8125 P

Hypothalamus and Regulation of Body Temperature.*

S. W. RANSON AND W. R. INGRAM.

From the Institute of Neurology, Northwestern University Medical School.

Recent work[1] has shown that the hypothalamus plays an important part in the regulation of body temperature. In the course of a series of investigations[2] on the functions of the hypothalamus we have had occasion to make lesions in this part of the brain in the rhesus monkey *(Macaca mulatta)* and have kept records of the resultant changes in body temperature. Bilaterally symmetrical electrolytic lesions were made with the aid of the Horsley-Clarke stereotaxic instrument, used in the manner described elsewhere.[3] The lesions were relatively small and sharply localized. The electrode, 0.9 mm. in diameter, did very little damage on its way down through the cerebral hemisphere. In some of the animals, parts of the thalamus were involved due to the interruption of their blood supply by the more ventrally placed lesions, but these thalamic lesions were not, as a rule, extensive and varied in their location from animal to animal without any corresponding change in body temperature. Two animals, which retained normal thermal regulation, had as extensive damage in the thalamus as any of the others. Moreover, in 3 of the animals (MC 10, MC 25 and MC 26) with the most marked disturbance in temperature regulation the thalamus remained undamaged. The results to be described were, therefore, due to the lesions in the hypothalamus, the rest of the nervous system being essentially intact.

Nine of the monkeys lost the capacity to prevent the body temperature from falling below a normal level. These animals were kept for many days, in one case as long as 10 weeks, in a small room, the temperature of which was regulated at 86°F. Under these conditions these monkeys maintained a normal temperature

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1 Keller, A. D., and Hare, W. K., PROC. SOC. EXP. BIOL. AND MED., 1932, **29**, 1069; Bazett, H. C., Alpers, B. J., and Erb, W. H., *Arch. Neurol. and Psychiat.*, 1933, **30**, 728; Davison, C., and Selby, N. E., *Arch. Neurol. and Psychiat.*, 1935, **33**, 570.

2 Ranson, S. W., Trans. of Col. of Phys. of Philadelphia, 1934, Series IV, 2, 222; Ingram, W. R., Fisher, C., and Ranson, S. W., *Arch. Int. Med.*, in press.

3 Ranson, S. W., *Psychiat. en neurol. bl.* (Feestb. C. U. Ariëns Kappers), 1934, **38**, 534.

except that sometimes during the first few days it would be slightly subnormal. If in the days immediately following the operation such an animal was removed for a few hours from the warm room to one ranging from 70° to 75°, the rectal temperature would fall rather rapidly. Gradually in the course of days or weeks these animals regained at least a fair degree of thermal control.

Seven other monkeys exhibited a fairly sharp post-operative rise in rectal temperature as the effect of the nembutal anesthesia wore off, reaching 105° to 106.5°F. within from 7 to 11 hours after the administration of the anesthetic and 5 to 9 hours after the completion of the operation. Most of these rises occurred at ordinary room temperatures but the first monkey in which this sharp rise was noted had been placed in the warm room (86°). None of these 7 animals developed a fatal hyperpyrexia and the temperature dropped to normal or to a point only slightly above normal within a day or 2 after the operation. It is interesting to speculate on the relation of this post-operative rise to the hyperpyrexia sometimes seen in patients after operations involving the hypothalamus.

Microscopical examination of the brains revealed that those monkeys which had shown a post-operative rise all had lesions involving bilaterally the rostral part of the lateral hypothalamus except one in which the damage was more medially placed and involved the lateral hypothalamus on only one side. In no case did the lesions extend caudally far enough to damage the region lateral to the mammillary nuclei. The lesions involved the fornix and the lateral part of the hypothalamus, extending rostrocaudally from the level of the optic chiasma to a point near the level of the rostral end of the mammillary nuclei. On the other hand, those monkeys which became cold when removed from the warm room all had bilaterally symmetrical lesions destroying the posterior part of the lateral hypothalamus, *i. e.,* the region lateral to the mammillary nuclei. The amount of involvement of the mammillary nuclei themselves varied greatly and did not seem to be an essential factor. The contrast between the lesions seen in these 2 groups of monkeys is fully as striking as the differences in their thermal reactions. Two animals may be selected as illustrative of these 2 groups. Before referring to them it may be well to mention that the normal rectal temperature of the monkey is about 101°F.

Monkey MC 10 developed a rectal temperature of 106.5° in the warm room (86°) seven hours after the administration of the anesthetic and about 5 hours after the completion of the operation. It was then removed to a cooler place and kept at ordinary room tem-

perature. The next morning the rectal temperature was 105.2°. The morning of the following day it was 103.3°. Subsequently a normal temperature was maintained. The lesions were typical of those described for the group of monkeys exhibiting a post-operative rise in temperature and the thalamus was uninjured.

Monkey MC 25 ran a subnormal temperature ranging from 97.6° to 99.9° during the first week in the warm room; and on the third day, when it was removed to a room at 70.8°, its rectal temperature dropped from 98.8° to 95.3° in one hour. On the thirty-eighth day its rectal temperature on removal from the warm room was 100.0° and it fell to 98.5° in 7 hours in a room the temperature of which varied from 70°-72°. The lesions destroyed the lateral hypothalamic area on both sides from the level of the optic chiasma to the caudal border of the mammillary bodies but did not involve the thalamus.

It may be concluded that bilateral destruction of the caudal part of the lateral hypothalamus causes a prolonged loss of the capacity to keep the body temperature up to normal and that lesions in the rostral part of the lateral hypothalamus may cause a temporary rise in body temperature if the caudal part remains intact.

8126 C

Oxidation-Reduction Potentials of Some Non-Sporulating Obligate Anaerobes.

G. M. DACK AND WILLIAM BURROWS.

From the Department of Hygiene and Bacteriology, University of Chicago.

Oxidation-reduction potential studies have been made on cultures of many aerobic and some sporulating anaerobic bacteria, but to our knowledge none has been made on the non-sporulating obligate anaerobes. The potentials produced by the latter group of organisms are of particular interest in connection with current theories as to the relation of such potentials to the growth of obligate anaerobes. A certain degree of negativity was thought to be necessary before the obligate anaerobes are able to initiate their growth processes. Experimental evidence of a positive limit of oxidation-reduction potential required for the germination of spores of *Cl. tetani* has been presented by Fildes[1] and by Knight and Fildes.[2]

[1] Fildes, *Brit. J. Exp. Path.*, 1929, **10**, 151.

[2] Knight and Fildes, *Biochem. J.*, 1930, **24**, 1496.