy slough covering the fauces, a copious acrid discharge flows from the

excoriated nostrils, the temperature does not fall, the pulse cannot be counted, and the child sinks, worn out by the fever and by the labour of breathing; but these are exceptional cases. The more ordinary course of the severe form known to older writers by the name of *scarlatina anginosa*, without any further complication, may be thus described: A child previously well complains of headache and langour, sickness soon comes on, the skin is felt to be intensely hot, probably there is sore throat; after a few hours, in which the sickness is almost constant, a rash appears on the chest or stomach, at first in scattered points soon spreading into larger patches, the child becomes delirious, the pulse is very frequent, the skin becomes hotter, the rash becomes more marked, and spreads upwards to the neck and face, and downwards to the extremities, it becomes dark deep red with purplish or crimson puncta; very little if any of the skin is to be seen between the patches of eruption, the urine becomes scanty, the throat and palate are swollen, as also the glands of the neck, the conjunctivæ are red and glassy, the tonsils have on each a dirty sloughing sore, perhaps circular in form, perhaps in separate patches, but more generally as a longitudinal fissure sometimes spreading to the fauces, the uvula is much swollen and turgid, so as to impede the breathing. After lying for about twenty-four hours in this state the sickness gets better, the temperature slightly falls, though to rise again with the evening exacerbation, the sleepy condition, half coma, half delirium, gradually and slowly passes, and the progress towards recovery begins, the tongue loses its first furred state, and becomes red with swollen papillæ, a condition of tongue as characteristic of scarlet fever as the very eruption itself; sudameria now appear about the lower part of the neck and chest, the sloughs are

thrown off from the tonsils, the patient breathes and drinks more freely, and the fall of temperature continues ; about the fourth or fifth day the eruption begins to fade, and soon after the skin peels off in scales. About the twelfth or fourteenth day the patient, though still very weak and ill, is of normal temperature, and, as far as the primary effects of the disease are concerned, out of immediate danger. The desquamation is probably not completed for another month or six weeks. It is impossible in so general a view to give the various conditions and changes in function of every affected organ, so it becomes necessary to examine them each somewhat in detail, and as it were separately. Firstly, then, with regard to the skin, it is difficult to fix any exact time for the appearance of the rash. Sennertus, who wrote in the beginning of the seventeenth century, and was therefore before Sydenham's time, says of it : "Maculæ rubræ per universum corpus, quasi quædam parva erysipelata erumpunt in principio, seu morbi die quarto vel quinto." It may vary with the epidemic, but certainly my own experience would teach that it always appears before the close of the second day. Sometimes, as before said, it is the first recognisable symptom. When its appearance is only a question of hours, the time stated would much depend on the power of endurance of the sufferer, and the keenness of observation in those around. Its duration may be said, as a general rule, to be in direct proportion to the severity of the disease. Seventy-four cases from the Children's Hospital are here tabulated :

Visible duration of Rash.	No. of Cases.
2 days	14
3 days	4
4 days	6
5 days	19
6 days	14
7 days	11
8 days	6

The epidemic of 1881 was prolific in mild cases, and hence the large number for two days only. Five or six days is the usual length of time for a severe but not dangerous case. The eruption first commences at the root of the neck and upper part of the chest, at first consisting of minute distinct scarlet points about the size of a pin's head, these spread so as to form a scarlet rash, more or less confluent, the whole surface seems swollen, as is especially noticed in the face and hands, in mild cases there are free patches of skin between the rash which has been defined to be "a large scarlet red, irregularly margined exanthem," and Sennertus says well of the severer cases: "Universum corpus rubrum, et quasi ignitum apparet, ac si universali erysipelate laboraret." This redness has in these cases rather a livid or violet hue; the dark puncta are clearly visible, and often livid spots or even blotches of purpura are mixed with them. Some authors even describe a gangrenous state in which blisters are found on the cutis, with a fetid fluid beneath them. Sometimes the eruption is only partly developed and in patches, sometimes it is entirely absent, and often those who have had scarlet fever previously, when subject to the risk of infection, have an ulcerated sore throat, but no rash whatever. It does not seem to be a mere congestion of the skin, since Fenwick describes a distinct exudation into the rete malpighi. Yet the hue depends on congestion, for pressure will empty the vessels and make the surface temporarily pale. Moreover, the redness varies with the position and temperature. After the eruption there is a great production of epidermic scales, followed soon by an abundant exfoliation, and this desquamation and the eruption are not always in proportion to each other; generally the skin peels in small bran-like scales from the body, or at

the most in small plates ; but in larger flakes from the hands and feet, sometimes the skin of a finger coming off like a glove, and some authors describe even the shedding of the nails. The falling off of the hair is more frequent. In severe cases the desquamation begins before the rash has faded, the process is often not completed for weeks, and occasionally more than one peeling takes place.

Picot so well describes the tongue that a translation of his words will be our best text : " The tongue is at the commencement covered with a whitish yellow fur on the centre, whilst the sides and tips are of a vivid red, then it cleans, and all its surface presents a strawberry appearance, and a velvet-like look owing to the prominence of the papillæ ; the lips are red, dry, covered with sordes, often ulcerated and bleeding." The strawberry look of the tongue is most characteristic. To this account may be added that in the worst cases the tongue becomes swollen, brown, and dry, coated with sordes, and presenting much the same look as in typhoid. The throat may present every appearance from a simple congestion, and increased depth of colour, with slight swelling only, to a gangrenous slough involving the whole fauces, the ulceration extending into the posterior nares above, and the pharynx below, with often considerable œdema, though rarely ulceration, of the larynx.

The more common forms are slight swelling of the velum, the tonsils and uvula reddened, with slight follicular ulceration of the former. This is very mild. In the next form we see the velum and uvula swollen and shining, the anterior pillars œdematous, and an ashy slough on each tonsil ; and in the third we find the posterior nares and pharynx as it were involved in the mischief, and secreting a fetid ichorous fluid, the whole palate swollen, and the sloughs extending beyond the

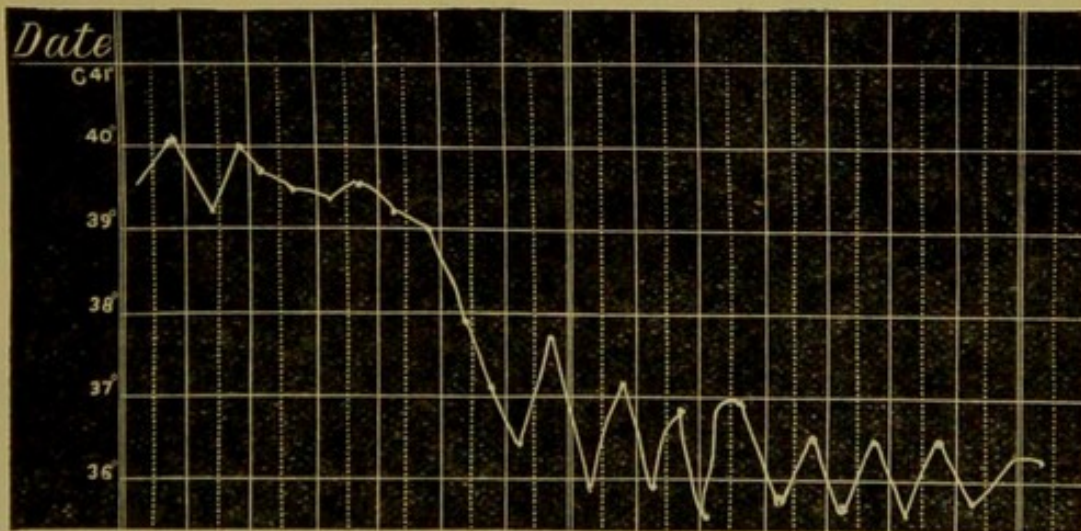
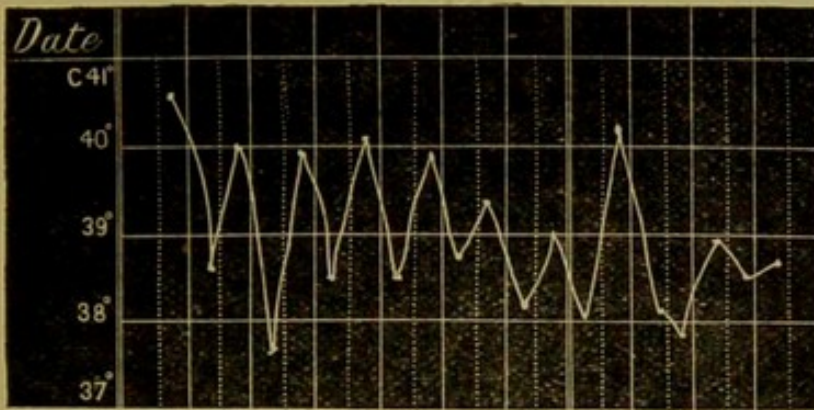
tonsils, and reaching the velum and uvula, the larynx often œdematous but rarely ulcerated. This is one great difference between scarlet fever and diphtheria, nor does it seem to me that Trousseau speaks too strongly when he says, "Scarlet fever abhors the larynx," so rare is it to find decided ulceration here. It may be said, moreover, that the sloughs of scarlet fever are very different from the membranous exudation of diphtheria, and, though often described, the combination of the two diseases must be very rare. In these three forms of sore throat the scarlatina simplex, anginosa, and maligna of old writers are attempted to be sketched out, but there is every gradation between the cases.

It is only in the severest forms that ulceration extends into the inner ear, but there is very frequently a discharge from, and ulcerated condition of, the external meatus. The glands of the neck are always large and swollen, generally in proportion to the more or less throat mischief. In this condition there is rarely much injury to internal organs, save congestion. The spleen is, however, slightly enlarged. There is almost always delirium, generally with a tendency to sleep or stupor, sometimes, on the contrary, intense wakefulness. Convulsions, as before said, occasionally usher in the attack.

The temperature is always high, often very high at the outset, sometimes as high as 43° Ct., often reaching to 40° and 41° . In a case that tends to recovery, the fall is rapid, and the evening exacerbations not high; in a case tending towards death, the morning remissions are great, but the temperature is again regained at night, and there is no gradual downward movement. Some authors have mentioned a desquamating febrile period. Of this myself I can find no evidence.

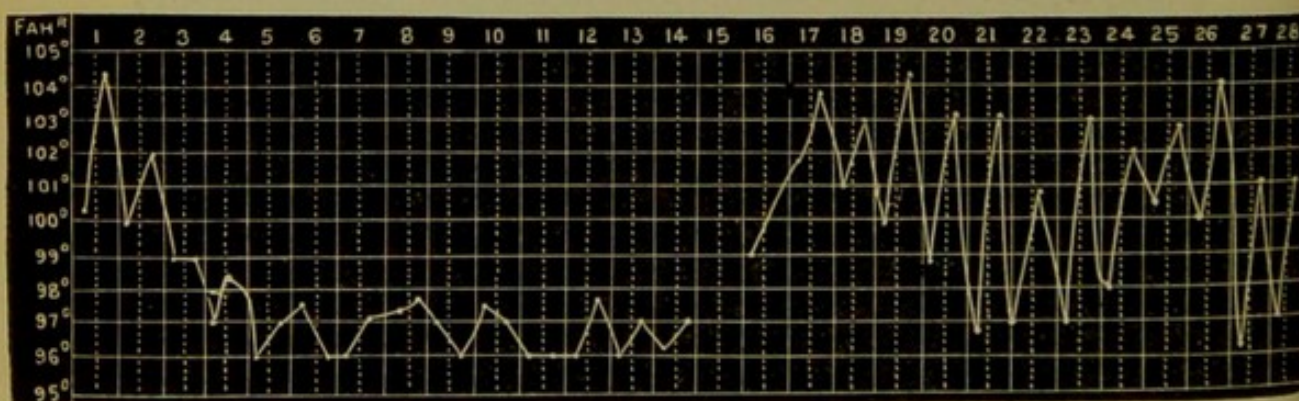
The charts give the temperatures of two cases, one of

which ended fatally, whilst the other terminated in convalescence. Both begin with a high temperature, but in the favourable example a rapid descent soon takes place, whilst in the other the evening temperature always regains the slight decrease of the morning. The pulse is always very high, and sometimes it cannot even be counted; the breathings are quick, more rapid than the



chest symptoms, or often even than the throat accounts for. The kidney secretion is always scanty during the first day or two of the fever, it is generally acid, apparently from lithates. The appearance of albumen in the early stages of the disease is rare, and when existing always an unfavourable sign. Constipation is the rule during the febrile attack. If diarrhœa be present, it is a bad symptom.

The earliest sequela, if indeed it can be called a sequela, for in some cases it seems to be a direct continuation of the malady, is a rapidly increasing swelling of the neck, usually beginning just beneath the parotid, near the angle of the jaw, and often at first confined to one side. There is much that resembles pyæmia in the mode in which these attacks commence; often the case, though generally a severe one, seems going on favourably, when, about the middle or close of the second week, the temperature rises greatly, and at the same time a shining swelling becomes visible in the neck; such a sign is always of grave import, and augurs badly for the future of the patient; however favourable the symptoms were before, the case now assumes the most malignant aspect. This primary sequence is much more common in some epidemics than others, and was notably so in Birmingham during the fatal years of 1873 and 1874. Sometimes the symptoms, dangerous from the first, have never subsided, and the scarlet fever seems, as it were, to merge into this fresh invasion; at others, there is a distinct interval of remission, and the second attack comes on as a sequela, generally



TEMPERATURE CHART OF A CASE OF SECONDARY NECK SWELLING ENDING FAVOURABLY. THE SWELLING COMMENCED AT THE BEGINNING OF THE 3RD WEEK.

during the course of the second or beginning of the third week; the neck then begins to swell, the throat

internally becomes much worse, or ulcers break out anew, the pulse becomes very rapid, the evening exacerbations of temperature are very high, so that the lines zigzag much; as the case progresses, the neck is so swollen, that just below the angle of the jaw it seems more prominent on each side than the face itself, the swelling becomes glazed and shining, tense and almost brawny to the touch, the nostrils are now ulcerated, and filled with an acrid secretion of mucus, so as hardly to admit the passage of air, the lips are dry, swollen, and excoriated, the gums and teeth are coated with sordes, the whole mouth is swollen, the uvula and tonsils enormously so, and coated with a grey dirty slough, the larynx œdematous, the tongue is brown and thickly coated, the breathing is very difficult from the mere mechanical obstruction to the entrance of air; even an attempt to drink generally causes the return of the fluid by the nose passages, bringing with it a quantity of the acrid secretion, the whole face is of a livid red, every feature swollen and turgid, the eyes congested and glazed, the mouth open and the fœtor of the breath intolerable. It must have been cases like these that made Morton, in his account of the epidemic of 1696, exclaim with somewhat of the rapture of an enthusiast, "*Quantum tonsillas, uvulam, fauces, nares, et quam diu intumuisse vidi! quam turgida nonnunquam labia! et quam sordidâ scabie obducta et exulcerata ab eâdem causâ animadverti!*" As the disease progresses the swellings under the angles of the jaw grow larger and more shining, the whole cellular tissue of the neck is infiltrated with serum, and hence an indistinct sense of fluctuation is given to the finger, the tense skin often sloughs, and the sloughing then extends rapidly over the neck. Many times have I seen the whole of the posterior triangle as clear and distinct as in the dissecting room,

the cellular tissue perfectly sloughed away, and the posterior portion of the omohyoid plainly visible.

Death from hæmorrhage is said not to be very rare in these cases, but the only instance that has fallen under my own notice was in a very young child, and here it was the internal and not the external sloughing that caused the mischief, some branch of the tonsillar artery being eroded. When this secondary scarlet fever assumes the malignant type here described, it usually ends fatally, the causes of death being either slow suffocation from the swelling of the throat and nostrils, or else exhaustion from the febrile heat of the body; true abscesses sometimes form in the neck, or perhaps noma, or some other phagedenic ulceration helps the work of destruction. It is chiefly in these cases that those extensions of the disease to the internal ear occur, causing not only total deafness, but perhaps death through a slow caries of the temporal bone even after the lapse of many years. Diarrhœa perhaps ends the history, the kidneys almost always participate in the mischief, albuminuria being a very frequent concomitant symptom. These cases bear, as before said, a marked resemblance to a secondary or pyæmic poisoning, and they are here described as the first sequela of scarlet fever, since often there is a distinct remission, and every hope of recovery when this second outbreak commences, but at other times the primary attack seems gradually to glide into the condition here attempted to be described, but which no words can accurately paint.

It is necessary to say a few words upon treatment, and would that here any definite plan could be laid down for guidance in all cases! All ideas of prophylaxis need only this mention, that they are worse than useless, they turn the mind from the real and only true prophylactic, which is isolation and separation. The simple cases of scarlet

fever first mentioned need no treatment except confinement to bed, and this should be done however slight the attack, for at least six weeks, a mild drink of chlorate of potash, with a little lemon or orange tea is all the medicine needed. In the more severe forms, some tonic should be given that does not check skin action but rather encourages it. A good prescription is the tinct. of muriate of iron added to the solution of acetate of ammonia; probably the mixture is in part at least acetate of iron. Some use chlorate of potash with the ammonio-citrate of iron, and others quinine with the chlorate of potash. All these medicines fulfil the same end. Free ammonia in any form has this objection, that it causes great pain in swallowing. Wine or brandy are often needed in the more malignant forms; in the very severe sequelæ, and in the more dangerous forms of sore throat, constant watching and nursing are required; ice should be given to the patient to suck freely, the nostrils should be frequently syringed out with a solution of chlorinated soda, or much diluted hydrochloric acid, and the throat should also be swabbed out with either the same solution or with tincture of muriate of iron, and if the ulceration show signs of spreading rapidly, this last may even be used undiluted. True abscesses must of course be opened, but it is useless to open the parotid swellings described; the cut edges become everted, and form the commencement of a future slough. If the temperature be very high, cold affusion should be tried. This is one of the remedies about the use of which it is most difficult to speak, since it is usually only tried as a last resource in those cases which seem to hold out little hope without it.

The credit of the first use of this remedy in fever is due to Dr. Currie. After describing in very accurate language the advent and progress of a severe case of

scarlet fever, and laying stress upon the high temperature of the body in this disease, higher, as he points out, than in any other febrile affection (the temperature he says he has known as high as 112° Fahr.), he gives the following details of his treatment by cold affusion.—“The plan that I follow, if called in at an early period, is to strip the patient, and dash four or five gallons of the coldest water to be procured, over his naked body. This produces its usual cooling effects, but these are less permanent than in typhus. In one or two hours afterwards the heat is often found on examination as great as before. The affusion is therefore repeated again and again, as the obstinacy of the heat may indicate. It is sometimes necessary to use it ten or twelve times in twenty-four hours. At the end of this time, but commonly earlier, the force of the fever is broken, and a few tepid affusions at longer intervals are sufficient to subdue it entirely.” Most graphic is his account of finding nine children ill with fever in a court at Liverpool. “The mode of applying affusion was simple enough. The weather was warm, and the patients were brought out into the middle of the court naked, where the water from the neighbouring pump was dashed over them. As the heat declined the water was made tepid. Not only was the affusion employed for the sick, but once a day for the children in health also. It might serve as a preventive, and at any rate it promoted cleanliness, which was enforced as essential.”

In Ziemssen's *Cyclopædia*, Thomas, the author of the article on Scarlet Fever, says, “In cases of mild scarlet fever, where the children are especially sensitive to cold, and the parents very apprehensive, it is best to use only the warm baths, bearing in mind, however, that such considerations should have no influence in preventing the carrying out of the appropriate and correctly administered

cold water treatment, which alone is suitable in serious cases with an intense degree of fever."

Trousseau again speaks equally clearly upon this point:—"I declare to you," he says, "that I have never resorted to the employment of cold affusion without obtaining beneficial results." "Even those who died experienced a temporary relief from suffering, and the affusion always moderated the symptoms; and you must not flinch from having recourse to this method of treatment because it is opposed to the prejudices of the public." Independently of this medical use of cold water when the temperature itself is a source of danger, tepid baths are a great comfort to patients during the process of peeling, and may be always used with perfect safety.

Certain circumstances would seem to teach us that the exfoliation of the skin is not the direct consequence of its death by the inflammatory eruption, but is just as much a phenomenon of the disease as the eruption itself. Cases have occurred to myself where no redness was visible, and yet the peeling of the skin has taken place. Graves, in his clinical lectures, relates a very striking case of this kind; it occurred in a lady whom he visited twice a day for the first four or five days of her illness, carefully examining the skin at each visit; but he could not discover the slightest trace of any efflorescence, "yet the result proved that it was scarlatina, for the desquamation of the cuticle, which always attends the disease, took place, and the lady communicated the infection to others. "Here," he adds, "we had an extensive desquamation of the cuticle without any eruption." It is during this period of exfoliation that the real sequelæ of scarlet fever take place. Very variable is it both in amount and duration, and sometimes the process seems to be repeated more than once, and that, even in cases where there was only a single eruption;

a second rash being by no means a rare anomaly. The following is an analysis of the duration of desquamation in fifty cases, watched from the commencement of the eruption :—

DATE OF CLOSE OF DESQUAMATION, DATING FROM BEGINNING OF RASH.

Below 30th day	.	-	-	-	6 cases.
Between 30th and 40th day		-	-		10 cases.
Between 40th and 50th day		-	-		17 cases.
Between 50th and 60th day		-	-		11 cases.
Over 60 days	.	-	-	-	6 cases.

The majority, therefore, completed the peeling process between the 6th and 7th week, the quickest case ended on the 14th day, and the longest on the 80th. Long as the time may seem, no one can be called completely well until this period is over.

The sequelæ of scarlet fever are so varied that they well constitute by themselves a distinct chapter in its history, and no notice of the disease can approach completeness unless it takes cognizance of them. First in importance, as well as in frequency, is, without doubt, the form of nephritis known so well as "scarlatinal dropsy." The earliest writers mention this as a common complication of the disease. Sennertus speaks of it. Schultzius, in recording the epidemic of 1664, as it occurred in Poland, says that there was frequently a swelling of the whole body, as in a leucophlegmacy, and that its end, after a troublesome duration of some weeks, was either by sweating or by an increased secretion from the kidneys, "sudoreque etiam solvebatur, interdum etiam urinâ largius profluente." It may come on at any time during the first two months, even when the patient seems to be quite well. At the same time with the desquamation of the skin, there is a tendency to catarrhal inflammation of the kidneys; and if any extra-work be thrown upon them, as by cold

checking the skin perspiration, or even by an injudicious meal, scarlatinal nephritis, albuminuria, and its concomitant dropsy, are the results. Those who know nothing of the importance of warmth after this disease, do not restrain their children from going out into the air and getting chilled, and in consequence many a little patient, who was seemingly well the day before, awakes on the following morning with his face swelled and œdematous; and this sudden development of dropsy may come on after even the mildest attack of scarlet fever, so mild that sometimes the disease itself has not been noticed, and the dropsy is the first symptom seen by the parents, and the malady for which the child is brought under medical care. It does not seem to me, as many say, that dropsy is more common after mild attacks: the truth rather being that people are more heedless after them, and that less care is taken of the patients.

Here an important question is prominently brought before us: Is nephritis an integral part of scarlet fever, as bronchitis is of measles, or is it a direct consequence of cold acting upon a skin in a state of hyperæmia, and thus an accidental sequela only? This is an important difference in a pathological sense, fortunately not so important in its relations to treatment—fortunately, for it cannot be said to be completely settled. Yet, to my mind, there seems little doubt but that the poison has a natural tendency to affect the kidneys. The mucous membrane of the lungs is rarely attacked in scarlet fever, whilst in measles it very rarely escapes; on the contrary, the kidneys are very rarely the subject of disease in measles, frequently so in scarlet fever. In diphtheria there is the same tendency to kidney irritation, yet there is no hyperæmia of the skin, and no desquamation of the cuticle. Again, just as in some epidemics of scarlet

fever there is a greater tendency to severe sloughing of the throat than in others, so in some there is a greater tendency to kidney affections; and in some severe cases albuminuria is coincident with the rash. There are authors who have said that such is generally the case, but they must have been misled by the peculiar character of the epidemics which they have witnessed; for certainly there is neither catarrh of the kidney, nor albuminuria, as a common rule, in the early stages of scarlet fever: they come on at a later period of the disease.

The effects of scarlet fever on the secretion of the kidneys are, (speaking generally) the following: at first during the rash the urine is diminished in quantity, acid, and loaded with urates, it then becomes more copious, and this continues until the third week, when there is very frequently a little rise in the temperature which had before gained its natural standard, and coincidently with this a second diminution in the water, which now contains much mucus. In a few days this passes away, and again the secretion is poured out in natural quantity. Renal catarrh to this extent seems from my observation to be a part of the natural history of the disease. The following analysis of ten cases of albuminuria occurring in the Children's Hospital during the last epidemic serves to illustrate this point. These, it must be remembered, are cases occurring naturally, where the child was carefully tended during the whole illness, and kept in bed, so that cold can hardly be admitted as an important cause:—

- 1.—Albumen appeared gradually at the end of the second week. Secretion of urine diminished.
- 2.—Albumen appeared gradually in the third week of disease. Secretion of urine diminished.
- 3.—Similar.
- 4.—Albumen appeared gradually in the second week. Urine diminished.

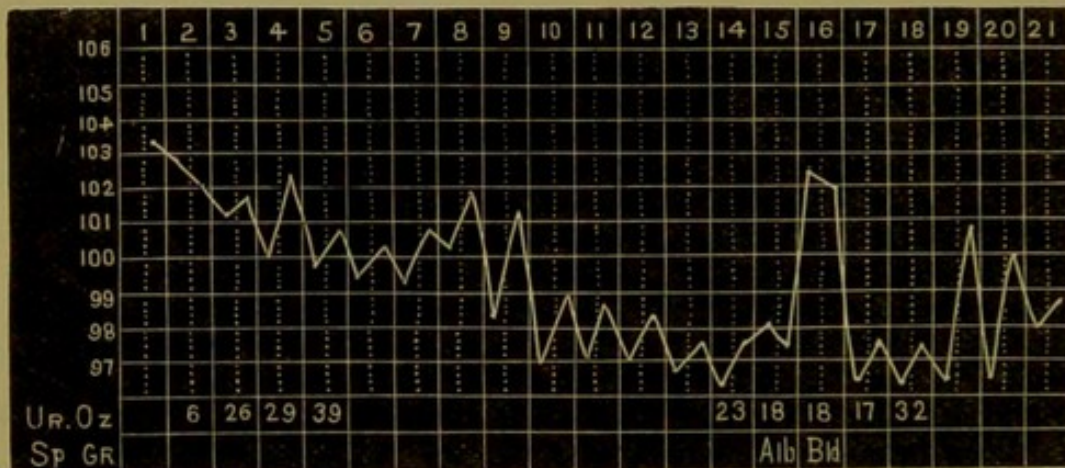
- 5.—Albumen appeared gradually with much diminished kidney secretion at the end of the second week, during the third week, blood appeared in the urine.
- 6.—Slight albumen at the end of the second week with marked increase in the secretion.
- 7.—Albumen came on gradually during the third week with diminution of the secretion.
- 8.—Ditto ditto
- 9.—Slight albumen at the end of the third week, with great increase in the quantity of the secretion, sp. gr. 1.010.
- 10.—After a few returns of great nightly exacerbations of temperature, blood appeared suddenly at the end of the second week. This case, which was very severe from the commencement, ended fatally.

From these cases it would seem that the natural time of the occurrence of kidney catarrh is during the third week, but it must be remembered that these examples are taken from one epidemic only. Certainly my impressions from out-patient work were that the advent of albuminuria was at a later period; yet the longest interval of which accurate and reliable notes were taken under my care, came on during the sixth week. Probably cold may act as a cause after this time. If the accounts of parents, in dropsical cases, were to be relied upon, such would certainly be the fact; but it is probable that in most of these albuminuria has been present for some time unnoticed, and its duration is uncertain; indeed in neglected patients it may last for months.

The microscopic examination of the urine at this stage shows an abundant shedding of renal epithelium, and some granular casts even when no albumen is detected in the secretion, when this is present the same appearances

are found, the casts more numerous, though rarely plentiful, often also blood corpuscles, generally more or less disintegrated.

In two of the cases here recorded, the presence of albumen was coincident with a marked increase of urine. This increase was only temporary, lasting for one day, and



TEMPERATURE CHART OF CHILD WITH ALBUMINURIA COMING ON DURING TREATMENT IN BED—ALBUMEN APPEARING ON THE 15TH AND BLOOD ON THE 16TH DAY—URINE DIMINISHED.

in both cases, as might have been supposed, the albuminuria was slight, and of short duration. In the other eight instances secretion was considerably lessened, in some almost totally suppressed, being reduced in one case to three, and in another to six fluid ounces. This diminution usually only continues for a day or two, gradually regaining the normal standard. It will be noticed that in seven of these cases the albuminuria commenced gradually, but in one the onset of the attack was severe and sudden. This is rare where the kidney inflammation has what may be termed a natural origin, but more frequent where cold is an important factor in the attack; that is in those cases where the natural tendency which the disease shows towards catarrhal nephritis is aggravated by improper exposure. The view here advocated is, therefore, that the scarlatinal poison

has a natural tendency to attack the kidneys, since, without doubt, some who have been most carefully nursed and kept warm throughout the disease, become dropsical; but cold greatly increases this tendency, and is an important agent for mischief.

About the third week of scarlet fever, it therefore follows that we have a right to dread nephritis as a complication. Sometimes there is a warning given of its advent by a diminution of the urine with mucus deposit and increase of temperature. Sometimes the amount of albumen is very slight at first, the attacks commencing gradually; in others, especially where exposure to cold has been a cause, the mischief commences suddenly, and apparently without warning, so that, as before said, a child may go to bed well, and awake up dropsical in the morning.

Dropsy is not a necessary sequence of albuminuria; if the kidneys can still perform their functions fully, it will not occur; but this is not usually the case, and hence effusion into the subcutaneous areolar tissue generally follows in a day or two after the albumen occurs in the urine, sometimes comes on simultaneously with it, sometimes even slightly precedes it. The face is at first pale and puffed, the whole body then soon becomes dropsical, the swelling being especially marked in parts where the cellular tissue is loose, as in the orbits and the genitals; the skin around the eyes is often so distended as to seem half transparent, but indeed the whole body often becomes œdematous very rapidly, so that the hands and feet become enormously swollen. Nor is this all, for there is often œdema of the lungs and of the brain in the severest forms, ascites is frequent, and more rarely effusion into the pleuræ, pericardium, or ventricles. The urine during this time is generally scanty, containing a varying amount of

albumen (sometimes so much that it becomes almost solid on boiling); often also blood, sometimes fresh and scarlet, but more generally recognised by its smoky colour. The microscope shows urates in plenty, abundant renal epithelium, and casts—for the most part granular, but sometimes hyaline and transparent.

From what has been before said as to the modes in which the albuminuria begins, it may almost be deduced that the dropsy would also have, as it were, two modes of commencement, the one acute and sudden, the other more gradual; and such will be found to be the case in reality. Of course, the more rapid the onset of the dropsy, the more need there will be of vigorous treatment; but in all cases the drain of albumen is quite antiphlogistic enough, and though the severity of the symptoms may make it necessary to relieve kidney mischief by such local means as leeches, or cupping, yet general depletion, such as was formerly used in this acute dropsy, is better avoided.

There is very little natural tendency towards recovery in these cases. If left alone they gradually become worse, and the effusion greater. The chief tendency to death is however from the œdema of the lungs, and the great impediment to breathing. The child in such cases becomes a pitiable object, sitting up in bed, with the face livid in colour, and enormously swollen, looking as if its whole remaining life was an effort to breathe, or perhaps lying down scarcely conscious, yet struggling for power to draw air into its lungs—perhaps effusion into the pericardium impeding the heart's action at the same time. Obviously, our common sense points clearly to the treatment in these cases, and it should be carried out vigorously and decidedly. The kidneys will not act, they are actively congested, but the system must be speedily relieved through other channels. If the bowels be chosen, there is no better

agent than the old compound jalap powder, which should be given freely so as to produce copious watery evacuations. This rarely fails to produce relief. If it be preferred to act on the skin, the hot air bath is the most certain diaphoretic, both methods may indeed be combined. As an adjunct to these, mustard plasters to the loins, or dry cupping are very useful, and certainly aid in relieving the congestion of the kidneys. The diet must be chiefly milk. When the albumen is nearly gone from the urine, and the patient seems almost convalescent, one meal of meat is often quite sufficient to cause a complete relapse.

Sometimes, perhaps suddenly, perhaps during the course of a previous nephritis, but more generally where the patient has been neglected and cold has been allowed to add to previous mischief, the urine becomes almost entirely suppressed, the little that is passed being of a dark smoky brown from the presence of altered blood; coincidently with this suppression, the patient complains of severe headache, and there is frequent vomiting; the pupils of the eyes are also widely dilated, the sight may be dim, or, indeed, there may be temporary blindness, and there is often an obvious tendency to coma; slight pain in the back may be the only other symptom. These are, however, signs of the greatest import. Vomiting alone is always a grave symptom in albuminuria; uræmic convulsions speedily follow, the patient has a violent epileptic fit, from which he lapses into coma; in a very short period another fit occurs, and these may alternate with coma at brief intervals until death closes the scene.

In such cases as these there is little time to spare, and the treatment must be proportionately vigorous; here, as in other forms of scarlatinal dropsy, it must be directed towards relieving the congestion of the kidneys, and making some other organ do their work until they are

able to resume it. The convulsions are not from œdema of the brain, but from uræmic poisoning, and means to eliminate that poison must be adopted. A little blood may be taken from the loins by cupping; and if the patient be in any way able to swallow it, the compound jalap powder may be given as before; if not, calomel in powder may be placed on the tongue, and the hot air bath used so as to make the skin act vigorously; and indeed in this the convulsions are in a certain sense beneficial, for a copious perspiration often occurs during the paroxysms. By such means these cases are generally relieved, though sometimes they are fatal in spite of all treatment. As in the convulsions of children, so here, hemiplegia may follow, and in some cases leaves a certain degree of weakness of the affected side. This is, however, a rare sequence. One case especially recurs to my own mind, where the movements of both arm and leg were very much weakened, and remained so to the end of life, which was prolonged for several years.

Here it may be worth while to pause for a moment and consider how wide the divergence is between scarlatina and diphtheria in their sequelæ. After scarlatina, paralysis is a very rare and unusual symptom, after diphtheria it is so general as to form part of the usual history of the disease. If the drain of albumen were the cause in diphtheria it would be equally the case in scarlet fever; such, however, is not the fact. The paralysis of diphtheria may be regarded as part of the disease, and dependent on the same specific poison.

It is impossible to speak with any certainty of the duration of scarlatinal nephritis, it seems to me to depend very much upon the care taken and the treatment employed; of course there would be in the young especially a natural tendency for the kidneys to return to

their normal state, and if the patient was placed in favourable conditions, such, in mild instances, would undoubtedly take place after probably a period of two or three weeks; but it is our obvious duty to aid nature in all such cases, and not to allow the experiment of a spontaneous cure. Our duty is to relieve the congestion of the kidneys, and to supplement their work by increased secretion from other organs. The disease is one which may be much aggravated by neglect, either of treatment, or still more, as is often the case in the children of the poor, by the neglect of that primary rule in all illness, to place the patient in a favourable condition for recovery.

But sometimes scarlatinal nephritis becomes chronic, and the albuminuria lasts for months. There can be little doubt that if circumstances would permit, the best treatment here would be to send your patient to one of those warm Mediterranean climates where albuminuria is almost unknown; such however is seldom possible, and then our next best plan is to attend most carefully to diet, and to prevent any exposure to cold. The tincture of muriate of iron has seemed to me useful in some of these cases; if this fails, just as you would use nitrate of silver to an eye whose vessels are congested and relaxed, so here small doses of steel with tincture of cantharides, or copaiba, or turpentine may be tried. But in some cases the mischief does remain for years and doubtless becomes a grave source of future danger to the patient. Happily they are very rare.

LECTURE III.

SCARLATINA—FACTS.

NEXT in importance to scarlatinal nephritis is the occurrence of acute rheumatism. This may come on at any stage of the disease, and is therefore sometimes a complication, sometimes a sequela. Very strange is it, and a subject well worthy of our study, that a disease like scarlet fever should cause a malady which is certainly often the direct product of cold and damp. In the records of a case now before me, the rheumatic fever began on the sixth day of the illness, when the rash was



TEMPERATURE CHART OF A CASE OF SCARLATINAL RHEUMATISM,
RASH COMMENCING ON THE SECOND DAY, DESQUAMATION
ON THE FOURTH, RHEUMATIC FEVER WITH MITRAL MURMUR
ON THE SIXTH; RASH ENDING ON THE NINTH DAY.

still vivid ; it is, however, often a sequela occurring during the stage of desquamation. It is not so acute in its course as the common form of articular rheumatism, sometimes, indeed, only one joint is affected ; the effusion in many cases is also slight, though the part is always very tender to the touch. In some instances, however, effusion is more evident ; it may invade any joint, from the shoulder to the fingers, or the hip to the toes : the wrists, the ankles, and especially the fingers are frequently attacked. There does not seem the same tendency to

sweat as in the ordinary cases of acute rheumatism, but this probably arises from the diseased condition of the skin. The urine is acid, usually containing lithates, and in some cases crystals of lithic acid. Acute scarlatinal rheumatism may lead to any of the complications of the ordinary disease; thus endocarditis, causing permanent injury to the cardiac valves, is frequent; pericarditis is less common; pleurisy occurs sometimes. Pericarditis is always much to be dreaded; when it happens, the effusion is frequently large. Chorea follows sometimes in the wake of scarlatinal rheumatism, as it does after rheumatism of the ordinary type.

It sometimes happens that the synovitis is confined to one joint, and the attack is so severe as to lead to the formation of pus in its cavity. This has happened in one case seen by myself, when the knee was the joint affected; such a sequela is fortunately rare, but many cases are on record.

Phlebitis is sometimes an accompaniment of this rheumatic condition, and in one case in the Children's Hospital, the femoral vein was as completely plugged up as in a case of phlegmasia dolens.

Pleurisy occurs with rheumatism occasionally, but it is not very rare in scarlet fever without this as a cause; it may come on even during the acute stage, it is then usually confined to one side, and frequently purulent; it may again occur, but rather as a simple effusion than true pleuritis, during the course of dropsy, when it adds a heavy burden to the œdema of the lungs which is almost always present, and renders this more dangerous; it may also be a rheumatic complication as before said, or finally a true sequence of the disease; pericarditis and endocarditis must always be looked upon as of rheumatic origin, though either may be present without any joint affection; effusion

into the pericardium also frequently takes place as one of the symptoms of a failing circulation, and therefore one of the signs of approaching death. Pneumonia is met with sometimes, but certainly not more frequently than after other zymotic diseases, not so often as after measles or typhoid fever.

Diarrhœa is in some cases a prominent symptom during the course of scarlet fever. It seems in these rather anomalous instances, that there is much irritation of the solitary glands, and of Peyer's patches, which are often found swollen and inflamed, but rarely ulcerated; these exceptional cases somewhat simulate typhoid fever.

The lymphatic system is often considerably affected, and marked swelling of the neck glands remains long afterwards; it is not rare for them to suppurate. Boils are also frequent, as indeed they are after all the exanthemata. General tuberculosis sometimes follows, but probably only in those possessing a previous tendency towards the disease.

Periostitis and affections of the bones do develop, but rarely, during the later stages of scarlet fever.

The nervous system is much affected during the whole progress of the disease, the sickness, the delirium, the frequent coma, or on the other hand the utter wakefulness, show this clearly in the early stages, but in the later periods true meningitis occurs sometimes as a fatal termination; the symptoms which indicate its approach may be very anomalous, and there may be even no sickness, but the headache is usually very strongly marked. In a case that occurred at the Children's Hospital, under my care, and of which the notes are now before me, intense shooting pain in the head was noticed for a week before death; this, and slight drowsiness with high temperature being

the only symptoms until twenty-four hours before the end, when convulsions came on, alternating with coma: such cases are very easily distinguished from the uræmic convulsions before mentioned, to which indeed they bear no relationship. In this instance the *post mortem* appearances were as follow: the arachnoid was opaque, and there were patches of lymph amongst the meshes of the pia mater, the opacity dipped down between the convolutions. This was most evident on the upper and posterior portions, but not so marked anteriorly. At the base of the brain only slight opalescence was observed, and no lymph or tubercle in the neighbourhood of the optic commissure, or in the parts forming the floor of the fifth ventricle; the brain itself was soft, but clearly not œdematous, and there was considerable effusion into both lateral ventricles. Many cases of this post-scarlatinal meningitis will be found recorded in books, and several have come under my own notice: in most of these the amount of fluid in the lateral ventricles was large, but in none was there any œdema of the brain present, nor did they come on during the course of dropsy or albuminuria.

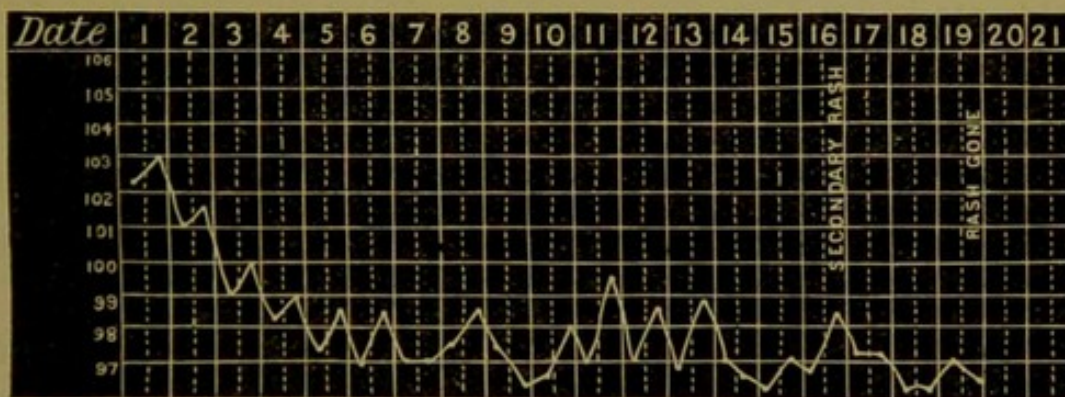
It has been before stated that hemiplegia, more or less complete, was a rare sequence of uræmic convulsions. Facial paralysis has more than once come under my notice; it has been usually only temporary, and seemed to arise from the great swelling of the tissues about the parotid pressing on the branches of the portio dura; in cases where it is permanent, caries of the temporal bone is the most probable cause to be suspected. There are some direct consequences of the previous throat ulceration which are rather extensions of the old mischief than true sequela. The two most prominent and dangerous of these complications are, retro-pharyngeal abscess, which may occur as a remnant of the ulceration, and caries of

the temporal bone, from the spreading of the disease to the middle and internal ear. This last is a most insidious danger. It may go on even for years with no symptom save the offensive purulent discharge from the ear, the total deafness on the affected side, and an occasional headache, until it develops itself suddenly with all the symptoms of acute cerebral abscess, and death speedily results. This disease of ear and slow spreading caries of bone must not be confused with a very common, and far more simple sequela of scarlet fever, namely, an offensive discharge from the external meatus with eczematous inflammation; there is no total deafness in these cases, and no perforation of the tympanum; it may indeed be thickened, and the hearing slightly impaired, but this is the worst evil which can take place—far different from the future danger of the more serious injury.

Of course any evil might happen during scarlet fever, but in this notice only those sequelæ have been mentioned which seem decidedly connected with the previous disease.

There are anomalies that sometimes occur, either at the onset or during the course of scarlet fever, which claim a few passing words of notice; amongst these, varieties in the eruption are the most frequent. This may be entirely absent, or so slight as not to be noticed, even though it be carefully looked for, and yet the desquamation of the skin may afterwards be more marked than usual. Sometimes when present it so departs from the common form of scarlatinal rash in appearance, that, except in the crescentic figure, it more resembles the eruption of measles, and in such cases it is the other accompanying phenomena rather than the rash alone which tells the true nature of the disease. It may

again be partial, and only invade some portions of the body; it may also be as it were postponed, and its first appearance may be delayed to more than the usual time after other symptoms have commenced. As has been before shewn, its duration is much more variable than in the case of measles, and may be generally stated to be in direct proportion to the severity of the attack. Sometimes, indeed not very rarely, there is a recurrence of the rash, or of a roseoloid rash resembling it even after the skin has commenced to peel: this secondary rash is not dangerous, and does not bring even much increase of temperature, as is shewn in the chart here added from a patient in the Children's Hospital. Petechiæ or purpuric



spots are so constant in the severe forms as hardly to be called an anomaly, but sometimes the plastic power of the blood is so changed that a temporary hæmorrhagic diathesis is established, and there is a tendency not only to large effusions of blood underneath the skin, but also to hæmorrhage from the different mucous membranes. Such a form of disease is always most serious. This form seemed to have been frequent in an epidemic recorded by Dr. Fothergill. He says—"some were comatous; others had a delirium; some died in a lethargic stupor; others bled to death at the nose." Fatal menorrhagia is apt to occur in women where there is this tendency; and very serious cases have come under my own notice.

There is a form of scarlatina which so resembles typhoid that there is sometimes almost a difficulty in distinguishing them, unless the whole history of the case is known, or it has been watched from the beginning, when the rash and sore throat, though these may be slight, would distinguish between the two. In these cases there is the same tendency towards stupor as in typhoid cases: there is tenderness of the belly, and diarrhœa is a prominent symptom; the patient is often deaf, and lies almost always drowsy, just as in ordinary typhoid. There is found on a *post mortem* examination in fatal cases, a diseased condition of the follicles of the large intestine, and of Peyer's patches, but these last are never extensively ulcerated.

Many other anomalies occur, but these may be summed up under three heads:—

- 1.—Variations from the longer or shorter duration of the natural concurrent phenomena, as for example the rash.
- 2.—Variations from the presence or absence of different sequelæ, as also from their degree of intensity.
- 3.—Variations, or rather complications, caused by accompanying diseases, as rheumatic fever or pleurisy.

All these have been before considered, and need now no second repetition.

It will be thought that comparatively little has been said of the treatment of scarlet fever. How can it be otherwise, when in one case the danger to life is from high temperature, in another from nervous exhaustion, in a third from dyspnœa? Every separate attack may require different remedies, and must tax the skill and judgment of the practitioner who treats it. The public

often seem to think that one drug is good for a cough, another for a fever, regardless of their exciting causes ; the physician feels that there are few, if any, specific remedies, but that every case needs his thought, and must be treated on its own individual symptoms.

There now only remains for us to consider the morbid appearances in fatal cases of scarlet fever ; and here it is not going too far to state that there is no great distinctive change which cannot be observed nearly as well during life. The anatomical lesions of the skin, and of the throat, and the swelling of the cervical glands are, it is true, characteristic enough, but they are all clearly visible during the progress of the malady : the changes in the kidneys would not distinguish it from diphtheria, and the slight enlargement of liver and spleen would even be more marked in typhoid fever. Other lesions will be found in almost every case, but these rather depend on the complications of the disease, than on the scarlet fever itself ; thus, as has been before said, there may be pleurisy, or pericarditis, or endocarditis, but the pathological changes would not be different from those occurring in the same diseases, when they are of idiopathic origin. Dropsy is so common a sequel that the state of the kidneys after death needs some special notice ; yet it must be confessed that there is nothing peculiarly distinctive in the changes found in these organs on an ordinary examination. They are usually seen to be swollen, with the fascia around them discoloured, and easily detached ; their surface is then found dull and paler than usual, with the vessels congested in little patches of ramifications. On section the cortical substance is thickened, pale in hue, and easily friable, the pyramids are more congested than natural, and the interior of the calyces is also redder than in the healthy kidneys.

It is in the minute pathological anatomy of scarlet fever that the chief interest is centered, and here the changes are many and very distinctive of the malady. Firstly, let us examine the skin. Here the increased thickness of the epidermis is a marked feature even in those cases where death takes place at a comparatively early stage; indeed the rete Malpighi is more thickened in the eruptive period than at an after date. The changes may be thus summed up briefly. In the corium there is usually more or less exudation, and amongst this are usually visible some lymph cells, or even blood corpuscles; the papillæ are enlarged. In the rete Malpighi there is at first considerable thickening, with effusion between the cells, causing the intercellular spaces to be more distinct than usual. That an increased energy exists in this layer is shown by the evident signs of division in the nuclei and nucleoli, and the consequent more rapid multiplication of the cells. The change of the superficial portion of this layer into the stratum corneum also takes place more rapidly, so that desquamation must be regarded as a vital process.

These changes in the skin also seem to affect the hair follicles and the sweat glands. In the hair follicles there is thickening of the internal, and distinct increased growth in the epithelium of the external root sheath. In the sweat glands is a more rapid development of the lining epithelia, with a coincident loosening of them from the basement membrane, so that the tube is completely filled.

The changes in the tongue, palate, and fauces are more or less those consequent on inflammation and ulceration, and it is to be noted that the ulceration of the soft palate is chiefly on its upper or nasal surface, and that in the pharynx the chief mischief is also in the part nearest

to the nose cavity. The tongue is always inflamed, the epithelium is thickened, and infiltrated with lymph cells; the papillæ are enlarged and swollen, owing chiefly to this same exudation, and hence giving the well-known strawberry appearance. The superficial layers of epithelium contain more of these migratory cells than other parts, these being chiefly contained in cavities formed by the partial destruction of this surface, which has quite a honeycombed appearance. Groups of micrococci are here met with, as well as on all the ulcerated surface of the throat. These probably have no peculiar relation to scarlatina. The follicles of the tonsils are always the centres of sloughs, which often extend deeply into the tonsillar structure; all the parts are swollen and infiltrated with lymph cells. The pharynx is chiefly ulcerated near the opening into the nasal cavity. These inflammatory changes extend to the epiglottis, where the posterior part is mostly affected, also to the larynx, and in a less degree to the windpipe. So, in a similar manner, the inflammatory process extends to the œsophagus, and indeed a catarrhal increase of epithelial elements seems to extend along the whole alimentary canal, the only remarkable change, however, being the enlargement of the solitary and aguate glands, and this is by no means to be met with in every individual case. In the salivary glands and pancreas, infiltration of lymph cells, chiefly around the divisions of the ducts and the larger vessels, seem to be the chief change in structure. The liver is always enlarged, but presents little real alteration, the chief increase in size being from effusion, and the presence of lymph corpuscles amongst both the intralobular and the interlobular ducts and vessels.

In the spleen there is "enlargement of the adenoid sheaths of arteries, and of the Malpighian corpuscles,"

“degeneration of arteries,” and “thickenings of the walls of large veins, owing to the presence underneath the endothelial lining of cell accumulations very much resembling adenoid tissue.”*

In all the lymphatic and the mesenteric glands the changes are essentially the same, though the glands of the neck are always the most diseased. The fibrous portion is thickened, and the lymph follicles are filled with large lymph cells. Some, also, have undergone fibrous degeneration. The change may be summed up as, firstly, an inflammatory increase; and, secondly, a degeneration of all the constituent parts.

The changes in the kidney fully bear out what was said in a former part of this lecture, that nephritis is an integral part of scarlet fever, and not only a mere sequela, since there is evidence of its existence even in those who die in the very early stage of the disease. Amongst the first changes may be noted degeneration of some of the minute vessels of the cortex, and also of the Malpighian corpuscles with thickening of the capsule; there is also frequently blood and granular matter effused into the capsule and the convoluted tubes; in addition to these changes a great increase in the muscular coat of the minute, and even of some comparatively large arteries, may be observed; this hypertrophy being induced by active germination of the nuclei in this lining, afterwards, a considerable effusion of lymph cells into all the connective tissue of the kidney, causing a true interstitial nephritis, takes place, and this to such a degree that considerable portions of the cortex may be changed into a

* From the very valuable paper by Dr. Klein on the minute pathology of scarlet fever in the Public Health Report, 1876. To this paper I am indebted almost completely for the condensed account of scarlatinal anatomy, which I have tried to verify to the best of my power.

fibrous mass, these patches being large enough to be seen with the naked eye; in these parts the structure of the kidney has undergone so much compression as to be barely recognisable. The following excellent remarks are appended to the paper of which this minute pathology may be said to be in great part a condensed summary:—
“In all cases that die during and from scarlatina, after a certain time, generally after about one week, the kidney is the seat of more or less marked interstitial nephritis. At first the inflammation is so slight, and the places of infiltration so scarce, that it requires careful examination to detect them; they become well marked as the disease proceeds. If the stage is reached in which the foci of interstitial inflammation are numerous and extensive, the kidney shows a perceptible increase in size, and a conspicuous increase in thickness of cortex, which at the same time is exceedingly pale. In the earlier stages—that is, when there are only slight interstitial changes—the kidney is not enlarged.”

It will have been noted that an increased proliferation of cells is everywhere a marked feature in the pathology of scarlet fever, and this may be claimed as favouring the hypothesis of Dr. Beale, unless this proliferation be regarded as common to all febrile conditions, and therefore rather a consequence than a cause of the malady.

With this brief account of the morbid anatomy of scarlet fever, which has thus been followed from its cradle* to its grave, these lectures must end; save that in conclusion a short summary by way of postscript may be

* The following most interesting cases have been communicated to me by Mr. Philips, the house surgeon of the Children's Hospital, Birmingham, since these lectures were given:—

L. T. was discharged from the Children's Hospital cured on October 20, 1882. Desquamation ceased on October 6th. Before leaving he was most thoroughly bathed, and he carried away nothing from the ward. There

permitted to me. The first lecture was devoted to hypothesis, the hypothesis of infection. It was here shown that, instead of vague dreams and vaguer guesses as to its cause, this subject was now looked upon as one that experiment would soon unveil to us. It was shown that scientific men were actively engaged in trying to solve the problem, and that the most probable of modern investigations tended to trace its source to the presence of minute vegetable germs. It was pointed out, however, that this could only as yet be looked upon as a plausible hypothesis; the mountain is not scaled, but the path that will lead to the summit seems to be outlined before us, though even now it must be confessed only dimly and confusedly, since the bacterium of the cattle plague is the only one of whose existence at present we can speak with anything approaching to certainty. Even, however, supposing that different bacteria were proved to belong to every different disease, and that the specific characters of each were well known, and supposing that their presence was clearly proved to be the cause and not the

was, however, slight ozæna. After a further quarantine, he returned home on October 28th at 1 p.m.

His sister, V. T., was noted as having a rash on the evening of the 30th. There had been no premonitory sickness. On the 31st she was admitted to the hospital with the rash all over the body. On this, the first case, L. T. was again immediately put into quarantine, but another brother, C. T., was admitted into the hospital with the rash well out on Nov. 2nd.

There can be no doubt that the source of infection was to be found in the discharge from the nose, and the most probable mode of communication was direct inoculation from kissing. Here it may be said that there appears to be no physiological reason why infection should not be taken into the system by food or milk. This is, however, certainly not a common mode of its dissemination. and, as before said, the published instances seem to my mind to point to the milkman as the agent, rather than to the milk itself.

A. W. was strongly exposed to infection of scarlet fever from Oct. 4th to Oct. 18th, when she was completely isolated. On Oct. 23rd she complained in the early morning of general malaise, and a rash became visible over the chest on the evening of the 24th. This case points out a longer period of incubation than any previously known to me from personal investigation.

consequence of the disease, even then there would be much for us to learn. We should still have to find out why each separate form should produce such different symptoms, why one epidemic even of the same kind was so much more fatal than another; what conditions of atmosphere were most favourable to the propagation of germs, and why this was the case. How clearly, for example, does an epidemic of "influenza" illustrate this, when the wave of infection comes upon us almost as suddenly as a thunderstorm, and when the whole population of an infected district may be almost simultaneously affected! Whence come these germs? What has led to their inexplicable profusion? What, again, constitutes that remarkable immunity from infection which some seem to possess? Why should germs, as, for example, in measles, which have been nearly three weeks, as it were, latent in the system, produce a short fermentation of three days, and then become entirely extinct? What strange chemical change has taken place in the blood, that makes it impossible for this fermentation ever to occur again? Why should some germs, as in the case of mumps, be so limited in the organs they affect, whilst others seem to attack the system universally? Why should the germs of whooping cough only exert their power on the parts supplied by the pneumogastric nerve? Why, again, and this is a crucial instance, why should the germs in syphilis, in striking contrast to the evanescent existence of these other infectious diseases, infest the system for years—indeed for life, and more than life, because they can be transmitted to the offspring of the affected person? Here, certainly, Beale's views would better suit the exigencies of the case than any germ hypothesis. It is well for all investigators to feel that it does not absolutely follow as a consequence that what is

proved in one of these diseases, is necessarily true of the whole group. There are, indeed, such wide differences in infectious maladies that we can by no means be sure of an homology in their several causes. Had we only measles and scarlet fever to reason upon, it might be said that disease germs always perished after a short fermenting period. Syphilis affords us a crucial instance to the contrary; and it is often by the singular and crucial instances that the most light is thrown upon methods of research. All these questions, and many more might be added, are in the present state of our knowledge quite unanswerable; yet in spite of this unknown labyrinth before us, it may be positively predicated that the causes and laws of infection will one day be laid bare to the researches of science. What a future does this promise for preventive medicine!

My remaining lectures treated of the direct natural history of, and the facts relating to, scarlet fever, showing its course, in some cases so mild as to be only the mere name of a disease, in others so severe as to cause death in a few hours. This and its complications have occupied our remaining time; and here it has been my endeavour to give a summary of the accumulated knowledge and experience of those who have written on it, since its first recognition as a distinct malady, and truly it has been a wide subject, for scarlet fever has, more than most diseases, the names of our greatest physicians linked with its history: Sydenham, Fothergill, Fordyce, Currie, Cullen, Withering, all rise to our minds, nor must Bright be forgotten in its associations. In this lecture there is therefore little claim to novelty; it relates my own experiences, few and insignificant in character, and only important here because added to the larger details so carefully collected by our fathers of the past, and our

fellow workers of the present. I am painfully aware that the Ingleby Lectures ought to be more than this; they ought to be original work—work that should fix firmly another step on the ladder of knowledge; feeling this, I would venture to suggest that at least two years' notice should be given to the future lecturers; the time which a physician or surgeon has for original investigation is always scanty; the hours of happy inspiration to a hard-worked brain are rarer still. I have tried to do my best, but had longer time been given, more original thought and more original research might have been rightly expected. There now only remains for me to give my cordial thanks for the kindness with which you have listened to details, so many of which must have been previously familiar to you all, and for an attention courteously kept up to the last, when it would scarcely have been a subject for wonder if, instead of listeners, my audience, as at the close of Plato's banquet, had been divided into two great divisions, *καθέυδοντας καὶ οἴχομένους*.

