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Significance of Peripheral Receptors for Excitability of the Central Nervous System.

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Galkin[1] published extensive investigations in which he tried to show that the elimination of the olfactory receptors in dogs produced a permanent state of somnolence and, finally, death in the animal. The removal of the eyes and the destruction of both cochleæ did not have any such effects. He assumed that the elimination of those sense organs which are most important for the normal behavior of the animal are responsible for the lethargic state observed in his experiments. These observations seem to be in contrast with experiences of Goltz,[2] Rothmann,[3] Dusser de Barenne,[4] and others, who did not observe such a state in dogs and cats whose hemispheres had been removed and in which the olfactory nerves had also been severed. Pavlov[5] stated that a dog deprived of the anterior half of its hemispheres showed, at least after some months, a nearly normal locomotion, and even states of excitement during periods of hunger. He did not mention any lethargic conditions in spite of the severance of the olfactory nerves. In view of the principal importance of the question as to the significance of the biologically most important sensory nerves for the general excitability of the central nervous system and the behavior of the animal it seemed advisable to repeat Galkin's experiments.

We have operated 4 dogs in which the olfactory nerves were severed and we employed the same method which Galkin described. Careful histological investigations were carried out which were omitted by Galkin. The result of these histological studies is that in 2 of our dogs the olfactory nerves were completely severed, whereas in 2 others some fibers were still intact. The dogs were observed over a period of 1-4 months. Except for one case in which a somewhat somnolent state of the dog was observed for several days, a state which was accompanied by a nasal discharge but with no fever, the dogs appeared to be completely normal in their behavior

1 Galkin, W. S., *Z. f. exp. Med.*, 1933, **88**, 316.

2 Goltz, F., *Pflüger's Arch.*, 1892, **51**, 570.

3 Rothmann, M., *Neurolog. Zentralblatt*, 1912, **31**, 867.

4 Dusser de Barenne, J. G., *Arch. Neerland.*, 1919, **4**, 31.

5 Pavlov, I. P., *Conditioned Reflexes*, Oxford Univ. Press, 1927, p. 365.

and excitability for several weeks or months before they were sacrificed. These observations do not lend any support whatever to the statement of Galkin, and make it not improbable that his results are due to some chronic infections which may have been overlooked, since a histological study of the brain was omitted. We add here the microscopic findings of the 2 dogs which showed complete severance of the olfactory nerves.

Dog A. Both frontal lobes and olfactory bulbs show areas of organized anemic softening, which had produced a severe destruction of the olfactory bulbs. In the latter the characteristic histologic pattern has been replaced by a diffuse infiltration with glia nuclei and overgrowth of collagenous connective tissue fibers. The pia-arachnoid covering of the frontal lobes is thickened, but no inflammatory reaction is present.

Dog D. There is a severe destruction of both olfactory bulbs. The inner cavities are markedly enlarged and only a thin wall of tissue remains. The main part of the bulbs is destroyed by anemic softening and large amounts of compound granular corpuscles are seen. The olfactory nerves as they pass through the lamina scribrosa are degenerated. They show a considerable increase in elongated nuclei and a mild proliferation of endoneurial connective tissue. No inflammatory reactions are seen.

The experiments were extended to rabbits and were carried out on 6 animals, 2 adult and 4 about one-month-old rabbits of the same litter. In these animals the olfactory bulbs were completely removed. The animals were observed in the laboratory for about one year and did not show any abnormal behavior. The growth curves of the young rabbits were very similar to that of other rabbits of approximately the same age. These observations seem to agree with the work of Swann,[6] who studied effects of the destruction of the olfactory tracts and various parts of the archipallium on the retention of olfactory habits in rats. He finds that the destruction of the primary olfactory tracts abolished olfactory habits but failed to observe any other general disturbances.

Conclusion and Summary. The sectioning of the olfactory nerves in dogs and the removal of the olfactory bulbs in rabbits do not cause any general symptoms such as lethargy, as has been claimed by Galkin. The general excitability of the central nervous system remains unaltered after the elimination of olfactory perception in odoriferous animals just as well as the removal of sight and audition does not influence the central nervous system as a whole in the

[6] Swann, H. G., *J. Comp. Neurol.*, 1934, **59**, 175.

human. The removal of the olfactory bulbs in young rabbits does not interfere with normal growth.

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Nature of Diet in Its Relationship to Control of Dental Caries.

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Previously it has been reported that dental caries may be arrested within 8 to 10 weeks through the regular ingestion of a diet high in protective foods, including a teaspoonful of cod liver oil daily.[1] This report correlates the response of the teeth with the level of intake of certain dietary constituents.

Five orphanage children between the ages of 3 and 6 years were observed in the metabolism ward for 7 months under varied intakes of vitamin D; concomitant dental examinations and balance studies were made at frequent intervals. Two had active caries of noteworthy extent and activity; one had 20, the other 6 cavities. A third child had one small proximal cavity. The remaining 2 children were free from demonstrable tooth decay. Activity of caries was determined on the basis of the permeability of the exposed dentin to the exploring tine; if at all permeable, the decay was considered active.

Throughout the studies the food intake was quantitatively controlled. During the fall months especially the children received considerable sunshine out of doors. Several dietary regimens were used progressively, each for a period of from 5 to 8 weeks.

Diet No. 1 was an approximation of that employed at the orphanage. It provided 800 gm. whole milk daily, with fair amounts of vegetables, fruits, meat and butter. The second diet was that employed in the Children's Hospital; it provided 1000 gm. of milk, and was higher in vegetables and fruits than the orphanage allowance. The third diet was similar to the second, except that 450 cc. of irradiated evaporated milk, suitably diluted (155 units of vitamin D), was substituted for the fresh whole milk. In the fourth period the second diet was supplemented with a teaspoonful of cod liver oil daily. The latter had an assayed content of 175 units of

[1] Boyd, J. D., Drain, C. L., and Nelson, M. V., *Am. J. Dis. Child.*, 1929, **38**, 721.