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THE HYGIENE

OF

THE INFECTIOUS FEVERS.

BY

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THE HYGIENE OF THE INFECTIOUS FEVERS.

Sixty thousand one hundred and sixty-two lives were sacrificed in England during 1878 to these infectious diseases—smallpox, scarlet fever, measles, diphtheria, hooping-cough, typhus, enteric, and simple continued fever. The latest information available for Scotland is for 1876, when the mortality was 8739. All these diseases are preventable. The immense importance of this subject is therefore abundantly manifest; and two communications by Drs Ransome and Vacher, which appeared in the *British Medical Journal* of May 8th, suggested to me that much practical benefit might be gained by introducing it for discussion at our annual meeting, and for this reason especially, the very great diversity of opinion, and therefore of practice, which prevails with regard to the sanitary precautions which should be enforced. This discrepancy has a bad effect in more ways than one. Firstly, as regards ourselves, it unavoidably occasions criticism on the part of the non-medical public, not complimentary to the wisdom and scientific knowledge of the profession; but, secondly,—and this is more important,—the opinion is apt to be formed that little is certainly known on the subject of contagion,[1] that our instructions are founded on mere guess-work, and are therefore possibly all wrong. A wide-spread scepticism still exists as to the reality of infection, many intelligent people still looking on such a belief as a sort of weak-minded superstition, and this scepticism is fostered by the frequent collision of medical opinion. The further very practical evil also results, that so long as this doubt exists to any great extent, sanitary measures will have but partial success; because, unless those persons on whom it devolves to put them in force believe thoroughly that they are effective for their purpose, they will be applied in a perfunctory and inefficient manner, the result will probably be unsuccessful, and so discredit is brought upon the system, and the sceptic sees in the failure a certain proof that he was right, and that sanitation is a myth; and so the evil perpetuates itself. We need not be ashamed to confess that

[1] I need hardly say that I use the terms infection and contagion as synonymous.

there is yet much to learn, but enough is known, and with certainty, to guide us to measures which, if intelligently carried out, would assuredly prevent a large amount of disease and death.

It is not probable that unanimity can be attained as to what diseases demand quarantine measures, and the necessary duration of these, but it appears to me that it should be possible to come near an agreement as to some broad practical rules on these points, by which we might regulate our practice, and to which a practitioner might point in his dealings with dissatisfied patients, in proof that he is not pursuing some mere whim or crotchet peculiar to himself. The laxity of practice at present is simply absurd. Visitors come and go between infected houses without let or hindrance, often building themselves up in the curious belief that if not afraid they are safe. As well may the soldier on the battlefield imagine that absence of fear will prevent him being shot. Clothes, provisions, books, toys, are freely interchanged without any attempt at disinfection; convalescent patients and members of infected families mix in society, attend crowded meetings and church, and children return to school, before it is possible that power to infect has ceased. Convalescents from measles, for example, frequently re-appear at school after a fortnight's absence or less. I have known an instance where a sanitary authority was requested to send for the infected articles from a scarlatinal patient within ten days after the first intimation of the case, which was said to have been reported within a few days of its commencement. If disinfection were attempted at such a period, it is easy to conceive the probable course of events; desquamation might be only about beginning when the disinfected articles were returned, and the house would remain a centre of scarlatinal infection for an indefinite time, and doubly dangerous because now a trap, having the appearance of safety, for has it not been disinfected? On the other hand, errors in the opposite direction are of common occurrence, friends meeting in the street abstaining from shaking hands, or even crossing to the other side. On one occasion in my own experience, after an outbreak of scarlatina in a family, in which all the children were attacked within the first week, had been convalescent for about two months, and freely in the open air for one of these, I gave at the end of three months the necessary certificate for return to school; they were refused admission, and I was told that other parents had intimated that if these children returned they would remove theirs. I have heard of equally absurd fears elsewhere. So much in proof of the present unsatisfactory state of matters.

The strict enforcement of isolation is no doubt a great inconvenience, and sometimes very prolonged, especially in the instance of a large family where the disease is being always, as it were, "continued in our next," entailing, it may be, a great sacrifice both of time and money. But the neglect of the proper precau-

tions, so far from terminating the hardship, only shifts it to other shoulders, burdening not merely one other family, but probably many, and causing to some, who might otherwise have escaped, perhaps lifelong infirmity or even death. That is no exaggeration, because if, for example, a scarlatinal patient return too soon or with infected clothes to a crowded school, the disease will almost certainly spread; and if, say, twenty or thirty cases result, it is very probable that two or three will terminate fatally, a very ordinary mortality being 12 per cent., and it is occasionally much higher. The carelessness which so widely prevails is, however, I am persuaded, much more a consequence of defective knowledge than of wilful recklessness or indifference to the welfare of others; and this need not occasion much surprise while so much contradiction is apparent amongst ourselves. All education of the people on matters of health must emanate primarily from the medical profession; and it can hardly be denied that we could with much more effect both diffuse sound knowledge and enforce sound practice were we to show a more united front ourselves.

To begin at the beginning, then, Is infection a fact? That we are unanimous on this point may be taken for granted; but the contagium should be regarded much more than it is, not as some mysterious influence, nor even a gaseous emanation, but as consisting of minute particles of solid matter This is absolutely proved as regards the vaccine contagium, and analogy would lead to the conclusion that the contagia of other diseases are probably similar. These are given off in different diseases from different parts, from the skin, or by the breath from the mucous membrane of the throat or lungs, or from the intestinal mucous membrane, or in other excretions, and, floating in the air, may be transported a considerable distance.[1] Every one has observed how soon a rose diffuses its odour through a room, and in all probability contagia are in like manner diffused, and become attached to clothes, etc.,; and as odours have varying degrees of tenacity, so have contagia. The effect of colour is also a very curious fact. Murchison writes:[2] "Haller of Vienna observes that dark-coloured materials of clothing are more prone to absorb the contagion of typhus, and to convey it to other individuals, than those which are light-coloured. He found that among troops wearing dark-coloured uniforms it more frequently happened that new cases of typhus entered the hospital, after a convalescent had rejoined his corps, than those wearing light or white uniforms. It may be mentioned, also, that Stork found that in dissecting-rooms dark clothes acquired the cadaveric odour sooner, and were deprived of it less readily, than light ones." Such facts afford useful hints for practice.

[1] Recent observations in Paris by Dr Bertillon appear to show that the contagia of smallpox and diphtheria may even be carried across the open air from a hospital to surrounding dwellings.—*British Medical Journal*, June 5, 1880, p. 863, and June 19, p. 934.

[2] *Treatise on Continued Fevers*, 2nd edition, p. 89.

Infection being granted, is it in our power to prevent or control the spread of infectious diseases by sanitary precautions, such as isolation, ventilation, cleanliness, disinfection, etc.? Professor Stephenson begins his excellent little book on the management of these diseases[1] with this forcible sentence, "The prevalence of infectious disease is within human control quite as much as is that of fires." That is, I believe, a great fact, and one which should be dinned into the ears of all, medical and non-medical, till it takes firm root in their minds as an undeniable axiom. But he makes the important qualification that "from accidents and carelessness we are ever likely to have outbreaks of both," which is only a reason for greater energy in arresting the danger when it has arrived. It is too much a habit to consider it, as it were, an unavoidable fate that children must sooner or later undergo, for instance, scarlet fever and measles; but in Dr Page's opinion,[2] if a child have either, it "points to some one's ignorance or neglect." The efficiency of public health measures is attested by the great diminution in the prevalence of several diseases—typhus fever, for example; but their power is especially manifest in controlling enteric fever, of which Dr Parkes writes,[3] "The grand fact is clear, that the occurrence of typhoid fever points unequivocally to defective removal of excreta, and that it is a disease altogether and easily preventable."

The first step to be taken against the spread of infection is the enforcement of the law for registration of these diseases, so that the earliest cases may become known to the sanitary authority, which can immediately endeavour, by means of its medical officer, to trace if possible their source, and, if this be discovered, to cut off the introduction of fresh cases, and to prevent or at least limit diffusion. This at once raises the question as to what diseases should be included in the police list, and the several authorities who have enforced registration vary somewhat. From a report by Mr Ernest Hart as Chairman of the Parliamentary Bills Committee of the British Medical Association, which he has kindly sent me, I have drawn up a statement of these several lists, adding that of Dundee (see p. 7).

Thus, ten of these fifteen sanitary authorities specially name cholera, smallpox, typhus, enteric fever, scarlatina, and diphtheria; seven add relapsing fever; five, puerperal fever; three, measles; and one, erysipelas. Two of the remaining five specially mention only smallpox and cholera, including other diseases under a general description; and the remaining three make no special mention of any disease. None includes hooping-cough. I am strongly of opinion

[1] *The Fight with Infection, etc.* By William Stephenson, M.D., F.R.C.S.E., Regius Professor of Midwifery and Diseases of Women and Children, University, Aberdeen.

[2] *Facts about Fevers, etc.* By David Page, M.D. Edin., Medical Officer of Health to the Sanitary Districts of Westmoreland, Ulverston, and Sedbergh, 1880, p. 6.

[3] See *Science and Practice of Medicine*, Aitken, 4th edition, vol. i. p. 418.

Blackpool.	Bolton.	Burton-on-Trent.	Dundee.	Edinburgh.	Leicester.	Llandudno.	Norwich.	Nottingham.	Warrington.	Huddersfield.	Rotherham.	Derby.	Greenock.	Jarrow.
Cholera Smallpox Typhus Enteric Fever Scarlatina Diphtheria Relapsing Fever Puerperal Fever Measles	Cholera Smallpox Typhus Enteric Fever Scarlatina Diphtheria Relapsing Fever Puerperal Fever	Cholera Smallpox Typhus Enteric Fever Scarlatina Diphtheria Relapsing Fever	Cholera Smallpox Typhus Enteric Fever Scarlatina Diphtheria Relapsing Fever Puerperal Fever Measles	Cholera Smallpox Typhus Enteric Fever Scarlatina Diphtheria Measles	Cholera Smallpox Typhus Enteric Fever Scarlatina Diphtheria Puerperal Fever Erysipelas	Cholera Smallpox Typhus Enteric Fever Scarlatina Diphtheria	Cholera Smallpox Typhus Enteric Fever Scarlatina Diphtheria Relapsing Fever or any other infectious disease which the corporation may from time to time specify with sanction of Local Government Board.	Cholera Smallpox Typhus Enteric Fever Scarlatina Diphtheria Relapsing Fever	Cholera Smallpox Typhus Enteric Fever Scarlatina Diphtheria Relapsing Fever Puerperal Fever	Cholera Smallpox or any contagious or infectious fever of a dangerous character	Cholera Smallpox or any contagious or infectious fever.	any infectious disease.	Epidemic, contagious, or infectious disease.	Infectious disease.

that this disease should be one of those demanding registration. The mortality which it causes is very great; in England alone, in 1878, the deaths reached the large figure of 17,784, the smallest annual mortality since 1850 having been 7905. Probably the contagion is not one which can be successfully attacked by the usual sanitary measures; but some check should decidedly be put on the attendance of infected children at school, and for this purpose it is necessary that information should be obtained of the first appearance and the extent of the prevalence of such an epidemic. I regret that here I am at variance with so high an authority as Dr Ransome of Manchester, who says[1] he considers it "hopeless to attempt, by quarantine or isolation of any kind, to arrest the spread of measles and hooping-cough. In my own experience these complaints are most frequently caught in their early stages, often before the occurrence of their characteristic symptoms." But if such be a correct view, I do not see how we can hope to arrive at the triumph of sanitation, which the same author describes in a foot-note as "that happy time when preventive medicine has been thoroughly carried out, when houses are properly ventilated, when drainage and sewerage are perfected, when the water and milk supplies are unpolluted, and when vaccination has been universally and completely performed. At this much desired epoch, to which it may be hoped we are advancing, hospitals for the reception of cases of other diseases will be an anachronism, and scarlet fever alone will have to be provided for." As to arresting or even limiting an epidemic of either of these diseases in full tide I quite agree with him, but I cannot think that if the initial cases were dealt with, sanitary measures would prove so ineffectual. Moreover, the non-inclusion of hooping-cough in the police list must tend to strengthen the too common belief that its infectiousness is too doubtful to be worthy of much consideration. Now, so far from this being true, its infection is very strong, and there is evidence that it may even be conveyed by a third party.[2] Stephenson says[3] that it is "not propagated by a third party; . . . . he will not carry it away (except by fomites) in his clothes;" he also thinks it unnecessary to absent from school, children from an infected house, provided they have had the disease.[4] I feel compelled, though with all deference, to express a different opinion, and he even makes some qualifications himself, such as that there would be risk if the person visiting were to receive on clothes some of the expectoration; and as regards the healthy members from an infected family attending school, he directs "that all due care should be taken to keep them apart from

[1] *British Medical Journal*, May 8, p. 689.

[2] Case of a boy in health, except teeth-cutting, visited by some friends who had a child ill of hooping-cough at home, and infected by them, the hoop appearing after 25 days.—*The Period of Infection in Epidemic Diseases.* By W. Squire, M.D., F.R.C.P., Hon. Secretary to the Epidemiological Society, London, 1874, p. 33. [3] *Op. cit.*, p. 16. [4] *Op. cit.*, p. 36.

the affected as much as possible." We know what kind of attention would in many households be given to this instruction. The only safe plan, therefore, is to keep at home all the members of a household in which there is hooping-cough. Considering that the contagium particles are given off in the breath and float in the air of the room, and that the degree of concentration of the poison depends on the presence or absence of good ventilation, it is difficult to see that there is no danger of its being conveyed away on the clothes of a third party. Aitken gives a convincing instance of its conveyance by fomites.[1] A captain sent on shore at St Helena, to be washed, the clothes of some hooping-cough patients who were on board his ship, and so introduced the disease into the island, where it proved very fatal. And Squire is of opinion[2] that fomites readily attach themselves to surfaces, whether articles used by the sick or near them, and to the clothes of attendants;" so that although the contagium may be more volatile, or evanescent, or perishable than some others, there can scarcely be any doubt but that it is communicable like them, though possibly in less degree.

Enteric fever is of necessity a disease demanding registration, on account of the undoubted efficacy of sanitary measures; but its presence in a family by no means renders necessary the isolation of its healthy members, and this should not be inferred from the fact of its being on the police list. It must be borne in mind that this fever is only infectious by the intestinal excreta, and that the poison is not present in these when fresh, but is developed by putrefaction, as in cholera and dysentery.[3] One fact given by Murchison[4] is conclusive proof against its communicability in the ordinary way from person to person. It is this, that during nine years, in the Fever Hospital, 3555 enteric patients were treated in the same wards, both during the acute stage and in convalescence, with 5144 patients not ill of any specific fever, all using the same night chairs, and disinfectants being only exceptionally employed, yet, notwithstanding, not one of the latter caught the disease. The infection may, however, be conveyed by the air, as by emanations from an open sewer.[5]

The action of the sanitary authority, however, is only half the battle, and its best endeavours to control epidemics will be vain unless intelligently and conscientiously supplemented by individual members of society in their own households as occasion arises; and it is especially in the private household that it becomes important to have an answer to the next question: How long does the power to infect last? When does it begin, and when terminate? And this is the most difficult feature of the matter, there being a great want of exact observations on which to found definite opinions. It by no means follows, however, that because we can-

[1] *Op. cit.*, vol. i. p. 558. [2] *Op. cit.*, p. 35. [3] Murchison, *op. cit.*, p. 466.
[4] *Op. cit.*, p. 463. [5] *Op. cit.*, p. 472.

not fix the period of infectiousness with scientific exactitude, we should rest content with the present chaotic state of practice. The great tendency of the public is unduly to curtail the time of isolation, and in the absence of definite data to the contrary there is strong temptation to the doctor to fall in with the desires of his patients. But it appears to me that the issues are fraught with so much peril it is our duty to seek to arrive at some workable solution, and that this may be accomplished by making a careful comparison of the opinions of those authorities whose reputation renders it likely that they are able and trustworthy observers, being always careful, if I may use an engineering expression of which we have lately heard a good deal in Dundee, to leave an ample "margin of safety." Were some such general agreement arrived at, what a source of almost daily annoyance would be removed! There are few questions more troublesome to a physician desirous of giving a conscientious and practical reply than that often recurring one, "When may the children go back to school?" And if his reply happen to be that another fortnight of quarantine is necessary, he may very probably be told that Mrs So-and-so's doctor allowed her children to return as soon as the patient was able to be out of bed; and thus frequent irritating discussions arise. Dr Ransome says, in the paper already quoted from, "But there is another and more serious result of this individuality of opinion, of this want of some authorized doctrine on those points that are so frequently brought before us. Very frequently a serious difference of opinion ensues between two sets of medical advisers, the family attendant often differing widely from the school or hospital physician in his estimate of the needful interval of isolation. Even without a sufficient foundation of facts, if the medical world were agreed as to the limit of safety there would, perhaps, not be much harm done beyond the probable waste of time involved in getting to the safe side of precautionary restrictions."

There is ample authority for holding it established that in smallpox and measles infectiousness exists very early—in the beginning of the prodromal stage of measles, or last day of the incubative period;[1] and in smallpox "infection is also possible during the period of incubation, which is generally free from every symptom of the disease."[2] Marson also states[3] that "smallpox is communicable from the moment the initiatory fever begins." Speaking of measles, Squire says,[4] "it would not be too much to say that one-half of all the cases met with are contracted during the premonitory or catarrhal stage." Hooping-cough is infectious before the child hoops.[5] This is clearly proved by a case given by Dr

[1] Thomas, *Ziemssen's Cyclopædia*, vol. ii. p. 58.
[2] Curschmann, *Ziemssen's Cyclopædia*, vol. ii. p. 335.
[3] See Squire, *op. cit.*, p. 12.
[4] *Op. cit.*, p. 12.
[5] Squire, *op. cit.*, pp. 10 and 32.

Haddon of Manchester; and Stephenson holds[1] that no child who has not had the disease should be sent to school if suffering from a cold or cough, however slight." So also with measles, how often it happens that a child continues at school with catarrhal symptoms till the rash appears. It must be remembered that these extreme precautions are only called for during epidemics, or at other times in the case of children from infected households. In scarlet fever[2] also and diphtheria infection appears to be present from the commencement, although increasing in intensity as the case progresses. Stephenson[3] suggests that when diphtheria is epidemic it may be advisable to absent from school all cases of apparently common sore throat. If these doctrines as to early infectiousness be true, it is obvious that there is much danger in the almost universal custom, which is, that isolation is not put in operation until the infectious nature of the disease is beyond doubt; *whereas the only safe course is that this should be done immediately on the appearance of suspicious symptoms, and rigorously persevered in till it is certain that the disease is not of this nature.* Dr Page holds the same opinion.[4]

The Lancashire and Cheshire branch of the British Medical Association seven years ago appointed a committee, at the request of Dr Ransome, to investigate the duration of infection, also the period of incubation, and the commencement of infectiousness; and in 1877 Dr Haddon of Manchester read a paper giving the results up to that date. By his courtesy in sending me his manuscript I am enabled to utilize these. Although the data are not very numerous they are valuable, and afford an example by following which much information might be gained. In the course of his remarks he says, "One fact well established by the returns deserves special notice, namely, that in measles, scarlet fever, hooping-cough, and mumps, infection is being spread before we can diagnose the disease. If these diseases have the power to spread infection so early, it is probable, from what we know of infection generally, that other diseases, such as smallpox, typhoid fever, etc., have the same power."

A correct knowledge of the duration of the incubative period is important in reckoning backward for the origin of cases, and for giving directions as to the length of quarantine necessary before healthy persons who have been exposed to infection can be considered safe. This period varies considerably both in different diseases and in different cases of the same disease. The following is a statement of the duration of the period of incubation in each of the diseases named, as given by several good authorities:—

[1] *Op. cit.*, p. 56.
[2] See Thomas, *Ziemssen's Cyclop.*, p. 171.
[3] *Op. cit.*, p. 51.
[4] *Op. cit.*, p. 6.

Periods of Incubation.

	Authorities.
Cholera.	
2 to 3 days, exceptionally 1 to 2 days. Average does not exceed 1 week, though one or two weeks is by no means rare ; a longer time is exceptional, ...	Lebert, *Ziemssen's Cyclopædia*, vol. i. p. 397.
2 to 3 days or less, ...	Goodeve, *Reynolds's System of Med.*, vol. i. p. 139.
A few hours to 3 days, . . .	Bristowe, *Treatise on Theory and Pract. of Med.*, vol. i. p. 233.
Smallpox.	
10 to 13 days ; extremes, 5 to 14 days, ...	Curschmann, *Ziemssen's Cycl.*, vol. ii. p. 341.
13 days, ...	Marson, *Reynolds's Syst. of Med.*, vol. i. p. 434.
7 to 8 days (inoculated), . . .	Bristowe, *op. cit.*, p. 164.
12 or 14 days (counting to eruption),[1]	Gregory, Geo., M.D., physician to Smallpox Hospital, 1832, *quoted by Squire—Further Remarks on the Period of Infection, etc.*, 1876, p. 1.
11 days in one case, 13 days in another, ...	Haddon.
Enteric Fever.	
10 to 14 days (sometimes immediate), ...	Budd, Dr W., *quoted by Tanner, Pract. of Med.*, vol. i. p. 244.
Average, 21 days ; extremes, 2 to 4 weeks, ...	Liebermeister, *Ziemssen's Cycl*, vol. i. p. 56.
Most commonly about 2 weeks ; may be more or less, and may be so short as 1 or 2 days, . . .	Murchison, *Treatise on Contin. Fev.*, p. 469.
May be shorter than 14 days, and as long as 24 days (4 *returns*), . .	Haddon.
10 or 12 days, and may be only 4, .	Squire, *Period of Infection, etc.*, p. 41.
Typhus Fever.	
12 days, frequently shorter, rarely longer, ...	Murchison, *op cit.*, p. 91.
5 to 14 days—extreme, 21 days, or even more, ...	Bristowe, *op. cit.*, p. 182.
1 or 2 to 12 days, ...	Tanner, *op. cit.*, vol. i. p. 230.
5 to 7 days, or even 1 day, . .	Lebert, *Ziemssen's Cyclo.*, vol. i. p. 308.
Scarlatina.	
A few hours to 10 days, . .	Aitken, *Science and Pract. of Med.*, 4th ed., vol. i. p. 337.
Probably less than one week ; may be no more than 24 hours, . . .	Gee, *Reynolds's Syst. of Med.*, vol. i. p. 334.
6 to 8 days, rarely longer, often shorter, even 1 day, ...	Bristowe, *op. cit.*, p. 155.

[1] Dr Squire follows Dr Gregory in including the period of invasion in the period of incubation. This is somewhat apt to cause confusion, for most authors limit it to what is otherwise called the "latent period." Thomas, *Ziemssen's Cyclop.*, vol. ii. p. 57, speaking of measles, says that it should be held to terminate with the commencement of the fever.

Scarlatina—continued.	Authorities.
4 to 7 days (Thomas quotes other authorities for occasional longer periods, up to 14 days. In a successful inoculation case it was 7 days,	Thomas, *Ziemssen's Cyclop.*, vol. ii. pp. 169 and 170.
A few hours to 11 days at most (8 *cases*),	Haddon.
Within 7 days (generally)—may be only a few hours. Longest met with, 8 days, ...	Squire, *Period of Inf.*, p. 35, and *Further Remarks on Per. of Inf.*, pp. 7 and 12.
Diphtheria.	
2–5 days (other authorities quoted for longer periods, exceptionally even to 14 days), ...	Oertel, *Ziemssen's Cyclo.*, vol. i. pp. 594 and 595.
A few hours to 8 days, . . .	Bristowe, *op. cit.*, p. 204.
Within 8 days. May be within 30 hours, ...	Squire, *Per. of Inf., etc.*, p. 35; *Further Remarks, etc.*, p. 7.
Relapsing Fever.	
Immediate, up to 14 days (founded on observ. of 12 cases, when period exactly fixed—3 being immediate, others varying), ...	Murchison, *op. cit.*, p. 331.
3 to 7 days—oftener over than under 5 days, and sometimes extended into second week, ...	Lebert, quoted by Murchison, *loc. cit.*
Measles.	
12 to 14 days—extreme, 7 to 21 days,	Bristowe, *op. cit.*, p. 149.
10 days, ...	Thomas, *Ziemssen's Cyclo.*, vol. ii. p. 61.
13 or 14 days, ...	Aitken, *op. cit.*, vol. i. p. 305.
10 days at least to 14 days at most (9 *cases*), ...	Haddon.
10–14 days, ...	Tanner, *op. cit.*, vol. i. p. 287.
7–14 days—usually 10 or 12—extreme, 17 days (reckoning to rash), . .	Squire, *Period of Inf.*, p. 14, and *Further Remarks, etc.*, p. 2.
Hooping-cough.	
5 to 6 days (doubtful), . . .	Aitken, *op. cit.*, vol. i. p. 559.
Probably about a fortnight, . .	Bristowe, *op. cit.*, p. 142.
Generally a week, ...	Squire, *Period of Inf.*, p. 34.

Looking at the variation of range here shown, it is somewhat difficult to make practical application of the information. An average will not do, because about as many cases would exceed as fall within a limit so fixed. The only method available is to carefully consider the weight of the different opinions, and, adding a considerable "margin of safety," fix a definite number of days as that which should be held to be the incubative period. Because a *definite* period must be decided on, it would be nearly useless advice to a school proprietor about to disperse his pupils on account of an outbreak of some infectious fever, to say to him, "You must delay them for from seven to twenty-one days." In fact no physician would do so; he would fix some limit for himself, and the evil at present is that another, though not really differing much in opinion, may at haphazard name a shorter or a longer period, much to the mystification of the public.

The difficulty is even greater of knowing when infectiousness terminates; and it is quite impossible for us, as seems frequently to be expected, to name a day within which it is present, and beyond which the danger has disappeared. Trustworthy data to settle this question can only be gathered from the carefully recorded experience of good observers in cases where the source of infection was the only possible one, and the day of the infecting person's illness at which infection occurred was accurately known. Such cases are few. Some observers give instances of extreme prolongation of power to infect, but it is most difficult to exclude from one's mind the possibility of fomites being the explanation; and when the period far exceeds that generally observed, this theory would appear the more reasonable one. And caution must be exercised not to fix a longer period than safety imperatively requires, because that period is sufficiently protracted to tax patience to the uttermost. It is a fortunate provision that these disease-germs gradually perish by natural processes; "like all organic substances which propagate from minute or invisible beginnings, myriads perish for one that is fruitful."[1] If it were not so, the world would have been depopulated long ere now.

Squire remarks that diseases with a long incubative period generally cease to be infectious comparatively early in convalescence, and *vice versa*; this reminds one, except that it is the converse, of the meteorological aphorism, "long threatened, long last; short warning, soon past;" but I suspect there are many exceptions. Dr Page[2] sums up in one paragraph his opinion, holding that the risk of infecting lasts "so long as the diarrhœa or looseness of the bowels in typhoid fever or cholera continues, so long as the least particle of peeling skin in scarlet fever or measles, and of scab in smallpox, is seen upon the face, hands, or feet, and *for a fortnight* after the apparent disappearance of these signs of infection; and by experience it is found that no patient is free from infection until six weeks from an attack of typhoid fever or cholera, measles or diphtheria, and two months in the case of scarlet fever. No case of scarlet fever is safe, and no child recovering from scarlet fever should be received at school, until the end of the eighth week from an attack. By neglect of these precautions children will almost certainly bring infection with them, and with the result that other healthy children will carry it to their homes." Professor Stephenson does not demand so much; he says,[3] "For safety, isolation in the cases of scarlet fever should extend to seven weeks. In measles the period is shorter, but four weeks is the shortest limit. In diphtheria a patient is not free from the risk of communicating the disease until the throat is perfectly well, even although convalescence is otherwise established." He goes on to say that for hooping-cough "two months is

[1] Aitken, *op. cit.*, vol. i. p. 218.
[2] *Op. cit.*, p. 4.
[3] *Op. cit.*, pp. 23 and 24.

the shortest limit that can be assigned," and that in typhoid fever "the power of communicating infection often continues long after convalescence." Of this disease Aitken expresses the same opinion.

Regarding typhus, Murchison[1] considered the contagion to be strongest "from the end of the first week up to convalescence, when the peculiar odour from the skin is strongest, and that the body ceases to give off the poison as soon as the fever subsides, and the appetite and digestion are restored;" and that during the first week there is little danger. He does not say that there is none.

As to measles I have already quoted Page and Stephenson. On the margin of his pamphlet kindly sent to me by Dr Squire, he writes, "that three weeks of convalescence, calculated from the cessation of the specific febrile action, would suffice. Prudence might suggest that an additional week should be allowed." This would give five or six weeks from the commencement of the illness. It is generally considered, and with much reason, that it is nearly hopeless to attempt to limit measles in a family; but Squire states,[2] that "when children have been kept apart during the earlier stages of measles the limitation of the infection is possible." It is surely desirable to attempt limitation, for this disease causes many deaths, the annual mortality in England alone having been as high as 12,255; and the lowest since 1850 having been 4895. In Scotland during 1876 it was 1241.

But scarlet fever is in this connexion beyond question the most important of these diseases, both on account of its great fatality, and the frequency of sequelæ often entailing life-long infirmity and disablement. In 1878, 18,842 lives perished from this cause in England; in 1870 the number reached 32,543. In Scotland during 1876 it was 2364. The infection is also very intense and persistent. Thomas says[3] that the shortest exposure may suffice, and quotes in proof, that "a mother after remaining only a moment with a scarlatinous patient, immediately returned home, a distance of about six miles, but communicated the disease to her children." He considers the contagium less volatile than that of measles, and that it consequently spreads less rapidly through a house.[4] He says that "it is certain that the contagiousness diminishes as health becomes restored, but it is impossible to say when it ceases."[5] He doubts that the contagium is exclusively or even chiefly contained in the desquamating scales of epidermis, and states that it may be presumed that it "enters from the blood into all secretions and excretions of the patient." It appears to me that Gee[6] puts the matter correctly when he states his opinion, that the disease does not cease to be contagious till "those natural fomites, the epithelial scales, which were existing at the time of the fever have been removed; or, what is nearly

[1] *Op. cit.*, p. 93.
[2] *Period of Infection, etc.*, p. 17.
[3] *Ziemssen's Cyclop.*, vol. ii. p. 164.
[4] *Loc. cit.*
[5] *Op. cit.*, p. 172.
[6] *Reynolds's System of Med.*, vol. i. p. 33.

the same, not until desquamation has ceased." He goes on to say, "Uncovering a scarlet fever patient in the direct rays of the sun, a cloud of fine dust may be seen to rise from the body,—contagious dust, which, no doubt, subsides into every crevice near the bed;" and he admits the possibility "of the contagion having been conveyed hundreds of miles by letter or similar means." When attached to clothes especially, and shut up from the air, it may retain its activity for very prolonged periods. Gee gives an instance on the authority of Watson, where a strip of flannel was the medium at a year's interval; but indeed several remarkable examples are recorded. Too much importance is however probably attached to desquamation as a measure of the duration of infectiousness, because it is in some cases unusually rapid, and completed before infectiousness has disappeared.[1] Squire [2] writes that "scarlet fever continues to be infectious long after all remnants of local morbid action are removed, so that personal contagion may persist for nine or ten weeks from the commencement of an attack." Dr Haddon gives two cases in which it was communicated eight weeks from the beginning of the illness.

Diphtheria is held by Bristowe[3] to continue infectious into advanced convalescence, even when "patients have been apparently well for two or three weeks." He says[4] that "the contagion is doubtless for the most part carried by the atmosphere," [5] but that it may also be conveyed by fomites, and thus present prolonged vitality "several weeks or even months." The opinions of Stephenson and Page have already been given. Squire says [6] "the persistence of personal infection for from four to six weeks is abundantly proved." Its contagiousness appears to be very capricious; we all see many cases in which it does not spread, and yet the proofs of its intense infectiousness at times are unquestionable; if any one doubted this, the tragic history at Darmstadt surely convinced him. It would appear to bear some proportion to the severity of the case.[7] I do not at all agree with those who, when mild cases occur, recovering quickly, leaving no sequelæ, and not infecting others, dismiss the subject by holding that they were not cases of diphtheria at all; there is no wider difference between such a mild case and a severe one in which the diagnosis is beyond question, than between a simple and a malignant case of scarlet fever. It is well to remember also that now and again the infection from one of these mild cases may give rise to the worst form in an individual predisposed to throat mischief.[8]

It is most difficult to determine when the infectiousness terminates in hooping-cough. There can be little doubt but

[1] See Squire, *Further Remarks on Period of Infection, etc.*, p. 5.
[2] *Period of Infection*, p. 12.
[3] *Theory and Practice of Medicine*, p. 204.
[4] *Loc. cit.*, p. 203.
[5] Oertel teaches the same, *Ziemssen's Cyclo.*, vol. i. p. 586.
[6] *Further Remarks, etc.*, p. 4.
[7] Oertel, *op. cit.*, vol. i. p. 585.
[8] Oertel, *loc. cit.*

that it is frequently at an end a considerable time before the cough disappears. West, however, says[1] that he would hesitate to restore a child to the society of children unprotected by a previous attack, until the cough had ceased. I have stated Professor Stephenson's opinion, that two months is the shortest period which can be allowed before a patient can be considered safe from conveying the disease. Of course by fomites, if he continue to wear infected clothes, he may spread the disease for some time after this. It is with regard to hooping-cough that the widest difference of opinion prevails, but, as I have already stated, I cannot believe that rigorous quarantine precautions in the early cases of an epidemic would prove wholly ineffectual in at least limiting its spread.

Indeed, it is only at the beginning of an epidemic of any of these diseases that decided success of sanitary measures can be looked for, just as it is only by arresting the first leak in the dyke of a reservoir that the inundation can be averted; and however great the hardship of quarantine to the first affected individual households, it would be as a drop to the ocean when compared with the aggregate of suffering after the epidemic had attained its full development.

In conclusion, my object has been to lay before you as concisely as possible the opinions of some leading authorities, as an aid towards the formulation of definite rules having special reference to the duration of quarantine precautions which safety demands; and if the Association see fit to act on my proposal, I would further suggest for its consideration, whether it might be expedient to have such rules printed and circulated amongst the lay public, perhaps adding some plain instructions as to the details involved in isolation, for example, as regards attendants, clothes, books, toys, etc., and also as to the best methods of disinfection. It is scarcely necessary to say, that I do not contemplate that it should be attempted to coerce individual practitioners into any particular line of practice, even if power to do so existed, which it does not; but it appears to me that such an endeavour as I have indicated, to terminate if possible the conflicting practice which at present prevails, is quite within the legitimate sphere of action of the Association.

In the course of some remarks which followed the reading of the foregoing paper it was very properly observed by one or two of the speakers that the suggestion put forward involved considerable difficulty, and this especially on account of the widely varying conditions as to persistence of infection presented in different households, because, on the one hand, a household intelligently conducted with every care as to isolation, disinfection, and general cleanliness may be restored to a perfect sanitary condition in a comparatively short time; whereas, on the other hand, a household in which the

[1] *Diseases of Infancy and Childhood*, 4th ed., p. 429.

reverse of these conditions prevails will continue to be a hotbed of infection for an indefinitely prolonged period, and as far as the latter is concerned no rule which could be framed would secure safety. I entirely concur in the justice of this observation, but nevertheless believe that, were my suggestion carried out, a very positive improvement in sanitary measures would result, because the period of time which at present satisfies many for the maintenance of quarantine is in far too many instances utterly inadequate for even the well-managed households above referred to, a fortnight or three weeks, for example, after the occurrence of scarlet fever or measles being frequently considered amply sufficient. My contention is that we should agree upon some rule for practice which would put us on the safe side with regard to at least the greater number of the cases which come under our care. Although the remaining cases must necessarily continue to be sources of danger, there would, notwithstanding, be a great diminution in the spread of infection were practitioners to act heartily in unison in endeavouring to carry out any recommendation which the Association may see fit to make. And further, seeing the beneficial influence would, as years roll on, make itself more and more felt, even unsanitary households would come in for a share of the good result as their opportunities for receiving infection became less frequent; for it must be remembered that, however bad the sanitary state of a house may be, it will not generate these diseases *de novo*. Absolute safety is certainly unattainable, but that is no reason against a strenuous endeavour to secure as great a measure of protection as the nature of the circumstances permits.

It is a frequent complaint by medical officers of health that there is undue delay in reporting infectious disease, and thus the all-important opportunity of arresting it in its first source is lost. If it were practicable to enact a law with reference to quarantine, defining what should be its duration for the different fevers, and requiring the period so fixed to reckon from the date of reporting, it would obviously be for the self-interest of householders to report every case as soon as possible. It is doubtful if the education of the public in sanitary matters is sufficiently advanced for such a law to be proposed, and there would probably be much rebellion against what many would consider an unjustifiable infringement of the liberty of the subject.

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