COMMON

# INFECTIVE FEVERS,

AND THE

# USE OF DISINFECTANTS.

WITH NOTES ON

# THE HEALTH OF CHILDREN,

BY

WILLIAM SQUIRE, M.D.,

*Fellow of the Royal College of Physicians;*
*Physician to the St. George's, Hanover Square, Dispensary;*
*Member of the Epidemiological Society of London.*



LONDON:
J. & A. CHURCHILL,
11, NEW BURLINGTON STREET.

1887.


COLL. REG. MED. LOND.
MDXVIII
Ο ΒΙΟC
ΤΕΧΝΗ
ΒΡΑΧΥC Η
ΔΕ
ΜΑΚΡΗ

# INFECTION

AND

# DISINFECTION.

LONDON:

PRINTED BY GEORGE PULMAN, 24 & 25, THAYER STREET,

MANCHESTER SQUARE, W.

# COMMON INFECTIVE FEVERS,

AND THE

# USE OF DISINFECTANTS.

WITH NOTES ON

# THE HEALTH OF CHILDREN,

BY

WILLIAM SQUIRE, M.D.,
*Fellow of the Royal College of Physicians;*
*Physician to the St. George's, Hanover Square, Dispensary;*
*Member of the Epidemiological Society of London.*

MEDICINA LITERIS



LONDON:
J. & A. CHURCHILL,
11, NEW BURLINGTON STREET.

1887.

# TABLE OF CONTENTS.

TABLE OF CONTENTS—*Continued.*

# ON INFECTION AND DISINFECTION.

SANITATION twenty years ago meant good drainage, a wholesome water supply, and air untainted by any common nuisance that could be abated or removed. The immediate gain from measures then urged forward was great, and no wonder; cleanliness, with purity of air and water, must always be the basis of hygiene. Many of the well-named "filth diseases" were prevented, some diminution was noticed in the prevalence of comsumption, improvement was even hoped for in the common infective fevers; for was it not possible that some of them might arise from decomposition or damp, and probable that their fatality was increased by insanitary surroundings? The latter of these suppositions is well founded, the former has had to be gradually relinquished. A specific 'germ' is concerned in all infective disease. Such a one is found in Phthisis; another is propagated in outbreaks of Enteric fever; the necessity for such an agency in Malarial fever is generally admitted, even if the *bacillus malariæ* of Klebs and Tommasi-Crudeli had no better acceptance than the Cholera *komma*.

Proofs of the latter of the above suppositions abound. Very often the greater severity of Measles leads to the discovery of something wrong about the house; or the fatality of scarlet fever is traced to a local sanitary defect; should this not be discovered and remedied, all attempts to remove infection may fail. A house has been unoccupied for a year, and for another six months under repair, but old drains and a cess-pit remaining infection has seized the new comers soon after commencing residence. Yet with full attention to such sanitary matters in Scarlet fever, and also to the one necessary precaution against Small-pox, both those diseases have occured in their greatest severity since the era of sanitation was fully inaugurated; nor has the prevalence of Measles, Rubella, Mumps, Varicella or Whooping Cough been in any degree lessened. The reason of this is that one factor, that of infection, has been disregarded or kept in the back ground. Much has been said of 'wash and be clean,' little of 'do as you would be done by,' the chief maxim to be acted on in restricting the spread of infectious diseases; if you would not wish infection to be brought into your own house or family avoid all risk of being, in any way, the medium of taking it elsewhere. To make it possible to act up to this rule, the laws of infection for each of the infective fevers should be known; and, one must always bear in mind that it is the slightest forms of these diseases that mostly carry infection; the sufferers from the more severe attacks are confined to their rooms, and are seldom the cause of any spread of infection while they are under the charge of nurses and doctors. There remain the dangers of convalescence, against which, also, it is the object of these pages to give some words of caution.

Scarlet fever differs from small-pox in three important particulars;

first, in the shortness of the incubation period, or the rapidity with which the disease is declared; secondly, in the variety and duration of the complications which follow; thirdly, in the long convalescence and increased length of time during which infection persists. Separate wards are required for cases of different degrees of severity, and unless a convalescent department is available, the length of time necessary to retain patients in hospital, lest they should be a source of danger to others, is double that for small pox, thus crippling the amount of hospital accommodation for acute cases by half the whole number of beds.

Vaccination affords a protection against small-pox hardly to be hoped for in any other disease of this class. No modified form of scarlet fever will ensure against its recurrence in a more severe form. Were we to inoculate from a mild case of the disease, it is likely we should set up a severe, and it might be a fatal attack; however mild a form might result it would involve the danger of infecting others, and every case risks the well-known after-complications. The modified disease lately discovered in the cow produces a slight form of illness in some cases, but not in all. The milder epidemics, conveyed through the medium of milk would continue to spread, and give rise to serious effects, if not so narrowly watched to their end. A first case of scarlet fever is often of a mild character, while a second, perhaps directly derived from the first, may be very severe, the more so if both were treated together in one room. This was observed in the Hendon milk epidemic. Moreover the milder cases, some from milk infection, give no certain immunity against a recurrence. We cannot hope to protect by inoculation in a disease not clearly self-protective. It is not an unusual thing to see scarlet fever happen at twice, as it were; a child has sore-throat and very little rash, or none, yet the illness is followed by desquamation, and, it may be, with other marked special signs; a year or two after this child is exposed to scarlet fever and has well-marked rash, a short illness, and no desquamation. Reinfection from scarlet fever has recently occurred, to my knowledge, in a child four weeks after a first typical attack the second attack being the more severe and both followed by desquamation. If the unmodified virus does not confer immunity from a future attack, it is not likely that a modified virus will do so. Two years ago, or more, Dr. Klein shewed that scarlet fever could be conveyed from man to the cow; he has now proved the converse. Quite recently at a meeting of the Royal Society he has shewn that a specific micrococcus from the abraded udder of an infected cow, cultivated in milk or gelatine, produced effects when inoculated under the skin of calves precisely like those resulting from a primary inoculation from the affected cow. Dr. Klein has obtained this micrococcus during the acute stage of scarlet fever in man; these, when inoculated in calves, after cultivation apart from the living body, reproduce themselves and a disease identical with scarlet fever. There is no proof, in the eager comments a discovery of so much interest has called forth, that we have here the origin of scarlet fever in man; the inference is rather the other way. Still less is it to be supposed in the case of a disease highly infectious from person to person, that we should soon do away with scarlet fever by care as to cows, or drinking no milk that has not been boiled. The real utility of this discovery rather lies in the fact, that, having the microscopic agent of the disease directly under observation, we can ascertain what circumstances are inimical to its activity, and how it can best be destroyed.

Isolation of the sick and convalescent, varying in time and degree with the nature of the disease, and disinfection chiefly personal are our two great means of controlling the spread of infectious fevers. It may be premature to attribute the recent remarkable reduction in our small-pox and scarlet fever epidemics exclusively to our increased means of isolation, but it is well to call attention to the coincidence. The first action of the London Asylum Board Hospitals was to reduce the small-pox mortality in London from 7,912 in 1871 to 113 in 1873, or lower than ever before, and in 1874 and 1875 to 57 and 46; it was only 24 last year. The annual Scarlet Fever mortality in London, for the years 1875 and 1880 exceeded 3,000; in 1884 it was reduced to less than one half this, and for 1885 and 1886, the average is 700, the hospital accommodation for these cases having increased at the same time fourfold. This, and no vague general cause, is to be assigned for the remarkable decrease in scarlet fever in London. While declining in one place, even now the disease is seen to be increasing in another.

---

THE results obtained in our largest communities towards the control of Scarlet Fever raise two questions. First, can much in the same direction be done for the protection of our villages, schools, and families? Second, how far might what is trustworthy and possible in our large towns fail us at home, or be inapplicable in detail to the smaller units of the community. The room for doubt on this latter point is small, when we consider that the natural history of the disease has been gathered from the collection of individual facts, and by observations made in families; and, that having proved the validity, on a large scale, of the laws thus deduced which govern the spread of Scarlet Fever, we can the more confidently apply them to special cases in limiting infection. As infection is reproduced in the sick, and spreads from them, all effective measures of disinfection should begin at the bed-side, and follow the sick person; consequently the answer to the first question must be largely in the affirmative.

Six weeks is the shortest period in which simple cases of scarlet fever can be considered free from infection. Some careful observations on convalescents as to the period of infection in epidemic disease published more than twelve years ago* by the author, showed that persons recovering from scarlet fever, and apparently well, had imparted the disease to others six weeks, or, with certain complications, for a much longer period, after the commencement of the attack. Abundant proof of this has since accumulated.

* Transactions of the Epidemiological Society of London, Vol. III., p. 442.

The duration of infectiveness is shorter for small-pox and measles than for scarlet fever; it is shortest after chicken-pox, where after a week's convalescence, or ten days from the full eruption, while the places left by the spots had barely healed, children have safely mixed with others, although another week's seclusion is needed for their own safety. Long care is required for convalescents from all the exanthems; even in the least of them, chicken-pox, dropsical symptoms have appeared, and fatal kidney congestion from exposure to cold, three weeks after the attack. Two simple points serve to distinguish the severer forms of chicken-pox (Varicella) from modified small-pox (Variola); one is, that in the first a spot of eruption may be found on the head or neck with some prominent small glands, on the same day the fever begins; the other is, that allowing for an initial high temperature, the fever continues and mostly increases during the four days of eruption, while that of small-pox occurs two days before the spots appear and falls as they get full.

The infection of whooping cough may persist as long as that of scarlet fever, or be kept up by intercurrent disease; for this is one of those diseases which, unlike small-pox, can be intensified and prolonged by multiplying the number of cases treated together, and by keeping them in one room. Under favourable conditions infection may end in this disease at any time after the first three weeks. When the cough has ceased thus early, some precautions against a relapse or re-appearance of the cough must remain in force for a week or more. Spasmodic cough may recur much later without infection, for, as after scarlet fever the nutrition of the skin may remain altered when infection is over, so after whooping cough some cough may remain, or return and be spasmodic, long after all infective power has ceased.

More young children die of whooping cough than of scarlet fever; but the more serious and fatal consequences of that disease are accidental to the feeble frame of the youngest sufferers from it; they are not the specific and inner constitutional or organic changes such as are set up by scarlet fever, which are capable of reproducing this disease, and from which no age is exempt. The deaths from whooping cough, under five years, often exceed in number those from scarlet fever at all ages; last year they were twice as numerous in London.

To quote again from the last report of the Registrar General, the twenty-fifth, p. xii., after noticing that the mortality from this cause remains unchanged from one decennium to another, the report continues:—"Owing to the very early age at which whooping cough usually occurs, and the consequent impossibility of removing the sick from the healthy, this disease is less amenable than most other zymotic ailments to sanitary control. As was said in speaking of measles and scarlet fever, the mortality from whooping cough in a given decennium is determined mainly by the number of epidemical years that occur within the period; and there was one such year in each of the last decennia, viz., 1866 in the earlier, and 1878 in the later decennium." We may already add 1882 for the next period. Surely much is due from intelligent effort towards minimising the effect of such epidemical recurrences.

The early Spring is always that part of the year when this epidemic is most prevalent and most fatal; at this time, together with croup and laryngitis, it is almost as deadly to young infants as the diarrhœa of the hot season of the year, or the bronchitis of winter. Scarlet fever always extends in the Autumn ; diphtheria mostly in the Winter and Spring; measles has two seasons of greater prevalence, which curiously correspond with children's holiday times. The constant manner in which the autumn fatality from scarlet fever is balanced by the great increase of that from whooping cough in the Spring is a note of difference. Scarlet fever differs also from the diseases above mentioned in not being specially fatal to infants of a year old and under.

As the spread of infection is very often less from want of care during the illness than from ignorance of the natural history of the more common infectious fevers, the following points, to be remembered in dealing with each of them, are given in a tabular form.

Table for each infectious disease :—(i), of the time at which it is likely to show itself after exposure to infection; (ii.), the time after separation from infection, when, if no illness appear, we may conclude the disease has been escaped; (iii.), the time for the rash or other characteristic sign of the illness to appear after the first sickening for it; (iv.), the time from the beginning of the illness to the end of infectiveness :—

| Name of Disease. | Usual time of Incubation. (i.) | Possible interval. (ii.) | For rash or other sign. (iii.) | Duration of infectiveness. (iv.) |
|---|---|---|---|---|
| Small Pox ... ... | 12 days ... | 15 days | ... 2 to 3 days | ... 3 to 4 weeks |
| Measles ... ... | 8 to 12 „ ... | 18 „ | ... 3 „ 4 „ | ... 3 „ 4 „ |
| Scarlet Fever ... | 2 „ 5 „ ... | 8 „ | ... 2 „ | ... 6 „ 8 „ |
| Rubella ... ... | 10 „ 21 „ ... | 3 weeks | ... 1 „ 2 „ | ... 2 or 3 „ |
| Chicken Pox ... | 10 „ 14 „ ... | 2½ weeks | ... 1 „ | ... a fortnight |
| Mumps ... ... | 12 „ 21 „ ... | 3 weeks | ... 1 „ 5 „ | ... 2 or 3 weeks |
| Whooping Cough ... | 6 „ 12 „ ... | a fortnight | ... 1 to 3 weeks | 6 weeks more or less |
| Diphtheria ... ... | 2 „ 12 „ ... | a fortnight | ... 1 to 2 days | ... 6 or 8 weeks |
| Enteric Fever ... | 5 „ 20 „ | a month or more | 10 to 12 „ | 4 to 8 weeks or more |
| Typhus Fever ... | 2 „ 12 „ ... | a fortnight | ... 5 days | ... 3 or 4 weeks |
| Cholera ... ... | 2 „ 5 „ ... | a week | ... sudden | ... uncertain |

It may be noticed in the above table, that, in most cases, the longer the period of incubation, the shorter the duration of infectiveness.

The interval in the first and second column has to be reckoned both from the day of separation from the infecting source and also from that of first exposure to it, for infection may have been received at any part of that time. In the case of small-pox if the exposure has not exceeded three days, re-vaccination has a reasonable chance of success; indeed all exposed to this infection, if not thoroughly protected, should be immediately re-vaccinated. To those who have not previously been vaccinated a single exposure may prevent the success of vaccination. In the third column two days or more of uncertainty are seen in the first stage of infectious diseases; these days are infectious. An early guide to a further separation of doubtful cases from others, will be found in some enlargement of the small glands of the neck or behind the ear. In children some of these glands may be very prominent three days before the rash of measles, and the day before the eruption is noticed in rubella, or in chicken-pox; smaller glands down the side of the neck near the windpipe become palpably perceptible before whooping cough, and in croup; their presence alone is not a sign of infectious disease, but with any febrile symptoms they suggest the need of further caution. The fall in body-heat noticeable before the ingress of certain of these diseases can seldom be acted on as a warning from want of continuous skilled observation.

Precautions against the spread of infection on the ingress of scarlet fever are more often successful than in other common communicable fevers, because the onset of the disease is sudden, and is generally so marked as to oblige the sufferer to lie up at once. Two days are required for the distinctive rash, but the sore throat is at once enough to arouse suspicion, and it is not difficult to keep the patient apart from others while the nature of the illness is in doubt; a rash that has been preceded by three or four days of irritable cough with sneezing, is probably measles; a bright spotty rash beginning on the face without marked previous illness, is most likely rubella, or false measles; the fine rash of scarlet fever, first found on the neck or loins, seldom begins on the face and is not in spots, though red points may be seen in the finely diffused and often dusky redness that extends over a large extent of surface from neck, chest, or wrists, and soon becomes general.

Separation when the rash first appears is mostly in time to save the susceptible from scarlet fever. This is not so in measles, where the earliest symptoms convey disease; nor in any other prevalent infection. Diphtheria is communicable in the stage of sore throat, or of malaise preceding the more marked signs of the disease; whooping cough is catching during the first catarrhal symptoms, before their specific character is recognised. These diseases are often spread in their early stages; scarlet fever is not without such risk, but, from the shortness of incubation, it is more under control; after one week of separation, if no symptoms of illness appear, we know the disease is escaped from; the other infectious fevers, to which children are most liable, require nearly a fortnight for their development, and two or three of them sometimes as long as three weeks. In some mild cases of scarlet fever, we may have to wait as long as this before we can be sure we have scarlet fever to deal with, that is, until desquamation removes all doubt as to the nature of the disease.

Besides the danger of infection being carried by those only sickening for an infectious illness, there is the ready conveyance of it by what are called *fomites* to be guarded against; particles given off by the sick readily attach themselves to any surfaces they come into contact with, and may settle from the air of the sick room, even as it escapes into passages or other parts of the house, and so cling to clothing stored near, or be carried in the folds of the dress by those going to and fro. Without these means of conveyance infection, of the kind we are here dealing with, can travel but a short distance out of doors, and soon loses its dangerous powers when exposed to the action of fresh air and light; how this comes about is not clear, neither physical dilution, chemical change, or modified activity of the germ, will alone explain a fact that is, perhaps, more obvious in our crowded streets than in villages where sanitary surroundings are equally observed; country gossips often spread infection, while in London, where next door neighbours hardly know each other, infection seldom passes from house to house, still more rarely across even a narrow street.

An important rule, never to be neglected, follows : this is, while one member of a household is laid up with an infectious illness others of that family should not mix with parties of susceptible children, or be sent to school or to church. This rule should be observed during the progress of a doubtful illness. School managers cannot be too careful in this respect; in day schools when any child is absent from illness, inquiry should be made as to the nature of the ailment, and while the reply is not satisfactory other children from that home should stay away. Still more strictly should the return of a convalescent be guarded against until every precautionary measure has been fully completed; after scarlet fever and diphtheria six weeks must have passed and a certificate should be required from the health authorities that clothes and room have been disinfected. When a series of cases of this kind have occurred in any one school, the best plan is to close it for a time. In any village epidemic among children, school attendance should be suspended for two months.

A former word of advice as to scarlet fever may be quoted, not only important to the convalescents themselves, but which, if largely acted on, would further reduce the spread of the disease and relieve our health resorts from one of their greatest risks : " Do not seek change of air too " soon for scarlet fever convalescents ; they are better in their rooms for " the first three weeks ; they are not only safer in their homes, for the

" next three weeks after that, but they gain strength, just as fast, often " faster, than if they had been sent off for change of air, to the danger " of the conveyance used, to the danger of the lodging they go to, and " to the danger of all with whom they come into contact."*

Whooping cough, as an example of infectious disease not fitted for treatment in hospital, may furnish some hints as to the management of those cases of scarlet fever which cannot conveniently receive hospital treatment. The severity of whooping cough is certainly increased, both by inclemency of season, and by overcrowding. In all likelihood the latter may claim the greatest share in causing the high rate of infantile mortality. To avoid such risk, if we cannot separate the sick infants from the healthy, we can take means to separate healthy infants from the sick. In this as in other diseases of the class, more than in some others, the two room treatment is essential; with varicella, rubella, and even measles (all short self-limited fevers) the sick may be kept in one room with advantage during the strictly specific process; not so with diphtheria nor influenza-catarrh, in both of which children often suffer from strict confinement to one room. A too free or constant use of the steam-kettle does harm both by displacing fresh air and by favouring germs. In common colds and sore throats confinement to the house for considerable periods is often beneficial. It is worth noting that except in specific catarrhs children seldom expel mucus by coughing. Might not an effective isolation often be obtained in villages by boarding out the susceptible members of a family invaded by epidemic disease.

Next, to avoid the chance of aggravating their own illness by going out of doors, and of spreading the disease to others, young children with coughs and colds should be kept at home till they are well, or until the nature of the disease is clear. However useful change of air may be in convalescence from most ailments, nothing is so hurtful in the catarrhal stage of whooping cough as exposure to even moderate wind or chill. In this way more harm than good results from sending children to gasworks, and other places, to inhale the vapours of tar or sulphur. Here again the two room system is required, the one chiefly occupied by the sick must be cleaned, ventilated, and perhaps disinfected while they are placed in a second room, which afterwards has to be purified in its turn before it is used again by the healthy. Intelligent visitors, and in some districts a special nurse, may do much by words of advice during illness, with hints as to pure air, cleanliness, and disinfection, to lessen the danger and stop the spread of disease.

The room set apart for nursing a case of infectious illness, should have a clear capacity of seven hundred cubic feet at least (a room 8 feet high and 10 feet square will give this), so that the air may be continuously renewed without draught or undue lowering of the temperature. A fireplace is essential; even in the summer a lighted

*Social Science Transactions, 1875. Longmans & Co., p. 563.

fire aids ventilation. Not only should a screen be interposed between the door and the patient, but a smaller screen on a stand, or perhaps only a towel rack, can be so placed as to intercept the free diffusion by coughing, or otherwise, of exhalations from the patient throughout the room. No article of food is to be kept in the room. The air can be thoroughly changed and the windows opened while the child is covered.

When two children are treated in the same room for infectious illness, they should occupy separate beds in a large room with 500 cubic feet of space to each; they should be placed some distance apart, or on either side of the fireplace, so that the air current from door or window to the fire may pass between them; the separation thus effected is complete enough—aided by some interposed screen, with careful management and separate service, even when only one room is available—to enable a susceptible child to occupy one side of the room, and to keep in health, while on the other side a child goes through all the stages of an infectious illness. If only a small room is available the patients must be more frequently moved into a second room. Both rooms must be cleared as far as possible, thoroughly cleaned, and alternately purified; sometimes fumigation or a coat of limewash can be applied in the interval, and by some of these means mentioned the infectious period of many diseases has been much shortened; the duration of whooping cough has been reduced to three weeks by filling the room with sulphur fumes for a few hours, the patients being removed till it is cleared and warmed.

Free ventilation with neatness and cleanliness is at the root of all thorough disinfection. The action of any agent absolutely destructive to infective particles is necessarily very limited, both as to the extent and the conditions in which it can be applied; for each one of them in full intensity is also destructive to organized matter or to life. In trusting to germicides of more moderate powers, even those only antiseptic, or to the promoters of chemical change as our aids to disinfection, it is well to employ some whose powers can be judged of by sight or by smell; yet whatever disinfectant of this class is used, at whatever strength, its presence in the air of the room ought not to be so marked as to mask the sense of freshness in the air. It is not only useless to load the air of the sick chamber with any disinfectant, unless free ingress of air is provided, but positively injurious to the patient.

The disinfectants used may be either Carbolic acid, a teaspoonful to a pint of water, or Permanganate of Potash, two grains (equalling a teaspoonful of Condy's fluid) to a pint of water; these are cheap and their use obvious to the senses, for the one is made evident by its disagreeable odour, the other by its well-marked colour. Carbolic acid has the advantage of not discolouring anything in which or to which it is applied, and may be used to cover all refuse for removal from the room, or be ready to receive expectoration, &c. When sprayed about the room, it is not so refreshing as the diluted Condy; this latter may again be diluted by one half and used to purify any articles that have been handled by the patient, or even that have been on or near the bed; thus used, the pink colour is lost or becomes a dull brown as long as any impurities remain, so indicating the need of more of the disinfectant.

Among the more useful disinfectants, Sanitas and Terebene yielding Hydroxyl or peroxide of hydrogen, deserve a high place; they are derivatives from Oil of Turpentine with which the latter is isomeric; both give off a penetrating odour, ozonising the air; they are equally serviceable mixed with water to check infectious emanations from excreta, as for sprinkling about the room, on the screens, clothes, and carpets, or for use in spray; this latter method answers well for freshening the air of the sick room, and sometimes for its directly curative action; as is seen after the use of the Permanganate in sore throats, or of Terebene in coughs. A purer colourless form of Terebene is prepared for internal use; the crude, darker liquid is to be diluted in the same way as Condy for general purposes, or used in small quantities of full strength, where a stronger disinfectant is wanted. A Sanitas Oil is vaporized from boiling water; diluted it affords a cheap form of the ordinary liquid. As one disinfectant should serve as much as possible for all purposes the choice will often fall on Sanitas. A little of either of these weaker fluids can be used directly to the mouth or nose; any expectoration should be immersed in them. These means are to some extent required in common colds, and attacks of diarrhœa; also in consumption, and prolonged or other chronic illness; a five per cent. Carbolic acid solution serves for phthisical sputa. Some embrocations in common use are disinfectant; such are the Camphor and Turpentine liniments of the pharmacopœia, and the oil of amber. Benzoin used internally and the Balsam of Peru used externally have some effect of this kind, the former yields Benzoic Acid, the latter Styrone and Resorcin, all effective germicides. The use of Borax and the still greater potency of Boracic acid are well known.

Stronger disinfectants are sometimes required for special purposes. Benzine, in the carbolic series, is effective; coal-tar naphtha, paraffin or common petroleum oil, is a handy form and can, with any tainted shreds, be completely burnt afterwards out of doors; it is equally potent in destroying the germs of virulent discharges, as against those of the grosser parasites. The Chlorinated Soda of the Pharmacopœia is a strong disinfectant. The strongest are Chlorine and Corrosive Sublimate; the latter is now to be had in a soap, wherein there is less danger of any mistake in its use, and the efficacy is not lost. The Milton Chemical Company, of Glasgow, makes this and other disinfective soaps, such as that with Iodoform or Eucalyptus, that are preferable for some purposes to those made with carbolic acid.

The stronger disinfectants are *germicide*, that is, they kill the germs of disease. This is done either rapidly and absolutely as by fire, more slowly but not less surely by any heat over 240° F., and with varying degress of intensity by chemical agencies; among these must be reckoned the slow combustion of all particles brought back to common earth, also the absorption and purification of foul gases by charcoal. The latter is one type of *Antiseptic*, it holds the poison in its pores and secures its ultimate destruction; this class of antiseptic hastens change, the intended oxidation of the mass or the particle may go on in time to completion, till all traces of either are removed, or only go so far as to purifying the surrounding air. The second class of antiseptic acts rather by delaying change and so keeping the air pure from taint; this is done in two ways, either by a "pickling" action on the offensive medium, so that it can undergo its further destructive changes elsewhere and under conditions not likely to be harmful, or by sterilizing the activity of the germs of disease. Some power of this kind is possessed by all antiseptics; as by Sanitas or Peroxide of Hydrogen, and Permanganate of Potash of the first class,—where even the 'germ of decay' has a part—and, in the two divisions of the second class by common salt, alum, zinc, iron, vinegar, and alcohol, or by lime, the hydrochloric, carbolic, boracic, and salicylic acids, by quinine, and by all the stronger germicides in their weaker forms.

A knowledge of the relative powers of various germicides and antiseptics is needful to the intelligent use of disinfectants; all sure germicides, short of the energy which destroys organic structure, must have an intensity or continuity of action destructive to every kind of life and even to the protoplasm through which it is manifest. Yet these may either be used in full potency without danger, or may be reduced from any degree of activity to merely antiseptic power. In the first case, by removing all living creatures from a room till it is free again, sulphur can be burnt or chlorine evolved sufficient to penetrate and fill the whole space; then by allowing sufficient time, 24 hours or more, disinfection is complete. Again, the protoplasmic poisons, such as mercury, arsenic, or iodine can be strictly under the control of the doctor, and not left with either nurse or attendant in their strongest form. In the second case, by using a smaller proportion of sulphur or chlorine for a shorter time, or to a limited space, a purifying effect short of absolute disinfection, but very useful, can often be obtained.

Experiment has determined for several disinfectants their relative germicide and antiseptic power; of Chlorine, one part to 25,000, is an effective germicide; it is readily obtained from Chloride of lime by adding to it rather more than the same quantity of strong hydrochloric acid previously mixed with water. Next in power comes Corrosive Sublimate, of which 1 to 5,000 is germicide, 1 to 20,000 (1 to 300,000 Koch) is antiseptic; or one grain to ten ounces, half-a-pint, is fully disinfectant, and from a quarter of a grain up to 3 grains to the gallon sufficient for many of the more common purposes. Iodine or bromine have one-tenth of this power, neither are very available. Iodol is better than Iodoform.

Sulphurous acid has a high place as one of the more powerful and most useful disinfectants; it is very volatile and penetrating, is absorbed by cloth and by leather, bleaches vegetable colours, and acts on iron; burning 1lb. of sulphur gives 11·7 cubic feet of this as gas. The gas is very soluble, and is powerful in the disinfection of liquids, it destroys sulphuretted hydrogen, and is not hindered in its actions by albuminous matters. The Pharmacopœial acid, a 5 per cent. aqueous solution, 1 part of gas to 20, is always obtainable, and, when fresh, is both effective and safe; this can be mixed with 20 parts of other matters, and as long as the mixture retains its acidity is effective for certain purposes; it is not merely a deodorizer, but will check the development of 'germs,' while, with free access of air, it rather hastens than retards other changes; with two parts of water this acid is useful, both as a lotion and in the form of a spray; it is a deoxidizing agent, and, therefore, opposed to the next.

Permanganate of Potash ranges with sulphurous acid in efficacy; it acts more by oxidizing and destroying organic matter than as a germicide; sometimes it leaves the bacteria of decay unchecked in their activity, and thus indirectly aids disinfection; at others one part to 5000, or even 15,000 if no albuminous matters are present, will prevent the growth of germs, for, as with chlorine, albuminoids interfere with its full activity; one part to 800 is germicide, so that except in the presence of much animal matter, a strength of two grains to the ounce is fully disinfectant. The Permanganate can be bought at a cost of one penny per ounce; twice its quantity of strong acid, or five times as much Dilute Hydrochloric of the Pharmacopœia, added gradually to it gives rise to ozone, which oxidises organic matter, and so destroys noxious emanations with increased energy: instead of inert Condy placed in remote corners, the salt in a jar moistened with the acid from time to time is effective in refreshing the air of the sick room.

Carbolic acid, eight times less powerful than the above, is about equal in strength to Condy's fluid. If germicide at one per cent. it should be used to this end at about one to twenty; this will serve to disinfect an equal quantity of any matters to be acted on. An ounce or two of Calvert's dark fluid mixed with hot water in the slop-pail to pour down the drains is a good deodorizer; this is useful for stables and out-houses, when no infection has to be dealt with. When Carbolic Acid is used to disinfect excreta a strength of two per cent. is required, or an ounce of Crude Acid to three pints or pounds of medium; hence, unless obtained wholesale in considerable quantity, it is not a very cheap agent. One part to 200 is antiseptic, and in this way, it is highly serviceable for many ordinary purposes, the more so from its special action on the albuminous matters in which infection dwells. The carbolic powders sold as disinfectants and deodorants are to be recommended for the above reasons; their hygienic usefulness is increased by the lime they contain, and also by the Cresylic acid which gives the reddish colour. Crude Carbolic acid of a dark colour, from the presence of crysol, is said to be stronger than the white as a disinfectant, but none of these are certain germicides; they save the air from contamination by averting change in organic matter rather than by favouring oxidation or restoring freshness to the air. Some other disinfectants of this class act on the medium in a different way, yet so as to prevent the multiplication of the germs. Chloride of Zinc (Burnett's fluid), and the Sulphate of Copper and of Iron, are comparable in effect with Carbolic acid. The Perchloride is the more effective iron compound; one per cent. is germicide, and half that strength is antiseptic. Chloride of Zinc can be made at little cost by mixing Calamine, a carbonate of Zinc, with Hydrochloric acid.

Hydrochloric acid is itself an effective germicide; Sulphuric acid is more potent, but less manageable; the former known as Muriatic Acid or Spirit of Salt is very cheap and serviceable; when diluted with nine parts of water it does not act in iron vessels or fittings unless Chloride of Lime is also used; both these are cheap and effective agents, less suitable for town than for country use. The acid further diluted is useful for chamber purposes. A solution of Chloride of Lime, 1 to 40 serves to wet the corpse-cloth after death from Small-Pox or Typhus; two ounces to the gallon, 1 to 80 answers well for the immersion of soiled linen when it is removed; a strength of 5 per cent. in this solution, 1 to 20 or an ounce to a pint, is needed to disinfect tuberculous matter. Sanitary Authorities and Establishments for infectious diseases will find both the Chloride of Lime and the Spirits of Salt among the best and cheapest disinfectants; either can be obtained at less than twopence per pound, the one in cwt. casks, the other in carboys.

Complete disinfection is so often conveniently carried out away from the sick room, either by heating or boiling in an out-house at home, or by stoving or steaming at some public establishment at a distance, that we come to rely more in personal and domestic use upon such antiseptics as arrest infective actions in various slight and efficient ways than upon the stronger disinfectants. The relative potencies already given for these has been estimated from the point at which they kill, or stop the growth of certain low organisms, agents of decay, closely allied to germs of disease, and, in case of one microscopic rod or *bacillus*, the actual germ of a disease—splenic fever—in animals; this germ produces 'spores' out of the body, very resistant to heat and difficult to destroy; none of the microzymes hitherto detected in the course of any of the infectious diseases of man are known to produce spores. The bacillus in question, owing to its power of resisting many antiseptic agents has been taken as the test for germicide action; it only produces spores when it leaves the blood for sites with more available oxygen, as in cultivations.

With some differences for certain germs the results of experiment have been remarkably uniform; thus the increase of every species of *microphyte*, or microbe, as these minute forms of life have been called, is stopped by 0·5 of sulphate of iron, or one part to 200, but none of them are checked by 0.25 or half that proportion; moreover mercuric chloride at 0.003, and iodine at 0.025 were effective or not, according to the time of exposure. In all experiments with disinfectants, their intimate access to every part of the infected material, and duration of the contact are necessary to success; the time of exposure is often of the very essence of the question.*

On the lowest organisms and especially upon the unorganised ferments, however, a great difference of action is observed; *i.e.* the activity of the latter is arrested by some weak germicides, but they are not affected by some of the more potent, nor by so strong a protoplasmic poison as Mercuric Chloride. Alcohol acts on the septic *micrococcus*, and controls infective suppuration; Boracic acid on the *bacterium* of putrification. The anti-ferments are feeble germicides, and except in the case of the yeast plant, they stop fermentation without destroying its agents. They are more to be used as remedies, than as disinfectants.

But, all diseases are not owing to germs, most of the infective fevers in all probability are due to a protoplasmic particle of this kind, but whether due directly to their growth and increase, or to some outcome of their activity is not thoroughly ascertained. However fever is excited or carried on, it is evident that without germs that can be transported to another home, and not only excite a similar action there but be multiplied in the process, the disease can hardly be called infectious. Snake poison is infective, but it does not set up an infectious disease; it is not a chemical, but an albuminoid or proteid body;† not an independent organism, not a living entity, but the product of cell-life, a formed material, no longer even protoplasmic.

The unorganized ferments are also proteid particles, many of them concerned in vital processes, as in those of digestion, others in the causation of disease; though destroyed by a heat of 160° F., they are not acted on by some germicides, and have this special resistance to the action of others, that, while inert in their presence, no sooner is the anti-ferment removed than the fermentive power reappears.

Boracic and Salicylic acids, are of this latter class; both, germicide at or below 1 to 200, are antiseptic at 1 per 1,000, and under some

* In Dr. BUCHANAN'S most valuable Reports to the Local Government Board (14th, p. 208); the degree of dilution at which Sulphuric Acid prevents the growth of *Bacillus Anthracis* is given as 1 to 1,800; at 1 to 600 it kills them in two hours of exposure; at 1 to 500 in ten minutes; at one per cent. the spores are inert after a week. An acid of the carbolic series was germicide at 0.16 or 1 to 600 in an albuminous medium, yet in the absence of nitrogen 0.05 of this acid, 1 to 2,000 killed the *bacillus*, and killed it in a shorter time, p. 186. I am also indebted to Dr. G. M. STERNBERG, of the United States Army, and National Board of Health, for many germicide values; he says, "a re-agent with little or no power of this kind may be capable of *restricting the development* of pathogenic organisms, and thus limiting their power for mischief." See American Journal of the Medical Sciences, April, 1883, p. 333.

† R. H. Wolfenden, Journal of Physiology, Vol. VII. 327-364.

circumstances to double that extent ; the latter at 1 to 15,000 has kept a solution of grape sugar from fermenting. This acid combined as Salicylate of soda has no antiseptic power, unless under conditions where the acid is set free; the bi-borate of soda retains near upon half the power of the uncombined Boracic acid. Formic acid has a similar activity. These three antiseptics are powerful anti-putrescents, yet in such strong solutions as 1 to 25 are not always disinfectant; they, with other germicides as carbolic acid in spray or some preparation of acetic acid, without destroying the germ, impede its developement by uniting with the substances indispensable to germ growth; they also act by preventing germs being set free during decomposition. Chromic acid 1 to 8 is potent.

The anti-febrile power of quinine is partly due to some resistance of this kind imparted to the tissues, as by restraining the absorptive power and motility of the white blood corpuscle: it is also seen directly to check the increase of germs by some special action on them; Iron, alum, tannin, and zinc, act in one or both of these ways. A similar power, long known to reside in the volatile oils, has of late been largely utilised in Thymol and Menthol, the derivative camphors of two of them, and in the oil of Eucalyptus from the leaves of the Australian Blue Gum Tree. The latter also has an ozonising effect on the air while it oxidizes; it is not an irritant even to tender surfaces; an ointment of one part to five is in use. Boracic acid, a weaker germicide, is used in the same way; this acid is soluble in 25 parts of water. Salicylic acid disolves in 760 parts of water, or in 120 parts of olive oil; an ointment of 1 to 27 is ordered in the pharmacopœia; by mixing an equal part of borax with this acid, the solubility is increased to 1 in 24, so that 20 grains can be disolved in an ounce of water, and its germicide power of 1 to 200 maintained.

By heating nine parts of Salicylic Acid with ten of Carbolic Acid oxygen is set free and a new antiseptic, Salol, with an odour like that of 'Sanitas' is developed; this scent is more marked if one part of Eucalyptus oil be added. As this compound is soluble in alkalis and, to a sufficient extent, in fatty matters it has been incorporated into a useful sanitary soap. When used with oil or vaseline for inunction, the proportions should be eight or ten grains of this compound to an ounce of the medium; a drachm heated with half an ounce of lard and mixed with three parts of hot vaseline makes a strong and effective ointment. Vaseline takes up 5 per cent. of Carbolic Acid. The use of adding lard or other fatty matter to Vaseline for innuction is that it remains longer on the surface, and aids the diffusion of the Carbolic Acid. Salicylic Acid readily disolves in lard, and this mixed with Vaseline, so that 5 or 10 grains of the acid are contained in each ounce of the Carbolated Pommade, secures better penetration into the epidermic scales, and the carbolic odour is lost. Salicylic soap checks and removes disagreeable perspiration.

It is a good rule to keep to one disinfectant, and to bear in mind the way in which it acts; the above exceptions are allowable, but it is to be remembered that Chlorine cannot be used with Peroxide of Hydrogen, nor Carbolic acid with Sulphur or Condy's fluid; the latter is decolorized by Carbolic acid, and rendered inert. One important exception to the rule is that, when antiseptics are trusted to in the sick room, the more effective means of disinfection must not be forgotten; in Enteric fever (typhoid), and in Cholera, beyond removing all excreta in diluted mineral acid, as before recommended, some further means are required to disinfect; any increase of germs is prevented, while the medium retains its acidity, but this is soon lost if carried by water along the sewers; when not got rid of in this way, the addition of chloride of lime would destroy infection, and in country places this might be insured by covering with earth in a trench, when this cannot be done, a little quicklime might be added; slaked lime with sulphate of iron or copperas would precipitate solid matters, and then using permanganate of potash would have full effect on the effluent; any permanganic acid set free by the mineral acid, would act further as a disinfectant. Corrosive Sublimate is most effective.

Desiccation, which arrests the development of all germs, has been ingeniously applied to this purpose, by Astrop's procees (*Lancet*, vol. i, 1887, p. 287). Cold checks the activity of germs, but does not destroy them; excess of oxygen, and exposure to light as recently shewn by M. Arloing stops their growth; warmth and moisture favour their increase. All germ-growth implies rapid interchanges with the environment, where oxygen, some nitrogen, and much water must be present. The microphytes of some of our common infections (*e.g.*, Vaccinia) when cultivated out of the body, and supplied with sufficient nitrogen and abundant oxygen, increase in size but lose their infective power. This agrees with Pasteur's demonstration, that a full supply of oxygen favoured the growth of the yeast plant, but lessened the activity of fermentation; one part of ferment in a deep vat destroyed one hundred parts of sugar, but only five parts in the shallow vat with freer access of oxygen. Most diseases are less active in fresh air, some may even pass unrecognised under milder forms. All germs are killed sooner after removing any of the elements on which they grow or increase.

Water and aqueous vapour, while giving activity to germ life, are also the means of bringing germicides into play, and of securing their full effect; germ-spores that resist for some time the hot-air chamber are soon reached when steam is admitted even in small quantity. A little water evaporated while sulphor is burnt in an empty closed room favours the action of the sulphurous acid, probably by aiding its penetration; a considerable quantity of water should be evaporated when chlorine is to be generated in sufficient amount to thoroughly purify a disused room; which of these gases is best for this purpose must depend on the quantity present and the length of time allowed for their action. The proportion of sulphur to be used for a room of given size is more definately known than the volume of chlorine required, the only rule for the latter is that it must be sufficient to render the air irrespirable. Chlorine as an air-disinfectant has a much wider range of utility and power. In the 13th Annual Report of the Local Government Board, 1884, p. 131, we see that a healthy animal can be placed in the same compartment with a diseased one, even for so long a time as six hours, for five successive days, without being infected, provided the place remained well fumigated with chlorine gas up to marked pungency, twice during the six hours being sufficient. Sulphurous acid gas at the strength at which it could be used was only successful against milder forms of disease.

The disinfection of the clothes worn by every one brought near to sources of infection, should be followed by full exposure to air and light before they are either worn or put away. Re-packing should be done out of doors, or some of the atmosphere of the infected house is packed up and taken away with the clothes. The necessity for this precaution is specially great in scarlet fever. From the Reports quoted above (13th p. 61), Dr. Page relates how in this disease, the assistant mistress of a board school, closed because child after child, none of them resident, had scarlet fever, though not herself ill, carried infection with her to an isolated farm-house and started the disease within a week of her arrival. Dr. Murchison mentioned before the Clinical Society in 1878, an instance of scarlet fever breaking out on board ship in the Red Sea, seven weeks after leaving Sydney. Three weeks before embarkation in April, a family on board had resided with friends in Queensland who had scarlet fever; all went well at starting, but the light clothing they had worn in the semi-tropical heat of Queensland had been packed up there for the voyage, and the boxes had not been opened until after leaving Aden and reaching the terrible summer heat of the Red Sea, when it was unpacked and again called into use. It was in this family that the two first cases occurred, three months after they left the infected house in Queensland. Of 147 passengers and 40 children, 30 cases of scarlet fever appeared in four days before reaching Suez.

The general principles of disinfection only will be stated with hints as to their applicability to scarlet fever; as where any one is under treatment for this disease much detail must be left in the hands of the doctor and nurse. With a sufficiently airy room either a little apart from those used by other inmates, or at the top of the house with an adjacent room or landing at the disposal of the nurse, the risk to others in the house, except to the young, is not great. In removing all unnecessary furniture and clothes from the sick room, none in use since the sick person occupied it should be packed away without first having been well cleaned and exposed to heat. A linen cloth or screen should be fixed over the doorway, on which some simple disinfectant should be sprinkled. Sanitas answers equally well for these purposes, also as a spray in the room, and for use in other ways. Sponging parts of the skin with the diluted permanganate, or with a little aromatic vinegar, or the use of Sanitas or of Eucalyptus Soap is pleasant to the patient. Carbolic soap is less effective as a disinfectant than that containing Eucalyptus and Iodoform. Lubricating the whole surface of the body, as is now a very general practice, certainly restricts the dissemination of infectious particles. Carbolic oil (1 to 40) or the Eucalyptus or Boracic ointment during convalescence can be used after detergent baths; either of these, or a hair-wash of Acetic acid two parts, with one each of Spirit and of Glycerine to two of Rose water, can be used to the head after it has been washed.

At first a little cold cream or vaseline only should be applied to the skin after sponging. Vaseline is specially suited for this purpose, it keeps moist for eight hours or more and is not readily absorbed; this is of great advantage in the use of carbolic or salicylic acid, or of the two combined in the manner before mentioned, as their effect is thus properly restricted to the skin-dust during convalescence. In young children, and where the skin is tender, all irritants should be avoided. Olive oil will take up one part to nine of Carbolic Acid, even at this strength, an ounce to half-a-pint of oil, it is not a reliable disinfectant, and there is fear of the acid being absorbed and acting injuriously on the kidneys, a serious objection to the use of even the weaker carbolic oil in many cases.

The topical use of the milder disinfectants in the daily toilette is advantageous throughout the illness; after the first remission or on the subsidence of the more marked symptoms they should be carefully applied, especially to the hair, in connection with a warm bath and change of clothes. To freshen the air of the sick room, Sulphurous Acid, the gas in aqueous solution, one part to two of water, or a solution of Peroxide of Hydrogen in similar form can be used in spray; the latter gas has no odour. This, with ether, called Ozonic Ether, of thirty volumes strength, three times that of the liquid, may be sprinkled about the room, and in the hair, or on to a handkerchief; it has been used as a gargle with two parts of Glycerine, and thirty parts of water. A bad throat is better sprayed with weak Condy, or the diluted Sulphurous Acid; or cleared with Chlorinated Soda solution, one part to ten of water; gargling is less effective and often painful. A solution of Chlorinated Soda mixed with two parts of water is often required in the room as a stronger disinfectant for soiled lint or rag that cannot be immediately burned, or for use to bedding or carpet without injuring the fabric as the chlorinated lime is apt to do. All linen clothes after use should be removed from the room and immersed in water with some disinfectant.

Chlorine seems specially suited to counteract scarlet fever infection; one or two dishes with a little moist Choride of lime set about the room will, by means of carbonic acid in the air, give off enough Euchlorine to deodorize without any irritating effect on the inmates; the same gas can also be liberated slowly in the room by placing on the top of a shelf, not too near the patient, a wide mouthed bottle in which ten grains of crystals of chlorate of potash, and half a teaspoonful of strong hydrochloric acid have been placed; or, more of the crystals can be used and the acid renewed from time to time.

It is not necessary that these vapours should be of a strength to kill the germs of disease; if they prevent contamination of, or restore the oxygen to the air they are of service. Many antiseptic or disinfecting agents are not really germicide or absolutely destructive to all infection; some do little more than deodorize; others arrest the septic power; some have their use in safely conveying away the agents of disease from the room or house. In this way clothes can be taken to the laundry, but must not mix with others, until they have undergone the requisite boiling for half an hour or more; this really destroys all infective power.*

Very often it would be possible, in the course of the disease, to remove the patient to a well-aired room for a whole day, and thoroughly purify the sick room with sulphur vapour. Spread open the bedding, clothes, playthings, &c., close the windows, chimney or other apertures, and burn, in the centre of the room, 1 lb. of yellow Sulphur moistened with methylated spirit, with precautions for its safe and complete combustion. After five or six hours the room can be entered and cleansed ready for use again by night. The room occupied by the convalescents during the day can then be similarly fumigated, a pound of sulphur will suffice for this purpose. Either allow half a pound of sulphur for each person occupying the room or a pound per 1000 cubic feet. A larger quantity is needed, and a much longer time of exposure, for full disinfection.

Thorough and complete disinfection is only effected by heat; that of boiling water if applied long enough is sufficient. Steam applied under moderate pressure for five minutes destroys the germs of most diseases. Boiling the linen clothes for half an hour with a little soap and soda or common salt disinfects thoroughly, if so managed that the heat reaches to all parts; any stained linen after the use of the strong disinfectant should be steeped and rinsed in cold water to remove the stain before boiling, as by steaming or long boiling the stain is fixed. Woollen clothes require dry heat, as hot water shrinks flannel and woollen textures; felt hats, shoes, and leather goods are spoilt by steam or by wetting, these stand dry heat well; mattresses should be unpicked before exposure to heat and re-made afterwards to ensure disinfection. Some degree of safety is obtained by placing articles of this kind before the fire, or in an oven, after they have been cleaned. Any heat over 240° is injurious to these materials, a heat of 250° scorches flannel.

After a sick-room is no longer occupied, complete disinfection should be brought about by means of the full use of sulphur fumes, the sulphurous acid liberated by burning sulphur, in sufficient volume, may be relied on to reach and act upon all that is most conveniently left in the room. To effect this, the bed should be uncovered and raised from the frame, the brass or iron work here and elsewhere, as on

* We are indebted to Dr. James B. Russell, of Glasgow, for establishing this fact on a sufficiently large scale. Dr. James A. Russell, of Edinburgh, in Quain's *Dictionary of Medicine*, gives a very complete article on Disinfection.

doors, windows, &c., is to be protected by a coat of grease, drawers and cupboards are to be set open, the windows and chimneys closed; then a pound or more of sulphur, according to the size of the room, in a perforated earthern or iron pan, is to be moistened with methylated spirit and placed for security, during combustion, over a tub of water in the middle of the room, or in more than one place, if the room be a large one. When this is lighted the room is to be closed and left so for more than twenty-four hours; then means can be taken for dissipating the sulphur fumes, and the room and everything in it must be well cleaned and ventilated.

A small room can be very conveniently disinfected after short occupancy by igniting Bisulphide of Carbon, by means of a cotton wick placed in the half-pint bottle the liquid is sent in, and letting it burn out while standing in a good sized vessel of water; over the flame water can be evaporated at the same time from a shallow dish. This is a convenient way of disinfecting any private carriage used for the conveyance of the sick. It is more effective than the pan of Chloride of Lime moistened with dilute hydrochloric Acid as generally used for this purpose.

This fumigation, after the end of the disease, should be superintended by the Sanitary Authority of the district, to whom notification of all infectious illness ought to be made, at the beginning of the illness as well as at the end. In this way much assistance is often obtained, and especially in the complete purification of bedding, and intractable material, either in the steam chamber kept for this purpose, or by removal under all proper precaution to where thorough stoving can be done. Some colored fabrics are better disinfected by stoving, than by sulphur fumes which bleach. After the use of sulphur a thorough cleaning and a general lime-washing of ceiling, walls, and passages, should be carried out. In re-painting and re-papering walls, cupboards, and recesses, no shred of old paper must be allowed to remain.

Disinfectants may be classed, excluding those destructive to all forms of life, such as fire and nitrous fumes, into *direct* and *mediate* disinfectants; the former are again divided into—1 local, used to substances apart from the living body, or—2, surface, applied to the body; the latter into—3, those acting through the air, and—4 through the medium of water. Under division 1, are Lime, Charcoal, Chloralum, Carbolic Powders—Calvert's or McDougall's. Waste Chlorides from Chlorine works should be cheap, and would be very effective if not used with Carbolic compounds. Division 2, includes Nitric Acid, Nitrate of Silver, Iodoform, Ferric Chloride, Alum, Acetic, Carbolic, Chromic, Boracic and Salicylic Acids, Eucalyptus Oil, Thymol; in division 3, are Chlorine, Sulphurous Acid Gas, Peroxide of Hydrogen, Sanitas and Terebene; in division 4, Hydrochloric Acid, Mercuric Chloride, Burnett's fluid (Zinc Chloride), Condy's fluid (permanganates), the Sulphates of Iron and of Copper, Sulphurous Acid, and Chloride of Lime, find a place.

With reference to the patients welfare, cleanliness and fresh air are the first essentials ; common soap and water, careful attention, and good ventilation, are needed in the room to keep the air from taint. Terebene or Sanitas have an advantage over Condy and Carbolic Acid, that both the latter interfere with the efficacy of chlorine and sulphur in further disinfection, moreover they counteract each other and should never be used together. The liquid Sulphurous Acid or diluted Hydrochloric Acid are the best of the stronger disinfectants to add to the water used for covering the excretions, or for removing linen from the room, and even for these purposes either of the first mentioned preparations will mostly suffice.

But little variation is required in the management of the different diseases that have been enumerated. In all of them, isolation of the sick is the first object, and if this is not done by removal to hospital the same end is to be attained as completely as possible at home. In Small-pox the attendant should be known to be protected from liability to this infection ; no one who has not previously been re-vaccinated should come into the sick room until four days after this operation has been performed, and it is seen to be successful ; any matter from the spots has to be steeped in the strongest disinfectant, or at once burned ; the crusts separating during convalescence should be burned.

Scarlet fever patients must be nursed by those who are protected through a previous attack ; both surface and air disinfectants are required ; chlorine is advantageous. Convalescents must observe six weeks quarantine whether desquamating or not.

Diphtheria requires most of the precautions given for scarlet fever ; the attendants should not be selected from the young, nor should they remain continuously in the sick room ; all secretions from the throat should be destroyed, and some surface antiseptics either as spray, liquid, linctus, or powder, used to the throat ; in the last form, Magnesian Sulphite is useful.

Measles and Whooping Cough are aggravated by insanitary surroundings ; the air, the surface of the body, and the clothes require disinfectants ; chlorine is objectionable. Convalescents after measles should be kept four weeks, and after whooping cough six or eight weeks from mixing with the young and susceptible.

Mumps and Chicken-pox require a disinfectant mouth wash, weak Condy is best, as well as other precautions.

Enteric fever needs moderate air disinfection and most careful and efficient water disinfection for the excreta up to complete convalescence. In Typhus fever a free air supply, absolute cleanliness, some aerial freshening, and complete disinfection of the clothes, if they were not at once destroyed, are required. The attendants should be selected from the younger nurses, as the persons protected by a previous attack are few, and older persons are most liable to severe attacks.

In Cholera, disinfect the excreta as quickly and thoroughly as possible; this is more effective if the medium is made acid. The attendants should take none of their meals in the sick room, and be as attentive to their own ablutions as to those of the patient.

The germs of all these diseases excepting cholera, enteric fever, scarlet fever, and possibly of diphtheria, multiply exclusively in the bodies of the sick; they get into the air, water, food, clothing, and bedding near the patient, to be carried forth or remain in the room to infect others either quickly or after some length of time. When the conditions of their existence are widely known and the means at our disposal for dealing with them more widely understood, it is to be hoped that a marked diminution of these "preventable" diseases may be secured. Even the less fatal of them will then receive the care necessary to their restriction, for much discomfort, much inconvenience, hindrance to education, arrested development, and often permanent injury to health and activity, result from neglect of the minor infectious diseases.

One attack of any of the truly infective diseases, the germs of which increase only in the living body, is usually protective against the recurrence of another. This is fairly constant for Measles, Typhus, and Hydrophobia, nearly so for Small-pox, Varicella, Rubella, Mumps, and Whooping Cough. It is the rule in Scarlet fever, and is not exceptional in Diphtheria. Cholera may recur, and is so far like Ague and Influenza; but in this disease one attack predisposes to another, instead of conferring any immunity as Enteric fever certainly does. The latter may proceed from a micrococcus allied to that of Pneumonia, and Erysipelas, or to a *bacillus* like that of Tuberculosis or Struma. In the other diseases dealt with, two kinds of germs must be concerned, one re-produced only in the bodies of the sick, the disease being self-protective; the other capable of multiplication outside the body, resulting in a disease liable to recur. The germs of Ague, and Remittent or Malarial fever are certainly of the latter type; and probably those of Influenza and Cholera.

The various germs associated with the infective diseases are referred to the lower forms of vegetable life both from their morphological characters, as accepted by skilled observers, and from dynamic considerations. Animals convert simple elements into the more complex, as carbon into carbonic acid, setting free energy—some of it as heat. Plants reduce the complex to more simple elements, the unstable to more stable compounds. The lowest "germs" do this; with the forms of life they are agents of decay; their activity is increased by the heat from condensing vapour or of decomposition, for their energy is evolved from the medium they destroy. Death, or the shaded side of the globe of change, is another mode of life; when the higher and controlling vital power fails, the lower comes into play, and we do but substitute chemical for vital processes in disinfection.

The courtesy of Dr. George M. Sternberg, Chairman of Committee, has supplied me with the Report of the American Public Health Association on Disinfectants, and also with a copy of his Prize Essay, on Disinfection, published last year. The utility of Choride of Lime and the efficacy of Mercuric Chloride are fully recognised in both works. To render these agents more readily available, standard solutions are recommended to be kept in constant readiness for use. That of Chloride of Lime,1 to 20, eight ounces to a gallon of water, is very handy; it can be diluted for use by one-half, or more where no organic matter has to be dealt with. This solution, or one of Chlorinated Soda 2 per cent., serves for steeping infected linen. The power of the Bichloride of Mercury may be utilised while its dangers are guarded against, either by giving to it the red colour of Permanganate of Potash, as in the Standard Solution No. 2 in the Report, p. 131 where two drachms of each salt are dissolved in a gallon of water, or by the strong blue colour of copperas as in Solution No. 3, to be issued in special bottle :—

| | |
|---|---|
| Bichloride of Mercury ... ... ... | 4 ounces. |
| Sulphate of Copper ... ... ... | 1 pound. |
| Water ... ... ... ... ... | 1 gallon. |

This, is further diluted with eighty parts of water, two ounces to a gallon, for the immersion of infected linen or clothes for two hours before they go to the laundry. When thus diluted, the fear of accidental poisoning is reduced to a minimum. It cannot be used in metallic pans for the Mercury is precipitated by contact with copper, lead and tin; leaden pipes are acted on injuriously by it and rendered brittle. When clothes cannot be immediately disinfected by boiling, immersion for four hours in this solution is efficacious, and equal in effect to a 2 per cent. solution of Chlorinated Lime or Soda. When circumstances make it expedient to use the more potent and odourless disinfectant the solution as above, or coloured with indigo or by other means, offers an additional safeguard against the dangers, not greater than for Carbolic Acid, which may be incidental to its use. Either of these solutions diluted may be used on the moist cloth with which any surfaces exposed to dust in the sick room should be wiped. Wet sawdust impregnated with Sanitas can be used in clearing the floor, with the object of preventing any dry dust being raised and diffused.

Thoroughly to disinfect a vacant room, experiments shews that 3 lbs. of Sulphur should be burnt for every 1,000 cubic feet of space; it is impossible so to close all apertures as to keep vapour enough in the room from 1 lb. of Sulphur for the requisite time, 12 hours, to be efficient. All fumigations are injurious to the sick, and it is useless to burn Tar, Turpentine, and scented things in the room; Carbolic Acid loses its properties on being vapourized by heat, and burns to inert particles of Carbon.

# NOTES

ON THE

# HEALTH OF CHILDREN.

[*Reprinted from* "Our Homes," *with some alterations. By permission of* Messrs. CASSELL.]

# THE HEALTH OF CHILDREN.

A FIRST series of observations on the variations of body-heat in infants and children, made, as a foundation for the study of the diseases of childhood, mostly in the ten years before 1865, has long been out of print. Further enquiries of the same kind led to some hygienic comments recently embodied in "Health in the Nursery," a contribution to the volume entitled, "Our Homes, and how to make them Healthy," published by Messrs. Cassell; their kind permission enables me to add many extracts from this later publication to the reprint of my earlier paper. My best thanks are also due to Messrs. Cassell, for the opportunity of including among more strictly medical essays the diagrams prepared by them at my suggestion, from vol. xxxiii. of *The New York Medical Journal*, of the normal rate and ratio of growth in the first year of infancy. These illustrate the way in which our first start in life is made; they need to be brought to the more special notice of professional readers, as our medical text books give no standard by which healthy infantile development can be judged by, and it is but quite lately that the very constant physiological loss of weight in the first week of independent existence has been noticed in our medical journals as well established.

Among the more recently acquired facts bearing on the subject in hand are the determinations, by Dr. Percy Frankland, of the relative proportion of germs found in the air under different circumstances. These were brought before the Society of Arts, March 22nd, 1887. Fewer germs of decay are found in country air than in town air; fewer in winter than in summer. In January, about 600 cubic inches of air passed through a glass tube lined with prepared gelatine produced four colonies of germ centres, while in August 105 were obtained in the same way. On May 19th, 1886, the air on Primrose Hill gave 9 colonies, at the foot 19 were obtained; the number from air above the dome of St.

Paul's was 11, from the churchyard below it was 70. In Exhibition Road, when crowded, on June 8th, 1886, the air yielded 554 colonies. Few germs are found in the air of rooms when very still and quiet, but many if dust arises. From a room tenanted and closed dust should be removed in a moist state. In an occupied room germs are not the only spoilers of the air; the carbonic acid given off by respiration is almost equalled by the organic emanations constantly going on. It is most important for children, whose resistance to the encroachment of adverse influences is less than in adults, to have ready access to fresh air in open spaces. The ill effects of any leakage from gas pipes on health, set forth by Dr. Richardson in "Our Homes," has since received further elucidation from Dr. Corfield.

---

SANITARY defects in dwellings are most plainly shown in spoiling the health of children; the young soonest suffer from bad air, noxious vapours, damp, dust, and want of cleanliness. Into houses where the children are lively and well we may be sure no sewer-gas enters; this may not be the particular cause of illness where children are sickly, but some violation of sanitary law will be found that checks healthy development. Nowhere is the right of health to be more vigorously maintained, or more jealously guarded, than in the nursery; for while the neglect of sanitation here saps the cheerfulness of childhood, and ruins the fair prospect of youth, nowhere is attention to sanitary law more promptly and permanently rewarded than in the normal evolution of all we hope for in the young. The healthy condition of the child, and the means of ascertaining it, will be set forth as the measure of how far the children's rooms at home and at school are made healthy.

The details of nursery fittings must vary extremely in the different grades of society, while many of the same details of nursery management can be commonly carried out; the principles to be kept in view are the same in all stations of life, and may often be as well observed in the poorest as in the richest dwellings. No amount of grandeur will keep mansions free from noxious gases; the most costly chamber soon becomes unhealthy if constantly occupied. Luxury can add nothing to the pure milk required by infants; when this has to be supplemented, the same care must be taken that the added food should be fresh and uncontaminated, a care required earlier and oftener among the rich than among the poor. Arrest of nutrition, actual starvation, from dieting an infant on what it cannot assimilate, is still frequent among all classes. Danger from placing a baby in the horizontal position the moment it has finished a full meal, or of covering its face completely during sleep, may happen on a bed of down. Sleep may be prevented by tight bands, or miserable swathes, in a satin bassinette or gilded cradle. Warmth can be kept by plain clothes or loose wraps, while all the evils of chill may be suffered in the embroidered dress of fashion.

> " If onely to go warme were gorgeous
> Why Nature needs not what thou gorgeous wear'st,
> Which scarcely keepes thee warme."
> *King Lear*, Act II., sc. 4.

Children are the better for frequent changes of room ; they have to spend most of their time in the house; they require short intervals between their meals, with quick transitions from play to rest. The meals should be taken where there is no litter of toys ; a quiet room is needed both for work and sleep. Means of getting change of air, and of taking exercise within-doors or under cover, are essential. Children thrive best with free and frequent access to the outer air ; no attempt should be made to render any suite of apartments for the young independent of this, and any arrangement that makes it difficult for children to get out of doors is to be avoided. The infant schools for the poor in large towns are distinctly useful in bringing young children, from the rooms they occupy at home, into the fresh air twice a day. All schoolrooms are now improved.

Home life to the younger members of a family and to the gentler sex means that by far the largest part of every day must be spent indoors, and half of it—at least for the very young—in the bed room. No attempt should ever be made to rear children in a single room. The necessity of providing a full supply of pure and fresh air in youth, when change and growth are most active, is obvious. Whatever has been said of the general requirements of a house, it is in the nursery where all that is most essential to health and comfort should be most perfectly represented. The active man, whose duties for the greater part of the day call him abroad, sooner forgets his fatigue, and has his strength for renewed activity more thoroughly restored, where a healthy home awaits his return. For those who have to spend most of their time within, from duty or necessity, the greatest care in all the details of a wholesome dwelling are most wanted. The strong man after free respiration out of doors may pass through foul or damp air in the basement of the house with the inner breath of his capacious chest untouched ; he may sit in a close hot parlour without enervation, or sleep in a chilled bedroom without his vigorous circulation being seriously depressed Not so those who stay at home ; from these evils even the strong would suffer ; delicate women, susceptible youth, tender childhood suffer most. The mature and robust bear cold well, so that the air be dry and pure ; the young must have warmth. Another necessity for those much indoors is light. No room can be healthy however well calculated for its inmates, unless, in addition to the requisite air-space, the air it contains is being constantly renewed ; this is ventilation. Most important of all those requirements is cleanliness.

The cares exercised for a healthy person kept in bed by an accident, or for an invalid confined to the house or room for a season, set forth what infants always need. At first the comfort of the bed room is everything ; the night is not all rest, and part of the day has to be shaded into night. Soon it becomes possible to change the room for a time ; then, open the windows, brush the floor, dust and clean the chamber, so as to replenish it with pure air, and remove the myriad particles ever spoiling the oxygen of its freshness. While the room is still occupied much of this can be done ; done quickly, that the temperature be not lowered unduly, and so done as not to expose the patient to chill. The air of the room must be changed, to some extent, both in the day and at night ; a partly-open door or window only admits fresh air to some part of the room, but if not to the part of the room occupied, or even to the very face of the occupant, the breath is breathed over again, and effete matters or injurious emanations mingle with the vital air. A special atmosphere, readily vitiated, forms around a cot or within the curtains of a bed. The lowest layers of air about or under a bed, or by the cot near it, become soonest impure ; respired vapour is heavy, and contains moisture, with numerous particles that settle in it, contaminating the lower stratum of air even when nothing is left near the bed that should be removed.

Young children bear cold badly. In removing them to a separate room means must be taken to secure moderate warmth. Sudden changes of temperature are to be avoided, and special care must be taken against any long continuance in a low temperature. A small child soon loses heat, and is most depressed by such loss during sleep. In many cases of illness or weakness a fall of ten degrees in the child's room may be of the utmost injury. Besides proper means of warming children's rooms, and care to see that windows are closed in cold weather after the air of the room is changed, the chamber thermometer, an indispensable requisite for the nursery, must always be consulted. The bath thermometer, with its metal trough and high index, often extending to the boiling-point at 212°, does not answer the purpose ; and, moreover, should always be kept in the bath-room to be ready for use in any bath, whether cold, tepid, or hot; but a cheaper instrument, mounted on wood, with more open register, the degrees from 50 to 70 conspicuously marked, should be so placed in any room that the variations can easily be noted.

The temperature of the room is a fair guide for the cold and tepid bath. It is well to add a little warm water to the children's bath, or to wash them in warm or tepid water and sponge over the surface with water of the temperature of the room, just before drying with a warm towel and gentle friction. The ablution of young infants must always be in warm water about 90°, or raised as much above the temperature of the room as the nurse may judge necessary; here the sensation of the hand and arm may generally be trusted, but the correctness of the estimate should now and then be tested by a thermometer. A warm, or hot bath, for the complete immersion of a child, should never be given without careful use of an accurate thermometer. A temperature of 98° is quite enough to begin with, and even then the child should be immersed gradually and gently. For the relief of pain a heat of 99° or 100° may be required; if so, the child should be removed on to a warm flannel while more hot water is added, and the exact thermometric degree obtained. No hurry is ever allowable in preparing a hot bath. Many of the emergencies for which a hot bath is recommended would be more safely managed with merely a warm or tepid bath. Time is also required for consideration as to whether a hot bath is appropriate; it is seldom proper during febrile symptoms of any kind; elevating the temperature of the blood above the normal is a stimulus to be used with caution; warmth just sufficient to dilate the surface circulation, while still below the body-heat, cools the blood as it comes by successive pulsations in contact with the surrounding medium, and often gives much internal relief. Any sudden impress of heat tends to close the surface vessels, much as the shock of cold would do, for the moment. Too warm a medium, beyond the excitement at first produced, rapidly induces exhaustion in young creatures. Older persons may be reminded that in consequence of the contraction of the surface-vessels by sudden chill, less heat is abstracted from the body by a plunge into ice-cold water than by a long stay in water not many degrees below the heat of the body. This applies to the bath in health; a good swimmer may indulge long in the summer bath, as exercise raises the body-heat; the morning "tub" should be a short process. A bath to lower fever should not be far below the degree of fever present.

Children sometimes suffer fatigue or chill from the way in which they are first dressed in the morning; they require a biscuit or some milk as soon as they get up, and before the ablutions begin; it is much better to give them a general wash in warmed water, in which they could stand while being sponged over with cool or tepid water, than to chill them when their powers of reaction are at their lowest. The soap used should not be irritating from excess of alkali, or from impure and imperfectly combined ingredients. Babies most easily suffer from this, and also from want of care in the warmth of the water used, or from harsh rubbing; they also suffer many things both from the kind of dress and the fashion of dressing them; a broad band is so rolled on as to compress the abdomen, and comes up so high on the chest as to interfere both directly and indirectly with free breathing; then come complex, many-stringed instruments of torture, while thick folds of linen, flannel, or even macintosh, curiously involve the legs; over all comes an inexplicable length of garment that is actually doubled on to the child, so as to ensure every form of over-heating, pressure, and encumberment. After a month of this process, aided by hoods, flannels, shawls, and wraps of all kinds, a strange variation is adopted; the under bands and folds are left, but a short outer garment is provided, with curious holes cut in the stiffened edges, so as to make sure that it shall afford no protection to legs, arms, or neck, if it were, indeed, fashioned to cover or even to come at all close to them. To prevent the possibility of this, and thoroughly to expose the chest and arms a string or ribbon ties the edge of the degenerated or absorbed neck or shoulder-piece to what remains of a rudimentary or metamorphosed sleeve.

It is interesting to know that this picturesque fragment of some past phase of dress development can be preserved without the sacrifice of effective covering by inserting a close sleeve, or putting beneath the frills a little knitted jacket; or one of soft texture can be made to go moderately high on to the neck, with a seam over the shoulder, to let it lie flat to the upper part of the chest, and a sleeve cut with a good angle for the elbow and a very short inside seam; this bit of clothing, if of nice material and colour, has a pretty effect under the open-work embroidery, thus shown off to advantage without risking the exposure of half the child's body. Effective protection of the other half, which it is most important to keep warm, presents greater difficulties. Much irritation is produced by keeping damp clothes close to the skin, and more when caustic soda has been used in washing and is left from careless rinsing and drying. All impervious wraps are to be avoided; there must be frequent changes of linen. An infant's tender skin has to be kept dry; it is soothed and protected by the use of violet powder after being washed. The best toilet powders are, in some degree, antiseptic, and are constantly improving in this direction. French chalk, white fuller's earth, or Taylor's Cimolia already replace starch, and, instead of orris-root, eucalyptus oil, oleate of zinc or boracic acid might be, and are, used in nursery powder; some of the milder disinfecting powders may be sparingly brought into use.

Young children suffer much from the direct effect of a hot sun, or from hot weather and out-door exertion during the hotter parts of the day. Not only is sun-stroke, or the fever of insolation, a danger, but the enervation from heat renders children specially unable to resist many of the diseases of warm seasons, particularly diarrhœa. Besides care as to the time for, and duration of, exercise and exposure in hot seasons and climates, cooling the room by ventilation, perhaps with evaporation outside and ice within, should be attended to. The degree of warmth that enfeebles us is also that most favourable to many lower forms of life inimical to ours, and to many of the disintegrating changes on which they flourish; great care is therefore necessary in keeping rooms, inside and outside, clear of all refuse that might favour their development; also that no remains of food are left in dwelling-rooms, nor any article of diet kept there.

In warm weather various methods of artificial refrigeration will be required for the food kept in the house. A porous cover for some things, with means of evaporation, will answer, or ice can be used. It is not always easy nor convenient to keep the larder below 50°, yet there is risk in having any kind of food day by day in rooms at the temperature suitable for one's own health or comfort. There are other reasons to be given farther on for not allowing milk, bread and butter, biscuits, or fruit to be kept in the nursery, but here it is well to insist on one particular point—viz., that the temperature of a room for children to live in should be higher than that where food can be safely kept; and, conversely, that a room cool enough for a larder is not fit for a nursery.

Short contact with quite cold air or water is injurious to infants; prolonged exposure to the low temperature of a cold house or chamber still more so; most so when the air is not only cold, but damp. In houses otherwise healthy, the onset of acute disease in children, of inward congestions, glandular swelling, tubercle, dropsy, has started from the occurrence of unusually low temperature in their rooms, during exceptionally cold weather, when the means of maintaining sufficient warmth have been neglected, or applied with difficulty.* Children are also

* The germs of some diseases, as the *micrococcus* of pneumonia for one, are either always present in the body or readily developed from healthy protoplasm under the influence of chill or depression.

to be guarded against sudden changes of temperature. After some days in a well-warmed room the first promenade should be short. A child of four or five years old cannot bear a long walk in cold weather, but soon tires, and is then still more liable to suffer from cold. Out of doors, children passing from a sheltered to an exposed position, the turn of a street, the draught in a passage, may get a chill; or, returning indoors hot and excited from running or play, the wraps being removed though the room to which they have returned is only half warmed, perhaps has become too far cooled from open windows or neglected fire, they catch cold more on coming indoors than on going out. An infant in arms is often chilled in this way; closely muffled at starting out, carried near the nurse's body, under warm coverings, or shut in a carriage with closed windows, it is brought home, hot and perspiring, and laid down asleep (its load of clothes removed) on a cold cot in the chill quiet of the bedroom, while the other children prepare for dinner; no wonder the youngest suffers first. Not only should the woollen clothes and coverings not be removed at once, but the chamber thermometer should be consulted. Prevention of illness is better than cure, and for both objects a thermometer in the children's room is indispensable. The delicate and expensive clinical thermometer, invaluable in marking the changes of disease, and useful in some of the variations in health when in skilled hands, is often misleading in the nursery; there its only safe purpose, in the hands of the nurse, is to test the accuracy of the bath thermometer.

The best and most trustworthy means of being assured of the continuous well-being of infants and children is an accurate record of their weight. In infants weight alone may be depended upon; for older children, growth as measured by height must also be noted. The two taken together, if increasing, afford evidence of progress, and, if interrupted, give timely warning of some impending difficulties. At first, gain in weight is much more marked than increase in length; these increments seldom advance in close proportion to each other, though a certain relation between the two should always be preserved. An increase in weight often precedes further growth, and rapid growth is often interrupted while weight is being made up. Particular care both as to rest, occupation, and food is required when a growing child ceases to gain in weight.

The rate of growth for young children varies greatly at different periods of infancy, and follows laws of its own.

The proportion between the age, weight, and height of infants has a bearing on successful nursery management of much the same import as that observed all through the period of childhood. On comparing healthy, well-fed infants, with others on artificial food, very little difference in height is found at first, but instead of gaining four pounds of weight in three months, they gain less than three pounds, and advance by half a pound monthly, instead of by a pound or more. The rapid rate of increase in the earlier months of infancy, and the variations which are then observable, make a separate study of this period essential. A vigorous healthy child should double its birth-weight in the first four or five months, and treble it at a year old. This rate of growth is not uniform, nor does it proceed at any steadily-decreasing ratio, but is subject to the variations shown on the diagrams.

Fig. 407 is a diagram of the rate of increase for the first year, from "Our Homes" by permission :—

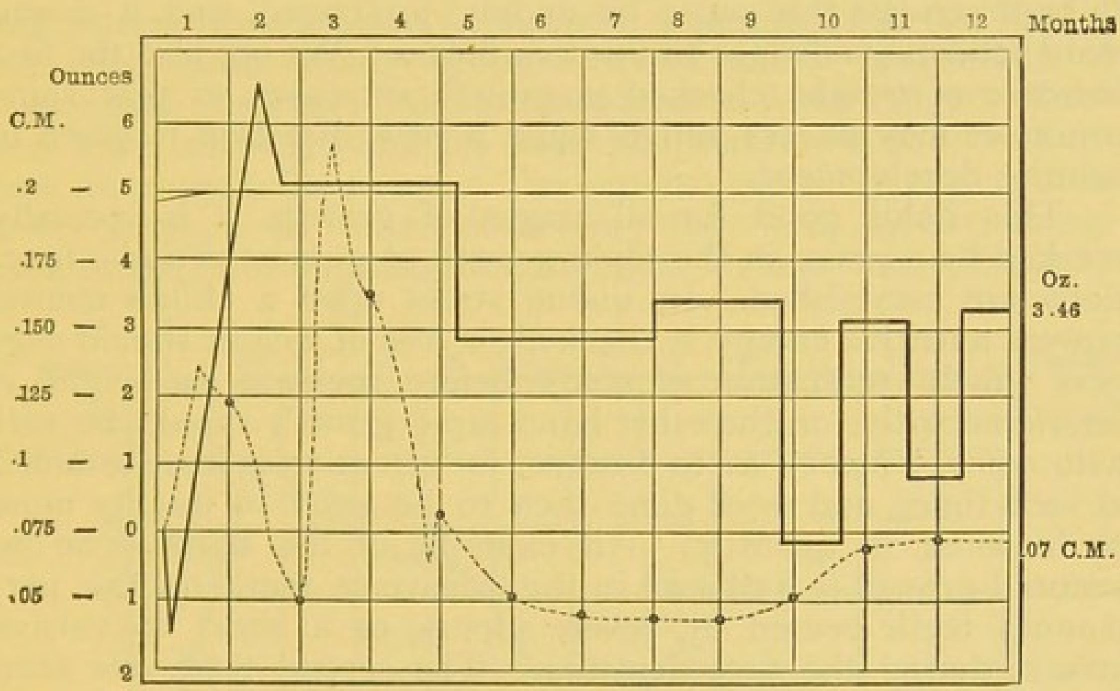



Fig. 407.—The black line shows the Average Weekly Rate of Increase in ounces, The dotted line gives the Average Daily Growth in centimetres, two fifths of an inch, from measurements by Dr. Haehner.

At first, under the new conditions of life, there is always a *loss* of weight, amounting on the second and third day to three or four ounces a day; so that a child three days old may weigh half a pound less than it did at birth. This is called the physiological loss, and is said to average six per cent. of the birth-weight. Nutritive matters, or the waste of past nutritive processes, stored up in the body of the child, are now utilised, and the way is cleared for new material to be readily assimilated Very soon, after food is taken freely, the loss of weight ceases;

often a gain begins on the fourth day. The first loss in weight is mostly, or should be always, more than made up before the end of the first week. A progressive increase of weight now goes on at the rate of two or three ounces for the second week, at four and five ounces for the next two weeks, and at six ounces a week, or even an ounce a day, in part of the second month, when the increase is greatest. For the next two months a uniform gain, at the rate of five ounces a week, is maintained, while growth is more rapid than in the previous month. In the fifth, sixth, and seventh month, the rate of increase for weight falls to three ounces a week; growth also pauses a little, and both undergo some variation while dentition is proceeding. The natural period of most rapid growth comes to a pause about the fifth month in healthy children, when the teeth are forming, and a further demand on the nutritive supply is made. Care has to to be taken lest this pause be unduly prolonged, and a downward tendency advance to positive illness. We see also the first increase of weight checked as growth increases, so that some processes may be less active while a new direction is given to healthy development.

This holds good for all stages of growth, it is specially marked by a pause in the rapid growth of girls as periodic functions are established. In undue stress upon a child's mental powers nutritive energy is checked; a loss of weight should suggest timely relaxation of study before increase in height is interfered with; on the other hand rapid growth should be met with some leniency as to lessons, for attention is less sustained at such times, and work done then to be good in quality must be lessened in quantity. An example of the harm done by arrested growth is well seen in the transverse mark on the permanent teeth caused by severe illness, or a short convulsive attack, during the first dentition. The second teeth are then forming, and as they suffer permanently so must other structures essential to future vigour. It is possible that the fall in growth-rate from six to ten months, both in weight and height, seen in the diagram, would be less if dentition were aided by some fitter food supply. The formation of teeth is itself an evidence of healthy progress; any interruption of health delays their appearance. To persist in the use of diluted milk, highly charged with sugar, or thickened with the starch of corn-flour, instead of with whole meal or other more substantial food, until the teeth appear, is to become involved in a vicious circle from which the escape is slow, and not without risk. Good teeth are the sign of precedent health; not only do the first teeth decay early when health has been precarious in infancy, but in serious constitutional disease, the second set of teeth will be injured, and the six-year-old molars imperfect. In estimating healthy development at the end of childhood, the change of teeth, and the appearance of the bicuspids and large molars, at twelve years old, is as much part of healthy growth as the increase in weight and height then observable.

The diagram of these changes will serve to fix attention on normal progress of infantile growth, and as a reference-table by which any slight departure from health in the earlier months may be at once recognised, and so lead to the detection, perhaps to the removal, of its cause before any serious interference with sound development has occurred.

Much of the comfort and happiness of all concerned depends upon the uninterrupted well-being and steady nutrition of infants in the earlier months. Regular and systematic weighing, as the only trustworthy criterion of healthy infantile progress, has of late years been widely adopted in the public institutions of France and Germany. We are indebted to Anna Angell, of the New York Infant Asylum, for many hundred careful observations, week after week, for a year. The results agree very closely with those obtained by other observers; they are approximately given in the following diagram, Fig. 408. *(From "Our Homes.")*

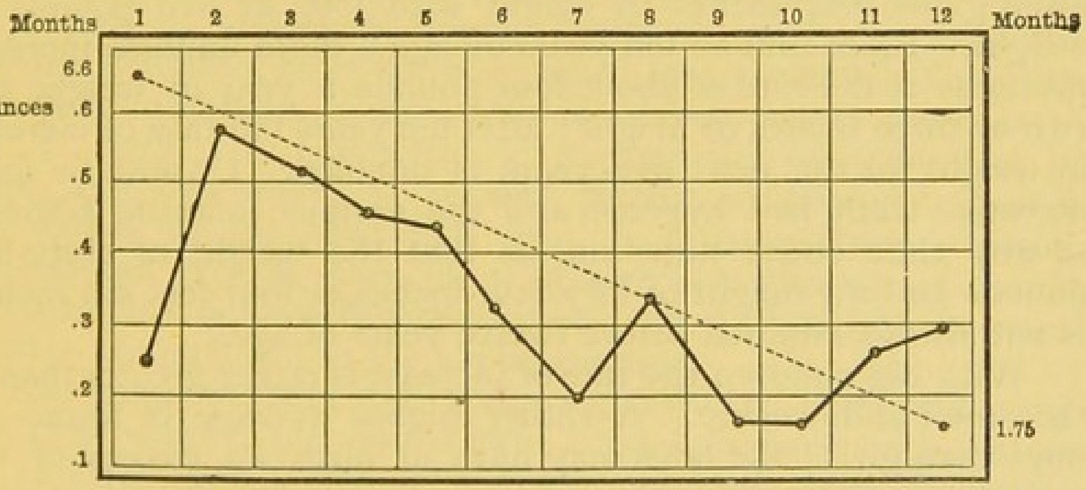



Fig. 408.—Average Weekly Gain in Weight for each Month, drawn from observations by Dr. Anna Angell, of New York. The dotted line shows Bouchut's estimate of the Progressive Decline in Rate of Growth.

By these Figures the rapid rate of growth after the first week is seen at a glance. The critical time for making sure that the infant is obtaining the proper supply of food, and is thriving on it, is in the first six weeks, and there is no means of doing this so reliable as weighing. In this way the check to nutrition is often discovered before any of the painful, and often unmanageable, symptoms of athrepsia are declared. There are some conditions unfavourable to the health of infants not discoverable by weighing, but this means would serve to point out the most frequent of them in time to avert their worst consequences.

For infants under three years of age, weight is the best criterion of progress; for children of three years old and upwards, height and weight must always be taken together; in order to judge of healthy growth it may be sufficient to do this three or four times a year.

Growth is very irregular in children and young people generally; perhaps two inches may be gained in two months, and for the next ten months not another inch, even up to the ages of ten or twelve years. This increase is most noticed in the spring and early summer with us; but it is not restricted to this part of the year as seems to be the case in more northern latitudes. While growth is most rapid, fatigue is readily induced; during the pause weight is gained, and work or training can go on again.

In the first two years after birth a child should gain twenty pounds in weight and ten inches in height. The chief increase in growth and weight is in the first year, thirteen or fourteen pounds of the gain in weight being in the first year, and seven or eight pounds in the second. The third year also is one of active growth, the first dentition is completed, and the child often gains four inches in height with four or five pounds in weight. From four to ten years of age a more uniform increase proceeds at the rate of about four pounds a year in weight and two or three inches in height; after ten years the rate of increase in weight for the next five years is doubled. Unsuitable food, defective teeth, bad hygiene, and the various infantile ailments at any time check nutrition, so that the weight of sixty-five pounds and the height of fifty-four inches, or four feet six inches, is not always attained before twelve years of age.

With big children the rate of increase is rather greater than in the small and weakly. A rather higher average is found for boys than girls; the boys may have at birth an excess of ten ounces in weight and half an inch in length, but this is of very little importance, as individuals of either sex may commence life at a weight of nearly two pounds, more or less, than the average. Setting aside the extremes, and taking children who are within a pound weight either way of the ordinary size at birth, there is less difference than might be expected in the rate of growth after the first year. This is also true for the difference in sex, and exactly corresponding weight and measure for both sexes at each age up to ten or twelve years occur; at this time girls grow as fast as boys or faster, and often increase as much in weight, but growth ceases sooner with them.

## TABLE OF CHILDREN'S HEIGHTS AND WEIGHTS.

*(For both sexes: add to height half an inch for shoes, and to weight* 5, 7, *or* 10 *lbs., according to age, for clothes.)*

| Age. | Average Height. | Average Weight. | Range more and less. | |
|---|---|---|---|---|
| | | | in inches. | in lbs. |
| At birth. | 19 inches | 7 lbs. | 3 | +5 − 2 |
| 1 year. | 28 „ | 21 „ | 4 | 4 − 3 |
| 2 „ | 32 „ | 28 „ | 4 | 3 |
| „ | 35 „ | 31 „ | 4 | 3 |
| 4 „ | 38 „ | 35 „ | 4 | 5 |
| 5 „ | 41 „ | 40 „ | 4½ | 5 − 3 |
| 6 „ | 43 „ | 44 „ | 5 | 6 |
| 7 „ | 45 „ | 48 „ | 4½ | 8 |
| 8 „ | 47 „ | 52 „ | 4 | 10 |
| 9 „ | 49 „ | 56 „ | 4 | 10 |
| 10 „ | 51 „ | 60 „ | 4 | 10 |
| 11 „ | 54 „ | 67 „ | 5 | 12 |
| 12 „ | 56 „ | 72 „ | 6 | 14 |
| 13 „ | 58 „ | 80 „ | 7 | 19+ |
| 14 „ | 60 „ | 90 „ | 8 | 20+ |
| 15 „ | 62 „ | 100 „ | 8 | 25+ |

The above are the limits found to be consistent with health in children. Divergences due to illness or markedly abnormal in either direction, have not been taken into account. The birth of a child weighing twenty pounds is recorded in the *Lancet*, Vol. II., 1886. A Gargantua at a year old, of three feet in length and five stones, or seventy pounds weight, who gained two stones in the next half year, is reported from Canada. Exceptional growth more often occurs from the age of twelve onwards; but neither Brobdignadians, nor Lilliputians, however healthy, are included in the above averages.

The range in both directions is given from cases under my own observation; the results have been compared with Tables in Charles Robert's "Manual of Anthropometry." Weight should vary with height, thus lads who are only fifty-four inches high at fifteen and sixteen weigh seventy pounds, the same as boys who are that height at twelve years; yet rapid growth has to be allowed for on the one side and mature age on the other. A youth five feet four inches at thirteen weighed over one hundred pounds, but others the same height at seventeen and nineteen years of age were from five to ten pounds heavier; an addition of this amount has to be made in estimating the right ratio of weight to height in adults.

The circumference of the chest, and the degree of expansion at different ages is noteworthy. The average chest measurements of 3,362 children from eight to ten years of age was from $22\frac{1}{2}$ to 23 inches after breathing out, and 24 to 25 inches after drawing a full breath ; of 3,478 children, eleven and twelve years of age, the average was, chest empty, 24 and $24\frac{1}{2}$ inches ; chest full, 26 and $26\frac{1}{2}$ inches. Rather more boys than girls were measured, they were factory hands ; the boys had a somewhat freer chest expansion. My own measurements give 27 and 30 inches for girls twelve years of age.

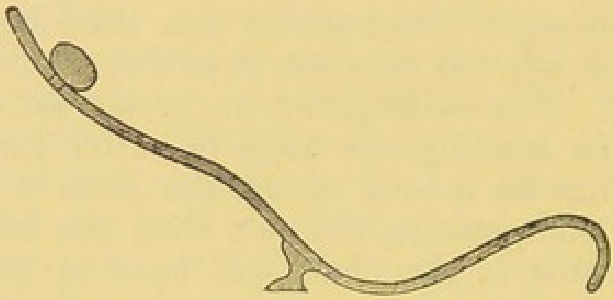
Of the changes produced by illness in children, two or three instances may be given. First, a boy ten years old, after scarlet fever had lost four pounds in weight ; this he regained in one month after convalescence, and added another five pounds in the next three months. Second, a weakly boy, eight years old, height forty-six inches, weight forty-two pounds, had gained no weight and but one inch in height during six months' care in London ; he then goes into the country for three months—August, September, and October—gains eight pounds and grows another inch ; at nine years old he gets to the proportions of fifty pounds and fifty inches, the average height but not the average weight, until, after another year of care, he became strong and well. Another boy of this age, the same weight but an inch shorter, made no advance, and then, with slight febrile action, began to lose flesh, till his weight in pounds became less than his height in inches ; he did not recover. It may be noted in the table that till the sixth year the height in inches exceeds the weight in pounds, and that, from eight to twelve years, the height in feet and the weight in stones nearly correspond ; as growth advances a still further increase of weight over height should occur. A child in the fourth year should be three feet high, and weigh more than two stones ; in the sixth year, three and a half feet high, and weigh three stones ; in the ninth year, four feet high and four stones in weight. At adolescence, one stone should be gained for every two or three inches of height ; eight stones for five feet four inches ; ten stones for five feet eight ; eleven stones for five feet eleven inches ; and twelve stones for six feet of height is good weight.

The increase of short-sightedness with the increase of education, is an evil so important to guard against and prevent, that some of the rules to this end will be explained. Young children must have a good light while they are busy ; they should not be long engaged with small objects very near the eyes, close attention to threading beads, or toys held to the mouth for blowing through, may lead to weak or short sight, or to squinting. A stooping position and too prolonged attention conspire, with other causes, as a child's instruction advances, to produce that widely spread but avoidable evil of civilized life, short sight. Books for the young should have large type and not be used in a dim or a hot glaring light. Insufficient or ill-arranged light obliges us to lessen the distance between the eye and the book; this is done in twilight, and must occur if the desk and seats are not rightly proportioned. Children are sometimes seated on insufficiently raised seats and so have their faces too near the table. Ten inches should be the least distance between the eye and the book, and copy-books should not be placed straight upon the desk, but so that the lines slope upwards to the right; a straight down-stroke can then be made without bringing the left eye too near the paper, or giving a twist to the head and body. For writing, the paper should be raised by an angle of 20°; for reading, the book is better raised to 40°; the two eyes can thus be moved along the lines without fatiguing the muscles or compressing the eye, then the book must not be too far on the table, or the child will have to sit on the edge of the seat and lean forward and press against the chest, or use the arms in support. The seats must have backs, not too high, and not standing backwards; the back ought to be straight, with a firm bar of wood about three inches broad to come across the loins close above the hips. The seat should be broad enough to take the whole length of the thigh, and a foot-board should be so fixed as to let the foot rest naturally on it. The edge of the desk must be perpendicularly above that of the seat, and just high enough to allow the elbow to rest on it, without displacing the shoulders. For school work the back of the seats should consist only of the support before mentioned; for boys it should be one inch lower than the edge of the table, and for girls one inch higher than the table. The keyboard of a piano is 2ft. 3in. high; for children, a high chair, with low back and movable foot-rest, should take the place of the music-stool. Too long a time at once is often directed to lessons; the length of application or attention has to be varied with the age of the child.

Not only short sight, but various spinal deformities, result from inattention to the above directions. The reciprocal influence of seats and lighting is well insisted on by Mr. Liebreich; he says, "A back-rest is necessary to avoid short-sightedness, and good light is necessary to avoid curvature of the spine. For preservation of sight, as well as of a normal figure, the possibility of remaining in a normal posture during school time, and especially when writing, is an absolute necessity."

Growing girls require a complete and easy rest for the body during some part of the day. In Mr. Liebreich's lectures on

" School Life and its Influence on Sight and Figure," a model of a good chair for this purpose is given. The essential part of this is the firm upper surface bent to follow the curves of the spine, and so give complete support and rest to the back. By prolonging the lower end a little downwards, and adding a projecting foot to the lowest part of the back, the framework is done away with, and the bent board will stand firmly anywhere, and form a very convenient reclining-board. Messrs. Callaghan, New Bond Street, are the agents for this simple structure.



Such boards are very useful, for a rest of ten minutes, in relieving the fatigue of the upright position, or in the intervals of lessons when active play is not to be had. By means of easy rest and varied exercise, rather than by the rigid backboard and wooden foot-frame of a past age, we may hope to avoid the tendency to spinal curvature and short-sightedness so frequently met with.

A careful hygiene should guard the early training of childhood from every hindrance to full development, and from all interference with growth, activity and health.

Children are sometimes seated on insufficiently raised seats, and so have their faces too near the table. The ordinary tables both for meals and for books or pictures should be somewhat less in height than the average dining-table. The tables for meals or lessons should not be more than 2ft. 3in. high ; a foot-ledge can be fixed across one end of the nursery table for the younger children ; a cross-bar joining the table-legs at a lower level may be used by others. Dining tables are nearly 2ft. 6in. high. Some dining-chairs are 1ft. 6in., not high enough for young people under twelve years of age ; a cane-seated frame with raised backpiece, can be added to the chairs, and a footstool or hassock placed for the feet. Besides the high chair for infants, with its lower part convertible into a table on occasion, several low chairs, and a low stand or table big enough to set out an ark or a toy farmyard, should be provided. The top of this, fifteen inches from the floor, can be raised or extended by a movable board kept for the purpose. The little chairs should be eight inches high, with seats nine or ten inches square; others measuring twelve or fourteen inches in each direction are useful for children of all ages. The infant's chair for sitting at table is usually twenty-four inches high at the seat, with a foot-rest five inches below that. Another is made twenty-two inches high, with a foot-rest at six inches; the seat can be raised by a cushion. A child seven or eight years old requires a chair twenty inches high, with a midway foot-rest.

All rooms, whatever their purpose, should be well lighted, so that everything in them can be distinctly seen, and no part left in obscurity, nor in danger of neglect; the door should not be directly opposite the fire-place in day-rooms, without a special contrivance for ventilation, to be described farther on, as the draught is mostly from under the door to the fireplace, and so along the floor; this can do no harm in the bed-room, but is bad in a sitting room, and specially bad for children, who do, or should, spend much of their daytime in creeping or playing on the carpet.

The windows are a great means of ventilation as well as of lighting, and can be used either as outlets or inlets of air; they should not be near either the door or the fireplace, for in ventilation the outlets and inlets should not be near together; the door is always an inlet, and the fireplace should always be an outlet.

The importance of careful and efficient ventilation of the rooms occupied by children can hardly be over-estimated. The air of a closed room soon loses its freshness even when unoccupied. Chemically the proportion of oxygen may not be appreciably altered, but the more active, or ozonised, part of it is changed; innumerable particles are brought into contact with it which, if not "stealing and giving odours," may add what is imperceptibly injurious, and will certainly take away from it the quality of freshness. Movement of air through a room is a first essential of ventilation; then the quantity and rate of movement has to be considered, taking care that the temperature, and other qualities, are so preserved as to be both pleasant and wholesome.

Exact comparisons are wanting as to the relative amount of respiratory products between children and adults; children, though with smaller organs, have more activity of function, a quicker rate of breathing, and tissue-change is rapid. Instead of considering two children as one adult in the cubic space allotted and the amount of air per hour required, "the safest course is," Dr. Parkes observes, "to have the same rule of whatever age, excepting the very youngest and oldest, who require special conditions of warming." He also adds, "If any difference is made, children ought to be considered as evolving not less than 0.45 of a cubic foot of $CO_2$ per hour: the amount 0.6 ought to be retained for women, and 0.7 ought to be allowed for men. In this way the minimum hourly supply in health in repose ought to be for children 2,250; for women 3,000; in ordinary sickness 3,400 and 4,000 cubic feet respectively." A larger initial cubic space is required for a room that has to be continuously occupied for some days and nights, than for one occupied only at night; again, the space required in an ordinary bed-room for each person is greater than is always necessary in a room only used for a limited time, as for meals; in these rooms a greater amount of air can be admitted at one time, and they can be swept through with fresh air at more frequent periods.

The efficient ventilation of a child's first nursery, under the special conditions of warmth required, demands a full allowance of cubic space to begin with. In calculating the necessary space for bed-rooms, where equable warmth is required, any height exceeding ten feet is disadvantageous and to be left out of account. A good double-bedded room should be twenty-five feet square, giving a clear 2,000 feet for each occupant after deducting the space taken up by furniture. No bed-room should be without a fireplace.

The nurse's room should be not less than 15 feet square, if the child has to sleep there; no food is to be kept or prepared in the room and no clothes dried or aired there; moreover, a convenient lobby must provide for the immediate reception of all that has to be removed; soiled clothes should be taken out at once, and covered with a weak deodorising solution.

If any accident or illness befall a child, not only separate care but an increased air-space is at once needed. It has been calculated that a single drop of decomposing matter from a burn or abrasion of the skin would supply one hundred million* diffusable particles, or "germs," to the air; or from five to ten times the number likely to be found in the atmosphere of a good-sized room. With the most scrupulous attention to every detail of cleanliness, to keep the air pure, it is still necessary that invalids should be changed from one room to another during illness, and afterwards removed for a change of air altogether. What has been called the two-room treatment of

---

* It is said (Graham Lectures, 1887, T. E. Thorpe) that the smallest organic particle visible by the microscope contains near a million organic molecules, and that a molecule of organic matter has some 50 elementary atoms. The smallest microscopic cube as yet measured has been calculated to hold two million organic particles, equal to 60 million molecules of oxygen.

disease should always be adopted ; for infectious diseases these rooms should be in the upper part of the house, or on a level above the nursery floor.

Ventilation of the spaces under the floors of houses is very necessary ; gratings in the opposite walls should admit air-currents between the floors and ceilings ; any evils from chilling the floors are less and more easily obviated than those arising from the heated and stagnant air of the spaces beneath. Organic particles from the room penetrate and settle in the joints of the boarding, or are scoured into them with moisture enough to make them dangerous. The temperature of these spaces beneath the boards often becomes higher than that of the room —much higher near any stove or fireplace, and remains long at the point most favourable for the development and activity of infectious particles.

A room fifteen feet square and nine feet high may afford sufficient cubic space for a nurse and two children ; with good and careful management, a nurse, infant, and two other young children, have occupied a bed-room of this size without detriment to health ; no useless articles of furniture or of drapery were allowed entrance ; both a dressing-room and a bath-room were close at hand, care was taken to keep the air of the room pure, no open vessels were allowed to remain, the door, never quite closed, admitted light and air from the passage, the two windows were partly open on the summer nights, and the fire always lighted before bedtime in the winter. Children from seven to nine or ten years of age may have separate bed-rooms, and after that age a separate dormitory for each is requisite. A space of fourteen or fifteen feet by eight or nine feet wide permits of a bed four feet wide to be placed between the door and the wall, and a fireplace in the opposite wall to be beyond the foot of the bed.

A child until two years old must sleep with the nurse, and requires the same allowance of cubic space. From two to five or seven years of age two children may be estimated as one adult in calculating the amount of initial air-space wanted in the bed-rooms, and this only in rooms of the best construction and management ; each candle is to be counted as a child, and every gas-burner as a grown-up person. In well-arranged houses a good supply of pure warmed air will enter the bed rooms from the staircase and corridors by spaces purposely left near the floor or under the door ; half an inch left under each door, or three-quarters of an inch at the top obtained by bevelling the upper edge of the door, would provide such spaces, which should together be equal to twenty-four square inches for each person ;

theoretically, the inlets and outlets should be equal; practically, they equalise themselves whatever we do, and one or two grated openings may be placed in the angle of the walls and ceiling. A fire will draw to itself a supply of air, and so ensure ventilation, and perhaps a draught; an open fireplace with no fire in the winter will let in cold air, unless some means of prevention are used. A Galton's stove is so constructed as to warm the air before it is admitted to the room.

The windows should be provided with shutters, both to keep off draught and to shut out some of the light when this may be necessary; they aid materially in lessening the chill that in cold weather always strikes in from the windows, and then require the aid of curtains for further preservation of warmth. A stout linen or jute fabric makes a good protective window-curtain for the winter. All woollen hangings are objectionable in a bed room, as they readily absorb moisture and all organic particles suspended in it or floating in the air; the bed-curtains should be confined to the upper end of the bed, and be of dimity or some thin linen material. The ceiling of the room should be such as to bear rubbing over; it is better of a grey or cream colour than white, so as not to reflect too much light on the upward gaze of children. The walls of the bed-room are best distempered, or painted in some even tone of quiet colour; if the wall is papered it should be varnished over, and the paper must have no bright-coloured, intricate pattern spots, and no vivid greens likely to contain arsenic. The floor must not be carpeted all over, certainly not under the bed, and it is better to have the boards stained and left bare round the sides of the room; the top edge of the skirting-board should be rounded off in all rooms for children. Iron bed-frames should have round edges. Slips of soft carpet by the sides of the bed, and from the door to the fireplace, if not all over the centre of the room, are sufficient.

The materials in general use for bedding are such as comply fairly with the qualities that are required in them and the purposes to be served. Wool, though the best material for preserving the warmth of the body, absorbs moisture very rapidly; but the moisture from the breath and skin contains much that is better not absorbed, consequently, the woollen blankets are properly covered with linen or cotton sheets. Cotton is best for the night covering, as it is very non-absorbent of water, and conducts heat rather less rapidly than linen. Linen makes a very good covering for the mattress; this should be stuffed with horsehair, and the under palliasse with straw; these are the two materials least absorbent of water and permeable organic matter. Wool and feathers are most absorbent, hence the stout tick and white linen cover requisite for a pillow-case. All hydroscopic substances absorb animal effluvia most freely, and more so if of a dark colour.

The sleeping-rooms for children should never be at the top of the house, or there will be tiresome stair-climbing; the day-room should never be in the basement, as arranged for in some otherwise good suburban houses, for the air of a room below the ground-level can never be dry and pure. No sink or cistern is to be placed on the same floor as the nurseries. The position of the closet has received full notice elsewhere. Any water-closet, of course, will project beyond the walls of the rooms so as to allow of cross ventilation and preclude all air entering from it to the house. The cistern for the supply of this closet will be out of doors, covered, and sheltered from the sun. Warmth fills any space above the water with vapour that readily entangles organic particles and favours their increase. An indoor cistern is likely to give off malarial moisture as well as itself to receive taint.

Drinking water should be brought up fresh, filtered, and kept cool. Children require a large supply; this may be supplemented by some drinks, as lemon, or toast-water, made with boiling water, which has been thus further purified; it will remain fit to drink for a day or night, if covered, in a cool place, and not kept too long. Any tap for drinking-water is never prudent; nor should there be a tap for any domestic supply of water near the nursery. A tap implies a something to catch drops from it, and so either a damp surface is maintained, or there must be a pipe to carry off the overflow, which, if it conducts nothing bad into the house from a distance, becomes the source of multitudinous particles that will ferment everywhere. So with a sink, however ingenious the trapping, foul air returns by the waste-pipe. This must be as short as possible, just so as merely to pierce the wall, and open with a free end over a catch-basin; the pipe will be foul even if only clean water pass through it, and it is difficult to prevent it becoming part of the ventilation of the house, mostly as an inlet. The manifest convenience of having a sink near to rid the nursery department of soiled water has to be weighed against the tendency of all servants to misuse such convenience, and it is best to decide against such sources of mischief, and to make the best of a well-placed lobby or closet for the temporary reception of waste. All slops must be carried down to some place in the basement; washing up is best done below stairs in some outhouse or scullery. The waste-pipe of the bath is a difficulty; it must be short, and end directly in the open air without any close connection with other pipes or drains; the bath opening of it should be kept closed when the bath is empty. The bath-room is often a vestibule to the closet, or an offshoot of the dressing-room; where a lavatory may be convenient, the washing-basin should open into a removable slop-jar beneath; and, if this is in a lobby to the closet, besides a small hand vessel there, a wooden frame ten inches square, with a moveable round lid, should cover an ordinary chamber vessel, a little raised, and so placed as to be ready of access for children.

The day and night nurseries are better situated on separate floors, or at some distance apart; where this cannot be done, they should be arranged not to communicate directly with each other, so that one set of rooms may have the windows left open to the air for a good blow through, without fear at the same time of the other room being chilled.

In the bed-room less light is needed, more care is required as to draught, nor do children want to be constantly looking out of window. Moreover, a large window is the great cooling surface in a room, one which cannot be banked up and shut off by thick heavy curtains, as in the sitting-room, nor can its cooling effect be counteracted by a jolly fire; that would be disturbing and out of place in the children's sleeping-room. Neither thick bright carpets on the floor, nor pretty patterns on the wall, nor shelves, nor books, nor pictures, nor the endless little ornaments and toys of the sitting-room and play-room, would be in place in the bed-room.

There should be a dressing-room in close proximity to the bed-room, where the children's clothes can be left in readiness for the morning. A fire can be lighted here on cold nights and mornings, or hot water brought; a fan-light over the door of this room would convey light enough to the nursery for the night. The nurse's room must communicate directly with the children's bed-room, and so give them sufficient light. The nurse must have means of illumination at command; a candle, with a glass shade ready, can be lighted at the night-light. A covered vessel over an ordinary Child's or Price's night-light will serve to keep food warm for an infant. A gas-light in a lobby, with glass over the doors leading into both rooms, is easily turned higher when wanted, either for better light, or for warming food with a proper arrangement.

There is always risk in using spirit lamps in the nursery; the open flame is most dangerous, and the safest lamp may be upset. A solid-flame spirit-lamp, with stand, kettle, and other additions, affords a convenient method for warming food, or even for boiling water in the night. This is better done out of the bed-room, not only to avoid a chance of accident and the disturbances of noise and glare, but to prevent the possibility of food being brought into the room before it is wanted. Milk is specially prone to absorb into itself any volatile or organic emanations floating in the air; and the very qualities that adapt it, in a way that no other food is adapted, to be the most suitable nourishment of a child, render it more liable to convey injurious particles to the child's actively-absorbent surfaces. Any article of food brought upstairs for the night should be carefully covered, wherever it is placed. Milk requires more care than any other, both as to position and temperature; the nurse should have it brought up fresh at the time it is wanted for use, and see where it is kept: if not left in a sealed can, at least it should be covered, and not put near cheese, game, or remnants of food. For night use, slightly heating it and adding a little salt helps to preserve it from change. The feeding-bottle should be "scalded" after use, and the tube immersed in cold water until it is wanted again. Microscopic germs, and even masses of fungoid vegetation, were found in twenty-eight out of thirty of the caoutchouc tubes and nipples in use at a *crèche* in Paris; in some of those said to be clean some acid milk remained containing *bacteria,* these would soon set up offensive changes in any new milk added, and are themselves known as "germs of disease."

Just as no article of food and no part of the service for meals is to be kept in the day-room, so neither are they, or any clothes or linen not in use or on the beds, to be kept in the bed-room. All cupboards, closets, and wardrobes diminish by their size so much of the cubic space calculated for fresh air, and most contain things that tend to spoil its freshness. A closet built up to the ceiling in the recess by the side of the fireplace is better than a wardrobe; no dust can settle upon it, and it can be more easily cleaned and rubbed inside. The store-room will be in another part of the house, and all airing and drying of clothes should be done away from the nursery.

The robust aspect of healthy children is good evidence of the thorough hygienic state of the dwelling-house, and of the excellence of its domestic management. A ruddy glow in the face of a child tells at once of sufficient outdoor exercise and indoor ventilation. Without a full amount of fresh and pure air the cheek loses its colour and the flesh its firmness; the blood is impoverished, its circulation languid, and nutrition is interrupted. The effect of what is called "change of air" in stimulating these processes is well-known, and particularly obvious in children. Very often the good that would be done in this way is put in jeopardy by too much attention being directed to the particular place where this change is to be obtained, and too little to the sanitary state of the house and the size of the rooms to be occupied. Perhaps the smaller bed-rooms are allotted to the children, unmindful of the fact that they spend nearly half of the twenty-four hours continuously in the bed-room; or they have but one room for meals and for play, so that if kept indoors by a wet day they have to pass many hours together in one room. It may be that neglect of some of these particulars at home has occasioned the necessity for the change; if they always received the attention deserved, both at home and abroad, periodic visits to so-called "health resorts" would be required less frequently; and we might find a more uniformly healthy appearance among the children of the residents at these places were the above rules generally observed.

---

John Bale and Sons, Steam Printers, 87-89, Great Titchfield Street, W.