dioxide by the skin is an expression of the general metabolic activity of the skin, and not that of a respiratory function. This view, moreover, is in harmony with the physiology of the tissues generally.

In dry dermatitis produced by carbolic acid, the tendency noted to initial decrease of the carbon dioxide output, followed by increase when desquamation occurs, is presumably related to the thickness of the horny epidermis, which is at first increased owing to the arrest of the normal mode of shedding in fine scales, and subsequently diminished when peeling occurs.

The elimination of water by the skin now remains to be considered. This, unlike the discharge of carbon dioxide, is known to stand in relation to the general needs of the economy, in particular is it associated with heat regulation.

The diminution of the aqueous discharge of the skin caused by the application of a ligature seems to be attributable not to compression of nerves, which is probably too slight in amount and too small in extent to cause such diminution, but to the mechanical obstruction of the blood vessels which presumably in this case, as in that of ligature of the renal artery, tends to throw the secreting epithelium out of action.

The restriction of the output of water caused by the application of carbolic acid to the skin of the upper limb is associated with a remarkable parchment-like hardness of the skin, especially of the palm. That this is due to the horny epidermis becoming abnormally dry is shown by the fact that the stiffness of the skin exactly resembles that which horny epidermis [in the form of shed scales or shavings from a corn] exhibits when dry, and disappears when the skin is soaked in water; and on the other hand when horny epidermis is immersed in liquid carbolic acid it swells up and becomes softened, but on subsequent washing and drying its characters are found to be unchanged, beyond perhaps a slightly greater opacity when soaked in water, and a somewhat increased brittleness when dry. The hard, harsh condition of the epidermis in dry dermatitis is therefore due to the arrest of the secretion of sweat, being not the cause but the effect of the absence of perspiration.

On the other hand, it is quite clear that the epidermis offers a resistance to the passage of perspiration through it, for when the harsh, dry, horny cuticle is pulled off visible perspiration again makes its appearance while, conversely, so long as the hard epidermis remains attached, the surface continues hard and dry.

When vesiculation of the skin or the formation of bullæ occurs the contained fluid does not visibly escape by the ducts of the coil glands, although these may be torn across. The fluid in the cavity of the vesicle or bulla contains coagulated material, part of which is free, while the rest is deposited on the walls of the cavity, some of necessity obstructing the sweat ducts. In dry dermatitis a similar blocking of the sweat ducts occurs, for although there are no macroscopic vesicles, yet the pathological condition which forms a necessary precursor of vesiculation is present—that is to say, there is a moderate degree of spongy transformation of the prickly layer, the prickles themselves are elongated, and the spaces between them distended with coagulable exudation, some of which finds its way into the sweat ducts and is the cause of the arrest of the secretion of sweat which occurs. The dryness of the skin must therefore be regarded as mechanical in its origin.

In conclusion, I must express my great indebtedness to Professor Vaughan Harley for his kind assistance throughout the course of this research.

REFERENCES.

- ¹ On the Normal and Pathological Elimination of Carbonic Acid and Water by the Skin, *Jour. of Physiol.*, xxi, 1897, pp. 192-208. ² *Ibid.* ³ On the Elimination of Water and Carbon Dioxide from Inflamed Skin, *Jour. of Physiol.*, xxii, 1897, pp. 206-214.

ON THE INCUBATORY PERIOD IN VARICELLA OR CHICKEN-POX.

By WILLIAM SYKES, M.D., F.S.A.,

Gosport, Hants.

A CONSIDERABLE difference of statement as to the incubatory period of chicken-pox is to be found in the literature of the subject. Dr. Tannei¹ gives it as no longer than four days:

7

Dr. George Gregory² four to six days; Dr. Heberden³ who in 1761 first differentiated chicken-pox from small-pox, believed it to occupy eight or nine days; Dr. Bristowe⁴ gives it as in some cases exactly a week, but more commonly a fortnight; Dr. Eustace Smith⁵ practically the same, namely, from seven to fourteen days; Dr. Goodhart⁶ eight to sixteen days; the German author, Thomas⁷ who quotes Körber and Hesse as agreeing with him, fixes the period at thirteen to seventeen days, as does Dr. McCombie,⁸ Dr. Liveing⁹ at about thirteen days with eruption on the fourteenth; Dr. S. Gee¹⁰ gives the time as a fortnight; Dr. Clement Dukes, of Rugby (a high authority), fourteen to nineteen days, while Trousseau extends the incubation to so long a period as from fifteen to twenty days¹¹.

With the honourable exception of Dr. Goodhart, all the authors quoted have omitted to supply any details of the cases upon which the statistics of length of incubation were founded, so that it is impossible to compare their statements and reject those which appear untrustworthy. But as their observations differ so widely from each other, it seems worth while recording fresh instances which can be verified, in order to secure some certainty on the subject, and as I have had under observation a limited epidemic of chicken-pox among children of the better classes, in which I have been able to ascertain the incubation period with some approach to accuracy, I venture to bring my observations to the notice of the profession.

M. R., a young lady, aged about 17, was teaching her Sunday-school class of girls in the village school on Sunday, April 17th, 1898, when one of her little scholars complained of feeling ill and asked permission to lean against her teacher, a request good-naturedly granted. The very next day the sick child developed the rash of chicken-pox. M. R. herself exhibited the chicken-pox rash on April 23rd, just six days from this exposure, but as the disease was not recognised by her friends she was not isolated in any way. Seven days later, namely, on April 30th, her youngest brother, O. R., showed a few spots in the evening and was fully out on May 1st.

I am aware that in both these cases there is just the possibility of a fallacy of coincidence. M. R. may not have received the infection from the child who leant against her in school, but from some other source; or, on the other hand, she may have conveyed infection in her clothes from this child directly to her little brother, so lengthening his period of incubation to thirteen or fourteen days, but I do not think either of these errors likely. There were, so far as I can ascertain, no cases of chicken-pox either in class or among M. R.'s friends other than the child mentioned; while, as M. R., who is much attached to her little brother, had both nursed him and played with him frequently while her rash was fully out, it is more probable that he had been infected by her than by any other conveyed infection. It will be noticed that in both these cases when there had been close direct personal contact the incubation period was short, namely, six or seven days. As the nature of the disease was still unrecognised, little O. R. continued to attend a small Kindergarten school for the children of the upper classes. He was there for two hours each day on Monday and Tuesday, May 2nd and 3rd, with the rash fully out upon him. I saw him on the evening of May 3rd for the first time, when he was at once excluded from the school. This little Kindergarten had 16 young scholars meeting in an ordinary sitting-room. Two little boys, elder brothers of O. R., developed rash on May 5th and May 18th respectively. These cases must, however, for the purpose of our inquiry be ignored, since we have no certainty from which relative they contracted the infection. They were, moreover, both too old to attend the Kindergarten. Eleven days after O. R.'s removal from this school, on May 14th, one little pupil, H. C., exhibited a few spots of chicken-pox, and was fully out with the rash on the next day. Three days later, on May 17th, and fourteen days after O. R.'s exclusion, G. C., a brother of H. C.; F. L., T. H., W. G., L. C., and W. C., six pupils of the Kindergarten, all exhibited spots of chicken-pox; while P. L., the little sister of F. L., also an attendant of the school, showed rash the next day, May 18th.

Of one other scholar, who was removed to another town and developed chicken-pox after he arrived there, I have not as yet been able to ascertain the exact date of sickening.

So that of fifteen young children attending the Kindergarten

and brought into contact with O. R. while he was infectious during two days, one developed the eruption eleven days, six fourteen days, and one fifteen days after his removal; while in the case of one child I have no information. Therefore, of fifteen children exposed to infection 60 per cent. succumbed to the disease, and of these, 66 per cent. succumbed exactly fourteen days after their last exposure. On the other hand, H. R., an elder brother of M. R. and O. R., set out for a distant public school on May 3rd, before his brother's and sister's disease had been recognised. He developed rash on May 22nd, exactly nineteen days after last exposure to infection.

Placing these data in tabular form for the sake of ease of comparison, we get the following results:

Initials of Patients.	Date of Infection.	Date of Eruption.	Length of Incubatory period.
M. R.	April 17th	April 23rd	6 days exactly
O. R.	April 23rd and after	May 1st	Not more than 7 days
H. C.	May 2nd and 3rd	May 14th	11 or 12 days exactly
G. C., T. L., T. H., W. G., L. C., W. C., six children in all	" " "	May 17th	14 or 15 days exactly
P. L.	" " "	May 18th	15 or 16 days exactly
H. R.	May 3 or earlier	May 22nd	19 days at least

REMARKS.

1. We know so little what is taking place during the incubation period of microbic disease that we must not dogmatise on the subject. Two factors, however, we may assume to influence the earlier or later appearance of eruption in this class of cases; (a) The tissue resistance of the person infected, and (b) the amount of poison, namely, number of microbes received by him. The first factor is an obvious one, and quite sufficiently accounts for the two cases (H. C. and P. C.) recorded above, where two children, who had apparently received the same amount of poison as their schoolfellows, developed the eruption, the one three days before, the other one day after, their companions. Of course there may be accidental causes, such as propinquity or distance of seat in school, belonging to the next class of factors, which may have partly affected these results as well. The second factor requires a little more consideration, but whether we believe the period of incubation to be occupied by the increasing of the invading microbes to such a sufficient number as to be able to produce by their irritation that peculiar inflammation of the skin which constitutes the eruption, or by the development of certain chemical poison, the resultant of bacterial occupation to produce the specific inflammation in question, it seems to me obvious that the more microbes can be introduced either suddenly or continuously during the period of infection the more quickly will they themselves increase and multiply to the requisite saturation of their victims, or the more quickly will they pour out their chemical excreta to the requisitely poisonous extent.

2. In consonance with this last theory one sees why six children exposed to practically the same dose of infection absolutely all sickened on the same day. While two other children exposed to actual close bodily contact with infection sickened in a much shorter time—just exactly as inoculated chicken-pox takes a less time,¹² namely, eight days to incubate—than the average fortnight of the naturally incurred infection. While, again, the elder boy, who was only exposed to infection for a short time and in much less degree than his young brother, required the longest period of nineteen days to develop his eruption.

3. It thus appears probable, as is only reasonable from the above considerations, that the period of incubation of this class of disease is not a fixed quantity, but varies widely within certain limits; thus, while we may take fourteen days as the average period of incubation in chicken-pox, we have no great difficulty in accepting Tanner's four days or Trousseau's twenty-five days as outside limits in different direc-

tions to which the incubatory period may in certain, not perhaps very unusual, instances attain.

4. It is interesting to note in this connection that all the older writers quoted give much shorter periods of incubation in chicken-pox than the more modern ones, and that the more modern the author the longer period does he fix. Is this because we are closer and more accurate observers than our ancestors—a statement I for one cannot readily accept—or because, in consequence of our better ventilation and less stuffy rooms, the microbic poison is really less concentrated, and the period of incubation consequently longer than in earlier times? If the latter be the case, we ought to find a corresponding discrepancy in the statements of earlier and more modern authorities on the subject of the incubatory period of other microbic diseases.

[Since writing the above I have ascertained that the young scholar who was reported to have been removed to another town and there developed chicken-pox—of whom at the time of writing I had no information—who was last exposed to infection on May 3rd, developed rash on May 22nd, namely, nineteen days after last exposure to infection. It is a curious coincidence that both this child and the elder brother of O. R. who were each removed directly after infection to distant places, took the long period of nineteen days to incubate the disease, a length of incubation period only given by Dr. Clement Dukes, of Rugby, amongst English writers, who can himself for the most part only see similar cases removed as these were from the scene of infection to Rugby. Can it be that removal from local poison to pure air prolongs the incubation period?]

NOTES AND REFERENCES.

- ¹ A Practical Treatise on the Diseases of Infancy and Childhood, 1858, chap. xii, p. 223.
- ² Lectures on Eruptive Fevers, Edin., 1843.
- ³ Transactions of College of Physicians, vol. x, art. 17, vel. Comment. de Morbis, cap. 96.
- ⁴ A Treatise of the Theory and Practice of Medicine, 189, s. v. Chicken-pox.
- ⁵ A Practical Treatise on Diseases of Children, 2nd edit, 1889, chap. iv, p. 50.
- ⁶ The Diseases of Children, 4th edit, 1891, chap. xiv, p. 225.
- ⁷ Ziemssen's Cycl. of Medicine, English Trans., 1875, vol. ii, p. 15.
- ⁸ Allbutt's System of Medicine, 1897, vol. ii, p. 179.
- ⁹ Handbook of Diseases of the Skin, 1880, s. v.
- ¹⁰ Reynolds's System of Medicine, 2nd edit, 1876, vol. i, p. 219.
- ¹¹ Trousseau's Clinical Medicine, N. Syd. Soc. edit., vol. ii, p. 160.
- ¹² Thomas in Ziemssen's Cyclopaedia of Medicine (loc. cit.) gives the incubation period according to Trousseau as 13 to 17 days, while Dr. Gee in Reynolds's System repeats the statement as to Trousseau with the slight difference of 15 to 17 days. An illustration of the necessity of verification of reference. I may note here, though not altogether apropos, that Trousseau describes cases of chicken-pox apparently identical with Hutchinson's varicella prurigo. I note this as I have not seen it remarked before.
- ¹³ Steiner quoted in Ziemssen's Cyclopaedia of Medicine, supplemental volume to English translation of 1881, p. 100. On the same principle inoculated small-pox has a shorter period of incubation than the natural variety. Scarlatina also, accidentally introduced by the obstetrician into the system of the puerperal female, has a decidedly shorter incubatory period than in ordinary cases.

MEMORANDA:

MEDICAL, SURGICAL, OBSTETRICAL, THERAPEUTICAL, PATHOLOGICAL, Etc.

BROMOHYDRATE OF ARECOLINE AS A MYOTIC.

I wish to call the attention of the profession to the advantages possessed by bromohydrate of arecoline as a myotic. In this country the drug, from its clinical aspect, seems to be but little known. Slight reference has been made to it in a few of the medical papers,¹ but no one appears to have gone very deeply into the subject. On the Continent also, though Mouquet, Bardet, and Amilcare Bietti,² have mentioned it; but one, Lavagna of Monaco,³ really advocates its employment. Arecoline is one of the alkaloids of areca nut, the seed of areca catechu, and the bromohydrate is a white crystalline soluble salt. Its physiological action is closely allied to those of pilocarpin and pelletierine. Taken internally it causes vomiting and diarrhoea, and it is, in addition, a sialogogue, diaphoretic, and vermifuge.

When applied to the eye, in the form of a half per cent. aqueous solution, a sense of tingling or pricking is experienced. This lasts, however, for only a few moments and

¹ EPITOME BRITISH MEDICAL JOURNAL, October, 1890, page 15; and November, 1895, par. 485. *Pharmaceutical Journal*, November, 1896, page 39. *Manchester Medical Chronicle*, November, 1897, p. 151. *Year Book of Treatment*, 1898, page 368.

² *Archivo di Oftalmologia*, 1897, vol. v, fasc. 1-2.

³ *La Clinique Ophthalmologique*. No. 16, page 197; and No. 18, page 229.