A manual of infectious diseases occurring in schools / by H. G. Armstrong and J. M. Fortescue-Brickdale ; ; with chapters on Infectious eye diseases by R.W. Doyne and Ringworm by H. Aldersmith.

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(Issued by the Association of Preparatory Schools).

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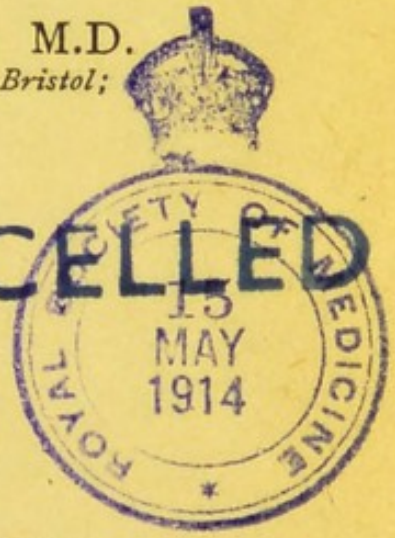

WITH CHAPTERS ON

INFECTIOUS EYE DISEASES

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PREFACE.

THIS manual of Infectious Diseases has been written for, and is being issued by the Association of Preparatory Schools.

The assemblage of large numbers of young persons under one roof leads to the introduction and ready spread of the infectious diseases to which they are specially liable. The Association feels that a manual, setting forth the characteristics of each disease, will be of assistance to the masters and mistresses of schools in dealing with them. Intended primarily for their use, the effort of the authors has been to give a clinical picture, as complete as possible, of the features of the various diseases; questions of pathology have been only lightly touched on and treatment has been dealt with only in a general way, the special treatment of each individual case being the province of the medical man in charge. Though written primarily for laymen, it is hoped, however, that the manual may be found to be of some assistance to doctors in their school practices.

For its compilation the Council obtained the services of medical men, who, being in charge of large Public Schools, were able to write from their

personal experience. Although the authors have, in the main, depended on their own experiences, ample use has been made of the writings of others; but, in a work of this scope and object, it has not been found possible to give many bibliographical references.

The chapter on Infectious Ophthalmia has been contributed by Mr. R. W. Doyne, the Margaret Ogilvy Reader in Ophthalmology in Oxford University.

It has been found difficult to avoid altogether the use of medical and scientific terms, but these have, as far as possible, been placed in foot notes. A glossary has been appended of those employed in the text.

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A MANUAL OF INFECTIOUS DISEASES OCCURRING IN SCHOOLS

CHAPTER I.

THE SPECIFIC INFECTIOUS DISEASES.

THE group of diseases known as the "specific infections" comprises a large number of complaints varying greatly in their symptoms, course, and geographical distribution. Some last for a few days or weeks, others, it may be, for a life-time; some are limited to certain regions, such as the tropics, others occur wherever man makes his habitation; some are severe and dangerous, others almost invariably mild, others again vary in the severity of their symptoms in different races, climates and circumstances. But in spite of these diverse characteristics, one fact serves as a basis of classification and unites the whole group, and this fact is that the diseases in question are directly or indirectly communicable from one individual to another, and that in no case can any one disease give rise to another different one; in other words, the specific infections always "breed true." The word "specific" is applied to the group to denote this fact.

Various subdivisions of this large and important class have been made. In these pages only a very few of the specific infections will be considered—

namely, those which run a short and more or less definite course usually accompanied by fever, and in which the infection is readily passed from one person to another; they are therefore known as the "acute specific fevers," or "infectious fevers." Owing to the fact that a prominent symptom in many cases is the appearance of a rash or eruption upon the skin, the term "eruptive fevers" is also used, while their infectious character is indicated in the general term "communicable diseases," which is applied to the whole group. The term "zymotic diseases," which is still not infrequently used, is intended to give expression to the opinion now widely held as to their real cause or causes; the word having been scientifically applied to the so-called "living ferments" (*zymæ*) which are now more usually known as germs, microbes or bacteria. This name may conveniently lead us on to consider the origin of the specific infections.

According to the view now generally held, all these diseases are due to the invasion of the body by minute living organisms, each disease being produced by its own particular germ. These microscopical particles of living matter belong to various groups, but are all of them, as far as is known, unicellular, that is consisting of a single cell or unit of living matter (or *protoplasm*) which is able to perform all the vital functions of nutrition, excretion, reproduction, and in some cases the function of locomotion. Some of these belong to the class known as *bacteria* which lies on the confines of the animal and vegetable kingdoms, but is usually held to belong to the latter. The bacteria themselves are subdivided into families according to their shape, round ones being known as *cocci*, straight, rod-shaped

ones as *bacilli*, wavy rod-shaped ones as *spirilla*, *vibriones*, or vibrios.

Other classes of unicellular organisms, however, also contribute to the army of disease producers; these are of a rather more highly organized and more definitely animal type; they belong to the group known as *protozoa* or primitive organisms, and the exact classification of the species within the group is still, in the imperfect condition of our knowledge, a matter of great difficulty and not a little dispute. All these germs are called "pathogenic," that is to say, disease producing, and it must be clearly understood that a much larger number of both bacteria and other unicellular organisms are known, which are apparently quite incapable of producing disease either in man or other animals; others affect particular classes of animals only, and others again are injurious to plants.

Organisms producing disease do so by living and growing in the body of the animal affected, and are thus called *parasitic*. But in many cases they are quite capable of leading an independent existence to which the term *saprophytic* has been applied. Thus three modes of life are known among germs: the purely parasitic, the purely saprophytic, and that which at one time is parasitic and at another saprophytic according to circumstances. In many cases very little is known of the life history of germs outside the body of man or animal, but it is obvious that this is an important branch of knowledge in relation to the prevention of disease.

One fact, however, is of importance in this connexion, though it applies only to a certain number of cases. Some bacteria have the power of forming

what are called *spores*, minute rounded bodies which are remarkably resistant to adverse environment, and can live in a quiescent state for long periods and under circumstances in which their parent organisms would certainly and speedily succumb.

The following diseases are known to be caused by *bacteria* : typhoid fever (or enteric fever), diphtheria, cerebro-spinal meningitis, impetigo, besides others not dealt with in this book. Whooping cough is probably due to a bacillus somewhat resembling the so-called influenza bacillus of Pfeiffer ; scarlet fever is possibly due to a protozoon, though a special form of streptococcus (one of the bacteria) has also been considered the causal agent by several high authorities. Smallpox is very probably produced by an organism of the same class as that which causes malaria.*

There is at present no evidence that chicken pox is produced by any allied protozoon, and with regard to this disease, as well as measles, rubella, and certain others, we can only say at present that the presumption is very strongly in favour of their being due to some form of minute organism the characteristics and history of which have not yet been discovered.

Organisms may enter the animal body in various ways. A slight abrasion of the skin may allow the *coccus* of impetigo or the more deadly *streptococcus* of erysipelas to make its entry ; the mucous membrane of the mouth, throat, and nose may similarly allow the entry of organisms through some slight local lesion. This very likely occurs in diphtheria, and

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* It is called the *Cytoryctes Variolæ*, and probably passes through several phases of existence, one of which produces the disease.

possibly in cerebro-spinal meningitis, though some think that in the latter case the organisms enter by the intestinal mucous membrane. In typhoid fever the lining membrane of the bowel is most probably the portal of entry for the bacillus.

When once the germ has gained a hold on the animal body, one of two things may happen. It may, in the first place, pass into the blood stream or the small channels called the lymph vessels, which everywhere help to convey fluid to the tissues, and by this means become widely distributed throughout the body ; or it may, in the second place, remain close to the site of invasion, and there grow and multiply. In either case it is probable that many, if not all the symptoms of disease are produced by certain products formed by the germs and known generally as toxins or poisons. These toxins are sometimes excreted by the germs during their life, and pass into all the tissues of the body ; this will happen even when the actual organisms only live and thrive in a small restricted area, such as the throat in the case of diphtheria. Other organisms appear to retain their toxins within their own bodies, but are thought to yield them up when they die and become disintegrated, so that the ultimate effect is similar in either case. This distinction, however, is of considerable practical importance with regard to the means at our disposal for combating the disease caused by any particular germ.

Now it is a well known and generally recognized fact that all persons who are exposed to an infectious disease do not develop the symptoms with the same degree of severity, and that in some cases individuals appear to escape infection altogether.

This has been expressed by saying that in all infections there are two factors, the "seed" and the "soil." The seed is represented of course by the germ, the soil by the tissues of the person in whom the germ is located. The seed may be strong and healthy, but there may be some characteristic in the soil which prevents its growth and development, so that instead of thriving and multiplying till it produces the symptoms of disease, it remains in a passive condition or dies out altogether. When an individual is insusceptible to any given disease of this nature, he is said to be "immune."

The question of immunity is indeed a vast and difficult one, and although it has been largely investigated by a great number of able men, it is still in considerable confusion, so complex and difficult of interpretation are the facts, and so elaborate are the experiments and deductions which have been devised to explain them. This at least is known; immunity may be of two sorts, natural or acquired. Natural immunity is exemplified in certain animals; thus fowls are naturally immune to the disease known as *anthrax*, and tortoises to the disease known as *tetanus* or lockjaw. Acquired immunity is exemplified in the case of individuals who have passed through an attack of infectious disease, and are then protected for a longer or shorter period from a second attack of the same character. These two conditions probably differ essentially in the way in which they are produced. In the first case it is possible that the animal fails to acquire the disease because its tissues are incapable of being affected by the poison or toxin produced by the invading germ; the toxin is possibly formed, but is, for that animal or individual,

innocuous. In the second case it is possible that the infected animal has, as a result of the previous attack, produced within itself an antidote to the poison or toxin, which neutralizes it as soon as it is formed. This form of immunity can be artificially induced in the case of some diseases by injecting into a susceptible animal small quantities of the germ causing the disease or its toxin, and gradually increasing the dose as the animal becomes more and more immune. In diphtheria, to take the best known and most conspicuous instance, it is possible by injecting repeated and increasing quantities of the bacterial toxins into a large animal (such as the horse) to produce a condition of immunity, so that very large doses, much greater than those which would ordinarily be fatal, fail to produce any reaction. The animal is then said to possess *active* immunity. The serum or fluid portion of its blood can be shown experimentally to be capable of neutralizing the toxins or poisons produced by the bacillus when artificially cultivated. When injected into the body of a patient suffering from diphtheria the same result occurs; much of the poison is immediately neutralized, and the patient is thereby considerably helped on towards recovery.

The neutralizing agents in the blood serum are known as "antitoxins," and belong to a large class of substances which are produced by the injection of foreign substances into the blood stream of an animal and by other means also, and which are collectively known by the barbarous name of "antibodies." Thus the antitoxin of diphtheria is an antibody to the toxin of the diphtheria bacillus; the serum recently introduced for cerebro-spinal meningitis is not a definitely antitoxic serum; it is

stated by some to be an anti-bacterial serum which weakens or kills the bacteria themselves. Sera have also been prepared to act against typhoid, pneumonia, and other diseases, but they have not as a rule been very successful, partly perhaps because they cannot be produced in a sufficiently concentrated form, and partly owing to variations in the toxins they are designed to combat.

The immunity produced by the injection of anti-toxin (which is also used to a certain extent to protect those likely to be attacked) is what is called a *passive* immunity, and from the blood of those so immunized no curative serum can be obtained.

In the case of other diseases, immunity can be produced by the injection of an artificial preparation containing the dead bodies of the causal organism. There have been many technical difficulties to overcome before this method could be practically applied to medicine; sometimes by means of an elaborate technique the actual number of organisms to be injected is counted, in order to obtain an appropriate dosage; in others the dose has been determined by special observations on the animal into which they are injected. These preparations are known as "vaccines"—again an unfortunate name, as they differ essentially from the smallpox vaccine. Vaccines have been employed successfully in curing a number of conditions, mainly those produced by various cocci, and associated with the formation of pus, or matter, such as boils, abscesses and the like. A successful vaccine has also been prepared as a protective against typhoid fever (see page 95).

The ordinary "vaccination" against smallpox differs from the above described vaccines, for here the organism (which is almost certainly not a

bacterium) is not artificially grown and then killed, but is naturally modified by its passage through the living body of another animal, namely the calf, which so alters its virulence that it can no longer set up the train of symptoms known as variola or smallpox; it is still able, however, to produce immunity in the person into whom it is passed. Before use the vaccine is in this case subjected to many processes which effectually prevent the introduction of other possibly harmful bodies, and the finished product is really a highly artificial substance suspended in glycerine.

We can now consider the various ways in which infectious diseases are passed on from one person to another under the actual conditions of life. A distinction is sometimes drawn between *infectious* and *contagious* diseases, the former being those in which very close contact is not necessary for the transmission of the infection, and the latter being those in which something like actual contact is required. The distinction is not really of much value, and is also somewhat artificial. It is perhaps better to drop it altogether and to speak of all these diseases as infectious or communicable. The following are the chief methods of transmission :—

(1) *Direct.*—That is from one person to another. In a disease like diphtheria, when the germs are in the throat, they may easily be ejected by coughing, and, becoming mixed with the fine almost invisible dust of the air, be inhaled by another person. Probably measles, scarlet fever and other diseases are spread from one person to another in a similar manner. In smallpox, the causal organism is contained in the pustules on the skin, in typhoid

fever it is in the excretions from the bowel, and in these diseases may easily spread on to the persons generally of those who are suffering from an attack. In some diseases, however, it is now quite well known that persons may harbour the causal germs without themselves presenting any symptoms of illness. In diphtheria and typhoid this has repeatedly been shown to occur. Apparently healthy children may have diphtheria germs for many months in their throats, and adults may carry typhoid germs in their intestines. These persons are called "carriers," and as the germs are in many cases virulent, these carriers may set up the disease in others with whom they are in contact.

(2) *Indirect.*—That is by means of some intermediary person, object, or animal. Germs may be carried on the clothes or hands of those attending on the sick, or on inanimate objects, such as books, bedding, food, or feeding utensils. The degree in which this is possible varies in different diseases. In some the germ causing the disease is capable of surviving for a long time outside the human body, in others, especially if exposed to air and sunshine, it very quickly dies.

Inanimate objects which are infected by a sick person are often called *fomites*, because they may set up a wide-spread epidemic, as a spark may kindle a conflagration. Dust, either the palpable dust such as we all know in dry windy weather, or those fine particles which occur in the air of most houses but are only seen as "sunbeams," may be impregnated with the germs of disease and assist in spreading infection. This occurred in the South African war when dust charged with typhoid germs carried the disease to great distances, but,

on the whole, the theory of air-borne infection is now held to have only a very limited application.

Insects may also carry germs. The common house-fly is a notorious offender in this respect; he walks upon contaminated material, or even feeds upon it, and then, in the course of his peregrinations, alights on articles of food on which he deposits virulent germs. Hence the importance of clearing out dust-bins, manure heaps, and refuse of all sorts, which are the usual breeding ground for these creatures. Milk, and water may, as is well known, carry disease germs and set up an epidemic. The diseases most commonly propagated in this manner are typhoid fever, scarlet fever, and to a lesser extent diphtheria. Butter and cream may act, of course, in the same way as milk.

It will be noticed that in this account of the way infective diseases are spread no mention has been made of defective drainage as a cause of epidemic disease. Practically the only disease in this country which is likely to occur in epidemic form owing to defects in drainage is typhoid fever. If the discharges from a patient containing the typhoid germs are carelessly emptied into the drains, and owing to some leak or defects the contaminated sewage gets into the water supply, obviously fresh cases of disease are likely, if not certain, to occur in those drinking the polluted water. But the popular idea that if a case of diphtheria or scarlet fever occurs in a house, something must be wrong with the drains, is for the most part erroneous. It is true that expert investigation will often detect faults in any drainage system, but this does not prove that the disease in question was caused by the defect which has been discovered, and the hasty assumption that when the drains are set right all has been done

that is needful may prove an absolute danger, because it tends to divert attention from the true cause of the infection, which is possibly to be found in a "carrier" or some mild and consequently undiagnosed case.

A house into which sewer gas is constantly escaping is, of course, not a desirable residence from the point of view of health, and may have a deleterious effect on the general condition of those living in it. Under these circumstances they may be less able to resist the attacks of disease-producing germs, so that bad drainage, as may any unhealthy environment, may pave the way to epidemic disease, though it is not the actual cause.

The next point with which we must deal is the general course of an infectious fever. After the germ or organism causing the disease has found a lodgment in the body, or as we may say, the patient has taken the infection, a more or less definite period elapses before any symptoms occur. This is called the "incubation period," and is perhaps partly occupied by the multiplication of the germs and partly by the elaboration of their poisons and the fixing of these poisons on to the tissues and cells of the body. This period is succeeded by the period of invasion, when the characteristic symptoms of the disease are suddenly or gradually manifested. As with the period of incubation, the stage of invasion is more or less definitely self limited in each disease; that is to say, most cases pass into the developed acute stage and then into the fourth stage of defervescence; or else they die within a period which may be roughly forecast. During the last period (defervescence) the symptoms gradually abate and the patient becomes convalescent.

The period of invasion is in most cases characterized by "fever," a term which connotes a group of symptoms, and not, as is popularly thought, a rise of temperature alone. These symptoms are: a rise of temperature, a rapid pulse and respiration, a hot dry skin, a furred tongue and sometimes shivering fits or "rigors." Appetite is lost and digestion much impaired; the urine is usually scanty and high coloured, and on standing may show a thick red deposit. The bowels are constipated, and the patient complains of thirst, headache, pains about the body, nausea, and a general sensation of discomfort or illness, which has been summed up in the word "malaise." Often the febrile condition is ushered in by vomiting.

A few words may now be said on the general management of fever patients. The temperature itself, unless it rises to an abnormally high degree or continues an unusually lengthy period, is not usually treated. In some cases patients are thought to do better when their temperature is high, rather than below what is the usual average for the disease. In any case the rise in temperature is very likely a protective reaction; that is, it is one of nature's methods of combating the invading germs, and should not be unnecessarily checked. A fever patient should be nursed in a large airy room; where several are nursed together 144 square feet of floor space should be allowed to each bed,* and the room should be fairly lofty, adequately ventilated, and well supplied with sunlight. The patient's

* In practice it is not always possible to give so large a floor space to each bed, though all authorities consider that this is the proper amount to allow. At any rate the floor space should not be less than 100 square feet to each bed.

skin should be well sponged over with tepid water once or twice daily, he should be allowed plenty of water to drink, the bowels should be kept acting, and the diet be confined to fluid and easily digested substances, of which the principal example is milk. The temperature of the room should be kept at about 60° Fahrenheit and should not vary more than two or three degrees ; and though protected from draught and chills, the patient should not be overloaded with bed clothes. Quiet must be enforced, both in the sick room and outside it, as undue noise may often prevent that sleep which is so important to the well-being of the invalid.

We will conclude this general account of the infections by a few words on the subject of the prevention, or, as it is called, "prophylaxis" of disease. The measures at our disposal may be classified under the following headings :—

1. *Preventive inoculations and antitoxins.*—These, the best of all known methods of prevention, can unfortunately only be applied to a few diseases, owing to the imperfect state of our knowledge.

Foremost, of course, comes smallpox, which by a thorough system of vaccination and revaccination can be practically abolished, or at any rate reduced to inconsiderable dimensions. Next, with regard to typhoid fever, it seems fairly certain that protective injections of antityphoid vaccine are of considerabe value, but at present their application cannot, for reasons too technical to be gone into in this place, be so widespread as is possible in the case of vaccination for smallpox. In any given case expert opinion must decide whether this measure is applicable or not. The same may be said of protective injections of anti-diphtheric serum, which, though for different

reasons, cannot always be carried out, although in many cases they may be found very advisable.

Against the other infectious diseases common in this country, we have at present no means of this kind on which we can rely.

2. *Isolation.*—The isolation of the patient is the chief measure on which we rely for the prevention of the spread of the disease, and this therefore should be carried out as thoroughly and at as early a moment as is possible. In schools, infectious cases should be nursed in a separate building, or where this is not possible on a separate floor, preferably at the top of the house, or in a wing into which the other inhabitants do not enter. It has been suggested that the infective agent being a material body will tend to fall downwards by the law of gravitation, and that therefore patients should not be isolated at the top of a house. This seems to be a somewhat academic point. Practically, isolation at the top of a house is more convenient and likely to be more thorough, and owing to their lightness infective organisms are just as likely to be carried upwards by draughts as downwards by gravitation.

The room or ward should contain no unnecessary furniture; boards should be bare, and there should be no hangings or curtains except what may be necessary for darkening the room. The nurses should not mix with the other inhabitants of the house, and when going out for exercise should change their outer garments. Visitors should only be allowed in the room under conditions to be determined by the medical man in charge. In cases of scarlet fever it is usual and advisable for the doctor, and any other person allowed to visit the patients, to wear a washable overall, which is kept in the infected quarters.

Nothing should be taken out of the sick room or sick quarters without thorough disinfection; all slops, remains of food, and refuse of all descriptions should be disinfected before they are emptied into the drains, and, wherever possible, solid articles, such as rags, bandages, etc., should be burnt immediately after use. No papers, books, or other articles of permanent value should be allowed in the sick room, as all such things are better burnt at the end of the illness, and are liable to damage if attempts are made to disinfect them. When patients are sufficiently convalescent to go out of doors, they should only be allowed to do so if they can go straight from the sick room into the open air, without passing through the house. During their walks they should be accompanied by a nurse, who will see that they do not come in contact with other persons.

With regard to isolation it is only fair to say, however, that at present it has more practical utility than theoretical justification. It is no doubt possible to nurse a great many of the infectious diseases in the same ward with other patients, or at any rate in a ward in which the different patients are only partially separated by such physical barriers as walls and solid partitions. Typhoid is often nursed in the general wards of hospitals, and until recently diphtheria was so treated in many institutions without bad results; many other infections such as measles, mumps, and scarlet fever may be similarly managed. But the degree of care necessary for the successful carrying out of such an arrangement is great, and under the present conditions the isolation of infectious patients is simpler and less likely to break down in ordinary practice.

3. *Disinfection.*—This is applied to the patient, at

the end of his attack, to the room or building in which he has been nursed, and to various articles which have been used by him or by those nursing him during the attack of infectious disease.

Before describing in detail the methods of disinfection usually adopted, I should like to make a few general remarks on the rationale of this procedure. In the first place, we must remember that of the common acute infectious diseases of this country the causal germ is known in only a few Thus they may be divided into three groups,—

(1) Those in which the causal agent is well known :

diphtheria, a bacillus
typhoid fever, a bacillus
impetigo, cocci
cerebro-spinal meningitis } a coccus.

(2) Those in which the causal agent is known with some degree of certainty :

whooping cough, a bacillus
mumps, a coccus (?)
smallpox, a protozoon (?)

(3) Those in which the causal agent is not known : scarlet fever, chicken pox, measles, rubella, epidemic poliomyelitis, glandular fever.

1. In the first of these groups, disinfection can be scientifically carried out. Special methods can be adopted to ascertain whether the patient is free from the organism or not, and definite measures taken to rid him of it in the latter eventuality. It is known on what articles, used by or for the patient, the organism is likely to be found, and what means will effectually destroy it. The secretions of the throat and nose in diphtheria and cerebro-spinal meningitis, the stools and urine in typhoid, and the

skin lesions in impetigo can all contaminate things brought near to them, but on these objects the organisms do not long survive, especially in a dry state ; probably the most long lived are the cocci causing impetigo.

The disinfection of rooms has very little place in these diseases, nor would antiseptic baths have any appreciable effect in diminishing the infectivity of a patient in whom the germs still existed. Diphtheria bacilli have been found on the walls of rooms in which diphtheria patients have been nursed, but they are mostly deposited in the earlier stages of the disease, and die before the patient is convalescent. In the larger proportion of cases they are not found at all on walls. Typhoid bacilli, when due care is taken in nursing the patient, should not be present on the walls or floors of rooms, and the wards of general hospitals are not disinfected after typhoid patients are discharged.

2. With regard to the second group, our knowledge is less certain. It is only, however, in the case of smallpox that the virus is capable of marked dissemination into the air surrounding the patient, and is able to survive for any considerable time. In a well known case the virus of whooping cough survived on a third person for at least twenty-four hours.

3. With regard to the third group, we are practically fighting in the dark against an unknown enemy. The virus of epidemic poliomyelitis is smaller than any organism which can be observed under the microscope. A number of such organisms are now known ; one which produces yellow fever is transmitted by a species of mosquito, or by the blood of an infected person, but not otherwise.

When, therefore, we adopt a number of disinfecting methods in the diseases of this group, we are going on the shot-gun principle, hoping that one of the many small pellets will hit the mark. What we know, however, of the diseases in which the organism can be traced, makes it probable that, in time, many of these methods will be discarded as superfluous. The virus will be shown in many cases to be incapable of long survival outside the body when exposed to light and air; and very likely special methods for its transmission will be definitely determined in each case. In the meantime the elaboration with which disinfection should be carried out must be determined by the seriousness of the disease. In scarlet fever and diphtheria, for instance, which are the most serious of all common infections in schools, no precaution should be omitted. In chicken pox and rubella a very ordinary degree of care and cleanliness will suffice.

(*a*). The patient is usually disinfected by means of one or more warm baths, with plenty of scrubbing and soap, followed by sponging over with an antiseptic solution, such as Izal 1 in 200.

After the last bath the patient puts on entirely fresh non-infected clothes, those he had worn during his convalescence being removed from the bathroom before he is out of the bath. He then leaves the infected quarters immediately.

(*b*). The disinfection of the ward or building is, in large towns, usually carried out by the sanitary authority. Thorough scrubbing and cleaning of floors and walls should be carried out after all cases of infectious disease, and in the more serious ones the full routine is necessary. After articles to be otherwise dealt with, such as bedding, crockery,

etc., have been removed, the room is first fumigated with sulphur or formalin. Sulphur can be merely pounded up and burnt in an iron saucer suspended over a bucket of water to obviate the danger of fire, or the more convenient sulphur candles may be employed. In any case all cracks and orifices should be sealed up as securely as possible, and all cupboards, etc. opened, before fumigation begins. The walls and floors should be wetted and the air rendered thoroughly moist. The presence of curtains and hangings in a room considerably impairs the efficacy of this form of fumigation. Two or three pounds of sulphur must be allowed for every 1,000 cubic feet of air-space. Often the room is left for twenty-four hours, by which time it will usually be possible to enter it, but after three hours the windows may be opened if the person entering the room protects his face with a towel soaked in a solution of washing soda.

Sulphur has the disadvantage of damaging certain articles, notably polished metals, such as gas fittings, window fasteners, etc. In its place formaldehyde gas (the commercial solution of which is known as formalin) may be employed. The Alformant lamp is a convenient way of fumigation by formalin in small rooms. Thirty tablets are used for every 1,000 cubic feet. The air must be moist and the temperature not under 60° Fahrenheit. The usual period of fumigation is 4 hours. For large rooms the apparatus known as Trillet's, or the more convenient Lingner's, must be employed. The former method at any rate, can only be carried out by sanitary authorities. After any form of fumigation thorough ventilation of the room must take place, in itself a valuable proceeding. The floors, etc.,

are then scrubbed with a disinfectant solution, such as 1 in 100 Izal, Cyllin, or Cresol. Papers should be scraped off the walls, the ceilings lime-washed, and the walls if unpapered sprayed with 2 per cent formalin solution or washed with one of the disinfectants used for the floors. In Germany the walls are first rubbed over with breadcrumbs, which are subsequently swept up and burnt, and then sprayed with carbolic acid solution 1 in 100.

(*c*). Bedding, clothes and materials generally must be disinfected by steam generated under pressure in a special apparatus. Leather articles, such as boots, which are damaged by steam, must be exposed to sulphur or formalin when the room is fumigated. Sheets and linen articles may be disinfected by soaking in carbolic acid solution 1 in 25 to 1 in 50, Izal 1 in 100 to 1 in 200, or Cyllin 1 in 150 to 1 in 300 for an hour. They may then be wrung out and sent to the wash. Crockery, glass ware and enamelled metal ware may be placed in water and boiled for fifteen minutes. In some cases it is necessary to disinfect the stools of patients. This is done by pouring on to them 1 or 2 pints of 1 in 40 carbolic acid, Lysol or Cresol. The mass is thoroughly mixed, covered up and allowed to stand for at least one hour. It may then be disposed of in the usual way. Urine may be similarly treated, being mixed with an equal bulk of the disinfectant solution.

4. *Quarantine.*—Owing to the fact that infectious fevers present no symptoms till after the "incubation period" proper to each has elapsed, it is impossible to say whether a person exposed to infection will develop the disease or not until a certain time has expired and the characteristic features begin to appear. When therefore definite exposure to an

infectious disease has occurred, those who may develop it should be prevented from mixing with others until it becomes known whether or not they have taken the infection. In practice it is usual to allow a few days over the longest incubation period, in order to give a margin for safety, and this is called the quarantine period. The term quarantine therefore should not be applied to a patient who is isolated because he has an infectious complaint; it should be used only to denote the time during which suspected persons are isolated and watched to see if they are going to develop symptoms. A child is usually placed in quarantine, and not allowed to attend school if a case of infectious disease has occurred in the house in which he lives, and the period is reckoned either from the day the patient is removed from the house or otherwise completely isolated, or from the day on which the suspected individual is removed from the house in which the case is being nursed. The various periods of quarantine will be stated under their respective diseases in the subsequent chapters of this book.

5. *Certificates.*—These will be dealt with later (see pp. 139-140).

J. M. F.-B.

CHAPTER II.

THE ACUTE EXANTHEMATA

THE acute exanthemata belong to that group of infectious diseases in which the poison is generated within the human body, and in the course of which there is developed on the skin and mucous membranes a rash characteristic of each of them.

The poison is transmitted from one individual to another, generally by proximity, but also, in some of them, by fomites or articles of food such as milk or water. Direct contact or inoculation is not necessary.

An individual who has been attacked by one of them is not, as a rule, subject to a second attack of the same disease. The exceptions to this rule are very few and may, in practice, be disregarded. An attack of one of them does not, however, protect an individual from the other members of the group. On the contrary it seems to render him more susceptible to the poison of the others.

Two or more infectious diseases may run their course concurrently in the same individual. The experience of the fever hospitals shows that this is far from uncommon. The opinion is generally held that there are no modifications of the characters of one disease by the co-existence within the body of another; and that there is no interference with the incubation period of either. The following case is

evidence to the contrary. A boy returned to school on May 6th, having been to a place of public entertainment on the previous day. On the 9th he was found to have a copious scarlatinal rash, and was at once isolated in a room at the sanatorium which had not, previously, been used for any other disease. The scarlatina ran an ordinary uncomplicated course, the fever being rather prolonged; convalescence was reached on the twelfth day, the temperature remaining normal for the next ten days. Then, on the 22nd day from his isolation, the temperature again rose rapidly, and an eruption of chicken pox appeared on his body. The attack was very severe and the temperature reached 104° on four successive evenings.

In this case the incubation period of the chicken-pox was certainly not less than twenty-two days and was probably twenty-six, as the patient most likely received the poison of both diseases on the occasion of his visit to London.

The diseases of this group, which will be considered here, are **Measles, Rubella, Scarlet Fever, and Chicken Pox.**

They present certain features in common. In each of them, after the reception of the poison, there is a period of latency while the poison is multiplying—*period of incubation,* during which there are no obvious manifestations of disease; this is followed by a period of somewhat indefinite symptoms —*prodromal period*; after which the characteristic rash appears and runs its course—*exanthemic period*; to this succeed the periods of *defervescence* and *convalescence.*

Rashes are described, according to their characteristics, in the following terms:—

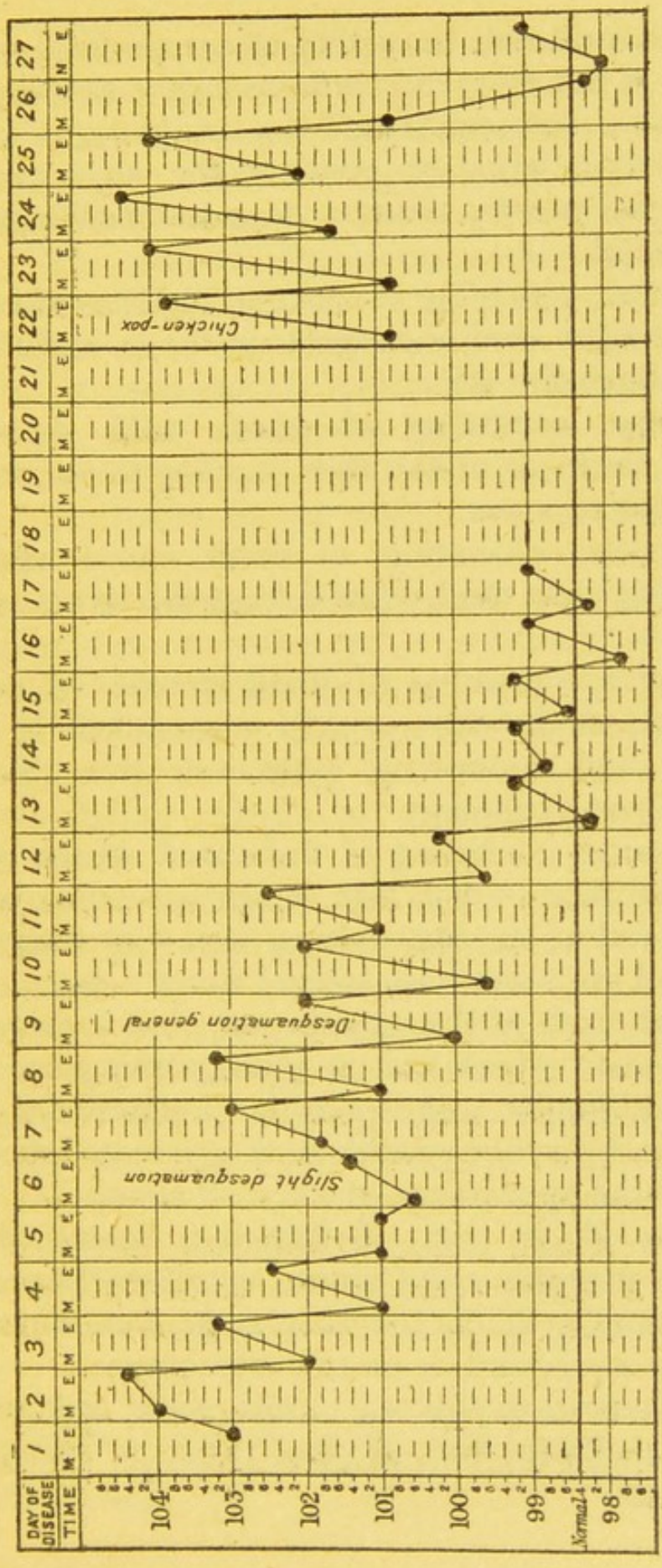

Fig. 1.—Chart of a Scarlet Fever Case occurring concurrently with Chicken Pox.

Erythematous, consisting of a superficial inflammation of the skin, with redness, slight swelling, and often some desquamation. An erythema is said to be *Punctate,* when it presents the appearance of minute red points, situated on a less brilliantly red background.

Macular, consisting of spots or blotches of various tints, circular, oval or irregular in shape, and slightly raised above the skin.

Papular, consisting of small, solid, somewhat pointed swellings of the skin, varying in size from a pin's head to a pea.

Vesicular, consisting of small raised bladders, containing clear fluid derived from the serum of the blood.

Pustular, consisting of small globular or conical elevations of the skin, usually surrounded by a red margin, and containing matter or pus. Vesicles often become pustular.

Urticarial, consisting of indurated wheals raised on the surface of the skin, which are white at the top and red at the edges ; they itch very much, and come and go, sometimes several times a day.

Though each of the exanthemata has a characteristic eruption which aids in distinguishing one from the other, similar rashes may be produced by other causes, and it is not possible to diagnose an infectious fever by the appearance of the rash alone.

Certain *drugs,* e.g., Belladonna, many of the Balsams, Morphia and Quinine, occasionally produce rashes, usually of the urticarial type, but sometimes having a scarlatinal or measly appearance.

Some articles of *food,* e.g., mushrooms, eggs, strawberries, shell-fish, etc., produce rashes in susceptible individuals.

The *serum* used in antitoxin inoculations frequently produces rashes of various sorts, some like scarlatina and some like measles. They appear from seven to fourteen days after the injection, and are often accompanied by some fever and other symptoms of illness. The rash usually makes its first appearance at the seat of injection.

The use of *enemata*, especially if hard soap is used, is not uncommonly followed by the appearance of a rash. This sometimes takes the form of a punctate erythema, not unlike the rash of scarlatina ; usually the backs of the wrists are the first to be affected.

Boys who handle *caterpillars* or the cocoons of certain species of moths, get a rash on their hands, which can be transferred, by rubbing, to other parts of the body. The eyes are specially liable to be affected, becoming swollen, red and watery, thus simulating rubella or measles in their early stages.

The most common of the above species are, the Gold tail* (*P. similis*), the Vapourer (*O. antigua*), the common Tiger or Woolly Bear (*A. caia*), the Lackey (*M. neustria*), the Oak Eggar (*B. quercus*), the Fox moth (*B. rubi*), the Drinker (*C. potatoria*).

Contact with certain plants, especially those belonging to the Primula group, e.g., Primula obconica, is capable of setting up irritant rashes.

The rash of *idiopathic rose-rash* closely simulates that of the infectious variety, and a diagnosis between the two may be impossible. The idiopathic variety,

* The Gold tail is also known as Liparis Auriflua, and in the North of England as the Palmer worm. Possibly the moth is irritant also, especially when freshly emerged from the cocoon.

however, is frequently patchy, disappearing from one place and appearing in another.

It is well to remember that a brush, vigorously applied to the skin of the chest or elsewhere, will produce a rash not unlike that of rubella. This is only local, and confined to the parts which have been treated.

H. G. A.

CHAPTER III.

MORBILLI. MEASLES.

French: ROUGEOLE. *German*: MASERN.

MEASLES is an acute infectious disease, of which the characteristic symptoms are catarrh of the respiratory passages, a peculiar rash on the mucous membrane of the mouth, and a blotchy eruption on the skin. Its geographical distribution is very wide, for measles occurs in every portion of the civilized world, though certain districts have, at times, remained free from it for a considerable period.

Though we have no certain knowledge of its antiquity, it was probably known to the early Arabian writers, but it was not separated from scarlet fever, and described as an independent disease, till the middle of the eighteenth century; and it was not till towards the end of the last century that the distinction was established between true measles and the disease now known as *rubella*, and popularly called *German measles*.

Measles never entirely dies out, but persists as an endemic disease, which at intervals bursts forth into epidemic form. The length of the intervals between epidemics is to a great extent determined by the number of susceptible individuals—i.e., unprotected by a previous attack—who are added to a community. Experience in large schools of four or five hundred boys shows that, when the number of those thus

unprotected reaches one third of the total number, an outbreak may be looked for.

Susceptibility to the contagion of measles is almost universal, and owing to this it is almost entirely a disease of childhood. In England, in the elementary schools, 84 per cent of the children have been attacked before reaching the age of ten years; in the preparatory and public schools, 35 per cent have been attacked before the age of nine, 68 per cent before fourteen, and at the termination of the school period not more than 3 per cent have escaped. It has been found, however, that when introduced into districts from which it has been absent for a considerable period, measles attacks both old and young indiscriminately, and the older people suffer most severely. This was the experience in the Faroe Islands, when the disease was introduced in 1846, after an absence of sixty-five years. Panum states that 6000 out of a population of 7782 were attacked. Similar observations have been reported from Mauritius, Iceland and Fiji. In these outbreaks the mortality was very large, which gives some reason to suppose that, in districts where epidemics constantly recur, there is, to some extent, a transferred immunity from parent to child, leading to a milder type of the disease. The opposite to this is also true, for there seems in some families to be a certain hereditary transmission of a predisposition in their children to a special severity of type.

The infection of measles is, in almost all cases, contracted by direct personal intercourse. There is very little, if any, positive evidence that it can be conveyed by intermediaries or by *fomites*, such as articles of clothing or utensils; on the other hand,

the evidence to the contrary is very strong. The poison is given off from the affected person during the prodromal stage, before the characteristic eruption has appeared, during the eruptive stage, and possibly for some days after the rash has disappeared: the secretions from the eyes, nose, mouth, and respiratory passages being the principal vehicles. The poison is air-borne to a limited distance. Observations made in cases where infection has spread during the time of attendance in chapel, indicate that the outside range is twelve feet, but the great majority of those infected were found to have been within six feet of the focus.

Though it is practically certain that measles is due to a specific micro-organism, its nature is as yet unknown.

Incubation.—From the time of the reception of the poison till the appearance of the characteristic eruption on the skin, a fairly definite period of from thirteen to fifteen days elapses. This period is divided into two: the *incubation stage* and the *prodromal stage*; that of incubation usually lasting ten days, of prodromal three days; but this is liable to variation.

The stage of incubation presents no easily recognisable symptoms, though complaint may be made of lassitude and general indisposition. Meunier, a French physician, has, however, called attention to a peculiar alteration of weight which is known as *Meunier's sign*. He says, "There exists during the stage called incubation of measles a phenomenon which we have constantly observed, and which consists in a marked lowering of the body weight. It begins about the fourth or fifth day after contagion, that is to say five or six days before

the appearance of the first catarrhal or febrile symptoms, eight or ten days before the eruption. It lasts several days, more often even to the beginning

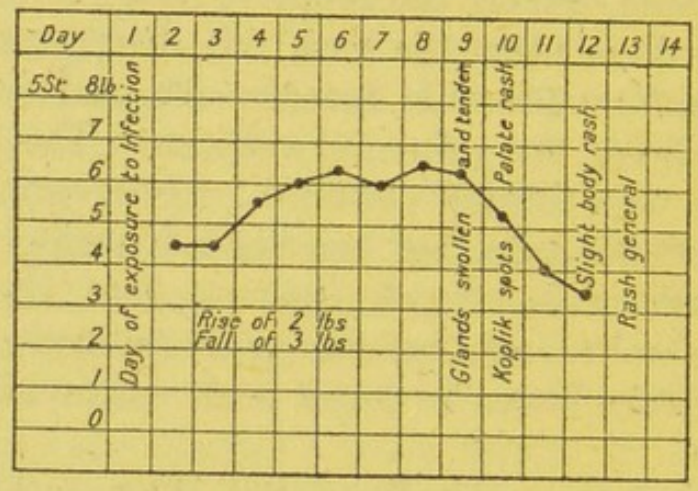

Fig. 2.—Chart showing rise and fall of weight in incubation of Measles.

of invasion. The loss of weight is about 10 oz., or 1½ oz. a day in a child of four or five years; it may reach 22 oz., and has not been observed less than 3 oz." Observations made on the lines indicated by

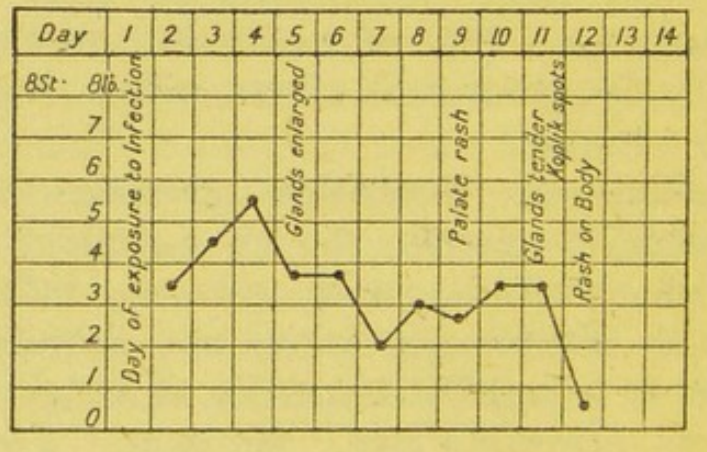

Fig. 3.—Chart showing rise and fall of weight in Measles.

Meunier, show that the weight rises during the first five or six days, and then gradually falls as shown in the charts (2 and 3). The fall is greater

than that stated by him, probably accounted for by the fact that the observations were made on older and heavier subjects.

About the sixth day the glands, especially those in the neck and armpits, become enlarged ; not at first tender, but they usually become so a day or two later. The swelling and tenderness of the glands continue till the termination of the fever, but suppuration rarely takes place.

Prodromal Stage.—On the tenth day from infection, in a typical case, the period of invasion, or prodromal stage, is reached. In most cases the onset is sudden, but in some the symptoms develop gradually. Of these the earliest are a moderate degree of fever, the temperature rising to from 101° to 103°, running from the eyes and nose, catarrh of the upper air passages, with a troublesome cough. The patient presents the ordinary symptoms of a cold in the head. During the prodromal stage, and two or three days before the appearance of the rash on the skin, a peculiar eruption may be seen on the mucous membrane of the mouth. This was first described by Flindt in his reports to the Danish Board of Health, but the credit of drawing attention to its diagnostic importance belongs to Koplik of New York.*

The changes in the mouth appear in the following order :—

On the first day of fever there is a slight diffuse redness of the tonsils.

On the second day, the redness of the tonsils has

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* Koplik's spots are not *always* found ; their absence does not negative the diagnosis of measles. In 187 cases, Koplik's spots were unmistakably present in 169, absent in 8, doubtful in 10 (Holt).

increased and spread to the pillars of the fauces and the soft palate; and certain characteristic spots—*Koplik's spots*—appear on the mucous membrane lining the cheeks. These may usually first be seen opposite the molar teeth. They consist of small irregular spots of a bright red colour. In the centre of each spot may be noted, in strong daylight, a

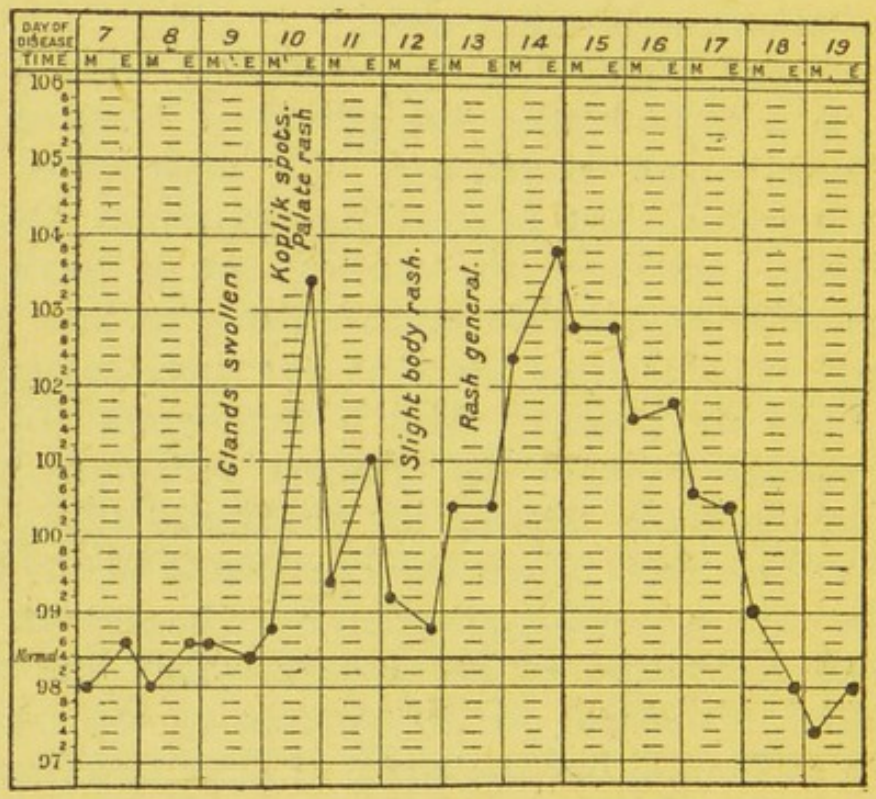

Fig. 4.—Temperature Chart in Measles.

minute bluish-white speck. These specks on a red background may be regarded as diagnostic of measles, for they occur in no other disease. The gums, also, show evidence of congestion, are red, injected, and slightly swollen, being covered with a white patchy scum, which may readily be removed. The tongue is covered by white fur, its edges are red, and the papillæ enlarged.

On the third day, the rash in the mouth has become more intense. The soft palate is entirely covered and the hard palate involved. The Koplik's spots have greatly increased in number and may be observed on the inner sides of the lips. The eruption now begins to appear on the skin.

During the prodromal stage, there is frequently,

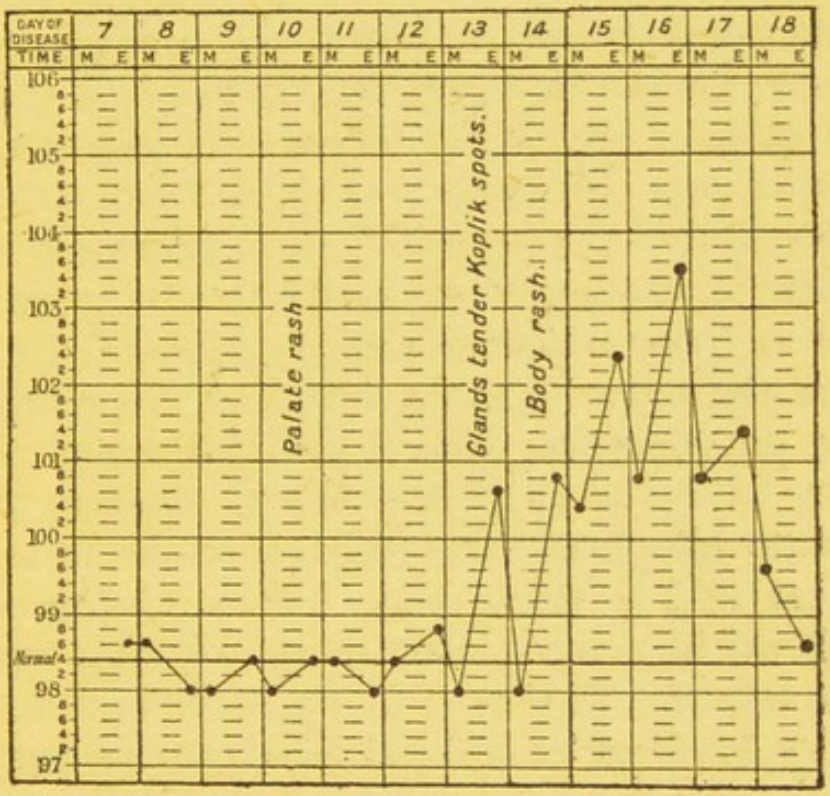

Fig. 5.—Temperature Chart in Measles.

on the second or third day, a remission of all the symptoms; the temperature may fall to normal or a little above, while the cough and catarrh may almost entirely disappear. This remission may often give a false sense of security and the nature of the illness may be overlooked. (Figs. 4 and 5.)

In the stage of primary fever, evanescent rashes often appear and disappear on the skin. The most

common of these is a spotty rash not unlike the proper one of the disease. In some epidemics a general erythema on the trunk, similar to the rash of scarlet fever, has been observed. Attacks of nettle rash are not uncommon.

Eruptive Stage.—The skin eruption of measles appears, as a rule, first upon the face near the mouth and nose, or behind the ears, and spreads downwards over the neck, chest and arms, and lastly over the abdomen and lower extremities. It is not uncommon, however, for the first appearance to be on the neck or the sides of the chest. There is no foundation for the belief that the severity of the subsequent attack, or the liability to complications, is influenced by the situation in which the rash first makes its appearance.

The eruption consists of slightly elevated, deep rosy or dark red separate spots, scattered irregularly, and fading on pressure. The individual spots quickly increase in size and coalesce with one another to form crescentic blotches. The rash continues to increase for from two to three days, the blotches becoming continuous in many places, more elevated, and of a darker colour. But even at its maximum development, patches of unaffected skin can be seen contrasting with the deep colour of the rash. Shortly after attaining its maximum, the eruption fades rather quickly in the same order in which it appeared, leaving behind a yellowish discoloration, which may persist for some time. In a proportion of cases minute hæmorrhages appear on the skin, especially in the flexures of the joints ; in a few the entire eruption becomes hæmorrhagic. With the appearance of the rash and its increasing development, the temperature continues to rise and may often reach, in a case of moderate severity, 105°. In most cases, however,

PLATE I.

Fig. 6.—MEASLES; second day of rash. The appearance often resembles chicken-pox or small-pox; but the features have a characteristic bloated appearance.

Face page 36

104° is not exceeded. The eruption on the skin and the temperature, usually reach their maximum development on the fifteenth day from infection, or the sixth from the primary fever. Both then subside, and a normal temperature is reached in from two to three days. During the eruptive stage all the symptoms of the prodromal stage increase in severity. The eyes become inflamed and there is often great intolerance of light. The cough is persistent and troublesome, and there is catarrh of the upper air passages, due, probably, to the downward spread of the eruption from the throat. Often there is a moderate amount of bronchitis, the respirations being short and frequent, and there is usually some complaint of soreness of the throat. The pulse is quickened in proportion to the temperature. The patient is generally restless, and the sleep much disturbed by the cough. The tongue usually continues furred, but occasionally the fur peels off, giving the red appearance with enlarged papillæ, usually associated with scarlet fever.

The disappearance of the eruption is followed by some desquamation of the skin, of a branny description, which may last a week or more.

The above is a picture of an ordinary typical attack of measles, as seen in a child of school age. It is liable, however, to some variations. The commencement of the prodromal stage may be delayed till the twelfth or the thirteenth day, and the appearance of the rash may also be delayed for one or two days. In every epidemic some cases are seen of very mild type, the amount of fever being small and the eruption slight and evanescent. On the other hand, the effects of the poison may be profound and the fever more intense and prolonged.

Complications.—The most important are those which affect the larynx, the lungs and the ears.

The extension of the rash from the mouth to the larynx may cause swelling of the vocal cords, with symptoms of croup, difficulty of breathing, and a short barking cough, occurring in paroxysms.

The bronchial catarrh, which is common to all cases of measles, may develop into a general bronchitis; or the lung may itself be involved and pneumonia, in one of its forms, result. This, a grave complication, may take place at any period of the attack, even in the prodromal stage, but more commonly at or about the time of the maximum intensity of the fever. If the patient appears dull and apathetic, the fever unusually high and remaining so, and if the ratio between respiration and pulse is altered,* an oncoming pneumonia may be feared and its physical signs looked for.

Inflammation may spread up the Eustachian tubes to the middle ear, giving rise to pain and, possibly, abscess. Occasionally this spreads through the bone tissue and affects the brain and its membranes.

Among the rarer complications are various kinds of paralysis.

Diarrhœa is often present. This varies greatly in different epidemics. In some it is almost a constant symptom, in others almost absent. It has been observed that in those epidemics, in which there is much diarrhœa, lung complications are less common.

Bleeding from the nose frequently occurs. If this

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* The normal being 1 to 4 (for example, respiration 20 to pulse 80 with a temperature of 99°), the ratio in oncoming pneumonia often approximates 1 to 3; for example, with a temperature of 104° the respirations rise to 40, the pulse to only 120.—*Nothnagel's Encyclopædia,* Translator's note.

is not severe, it may be regarded as beneficial. Patients often feel relief of their general symptoms after a moderate loss of blood, and it seems to diminish the tendency to ear troubles. The bleeding may, however, be so severe as to call for special treatment.

Convulsions not unfrequently occur in the prodromal stage, especially in young children, and are not, necessarily, of serious import. When they occur in the later stages their significance is very grave.

Diagnosis.—There is little difficulty in detecting a well marked case of measles, especially when it occurs in the course of an epidemic. The non-specific eruptions, which may be mistaken for measles are referred to on page 26. They may be distinguished, partly by the character of the rash, but more by the absence of the typical symptoms of the disease. The main features distinguishing measles, rubella and scarlet fever are set out in tabular form on page 56.

Prognosis.—When the disease is treated under favourable hygienic conditions, the mortality is not great. Fatal cases are almost always due to lung complications or to extensions of inflammation from the ears to the brain. Epidemics vary much in their severity, and age has a considerable influence. Before the age of five and after fifteen the tendency to severe attacks is increased.

Treatment.—An ordinary case of measles does not require much treatment; the anticipation and prevention of complications being the most important. The patient should be put to bed and kept there for a fortnight. The room should contain 1500 cubic feet of air-space; if other patients are treated in the same room, the floor area allotted to each bed should

be sufficient to allow of free ventilation without the production of draughts. The temperature of the room should be kept at about 65°. The windows should be shaded, but complete darkness is undesirable. Fresh air and sunshine are very beneficial. Patients who complain much of intolerance of light may be supplied with a shade: a suitable one can be made out of blue sugar paper to which tapes are attached. Sponging with tepid water, to which some mild disinfectant, such as Condy's fluid, has been added, relieves the skin irritation; but baths during the febrile stage are not desirable.

The diet should be light, consisting of milk, eggs beaten up with milk, beef tea or chicken broth. To relieve the thirst, fluids, such as plain water, lemon or barley water, may be freely supplied. Should there be much prostration, small doses (two to four teaspoonfuls) of brandy may be added to the milk and egg mixture.

For the cough, chlorodyne and Friar's balsam in suitable doses, often gives relief. The application to the neck and chest of a liniment, composed of goose grease, 2 parts; soap liniment, 2 parts; and oil of amber, 1 part, gives much relief, induces expectoration, and seems to avert lung complications. The use of antiseptic applications to the mouth, throat and and nose is very desirable. A solution of boric acid (1 or 2 per cent) is suitable, and may be applied as a mouth-wash, a spray, or better with a syringe. Gargling is inefficient and undesirable. Lozenges composed of formalin and menthol may be frequently sucked; they relieve the throat irritation and the cough, and diminish the probability of ear complications. Nose bleeding may, when necessary, generally

be stopped by the injection of hot water into the nostrils. Plugging the back of the nose should be done only by the doctor, and should be avoided unless absolutely essential, as the plug quickly becomes foul, and may set up septic conditions.

For diarrhœa, castor oil in emulsion is useful; astringents should not be used while the motions are unhealthy. If there is much laryngeal trouble with symptoms of croup, the air should be kept moist by the use of a steam kettle or spray, to which a teaspoonful of Friar's balsam, or a few drops of creasote may be added.

So far as medicine is concerned, a mixture containing acetate or citrate of potash is all that is required. The more severe complications will require special treatment adapted to each case. It is, however, very important to remember that the pneumonia of measles is itself an infectious complaint. Patients with this complication should not be nursed in the same room as other cases.

During the convalescent stage, the patient should have nourishing food, tonics and out-door exercise in suitable weather during the third week. A disinfecting bath should be taken each night.

Duration of Infectiveness.—A patient should be regarded as infectious for *three* weeks from the appearance of the rash.

H. G. A.

CHAPTER IV.

RUBELLA. ROSE-RASH.

French: RUBÉOLE. *German:* RÖTHELN.

RUBELLA is an acute infectious disease, characterised by a short prodromal period, a rose-red papular rash upon the skin, slight sore throat, and marked enlargement of the glands.

About 150 years ago it began to be recognised that there was an infectious eruptive disease, differing essentially from scarlet fever and measles, although somewhat resembling both in some of its features. Much doubt existed as to the nature of the affection, and for a long time it was regarded as a hybrid between measles and scarlet fever, but this idea has now been entirely abandoned. In 1875 it was accurately described in German medical literature under the name of **Rötheln,** which was, unfortunately, translated into English as **German Measles.***

This has led to much confusion, and the term German measles ought to be abandoned, for it cannot be too strongly insisted upon that rubella, measles, and scarlet fever are different diseases, each due to a separate and distinct poison. An attack of one of them does not render an individual immune from the other two. The disease is universally distributed.

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* In their issue of the Nomenclature of Diseases, 1905, the Royal College of Physicians adopted the title of Rubella with the synonyms, *German Measles—Epidemic Roseola.*

First accurately described in Germany, it has received attention from many writers in England, France, Italy and India, and it is well recognised in both North and South America.

Most medical writers state that the disease is most prevalent in young children ; but this appears to be an error, it being more commonly seen in adolescents and young adults. From statistics obtained from a number of Preparatory Schools, it was found that not more than 5 per cent of their entrants had already been attacked and, of the entrants at the Public Schools, only 22 per cent are protected by a previous attack.

Epidemics of the disease are most liable to prevail in the late spring and early summer months. The disease is highly infectious and, in most, if not in all cases, is communicated by direct personal intercourse. There is no evidence that the poison is retained in or conveyed by fomites.

Incubation.—Owing to the insignificance of the early symptoms it is not easy to determine the exact duration of the incubation period. In the great majority of cases it is fourteen days ; in a few, a day or two more or less.

Eruptive stage.—After a short prodromal period, not usually more than twenty-four hours, in which there is some headache and feeling of general ill health, the rash appears on the face, especially at the base of the nose and round the mouth. From the face it quickly spreads to the neck and body, the whole of which may be covered by the second day of the disease. The appearance of the eruption presents three varieties : (1) Papules, varying in size from a pin's head to a small bean, slightly elevated above the skin, usually round or oval in

shape, and of a rosy-red colour. This somewhat resembles the rash of measles, but the colour is lighter and there is not the same tendency to the formation of crescentic blotches. (2) Like measles on the face and body and a diffuse erythema on the limbs. (3) Erythematous throughout and resembling that of scarlet fever, but without the punctate appearance. The eyes are frequently suffused and present a bright red appearance, but, usually, there is no intolerance of light.

The glandular system is always involved; the glands in the sides of the neck, at the back of the ears, and especially those at the back of the head are enlarged and tender; those in the armpits and groins are usually affected also. It is very uncommon for the inflammation of the glands to proceed to suppuration and abscess. There is often some complaint of sore throat, and the tonsils and soft palate are swollen and red. The respiratory organs are not affected, and although there is occasionally some cough, there is no bronchial catarrh.

The amount of fever varies greatly in different epidemics. In a few cases the temperature may rise to from 103° to 104°, but a maximum of 101° is more usual. In a recent epidemic of two hundred cases, two of them had a temperature of 103°, in 25 per cent the temperature reached 100°, and in the remainder, it did not reach that figure.

There is practically no feeling of illness, even in those cases in which the temperature is raised. On the third or fourth day the rash has entirely disappeared, some discoloration of the skin may be left, and there is, generally, some branny desquamation of the skin, more copious in those cases in which the eruption has been of the scarlatiniform type.

The swelling of the glands may persist for some time after the disappearance of the eruption.

Treatment.—Little treatment is required during the attack. The patient should be kept in bed during the eruptive period and may then be allowed out-of-doors. Tonics, such as Easton's syrup, may be useful during convalescence.

Duration of Infectiveness.—A patient may be regarded as not infectious after eight or ten days from the appearance of the rash.

Diagnosis.—The non-specific eruptions resembling rubella are referred to on page 26.

The main features distinguishing rubella, measles, and scarlet fever are set out in tabular form on page 56.

H. G. A.

CHAPTER V.

SCARLATINA. SCARLET FEVER.

French: SCARLATINE. *German:* SCHARLACH.

SCARLET FEVER is a specific infectious disease, attended by inflammation of the tonsils and by a punctate scarlet eruption, followed by desquamation of the skin.

Although it is probable that scarlet fever must have existed long before it was described as a separate disease by medical writers, the first definite record, according to Hirsch, dates from 1543. Its original habitat is unknown, but in later times it has been confined principally to Europe and North America.

Susceptibility to the contagion of scarlet fever is not nearly so universal as that to measles. When it was introduced into Thorshaven in 1873, only 38 per cent of the inhabitants, who were unprotected by a previous attack, were affected; whereas 99 per cent of the unprotected were attacked by measles two years later. In England, in the elementary schools, 12 per cent of the children have been attacked before reaching the age of ten years; in the preparatory and public schools, 8 per cent have been attacked before the age of nine, 11 per cent before fourteen, and about 13 per cent before the termination of their school career.

Age has a considerable influence. About one-

third of the cases occur in children under five years of age; another third between five and ten; and of the remainder, one-half are under fifteen. No age is altogether exempt, but cases over twenty-five are uncommon.

Some individuals seem to have a special immunity to the disease, and although frequently exposed to infection, are never attacked. Sometimes this immunity is common to all the members of the same family.

One attack of scarlet fever confers immunity to a second attack, which usually persists through life; but second attacks in the same individual occasionally occur. The infection of scarlet fever is in most instances due to direct personal intercourse. But there is no doubt that the poison can be retained in and conveyed by *fomites*, such as articles of clothing, cups, syringes, etc., used by the sick; books and letters; the clothes of doctors and nurses; and articles of food. It retains its vitality for a considerable period; and articles of clothing or toys, which have been put away, unexposed to light and air, may be sources of danger for a long time. There is some doubt whether it is ever water-borne, but many instances have been recorded of the poison having been conveyed by milk. The poison is chiefly air-borne, but probably not to a great distance. Residents in the neighbourhood of fever hospitals do not appear to be specially liable to attack. The secretions of the throat and nose, and the particles detached from the skin, especially in the early stages of desquamation, are the principal vehicles of infection.

It is certain that scarlet fever is due to a specific micro-organism, and various claims that this has been isolated and identified, have been put forward.

These have not yet been substantiated, and the matter is still *sub judice.*

Predisposing Causes.—Amongst these are a recent attack of another infectious disease; poverty; overcrowding; ill health; surgical injuries, especially burns; and operations, especially those on the throat and nose, such as the removal of tonsils or adenoids.

Incubation.—The incubation period is, in the great majority of cases, less than seven days; most often three or four days. Where milk has been the vehicle of infection, the period is somewhat shorter, averaging two or three days. There seems some reason to believe that in scarlet fever as in diphtheria, the poison may be received into the body and remain latent, probably in the tonsils, till some disturbing factor, such as ill health, accident or operation, renders the individual more susceptible to its development.

Prodromal Stage.—In most cases the attack develops with rapidity. For one or two days there may be evidences of ill health, indicated by shivering, general pains, headache, furred tongue, and loss of appetite. The most typical symptoms are sore throat and vomiting, the latter being specially common in young children. The sore throat is indicated by difficulty in swallowing, and by pain and tenderness at the angles of the jaws. The temperature quickly rises from 101° to 104°. As a rule the severity of the initial symptoms, particularly as regards vomiting, is an indication of that of the subsequent attack. Adults sometimes complain of sore throat for some days previous to the other symptoms of invasion.

Eruptive Stage.—The eruption is characteristic,

usually appearing within twenty-four hours of the first symptoms and rarely being delayed beyond the second day. This consists of two parts; first there is a general deep red blush (erythema), and scattered over it are a number of minute, deeper red, slightly elevated spots, giving a peculiar *punctate* appearance. Usually it is brightest on the chest, loins and inner sides of the arms and thighs.

In the flexures of the joints, especially in the arm-pits, elbows and groins, the punctate appearance is most evident. The rash entirely disappears on pressure unless, as is often seen on the neck and flexures of the joints, there are minute hæmorrhages (petechiæ) in the skin. The parts over the collar-bones and breast-bone are first affected, and later the trunk and limbs, the legs being reached last. Certain portions of the skin are, almost invariably, unaffected, namely *the face*, scalp, palms of the hands, and soles of the feet. The freedom of the face from rash is a valuable distinction between this disease and rubella. The face is often deeply flushed, especially over the prominences of the cheeks, and on the second or third day appears to be dusted over with a fine white powder, giving the so-called powder-and-rouge appearance. The region about the mouth is not flushed, but is bloodless and pale (circum-oral pallor), contrasting vividly with the surrounding redness. The skin, where affected by the rash, becomes swollen with effusion, and difficulty may be experienced in bending the joints. The eruption fades in the same order in which it appeared, and with it the sub-cutaneous effusion. In an ordinary well-developed case, it is gone by the end of a week, leaving behind a yellowish parchment-like appearance of the skin.

The tongue, during the initial stages, is covered with a thick creamy fur ; the papillæ are enlarged and stand out as red points through the fur. Early in the eruptive stage this begins to peel off at the tip and edges of the tongue, which by the fourth day presents a red moist surface, the condition being known as " strawberry tongue." This, though common in, is not peculiar to scarlet fever, as it is also seen in other diseases, by no means rarely in measles. The inflammation of the throat bears a relation to the severity of the general attack. In the early stages the tonsils and uvula are red, dry, and shining. Should the disease be intense, these become swollen and velvety, and covered with a white secretion which may be seen exuding from the mouths of the follicles.

The glands in the neck are moderately enlarged and painful, in sympathy with the inflammation of the throat. The temperature, which was raised during the initial period, continues high, 100° to 104°, during the eruptive stage. With the fading of the rash the fever recedes, and the normal is reached in from five to seven days from the onset (Fig. 1, page 25).

The pulse is always accelerated, much more so than is accounted for by the amount of fever. The disproportion between the pulse and temperature rates is an important point in distinguishing between scarlet fever and other eruptive diseases. In the early days of convalescence the pulse and temperature may be subnormal.

Desquamation.—With the subsidence of the febrile and eruptive symptoms, a characteristic desquamation of the skin commences, appearing first on the face in a white powder. Peeling may usually be

PLATE II

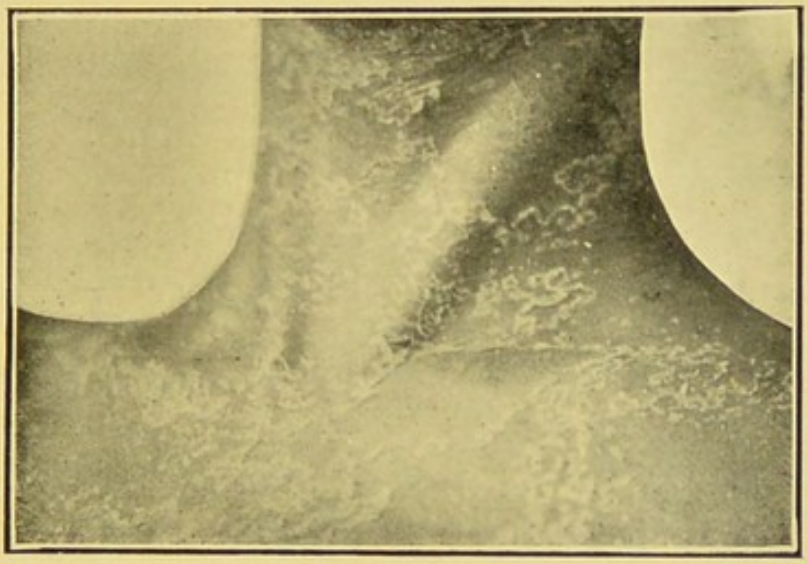

Fig. 7.—Scarlet Fever. Peeling, or desquamation stage. In infants and small children the peeling is rarely so well marked as in this case.

Face page 50

first observed on the ears and lips, but soon afterwards extends to the neck, where it often has a pinhole appearance. The palms and soles, from which the skin comes off in flakes or scales, are the last to become free. The amount of desquamation is usually, but not always, in proportion to the intensity of the eruption and the swelling of the subcutaneous tissues.

VARIETIES.—Scarlet fever varies more than the other eruptive diseases. There are three principal varieties, which have not however any fixed line of demarcation.

1. *Scarlatina Simplex.*—The fever and throat affection are so slight that little discomfort is felt. The eruption is slight and transient.

2. *Scarlatina Latens.*—This also is very mild and sometimes overlooked, only being recognised by the sequelæ.

3. *Scarlatina Maligna.*—All the symptoms are pronounced; the fever is high and prolonged; the throat affection severe, with, possibly, some sloughing of the tonsils; a copious discharge from the nose of clear, viscid, irritating fluid, which may appear on the second day; the rash is unusually livid, and hæmorrhages (petechiæ) are common; sleeplessness and delirium; a tendency to complications.

Complications.—The most common are:—

1. Inflammation of the ears, more especially in cases where there is much throat trouble, the inflammation spreading up the Eustachian tubes. This also occurs in mild cases, especially in young children.

2. Inflammation of the kidneys, indicated by the passage of blood and albumin in the urine, and dropsy. The appearance of albumin in the urine during convalescence does not necessarily imply

that there is inflammation of the kidneys, for adolescents, who are the subjects of functional albuminuria, very frequently give, under these circumstances, evidences of this condition. This is also the case during convalescence from other infectious diseases.

3. Severe inflammation of glands, leading to suppuration and abscesses.

4. Rheumatic affections of the joints, usually appearing at the end of the first week. These do not differ from ordinary rheumatism, and may give rise to heart complications.

5. Secondary rashes, appearing towards the termination of the second week. These are papular or erythematous in appearance, and are usually due to absorption of septic matter from the throat.

Diagnosis.—A well marked case of scarlet fever presenting the features given above can hardly be mistaken for anything else. In mild and atypical cases the diagnosis may be difficult or even impossible.

From tonsillitis, especially when it is accompanied, as is often the case, by some erythema of the neck and chest, there may be considerable doubt in drawing a distinction. In tonsillitis there is, as a rule, no vomiting, the rash is not punctate, nor does it spread, and one tonsil is usually affected before the other; the tongue remains furred and does not peel. A very high initial temperature is rather in favour of tonsillitis.

The non-specific eruptions resembling scarlet fever are referred to at page 26.

The main features distinguishing scarlet fever, rubella, and measles are set out in tabular form, page 56. For those distinguishing it from diphtheria, see *Diphtheria*.

Should there be any doubt, it is better to err on the safe side and isolate the case "on suspicion."

Prognosis.—This, at the present time, is favourable; the case mortality during the last thirty years having considerably decreased. It must be remembered, however, that history shows that it is the nature of the disease to pass through alternate cycles of great and slight severity. It is by no means improbable that there will be a recurrence to the severe type of forty years ago.

Treatment.—The patient should be put to bed in a well ventilated room with a capacity of not less than 1500 cubic feet. Even a mild case should be kept in bed for not less than fourteen days, the period being lengthened according to the severity of the attack. The temperature of the room should be from 55° to 60°. The body should be sponged daily with tepid water containing some mild disinfectant. In all cases antiseptic treatment should be given to the throat and nasal passages. The best antiseptic for this purpose is chlorine water, made in the following way. In a closely stoppered bottle put ten grains of chlorate of potash, and pour on twenty drops of strong hydrochloric acid, cork tightly and leave for five minutes; then add water, two ounces at a time, to twelve ounces, replacing the stopper and shaking the bottle on each addition. To this some syrup may be added before use, but it is not essential. In mild cases, this may be used as a spray; in severe cases the throat and nostrils should be syringed every two or three hours and the tonsils swabbed with cotton-wool soaked in the solution. Gargling is quite ineffective. The insufflation of flowers of sulphur on to the throat after it has been thus treated, has a very beneficial effect.

Mild cases need no medicine except an ordinary febrifuge mixture and purgatives to counteract the

constipation which is usually present. Salicylate of soda and salol are valuable drugs for the treatment of severe cases, and seem to have some influence in preventing rheumatic complications.

Complicated and severe cases will require special treatment according to their symptoms.

The diet should be light, consisting for the first few days of milk, and beaten-up eggs, arrowroot and cornflour; later, beef-tea, broth, and meat jellies may be added. Water or lemon-water to drink, and fruit, such as oranges or grapes, may be allowed at any time. At the termination of the febrile stage, meat, fish, poultry, etc., may be commenced. There is no reason for withholding nitrogenous food on the theoretical ground that it may induce kidney trouble.

Specific remedies, for the prevention of, or cutting short attacks and diminishing the periods of infectiveness, have from time to time been suggested. None of them stand the test of time and experience.

Duration of Infectiveness.—This is summed up in the *Medical Annual* for 1912 thus: "The question is frequently asked, 'How long does a scarlet-fever patient remain infectious?' It is not so very long ago that the stereotyped reply was, 'As long as he continues to peel.' But it is now recognised that desquamation is not to be taken as a sign of infectivity. One may say that scarlatina is a moderately infectious disease for two weeks after the onset, but that a majority of the cases cease to be infectious some time during the second fortnight, so that at the end of the fourth week, only a small percentage remain so. Out of this small percentage some, including some mild cases, probably remain infectious for several months, though they are not so recognisable by any known method; it is possible

a still smaller number retain the power of infecting for a much longer period, perhaps even as long as a year."

At present the best working rule is to regard every case as infectious for six weeks, the period being extended if local affections, such as discharges from the throat, nose, or open sores, make it necessary.

Disinfection should in all cases be thorough. The patient and nurse must be completely isolated. Handkerchiefs and rags used for wiping discharges should be at once burnt; and at the termination of the case, books, toys, games, etc., should be dealt with in the same way.

H. G. A.

THE FOURTH DISEASE.

Clement Dukes (*Lancet*, July 14th, 1900) has suggested that there is another infectious disease, in some respects similar to both rubella and scarlet fever, but in others differing from either. To this he has given the provisional title of "The Fourth Disease."

He says that the principal characteristics are:— An incubation period of nine to twenty-one days; a short and ill-defined prodromal stage; an eruption somewhat similar to that of scarlet fever, which is followed by desquamation; a temperature varying from normal to 104°; pulse, if quickened, bearing a ratio to the amount of fever; throat red and swollen; glands universally enlarged and tender; tongue slightly furred, but not peeling and giving the strawberry appearance; no sequelæ or complications; the duration of the illness short; the period of infectivity not more than twenty-one days.

The suggestion has received the careful attention of many observers, but has not been confirmed.

H. G. A.

TABLE OF THE PRINCIPAL FEATURES DISTINGUISHING

	MEASLES	RUBELLA	SCARLET FEVER
Incubation ..	10 days to initial symptoms; 13 or 14 to rash.	12 to 16 days; average 14 days.	2 to 6 days; average 4 days.
Premonitory Symptoms	Fever with remissions; running from eyes and nose; cough, sneezing, and malaise for two or three days.	Often none; but sometimes headache, sore throat and slight fever for one day.	Sometimes absent; but usually fever, headache, vomiting, occasionally rigor, sore throat.
The Eyes ..	Very red and watery and much intolerance of light.	Pink and suffused, and no intolerance of light.	Bright and intelligent.
The Mouth ..	Tonsils and palate red and swollen. Koplik's spots. Gums swollen.	Throat red, sometimes rash on soft, not on hard palate.	Tonsils uniformly red and swollen.
The Tongue ..	Covered with thick white fur; rarely peels.	Slightly furred, not coated; never peels.	Covered with thick white fur, which peels on 4th or 5th day, leaving a strawberry appearance.
The Glands ..	Swollen and tender, especially in neck.	Enlarged, tender and hard throughout the body, especially in neck, behind the ears and head. Those in armpits and groins also affected.	Those in neck enlarged in proportion to the amount of throat affection.

The Rash ..	Appears on 3rd day, usually first on face and behind ears. Then general on body; first as red papular dots, which coalesce, forming irregular-shaped crescents, or semicircular patches. Brick red at first, afterwards of a bluish tint.	Usually appears first on face. Three varieties: 1. Separate rose-red papules. 2. Like measles on face and body, and erythematous on limbs. 3. Erythematous throughout, resembling scarlet fever, but rarely punctate.	A diffuse punctate erythema over the body; the punctate appearance most apparent in the flexures of joints. *Does not appear on the face,* though this is flushed; nor on the palms or soles. Skin markedly hot to the touch.
Temperature ..	From 101° to 104° or more.	Often no fever, but may be 103° or 104°.	Subject to great variation. In mild cases may be no fever. In those of moderate severity from 101° to 103°. In severe cases from 103° to 106° or more.
The Pulse ..	Quickened in proportion to fever.	In most cases unaffected.	Much quickened, and out of proportion to amount of fever.
Sensation of Illness	Considerable.	Very little, if any, even when temperature is high.	May be very little or very great.
Rheumatic Pains ..	None.	None.	Frequent, towards end of first week.
Desquamation ..	Branny.	Branny; most often on face.	In proportion to the extent and severity of the eruption. In scales and shreds, especially on hands and feet.

CHAPTER VI.

VARICELLA. CHICKEN POX.

French : LA VARICELLE. *German :* WASSERPOCHEN.

CHICKEN POX is a specific infectious disease, of which the characteristic symptom is an eruption of vesicles, usually appearing in successive crops.

For a long time it was confounded with smallpox, but since the two diseases were differentiated in the latter part of the eighteenth century, no one of any authority has affirmed their identity. An attack of smallpox confers no immunity against a subsequent attack of chicken pox, and *vice versa* ; and vaccination has no influence in protecting from chicken pox. Moreover smallpox is readily inoculable in unprotected persons, but attempts to do this with the material from the vesicles of chicken pox have generally, if not always failed.

The disease occasionally prevails in epidemic form, the highest seasonal prevalence being in the winter months. Children are more frequently attacked, but adults and even old people are not exempt. Statistics show that of the entrants at the preparatory schools, 32 per cent have already had the disease, and 32 per cent get it before leaving ; at the public schools, 7 per cent are attacked, and 29 per cent leave school unattacked.

The infection of chicken pox is due to direct personal intercourse ; but it is possible that the

PLATE III.

Fig. 8.—CHICKEN POX. Often the marks are closer together, as in smallpox, with which the eruption may be confused, as well as with measles.

Face page 59

poison may be retained in and conveyed by fomites. The specific organism has not yet been isolated.

Incubation.—A wide margin of from twelve to twenty days is given by most authorities, but in the great majority of cases fourteen days elapse between exposure to infection and the first appearance of the rash.

Prodromal Symptoms.—These are not well marked and may be entirely absent. Usually, in young children especially, there is some headache, lassitude, and peevishness; the temperature is occasionally raised. A prodromal rash, sometimes morbilliform and sometimes erythematous, and sometimes one followed by the other, is occasionally seen upon the chest and abdomen.

The Eruption makes it appearance, usually, on the first day and rarely later than the second day; and is, often, the first thing to attract attention. There is no definite rule as to the part of the body which is first affected; more generally, perhaps, the chest and back, but, also, in many cases the face and scalp, in which case the glands at the back of the ear are swollen and tender. The eruption, at first, consists of a number of small rose-coloured spots, which fade on pressure. They are circular or oblong in shape and slightly raised above the skin. Very quickly, usually in an hour or two, the spots are converted into vesicles, containing clear watery fluid. In from twelve to twenty-four hours each vesicle begins to dry up and a scab forms which in five or six days falls off and leaves a reddened, flat, or slightly indented surface. Occasionally the papular stage is wanting, and the vesicles then look like small drops of water on the skin. The eruption comes out in crops, most often on three successive

days. After the appearance of the successive crops, the eruption can be seen in its different stages of papules, vesicles and scabs on the body at the same time. Some of the papules, especially those of the last crop, do not become vesicles. It is not uncommon for some of the vesicles to become purulent. Spots often appear on the mucous surfaces of the mouth and inside the eyelids.

The distribution of the rash is characteristic of the

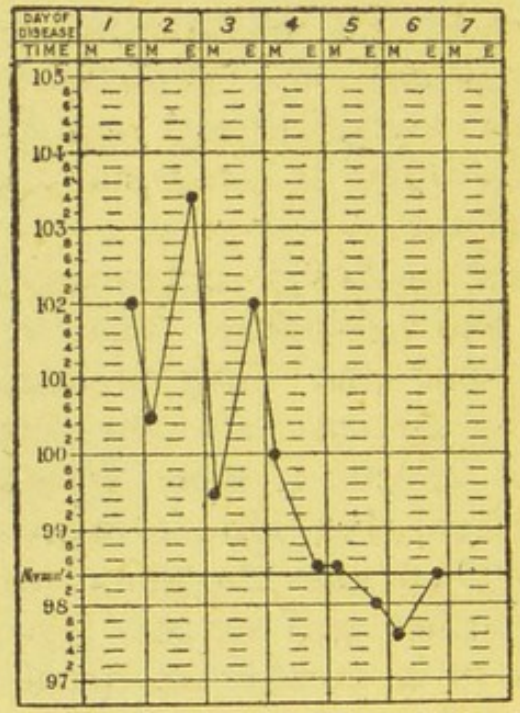

Fig. 9.—Temperature Chart in Chicken Pox.

disease; appearing most abundantly on the trunk and scalp, less so on the face and limbs, and sparsely on the hands and feet. The palms and soles generally escape.

Symptoms.—In most cases chicken pox runs a mild course, without any marked symptoms. Sometimes there is considerable skin irritation, especially if the vesicles are abundant. There may be only slight elevation of the temperature, but

frequently there is an evening rise with morning remission on three or four successive days, coinciding with each fresh outcrop of spots (*Fig.* 9).

Convalescence is usually reached in the course of a fortnight, by which time all the scabs have fallen off. When the vesicles become pustular, a suppurative condition of the skin may follow, which will require special attention (see IMPETIGO).

Treatment.—Little treatment is required. Cases should be kept in bed for a week, and a further period of a week allowed for convalescence. The skin irritation will be relieved by the application of a lotion containing calamine and oxide of zinc; or a dusting powder, consisting of oxide of zinc and starch in equal parts, may be used.

Duration of Infectiveness.— Fourteen days from the appearance of the rash.

H. G. A.

CHAPTER VII.

MUMPS.

(SPECIFIC OR EPIDEMIC PAROTITIS.)

French: OREILLONS. *German:* ZIEGENPETER.

MUMPS is an acute infectious disease usually characterized by swelling and inflammation of the parotid glands, which are salivary glands situated in the cheek just in front of the ears. Most of the cases are mild, but severe symptoms occasionally occur. These, however alarming they may appear, nearly always end in recovery.

It is a disease of children and young adults, the majority of cases occurring between 5 and 15 years, but young men over 20 are not very infrequently attacked. Some think that epidemics occur more commonly in cold, wet and windy weather.

Although the disease has been recognized since the time of Hippocrates, its cause has not even now been determined with certainty, though it is most likely a bacterium.*

Incubation Period.—Very short incubation periods, such as three, four, or five days and very long ones, such as thirty-five days or even six weeks, are mentioned in the literature on the subject. If these really occur they must be very exceptional and can be disregarded in practice. Fourteen to twenty-six days may be taken as the usual limits; in the majority

* The Diplococcus of Laveran.

of cases the first symptoms appear between seventeen and twenty-one days after exposure to infection.

Quarantine.—Usually twenty-four days is considered sufficient.

Infectivity.—The secretions of the mouth are no doubt infectious, and the disease is usually transmitted directly from patient to patient. Those sleeping in adjoining beds or sitting next to one another at work are very likely to transmit and receive the disease. It is only carried a very short distance by third persons, and does not readily spread from one house to another. The patients are probably infectious for a few days before recognizable symptoms of the disease begin, and remain infectious for at least a week after all symptoms have subsided. Cases are recorded in which they have apparently remained infectious for much longer (three or four weeks), but this is exceptional, and as a rule no harm will be done if patients are allowed to return to ordinary life a clear week after they have apparently recovered.

Clinical Course.—The incubation period may be free from any symptoms which attract attention, but in some cases there may be, for a day or two, ill-defined feelings of indisposition, or even more definite prodromal or preliminary symptoms, such as nose-bleeding, earache, sore throat or fever.

An interesting and little known symptom was described by Mirchamp in 1903 as occurring in mumps even before the swelling and pain in the parotid. If the patient's tongue is touched with a drop of vinegar or some similar substance of sharp flavour, a marked secretion of saliva from the parotid takes place which is accompanied by a spasm of pain. The sign might be of value in testing those who had

been exposed to infection, towards the end of the probable incubation period.

The onset, in the great majority of cases, however, is marked by a swelling behind the jaw, just in front of the ear, accompanied by a rise of temperature, and more or less feeling of illness. The swelling rapidly increases, and in two or three days may become very considerable, extending down the neck and forwards on to the cheek. All movement of the jaws becomes very painful, and it is difficult for the patient to open his mouth, to swallow, or even speak. The corresponding gland on the other side usually begins to swell a day or two after the first. Nose-bleeding and earache are not uncommon. In a few days the swelling begins to subside, and the whole attack may be over in a week or ten days, leaving no permanent damage. As a rule, adults who contract mumps have a more severe attack than children. Although mumps is nearly always a mild disease, and it appears to be very doubtful if any one ever died of it, it should always be carefully nursed and treated because certain complications may occur which are distressing in themselves and occasionally leave serious results behind them. These complications are much more frequent in some epidemics than in others, so that a comparatively limited experience of mild cases should not put us off our guard. A simple, uncomplicated attack may give rise to severe fever, or to actual delirium, and symptoms which closely resemble those of meningitis. The chief complication is pain, inflammation, and swelling of the testicle (known as *orchitis*) which occurs more commonly in older boys and adults. It always subsides, but in some cases the organ subsequently atrophies. This complication

usually begins when the swelling in the cheek is subsiding, but it may come on quite early or even occur as a first symptom. Owing to the possibility of this complication (which cannot be foreseen in any particular case) older boys with mumps have to be kept in bed for ten days. Another complication is inflammation of the pancreas, a gland concerned in digestion which lies in the upper part of the abdomen. This gives rise to pain and often serious symptoms of illness, such as vomiting of blood, passage of blood with the stools, and considerable collapse. It appears however always to end in recovery. In girls, inflammation of the breasts is said to occur occasionally. Symptoms which have been attributed to inflammation of the ovaries are also said to have been observed, but this is very rare. The most serious complication is probably deafness, which, when it occurs, is sometimes permanent.

All these occasional complications point to the fact that mumps is a general, not a local disease, and is due to some germ which circulates in the body and though usually making its effects seen in the parotid gland, at times lodges in other organs also. In fact cases have been described in which the parotid gland escaped while one of the other structures mentioned became inflamed.

The submaxillary gland (another salivary gland lying under the side of the jaw) is also sometimes involved, either alone or with the parotid. When an epidemic of mumps is in progress these cases give rise to no especial difficulty, but when, as sometimes happens, a single case of inflammation of the submaxillary gland occurs, its true nature may not be recognized, until, perhaps, the infection has been transmitted to another person who develops the disease in its usual situation. J. M. F.-B.

CHAPTER VIII.

WHOOPING COUGH. PERTUSSIS.

French : COQUELUCHE. *German :* KEUCHHUSTEN.

WHOOPING cough is a specific infectious disease, characterized by catarrh of the respiratory passages, and by a peculiar spasmodic cough. It is specially common in children under five, but may occur at any age, cases having been recorded at eighty years. Although no case of whooping cough is to be treated lightly, it is hardly ever fatal in children over ten ; 99·7 per cent of the deaths in England and Wales from this disease in 1908 occurred in children below this age. It is said to occur more frequently in the wet, cold weather ; and though cases are always present in large towns, epidemics usually take place only every three or four years.

Whooping cough is generally believed to be due to a germ which, like that of diphtheria, is lodged in the respiratory passages, and thence diffuses its poisons or toxins into the blood.*

Incubation.—The period is not easy to determine. but seems to lie between four and fourteen days or longer.

Quarantine is fixed at twenty-one days to allow

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* A germ described by Bordet and Gengou in 1906 is the best accredited among several which have been described as the causal agents.

for cases in which slight catarrhal symptoms may be overlooked owing to the whoop not appearing for a week or so.

Infectivity.—There appears to be no doubt that the most infectious stage of whooping cough is that before the whoop develops, and that from the appearance of this symptom the infectiousness of the patient begins to decline. After six weeks, in most cases at any rate, the patient has ceased to be infectious; certainly he is so if the whoop has been absent a fortnight. In very brief, slight cases the infectivity is no doubt still shorter, and in severe cases it may be longer, but the occurrence of an occasional whoop, or even of several such, months after the disease has apparently ceased cannot be held to denote that the patient is necessarily still infectious. As the infection is in the catarrhal secretions of the throat, and is spread by coughing, fairly close contact is necessary for its transference to other persons. It is not very easily carried by third persons, as the germ soon dies on exposure to light and air, but at least one well authenticated case is on record in which it was conveyed by clothes which had been well sprinkled with germs by an infected child, and retained their infectivity for some hours. Thorough washing and cleaning is probably all that is necessary for the disinfection of rooms in which whooping cough patients have been isolated.

Clinical Course.—The period of *invasion*, after the usual incubation, is characterized by what appears to be a feverish cold and cough, and for a week there may be nothing absolutely typical.

In suspected cases, however, or where the patient is known to have been exposed to infection, an

examination of the blood may help to clear up the diagnosis before the typical symptoms have developed. The total number of white blood cells is normally greater in young children than in adults, but it is still further increased in whooping cough, and the proportion of the various kinds of cells is also altered. The test, however, can only be made by one accustomed to this form of blood examination, and the transmission of specimens for examination at a distant laboratory, though methods have been devised for its accomplishment, is not a satisfactory proceeding.*

The cough usually becomes less frequent and more "paroxysmal" in character towards the end of this period, and then the second stage is ushered in by an attack of vomiting or a definite whoop. This second stage is the one in which the disease is most frequently first recognized: though, as the patient often begins to whoop at night, it is the nurse and not the doctor who is usually able to make the diagnosis. A typical attack of coughing consists of a number of rapid expiratory efforts, such as are made by any unfortunate person who has swallowed a dry breadcrumb "the wrong way." The face in a severe paroxysm becomes swollen, puffy and congested, and especially in younger children, the choking nature of the seizure is very painful to witness. Then suddenly the cough comes to an end and the patient succeeds in drawing air into his lungs again with a loud, crowing noise; this is the

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* Bordet and Gengou have also described a method of diagnosis which is dependent on finding the bacillus in the expectoration. This may be done early in the disease, when it is most abundant. The method is somewhat costly and elaborate, and is therefore quite unsuited for routine practice. In special cases it might be advisable to adopt it.

"whoop." Sometimes several of these paroxysms follow one another immediately; often the attack ends in vomiting. Sometimes a little blood-stained mucus is ejected at the end of the cough, and at times there may be considerable hæmorrhage from the nose or elsewhere. These bleedings however are not as a rule at all dangerous. In some cases the attacks may occur as often as once an hour, and the child if young may become seriously exhausted. Usually, however, they are not nearly so frequent even at the height of the attack, and older children are generally fairly well between the fits. The stage of defervescence is marked by a diminution in number and violence of the fits, until they gradually cease altogether.

During the first or catarrhal stage, patients are best in bed, during the second or "whooping" stage they are usually best up and about, and in good weather can go out-of-doors. The danger of whooping cough is that it is liable, like measles, to be followed by broncho-pneumonia. Among young children and among those who are badly fed and nursed, this is a very fatal complication. It usually appears in the third or fourth week after the onset of the symptoms. In infants, convulsions may complicate an attack and may prove fatal. In patients of any age the violence of the cough may more or less strain the heart. The protection against a second attack afforded by whooping cough is very complete. The majority of cases in which a second attack appears to occur are no doubt instances of mistaken diagnosis. This is rendered probable by the difficulty of making a positive diagnosis which even experienced doctors may feel in some cases.

J. M. F.-B.

CHAPTER IX.

GLANDULAR FEVER.

(FEBRILE POLYADENITIS).

French : FIÈVRE GANGLIONARE.

German : DRÜSENFIEBER.

THIS condition was first described as an acute specific disease in 1889 by Pfeiffer, the discoverer of the influenza bacillus. It usually occurs in children between four and twelve years of age, and is not common in younger or older persons. It is almost certainly due to a germ, which probably enters through the mucous membrane of the throat or nose ; it does not, however, appear certain that the same germ is responsible for all epidemics. The patient is presumably infectious during the continuance of the symptoms.

Incubation Period.—This appears to vary. In one case it was as short as twenty-four hours. In other epidemics the limits have been seven to nine days, and four to seven days.

Clinical Course.—The onset is fairly sudden, with fever and pain in the neck ; sometimes there is sore throat, swallowing may be difficult, and vomiting or shivering sometimes marks the beginning of the disease. In twenty-four to forty-eight hours the glands in the neck become swollen, painful, hard, and tender to touch. They may continue in this condition for some days. Sometimes there is pain and

tenderness in the abdomen, and glands in other parts of the body may be affected. They never form abscesses. When the glands subside (which is usually in two or three weeks) the fever abates, and recovery is usually absolute, though convalescence may be prolonged. There is often constipation during the attack, less frequently diarrhœa occurs.

Complications are rarely observed, and usually also end in recovery. The most serious is inflammation of the kidney. Bleeding from the nose and from the bladder may occur.

Mortality.—In 96 cases 1 died.

J. M. F.-B.

CHAPTER X.

DIPHTHERIA.

French : DIPHTÉRIE. *German :* DIPHTHERIE.

DIPHTHERIA is a specific infectious disease characterized by the formation of a membranous exudation in the throat, nose, and upper air passages, and later by the occurrence of paralysis in various parts of the body, in a certain proportion of cases.

History.—The disease appears to have been recognized in very early times. It was probably known to Hippocrates and Galen and is described by Aretæus (III A.D.). It was not, however, till the eighteenth century that its clinical features were accurately distinguished, and the name is comparatively recent, having been coined by Bretonneau in 1821.

Considerable difficulty was experienced, however, in separating cases of diphtheria from other severe kinds of sore throat, until in 1883 Klebs demonstrated the causal organism, which was first successfully cultivated on an artificial medium by Loeffler in the following year.*

The bacillus can easily be cultivated on special media in from eighteen to twenty-four hours and then presents, when stained by appropriate methods,

* This organism is now known as the Diphtheria or Klebs-Loeffler bacillus.

a characteristic appearance under the microscope. At present, therefore, there are two methods by which diphtheria can be recognized, and in all cases it is important that both should be employed, for reasons which will appear shortly. The first is the "clinical" method, and until the bacillus had been discovered, this was the only one available. Physicians by observing the symptoms can, with considerable accuracy, determine whether a given case is one of diphtheria or not. The second method is the "bacteriological." A small cotton-wool swab is rubbed over the throat of the suspected person, and sent in a closed tube to a bacteriologist. The latter, by transferring the material absorbed by the cotton-wool swab on to a suitable culture medium, obtains in some twenty hours, a "culture" or "growth" of the organisms from the throat, which he examines. In a large percentage of cases he is able to report definitely the presence or absence of the characteristic bacillus.

These two methods of diagnosis should always be employed together, for the following reasons. In typical cases an experienced physician can generally diagnose diphtheria with certainty, but in a certain number, the signs he expects to observe are misleading or absent, and here the bacteriologist is of great assistance. It is now known that other bacteria can produce a condition in the throat closely resembling diphtheria. On the other hand, it is not safe to rely solely on the bacteriological examination, for several fallacies may occur. In the first place the swab may fail to "catch" any of the bacilli, especially if only a few are present or if there is any difficulty in applying it to the part of the throat affected. In the second place, even though the

bacilli are taken up on the swab they may not grow properly when cultivated. This, in many cases, is due to some antiseptic having been applied to the throat a short time before the swab was taken. In other cases the reason may be obscure. In the third place, cases of undoubted diphtheria have been known to occur in which the bacilli have not been found until quite late in the case, while in what is known as "laryngeal" diphtheria they may be situated only in the larynx too far down for any ordinary swab to reach them.

At present it may therefore be definitely laid down, that though swabs should be taken in all suspected cases, the appropriate treatment should always be adopted where the clinical evidence points to diphtheria, even though the results of the bacteriological examination are negative. On the other hand, if the bacilli are shown to be present, the treatment should be adopted, even if the case is not typical from the clinical point of view. The treatment of "carriers" will be discussed later on.

As regards the life of the diphtheria bacillus outside the body, comparatively little is known. It is thought by some to have its habitat in the soil, and importance has been attached in this connection to the opening up of old drains or foundations as setting free the bacilli and starting epidemics. However this may be, it appears certain that the spread of the disease is almost entirely a matter of personal contact, and that the segregation and treatment of persons harbouring the bacillus is at present the most successful method of arresting the course of an epidemic.

Mode of Infection.—The diphtheria bacillus lodges on the mucous membrane (usually on some part of

the upper respiratory passages) and there proceeds to grow. A slight abrasion, microscopic possibly in size, which may easily be produced by accidental causes, allows of the poison produced by the organism becoming absorbed into the body, while the local damage to the mucous membrane favours the growth of the bacillus and leads to the formation of the so-called membrane. The bacillus itself does not pass into the body fluids, at any rate not to an appreciable extent, but remains growing on the mucous membrane and manufacturing the toxins or poisons which give rise to most of the symptoms of the disease.*

Incidence.—Diphtheria is for the most part a disease of childhood, though adults are not exempt. It is not very frequently seen in infants, but between the second and twelfth years the large majority of the cases occur. An attack confers only a very short period of immunity.

Clinical Course.—The incubation period is short, and may be only twenty-four hours. Usually it is two or three days, but may be a week. The

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* The foregoing account is necessarily much simplified, as the bacteriology of diphtheria is in reality a very large subject in itself, and many of the problems connected with it have not yet been satisfactorily solved in spite of the enormous amount of work which has been lavished upon them. It may be as well, however, to mention that, besides the diphtheria bacillus proper, organisms closely resembling it are known and found in healthy and diseased throats. Of these one, called Hofmann's bacillus, occupies a peculiar and very dubious position, and its presence in the respiratory passages has been variously interpreted. At least this can be said concerning it, that during an epidemic its presence should be regarded as a suspicious circumstance, sufficient to justify further investigation and a certain amount of local treatment; isolation of the persons harbouring it need not however be insisted upon at the present stage of our knowledge.

quarantine period of ten days is certainly a full allowance. The *infectivity* of the patient is now determined by the presence or absence of the diphtheria bacillus and by this alone. When three negative results have been obtained at a few days' interval, the patient being otherwise free from all symptoms and apparently well, he may be regarded as non-infectious.

The first symptom of an attack of diphtheria is usually fever, that is a rise of temperature which is moderate in most cases, accompanied by headache, vague pains, *malaise* and sometimes vomiting. The subsequent symptoms will depend upon the situation of the lesion, which may be in the tonsils and palate (faucial), in the larynx (laryngeal), or in the nose (nasal). Other parts of the body are occasionally affected, but these are the usual situations. In the faucial cases, which comprise the majority, the symptoms are those of a sore throat, together with enlargement of the glands in the vicinity of the throat and, what is very important, a much greater depression of the general health than either the temperature or the amount of soreness experienced in the throat would seem to warrant.

The patient is languid, sometimes drowsy, apathetic, and ill; although there may not be much difficulty in swallowing, and the temperature, never very high, may fall in a few days. Meanwhile the throat, if examined, shows a more or less characteristic condition, being covered by large or small patches of greyish white glistening "membrane" or exudation which varies in amount, consistency, and distribution, but is often distinguished by the facts that it is not limited to the tonsils and that if removed it leaves a raw inflamed surface beneath.

In the laryngeal cases, the earliest characteristic symptom is the hard brassy cough which denotes the presence of some obstructing substance in the larynx, and which is commonly described as *Croup*. This croupy cough may doubtless occur in many other conditions besides laryngeal diphtheria, but it is also certain that, before the advent of modern methods of diagnosis, many cases diagnosed as croup were in reality due to the diphtheria bacillus. Then, sooner or later, symptoms of serious obstruction to respiration arise due to the presence of membrane in the larynx. Attacks of dyspnœa or difficulty in breathing occur, and the patient becomes blue in the face, gasps for breath, and—in young children especially—the spaces between the lower ribs become sucked in with each attempt at inspiration. These attacks become more frequent until the child is in a condition of permanent suffocation which, unless prompt measures are taken, is almost certain to prove fatal.

The nasal type of diphtheria is characterized in most cases by a persistent nasal discharge, and sometimes by the presence of actual membrane in the nasal passages. Constitutional symptoms are often but slight, although the patient is extremely infectious, and is very difficult to cure even under careful treatment.

It must be understood that any one of these types may pass into any other type by extension and growth of the membrane, especially in untreated cases.

The subsequent course of the case will depend on the severity of the attack, the situation of the membrane, and the period at which the patient first receives treatment by antitoxin. A considerable degree of general weakness is usually seen both

during and after an attack, and besides this, the toxins or poisons are specially prone to attack the heart and certain parts of the nervous system, causing cardiac failure and diverse forms of paralysis.

Heart failure may occur early in a case of diphtheria, that is within the first week or fortnight, and is a most serious complication, frequently ending fatally. Sometimes death occurs quite suddenly and almost unexpectedly. But the possibility of heart failure does not cease after the acute stage of the disease has passed off, and convalescents may suddenly collapse, especially if due care has not been taken to save them from exertion or physical strain of all kinds. A child apparently nearly well may sit up in bed and fall back dead, or, in less severe instances, faint away owing to some slight extra exertion.

The various forms of paralysis usually appear after the second week, but may occur earlier. They are mostly seen in the more severe cases. The commonest form of paralysis is that affecting the soft palate which leads to the regurgitation of fluids through the nose when an attempt is made to swallow them, and imparts a peculiar twang to the voice. The muscles moving the eyes may be affected, causing squint, or loss of power to accommodate the sight for near objects, so that the patient becomes unable to read. Paralysis of the limbs is fairly common, so that the patient cannot stand or move his arms and legs. The muscles of respiration are also affected in some cases, as well as those in other parts of the body.

Unless the heart is affected, the outlook in these various forms of paralysis is usually hopeful, and complete recovery ultimately occurs, but their

significance is really important as indicating a tendency to heart failure and necessitating the most careful treatment and watching.

Treatment.—It is practically of little use to try and destroy the bacilli in the throat by means of antiseptics, though mild antiseptics are of use in most cases. In view of the fact that the patient is suffering from a severe form of poisoning and is liable to heart failure, rest in the recumbent position, a nourishing and easily digested diet, and very careful nursing by experienced persons, are absolutely essential in all cases.

The main point in the treatment of diphtheria is, however, the *early* administration of antitoxin (see page 7). The details of this process must be left to the judgment of the medical adviser, but it will not be out of place here to mention some of the reasons which have convinced the vast majority of medical men of the value of this method.

1. The mortality from diphtheria has fallen, since the use of antitoxin became general, in all parts of the world from which statistics are available. Considering the large number of figures whch have been collected this evidence in itself is of considerable value ; but it must be allowed that it is not absolutely conclusive, because there is reason to believe that the type of the disease is somewhat milder than formerly, and because many very mild cases can now be correctly diagnosed by bacteriological methods, which in earlier times would not have been classed as diphtheria at all. As an example, however, the figures of the Metropolitan Asylums Board may be quoted. The average mortality in the hospitals of the board during the five years before the introduction of antitoxin was about 33 per cent, whereas in the

seven years following its introduction it fell to about 16 per cent, and in the subsequent years to 9·5 per cent.

2. Better evidence can be obtained from the mortality returns of the laryngeal diphtheria, which is always a severe and dangerous form, owing to the extreme likelihood of asphyxia. Before antitoxin the mortality in these cases was quoted as about 66 per cent, and after antitoxin the mortality fell to about 27 per cent.

3. Probably the strongest point in favour of the value of antitoxin in diphtheria is that the mortality can be shewn to decrease progressively the earlier the remedy is administered. Thus at the Brook Hospital (Metropolitan Asylums Board) during eleven years, cases treated on the first day had a mortality of zero; those on the second day a mortality of over 4 per cent; those on the third day of over 11 per cent; those on the fourth day of over 16 per cent; those on the fifth and later days of over 18 per cent.*

There are two points with regard to the administration of antitoxin which may be mentioned, as they are sometimes urged as reasons against its use. In the first place it has been said that since antitoxin has been generally employed more cases of diphtheritic paralysis have been observed, and that consequently the antitoxin must predispose persons to this. There is, however, no positive evidence as to this being a direct instance of cause and effect. Diphtheritic paralysis is more likely to occur in cases of virulent infection, and as, before antitoxin was introduced,

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* For these points the writer is indebted to Bosanquet and Eyre's *Serums, Vaccines, and Toxines*, 2nd edition, 1909.

a much larger proportion of such cases died early in the course of the disease, it manifestly follows that fewer survived to manifest the complication.

In the second place, in a small proportion of cases, unpleasant symptoms such as fever, pains over the body, and peculiar irritable rashes, have been observed. These symptoms are not due to the antidiphtheritic principles in the injection, but to the serum, or vehicle in which they exist, and may occur if the blood serum of any animal is injected into one of another species. The condition is seldom more than annoying to the patient, and soon passes off. It should not be allowed to weigh against the now well established advantages of antitoxin in so serious a condition as diphtheria.

In cases where the membrane is situated in the larynx, the obstruction to respiration may necessitate the operation of tracheotomy, in which an opening is made in the wind-pipe or trachea, below the point of obstruction, and a tube is inserted through which the patient breathes. Great relief is often afforded and many lives have been saved by this proceeding, but sometimes the patients succumb to the poisoning of the system which, of course, is not directly influenced. The early use of antitoxin has certainly rendered this operation less frequently necessary.

In place of tracheotomy, the procedure known as "intubation" may be adopted. By means of special instruments a small tube is inserted through the mouth and lodged in the larynx; through this the patient is enabled to get sufficient air, in spite of the presence of the membrane. The choice between these two methods must be left to the practitioner in charge of the case, and will reasonably depend partly upon the experience he has had; every man

will be more likely to get a good result from a method with which he is familiar than from one of which he has little practical experience. In general, however, it may be said that intubation, although it avoids a cutting operation, and is less likely to be followed by bronchopneumonia, requires the more constant and immediate presence of the doctor, and is thus hardly suitable for cases where it may be some time before he can be brought in case of emergency. In hospitals where there is always a medical officer at hand, intubation is undoubtedly a very valuable proceeding, and presents many advantages and but few disadvantages; in the country, on the other hand, tracheotomy is perhaps, on the whole, a safer method, as a trained nurse can deal with any emergency until the arrival of the doctor.

Prophylaxis.—As has been said, the spread of diphtheria is nearly always a matter of personal contact, so that whenever a case occurs in a school the throats of all those in contact with the patient should be submitted to a bacteriological examination. In private schools the boys and all members of the household should be thus examined; in public schools it is generally enough if the boys and others living in the same house are so tested. When this is done, it may often be found that several persons not showing any sign of illness, are carrying the diphtheria bacillus in their throats or noses. These persons are called "carriers" and are a source of possible infection in others. They should therefore be isolated, but not placed with actual sufferers from the disease, as the bacilli they carry may not be virulent, and they are liable therefore to acquire a fresh and virulent strain of bacillus from the patients.

Antitoxin is not of much value in the treatment

of "carriers," as it mainly acts by neutralizing the poisons formed by the bacillus. In "carriers" there is little or no poisoning going on, as is evidenced by the absence of the symptoms of illness. Antiseptics of various kinds may be tried; probably the most efficacious is some preparation of peroxide of hydrogen. But in spite of the most active treatment, the bacilli still remain present in the throat for long periods in some cases. Three to six weeks is by no means an unusual time, and in exceptional cases the bacilli have been present for a year. When a case of this sort occurs, it is possible to test the virulence of the bacilli by means of an animal experiment; and this should always be done when the bacilli are found for more than a month in an apparently healthy throat.

Animals may be a source of infection; it is not certain that pigeons or fowls can convey diphtheria to human beings, but the case against cats is fairly well proved.

Diphtheria may in certain cases be traced to an infected milk supply, so that not only should full enquiries be made as to the source of the milk and the possibility of its contamination, but a sample should be sent for bacteriological examination. The detection of the diphtheria bacillus in milk is, however, a somewhat complicated process and is beset with certain sources of error. Great care must therefore be taken in selecting a thoroughly competent and well known bacteriologist to perform the test. It is also advisable to have the drainage system overhauled. In the opinion of the writer defective drains are far more often a predisposing than an immediate cause of an outbreak of diphtheria, and in a great number of cases no sanitary defect

exists in houses where the disease occurs. Still, it is never advisable to omit any reasonable precaution in a serious condition such as diphtheria, and an assurance that all is well with the drainage is decidedly advantageous from the public point of view. Strict isolation of the patient and of all "carriers" is essential in diphtheria, and all articles used by them must be carefully disinfected after use (see page 15).

The Klebs-Loeffler bacillus is destroyed by exposure to a temperature of 54° C. (130° F.) for ten minutes, if not in a dry state. Thorough room disinfection is also necessary after the patient has recovered (see page 16), as the bacilli may be found on walls and furniture, and can probably live on under these conditions for a fortnight (see page 18).

Finally, by way of prophylaxis it is often advisable to give a small dose of anti-diphtheritic serum to all those who have been in immediate contact with the patient. The necessity for this somewhat elaborate precaution must be decided in each instance by the medical man in charge. In the opinion of some recent authorities prophylactic injections of antitoxin should only be given to weakly children who have been exposed to a particularly virulent type of infection, and to those who are suffering from some other disease, such as scarlet fever or measles.

J. M. F.-B.

CHAPTER XI.

TYPHOID FEVER.

(ENTERICA, ENTERIC FEVER.)

French: FIÈVRE TYPHOÏDE.

German: ABDOMINAL-TYPHUS.

TYPHOID fever is an acute specific disease with a somewhat prolonged course, characterized by the formation of ulcers in certain parts of the small intestine, a distinctive rash, and more or less severe general depression of the system.

History.—The medical writers in classical times, although conversant with typhoid fever, did not differentiate it from other superficially similar conditions. It was not, indeed, until the beginning of the nineteenth century that the distinction between typhoid and typhus or jail fever was made; the latter disease, now very uncommon in England, suggested the name by which the fever now under consideration is generally known, because it was thought so similar in many of its features. The final differentiation of typhoid from typhus was made by Sir William Jenner in the middle of the last century. Various theories were held as to the causation of typhoid, mainly based on the view that it was connected with defective drainage. The great sanitary advance made in the mid-Victorian period decreased the incidence of the disease considerably, but it was not until 1880, when Eberth discovered

the bacillus of typhoid, that the way in which epidemics arose was understood.

Bacteriology.—A very large amount of important work has been devoted to this subject since 1880. The bacillus* is closely related to one of the normal denizens of the intestinal canal of man and many other terrestrial animals, called the Colon bacillus. It is present in the intestines of infected persons, but its presence, in the early stages of the disease, is not easily demonstrated, so that (unlike diphtheria) no ready means of diagnosis can be obtained by an examination of the stools. It is also present in the blood, but here, too, technical difficulties deprive this fact of practical application. A patient suffering from typhoid fever, however, in a very large proportion of cases, develops certain substances in his blood about the end of the first week of the disease which produce a typical reaction when added to a pure culture of the bacillus of Eberth.

The careful study of this reaction by Durham and Bordet in 1895 was followed in 1896 by its application to practical medicine almost simultaneously by Widal and Grünbaum; it is now usually known as Widal's test. In practice, a few drops of the patient's blood are drawn into a small glass bulb and sent to a bacteriologist, who reports on the dilution of this blood which gives the characteristic reaction with the bacillus, known as "agglutination" or "clumping." If the blood in high dilution gives the reaction, the diagnosis is practically certain; lower dilutions are not so conclusive, and a negative reaction does not absolutely prove that the case is not one of

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* Now generally known as the Typhoid Bacillus, *Bacillus typhosus*, or Eberth's Bacillus.

typhoid. Patients who have previously suffered from typhoid fever, may sometimes show the characteristic reaction in their blood for a long time after recovery, in a few cases even for years. In some, the reaction is only developed late in the course of the disease, and in one remarkable instance it was absent during the primary attack and also during several relapses, being at last present in what proved to be the final relapse. In a suspected case, therefore, the test if at first negative should be periodically repeated. The limit of error from all sources is probably about 5 per cent.

Mode of Infection.—The bacillus of typhoid is probably always swallowed, and thus reaches the small intestine, where it lodges, grows and multiplies.*

The principal ways in which the bacillus may reach the mouth and thus get taken into the body are as follows :—

1. Directly from another patient. A person suffering from typhoid is continuously giving off the bacilli both in the stools and urine. Under these circumstances his skin, clothes, and surroundings generally are practically certain to become contaminated, and contact with him or his belongings leads to the transference of the bacilli on to the hands and persons of others, who then ingest these bacilli and acquire the disease. Dirt and overcrowding obviously facilitate the direct transference of the disease and, in fact, the ordinary cleanliness of the well-to-do educated classes in this country would not be sufficient to prevent its spread from the sick to the healthy, in the absence of special precautions.

* Recently, however, the view has been put forward that the bacillus enters the body by the tonsils, and is excreted into the intestine.

2. Articles of food, especially milk, butter and cream, handled by infected persons, or those in contact with infected persons, may easily transfer the bacillus to others. "Ice creams" sold in the streets have many times been a source of infection.

3. The stools of a typhoid patient may be thrown into a faultily constructed drain, through which sewage percolates into the sources of a water supply. Thus the bacillus, which lives quite comfortably in water, may be spread broadcast, either when the water is used for drinking or when it is employed for washing articles in which food is placed, such as milk cans, dishes, cups and the like. Water-borne epidemics are well-known.

4. Contaminated material may be left exposed to the air, and flies settling upon it may carry the bacillus on to articles of food to be consumed by others.

5. In dusty regions, the dust may similarly act as a carrier.

6. Sewage, when contaminated by typhoid bacilli, may carry them to oyster and mussel beds, and so infect those who consume these shell fish in the raw condition.

7. It has recently been shown both in this country and Germany, that a certain number of persons who have had typhoid fever continue to carry the bacilli in their intestines and elsewhere for long and indefinite periods. These are the "typhoid carriers," and their treatment from a public health point of view is still an anxious and much-debated question. A certain intermittence has been noted in their power of infecting others, which does not tend to simplify the problem.

Incidence.—Typhoid fever is widely distributed

over the globe. It is essentially a disease of young adults, but children over five are not infrequently affected. It is rare in the aged.

Clinical Course.—The *incubation period* in typhoid is apparently usually about a fortnight, but many cases are recorded in which it has been much shorter, and some in which it has been extended to three weeks.

Quarantine is not as a rule an effective agent in arresting the spread of an epidemic, because with the discovery of the cause the occurrence of fresh cases should immediately cease. When under special circumstances it is applicable it should last for three weeks.

The period of *invasion* in typhoid is somewhat indefinite in the early stages. The disease begins to show itself very gradually, little being noticed at first but slight feelings of indisposition. Gradually these increase; there is slight shivering, headache, and perhaps abdominal pain. The bowels are usually confined; but there may be, on the other hand, diarrhœa. Often there is a slight cough, sometimes vomiting, and sometimes nose-bleeding. With these symptoms fever gradually sets in, and the temperature usually rises a little higher every evening, and fails to fall quite so low every morning as on the previous one, till at the end of a week or so it reaches 101° or 102° or more in the evening, only dropping a degree or two lower in the morning.

When this stage has been reached the period of invasion may be considered ended, and the patient enters into a condition of high fever, usually with much prostration, which may last one or two weeks or, in severe cases, much longer. In a typical case of average severity the patient during this period is in a

peculiarly apathetic, dull, and prostrate condition. He exhibits little interest in his surroundings, is extremely stupid mentally, often more or less deaf, and at night may be slightly delirious. There is often some loose cough, the headache continues, the mouth becomes dry and parched, and the tongue coated with whitish or brown fur, especially in the middle, while the tip and sides are left red. The abdomen is distended, and if there is diarrhœa the stools are of a characteristic yellow, fluid nature, and have been compared to pea-soup. They are usually very offensive.

On or about the sixth day a number of small raised pink spots appear on the abdomen and sometimes elsewhere, which bear a strong likeness to flea bites. There is, however, no small dark central point which marks the spot where the proboscis of the insect enters the skin. When lightly pressed the pink colour of the spots completely disappears. They are called the " rose spots," and are usually described as *lenticular* or lentil shaped. They come out in crops during this and the following stages of the disease, each crop lasting two or three days, and vary very much both in number and distribution. They are present in at least half the cases, or perhaps more. The spleen is always enlarged, and this enlargement can be demonstrated by examination in the majority of cases. Towards the close of this period the patient has often become extremely thin ; there is also marked pallor of the skin, though the cheeks may show small flushed areas. The eyes are bright and clear, and the pulse." soft," that is, easily compressed by the finger.

During the third week, or perhaps later, the temperature should in favourable cases begin to fall

in a gradual, step-like manner, corresponding to its rise during the period of invasion. This is the period of *defervescence*, and after this a gradual return to health occurs, the symptoms clearing up and the patient usually becoming extremely hungry. Relapses, which usually resemble mild and shortened primary attacks, occur in some cases after the temperature has become normal. Their frequency varies very much in different epidemics, and they may occur in as much as 18 per cent of the cases. Two or more relapses may follow at intervals.

After an attack of typhoid the general physical and mental powers of the patient are often markedly depressed for some months.

Varieties of Typhoid.—In young children typhoid is often a mild disease, which is fortunate, as the restraints as to movement which are imposed on older patients are almost impossible to enforce. Besides this, mild cases occur in adults in which, though feeling ill, the patients are able to get about and thus expose both themselves and others to serious risks. A fatal and sudden complication may be the first symptom for which the medical man is consulted. Severe cases are those in which the temperature remains high and the period of defervescence does not set in during the third or fourth week. Marked delirium, absolute prostration, rapidity and weakness of the pulse, and sometimes severe diarrhœa characterize these cases. The later in the disease that the patient comes under proper treatment, the more likely is it that the attack will be severe. Generally speaking, children over ten present the same course and symptoms as adults. In those under that age the onset is apt to be less gradual, nervous symptoms are more marked in the severe

cases, and complications are less frequent. The rash is also seen in a smaller percentage of cases.

Dangers of Typhoid.—Severe cases are always the cause of considerable anxiety, as the patient may die from the general poisoning produced by the bacillus of typhoid. In addition there are two very serious complications or accidents which depend on the presence of the ulcers in the intestine. (1) The ulcer may become so deep that only a very thin layer of the outer wall of the bowel remains intact. Some slight cause, often not apparent, but which may be some sudden movement of the patient, the passage of hard material over the ulcer, or a little distension of the bowel by gas, may tear a hole in this thin layer. This is called "perforation." It usually occurs during the third week, when the ulcerative process is at its height. It is fortunately not a common event, most statistics show that it occurs in between 2 and 3 per cent of the cases, though others give a higher figure. This nearly always proves fatal, as severe peritonitis is set up by the escape of the contents of the bowel into the abdominal cavity. Sometimes immediate surgical operation may save the patient's life. The earliest symptoms are pain in the abdomen, which may be sudden and violent, a fall in the temperature, and collapse. In addition there is sometimes a slight shivering fit and vomiting. In other cases, especially when the patient is already very ill and almost comatose, the symptoms may be very slight and ill defined. Perforation is however not limited in its occurrence to the severe types of the disease, and may arise in cases which are regarded as mild. (2) The ulcers may bleed severely. Slight hæmorrhages are not very uncommon; those sufficiently serious to be classed as a complication occur

in a varying proportion of cases, usually not earlier than the third week. It is a more frequent complication than perforation. Severe hæmorrhage probably does not occur in much more than 3 per cent of the cases, but if the slighter instances are counted in, the percentage may be reckoned as at least double that figure. The symptoms vary with the amount of blood lost. Sometimes the only indication is the appearance of blood in the stools; in more copious hæmorrhages the patient becomes pale and collapsed and his temperature falls. Recovery may occur, even when very large amounts of blood are lost.

Sequelæ and Complications.—These are not very common, and need not be described in detail. Pneumonia is perhaps the most frequent; then come neuritis, periostitis and bone disease, inflammation of the joints (arthritis) and of the middle ear (otitis media). The gall bladder also becomes inflamed in some cases.

General outline of Treatment.—The treatment of typhoid is so much a matter of special knowledge and experience, that the details from first to last must be left entirely to the medical man in charge of the case, and to the nurses who, under him, are responsible for carrying them out successfully. It may not be improper here, however, to mention the main objects which all treatment is designed to secure. In the first place rest, as absolute as possible, must be secured for the patient, not only because the prolonged course of the fever puts a great strain on his powers, but in order to avoid the risks of perforation and hæmorrhage. In the second place, the diet is so regulated and restricted that while the maximum possible of nourishment is allowed, no hard or indigestible matter can enter the intestine and damage

still further its ulcerated walls. In the third place, to combat the damaging effects of the prolonged fever, cold sponging or sometimes cold baths are employed. This tends to lower the temperature and diminish the severity of the nervous symptoms. Drugs are employed to a certain extent, some with a view to disinfecting the contents of the bowels and others to reduce the temperature. The latter class are not often employed in this country, though in Germany they seem to be more extensively used. Finally, it may be laid down that no amateur should ever attempt to nurse a case of typhoid, however mild may be its symptoms. A little want of experience and training may have the most serious results for the patient, and also expose the nurse to the risk of contracting the disease herself. Well-trained and careful nurses occasionally take typhoid from their patients, and the chances of an untrained person doing so are immensely greater. So far no anti-typhoid serum has been found of any great practical value in treatment.

Prophylaxis.—Patients with typhoid fever are usually nursed in the wards of general hospitals, along with persons suffering from other diseases. Special precautions, however, are adopted, and as these are somewhat elaborate, in most hospitals there is a rule which limits the number of typhoid cases which may be nursed at one time in a ward. In private, however, typhoid patients should be isolated as are other infectious cases, though where the nurses are quite trustworthy and the general arrangements adequate, there could be no objection to responsible persons occasionally visiting the patient, at the discretion of the doctor.

The infection of typhoid being spread by the stools

and urine of the patient, these must always be disinfected before being thrown into the drains, and linen and washable articles must be soaked in disinfectant before being washed (see page 21). All utensils used in feeding and otherwise ministering to the patient should be kept for his use alone and specially washed, and a special lavatory and sink should be reserved for dealing with such articles. They are also to be disinfected after use. The room in which a typhoid patient has been nursed may be disinfected after his recovery, and the bedding and blankets sterilized by steam. Careful investigation as to the origin of the infection will have to be made in conjunction with the local sanitary authority. This will include an examination of the milk supply, the water supply, and the drainage system, together with any other possible source of food infection, such as may occur in the case of oysters, ice-creams, or uncooked vegetables. As patients who have apparently recovered may still continue to discharge typhoid bacilli in their stools and urine, specimens of these should always be sent to a bacteriologist for examination before these persons are again allowed to mix with others, and they should not be regarded as free from infection until the bacilli are no longer found to be present.

Recently considerable success has attended the preventive inoculation of a typhoid vaccine in those who are likely to be exposed to infection. Although it does not in all cases confer absolute immunity, it considerably diminishes the risk of a severe attack. The usefulness of the method is, however, somewhat impaired by the fact that for a short time after the inoculation has been made the individual is rendered more liable to contract the disease, so that it is unwise

to inoculate those who are already in the danger zone. Three inoculations are made during successive weeks, and the last should be some weeks before any special risk of infection is likely to occur. The inoculations are entirely without serious risk, though for a few days there may be temporary symptoms of an unpleasant character, such as pains, fever, and the like.

PARATYPHOID FEVER.

There are several strains of bacilli which are closely related to the typhoid bacillus and are also capable of setting up disease in human beings. They are collectively known as the paratyphoid group. The infection they set up resembles typhoid clinically, but ulcers are not usually present in the intestines. The blood of these patients fails to give the "Widal reaction" with the bacillus of Eberth, but gives a similar reaction with one or other of the members of its own group.

J. M. F.-B.

CHAPTER XII.

CEREBRO-SPINAL MENINGITIS.

(Spotted Fever).

French: Méningite Cérébro-spinal épidémique.

German: Epidemische Genickstarre.

CEREBRO-SPINAL meningitis is a specific infectious disease, due to an inflammation of the membranes covering the brain and spinal cord, characterized by fever, a peculiar rigidity in certain muscles, and in some cases by a rash, and liable to cause permanent damage to the brain and special senses in those cases which recover.

History.—It is probable that this form of meningitis was not in former times properly distinguished from others, the causal organism and the methods for detecting it having only been described in recent years. A resemblance in the rash to that of typhus fever has also led to confusion in the reports of earlier epidemics. Four great epidemics have been described between 1805 and 1885, and four others since then in New York (1894–5), Glasgow (1906–7), Germany (1905–6), and Belfast (1907–8). Besides this form of meningitis, "sporadic" cases, that is single instances which have not spread, are recognized as not infrequently occurring, and are often known as "posterior basic meningitis."*

* These may however be due to a slightly different organism.

Bacteriology.—The causal organism was discovered by Weichselbaum in 1885.* It is thought to gain access to the system through the nose and throat, whence it makes its way into the spaces surrounding the brain and spinal cord; it may also be found in the blood. It is capable of existing in the nose and throat (of adults especially) without producing symptoms, and these "carriers" are thought to be an important factor in setting up an epidemic. The organism can be fairly easily recognized in the fluid which surrounds the spinal cord, and this fact has been utilized in the diagnosis of the disease. In a suspected case, a hollow needle is thrust into the spinal cavity between the vertebræ of the loin, and some of the spinal fluid is withdrawn by means of a syringe and examined by a bacteriologist.

This procedure is found to be perfectly safe provided certain precautions as to asepsis are taken, and has now become a routine method.

Mode of Infection.—This has already been indicated, but the subject is not yet quite completely understood. The disease does not appear to be highly infectious from one person to another; "carriers" are probably an important link in tracing the spread of an epidemic. Overcrowding no doubt increases the chances of an epidemic occurring, and the outbreaks are often "institutional" in character, affecting a limited number of persons in a school, a barrack, or an asylum.

Incidence.—Cerebro-spinal meningitis is mainly seen in children, but adults are also attacked. It

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* It is known by the somewhat cumbrous name of the *Micrococcus intracellularis meningitidis.* Frequently "for short" it is called Weichselbaum's meningo-coccus.

has been observed in many parts of the world, and epidemics are most frequent in the winter and spring.

Clinical Course.—The *incubation period* has not been determined with any certainty; probably it is only a few days.

The *quarantine period* cannot therefore be laid down, but it would be reasonable to isolate "carriers" until a bacteriological examination showed they were free from the organism. Secondary cases have been observed to occur a month after the primary batch, but the bearing of this on a possible quarantine is not at present clear.

The onset of the disease is in most cases remarkably sudden and is marked by two main features, severe headache and vomiting. Sometimes for a few days or hours before the definite onset there are vague feelings of illness, sometimes these are entirely absent, and the patient may fall down suddenly in the street or elsewhere with intense giddiness and headache. The temperature rises abruptly to 102° or 104°, and for the first few days the patient may have all the appearances of one suffering from acute pneumonia. The breathing is disproportionately rapid, the face flushed, the eyes bright and perhaps bloodshot, and there is abundant *herpes* (small crops of vesicles) round the corners of the mouth and nose. Usually, however, quite early there is some stiffness and rigidity in the muscles of the neck and perhaps the back, and the signs of pneumonia cannot be heard in the lungs. The rash, which consists of small hæmorrhages under the skin of a purplish colour and not fading when pressed, appears usually on the fourth or fifth day, and may continue to come out in crops throughout the illness. It is by no means always present, however, and varies very much in

extent and distribution. During the height of the fever the mental condition varies with the severity

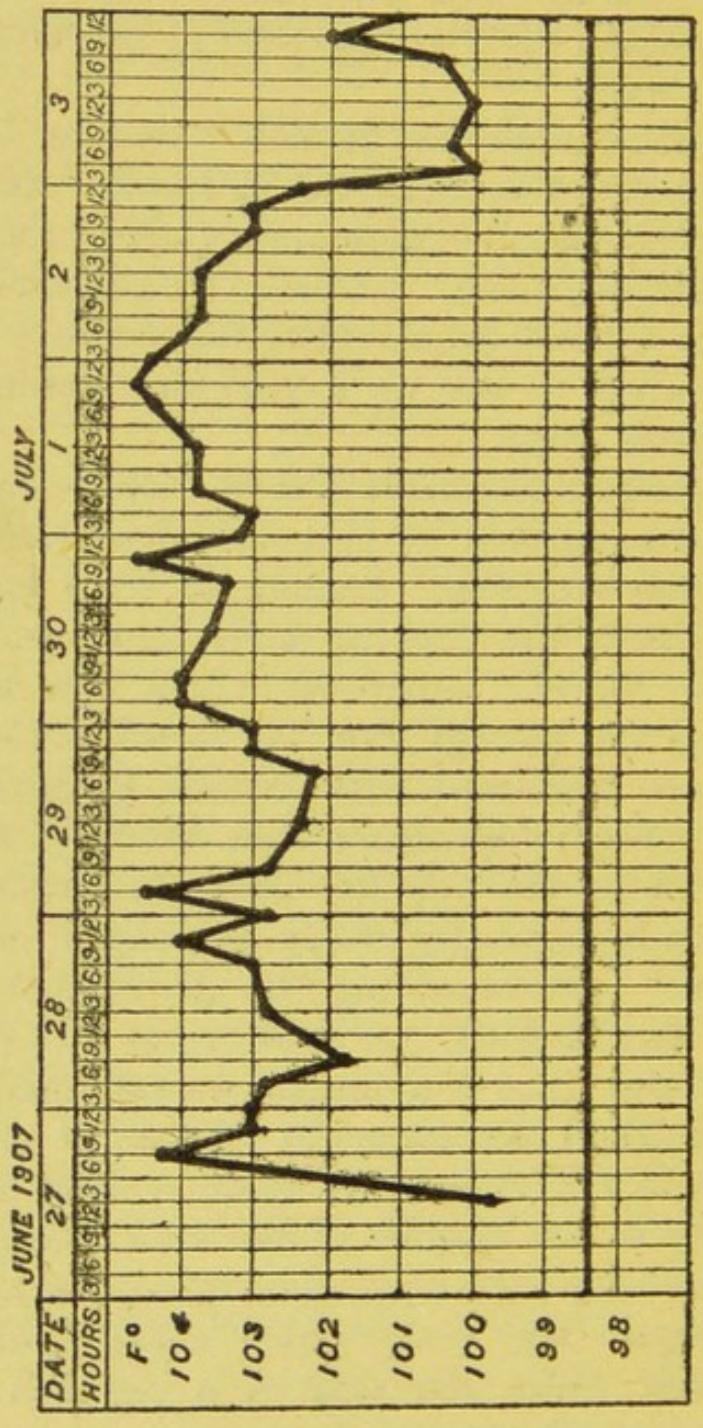

Fig. 10.—Epidemic Cerebro-Spinal Meningitis. Typical Temperature Curve.

of the illness. In bad cases the patient may be completely unconscious or actively delirious. In mild

PLATE IV.

Fig 11.—Epidemic Cerebro-spinal Meningitis. Rigidity of the Neck ; Opisthotonos ; characteristic position of the arms (Koplik).

Face page 101

cases there is only drowsiness or hardly any interference with the mental functions. The worst cases may die in thirty-six hours—usually too early for a diagnosis to be made—others may live a few days. In less severe attacks after a day or two the vomiting ceases, but the comatose condition deepens gradually; the stiffness of the back increases, so that it becomes arched backwards, the patient resting on his heels and the back of his head (opisthotonos); or the head becomes excessively drawn back and rigidly fixed in that position. Sometimes there is tenderness of the skin; groups of muscles become weakened or paralysed; squint and irregular movements of the eyes develop; and the breathing becomes very irregular in rhythm and perhaps slow and sighing at intervals. The fever continues high, the coma deepens, restlessness is succeeded by ominous quiet, and the patient dies within the first fourteen days from the onset of the symptoms.

No disease, however, shows more variation in type and symptoms than cerebro-spinal meningitis. The temperature is occasionally quite low, even in fatal cases; the rash is more often absent than present; the patient though *in extremis* may retain his full consciousness; or after more than three weeks of severe illness may recover completely.

The longer the acute symptoms last the more likely is the patient to pass into the chronic stage, provided he survives. This is characterized by the same variations which mark the acute stage. Sometimes periods of acute illness resembling that just described alternate with others in which the temperature falls to normal and all the symptoms subside. In others the temperature is quite irregular, in others again it may be normal or subnormal. A

marked feature in the chronic stage is the persistent and extreme emaciation, which occurs in spite of the fact that the patient usually takes his food well. A patient may die at any period of the chronic stage, either suddenly from collapse, or with an access of fever and delirium ; or gradually, in a semi-comatose condition, may sink to his end. Varied forms of paralysis, usually temporary, are seen during this period, and not infrequently the patient becomes both deaf and blind. In cases which ultimately recover, the paralysis and sometimes the blindness pass away, but the deafness is usually permanent and complete. The duration of the chronic stage may be for several months.

The mortality from cerebro-spinal fever is very high ; in many epidemics more than three-quarters of the cases have died, but possibly the employment of the serum treatment may considerably reduce this terrible percentage in the future.

The Serum Treatment.—A large number of sera have been prepared, mostly with a view to injection under the skin, but the results obtained have, on the whole, been disappointing. A more promising preparation is the serum of Flexner, which is injected directly into the spinal canal. This serum should always be used when it can be obtained, but failing this, one of the others may be tried, as they cannot make the outlook worse, and may perhaps improve it.

Prophylaxis.—The patients should, in cases occurring in schools and private houses, be isolated, just as typhoid patients are isolated, though in general hospitals they can be safely nursed in the wards under suitable precautions. Where possible, a bacteriological examination should be made of the nose and throat organisms of all who have been in contact

with the cases, and if any are found to harbour the micrococcus they should be isolated and treated with antiseptic mouth- and nose-washes. All the secretions from the mouth and nose of patients should be disinfected, and all feeding and drinking vessels treated as are those used in typhoid cases. A thorough cleaning and disinfection of houses where patients have lived, or in which they have been nursed, should be carried out, as the organism sometimes appears to cling to rooms and buildings.

J. M. F.-B.

CHAPTER XIII.

EPIDEMIC POLIOMYELITIS.

A BRIEF note on this disease, which has recently attracted considerable attention, may not be without interest in a work such as the present, although a detailed consideration of the many points still under discussion is not possible. For the last twenty-five years it has been recognized that a form of paralysis, so usually limited to children as to be commonly known as " Infantile Paralysis," occasionally occurred in groups, and its infective nature has been suggested in most medical text-books. During the last six years definite epidemics have been observed in many countries, such as Norway (1903–6) New England (1907), New York (1907), Australia, The Rhine Provinces (1909), Lower Austria (1909), France (1910), while less extensive ones occurred in Essex (1908), New York (1909), and North Devon (1911). In 1910, indeed, the disease appeared in a large number of countries at once. The epidemics have in some instances followed those of cerebro-spinal meningitis, and in others they have coincided with them. The diseases are, however, quite distinct, epidemic poliomyelitis being due to an extremely minute organism which has not yet been isolated ; it passes through a bacterial filter, and is probably too small to be visible by means of the microscope. It

may belong to the same class as the unseen virus which is responsible for rabies or hydrophobia.

Epidemic poliomyelitis is only feebly infective, and the mode of infection is not clearly understood. The incubation period seems usually to be about a week, but varies very much in experimental cases (four to forty-six days in monkeys). The onset is usually with fever, vomiting, and convulsions, followed by pains which may easily be mistaken for those of acute rheumatism. In some epidemics catarrh and inflammation of the nose and throat are constantly observed. In others these symptoms are absent. In many cases again, there are intestinal disturbances such as diarrhœa. Paralysis of groups of muscles or entire limbs generally occurs within a week, and is followed by wasting of the affected parts. In most instances, however, only a portion of the parts originally involved become permanently affected. A few cases occur without paralysis or pain. Complete recovery is uncommon (5 per cent), but recovery with only slight paralysis is not infrequent. A fatal issue during the acute stage is not frequently seen, but in some epidemics has reached 15 per cent. There is no specific treatment.

Prophylaxis.—So little is known of the methods by which the disease is spread that it is difficult to lay down definite rules. Isolation for three weeks and the usual methods of disinfection are probably advisable. In some cases dirty swimming baths have been thought to spread the disease ; so that for this, if for no other reason, all swimming baths should be kept as bacteriologically clean as possible.

Dust has been held responsible for the spread of the disease, and in one epidemic (Stowmarket, 1911) the cases ceased when thorough watering of the streets

with antiseptic solutions was adopted. Flies have also been accused of carrying the disease; but epidemics do not always coincide with the times in which flies are most prevalent. The worst months are June, July, and August. Many slight and abortive attacks arise which may transmit the disease, as may also human "carriers." Domestic animals, such as hens and rabbits, have sometimes been thought to be connected with the outbreaks.

J. M. F.-B.

CHAPTER XIV.

INFECTIOUS DISEASES OF THE EYE.

EPIDEMICS of acute inflammation of the eyes have long been recognized as one of the pathological troubles incidental to school life, and are spoken of vaguely as "Ophthalmia," or by the descriptive term of "Pink Eye." The epidemics usually occur in the spring and early summer, but are by no means limited to such times. They come on suddenly, and usually cannot be attributed to a definite source, and involve a very large proportion of those exposed to the morbid influence. The trouble very often produces a much greater degree of anxiety than the severity of the symptoms demands, among parents and guardians, and consequently among the school authorities. As a matter of fact, however, the symptoms and incidental disabilities, as well as their possible gravity, are not so marked as those of a "cold" that is recognized as "catching" and generally "runs through" a household. The symptoms are readily recognized by those who have been in contact with an epidemic; a sense of sandiness in one or other eye, sometimes both, accompanied by, it may be, some watering, followed the next morning or the morning after by some yellowish discharge sticking the eyelids together, and in an increasing degree for two or three days; in those who had one eye affected first, the other will take on the same

trouble within a couple of days. The eyes become very red and bloodshot, and in the more severe cases spots of hæmorrhage appear on the "white" of the eye. There is generally a good deal of dazzling and irritability. After the attack has reached its height, it begins to ameliorate, and practically passes off in from ten to fourteen days, though a slightly bloodshot appearance, especially of the inner surface of the lids, may persist for some days longer. Occasionally exacerbations or recurrences occur, and the attacks may last for four or five weeks; but ultimately complete recovery may be looked for. Such is the usual order of events, though variations occur; for instance sometimes only a few may be affected; at other times the attacks may not be so short and sharp.

The means by which the infection is spread are not clear. It is popularly supposed to be due to using the same water and towels; but boys, at any rate those in the better-class schools, where the trouble is as rife as elsewhere, do not use the same water for washing, though they may be careless about their towels. Probably the only measures, that are really of any avail, are prophylactic ones, such as bathing the eyes of those who have not been attacked, with some antiseptic lotion, as saturated solution of boracic acid. Each person in the infected area should swab his eyes three or four times a day with this lotion, and smear the eyelids and lashes with boracic ointment before going to bed. The lotion is easily made by placing some boracic acid in a bottle, and adding water as it is used, so long as some of the boracic acid remains undissolved at the bottom. This bathing, however, is not an easy matter to carry out with boys, and a more effectual expedient is to remove them outside the infected area, if such a thing is possible.

After the symptoms have set in, probably no treatment whatever is of any avail, so far as the actual attack is concerned, for cure is brought about by a process of self-immunization arising from the disease ; but to prevent the spread of the infection and subsequent complications the utmost cleanliness of the part must be observed.

This account of the usual form of the epidemic must not conceal the fact that more serious trouble may arise in much the same way, and thus no epidemic should be lightly viewed until medical sanction has authorized it, for, as will presently be pointed out, the infection in these epidemics is not always, though such is usually the case, of the same kind, some being more serious than others.

Besides these attacks of acute ophthalmia, there are other chronic forms, which, though they do not occur in epidemics, are not the less contagious—I allude particularly to the form that presents redness and scurfiness at the outer corners of the eyes, where the skin may be sore and excoriated. There is no discharge of matter, but some mucus, and, when the condition is severe, the affected part is wet and soppy. The condition is undoubtedly contagious, is very chronic, and, when established, shows little tendency to get better, or, in cleanly surroundings, worse. It is one of the most satisfactory troubles to treat, for however long it has lasted, it is easily cured by sulphate of zinc lotion.

Not in the least resembling this, though the description may sound much the same, are the red, scurfy edges of the lids that are so commonly seen, and which are too often taken as a matter of course and neglected, the consequence being that they become a lifelong disfiguring trouble ; and, in some cases,

from destruction of the hair bulbs, loss of the eyelashes occurs. Such a condition is not infectious in the ordinary sense of the word, but in its established form is always associated with infection of the hair bulbs and the glands arranged along the edge of the lid. The cause of the infection is present with every individual, and consequently the only precaution that can be taken against infection is to prevent an unhealthy condition of the parts.

Such occurs frequently from congestion due to eye strain in those who need spectacles, or who have a natural intolerance of the parts to wind or glare. In those who show this tendency to redness of the lids, errors of refraction should be corrected and, when a natural intolerance exists, the parts should be stimulated to a healthier and more robust condition by the inunction of yellow mercurial ointment, which has at the same time the advantage of being an antiseptic and, therefore, destroys or prevents infection.

Before proceeding to the more technical description of these infectious ailments, their complications, and treatment, it may be well to draw attention to an epidemic of ophthalmia of a certain trivial kind, which arises from more or less mechanical causes, such, for instance, as exposure to a very keen, cold wind, or non-infective dust, in which may be included the pollen of fir or other trees ; this especially has been confounded with the acute contagious ophthalmia, and may certainly render the eyes more susceptible to contagious infection of any kind. For the above condition bathing with boracic acid lotion may well be adopted.

In quite another category is the irritation called hay-fever, extreme in some cases, that arises from the pollen of flowers in those who are susceptible thereto,

and the implication of the skin as well as the surface of the eyes excited by the primula group, and, more rarely, by certain other flowers. In these cases there appears to be an influence of a certain chemical poison. The question, however, has not been satisfactorily cleared up.

It is necessary also to mention that form of ophthalmia that used to be, and still is to a less extent, the curse of the Poor-law schools of large cities. It is this condition which tends to raise the scare which surrounds the term "ophthalmia" when it occurs in better-class schools. It has been known by various names, such as Egyptian ophthalmia, workhouse ophthalmia, granular ophthalmia, but it is technically known as trachomatous ophthalmia. It is not ordinarily met with in better-class schools, nor is there any danger that it may become epidemic in them, but individual cases now and then occur, which would be a source of danger if the patient were allowed to remain with the others. It would not be wise, therefore, under any conditions, to allow such a one to remain at school, even with the most elaborate precautions. Scares of outbreaks of this trouble have every now and then occurred, but they have not been substantiated, nor is there any real danger, for something more than infection is required to give rise to an epidemic.

The real difficulty in dealing with these cases is the recognition of the disease, for so-called granulations occur quite commonly in the lids of the young which have nothing in common with trachoma granulations, but with which they are often confused. The innocent granulations are commonly described as follicles. They consist of lymphoid tissue, like "adenoids," and are usually to be observed on the inside of

the lower lids near the eyeball. They are translucent, and when present in sufficiently large numbers are situated in rows. They do not occur to any extent in the upper lids, but may be seen sometimes creeping round from the lower lid at the inner and outer corner.

Other than this, granulations of any kind on the upper lid should give rise to the gravest suspicion. The granulations due to trachoma resemble a very small boiled sago grain. When inflamed, as they frequently may be, they give rise to a condition of follicular ophthalmia which can further be classified under the cause which has given rise to the inflammation. They arise in eyes that have been subject to irritation or eye-strain, or excessive use of drops, such as atropine or cocaine. They have been recently described as the result of an attack of epidemic ophthalmia, though in the writer's experience, while they may arise from any chronic irritation, an acute inflammatory attack will bring about their disappearance, had they been present. Such eyes, too, show themselves as particularly liable to become attacked, when the patients are present in the infective zone of an epidemic. It is always advisable to get rid of these follicles by active treatment with astringents, and especially by removing the cause, if it can be ascertained. It is well, therefore, to add that eye-strain from the need of spectacles is a very frequent cause. From the school point of view, the only treatment that need here be mentioned as regards trachoma is as above stated, that the boy must be removed from the school at once.

Of late years scientific enquiry into the causes of conjunctivitis has led to considerable alteration of the nomenclature of this form of disease, and, although

there is still a good deal of uncertainty in the share that the several micro-organisms, which have been discovered, take in the production of the inflammation, yet they form a good general basis for the classification, scientific study, and treatment of the inflammatory conditions of the conjunctiva. While laying special stress on the epidemic produced by infection with the Koch-Weeks bacillus, and the infectious character of the Morax-Axenfeld diplococcus, the writer will do little more than mention the other forms of ophthalmia due to infection, for the study of which the reader is referred to a more complete treatise.

Acute Contagious Conjunctivitis ("Pink-eye," Acute Muco-purulent Ophthalmia, etc.).

Symptoms.—Irritability and a feeling as of sand in the eye mark the early stage after infection. Usually on the second morning, the eyes are stuck together by muco-purulent discharge, the conjunctiva is congested, the lids puffy, and free lacrymation occurs. These symptoms increase in severity for about two days, and in severe cases small conjunctival hæmorrhages take place. This stage lasts for three or four days, when the acute symptoms begin to subside, and after ten days from the outset little trace of the attack is left, except, may be, some redness of the lids, and in a fortnight most patients are practically well. Occasionally exacerbations or relapses take place, and the attack may be prolonged for another two or three weeks. Sometimes phlyctenules and corneal ulcers supervene.

Cause.—The inflammation is due to infection by micro-organisms, and that which is present in a very large majority of cases is the Koch-Weeks bacillus; but the pneumococcus or influenza bacillus may be

found, in which cases the attacks are usually milder, but the microscope is needed for differentiation.

Treatment.—Cleanliness is all important, and it is very doubtful if anything more is needed, for recovery is due to self-immunization, although the immunity does not necessarily last for long. When relapses and exacerbations occur, astringents are recommended ; but for the usual cases some antiseptic wash, as a saturated solution of boracic acid, perchloride of mercury lotion 1 in 9000, or diluted glycothymoline is sufficient. Some authorities recommend more strenuous treatment, such as nitrate of silver or argyrol. Where complications arise, such as ulcers of the cornea, atropine or other treatment applicable to the complication must be used.

Prophylaxis.—This is an important question, for an epidemic of this sort upsets school routine so much. At the same time precautions, unless they are very thorough, will avail little. The exact means by which the infection is conveyed is not yet determined. The vitality of the Koch-Weeks bacillus very readily perishes, and is easily destroyed, and the fact that drying destroys it would seem to indicate that it is not conveyed by air as one might otherwise suppose. Bathing the eyes of those who are uninfected two or three times a day with some antiseptic lotion would certainly be valuable, but this must be done consistently. Complete isolation of those infected would also tend to prevent the spread of the trouble. This is, however, seldom possible, and in cases where it would be, the question arises whether such a step is required for so comparatively trivial a disease, especially as no guarantee can be given that the trouble will not continue to spread.

Subacute Contagious Conjunctivitis. (Angular Conjunctivitis).

Symptoms.—Irritability, with excoriation and a soppy condition, of the skin at the corners of the eyes, especially the outer, accompanied by redness of the margins of the lids. In long-continued cases, the condition of the corners of the eye may spread all round the lid margins. There is no secretion of matter, and the lids do not tend to stick together. There is, however, some mucous discharge. The condition is especially chronic, and occasionally small ulcers form on the margin of the cornea.

Cause.—Infection by the Morax-Axenfeld diplobacillus.

Treatment.—The condition is readily cured by sulphate of zinc drops, two grains to the ounce. If ulcers of the cornea occur, the same drops, but half the strength, combined with atropine, half a grain to the ounce, should be used.

Trachomatous Conjunctivitis need only be mentioned, as such cases should not be treated in schools. A specific micro-organism probably exists, but has not been definitely isolated. Other conditions, however, which are not present in high-class schools, are required, in addition to the infective virus, to bring about an epidemic.

Membranous Conjunctivitis is a comparatively rare disease, usually due to the presence of the bacillus of diphtheria or a streptococcus, and sometimes to other micro-organisms. The diphtheria bacillus should always be suspected and the patient treated accordingly. Besides the membranous form, a mild attack of acute conjunctivitis may be due to the streptococcus occurring in cases of impetigo.

Acute Purulent Ophthalmia.—This is hardly

likely to occur in schools. The infection is due to the gonococcus, and in milder cases to the diplococcus catarrhalis and meningococcus.

There are other micro-organisms which affect the conjunctiva, but which need not be enumerated here; it may, however, be well to mention that under unfavourable conditions of the part, when its vitality is lowered, the staphylococcus aureus will excite acute conjunctivitis.

R. W. D.

CHAPTER XV.

RINGWORM. TINEA.

RINGWORM is a well-defined and distinct affection of the skin, caused by different varieties of a microscopic parasite, and due to a minute fungus invading the outer layer of the skin, the hair-follicles, and the hairs. It is highly contagious; and when occurring on the head, if not properly treated in the early stages, may rapidly spread and become rebellious to ordinary treatment, and seriously interfere with a child's education.

It is a mistake to think ringworm is due to dirt or want of personal cleanliness. Dirt affords no pabulum for the fungus to grow in; and the disease is not found in a greater percentage in dirty and neglected children than in those who are clean. Washing the head does not prevent the fungus from developing if it has effected a lodgement on the skin.

The most common age for ringworm of the head is from five to eleven years, and about three out of four cases commence between those ages. From the examination of boys (coming from all classes) for admission into Christ's Hospital during the last forty years, I have come to the conclusion that ringworm of the head is rapidly declining. From 1875 to 1885 I rejected (on account of ringworm)

about 8 per cent of the candidates for admission; from 1887 to 1897 this was reduced to 4½ per cent; and during the last ten years the number rejected has been only about 3 to 2 per cent. This proves that ringworm is now diagnosed and treated more efficiently than formerly, and that by care it ought to become a rare disease.

Incubation Period.—This is uncertain, but a small spot may form in a few days from the implantation of the fungus. If the disease is contracted it can usually be detected by an expert within a fortnight, but sometimes the fungus may remain latent for a time.

It is very difficult to say how long any place *must* have existed before being seen, as the rate of growth varies. Thus it is unwise to give a decided opinion, though an experienced observer can give a fair guess. A small place may develop in twenty-four hours, and a moderate sized one in a few days; but on the other hand, a small place may have existed for some time.

It is impossible to say how long it will take to cure any case of ringworm of the head. It may remain uncured, especially if treated by the old methods with ointments or lotions, for months or even years. In some children the fungus takes but slight hold, and is easily destroyed, while others are very susceptible and the disease quickly spreads.

The Fungus* consists of branching hollow tubes called *mycelia,* and of *conidia* or *spores*; and when it

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* The Different Forms:—

Tinea Tonsurans—ringworm of the head; and *Tinea Circinata*—ringworm of the body.

Tinea Tonsurans is divided into: *Microsporon Audouini*—tinea with small spores, and *Tricophyton megalosporon*—

PLATE V.

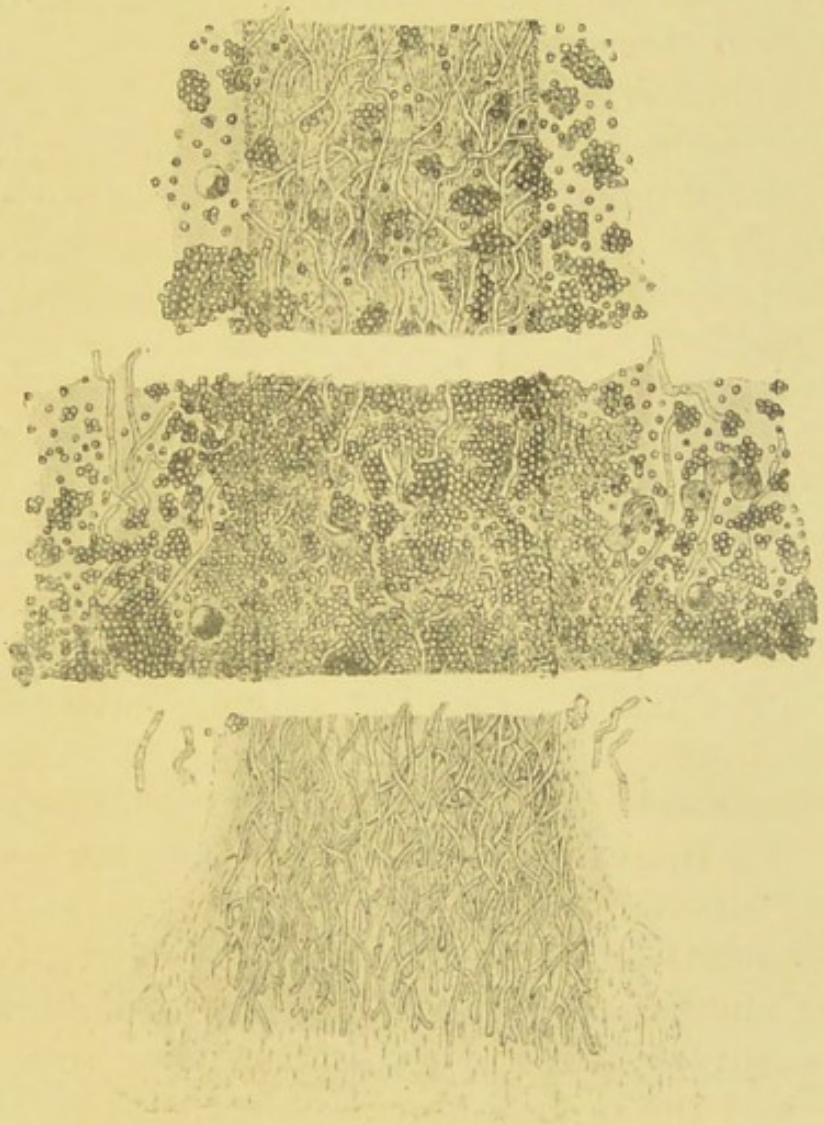

Fig. 12.—RINGWORM OF THE HEAD. *Tinea Tonsurans:* the small spore variety, or *Microsporon Audouini.* × 300 diam.

Plates V, VI, VII, reproduced by kind permission from "Ringworm and Alopecia Areata."

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PLATE VI.

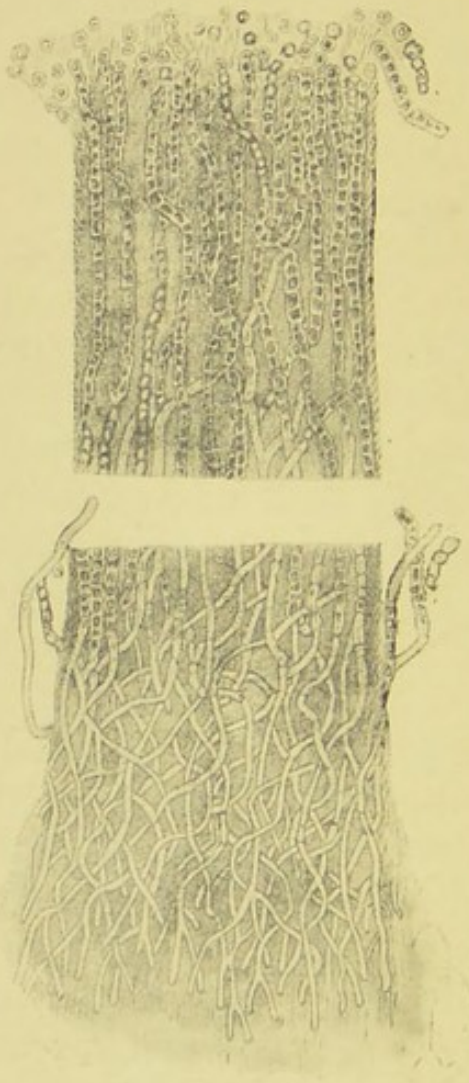

Fig. 13.—RINGWORM OF THE HEAD. *Tinea Tonsurans:* the large spore variety, or *Tricophyton Megalosporon (endothrix resistant).* × 300 diam.

invades the skin it develops into mycelium tubes which pass between the cells of the outer skin (epidermis or cuticle), and cause irritation and inflammation, and often a ring of minute papules and vesicles. If the head be involved, the hairs get diseased, and the case is infinitely more difficult to cure than if the body be the seat of the disease.

Diagnosis.—Patches on the body are fairly easy to detect, but there is no disease of the skin in which so many mistakes are made in diagnosis as in ringworm of the head; and when the results of such errors are considered, it is surprising that those who may have to discover this trouble, or to give certificates, do not more thoroughly acquaint themselves with the simple facts concerning its diagnosis, and what constitutes a "cure." Errors are often made, and children with well-marked ringworm are even certified to be cured and sent back to school; and yet there are definite signs by which anyone can tell whether a child has or has not ringworm, and mistakes ought not to be made.

In examining a head it is essential to have a good lens and a bright light (daylight best), and the light should be on the right side of the examiner.

The hairs should be turned up by a pair of forceps in the reverse way to the growth, so as to expose the *whole* scalp little by little. Any scurfy spot should be examined with a lens, when any uneven or broken-off hairs will stand out and be observed, even with the naked eye.

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tinea with large spores. The latter is also divided into *M. endothrix*, the commoner variety, and *M. ectothrix*, the rarer. Then there are two varieties of *M. endothrix*—*resistant* (much the commoner), and *fragile* mycelium. The latter is rarely seen in so-called black-dot and disseminated ringworm.

with those who are free; but, as ringworm is contagious and not infectious, there is very little risk of children taking the disease from simply being in the same room for lessons or meals with a case of ringworm, provided it is under efficient treatment.

One of the commonest causes of the spread of this trouble is the contact of healthy children with the head of, or with infected articles belonging to, a child with chronic, unknown, and therefore *untreated* ringworm, which is so often thought to be scurf or eczema.

Recent Ringworm.—At the earliest stage there is only a small scaly circular spot containing, perhaps, hairs more brittle than usual, but it is rare for a case to be discovered before a few hairs are involved and broken off. The usual position is the dome of the head, and attention may first be drawn to the case by the child scratching his head, or by the nurse or hair-dresser observing a partly bare place.

The patches vary in number from one to many, are more or less circular, non-symmetrical, and extend from the circumference. A typical patch of small-spore is usually a marginated one, where most of the hairs lie in one direction, and easily break off, "stumps" being left; but it is a great mistake to imagine that ringworm on the head usually presents the appearance of a red scaly spot, almost destitute of hair, with a raised edge and decided ring-like form. This appearance of ringworm of the body is rarely seen on the head.

The part looks as if nibbled, and this appearance is very distinctive and should never be mistaken for scurf or eczema. In the very early stage before the hairs break, the only way to diagnose the case is to examine the scales under the microscope for *mycelium*.

Stumps.—The diagnostic "stumps" are short broken-off *diseased* hairs, and care must be taken not to confound them with short cut-off healthy hairs. It is absolutely useless to examine (or to send up for examination) healthy short cut-off hairs for the fungus.

The stumps are usually thickened, lustreless, and easily broken off on attempted extraction with forceps; whereas healthy hairs, or the stumps in *alopecia** (*Fig.* 15) will come out entire with the root. In cases of chronic ringworm, especially after long treatment, the stumps are often difficult to find, as they may be hidden amongst the long hairs, or fastened down under scales, and only appear when the scales are carefully removed. They may even be found on the under-surface of the removed scales, sometimes twisted like a corkscrew.

A stump may sometimes be removed entire by using very gentle traction with the forceps, but more usually it breaks off a little way down the hair-follicle, leaving the bulb and some of the shaft behind. It is this little bit of hair (if a whole stump cannot be extracted) which should be examined under the microscope.

Sometimes the stumps, instead of sticking up, may be found lying close to the surface of the skin, looking dull and thickened, and often of a lighter or yellow colour, and possibly glued to the scalp by sebaceous matter.

Microscopical Examination.—The stumps should be placed on a glass slide with a drop of Liq. potassæ, and a thin cover-glass applied. It is best to let the specimen soak for an hour or two to make it trans-

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* *Alopecia areata*—bare smooth patches. (See page 125.)

parent; but if it must be examined at once, the under-surface of the glass slide should be slightly warmed. Prolonged soaking brings the fungus, especially the mycelium, into view; and it is better to soak the specimen some hours than to use heat, which may destroy the mycelium. Before examining, the cover-glass should be gently pressed down, and any excess of potash removed by blotting paper. It is also essential to have a good microscope with $\frac{1}{8}$th object glass, so as to magnify about 600 diameters. Stumps appear opaque if examined too soon, or if heated too much.

Often the form of fungus can be diagnosed at once as the sheath in the small-spore gets pressed out on either side of the stump, and looks whitish to the naked eye.

Small-spore Diagnosis.—The patches are usually round and distinctly circumscribed, more or less bare, and sometimes of a greyish or slatey colour. The skin is often raised above the surrounding level and the follicles appear prominent, having the appearance of "goose skin." The surface is covered with dry lamellated scales, giving the place a dirty scaly appearance, and at times slight crusts form. Small lustreless, sheath-like coverings* of a dull white or grey colour, and composed of innumerable spores, more or less surround the bases of the stumps. Hundreds of these lying close together give a white frost-like look to the skin. Almost all the hairs are diseased on the places, lie in one direction without any elasticity, and if pulled generally break. The diseased hairs are white and lustreless, look as if covered with fine dust, and when broken off have a nibbled appearance.

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* Called the "circumpilar collarette."

Under the microscope the most conspicuous object is the spread-out mass of spores heaped together on each side of the compressed stump. The chief characteristic is this mass of innumerable *round* spores, which are not arranged in filaments or linear series, or in the distinct bands and strings of beads found in the large-spore. They lie one against the other without any definite arrangement, forming a mosaic by mutual pressure outside the hair.

The surface of the hair is eroded, and mycelial threads can be seen on the hair and in its substance, and end at the neck of the bulb in a long terminal fringe of delicate threads characteristic of the small-spore.

Large-spore Diagnosis.—In both varieties the skin is much smoother than in the small-spore, and at times only broken-off stumps are to be found. There are no sheaths, and no frost-like look of the skin. The places are generally smaller, but large patches may exist with the hair growing freely, except that numerous stumps are to be found scattered amongst the healthy hairs. If the stumps are scattered about it is called "disseminated ringworm;" and "black dots" may be present, due to rubbing down of the stumps level with the skin. Though the places may be smooth and healthy looking, at times—especially after treatment—the scalp is very scurfy. This is the form so often overlooked, and thought to be only scurf. The "stumps" are generally seen mingled with the long hairs, erect, swollen, dark, and broken off very short; and may only be found under the scales. On attempted extraction they usually break off very short.

Microscopically, there is no heaped-up mass of spores round the shaft, and no opaque mass spread

out. Long chains of mycelium, which branch at times, are found transversely divided at intervals, and a fringe of mycelium near the bulb, but not having such long threads as the small-spore. The mycelium can be seen in the substance of the hair forming bands of mycelial spores. The divisions are doubly contoured, almost square, forming bands like the staves in a ladder, or in the *fragile* form like a string of beads. As a rule no mycelium is seen on the shaft outside the hair follicle, except from bursting of the hair. The shaft is not eroded like the small-spore, and the epithelium can be seen like so many minute tiles overlapping. Sometimes there is a "fish-roe" look of the masses of spores found packing the hair, resembling a bag of nuts.

Bald Ringworm.—The skin may be more or less smooth and clean, but the diagnostic sign is the presence of some diseased stumps, at times broken off and only looking like "black dots." This is a rare and chronic form, and has been confused with true *Alopecia areata*. It is very difficult to get away any portion of the diseased stumps, but if examined it will be found to be one mass of fish-roe fungus.

Diagnosis from Alopecia Areata.—Bald places due to true *Alopecia areata* may be thought to be ringworm, and often have "stumps" on them, and even black dots. The diagnosis is easy, as patches of alopecia are smooth, white, with absence of scales and *diseased* stumps. Generally there are some typical *club-shaped* stumps, especially where the patch is enlarging. The long hairs near the place may be very loose and come out easily when pulled, but the skin is not raised, and after a time gets thinner and depressed. The stumps are typical, with the ends larger than the root-part—like a note

of exclamation (!) without the dot. These stumps are easily extracted *entire* instead of breaking off, as usual with the stumps from ringworm. The roots are small and shrivelled, and under the microscope the bulb is observed to be atrophied, sometimes swollen at the upper portion and then tapering and much reduced in size. The shaft is found to be dilated and darkened in places, forming enlargements which are deeply pigmented in the centre, with a large amount of dark granular matter like pith. The free end is somewhat club-shaped, pigmented, and often exhibits a cluster of fibres radiating outwards in a brush-like form. No mycelium or spores are to be detected, and if found the case is not true alopecia, but bald ringworm.

Bald Spots, from cuts or injuries, can easily be diagnosed by their shape, the depression of the skin, its white appearance, and the absence of stumps.

Diagnosis of Chronic forms of Ringworm.—It is a great mistake to think ringworm is cured because the hair is growing again on the affected areas. Some of the most chronic cases are those in which the long hair is growing freely again, but on close examination "stumps" can be found. It is impossible to write too strongly on this point, as an outbreak in a school is generally due to the admission into it of an over-looked *chronic* case. Such are sent back, even with medical certificates, as "cured" and fit for school, and certificates may be given without a thorough examination of the head. Even after children have been said to be cured by the *x*-ray treatment I have often found many diseased stumps left. But apart from difficult cases to diagnose, I have had children sent to me *certified as "cured"* with typical patches of ordinary ringworm,

covered with scales and scurf, and broken and twisted short hairs. On pointing this out I have been gravely informed that the disease was "dried up and cured, and the stumps of no consequence."

It is often difficult to detect the short diseased stumps, which only protrude an eighth of an inch or less; and no patch should be considered "cured" until the new downy hair commences to grow, and the case has been carefully watched for a time after all treatment has been discontinued. Stumps often re-appear, so the head should be watched and examined for weeks after it seems to be free.

The fungus cannot be destroyed by parasiticides contained in ointments and lotions, so that the diseased hairs grow healthy again, but all the diseased hairs must be got out of the hair follicles, and new downy hair should grow.

Atrophied Stumps.—Sometimes, after shaving or close cutting, some atrophied stumps will be found though the case is cured. The diagnosis of these is easy, for they are bright and fine, and look like healthy hairs. They come out easily with atrophied roots, and of course no fungus can be detected.

Certificates.—It is a wise precaution for schoolmasters to insist on a certificate being obtained from some well-known specialist when a boy or girl returns to school after ringworm of the head; and in all cases the medical officer of the school should reject the child if any diseased hairs are present.

Ringworm of the Body is also caused by a plurality of fungi, and is often contracted from animals, but may be associated with ringworm of the head. It should be a golden rule always to examine carefully the head of a child who has a

patch of ringworm on the body. If the scalp is free it is easy to cure the trouble on the body.

The place or places are usually the size of a split-pea to half a crown, or larger, with circular and well-defined edges. They are slightly raised, covered with fine scales, and enlarge by growth at the circumference, while the skin may become more or less normal again in the centre. They are often distinctly red, with minute papules and vesicles at the edge, forming a distinct ring. The affection shows no disposition to symmetry, and there is usually some itching of the skin. Patches may be seen on the back of the wrist having more the appearance of eczema, but have a well-defined edge and vesicles.

Eczema Marginatum.—Under the combined action of heat and moisture, ringworm on the body may become severe and extensive. It may spread and be very chronic, especially on the inner and upper parts of the thighs. This form is called *Eczema marginatum*, but it is true ringworm, and often most difficult to cure.

There have been many cases lately in some schools, but it is more often seen in young men and adults, especially in those who ride much.

It commences with a raised red patch with papules and vesicles and much irritation, causing the patient to scratch the parts. The circumference has a well-marked defined border often thickened and raised, and it spreads rapidly, with a tendency to heal in the centre, leaving a dark-red scaly condition of the skin and, in time, marked pigmentation.

It differs from ordinary ringworm in the eczematous character of the lesions, and the congestion and pigmentation of the skin. At first there is a luxuriant growth of large mycelium, and the

fungus can easily be detected if the scales on the outer edge be examined, but when the disease has passed into the chronic form, the fungus may be difficult to find.

In all forms of body ringworm the diagnostic point is the presence of well-marked mycelium ramifying amongst the epidermic cells.

Microscopical Examination.—To obtain a specimen for examination, the inner part of the outer ring should be scraped, and the scales placed in liquid potash. The glass slide must be allowed to stand for some hours, or be gently warmed. The mycelium is seen as long, slender, sharply-contoured threads like ribbons, jointed at irregular intervals, and branching in all directions. Care must be taken not to mistake shreds of wool or cotton for mycelium, and not to confound the margins of the epidermic scales, where they overlap one another, with threads of mycelium. The diagnosis is easy if the fine adjustment be used, which will exhibit the outline of the scales.

Diagnosis.—Eczema, scurfy places, seborrhœa, and pityriasis may be mistaken for ringworm.

The patches may be circular, raised, sharply circumscribed with a ring-like border, and scaly. In *Pityriasis rosea*, especially, they may even become more normal in the centre whilst spreading at the edges, and thus look very like ringworm, and are often mistaken for it ; but as a rule there are many small red places not at all like this disease. If in doubt, the scales must be examined, and no mycelium will be detected. Seborrhœa may also simulate ringworm, but the patches are generally irregular, and have the same appearance all over. Even an experienced observer may be mistaken, and it is

advisable to examine microscopically the scales from any doubtful spot.

Ringworm of the body should not be considered to be cured until the place is almost normal again at its circumference. The place may still be slightly red and stained, but the margin should be quite free from all papules and scurfiness, and should not be raised above the level of the surrounding skin.

TREATMENT OF RINGWORM OF THE HEAD.—It is impossible to say much about the treatment of this trouble in a small space, and elsewhere* I have fully described the different ways adopted in the past; but since the *x*-ray treatment has come in, most that has been written is worthless.

The first thing to do is at once to isolate the patient and prevent the disease from spreading. This is often neglected, and some parasiticide is simply applied to the *place*. It is essential that *the whole scalp be treated.*

A good plan to adopt (at first) is to cut the hair off the place or places, and to thoroughly wash the head with carbolic soap, and carefully dry it. Then *at once* to rub in an ointment containing a mild parasiticide. I prefer sulphur, and use a drachm and a half of precipitated sulphur to the ounce of benzoated lard. This should be well rubbed into the entire head, at first avoiding diseased patches, and finally rubbing it also into them. A little carbolic-glycerine (one part of carbolic acid to seven parts of glycerine) may also be dabbed on to the affected parts; but it is not advisable to use any strong parasiticide at first, as *x*-ray treatment may be adopted later on. The great thing to do, *at first,*

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* "*Ringworm and Alopecia Areata.*"

is to make the whole surface of the skin of the head (the cuticle) in such a condition that the fungus cannot grow amongst the epidermic cells, and this is usually accomplished by using sulphur every day. Of course, it is well to cut the hair off the patch, but I never advise shaving the head, as then it is difficult to find the places. If sulphur be thoroughly rubbed in, ringworm rarely spreads, though small places which were not noticed at the first examination may subsequently be discovered. It is also advisable to disinfect with formalin any articles that may convey infection, as clothes, towels, brushes, combs, etc.

The next question, especially for the schoolmaster, is what course of treatment is to be adopted, as it may take many months. My opinion is that cases of ringworm of the head ought to be sent home, and not kept at school; and thus the selection of the treatment would be left to the medical man attending to the case.

Parasiticides are essential to stop the spread, but they rarely cure by killing all the fungus. The diseased hairs have to be got out of the follicles, and it is by causing inflammation, etc., that most of the parasiticides effect a cure. I have utterly discarded all the old treatments by ointments and lotions containing parasiticides (their number is legion). In nine cases out of ten it is simply a waste of valuable time, and the disease, especially if parasiticides are not constantly used all over the head, often spreads. Simple remedies will easily cure ringworm on the body, as it is easy to get the parasiticide into contact with the fungus; but in ringworm of the head we cannot by any amount of rubbing get parasiticides deeply enough into the

closed hair-follicles to get into contact with and destroy the fungus about the roots, and diseased hairs may continue to grow up for months or even years.

Before the *x*-ray treatment was discovered I cured the cases under my care by the so-called "croton-oil treatment." That is, by using a small quantity of croton oil with *great care*, and constantly bathing and poulticing the place, I produced sufficient inflammation of the skin to cause the diseased hairs to be thrown off, and new downy hair would grow again. Unfortunately, this treatment requires very special knowledge and experience, and few adopt it now that the *x*-ray treatment has almost entirely taken its place. Personally I still employ croton oil for *small* places of scalp ringworm, as I can get the places well more quickly than by *x*-rays. *X*-ray treatment also leaves a larger bare place for a time, and the new hairs do not grow again as quickly as when the stumps are removed by croton oil. Croton oil properly applied only removes the *diseased* hairs, while *x*-rays cause all the hairs on the part exposed to them to fall out. Therefore the bare place is generally much larger than the original spot. Again, *x*-rays only cause the hairs to fall out and do not kill the fungus, and unless great care is taken the disease may easily spread while the *x*-ray treatment is adopted.

At the present time most experts advise the *x*-ray treatment for ringworm of the head, even if only one or a few places. Great care is also exercised concerning the time the part is exposed, and mild parasiticides are kept over the head to prevent any spread of the disease. If *x*-rays be used they ought to be applied by some one thoroughly acquainted

with the method and the precautions to be adopted, as unfortunately if great care be not taken permanent bare places may be produced, and I have seen several during the last few years.

If the *x*-ray treatment is to be used, strong parasiticides should never be applied at first, as no careful operator will use *x*-rays to a patch of ringworm that is inflamed by parasiticides.

Then there is the treatment for disseminated ringworm, and the removal of scattered stumps left even after *x*-ray treatment has cured the patches. These can best be removed by what I have elsewhere described as "croton oil needling." A number of isolated stumps can be quickly caused to come out by running a fine special needle, coated with carbolised-croton oil, into the hair follicles; but this little operation requires the hand of an expert, and also much of his time.

The great point I wish to emphasize is that time ought not to be wasted in trying first one ointment and then another, but any spread of the disease should be stopped by using a parasiticide all over the head, and the individual places cured by the *x*-ray treatment, or by croton oil; but only by someone fully acquainted with its use and dangers.

Disinfection.—Clothing is best disinfected by formalin, and may be placed in a large closed receptacle, and formalin (one part of strong formalin (40 per cent) in ten of water) well sprinkled all over the clothes (brushes, etc., may be soaked in 1 in 20 formalin solution), and kept in for twelve hours.

Ringworm of the Body.—*Treatment.*—This is quite a different matter, and there is no need to send a boy home; isolation, and disinfection of the clothes are advisable, and the head should be examined to see that it is free.

Any simple parasiticide will cure body-ringworm, as the fungus is easily got at. I usually employ Coster's paste (consisting of iodine and oil of tar). It can be gently rubbed into the place, and for a quarter of an inch outside it, and a piece of lint fastened over it by strips of plaster. The Coster's paste may usually be applied every day for three to five days, and then the place will probably be cured; but I always keep a sulphur ointment on for a time, and watch it. If any fresh papules appear at the edge, more Coster paste should be used. Many other applications may be just as good, as liquor iodi, or iodine and acetic acid.

Eczema marginatum about the upper part of the thighs. It is advisable to treat this affection thoroughly, and with the patient in bed a few days. Good results are obtained from using Coster's paste, or the parts may be painted with a strong solution of iodine and iodide of potassium. Of course this will cause some pain, but it is an efficient treatment. Sulphur*ous* acid may also be used, but should be freshly made, as the acid gets weaker by keeping, and may get partly oxidized into sulphuric acid. Sulphurous (not sulphur*ic*) acid may be sponged on the parts many times a day. After using strong applications it is well to apply a sulphur ointment for a time, and most carefully to watch the edges to see if any fresh papules or extension of the disease appear. Thorough disinfection of any clothes worn next the skin is essential.

H. A.

CHAPTER XVI.

IMPETIGO.

French: IMPETIGO. *German:* KRUSTENFLECHTE.

IMPETIGO is a contagious affection of the skin, which is specially liable to affect football players, more particularly those taking part in the Rugby game,—Football Impetigo or Scrum Pox.

The disease appears as a slightly-raised erythematous patch on the skin, which quickly becomes a vesicle. This, at first, contains clear fluid, but rapidly becomes purulent, and ruptures. The discharged contents form a crust, which usually is surrounded by an erythematous margin. The discharge from the scabs is contagious, and there is a great tendency for the disease to spread, and for other portions of healthy skin to be infected by auto-inoculation by scratching with the nails, towels, etc. The glands in the neighbourhood of the patches enlarge and are liable to suppurate and become abscesses.

The disease is due to one or more micro-organisms, especially to the germs of suppuration.*

In football players the disease appears chiefly on the face, scalp, and behind the ears. It is produced by the excoriations received on those parts from contact with the jerseys, possibly infected, of other players. Players outside the scrum may become infected in other accidental ways.

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* Staphylococcus pyogenes aureus and albus.

The poison retains its vitality for a considerable period. It has been proved that jerseys may retain their infection for five or six weeks after they have been worn. Other articles of clothing or toilet, such as caps, towels, shaving brushes, may similarly be the agents of contagion. The attendant on a patient may be inoculated while carrying out the treatment.

Treatment.—No boy who has any appearance of the disorder should be allowed to play till he is completely cured. The jerseys should be made of some soft material, as merino; a linen collar is desirable. The coarse woollen garment, often used, causes, by its roughness, the abrasions through which the poison enters. Jerseys should frequently be washed, and, on the appearance of the disorder in a school, they should be disinfected by steam or, if that be impossible, boiled.

The crusts should be carefully removed by soaking with boracic lotion, and an antiseptic ointment applied, such as sulphur and mercury, or dilute nitrate of mercury. The application of peroxide of hydrogen (20-volume solution) daily gives very satisfactory results.

H. G. A.

CHAPTER XVII.

SCHOOL EPIDEMIOLOGY.

EVERY schoolmaster and school doctor will, both for their own sakes and for that of their school, naturally be anxious to prevent the introduction of the infectious diseases to which all associations of young people, such as schools and institutions, are specially liable. It is somewhat unfortunate that the greater care exercised in this direction during recent years has appeared to operate rather in the opposite direction, and that the incidence of infectious diseases in schools has increased rather than diminished.

As an illustration of this the following figures are given, compiled from statistics, for the last twenty-eight years, of a large public school. During that period, the numbers have varied from 400 to 500, and 3843 boys have been admitted at the average age of thirteen and a half years. Infectious diseases, of one kind and another, were introduced on ninety-eight occasions, of which fifty-two were at the beginning of terms, and forty-six in mid-terms. The total number of cases was 1850. The yearly average of these during the first half of the period was forty-two, that for the second half ninety, more than twice as many. The reason for this, doubtless, is that the stringency of the quarantine regulations now imposed, makes the parents more anxious to avoid

the occurrence of any infectious disease in the home ; and, as a result of this, many more young people enter school unprotected by previous attacks of the several diseases.

It is desirable for the purpose of taking precautions that :—

1. An accurate knowledge shall be obtained of the diseases with which each pupil has already been attacked.

2. That information should be obtained of any pupil having been exposed during the holidays to infectious disease, so that

3. The necessary quarantine should be imposed, the period of this being determined by the circumstances of each case and the incubation period of each disease.

1. For the purpose of knowing by which diseases each pupil has been attacked, in addition to statements as to his general health, a record should be obtained on a form similar to this :—

This paper must be filled up and sent to the Head Master *before* the boy joins the School.

1. Name at full length.....
2. Date and place of birth.....
3. Has he had Diphtheria, and when ?.....
4. Has he had Whooping Cough, and when ?.....
5. Has he had Mumps, and when ?.....
6. Has he had Measles, and when ?.....
7. Has he had Rubella (German Measles), and when ?
8. Has he had Scarlet Fever (Scarlatina), and when ?
9. Has he had Chicken Pox, and when ?.....
10. Has he been vaccinated, and when ?.....

11. Is his general health good ?.....
12. Is there any peculiarity of his constitution necessary to be considered ?.....

Signed .....

Address .....

Date .....

The information thus received can be kept in a convenient way on a register similar to this which shows at a glance the number of individuals unprotected from each of the diseases :—

ALPHABETICAL LIST.

From first term, 1912, *to* .....

NAMES OF SCHOLARS	SCARLET FEVER	MEASLES	RUBELLA	CHICKEN POX	MUMPS	WHOOPING COUGH	NOTES + Attacked before entry — Attacked after entry
Addison, J. ..		+		+			
Akenside, M. ..	+	−				+	
Arnold, M. ..		+	+		−		
Beaumont, F...					−	+	
Blair, R. ..		+			−		
Blake, W. ..	+					+	
Blunt, G. ..		−	+				
Browne, T. ..		−		+			
Cowley, A. ..		−			−	+	
Cowper, W. ..		−			−		

2. *Certificates.*—The information as to exposure to infection during the holidays may be obtained in two methods (*a*) The Negative ; (*b*) The Positive.

(*a*) *The Negative Method.*—Each parent or guardian of a pupil is supplied with a certificate which he must fill up and sign at the termination of each holidays, to the following effect :—

Name of School.....

HEALTH CERTIFICATE.

This certificate is to be signed by the Parent or Guardian, *not earlier* than the day before the pupil's return to school It must be presented by the pupil immediately on his arrival, or forwarded the day before to the Head Master.

I hereby certify that, to the best of my knowledge and belief .....
has not, for at least three weeks, been suffering from any infectious ailment, or been exposed to infection.

Signed .....
(Parent or Guardian).

Date.....

N.B.—If the pupil be exposed to any infection during the holidays, *immediate* notice is to be sent to the Head Master.

(*b*) *The Positive Method.*—On each notice, bills, etc., sent to Parents or Guardians, the following is inserted :

IMPORTANT.

No pupil shall enter or return to the School from a house in which there has been any infectious disease, during the holidays, without giving previous notice to the Head Master and obtaining his permission. Notice should also be given, and permission to return obtained, in cases where there is the slightest suspicion that a pupil has been in contact with any infectious disease.

Both methods have their advantages ; but in the experience of the writer, the second method gives the same results as the first with much less trouble to all concerned.

There should be a similar obligation on the part of the School authorities to give information to the home, of any infectious disease occurring in the school, before the boys return for the holidays.

The period of quarantine to be imposed in each case will be determined by the incubation period of each disease, a margin of a few days being allowed for safety. These have been considered in the previous pages, and are arranged here in tabular form for convenience of reference.

TABLE OF INCUBATION, QUARANTINE, AND DURATION OF INFECTIVITY

	INCUBATION DAYS	AVERAGE DAYS	(QUARANTINE) DAYS	INFECTIVITY
Measles	10–13	12	16	21 days.
Rubella (German Measles) ..	9–18	14	20	8 to 10 days.
Scarlet Fever ..	2– 8	4	14	6 weeks.
Chicken Pox ..	12–20	14	20	14 days.
Mumps	17–21	19	24	14 days.
Whooping Cough	4–14	14	21	5 weeks.

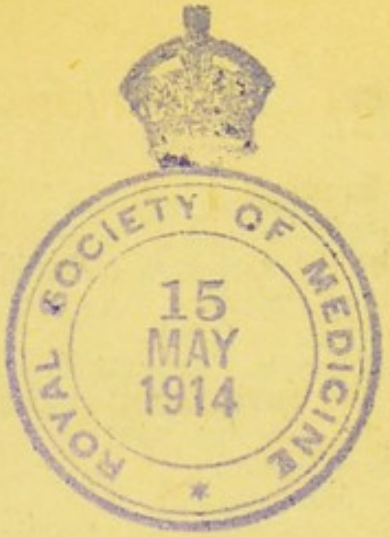
H. G. A.

GLOSSARY.

ANTISEPTIC	Having power to prevent putrefaction. Now technically applied to those chemical substances which can check the growth of bacteria.
ANTITOXINS	Antidotes to poisons.
ASEPSIS	Freedom from germs.
BACILLUS	A rod-shaped bacterium.
BACTERIA	(Little sticks.) Minute vegetable organisms, germs.
CATARRH	An increased secretion of mucus.
COCCUS	A cell or capsule, now applied to germs having a circular shape.
COMA	A state of deep sleep.
COMATOSE	Lethargic. Affected with coma.
CONJUNCTIVA	The membrane which lines the inner surface of the lids and is reflected forwards on the globe of the eye, the front part of which it covers.
CORNEA	The strong horny transparent membrane in the fore part of the eye through which light passes.
DEFERVESCENCE	The period of a febrile attack in which the temperature falls.
DESQUAMATION	The separation of the skin in scales.
DIAGNOSIS	The discrimination of disease by its distinctive marks.
ENDEMIC	Peculiar to a people, country, or neighbourhood ; applied to those infections which are constantly present in a given locality.
EPIDEMIC	Prevalent among a community ; applied to infections only occasionally present.

ERYTHEMA	A diffuse red rash on the skin, which disappears momentarily on pressure.
ERYTHEMATOUS	(Adjective.) Like an erythema.
FOMITES	(Chips of wood.) Applied to any substance capable of retaining particles of contagium.
HAIR FOLLICLE	A depression for the reception of the root of a hair.
"ITIS"	A suffix used to denote inflammation.
LAMELLATED	Composed of thin plates or scales.
LESION	An injury, hurt, or wound.
MALAISE	Undefined uneasiness of the body not amounting to illness.
MENINGITIS	Inflammation of the membranes covering the brain and spinal cord.
MICRO-ORGANISM	A minute organism, visible only under the higher powers of the microscope.
MYCELIUM	The part which ministers to the support of a plant in opposition to the structures devoted to reproduction.
PAPILLÆ	Conical projections, especially those at the root of the tongue.
PARASITIC	Growing or living on some other body.
PATHOGENIC	Disease producing.
PRODROMAL	Premonitory.
PROGNOSIS	Forecasting the probable course of a disease.
PROPHYLAXIS	Preventive treatment.
PROTOZOA	The lowest class of the animal kingdom.
PUS	Matter from a wound or sore.
PUSTULE	A little pimple containing pus.
RIGOR	A strongly marked shivering fit.
SEBACEOUS	Composed of *sebum*, the secretion of certain glands in the skin.
SEQUELÆ	Symptoms occurring as a direct result of disease.
SERUM	The yellowish transparent fluid of the blood.

SPORES	Minute bodies capable of reproducing the parent organism, but less easily destroyed. Also often applied to the reproductive organs of moulds, e.g. tinea.
STREPTOCOCCI	A chain of cocci linked together.
TOXIN	A poison (originally arrow poison). Now usually applied to the products of living organisms.
ULCER	An open sore.
VACCINE	The killed virus of any specific disease introduced into the body by inoculation — originally the virus of cowpox.
VESICLE	A small bladder.
VIRUS	A poison; usually, at present, applied to living organisms which can produce disease.



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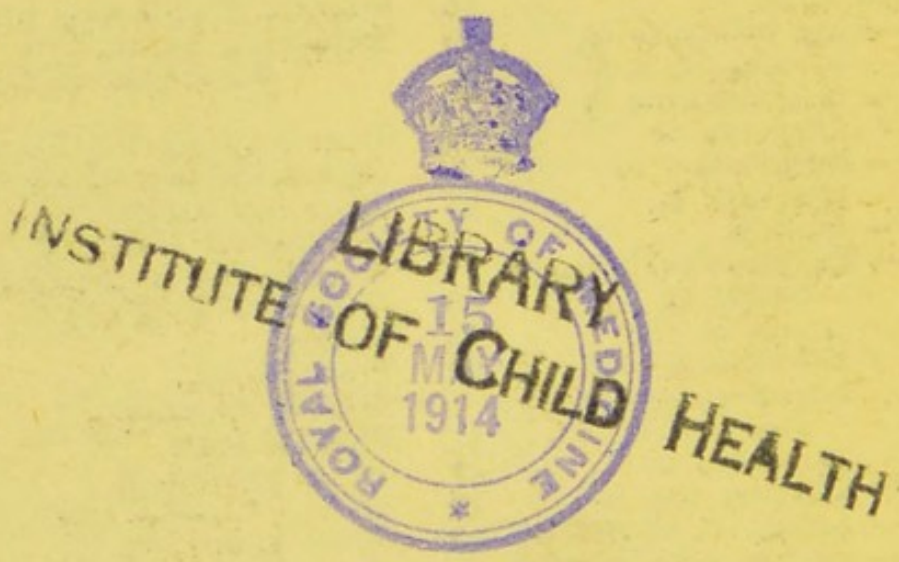

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