With the lamp described above, the intensity of this line was such as to permit a reading within ± 0.015° with a half shadow angle of 4°. Using a photographic process the angle could be read within ± 0.003° (exposure 60 seconds, half shadow angle 4°).

Measurements with the yellow line 5875.6Å were consistent within ± 0.002°.

The lamp used, which is reproduced in the above diagram, was an all-quartz hot cathode helium lamp built by the General Electric Vapor Lamp Company, Hoboken, N. J. The arc was operated under 160 volts and carried 5 amperes.

ALEXANDRE ROTHEN
THE ROCKEFELLER INSTITUTE
FOR MEDICAL RESEARCH,
NEW YORK

SPECIAL ARTICLES

ACTION CURRENTS IN THE AUDITORY TRACTS OF THE MIDBRAIN OF THE CAT

IN the course of an investigation of action currents in the central nervous system of the cat by means of an amplifier in connection with ear phones or a string galvanometer, responses were obtained from the auditory tracts of the midbrain. The intensity, timbre and pitch (up to at least 1,000 per sec.) of the sounds applied to the ears of the cat were reproduced with considerable accuracy in the ear phones. The observations of Wever and Bray[1] on the auditory nerve were repeated and their results confirmed. Adrian's observations,[2] which led him to suggest that the effect in the nerve is due to a diffuse electrical spread from the cochlea, have also been confirmed, but with the following qualification: (1) The responses are much greater in the auditory pathways than in the surrounding tissue. (2) There appears to be a decrease in the size of the responses upon the local application of narcotics.

We believe that the effect in the brain stem represents at least two elements: primarily, action currents in the particular auditory tract to which the electrode is applied; and secondarily, electrical spread from more distant parts of the auditory mechanism.

Our method allows stimulation of either or both ears. A stethoscope is fitted to the decerebrate cat. Its bell receives taps at constant rate and intensity. Voice or other sounds may be delivered through a funnel in place of the stethoscope bell. The sound may be localized to one ear or the other by clamping the appropriate arm of the stethoscope. A diffuse silver electrode is placed subcutaneously on the muscles of the skull and a differentiated electrode consisting of a fine silver needle, insulated except for the very tip, is pushed down the brain stem caudally at right angles to the planes of decerebration.

Sharpness of localization is characteristic of responses in the brain stem. Using the string galvanometer with one stage of amplification the responses are obtained *only* from certain points. A movement of the electrode of one millimeter or less suffices to pass through a maximum and usually to loose the response. With a more sensitive amplifier and ear phones this point represents a very sharp maximum, many times louder than the responses from neighboring points. These active points have been shown by subsequent gross section to lie invariably upon the auditory pathways, including the trapezoid body, acoustic striae, and lateral lemnisci up to the inferior colliculi. Numerous other regions explored, not on the pathways, have never given any response with the less sensitive apparatus.

When electrodes are placed upon crossed tracts, such as the lateral lemnicus, the responses are chiefly contralateral, *i.e.,* the electrode in the left midbrain is much more sensitive to stimuli applied to the right ear than to those applied to the left ear. This contralateral relationship agrees well with the known anatomy of the auditory pathways.

When the cat dies in the course of an experiment the responses from the brain stem are lost as soon at the heart stops beating, and sometimes a few minutes before. The responses from the acoustic nerve persist after those from the brain stem are no longer detectable, and sometimes for several minutes after the heart has stopped.

Narcotization of parts of the brain stem by injecting 5 per cent. or 10 per cent. novocaine in Ringer's solution near the electrode obliterates responses on the string. The responses return after one to three hours. If the novocaine is injected on one side of the brain stem between the electrode and acoustic nerve, responses from that ear disappear, while those from the other ear persist.

Comparison of responses from the acoustic nerve with those from the brain stem shows that those from active points in the brain stem are usually slightly greater than those from the nerve. This is true even if the electrode pierces the sheath of the nerve, thereby yielding greater responses than if on its surface.

[1] E. G. Wever and Charles W. Bray, SCIENCE, 71, 215, 1930.

[2] E. D. Adrian, *J. Physiol.*, 71, 4: 1931.

Words are always reproduced more clearly and intelligibly from the nerve. Those from the brain stem, while often intelligible, are always somewhat blurred. There is some doubt as to whether the upper limit of pitch is as high for the brain stem as for the nerve.

We believe that the above evidence indicates that we are dealing with true action currents in the auditory pathways. It demonstrates the possibility of direct study of the activity of individual tracts within the central nervous system, by such methods as have been employed for peripheral nerves and the cerebral cortex.

H. DAVIS
L. J. SAUL

DEPARTMENTS OF PHYSIOLOGY
AND OF PSYCHIATRY,
HARVARD MEDICAL SCHOOL

THE EFFECT OF HYPOPHYSECTOMY ON GESTATION IN THE RAT[1]

EXPERIMENTAL work on the functions of the pituitary gland has dealt largely with the effects of extirpation of this gland on growth and on the development of the reproductive organs, and, with the exception of the early work of Aschner on pregnant dogs, no further studies seem to have been carried out on the effects of hypophysectomy on the maintenance of pregnancy in mammals. It seemed of interest, therefore, to see what effects, if any, removal of this gland would have upon the course of gestation in the rat.

A total of 43 pregnant rats were operated on for the removal of the anterior and posterior lobes of the pituitary gland. The age of the rats at the time of operation ranged from 92 to 247 days, the average being 126; while the day of pregnancy varied from the eleventh to the twentieth, most being within the twelfth to the sixteenth.

Of the 43 operations, 21 resulted in the incomplete removal of the gland, for at necropsy it was easy to find under a dissecting binocular small pieces of anterior lobe, or of anterior and posterior lobes, *in situ*.

In all the foregoing 21 rats, gestation ended in parturition, the young in most cases being alive. In 18 of these rats the gestation period was of normal length, and all the newborn were living and were suckled. Pregnancy in the other 3 animals was prolonged. One mother gave birth to 2 living young and 3 dead on the twenty-fifth day, one of the litter showing signs of having milk in its stomach. On necropsy a very small piece of the anterior lobe was found to have been left. The second mother gave birth to one dead and one living young at 11 A. M. on the twenty-fourth day of pregnancy. Three hours later two more living young were found in the cage. The following morning all were dead, apparently without having been suckled by the mother. The mother was killed the same day and was found to contain *in utero* one macerated foetus, and at the site of the pituitary a small piece of the gland. In the third case, on the twenty-fifth day one was found born alive. Necropsy revealed no others *in utero,* although there was evidence of others probably destroyed after birth. Traces of pituitary tissue were found.

Twenty-two of the 43 pregnant rats used in the experiment retained none of the pituitary. Microscopic findings will be reported later. In all these the period of pregnancy was lengthened by from 3 to 4 days. With two exceptions, noted below, the mothers died without being able to give birth to their young. One of the two exceptions was sacrificed on the twenty-sixth day in order to secure good necropsy material. In the other exceptional case, the young were removed by caesarian section on the twenty-fifth day, the result of which was that the mother recovered. At necropsy a month later, the former site of the pituitary showed no traces of the gland, and the ovaries, uterus, thyroid and adrenals exhibited all the characteristics of a completely hypophysectomized animal.

The evidence at hand thus shows that complete removal of the pituitary is followed by death at the end of a prolonged pregnancy, unless, as in one case, the mother's life is saved by removal of the foetuses from the uterus.

R. I. PENCHARZ
J. A. LONG

DEPARTMENT OF ZOOLOGY,
UNIVERSITY OF CALIFORNIA

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