tures down to the pelvic and sacrococcygeal bones were replaced by a similar alveolated whitish tissue, which surrounded and narrowed the anogenital canals. The pelvis and its contents, however, were uninvolved. The inguinal (left), lumbar and iliac lymph nodes were considerably enlarged. Both uterine horns were thickened and nodular. There was otherwise no other gross visceral involvement. X-rays confirmed the soft tissue thickenings in the regions cited above, but failed to demonstrate lesions of the bones or joints.

In sections of skin examined microscopically there is massive infiltration of corium and subcutis by large pale monocytic cells similar to the lepra cells described in the rat. These possess a stippled, somewhat basophilic cytoplasm stuffed with acid-fast bacilli when stained by Ziel-Neelsen. The bacilli are delicate rods, occasionally curved, measuring 1.5–5.4 μ in length. They are more or less concentrically and closely packed within the cell. The cigar-like bundles of bacilli and globi of the human lepra cells are not seen.

Within these areas of extensive cellular infiltration, there are practically acellular zones made up of masses of acid-fast bacilli. Commonly within and about these areas there are lepra cells with karyorrhexis of the nucleus. In the well-preserved cells the nucleus is eccentric, oval or spherical, occasionally compressed and deformed. Only strands of atrophied collagen course through the infiltrative areas, except in instances where the immediate subepidermal zones of the corium are relatively spared. The epidermis is markedly atrophied and the papillae are obliterated in sections of skin where the infiltration extends to the epidermis. The cutaneous appendages in such instances are often lost or atrophic. The perineural sheaths of otherwise intact nerve fibers are infiltrated by lepra cells. There is moderate involvement of the skeletal muscle. Perimysium and endomysium, particularly adjoining the subcutis, are heavily infiltrated by lepra cells leading in instances of greater infiltration to atrophy and loss of muscular fibers. Portions of an axillary and sections of lumbar and iliac lymph nodes are diffusely and heavily infiltrated by lepra cells. Practically all other organs are involved to a degree. There are single and groups of lepra cells in the myocardium, lung (peribronchial, perivascular and interstitial), spleen, pancreas, liver (conglomerate groups more frequently adjoin larger venous radicles, chiefly hepatic, and numerous Kupffer cells are stuffed with bacilli), kidney (chiefly in glomeruli), adrenal, ovary, uterus (largely in the thickened endometrium), serosa of peritoneum, paravertebral muscles (largely at musculo-periosteal junctions), paraganglia and bone marrow (as scattered single cells). The dorsal ganglia and spinal cord are not involved, except for the perineural sheaths of spinal nerves. Intravascular polymorphonuclears and monocytes infrequently contain acid-fast bacilli.

Mice were inoculated with an emulsion of the lesions, and at present the course of the experimentally-induced disease is being studied in mice and rats. It is known that the rat strain of leprosy can be induced in all other types of rats. The mouse is, however, essentially refractory. It will be of interest to determine whether this is as specific a strain for mice as the murine form is for rats.

CECIL KRAKOWER
LUIS M. GONZALEZ

SCHOOL OF TROPICAL MEDICINE,
SAN JUAN, P. R.

ENCEPHALIZATION OF BRIGHTNESS DISCRIMINATION IN MAMMALS

IT is well known in comparative neurology that in mammals the visual system, like other systems, shows an orderly and progressive development in structure. Although the point to point projection of the retina on the lateral geniculate body, the striate area and the superior colliculus, is as exact in lower as in higher forms,[1,2,3] there do appear certain systematic differences in structural organization. These differences appear to be quantitative rather than qualitative. For example, passing up the phylogenetic scale it is found that the proportion of uncrossed fibers of retinal origin increases. We have, then, an increase in the size of the binocular projection fields in the primary visual centers. There is also an increase in the size of the geniculo-striate complex at the expense of the lower visual centers and a gradual merging of the pretectal area with the superior colliculus.[4]

On the basis of this structural development of the visual system as we pass up the phylogenetic scale, it might well be expected that there would be a parallel change in the functional importance of the various visual stations. The doctrine of encephalization would lead one to suspect that in the lower mammals the subcortical visual centers would be of relatively greater importance, and passing up to the primates the geniculo-striate complex would gradually become dominant. The facts, however, do not support such a view, at least in the discrimination of differences in the intensity of lights. The evidence indicates that even in the rat the geniculo-striate complex alone mediates the brightness discrimination habit in the intact animal. This is shown by the following facts. After the brightness discrimination habit has been formed, de-

[1] K. S. Lashley, *Jour. Comp. Neur.*, 59: 341, 1934.
[2] K. S. Lashley, *Jour. Comp. Neur.*, 60: 57, 1934.
[3] B. Brouwer, "Anatomical, Physiological and Clinical Studies on the Central Nervous System." Baltimore: 1927.
[4] C. U. Ariëns Kappers, G. C. Huber and E. C. Crosby, "The Comparative Anatomy of the Nervous System of Vertebrates." New York: 1936.

struction of the superior colliculus has no effect either on the retention of the habit or on the threshold of brightness discrimination.[5] Destruction of the superior colliculus before learning also has no effect on the formation of the habit.[6,7] Dr. C. W. Brown and the writer produced several cases in which the pretectal and large-celled nuclei were destroyed. In one case both of these nuclei and the superior colliculus were either destroyed or their optic connections severed. This left the geniculo-striate complex as the only functional primary visual structure. All these cases also learned to differentiate brightnesses. Only complete destruction of the striate area produces a loss in the retention of the habit.[8] With further training, however, the habit can be reestablished, but the threshold of brightness discrimination is heightened.[9] Thus, while brightness vision can be carried on by subcortical visual centers they do not function as efficiently as the striate area.

It is seen, then, that even in the rat the cortical visual area is of prime importance, and certainly in higher forms it would not be expected to play a less important rôle. Furthermore, although the rat can learn to respond on the basis of visual cues in the total absence of the striate area, this has also been shown to be the case for the rabbit,[10] the cat,[11] the dog[12,13] and the monkey.[14,15] It is only in man that destruction of the striate area abolishes vision of any kind.[14]

It would seem, therefore, that the principle of encephalization of function which suggests that there is a gradual shift in function from subcortical to cortical centers does not hold for brightness vision in the mammalian series. In the intact organism the striate area plays as important a rôle in the rat as in man, and the visual subcortex is so organized in all mammals except man that in the absence of the striate area it can carry on the function, although it does so with lowered efficiency.

EDWIN GHISELLI

CORNELL UNIVERSITY

SCIENTIFIC APPARATUS AND LABORATORY METHODS

PREPARATION OF CASTS OF THE BONY LABYRINTH

ALTHOUGH many accounts of various techniques for preparing casts of the osseous[1] and membranous[2] labyrinth appear in the literature, the paucity of such material available for the teaching of gross and comparative anatomy would apparently justify the present description of what is a relatively simple method of preparing such material and one requiring no elaborate equipment. In the course of a routine dissection the size, shape, position and general relations of the internal ear can not be revealed by exposing its several canals. These facts are more easily ascertained from actual models of the labyrinth made available for this purpose or prepared by the student from the material at hand.

The process here described may be divided into two phases; first, the preparation of the temporal bone which serves as a mold and, secondly, the instillation of a molten metal under positive pressure to form the cast.

The petrous portion of the temporal bone is removed from the skull and all the superfluous bone cut away from the labyrinth without actually entering its canals. In so doing the eustachean canal should be sawed through and the incision continued caudally through the middle ear, thus splitting it in a vertical plane. The medial wall of the middle ear with its fenestrae is thus exposed on the lateral aspect of the petrous bone. The bone is next boiled in a weak alkali. $NaHCO_3$ is well suited to this purpose. It should be treated with 95 per cent. alcohol for about 24 hours, more or less depending upon whether or not the bone is fresh. Then it is degreased in xylol, for from 4 to 16 hours, depending on the condition of the bone, and finally placed in hydrogen peroxide until every vestige of the membranous labyrinth is removed. The time required to accomplish this will naturally vary with the original condition of the specimen. If a thoroughly dried petrous bone is taken from an old osteological collection, only a short time will be required. On the other hand, if the bone is from a fresh specimen a week or longer may be necessary to accomplish the desired end.

The second phase or the actual casting could presumably be accomplished by merely pouring the molten metal through the fenestrae into the labyrinth. If

[5] E. E. Ghiselli, *Jour. Comp. Neur.*, 67: 451, 1937.
[6] G. L. Freeman and J. W. Papez, *Jour. Comp. Psychol.*, 11: 185, 1930.
[7] J. D. Layman, *Jour. Genet. Psychol.*, 49: 33, 1936.
[8] K. S. Lashley, *Comp. Psychol. Monog.*, 11: 43, 1935.
[9] K. S. Lashley, *Jour. Genet. Psychol.*, 37: 461, 1930.
[1] Alfred Denker, "Vergleichend-Anatomische Untersuchungen über das Gehörorgan der Säugethiere nach Corrosionpräparaten und Knochenschitten." Verlag Von Vert und Comp. Leipzig. 1899.
[2] Albert A. Gray, "The Labyrinth of Animals," J. and A. Churchill, London. 1907–08.
[10] J. Ten Cate and A. W. H. Van Herk, *Arch. néerland physiol.*, 18: 337, 1934.
[11] J. L. Kennedy, *Psychol. Bul.*, 33: 598, 1936.
[12] D. G. Marquis, *Proc. Asn. Res. Nervous and Mental Disease*, 13: 558, 1934.
[13] E. R. Hilgard and D. G. Marquis, *Jour. Comp. Psychol.*, 22: 157, 1936.
[14] D. G. Marquis, *Arch. Neurol. and Psychiat.*, 33: 807, 1935.
[15] H. Kluever, *Jour. Psychol.*, 2: 49, 1936.