height slight ptosis of the left upper lid manifested itself, and this feature, it was particularly noticed, became more marked when the patient was apprehensive or suffering from mental excitement, as, for instance, when the idea of operative measures was suggested to her at the consultation.

She was last seen in October and complained then of occasional attacks of blurred vision, more marked on getting out of bed in the morning or when entering a brightly lighted room. She experienced no difficulty in near work or moving about outdoors or in the house. She still suffers at times from pain down the right side of the neck, aggravated when the head is turned suddenly to the right. Has no diplopia but occasionally stumbles. The eyes show equal but dilated pupils, which react feebly to light but fairly to accommodation and convergence. Slight jerky nystagmus can still be elicited, otherwise the ocular movements are full and free; there is no squint or ptosis. The left disc is still hyperaemic, its edge blurred but definable, exudation covers the vessels in places but does not seem to cause any sudden diminution, although they as a whole seem narrowed.

A less marked condition is present in the right disc, and in addition are two patches of exudation, one above to the nasal side and one below. The vision in both is $\frac{5}{6}$ and J.1, the visual fields uncontracted, but the central scotoma remains about the same size.

The case presents several features of interest, and some problems, the solution of which can only be surmised. When first seen the only objective signs were the slight weakness of the left abductor and the suspicious neuritis of the left disc. The length of time which elapsed before the neuritis became definitely evident on the face of the disc undoubtedly pointed to a lesion affecting the nerve a long way behind the eyeball. This was further confirmed by the absence of pain or tenderness on pressure over the eyeball and the primary implication of the sixth nerve. The implication of this nerve still further assisted the localization of the seat of the mischief, for such could scarcely be anywhere else than at its situation on the body of the sphenoid where it traverses the cavernous sinus alongside the carotid artery. By direct extension of the mischief forwards the implication of the optic nerve can be explained, for, as pointed out by Onodi in his investigations on the relations of the optic sulcus, this canal can be formed entirely by the bone forming the sphenoidal sinus. It is possible that in this case the sixth nerve may have had an abnormal relationship to the carotid artery in the cavernous sinus, and instead of lying external to the artery might have lain on its mesial aspect in contact with the bone. This theory would explain why the occurrence of abducens paresis has not been recorded before. Again, the localizing feature of this paresis enables one to put out of court any liability on the part of the posterior ethmoidal cells, which, as is well known, are a frequent cause of optic neuritis.

A more difficult symptom to account for is the complaint of occipital pain, which is, I believe, almost pathognomonic of sphenoidal sinus trouble. In my humble opinion such may be attributable to implication of the sympathetic plexus around the carotid artery. That this was affected is proved by the character of the ptosis. The drooping of the lid was clearly not due to levator paresis, nor would it be reasonable to expect to find the frontal division of the third nerve implicated without at the same time the fourth nerve being involved. The ptosis in this case was due to weakness of the bundle of non-striated muscle fibres (arising between the striated fibres of the levator, along the under surface of which they run to be inserted in the upper margin of the tarsus) a muscle discovered by and named after Heinrich Müller and innervated by the sympathetic. That the sympathetic was affected is confirmed by the aggravation of the ptosis under mental excitement despite the fact that the other classical and textbook(?) symptoms were not at the same time present.

The fortunate termination of the case is not without interest. At the first consultation one had a very strong suspicion where the mischief lay, due in no small degree to the history of rhinitis which had suddenly ceased. When, then, a fairly lengthened interval elapsed before the neuritis became evident on the face of the optic nerve, the diagnosis became settled and I ventured to express the opinion that the recurrence of the original cold in the head would prove a blessing in disguise. The sequel proved the truth of this surmise, although one scarcely expected it would result so beneficially.

THE late Dr. Eustace Smith left estate valued at £2,826.

THE EFFECT OF DAYLIGHT AND DRYING ON THE HUMAN AND BOVINE TYPES OF TUBERCLE BACILLI.*

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MUCH work has already been done on the type of tubercle bacillus occurring in tuberculous lesions in the human subject.¹ The potency of the bovine type of bacillus in producing gland, bone, and joint tubercle, particularly in young subjects, is now well recognized,² as also its ability to set up a miliary tuberculosis,³ but there is a striking absence from published records of instances of primary pulmonary tuberculosis associated with bovine type infections.⁴

This incidence of bovine type infections in man is noteworthy, for in general the lungs of mammals are particularly good sites for the development of tuberculous lesions, and experimentally it is much easier to induce tuberculosis in healthy, susceptible animals—for example, rabbit or guinea-pig—by inhalation than by ingestion.⁵ The bovine type of bacillus is the less virulent for man, yet when it does infect it apparently enters by the less favourable route! A rational explanation of this anomaly is still wanting.

The lesser pathogenicity of the bovine type for the human species, though it accounts for the restriction of bovine type infections to the most susceptible members of the community—namely, the young—gives no hint why primary lung infections with the bovine type of bacillus should be so rare.

Further, while opportunities for respiratory infection with the human type of organism are admittedly numerous, as large numbers of human bacilli may be contributed to atmospheric dust through the expectoration of phthisical subjects, it hardly appears reasonable to assume that a notable number of bovine bacilli are not also disseminated atmospherically by the drying of discharges and secretions containing them.

In the naturally acquired tuberculosis of domesticated animals differences are also met with. Cattle, horses, and swine are all liable to spontaneous bovine type infections, yet while respiratory infection is the chief mode in the cow, in the horse and the pig it is most frequently alimentary (Nocard).⁶ Whether this lung incidence in domesticated animals is due to real differences in susceptibility of the lungs of these species, or merely to different modes of infection consequent upon the habits of each species, could only be settled by comparative inhalation experiments upon them.

To account for the absence of aerial infection of man by the bovine type of bacillus it has occurred to us to inquire whether atmospheric influences are more deleterious to the bovine than to the human type of bacillus. The effects of desiccation and daylight on tubercle bacilli have been studied by several observers, and, depending largely upon the experimental conditions, markedly different results have been obtained; but, so far as we know, no comparative tests have been made between typical human and bovine types of bacilli. There is general agreement that drying, even for months, has of itself little influence;⁷ however, when dried in dust Kirstein,⁸ for example, found that human tubercle bacilli did not survive diffuse daylight longer than fourteen days. Koch's cultures, exposed at a window to diffuse sunlight, died in five to seven days, while in direct sunlight they were killed in from a few minutes to several hours⁹—a period which Weinzierl¹⁰ finds shortened to from two to ten minutes when the organisms are spread in thin films and are unshaded by glass.

In our experiments we used pure cultures on egg media of bacilli of known pedigree and virulence. Both were originally derived from the human subject, had been

* A paper read in the Section of Pathology and Bacteriology at the Annual Meeting of the British Medical Association at Aberdeen, 1914. The expenses of this research were defrayed by grants from the British Medical Association and the Carnegie Trust.

TABLE I.—*Effect of Desiccation Alone.*

Weighed amounts of cultures, four weeks' growth, were placed in small sterile test tubes, loosely plugged with cotton-wool, and kept in a dark, well ventilated cupboard. Under these circumstances definite desiccation occurred. Emulsions were finally made in salt solution and amounts equivalent to 165 mg. of moist culture were injected intravenously into rabbits.

Time Culture Dried.	Rabbit.	Duration of Animal Experiment.	BOVINE TYPE.				Rabbit.	Duration of Animal Experiment.	HUMAN TYPE.			
			Lungs.	Kidneys.	Spleen.	Liver.			Lungs.	Kidneys.	Spleen.	Liver.
0 days	No. 1	23 days (k)	+++++++	+	+	+	No. 8	23 days (k)	+	—	—	—
1 day	No. 2	41 days (k)	+++++++	+	+	+	No. 9	41 days (k)	(only 1 nodule) ++	—	—	—
2 days	No. 3	39 days (d)	+++++++	+	+	+	No. 10	40 days (k)	(25 nodules) —	—	—	—
3 days	No. 4	40 days (k)	+++++++	+	+	—	No. 11	40 days (k)	+	—	—	—
4 days	No. 5	40 days (k)	++++++	+	+	—	No. 12	40 days (k)	(2 nodules) +	—	—	—
6 days	No. 6	22 days (d)	++ (25 nodules)	—	—	—	No. 13	22 days (k)	(6 nodules) —	—	—	—
7 days	No. 7	40 days (k)	+++++++	+	+	+	No. 14	40 days (k)	+	—	—	—

(d) indicates that the animal died, (k) that it was killed. The relative severity of the lesions *post mortem* is indicated by the number of crosses (+). The minus sign (—) indicates that no naked eye lesions were found. In this series the virulence of the human type of bacillus was lower than usual; see other tables. (Series begun on January 27th, 1914.)

TABLE II.—*Effect of Diffuse Daylight Alone.*

For this purpose cultures, five weeks' growth, sealed with paraffin to conserve water of condensation, were exposed at the window. After desired intervals, weighed quantities of growth were removed, emulsified and injected as before.

Time Culture Exposed.	Recorded Hours of Sunshine.	Duration of Animal Experiment.	BOVINE TYPE.				Duration of Animal Experiment.	HUMAN TYPE.			
			Lungs.	Kidneys.	Spleen.	Liver.		Lungs.	Kidneys.	Spleen.	Liver.
0 days	0.0	No. 1, 36 days (k)	+++++++	+	+	+	No. 8, 36 days (k)	++++	—	—	—
1 day	1.3	No. 2, 35 days (k)	++++++	+	+	+	No. 9, 35 days (k)	++++	—	—	—
2 days	1.3	No. 3, 29 days (d)	+++++	+	+	—	No. 10, 34 days (k)	++	—	—	—
3 days	1.3	No. 4, 31 days (d)	—	—	—	—	No. 11, 33 days (k)	+	—	—	—
4 days	1.5	No. 5, 32 days (k)	+++++	+	+	—	No. 12, 35 days (k)	+	—	—	—
5 days	3.4	No. 6, 25 days (d)	++++	—	—	—	No. 13, 34 days (k)	+	—	—	—
7 days	11.7	No. 7, 32 days (k)	++	+	+	—	No. 14, 32 days (k)	—	—	—	—

Animal No. 4 was accidentally cremated before an examination had been made. This series of experiments was begun on March 16th, 1914.

TABLE III.—*Effect of Diffuse Daylight with Simultaneous Desiccation.*

Weighed quantities of cultures, four weeks' growth, were exposed at the window in small sterile test tubes loosely plugged with cotton-wool. Desiccation rapidly occurred. At intervals emulsions were made and injected as before.

Time Culture Exposed.	Recorded Hours of Sunshine.	Duration of Animal Experiment.	BOVINE TYPE.				Duration of Animal Experiment.	HUMAN TYPE.			
			Lungs.	Kidneys.	Spleen.	Liver.		Lungs.	Kidneys.	Spleen.	Liver.
0 days	0.0	No. 3, 23 days (k)	+++++++	+	+	+	No. 1, 23 days (k)	++++	—	—	—
3 days	11.1	No. 7, 23 days (k)	+	—	—	—	No. 5, 23 days (k)	++	—	—	—
7 days	14.3	No. 9, 24 days (k)	—	—	—	—	No. 11, 24 days (k)	—	—	—	—
17 days	27.5	No. 15, 32 days (k)	—	—	—	—	No. 13, 34 days (k)	—	—	—	—

This series of experiments was begun on September 6th, 1913.

under cultivation for two years, and still retained their distinctive characters. They were exposed simultaneously and under identical conditions in each series of experiments in a room (temperature 50–60° F.) with a northern exposure, and their virulence for the rabbit was then estimated by intravenous inoculation of amounts equivalent to 0.01 milligram of moist culture. The results are given in the accompanying tables. It is to be noted that only the desiccating action of room temperature and the actinic effect of diffuse daylight were thus observed, either singly or together. As days vary much in brightness, in order to give some measure of them, we have included in our tables numbers indicating the hours of sunshine recorded during each of the periods of exposure. These figures were obtained, through the kindness of Professor Becker, from the records of the University Observatory, which is situated within half a mile of the laboratory.

From Table I it is seen that there is little appreciable loss of virulence of either type after seven days' desiccation.

From the experiments recorded in Table II it is seen that diffuse daylight causes a definite lowering of the virulence of both types; within seven days the human being avirulent. Note the small amount of sunshine recorded (3.4 hours) during the first five days.

In Table III a marked diminution of virulence is seen to have occurred within three days (11.1 hours recorded sunshine) and after seven days (only 3.2 hours more of recorded sunshine) pathogenicity had gone. The main point that emerges from this series is that under the combined influence of desiccation and diffuse daylight not only is there a fall in virulence, but also that the drop is much more pronounced in the case of the bovine type.

The general conclusion, then, is that, tested in this way, the bovine type is distinctly more susceptible to the prejudicial effect of ordinary atmospheric influences (daylight and drying) than is the human type of tubercle bacillus. This difference between the types may in part explain why aerial infection with the bovine type is so infrequent in human beings.

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