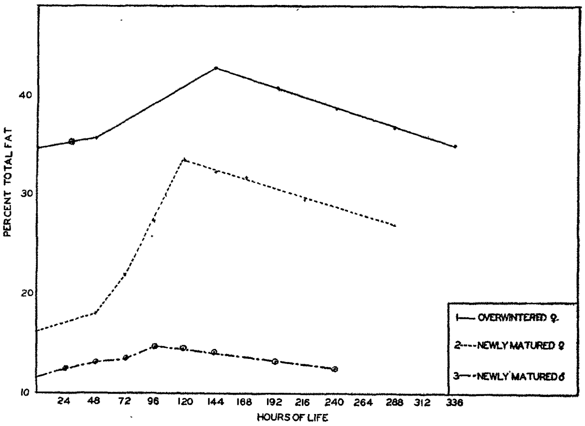

FIG. 2. Variation in fat content of overwintered *Eutettix tenellus* fed upon a mixed solution of 1.5 per cent. fructose and 1.5 per cent. glucose, showing evidence of the ability of *Eutettix tenellus* to synthesize fats from carbohydrates.

During the period of this test three to four of the caged leafhoppers in each set died from natural causes.

At the same time the foregoing test was made, a third experiment upon newly emerged males was conducted. In this experiment two sets of 75 males each were fed upon solutions of the same composition previously described. Six to seven insects were removed at the time intervals indicated in the graph (Fig. 2) and total fats determined in duplicate for each series. In this set determinations checked in all cases within four to five tenths of one per cent. Although the fat content of the males is consistently lower throughout (starting at 11.5 per cent. and attaining a maximum of only 13.2 per cent. at 96 hours) the general form of the "curve" is still clearly the same as previously determined for both overwintered and newly emerged females. In this experiment 7 to 9 males from each set died from natural causes.

It is clearly apparent from the results of the foregoing experiments that the beet leafhopper is capable of synthesizing glycerides when fed only upon glucose and fructose. This ability does not continue indefinitely, however, and its cessation is undoubtedly correlated with the general insufficiency of the pure sugar diet which reflects itself, after a more or less extended time, in those general metabolic disturbances which ultimately result in death.

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SPECIAL ARTICLES

VASOMOTOR REPRESENTATION IN THE CEREBRAL CORTEX[1]

IT has long been known that vasomotor conditions of the body are regulated in part by the central nervous system, but the anatomical position of the regions involved in this control has not been sufficiently studied. In 1880, W. Hale White[2] reported changes in body temperature in human beings, and in rabbits, after lesions of the corpus striatum. Since that time, the hypothalamus has come into prominence as the area chiefly responsible for regulating body temperature. Keller[3] and Bazett[4] find that a cat maintains constant temperature when the hypothalamus is intact, but fails to do so when it is destroyed. Moreover, Cushing[5] in 1932 reported changes in body temperature following intraventricular injection of pituitrin, the accompanying hypothermia, vasodilatation and diaphoresis being attributed to the action of the drug on a possible parasympathetic center in the hypothalamic area.

The presence of unilateral vasomotor changes accompanying lesions restricted to the cerebral cortex suggests that higher centers may also be involved in the more delicate vasomotor adjustments. In 1876 Eulenberg and Landois[6] found that stimulation of the post-central region in dogs and rabbits resulted in a rise in skin temperature of the contralateral extremities, and in 1888 Gowers[7] observed that vascular changes were often present in the paralyzed limbs of patients with hemiplegia. Bechterew[8] in 1911 concluded, both from the work of other investigators and from his own experiments on dogs, that stimulation of certain cortical areas influenced heart rate and blood pressure, and in addition he cited cases of traumatic lesions of the "central gyrus" in man with

[1] From the Laboratory of Physiology, Yale University School of Medicine.

[2] W. Hale White, "The Effect upon Bodily Temperature of Lesions of the Corpus Striatum and Optic Thalamus," *Jour. Physiol.*, 2: 1, 1890.

[3] A. D. Keller, "Observations on the Localization of the Heat Regulating Mechanisms in the Upper Medulla and Pons," *Amer. Jour. Physiol.*, 93: 665, 1930.

[4] H. C. Bazett, B. J. Alpers and W. H. Erb, "Hypothalamus and Temperature Control," *Arch. Neurol. Psychiat.*, 30: 728, 1933.

[5] H. Cushing, "Papers Relating to the Pituitary Body, Hypothalamus and Parasympathetic Nervous System." Springfield, Ill., Charles C. Thomas, 1932.

[6] A. Eulenberg and L. Landois, "Über die thermischen Wirkungen experimentellen Eingriffe am Nervensystem und ihre Beziehung zu den Gefassnerven," *Virchow's Arch.*, 68: 245, 1876.

[7] W. R. Gowers, "A Manual of Diseases of the Nervous System." London, J. and A. Churchill, 1888.

[8] W. v. Bechterew, "Die Funktionen der Nervencentra." Jena, Gustav Fischer, 1911. Vol. 3.

increased temperature in the contralateral half of the body. This elevation in temperature of the affected extremities has since been noted repeatedly in clinical cases of cortical hemiplegia, but the vascular changes have usually been attributed to atrophy or to paralysis and disuse. Langworthy and Richter[9] have found two regions adjacent to the motor area of cats which, when stimulated, produced a change in sweating as measured by galvanic skin response. Stimulation of no other area of the cortex produced such a change, but faradization of the cortico-spinal, cortico-pontine and rubro-spinal and vestibulo-spinal tracts all resulted in characteristic galvanic skin responses.

A human case showing unilateral vasomotor disturbance has recently been reported.[10] The patient had a tumor of the right premotor area which produced symptoms of paresis and Jacksonian attacks confined to the left *arm* alone, but there was increased redness, heat and sweating over the entire left side of the body, together with inconstant edema of the left hand.

Recently, in the course of some experiments on the effect of extirpation of the premotor cortex (area 6 of Brodmann) on the motor performance of subhuman primates,[11] a difference in the skin temperature of the extremities on the two sides was observed, following unilateral ablation of the premotor cortex. On further investigation of this phenomenon it was found that the palm and sole of the extremities contralateral to the lesion were definitely colder to touch than those of the ipsilateral side. This difference in skin temperature, measured by a Leeds-Northrup temperature recording apparatus, varied between 2 and 4 degrees F. A very transient edema lasting 24 to 48 hours accompanied this change, which was also transitory, but lasted one to two months after operation. In one chimpanzee the affected extremity showed a very evident alteration in the texture of the skin which became drier and thicker than on the normal side. These changes of temperature and skin consistency were present after the temporary paresis had disappeared, and this could not therefore be attributed to disuse.

In order to analyze this vasomotor phenomenon in greater detail the following observations have been made. When a normal animal is subjected to rapid alterations in the temperature of its surroundings, there is an immediate reflex alteration of the skin temperature of the soles and palms which is equal on the two sides. After unilateral extirpation of certain portions of the frontal lobe, abrupt cooling gives rise to *vasoconstriction,* which occurs equally and simultaneously in both feet as it does in a normal monkey; but on heating *vasodilatation occurs very slowly in the foot opposite to the operated cortex,* whereas in the ipsilateral foot it is prompt and normal in character. This alteration in the vasodilator mechanism is marked immediately after operation, but disappears slowly in the course of several weeks. Sweating is bilaterally equal, as determined by the starch iodine method of Guttmann,[12] only when the temperature of the two extremities happens to be the same.

The following manifestations related to the parasympathetic systems are also associated with disturbance of the premotor cortex: (1) stimulation of the premotor area in monkeys results in slowing of the heart, and eventually in irregularity of heart beat; (2) stimulation of the premotor area also produces an increase in intestinal peristalsis;[13] (3) bilateral extirpation of the premotor area has been followed in monkeys by intestinal stasis and in several instances by intussusception.[13]

CONCLUSIONS

The premotor area of the cerebral cortex directly influences the autonomic nervous system and in particular the vasomotor mechanism, since lesions confined to this area, both in man and in subhuman primates, result in: (1) alterations in skin temperature in the contralateral side of the body; (2) alterations in color and texture of the skin; (3) occasional and inconstant edema of the contralateral extremities; and stimulation of this region causes (4) changes in heart rate, and (5) alterations in intestinal motility.

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[9] O. R. Langworthy and C. P. Richter, "The Influence of Efferent Cerebral Pathways upon the Sympathetic Nervous System," *Brain,* 53: 178, 1930.

[10] Margaret A. Kennard, H. R. Viets and J. F. Fulton, "The Syndrome of the Premotor Cortex in Man; Forced Grasping, Spasticity and Vasomotor Disturbance," *Brain,* 57: (in press), 1934.

[11] J. F. Fulton and Margaret A. Kennard, "A Study of Flaccid and Spastic Paralyses Produced by Lesions of the Cerebral Cortex in Primates," Research Publ. Ass. Res. Nerv. Ment. Dis., 13: (in press), 1934.

[12] L. Guttmann, "Die Schweisssekretion des Menschen in ihren Beziehungen zum Nervensystem," *Zeits. f. ges. Neurol. Psychiat.,* 135: 1, 1931.

[13] J. W. Watts and J. F. Fulton, "Intussusception—the Relation of the Cerebral Cortex to Intestinal Motility in the Monkey." *New Eng. Jour. Med.,* 210 (to appear), 1934.

THE PRESENCE OF NITRIFYING BACTERIA IN DEEP SEAS[1]

PROBABLY no other phase of marine bacteriology has attracted as much attention as the process of oxidation of ammonium salts, which results in the formation of nitrite, followed by the oxidation of the nitrite to nitrate. Some investigators believed that the cycle of nitrogen in the sea is practically similar

[1] Contribution No. 44 of the Woods Hole Oceanographic Institution and Journal Series Paper, New Jersey Agricultural Experiment Station, New Brunswick, N. J.