THE JOURNAL

OF

Comparative Neurology

A QUARTERLY PERIODICAL

DEVOTED TO THE

Comparative Study of the Nervous System.

EDITED BY

C. L. HERRICK,

Professor of Biology in Denison University.

VOLUME III.

PUBLISHED BY THE EDITOR.

GRANVILLE, OHIO, U. S. A.

R. Friedländer & Son, Berlin, European Agents.

The Journal of Comparative Neurology.

Contents of Vol. III, 1893.

MARCH, 1893.

Pages 1–34, i—xlii. Plates I–II.

JUNE, 1893.

Pages 35—106, xliii—lxxxii. Plates III–VIII, X–XIII.

SEPTEMBER, 1893.

Pages 107—162, lxxxiii—cxxvi. Plates XIV—XXV.

DECEMBER, 1893.

Pages 163—182, cxxvii—clxxxvi. Plates IX, XXVI and XXVII.

NEUROLOGISTS AND NEUROLOGICAL LABORATORIES.

II. Neurological Work at Zurich.

By Ad. Meyer, Ph.D.

The names of F. Arnold, Henle, v. Gudden, Huguenin, Forel, v. Monakow, T. Martin and Honegger prove that Zürich is connected with a good amount of first class neurological work. It is, I think, well worth giving a short account of the men working there at present and of the opportunities for students in the laboratories of the different institutions.

Zürich is a town of about 100,000 inhabitants, wonderfully situated at the end of a fine lake. This relatively small town has at present the following men working in anatomy of the nervous system: Prof. Aug. Forel, the director of the Lunatic Asylum, Burghölzli; Privatdocent, Dr. C., v. Monakow, lecturing on neurology at the University; Paul Martin, Professor of physiology at the Veterinary School; Dr. S. S. Honneger, specialist for nervous diseases; Huguenin, formerly professor of internal medicine, doing little neurological work at present; the physiologist, Prof. Gaule, and his assistant, Dr. Wlassak, in the physiological institution of the University. It is very interesting that all these men work independently from each other; they form, so to say, so many schools or independent work shops.

Professor Forel holds no doubt one of the most prominent positions among the anatomists of the brain. A pupil of Meynert and of v. Gudden, and besides an expert entomologist, he unites a great number of faculties which must be considered as the essential condition for successful work in anatomy of the brain.

His first original contribution was made under the auspices of Meynert, in 1872,[1] and accepted as an inaugural discussion by the University of Zürich. I wish to give here a short sketch of the ground which this paper covers, as it is not easy to get it in the original. The optic thalamus of the lower mammals differs from that of man and of the monkey by a gradual decrease of the pulvinar, which is very short in the carnivora and can be considered to be absent in the ungulata and rodents. The thalamus is however even shorter in the lower mammals than it seems to be, as what appears to be its posterior part, is formed by an unproportionately large external geniculate body, which reaches the upper surface of the thalamus. The small cuneiform external geniculate body of man is much more independent from the thalamus, and it is easy to see why it was not recognized in the lower mammals, although it is much larger: it is too little marked off from the thalamus. In the carnivores the external geniculate body is right above the internal one; in the rodents, in which the thalamus is even shorter than in the carnivora, the internal geniculate body is situated caudad of the external geniculate body. The fibres of the optic tract which pass through the external geniculate body to the corpus guadrigeminum anterius are covered in man by the pulvinar thalami, but are superficial in the lower mammals, where the pulvinar is not developed. The stratum zonale thalami of man is therefore different from what might be called stratum zonale thalami in lower mammals, where the superficial layer in the posterior part of the thalamus is formed by fibres of the optic tract passing through the superficial corpus geniculatum externum.—There are other points which help to explain the difference in the internal structure of the optic thalamus in man and in lower mammals. In the latter the hemispheres are small; the corona radiata is correspondingly small and covers only the anterior part of the optic thalamus leaving the posterior part free. This is why the fibries of the corona radiata do not show as a

1. Beiträge zur Kenntniss des Thalamus opticus und der ihn umgebenden Gebilde bei den Säugetieren, von August Forel aus Waadt. Kaiserl. Academie der Wissenschaften in Wien, 1872. No. XVI. Math-naturwiss. Classe. 6 Juni. Ueberreicht von Prof. Dr. Th. Meynert.

radiation, but have a longitudinal course in the posterior part of the optic thalamus, which is itself covered posteriosly by the large external geniculate body. The difference in the form of the laminae medullares is explained in a simular way. The fornix, before it ends in the corpus mammillare, sends fibres into the pedunculus glandulae pinealis. The part of the fornix situated above the thalamus opticus (corpus fornicis) becomes thicker than the corpus callosum in lower mammals, because the commissural fibres corresponding to the Lyra Davidis in man are much more numerous, in proportion to the greater area of the origin of the fornix in these animals.

The latter part of the paper is very often quoted. I can not help thinking however that many of those who quoted it did not know it but from quotations; a perusal of the paper would have made many mistakes evitable.

In 1874 Forel's splendid work on the ants of Switzerland[1] appeared, a wonderful testimony of his talent of observation and of classification, and this was followed by a number of myrmecological studies.[2] In the same time he worked out the classical paper on the anatomy of the tegmentum and its connections with the cephalad portions of the brain.[3] There is no doubt that v. Gudden who was psychiatrist at Zürich when Forel was a student made a deep impression on on him. Huguenin was at that time working in Meynert's sense and ways and published his anatomy of the brain 1873.[4] Forel too become a pupil of Meynert, but his independent mind, trained so well by his entomological studies, led him another way. Whereas Huguenin furnished a translation of Meynert's work into intelligible Ger-

---

1. Les fourmis de la Suisse : Nouveaux mèmoires de la Sociètè helvètique des sciences naturelles, 1874.

2. Etudes myrmècologigues, Bull. Soc. vaud. sc. nat. xvi, 81 etc.

3. Untersuchungen über die Haubenregion und ihre oberen Verknüpfungen im Gehirne des Menschen und einiger Säugethiere, mit Beiträgen zu den Methoden der Gehirnuntersuchung. Von Dr. August Forel, Assistentarzt an der Kreis Irrenanstalt München. Arch. f. Psychiatrie, Bd. vii. 1877.

4. Allgemeine Pathologie der krankheiten des Nervensystems. I. Theil. Amatomische Einleitung. Zürich, 1873.

man, as Forel remarks very wittily, with figures still more schematized than Meynet's, Forel made an attempt to leave the ground of speculation and to study attentively what serial sections of the brain show and what they don't show. The scientific training which he has shown in his dissertation and afterwards in his work on the ants, found congenial encouragement with von Gudden, whose assistant he had become in the Lunatic Asylum of Munich.

I am perhaps too enthusiastic about Forel's paper on the tegmentum. Yet I believe it is to this paper that I owe nearly all my education for anatomical studies. Edinger's classical lectures as an introduction, then Forel's papers and Burdack's famous work ought to form the first school for the study of the numerous monographs and for original work. The writer of the present sketch had the chance of getting the late Prof. Meynert's copy of Forel's paper. The numerous remarks by Meynert's own hand show with what attention the famous master studied the work of his critical pupil.

It is impossible to give here a fair review of the paper on the tegmentum. I hope that the reader of this paper is already familiar with it or, if not, he will be sufficiently rewarded by reading it in the original. Forel has a great advantage over most writers on anatomy of the brain. French being his native and I might say natural language, his education and mental tendancies being German, he handles the difficult subject with an astonishing simplicity of stile without becoming inexact and superficial. Let me mention the characteristic features of Forel's paper.

The speculative anatomy of Meynert and especially of Luys are entirely abandoned and purely anatomical methods are used. The defective nomenclature which has been and for a long time will be a great impediment for the progress of our science, is examined and careful definitions are put in the place of vaguely used terms. It seems that too often names were created first and then applied to fibres and nuclei which would best suit the hypothesis, whereas we should try to analyze the elements first and give them a name when we have recognized them sufficiently well as independent elements. Forel follows the rule of adopting the term which has been used first; he adheres to historical principals. This requirers a knowledge of the definition of a term used by the various authors; as there is no dictionary of synonyms of anatomical terms which would give all the various uses and misuses, it is advisable that we should say what definition of the term we assume, by quoting the name of the author. Where new terms have to be created, we had best avoid the so-called rational nomenclature, because experience shows that the most irrational and confusing nomenclature has been created in this way. This is all the more true now, where the brains of lower vertebrates are studied and we have to adopt the oddest names.

In 1881, Forel was called to Zürich for the chair of psychology, which is connected with the position as director of the lunatic asylum of the Canton Zürich. In this position he lectured for several years on anatomy of the brain, until he gave this branch to Privatdocent v. Monakow. The enormous work connected with the direction of the institution, the active interest which Prof. Forel began to take in the anti-alcoholic movement, and his continued work in the study of ants, did not paralyze him. Through the hands of several pupils he published important observations,[1] in 1886 he wrote the most important contribution to neurology,[2] in which he shows again his great talent for classification and assimilation. This paper even more so than the papers on the tegmetum, defies every attempt of making an abstract. It is itself an abstract of an immense field work, a great numner of observations of various authors and of Forel himself, brought under one new head: the theory of the neuron, of the element of the nervous apparatus. Had not Veja's work on the spinal ganglions misled Forel somewhat, he would have given us the complete plan of the nervous

1. Br. Onufrowicz. Ursprung des N. acusticus. Arch. f. Psych. Bd. XVI, Heft 3. Wl. Onufrowicz. Das microcephale Gehirn Hofmann. Arch. f. Psych. Bd. XVII.

2. Einige hirnanatomische Betrachtungen und Ergebnisse. von Prof. August Forel in Zürich. Arch. f. Psych. XVIII. Heft 1.

system which we know now. The numerous facts which he had observed when using v. Gudden's degeneration method combined with the new discoveries of Golgi, brought him to the conclusion that the nerve-cells and their prolongations (fibres) form one entity, ending free, without anastomosis. The same idea based on embryological facts was published independently and in the same month (August, 1886,) by His. This paper of Forel is so classical that I do not make an attempt of giving a review of it; it is absolutely necessary to know it in the original. It contains many details on von Gudden's, v. Monakow's and Forel's work, which are as a rule omitted in the current text books.

Forel's last contribution for neurological literature is a short communication of results obtained with v. Gudden's method with regard to the IX, X, and XII nerves.[1] In the introduction he gives a general review of the methods for anatomical research on the brain. The chief result of this work is that it proves that there is no crossed root in the motor part of these nerves, such as Obersteiner maintains in his work.

To complete the review of the work published by Forel and his school, I should like to mention here a short communication of Dr. Schiller,[2] who tried to compare the numerical difference between the elements of the new-born and of the adult cat. He chose as a typical object the third nerve and he found the average number of fibres 3,000. The new-born cat had about 50-75 fibres less than the adult one, a difference which may be caused by the very small size of the fibres in the young cat—some may have escaped the eye of the observer; we may however quite as well think of the individual differences. Whereas in the new-born animal the fibre measures between 1.5 and 5m, the fibre of the adult measures between 6 and 20m.

Prof. Forel has in his laboratory a fine collection of serial sections made by himself and by his assistants. Of late years, he appears rarely in those two rooms; Dr. Mercier has the whole under his care at present. Those who wish to work in the laboratory will however always find a hearty welcome.

---

1. Kölliker's Festschrift. Albert Müller, Zürich, 1891.

2. Comptes rendus des sèances de l'Acadèmie des Sciences de Paris. Sept. 30, 1889.

THE INSULA OF THE PIG.

By T. E. Clark.

With Plate I.

The insula (island of Reil) of the pig (*Sus scrofa*) is located between the frontal, parietal and temporal lobes and the olfactory tract.[1] A small portion of this area is included in the Sylvian fissure, but by far the greater part, as in the sheep, lies in what some authors call the vallicula or Sylvian fossa (rhinal fissure, Turner), cephalad of the temporal lobe and dorsad of the enormously developed olfactory tract. The operculums are not well developed and if present at all are very rudimentary. Lussana and Limoigin say they are wanting in the pig.[1] In at least three-fourths of the 20 brains examined, a fissure was found at P. (see Figs. 2 and 4,) and I have assumed it to be constant inasmuch as the brains in which it was wanting were those of pigs under one year old. This fissure, although rudimentary, is well defined and may be the rudiment of the presylvian.

The insula is entirely overlapped dorsally and, when concealed, is also covered laterally by the area in figs. 2 and 4. Its cephalic portion is somewhat concealed by the area N (fig. 2). Accordingly I have concluded that the operculum (m) and the prae-or sub-operculum (n) are sometimes present though rudimentary.

Professor Sir Wm. Turner[3] names the fissure dorsad of the olfactory crus (ex, fig. 1) the rhinal fissure (r). This fissure may be no other than the rhinal fissure if the frontal and parietal lobes are so developed as to completely overlap the insula laterally, as the Sylvan fossa will then be closed up and the rhinal fissure would extend to the surface as in fig. 1. How-

1. Fisiologia der Centri Nervosi Encefalici, Vol. I, p. 150.

3. The Convolutions of the Brain, p. 35, Fig. 29.

ever, in fig. 2, it will be noted that the lateral surface of the insula is exposed in two areas which although connected are quite distinct. The intervening space in which the insula is exposed can be no less than the Sylvian fossa. In brains having more highly developed frontal lobes, this fossa is limited, in the adult, by the development of the pre-and sub-operculums, to a small portion cephalad of the temporal lobe. The width of the fissure which Turner calls rhinal, cephalad of its junction with the Sylvian fissure, is always greater than its width caudad of the Sylvian or cephalad of the fissure P. (fig. 2) where it is the true rhinal fissure. This increase in width is probably due in most cases to the entering of numerous blood-vessels which transverse the insular area and these go mainly to its dorsal surface. I think therefore that Professor Turner erred in naming this the rhinal fissure instead of Sylvian fossa, as the rhinal fissure extends ventrad of the insula and the crus is not connected with the insula at its lateral surface.

Huxley (Anatomy of the Vertebrated Animals, p. 61, Fig. 21) figures (see Fig. 3) the left half-brain of a pig and represents the insula as normally exposed in the Sylvian fossa. Krueg[1] says "the so-called insula, as in the carnivora as well as in the pig (presumably all Suillidae), lies concealed in the depth of a fissure, while in the remaining ungulates it is exposed."

In sixteen brains of pigs ranging one year and under, nearly three-fifths of the insulas were entirely concealed, while in the remaining two-fifths the areas of exposure differed greatly, the extreme being shown in Fig. 2. In five brains of pigs between one and two and a half years, all insulas were entirely concealed and the conclusion reached was that the insula is not normally exposed in the pig. There is considerable variation in the insulas of the same brain.

In No. 9, Left exposed, Right concealed.

In No. 13, Left scarcely exposed (?) Right exposed in two places, Fig. 2.

In No. 17, Left exposed, Right concealed.

---

1. Ueber die Furchung der Grosshirnrinde der Ungulaten, in Zeitschrift für Wissenchaftliche Zoologie, Vol. 31, p. 313.

The plane of the insula is perpendicular to the lateral aspect of the brain, as is the case in the sheep and calf. This position of the plane, as well as the location of the insula in the Sylvian fossa, is probably due to the undeveloped state of the frontal lobes and the unusual development of the olfactory crus. For in the horse, whose frontal lobes are more highly developed and whose crus is much smaller, the insula stands at an angle of about 45° to the lateral surface and the larger part of the insula is located in the Sylvian fissure. Moreover in one brain (pig) (No. 4) this plane makes an angle of not more than 60°-65° with the lateral aspect. This being the case in but one brain, it naturally suggests an individual peculiarity.

The area which represents the insula in the pig is quite large and generally well defined except at its junction with the temporal lobe. In but three instances was there any distinct line of demarcation. In one of these the depression was slight, about like the average fissure upon the insular area and might have been caused by pressure of an artery. In the second insula this depression was at least twice as deep as the first and easily recognizable as a true fissure. In still another, Fig. 7, this depression reached a depth of nearly four mm. completely separating the insular area from the temporal lobe. In the last mentioned brain the fissure in question was visible upon the lateral aspect of the brain while in the two preceding it was not.

The cephalic boundary of the insula is unusually sharply defined by the circuminsular fissure in pigs of one year and over, as shown in Figs. 6, 7, 8, 9 and 10, while in those of 6–10 months the insula is so narrow cephalad that it may graduate insensibly into the frontal lobe without the formation of a fissure. This is shown in Fig. 5. The area becomes suddenly much thicker dorso-ventrally near the temporal lobe. Upon this area one fissure (t, Fig. 5) at least, appears to be constant. It seems to originate upon the lateral surface of the insula nearly opposite the mouth of the Sylvian fissure. It sometimes extends scarcely to the dorsal surface while in others (those of one year and over) it may extend dorso-caudally almost across the insular area as in Figs. 6, 8 and 10.

Other fissures are nearly always found upon this area. The cephalic portion of the insula is divided sometimes into as many as three gyres but these divisions are not believed to be constant, and in the pig, as in the sheep, owing to its comparatively simple character, these individual differences are very striking. The fissures as a rule grow deeper as they approach the meson and the cephalic portion of the insula does not extend as far as laterad as the rest.

DESCRIPTION OF PLATE I.

Fig. 1. Lateral aspect of the Left Hemicerebrum of a Pig, (after Turner). r, rhinal fissure; s, Sylvan fissure.

Fig. 2. Right Hemicerebrum of Pig. No. 13; x 2/3. In, Insula; Sy, Sylvian Fissure; Rh, Rhinal Fissure; Olf, Olfactory Tract.

Fig. 3. Lateral aspect of Left Half Brain of Pig (after Huxley). Sy, Sylvian Fissure; In, Insula.

Fig. 4. Lateral Aspect of Right Half of Brain of Pig. No 17; x 2/3 Rh, Rhinal Fissure; Sy, Sylvian Fissure; Olf, Olfactory Tract; Op, Optic Nerve.

Fig. 5. Left Hemicerebrum of Pig. No. 12; x 2/3. Olfactory bulb removed. Olf, Olfactory Tract; In, Insula.

Fig. 6. Left Hemicerebrum of Pig, showing Insula as seen when the Dorsolateral overlapping portions are removed. Olfactory Bulb removed No. 13; x 2/3. In. Insula; T, Union of Insula with Temporal Lobe; Olf, Olfactory Tract.

Fig. 7. Right Hemicerebrum of Pig. No. 9; x 2/3. In, Insula; C, Circuminsular Fissure; R, Rhinal Fissure.

Fig. 8. Left Hemicerebrum of Pig, showing Insula as viewed from dorsolateral aspect. No. 9; x 2/3. In, Insula; Olf, Olfactory Tract.

Fig. 9. Right Hemicerebrum of Brain of Pig. No. 9; x 2/3. In, Insula.

Fig. 10. Left Hemicerebrum of Pig. No. 17; x 2/3. In, Insula; Olf, Olfactory Tract.

THE DEVELOPMENT OF MEDULLATED NERVE-FIBRES.

With Plate II.

By C. L. Herrick.

It is remarkable that a question apparently so simple as that respecting the development of the nerve fibre should remain without an answer. The necessity for a clear comprehension of the course of normal development of nerves is more important than it might otherwise appear because of its bearing on the vexed question of the degeneration and regeneration of the same structures. The literature upon the latter subject has been steadily increasing without affording unambiguous evidence as to the exact method of regeneration. While several writers, like Notthaft,[1] claim that the regeneration proceeds from the central stump peripherad, others, like Howell and Huber, find that the new axis-cylinder originates cotemporaneously throughout the newly-formed sheath. Much obscurity still prevails as to the part played by the nuclei of Schwann's sheath during the regeneration of the axis-cylinder though it is not doubted that the remarkable proliferation which they undergo sustains some important relations to the absorbtion of the exudates from the decomposing nerve and the regenerative processes which follow.

The influence of high authority has supported the view that a nerve fibre is derived from a central neuron (cell of ventral cornu or spinal ganglion) and extends unbrokenly to its peripheral end-organ whether the distance thus covered be millimeters or meters. So long as the dogma of nervous conduction by continuity prevailed this seemed to physiologists a natural if not a necessary postulate. When, however, we discovered that within the neuraxis the tracts of nervous conduction are frequently composed of series of contiguous neurons,

---

1. Neue Untersuchungen über den Verlauf der Degenerations- und Regenerations–processe. *Zeitsch. f. wiss. Zool.* iv. 1.

the necessity, at least, of the primitive continuity of a nerve fibre no longer maintained. The outgrowth of ventral nerves from the spinal cord was first conjectured by Bidder and Kupffer who also supposed that the dorsal arose in this manner. Koelliker, Marshall, and especially His have adopted the same view. The last mentioned has given very complete descriptions of the process of histogenesis and has showed that the sensory fibres are derived from the ganglionic ridge or spinal ganglion rudiments and send fibres in both directions, i.e. into the neuraxis and peripherad. Almost all these authors, including Sagemehl, His, and Koelliker, have assumed that the outgrowing fibres are continuous processes of the central cells, which, accordingly, must attain a prodigious length in order to reach their peripheral end-organs. According to Koelliker and His, cellular elements from the mesenchyme surround the bundles, penetrate between the fibres and, at first sparingly, but afterwards at regular intervals produce the sheath of Schwann. Balfour, on the other hand, remained unshaken in his belief in moniliform adhesions of outgrowing cells which arise in the cord. In vol. II. of his Comparative Embryology he says "The cellular, structure of embryonic nerves is a point on which I should have anticipated that a difference of opinion was impossible, had it not been for the fact that His and Koelliker, following Remak and other older embryologists, absolutely deny the fact. I feel quite sure that no one studying the development of the nerves in Elasmobranchs with well-preserved specimens could be for a moment doubtful on this point." Dohrn at one time took the same position though we believe he has since receded from it. Hensen's view is, at first sight, quite different. I quote from Hertwig's Embryology as follows. "He [Hensen] opposes the doctrine of the outgrowth of nerve-fibres chiefly from physiological considerations. He can think of no motive which is capable of conducting nerves which grow out of the spinal cord to their proper terminations—which shall cause, for example, the ventral roots always to go to muscles, the dorsal to organs not muscular, and shall prevent confusion taking place between the nerves of the iris and those of the eye-muscles, between the branches of the trigeminus and the acoustic and facialis, etc. Therefor Hensen maintains on theoretical grounds that it is necessary to assume that '*the nerves never grow out to their terminations, but are always in connection with them.*' According to this view, which he endeavors to support by observations, the embryonic cells are, for the most part, united with one another by means of fine connecting threads. He maintains that when a cell divides the connecting thread also splits, and in this manner there arises an endless network of fibres; Out of these the nerve-tracts are developed, while other parts of the network degenerate."

Respecting this theory it may be said that it has the obvious virtue of recognizing a difficulty which has been systematically underestimated or ignored. Furthermore recent discoveries in lower vertebrates and worms show that the sensory nerves primarily arise from the general epidermis which in the primitive state consisted of a blending of neuro- and spongio-epithelium. The ectoderm was homogeneous throughout. In the worms the neuroblastic cells are not concentrated as perfectly as in vertebrates and even in vertebrates the concentration varies within wide limits. In Amphioxus the spinal ganglion lies along the whole length of the dorsal root to its bifurcation. We believe that the spinal ganglia of other vertebrates are to be homologized with the disperse neuroblastic cells of the general ectoderm and that the central trunk contains homologues of one set of anastomosing branches, the peripheral trunk those of another.

It would seem impossible to doubt that the motor roots actually arise in the cord and pass to their motor or trophic termini, though it has often seemed to the writer that the evidence is that the formation of the specific muscle or gland is to be ascribed to the influence of the migrating nerve rather than that the nerve "fundament" gropes blindly toward its destination and plays a temporary game of hide and seek with the latter.

Much more investigation in invertebrate neurology is needed to enable us to grasp the morphological and physiological laws which have been involved in the formation of the concentrated motor apparatus in the cord and its relations with muscles, etc., external to the neuraxis. It may be assumed that the principle enunciated by Hensen will be found to lie implicate in earlier conditions than those which now prevail.

It is intended to give at this time a part of the evidence which led the writer to say in a previous number of this Journal (p. cxxxix), "study of the growth of nerves in embryos of serpents, amphibians and mammals has convinced the writer that, in some cases at least, the growth is by moniliform adhesion of neurons."

The facts and observations will be given as briefly as possible without attempt to cite literature. Our thesis is the following: Medullated nerve fibres are formed from proliferating cell-masses which arise either within the neuraxis from niduli of multiplying cells (centrifugal fibres) or from spinal ganglia (centripetal fibres.) The nerve grows by intrinsic proliferation due to karyokinetic multiplication of the neurons. Such proliferation may take place anywhere in the nerve. The nuclei of the neurons at first lie in the fibre thus produced and only subsequently are "side-tracked" and are connected with the sheath. They probably retain a vital connection with the fibre. The sheath is to be regarded as a peculiarly modified cell-wall of the neuron. (It is possible that the segment-forming cells of the nerve-fibre should be compared with spongioblast elements, and it is doubtful whether an arbitrary separation can at first be made between spongioblasts and neuroblasts, but the point here made is that they are derivations of the neuraxis.)

1. The nuclei of the nerve fibres are derived from the neuraxis. Fig. 1, of Plate II, illustrates the origin of the oculomotor nerve in a young snake embryo. In this case, as in all other motor roots at an early stage, there is a peripheral migration of cells connected with the root. Other neuroblasts are crowding peripherad from within. Some may be traced to the boundary of the medulla and resemble in every respect others which lie in the peripheral part of the nerve. Throughout the entire course of the nerve it is made up of neurons of a similar sort. Fig. 3, of the same plate indicates the relations in a sala-

mander larva, where some of the nuclei are actually emerging. Fig. 11, shows the relations as seen in a horizontal section of the thoracic cord near its ventral surface. *a—a* indicates the position of the median line. The karyokinetic figures near the periphery belong to the sheath, but the others are undoubtedly elements of the root system. At an adjacent level very numerous neuroblasts in mitosis are seen near the central canal.

2. After issuing from the neuraxis the cell masses continue to multiply. Fig. 2 illustrates subdivision of a neuron in the seventh nerve of a very young embryo of Eutænia near its exit from the medulla. Fig. 10 is an illustration of mitosis in the midst of a fibre of spinal nerve in the salamander larva some distance from the ganglion. Only a few of the neurons are drawn, but lines mark the width of the nerve. Fig. 12 indicates the subdivision of neurons in the ganglion of the eighth nerve, (here only a few cells are drawn.)

3. The nuclei thus formed are at first continuous with the embryonic fibres out of which the axis-cylinder is formed. Figs. 4, 7 and 8 are introduced to verify this point and were drawn by aid of an excellent one-twelfth immersion and Abbe illuminating apparatus. The preparations are from salamander larvæ fixed with chromacetic and platinic chlorid and stained with hæmatoxylin and acid fuchsin after sectioning in paraffin and walrath in continuous bands. Fig. 5 is a cross section of a similar nerve showing the only case observed where the fibre lay beside the nucleus (a) instead of continuous with it. In all other cases at this stage the nucleus alone occupied the walls. Fig. 6, which cuts obliquely through a spinal ganglion, illustrates the same fact. Fig. 10 shows that the cells of a spinal ganglion actually are converted into nuclei, *b* being regarded as an intermediate state.

4. In none of the cases cited is there any other source visible for the nuclei, which are obviously rapidly multiplying, than that indicated. There is no evidence of the intrusion of connective elements to associate themselves with the nervous fibres. This is especially true in the salamander, where there is the most diagramatic simplicity in structure. Fig. 9 gives an

idea of the extreme simplicity where the spongioblasts and neuroblasts are clearly seen in their relation to the root and tracts. In those cases where the sheaths of nerves are forming there is no difficulty in distinguishing the elements of the latter from the nuclei of the nerve fibres.

The part played by these nuclei in regeneration is most simply explained as a mere repetition of that part which they originally took in the formation of the nerve. In the optic nerve the formation of sheathes by interpolation of connective matter is very readily seen in reptilia but the sheath material cannot be compared with the neurons or their derivatives. In mammalia and birds the relations are obscure. The chick is one of the least satisfactory subjects for histogenesis in the whole realm.

DESCRIPTION OF PLATE II.

Fig 1. Root of oculo-motor nerve. Black snake embryo.

Fig 2. Seventh nerve near its junction with the medulla of very young Eutaenia embryo. *a. a.* case of subdivision of the neuroblasts.

Fig. 3. Very early stage of Salamander larva, showing actual emergence of neuroblasts from the medulla (on the right.)

Fig 4. Isolated neurons of motor nerves in salamander larva. A double stain of hematoxylin and acid fuchsin.

Figs. 5, 6. Cross sections of ganglia with the emerging nerve, illustrating the fact that the nuclei as well as the fibre, are independent of the wall and that as a rule at this stage one does not encounter *both* fibre and nucleus within the sheath but one or the other as the section may pass. At *a*, however, the fibre has been differentiated off from its nucleus whose protoplasm has disappeared.

Fig. 7. A neuron in which the thread is being differentiated off.

Fig. 8. Fibres from the dorsal root crossed by others of the ventral root passing to the dorsal muscles.

Fig. 9. Portion of a transection of the spinal cord of salamander larva showing the distinction between spongioblast and neuroblast cells in the ventral portion.

Fig. 10. A few neurons from a nerve at its exit from the ganglion. At *a* karyokinetic subdivision of a neuron ; at *b* a ganglion cell producing a fibre and transforming into a nerve nucleus ; at *c* an unaltered ganglion cell. The width of the nerve is indicated by the outlines.

Fig. 11. One half of a section through the ventral part of the spinal cord of salamander at the exit of a root. The median line is along *a—a.* The large karyokinetic figures doubtless belong to the sheath in which mitosis is very easily observed.

Fig. 12. Eighth nerve? Several cells of the ganglion and the nidulus.

EDITORIAL.

The Scientific Utility of Dreams.

Our practical age is prone to antagonize anything which cannot be converted into substantial utility, yet the very delving after utility not infrequently discovers stern realities in the most shadowy regions. Even practical men dare not openly revile the scientific employment of the imagination and the genius which condenses the vapors of our furnaces into commercial worth may yet succeed in condensing the vaporings of the sleeping brain or distilling the mercurial humors which the school of Descartes fancied hissed through the tube-like avenues of the cerebrum.

Dreams have undoubtedly had more to do with the origin and coloring of religious belief than any physical influence whatever. While the careful student will avoid the rash statement hazarded by Radestock that the belief in the supernatural is a direct product of dream association and disassociation, the most reverent critic will recall that in the older time the most characteristic avenue of inspiration has been "dreams and visions of the night." It is true that destructive scientific criticism has employed this fact with rude force to undermine the validity of all revelation and especially to destroy the grounds of confidence in the existence and immortality of the soul, nevertheless after such attempts there must follow a period of reconstruction. Because the source of familiar ideas and beliefs is not just what we supposed or the medium of vision is of an unexpected character it does not follow that the content—be it faith or sight—is worthless or totally unreliable. Narrower inspection, sharper criticism, wider generalization—these are the correctives which doubt needs rather than the mildly soporific prescription of ignorance offered by bigotry and conservatism.

The literature of the subject is enormous but with few exceptions genuine scientific methods have been conspicuously absent. Either the mind has been dominated by a mysticism akin to dream-life itself or the student has failed to take the subject seriously. The scientific study of dreams requires peculiar discipline and unusual conditions. First catch your dream—and this is by no means so easy as it first appears, not so much because one cannot dream at will as because the tissue of a dream deliquesces on exposure to the daylight of cortical consciousness. A dream melts in the warm hand, it is distorted by a breath, it phosphoresces and burns out in an oxygenated atmosphere, the cinder left at the terminus of its comet-like trajectory is very unlike the actual dream. A dream must be prepared by a special technique as essential as paraffine imbedding for sectioning the tissues of the brain which produces it.

One must be conscious of two sets of physical environments. The dream association is played upon a different stage and before a different audience from that of waking states. Yet the drama of the day is frequently the parody of the night. When one recalls a dream, especially to repeat it, the elements are clothed in the language of day association and unconsciously to ourselves we recreate the whole scene to an extent which deprives it of much of its scientific value. Even when one lies quietly with closed eyes and immediately upon waking traces hastily on a scratch book the outlines of the dream, he finds no words to express the peculiar shadowy character of his dream. I am convinced that one peculiarity of the dream which distinguishes it from presentations of waking experience is the fact that a concept is incompletely associated with its sensuous elements. During normal states the concept of a dog involuntarily associates with itself the presentations of hairiness, size, bark, wagging of tail, warm breath, etc., etc., but the dream dog may possess only the wag of the tail and be neither hairy, warm or noisy. The image is like that of a triangle with three angles and no sides which the geomety of dreams finds no difficulty in construing. Another peculiarity of the dream is that generally some predominant feeling or general notion is the determinant which groups the scanty materials at disposition in aggregates consistent with it. The sudden opening of a new avenue of association, adding new elements to the complex, changes the whole setting of the dream, forming new associational groups according to definite laws, but the feeling is not altered and the change does not bring with it any sense of incongruity—its personal value remains unaltered.

An illustration of the result of this one-sided association is a dream which the writer had when a student in Germany. Being seated with a friend in a garden, a small lizard-like, active animal appeared which at the same time seemed to be a Japanese student. The impressions were not vivid enough to be readily recalled but the effect was of some small active unfamiliar animal associated on one hand with the concept *lizard* and on the other with the concept *native of Japan.* I was told that most Japanese students were good linguists and accordingly addressed the lizard in the best German I could command, politely inquiring if he was familiar with the language. He at once reqlied in fairly good German and with irreproachable suavity. There was considerable surprise that the lizard should speak *German* but none whatever at the fundamental marvel that he could speak at all. In general, during that period the presentations of words and phrases were uncommonly distinct as a result of a struggle with a new language.

A great deal of historical matter has been collected by recent writers on dreams, for an excellent summary of which one may consult Radestock, (Schlaf and Traum, Leipzig, 1879,) to which author we are indebted for many of the facts here cited. The older Greek writers recognized dreams as of divine origin. In Homer they are represented as derived from Zeus, who, however, was not above sending delusive visions when it suited his purposes. The Pythagoreans, Socrates and Xenaphon trusted to the prophetic nature of dreams and even Plato taught that the moral man might acquire a deeper insight into truth during sleep than amid the distractions of the day. Paracelsus describes what he calls the sidereal part of the soul which ascends to its native stars during sleep, there extending its ordinary sphere of knowledge. A curious approach to the modern doctrine of hypnotic suggestion is found in the view of Von Nettesheim that through an effort of the will one may control the dreams of another person even though ignorant of the distance and position of the subject.

The philosophical importance of dreams lies obviously in the belief openly expressed by Tylor, Radestock and others that the concept of the immortality and even the separate existence of the soul originally grew out of dream appearances. It is certainly the fact that in the earliest ages dreams were regarded as the most direct and important means of revelation. The office of "interpreter of dreams" was more important far than the corresponding meterological bureau of the modern regime. The history of the Hebrew people would have been far different, as Dr. Hale has shown with no less acumen than wit in his clever tale of the yellow dog, if Providence had not watched over the career of Joseph, the dreamer of Dothan. When the Guinea negro sees his departed foe in visions upon his bed it never occurs to him to doubt the reality of the visit. When the savage dreams of the happy hunting grounds he awakes with full confidence that his spirit has left the bodily tenement and tasted the first fruits of his pious ferocity. The Tagli in Luzon believe that a dreaming person should not be awakened lest his soul should perchance be absent. An Indian in Manilla, on awakening suddenly, found only the part of the body of his companion from the middle upwards lying by his side, the rest having wandered away in the form of "Tigbalang," He covered the torso with ashes, at which the missing portion returned with threatening gestures being unable to reunite with the trunk by reason of the ashes. It is not merely the savages of Africa and the Chinese who believe that the air is thick with spirits who share our food and largely control our acts. A certain grade of mental development and various conditions of body and periods in life predispose to a belief in what we characterize, in the natives of New Zealand, as gross superstition.

The most diverse and widely separated races have the common belief that special precautions are necessary to prevent the spirit from returning to its once familiar scenes. The Greenlanders, Siamese and Hottentots carry the body through a breech in the wall or a window, to prevent this unwelcome visitation. Many African races avoid the hut for a certain time. It is not difficult to believe that this time is an approximate measure of the vividness of the association which calls up in sleep the image of the departed one.

Lower animals and even inanimate objects thus come to be animated with a being, an essence which corresponds in certain points with the corporeal object of experience. This dualism is so universal that philosophy is quite as much under its influence as popular language and thought. Some modern thinkers seem to react so far from this view as to be willing to ascribe all ontological concepts to the effects of visionary misconceptions—in fine, to dreams and analogous products. The monism of a modern psycho-physicist is inclined to say with Fechner, "The soul is not an independent being within or associated with the body, but it is bound up with the corporeal substratum. Spirit and matter, soul and body are two different aspects of one and the identical essence, depending on whether it is presented to the external or internal experience."

Enough has been said to indicate that the phenomena of dreams have a deep interest for every thinking man and, inasmuch as the scope of this article does not include the speculative problems just referred to, it will be sufficient to add a word of warning. Because it seems more or less probable or possible that some of the very highest and most potent beliefs of the human mind may have been formulated or given conceptual expression through the instrumentality of the airy touch of dreams it by no means logically follows that these same beliefs and concepts may be lightly rejected as a tissue of fantasy with no real foundation. It would be quite as legitimate to distrust visual impressions because they are the result of an intangible image utterly dissimilar to the real object which they present to our perception. To the psychologist dreams are of value primarily because they afford a method of analysis which serves to separate elements which in waking experience are indissolubly connected by association. At the same time new applications of the laws of association themselves are afforded.

The dream is generally a spontaneous abstraction which does not rise above its simplest form. The qualities thus abstracted are not generally associated with concrete names or, if so, are so erroneously associated that the separation may be affected by sufficient care. This abstraction is of the character of what Morgan calls an isolate rather than a general notion. It is as though the highly illuminated side of a cube were separated from the rest of its sides and presented in consciousness when the latter is too torpid to supply by associatlon the parts necessary to a perfect image. On waking one fills out the hiatus unconsciously but with a degree of uncertainty which he cannot account for in view of the great vividness of the dream. Spitta says, "the first symptoms by which sleep ordinarily announces its approach a longer or shorter time in advance of its actual entrance, the feeling of stupidness, weariness, sleepiness, consists primarily in the fact that we are involuntarily forced to turn our attention to our own subjective condition." He calls attention to the fact that, during the day, activities are carried out with a certain spontaneity which is gradually lost with the approach of sleep. Even the fixation of the attention upon external objects is lost.

It seems to us that this analysis is uncritical in one respect. Granted that the senses become fatigued and that every attempt at giving expression to the will meets serious hinderances which force themselves upon our attention if we persist in our purpose, and granted that our internal sensations are not so quickly quenched, it does not follow that the latter are increased or that self-consciousness is intensified. That such an appearance is simply relative is easily seen. Every one knows that the concentration of thought upon one's subjective states is not a good method of conquering sleeplessness.

Yet in another sense we agree with Spitta that during sleep subjectivity dominates.

The wide divergence of opinion respecting the psychical nature and value of sleep is gathered from a comparison of Hegel, who said life is divided into two realms—a night life of genius, and a day life of consciousness, or of Fortlage who says, "only in as far as we sleep do we live, when we awake we begin to die," or Erdman, who said "sleep is a regression into embryonic life," with that of Spitta, who says that in sleep the life is impoverished as though it were only present in outline.

The view held by Hegel resembles more than any other the opinion prevalent among the Greenlanders that there are two souls; 1st, the breath of life which forms the psychical continuum during the entire life; 2d, the spirit or shade, which is a more etherial essence not so strictly connected with the body. The latter during dreams may entirely leave the body and pursue an independent avocation in the realm of shades.

The question whether the active life of the soul is interrupted during dreamless sleep has a theoretical importance quite disproportionate to its practical significance. Were it true that such an interruption occurs, it would never enter consciousness, since an unfilled portion of experience like the non-visual portion of the retina never finds immediate expression. On the one hand, if the soul were simply the sum of the physical stimuli which attain a certain violence or refinement there could be no question of chronological continuity or integrity; on the other, if the soul be a being distinct from the body and only incidentally connected with the latter in certain conditions of excitation, the activity of consciousness might be doubly determined by the variations of the body and entirely inaccessible psychical phenomena beyond consciousness. If we substitute the monistic interpretation and consider the conscious life as one aspect of a real being whose other side finds expression in terms of physical phenomena it would be natural to expect these two manifestations to be continuously associated though with varying intensity. Strümpel, [1] says, "The activity of the soul in sleep is not limited to dreams, as it is not limited when awake to consciousness. It withdraws

1. Natur u. Entstehung der Träume; Leigzig, 1874.

inward in its unconscious forms without ceasing to be soul on that account. But this position, which is also unquestioningly accepted by Spitta, seems but a begging of the whole question. If there is a psychical activity apart from my consciousness how do I know that it is the activity of my soul? Might we not with equal reasonableness take the position of the savage that some spirit visited us in dreams?

So long as we do not know the conditions which enable the physical stimuli resulting from external and internal physiological irritation to appear in consciousness, we can only say that since these processes are uninterrupted there may be even during deep sleep some feeble and imperfect consciousness. That such is the case is rendered probable by the fact that even very vivid and painful dreams vanish on awaking in case their content has no direct connection with the present. A fact which has been variously interpreted is that one can readily determiue to awaken at a given hour and rarely fail in so doing if the importance is sufficiently realized. Perhaps one awakens too soon or is somewhat restless, in other cases the sleep is profound. I have observed in such cases that upon accidental awaking early in the night a certain burden is always upon the mind, i.e. a consciousness of an obligation which may require some time to clear up sufficiently to produce a concept of that which is to be done. This is true of the early part of the night; later, as the hour approaches, the association with the purpose to rise is often more close. Many times the writer has plunged out of bed in a condition of stupor requiring some minutes to gain a concept of the reason for the act and the place in which he was. These phenomena we interpret as indicating an enduring effect exerted by the waking will on the sleeping associational processes. If one dreams, this impress is nearly always present in one form or other. It sometimes happens that in dream the obligation is fulfilled and the pressure is thus relieved and one fails to awaken at the proper time or awakes with the feeling that the purpose for which he was to rise is accomplished.

It must be insisted that the fact that no dream was recalled is no proof that one has not dreamed. As an illustration of the last mentioned fact I may mention that one day as I sat in Prof. Ebbinghaus' lecture room following a discussion, I caught sight of the back of a man's head, who reminded me of General C., whom I had not seen for nearly a year. A second glance showed that there was no resemblance except in the position of the head and the gray hair, but I then became aware of a dream of the previous night in which I had conducted a party of children to the rooms of the general in an American city where the latter exhibited his interesting collection of microscopic objects. It appeared that I had conducted the children at the instance of a lady who might have been the principal of a school or head of a pension and who, as it proved, had presumed to send the children without invitation. While embarassed by this information, General C. reassured me by saying that it was a pleasure to serve in this way as it was the only service he was now capable of in his failing health. The whole dream was vivid and affecting. It was a composite of which most elements were clear on reflection. The evening before I had thought of General C., had planned to write him in explanation of an apparent neglect. I had been to Urania, a popular Berlin scientific institute, and had been reminded of General C.'s collection, had seen a teacher conducting a squad of boys of say fourteen years, had recalled a social obligation respecting a certain lady at the head of a pension in Berlin and had felt some uneasiness as to my health. That a dream of this vivid sort did not remain in memory in the morning when, as was my habit, I lay with closed eyes ransacking my consciousness for any evidence of dream activity may serve to indicate that a vast deal goes on every night the burden of which we are not forced to carry in memory during the day.

This is a question which has usually been settled as Descartes settled it by deduction from the systematic standpoint: "As the light always shines, and heat always warms, so the soul constantly thinks."

But we pass to the nature of dreams and the lessons we may learn from it.

Spitta defines dreaming as the process of unconscious outward projection or objectivizing of a series of conceptual images in consciousness during sleep, through which they attain an appearance of reality. In other words, it is, in a sense, a dramatization of purely subjective processes of the soul during sleep.

Nearly all modern authors except Wundt agree that dreams are characterized by a special development of the feelings. We may add that the most striking peculiarity of dreams is the small number of elements associated in a concept. In this respect the study of dreams promises much, but it must be critical study, no mere collection of anecdotes. Of this sort of critical analysis we have as yet no illustration. The difficulty lies chiefly in the impossibility of preventing a completion of these incomplete concepts. Thus I dreamed of a person who was not sensuously presented at all but simply the peculiarity that he was a student of history; this "isolate" alone seems to have come into consciousness. Such an unclothed concept is never tolerated in waking consciousness long enough to be observed and when we reach the corresponding "abstraction" we seem to have a composite element. An attentive study of dreams will show that a certain variety of dreams consists chiefly in this promenade of isolates. Properly understood we believe that the same activity is also constantly at work in waking thought. The formation ot abstractions is not so inexplicable as it seems if we grant that the elements of a concept are not bound up into any such essential unity as we think but first appear as concrete in every case.

These isolates also exist in waking experience separated from their concrete. For example, I was walking in a careless state of mind down a street in Cincinnati and observed a partially finished stone foundation. I thought nothing of it and continued musing when I saw on the other side of the street an incomplete brick building. As I looked I became conscious of a peculiar recognition of a recent experience. My interest was excited and I asked myself what is it which I seem to recognize as familiar. It is not the house—that is entirely unfamiliar—ah, it is the fact that it is incomplete, a concept of incompleteness is in my mind. Where and what have I just seen which has left only this element? I could not tell, but, as I turned back and the foundation came into view, I suddenly became aware of the concrete which had been the origin of my abstract —it was the foundation which bore no resemblance to the brick building. A concept of incompleteness could form an independent element in a dream and associate with itself the most heterogeneous elements.

It is true that dreams often consist in simply sensuous images, but these are not dreams proper but states of visual fantasy in no way different from those which one has before falling asleep.

Where sensuous images play a part in true dreams there is usually but one sense occupied at one time. On waking we add the associative elements from other senses unconsciously. Thus a dream which contained only visual sensuous elements and a series of general concepts is clothed with tactile sensations and the concepts are furnished with words. How often in attempting to relate a dream which seemed perfectly clear in recollection have we been obliged to subject it to curious metamorphoses in order to adapt it to speech in any form. Our ordinary speech does not enable us to accurately describe the fact that we were in some way prepossessed by a feeling of danger and, looking up, saw a mountain, which was not a mountain but a painted canvas, which seemed about to fall upon us and yet, at the same time, would only fall upon us in the belief of some other people (perhaps an audience) while we knew that it was all a play and we should escape, but that nevertheless we must feel a certain fear in our capacity as players. Such a combination of concepts (derived from a recent dream) we would either describe as a dream of being in Pompeii or acting a part in a play representing the destruction of Pompeii.

The careful study of dreams shows that the interpretation of our own immediate mental states is much more complicated than psychologists are wont to admit. The idea that, by introspection, we reach simple and unambiguous realities of our experience is founded on a fallacy which is especially obvious in the recollection of a dream. As Münsterberg well says of will:

"The method of study of the will does not consist simply in self-observation but in a first stage of involuntary perception, and second, a stage of reproduction in memory of the perception, and third, analytical dismemberment of the reproduction." But it is well known that only a very few elements in any presentation of sense are selected by attention for actual perception and the vast spaces between these characteristic elements are unconsciously filled out by fancy under the laws of association. In dreams the number of elements associated in a presentation or concept is very much reduced and the interval between the perception and act of recollection is greater. We are able to observe more accurately the process of rehabilitating the isolated elements. Often it is beyond our power to combine them by associational processes proper to waking states and they slip through our fingers.

The sensorial side of dreams finds many analogies in waking states. It is the belief of of the writer that the images (visual or otherwise) which have once set their seal upon the mechanism of consciousness continue to glow there for a longer or shorter period and that, while ordinary states of attention obscure them by the superior brilliancy of immediate recepts, there are physical and mental conditions which may blow them into a flame vivid even to waking consciousness. As a child, living apart from others of the same age and nervously sensitive, it was for many months an almost constant experience, whenever tired at night, to be greeted on closing the eyes in a recumbent posture by a succession of involuntary images of the most varied and complicated description. These appeared in monochrome or in natural or even brilliant colors, embracing landscapes of great beauty as well as faces with the most diverse expressions. These panoramic displays were enjoyed and the attempt was made to prolong them, which was rarely successful for more than a moment. They seemed to be associated with after images which in my then condition persisted for hours. The effort to retain the visions were chiefly oculomotor. No conscious control or immediate suggestion was recognized, though landscapes usually succeeded landscapes and faces followed faces.

These images were not reproductions of familiar scenes or faces, but fantasy products in which the variety was infinite. In only one or two cases have similar experiences been admitted by others. One friend occasionally hears a band of music with all the parts and claims that it would be possible to write the score. The explanation of such phenomena seems to be that latent residua are revived and intensified by defective blood pressure and the correlations are carried out in accordance either with the varying intensity of the irritant or in obedience to laws as yet undiscovered. It is believed that there is a similar process continually going on in our subconsciousness and that the results of these phenomena make themselves felt in the thoughts which "pop into our heads" as we are wont to say without obvious sense or source.

It has frequently been observed that it is easier to account for dreams than for sleep. Lotze vainly sought to solve the problem of the intermittent manifestation of the soul—a problem of vital consequence to his theory of the existence of the soul—by postulating a large number of small irritants which coöperate to depress the psychical activity and finally succeed in temporarily inhibiting it.

For those, on the other hand, who identify psychical processes more or less closely with their physical or rather physiological concomitants the more reasonable explanation is that exhaustion of the nervous system diminishes its receptivity for external stimuli which are far the most efficient agents. The internal irritants, on the other hand, arising from the organic processes, although normally less intense during sleep, acquire a greater significance and to a certain extent take the place of cortical excitements. The seat of the soul is thus in a sense transferred from the cerebral cortex to the axial portion of the brain. Thus, the inhibitory or controling effect of cortical innervation being diminished, the sub-cortical processes are free to make such use as they can of the avenues of association chance leaves open to them.

If the above theory be true the closer connection of dream experiences with dominent states of feeling becomes clear upon the basis the association of somatic nervous changes with the feelings.

It is needless to spend time with the earlier attempts to ex plain sleep. It has been ascribed to a sort of dropsical condition and to a dessication of the brain, to a plethora and poverty of blood, to a change in the spleen and a collapse of the vetricles, to an accumulation of carbon dioxide and simple fatigue, to heat and electricity; sleep has even been ascribed to a peculiar explosive action in the brain.

All modern authors agree that the active and quiescent states of the brain are constantly associated with changes in blood pressure and composition, but there is little unanimity as to the exact chemical and physical conditions of sleep. It cannot be doubted that oxygen is a very important factor in the normal activity of the nerve cell as well as all other elements. The well known facts that in a trepaned subject the brain becomes pale and shrunken during sleep and that ligaturing of the carotid arteries causes unconsciousness, are explained by Preyer on the assumption that the diminished quantity of oxygen is the direct cause of the depressed function. He says, "Except the liver there is no other tissue in the body which deprives the blood corpuscles of their oxygen so rapidly as the brain." The same effect as that produced by the ligaturing of the carotids may be produced by diminishing the oxygen content of the atmosphere. However, it is impossible to demonstrate a sufficient difference in blood supply to account for the peculiar phenomena of sleep. It is necessary to assume that the oxygen is otherwise employed in sleep than during waking. During active waking hours the muscle and nerve cells form an accumulation of easily oxidizable substance (lactic acid) which during sleep is oxidized, thus abstracting from the blood a large portion of its oxygen. The experimental attempts to demonstrate the availability of lactic acid and its compounds have been variously interpreted and the result must at present be considered negative.

Quite recently we have acquired more definite evidence of great histological changes in nerve cells as a result of fatigue. It is demonstrable that motor nerve-cells after prolonged activity undergo important chemical changes which results in a changed reaction toward stains and in shrinkage of the nuclei and vacuolation and crinkling of the nucleus. Similar changes may be assumed in cortical cells and these must play an important part in producing sleep.

Pflüger has attempted a detailed chemical theory of vital phenomena in which oscillatory motions of the molecules resulting from explosive decomposition and recomposition constitute the active agents. It does not appear necessary to associate his chemical theory with his physical ideas which, as is well known, demand a physical continuum between all parts of the neuro-muscular and glandular system—a meshwork with absolute physical continuity and physiological conductivity, but even without this physical continuity, which recent histological investigation renders doubtful it might be supposed that the gradual destruction of substance, waste of oxygen and acumulation of carbon dioxide might serve to illustrate, if not entirely explain the intermittent character of sleep. The attempt is also made to apply the same principle to the explanation of hibernation and the analogous summer sleep of amphibia. The fact that hyperæmia as well as anæmia of the brain may produce unconsciousness is perhaps simply explained by the supposition that in the former case blood pressure operates mechanically, producing disturbing oscillations. The great variety of nerve stimulants owe their effect to changes induced in circulation, in the nutrition of the cells, or secondary effects which indirectly produce these effects. Whatever view may be taken of the chemico-physical causes of sleep it is still important to have a clear idea of the physiological connex between these processes in various parts of the nervous system. It grows out of the anatomical structure of the brain that nutritive and circulatory processes will not be identically effected in all parts of the organ, and it is by no means indifferent what relation and order prevails in the variation of these proces, as in various portions of the brain. Meynert, who has attacked this problem, as is well known, symbolizes the nerve ganglia as so many colonies of independent vital beings like protozoans with common stalks.

The most recent theory concerning the physiological cause of sleep is that of Meynert, which is repeated in his latest lecture. He says: "As we discover that the cell colonies of the axial portion of the brain at one movement put forth feeble activities compared to those of the cortex and again the situation is reversed, we must recollect that of the myriads of cortex cells capable of consciousness all are never simultaneously awake but the greater number are always, in the language of Fechner, immersed in partial sleep. Consciousness is never animated by all its images and impulses at once, but rather only those elements which are wide awake, i. e., according to Fechner, are attentive, are the sustainers of the momentary consciousness. As the animal in its hibernation sleep is in a condition of depressed nutrition and respiration, so the nutritive condition of the waking cortical cells is different from that of the sleeping. The work produced by a cerebral cell we call its state of irritation. Virchow has shown that, in the case of the epithelium of the kidney, the cells expand when irritated, the muscle expands when excited, and the nerve cell must, in like manner, through its molecular activity, exert a nutritive attraction on the protoplasmic tissues when excited and in greater activity, as an accompaniment of which its excitement rises, according to Fechner, above the threshold of consciousness. In the most characteristic activity of the brain, such as the delicate play of association, in which state only a few out of vast numbers of cells are active and these, through the excitation of associational fibres, call into activity cells in a widely separate area either simultaneously or in a definite serial connex, this selective nutrition can only be produced by an individualized suction of the elements."

This idea of a vital-endosmotic nutritive activity or "cell-suction" receives an anatomical support from the recent discoveries by means of Golgi's method which demonstrate that the nerve cell is always provided with a vast number of fine tubular fibrils which tend to collect about blood-vessels and lymph spaces and are regarded by Golgi as protoplasmic or nutritive as contrasted to nervous or excitory fibres. Van Gehuchten, it is true, feels confident that Cajal is correct in denying any such radical distinction in function, but, in any case, the absorbtive power of a cell must be greatly increased by such intimate communication with the .spongy neuroglia and its circulating vital sap. In a recent address, Jan. 20, 1891, before the scientific club of Vienna, Prof. Meynert takes up the subject from the same point of view. "What is sleep? Obscure as its chemism undoubtedly is, it may be compared to an intermission of the pump-like suction of the cortex—a temporary loss of the molecular attraction which supplies the cells, fibres and centres of consciousness with nutritive plasma and at the same time sucks away at the permeable surfaces of the fine capillaries, fills them with blood and produces a functional hyperæmia, a congestion of the active organ.

This loss of the functional attraction may take place very quickly, as illustrated in the falling asleep of children who seemed perhaps in the previous moment wide awake." The author applies the same explanation to the phenomena of epileptic fainting, hysterical and hypnotic conditions. In the latter the cortical nutrition is sluggish while the subcortical centres, being more directly supplied with blood, and thus at a higher pressure, are still active. The possibility of suggestion lies in the fact that the influence of another supplies the subcortical ganglia with the impulses ordinarily derived from the cortex.

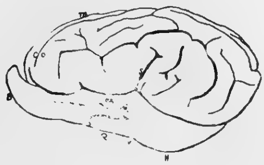
The continual gazing at a fixed point serves to divert the blood supply, while the expectancy causes exhaustion of the cortex, facilitating the hypnotic state.

It is interesting to learn that the theory proposed by Meynert of the differential nutrition of the central ganglia and the cortex gives a physiological basis, in a certain sense, to the view held by the psychology of the middle ages that the soul wanders out of the cerebrum into lower parts of the nervous system during sleep.

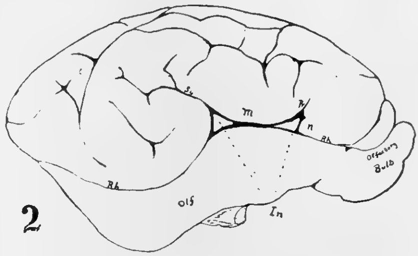
In general, the arena upon which dreams disport themselves is more or less completely disassociated from that of practical life. We awake with the recollection of having had a very interesting dream but not one element in it can we recall. Perhaps on the following night it is continued and some associational element recalls the whole senseless panorama. As already remarked the feelings ordinarily are the starting point or centre of crystallization in dreams. Often, too, the feeling is apparently presented without any concrete basis and a variety of entirely unsuited elements are associated with the feeling. Thus a great feeling of satisfaction and amusement was associated in my mind with a pun which on awaking proved to consist in the employment of the words "fiend-in*snar*nate" instead of "fiend-incarnate," some special witicism being supposed to lie in the italicised letters. Again, dreaming that I was called upon to examine the exercises of a class in logic and feeling distressed by my long neglect of the subject and fearful of not comprehending the purport of the topics, I was greatly relieved to learn that a syllogism ran "two things separately equal to the same thing are equal to each other" with which I found myself sufficiently familiar.

Illustrations. External stimuli may be exalted or over-estimated. (1) During a period of half slumber scarcely to be distinguished from sleep one becomes conscious of being annoyed by the barking of a dog. By a strong effort one rouses sufficiently to discover that the sound is the ticking of the clock which is usually not heard at all.

(2) Just as one is falling asleep he becomes conscious of standing with others before an open grate which produces a comfortable roar. A feeling of draft is associated. On rousing again the roar is identified with the sound of traffic on a distant street. Chills about the shoulder supply the draft and the comfortable warmth which is just beginning to creep over one supplies the heat of the fire.

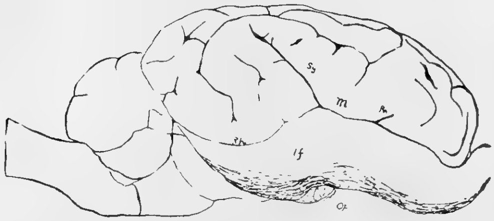


1

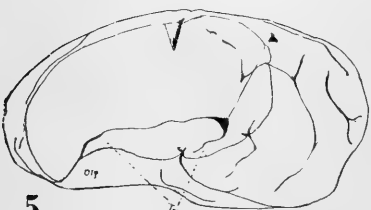


2

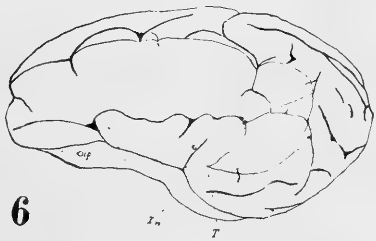
3



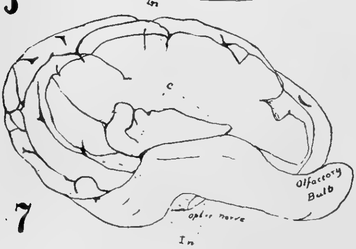
4



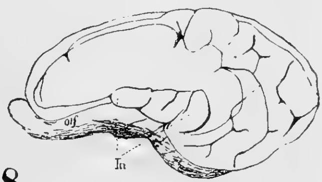
5



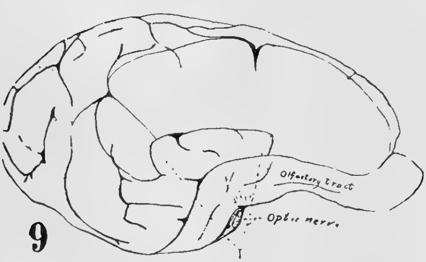
6



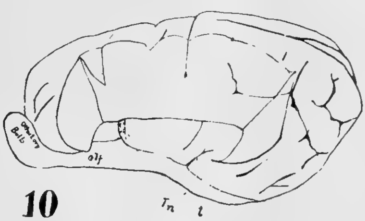
7



8



9



10


1
2
3
5
4
6
7
Spinal cord
Dorsal root
Dorsal branch ventral root
8
root
Spinal cord
Ganglion
12
spongioblast
Motor neuron
Ventral fasciculus
9
10
Root fibres
11

PRELIMINARY NOTE ON THE NERVOUS SYSTEM OF THE GENUS CYPRIS.

[*With Plates III and IV.*]

By C. H. Turner.

Some time ago I began to collect material for a study of the histology of the Ostracoda. The work is progressing, but, owing to delays in obtaining material, it will be a year or more before the work is completed. This being the case and since, so far as I have been able to discover, no work has been published on the histological neurology of the fresh-water Ostracoda, it is thought that a preliminary note on the nervous system of Cypris will not be an unwelcome contribution to Biology. Since it is intended, in the final paper, to give a resumé of all the histological papers that have been published on the Ostracoda, no bibliographical list is given in this note: however, comparisons will be made between the nervous system of *Cypris* and that of the other forms that have been described. For a similar reason, it is not considered necessary to give an account of the technique involved. The following remarks are based chiefly on a study of *Cypris herricki*, but sections of other members of the genus have been used for comparison.

The nervous system of *Cypris* agrees with that of other crustacea in being composed of a compound supra-œsophageal ganglion and a multi-ganglionic ventral chain.

The supra-œsophageal ganglion [fig. 9] or brain lies much nearer the dorsal than than the ventral surface of the body and lies cephalad of the foregut. This is a compound structure, being composed of at least three sets of ganglia. These sets are: the optic ganglion, the antennulary ganglia and the cerebral ganglia. The optic ganglion occupies the dorso-cephalic portion of the brain. It is a median unpaired structure, but its histology seems to indicate that the ganglion has been formed by the fusion of three ganglia. From the apex of the optic ganglion, which is also the apex of the brain, a single median nerve [fig. 10] arises. This is the optic nerve. After passing dorsad a short distance this nerve separates into three branches —one branch for each division of the tripartite median eye [fig. 2] The antennulary ganglia occupy the lateral portions of the brain. From each of these ganglia a nerve arises [fig. 10] which passes latero-cephalad to the antennule of the same side. Near the meson, but ventrad of the optic ganglion, there is a pair of ganglia. These I have considered the cerebral ganglia. There is a commissural connection between the two halves of the supra-œsophageal ganglia; but nothing has been discovered that would lead one to suppose that the nerves decussate within the brain.

The brain is connected with the ventral chain by two circumœsophageal commissures. These are not true commissures, for about midway between the brain and the ventral chain each commissure contains a ganglion. This is the antennary ganglion. The antennary nerve [Fig. 3, 8] of each side leaves the corresponding circum-œsophageal commissure immediately behind the brain. A few of the fibres of this nerve arise in the brain, the remainder arise in the antennary ganglion.

As far as I have been able to ascertain what is known about the ventral chain of the Ostracoda may be summarized in the following words of Professor Lang[1]: "The ventral cord of *Cythere* which follows the brain and œsophageal commissures is said to consist of an infra-œsophageal ganglion and of four subsequent ventral ganglia. The infra-œsophageal ganglion is said to show its composition out of two ganglia and to innervate the jaws, while the three subsequent ganglia give off nerves to the limbs, and the last ganglion nerves to the most posterior divisions of the body and the genital apparatus.

[1]Text book of Comparative Anatomy. Trans. by H. Bernard, 1891, Vol. 1, p. 344.

In contrast with the above, the ventral chain of *Halocypris* appears much concentrated. It consists of an infra-œsophageal ganglion with nerves to the jaws and maxillipedes, and a small ventral ganglion. Out of the latter arise two pairs of nerves, which probably innervate the musculature of the limbs and the abdomen."

Morphologically the ventral chain of *Cypris herricki* Turner, is intermediate between these two extremes. It is more concentrated than that of *Cythere* but not quite so compact as that of *Halocypris*. In this case the ventral chain consists of an infra-oesophageal ganglion and two subsequent ventral ganglia. All these ganglia are connected not only by two longitudinal commissures, [fig. 7] which extend throughout the chain, but also by straggling chains of cells [fig. 9].

The infra-œsophageal ganglion is compounded out of three pairs of ganglia and innervates the jaws and maxillae. Three transverse commissures can be demonstrated in this compound ganglion corresponding to its three pairs of nerves; viz. the mandibular and the two maxillary nerves. The mandibular nerve arises in the cephalic portion of the infra-œsophageal ganglion. It passes forward into the circum-œsophageal commissure for a short distance and then passes laterad to the mandible. [fig. 3] A short distance caudad of the mandibular nerve the first maxillary nerve leaves the infra-œsophageal ganglion and passes laterad to the first maxilla. [fig. 7] Still further caudad the second maxillary nerve leaves the infra-œsophageal ganglion and passes latero-caudad to the second maxilla. [fig. 7] In addition to these nerves, in some of my sections I have observed what appears to be a nerve passing to the digestive tract. If this be a nerve (which I doubt) it may be a representative of the sympathic system.

The two ganglia which follow the infra-œsophageal ganglion correspond to the two pair of legs which follow the maxillæ. From the lateral borders of each ganglion nerves pass to the corresponding pair of legs. In addition to this, from the last ganglion a prominent tract passes caudad to innervate the posterior portion of the body and the post-abdomen. As this tract nears the caudal portion of the body it becomes more and more attenuated. This attenuation is probably due to the giving off of nerves to the neighborlng parts.

The entrance to the mouth of these creatures is fringed with hairs. These hairs, I am inclined to think, function as sensory setae. This view is supported by the fact that these hairs rest upon a layer of elongated cells [fig. 4] which have, in well stained preparations, large clear nuclei and small densely colored nucleoli—cells that are innervated by the infra-œsophageal ganglion and whose general appearance indicates that they are nervous in function.

The most conspicuous sense organ of the genus *Cypris* is the eye. This is a tripartite structure [fig. 2]. It consists of a median and two lateral portions. The median portion lies further ventrad than the two lateral. The space between these three portions is liberally supplied with pigment. Each of the three divisions of this so-called pigment spot is multicellular. In the lateral portions the cells are as long as the structure is wide, and they are arranged with their longitudinal axes perpendicular to that section of the eye. In the median portion the cells are arranged radially. The median eye of the Copepoda, according to Grenacher, is, in all essentials, similar to the eye above described. In describing that eye, Lang[1] considers the three divisions to be retinal cells. In that connection he says, in describing the tripartite eye of *Calanella mediterranea*: "Each single eye is composed of a pigment cup and a strongly refractive transparent 'lens' laid in and on it. The term lens is, however, not applicable. It is composed of several cells, each of which is connected, whether at its outer or inner side is not yet certain, with a fibre of the optic nerve, and must, therefore be considered as a retinal cell."

In *Cypris herricki* the nerve fibres are united to the outer ends of the cells. This agrees with what Dr. Claus found to be

---

[1] Op. cit., p. 352.

the case in the median eyes of the Copepoda, Cladocera and Ostracoda investigated by him.[1]

Since the publication of the paper[2] in which O. Bütschli attempts to show how the lateral eyes of the vertebrates may have been derived from the median tripartite eye of *Salpa*, this tripartite eye, which is of almost universal occurence among the entomostraca, becomes enhanced in interest. One at once begins to speculate on the possibility of this median tripartite eye of the entomostraca becoming transformed into the lateral eyes of the crustacea. Indeed, Dr. Claus, in his late work,[3] has already stated that the lateral eyes of the Corycaeidæ are laterally rotated portions of the median eyes. In this connection it may be of interest to quote a portion of Dr. Giesbrecht's resume of Dr. Claus' paper: "Die Seitenaugen der Corycaeiden sind abgerückte Theile des medianauges, diejenigen der Pontelliden entsprechen dagegen dem zusammengesetzten Arthropodenauge, während ihr ventrales Auge ein dreitheiliges medianauge dürfte ebenso wie die beiden frontalen Sinnesorgane der ersten anlage nach auf Zellengruppen der Scheitelplatte, von der aus wir, . . . die obern Schlundganglien der gliederthiere abzuleiten haben, zu beziehen sein; die drei Augentheile sind vielleicht mit den drei Punktaugen an der Scheitelplatte von Annelidenlarven phylogenetisch in Beziehung zu bringen; die Lage ihrer Pigmentzellen und ihre inverse Form werden auf eine convergent nach einem Punkte gerichtete Drehung zurückgeführt, welche mit dem Herabrücken des Organs in die Tiefe verbunden war: die Secret und Cornealinsen werden von Hypodermiszellen abgeschieden, ähnlich wie Krystallkegel und Corneafacette des zusammengestzten auges: das auge besitzt eine mesodermal Hülle, die sich in das neurilemm

---

[1] C. CLAUS. Ueber die feineren Bau des Medianauges der Crustaceen. *Anzeiger Akad. Wien.* 1891, pp. 124-127. Ref. in *Zool. Jahresbericht für* 1891, Arthropoda 29.

[2] Einige Bemerkungen Ueber die Augen der Salpen, *Zool. Anzeiger*, XV, Jahrg., 349.

[3] Op cit.

des Opticus fortsetzt: Die function des medienauges war ursprünglich, das Thier bezüglich der Richtung der Lichtquelle zu orientiren; bei complicirterem Bau, schon bei den Calaniden, hat es wahrscheinlich auch die Fähigkeit einer beschränkten Bildperception. Am medianauge der malakostrakenlarven ist der ventral Becher bisher nicht beobachtet, aber wohl auch vorhanden."

In a *Cypris* obtained at Burlington, Ohio, each of the three divisions of the median tripartite eye appears to be supplied with a lens.

DESCRIPTION OF PLATES.

a^1, antennulary nerve; a^2, antennary nerve; *c*, circum-oesophageal commissure; *md*, mandibular nerve; mx^1, mx^2, first and second maxillary nerves; *n*, ventral chain; *W. S.*, infraœsophageal ganglion; *O*, optic nerve; *S. G.*, supraœsophageal ganglion,

All figures were drawn with an Abbé camera from sections of *Cypris herricki.*

Fig. 1. Transverse section of body in the region of the posterior portion of the midgut.

Fig. 2. Transverse section of median eye.

Fig. 3. Longitudinal section of circum-œsophageal commissure.

Fig. 4. Transverse section through sensory organ at margin of mouth [fig. 7 A.]. Only the bases of the hairs appear in the section and look like teeth, but in adjoining sections the tips of the hairs can be demonstrated.

Fig. 5. Transverse section of the chitinous muscular support which lies immediately dorsad of the nervous chain. This is show in situ in fig. 1.

Fig. 6. Transverse section of body in the region of the lateral diverticles of the midgut.

Fig. 7. Longitudinal section through the infraœsophageal ganglion.

Fig. 8. Longitudinal section through the brain at the level of the origin of the circum-œsophageal commissures.

Fig. 9. Median longitudinal section of the entire body.

Fig. 10. Transverse section of brain, through the origins of the optic and antennulary nerves.

Fig. 11. Longitudinal section through a portion of ventral chain showing its intimate connection with the mesenteries. Seen in situ in fig. 9 B.

NEUROLOGISTS AND NEUROLOGICAL LABORATORIES.

III. Neurological Work at Zurich.

By Adolf Meyer, M. D.

Pathologist of the Illinois Eastern Hospital for the Insane, Kankakee: Honorary Fellow of the University of Chicago.

Dr. C. v. Monakow, private docent for anatomy, physiology and pathology of the nervous system at the University of Zürich, is another very active disciple of v. Gudden's School. As assistant physician of St. Perminsberg, one of the Swiss asylums, he made numerous experiments, especially on new-born rabbits and cats, and later on, as Privatdocent of the Zürich University (1885), he had the opportunity of doing much valuable work in experimental and pathological anatomy at the University and in his private laboratory.

He began with experiments on the connection of the cerebral cortex and the subcortical ganglia. Among these experiments, those on the visual apparatus have been completed and combined very elaborately with the study of pathological material. The auditory apparatus comes next, but still shows a number of gaps; further, we find remarks on the fornix and its supposed connection with the optic thalamus, and finally, numerous remarks on the more peripheral connections of the cortex cerebri.

The examination of a case of tumor of the superior parietal gyrus causing chiefly sensory symptoms, Munk's discovery of sensible and sensory areas of the cerebral cortex and a communication of von Gudden (partial atrophy of the thalamencephalon after extirpation of a cerebral hemisphere of a dog) induced v. Monakow to study the course of the fibres which connect the cortex with the periphery and more especially with the infracortical ganglions.[1] After the removal of a cortical area of the parietal lobe, the lateral nucleus of the thalamencephalon was remarkably atrophied; after the removal of a region from the occipital lobe corresponding to Munk's area A, in the dog, the external geniculate body was found atrophied, and the internal geniculate body was shown to have the same relation to Munk's area B, (the auditory sphere).

v. Monakow arrives at the following conclusions based on a great number of experiments:

1. The extirpation of limited cortical areas in the new-born rabbit invariably causes a limited degeneration of the tracts depending on them, no matter what their physiological significance may be.

2. As a rule every single cortical area is in distinct connection with more than one tract of fibres.

3. Every nucleus of the thalamencephalon, as well as the external and internal geniculate bodies is distinctly connected with a limited cortical area.

4. The external and internal geniculate bodies are analogous to the nuclei of the thalamancephalon, and ought to be classified with them.

Subsequently, v. Monakow began to pay special attention to the optic apparatus. One of the papers published in 1883,[2] initiates a series of contributions, by which he has done so much to elucidate the anatomy of the parts concerned, and at the same time to furnish material of great theoretical and histological importance. These studies were taken up and treated in a more elaborate form later on, and have been brought to a certain conclusion in a new series of contributions

---

[1] Ueber einige durch Extirpation circumscripter Hirnrindenregionen bedingte Entwicklungshemmungen der Kaninchen Gehirns. von Dr. med. C. v. Monakow, Assistentarzt in St. Pirminsberg (Schweiz). *Archiv. fuer Psychiatrie*, Vol. XII, pp. 141-156 and 535-549, plates II and IX.

[2] Experimentelle und pathologisch-anatomische Untersuchungen über die Bezeichungen der sogenannten Sehsphaere zu den infracorticalen Opticuscentren und zum N. opticus. von Dr. v. Monakow, II. Arzt in St. Pirminsberg (Schweiz). *Arch. f. Psych.* Vol. XIV, pp. 699-751, Plate IX.

last year.[1] I have no right to enter here upon a complete analysis of these important testimonials of v. Monakow's talent and activity, the chief results of the work referring more to the anatomy and physiology of the higher mammals and to the pathology of man ; I restrict my present communications to those points which are of the greatest importance for the understanding of modern views about the brain as a whole. It is the condition of the external geniculate body, of the pulvinar and of the corpora quadrigemina ant., and the varying appearance, according as the visual area of the cortex, or the eye, is removed by operation in new-born mammals. The external geniculate body and the pulvinar lose most of their ground substance if the eye-ball is removed, whereas the cells persist and seem to be more numerous, as they are in very close contact instead of being separated by ground substance. If, however, the occipital lobe, or rather part of the visual cortex of the occipital lobe is removed, the cells themselves undergo atrophy and the external geniculate body shrinks. This observation, together with others obtained by v. Gudden's method, was one of the reasons why Golgi's theories of nervous histology found such a ready reception and able criticism in Prof. Forel's paper, written in 1886. Indeed, it forms one of the finest documents in favor of the "Neuronenthorie." I do not find a satisfactory explanation for the fact that even in recent contributions on the anatomy and physiology of the optic centres, there are blunders in very elementary views, which ought to be considered as overcome once for ever by the clear and unambiguous results of v. Monakow's work.

If I am not able to do full justice to v. Monakow's views on the subject here, I wish at least to say that they give, more than any other, a nearly complete and satisfactory exposition of the matter both from the standpoint of the anatomist and physiologist and also from the standpoint of the pathologist.

---

[1]Experimentelle und pathologisch-anatomische Untersuchungen über die optischen Centren und Bahnen (Neue Folge) von Dr. C. v. Monakow, Docent an der Universität in Zürich. Arch. f. Psych. Vol. XX. Plates XI.–XIII. Experimentelle und pathologich-anatomiche Untersuchungen über die optischen Centren und Bahnen nebst klinischen Beiträgen zur corticalen Hemianopsie und Alexie. (Neue Folge.) Archiv für Prychiatrie, Vol. XXIII.

Another, though less complete, series of experiments has the same relation to the auditory apparatus as the one mentioned has to the optic apparatus. I have already alluded to the connection found between Munk's area B (Hörsphaere) and the posterior corpora quadrigemina. In a most valuable paper,[1] he explains the character of the striae acusticae (s. medullares) as a secondary tract of the auditory apparatus, originating from the long ganglion-cells of the tuberculum acusticum, whereas the posterior auditory root ends in the deep layer of the tuberculum. It is certain that the striae acusticae form part of the lower fillet and that, most likely, part of them end in the posterior corpora quadrigemina and especially in the internal geniculate body. In an early paper[2] v. Monakow had proved that the so-called external auditory nucleus, or nucleus of Dieters, as v. Monakow calls it, has nothing whatever to do with the auditory apparatus. I merely mention another of v. Monakow's contributions[3] which deals with the fornix and the bundle of Vicq d'Azyr, showing that the latter cannot be a direct continuation of the former.

The reader of these notes will see how all these works have a certain logical connection, as they concern the study of sensory paths of the brain. It is very interesting to see what a great number of facts has been produced in this field by the use of v. Gudden's method. It is to be hoped that Dr. v. Monakow will be able to carry out his researches on the auditory centre in the same thorough and successful manner which we so admire in his work on the optic centres, and that he will develop before long the deductions drawn from the numerous facts with regard to the general architecture and the physiology of the brain. Dr. v. Monakow is still in the commencement of his career. Besides a successful practice in nervous diseases, his activity in his private laboratory—which is open to students of the university, and his lectures at the university, secure to him and to us an outlook for eminent work in neurology.

---

[1]Striae acusticae und untere Schleife. Archiv f. Psychiatrie, Bd.XXII.Heft 1.

[2]Experimenteller Beitrag zur Kenntnis des Corpus restiforme, des "aussern Acusticus Kerns" und deren Beziehungen zum Rückenmark. Arch. f. Psychiatrie Bd. XIV. Heft 1.

[3]Einiges über secundäre Degeneration im Gehirn. Schweizer ärztl. corr. Bl. XVI. p. 398, 1886.

NEUROLOGICAL NOTES FROM THE BIOLOGICAL LABORATORY OF DENISON UNIVERSITY.

The following notes are derived from the memoranda taken during the preliminary studies of various members of the laboratory corps, and are gathered at this time in the hope of calling the attention of others to points in course of elaboration. The undersigned acknowledges responsibility for the morpological generalizations involved. C. L. HERRICK.

I. SELENKA'S "PHARYNGEAL SAC" IN THE DUCK.

By H. H. BAWDEN.

In his monograph on the development of the opossum [Studien über Entwicklungsgeschicte der Thiere. Heft. IV. 1887] Selenka describes a branched diverticle of the pharynx immediately back of the pharyngeal velum.

In the case of embryos of five days the glandular organ has attained its maximum development. A few hours earlier a connection can be demonstrated with the chorda dorsalis which is so direct and obvious as to admit of no doubt that there is ontogenetic connection between the two structures. The pharyngeal sac is very transitory and leaves no trace behind it after the seventh day. It appears earlier than the hypophysis and has all the characteristics of a rudimentary organ. The tubular portion which communicates with the pharynx is hollow while the remainder is solid and variously lobed and divided, one lobe only being in communication with the chorda.

The author says:—"Die morphologische Bedeutung der Gaumentasche konnte gleichwohl mit Sicherhelt festgestellt werden." "Damit ist der Nachweis erbracht dass die Gaumentasche nichts Anderes ist als das verdickte, lappig verzweigte und ausgehöhlte Vorderende der Chorda dorsalis, mit anderen Worten, die vordere Chordahöhl oder Chordatasche!"

"Die Umgestaltung des vorderen Chordaendes zu einer drüsenformigen Tasche erscheint auf den ersten Blick höchst seltsam, verliert jedoch bei näherer Betrachtung das Auffallige. Ist doch die Chorda ihrer Genese nach anfänglich ein hohler Schlauch [Nebendarm, *Ehlers*], welcher swar schliesslich zu einem soliden strange wird, aber während der Entwickelung seine ursprüngliche Gestalt nie ganz verläugnet." "Auch die Knie oder Scheifenform des vordern Chordaendes erklärt sich auf einfache Weiss. Durch die Hirnbeuge wird das unter Vorder und Mittelhirn gelegene Mesodermgewebe sowie auch die Chorda, welche ja Anfangs bis unter den vorderen Rand des Vorderhirn erstreckte, zusammengedrückt und zuzammengeklappt und zur vorderen Sattellehne umgemodelt." "Sehr deutlich fällt dieser Process der Verlagerung des vorderen Chordaendes in's Auge, wenn man sich die Hirnbeuge wider aufgehoben denkt: dann würde die Mesodermmasse der Sattellehne wider auseinandergeklappt, die geknickte Chorda müsste sich wieder gradestrecken und ihr Vorderende, d. h. die Mundung die 'Gaumentasche', käme *ganz dicht an das vordere Ende des Körpers zu liegen.* Die Hypophyse wäre dann dorsal über dem vorderen Chordaende zu suchen!"

At the date when Selenka wrote he was unable to find descriptions of the structure mentioned in any other type. This was explained as due to the transitory nature of the organ. In view of recent studies upon the morphogenesis of the head, notably the papers of Kupffer, which are tending to locate the cephalic extremity of the head at a point farther forward than the optic chiasm, it seems worth while to call attention to the evidence implicit in the above mentioned facts that the region of the infundibulum represents approximately the cephalic extremity of the brain. [Cf. His, in *Arch. f. Anat. u. Phys. Anat. Abth.*, 1892.]

From this point of view we call attention to the existence of the structure, described by Selenka in the opossum, as it appears in the duck. The specimen figured was about six days old and was provided with both epiphysis and hypophysis "fundaments." [Fig. 1.] The former lies, as in amphibia, near the middle of the roof of the diencephalon. The pharyngeal sac in this stage is situated immediately behind the hypophysis, the interval between the two being filled for the most part with the same dense variety of connective tissue which occupies the site of the future basis cranii. [See also fig. 2.] There is, however, a small opening or blood sinus which extends nearly parallel to the axis of the hypophysis for the whole length of the latter.

The pharyngeal velum is absent at this stage; but must have been situated immediately caudad of the hypophysis, so that the sac in question belongs to the hypoblastic tissue of the alimentary tract. The sac is simple and in this respect differs from the same organ in the opossum. Its cavity, which at first is narrow, expands dorsally and the walls rapidly thicken, giving a bulb-like configuration to the whole organ. There is a slight tendency to lobate form, but no actual diverticles at this stage. [Fig. 2.] The epithelium is single-layered, vacuolated toward the free surface, and much elongated in the deeper portions, the nuclei collecting at the ental poles of the cells. There is an indication of close connection of the dorsal part of the walls of the sac with the adjacent connective tissue, the epithelium cells being apparently in process of transformation or degeneration, losing their distinctness and becoming permeated with the surrounding connective tissue elements.

The chorda at this stage exhibits curvatures in the lateral as well as the vertical plane. The latter curvature is obviously due to the head flexure. The unaltered part extends to within a short distance of the hypophysis, but the entire cephalic extremity has suffered a peculiar degeneration and reduction in size, and is composed of closely massed nuclei bearing an unmistakable resemblance to the nuclei of the connective elements. [Fig. 1.] The end of the chorda is not only flexed and reduced but irregular in outline. From a ventral protuberance of the degenerated tip of the chorda a slender cord, resembling in structure the chordal sheath, passes ventrad and terminates in immediate proximity to the sac with which, however, no direct connection can now be traced.

In later stages this organ seems to disappear, but a glance at Fig. 3 will show that it becomes amalgamated with the stalk of the hypophysis, In the stage figured, the pituitary has acquired its glandular form and has nearly severed its connection with the pharnyx. The chorda has become encased in the cartilage of the future basis cranii, but there are still ill-defined rudiments of the connecting cord. [*Ch. con.* and *x.* Fig. 3.] The cause of the union of the two bodies is obviously the increasing of the head-flexure and development of the saddle-cleft. Fig. 4 illustrates the poorly developed pharyngeal sac of the chick at about four days.

II. THE PINEAL AND PARIETAL ORGAN IN PHRYNOSOMA CORONATA.

By A. D. SORENSEN.

The external appearance of the pineal organ in Phrynosoma has been so amply described that futher mention of it need not be made here. The different structures associated with the epiyhysis and their interrelations have not, I think, been fully or satisfactorily determined.

In an article which appeared in the Bulletin of the Museum of Comparative Zoology for 1890, Mr. W. E. Ritter has given a detailed discription of the epiphysial structures of P. douglassii and P. coronata. Among the sections of different groups of which a comparative study of the epiphysial structures is being made, a number of sections of P. coronata have been studied and relations have been found to exist which do not appear in Mr. Ritter's drawings.

The Parietal Organ. The position of the parietal organ with reference to the parietal bones, is not the same as described by Ritter in either of the three different animals that have been studied. No pit or even depression appears below the organ. The terminal points of the parietal bones differ somewhat in their positions as related to the parietal organ. The preparietal bone lies in the normal position, while the post parietal bone appears to project backward, the parietal organ lying in a straight line with the terminal points. Between the post-parietal bone and just above the nerve (to be described later) is a distinct blood sinus, which was traced some distance toward the epiphysis. The parietal organ is spheroidal in form and consists of three parts, a lense and an inner and outer wall. The walls are deeply pigmented and their histology has not yet been studied.

The Epiphysis. The combination of structures arising from the roof of the diencephalon, Mr. Ritter, in keeping with the former nomenclature, designated as the Epiphysis. He the gave the following parts: A proximal part with an anterior, much folded, epithelial wall, and a posterior, not folded and thiner epithelial wall; an epiphysial vesicle; a blood sinus; and a string of connective tissue. From a study and comparison of his drawings it is quite evident that what he has termed the 'proxiimal part with an anterior, much folded, epithelial wall' is the plexus formed anteriorly to the supra-commissure and found in many groups ("Polster" of Burckhardt.) It is evident, moreover, that no connection appeared in his sections between the "epiphysial vesicle" and the roof of the diencephalon. In the sections which I have studied, the following structures appear: Epiphysis (epiphysial vesicle); epiphysial stalk; nerve; blood sinuses; and plexus.

The Epiphysis is prominent and cannot be mistaken. It is composed of columnar epithelium very different from that of the plexus and profusely pigmented and consists of a large number of diverticles from the same visicle.

The *epiphysial stalk* connects it directly with the roof of the diencephalon just back of the supra-commissure. There can be no question that the so-called vesicle, with its stalk, constitutes the true epiphysis which is in this case flexed cephalad at the tip. Moreover the entire structure exhibits the same relations which are encountered in all other Sauropsida.

The *epiphysial nerve* was traced through different sections from its origin in the supra-commissure to its terminus just below the parietal organ. No fibers, however, were found to enter the organ.

Two *blood sinuses* lie one on either side of the Epiphysis. The one lying posteriorly being considerably larger.

The plexus, as was noted by Mr. Ritter, is an exceedingly complex and intricately folded mass. Its points of origin, however, are not uncertain, as it forms the roof of the diencephalon cephalad of the supra-commissure. The plexus, as in other reptiles, consists of two parts. The posterior part, at least, is identical with Burckhardt's "Polster." The caudal extremity unites with the supra-commissure and the cephalic end with the hippocampal commissure and projects laterally a short distance into the lateral ventricles.

The connective tissue is also present as Mr. Ritter describes it.

So far from agreeing with Ritter that "the epiphysial vesicle is not a portion of the epiphysis" we have seen that it alone, with its stalk, has any claim to this name.

III. THE ROOF OF THE DIENCEPHALON.

By A. D. SORENSEN.

Professor V. Kupffer, in his interesting discussion of the roof the Diencephalon,[1] calls attention to the fact that the position of the pineal and associated supra-commissura is not the same in amphibia as in other groups.

He says: "The roof of the thalamencephalon or diencephalon (Zwischenhirn) in the usual sense lies in front of the superior commissure in Acipenser, while in the frog, according to Professor Osborn's drawings, it lies behind that commissue. In Acipenser the supra-commissure and post-commissure are closely approximated, while in the frog (*fide* Osborn), they are widely separated. In Acipenser the pineal lies immediately cephalad of the post-commissure as in Amniates and particularly in man, in the frog there is an extensive segment of the brain roof, separating the pineal from the post-

[2] Studien zur vergleichenden Entwicklungsgeschicte des Kopfes. Heft .1. 1893.

commissure, which Osborn calls the thalamencephalon. It is obvious that the part of the brain since considered as diencephalon in ganoids, and which I have called "Nebenhirn," or parencephalon is not homologous with Osborn's thalamencephalon, in the frog. In the frog larva there is a segment of the brain roof between the post-commissure and the stalk of the epiphysis." In another paragraph he states that these relations are peculiar to Amphibia (p. 36.) "und eine vergleichende Beleuchtung erfordern."

Such a comparative study is now in progress and the following lines are intended to call attention to the topographical relations in a few cases, with only incidental reference to the morphological problems involved. In a median longitudinal section of a duck embryo of six days the pineal appears as a knob-like evagination from the median portion of the roof of the diencephalon. Between ⅓ and ½ of the roof between the pineal and mesencephalon is occupied by the post-commissure. The remaining portion is precisely similar in structure to the pre-pineal portion of the roof. The pre-pineal portion, i. e., the roof of the diencephalon from the pineal to the velum transversum, describes a uniform convex curve, there being no trace of supra-commissure, "polster," dorsal sac, plexus, or paraphysis. The pineal diverticle or recess exhibits the same structure as the rest of the roof of the diencephalon, with, however, rather more numerous karyokinetic figures.

In this stage the pineal is in almost immediate contact with the epidermis.

The dorsal roofs of the mesencephalon, diencephalon and primary prosencephalon are approximately equal in extent and lie in about the same straight line. The pituitary and pharyngeal pouch are both lightly developed in this stage. The former is closely approximated to the relatively large Infundibulum (Hypencephalon). It therefore appears that the relations, which Kupffer claims are peculiar to Amphibia, are found in the early embryo of the duck, and it becomes important to trace the subsequent modifications. In embryos of the same species, two or three days later, the relative position of the pineal has evidently changed. Instead of lying midway between the terminal points of the diencephalon, the pineal is included in the caudal one-fourth. The pre-pineal portion retains approximately the same thickness, but grows rapidly forward, keeping pace with the roof of the prosencephalon.

While the post-pineal portion becomes depressed and thickens and is rapidly encroached upon by the fibers of the post-commissure. At this stage important changes are also taking place in the pineal itself. It becomes irregularly lobed, thickens and projects forward.

Thus the conditions which are shown to be permanent in Amphibia, are transitory in the amniate vertebrates. In trout fry of nine days old, the post-pineal segment is thrust under by invagination forming the torus, in which process the post-commissure is also sharply plicated.

It would appear that the bony fishes are more closely allied, in this respect, to amphibians than are the ganoids.

In duck embryos of a somewhat later stage the entire roof of the diencephalon has undergone important morphological changes. For convenience, the following nomenclature will be used: 1, post-commissure; 2, pineal recess; 3, pineal; 4, supra-commissure; 5, post-paraphysis; 6, vellum transversum; 7, pre-paraphyses, with a possible post- and pre-plexus. In this stage the pineal recess does not appear, having been partly encroached upon by the post-commissure, and partly absorbed into the pineal.

The postparaphysis extends from the supra-commissure to the velum and is somewhat corrugated. The velum separates the post- and preparaphyses and joins the roof and base of the cephalic limit of the diencephalon. The preparaphysis unites the velum with the prosencephalon. From the cephalic side of the velum the preplexus has developed and enters the prosencephalic ventricles.

The epiphysis at this stage projects cephalad and forms several diverticles. This process goes on as development continues, until the base or undivided portion of the epiphysis becomes almost disconnected from the third ventrical, or, in other words, resembles the so-called epiphysial vesicle of Phrynosoma.

In the turtle the entire outgrowth from the roof of the Diencephalon resembles in size and the relative position of its parts the epiphysial structures of the horned toad already described.

The epiphysis arising immediately behind the supra-commissure and grows forward by a somewhat narrow stalk, which soon expands to form the vesicle of the epiphysis. This vesicle is somewhat irregular in that several lobes project from the main vesicle. The whole structure is highly vascular, the walls being permeated with numerous blood vessels.

The epiphysis rests on the slender lamina of the plexus, which runs forward to the cephalic extremity of the epiphysial vesicle and there becomes intricately plicated. The infolding of the plexus at this point forms between this plicated structure and the cephalic origin of the plexus, another structure which is also found, formed in apparently the same way, in snakes, and which I have called for convenience the dorsal sac. This sac runs dorsal toward the cephalic end of the epiphysial vesicle.

Just in front of the cephalic end of the plexus is a large blood sinnus which runs the whole length of the dorsal sac and joins a blood vessel above.

The whole structure, including the epiphysial vesicle, plexus, and dorsal sac is extremely vascular.

EXPLANATION OF PLATE XI.

BAWDEN.

Fig. 1. Part of a median-longitudinal section of the head of a duck-embryo at six-days illustrating the relations between the chorda and pharyngeal sac. The relation of the commissures of the diencephalic roof to the epiphysis may also be seen.

Fig. 2 The pharyngeal sac and hypophysis from the preceding section.

Fig. 3. The same region from a much older embryo.

Fig. 4. A similar section from a chick of four or five days.

Fig. 5. Median-longitudinal section through the head of a duck embryo somewhat older than that figured in Fig. 2.

DESCRIPTION OF PLATE XII.

SORENSEN.

Fig. 1. Composition drawing from several longitudinal sections of Phrynosoma coronata, showing the epiphysial structures and parietal nerve and vesicle. The nerve arises from the supra-commissure, while the pineal stalk springs from the roof immediately caudad of the commissure.

Fig. 2. A single section illustrating the relations of the pineal on a larger scale. The nerve is not shown.

Fig. 3. Median-longitudinal section of the head of a duck embryo at six days.

Fig. 4. Similar section (somewhat oblique) from a later embryo, showing relative increase of the prepineal roof of the diencephalon.

Fig. 5. Enlarged view of the epiphysis figured in 4.

Fig. 6. View of the roof of the diencephalon and mesencephalon in later duck embryo.

Fig. 7. Epiphysis in still later stage.

Refer also to Plate VI.

Fig. 4. External view of the Epiphysis of Cistudo, from a model composed with the aid of the camera lucida from sections.

Fig. 5. Composite section of the same showing the relation of Epiphysis and paraphyses.

IV. REVERSION OF THE CEREBELLUM IN AMERICAN LIZARDS.

By P. T. EVANS.

In the March number of the JOURNAL OF COMPARATIVE NEUROLOGY for 1891, Prof. Herrick calls attention to a forward folding and consequent reversion of the cerebellum in the Sceloporus undulatus. The passage in question is found on page 7, and reads as follows: "In the case of lizards we have apparently a completely dissimilar plan of structure. Here the gray matter is dorsal and white ventral (Plate IV, Figs. 4 and 5). This reversal of the two layers is explained, upon a more careful examination, as the product of a complete forward and median fold of the caudal and lateral margins of the cerebellum (compare Plate IV, Figs. 6-9). This is but the completion of the process indicated by the incipient retroflexion seen in the turtle. The result of this fold is the formation of an actual cavity surrounded caudad and laterad by the white (morphologically dorsal) zone of cerebellum. Thus the fusion of the lateral margin, or, more accurately, the union of the whole latero-caudal reflected margin due to a general cephalo-median increase, produces the hollow organ just described."

Dr. Ludwig Edinger, in his report[1] upon the investigation of the anatomy of the central nervous system for 1891, offers the following criticism: "Herrick comes to the conclusion, as a result of the tracing of the various layers of the cerebellum thoughout the vertebrate series, that in the reptilia there prevails a forward reversion of the cerebellum in such a way that parts which before lay upon the surface come to lie ventrally. The preparations which were prepared by the carmine method do not enforce this conclusion."

The last statement is erroneous. The carmine method was not used. Being a student of Prof. Herrick's, I was led to investigate this point in other species since we have received more material. An examination of the brain of Phrynosoma as seen in Fig. 8, Plate VI, reveals the forward reversion very plainly. It is not possible to be mistaken in this. In noticing this figure it is to be seen that there is no plexus. This was torn away in order that this forward reversion might be seen. The tearing away of the plexus leaves the fourth ventrical uncovered. It is also noticed in Fig. 19—c, Plate V, Vol. 55, No. 1, of the Zeitschrift für Wissenschaftliche Zoologie, that the same thing exists in Iguana, but Dr. Meyer doest not seem to have noticed it. In the study of sections of the species of which Fig. 1, Plate XII and Fig. 10, Plate V, are representative, I find the histology to be the same as that of all reptilia. This forward reversion of the cerebellum gives the ventral surface the dorsal position and the white upper layer is inverted over the optic lobes. In comparing the sections from which figures 4, 5 and 6, Plate IV, of the March number, Vol. I, were made, with the sections of which Figs. 10, 11 and 12, Plate V, were taken, I find that the histology agrees in every particular, and the histology of the part spoken of as the plexus in Figs. 10, 11 and 12, Plate V, agrees with the histology of the plexi. There can be no doubt that this reversion is a fact. We find the same thing in the Iguana, Sceloporus, and in Phrynosoma the same condition exists, and, curiously enough, all these lizards also have the parietal eye.

[1] Schmidt's Jahrbücher der gesammten Medicin Bd. CCXXXVI, p. 20.

V. THE HIPPOCAMPUS IN REPTILIA.

BY C. L. HERRICK.

In his most instructive paper on the olfactory and hippocampal apparatus[1] Dr. Edinger offers many valuable suggestions growing out of his own investigations and those of others. With these the present writer is fully in sympathy and now desires simply to call attention to the fact that even in his earlier papers, to which Dr. Edinger refers, there existed no such difference as he supposes. He says "Von späteren Untersuchern des Reptilien-gehirnes hat sich Köppen meiner Auffassung angeschlossen, während Herrick ein ganz anders Gebeit, die Gegend caudal von stammganglion, an der Basis des Gehirnes, also nicht ein echtes mantelgebiet, als "Occipito-basal nucleus" der Ammons formation homologisiren möchte." Reference is made to the papers "Notes on the Brain of the Alligator," *Journ. Cincinnati Soc. Nat. Hist.*, 1890, and "Topography and Histology of the Brain of certain Reptiles," *Journ. Comp. Neurology*, March, 1891. At the time when these were written (1890) Dr. Edinger's paper was as yet inaccessible to me and any agreement found between our views may be taken as entirely independent. In both of the papers, which purported to be simply "preliminary notes," very slight reference was made to the literature as the comprehensive paper, now approaching completion, was then contemplated, On page 141 are the following lines: "The olfactory fibres gather in the lower median angle . . . it may be conjectured that fibres proceed to the cortex of the calloso-marginal or occipital region. It is probable that other and important parts of the tract are superficial on the inferior and lateral basal areas, collecting at the postero-basal margin, and sending fibres by way of the fornix to the colloso-marginal region." Of course the use of the word "fornix" was here a slip of the pen. On page 143, in describing the cell areas, this passage occurs: "A third cell-

[1] Vergleichend-entwickelungsgeschichtliche und anatomische Studien im Bereiche der Hirnanatomie. *Anat. Anzeiger*, VIII, 10, 11.

clustre, which occupies a relatively small area anteriorly, but increases caudad, occupies the lower median portion of the mantle. It consists of flask-like or sensory cells with fibres which can be traced ventrad to the ventral median portion of the posterior part of the brain, i. e. the hippocampal region, and seems to embrace the continuation of the olfactory tract." If the sentence is perhaps awkward, it would nevertheless unmistakably indicate that the writer homologized the mesal and caudal region of cortex with the "Ammonshorn" as he has continued to do up to the present time, differing from Edinger only in restricting the hippocampus to the caudal part and excluding the cephalic region of the calloso-marginal mantle area. On page 145 a more explicit passage occurs. "The remaining median part of the ventricle . . . separates a thick portion of the mantle, corresponding in some respects with the anterior portion of the Ammonshorn."

It is really remarkable that there could be any mistake as to the view presented in the second paper referred to. On page 15 occurs the following passage: "The base (ventral surface) of the hemispheres exhibits a slight protuberance in the latero-caudal portion, which is due to the *occipito-basal lobe.* (The use of the word lobe is a pure convention from which no escape could be found.) The latter is not a sub-division of the cortex but a well-defined portion of the axial lobe. [It is the same as Edinger's "kugelförmiger Kern," which the latter now agrees with the writer in considering an implicate or masked bit of cortex.] This lobe can probably be distinguished in all Sauropsida. It is partially separated from the remainder of the axial lobe by a fibre tract, and bears laterad and dorsad a film of cortex which projects caudad as a free *occipital lobe* of cortex for a short distance and terminates in a *velum cerebri. The latter is morphologically a part of the wall of the lateral ventricle*, which has lost its cellular elements and contains, at one point, the tænia thalami. The extent to which this lobe [i. e. the occipital not the occipito-basal, as understood by Edinger] is developed varies greatly even in reptiles. It is reduced to a minimum in birds. *It contains the undoubted homologue of the hippocampus,* but in the black-snake that portion homologous with the hippocampus is relatively highly differentiated. Even the portions corresponding to the fornicate and uncinate gyri may be distinguished, though there is, of course, no external indication of the distinction."

On page 16, it is said that "the ventro-basal protuberance of the hemispheres, which seems analogous with the pyriform lobe of Rndents, for example, contains a concentric zone or hollow spheroid of gray matter greatly (*though spuriously*) resembling the hippocampus,"

Certainly there can be no ambiguity in this passage and we are unable to find a passage which can be construed to indicate a belief that the "occipito-basal lobe" corresponds to the "Ammonshorn."

In his first paper on the forebrain, Edinger calls attention to the existence of a distinct bundle from the median wall of the hemisphere to the diencephalon which he unhesitatingly homologizes with the fornix. The median part of the mantle contains a cortex characterized by the small size and close arrangement of its cells. This corresponds to the region where in mammalian embryos the arcuate fissure appears. At the point where the median wall thins to form the plexus choroideus the cortex is exposed. Between it and the margin of the hemisphere is a protuberant ridge, in which are fibres. This ridge Edinger identifies as the fornix ridge. The layer of closely associated cells above it in the median wall of the hemisphere is called Ammonsrinde or hippocampus. "Das betreffende Rindstück muss man als erstes Auftreten der Ammonsrinde in der Therreihe ansehen." "Sie enthalt also bei ihrem ersten Auftreten alle die elemente, welche später, wenn auch durch Windungen und dergleichen verwischet, das characterisch Ammonshorn bilden."

On page 20 of this Journal for March, 1892, the relations of the occipital cortex to the septum (intra-ventricular lobe) are indicated. "In the meantime the free caudal margin of the cortex has extended medianly, fusing with the intra-ventricular lobe, completing a ring or cap of cortex, which entirely en-closes the axial lobe, which latter, by the encroachments of the ventricle, has become separate from the wall. The cells of the occipital cortex resemble those of the fronto-median lobe."

While, therefore, the writer independently identified much the same region as that called by Edinger Ammons cortex with the hippocampus, it will be seen that it is rather the caudal than the mesal region which is thus identified; while Dr. Edinger seems to include the whole median wall as far forward as the callosum and does not specifically include the occipital cortex. A comparison of the hippocampus of reptiles with that of the opossum is exceedingly instructive. In the latter case, where the callosum is not developed to the extent characteristic of higher mammals, the relations are identical with those of reptiles except that the backward development of the cortex has folded the free caudal margin upon itself. (See plates A, B and C, Vol. II., Feb. 1893.) The influence of the fold is felt far forward and there is other evidence of the unity in structure of the whole belt of cortex thus folded. In rodents the folds are enormously exaggerated and carried beneath the callosum, but it is still morphologically the caudal margin—that part which lies next the tela—which is thus modified.

Inspection of Fig. 5 of Plate V. will show that in *Phrynosoma* the evidence for our position is quite conclusive. In that genus there is a distinct fornix commissure. It is about half way between the callosum and the supracommissure and contains a number of fibers, being nearly as large as either of the others mentioned. These fibers are associated with the fornix columns which pass forward in Edinger's Fornix-leiste and describe the ventro-caudal curvature. Both sorts of fibers pass caudad and spread out in the entire caudal cap of cortex. (Fig. 6, Plate V.)

Meyer,[1] writing without knowledge of the writer's paper, in 1892, makes very much the same distinctions between the small-celled (facia dentata) and large-celled lateral portion. He is convinced that there are no connections with the olfactory tract. Meyer identifies the mesal wall cephalad with the sep-

---

[1]Ueber das Vorderhirn einiger Reptilien. *Zeitsch. wiss Zool.* VI. 1, Nov.1892

tum, as we had done the "intra-ventricular lobe," although unwilling to use this term which has a special sense in mammals. Meyer has also noticed the fornix commissure and carefully figured it (Op. cit., Figs. 33–36) in Iguana. We feel confident that this commissure is, as Rückhard suggested, a true fornix commissure. In serpents the same fibres lie within that part of the mesal wall which corresponds to the fornix body. The occasion for the separation of these fibers in reptiles is the folding of the brain axis which thrusts the dorsal cortex backward over the diencephalon.

The statement has been made that the so-called fornix or hippocampal commissure of reptiles cannot be homologous with the organ so named in mammals, because in the former the plexus passes dorsad of it. This is, however, an illusion as the study of these fibers in Ophidia, Lacertilia and Chelonia has fully convinced the writer. In those cases where the plexus lies dorsad of the commissure, it is in the form of a diverticle of the roof cephalad or caudad of the commissure. The fibres themselves lie *in the roof* of the aula.

In amphibia the callosum is very small and, if we correctly identify it, lies for cephalad so that it appears in the same horizontal section with the hippocampal commissure. The latter is quite a strong band which after passing along the line of union of the cerebral hemispheres and thalamus turns ventrad and crosses immediately dorsad of the precommissure. We cannot agree with Osborn who identifies this bundle with the collosum. In the first place, its fibres are derived from the caudal part of the cortex and, in the second, they cross caudad of the porta, and, finally, there is a small band of fibres crossing in front of and dorsad of the porta which better deserves this title. The above remarks are based particularly upon several good series of *Menopoma*, *Menobranchus*, *Salamandra* and *Rana*. The larval salamander has the hippocampal tract well-developed while the callosum is not apparent at all.

THE INDUSIUM OF THE CALLOSUM.

By Pierre A. Fish, B.S.

Instructor in Physiology, Vertebrate Zoology and Neurology, Cornell University.

The recent papers by Blumenau[1] and Marchand[2] on the development of the callosum have conduced to a much more complete morphological understanding of that important region. Simple as it may appear superficially, there are nevertheless involved questions which may be of the profoundest significance, from a physiological as well as from an anatomical standpoint.

Perhaps no other part of the human body exemplifies bet- than this the importance of correlating the earlier and later conditions of organs and their parts, in order to obtain an adequate and true conception of their structure and function. Embryology and morphology should go hand in hand—one should supplement the other.

Indusium griseum is the name applied by Obersteiner[13] to the vestigial layer of the cerebral cortex, existing with greater or less distinctness upon the dorsal surface of the callosum, in many other mammals.

It has long been known that the apparent dorsal surface of the human callosum does not present a distinct transversely straited appearance. Lancisius[17] noted two mesal and two lateral striations passing longitudinally over the dorsum of the callosum: He describes the mesal as *teretes nervi similiter medullares* and the lateral as *non veri nervi sed limbi.*

Valentin[3] has recognized a delicate remnant of gray substance between the meson and the *striae laterales,* which appeared to be identical with that of the fasciola. Jastrowitz[4] found that the fibers(?) do not lie freely on the dorsum of the callosum, but are imbedded in a layer of nerve cells. Stieda[5] observed the indusium in the dog and the rabbit. In the dog he found that the extension from each side projected far enough to meet at the meson, but at this point there were no nerve cells. In the rabbit there also existed an extremely small layer of nerve cells, connecting both hemispheres, representing extensions of the cortex over the callosum. Blumenau finds the free dorsal surface of the rabbit's callosum very small and covered with a thin and scarcely noticeable layer of cinerea. The same writer finds the indusium well developed in the pig. The *striae laterales* are large, but caudad they recede from the meson and flatten out; between these striæ there is a minimum layer of cinerea.

Giacomini[6] has also noted that the elements of the brain cortex enclose these striæ, and that a thin intermediate layer of cinerea exists. This he differentiates into two layers: A superficial (continuation of the molecular stratum), and a deep layer containing scattered nerve cells with many processes, which confirms his opinion that the dorsum of the callosum is covered by a thin but unfailing layer.

Wilder,[7] states that he observed the continuity of the cinerea upon the human callosum, in 1880; he adopts Obersteiner's term *indusium*, dropping the adjective *griseum*.*

The intimate relationship existing between the indusium and the callosum during development, renders necessary a description of the changes undergone by the callosum. Marchand's[2] paper, with the beautiful figures accompanying it, has given, in its representation of the different stages, quite a complete series from the proton† or beginning of the combined callosum, fornix, precommissure and hemiseptum, to the conditions found in the adult. This proton appears first as a thickening in the terma. There is formed at this time, or a little previously, along the mesal aspect of each hemicerebrum, a fur-

*Since the noun *indusium* is employed in several senses, and is, therefore, what Wilder has termed (16, § 23) a polychrestic word, its special application should be indicated in the title of a paper, or when first used in a paper, by a qualifying word or phrase. e. g., *callosale*, *callosi*, *of the callosum*, or *griseum*.

†A term suggested by Wilder (7, § 46), "to designate the primitive, undifferentiated mass or rudiment of a part;" it is the equivalent of the words *Anlage* and *fundament* as employed by Minot[12] and Mark, respectively.

row relatively at some distance from the margin of the hemicerebrum, but approximately parallel with it. This is known as the arcuate fissure or "Bogenfurche;" it involves the whole thickness of the wall (total fissure) and ultimately becomes the callosal and hippocampal fissures, the latter remaining a total fissure. The portion of the embryonic brain substance situated between the arcuate fissure and the encephalic cavity is the arcuate gyre or "Randbogen." As the proton develops it assumes a more or less triangular form, the apex pointing dorso-caudad. The dorsal side represents the callosum the ventral the fornix and the area between the septum (or hemiseptum).

Relatively the precommissure seems to retain the approximate original position of the proton, while the callosum and fornix grow away from it. During the process of growth the side opposite the point of union of the callosum and fornix, or the base of the triangle, seems to separate from its attachment near the precommissure in the great majority of mammals, so that these parts then present, roughly at least, an interrogation point or falciform outline. This condition is also usually represented as occurring in man, but here is a morphological reason for doubting it, since in the human brain before birth there exists—and it remains throughout life—a direct continuation of the rostrum of the callosum with the terma, the copula, and it seems quite reasonable to consider this continuity of the parts as having existed from the primitive stages. The alternative to this postulate is, that these parts, originally one, have separated and grown together again secondarily. It would be exceedingly instructive to know when and how this occurs.

In its dorso-caudal growth the proton ploughs its way, as it were, through the arcuate gyres as far as the hippocampal region. As it grows the parts become more and more differentiated and the arcuate fissures and gyres become less apparent. It is the remnant of these gyres that forms the indusium of the adult, and there seems to be ground for Blumenau's generalization that the whole ectal surface of callosum is covered with a layer of cortex of varying thickness.

The indusium arches around the splenium and on its ventral surface is bent caudo-laterad, at quite an acute angle, merging into the fasciola on either side. At this point there is usually a distinct tubercle, *Tuberculum fasciae dentatae* (Zuckerkandl). In man and apes there are apparently numerous, small transverse fissures, given off from the hippocampal fissure, toward the fimbria, forming the so-called *fascia dentata.* Zuckerkandl[8] divides the hippocampal portion of the arcuate gyre into an inner and outer "Randbogen," the former comprising the fimbria and fornix and the latter the fasciola plus the striae Lancisii. He also employs the term *gyrus marginalis*, or "*Randwindung*," as a synonym for *indusium.*

During the fifth month of fetal life[9] there is recognizable in the shallow arcuate fissure a small longitudinal bundle of fibers (*nervi Lancisii*) passing along the length of the callosum. As there is considerable variation in the appearance of these striæ, some difference of opinion exists as to what becomes of the cephalic and caudal ends of them. It is generally conceded that the caudal end passes over into the fasciola, forming, according to Mihalkovics, the *substantia reticularis alba.* The cephalic end, according to Blumenau, has two terminations: first, the deeper layer passing over the genu, into that portion of the first (super) frontal gyre, appearing on the mesal surface, and connecting with the *gyrus cinguli* (callosal gyre). Through the intervention of this (frontal) gyre and therefore, indirectly, the fibers are brought into connection with the olfactory lobe: second, there is a direct connection of the superficial fibers from the genu, around the edge of the frontal gyre, into the inner or mesal olfactory root, giving the characteristic, whitish appearance to the same. An old but undoubtedly erroneous belief is that the callosal gyre has become elevated from the dorsal surface of the callosum and has left behind a small portion of the fibers, from the longitudinal association bundles.

Spitzka[10] states that the cerebral cortex covers the walls of the *septum lucidum* (hemiseptums). Similarly Blumenau[11] says: "Und in der That findet sich eine dünne graue Schicht auf der betreffenden Fläche, erstens an der Stelle, wo der Balken den sogen. Ventriculus septi begrenzt. Diese Schicht ist derjenigen gleich, welche die lateralen Wände desselben Ventrikels, also die *Laminae Septi* bedeckt. Auch enthält sie markhaltige sagittale Nervenfasern." If it be true that the triangular area that is to form the hemiseptum remains circumscribed throughout development (in man) by the callosum, fornix and copula, then there would exist an effectual barrier to the intrusion of the cortex into this region. In the absence of figures and a specific description of the formation of this cortex, there is at least room for a difference of opinion. In the sheep, that part of the septum immediately adjacent to the ventral surface of the callosum presents no evidence of cerebral cortex.

In the specimens examined for this paper no attempt was made to go into the fine histological structure, but to determine the morphological relations of this region in some animal forms that have not, as yet perhaps, been studied in this connection.

In the human indusium there is a distinct indentation of the surface at the meson, with an elevation at either side gradually sloping laterad toward the bottom of the callosal fissure and near its point of union with the true cerebral cortex, becoming so much thinned out in some regions as to be scarcely perceptible. At about the middle of the distance from the meson to the bottom of the callosal fissure, there is a short isolated layer of nerve cells lying nearer to the dorsal than to the ventral border. The cells are pyramidal.

The highest level of the indusium was not found at the layer of the cells, as is commonly shown. The indusium is composed chiefly of an extension of the neuroglia layer of the cerebral cortex, in which are also found true nerve cells, varying in number and arrangement. The "grain" of the indusium is more or less vertical, while that of the callosum is distinctly transverse.

The brain of the Chimpanzee, *Troglodytes niger*, had been medisected so that the absolute continuity of the indusium across the meson was not determined. It is, however, to be strongly inferred since the cut was made a little laterad of the meson and the true dorsal surface of the callosum was not exposed.

The layer of nerve cells differs from that of man in being nearer to the ventral than to the dorsal margin. The cells are also relatively more numerous. At the mesal end of the layer of cells, and more dorsal than ventral, there is an irregular area of loose texture which corresponds, perhaps, to the longitudinal bundle of fibers.

In a monkey, *Macacus cynomolgus*, the most striking feature of this region is the absence of any indication of a callosal fissure and the close approximation of the hemicerebrums. At the bottom of the intercerebral fissure lies the single large callosal artery, separated from the callosum by an exceedingly thin and small indusium. No nerve cells are present and but few neuroglia cells.

The sheep presents an almost typical arrangement for this region, justifying the diagrammatic representation of it on Pl. XXVI. of Wilder's "Physiology Practicums."

The indusium as a whole is very distinct and can readily be separated into a superficial and deep layer. The nerve cells are almost directly continuous with the layer of pyramidal cells in the true cortex. It becomes very much thinner at the meson and, as in the other forms, is continuous. The nerve cells do not appear in this thin portion. In a Golgi preparation the fibers from the cells run almost directly transversely.

The indusium of the cat differs from any of the other forms studied, in being non-continuous across the meson. The section was taken from the region of the splenium and it is quite probable that the break in continuity is not as great farther cephalad as it is here. The nerve cells continuing from the cortex to the mesal edge of the indusium, fig. 6.

This want of continuity is not easily explained unless we may consider that, during development, there has been so great a growth in a lateral direction as to rupture this delicate covering and to leave quite an area of the dorsal surface of the callosum, along the meson, bare.

The morphological significance, then, of the indusium is the retention in the adult, of a feature that is quite prominent in the embryo. It is important also in that it brings the callosal fissure into line with all the other true cerebral fissures in having its two walls composed of cinerea. The so-called choroid fissure (rima) does not enter into the category of true fissures except, perhaps, transiently at a very early embryonic stage.

The physiological significance is largely hypothetical and, as stated by Blumenau, awaits further elucidation. The striæ or longitudinal fibers of the indusium, as stated before, are connected cephalad with the olfactory lobe and caudad with the fasciola and thus indirectly, perhaps, with the temporal lobe and are possibly correlated with the centers for olfaction. It is worth noting, however, that we should, on this ground, expect a high state of development of the indusium or striæ in the macrosmatic animals. The order to which the cat belongs (Carnivora) is preeminently macrosmatic, and yet the indusium and its constituents are less developed than in any of the other forms studied; man and chimpanzee are noteworthy examples of the microsmatics, yet their indusiums are well developed.

In conclusion, the writer wishes to acknowledge his indebtedness to Professor Wilder, at whose suggestion the paper was prepared, for certain rare and well-preserved material placed at his disposal.

LITERATURE.

[1] L. Blumenau. Zur Entwicklungsgeschichte und feineren Anatomie des Hirnbalkens. Arch. f. Mikr. Anat XXXVII., 1. 1891.

[2] F. Marchand. Ueber die Entwickelung des Balkens im Menschlichen Gehirn. Arch. f. Mikr. Anat. XXXVII., 298–334. 1891.

[3] Kölliker's Gewebelehre.

[4] Arch. f. Psychiatrie. Bd. III.

[5] L. Stieda. Studien über das centrale Nervensystem der Wirbelthiere. Leipzig. 1870.

[6] Giacomini. Giornale della r. Accad. Med. di Torino. 1883.

[7] B. G. Wilder. Article, Brain. Supplementary volume of the Reference Hand book of the Medical Sciences. 1893. [In Press.]

[8] E. Zuckerkandl. Uber das Riechcentrum. Stuttgart. 1887.

[9] V. Mihalkovics. Entwicklungsgeschichte des Gehirns. Leipzig. 1877.

[10] E. C. Spitzka. Article, Brain Histology. The Reference Handbook of the Medical Sciences. Vol. VIII. 1889.

[11] G. Schwalbe. Lehrbuch der Neurologie. 1881.

[12] C. S. Minot. Human Embryology. 1892.

[13] H. Obersteiner. Central Nervous Organs. 1890.

[14] T. Meynert. Psychiatry. 1885.

[15] C. Golgi. Rivista Sperimentale di Freniatria e di Medicina Legale. 1883.

[16] B. G. Wilder and S. H. Gage. Article, Anatomical terminology. Reference Handbook of the medical sciences. Vol. VIII., 1889.

[17] J. M. Lancisics. Opera Omnia Lib. VII., de sede cogitantis Animae. Genevæ. 1718.

DESCRIPTION OF FIGURES.

Cal. callosum ; *cal. f.* callosal fissure ; *fas.* fasciola ; *fim.* fimbria ; *gen.* genu ; *ind.* indusium ; *ncl.* nerve cell layer ; *prcs.* precommissure ; *sept.* hemiseptum ; *sm.* stria mesalis ; *spl.* splenium.

Fig. 1. Human fetus of five months, after Marchand.

The outlines of the remaining figures were drawn with the aid of Abbe's camera lucida, using, except for figures 2 and 7, Leitz's No. 1 ocular and No. 2 objective. The details are filled in free hand and absolute accuracy is not intended.

Fig. 2. A transection through the callosum of man. The specimen was hardened in a ¼ per cent. solution of ammonium bichromate in 50 per cent. alcohol. Stained with hematoxylin. Enlarged twenty diameters.

Fig 3. Chimpanzee, *Troglodytes niger.* The brain was hardened by a continuous injection of alcohol through the blood vessels. The section was taken from the region of the genu. Stained in hematoxylin. Enlarged forty diameters.

Fig. 4. *Macacus cynomolgus.* Hardened in alcohol 20 c. c., water 80 c. c., glycerin 8 c. c., zinc chloride 4 grams. Stained in an alcoholic acid solution of carmine. x 40.

Fig. 5. Sheep, *Ovis aries.* Hardened in a 5 per cent. alchoholic solution of zinc chloride. Stained in hematoxylin and eosin. x 40. From genual region.

Fig. 6. Cat, *Felis domestica.* Hardened in potassium bichromate 8 grams, potassium nitrate 4 grams, water 600 c. c. The specimen was transferred from hardening fluid direct to ammonia carmine stain. The section was taken from the splenium. x 40.

Fig. 7. Pyramidal nerve cell from the indusium of the sheep. Golgi preparation.

THE SIGNIFICANCE OF THE CORTEX CONSIDERED IN CONNECTION WITH A REPORT UPON A DOG FROM WHICH THE ENTIRE CEREBRUM HAD BEEN REMOVED BY PROF. GOLTZ.[1]

By Dr. Ludwig Edinger.

(*Frankfurt-on-Main.*)

Thanks to the kindness of Professor Goltz, of Strassburg, I have been placed in possession of most valuable material for cerebral anatomy—none other than the brains of a large number of dogs from which a larger or smaller portion of the cerebrum had been removed.

The anatomical investigation of these brains requires a long time and it is still far from completion. Nevertheless I shall report at present upon a part of the results which have been obtained from the study of the brain of that widely known dog from which Professor Goltz succeeded, by a method hitherto unapproached, in removing the entire cerebrum. This dog, which survived the last operation more than eighteen months, was doubtless known to many of you. The unparalleled success of the operation, the possibility of studying an animal entirely deprived of cerebrum so many months after the disappearance of all irritative phenomena, the valuable observations which have been made upon the animal, and which Professor Goltz has published in his Abhandlung über die Verrichtungen des Grosshirns, VII. (Plüger's Archiv. Bd. LI.) all these have awakend much interest in the anatomical results. Added to this is the interest which such a preparation has in virtue of its manifold secondary degeneration phenomena for those who realize upon how slender footing our knowledge of the fibre tracts of the diencephalon now stands.

---

[1] A lecture before the Medical Congress at Weisbaden. Printed from advance proofs very kindly forwarded by the author. Translated by the editor.

I may at once remark that this "dog without cerebrum, Goltz" actually proves, on anatomical investigation, to possess scarcely a trace of the cerebrum. This dog was able during its lifetime to employ its limbs in walking, running and standing, he perceived tactile irritation of all parts of the body and could be awakened from a deep sleep by these excitements or loud noises. He possessed a distinct sensation of the position of his members and could unquestionably be incited to adaptive activity by such sensory stimuli. Nor was he totally blind, though it could not be proven that he was so affected by visual sensations as to modify the position or movements of the body. It was evident that hunger and gustatory sensations remained. The animal was profoundly imbicile and it was impossible to enter into any sort of personal relation to him. No expressions of joy or fear escaped him. In restless and unvarying round he ran in his cage. With the exception of the gradual reacquirement of the power to feed himself, he never learned anything. However often an act may have been repeated, as, for example, his daily removal from his cage for feeding during eighteen months, it produced no evidence of acquired experience ; each time, no matter how hungry, he snapped and bit angrily. Every trace of methodical activity was lost. The dog was capable of a variety of vocal expressions. His spontaneous acts, which were numerous enough, exhibited no trace of reflection or the slightest evidence of experience.

The most remarkable deficiency resulting from the removal of the cerebrum was the suppression of all expressions which betray understanding, memory, reflection, and intelligence in the animal. On the other hand those faculties remained intact which may be exercised without these functions, such as a certain degree of motor power, sensation and general irritability.

And now, gentlemen, a glance at the charts [1] and preparations will show that, caudad of the great injury which has removed the entire cerebrum and somewhat injured the thalamus,

---

[1] The illustrations will appear at the proper time with the extended publication of the results of the study of the operated dog brains.

in the region of the corpora quadrigemina only slight divergence from the normal conditions are observable at first sight.

In this section of spinal cord you will detect nothing to distinguish it from a section from a normal dog, and it is only after close inspection that you will discover that a few fibres are absent from dorso-lateral columns and that the whole pyramidal tract, which is not very strongly developed in the dog at best, is affected by secondary degeneration on both sides. Even in these sections of the medulla and quadrigemina no one would discover without careful study that farther forward such an enormous region of the ventral nervous system had been injured. From these observations we might conclude that the spinal cord and the ganglia and fibres in the medulla and midbrain are distinct centres which possess a high degree of anatomical independence of those parts of the brain lying farther cephalad. The functions which they subserve, motor co-ordination, receptivity to sense impressions, were not so seriously affected in this dog. The opinion which might be formed on anatomical grounds, that an animal which retains only these centres intact could, in case of necessity, get on with them alone, has become certainty through the evidence afforded by eighteen months' observation of this dog. I shall discuss this point more in detail later.

Glance, in the next place, at the illustrations of sections through the forebrain. These were prepared by drawing the outline of the sections through the fragments of brain of the operated dog and projecting sections from the same level of normal dog brains. The projection distance was so adjusted that the two outlines were made to correspond and thus articial figures of two equal brains were produced.

It appears that almost the entire forebrain has been removed in an extraordinarily skilful and complete manner. Cephalad both the frontal lobes are absent, together with a part of the striatum and the callosum and corpus fornicis. On the right side a part of the internal capsule is retained with the body of the striatum but on the left side only traces of these remain. The precommissure, the olfactory fibres of which should be visible at this point, has completely disappeared.

Notice that the inner capsule, even in the first section, contains quite a number of medullated fibres. These, therefore, must have their origin not in cells of the cortex but in structures lying farther caudad. The next section shows that the caudatus is relatively well preserved on the right side while on the left only insignicant fragments remain. A trace of the cortex belonging to the trigonum olfactorium lies ventrad of the head of the striatum on the brain base. The lentiformis is almost completely removed with the hemispheres. Farther caudad, in region of the commissura media, the thalamus is present on both sides but all its niduli are atrophied to a marked extent. Only a much atrophied internal capsule, not a trace of hemispheres, no fornix and only the fragments of an ammonshorn of one side remained. The uncus of the parietal lobe is retained because the operator wished to pseserve the optic nerve. In this he was successful on the right side but on the left side the section passed a little too far mesad and also removed the corpus geniculatum laterale. Thus the optic nerve of that side is atrophied although intact on the other side. Behind the sections here figured all the thalamus ganglia are present and send their fibres caudad quite like those of a normal brain. In spite of the enormous injury in the forebrain region, the tegmental region and mesencephalon gradually appear, sections passing through which are but slightly distinguishable from those of a normal midbrain. The farther caudad one goes the fewer tracts are affected till, as already remarked, in the cord the only defect is the absence of the pyramidal tracts.

I have thus far scarcely taken into consideration tracts seconarily degenerated, in part because these relations lie outside the range of this lecture, and in part because the investigation is as yet incomplete. Our present purpose is to indicate the extent of the destruction due to the operation.

I again summarize the results. Of the entire cerebrum, aside from the remnants of the right Ammonshorn, there remains not a trace except a strongly atrophied uncus of the parietal lobe, which is reduced to a mere membrane. The incision on the right side passes laterad of the capsule leaving the thalamus ganglia and opticus intact, while on the left side the geniculalum externum, optic nerve, the gangalon of the lattice layer, and a part of the ventral thalamus nidulus were also removed. The left optic nerve remains visible only in the form of atread of nonmedullated fibres. Of the ganglia of the mesencephalon, cerebellum, etc. all are intact.

This dog which, as you see, had lost almost the entire cerebrum, possessed the greater part of those faculties which for a time we have been led to believe eminated essentially from the cerebrum. The experiments of Goltz, which have removed so large a mass of brain substance, have always produced great interest. But the results of these operations, which he described in his usual masterly manner, seemed to many to contradict the results of the majority of the physiologists who have employed stimulation and exterpation. In other words, a distinct contradiction was thought to exist between the results of localization and those produced by Goltz. Here, however, we must be content with the facts. It is possible to explain that, on one hand, a slight injury of cortex in man or the ape produces evident symptoms or lameness, motor insufficiency, etc., that we may diagnose the spot and treat it successfully, and that, on the other hand, this dog, and many others operated upon by Goltz, gave evidence of no marked motor disturbances.

I am convinced that the facts which comparative anatomy has taught us are well adapted to thro w a strong light upon the significance of the cortex and cerebrum and to explan the contradictions which so many find between the results of stimulation of the cortex and its total extripation.

There is a large class of animals which are totally devoid of a cortex and the fibres originating there. It is the gronp of bony fishes [Teleostei.] In this group the brain " begins ", *sit venia verbo,* with the axial ganglon, corpus striatum, as indicated in the drawing. The thalamus ganglia are relatively insignificant, it is only when we reach the mesencephalon that great cell and fibre masses appear. I may add that these do not differ in essentials of arrangement from those with which we are familiar in the mammals and man. No one would assume that the cortex-less fish is lame or without sensation or blind, yet it lacks those tracts which in higher animals conduct from the first termini of the motor, sensory and cranial nerves to the cortex. The sole conclusion which is warranted is that the first stations of these nerves suffice to exert those functions which we recognize as characteristic of the central organs.

As one ascends the scale there is added (I use the word "added" purposely) to the structures already existing a cortex. We are able to clearly distinguish the cortex from all other parts of the brain (by the form and arrangements of the cells) since we possess the Golgi method. Such cells appear first in an irregular and sporadic manner in the amphibia. In the reptilia we find a well-defined, regularly arranged cortex clothing the mantle. From it arise a few fibres which connect the mantle with the deeper centres. Even among the mammals the cortex is, as well known, exceedingly variable in its extent. Its amount in rodents and many other mammals seems quite small when compared with that of the thalamus and mid-brain ganglia. It is not until the higher mammals are reached that the cortical layer of the cerebrum gradually acquires its extensive development which, through the magnitude of the connections which it contains and especially the radiations which pass to the thalamus, produces the familiar convolutions. The cortex is, therefore, not a necessary element in the concept of a vertebrate brain, it is of gradual development and continues to increase in size in the group of mammals itself.

The latest to develop is that part of the cortex which, with its radiations, is called the frontal lobe. In the carnivora it is still very small, and even in the ape it has relatively slight development, while in the anthropoids, those apes which most nearly approach man, there are remarkable differences between the frontal lobe and that of the lowest races of men. The rate of development is not the same for all parts of the cortex. Those parts of the cortex pertaining to the olfactory sense, the marginal gyre and ammonshorn, may attain an enormous development in those animals which depend much on this sense, while in the case of the apes and man these parts occupy a subordinate place.

It is not necessary to rehearse in this circle the evidence that the cortex with its numerous cells and fibre tracts is essentially the bearer of the psychical functions. Comparative anatomy and Goltz's experiments show that its existence is not necessary for the so-called lower functions which take place without constant intervention of the intelligence and were formerly called instinctive. Schrader, by his experiments on doves and lizards has obtained results like those I reached on an anatomical basis and the experiments of Steiner have not offered any contradiction.

If the cortex is non-essential for the above functions, it by no means follows that it has no influence upon them, and at this point the results obtained by experimenters who have employed localization, offer a valuable supplement. It must be assumed that, in fact, a chart of the surface of the brain may be constructed, a chart which indicates at which points stimuli may be applied to produce a specific motor or sensory reaction upon the deeper centres. There is no contradiction between the two experimental tendencies, but one supplements the other. Goltz, however, shows that the removal of the cortex and its connections deprives the animal of the organ for all those functions which make possible the higher psychical manifestations, such as intelligence and reflection.

In progressive paralysis of insanity we meet clinically and anatomically a disease from focal beginnings which gradually destroys the cortex. The final result is just what Goltz obtained operatively, the patient becomes deeply imbecile. Naturally the symptomatic complex is greatly modified in man, who has become accustomed in his activities to permit the coöperation of memory and and reflection to a very great extent. Thus man bears cortical injuries much worse than animals and reacts from injuries which would hardly permanently affect a dog at all, to the extent of complete obliteration of function. Moreover the clinical symptoms of paralysis, so far as these questions are concerned, are much complicated by the fact that, in the course of the disease, spinal cord symptoms usually appear.

The new-born child has but few connections of the first centres with the cortex. The optic radiations do not develop until weeks after birth. In spite of this, however, it may be easily proven that the child sees well, but there appears for a time no evidence of comprehension of what is seen, as in the decorticated dog, nor of the power to practically apply what is seen. These appear only after the development of the optic radiation permits the cooperation of the cortex. But a man who in later life loses the occipital lobe of both sides no longer has the capacity to see, like the dog or the child, with the deeper centres. I have the record of a man who suddenly became completely blind. He lived for years without being able to see in the slightest degree. In the autopsy I found bilateral softening of the two occipital lobes, probably as a result of embolism.

The cortex plays a more important part and becomes more indispensable the higher we ascend in the animal scale. This is the explanation of the divergent results of the experimenters. It is not only possible but very probable that the destruction of the occipital lobes would have a very different effect on vision in the ape than in the dog or rabbit.

Since we have discovered that the cortex is something which has gradually been added to the rest of the brain in the animal series and that it serves the higher faculties of psychical life, such as intelligence, experience, and reflection, it is not of slight moment to enquire what sensations are localized in the small cortex which first appears in amphibians, or still better, in reptiles. It is only within the last months that I have reached a solution of this problem. It proves that the cortex of these animals is connected by a strong system of fibers almost exclusively with the olfactory apparatus. The phylogenetically oldest cortex serves the olfactory sense and has, even thus early, certain peculiarities which permit us to consider it closely related to the Ammonshorn. The conclusion which is self-evidently to be drawn is that the first of the higher psychological functions which makes its appearance in the animal kingdom is that which has to do with the memory and evolution of olfactory sensations (For particulars see Anatomischer Anzeiger, 1893, 10.)

I present not only the preparations from the dog operated on by Goltz but also a series from a normal dog and finally a number of sections of the brain of the giant turtle, *Chelone midas,* which clearly show the connection of the oldest cortex with the olfactory lobes.

CONTRIBUTIONS TO THE COMPARATIVE MORPHOLOGY OF THE CENTRAL NERVOUS SYSTEM.

II.—Topography and Histology of the Brain of Certain Reptiles.

(Continued from Vol. I. p. 37.)

By C. L. HERRICK.

Additional remarks upon the cerebrum. The *olfactory tuber* is large in nearly all reptiles. In some cases, as we have shown elsewhere, the tuber is carried forward by the growth of the skull and separated from the cerebrum, as in fishes. This is true in the alligator, giving rise to the mistaken idea that the peduncles are the olfaclory nerves (Rabl-Rückard and Wiedersheim). In serpents the tuber retains its direct connection with the hemisphere but it is greatly expanded, with a laterally divergent terminal bulb. The ventricle extends nearly to the end. It would appear that there are two distinct portions of the pero. The longitudinal sections of black snake brain (Plate VII., Figs. 1–3.) show that at the very tip there is a mass of isolated pero which is the source of the olfactory nerve proper, while the nerve to the large Jacobson's organ is derived from fibres from the mesal olfactory fossa. The real configuration of the tuber is best seen from the horizontal section (Plate VII., Fig. 4.) It will be seen that serpents have developed to an enormous extent the structure we have described as the olfactory fossa in the rhinencephalon of the alligator and opossum.[1] This structure consists of an excavation of the mesal aspect of the organ which is filled out by the fibres which enter there. The whole pero is greatly thickened and the rhinencœl is thus diverted laterad and describes an arch in both the horizontal and vertical plane. The ventricle is not only thus reduced to a half-moon shaped slit but the lateral walls of the tuber are thinned to such an extent that they contain little but the epithelium of the pes.

A longitudinal section (Figs. 1–3, Plate VII.) is very instructive in showing that the attenuation extends ventrad and dorsad so that the radix fibres emerge through these thin walls of the lateral aspect.

It is this delicate and one-sided structure of the tuber which, taken in connection with the flinty brittleness of the skull, makes the mutilation of the tuber almost a constant occurrence, explaining the incompleteness of earlier descriptions.

This configuration is established before birth. The localized development of the pero on the ventral aspect is perhaps correlated with the isolated course of the highly developed tract of Jacobson's organ.

The structure of the tuber offers nothing peculiar otherwise. The ganglion cells surround the cup-shaped fossa and send their slender apex processes into the glomerule layer where they enter into association with the olfactory fibre. The central end of the nerve cells sends out short processes which break up into dichotomous branches. The granules adjacent to the ventricle are, as usual, of two sorts; larger pale nuclei with slight protoplasm and which may be regarded as immature nerve cells, and small dark nuclei which are perhaps migratory corpuscles.

In transections of the olfactory tuber of serpents (*Tropidonotus*, *Coluber*, *Eutænia*) the fibres from the mesal aspect arch dorso-laterad and collect with those of the lateral aspect and

---

[1] Journ. Comp. Neurol. Vol. II. Feb. 1892.

form the radix lateralis, which is soon covered by a cap of cortex. On the mesal aspect a few fibres of uncertain origin collect and pass caudad into the post-rhinal lobe where they are closely enveloped with dense cell-clusters of that lobe. Into the same clustre the fibres of the olfactory branch of the precommisure may be traced, though it may be that the continuity is broken here.

The olfactory tuber in *Phrynosoma* is very small and slender and might very readily be mistaken for a nerve. It is cylindrical rather than bulb-like and passes well forward to the narrow space left for its reception in the frontal portion of the skull. The glomerulary structure occupies its terminal portion. Material now at disposal does not permit a careful histological examination. It would appear that the relatively slight olfactory development may be correlated with the small development of the occipito-basal lobe and hippocampus.

In the turtles the olfactory tuber is much simpler than in the serpents. The uniform oval form, absence of olfactory fossa and the symmetrical arrangement of the several layers about the ventricle all indicate a more primitive condition. The ventricle or rhinencœl is large and expanded. The peduncles are applied obliquely to the ventro-mesal aspect of the hemispheres.

The preparations at present at disposal throw but little light upon the course of the radices, which are disperse, rather compact and resemble the similar structures in Amphibia. It appears, however, that the lateral radix passes along the lateral aspect of the hemisphere and occupies a distinct fissura radicis, as in higher vertebrates. It enters the inverted convolution homologous with the "nucleus sphæricus" of serpents and thus connects with the hippocampus. More distinct than these fibres are those of the supracommissure, which pass ectad of the peduncles and cephalad of the optic tract and, entering the cerebrum, arch rapidly dorso-cephalad to connect with the above-mentioned lateral radix bundle, though with present material it is imposible to determine actual continuity.

The *olfactory radices* have been very carefully studied by the writer in fishes and the opossum and by Professor C. Judson Herrick in rodents and we have agreed in tracing the lateral radix along the fissura radicis to the pyriform lobe where the tract either splits or is met by fibres from the supra-commissure tract. The fibres remaining in the cerebrum spread out over the pyriform and can be traced more or less directly to the hippocampus. In fishes where the hippocampus is not differentiated from the "occipito-basal lobe" (homologue of the pyriform) the fibres pass, in a continuous sweep, from the olfactory tuber to the point where the hippocampus would appear. Dr. Edinger agrees with our suggestion that the latter body may be looked upon as an outgrowth from the occipito-basal lobe.

In reptiles we have found a similar arrangement. Dr. Edinger's recent paper follows the radix lateralis in the turtle through the occipito-basal lobe ("nucleus sphæricus") to the cortex of the Ammonshorn.

Dr. Meyer, in his discussion of the olfactory radices[1], says that the great majority of the fibres of the olfactory tract assemble laterad of the ventricle and thence pass to the nucleus sphæricus, where, apparently, the fibres, after losing their sheaths, break up into fine terminal brushes and are distributed to the inner portion which is poor in cells but is surrounded by a dense layer of cells, like a cap. According to our observation, however, this which has been regarded as a core of the organ is really but an invaginated portion of the caudo-ventral surface. It is so folded that the olfactory radix is included within the groove-like entrance and conducted into the central (morphologically ectal) space, where they spread out just as in other reptiles, If Dr. Edinger is correct and the nucleus sphæricus belongs specifically to the hippocampus then the fact that the radix lateralis fibres cannot be as distinctly traced to the free cortex as in other reptiles need produce no surprise. However, in suitable sections fibres can be traced from the nucleus sphæricus to the caudal cortex or hippocampus proper.

Dr. Meyer adds: "It is indubitable that other olfactory

[1] *Zeitsch. f. wiss. Zool.*, LV, 1.

radices exist; (1) the fine layer of the fibres forming dorsal remnant of the coronal fibres and (2) the basal [ventral] remnant of the same fibres.

[This so-called "Randfaserkranz" includes the fibres which clothe the ventral and mesal surface of the hemispheres immediately caudad of the olfactory peduncle.] As to the ental olfactory radix, or pars olfactorii of the precommissure fibres, Dr. Meyer is in doubt as to the identification (*l. c.* p. 81), but figures them as we have done.

Dr. Meyer describes the relations of the nucleus sphæricus to the remainder of the brain base and remarks that the olfactory radix passes through a groove of the lateral ganglion and then is separated from the surface. The way in which the nucleus sphæricus is formed accounts for both facts.

In turtles the relations are simpler, as the *nucleus sphæricus* can hardly be said to exist, but the occipito-basal lobe is simply forced into the caudal cornu of the ventricle by a direct invagination the nature of which is very plain. The connection of the hippocampal cortex is very close and distinct with the spurious cortex of this region and there seems to be no reason why it should not be recognized as a masked convolution. The radix lateralis enters this closed fissure as described by Edinger. We have verified these points in three species of Chelonia and find them constant.

The lizard *Scoleporus* affords an illustration of an intermediate condition. The "nucleus sphæricus" is scarcely developed and is in obvious connection with the hippocampus. The radix lateralis is somewhat submerged and enters a small blind sac formed on the same plan as the corresponding organ in serpents.

In *Phrynosoma* our sections are very unambiguous and one can easily trace the radix into the inner space of the sphæricus which here lies far latero-ventrad and which is plainly an invagination.

In the alligator no true "nucleus sphæricus" is formed, but there is a large massive occipito-basal lobe projecting into the caudal cornu of the ventricle. The transition of its superficial cortex into the hippocampus is direct and the fibres of the olfactory radix seem to be superficial.

The occipito-basal lobe, which is so largely developed in snakes, requires a more particular study. Though, as previously described, it is embraced within the axial lobe, it has many characteristics of a cortical area.

In the bird brain Mr. Turner found a submerged convolution or masked bit of cortex in the occipital region. Dr. Edinger in 1893 has explained the less highly developed organ in Chelonia—his "nucleus sphæricus"—as a continuation of the Ammon's horn, while the writer in 1890 and again in 1891 had contented himself with suggesting that the occipital cortex may have sprung from this lobe through the active proliferation there taking place.

It is obvious enough how the nucleus sphæricus may have been formed, but the corresponding organ of serpents is so unlike it, so deeply imbedded in the axial lobe, and so complicated that it is difficult to understand its origin. An attentive study of sections, however, shows that as above indicated, it is inverted cortex from a caudo-ventral region which has been thrust cephalo-dorsal and pushed bodily into the ventricle and axial lobe. (Really, of course, the process is incident to the compactness of the organ and the above expressions are to be taken as illustrative rather than literal.) The core of the lobe is therefore, morphologically ectal surface and its peripheral margin is morphologically ventricular. In some cases, where the brain had been slightly macerated and then rapidly hardened, the core became shrunken and revealed this connection with the surface. It is notable that the place where this invasion originates is just beneath the limb of the hippocampus where it joins the axial lobe, so that it would be possible to adopt Dr. Edinger's view and include it with the hippocampus. This homology, however, we hesitate to adopt unconditionally, because the elements of the hippocampus seem adequately represented otherwise and, besides, this body has its apparent homologue in the pyriform lobe of mammals which may therefore be regarded as a part of the basal portion of the pallium which has been thickened by conduplication. The cellular structure of this body in reptilia is nearer that of the axial lobe than that of the cortex. Fibres pass from this body, at its mouth on the ventro-caudal aspect, into the hippocampus. From the ventricular aspect (ental aspect of the cells) a strong bundle of large dark fibres passes to the precommissure. A part of these fibres do not enter the commissure but pass at once to the thalamus. These fibres the writer has compared to a separated tract from the fornix which took a more direct route than the rest whose position was described as like that in mammals. We find similar fibres in fishes and think it is a mistake to compare them to any part of the fornix. Edinger is probably in error in thinking these fibres (f^1 Fig. 4, Plate VII,) the bundles from the habena, for the latter, if our observations are correct, pass to the lateral aspect of the brain base and arch caudo-dorsad upon the convexity of the caudo-lateral cortex (parietal lobe ?) or connect with the radix lateralis. The fornix fibres appear at *f* in the same figure.

Inasmuch as the spheroidal structure which is so conspicuous in serpents is not developed in all reptiles even, it seems to us that the term nucleus sphæricus can hardly be adopted as a general term, but may be restricted to that organ where developed, while the occipito-basal lobe may include the whole region however developed. In the snake it would include more than the sphæricus.

THE HISTOLOGY OF THE CORTEX.

In conformity with our determination to postpone a discussion of the literature to a later period in this series, we only consider the recent papers which have a direct bearing upon the topics in hand.

Dr. Adolf Meyer has contributed an extended paper[1] upon the fore brain which covers much the ground of our own previous work in a thorough and painstaking manner. Although he has unwittingly repeated many of our own observations they are none the less welcome.

---

[1] *Zeitsch. f. wiss. Zool.*, LV, I.

The greater part of the paper deals with the brain of the adder, *Callopeltis æsculapii.*

The histological elements are so grouped that a number of fields are rather sharply distinguishable. The cells may be distinguished by their position as well as their form in several classes which are mentioned rather for convenience than as histologically distinct types. (1) Cells with multiangular, often pyramidal nuclei surrounded by a relatively small protoplasmic body, more or less parallel to the nucleus. These form the mantle layers. (Figured by Edinger, Plate IV, Fig. 36.) (2) Cells with round nuclei situated either centrally or near the wall in a clear space. These may be isolated or grouped in nests of from two to six cells somewhat resembling cartilage cells.

The present writer has already discussed these differences at length in several papers and has laid off the cortex into areas or "lobes" with their respective niduli each distinguished by the form of the cells. If any thing is needed to complete the evidence that these distinctions have physiological significance, it is found in the fact that the pyramidal cells lie in areas which are tributary to the ventral peduncles. The suggestion of Brill that the greater part of cortex is homologous with the subiculum cornu ammonis may be regarded as gratuitous assumption. The "fronto-median lobe" seems to be homologous with the limbic region of higher vertebrates and is of the flask-shaped type (sensory). As in mammals, the motor areas are mingled with sensory cells, so there is no exclusive seggregation in reptilia. The statement of Meyer that the processes of these cells can only be detected by Golgi impregnation requires modification.

The cell-nests of the axial lobe which Meyer compares to cartilage cells, have been described by the writer in the alligator, lizards, serpents and fishes, and by C. H. Turner in birds, and constitute a remarkable structural modification, for which the theory of proliferation has been proposed—a theory which adds probability to the view of Edinger and the writer that the hippocampus and other parts of the cortex are progressively thrust out from the axial lobe. Meyer follows Edinger in calling the median cortex cephalad of the callosum "cortex ammonis." This region the writer termed fronto-median lobe and cannot see how it is possible to so modify homologies as to compare it with the Ammonshorn. It seems clear that it is the limbic region—the sensory cortex of the mesal hemisphere wall.

Again the "intra-ventricular lobe" of the present writer is called septum pellucidum or "fornix ridge" of Edinger. To this usage we can only say that, if the term septum pellucidum is used in the restricted sense as employed in mammals, where it is limited to that part of the intra-ventricular walls which coalesce, it does not exist in reptiles. If the usage is extended to embrace the entire intra-ventricular wall, it includes too much and is liable to combine cortex and basal regions in one unnatural assemblage. We cannot assent to Edinger's employment of the term Fornix Leiste for the ventral median wall cephalad of the callosum. Its use, if restricted to that part containing the fornix fibres, makes it sufficiently identical with the corpus fornicis to deserve that term.

For a discussion of the septum, see Mihalcovics, p. 122, especially these words: "Durch die Verwachsung der Hemsiphäreninnenwande entstand vor dem 3. ventrikel eine solide Masse, die durchsichtige Scheidewand (septum pellucidum) des Saugethiergehirn."

The real nature of the cortex is well illustrated by a comparison of the embryonic condition of higher vertebrates with that of Amphibia and Chelonia. (As Meyer well observes, there are many points of resemblance between the amphibian and turtle brain.)

A comparison of Figs. 2 and 3, Plate XIX of Vol. II of this Journal will illustrate the early condition of the cortex in the snake and dog. It will be seen that the cortex proper is derived from wandering neuroblasts whose points of development were at the ventricular surface. The extent to which the free neurons separate from the less differentiated cells near the ventricle varies with age and with the group, as well as with the region of cortex. It would seem that the simplest form of pallium is that seen in nearly all regions of the amphibian brain where there is no sharp distinction of region, and where the ventricular and cortical layers are not yet distinguished. The number of fibres is, as yet, insufficient to develop a white layer. The pallium, therefore, consists, at that stage, solely of (1) outer neurolgia and fiber layer, (2) cellular layer, and (3) epithelial layer (i. e., layer of the nuclei of the spongioblasts.) Two elements introduce the differentiation; first, the increase of cellular elements adjacent to the ventricle through the process of proliferation of neurons to serve as reserves (as well as possibly for nutritive purposes) and, second, the increase of fibres forming distinct tracts and a more or less continuous white layer.

In many turtles the whole pallium retains much of its primitive simplicity. The pallium is relatively large and of a nearly uniform structure, and its cellular elements are in a common stratum, or at least, there is no marked line of separation.

We believe that it may prove expedient to distinguish two varieties of cortex. The first or more primitive type is produced by a migration of the whole cellular area to a belt some distance from the ventricle. This is found in almost the entire cortex of turtles and characteristic of the occipital and dorsal regions of serpents and lizards, and is retained in the hippocampal cortex of higher vertebrates. The second type is that which is found in other regions of the pallium where the ventricular belt is retained and a second band of cortex is differentiated. Both these forms are derivable from the embryonic structure where both are united in a common stratum about the ventricle. The latter condition is that which is, with slight modification, the permanent one in amphibians. The complicated cortex of mammals is a modification of the second type above mentioned.

We conceive that we are warranted in insisting upon the essential uniformity of the neuron, whether it takes part in the formation of a nerve or of a tract or of a cortical area. It is essentially a cell with processes which form associations, if not anastomoses, with like elements, and thus produces chains of progressive association and translation. The neuroblasts, which arise from the ventricle, migrate from it to a suitable position, and there produce their nerve-fibres which connect at suitable levels with others. The fibres which spring from one end may be many times longer than those from the other (for the neuron is primarily bi-polar), but it is indubitable that both may convey stimuli.

Transection of the cerebrum of the Phrynosoma. (Plate V.) Topographically considered there are few points of especial interest in this brain that have not already been alluded to. *Fig. 1* cuts the right olfactory tuber near its base. The tuber has already been described.[1] Its ventricle is very small. The left hemisphere is cut where it joins the rhinencephalon. The fibres of the radix lateralis accumulate laterally.

In *Fig. 2* the rhinencœl has expanded into the ventro-cephalic cornu of the ventricle and the latter communicates with a large sickle-shaped dorsal cornu. It will be observed that in this and other sections a sharply marked fissure on the mesal aspect, corresponding to a furrow of the ventricle opposite it, nearly separates the cortical from the basal part of the mesal wall.

In *Fig. 3* the projection of the central lobe (striatum *sensu strictu*) forms a large part of the section. The cortex is differentiated as already described in the lizard. That portion which lies dorsad of the fissure of the mesal cortex above referred to was called by me "fronto-median lobe" and its structure is fully described on p. 18 of this Journal for March, 1891. See *x*, *Fig. 5*. Laterad from this lobe there is a smaller portion of cortex which caps the front of the brain and is occupied, like the parieto-frontal lobe which clothes the lateral parts of the free cortex, by pyramidal cells or at least a variety distinctly different from the remaining regions. These two areas may be located upon *Fig. 5*, the one mesad, the other laterad of the reference line passing to the hippocampal commissure.

We still unhesitatingly adhere to our belief that these centres along the frontal and fronto-parietal aspects of the cortex

[1] It should have been added that the tuber is exceedingly produced in the adult, being, in fact, as long as the entire prosencephalon and cylindrical and slender throughout.

are motor. This belief, being founded not simply upon an analogy in appearance but upon the fact that the ventral peduncular bundle distributes its fibres to these regions; we cannot agree with those writers who claim the whole cortex for sensory apparatus, still less with those who appropriate it to the olfactory sense alone.

There is a rudimentary rhinalis fissure separating a ventral region devoid of cortex from one which although flanked by the central lobe still has a cortical differentiation. We have nothing to add to the description of the intra-ventricular lobe, or that part of the mesal walls which lies ventrad of the fissure. This is not cortical in structure and is wonderfully similar to the corresponding part in the opossum (we are not prepared to use the term septum pellucidum for this structure.)

As we pass caudad the peduncular fibres accumulate on the mesi-basal aspects and the occipito-basal lobes appear along the latero-basal aspects (*Figs. 4–5*. Fibres from the fronto-median lobe gather near the mesal fissure and accumulate dorsad of the intra-ventricular lobe, which now is forming a transition into what must be called corpus fornicis. The callosal fibres (in accordance with the usage of Osborn) pass from the fronto-median lobe of one side to the other, not without decussations but in just the same sense as in higher vertebrates. Before one can unhesitatingly commit himself to a term as much mooted as this one it is desirable to secure a unambiguous definition of it. This we evidently cannot soon expect. We propose for the present to consider as a callosum any bundle of nerve fibres passing from the dorsal cortex of one side to the dorsal cortex of the opposite side cephalad of the fornix. It shall not be obligatory to determine whether the parts connected are homologous or otherwise for the latest admissions of Meynert left us in doubt whether such fibres are characteristic of the human callosum.

The above definition excludes the commissure described by the the writer in fishes though recent studies have added evidence in favor of the hypothesis that homologues of cortical niduli may remain in the axial lobes. What was intended by the employment of the term callosum in that connection was to emphasize to the utmost the functional homologies believed to exist.

Back of the callosum the roof of the aula is a thin tela which is plexiform and gives rise at its lateral portions to the preplexus, which enters the lateral ventricles a short distance. Lying some distance caudad is the hippocampal commisure. This does not differ in any morphological respect from the corresponding body in mammals. The statement that it is peculiar in being situate beneath a plexus, i. e. that it perforates the ventricle instead of lying in the dorsal wall has been very carefully investigated in many families of reptiles and in birds. It is an error, or rather a misinterpretation. Above the commissure of Fig. 5, a part of the plexus may be seen but it is a *retroflexed* diverticle of the plexiform roof in front of it. In a section immediately following, the commissure lies plainly in the roof without connection with the plexus. Fig. 6. reveals the interesting fact that the fornix fibres and those of the commissure pass to the caudal cortex, i. e. to the exact locus which in the March number was identified with the hippocampus.

We differ from Edinger only in that he seems to include the whole mesal and dorsal region with our occipital lobe as hippocampus. This question, however, we discuss in full elsewhere.

The callosum. Dr. Meyer[1] regards the indentification of the callosum in lower vertebrates as unwarranted. He says: "In ungulates it is easy to see how the callosum stretches between the outer acuate gyre and the septum pellucidum or fornix fibres of the two sides in the form of a secondary bridge—a completely discrete organ. This locus corresponds to the groove which forms the mesal limit of the mantle—and such a structure is [in reptiles] entirely lacking." To this it must be said that embryology shows that the callosum develops within the lamina and never normally lies free upon the surface. The indusium, which is carefully described by Mr. Fish in this number, is the remnant of the supracallosal cortex which has be-

[1] l. c. p. 77 and 118.

come reduced proportionally to the development of that organ. Moreover in those cases where the callosum lies superposed upon the fornix there is always a remnant of the plicated roof of the aula between them.

The amount of gray matter covering the callosal fibres is a matter of no morphological importance.

In *Phrynosoma* and other lizards the callosum is in quite a different frontal plane from the precommissure and is quite distinct. Its fibres are derived from the ventricular aspect of the fronto-median cortex.

In his paper upon the callosum Osborn said, "the evidence regarding the fornix in Ophidia is not as yet sufficiently clear to be conclusive, but I believe that further evidence will soon be forthcoming to show that there are true fornix tracts in the reptilian brain." We think there can no longer be any doubt as to the constancy of the fornix and the hippocampal commissure in all vertebrates above the fishes at least. We subscribe fully to the view that the whole mesal mantle is united with its fellow of the opposite side by a common commissure which is divided into a cephalic and a caudal portion, the latter developing earlier because of its relation to the olfactory cortex which is first to become functional. It is not a little strange that Osborn should have failed to find the hippocampal commissure of snakes while recognizing the few and doubtful fibres of the callosum which Meyer thinks simply decussate.

It is certain that what Osborn called posterior bundle of the callosum is, as he thought probable, "the commissural portion of the "Cornu Ammonis."

In Chelydra we encounter a peculiar development of the commissures which is instructive as to the range of variation. The sections embracing the precommissure show that just dorsad of it and apparently connecting the two sides of the axial lobe, like the precommissure, is a strong bundle of fibres which turns sharply cephalad and then gradually enters the median cortex. In short, it is the (so-called) callosum, which is displaced ventrad and placed in juxtaposition with the precommissure. Its fibres pass to the ventricular aspect of the limbic cortex, as in other reptiles.

The course of the commissures of the mesal cortex can be well traced in *Cistudo.* The hippocampal fibres pursue the usual course but they are accompanied by cortex for nearly all their extent and the fimbria thus becomes small and incomplete. The fibres pass to the mesal side of the callosal tract without decussation and there turn abruptly ventrad and caudad. Such commissural fibres as there are are clesely associated with the callosum immediately dorsad of the precommissure. The callosum itself, after crossing in a large compact bundle extends for some distance on either side in the "septum" directly cephalodorsad and afterwards divides into scattered fascicles which pass to the ventricular aspect of the intraventricular wall of the pallium. In perpendicular sections it can be seen that these fibres include the whole extent of the fronto-median lobe and continue upon the dorsal surface at least as far as this lobe extends.

It might be questioned how far we are authorized to go, in following these commissures in their fluctuations with the familiar names of mammalian anatomy, but, for our part, we think our nomenclature should express our morphological point of view as far as consistent with clearness.

The explanation of the modifications here exhibited is found in the relatively great distension of the ventricles in turtles, which elevates the median wall disproportionately. The terma drops very abruptly and the course of all the commissures of the median wall below the arcuate fissure is lengthened. Thus the perpendicular length of the fronto-median cortex in a snake might form less than one third of the entire height of the cerebrum, while in a corresponding region of the turtle the fronto-median cortex is two thirds the entire height.

In Amphibia we are inclined to differ from Osborn in his identification of the callosum. He does not identify the fornix and hippocampal commissure, but classes all fibres connecting the mantle and crossing dorsad of the precommissure as callosum. The position and course of these fibres makes the identification of these fibres unsatisfactory for, as he indicates, the position is caudad of the porta and most of the fibres, so far as we can see, are derived from the caudal cortex, in other words, it resembles the hippocampus commissure and fornix and connects with a descending fornix tract. The early period at which these fibres develop is against their recognition as the callosum.

In horizontal sections of Menopoma one may trace the fibres from the caudo-median cortex ventrad immediately caudad of the porta till a level is reached slightly dorsad of the precommissure, here the fibres cross, as described by Osborn.

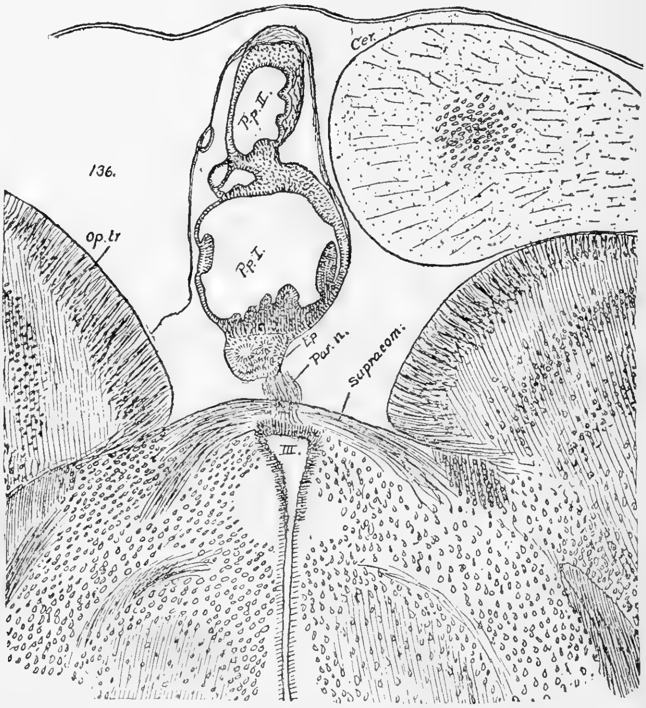
These fibres however, can hardly be compared to the callosum. Cephalad of the porta and just where one might expect it is a small bundle of fibres which crosses by a strongly curved course from one intraventricular lobe to the other. Study of the embryos of salamanders shows that the tract first above mentiontioned appears early, while the callosum was not found at all. All analogy would lead us to expect that the hippocampal commissure and fornix would be first to appear and most highly developed in the lower forms. This discovery is in harmony with our view that the cortex is derived from the axial lobes and the commissures with it. (The figures illustrating these statements are prepared but cannot be printed until a succeeding number.)

The epiphysis in serpents consists of a more or less balloon shaped modification of the original tube and a short stalk which communicates with a spot just caudad of the supracommissure. There are fibres which resemble the connective elements of a parietal nerve arising from the commissure itself but there is no special evidence of nervous function. The terminal bulb itself is contained within a special chamber formed by the adherent meninges and is directed cephalad between the hemispheres. A portion of the pigmented roof above the brain enters the intercerebral fissure and is closely associated with the tip of the epiphysis to such an extent that this portion of the organ becomes invested with chromatophores. No traces of a true parietal organ have thus far been noticed. In late embryos of Eutænia and the black snake the whole region of the dorson of the brain is enveloped in an enormous blood sinus. The epiphysis is slung by its membranes in such a way that it is attached ventrad to the region of the supracommisure and dorsad to the cranium. Even at the earliest stage observed it has the adult characters and is accompanied by a special blood vessel. The spaces occupied by the sinuses are subsequently encroached on by the hemispherses and the epiphysis comes to lie between the former.

The histological structure of the globular part of the epiphysis is peculiar. At first glance it seems to be a solid mass of deeply stained corpuscles, but inspection proves that it is formed of a ramosely branched tube which is closely packed within the space alloted to it. Each branch is enveloped by a delicate sheath of connective tissue and the interspaces in some species contain blood vessels and pigment while in others they are almost devoid of foreign elements. A large vessel lies caudad of the organ and follows its course. There are no paraphyses of sufficient prominence to be confused with the epiphysis. Its structure suggests a lymphoid gland and its size indicates that it is not entirely functionless. When it shall be recognized that nutritive processes are closely associated with all sensory organs it will cease to surprise us that a rudimentary sensory structure should function as a nutritive apparatus.

The epiphysis in turtles is one of the most instructive instances of an intermediate link. It develops, as in birds, in the form of a diverticle from the diencephalic roof immediately caudad of the supracommissure and increases rapidly in size. In the larger turtles it becomes a relatively enormous lobate sac connected by a tortuous tubular stalk with its origin. The perforation never fully closes but is so small as to be easily overlooked. The peripheral part becomes irregularly lobed and enveloped by a close net-work of blood vessels and connective tissue so that its lumen is partly encroached upon. Nevertheless it retains a close resemblance to the same organ in Phrynosoma, while far on its way toward the extreme modification afforded by Ophidia. The parietal organ and nerve have not been detected, though the resemblance is so close to the saurians in which they are developed that it would not be surprising if they should yet be found in embryos. The plexus development is excessive but follows familiar lines. The roof of the diencephalon cephalad of the supracommissure is wholly modified in this way. The caudal part follows the epiphysis closely while the cephalic portion forms a distinct sac with numerous plexiform diverticles. From its lateral aspect a rich plexus is thrust into the ventricle.

The whole structure becomes so complex that it is little wonder that Stieda thought the whole organ a mass of plexus and considered the epiphysis absent.



Description of Figure. Portion of a transection of the brain of *Phrynosoma* at the supracommissure. The curved epiphysis, Pp. II, is twice cut while the paraphysis, Pp. I, occupies the concavity left by the curvature. *Par n.* parietal nerve springing from the supracommissure; III. third ventricle; *op. tr.* optic tract.

The habena and related structures require closer analysis than is customary. We have elsewhere shown that the body frequently so-named is compound. The habena proper consists in snakes, as in all other groups, of a sharply restricted conspicuous nidulus perched upon the summit of the diencephalon and bounded caudad by the supracommissure. It is double, being continued on either side some distance beneath the plexus toward the cerebrum. The outline of a longitudinal section is triangular with the acute projection cephalad. The area thus marked off is enclosed by a close series of deeply staining cells and the interior is frequently filled with concentric or irregular rows of similar cells. This structure is found in a similar development in fishes.

The supracommissure penetrates the caudo-lateral part of the nidulus and passes along the cephalo-lateral border of the diencephalon, diverging to surround the ventral peduncles laterad and entering the sinus which separates the pyriform tuberosity from the postrhinal. A second part of the supra-commissure of authors, which we have elsewhere called the commissura habenaria, breaks up into numerous small bundles within the habena.

Laterad of the habena is a rather distinct nidulus (nidulus Meynerti) which is the origin of the Meynet's bundle. The cells of this nidulus are more scattered as well as smaller and are irreglarly arranged in a stroma of crossing fibres. A third nidulus is immediately ventrad of the habena and is enormously developed in turtles. It is larger even in snakes than the others and lies cephalo-dorsad and mesad of the ruber. It may be called the *nidulus infrahabenaria.* In structure it resembles nidulus Meynerti but may have a concentric wall of cells like the habena. From the cephalic aspect of the habena the tænia thalami extends to the cerebrum (?) From the caudo-ventral aspect of the nidulus Meynerti the Meynert's bundle passes almost directly caudo-ventrad to the inerpuduncular, while the tract of the supracommissure lies upon the cephalo-lateral aspect of the nidulus. The infrahabenary nidulus, in a section revealing these relations, lies mesad of the nidulus Meynerti and caudad of the cephalic part of the habena. For corresponding relations in fishes compare Plate VII, Figs. 6–9, and Plate VIII, Figs. 4, 6 of Vol. II.; also Plate XIII, Fig. 4, Plate XII, Fig. 8, Vol. I.

Figs. 1 and 2, Plate VIII, of the present number illustrate the relations in the black snake. Fig. 12, Plate IX, is a cross section of the black snake and Figs. 4 and 5 are from cross sections of Eutænia.

A series of consecutive sections of Tropidonotus give especially clear distinctions between the several miduli.

The Supra-commissural Tract.

The fibres of the supra-commissure, after passing through the habena in an oblique cephalo-ventral course, arch laterad and follow the lateral margin of the front of the thalamus to a point cephalad of the optic tract and laterad of the peduncles and there cross to the base of the cerebrum. The whole course of this tract from the habena to the post-rhinal lobe can be followed in one oblique section of *Tropidonotus.* (Fig. 1 (13), Plate VI.) The path of the fibres in the cerebrum is in the fissure separating the pyriform from the post-rhinal lobe.

There seems to be little doubt that the fibres are derived from the radix lateralis olfactorii.

It has seemed to the writer that the coarse fibred tract from the supra-commissure is not accompanied in this course by the finer fibres of the commissura habenaria but it can not be affirmed positively that the latter passes directly cephalad to enter the cerebrum at a higher level than its fellow, though such is the appearance.

The Diencephalon and Mesencephalon. It will be convenient to commence the study of these segments by an examination of a series of horizontal sections of the black snake. First, however, a glance at the brain itself, or the sections in the plates, will show that the major part of the roof is composed of two ovid segments corresponding to the nates of anthropotomy. Caudad of these are the buried testes or "corpora posterior." The roof of the diencephalon and its lateral aspects are largely embraced by the mesencephalon and, while the optic tracts cross its lateral aspects in a broad band only slightly penetrating the geniculata.

If our interpretation is correct, the front of the mesencephalon is limited dorsad by the post-commissure, while it lies close behind the tuber, ventrad. The substance of the basal region, which is displaced by the "saddle cleft," is pushed cephalad and dorsad into the third ventricle and optic ventricle.

1. A section near the dorson of the mesencephalon consists of two ovoid segments apposed along the median line and enveloped on all sides by fibres from the optic tracts. The interior exhibits the cellular structure characteristic of the tectum.

2. At a lower level the two important tracts of the tectum appear, at first, in one median region, where, however, the oblique fibres which make up the brachial tracts are easily distinguished from the radial bundles lying between them, which latter can be traced to the lemniscus. Fibres cross from one side to the other along the median line and constitute the Sylvian commissure. The lemniscus fibres gradually accumulate near the ventricular aspect while the brachial proceed cephalad.

3. In a section where the aqueduct is cut, the post-commissure is reached. It is underlaid by a remarkable thickening of the epithelium that can be traced far ventrad. The optic tracts are now collecting on either side of the habenæ and the tract of the supra-commissure is separated only by a narrow fissure from the former. The cells of the habena nidulus are large and stain deeply. The cells of the mesencephalic nidulus of the trigeminus are numerous along the dorsal walls of the aqueduct, especially caudad.

4. Somewhat farther ventrad the tuberosities of the corpora posteria appear upon the caudal aspect of the optic tectum. This is a mass of densely and irregularly clustered cells with interspersed fibres. Cephalad, the less dense and lighter colored Meynert's nidulus appears and lies laterad and ventrad of the nidulus of the habena. The lemniscus fibres collect in a very distinct zone entad of the brachial bundles. The post-commissural tract continues obliquely caudo-ventrad and is in about the zone occupied by the lemniscus.

5. Still farther ventrad the fibres of Meynert's bundle can be seen to emerge from the caudal aspect of Meynert's nidulus

and the collection of the fibres of the cephalic optic brachium begin to gather over the region of the geniculatum. A nidulus of large cells accumulates near the aqueduct caudad of the habena; this we may call *nidulus aqueducti.*

6. Proceeding still ventrad, a point is reached where the few fibres of the tænia thalami enter the median wall of the hemisphere from the cephalic base of the habena. These fibres are so few as to easily escape notice.

7. At the point where the cerebellum becomes attached to the corpora posterior, a strong decussating band comes into view immediately caudo-dorsad of the decussation of the trochlearis (Fig. 3, *mid. p.*, Plate VII—Fig. 1 (9), Plate VI—Fig. 6, *mid. p.*, Plate X.) These fibres, which are derived, *via* the corpora posterior, from bundles ascending from the pes pedunculi, decussate and pass into the ventricular layer of the cerebellum. The whole interior of the "colliculi" (Rückhard) or projection into the optic ventricles now become filled with isolated bundles of the sensory system.

8. Somewhat ventrad of the decussation of the middle peduncles of the cerebellum just described there appears a small dense nidulus caudad of the geniculatum and laterad of Meynert's bundles (thus somewhat cephalo-laterad of the tracts from the post-commissure.) This seems to be the homologue of the corpus rotundus of fishes or, according to our definition, the nidulus ruber. Like the corresponding organ in fishes it contains fibres passing toward the post-commissural region.

Fibres from the caudal brachium begin to collect caudad of the optic tract and assume the well known relations of this element of the inferior commissural system. In the region of the præcommissure the fornix fibres collect just as in fishes and descend toward the tuber.

9. The nidulus of the trochlearis appears below the site of the scattered cells of the mesencephalic nidulus of the trigeminus, and gradually receives its tract, which remains medullated and very distinct. The tract from the post-commissure seems to merge insensibly into the dorsal longitudinal fasciculus ven-

trad of which is the nidulus of the oculomotor, but many of its fibres pass toward the ventral surface.

10. At the level of the oculo-motor nidulus the decussation of the raphe is prominent. The passage of the dorsal peduncle into the cerebrum from the geniculatum is also seen at the level of the præcommissure. The lemniscus fibres diverge toward the lateral aspect of the medulla and are adjacent to the root of the trigeminus. The post-peduncle of the cerebellum passes from the latero-ventral aspect of that organ and, turning latero-ventrad, reaches a point somewhat cephalad of the trigeminus, while the medi-peduncle continues nearly directly ventrad toward the pes.

The cerebellum is continued ventrad as a tuber projecting from either side into the fourth ventricle. The origin of the fibres in the granule layer is very obvious. A strong nidulus of rather large, flask cells lies cephalad of the above tuberosity.

11. The dorsal longitudinal fasciculus describes a sharp ventrad curve and returns to its place along the floor of the fourth ventricle. Meynert's bundles converge toward the median line.

12. The vague nidulus ruber accompanies Meynert's bundle, preserving nearly the same relation to it. The two optic brachia collect entad of the optic tract. A large nidulus of flask cells collects in the median part of the thalamus cephalad of the ruber. It is perhaps the homologue of the nidulus subthalamicus. The fibres of the superior peduncle seem to pass into the caudo-dorsal parts. We cannot agree with those authors who urge that the whole cortex of the reptile is sensory if not specifically olfactory.

13. At a deeper level a strongly staining dense nidulus appears caudo-mesad of the inferior commissure tracts, and thus immediately cephalad of the midpeduncle tract from the cerebellum. Its cells are of the same peculiar sort described by us in the "nidulus niger" of fishes.

14. Still farther ventrad the fibres of the motor peduncles can be seen entering the same nidulus. The relations are, therefore, precisely as in fishes except that the hypoaria are not

developed upon the site of the switch station for the motor peduncles.

It will be instructive to compare the above with similar sections of a box turtle (*Cistudo*).

Figs. 1–9, Plate X, give a clear idea of the topographical relations of the parts and Fig. 10, of the same plate, illustrates the normal structure of the tectum opticum, which may with advantage be compared with the corresponding section of the tectum of the fish shown in Fig. 1, Plate VII of the May number of this Journal for 1892. The resemblance is quite unmistakable though the drawing of the fish is from a transverse section while that of the turtle is from a horizontal one.

Fig. 1 shows the upper part of the habena with the position of the epiphysis behind and the paraphysis cephalad of the supracommissure. It is especially easy in this type to trace the supracommissural tract. The habena consists of very large cells while Meynert's nidulus cells are scarcely half as large. Fig. 2 indicates the conspicuous isolation of the diencephalon from the sharply elevated optic lobes.

These sections incline cephalad so that we rapidly encounter the ventral structures. Another result is that we follow a large part of the optic brachia in a single section. In Fig. 3 one can easily distinguish the finer fibres of the brachia from the coarser optic tracts.

In the midst of the thalamus, immediately below the habena, is a large mass of densely stained material of the exact structure of the ruber but, of course, too far dorsad and cephalad. Whether to regard this mass as a special development of the subthalamicus or an organ peculiar to turtles is at first puzzling. It occurs in the same position in *Chelhydra*. Closer inspection reveals a small nidulus of the same general character ventrad of the habena of the black snake.

A series of longitudal sections may next be appealed to, the black snake being chosen in this case also. A section near the lateral margin shows the strong postpeduncular tract of the cerebellum wrapped about the lateral aspect of the medulla, arching cephalo-ventrad of the exit of the trigeminus and curv ing into the basal protuberance of the cerebellum. Cephalo-ventrad of the optic lobe, which projects well beyond the plane of section, are the two optic tracts arching over the geniculatum. In the cerebrum, the motor peduncles can be traced to a point near the front of the lateral ventricle where they curve sharply dorsad and enter the cephalic part of the cerebral cortex. The mid-peduncles of the cerebellum pass ventrad from the caudo-lateral aspects of the corpora posteriora, where they accumulate, after decussating in the valvula, to the region adjacent to the oculo-motor roots. The postbrachia of the optic lobes appear on their way cephalo-ventrad, a strong contingent passing to the inferior commissure.

A nidulus of large nerve cells lies dorsad of the oculomotor region and receives the mid-peduncle fibres from the cerebellum. As the sections pass mesad the large tuber cinereum enters the ventral part of the section and is seen to contain very numerous flask-shaped cells not distinctly collected in separate niduli. The ventral part of the third ventricle is expanded, forming a lateral cleft-like diverticle around which numerous small cells collect. The sections farther mesad cut the ruber in its lateral portion and this organ may be followed nearly to the median line. Fig. 1 Plate VII gives a good idea of the arrangements just described.

Fig. 2, Plate VII, illustrates a nearly median section. Dorsad, the supra- and post-commissures are nearly continuous. The latter is arched upon itself caudad and above it lies the sylvian commissure. The cells of the mesencephalic nidulus of the trigeminus are conspicuous in the ventricular roof. The decussation of the middle peduncles is immediately dorsad of that of the trochlearis tract. The niduli of III and IV lie beneath the aqueduct and the former is perforated by the dorsal longitudinal fascicle. A nidulus of very large cells lies in the median line cephalad of the oculo-motor cluster.

The front of the diencephalic roof is occupied by the double paraphysis with the plexiform intrusions from them into the third ventricle.

Fig. 1, Plate VIII, illustrates the relations still further laterad, while Fig. 2 of the same plate is a horizontal section through the same region.

In sections at one side of the median line the habena appears as a triangular body perched upon the Meynert's nidulus, which latter gives origin to Meynert's bundle, which here, as in fishes, consists of medullated fibres and "gelatinous tracts." These separate and arch laterad only to collect in the locus interpeduncularis at which point no very distinct nidulus occurs.

The tract of the post-commissure lies ventro-cephalad of the optic ventricle and is passing toward the dorsal longitudinal fascicle.

The ruber occupies a triangular space cephalo-ventrad of Meynert's bundle and extends ventrad of the latter. There is a distinct nidulus ventrad of the pre-commissure. Fibres from the the dorsal peduncle gather about the ruber and evidently effect new combinations. There is a band ascending through the ruber to the brachia, as in fishes. It probably originates from a branch of the infra-commissure. Far laterad what seems to be the homologue of the internal geniculate appears just caudo-mesad of the external.

None of the sections show any tracts in the course of the pre-preduncles of the cerebellum as described for fishes. An oblique series of longitudinal sections affords clear testimony to the fact that the optic brachia rather than optic tracts are closely associated with the geniculate and infra-commissure.

In all well prepared horizontal sections the region of the pes corresponding to the base of the hypoaria of fishes contains the same large branching "switch-cells" which we have described. This region, "locus niger," we regard as the point where motor fibres of the ventral peduncles from the cerebrum effect connections with the mid-peduncles of the cerebellum.

The mid-brain of turtles is characterized by the grest development of the ventricles and aqueduct, the whole structure being simplified and extended longitudinally.

The grey matter of the prethalamus (*i.e.*, region of chiasm) is collected in concentric bands about the ventricle ventrally. Dorsally the infra-habenaria occupy the triangular protuberance of either side. Laterad of this cell group is the tract from the supracommissure, which is a strong bundle entering the cerebrum at the point where the peduncles cross. Farther caudad the habena appears and niduli develop in the path of the dorsal peduncles.

One of the most remarkable peculiarities of the turtles is the development within the infra-habenaria of a very large spherical nidulus with a densely cellular core and radially arranged peripheral band and a concentric cellular envelope. Its structure is closely analogous to that of the ruber of fishes but is a specially differentiated portion of the infra-habenaria.

The infundibular region is so much produced ventrally in turtles that one is easily deceived as to the relative position of the parts and this structure might be located far dorsad if we did not obsesve that it is flanked by the small geniculata, and bordered ventrad by the nidulus subthalamicus.

In sections farther caudad the habena is shown to be sharply limited from the thalamus. The sensory peduncles break up in connection with the above concentric nidulus ("central nucleus of thalamus" of authors, or "nidulus centralis.") The other parts of the infra-habenaria, subthalamicus and geniculata also receive scattered tracts, but part of the fibres pass to a dense cluster at the cephalic boundary of the mesencephalon, which we identify with the ruber.

The motor peduncles pass on to the pes-pedunculi and in the "crusta" form associations with the mid-peduncle of the cerebellum. The infundibulum is not only greatly produced ventrad but its tip is flexed backward much as in the amphibia. At the apex is a paired diverticle analogous to the recessi infundibuli or mammillaria of fishes.

For material used in this instalment our obligations are to Professor Charlton, of Denton, Texas, whose kindness in repeatedly sending collections of *Phrynosoma coronata* we gratefully acknowledge, to Reverend C. L. Seasholes, who has supplied similar specimens, to Mr. George Osbun, who collected a variety of lizards in Alabama, the study of which is not yet begun, to many other friends who have assisted in similar ways.

The next instalment will be occupied with the mesencephalon and cerebellum and embryological data.

PLATE V.

Transections of the brain of the horned toad, *Phrynosoma coronata*. (See page 87.)

Fig. 1. Section at the union of olfactory tuber and cerebrum.

Fig. 2. Section where the dorsal cornu of the ventricle unites with the ventral. The arcuate fissure, separating the intraventricular and fronto-median lobes, is just appearing.

Fig. 3. Section near the cephalic limit of the fronto-median lobe. *tr. a.*, callosal fibres.

Fig. 4. Section at the callosum. *oc. bas.*, nucleus sphericus in occipito-basal lobe; *cen.*, central lobe; *ped.*, peduncle tracts. The chiasm and infra-commissure appear below.

Fig. 5. Section at the hippocampus commmissure, *Hip. c.*

Fig. 6. Section near caudal limit of the hemispheres. *tr. h.*, fornix tract spreading out upon the occipital region.

Figs. 7-9. Sections through the optic lobes.

Figs. 10-13. Sections through the medulla and cellebellum to show the retroflection of the latter. *Div.*, *V. IV.*, diverticle of the fourth ventricle

PLATE VI.

Fig. 1. An oblique longitudinal section through the brain of *Tropidonotus*. (1) central lobe, (2) fornix, (3) hippocampus, (4) longitudinal fasciculus, (5) lemniscus, (6) corpus posterior, (7) cerebellum, (8) postplexus, (9) medipeduncle cerebelli, (10, 11) niduli of thalamus, (12) optic tracts, (13) tract of the supra-commissure; (14) precommissure, (15) tracts from the same.

Fig. 2. Part of another section of the same series at a higher level. (*a*) tract of supra-com., (*b*) corpus fornicis, (*c*) geniculatum, (*d*) lateral ventricle, (*e*) pre-com., (*f*) tract to sphericus, (*gh*) tracts to pre-com., (*i*) supra-com., (*j*) paraphysis, (*k*) fornix.

Fig. 3. Portion of longitudinal section of blue racer, (a variety of the black snake,) illustrating relation of hippocampus commissure to plexus and the peduncles.

Fig. 4. The epiphysis of a turtle (*Cistudo*) from a model composed from sections. (*Sorensen.*)

Fig. 5. Longitudinal section of the brain of *Cistudo* to show the relation of epiphysis and paraphysis. (*Sorensen.*)

Fig. 6 and 7. Longitudinal sections of the brain of *Phrynosoma.* The curious reversion of the cerebellum is well seen.

Figs. 8-10. Superficial views of the brain of *Phrynosoma.* The olfactory tuber injured and mostly torn away. It is in reality as long as the whole cerebrum.

Fig. 11. The mid-dorsal region of the head of *Phrynosoma* to show the position of the parietal eye.

PLATE VII.

Sections through the brain of the black snake.

Fig. 1. Longitudinal section laterad from the median line, showing terminal structure of the olfactory tuber and its mesal fossa. *Br. opt.* optic brachia, *cent. l.* central lobule of axial lobe, *corp. forn.* corpus fornicis, *prec.* precommissure, *genic.* geniculatum, *pes. ped.* pes pedunculi region, where the interchange between the ventral peduncle tract and cerebellum is affected.

Fig. 2. Nearly median section. *Glom.* glomerules, *prep* , *postp.* prae- and postparaphyses, *infc.* infracommissure, *syl. c.* sylvian commissure.

Fig. 3. Section at the point of exit of the oculo-motor nerve, *fimb* fimbria, *lem.* lemniscus.

Fig. 4. Horizontal section through the precommissure, *f.* fornix, f^1 fibres from the occipito-basal lobe to thalamus, *sens. cor.* sensory cortex, *a.* hippocampus, *rad. lat. olf.* lateral radix on its way to the nucleus sphaericus or occipito-basal lobe (*oc.-b. l.*) *genic.* geniculatum, *post. p. c.* post-peduncle of cerebellum, *med. p. c.* medi-peduncle of cerebellum.

PLATE VIII.

Fig. 1. Portion of a perpendicular section through the brain of a black snake to show the relations of the paraphyses, hippocampal commissure, fornix and precommissure.

Fig. 2. Horizontal section through the same region.

Fig. 3. Transverse section through the hippocampal commissure of Eutænia to show the dorsal projection of the roof of the aula which covers it at this point.

Fig. 4. Adjoining section.

Fig. 5. Perpendicular section of black snake in the same region as Fig. 1.

Fig. 6–7. Horizontal sections of black snake brain illustrating hippocampus, lateral olfactory radix and nuc. sphericus.

PLATE IX.

(Omitted, will be printed in a subsequent number.)

PLATE X.

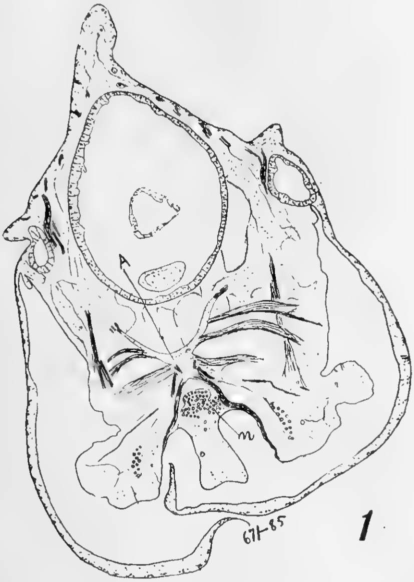
Sections from the brain of the turtle (*Cistudo*).

Fig. 1.–6. Horizontal sections at various levels. Fig. 1 illustrates the primitive simplicity in development of the cortical and rhinalic areas from a large vesicle. The distinction between cortex and axial portion is very slight. *Sup. com. tr.* tract from supracommissure, *rad, l.* radix lateralis, *br.* optic brachium, *p. c.* postcommissure, *mid. p.* medi-peduncle of cerebellum. In Fig. 4, at *x*, the transition of the hippocampal cortex into the occipito-basal lobe is readily seen. In Figs. 3 and 5 the entrance of the lateral olfactory radix is also seen.

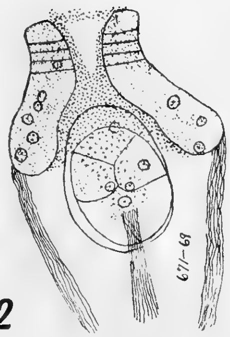
Fig. 7. Horizontal section through dorsal part of the cerebrum of the snapping turtle (*Chelydra*).

Fsgs. 8, 9. Longitudinal sections through the brain of *Cistuda* to illustrate the topography.

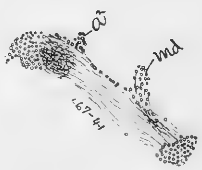
Fig. 10. A section through the tectum opticum from the horizontal series of Cistudo figured above.



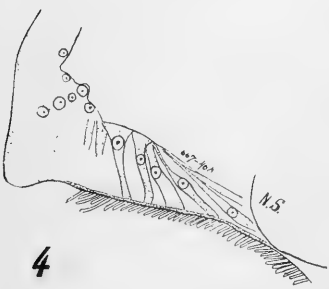
1



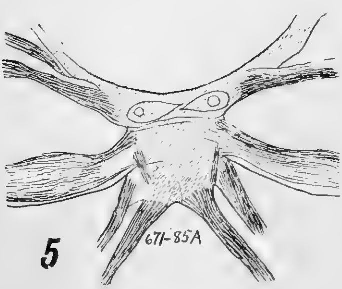
2



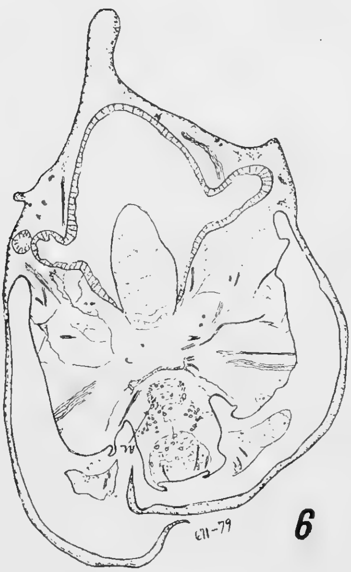
3



4

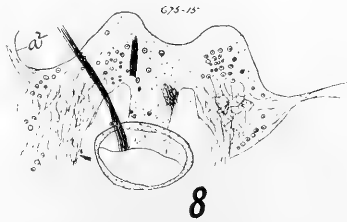


5



6

7

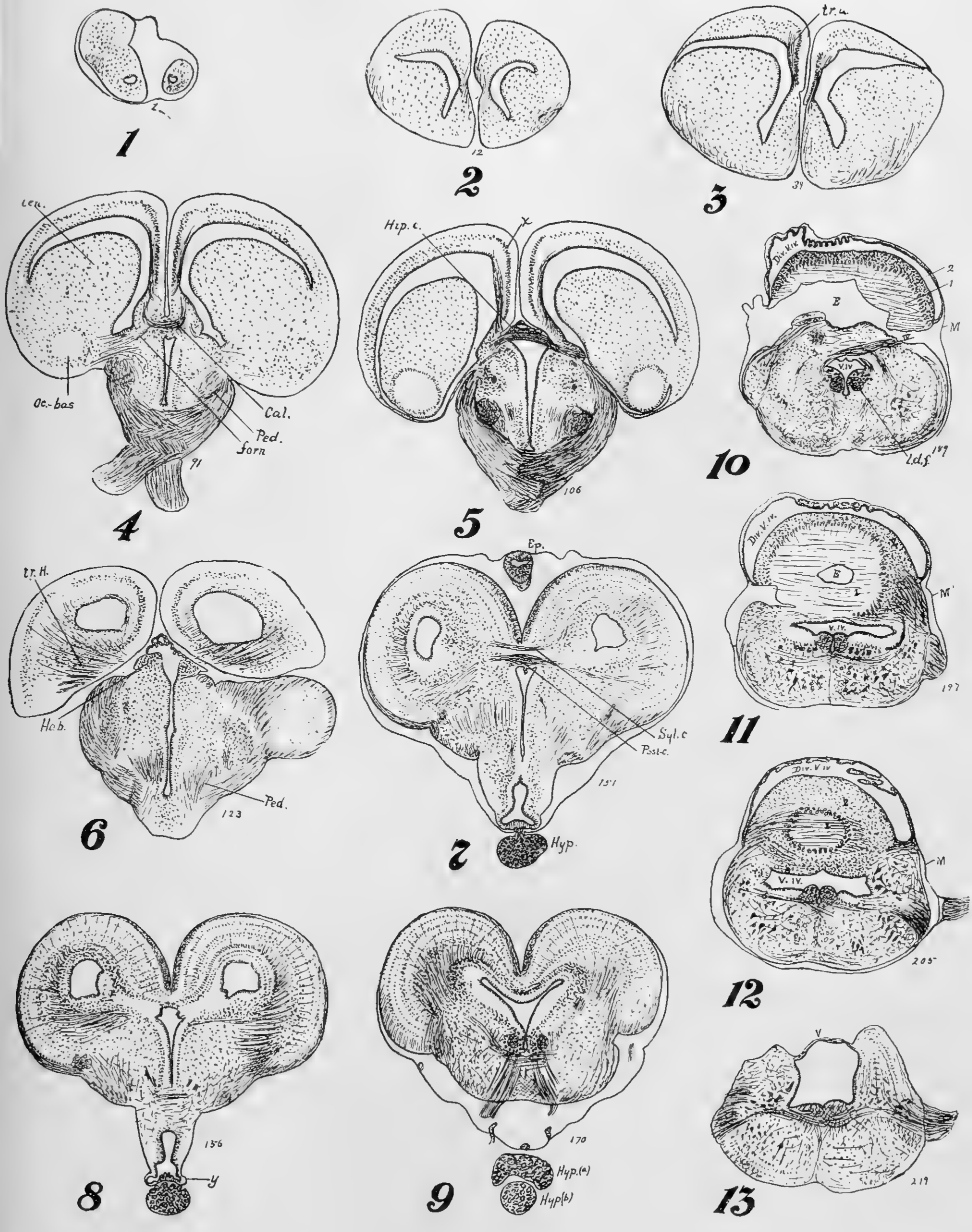


8

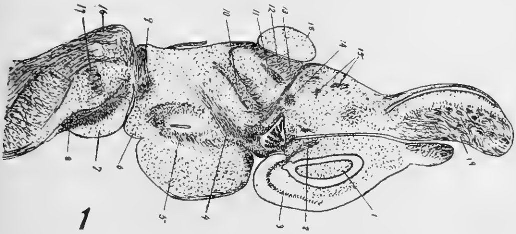
9

10

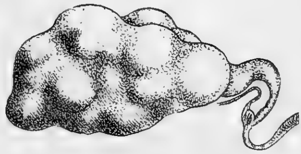
11


tr.u.
Hip.c.
Oc.-bas
Cal.
Ped.
forn
Div.V.iv
E
M
V.iv
l.d.f.
tr.H.
Hab.
Ep.
Syl.c
Post-c.
Hyp.
y
Hyp.(a)
Hyp.(b)
1
2
3
4
5
6
7
8
9
10
11
12
13

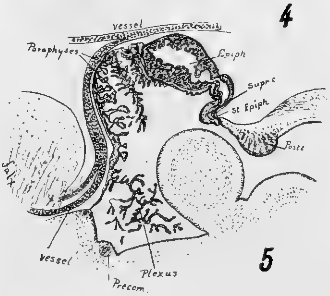
Journal of Comparative Neurology. Vol. III. PLATE VI.



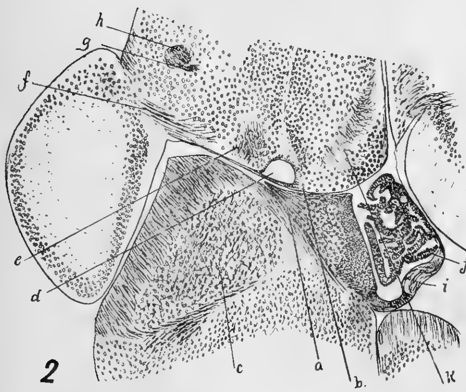
1



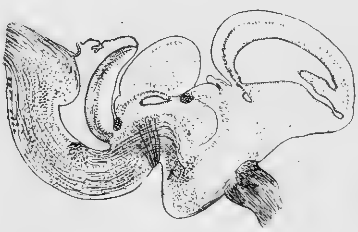
4



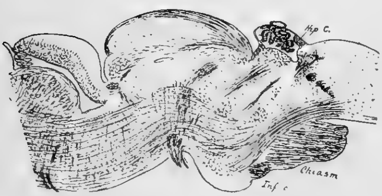
5



2

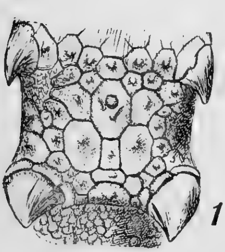


6



3

7

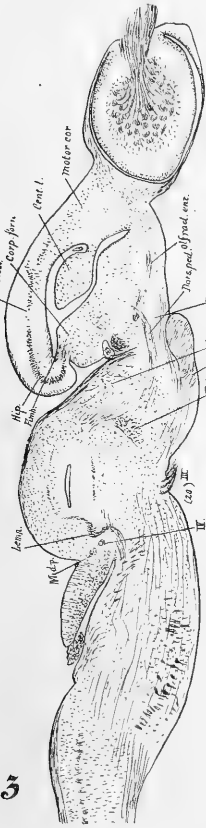


11

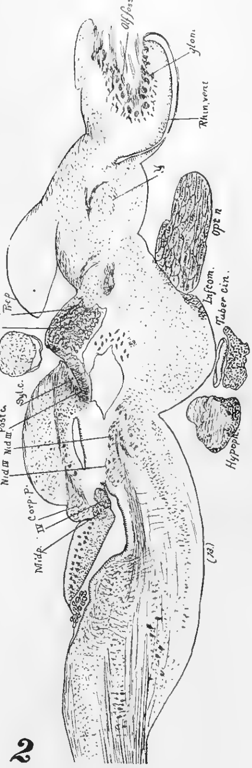
10

9

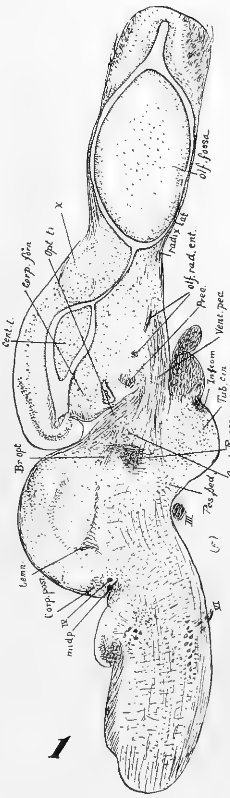
8


motor cor
Cent. l.
Corp. forn
Sens. cor
olf. rad. ent.
Dors. ped
Pars. ped
Genic
Infc.
Ruber
Hip
Lemn.
Midp.
III
IV

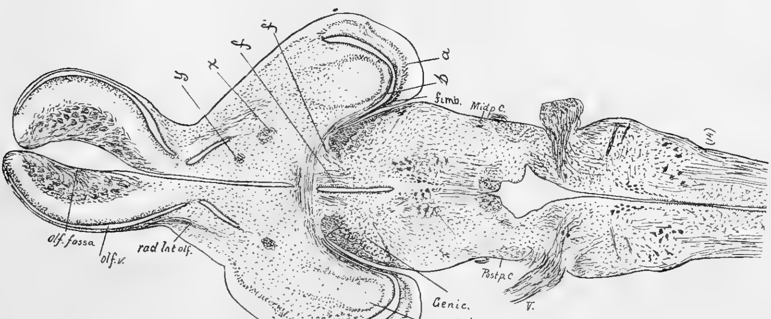
3


Olf. fossa
glom
Rhin. vent
Opt n
Inf. com.
Tuber cin.
Hypoph.
Post. p.
Epiph.
Syl. c.
Corp. P.
Midp.

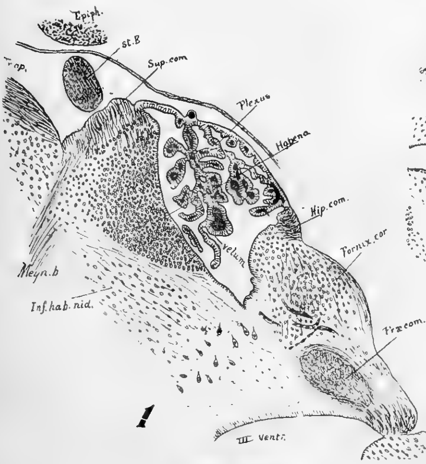
2


olf. fossa
Corp. forn
Opt. tr
x
Cent. l.
olf. rad. ent.
Ped.
Vent. ped
Inf. com
Tub. cin
Ruber
Genic.
Pes ped
Br. opt
Lemn.
Corp. post.
midp.
III

1

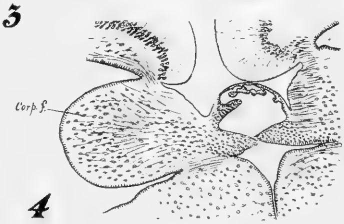

y
x
f
f'
a
b
fimb.
Midp. c.
(14)
Olf. fossa
olf. v.
rad Int olf.
Postp. c
V.
Genic.
oc.-b. l
Sens. cor

4

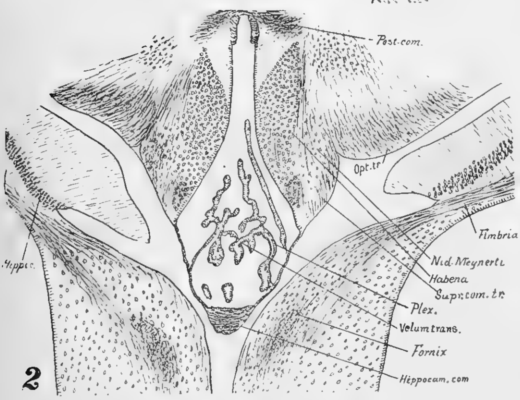

Epiph.
st. B
Sup. com
Plexus
Habena
Hip. com.
Fornix cor
Velum
Meyn. b
Inf. hab. nid.
Frx com.
III Ventr.

1

3


Corp. f.

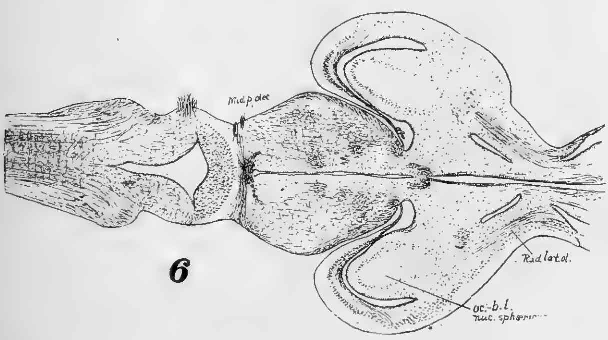
4


Post. com.
Opt. tr
Fimbria
Hippoc.
Nid. Meynerti
Habena
Supr. com. tr.
Plex.
Velum trans.
Fornix
Hippocam. com

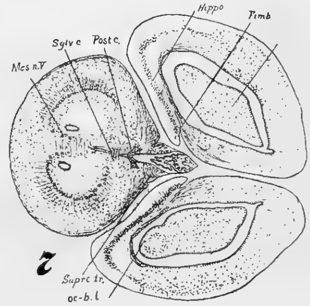
2


sup. c
Hy. c

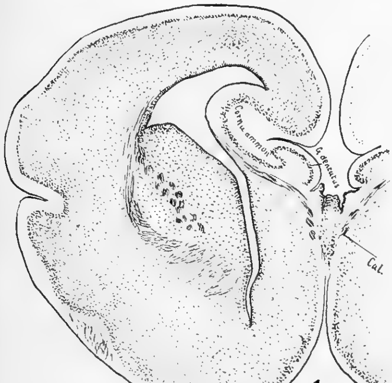
5


Mid. p. dec
Rad. lat. ol.
oc.-b. l.
nuc. sphæric.

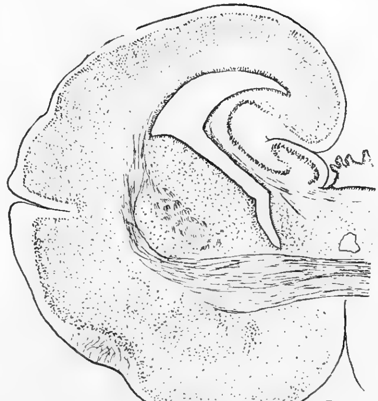
6


Hippo
Fimb
Sylv. c
Post. c.
Mes n. V
Supr. c tr.
oc-b. l

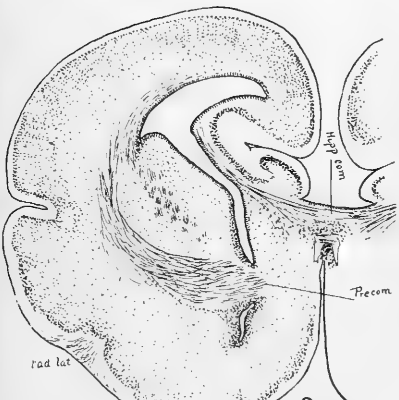
7


Cornu ammonis
G. dentatus
Cal.

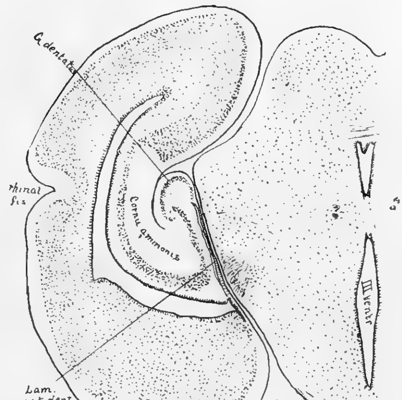
1



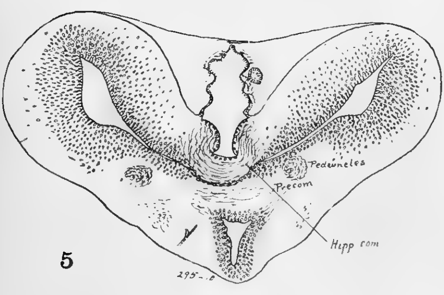
2


Hipp com
Precom
rad lat

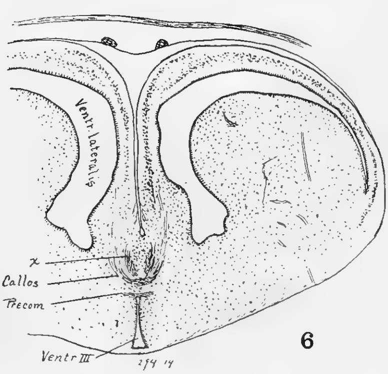
3


G. dentata
rhinal fis
Cornu ammonis
III ventr
Lam. int dent

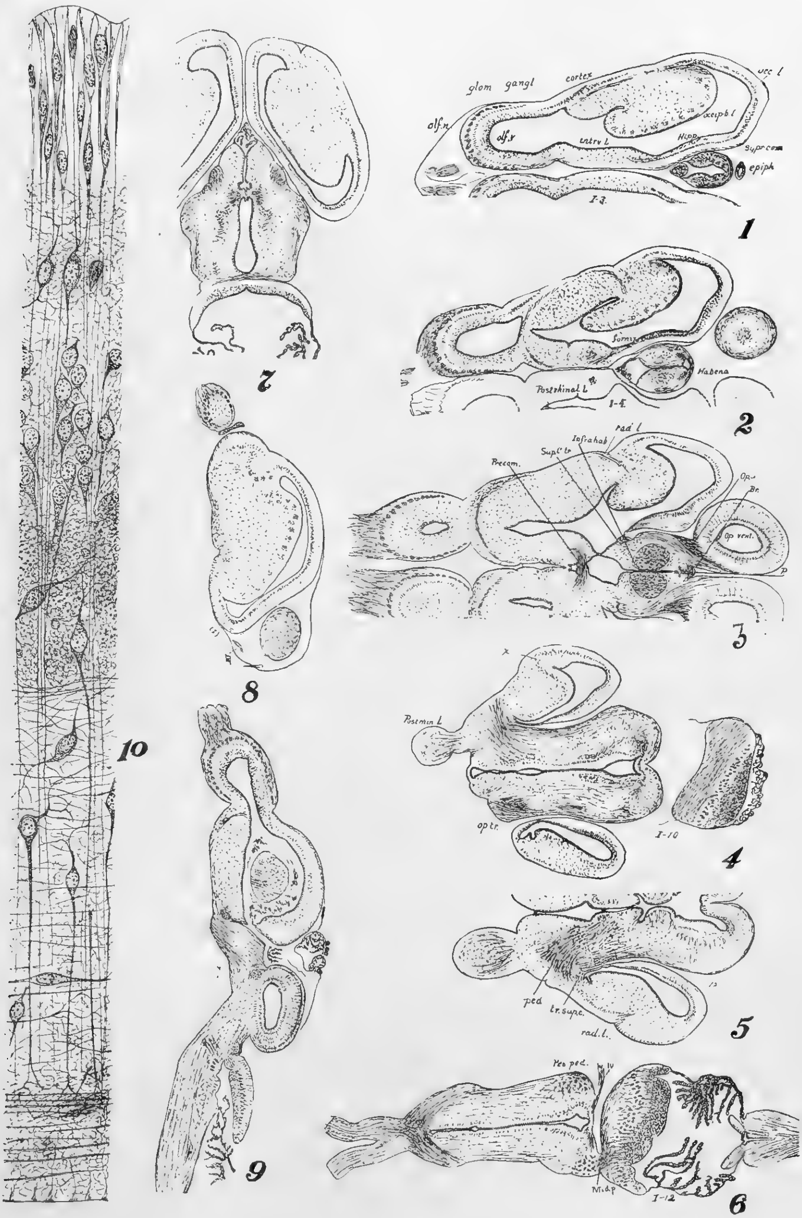
4

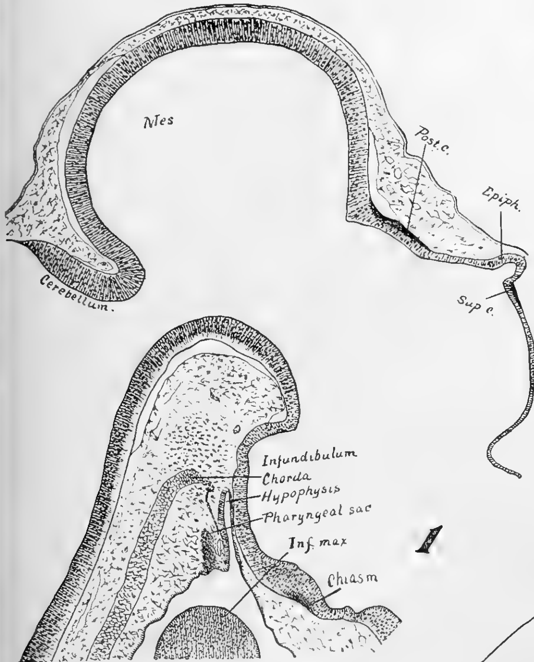

Pedeuncles
Precom
Hipp com

5

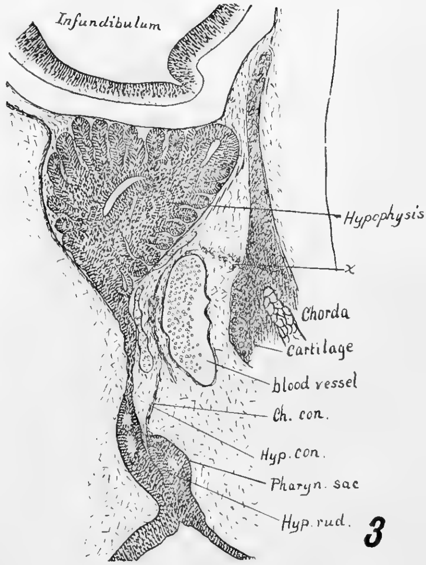

Ventr lateralis
x
Callos
Precom
Ventr III

6


glom gangl
cortex
vec l
olf.n
olf.v
entrv l
Hipp
epiph
1
formix
Habena
2
rad l
Precom.
Op vent.
3
Postmin L
op tr.
4
ped
tr. supc.
rad. l.
5
6
7
8
9
10


Mes
Post.c.
Epiph.
Cerebellum.
Sup c.
Infundibulum
Chorda
Hypophysis
Pharyngeal sac
Inf. max
Chiasm

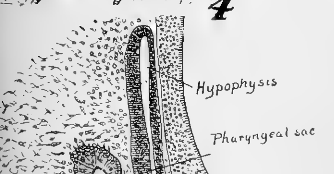
1


Infundibulum
Hypophysis
x
Chorda
Cartilage
blood vessel
Ch. con.
Hyp. con.
Pharyn. sac
Hyp. rud.

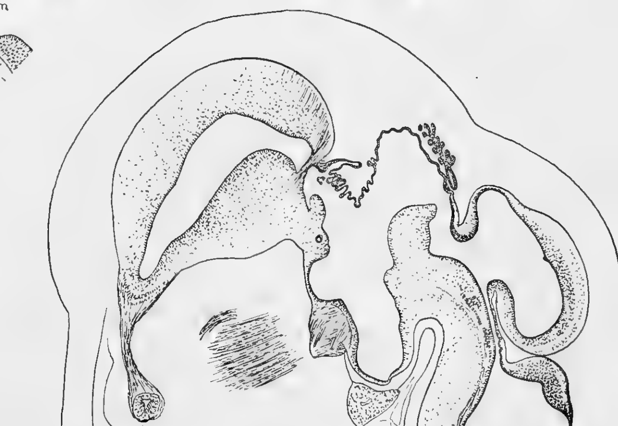
3


Infundibulum
Hyp
Chorda
Phary s

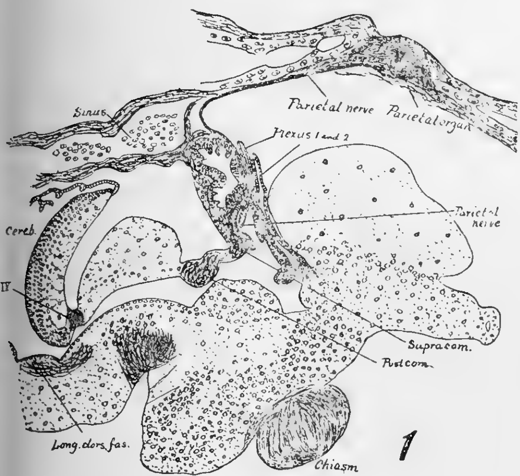
4


Hypophysis
Pharyngeal sac

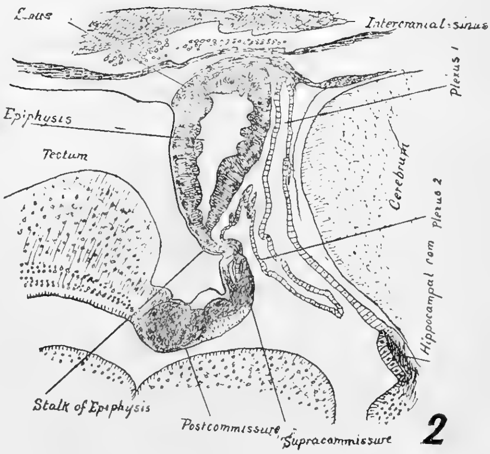
2



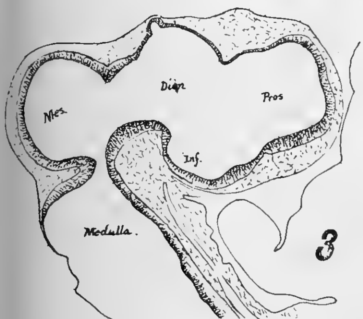
5


Sinus
Parietal nerve
Parietal organ
Plexus 1 and 2
Cereb.
IV
Parietal nerve
Supracom.
Postcom.
Long. dors. fas.
Chiasm

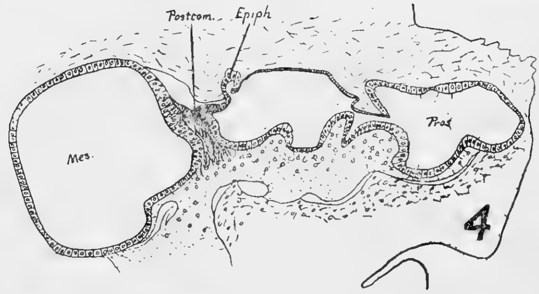
1


Intercranial sinus
Plexus 1
Epiphysis
Tectum
Cerebrum
Plexus 2
Hippocampal com
Stalk of Epiphysis
Postcommissure
Supracommissure

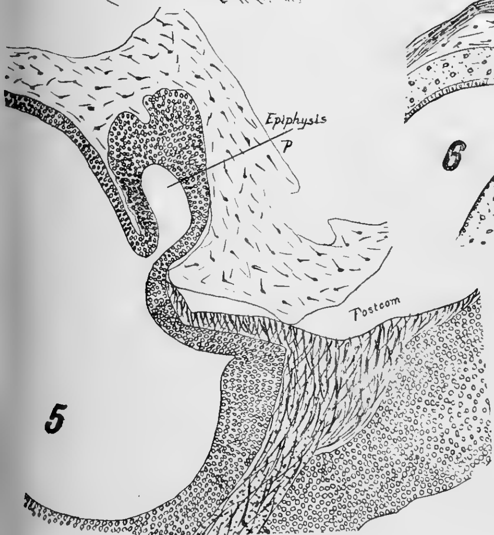
2


Mes.
Dien
Pros
Inf.
Medulla.

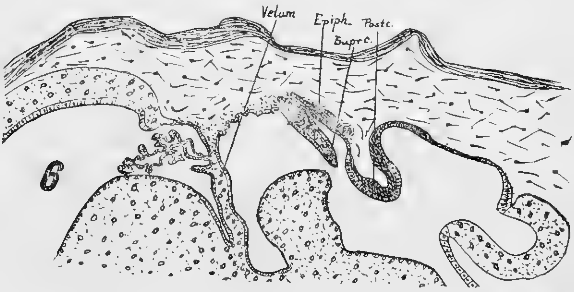
3


Postcom.
Epiph
Mes.
Pros

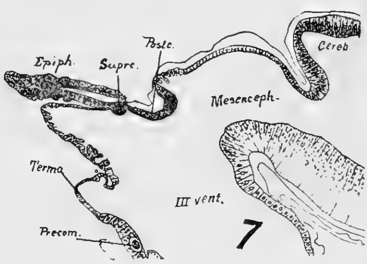
4


Epiphysis
P
Postcom

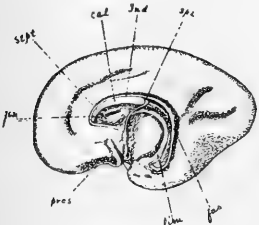
5


Velum
Epiph.
Postc.
Suprc.

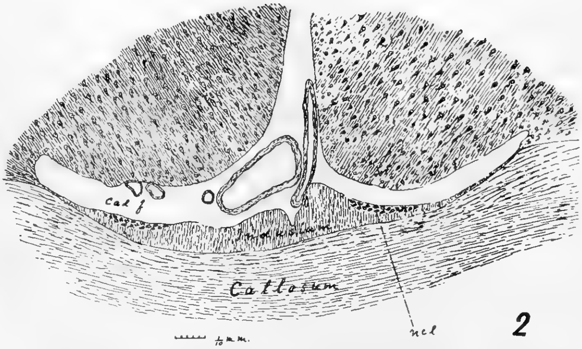
6


Epiph.
Supre.
Postc.
Cereb
Mesenceph.
Terma
III vent.
Precom.

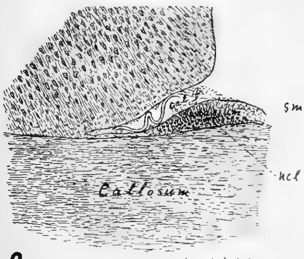
7


sept
cal
Ind
spl
pres
fim
fas

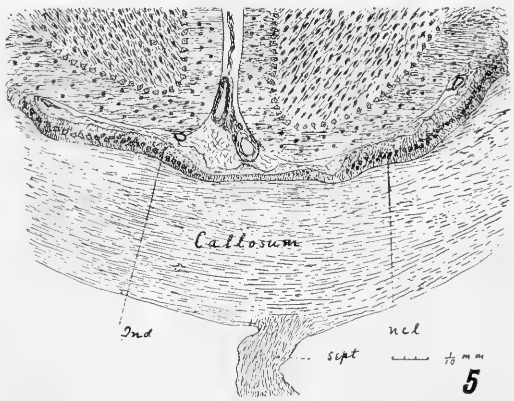
1


cal f
Indusium
Callosum
ncl
$\frac{1}{10}$ mm.

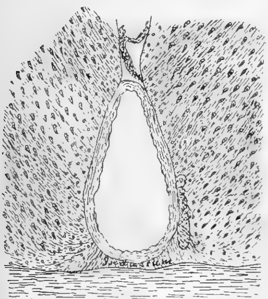
2


cal f
sm
ncl
Callosum
$\frac{1}{10}$ mm

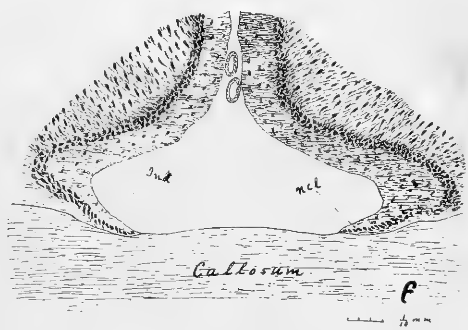
3


Callosum
Ind
ncl
sept
$\frac{1}{10}$ mm

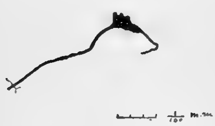
5


Indusium
Callosum
$\frac{1}{10}$ mm

4


Ind
ncl
Callosum
$\frac{1}{10}$ mm

6


$\frac{1}{100}$ mm

7

THE INTRINSIC PULMONARY NERVES BY THE SILVER METHOD.

[ABSTRACT PAPER.]

(*With Plate XIV.*)

From the Patholgical Laboratory of the Johns Hopkins University and Hospital.

BY HENRY J. BERKLEY, M.D., BALTIMORE.

Little information, from either histological text books or recent monographs, is to be found concerning the final distribution of pulmonary nerves. Krause[1] apparently gives the entire knowledge on the subject in the following words: "The pulmonary nerves course with the bronchi, and contain many pale nucleated as well as double contoured fibres, and have clusters of ganglion cells among the filaments. The first named fibres are distributed to the smooth muscular cells, the dark contoured to the mucous membrane of the bronchi. Their terminations are not known."

By the older methods of preparation with osmic, acetic, or chromic acids, it was more than difficult to obtain positive results beyond those already stated by Krause; even in preparations of the lung treated according to the Weigert hematoxylin methods little can be determined concerning the double contoured fibres (and of course nothing of the sympathetic ones), owing to the lung tissues decolorizing very slowly in the borax and ferricyanide of potassium solution.

For the purpose of this experiment the gray rat was almost entirely used, the fibres staining better in it than in other animals, and the methods of fixation and staining were the same as used in our recent investigation on the hepatic nerves, namely, the rapid Golgi, and its modification the picric-acid-osmium-bichromate method. The latter gave incomparably finer results.

The pulmonary nerves in general present some slight dif-

---

[1] Allg. Anatomie, 1876.

ferences in appearance from those distributed to the viscera of the abdominal cavity in a tendency to a more general fascicular arrangement of the nerves, and also to a greater inclination than is usually seen in glands to a racemiferous development of the bronchial terminations, both in the mucous membrane and non-striated muscular layers. The likeness to the nerve distribution of the layers of the small intestine is superficially striking, but close analogies are not apparent. The nerves themselves are of two varieties, an extremely fine fibre accompanying both the vessels and air-channels; and a much coarser thread, usually in pairs or bundles, also following the vessels and bronchi, but at times departing from them, and wandering off among the surrounding tissues. As the Golgi method does not allow of a distinction being made between medullated and non-medullated fibres, no conclusions can be drawn as to whether the coarse fibres are medullated, and the finer, especially the arterial plexuses, non-medullated, nevertheless it is reasonable to suppose that some of the coarser fibres are provided with a myeline sheath, as like fibres have been frequently seen by the older observers running with the air-tubes. Ganglion cells are stained somewhat sparingly by the silver, a few bipolar cells situated near the bronchi have been found, but they bear no proportion to those made apparent by other methods. Generally speaking, nerves are most numerously stained near the root of the lung, and gradually diminish in numbers toward the free margins.

Nerves of the Bronchi.—In the external fibrous layer of each bronchus is situated a considerable plexus of fine nerve fibres, with at the outer margin an occasional coarser tube, or small bundle; all connected together by frequent ramuscules. From this peri-bronchial plexus very numerous stems come off that have a two-fold destination: [1], they are distributed upon the cells of the smooth muscular layer, and show at many points simple end-knob terminations, usually in rounded, less frequently elongated shape. More rarely a fibre will come off from the parent marginal plexus, and after giving off a few side branches, will end in a very complex figure [Fig. 1], but all the final terminations are simple bulbs. All the end-knobs are apparently situated between the muscular fibres without especial relation to their nuclei, so far as we have been able to determine. [2]. Numbers of fibres, branched and unbranched, pass through and beyond the muscular zone, and form a sub-epithelial plexus, in the mucous layer. This plexus is quite distinct and well developed, not only in the larger bronchi, but also in divisions of the second and third order; and forms a circular network of interlacing and connecting filaments around the bases of the epithelial infoldings. From this meshwork nerve fibres ascend upon the fibrous tissue in the centre of the epithelial folds, some nearly to the apices, others only half way, and there terminate in knob-form [Fig. 2]. No trace of any ending is to be seen entering the cement substance between the columnar epithelial cells.

On the smallest bronchi, when the surrounding muscular cells have become very greatly diminished in numbers, the nerve arrangement is somewhat different, there is now only one plexus or network, and from its fibres new twigs penetrate quite numerously into the epithelial layer, where they terminate in end-knobs, after the development of curious arborescent figures with many thickenings and nodosities [Fig. 3]. These end terminations seem distinctly to lie between the outermost margins of the flattened epithelial cells surrounding the lumen of the tube, quite close to the fibrous layer.

In all the fibres of the networks, both peri-bronchial and mucous, are developed local thickenings and varicosities, but true ganglionic cells within the muscular layer have not been seen. That the ganglionic developments found in the paths of the fibres coming from the terminal arborizations in the epithelium of the bronchioles act the part of intermediate transmitters of nerve impressions from the epithelial surface of the air tubes, as is the case with some of the organs of special sense, in particular the cutaneous surfaces [see the studies of Retzius[1] and Lenhossék[2] on Lumbricus] to nerve cells in more

[1] Biol. Untersuch. Neue Folge IV, 1892, Stockholm.

[2] Arch. f. Mik. Anat. Bd. 39, 1892.

distant localities is possible, as they bear the same relation to the nerve terminations of the bronchi as the endings of tactile sensation do to their intermediate ganglionic cells, but their structure is so hidden by the dense silver precipitate that it is extremely difficult to decide if they are simply large varicosities of the fibre, or actual ganglionic enlargements provided with a nucleus and nucleolus.

Neither of the methods of preparation give a distinct clue if there are endings to the nerves upon the epithelium of the alveoli. It is true that near some of the bronchi, fibres depart from the main network surrounding the tube and artery, and for short distances give off branches to the air cells lying just along the edge of the tube, terminating near the pavement epithelium in a small bulb; but scattered muscular fibres cannot be definitely excluded from such situations, and it is quite possible that these endings are distributed to them.

Inter-alveolar fibres. Nerve fibres pass off from the broncho-arterial network in the form of bundles or single fibres and wander quite long distances in the septa between the air cells. Many of them give off dichotomously numbers of side branches, and all of them may either join the extensions of other bronchial plexuses or may be distributed to the inter-alveolar tissues, and also are occasionally seen supplying the surfaces of the smallest bronchioles. Near the root and in the mid-regions of the lung these inter-alveolar nerves are quite frequent and from striking pictures [Fig. 4], from their coarseness and prominence. Their final ending in the septa is in a simple bulb like arrangement.

Anterial Supply. The nerve supply to the bronchial arteries is an exceedingly rich one, and is more extensively developed than in any of the glandular organs, the ovary perhaps excepted. Quite often, as in Fig. 5, the peri-arterial spaces are marked out by lines of thicker nerve bundles, whose side branches anastomose with the fibres of the arterial networks proper. End-terminations are not so numerous as one would expect from the extreme closeness of the network, yet they are quite frequent, always arising as short branches from the plexus and ending as simple knobs, seemingly between the smooth muscular cells of the middle coat of the vessel. Few ganglion cells are to be found at the margin of the plexus, but local enlargements of the fibres are common.

The nerve distribution to the artery and bronchial tubes are intimately connected, nerve fibres not only wander off from the main bundles that follow the vessels, but from the vascular plexus itself come off quite numerous rami that are distributed to the smooth muscle, and to the epithelial lining of the air tubes, perhaps after the formation of numerous anastomoses and peculiar figures upon them.

Nerve plexuses also accompany the pulmonary arteries, but are not so well developed as those about the bronchial, still traces of them are rather frequently met with in the form of single fibres and portions of anastomosing networks following the direction of the artery, and here and there an occasional end-knob may be found bearing the same relation to the muscular layer as it does in the bronchial arteries. Nerve fibres in sparce numbers may also be found on the walls of the larger veins, but upon the smaller as well as upon the walls of the capillaries they are not to be seen.

June 24, '93.

DESCRIPTION OF PLATE XIV.

Fig. 1.—Intricate nerve termination from the muscular layer of a medium sized bronchus. The dotted line indicates the internal margin of the muscular zone.

Fig. 2.—Two adjacent infoldings of the mucous membrane of a larger bronchus, showing the relation of the nerve fibres to the epithelial cells.

Fig. 3.—Complex termination of a nerve fibre from from the epithelial lining of a bronchiole. The dotted line indicates the internal margin of the epithelium. A, marks what is apparently a small ganglion cell interposed in the path of the transmitting fibre.

Fig. 4.—Nerve bundles and single fibres in the septa between the air cells. From the mid-region of the lung.

Fig. 5.—Drawing from a arterio-bronchial plexus showing the intimate relation between the two. A, A, fibres arising from the plexus distributed to the layers of the bronchus. The *x* indicates the margin of the peri-bronchial spaces.

All the drawings are from picric-acid-osmium-bichromate hardened specimens, stained with silver nitrate. Zeiss, ocular 4, objective DD.

AN INTERESTING NEURITIS,

By F. D. Barker, Ph. M., M. D., Dayton, O.

The patient, Dr. G., is a dentist, 48 years old. For several years prior to 1890, there was slight twitching of the muscles on right side of neck. General health was good. He was a moderate though regular drinker.

In 1889 the twitching (chorea) increased till it became quite annoying. In January, 1890, he had a severe attack of *La Grippe.* The chorea increased under the best treatment attainable. Later the Doctor's general health improved, but a condition of "spasmodic wry-neck" developed with considerable deformity and great pain. Any attempt to maintain an erect posture was accompanied by powerful contractions of the right cervical muscles, drawing the head downward and to the side. These spasms were accompanied by most excruciating pain.

In June, 1890, two operations were performed by a Columbus, Ohio, surgeon, first making simple section and then excising the Spinal Accessory nerve. Neither operation was of any benefit. The skill of this surgeon is such that it is unlikely that he failed to reach the Spinal Accessory.

The patient's condition remained unchanged till in April, 1892, when he came to me for operation. May 5th, a subcutaneous tenotomy was done, cutting off the Sterno-cleido-mastoid at its insertion into the collar bone. The antiseptic dressings were removed on the fifth day, when the wound was healed. From this operation the Sterno-mastoid ceased to draw the head forward. It was, however, still drawn hard and strong to the side and somewhat backward.

On June 5th, I excised the posterior branches of the cervical nerves supplying the powerful group of muscles on right side and back of neck, including the Trapezius, Levator Anguli Scapulae, Trachelo-mastoid and Complexus.

This necessarily was a long and tedious operation. The patient was anæsthetized face down. A free incision was made about five inches long from the occipital protuberance downward, about one inch to right of median line and parallel with the spine. The transverse processes of the cervical vertebrae were layed bare. Free hemorrhages greatly obscured the field of operation.

A peculiar condition of the nerves existed. All were enlarged and there was great hyperæsthesia. The Great Occipital nerve was probably twice its natural size and gave evidence of long continued inflammation.

Although the patient was profoundly anæsthetized, whenever a nerve was touched there was marked muscular contraction. Sections of the Great Occipital and all the posterior branches of the cervical nerves were exercised at their points of exit from the spinal column.

Using the index finger as dissector, all the muscles were raised to the line of the ear and nerves freely excised wherever found. Notwithstanding the very extensive wound and free bleeding the patient made a rapid and uneventful recovery. When he sat up, to the intense disappointment of the patient and operator we found the head drawn over and a narrow bundle of the anterior fibres of the Trapezius stood out above its atrophied and paralyzed neighbors like a small rope.

For the third time under my direction the patient was anaestetized and a section over an inch in length was cut from the centres of the offending group of muscles. The ends retracted and I allowed a mass of blood to accumulate, hoping that the clot would prevent reunion of the muscles. This probably unique operation was successful. Rapid recovery followed.

After several weeks we found the head feebly drawn to the right. An apparatus was then made with a supporting mast at the back of the neck and passing around beneath the chin and occiput. Formerly no form of apparatus would control the spasms and the patient was compelled to lie down every half hour to avoid the terrible paroxysms of pain.

He left the hospital wearing the brace and able to sit or walk for an indefinite time, only growing weary sooner than usual. There was undoubtedly a low form of inflammation in the nerves that controlled the affected muscles. The patient seems to have been carefully and skilfully handled, both by physicians and surgeons. Medical and surgical skill have exhausted themselves in the effort to cure him. He is by no means well and sound. There are many similar cases and their disorders belong to that long list of neuroses that, alas, must be classed in our present knowledge as incurable. Will not the neurologists come to the rescue and tell us the nature and cause of the disease? Then let us hope a remedy may be found.

NEUROLOGISTS AND NEUROLOGICAL LABORATORIES.

IV. NEUROLOGICAL WORK AT ZURICH.

BY ADOLPH MEYER, M.D.,

Pathologist of the Illinois Eastern Hospital for the Insane. Kankakee. Honorary Fellow of the University of Chicago.

J. J. Honegger works quite independently of the other neurologists of Zürich. He is the representative of the old school of anatomical research, restricting himself as much as possible to the descriptive anatomy of the adult brain. Although a pupil of Huguenin and Meynert, unlike them, he never left the ground of anatomy proper and therefore never exposed himself to the criticism of belonging to the speculative school. This is certainly meritorious. Wild speculation has been so demoralizing that anatomy is, in the hands of many, little more than a yielding and practical source of apparent proof of preconceived ideas and is no longer the exact description of what the eye sees.

Our great biologists have shown us what anatomy has to be in order to be a creditable science. They had the advantage of finding a great amount of apparently dead material in the anatomical descriptions of former times; they brought it back to life by utilizing it for the problems of physiology and they continued its study so as to make it both profitable and trustworthy. The problems of physiology and of evolution take more of the interest of the present generation than the dry and often unsatisfactory humiliating study of descriptive anatomy. Yet, it is better that the anatomist should say: Here I am at the limit of my present knowledge—than that he should make the uncritical reader believe that his speculations belong to the category of proved facts. I admire Honegger for limiting his discussions to what belongs to his field, giving all that he could obtain, but with severe criticism, from a strictly anatomical standpoint. In this way he offers all the information which anatomy can give him; he leaves the solution of the physiological problems to the physiologist and is not misled, like Meynert, to be too ready to see in his preparations what his speculations made him presuppose.

Honegger began his anatomical research in 1876 under Huguenin's direction. In 1879 he worked in Meynert's laboratory and since that time he devoted much of his leisure adding to his splendid collection of serial sections. He was first working on the selachian brain, but was finally led to a question of more special interest which he treats so fully in the only publiaation he has so far produced, in the paper on the Fornix.[1] In order to understand Honegger, it is absolutely necessary to be familiar with Ganser's excellent monograph on the brain of the mole, and with most of the literature on the parts in question. He, who studied all this, will not fail to admire the learning and earnest research of Honegger, although it will be difficult to excuse him for giving the reader so much trouble, the style and the absence of more instructive drawings making the reading exceedingly difficult.

After a very elaborate review of the literature on the fornix, he starts with a discussion of the histological and morpho-

---

[1] Vergleihend-anatomische Untersuchungen über den Fornix und die zu ihm in Beziehung gebrachten Gebilde im Gehirn des Menschen und der Säugethiere. Mit 10 Lichtdruck-Tafeln. von J. J. Honnegger. Recueil Zoologique Suisse, t. V. Geneva, 1890.

logical relations of the cornu ammonis. He shows clearly that the knowledge of this region is still limited and that we are not justified in making too many assertions before the method of Golgi has satisfactorily shown the histological connections of all the various elements. After the cornu ammonis, Honegger treats the following parts: stria Lancisii; psalterium, fornix longus and fimbria; septum pellucidum and pedunculus septi pellucidi; columnae fornicis; tuber cinereum and corpus mamillare; decussatio subthalamica posterior and pedunculus corporis mamillaris; Vicq d' Azyr's and Gudden's bundles; fasciculus longitudinalis posterior; tænia thalami optici; ganglion habenulae, pedunculi conarii; Meynert's bundle, tænia semicircularis, nucleus amygdalæ. As I hope to enter very fully on Honegger's work in a future paper, I give merely these outlines here.

The results of Honegger's very intricate studies are rather unsatisfactory, inasmuch as they are to a great extent negative, telling us that we have no right to use many dogmatic views of authorities before they have found fuller proof. A comparison with Alexander Hill's speculative method shows, however, the value of such "negative" and critical work and numerous remarks, especially those relating to the anatomy of lower vertebrates, make us feel hopeful that the strictly objective study will finally triumph over apparently ingenious but often badly founded speculations.

Honegger's collection is worth seeing because it contains the finest carmine and gold series, such as are becoming very rare since the carmine of today is so bad that haematoxylin governs the field entirely.

Prof. Paul Martin, whose paper on the embryology of the cranial nerves[1] is not accessible to us, cannot devote as much time to neurology as the above mentioned scholars. His collection, however, is very interesting on account of the fine Golgi preparations and the embryological material. There is no

---

[1] MARTIN, P. Die erste Entwickelung der Kopfnerven bei der Katze. öster. Mon. Schr. f. Thierheilkunde. 15. Jahrgang; Sept., 1890.

doubt that we are going to obtain many valuable contributions from this author.

Prof. I. Gaule[1] has written several interesting neurological papers. His work is, of course, largely dealing with physiology but has so many original features that I wish to mention one paper on the numerical relations of the medullated fibres of the spinal cord of the frog. Gaule compares the number of the fibres of the cross-section with the corresponding number of the entering perpherial nerve-fibres. He starts from the following suppositions:

1. Every fibre of the white substance is in functional coordination with the central ends of the root-fibres.

2. The fibres of the white substance form connections among the central ends of the root-fibres themselves and with the brain.

3. The white fibres may be divided into the following groups:

a. tracts which go beyond the spinal cord into the oblongata and other parts of the brain,—the long tracts;

b. connections within the spinal cord among its various segments—intermediate tracts;

c. connections of all the single elements within the same area—short tracts.

4. The central end of every root-fibre corresponds to a certain number of fibres of the white substance, the number being constant for every one.

5. The central ends of the root-fibres and consequently the starting-points of the corresponding fibres are not far from the entrance of the roots into the spinal cord.

6. The length of the fibres of the white substance depends on their function, i. e., on the distance of the segments united.

7. The central end of every root-fibre contributes two fibres for the long tracts, the one for the same side, the other for

[1]Gaule, J. Zahl und Vertheilung der markhaltigen Fasern im Froschrückenmark, Mit 9 Tafeln. Abhandlg. d. mathemat. phys. Klasse der kgl. sächs. Ges. Wiss. XV. 9. p. 739. 1889. and Edinger Jahresbericht f. d. Jahr 1890; p. 31–33.

the opposite, the intermediate tracts receive one fibre, the short tracts eight fibres (two ascending and two descending ones on each side).

According to Birge, the brachial enlargement of the spinal cord receives about 4000 root-fibres, the dorsal "region 1500, and the lumbar enlargement about 4500," making altogether 10000 root-fibres. Gaule counted the fibres of five sections, and compared the actual number with the number obtained on ground of his hypothesis. For the first section (from the upper end of the cervical cord) he makes the following calculation:

1. Fibres of the long tracts, 2 for each of the root-fibres entering the spinal cord. 10,000 x 2	20,000
2. Fibres of the intermediate tracts: none; as they don't reach this segment.	———
3. Fibres of the short tracts. 4 to each fibre of the half of the brachial enlargement $\frac{4000}{2}$ x 4	8,000
Fibres of one half of the section	28,000
Fibres of the whole section	56,000

The results of the hypothesis and of the actual number obtained in the 5 sections compare very favorably:

Section	I.	Hypothesis	56000	actual	number	56674
"	II.	"	74000	"	"	74699
"	III.	"	45500	"	"	41825
"	IV.	"	60500	"	"	61058
"	V.	"	18000	"	"	16313

Conclusive as this proof of the hypothesis seems to be, there is no doubt that it has to be accepted with due reserve for reasons too numerous and too obvious to be mentioned here. I put this abstract before the reader, because this instance is a fair example of the speculative character of Gaule's work.

Dr. Wlassak, Gaule's assistant, has so far published an anatomy of the cerebellum of the frog and is now preparing a number of interesting studies on other parts of the amphibian brain.

In this short review I have not been able to do full justice to any one of the Zūrich scholars; but if I have succeeded in inducing some of my readers to take up a careful study of the works mentioned, I feel confident that they will agree with me in calling Zürich a remarkably productive neurological center.

CONTRIBUTIONS TO THE COMPARATIVE MORPHOLOGY OF THE CENTRAL NERVOUS SYSTEM.

II.—Topography and Histology of the Brain of Certain Reptiles.

(Continued from Vol. III. p. 106. With Plates XV–XX.)

By C. L. Herrick.

In seems desirable to supplement the previous instalment by a few data derived from a comparison with Amphibia and from an application of the Golgi method. The turtle and Anura have much in common in the structure of the fore-brain. while the Urodela displays a still greater simplicity of structure. In general, it may be said that a comparison of the two types of amphibian brain affords very strong evidence in favor of the view that all nervous elements are modifications of a single typical neuroblast. In Menopoma, for example, all of the brain regions retain very much of the embryonic simplicity. The structure of the optic lobes does not appreciably differ from that of the cerebrum or olfactory tuber. The connections via the various tracts, however, remain practically as in higher forms. In the Anura the optic lobe acquires the stratified structure found in turtles and fishes, and other regions are equally complicated. Suitable methods show that the idea that the Amphibian brain is chiefiy composed of disconnected granules is erroneous, for the size and ramification of the processes of the cells is marvelous.

Application of the Golgi method to the turtle brain. In connection with the data by the hæmatoxylin method, which is certainly most reliable, we have employed the method of silver impregnation. It is possible to use it readily in connection with the familiar process of paraffin imbedding. The fragments are passed into 90 per cent. alcohol from the nitrate of silver and then into absolute. They are then imbedded in paraffiin in the ordinary way and mounted in benzole balsam, covering at once, after gently heating to stiffen the balsam. The latter process, recommended by Huber, seems non-essential if the paraffin imbedding is used. We have not experimented a sufficiently long time to be sure that no change will be affected, but sections prepared without any more heating than that necessary to coagulate the fixative have remained unchanged for over three years. The results obtained compare favorably with anything we have seen and it is quite possible to cut serially or by a ribbon process if desired. Naturally the specimen must be small if thorough permeation is to take place.

In the *olfactory tuber* a fair number of the cells are permeated. There seems to be no essential difference between the more superficial and the deeper ganglion cells. The peripheral processes pass to the glomerules and there subdivide into a close brush which is in close contact with similar fibres from the olfactory fibres. From the base a long practically unbranched fibre (presumably the axis cylinder) can be traced toward the cerebrum. The protoplasmic processes of the deeper cells pass between the peripheral cells and subdivide similarly.

The relations described are illustrated by *Figs. 1-3* of Plate XIX. *Fig. 1.* is a section from the ventricle to the glomerule layer showing the general distribution of cells and processes. *Fig. 2.* shows two of the peripheral ganglion cells on a larger scale with their protoplasmic processes entering a glomerule. *Fig. 3.* shows the minute subdivision of the protoplasmic processes in the glomerules.

The structure of the cerebrum is not greatly simplified by a resort to the Golgi method. Everywhere evidence is afforded that the cells are abundantly supplied with processes but the clear and unambiguous distinction claimed by many writers between protoplasmic and axis cylinders is not obvious to the writer in all or even the majority of cases. The appearances seem to favor the interpretation of an obliquely peripheral process as the axis cylinder in the mid-dorsal cortex (*Fig. 4.* Plate XIX.) This is certainly not the case in the hippocampal region, however, where the unambiguous evidence of the haematoxylin prepararions agrees with that of the Golgi method in showing the axis cylinders extending entad toward the tract leading to the fimbria. The direction which the processes take is, however, obviously a secondary matter, for in the amphibia, where the embryonic type of cortex is persistent, i. e. the cells do not migrate from the ventricle, the same fibres have a peripheral course and yet can be traced via the homologue of the fimbria to the hippocampal commissure. *Figs. 5-6* illustrate the impregnated cells of the hippocampal region; the former being less highly magnified.

In the axial lobe a very complicated structure is revealed where it is difficult to get a sufficiently deep stain to bring out the processes in their full extent. *Fig. 8-9.* show that these cells (see *a*, *Fig. 10.*) are abundantly provided with processes. The appearance seems to warrant the assumption that we have an invaginated cortex as claimed by Edinger. It is interesting that it is the lateral part which has the fibres brought out; whether this is solely due to the greater accessibility to the reagents remains to be seen.

The region for transfer of impulse or switch-station seems to be on the basal aspect, *a*, *Fig. 10*, and corresponding regions farther cephalad. *Fig. 7.* illustrates the cells of the ventromesal angle of the cerebrum cephalad. The cells seem to be of a kind suitable to facilitate the transfer. Two axis cylinders appear to emerge from each cell, as in the niger, ruber, etc. *Fig. 10.* is a transection near the supra-commissure, the tract of which is seen at *x*. The figure gives a fair idea of the fickleness of the silver impregnation.

The interpretation of the relations in the region where the transition into the diencephalon is affected is peculiarly difficult. The whole ventro-lateral region is clothed with large pyramidal cells which seem (perhaps spuriously) to connect with the peduncular fibres. If one could trust appearances it would seem that the supracommissure tract blends with olfactory radix fibres and passes to the occipito-basal lobe (sphæricus.) A smaller tract leaves the supracommissure tract and passes mesad and caudad into the diencephalon. The peduncles (basal fore-brain bundles) break up into small fascicles and lie parallel to the ventro-lateral margin. They seem to receive fibres from the large pyramidal cells of that region and to continue to the cephalo-dorsal region. *Fig. 12.* illustrates a few cells from the optic lobe, from the deeper tectum layers. The arrows *v* and *d* indicate the directions ventrad and dorsad respectingly. *Fig. 13.* is part of the dorso-median region at the level of the front of the optic lobes. *x* is a cell in the optic tract which is shown more highly magnified in *Fig. 14.* No attempt is here made to discuss the arrangement of tracts in the mesencephalon.

The olfactory tuber in the frog has been studied by deeply staining with hæmatoxylin with results which closely correspond with those of Retzius and others by use of the Golgi method. The hæmatoxylin method has the advantage of permitting complete orientation. The elements of the rhinencephalon are very simple. About the ventricle we have the same relations which prevail in other regions of the fore brain. The elements of the olfactory ganglionic layer, or specific cells of the tuber, vary greatly in size but consist of a more or less bipolar cell body enclosing a nucleus nearly occupying its transverse diameter. Two processes of considerable size are developed, one from the peripheral or cephalic extremity, the other from the ental end. The former in many cases can be traced into a glomerule where it breaks up by dichotomous branching to intermingle with similar branches from the olfactory nerve. The other processes extends caudad beyond the limits of the tuber, beyond which we have thus far not succeeded in tracing the isolated fibre. In other cases the cell, while it has the form just described, seems to have its relations only within the pero and cannot be proven to give rise to an axis cylinder. Fig. 3, Plate XX, illustrates the typical olfactory neuron in the frog. Often the axis cylinder can be traced farther than in the case figured. While it has not proven possible to trace separately the various fibres of the olfactory neurons, it is easy to follow their combined course. Collecting on the caudo-lateral aspect of the pero these fibres form a strong radix which passes, by a strong lateral sweep, caudad and dorsad to a point behind the entrance of the peduncles. The tract there breaks up but part of it may be traced caudo-mesad to the hippocampal lobe. This tract for some time evaded us because it is not superficial but lies near the ventricle. There seem to be two main branches in the pero, one arising from the dorsal and the other from the ventral aspects, both curving to a common point on the lateral aspect.

It may perhaps be doubted whether this single strong band represents the precommissural radix or the radix lateralis, or both. Some fibres from it do, in fact, seem to enter the precommissure but, if our observation is correct, a larger part passes to the hippocampal region, (Plate XVI, Fig. 9.) There is a smaller tract passing from the region of the precommissure cephalad, which may correspond to the olfactory branch of the commissure but, inasmuch as the radix obviously branches about half-way from the ruber to the commissure and one portion passes dorso-mesad to the hippocampal region, it is better to think of the two radices as fused until more definite evidence is at hand. The region where the compound radix enters the cerebrum is differentiated from the adjoining cortex by the presence of certain deeply staining cells whose axes lie in the plane of transverse section, while the remaining cells are less susceptible to stain, less shrunken and with clear granular nuclei. Whether the peculiar dark cells which are locally distributed in the cortex should be regarded as motor or simply such cells as for any reason have been recently active, is yet a question. There is, of course, a possibility that the difference is wholly accidental, but this seems improbable. Fig. 12, Plate XVI, illustrated a portion of the transverse section with the olfactory radix. At a point farther caudad the course of the above olfactory tract is interupted by nuclei in the course of the fibres, These are evidently the second neurons in the course of the tract if the fibres to this point are supposed to be derived from the specific olfactory ganglia.

In longitudinal sections it is seen that the region where the disperse olfactory fibres converge to form the radix is at a point near the peculiar lateral olfactory lobule which lies adjacent to the post-rhinal lobe or ventral tuberosity of the cerebrum. (Fig.

9, *lat. tub.*, Plate XVI). In Necturus there are a few scattered fibres on the very ventral surface which run directly caudad to beyond the chiasm—probably to the mammillary region. These fibres have not been elsewhere encountered.

The hippocampal region of Necturus has proven susceptible to a stain which brings out the cellular relations with all desirable completeness. It is possible to trace the axis cylinder fibres from the scattering cells of this lobe into the tracts which collect to unite in the fornix commissure. It will be noted that in the figure the protoplasmic processes spring from the same end or the opposite end of the cell depending on the position of the cell. (Fig. 1, Plate XX.)

The above connection is precisely that which we have determined in reptilia except that in the latter case the hippocampal cells have assumed the secondary relation, i. e., have retreated from the ventricle in a body and, as a consequence, the axis cylinder processes have gathered entad of the cells while in amphibia the cells have departed little from their embryonic condition and the fibres remain ectad of the mass of cells. If these tracts are, as appears, homologous with the fimbria we have in the conditions prevailing in lower vertebrates a strong presumptive evidence in favor of the writer's position that fimbria fibres arise from the cortical cells of the hippocampus. Compare Fig. 13, Plate XX, which is a portion of the hippocampus of the black snake.

The white matter and tracts of the fore-brain and diencephalon of amphibians has received an exhaustive treatment at the hands of Dr. Edinger, which resulted in the statements summarized below.[1]

Connections with the prosencephalon. 1. The basal prosencephalic bundle (so also Osborn, Köppen's "round bundle,") Schulgin's "Tract P." or analogue of the pyramids. Osborn speaks of a branch to the thalamus as "infundibular tract," which Köppen terms "Thalamus Tuber cinereum Bahn."

2. Tænia thalami, or tractus ganglii habenulæ ad prosen-

[1] Untersuchungen u. d. vergl. Anatomie des Gehirns, 2. 1892.

cephalon—a fine bundle which passes from the mesal wall of the prosencephalon to the supracommissure.

3. Diencephalic radix of the olfactory (our tract of the supracommissure). It is described by Edinger (following Bellonci) as arising in the tuber and extending to the supracommissure. This is constant in all the vertebrates we have examined though its absolute continuity with the olfactory radix is not so clear.

4. Edinger thinks it very probable (influenced by studies in Selachii) that fibres arise in the lateral part of the mantle which pass caudo-ventrad, passing ectad of the chiasm and cross to the other side behind the latter. After decussation these fibres pass to the roof of the mesencephalon. In other words the course is the same as that of the "mantle bundle." He says "Bei den von mir untersuchten Arten war nur das Stück des Zuges, welches hinter dem chiasma liegt, gang sicher zu stellen, das frontale ende, der zug aus der Decussatio postoptica über den Sehnerv hinweg in das Vorderhirn liess sich aus einzelnen Befunde vermuten, aber nicht durch solche beweisen." Osborn described a tract from the optic nerve into the hemisphere which the author supposes to be the missing part of the mantle bundle.

The decussatio postoptica has been identified with the commissura transversa, but another decussation lying dorsad of it deriving its fibres from the caudad part of the mid-brain, Edinger considers equivalent to this or v. Gudden's commissure. (There is some confusion due to the fact that on the same plate the three names are used, viz: "Decussatio postoptica," decussation of the mantle bundle, and "decussatio transversa," and seem to apply to different tracts.)

From the diencephalon Edinger derives the following tracts: 1. Tractus thalami frontalis springing from the dorsal region of the thalamus and passing cephalo-ventrad and then suddenly caudad (its terminus caudad was not made out). 2. Tractus thalami caudalis, which springs from the ganglion caudale thalami and passes in the same direction as the preceeding but, because non-medullated, its fibres cannot be traced beyond the mesencephalon. Both the above lie in the ectal regions and seem to constitute Osborn's direct diencephalic tract. 3. Meynert's bundle. 4. Tractus ganglii habenulæ ad mesencephalon, fibres passing directly caudad. 5. Tractus descendens ganglii habenulæ, with no determinate end caudad. Edinger does not recognize Osborn's commissura infundibularis. From the mesencephalon, besides the optic tracts, no fibre tracts are recognized beside those of the commissura transversa. There remains only the *processus cerebelli ad diencephalon* which is said to arise in the caudal region of the gray matter of the diencephalon and pass caudo-dorsad to decussate ventrad of the fourth nerve decussation.

The following observations may be hazarded: First, as to the basal prosencephalic tract, we do not find all the fibres continuous into the medulla but in Anura sundry connections are formed with the cerebellum via the niger cells. There is also a fine-fibred tract from the thalamic niduli to the mesal or mesoventral part of the cerebrum. Some of its fibres seem to decussate beneath the precommissure, while others pass directly the caudo-dorsal parts of the hemispheres. This mass we homologize with the dorsal or sensory peduncles.

The tracti thalami, which Edinger derives from the frontal and caudal (or, on the plates, anterior and posterior) niduli of the thalamus we regard as part of the dorsal peduncle system which is continued cephalad as indicated.

The tractus ganglii habenulæ ad mesencephalon we fail to recognize as fully distinct from the optic brachia which follow the course indicated, though arising laterad of the habenæ in the geniculata and passing to the inner fibre layer of the tectum. It is important to determine whether the present suggestion can be erroneous; it is against it certainly that so thorough a morphologist as Dr. Edinger could find no cephalic tract from the tectum, although the frog is well supplied with eyes. Yet the brachia exist in fishes and reptiles. (See note at end.)

The course of the supra-commissure tract in the toad is clearly shown by the transverse section figured. (Plate XVI, Fig. 1). The tract passes cephalo-ventrad and laterad from the lareral aspect of the hemisphere where its fibres may be traced cephalad for some distance. Other fibres pass into the thalamus but they seem to be derived from the infra-habena or habena rather than the supra-commissure. The results of the Golgi method as applied to the turtle are in harmony with this case. Plate XIX, Fig. 10.

The Ventral Commissure System is diffuse and much less easily studied than in fishes. One element, the *commissura horizontalis* is sufficiently separable but consists of several bundles which keep approximately parallel. The fibres are first detected in the cells immediately cephalad of the post commissure, the "nidulus corticalis" of fishes or nidulus aqueductus (mihi) of reptiles[1]. The fibres collect into two or three distinct bundles which pass ventrad, traversing the whole extent of the nidulus ruber (as this term was used by me in fishes and reptiles) to near the ventral surface of the tuber. Its fibres pierce the peduncles caudad of the post-commissural tract and cross upon the ventral aspect of the tuber some distance behind the chiasm. It is not a little gratifying that the agreement between the course of these fibres in the Amphibia and the fishes should prove so close. It seems to warrant the hope that we shall ultimately determine homologies in detail from lowest to highest. The *ventralis* and *transversa* are not easily separable and consist of disperse fibres arising from the cephalo-lateral aspects of the diencephalon and decussate or cross from one side to the other dorsad of the chiasm. We are forced to admit our inability to find the mantle-bundle of Edinger which should connect with our com. transversa.

The *peduncles* in Anura sustain the same relations as in fishes, complicated by the presence of the cortex. The ventral peduncles enter the cerebrum far ventrad and pass into a strong nidulus corresponding to a part of the striatum, many of the fibres here affect union with cells whose opposite end is continued as a fibre extending cephalo-dorsad. The ultimate destination in the cortex seems to be the ventro-lateral region and the

---

[1] *Journ. Neurol.* Vol. III. p. 98.

cephalo-dorsal parts of the cortex. There is no apparent reason why this tract should not be homologized with the motor peduncles of higher brains. It is not clear to the writer that the fibres terminating in the striatum should be distinguished as basal fore-brain bundle in lower animals unless the same kinds of fibres in higher brains be distinguished within the motor peduncle. This Edinger has, in fact, done. In the present instance the fibres do not all emerge from cells at the same level.

The dorsal or sensory peduncles enter a dorsal and mesal region and are more disperse and less easily followed. They pass chiefly into the mesal portion of the axial lobe and come into more or less direct connection with cortical regions which for other reasons might be regarded as sensory.

In Urodela the apparent position of the ventral peduncles is rather farther dorsad relatively by reason of the fact that much of the axial lobe, which in frogs, etc., becomes crowded dorsad by the preoptic structures is, in the urodela, left upon the ventral surface and the base of the prosencephalon in the former is in part the lateral aspect in Urodela.

It would even seem possible that the dorsal peduncle to a certain extent changes places with the ventral. At any rate the precommissure seems to cross ventrad of the ventral peduncle.

The commissures of the fore-brain are left out of account in the present discussion. The whole question as to the relation of the calloso-fornix structurs requires special considerations on the widest possible comparative grounds. The fornix, at any rate, is fully represented. The fibres collecting from the hippocampal region collect in a strong tract which crosses dorsad of the precommissure, but there is a tract in Anura, at any rate, which passes near the ventricle obliquely caudad to the mammillary region. They may be followed in a single perpendicular section of the toad brain for most of their course. There is, therefore, close harmony with the conditions in the Reptilia.

The Gray Matter of the Thalamus. Edinger treats the gray matter of the diencephalon less extensively than the tracts. The geniculatum is recognized as usual but includes the whole mass of cells in the superficial portion of the region beneath the optic tract. The ganglion habenulæ and the gray matter of the tuber are distinguished and, in addition, a frontal and caudal ganglion or, as he elsewhere terms them, nucleus anterior and posterior occupying the median and lateral aspects of the thalamus. These masses constitute the subthalamus and ruber of our papers. We have been able to locate several other niduli and especially the homologues of the mammillaria just caudad of the infundibulum.

Where the thalamus adjoins the cerebrum the gray matter is not segregated from the ventricular layer. The peduncles pass into the striata in which are numerous scattered cells in a dense stroma. (Plate XVI. Fig. 2.) In the midst of this gray matter surrounding the preoptic recess of the third ventricle a nidulus of larger cells—the *preoptic nidulus* which lies a short distance caudad of the precommissure and extends from about the level of that commissure to a point well ventrad. The large fibres from these cells arch latero-ventrad and do not collect into a definite tract. It seems most probable that they form a part of the optic or infra-commissural system. Farther dorsad there is a gap in the gray matter about the ventricle in which the fornix tracts lie. Dorsad of this region is a clustre of similar cells which lie in the cephalo-caudal plane and give off processes which may be traced in the clear space enclosing the descending fornix tracts. These cells seem to be intercalated in the tracts. In longitudinal sections (Plate XVII. Figs. 2, 3.) a clear space containing fibres from the preoptic nidulus separates the gray matter of the preoptic recess into a cephalic and candal portion *pre. o. c. 1* and *pre. o. c. 2.*

A transection somewhat caudad of the region just described reveals the fact that the gray matter has considerable gained in complexity. The habena lies dorsad and beneath it a strong stratified nidulus which may be vaguely compared with the subthalamicus of fishes. Immediately ectad and rather dorsad of this group is what may be confidently homologized with the external geniculatum of fishes and, strangely enough, it shares with the latter group the striking peculiarity of having a pseudo-epithelium or radial superficial layer of cells with entally directed processes.

The geniculatum (Fig. 3, Plate XVI, *gen.*) lies dorsad of the ventral peduncles and receives fibres from the dorsal peduncle which are less compact than those of the ventral. Caudad of the level where the geniculatum occupies the surface a scattered infra-habena nidulus appears dorsad of the subthalamicus.

The infrahabenaria and Meynerts' nidulus are separable from the habena proper. The respective positions may be gathered from Plate XVI, Fig. 3, and the figures on Plate XVII.

The nidulus ruber has hitherto not been identified in amphibians. Reissner figures the bundles of the commissura horizontalis[1] and indicated them as "herabsteigende Bündeln von Nervenfasern," the figure is from a section somewhat too far cephalad to show the nidulus very well—its real site is in the most protuberant region dorsad and laterad of C in the figure. The structure of the nidulus is less close than in the fishes but it is obviously like the latter, a terminus of many of the dorsal peduncular fibres. Under a high power the cells resolve themselves into those with long processes extending into axis cylinders in different directions and those with less evident processes lying clustered as in fishes. The whole area is filled out with fibres from various directions. The recognition of this ele- in the thalamus is a useful step in construing the difficult region. The homology is made more complete by the fact that the tract of the commissura horizontalis traverses the nidulus ventro-dorsad and leaves it on its way to the post-commissure region. In the tailed amphibians I was unable to detect the ruber in 1892. (Vol. II, p. 67). (The fullest account of this nidulus yet recorded respecting fishes, etc., is that on pages 58-67 of the Journal of Comparative Neurology, Vol. II.) Although there is no distinct ruber in Urodela yet it is possible to trace fibres of the commissura horizontalis dorsad to a point a little cephal-

[1] Bau des Centralnervensystem der ungeschwänzten Batrachien, Plate XII, Fig. XI.

ad of the post-commissure. The niduli in this case simply remain undifferentiated from the ventricular gray, though potentially and functionally present. (Plate XVIII.)

The diencephalon and mesencephalon of Urodela constitute one continuous segment interrupted only by the post-commissure. It is probable that the most diagrammatic representation of the segments in question could be secured by generalizing the relations as they exist in Menopoma or Necturus, which are essentially similar. The drawings and descriptions of Osborn have made us sufficiently familiar with the external form and general relations. It will be desirable, however, to examine a series of horizontal sections beginning from the dorson in order to get a comprehensive view of the structures.

The most dorsal section shows three structures; 1. The preparaphysis (often mistaken for the epiphysis) consisting of an enormous expansion of the preplexus dorsad of the aula. It is composed of a large irregular central chamber with complicated peripheral diverticles of a tubular or irregular character around which blood vessels anastomose. The form is, in general, nearly spherical. 2. The post-paraphysis or "polster"—a dorsal expansion of the third ventricle with irregular projections ectad and entad. The diplexus is a derivative of this system. 3. Immediately caudad of this, but separated from it by the supra- and habena-commissures is the epiphysis, which consists of an irregular aggregate of vesicles connected with the third ventricle by a narrow opening. The supra-commissure system consists of two distinct bundles, a small cephalic and dorsal and a larger caudal and ventral bundle, a small branch to the epiphysis from the former was doubtfully identified (parietal nerve.) The ventro-caudal bundle passes laterad of the smaller commissure and comes to lie ectad and cephalad of it, forming the main body of the commissure, while the supra-commissure proper continues directly ventrad, forming (?) a part of the optic system. (?) *Fig. 1*, Plate XVIII, illustrates these conditions. *Fig. 2* is the region of the supra-commissure, showing the several tracts. From the habena as well as what seems to be the locality of Meynert's nidulus fibres arise from the cells and collect into Meynert's bundle with the usual course.

At a section farther ventrad (*Fig. 3*,) the dorsal part of the tectum appears. The optic tract enters laterad. The structure of the tectum is exceedingly simple, consisting of ganglion cells arranged about the ventricle with long bifurcating processes of great length and delicacy. There is no stratification into zones as in the higher forms but, nevertheless, the essential elements are present. The optic nerves are small and hollow (i. e., the old cavity of the primary optic ventricle is not wholly obliterated) and the small number of fibres in the optic tract calls out relatively few neurons from the second layer to the first. These few cells are scattered irregularly somewhat above the level of the general gray matter. A second layer of fibres approximately parallel to the ventricle is the brachial system. These fibres are smaller than those of the optic tract. They arise from cells in the region where in other vertebrates the geniculata occur and pass caudad to constitute the inner horizontal fibre zone. In the caudal aspect of the tectum bundles enter from obliquely ventro-laterad and caudad and penetrate the tectum between the meshes of and nearly at right angles to the preceeding. This tract can be none other than the lemniscus. Its course is obliquely latero-caudad to near the region of exit of the trigeminus. In the middle region of the tectum occur a few giant ganglion cells—the mesencephalic nidulus of the trigeminus. Each of these cells gives off a large dark fibre which passes entad of the lemniscus to the exit of the trigeminus, There are several bundles of such fibres in each side. The fibres are larger than those of the 4th nerve.

The optic tectum in the frog is exactly similar to that of the fishes in all essential particulars. It, therefore, differs from that in Urodela much as the cortex of reptiles differ from that in the embryo. It is very curious that none of the writers on the amphibian diencephalon seem to have systematically sought for the optic brachia or Sylvian commissure, The latter is a very evi dent band crossing from one tectum to the other and lying beneath the ectal ganglion layer. The cephalic brachia extend from the deeper portions of the tectum and run parallel to the optic tracts cephalad and penetrate the geniculata. The caudal brachium is difficult to make out certainly but seems to run parallel with the caudal optic tract and to be associated with the infracommissure tract, thence with the cerebrum. It is obscured by its association with the numerous other tracts of the base of the mesencephalon. The caudal optic tract is wholly distinct from the cephalic and, as in fishes, lies in a groove beneath the tectum, whence it arches over the caudal aspect of the lobe. The lemniscus tracts, which seem always to have been overlooked, have the usual course, springing from the deeper layers of the tectum and accumulating, after a separate course caudo-ventrad, into a loose bundle which follow the course of the caudal peduncle of the cerebellum. It would appear that Edinger's tractus ganglii habenulæ ad mesencephalon runs with or includes the cephalic brachium. Longitudinal sections, however, clearly show that a fine-fibred tract arising from the inner fibre layer of the tectum passes cephalad at some distance from the median and enters the geniculatum. The resemblance between the optic tectum in Anura and turtles and fishes may be seen by comparing Plate X, Fig. 10, Vol. III, with Plate VII, Fig. 1, and Plate X, Fig. 12, of Vol. II. This structure is strikingly contrasted with that in Urodela.

In Urodela the zone surrounding the common ventricle is clothed with neurons whose processes extent peripherad and interblend with the transversely or irregularly disposed neurons which send axis cylinders into the optic tracts. The conditions are much like those prevailing in very young fish [see Plate IX, Figs. 1, 2, 3. Vol. II.]

The tracts to the leminscus blend with the optic nerve tracts and brachia, while in the frog these several fibre layers are differentiated as in reptiles and fishes. In higher reptilia the relations are obscured by the complication of the tectum, as is also the case in mammals. The fish, turtle or frog is therefore an incomparably better subject for study of the tectum than the other groups, while the salamander is instructive as showing how this complicated mechanism is derived from the common type in which at first cells are everywhere collected about the ventricles.

Respecting the cerebellum, Osborn, in 1883, described in the Amphiuma, (1) a continuous band of fibres arching from side to side of the medulla, (2) a fine layer of fibres which have an antero-posterior direction, (3) an investing layer of cells one or two rows deep. The transverse band was homologized with the inferior peduncles and restiformia. The fine layer terminates in the lateral portions of the cerebellum and optic lobe and is morphologically ventrad of the preceeding. The cells are thought to be of a nervous character but no processes were discovered. In a later paper[1] he states that in Cryptobranchus the "cerebellum is chiefly composed of decussating tracts, passing on the one side into the lateral regions of the medulla and into the mesencephalon. It may even be questioned whether we have here the essential elements of the cerebellum, the structure is so extremely simple." He withdraws from the homology of the tract to the mesencephalon with the prepeduncles of the cerebellum and states that it is really the mesencephalic or descending trigeminal tract. The cerebellum of Amphiuma contains no cells except the ependyma, while in Cryptobranchus there is a small mass of round cell similar to those of the central substance of the optic lobes. The fine fibres of the first sort above described are derived chiefly from the eighth nerve though some come from the seventh.

Alborn considers that the fibres entering the cerebellum are commissural between the auditory niduli of opposite sides while Köppen and Osborn think they are decussating tracts from the nerve.

The middle peduncle of the cerebellum is fairly well developed in Anura but instead of tracing it unbrokenly into the infundibulum with Dr. Edinger it seems to us that most of its fibres either mingle with those of the ventral peduncles or come into relations with them through the scattered "niger" cells of the pes region. The decussation of these bundles ("Bindearme")

---

[1] *Journ. Morph.* II., 1. 1888.

is high up and the fibres then come into close relations with the corpora posterioria. The number of cells scattered in this region of interblending (niger locus) is not large but much greater than at first appears by reason of the dispersness of the nidulus. (Plate XVI., Fig. 7; Plate XVI., Fig. 10, *niger.*)

The cephalic peduncle of the cerebellum was not definitely located. A few dark fibres coming from the base of the cerebellum can be traced in a lateral arch cephalad to the region of the ruber, where they seem to turn dorsad but their actual course is simple surmised to correspond with that in fishes. It thus appears that, if the above surmise is correct, the amphibian cerebellum has the same major connections as other groups.

The cerebellum is ventro-laterally supported by a dense nidulus which Osborn figures and mentions; this "dentatum" (see Plate XVII., Figs. 2-3.) contains numerous spindle cells from which arise fibres constituting a tract which arches cephalad and penetrates the cell-clustre lying laterad of the nidulus posterior ("mucleus magnus"). The ultimate destination of the fibres is not easy to demonstrate but they can be traced to beneath the "colliculi" and apparently terminate in the sensory niduli of the thalamus.

The tract arising from the central or axis cylinder processes of the cells of Purkinje pass directly caudo-lateral and form the restiformia on the dorso-lateral aspects of the medulla. The fibres are thick and uniform.

The corpus posterior consists of a more or less spheroidal body with a dense peripheral zone of cells whose apex processes project into the core of the organ. This is one of the numerous illustrations of a pseudo-epithelial arrangements of cells, reminding one of the rodundus of fishes. In the caudal aspect the cells, which have deeply staining muclei, are as closely arranged as possible; elsewhere less compactly. The core is less close in structure than the periphery. The middle peduncle of the cerebellum comes into very close relations with it though the nature of the connection is not clear. (Plate XVIII., Fig. 9.)

While not here especially concerned with the homologies of the cranial nerves we may note in passing that the three eye-muscle nerves seem to be derived from one common band of ventricular gray on either side the median line. In the amphibia the primitive relations are little altered. The oculomotor-trochlearis nidulus is very large and lies very near the ventral aspect driving the dorsal longitudinal fasciculus almost into contact with the ventral surface. The cells resemble those of reptiles closely. The third nerve emerges a little distance caudad of the mammillaria and lie in the groove laterad of the tuber. Between the niduli of these nerves and the ventricle is a considerable mass of ventricular gray of the ordinary sort with small cells consisting almost wholly of the spherical nuclei.

There are two clusters of smaller cells lying laterad of the oculomotor tracts which seem to correspond with the peduncular niduli of other groups. Caudad of the trochlearis nidulus the dorsal longitudinal fascicle turns rather abruptly dorsad and soon attains its usual position along the floor of the ventricle.

In conclusion it remains to summarize a few general results of these studies hitherto.

1. The theory of neurons is clearly seen to be the sole adequate means of construing the concordant facts of comparative anatomy and histology and of embryology. All the nervous elements of the central nervous system arise as neuroblasts from the ventricle and undergo more or less extensive modification.

2. There is great difference in the degree of modification of the neurons. They may become functional when in an almost embryonic condition morphologically.

3. A considerable but variable number of the neurons are held back in their development to form reserves or accessory structures.

4. The nerve tube is originally similar in the arrangement of the neurons from end to end. In the Urodela this simplicity is largely retained. Their brain warrants us in the belief that they are *permanent larvæ*. They are not to be regarded as illustrations of the precursor of amphibia but as a form of modification which is due to the persistence of a larval state. They must be used in phylogenetic speculation with considerable caution and only in a general way. They cannot be fairly expected

to stand a rigid test in detail for such a purpose. A comparison of the structure of Anura and Urodeles must always take this into account.

5. In spite of these great differences and allowing for the practical absence of the cerebellum in Urodela there is remarkable correspondence not only with each other but with Reptilia in the actual fibre-connections.

6. The study of the fish brain is a good preparation for making out the amphibian problem.

7. The "projection system" theory of Meynert should be expanded. A more general theory of *neural concatenation* (no simpler term suggests itself) is nearer the truth. Chains of nervous translation may be affected between appropriate centres by the intercalation of as many neurons as may be necessary. There is no necessity for a physical continuum but a series of reciprocating elements is sufficient. The last stage in such a transformation is a perfect nerve fibre with shunted nuclei and continuous fibre. This is an expedient for rapid transit over long distances. The first stage in the series may be a slight reciprocal influence of parallel neurons through their processes. (See article page 11 of this volume.)

8. A physiological concomitant of this anatomical theory is that of *zygomorphism* which may be succinctly defined as the theory that when adjacent elements are brought into relations of mutual influence or one becomes a discharging agent for the other there is a tendency for the cells concerned to adjust themselves to each other. At first the result is interstitial change, later a closer connection is affected, and, still later, a polarity or actual rearrangement of the cell axes and, finally, a fusion and insulation may be developed by the transferring of the influence of the nuclei to the periphery and a change in the nutritive processes of the latter.

9. So far as our histological results are concerned we must confess their incompleteness but trust that enough has been suggested to indicate that the same structures (however obscured) exist in the frog as in higher vertebrates and that the gray matter is by no means so homogeneous as usually regarded. The

connection of the sensory niduli of the thalamus is on the one hand, with the cerebrum and, on the other, with the metencephalon.

The following *summary of tracts to and from the tectum* in reptiles should have appeared with the preceeding instalment. 1. Cephalic optic tract, covering the cephalo-lateral aspect of the tectum and passing to its superficial layers. 2. Caudal optic tract, passing along the caudal aspect, in a groove between the optic lobe and thalamus, to spread out upon the caudo-lateral and dorsal regions. 3. The cephalic optic brachium, collecting from the deeper layers and passing toward the cerebrum through the geniculata. 4. Caudal brachium, with a similar course. 5. Fibres of the Sylvian commissure, connecting the superficial layers of the two sides. 6. The lemniscus fibres, passing from the middle of the tectum to the lateral region of the medulla of the same side. 7. The descending mesencephalic tract, from the middle portions of the tectum directly caudad into the medulla. 8. The mesencephalic root of the trigeminal. 9. The coördinating oculomotor tract, which rises from the deepest regions of the cortex and passes in a slight curve through the raphe into close connection with the oculomotor nidulus. All of these are clear and unambiguous in reptiles as in fishes.

DESCRIPTION OF PLATES.

PLATE XV.

Figs. 1-3. Transections of the cerebrum of Menopoma, injected with gelatin through the heart.

Figs. 4-6. Three horizontal sections from the same species

Fig. 7. Perpendicular section of the cerebellum of a frog larva.

Figs. 8-9. Two horizontal sections of frog brain.

PLATE XVI.

Fig. 1. Transection of toad brain cephalad of chiasm. *prepar.* preparaphysis; *supr. c.* supracommissure tract on its way to rhinalis sinus in cerebrum; *x*, thalamic branch of commissure of habena? tract; *v. ped.* ventral or motor peduncle.

Fig. 2. Section of same brain at precommissure. *Hipp. c.* hippocampal commissure tract; *call.* callosal fibres; *striatum*, portion only of this body; *olf. radix*, fibres from the olfactory radix at point of division.

Fig. 3. Section of same brain in chiasm region; *Ep.* epiphysis; *H.* habena; *Inf. H.* infra-habena; *Meynrt. n.* Meynert's nidulus; *gen.* geniculatum externum, that portion forming a pseudo-epithelium at surface cephalad of optic tracts; *subth.* probably homologue of internal geniculata grouped with others as subthalamicus niduli; *vp.* ventral peduncles; *inf.* infracommissural fibres; *x,* ventricular gray.

Figs. 4-7. Sections from frog brain at different levels; *nid. V.* mesencephalic nidulus of trigeminus; *ped. nid.* peduncular nidulus or accessory nidulus of the third nerve; *corp. p.* corpus posterior; *Med. ped. cer.* middle peduncle of cerebellum which decussates after exit from the outer layer of the cerebellum and passes through and about the corpus posterior and, passing cephaloventrad, enters the ventral peduncular region, losing itself in the locus niger; *Lem.* lemniscus tract, fibres which pass from the inner fibre layer of the tectum to a region near the exit of the fifth nerve.

Fig. 8. Cells from the nidulus ruber. The fibres seen are from the commissura horizontalis.

Fig. 9. Longitudinal section of frog brain. Compare Plate XVII; *lat. tub.* lateral expansion or lobe of the olfactory tuber, near which the radix originates; *corp. dent.* the dentate nidulus.

Fig. 10. A similar section well mesad; *infh.* infra-habena nidulus; *Meyn. n.* Meynert's nidulus; *Br.* brachium; *inf.* infundibulum region or tuber cinereum; *x,* thalamic nidulus in the peduncle bundle.

Fig. 11. Cell from the intra-ventricular lobe of frog.

Fig. 12. Portion of the gray matter of the cerebrum of a toad about the cephalic end of the olfactory radix.

Fig. 13. Result of injection of Menopoma brain, fine meshwork of the gelatin emerging from blood-vessles. Are the cavities pre-existant or is this structure simply due to the peculiar texture?

PLATE XVII.

A series of longitudinal sections of the brain of the frog. *B.p.g.* Basal peduncular ganglion or part of striatum with fibres of the ventral peduncles; *Olf. n* olfactory nerve; *gl.* glomerulary layer; *gang. ol.* specific ganglia of olfactory tuber; *Chias.* chiasm; *Mamm.* mammillary body; *Supr. c.* supracommissure *M. n.* Meynert's nidulus; *Gen.* geniculatum; *n. o. p.* nidulus of the post optic region in the course of the ventral peduncles; *Corp. forn.* corpus fornicis; *Br.* brachial tracts; *tr. opt. ceph.* cephalic optic tract; *tr. opt. caud.* caudal optic tract; *P. c., Post. c.* postcommissure; *Sylv. c.* Sylvian commissure or tectum commissure; *d. l. f.* dorsal longitudinal fasciculus; *Hyph.* hypophysis; *Dors. ped.* sensory or dorsal peduncles; *Pre. o. c.* 1. and *Pre. o. c.* 2 Preoptic cinerea in two portions separated by a tract or space; *Pre. o. n.* preoptic nidulus. The series is from a lateral level to the centre.

PLATE XVIII.

Figs. 1-8. A series of horizontal sections through the brain of Necturus. Hæmatoxylin preparations.

Fig. 1. Section at the level of the supracommissure. *Prepar.* preparaphy-

sis; *Postpar.* postparaphysis; *Com. hab.* commissure of the habena; *Epiph.* epiphysis.

Fig. 2. Portion of a section, somewhat farther ventrad, enlarged, showing the two commissures of the habena.

Fig. 3. *Meyn. B.* Meynert's bundle; *Plex.* auliplexus; *Post. c.* postcommissure; *Br.* brachial tract.

Fig. 4. Section still ventrad.

Fig. 5. *com. horiz.* commissura horizontalis; *Mes. n.* V. mesencephalic nidulus of the trigeminus; *fimb.* fimbria.

Fig. 6. *Corp. forn.* Corpus fornicis; *Supra. tr.* supracommissure tract passing to cerebrum; *C. transv.* commissura transversa; *Lemn.* lemniscus.

Fig. 7. Section near ventral part of hippocampal lobe.

Fig. 8. Cells from region of ventricle adjoining the nidulus niger.

Fig. 9. Corpus posterior (left side) in frog. The arrow indicates cephalic direction.

PLATE XX.

Details of Histology of Reptiles and Amphibians.

Fig. 1. A portion of the hippocampal region of Necturus. Horizontal section (5-1), right hemisphere. The arrow indicates the direction of the fornix commissure.

Fig. 2. Olfactory cells from perpendicular section of olfactory tuber of the frog.

Fig. 3. Olfactory neuron and connection with glomerule (*glom.*)

Fig. 4. Hippocampal region of frog from a perpendicular section (7-6).

Fig. 5. Mid-cortex region of frog from perpendicular section (4).

Fig. 6. Perpendicular section of cerebellum of the turtle (*Cistudo*).

Fig. 7. Cells from a perpendicular section of cerebellum of frog

Fig. 8. Similar cells from horizontal section showing dissimilarity of adjacent cells. Due probably to differential functioning.

Fig. 9. Longitudinal section of cerebellum of black snake (13).

Fig. 10. Cells from the nidulus niger of frog. Arrow indicates ventral direction. From a perpendicular section.

Fig. 11. Cells of same region (3) Fig. a.

Fig. 12. Cells from thalamic niduli of frog from which arise infracommissure fibres.

Fig. 13. Cells from hippocampus of black snake (13-14.

REPORT UPON THE PATHOLOGY OF A CASE OF GENERAL PARALYSIS.

By C. L. Herrick, Professor of Biology at Denison University.

Note of Transmissal.*

Dr. A. B. Richardson, Superintendent of the State Hospital for the Insane, Columbus, Ohio,

Dear Sir: In pursuance of your suggestion, a microscopical examination has been made of the specimens placed in my hands with results which are detailed beyond. While the history of the case, as you informed me, warranted us in expecting only the usual lesions of general paralysis incident upon alcoholism it was thought worth while to not simply make such examination as should detect the expected lesions but to make the study extended enough to afford a somewhat complete picture of the diseased brain as a whole. Circumstances have prevented the completion of the task in the way at first contemplated. The employment of the slow and tedious fibre-stain methods was rendered impossible by pressure of work immediately upon reception of the specimen. The present paper is devoted almost exclusively to the cells of the various portions of the brain. It is thought that what we now need is the collection of minute, detailed data presenting the facies of a pathological state in its entirety and we have accordingly presented illustrations of the various regions even where involving some repetition and, in order to make the account more generally useful, some historical and physiological suggestions are added. Unexpectedly the distribution of the degenerated structures has thrown incidental light upon an important morphological problem, reenforcing generalizations derived from the comparative realm.

Hoping that the paper, imperfect as it is, may serve its purpose in preparing the way for more systematic and useful work in the same direction.

I am yours respectfully,

C. L. Herrick.

---

*Simultaneously appearing as Pathological Bulletin, No. 1, of the Columbus State Hospital for the Insane.

HISTORY.

Supplied by the Medical Corps of the Columbus Hospital for the Insane.

J—— W. S—— was admitted to this institution June 20th, 1891. He was a native of Ohio, forty years of age, a merchant and a man of good education. He had been addicted to the use of intoxicants for several years but was more temperate within the two or three previous to his admission. There was no history of specific disease and he had been a man of good character in his community and of active business habits. The mental symptoms began about six months previous to admission. When admitted he had delusions of grandeur and was becoming somewhat demented. He imagined he was quite wealthy and was anxious to run for the office of Governor or of President of the United States. His pupils were unequal, there was incoordination in gait and he had the characteristic defect in speech that marks the paretic. There was no history of insanity or nervous disease in his family and the cause assigned was financial trouble, of which he had had considerable. His intemperance was also in my opinion a cause. He continued an inmate of the institution until his death, which occurred Jan. 8th, 1893.

He became rapidly more demented and the paresis increased. His digestion was good during nearly all of the time and only failed him within the last month or two before his death. There was no evidence of focal lesion in a local paralysis and the disease pursued the characteristic history of general paralysis. I regret that the history is so meager, but while we could add illustrations of his delusions they would be of no value in a Pathological Bulletin. The previous history is difficult to secure, but there was nothing very characteristic in his life as far as we can discover. He was a man of active business habits and at one time was worth considerable property, but he lost it all, his reverses, in part at least, being due to his dissipation.

It is further stated that the first symptoms of motor enfeeblement were a slight speech disturbance, in the nature of a blurring of the articulation, and awkwarkness in the gait that denoted slight incoordination. These facts are significant inasmuch as it will be shown that the most seriously affected cortical areas are those in Broca's region and in adjacent parts, while still more serious lesions are located in the coordinating centers of the thalamus nnd mesencephalon. No sensory aura nor other disturbances, nor any visual, auditory, or olfactory hallucinations were detected. As it was not expected that a careful pathological investigation would be possible, no dynometric or aesthometric tests were made nor were systematic registrations of temperature or urine analyses attempted. *

NATURE OF THE DISEASE.

Mendel says of the etiology of progressive paralysis: "From the results there can remain no doubt that the essential thing is interstitial inflamation. The cell-multiplication, development of spider cells, the increased excretion of intercellular substance, these leave no doubt in this connection, and at the acme of the disease, according to my observation, the evidences of this inflamation are never absent."

"In acute paralysis the nucleary proliferation and the de-

*The following extract from a letter from Dr. Richardson received too late to be inserted in the proper place will be of interest:

"I have just learned a few facts in the history of J. S., whose case you are investigating, which may be of interest in case it is not too late to include them in the record. He was a man of more than usual business activity and conducted a mercantile business in a small town. He was always good hearted and indulgent and inclined for years to the use of intoxicants in moderate amount when with his friends. Through his indulgence to his friends his business became complicated during the years 1888 and 1889, and he was compelled to make an assignment about the close of the latter year. In the spring of 1890 he had an attack of La Grippe and after that never seemed as well as before, and was somewhat despondent. He grew worse that Fall and his disease began to change to a state of exaltation. He became talkative and excitable and enthusiastic over business, until finally, during the winter of 1890 and 1891, his actions velopment of spider cells is not great while they are replaced by the phenomena of hyperæmia of the vessels or stasis through the collection of blood corpuscles in the adventiva. In the very aged the preceding processes of irritation are only here and there to be noticed, or not at all; the general atrophy extends to include spider cells and granules." "The change in the cell bodies is, so far as our methods show, a secondary process, which in many cases can only be made out by microscopic observation, in a very limited extent, while in other cases, as above shown, producing a very remarkable alteration."

"Changes in the membranes are likewise, in the rule, secondary. . . . The pia as well as the dura, in most cases, is implicated through the disturbances in the circulation in the brain itself which react upon it, as well as through the progressive diseased condition of the vessels, From all these considerations I conclude that progressive paralysis is a diffuse interstitial cortical encephalitis resulting in brain atrophy.

"The beginning of the process is a transmigration of leucocytes and it is accompanied by an increase of the connective elements. The compression of the capillaries and of the small arteries through the accumulations in the adventitious sheath disturbs the regularity of the nutrition of the nervous elements,

---

became so unreasonable that he was adjudged insane and sent to the asylum. He remained there until about May of 1891, during which time he became more quiet and was finally taken home on a visit. In June of '91 while at home he had a sudden epileptiform seizure with hemiplegia on the right side, which, though not complete, lasted for about three weeks. His speech was much worse after this than before, and in August of the same year he had an attack of speechlessness lasting for a day or two, during which time he was entirely unable to talk. Soon after this he was returned to the asylum where he remained until his death and did not afterwards have any sudden attack nor any symptons of local paralysis. The history during this time we have heretofore narrated. There is no history of insanity in the family. During the four years previous to his death he did not drink any. In 1888 his only child became lost and the excitement and worry in the search for him was a severe shock to him and his friends were afraid at that time it would cause some mental trouble."

producing degeneration of the latter and finally leads to atrophy and shriveling."

Mendel suggests that the great diversity in the symptomology of general paralysis may be due to the existence of varieties with an interstitial and a parenchymatic origin.

The present case shows sufficiently well that the intensity of the degenerative process varies greatly in various regions. This is sufficient to account for great diversity in the facies of the disease. It would seem that there could be no limit to the range of variation where the slightest change in the seat of disturbance might interrupt a different set of channels of communication. Historically the opinions of the cause of the malady have varied between wide extremes. Meschede, in 1865, considered the alteration in the ganglion cells of primary importance and considered the disease a parenchymatous inflamation. Mangan, in 1866, described it as an interstitial encephalitis, while Rokitansky and, finally, Luys referred the trouble to the neuroglia; the latter called it diffuse interstitial sclerosis of the neuroglia.

It is not unnatural that vaso-motor changes should be appealed to as fundamentally important, as has been done by Obersteiner, Thompson and others, in fact it is difficult to see how the undoubted connection between mental strain, on the one hand, and vaso-motor disturbance of alcoholism on the other, with the degenerations of general paralysis is to be explained without admitting, via functional hyperæmia and temporary vaso-moter incordination, the graver and more permanent changes which should make way for morbid nutritive changes in the cells. If metabolism is altered by altered blood pressure it would be natural that other cellular elements besides the cortical cells should be modified. It would seem more rational to suppose that all the cellular structures in the region affected should feel the effects of vascular disturbance and react, each after its kind, while reciprocally modifying each other and thus the course of the disease. Instead then of drawing a distinction between interstitial and parenchymatous phases we may restrict ourselves to such practical classification in accordance with predisposing cause and the sequence of symptoms as shall most nearly correspond with the requirements of treatment. The prevailing unwillingness to recognize the great influence of alcoholism may account for the failure adequately to construe the influence of slight vascular disturbances if sufficiently long continued.

It will be gathered from our own observations that the facts seem hardly to bear out the statements of Hirt: "This view, according to which the atrophy is the primary process, is in all probability correct, though it is still combatted by many authorities (Mendel), who look upon the death of the nerve fibres as the secondary, upon the increase of the connective tissue, the thickening of the vessel walls and the appearance of spider cells as the primary process ('encephalitis interstitialis')." In the present case, however, the development of the spider cells, upon which Bevan Lewis, Mendel and others lay so much weight, is a very insignificant factor. The most important one seeming to be the involvement of the blood-vascular system and the greatest cellular modifications are seen in the motor co-ordinating centres of the axial lobe. Our case supports the view of Zeigler[1] that the phemomena of general paralysis are not uniformly inflamatory "but not rarely simply degenerative processes in the meninges and the cortex." He says: "Es erscheint danach die gestörte Ernährung und die Degeneration der Ganglienzellen und Nervenfasern als die wesentliche, und die entzündliche Infiltration und die Zunahme der fibrillären Stützsubstanz sind zwar für die anatomische Beurtheilung des Processes, nicht aber für die Krankheitssymptome von wesentlicher Bedeutung."

Mierzejewski and Voisin regard these spider cells and fibrous aggregates, which are not noticeable in some cases, as coagula of fibrin derived from homogeneous masses which may contain nuclei. It may be that diverse structures have been combined under this name. The "spider cells" which were

---

[1]Lehrbuch der Allgemeinen Pathologische Anatomie und Pathogenese, 4th Edit. 1885, p. 591.

sparingly present in this case may be of the character of a diffuse stroma. Ziegler says that the spider cells are frequently not increased in number but simply more conspicuous because of the atrophy of other parts of the cortex. The fact referred to by Lewis that representativeness is a function early lost in the course of general paralysis may have its anatomical explanation in the fact that slight sporadic changes would interfere with associational tracts (association being intimately connected with representation) before becoming sufficiently pronounced to interfere with the direct presentational processes of perception, etc. In fact, according to Tuczek, there is a marked primary atrophy of the fine medullated nerve fibres, particularly in the outer layers of the cortex, in the tangential "associational" fibres which run parallel to the surface. Friedmann describes four varieties of atrophy of the white matter and others have discovered secondary degeneration in the dorsal columns of the the cord. Our methods were selected with reference to the cells and, whether for this reason or because no genuine degeneration of the fibres had set in, only sparing and unimportant degenerations of white matter were encountered.

In determining the cause and nature of the circulatory changes preceding cerebral degeneration a thorough knowledge of the nature and reactions of the blood and lymph which fill the delicate cerebral organ as fluid fills a sponge is necessary. The brain is almost as really an erectile tissue as the pancreas and we already know enough to be convinced that slight changes in pressure may become the occasion for the rapid proliferation of the corpuscles and that the presence of small quantities of certain substances may greatly change the balance of the fluids in the capillaries, lymphatics and tissues. R. Heidenhain has conducted very elaborate investigations upon the lymph[1] and finds that there are lymphagogues or substances which increase the formation of the lymph. Various extracts of invertebrate muscles, egg albumen, peptone, etc., are

---

[1]Versuche und Fragen zur Lehre von der Lymphbilding. *Pflügers Archiv f. d. ges. Physiologie XLIX, p. 209.*

among the lymphagogues.[1] It is shown by experiment that in this case, as when sugar is injected into the veins, the capillaries exert a genuine secretory influence. In the latter case the blood is extracted from the tissues by the dehydrating action of the sugar. It seems probable that alcohol would operate in a similar way. There are many things which suggest that a sort of protoplasm poisoning is an early incident to the development of the circulatory changes preceding paralysis.

One must remember that even in the normal state the variations in metabolism find other expressions than in the form and reaction of the cells. Carazzoni[2] has shown that the ratio of solids in the cerebro-spinal fluids is greater in the morning than in the evening in the percentage of 135 to 100 and is more alkaline in the morning also. Substances injected into the abdominal cavity make their way into this fluid after half an hour or more which is, however, more slowly than their entrance into the blood or even the aqueous humor, as would be expected.

The theory that prevails to some extent in this country that the moderate use of alchohol serves to substitute to some extent for proteids in the diet has apparently been exploded by Minra's researches.[3] A slight increase of albumen is regarded as evidence that alcohol acts like chloroform as a protoplasm poisoning which may be expected as one of the incidents of early stages of the pathological condition now under consideration. (Cf. Heymans. Sur l'action toxique et antiseptique du chloroform etc., *Ann. Soc. med. Gand. 1892.*)

EXTERNAL CHANGES.

Macroscopically there was less alteration than might have been legitimately expected. Plate A. illustrates the appearance of the brain after the removal of the membranes. The membranes were slightly adherent but not closely enough to produce decortication upon their removal. The characteristic

---

[1] *Centralblatt f. Phys. 816.*

[2] *Centralblatt f. Phys. VI. 14.*

[3] Ueber die Bedeutung des Alkohols als Eweisssparer in der Ernährung des gesunden Menschen. *Zeitsch. f. Klin. Med. XX, 112.*

opalescence was noticed on the surface of the fresh brain and some hemorrhagic patches along the sulci. The cerebellum was superficially injected but section shows nothing abnormal in its deeper portions. The membranes themselves were thickened but there was no evidence of acute inflamation. The cortex itself appeared nearly normal but the sulci were more conspicuous than would be expected from the age of the subject. The atrophy was especially marked about the insula, fissure of Rolando and the tip of the temporal lobe and not noticeable in the occipital. A wax model made by the method of impregnation of the right hemisphere with Japan wax brought out the atrophy more clearly as the shrinkage incident to the method was more marked in the regions mentioned. The surface of the brain was minutely pitted throughout its extent. The figure sufficiently represents the configuration of the right hemisphere. The weight of the entire brain was about 58 oz., and there seemed to be an abnormal amount of ventricular fluid.

THE MEMBRANES

Circumstances have thus far prevented giving special attention to the meninges but, while somewhat thickened and adherent and while the surface of the brain when removed had the peculiar opalescent character so often described, the most noticeable changes are connected with the vessels. In the sinuses lying in the sulci great accumulation of leucocytes has taken place and the leucocytes fill the considerable space about the vessels and may be readily seen entering the brain and collecting at various levels below the surface. These changes are simply analogous to those which are taking place in the vessels within the cortex and, like the latter, point to an inflammatory condition.

In those regions in which the morbid changes are most marked the blood vessels are also greatly affected. The first characteristic of change is the increased number of white corpuscles and their transmigration into the surrounding tissue. There can be no doubt that normally this transmigration is continually taking place. The large pyramidal ganglion cells almost invariably have a certain number about their bases or active pole. They present a great variety of stages between the full, plump nuclei which have recently reached the cell and the dark, shriveled, exhausted cells which seem to have yielded their nourishment to the nerve cell. Whether as cause or effect, the condition of general paralysis is accompanied by an abnormal collection of leucocytes. These gather in great numbers in the space between the intima and adventiva of the vascular walls and thus narrow the lumen until a partial stasis of the red corpuscles results. Masses of yellow pigment accumulate in the adventitious sheath among the the leucocytes, sometimes in considerable quantities. These hæmatoid granules have been frequently noticed. This yellow pigment which collects in the adventitious sheaths of the blood vessels and elsewhere is doubtless derived from the red corpuscles, which are colorless in these cases. We are reminded of Mühlman's studies on the pigmentary metamorphosis of red corpuscles in the Arachnoid.[1] The yellow grains are found in the walls of the arachnoid vessels. They are not soluble in chlorform but, unlike fat, partially dissolve in sulphuric and nitric acids. Tests with sulphide of ammonia and potassium ferrocyanide demonstrate iron. The author supposes that the pigment formation is due to a state of irritation caused by pressure. They accumulate in the arachnoid because there the texture is so slight as to submit them to pressure. It might be supposed therefore, that the granules found so generally in the clogged capillaries of paralysis are due to a similar irritative cause.

THE CORTEX.

We may begin our examination by glancing at sections from the tip of the temporal lobe (middle convolution). The outer neuroglia layer differs little from that of the normal brain. A careful study shows, however, numerous so-called spider cells or scavengers, which here appear as multipolar bodies staining faintly and lying closely involved in the mesh-work of the neu-

[1]Zur Pigmentmetamorphose der rothen Blutkörperchen. Beobachtungen von der Arachnoides cerebralis. *Virchow's Arch.* (12) *VI, 1. p. 160.*

roglia (Fig. 9, Plate B). Opinion differs greatly as to the nature of these bodies, but from the sections before us one might conclude that they are essentially amœboid and their form depends upon that of the interstices in which they may happen to lie.

In the next succeding layer, that of small pyramids, the changes are not such as to attract the eye but we soon notice that a great number of the small pyramids have undergone more or less pigmentary degeneration. While their processes and form have altered little if any, small areas of degeneration are present in the protoplasm. Sometimes these areas are apparently but an extension of the normal pigmentation near the base and adjacent to the nucleus, but it quite as often happens that the area forms a rather sharply limited cyst in other parts of the cell. The pigmented areas refuse the stain and are recognized by their own brownish yellow color. Fig. 5, Plate B. is a cell from this region. In some cases the degenerated area causes a bulbous protrusion of the cell, yet the nucleus is not at all affected. In the third layer or region of medium pyramids the conditions are not much different but before one reaches the layer of large pyramids it appears that there has been a dispersion of granules which fill the whole field. It is the region of the ramification of small vessels. The larger radial vessels at this point give evidence of important morbid changes; the walls at first seem thickened but we soon see that the inner membrane or intima seems normal, but the outer or adventitious layer is gorged with leucocytes so that it occupies more space than the lumen. One frequent result is that the cavity is more or less occluded and the red corpuscles hence undergo degeneration. Their coloring matter collects among the white corpuscles forming hæmatoid masses. It seems improbable that this leaching is due to the reagents—in fact, this is a well-recognized pathological phenomenon. The smaller vessels are usually empty, as though by the cutting off of the source of supply. Fig. 8, Plate D, illustrates such a vessel as above described. See also Plate E. It will be remembered that Flemming[1] has shown that in the

[1]Ueber Theilung und Kernformen bei Leukocyten, etc. *Arch. für mikr. Anatom.* XXXVII. p 249.

extravascular leucocytes in salamander multiplication is by mitosis or nucleary cell-division. Löwit attempted to distinguish between erythroblastic and leucoblastic nuclei and claimed that mitosis occurs only in the erythroblasts, which are devoid of amœboid movements. Flemming, however, finds that mitosis is common in the amœboid leucoblasts and thus agrees with Müller, Bezzozero and Newmann. The author thinks it probable that fragmentating cells (i. e. amitotic elements) are in a state of decline and are incapable of reproduction. This may be compared with Frenzel's view that the cells reproducing by fragmentation are substituting and not constructive elements, as in the case of those cells in the mucous membrane which are to degenerate in the formation the mucous secretion. The nature of leucocyte proliferation in the brain should have careful study with modern methods.

In the layer of large pyramids the degenerative process is more conspicuous by reason of the larger size of the elements but no more general or relatively extensive. In the radial fibres we encounter here and there a phenomenon of which we find no mention elsewhere. Long deeply staining nuclei, resembling in color the leucocyte or "granule" nuclei, but many times as long as wide lie in the course of the fibre and seem to occupy the sheath. This is probably different from the varicose condition of the apex process sometimes encountered, Figs. 4, 5, Plate B. These bodies at times very closely resemble the nuclei of the intima of the vessels and must be carefully distinguished from these nuclei when greatly elongated in the finest capillaries. The color and appearance and the small diameter as well as the position of these bodies serve to prevent error. We incline to believe them characteristie of the degenerative condition as stated more in detail below.

The innermost cortical layer, that containing multipolar cells, offers no noteworthy peculiarity.

A typical motor region is found in No. 2, from the precentral or ascending frontal convolution. Here the nests of very large pyramids with long processes are eminently characteristic. Fig. 13 of Plate B. gives a good idea of these cells which are generally, though by no means universally, degenerate. The apical processes do not seem to be degenerate in any case and the atrophy of the protoplasm and fatty pigmentary degeneration at the base are the most malign symptoms. The smaller pyramidal cells of the ectal part of the cortex are generally intact. The usual alteration in the vessels occurs to a moderate extent. We do not encounter the enormous development of spider cells which Dr. Bevan Lewis considers characteristic of the disease.

In the region of Broca (Plate E, Fig. 1, No. 6) we are dealing with a motor area and encounter chiefly fatty or pigmentary degeneration of the cells. This change involves not only the deep pyramids but all the nerve cells to a greater or less extent. Figs. 2, 3, 7 and 12, Plate B., illustrate the varying phases of this degeneration. In Fig. 12 the cells are slightly altered while in Fig. 3. the degeneration appears in various parts of the cell causing a certain amount of deformation. Sometimes it is one of the basal processes while in others the apical process is occupied by the yellowish granular material. The nucleus is scarcely ever implicated. No changes of importance can be detected in the neuroglia or nutritive elements. Rarely we detect a degenerative fiber containing the serpentine bodies described above. Usually where one of a "nest" of motor pyramids is altered all of the cells are involved.

There seems to be no increase in the number of leucocytes about the injured pyramids—if anything, they are fewer than about the normal elements. There can be no doubt that these so-called "granules" are identical with those which under pathological conditions (congestion) pass through the vascular walls in such incredible numbers. It is a question of some importance to decide whether the proliferation of leucocytes take place within the vessels or at large within the brain substance, or whether the multiplication goes on in the usual sources and the accumulation in the perivascular spaces is due to a kind of retardation incident to impaired vitality of the brain. Our own observations thus far point to amitotic proliferation in the adventitions sheaths.

In none of these sections do we find any extensive muliplication of what Bevan Lewis calls the lymph-connective element. The pale corpuscles with flask-shaped faintly staining bodies are no more numerous than in the healthy brain. Occasionally the cell-body is shrunken, as a result of which the processes, which are originally very numerous, became more conspicuous. Golgi staining and our hæmatoxylin process seem to show that these cells are always supplied with an enormous system of processes whose terminal brushes often collect about blood vessels and other cells.

We venture to quote somewhat at length from Bevan Lewis respecting the lymph-connective elements or spider cells, (scavenger cells.)

"The cells which are usually called 'glia cells,' or what we have, in our anatomical section, alluded to as the 'flask-shaped elements' of the neuroglia, undergo a wondrous transformation, the real significance of which does not appear to have been hitherto appreciated. . . . These elements are small flask-shaped cells with a comparatively large nucleus at their greater extremity, which latter stains faintly with aniline-black, whilst the protoplasm of the cell itself remains unstained, and so delicate as to be recognized with difficulty in healthy states. Each has a connection by a delicate process with a neighboring blood vessel, and in frozen sections fresh examined, exhibits several branches so fragile and so excessively delicate, as to be seen only after a keen search, as they remain wholly unstained by reagents. In the morbid change to which we now allude, these flask-shaped cells enlarge very considerably into great amœboid masses of protoplasm, often exhibiting subdivision of the nucleus; and, what is of great import, their protoplasm *now stains deeply* with aniline, though not so intensely as their nuclei. From this extraordinary cell of protean form radiate on all sides numerous branching fibrils, forming an intricate and delicate network around it as a centre, all of which branches even to their most delicate subdivisions are readily stained by the same reagent. These cells have been termed Deiter's cells; they are all characterized by the presence of a vascular process; but well prepared specimens show not one, but often several, such processes distinguished by their greater diameter, their deep staining, and their termination in a nucleated mass of protoplasm upon the walls of a blood vessel."

The protoplasm of these cells is said to stain in abnormal states but not in normal, because in the former case there is an unnaturally increased vitality. They are said to spread throughout the neuroglia framework and multiply by nucleary subdivision and segmentation of the cell mass. The last stage in the development of these bodies is one of fibrillation in which the cell is exhausted by ramifying into innumerable fibrillary processes. As elsewhere stated, we are inclined to believe that these are truly nervous elements which become more accessible to stain as they shrivel. Proper methods demonstate richly branching processes even during health.

In the region of the hippocampus the evidences of morbid activity are fewer than in cortical motor areas, yet there are regions where profound alterations have taken place. There are many cases where the pigment degeneration is discoverable but the process has not gone far enough to implicate a large part of the protoplasm. The degeneration manifests itself here in the alteration of the fibres. These are large and distinct and even in our somewhat imperfect specimens the apical processes are seen to be shriveled and altered. One evidence of the change is seen in the remarkable vermiform or rod-like granules which lie upon or within the process or in the more distant part of the fibres. These are well-shown on Plate D Fig. 6 and Fig. 7 These vary from short ovoid to rod-shaped or long wormlike. It has not been possible to find a description of these bodies but we venture to suggest that they are the elongated nuclei of leucocytes or scavengers which have penetrated the sheath in pursuit of the decomposing protoplasm of the fibre. The reasons for this asumption are, 1. that the least modified of these bodies closely resemble the phagocytes, 2. no other source for these bodies is suggested, 3. analogy suggests that some means of disposing of the obviously decomposing processes, where as large as in this case, must be found.

Sections have been made from the most caudal part of the occipital lobe and show that, as usual, the purely sensory regions are not implicated. The cortex is almost wholly unaltered and, whereas the sections in the motor regions stained slowly and imperfectly with ordinary reagents, here the stain is well differentiated and uniformly operative.

THE BASAL REGIONS.

The histological changes of general paralysis are typically, if not exclusively, those of the cortex, and particularly of its cells. The references to the degenerative effects in the great ganglia of the axial portion of the brain are, so far as my observation has gone, very scanty. Mendel says: "Aside from the described changes, which occur chiefly in the cortex and adjacent parts of the white substance, which may, however, occur, though to much less extent, in the large ganglia (an atrophic condition is here developed only after paralysis of long duration and extensive laming), there may be observed the greatest variety of focal lesions in paralytics."

The peduncles have been found to be degenerated in a few cases (Huguenin), in one case the gray degeneration of the dorsal fasciculi could be traced from thalamus to the cauda equina and in the motor peduncles and pyramids, extended to the oculomotor region.

A section through the very cephalic portion of the thalamus shows that its small cells are but slightly affected while the somewhat larger multipolar cells scattered in the striatum at the same level are thoroughly implicated. Passing caudad, the thalamus retains the same general character though increasing to form a large quandrangular area (*Fig. 1 a, Plate D.*). Around the margins, near the peduncular fibres there are small multipolar cells which are greatly altered. These cells are like those figured on Plate D, figure 5, which are from *x* in *Fig. 1* of the same plate. They are larger than the cells of the thalamus proper.

For a study of the striatum we may select a portion of a section corresponding to "B" of the Pitres-Nothnagel's series

(Hirt's Diseases of the Brain, p. 197). Ectad of the internal capsule, which evinces no alteration that can be detected by the means here employed, is the head of the caudatum, consisting of a stroma of densely nucleated matter and sporadic fibre bundles. There is almost absolutely no alteration in the substance of either caudatum or lenticulare at this level. We may add that the present tendency to attribute important psychical functions to the striatum has as little anatomical foundation as psychological significance. By far the largest part of the striata is composed of sporadic bundles from the capsule. The vessels of the striatum are nearly normal. The lesion is decidedly cortical. A series of sections through the peduncular region is of special interest as showing that in this segment the degeneration is limited to the motor projection system. The cells of the tectum and niduli of the cephalic quadrigemina, as well as of the ruber, are scarcely modified at all. The nidulus of the oculo-motor is quite unaffected. There are slight changes in the pulvinar and other niduli of the thalamus, but when we turn to the vicinity of the motor peduncle fibres we encounter most conspicuous evidence of degeneration. The large and complicated nidulus niger, including the most remarkable cells of the mesencephalon is almost completely altered. These cells, which hug the ental margin of the peduncles and form the boundary between tegmentum and crusta are not only of enormous size, but by reason of the great extent of their processes they stand out among the elements of the brain. In a series of papers[1] the author has endeavored to follow the homologies of the nidulus throughout the veretebrate phylum. It has proven possible to trace the relation between the pecular cells, which are not easily mistaken for any other cells in the brain, from fishes to mammals. The development of the nidulus niger or Soemmering's nidulus stands in close ratio with that of the cerebellum. In fishes the ventral peduncular fibres, which can hardly be other than the

[1] Contributions to the Morphology of the Brain of Bony Fishes, Journ. Comp. Neurology, Vol. II. Notes upon the Histology of the Central Nervous System of Vertebrates. *Festschrift zum siebenzigsten Geburtstags Leuckart's; Anat. Anzeiger*, VII, 13, 14.

motor tracts, come into intimate association with cells which in form and relations seem to be homologous with the niger cells (i. e., cells in hypoaria). The cerebellar tract also enters into relation with this nidulus. Following this clue we trace the same relation in all the higher groups. It seems safe to affirm that the site of motor association with the cerebellum is in this cell-clustre. It need not surprise us that in a disease which is due primarily to a disturbance of the cortex and notably the motor-cortex, the projection centres of the centrifugal tracts should be especially injured. It seems to amount to an incidental confirmation of our anatomical observation and physiological theory that the nidulus niger is the only region of the mesencephalon in which pronounced indications of degeneration are observed. The nidulus extends from the exit of the third nerve to the point where the peduncles enter the striatum and throughout its entire extent nearly every cell is more or less completely degenerate. In some cases the whole cell body is reduced to a vague patch of yellow granules, while in others bands or stripes of unaltered protoplasm remain. Frequently the incipient stages of decay are seen in a deep pigmentation near the nucleus or one process only is disorganized. The characteristic features of these degenerate cells are best gathered from the figures.

Plate D, Fig. 3, illustrates a niger cell far cephalad near *y* in *Fig. 1.* It well shows the two axis-cylinders of a switch cell. *Fig. 2,* is a portion of the same field with cells in various stages of degeneration. One cell especially illustrates the rare condition where a bulbous swelling occurs upon a process. In some cases the nucleus itself has suffered partial destruction. *Fig. 4,* contains two unaltered cells giving a good idea of the various processes though the finer ramifications of the protoplasmic processes are not bought out. *Figs. 3* and *4,* of *Plate C,* illustrate the changes seen in the same nidulus at the level of the third nidulus.

Figs. 1 are *2* and portions of transverse sections at the level of the pulvinar and third nidulus respectively, for orientation. Both are figures of actual sections from which *Figs. 3* and *4* were drawn.

THE CEREBELLUM.

The cerebellum, although somewhat isolated from the real centre of morbid activity, might be expected to be involved with other portions of the brain. The vessels of the meninges are only slightly modified and the intrinsic capillaries not at all. The only way in which the extensive changes in the basal ganglia of the fore-brain could react indirectly on the cerebellar structures would seem to be through an atrophy of disuse. While the ganglia in the motor tracts bear unmistakable evidence of extreme degeneration it would seem quite improbable that an extensive atrophy should have had time to develop itself. It will be remembered that (in our view) the axis cylinders of the Purkinje cells passes directly into the restiformia, while the peripheral or protoplasmic processes afford opportunity for association by contiguity with the fibres of the mid-peduncles of the cerebellum which on their part may connect with the cells of the basal ganglia.

Since, then, the relations are very indirect, we should not be surprised to find the cerebellum normal in the absence of irritating causes in the organ itself. The cerebellum can hardly be subject to as rapid alterations in blood pressure as the cerebrum and contains within itself a large stock of reserve nutrient material. Careful examination reveals only a few cases where the cells of Purkinje have some traces of the fatty degeneration seen elsewhere (*Fig. 5, Plate C.*) Most of the lobules are normal, but occasionally there is one of the folia in which there is extensive atrophy of the cells of Purkinje. *Fig. 4, Plate E,* illustrates such an instance. In the sections wherein ordinarily a score or more of cells should stand, only one or two isolated cells remain. There is no notable degeneration in the other structures, but the space which should contain these bodies is empty or contains shriveled remnants. In these cases it might appear that the change was the result of early stages of the disease.

In the unaltered Purkinje's the structure is well preserved

(*Fig. 5, Plate E,*) and the adjacent elements are intact. Although this is perhaps not the place to discuss morphological questions we may call attention to the fact that the radial elements with fusiform cellular dilatations (*Fig. 3 a*) are apparently remnants of the spongioblast system, as may be gathered by a comparison with lower vertebrates.

THE MEDULLA.

It is unfortunate for our purpose that the medulla of the specimen was ruined during removal so that the important question as to the subordinate centres along the motor columns and particularly the condition of the vaso-motor centres remain unexamined.

THE CORD.

For a similar reason the cervical cord is not in a condition to report upon in detail. A number of sections from the cervical region show that the ventral cornua of the gray matter is very largely involved. The large ganglion cells are in some cases intact, but generally are more or less affected by the fatty degeneration. In some cases the entire cell is reduced to a mere sac filled with granules of a honey yellow color. These stages are illustrated in *Fig. 2, Plate E.*

No serious affection of the meninges or blood vessel is obvious from the specimen. If there is any secondary degeneration the only suggestion offered by our sections is a suffused condition of the crossed pyramidal tract of the lateral column. In the same region there is some gorgement of vessels and nucleary proliferation.

DESCRIPTION OF FIGURES.

PLATE A.

Lateral view of the right side of the brain drawn from the fresh specimen corrected by reference to the model subsequently prepared.

PLATE B.

Fig. 1. Pyramidal cortical cell and portion of a capillary vessel from frontal lobe (Plate E, Fig. 1, No. 4. The cell is but slighly altered. The vessel is in the first stage of degeneration. The granules are multiplying and escaping into the perivascular space.

Fig. 2. A group of cells from the layer of deep pyramids in Broca's region. An enormous cyst-like mass of pigmentary degeneration in one of the motor cells.

Fig. 3. Other cases of degenerated cells from Broca's region.

Fig. 4. A case of varicose alteration of the apical process.

Fig. 5. Similar instance from temporal lobe (No. 1).

Fig. 6. Incipient degeneration in a cell of the temporal lobe.

Fig. 7. Striking instance of pigmentary degeneration in Broca's region.

Fig. 8. Incipient degeneration of cell from frontal lobe.

Fig. 9. So-called scavenger cells from temporal lobe. The tangential fibres form the upper margin of the section.

Fig. 10. Deep pyramid of frontal lobe.

Fig. 11. Superficial pyramid of the same region.

Fig. 12. Three slightly altered large pyramids of Broca's region. The sole indication of the lesion is an increase in the pigment.

Fig. 13. Large Pyramids from Precentral convolution. (No. 2.)

PLATE C.

Fig. 1. Part of a transection through the cephalic corpora quadrigemina and pulvinar.

Fig. 2. Part of a similar section through the roots of the third nerve.

Figs. 3, 4. Degenerating cells of the nidulus niger from the sections above indicated.

Fig 5. Slightly altered cells of Purkinje from the cerebellar area shown in *Fig. 6.*

Fig. 6. Apparently normal cerebellar cortex. Compare with *Fig. 4,* Plate E.

PLATE D.

Fig. 1. Transection of left hemisphere through the thalamus and hippocamp.

Fig. 2. Forward extension of the niger beneath the thalamus at *y*, *Fig. 1.*

Fig. 3. Uninjured cells.

Fig. 4. Similar normal cells from the niger farther caudad.

Fig. 5. Smaller cells from dorsal region of the peduncles (*x*, *Fig. 1.*)

Figs. 6, 7. Cells from hippocamp showing certain amount of pigmentary degeneration and vermiform nuclei apparently attacking the fibres.

Fig. 8. A typical case of vascular degeneration. Nuclei accumulating in the adventiva and stasis of red corpuscles.

PLATE E.

Fig. 1. Diagram of front of left hemisphere to locate regions referred to in text. The shaded areas are portions actually sectioned.

Fig. 2. Cells from ventral cornu of the cord.

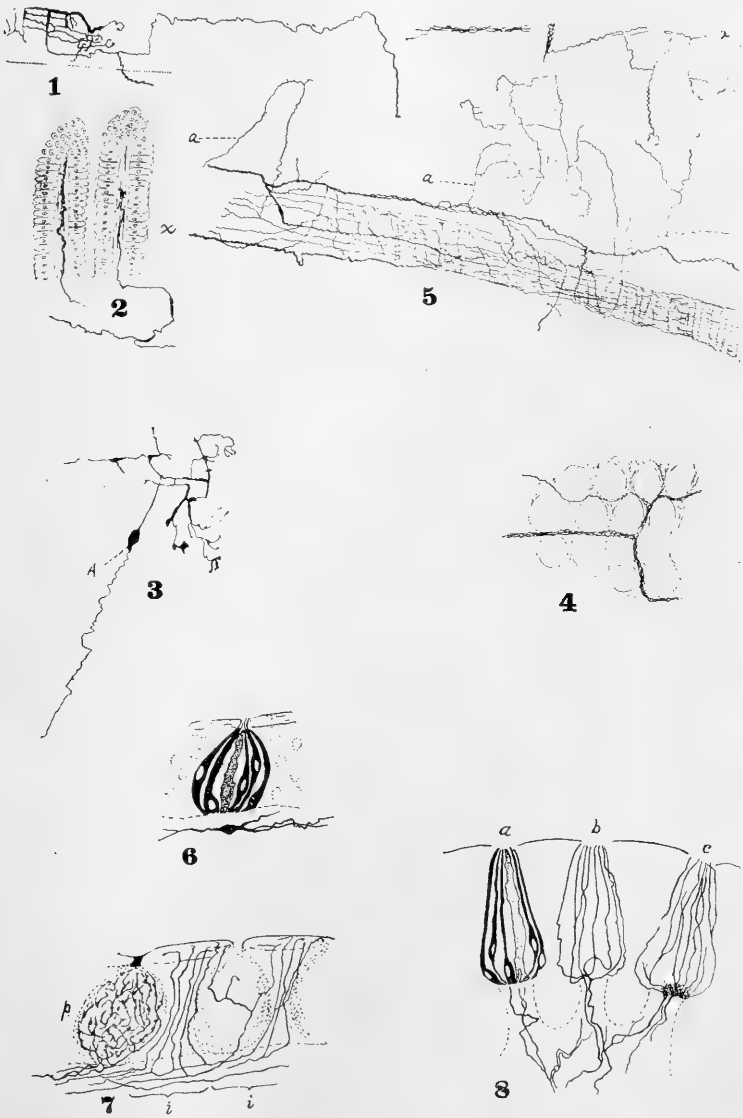
Fig. 3. Normal cells of Purkinje. *a*, spongioblast nuclei.

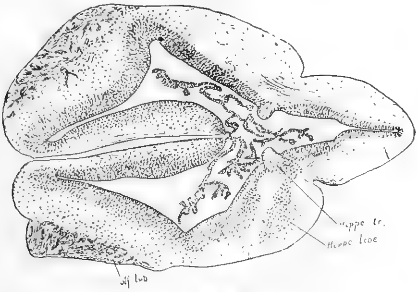
Fig. 4. Portion of cerebellar cortex where the cells have degenerated.

Fig. 5. Degenerate cells from temporal lobe.

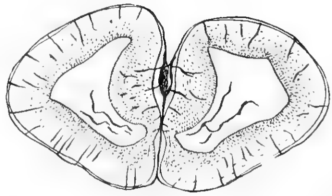
Fig. 6. Blood vessel where the intima has separated from the adventiva- The latter filled with corpuscles.

Fig. 7. Diseased cortex cells.

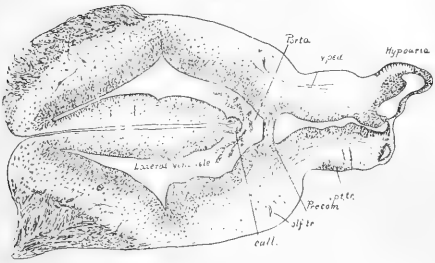

1
2
x
a
a
5
3
4
6
a
b
c
p
7
i
i
8


Hippoc tr.
Hippoc lobe
olf lob

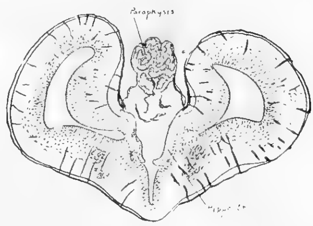
4



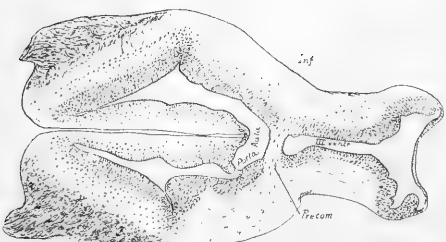
1


Porta
v.ped
Hypoaria
Lateral ventricle
opt tr
Precom
olf tr
call.

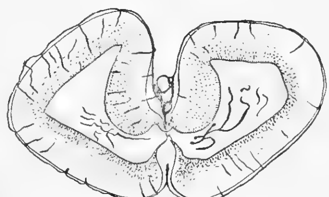
5


Paraphysis

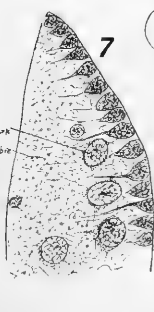
2


Inf
Aula
Porta
III ventr
Precom

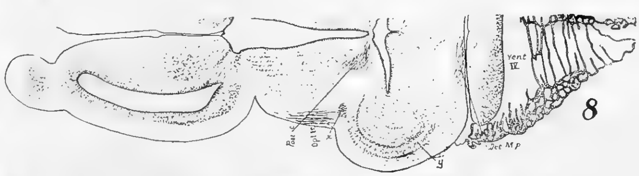
6



3


Purk
fibre

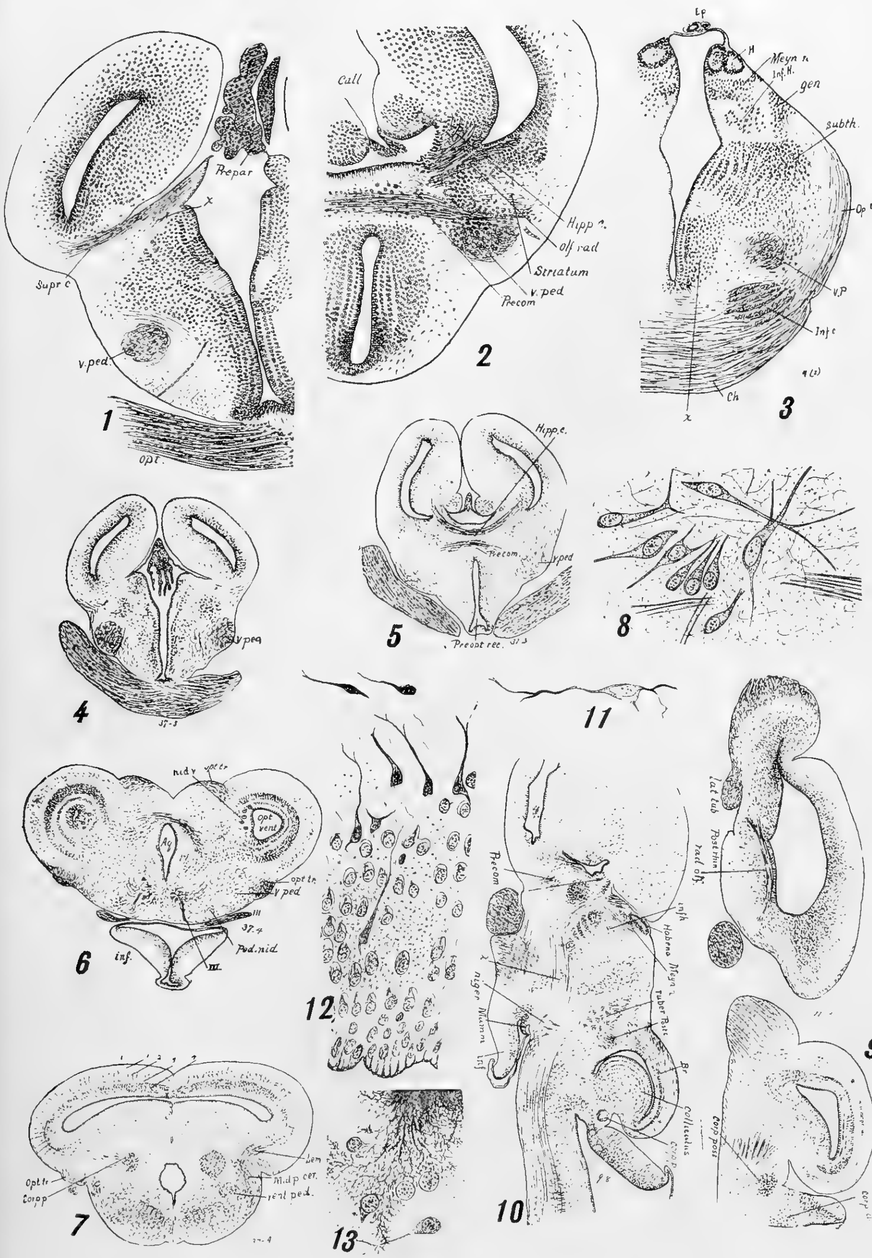
7

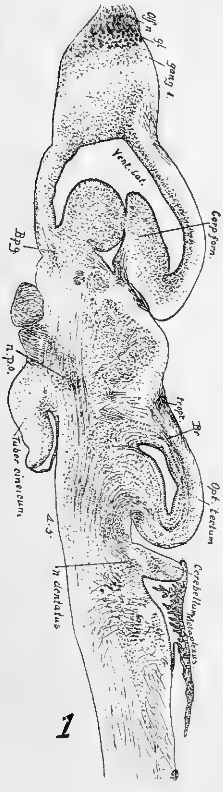

Vent IV
Post c
Opt tr
x
y
Dec M p

8

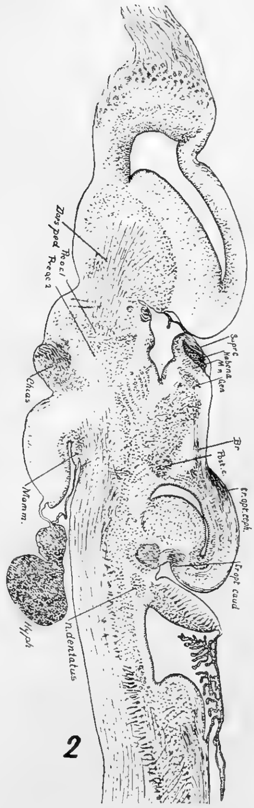

Chiasm

9

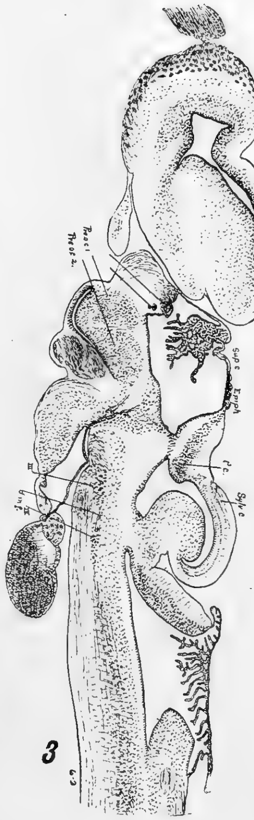



Olf n
gl
gang l.
Vent. lat.
Corp. strm.
Tuber cinereum
Opt. tectum
n dentatus
Cerebellum
Metaplexus

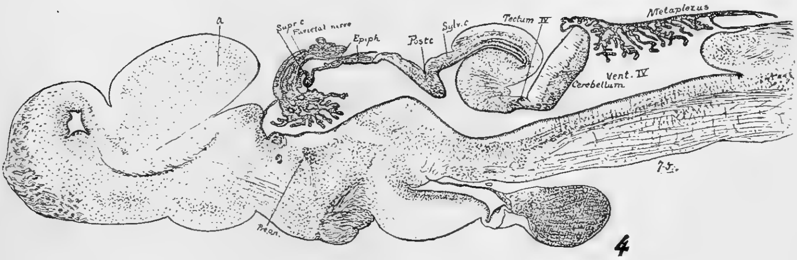
1


Chias
Mamm.
Hyph
n.dentatus
Br
Trop. caud

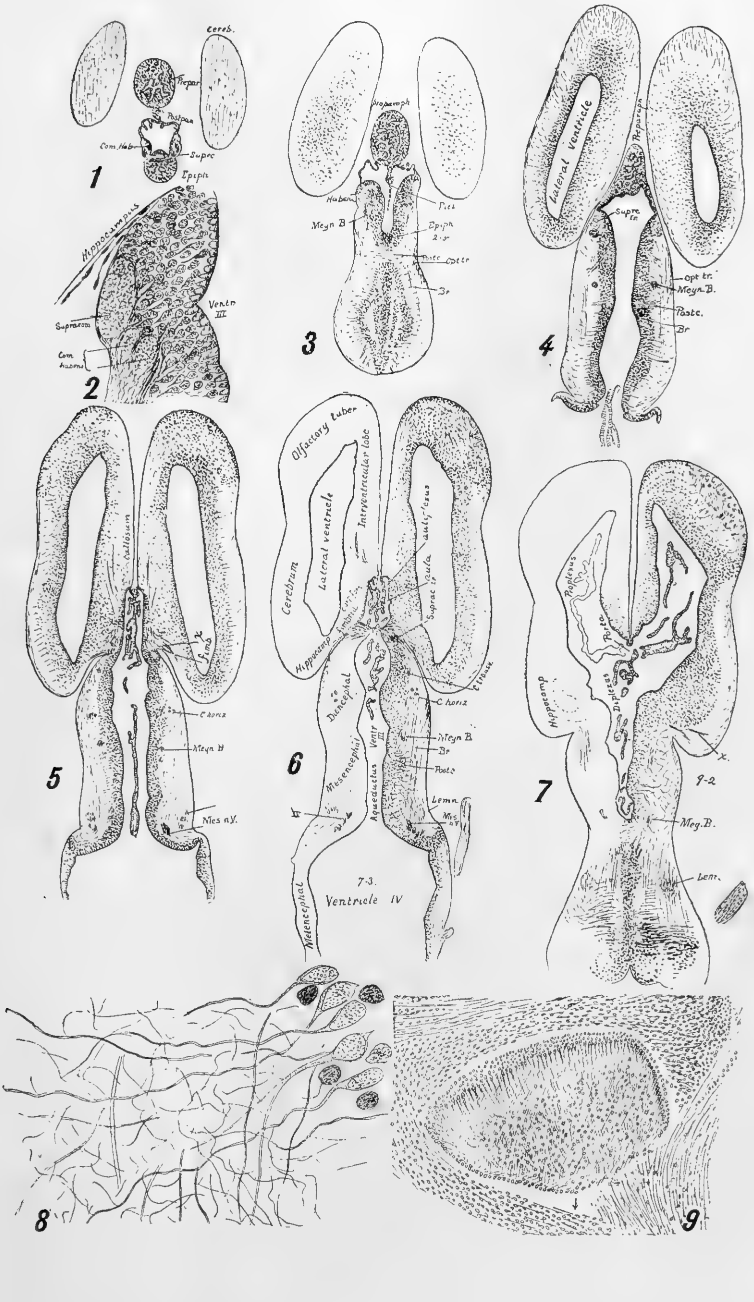
2

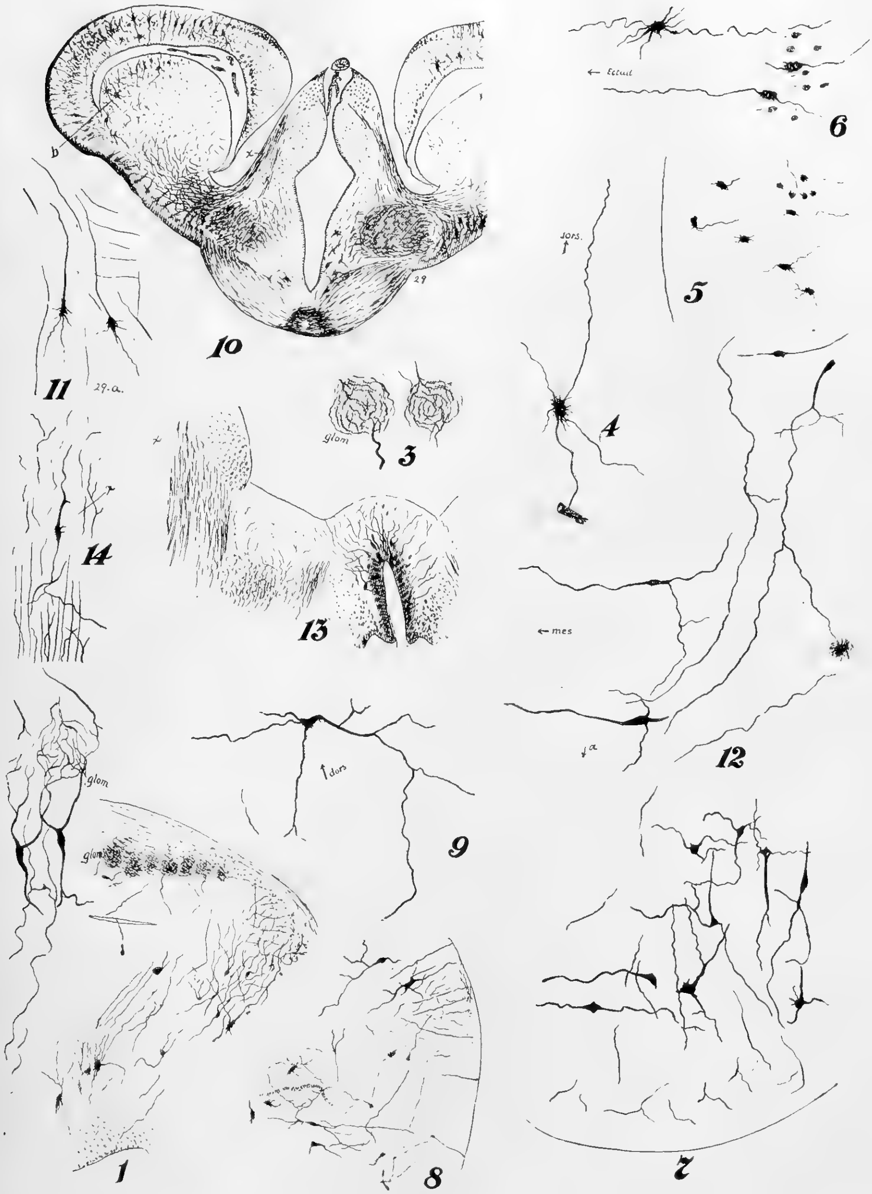

Epiph
Sylv c

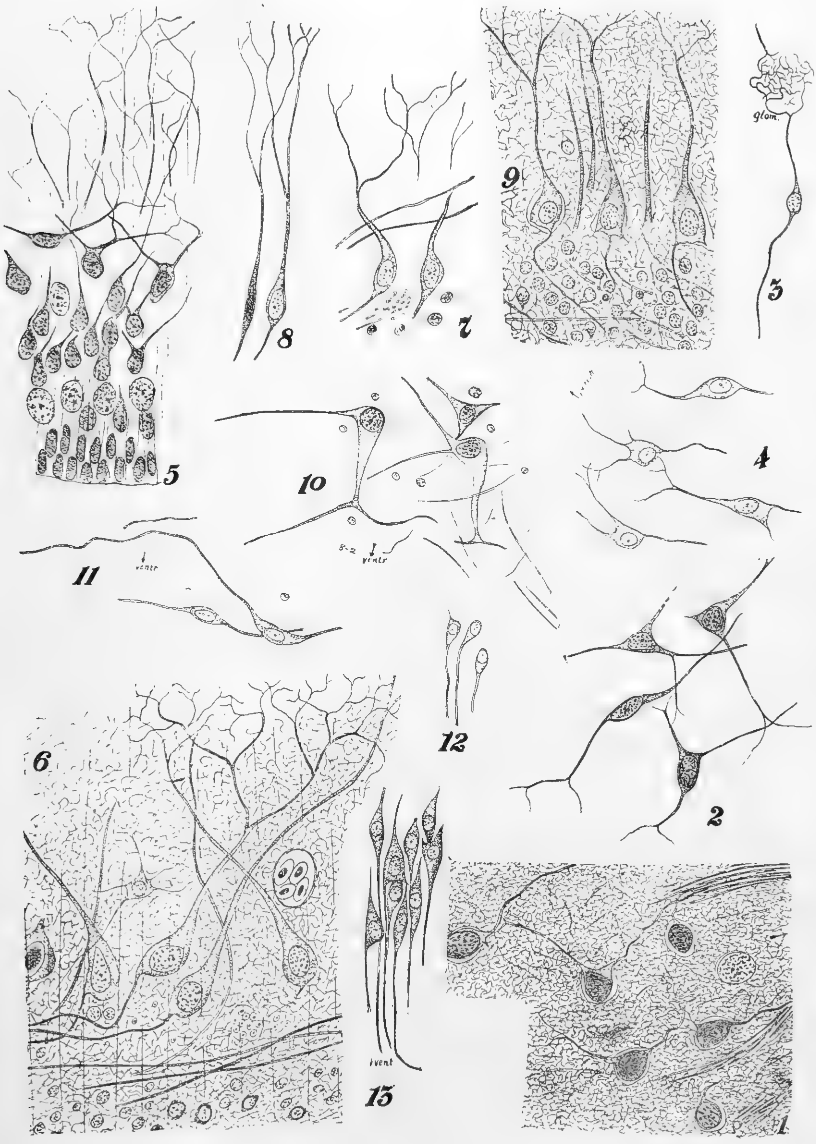
3


a
Supr c
Parietal nerve
Epiph
Post c
Sylv. c
Tectum IV
Metaplexus
Vent. IV
Cerebellum

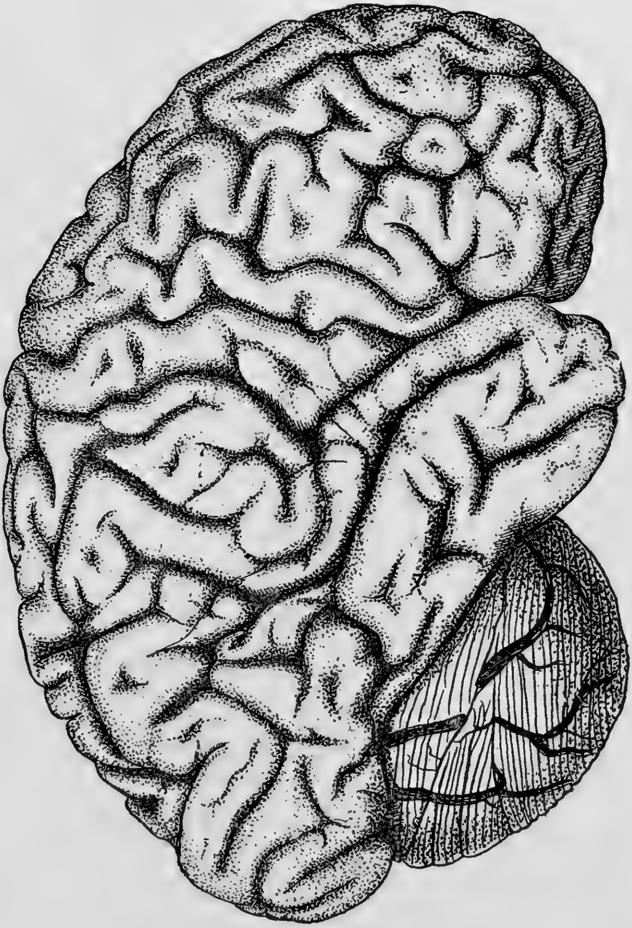
4

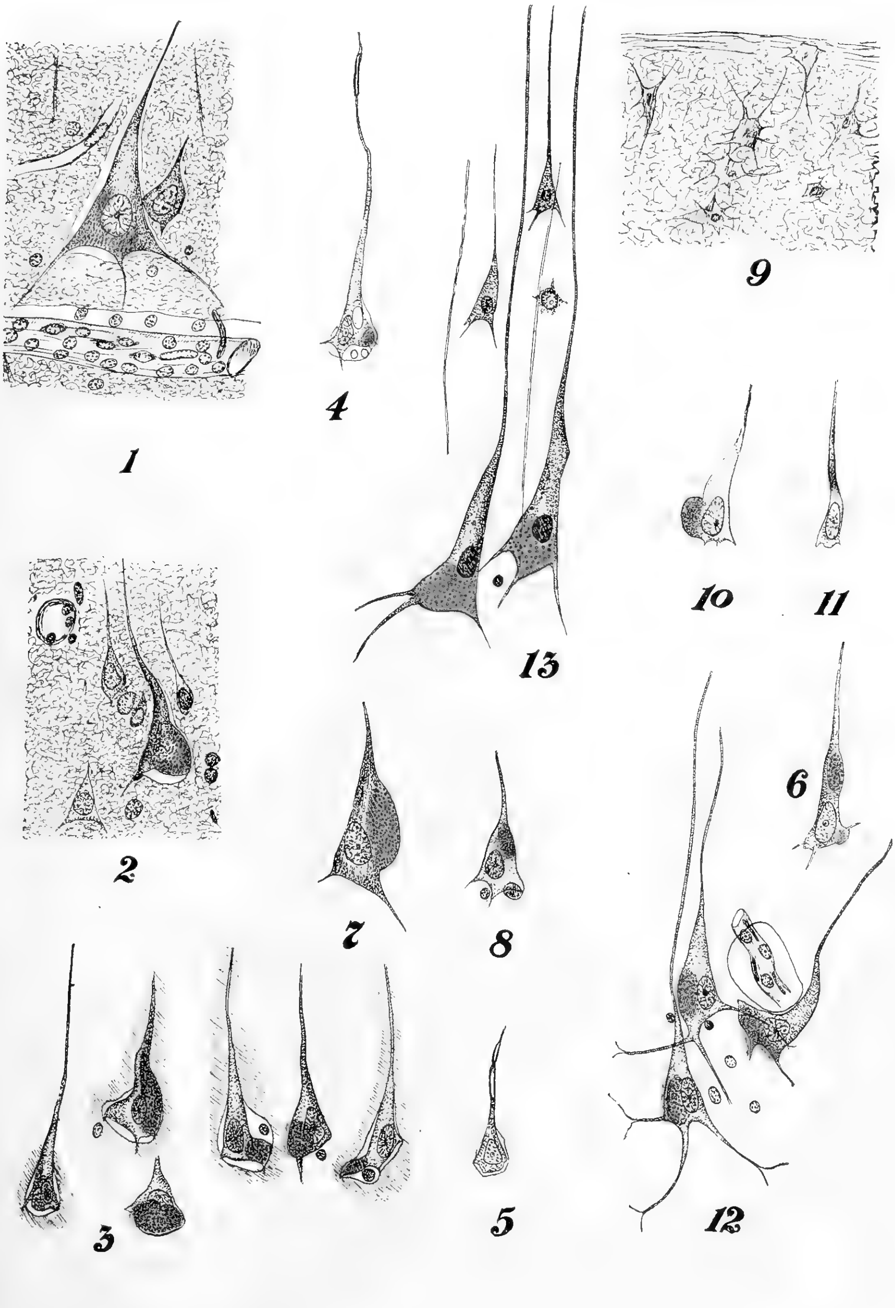

1
Cereb.
Prepar
Postpar
Com. Hab
Suprc
Epiph
2
Hippocampus
Ventr III
Supracom
Com haben
3
Praeparaph
Haben
Meyn B
Epiph
Postc
Br
4
Lateral Ventricle
Praeparaph
Suprc tr.
opt tr.
Meyn. B.
Postc.
Br
5
Callosum
Fimb
Choriz
Meyn B
Mes n V.
6
Olfactory tuber
Intraventricular lobe
Lateral ventricle
Cerebrum
Hippocamp
Fimbria
Aula
Diencephal
Mesencephal
Aqueductus
Ventr III
Choriz
Meyn B
Br
Postc
Lemn
Mes n V
7-3.
Ventricle IV
Metencephal
7
Hippocamp
Porta
Meg. B.
Lem.
9-2
8
9

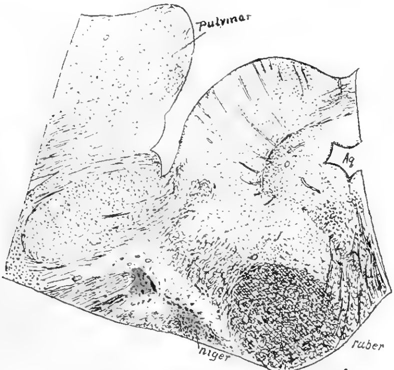

10
6
5
4
11
3
glom
14
13
12
9
dors
mes
glom
1
8
7



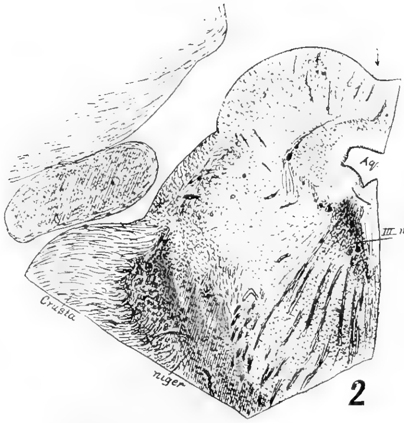
5
8
7
9
3
glom.
10
ventr
4
11
ventr
12
6
2
13
vent
1




1
2
3
4
5
6
7
8
9
10
11
12
13

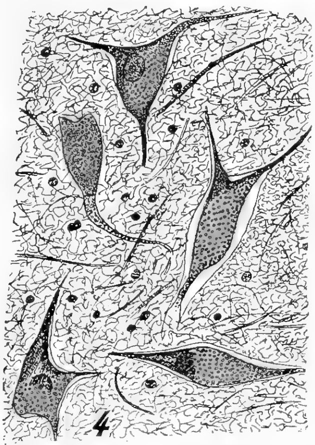


1

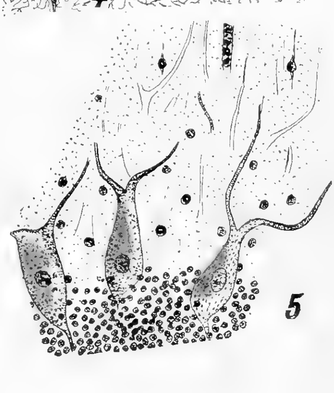


2

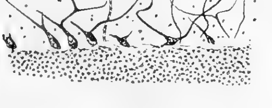
3



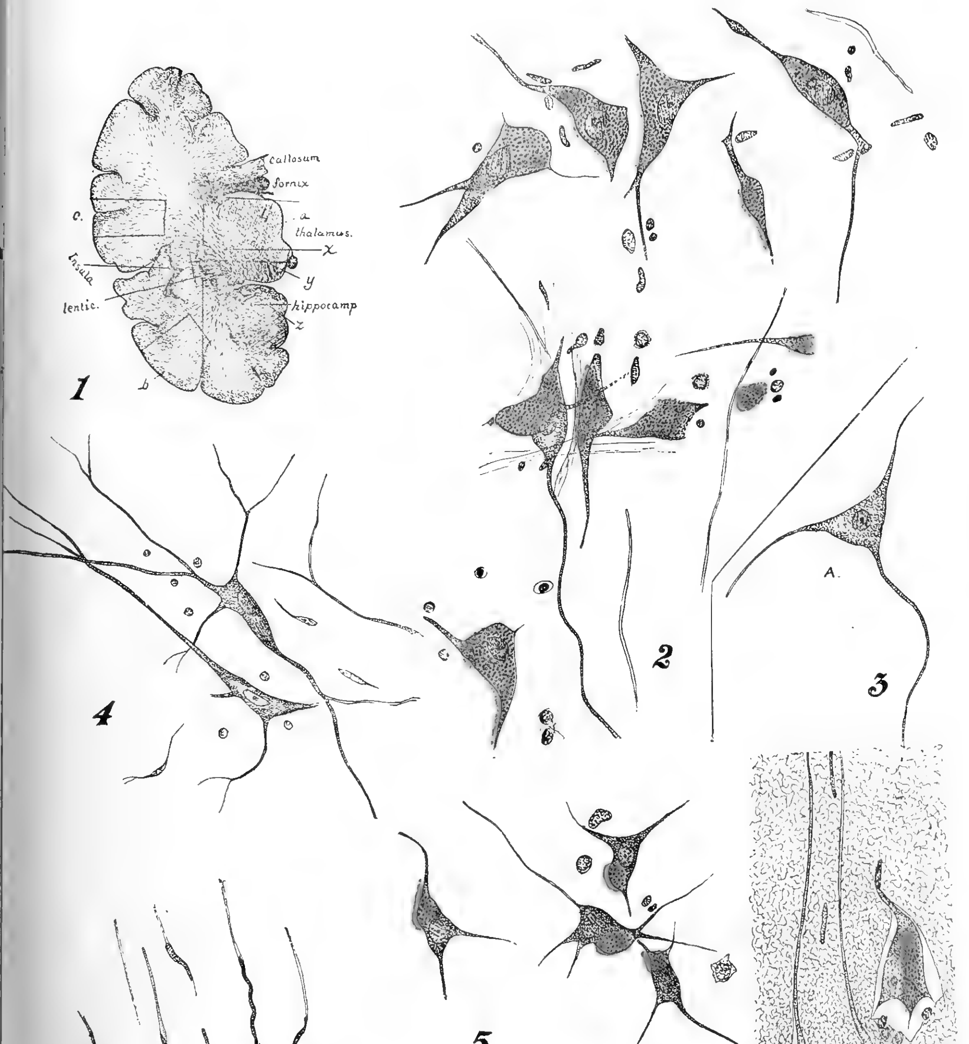
4

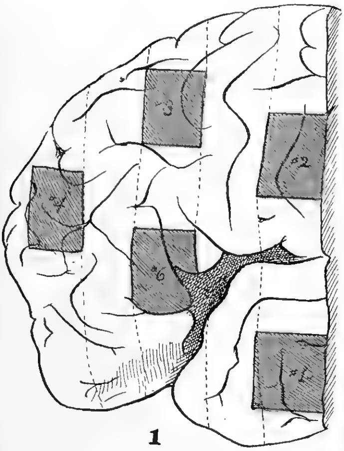


5

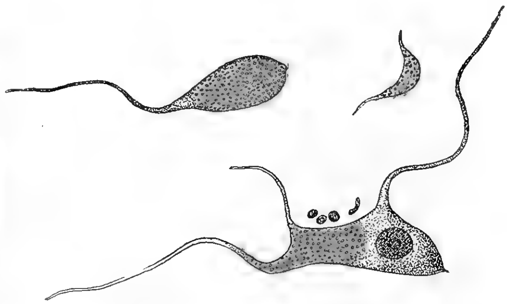


6

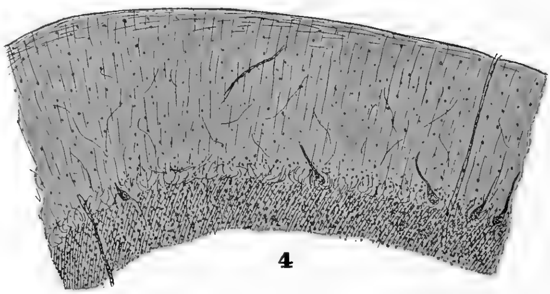

callosum
fornix
a
thalamus.
c.
x
insula
y
lentic.
hippocamp
z
b
1
A.
2
3
4
5
6
7
8



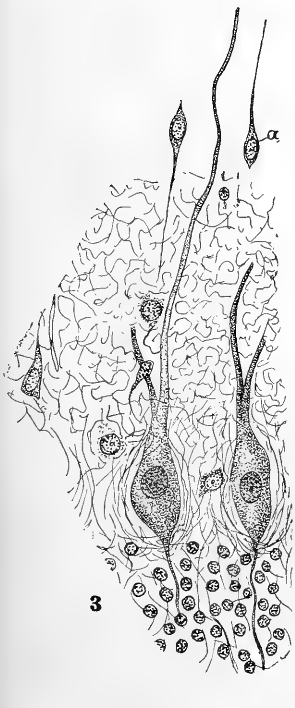
1



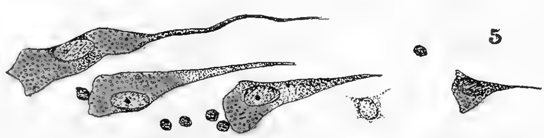
2



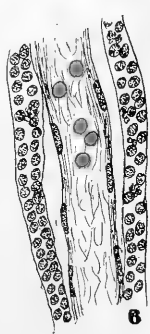
4



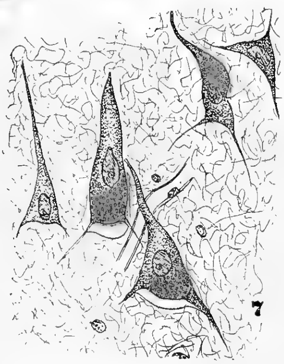
3



5



6



7

NOTE ON THE STRUCTURE AND THE DEVELOPMENT OF NERVOUS ELEMENTS.

By PAUL MITROPHANOW,
Professor in the University of Warsaw.

The question of the origin of the nerves, of their structure, and the character of the nervous endings in the sense organs was studied during the last year with special assiduity. In a recent session of the biological section of the Society of Naturalists in Warsaw I took occasion to indicate the investigations of Lenhossék[1] and Dohrn,[2] which seemed to alter essentially the opinions respecting the peripheral nervous system. A very important fact in these investigations is the part taken in the formation of the elements of the nervous system by the cutaneous integument—embryonic in vertebrates, but even in adults of invertebrates. But while Lenhossék sought simply to regard the cutaneous integument as the birth place of the sensory nervous cells and fibres, Dohrn attempted a revision of the doctrine of the nervous elements by demonstrating that the nervous fibre is a formation of many cells, that it is composed of a row of ectodermic cells, every one of which gives to the fibre its constituent parts: the axis cylinder, the envelops and the nucleus. He calls these cells nervous, wishing to distinguish them from the ganglionic ones which, according to his opinion, do not take any part in the formation of the nervous fibre, that is to say, of the axis cylinder, and are in connection with it only by contact.

Sometime since[3] I exposed the weak sides of Dohrn's position and the possible explanation of the facts from which he developed it. It was natural that I should expect a more par-

---

[1] M. LENHOSSEK. Ursprung, Verlauf und Endigung der Sensibeln Nervenfasern bei Lumbricus. *Arch. f. mikr. Anat.* XXXIX. 1892.

[2] A. DOHRN. Nervenfaser und Ganglienzelle. *Mittheilungen aus d. Zool. Station zu Neapel.* X, 1891.

[3] P. MITROPHANOW. Suggestions on the development of vertebrates. 1892.

ticular critique of this doctrine in the recent investigations, though it is scarcely to be expected on the part of Dohrn himself. However the new investigations of the embryos of Scyllium catulus of 13 mm. have revealed to him[4] the mistakes in his most essential observations and cast doubt upon the justness of his elaborately formulated theses. Opportunity did not afford for Kölliker to reply to the doctrine expressed in Dohrn's note, of which I speak, at the session of the Anatomical Society in Vienna for 1893.[5] Nevertheless, Kölliker has presented a refutation of the same doctrine on the part of Beard, and I am glad to say that his arguments are in many respects identical with those of my thesis,[6] which oblige me to differ from Maurer.[7]

This observer employing my observations on the origin of the lateral organs in the Selachia and Amphibia as a basis, considers the thickenings of the ectoderm, indicated by me, as germs of the nerves, which, in his opinion, are differentiated *in situ* from the elements of the ectoderm instead of entering it secondarily from the brain. He returns therefore to the standpoint of Dohrn. I have already shown whether it is well founded. He was not acquainted with my last work on the origin of the nerves and the formation of the lateral organs.

The contradiction pointed out by Maurer between his opinions and mine, relative to the development of the nervous lateral sense organs of the Amphibia, is due to the fact that he did not observe the difference which I established between the first origin of the nervous lateral sense organs and their new formation.

In the first case, as I have presented it (l. c. T. I. f. II,

---

[4] A. DOHRN. Die Schwann'sche Kerne der Selachierembryonen. *Anat. Anzeiger.* 12, 1892.

[5] A. KOLLIKER Ueber die Entwicklung der Elemente des Nervensystems contra Beard und Dohrn. *Ergaenzungsheft d. Anatom. Anz.* 1892.

[6] P. MITROPHANOW. (a) On the Organs of the Sixth Sense of Amphibians. (b) On the Nature of the Peripheral Nerve Endings. (c) On the Question of Peripheral Nerve Endings. 1887.

[7] F. MAURER. Hautsinnesorgane, Feder und Haaranlagen. *Morpholog. Jahrbuch.* XVIII. 1892.

T. III, f. 33, 34,) the elements of the lateral sense organ are more or less homogeneous, and Maurer insists on this; in the second, the difference between the central (sensory) and external (investing) cells becomes manifest (l. c. T. I, f. 2, 5, 6). Some cells, which form, according to my descriptions, the nervous lateral sense organs, have an entirely different significance from that attributed to them by Maurer; his opinion contradicts completely my conclusions as to the origin of the nervous lateral sense organs of the Amphibians. I have already had ocsion to give my standpoint concerning the nature of the sensory cells which Kölliker describes in the skin of the tadpole of the frog.[8]

The above mentioned investigations of Lenhossék do not change essentially the doctrine of the peripheral nervous system. His generalizations are not confirmed by his own later observations. In an article which appeared recently,[9] he concludes that the relations which he and Retzius have indicated in the skin of the earth-worm, do not exist in vertebrates in any other than the olfactory region. But even as to the last mentioned point, one of the most accurate investigators concludes very recently that the question of the connection of the olfactory cells with the nerves must be considered as open, although many observers make out this connection, relying on the method of Golgi.[10] A very original explanation is given by Goronowitsch,[11] for the processes which, until now, have been described as the beginnings of the formation of the cranial nerves. According to him, the outgrowths of the neural (ganglionic) ridge do not have any relation to the development of the nerves and ganglia, but simply take part in the development of the mesoderm (mesenchym). His opinion is the same

---

[8] P. MITROPHANOW, Die Nervenendigungen und die Stiftchenzellen. *Zool. Anzeiger*, 1886, 232.

[9] M. v. LENHOSSEK. Der feinere Bau und die Nervenendigungen der Geschmaksknospen. *Anat. Anzeiger*, 1893, No. 4.

[10] K. ARNSTEIN. The End-apparatus of the Gustatory Organ. 1893.

[11] N. GORONOWITSCH. Die Rolle der sog. "Ganglienleisten" im Aufbaue der Nervenstämme. *Anat. Anzeiger*. 1892. No. 15.

respecting the branchial sense organs, which appear later. The mesoderm, therefore, has its source in the ectoderm in the region of the central nervous system, and in other places. The formation of the cranial nerves begins, according to Goronowitsch, "in the early stages of the mesencephalic curvature" by differentiation from the mesoderm of the trunks of the meshwork [web] enveloping the nerve. The trigeminus is formed only by the mesoderm, and has no relation to the derivatives of the ganglionic outgrowths. In the formation of the supraorbital branch, however, the ectoderm of the supraorbital region also takes part. The facialis, that is to say, the trunk of the web enveloping the nerve, is equally composed of the outgrowths (the ganglionic one, secondäre Leiste) and also of the elements of the adjacent mesoderm. The glossopharyngeus, so far as I am able to understand him, is formed by the participation of the second lateral metamer—the derivate of the third outgrowth. In this way, the formation of the above-mentioned nerves occurs in the region of the ganglionic outgrowths, though not from them, but rather from the mesoderm which has been derived from these outgrowths. It is evident that in this case Goronowitsch simply gives an original explanation of facts already stated and, as he himself says, unites the opinions of Götte and His. How these opinions can be compatible is another question.

It seems to me that Goronowitsch has not sufficiently explained the exclusive participation of mesoderm in the formation of the nerves. It is also not clear how he presents the origin of the nerve from the neuroblasts and the appearance of the latter. If he defines the neuroblasts in the same sense as His, he does not add anything new to the development of the nerve; but if he admits the mesodermic origin of the ganglion cells (independently of the outgrowths) it changes the composition of the cranial nerves essentially.

The suffusion and loss of determinate contours in the ganglion outgrowths is not necessarily an indication of the transformation of their elements in the mesenchyme. In the Selachians these outgrowths always preserve the character which distingushes them from the mesodermic elements; the histological difference between the embryonic elements in the chick is less considerable. All our knowledge of the development of the nerves obliges us to think that the ganglionic outgrowths preserve their individuality till the formation of the nerves, though by the ordinary methods, this is inconspicuous, as we see it, for example, in the region of the trigemini. We know from the study of the Selachia that the embryonic group of this nerve (the first outgrowth ot Goronowitsch) presents complicated and well determined modifications; probably identical facts may occur in the chick.

If the nerve (or the ganglion) is formed at the point where the ganglionic outgrowth was at first clearly seen, it is natural to think that the elements of the latter have been used for the formation of the nerve (or ganglion) and not the elements of the mesoderm, which is formed from the same outgrowth. The late formation of the mesodermic elements (mesenchyme) of vertebrates from the ectoderm is a point to which much study must yet be given, and it awaits further elucidation. That the embryonic elements which form the germ of the nerve are exclusively used for the tissue enveloping the nerve is also a question to be developed. A part of these elements which have in every case been formed through the ganglionic outgrowths, or as I have presented it, through the embryonic groups, is certainly used for the formation of the ganglion cells; others perhaps form the sheath of Schwann and, through its agency, the medullary sheath, and the purely mesodermic cells, penetrating later into the nervous germ (fundament), are used for the formation of the connective tissue which combines the nervous elements into a single whole.[1]

---

[1] The editor has in a few instances taken some liberties with the phraseology in the interests of the conventional English idiom, but trusts that he has in no case departed from the meaning of the learned author's original. It is to be regretted that the typography of an American printing office make it impossible to give the titles of the Russian papers quoted in the course of this article. The editor ventures to express his gratification in the substantial identity of results attained by the author and those reached by other methods by himself.

JEAN M. CHARCOT.

By E. G. Stanley,

Fellow in Comparative Anatomy in Denison University.

In the person of Prof. J. M. Charcot, we mourn the loss of one of the brightest lights in the realm of neurology, especially of neuro-pathology, and neuro-psychology.

Born, in the year 1825, of humble parentage, his career will remain as an example of what almost unaided native genius and perseverence can accomplish.

In 1853 he was graduated from the medical school, and soon after accompained a wealthy parent on a foreign journey. During these months he was able to save the money needed for further study. In 1862 he was made physician to the Salpetriére, which became and remained renowned through the name and the reputation of Charcot. A fact that might have proved dangerous to his success was that he gained a fortune through marriage, but he seems to have loved science for its own sake; and indeed it is owing to the encouragement and efforts of his wife that much of the material used in his lectures, was made accessible to the public. He was so wrapped up in his investigations and in the preparation of new lectures, that he could only with difficulty be urged to prepare anything for the press. He became a member of the Academy of Medicine in 1873, and in 1883 he received the honor of election to membership in the French Institute. It was during a vacation trip with two of his friends, that, on the night of the 16th of last August, he quietly slept from life to death.

Among his numerous works, those of most lasting value and especially to the medico-psychologists are his "Maladies des Viellards et les Maladies Chroniques," his "Maladies du Systeme Nerveux," and his "Lectures on the Localizations of Cerebral and Spinal Diseases." The "Archives de Neurologie," commenced in 1880, and published under Prof. Charcot's direction, contain his first articles on hypnotism. For the past fifteen years, Prof. Charcot has done nearly all that has been done to develop hypnotism on a purely scientific basis, clearly recognizing its importance in the clinical study of neuro-pathology, but not seeming to attribute to it much therapeutic value. A short time before his death he himself says that he had found hypnotism "a rich field" for his studies in neurology. In his work in hypnotism, he held that the condition induced by artificial means is a neurosis, and a neurosis allied to hysteria. Charcot was by no means willing to accept the extreme maxim of the school at Nancy "no suggestion, no hypnosis," for while allowing the great value of suggestion in producing the hypnotic state he was able to adduce the highly interesting phenomenon of neuro-muscular hyperexcitability, one of the most certain characteristics, he used to say, of hypnosis. Delicate pressure on a point in a limb or on the face, which in the normal state produces no effect on the muscle, was found by him to be followed by its proper physiological action when the subject was in a certain stage of hypnotism. He used this incontestable fact in a two-fold manner, first to refute the explanation offered by the upholders of "suggestion" as a universal solvent, and second to confute opponents who had recourse to "imposture" as the correct explanation, for he was accustomed to say that both objectors must believe an ignorant woman to preserve as minute a knowledge of the action of each muscle as Duchenne himself.

In thinking of Prof. Charcot's doctrine, that artificial sleep is a neurosis allied to hysteria, the fact must be borne in mind, that his experiments were conducted almost entirely upon hysterical patients. This undoubtedly served to color the symptoms he observed, and consequently the inference he drew as to the close alliance between hypnotism and hysteria. Indeed, his lucid article in the "Dictionary of Psychological Medicine," bears as title the significant words, "Hypnotism in the Hysterical." While Charcot himself without doubt kept this fact in mind, it has been overlooked by many other experimenters, who, failing to find the phenomena as he sets forth, have blamed his descriptions as imaginary or possibly manufactured. Hysteria was the soil on which Charcot experimented, and when experiments are made upon another soil, the results may be very different frem those recorded by him, being no longer stamped with the hysteric seal.

No man was more opposed to quackery, and to him is due the credit of helping to rescue artificial somnambulism from the illegitimate embrace of the charlatan. His scorn of the frauds and follies which sprang up in a credulous circle outside his own school, was only equalled by that which he manifested for the incredulous ignoramuses of his own profession who sneered at phenomena which they could not understand, but in which he recognized a rich source of neurological and psychological knowledge.

Although the illustrious Professor has gone from us, he has left able successors imbued with his teaching and familiar with the nature and signs of hypnosis. More than this, he has left behind the solid and lasting results of his investigations in not only confirming, but extending, the conclusions at which Braid arrived; in reducing to something like order the multiform phenomena of artificial sleep, and in bringing within the range of medical science and the laws of physiology, abnormal states of the nervous system, regarded by the vulgar as miraculous, and formerly by many medical men as fraudulent.*

---

*The following letter from the Nestor of Cincinnati physicians, explains itself.

CINCINNATI, Nov. 13, 1893.

MY DEAR PROF. HERRICK: You have reminded me that in past conversations with you I have frequently alluded to the late Prof. J. M. Charcot as one of my instructors in clinical medicine in La Charité Hospital, Paris, and now you ask me to write briefly my notions of him.

Forty-two years ago M. Charcot was kind enough to receive me as a private pupil in his service in La Charité, where he was Chef de Clinique and therefore able to offer very large facilities to foreign students who went to Paris for clinical study.

He held a high position in that early period of his career as clinician and his instruction was very much sought for. His deliberate and careful manner of procedure at the bedside aroused the attention of his pupils, who soon were made to feel that the methodic investigation of disease requires the highest intellectual effort. It was not difficult at that time even to foresee for the young teacher a distinguished future.

What he did to develop the advance in the medical sciences during the past forty years, I shall not attempt to detail. That he has enriched and enlarged the pathological and clinical field to as great an extent as any man of the age, is generally conceded. More especially has he done his full share of the work that has brought again French medicine to the front line of modern progress. I believe that his genius, culture, and special researches entitle him to be ranked with the celebrated men of modern times.

I had the inexpressible pleasure of spending a short time in his house two years ago. He was then 68 years of age, as he said. In an interval of forty years he had changed in appearance much less than I had anticipated. His warm greeting touched me very much; he was no longer the clinician of La Charité, but a member of the Institute of France! I was merely passing through Paris, so our interview was brief. It seemed to me that he was good for several years still of important work.

Sincerely, C. G. COMEGYS.

LABORATORY NOTES FROM DENISON UNIVERSITY.

VI. ILLUSTRATIONS OF THE SURFACE ANATOMY OF THE BRAIN OF CERTAIN BIRDS. WITH PLATE XXVI.

By C. JUDSON HERRICK.

Fellow in Neurology.

These notes refer mainly to the brains of the following birds: the wood-cock, Philohela minor; the black tern, Hydrochelidon nigra; the white pelican, Pelicanus erythorhynchos; the golden eagle, Aquila chrysætos.

Of these, the one presenting the most striking peculiarities of form is the wood-cock, *Philohela minor.* This brain is flexed upon itself to a surprising degree (see Plate xxvi, Figs 1–3), forming a sigmoid curve, each limb of which forms nearly a complete semi-circle. The cephalic, ventrally concave curvature is strongest at the Sylvian region; the caudal, ventrally convex curvature is strongest in the pons region and is much shorter cephalo-caudad than the other curvature. As a result of these flexures the olfactory bulbs are directed ventrad, or even a little caudad, instead of cephalad and the spinal cord seems to be directed at first almost dorsad. The prosencephalic flexure, then, is longer than the pons flexure and so extreme as to bring the olfactory bulbs into close proximity to the chiasm. The chiasm itself is crowded caudad so as to appear in ventral view almost as if superposed upon the pons. This flexure of the brain is but an extreme application of the general compactness of the avian brain and is due to the unusual curvature of the whole head, which in turn is correlated with the feeding habits of this bird.

Although the prosencephalic flexure occurs mainly in the Sylvian region, yet the Sylvian fissure proper is not so deep as in many other birds. The dorsal fissure also is shallow and wide and disappears entirely caudad. It originates in the median line about one-third of the length of the prosencephalon behind the front of the latter, passes obliquely caudo-laterad and fuses with the wide Sylvian fissure. In this latter respect it differs from any of the brains figured by Professor Turner in his monograph.[1]

The crebrum is not only shorter, but narrower and shallower than that of the snipe, Gallinago wilsoni. The relative mass of the prosencephalon, estimated by Turner's method (i. e., the cube root of the product of length, breadth and depth —see Vol. I, pp. 58–61) gives 69.9 as compared with 75.2 for the snipe. The front part of the cerebrum is narrow and unusually shallow. All things considered, this is one of the most difficult of the American birds to which to apply any system of linear measurements. Any conclusions of taxonomic value which might be drawn from the measurements of this brain, as given in the appended table, must be interpreted with caution, in view of the extreme flexion and of the other peculiarities presented.

[1]C. H. TURNER, "Morphology of the Avian Brain," this Journal, Vol. I.

The olfactory lobes are not fused and project freely and are large, even for a bird so low in the taxonomic series. The optic lobes are exposed, as is usual in the lower orders of birds. The cerebellum is well developed, with strongly projecting flocculi. The medulla presents, in connection with the extreme curvature referred to above, an apparent enlargement of the pons region. This, however, is due to a spreading of the elements rather than to an actual increase in the volume of the medulla.

Pelicanus erythorhynchos, the white pelican. This brain resembles, as would be expected, the goose brain in its general features. This specimen, taken from a bird with an expanse of wing of 2.5 meters, has a total length of 49 mm., a total breadth of 41 mm. The mass of the prosencephalon, as shown by $\sqrt[3]{\text{L. B. D.}}$, is less than that of any of the birds given in Professor Turner's tables except the *Ardeidæ* and the *Cuculidæ*, being 64.4, as compared to 69.3 for the domestic duck. This is in harmony with the inferior position given to the *Pelicanidæ* in the systematic works.

The olfactory lobes were unfortunately mutilated, but seem to have been small, though quite distinct from each other. The dorsal fisure of the cerebrum is very deep in front, but unlike that of the goose brain it disappears entirely behind. Its cephalic end is considerably farther cephalad than in the goose. The optic lobes are much smaller than usual and are almost entirely covered by the cerebrum. The cerebellum, too, is smaller than usual. As is well known, this bird is a very clumsy flier. In order to discover whether the size of the cerebellum is correlated with powers of flight, a few comparative measurements have been taken. The comparative volumes of the cerebellum were obtained by the same method used by Professor Turner for the cerebrum. The ratios of the length, breadth and depth of the cerebellum to the total length of the brain, expressed in hundredths, were multiplied and the cube root of the product taken. This gives approximately the ratio of the cube root of the volume of the cerebellum to the total length of the brain.

This ratio for the black tern, Hydrochelidon, is 55.6; for the domestic duck, 33.3; for the white pelican, 36.9; for the wood cock, 42.8; for the great horned owl, Bubo virginianus, 39.7; for the golden eagle, 47.2.

The eagle and the owl, both belonging to the *Raptores* yet with conspicuous differences in powers of flight, differ by 7.5 per cent. in size of the cerebellum. There is a difference of 8.2 per cent. in the volumes of the cerebrum in the opposite direction, i. e. in favor of the owl. The domestic duck and the pelican each possesses a very small cerebellum, while the tern which is also a low type, but which has remarkable powers of flight, has a larger cerebellum than any of the birds tabulated by Professor Turner. Upon inspection of his table (Journal Com. Neurology, Vol. I, p. 84-85), it is apparent that the swallow and other birds of strong wing-power have as a rule large cerebella, as compared with the more inactive birds. Such measurements, however, must be used with some caution, as a highly developed flocculus, for example, may greatly exaggerate the apparent volume of the cerebellum. Yet it would seem that the size of the cerebellum is to a large extent regulated by the habits of flight of the bird independently of taxonomic relations, though much more extensive observations would be necessary to establish the generalization for the Aves as a whole.

Hydrochelidon nigra, the black tern, is remarkable for the large dimensions of the brain. As above noted, the cerebellum is relatively larger in this bird than in any other whose measurements are recorded. The cerebrum, too, is larger than that of many birds which are placed far above it in the taxonomic series. The $\sqrt[3]{\text{L. B. D.}}$ is 77.9, which is not equaled by any cerebrum below the *Raptores* in Professor Turner's tables. It will, however, be noticed that the large cerebellum is crowded forward so as to divaricate the cerebral lobes behind and thus to increase the apparent width of the cerebrum. This introduces a source of error which must be taken into account in making comparisons with other birds. The low rank of this bird is clearly indicated by the free, projecting olfactory lobes. The other features of this brain may be gathered from the illustration and the measurements presented elsewhere.

Aquila chrysætos, the golden eagle. The specimen from which this brain was taken measured 2.6 meters from tip to tip of wings. The total length of the brain is 4 cm. The olfactory lobes are not fused and do not project. The cerebrum is is small, the $\sqrt[3]{L.B.D.}$ being 70, as compared with 78.2 for Bubo virginianus. The surface is smooth and uniform, even the dorsal fissure being shallow and very broad. The dorsal fissure is frontal, but not so much so as in Bubo. (Compare Plate xxvi, Figs. 5 and 7 with Vol. I, Plate v, Fig. 1.) The optic lobes are almost wholly exposed, thus again differing from Bubo.

TABLE OF MEASUREMENTS.

		Aquila.	Philohela.	Pelicanus.	Hydrochelidon.
Rhinencephalon,	Length,	10	16		8.6
	Breadth,	12	16		12.5
Prosencephalon,	Length,	68	68	65	61
	Breadth,	98	87	84	104
	Depth,	50	58	49	64
	$\sqrt[3]{L.B.D.}$	70	69.9	64.4	77.9
Mesencephalon,	Length,	25	24	22	36
	Breadth,	25	37	22	43
Epencephalon,	Length,	52	47	39	64
	Breadth,	50	52	39	54
	Depth,	42	31	33	50
	$\sqrt[3]{L.B.D.}$	47.2	42.8	36.9	55.6
Metencephalon,	Length,	38	42	31	35
	Breadth,	38	47	31	50
	Depth,	20	26	16	25

EXPLANATION OF PLATE XXVI.

Fig. 1. Dorsal view of the brain of Philohela minor, x 2.
Fig. 2. Ventral view of the same.
Fig. 3. Lateral view of the same.
Fig. 4. Dorsal view of the brain of Hydrochelidon nigra, x 2.
Fig. 5. Lateral view of the brain of Aquila chrysætos. Natural size.
Fig. 6. Dorsal view of the same.
Fig. 7. Dorsal view of the brain of Pelicanus erythorhynchos. Natural size.

VII. The Callosum and Hippocampal Region in Marsupial and Lower Brains, with Plates IX and XXVII.

By C. L. Herrick.

In view of the fact that Dr. Alexander Hill, in his recent monograph "On the Cerebrum of Ornithorhynchus paradoxus" finds "it quite impossible to gather Professor Herrick's views with regard to the dorsal commissure in *Didelphys,*" it seems necessary to further define them. After expressing agreement with the position of Osborn, the passage in question runs as follows: "The motor cortex as such is thrown well cephalad, and the fornicate gyrus is carried forward along the mesial surface, as may be seen from an inspection of the transverse sections of Plate A. [This Journal, Feb., 1892.] Thus it happens that the caudal portion of the dorsal commissural system is much more highly developed than the cephalic or callosal portion. The latter consists of a few fibres which spring from the anterior prolongation of the sphenoid fissure, if this term may be applied to the fissure which bounds the cephalad continuation of the fornicate gyrus." Although minute discussion of these parts was (and must still remain) reserved for a more opportune time it seems that the morphological conception then held was clearly stated. The belief that the two commissures known as the callosum and hippocampal or fornix commissures are essentially homodynamous and are similarly related to the cephalic and caudal regions respectively is not a new or morphologically startling idea. Any one who has followed the development of the two commissures in the embryo of say the mouse or cat will find it hard to appreciate the difficulties which beset the conception for those who are familiar only with the conditions in adult higher mammals. The origin of the hippocampus as a fold or convolution of the cortex is as clear as any such process can possibly be. For the present, however, we deal with a question of fact. Does a separate commissure exist in the position to which the writer assigned it? In this we may be deceived and may fairly be asked to produce the evidence.

The series of horizontal sections of the brain of a pouch embryo of Didelphys may first be examined. The relations of the fornix and hippocampus are very clearly shown by this set of drawings. The relation of the fimbria as a band of fibres running along the ventricular aspect of the negative convolution forming the "fornicate gyrus" is perfectly evident. The com missure itself with its decussating elements forms in its transverse section (i. e. in saggital sections of the brain) a horse-shoe figure with the convexity dorsad. This is due to the cephalo-caudal curvature of the hippocampal structures which is also a dorsal curvature. Thus the middle portion of the commissure is cut in the dorsal horizontal sections Figs. 4-5, Plate IX, while farther ventrad the caudal and cephalic parts of the commissure appear, Fig. 6. The cephalic limb of the commissure might readily be regarded as distinct, but, although the arch of these fibres is cephalo-dorsad and that of the caudal portion is caudo-dorsad, the fibres seem to terminate in the forward extension of the same system. I shall not deny the possibility that these, or some of them, really correspond to callosal elements but desire to call attention to the existence of other fibres which pass cephalad of the hippocampal system; these are shown in Fig. 7. It will be seen that the position of these fibres, which are separated by a slight interval from the hippocampal, strongly reinforces the writer's position (primarily based on the results of localization experiments) that the motor cortex is thrown far cephalad.[1]

[1] One may be forgiven for a desire to homologize the transverse fissure of the opossum cortex with the crucial sulcus of carnivora (if he refrains from actually doing it!) It has been impracticable to repeat the rather unsatisfactory localization experiments thus far, but the recent results in the comparative morphology and psychogenesis of the sensory areas cetainly does not militate against the view that a very large share of the mantle of the opossum is sensory and that upon this area the olfactory sensation has a relative disproportionate claim.

In order to bring out the relations of the dorsal commissure system more clearly, a nearly median longitudinal section is given. The plexus was somewhat distorted in the section, but it is apparent that there is a slight depression separating the hippocampal from the collosal commissure.

The callosal fibres are separated from the hippocampal by a pre-plexus which at once reminds us of the relations described in reptiles where collosum and hippocampal commissure sustain just this relation. It has not been the writer's purpose to enter into details respecting Professor Osborn's theory in subscribing in a general way to the theory that the callosal and hippocampal systems are homodynamous. For example, we do not understand the statement that the "Commissura cornu ammonis is not a portion of the fornix system, as has been generally held, but is primitively a portion of the corpus callosum." It is, of course, a mere verbal quibble whether the callosum is part of the hippocampal or the hyppocampal commissure part of the callosal system. As a matter of fact the evidence now before us makes it probable that it is the hippocampal commissure which is first developed and in ambhibia this element is greatly in excess over the callossal rudiment. This, too, serves to explain a discrepancy which was noticed by Osborn in the relative date of appearance of the pre-commissure and callosum in mammals and non-mammals.

The callosum and hippocampal commissures in Amphibia are very peplexing. It would at first seem that a simple escape is furnished by Osborn's attempt to consider the dorsal commissure, although it lies beneath the ventricle and caudad of the portæ as simply an instance of retardation whereby the commissure simply remains in its primative place in the terma, while the brain pushes forward over it. In *Menobranchus*, however, he makes the significant discovery that "the upper bundle is completely separated from the lower and crosses the ventricle independently, so that a fold of the vascular plexus of the pia [sic], which in this genus is greatly developed, passes through the interspace." This statement of Osborn we had overlooked, but upon theoretical grounds suspected that the dorsal commissure would prove to belong to the roof and not to the floor of the ventricle. We, therefore, had introduced the accompanying drawing (Plate IX, Fig. 5.) before noticing that Osborn's Fig. 14 is substantially identical. We have never found the dorsal commissure so completely separated as represented by the latter, but always in juxtaposition with the floor; it was, therefore, a matter of congratulation to find a clearly defined continuous film of epithium separating from the subjacent pre-commissure. The series being continuous and faultless and doubly stained with hæmatoxylin and fuchsin to differentiate epithelial from nervous elements the evidence is conclusive. Knowing, as we now do, that the plexus is but a diverticle of the roof we recognize of necessity that the commissure is morphologically dorsal. The ventricle, which would otherwise be occluded, is in indirect communication by means of the paraphyseal vesicles. The pre-paraphysis lies in front of the commissure, the post-paraphysis behind it—in other words the relations are as in serpents in that respect. The relation of the fibres from this bundle is well shown in Fig. 5., Plate XVIII, of the present volume. The great mass of the fibres pass to those caudal and mesal walls of the hemisphere which may be confidently homologized with the hippocampus. Some of the fibres which lie in the intraventricular region certainly continue forward into the olfactory bulb, as shown by Bellonci, and hence should be homologized with the *striæ Lancisii.* On the basis of these facts it would seem most natural to conclude that the same relations once existed in Anura. If this could be admitted the caudal position of the commissure would be explained, as also in the similar Chelonia. If the callosum exists in Amphibia it would be expected to lie in the terma cephalad of the pre-paraphysis where a few fibres have been noticed in Menobranchus (see plate XVIII, Fig. 5.) though it might still be considered possible that callosal elements were bound up in the larger hippocampal commissure.

Reptilia. It is remarkable that the hippocampal commissure is well developed in terrestrial reptilia–Ophidia, and Lacertilia, in which the olfactory apparatus is largely developed, but absent or small in aquatic forms, Crocodilia and Chelonia. In a paper by the writer in 1890,[1] a rudiment of the fornix was located in the alligator. More recent examination fails to determine any definite commissure in the region. It will be noticed that the callosum is larger than the pre-commissure and lies in the very cephalic part of the terma. In the case of the alligator it should be remembered that in dealing with the brains of specimens 12 to 18 inches long, we have practically embryonic material before us. The olfactory tubers will ultimately separate from the brain and it is not improbable that new conditions may arise.

VIII. *The hippocampal region of Opossum.* Figs. 9-12, of Plate XXVII, illustrate the appearance of several cross sections of an embryo from the same litter of pouch embryos. The relations of the hippocampus are absolutely simple.[2]

One recent author[3] calls in question not only the homologies of the gyrus dentatus but is "absolutely opposed, however, . . . to all anatomists with whose works I am acquainted, in their attempts to homologize the elements found in the fascia dentata with those found in other parts of the cortex; or, in other words, to prove that the fascia dentata is a convolution comparable with other convolutions of the general cortex. *Firstly*, because in structure it does not appear to me to resemble the general cortex, and, *secondly*, because it does not behave like a convolution. For example, it does not vary in its development with the convolutions of the general surface." It seems hard to understand how such distinctions as Dr. Hill makes can be maintained in the face of accumulating embryological evidence. In tracing the development of the caudo-mesal border of the mantle one may follow step by step the gradual differentiation of the mantle border. The cellular border is for a time homogeneous, but gradually is thrown into folds

---

[1] Notes on the Brain of the Alligator, *Journ. Cincin. Soc. Nat. Hist.*

[2] Obscurity was needlessly introduced in the figures of Plate A, Vol. II, of this journal, by using the terms gyrus *fornicatus* and *uncinatus* for parts which are more often named *cornu ammonis* and *gyrus dentatus* respectively, without a discussion of homologies concerned.

[3] HILL, A. The Hippocampus. *Philos. Trans.*, CLXXXIV, B. pp. 30-429.

which result in two curvatures in opposite senses, together forming a "reverse curve." The primitive margin or point of connection with the plexus remains the margin of the mantle in spite of the accumulation of the fimbria or deeper fibres from this region to produce a spurious marginal band. This relation is rarely seen so clearly in adults as in Fig. 4, Plate IX, for example, where, in spite of adhesions to the inner aspect of the "cornu ammonis" for a distance, the thinned outer wall passes ventrad to unite with the projection from the pyriform. Farther cephalad this same thin wall is continued into the plexiform tela uniting with the thalamus. In Figs. 2-3, Plate XXVII, there is a very instructive illustration of the position of this thinned part of the pallium where the free margins of the gyrus dentatus are connected by it in the same longitudinal section (x). Of course in passing ventrad the tela would be traced into the plexus before uniting with the thalamus. Passing dorsad the two parts of the dentatus unite, as in Fig. 1. As to the great histological distinctions which are claimed as differentiating the gyrus dentatus from other cortical regions, we still claim that many of them result from the tortions in form which throw various parts into different planes and do not permit a direct camparison in a given section with the histological structures of the adjacent gyri. In the embryos just mentioned the gray matter of the gyrus dentatus passes into that of the cornu ammonis (gyrus fornicatus) without appreciable interruption and the difference between the two sets of cells is no greater than that between the last mentioned and the part of the mesal cortex just dorsad to it. The cells of the cornu ammonis are pressed into a close narrow band and are larger than those of other cortical regions, but this seems as valid a reason for refusing to regard the ammon's horn as cortex (as no one does) as does the small size and oblique axial position and large granular admixture of the gyrus dentatus.

EXPLANATION OF PLATES.

PLATE IX.

Figs. 1-4. Transverse sections of the fore-brain of pouch-embryos of the opossum. For comparison with Plate XXVII. Fig. 1. shows the cephalic part of the hippocampus. Fig. 4, shows how the gyrus dentatus is connected by a non-cellular wall with the ventral mantle so that the ventricle theoretically should be extended to the mesal terminus of the dentatus.

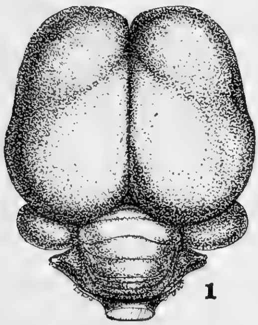
Fig. 5. Transection of fore-brain of *Menobranchus*, to illustrate the fact, discovered by Osborn, that the dorsal commissure is separated by layers of ependyma from the ventral or pre-commissure.

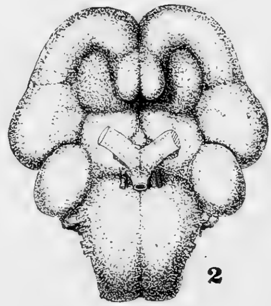
Fig. 6. Transection of the fore-brain of the alligator to illustrate the position of the callosum and precommissure in the front of the terma.

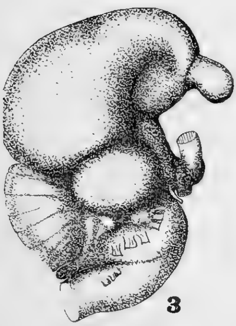
PLATE XXVII.

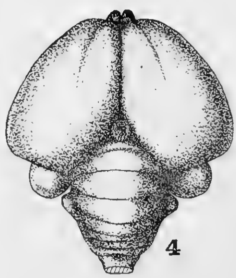
Figs. 1-7. A selection from a series of horizontal sections from the fore-brain of pouch embryos of opossum to illustrate the relations of the dorsal commissures and hippocampus. Fig. 1, is at the most dorsal level of the gyrus dentatus and illustrates the continuity of the cornu ammonis (fornicate gyre) with the remainder of the dorsal cortex and the nature of the influences which have transposed the relations of the gray matter. Figs. 2, 3 illustrate the continuity of the mesal margin of the gyrus dentatus, though it is partially devoid of cells (transformed into a tela.) In Figs. 3, 6 the hippocampal commissure and fimbria are clearly illustrated, while in Fig. 7, the callosum and striæ Lancisii appear.

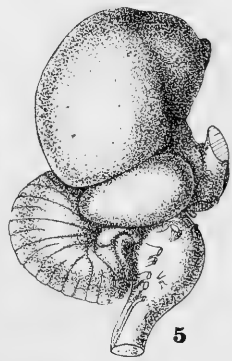
Fig. 8. Longitudinal section from a similar brain showing the separation between the callosum and hippocampal commissure.

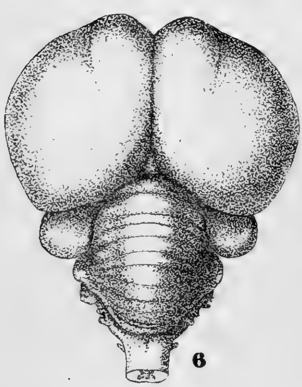

1

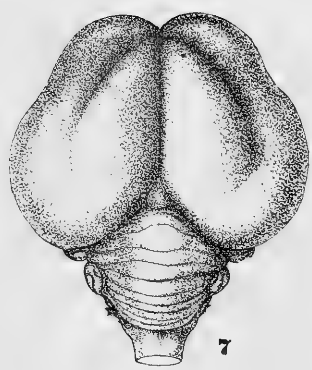

2

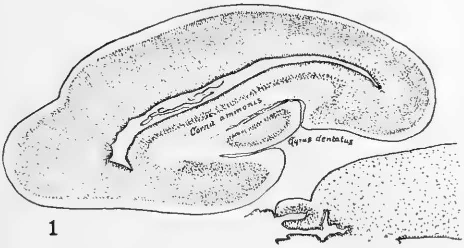

3


4

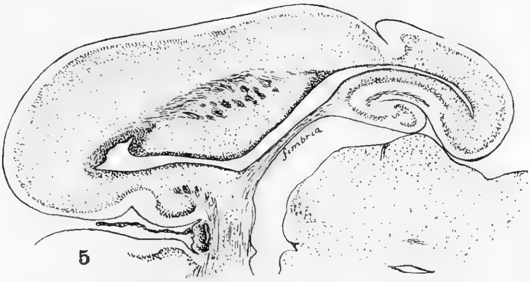

5


6

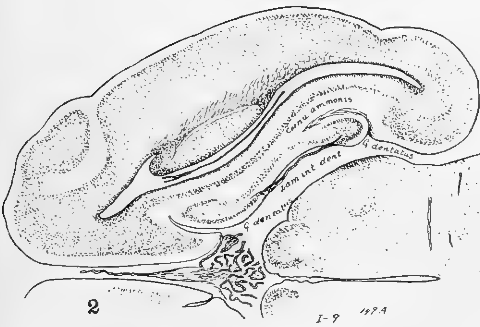

7


Cornu ammonis
Gyrus dentatus

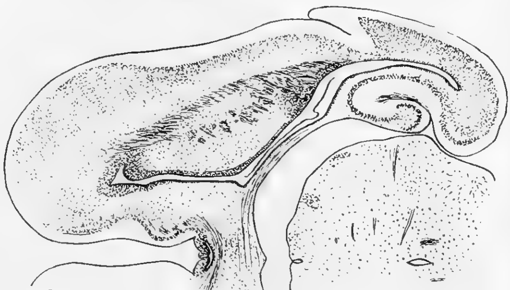
1


fimbria

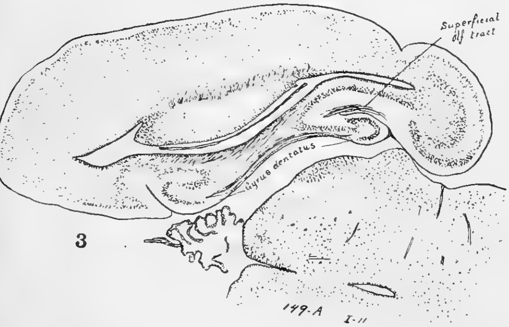
5


Cornu ammonis
Lam int dent
I-9
149.A

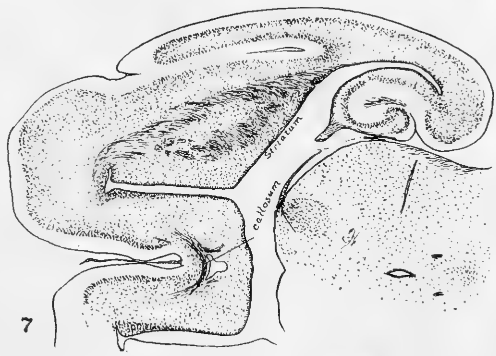
2



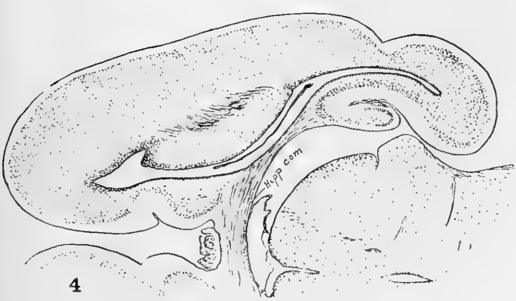
6


Superficial olf tract
Gyrus dentatus
149-A
I-11

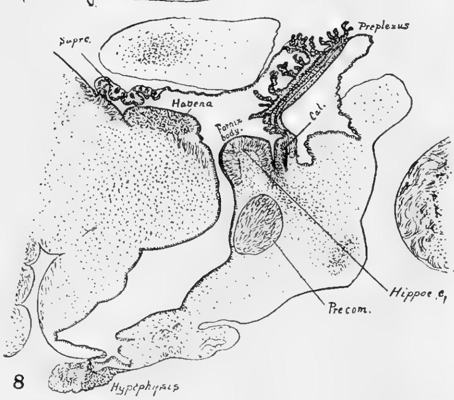
3


Striatum
callosum

7


Hipp com

4


Supre.
Preplexus
Habena
Fornix body.
Cal.
Hippoc c1
Precom.
Hypophysis

8

LITERARY NOTICES.

Fissures of the Cerebrum.

Dr. D. J. Cunningham,[1] in the memoirs of the Irish Academy of Science bearing his name, gives an extended account of the comparative development of the surface anatomy of the cerebral hemispheres. We condense from this work the following statements.

I. *Complete fissures* ["Total falten".] The transitory fissures which appear in an early period of the development of the hemispheres are distinguished by the fact that they are a result of a series of deep infoldings of the thin cerebral wall and form shelf-like projections into the ventricles.

Under normal conditions none of the fissures which appear on the lateral aspects of the hemispheres persist in the adult though, in the ape, two, at least, are persistent. Upon the mesal aspect, on the contrary, the choroid, a portion of the arcuate, and sometimes the parieto-occipital with part of the calcarine fissures persist. The choroid and arcuate appear as early as the fifth week. The choroid fissure occupies the lowest limit of the mesal wall, reaching the porta, cephalad, and extending caudad nearly to the extremity of the temporal lobe. Though not at first occupied by blood vessels and, therefore, not formed by them, its walls do not develop into nervous tissue but remain epithelial and are occupied by this preplexus. The fissura arcuata [*Ammonsfurche* of Mihalkovics] makes its appearance on the mesal face of the hemisphere at a higher level than the choroid fissure and while it extends, like the preceding, into the temporal lobe it also passes cephalad into the frontal region. That portion of the hemisphere lying between the two fissures mentioned is termed the *arcus marginalis*, in connection with which are formed the callosum, the gyrus dentatus and the fornix.

The caudal part of the fissura arcuata is retained in adults as the hippocampal fissure and gives rise to the elevation in the floor of the descending cornu known as the hippocampus major.

---

[1]Contribution to the Surface Anatomy of the Cerebral Hemispheres, J. D. Cunningham. *Cunningham Memoirs of Royal Irish Academy*, vii.

Dr. Cunningham does not agree with Mihalkovics and other writers that the cephalic part of this fissure produces the callosal fissure but regards this portion as transitory.

The remainder of the complete fissures are transitory. The mesal wall of the hemispheres being thicker than the outer the transitory fissures there first appear. They may appear as early as the eighth week and reach a high degree of development only after the tenth week. Their maximum development is reached between the periods when the fornix and callosum appear, i.e. near the beginning of the fifth month.

On the mesal aspect of the hemispheres the transitory fissures, which vary in number, radiate from the arcuate fissure toward the free border of the hemisphere and others, lying between them but not connecting with the arcuate fissure, appear near the margin. The usual number on each hemisphere appears to be eight.

The primitive fissures which bound the cuneus are the precursors of the calcarine and parieto-occipital fissures. As the wall of the cerebral vesicle thickens, and the hemisphere elongates, the stellate fissures become detached from the arcuate fissure and gradually disappear.

Upon the outer aspect the arrangement of the fissures is also radial, with the Sylvian fossa as the centre, but these fissures usually do not reach the fossa. There is frequently an additional fissure occupying the place of the future Sylvian. In some cases the precursor of the calcarine is carried horizontally around the occipital pole, appearing on the lateral surface as an external calcarine fissure.

It is regarded probable that under abnormal conditions, as when the callosum fails to develop, the transitory fissures may persist to a certain extent. The fact emphasized by Sir William Turner that in *Macropus*, where the callosum is rudimentary, the radiating fissures resemble those of an immature human brain is at least suggestive that the development of the callosum has some effect on the disappearance of these fissures.

Dr. Cunningham fully agrees with His and Koelliker that the occipital lobe is due to a general growth and not a local out-pouching of the hemisphere, its peculiar form is due to the transformations produced by axial flexures—especially the pons flexure. This backward thrusting of the posterior part of the hemisphere is chiefly responsible for the preservation of the precursory calcarine and parieto-occipital fissures. The temporary fissures are in all probability peculiar to primates and appear prior to the appearance of a distinct occipital lobe.

The parieto-occipital and calcarine fissures form upon the mesal aspect of a posterior part of the adult hemisphere a >— shaped figure. The stem is directed obliquely ventrad and intersects the gyrus fornicatus. The parieto-occiptal fissure forms the more direct continuation of the stem and continues on the ectal surface as the external parieto-occipital fissure. The calcarine branch passes toward the occipital pole. The stem is called the anterior calcarine fissure. The apex of the cuneus gives off two deep annectant gyri—the gyrus cunei and anterior cuneo-lingual gyrus. The gyrus cunei forms a barrier between the parieto-occipital fissure and the stem, while the gyrus cuneo-lingualis anterior separates the stem and the posterior part of the calcarine fissure.

The calcar (hippocampus minor) is formed wholly by the stem or anterior calcarine fissure.

In apes the calcarine fissure is deep and much more stable than the parieto-occipital. In the chimpanzee the gyrus cuneus is on the surface (a condition found in 3-9 per cent. of human brains) while in the orang and gibbon the cunei may be on the surface or at the bottom of the fissure. The gyrus cunei is never absent. Cunningham believes that the whole calcarine fissure of anthropoids corresponds to the "stem" of the human calcarine or rather the whole length of the precursor of the human calcarine is the equivalent of the ape calcarine. The posterior calcarine of man is of later origin and takes the place of an abolished portion of the original fissure. The cuneus of the ape does not have the same morphological value as that of man. Only the cephalic part is present in the ape, the caudal part is absent or blended with the gyrus lingualis. In the ape the entire length of the calcarine fissure is on the tentorial face of the hemisphere.

The posterior calcarine fissure is distinct from the "stem" in origin, the latter being a "complete fissure" and having unbroken continuity of existence with the fore-part precursor.

The occipital and parietal indices are the distances along the mesal margin of the hemisphere intercepted by the intersection of the external parieto-occipital fissure and the fissure of Rolando respectively, in the first case measuring from the occipital pole, in the second, from the parieto-occipital intersection, both these distances in terms of hundredths of the entire length along the dorsal margin of the hemisphere.

For the human brain the following averages are given:

5½ to 6½ months	—O. idex,	18.8;	P. index,	28.5.
6½ to 7½ months	— " "	18.6;	" "	24.7.
7½ to 8½ months	— " "	20.7;	" "	24.1.
Full time fœtuses	— " "	20.8;	" "	25.7.
First 12 months	— " "	22.3;	" "	25.6.
4 to 5 years	— " "	23.2;	" "	24.2.
11 to 15 years	— " "	20.8;	" "	27.4.
Adults	— " "	21.2;	" "	25.5.

For apes the following table is given:

Orang	—O. idex,	23.2;	P. index,	21.3.
Chimpanzee	— " "	24.2;	" "	19.9.
Homadryas	— " "	29.5;	" "	20.5.
Cynocephalus	— " "	29.7;	" "	22.6.
Mangaby	— " "	30.5;	" "	24.1.
Macaque	— " "	31.0;	" "	19.0.
Cercopithecus	— " "	32.9;	" "	19.0.
Cebus	— " "	33.1;	" "	20.6.

The low parietal index and high occipital index are instructive features. In low apes there is an enormous increase in the occipital portion of the border; whereas, in the high apes, the amount of increase is smaller. The relative shortness of the parietal border in high apes is due to the relative increase of the occipital and frontal borders. In low apes the reduction of the parietal portion is entirely due to the great size of the occipital lobe.

The following summary is reproduced verbatim:

1. At an early period in the development of the cerebral hemisphere a series of deep infoldings of its thin walls make their appearance. On the exterior of each hemisphere these show in the form of sharply-cut linear fissures.

2. Certain of these fissures are permanent; the great majority are transitory.

4. The transitory fissures, with two exceptions, have disappeared by the time the corpus callosum is fully formed.

4. A deficiency of the corpus callosum is associated with a persistence of the temporary fissures.

5. The temporary fissures indicate an important stage in the growth of the crebrum, and are apparently associated with the mapping-out of the occipital lobe.

6. A quadrupedal pause in the growth of the cerebrum brings the skull capsule into antagonism with the growth of the hemispheres, and in consequence, the wall of the cerebrum is thrown into folds. These folds disappear as the occipital lobe assumes shape, owing to

the expansion of the cranial cavity, and a restoration of growth-harmony between skull and brain.

7. Consequently it is only in Primates, which alone possess well-developed occipital lobes, that transitory infoldings of the cerebral walls in all probability exist.

8. The two transitory fissures which do not disappear before the full development of the corpus callosum are:—(*a*) the external calcarine, and (*b*) the external perpendicular fissure of Bischoff. In point of fact the latter fissure does not appear until after the full development of the corpus callosum.

9. The external calcarine fissure produces an infolding of the outer wall of the posterior horn of the lateral ventricle, which presents the same direction, and lies immediately opposite to the true calcarine infolding, or the calcar avis.

10. The fissure corresponding to this in apes is, as a rule, permanent, and in some species its anterior end forms in the adult, a bulging on the outer wall of the ventricle.

11. The external calcarine fissure disappears before the sixth month of foetal life in man.

12. The external calcarine fissure is present on the outer surface of the foetal cerebrum from the beginning of the fifth month to the end of the sixth month.

13. It is a complete fissure and corresponds to the "Affenspalte" on the ape's brain.

14. The "Affenspalte" on the ape's brain is also a complete fissure, and presents a well-marked bulging on the outer wall of the posterior horn of the ventricle; but, unlike the external perpendicular fissure of the human foetus, it is permanent.

15. Certain fissures, therefore, which are complete and temporary in the human brain are complete and permanent in the ape's brain.

16. The complete permanent fissures in the human are:—(a) the fore part of the calcarine; (b) the hinder part of the fissura arcuata; (c) in many cases the parieto-occipital; and (d) in some cases the mid-collateral. The Sylvian fissure is not a complete fissure.

17. Of the fissura arcuata the hinder part alone is preserved as the fissura hippocampi. The fore part, which is generally supposed to be retained as the callosal fissure, is in reality obliterated.

18. Synchronous with the appearance of the radial transitory fissures on the mesal face of the hemisphere two fissures appear, which lie in series with the former and occupy the ground afterwards

held by the parieto-occipital and calcarine fissures. These may be termed the precursors of these fissures.

19. The precursor of the parieto-occipital fissure sometimes shows an unbroken continuity of existence with the parieto-occipital fissure of the adult brain. In other cases it is obliterated, and its place is afterwards taken by a secondary sulcus, which attains, however, a very great depth.

20. In the adult brain the parieto-occipital fissure, even in its complete form, does not form any eminence on the inner wall of the posterior horn of the ventricle, because it does not extend downwards as far as the cavity. Above its lower end the hemisphere is solid.

21. The posterior end of the calcarine precursor is in every case obliterated, and the anterior part retained. The extent of the part obliterated varies considerably in different brains.

22. The anterior preserved portion of the calcarine fissure forms the "stem" of the —<-shaped fissural arrangement on this part of the hemisphere, and its hinder part corresponds to the calcar avis.

23. In the place of the hinder portion of the calcarine precursor, which is obliterated, a secondary furrow appears, This may be termed the posterior calcarine sulcus.

24. The posterior calcarine sulcus is formed in two pieces which run together, and also form the "stem." In this way the entire length of what, in anatomical language, is called the calcarine fissure is formed.

25. The posterior calcarine sulcus is not a complete fissure.

26. In the ape the entire length of the calcarine fissure is represented by that portion of the fissure which in man is termed the "stem," and by that alone. The posterior carcarine sulcus does not exist in any form in the apes.

27. The cuneus, therefore has a different morphological value in the apes and in man. In connection with this compare the abnormal human hemispheres. These exhibit certain conditions which approximate to those present in the apes."

The Fossa and Fissura Sylvii.

The sign of the Sylvian depression appears at the end of the second month of development, Dr. Cunningham summarizes his investigations as follows:—

"1. As growth proceeds the outline of the Sylvian fossa changes considerably. At first nearly circular, it elongates in a vertical direction and then backward on itself and assumes a triangular outline.

2. The high prominent mantle-border or rim which surrounds the depression is divided by intervening angles into four sections, viz.: the *temporal*, or lower; the *fronto-parietal*, or upper; the *frontal*, which is formed by an opening out and flattening of the primititive single anterior angle; and an *orbital*, or front portion.

3. Each of these portions of the bounding rim acts as an independent line of growth, and consequently, in course of time, four opercula grow over the Sylvian area so as to enclose it. The temporal and fronto-parietal opercula appear first; the frontal and orbital do not develop until a much later period.

4. The so called three limbs of the fissure of Sylvius are formed by the meeting over the Sylvian area of the contiguous lips of the four opercula; the posterior horizontal limb intervenes between the fronto-parietal and the temporal opercula; the anterior ascending limb between the frontal and fronto-parietal opercula; the anterior horizontal limb between the frontal and the orbital opercula.

5. The frontal operculum is therefore the same as the "cap de Broca," and it shows great variations in its length. It may be absent altogether and then the two anterior limbs of the Sylvian fissure are fused into one. When the frontal operculum is reduced in length we have the Y condition of the two anterior Sylvian rami.

6. The Sylvian fossa once mapped out on the surface of the hemisphere, it extends very rapidly. The growth is not proportionate with that of the hemisphere, it is much more rapid.

7. During intra-uterine life the anterior end of the insula maintains a very nearly fixed position with reference to the anterior end of the cerebrum, whilst the posterior end of the cerebrum moves rapidly towards the occipital pole. After birth the posterior end of the insula is fixed, whilst the anterior end, as growth advances, oscillates slightly—at first approaching and then retreating from the anterior end of the cerebrum.

8. An anterior limb of the Sylvian fissures can only be determined by the following tests: (a) it must cut right through the entire thickness of the operculum and reach the furrow surrounding the island of Reil. (b) It must lie in front of the præcentral sulcus.

9. A single anterior limb of the Sylvian was present in 30 per cent. of the hemispheres examined; the two anterior limbs quite distinct and separate were present in 37.5 per cent.; the Y-shaped condition of the two limbs was present in 31.5 per cent.

10. The two orbital limbs of the Sylvian fissure cannot be regarded as belonging to the same category of the true anterior limbs.

They are not developed as primitive deficiencies in the orbital operculum.

11. The posterior insula is not connected with the extremity of the temporal lobe, as Eberstaller has asserted, but with the limbic lobe.

12. On the surface of the foetal insula there appear three radial furrows which correspond in every respect with the three "Primärfurchen" on the outer surface of the mantle (viz: the fissure of Rolando, the inferior præcentral sulcus, and the vertical limb of the intra-parietal sulcus). The radial furrows on the insula clearly belong to the same fissural system and intermediate links between the three radial fissures on the outer surface of the hemisphere, and the three radial fissures on the insula may exist in the form of secondary sulci, cutting the margin of the fronto-parietal operculum.

13. The fissure of Rolando is clearly the proper boundary of the frontal lobe. Above, it is only separated from the calloso-marginal fissure, which bounds the lobe internally, by a narrow, but superficial gyrus; below, the inferior transverse furrow of Eberstaller acts as an intermediate link between it and the sulcus centralis insulæ. The sulcus centralis insulæ and the calloso-marginal sulcus are brought into close relationship at the anterior perforated spot on the base of the brain. An almost continuous fissural system, therefore, marks out the limits of the frontal portion of the cerebrum.

14. The temporal pole is formed entirely by the forward growth of the fore part of the temporal operculum.

15. In the adult brain the insula is proportionately longer in the male than the female. At all periods of growth it would seem that the insula is relatively longer on the left side than on the right side. In the negro brain it would appear that the insula is relatively shorter than in the European brain.

16. In the anthropoid ape the so-called anterior limb of the Sylvian fissure is not homologous with either of the anterior limbs in man.

17. In the chimpanzee and orang there are only two opercula, viz: the fronto-parietal and the temporal. The frontal and orbital opercula of the human brain are entirely absent in the anthropoid cerebrum.

18. Restricting the term insula to that part of the hemisphere surface which is concealed from view by opercula, the extent of this area in the ape is very much less than in man. The central index is 18.2 in the chimpanzee and 21.5 in the orang; in man the central

index is 29.6. In the lower apes the central index is higher than in the anthropoids.

19. In man the field of the insula shows marked changes with reference to the cranial wall during intra-uterine life. More and more of its area comes to lie under cover of the parietal bone, and relatively less under cover of the frontal bone, as development proceeds. In the adult the coronal line cuts the insula in such a manner that 13 per cent. of its length lies in front of it, and 87 per cent. behind it

20. In the chimpanzee and the low apes no part of the insula lies in front of the coronal line; in the orang the upper and anterior corner of the insula projects slightly in front of this line.

21. In the human infant and young child, as well as in the ape, the point at which the stem of the Sylvian fissure reaches the outer surface of the hemisphere is situated relatively further back than in the human adult.

22. The Sylvian fissure is relatively longer in the left hemisphere than in the right, and in the ape than in man." * * *

"28. In the cebus the Sylvian fissure lies above the level of the squamous suture; in the macaque, homadryas and orang, it lies immediately subjacent to the fore-part of the suture; in *Cynocephalus anubis* and the chimpanzee the fissure is situated in its fore part below the level of the front part of the suture.

29. The relative depth of the parietal and temporal lobes in the lower apes resembles that in the human child; in the anthropoid ape the relative parietal depth of the hemisphere exceeds that in the human adult."

The Fissure of Rolando.

Cunningham found that in 60 per cent. of the brains examined the upper end of the fissure of Rolando turned over the mesal border of the hemisphere: in 19 per cent. its ventral end was connected by a shallow transverse sulcus with the Sylvian fissure. The fissure of Rolando appears in two parts, the lower two thirds appears before and independent of the upper third. The relative position of the fissure of Rolando is remarkably constant. The upper fronto-Rolandic index is 53.3, the lower 43.3. In anthropoid the upper end of the fissure of Rolando is placed relatively further back than in man. The average Rolandic angle in the human brain is 71.7. The average relative length of the fissure of Rolando is 39.3.

The intra-parietal sulcus.

"1. The entire sulcus, single and continuous in some of the lower apes (e. g. Cebus), becomes broken up in the human brain into a group of furrows which present different relations to each other in different cases.

2. Three of the elements of the sulcus in the human brain, viz: the sulcus postcentralis inferior, the ramus horizontalis, and the ramus occipitalis, are disrupted portions of the original fissure; one, the sulcus post-centralis superior, is a superadded element.

3. In the development of the sulcus in the human foetal brain all the four segments of the sulcus have, as a rule, an independent origin, although, as Pausch has shown, the sulcus postcentralis inferior and the sulcus horizontalis very frequently appear as one continuous furrow.

4. The sulcus postcentralis inferior usually appears first; then the ramus horizontalis and ramus occipitalis; and last of all the sulcus postcentralis superior.

5. In Cebus there is no sulcus postcentralis superior, it is present, however, in most of the old world apes, e. g. the baboon, macaque, gibbon, chimpanzee, orang, and gorilla.

6. In the chimpanzee and orang there is reason to believe that this segment of the postcentral sulcus consists of two elements, one placed above the other.

7. Eberstaller's third and lowest segment of the postcentral sulcus (viz. the sulcus postcentralis transversus) is not only present in man but also in the majority of the old world apes.

8. In the apes the intraparietal sulcus is deeper than the fissure of Rolando, the opposite is the case in man. This would seem to indicate that the morphological value of the sulci is different in man and the apes. The phylogeny and ontogeny of these furrows are in apparent variance with each other. The fissure of Rolando appears first on the developing cerebrum of the human foetus, yet it is the intraparietal sulcus which first makes its appearance in the evolution of the primate cerebrum." * * *

"11. In man there appears to be a general tendency toward a union of the two originally distinct postcentral elements of the sulcus and a divorce from the lower of these of the ramus horizontalis." * *

"13. The ramus occipitalis was connected with the ramus horizontalis in 63.7 per cent. of the adult human hemispheres examined.

14. The union between these two elements of the sulcus, as Ecker and Wilder have shown, is much more common on the left side than on the right.

The sulcus transversus of Ecker is not the homologue of the "Affenspalter" in the apes, but merely a terminal bifurcation of the ramus occipitalis."

The Sulcus Præcentralis.

1. The sulcus præcentralis inferior in the human brain is composed of a vertical and a horizontal limb. The latter is carried forwards into the middle of the frontal convolution.

2. This furrow is the earliest to appear on the outer surface of the frontal lobe of the fœtal brain. In some cases it is seen in the fifth month cerebrum in the form of a long, deep, vertical sulcus, which subsequently undergoes a retrograde development before its adult condition is reached. In many cases, in its early condition, it presents a form in every respect comparable with that observed in the cerebrum of the low ape (Cebas.) Frequently it is developed in several pieces.

3. The sulcus præcentralis superior is closely connected with the basal part of the first frontal furrow. It is usually developed along with it. It consists of two pieces—an upper and a lower—which may be partially or completely separated from each other, as well as from the basal part of the first frontal furrow by an annectant gyrus.

4. Two additional furrows belonging to the præcentral system are occasionally present, viz: the sulcus præcentralis medius and the sulcus præcentralis marginalis.

5. The sulcus præcentralis medius may arise in two different ways: (*a*) it may be formed by the ramus horizontalis of the inferior præcentral sulcus divorced from the vertical stem and assuming a very oblique or an almost vertical position: (*b*) It may consist of a new element placed between the superior and inferior præcentral furrows, but showing a closer connection with the former." * * *

"12. The superior frontal gyrus and the middle frontal gyrus are each partially subdivided into two tiers or subdivisions by furrows which may be respectively termed the sulcus frontalis mesialis and the sulcus frontalis medius.

13. Both of these furrows have secured a firm footing in the human brain, but only one (viz., the frontalis medius) has established itself upon the brain of the chimpanzee." * * *

"17. The sulcus frontalis mesialis is absent or poorly developed in the brain of the negro." * * *

"20. The sulcus præcentralis inferior and the inferior frontal sulcus are the furrows which are most firmly impressed upon the brain of the apes. In Cebus they alone are present ; in Calithrix there are also traces of the sulcus præcentralis superior and sulcus fronto-orbitalis; in the baboon there are, in addition, a rudimentary sulcus frontalis superior, and perhaps (?) traces of a sulcus frontalis medius.

21. In the chimpanzee and the gorilla the sulcus frontalis medius is often present in a form precisely similar to that seen in the human brain; in the orang the condition of this sulcus is doubtful; in the gibbon the sulcus frontalis medius is absent.

22. In the chimpanzee, therefore, the same convolution tiers may be seen as in man with this exception: the superior frontalis is never split into two by a sulcus frontalis mesialis.

23. The inferior frontal convolution of apes is very different from that in man.

24. The frontal and orbital sylvian opercula are completely absent in the apes.

25. Consequently, a portion of the island of Reil is uncovered and exposed on the surface of the cerebrum.

26. The sulcus fronto-orbitalis of apes corresponds to the anterior limiting sulcus of the island of Reil in man.

27. There are no anterior limbs of the Sylvian fissure in the anthropoid apes. The so-called anterior limb of the Sylvian fissure corresponds to the anterior free border of the fronto-parietal operculum.

28. About the seventh month of fœtal life the inferior præcentral sulcus of the human brain attains a position which it retains unaltered throughout all the subsequent changes of growth; previous to this it is placed relatively further back on the surface of the hemisphere.

29. At first it is placed in front of the coronal suture. The sutural line, however, moves forward so that the sulcus ultimately comes to lie behind it.

30. In the ape cerebrum the inferior præcentral sulcus lies relatively much further forwards than in the cerebrum of man. It may be placed subjacent to, or in front of, the coronal line."

Animal Extracts as Nerve Stimulants.[1]

For a series of years Dr. Hammond has been experimenting with various extractives derived from normal tissues and intended to be injected into the circulation in order to supply the place of defective secretion or to correct imperfect nutrition or to restore the ravages of waste and time. Although the idea of treating certain diseases by means of a diet composed of animal tissues of the sort which happened to be impaired has been suggested [The Japanese practice has long embodied this idea.—Ed.] this procedure was rendered ineffectual by the results of digestion which reduced the compounds to a more elementary state. The author states that the difficulties of preparing fresh extracts are so great as to render this process impracticable, especially as the use of them is attended with great risk of blood poisoning or abcess-formation. Among the extracts produced is *cerebrine* which is prepared as follows: (See New England Monthly, p. 264-266.) "The whole brain of the ox, after being thoroughly washed in water acidulated with boric acid, is cut into small pieces in a mincing machine. To one one thousand grammes of this substance placed in a wide mouthed glass stoppered bottle, I add three thousand cubic centimetres of a mixture consisting of one thousand cubic centimetres each of a saturated solution of boric acid is distilled water, pure glycerine and absolute alcohol. This is allowed to stand in a cool place for, at least, six months, being well shaken or stirred two or three times a day. At the end of this time it is thrown upon a porous stone filter, through which it percolates very slowly, requiring about two weeks for entirely passing through. The residue remaining upon the filter is then enclosed in several layers of aseptic gauze, and subjected to a pressure of over a thousand pounds, the exudate being allowed to fall upon the filter and mixed with a sufficient quantity of the filtrate to cover it. When it has entirely filtered it is thoroughly mixed with the first filtate and the process is complete.

During the whole of this manipulation the most rigid antiseptic precautions are taken. The vessels and instruments required are kept in boiling water for several minutes and are then washed with a saturated solution of boric acid. Bacteria do not form in this mix-

---

[1]Wm. A. Hammond. On Certain Animal Extracts—Their Mode of Preparation; Physiological and Therapeutical effects. A lecture delivered at the New York Post-Graduate Medical School, Jan. 16, 1893. *New England Medical Monthly*, XII., 6.

ture under any circumstances, but it is necessary to examine it from time to time, microscopically, in order to see that no foreign bodies have accidentally entered. Occasionally, owing to causes which I have not determined, though I think it is due to variations in temperature, the liquid becomes slightly opalescent from the formation of a flocculent precipitate. It sometimes takes place in a portion of the extract kept under apparently identical conditions with other portions that remain perfectly clear. It can be entirely removed by filtration through Swedish filtering paper, previously sterilized, without the filtrate losing any of its physiological or therapeutical power.

Five minims of this extract diluted at the time of injection with a similar quantity of distilled water constitutes a hypodermic dose.

The most notable effects on the human system of a single dose are as follows—though in very strong, robust and large persons, a somewhat larger dose is required, never, however, exceeding ten minims—

1. The pulse is increased in the course of from five to ten minutes, or even less in some cases, by about twenty beats in a minute, and is rendered stronger and fuller. At the same time there is a feeling of distention in the head, the perspiration is largely increased, the face is slightly flushed, and occasionally there is a mild frontal, vertical, or occipital headache, or all combined, lasting, however, only a few minutes.

2. A feeling of exhilaration is experienced which endures for several hours. During this period the mind is more than usually active and more capable of effort. This condition is so well marked that if a dose be taken about bedtime, wakefulness is the result.

3. The quantity of urine excreted is increased, when other things are equal, by from eight to twelve ounces in twenty-four hours.

4. The expulsive force of the bladder, and the peristaltic action of the intestines are notably augmented, so much so that in elderly persons in whom the bladder does not readily empty itself without considerable abdominal effort, this action is no longer required, the bladder discharging itself fully and strongly, and any existing tendency to constipation disappears, and this to such an extent that fluid operations are often produced from the rapid emptying of the small intestine.

5. A decided increase in the muscular strength and endurance is noticed at once. Thus, I found in my own case that I could "put up" a dumb-bell weighing forty-five pounds fifteen times with the right arm and thirteen times with the left arm, while after a single

dose of the extract I could lift the weight forty-five times with the right arm and thirty-seven times with the left arm.

6. In some cases in elderly persons an increase in the power of vision is produced, and the presbyoptic condition disappears for a time.

7. An increase in the appetite and digestive power. Thus, a person suffering from anorexia and nervous dyspepsia is relieved of these symptoms, temporarily at least, after a single dose hypodermically administered.

"These effects are generally observed after one hypodermic injection, and they continue for varying periods, some of them lasting for several days. In order that they may be more enduring, two doses a day should be given every day or every alternate day, as may seem necessary, one in the morning and one in the afternoon, and kept up as long as the case under treatment seems to require. The most notable effects are seen in the general lessening of the phenomena accompanying advancing years. When some special disease is under treatment, the indications for a cessation of the injections will be sufficiently evident either by an amelioration or cure."

"To the substance obtained in this manner and held in solution, I have given as stated, the name of 'cerebrine' as the one, in view of its origin, most appropriate."

"I have employed the solution of 'cerebrine' with curative effects in many diseases of the brain and nervous system. It is almost specific in those cases of nervous prostration—the so-called neurasthenia—due to reflex causes or excessive mental work, or persistent and powerful emotional disturbance. A hypodermic injection of five minims, twice daily, continued for two or three weeks, and without other medicine, being sufficient to produce cure. It has proved equally effectual in cases of cerebral congestion, in which the most prominent symptom was insomnia, sleep being produced usually in the course of two or three nights. I have also employed it successfully in migraine, hysteria, melancholia, hebephrenia—the mental derangement occurring in young people of either sex at the age of puberty—in old cases of paralysis, the result of cerebral hemorrhage. In neuralgia, sciatica, and in lumbago, it has acted like a charm, except in one case of facial neuralgia, in which it did not appear to be of the slightest service."

"I have employed it in eleven cases of epilepsy. Three of these were of the *petit mal* variety; in two the effect has been so marked that I am not without the hope that cures will result, although I am not able, as yet, to speak positively on this point, the patients having been less than a month under treatment. In the other no influence appeared to be produced."

"Eight cases were of the *grand mal* variety. In two of these the number of paroxysms has been reduced more than one-half, and greatly mitigated in severity. In six other cases which were of long duration I could perceive no curative effects."

"In a case of general paresis no therapeutical influence was apparent beyond that of arresting the delusions of grandeur for a few days. In a case of hebephrenia, however, occurring in the person of a young lady eighteen years of age, the effect has been most happy, the symptoms entirely disappearing in a little more than a month's treatment."

"In several cases of nervous prostration, the result of long-continued emotional disturbance, and in which there were great mental irritability, dyspepsia, physical weakness, loss of appetite and constipation, relief was rapidly afforded. In three other cases in which the most notable symptoms was functional cardiac weakness, the effect has been all that could have been desired. In these cases it was employed in conjunction with 'cardine,' the extract of the heart of the ox, made in the manner already described"

These discoveries, associated with the respected names of Hammond and Brown-Sequard, cannot fail to attract the attention of the medical profession and, if found available, will open a new era in medicine. They promise also to throw fresh light upon the obscure problems of nutrition within the brain. If we recognize the fundamental processes of neurosis as nutritive, anything which serves to determine the nature and effects of the nutrition of the brain and nervous system will be of great significance to psychology. The histology of nerve-cells is advancing so rapidly that we may soon hope to know minutely the nature of those changes which express themselves in the shrinkage of the nuclei and destruction of the chromatin when a cell has been subjected to long and exhausting stimulation or in cases of natural exhaustion.

Treatment of Insanity of Myxœdema by Thyroid Grafts.[1]

Macpherson describes, in the Edinburg Medical Journal, 189-, No. 5, a case of myxœdema of three years' standing and characterized by melancholia and hallucinations. The tendon reflexes were exaggerated, the extremities cold and oedematous. Menstruation

[1] Archives de Physiologie normale et pathologique, 4, 1992.

appeared every fortnight and lasted seven days. A lobe of the freshly excised thyroid gland of a sheep was grafted under the skin of the two sub-mammary regions. The headache and melancholia disappeared permanently as did the hallucinations.

The skin nutrition became normal and the periods became regular.

Many other cases are mentioned by Brown-Sequard where injection of the prepared juice of the thyroids has been most efficacious in removing the effects of myxœdema.

The Lumbar Nerves of the Apes and Man.[1]

These nerves were studied in Cynocephalus, Rhesus, Hylobates Orang, Chimpanzee, Gorilla and man.

The most remarkable result of the comparison was that in man the last lumbar nerve is at least partially included in the plexus while in the apes it is wholly combined with the sacral plaxus.

The author remarks that the plexus exhibits, in origin, course and anastomoses, almost a complete identity between man and the apes Figures illustrate the relations in the several species.

The Nerves of the Arm and Hand in Apes and Man.[2]

Interest gathers especially about the brain and the hand of apes as it is in these respects that man is supposed to differ most remarkably from the anthropoids. The paper just noted gives a very detailed and apparently precise account of the distribution of the nerves and Paccinian corpuscles.

The three nerves of the flexor aspects of the upper extremity, the medianus, musculocutaneus and ulnaris are related and have been separated from each other in the course of philogenetic development. The resulting variability renders them unreliable in determining the homologies of the muscles they may supply. The radialis, supplying the dorsal aspect, is relatively constant in apes as in man. The principal variations are in the sensible branch to the back of the hand which has a larger area of distribution in apes. In general, deep and permanent distinctions in these respects do not exist between man and the apes but the differences are frequently such as appear occasionally in man as variations.

---

[1]Die lendennerven der Affen und des Menschen. ANTON UTSCHNEIDER *Münchener medicinische Abhandlungen.* VII, 1. 1892.

[2]Die Nerven des Armes und der Hand bei den Affen und den Menschen. DR. WILHELM HÖFER. *Münchener medicinische Abhandlungen.* VII, 3, 1892.

Changes Due to Functional Activity in Nerve Cells.[1]

Dr. Hodges has performed numerous experiments upon several vertebrates for the purpose of seeing what changes if any are produced in nerve cells as a result of activity. These experiments were of two sorts; in one case the ganglia were removed from animals that had undergone normal fatigue; in the other case fatigue was produced artificially. In the first case a ganglion was removed from an animal early in the morning and in the evening a corresponding ganglion was removed from another specimen of the same animal. Both of these ganglia were submitted to exactly the same hardening, staining, cutting and mounting methods. For this purpose the author used spinal ganglion and brain of English sparrow, pigeon, swallow, and the brain of a honey bee. For producing the artificial fatigue use was made of electricity. The ganglion was stimulated by a current from a DuBois-Reymond coil. The circuit was broken once a minute by means of clock work. At the end of the experiment the desired ganglion and its mate on the opposite side were removed. From this point on every effort was made to submit the ganglia to exactly the same treatment. "In no instance were they separated from the time they left the animal to the time when, placed side by side upon the same slide, they appeared under the microscope for study. In every case they were carried through the same reagents, in the same bottles or dishes from the first fixing fluid to the solid paraffin. And further, the two are cut at the same stroke of the microtome knife, fixed to the slide together, stained together, and appear side by side in same field of the microscope." For these experiments the author used: spinal ganglia of dog, cat, and frog.

The experiments thus conducted demonstrate, beyond a doubt, that metabolic changes in nerve cells are as easily demonstrated as similar changes in gland cells.

Under the influence of fatigue, the nucleus decreases in size, loses its reticulated appearance, and its cell wall becomes jagged and irregular in outline.

Under the influence of fatigue, in the spinal ganglia the cell protoplasm shrinks slightly and becomes vacuolated; while in the cerebrum and cerebellum, the cell protoplasm shrinks a great deal and there is an enlargement of the pericellular lymph spaces. It was also discovered that fatigue lessens the power of cell protoplasm to be stained or to reduce osmic acid.

---

[1] *Hodges, C. F.* Study of changes due to Functional Activity in Nerve Cells. *Jour. of Morphology.* Vol. VII, 1894, pp. 95-168; pl. VII-VIII.

Fatigue causes the nuclei of the cell capsule to decrease in size. Rest, if sufficiently long, will restore the normal morphological peculiarities of cells that have been fatigued by electrical stimulation. The process of recovery is slow, twenty-four hours being required to repair the damage done by five hours stimulation.

The curve of nerve rest or fatigue is not a straight line.

The author appends a long list of bibliography.

[C. H. T.]

The Brain of Mud Fishes.[1]

The Dipnoi are full of interest to the morphologist and have already attracted their share of attention. Owen and Weidersheim have described the anatomy of Ceratodus and Günther and Huxley have investigated Lepidosiren. The habit of some of these fishes of encasing themselves in a firm casket of mud and mucous during the dry season has enabled naturalists to bring them alive from their native waters. Dr. Burckhardt was fortunate enough to receive a number of such cases through the agency of Herr W. Jezler, a merchant who lived at Bathurst, Senegambia, but who died while searching for the early stages.

It thus became possible to make a careful study with the aid of modern technique, for which Dr. Burckhardt was well equipped by his extended experience. Some of the results of these studies were published in this Journal for September, 1892.

The prosencephalon is relatively much larger than in Petromyzon but is otherwise very similar. As in that genus there are well-developed hippocampal lobes to which, as the writer has shown to be the case in bony fishes, the lateral radix of the olfactory passes. The diencephalon reminds one in many respects of the Lampreys, but in others approaches Amphibia. The cerebellum is developed about as in the latter group, while the elongated medulla and extensive metaplex gives the brain a very primitive aspect.

The cord. The arrangement of the elements in the cord is very simple. The spongioblastic framework is a mere radial system as in the embryo and the gray matter is of small extent.

The substantia gelatinosa appears for the first time in this group. The cells of the ventral cornua are of relatively enormous size. The Mauthner fibres are also of great size and exhibit a fibrous structure,

---

[1] Das Centralnervensystem von Protopterus annectens. Eine vergleichend-anatomische Studie. DR. RUDOLF BURCKHARDT. R. Friedländer and Son, Berlin, 1892.

which in horizontal sections is seen to be due to the entrance of fibres from without.

The medulla is very simple and is wedge-shaped with the broadest portion at the entrance of the trigeminus. The form is wonderfully like that of the human at an early stage. The hypoglossus emerges in two bundles from the ventro-lateral aspects.

The vagus consists of a motor portion with three ventral roots which arise in niduli, corresponding to the ventral cornua, and four chief groups of fibres on the lateral aspects: 1, a small root lying dorsad of the caudal motor root and receiving the fasciculus solitarius; 2, in front of this a bundle with three lateral fibres from lateral niduli and two apparently sensory bundles; 3, a group with four lateral bundles at the same time containing ascending fibres; 4, a cephalic group of two roots, one being sensory, the other lateral motor.

The glossopharyngeal emerges somewhat cephalad with two closely associated sensory and one motor root containing fibres from its nidulus and the fasciculus communis.

The acustico-facial is the largest nerve which emerges from the medulla. A dorsal root (VII) emerges from an adjacent motor nidulus and also contains sensory fibres passing to the dorsal region of the medulla. Ventrad of this is a large root from the fasciculus communis also containing sensory fibres (VIII, 1). The strongest branch lies just ventrad of the above and is the same plane as the cells which give rise to Mauthner's fibres (VIII, 2). The remaining roots lie still ventrad.

Burckhardt discovered fibres corresponding to the sixth and fourth, thus showing that Weidersheim's statement that the Dipnoi lack the abducens and trochlearis was founded on insufficient information and completing the evidence that these nerves are common to all vertebrates.

The trigeminus contains fibres from its nidulus in the floor of the metencœl and mescencephalic nidulus, which latter is connected by fibres passing through the cerebellum. The sensory contingent is composed of the ascending root and cerebellar fibres.

The cerebellum resembles that of amphibia. Cells are found in its basal and lateral portions, but Purkinje cells are absent.

The fibres contained are (1) decussating tracts from the mesencephalic nidulus of the trigeminus; (2) fibres passing from the latter cells to the acusticus; (3) fibres which decussate and pass cephalad of the opticus (?). This tract compares with the cephalic cerebellar peduncles, which in bony fishes have somewhat different connections than those here described.

The mesencephalon resembles that of amphibia. Two ventral expansions in front of the region of the oculomotor may be thought to give plausibility to the theory that the mesencephalon is composed of three neuromeres. That one of these corresponds to the hypoaria does not seem to have occured to Dr. Burckhardt, who identifies these bodies with a protrusion of the diencephalon *cephalad* of the hypophysis. The oculomotor arises from two niduli. Aside from these roots the mesencephalic roots of the trigeminus and the optic tracts arise in the mesencephalon and there pass into it fibres from the supracommissure, and postcommissure; the lemniscus and Meynert's bundle and the dorsal longitudinal fasciculus, basal prosencephalic tract and cephalic cerebellar peduncles pass through it.

The diencephalon is almost exactly as in amphibia. The form of the roof is very simple and gives a good idea of its typical structure in all vertebrates. Great divergence in nomenclature has existed which arose out of misinterpretation of the various elevations and modifications of the roof. Burckhardt applies the term conarium to the homologue of the dorsal sac of fishes. This is in communication with the praeplexus cephalad and the velum caudad. The latter is continued backward in the socalled pineal pillow (Zirbelpolster). The pineal proper lies behind the supracommissure So far from these relations being abnormal, they may be recognized in all vertebrates.

It seems to the the writer that Dr. Burckhardt is in error in identifying the ventral protrusion of the diencephalon (tuber cinereum) with the hypoaria (lobi inferiores.)

The hypophysis is almost exactly as in amphibia. Burckhardt distinguishes lobi hippocampi upon the caudo-lateral aspects of the hemispheres as the writer has done in bony fishes and demonstrates a connection with the olfactory lobes. The latter are divided into tuber, tract and bulb. A large protuberance on the ventral surface beneath the tubers forms a lobus postolfactorius. The presence of a rudimentary cortical layer is of interest as probably indicating the first appearance of the cortex among vertebrates. The precommissure is well developed but the so-called "mantle bundle" of Edinger is absent. The callosum is present in the form described by Osborn.

Wiedersheim had described in 1876, in *Phyllodactylus europæus*, a sac with many branching diverticula, filled with otolith-sand and lying in relation to the choroid plexus of the 4th ventrical. Hasse had previously seen in Amphibia a similar structure, which Coggi had investigated in the frog. Burckhardt has for the first time observed and figured it in Protopterus. The saccus communicated by a narrow neck with the sacculus and utriculus of the auditory vesicle, and with its diverticula overlaid the region of the 4th ventricle, and extended as far back as the 1st pair of spinal nerves.

The memoir contains a short chapter on the phyletic development of the brain of Protopterus. Starting with Selachia, he considers that one line of development has been through Protopterus to Ichthyophis, and thence to the Urodela and Anura; another through Ceratodus to Reptilia and Mammalia; whilst a third line is from the Selachia to the Ganoids and Bony Fishes.

The Structure of Nerve Cells.[1]

Dogiel has investigaied the minute structure of the retina by means of the methyl blue process [precipitating the blue by picrate of ammonia-osmic acid mixture) and sums up his results as follows:

1. The retina contains the following nervous elements: (a) cells with protoplasmic processes and an isolated axis-cylinder process which passes directly into the axis cylinder of a nerve (cells of the first group;) (b) cells with protoplasm process and an axis cylinder process but the latter not directly connected with nerve fibres but dividing into these branches forming a reticulum; (c) cells with only protoplasm processes.

2. The axis cylinder of nerve fibres begin: (a) directly from the cell body or a protoplasmic process of such a cell; (b) from the nerve net formed by the axis cylinder processes of the second group, and finally, (c) directly from nervous branches and threads derived from the subdivision of the group III.

3. The protoplasmic processes of all nerve cells of the retina unite to form a reticulum as a result of which the cells belonging to a group or type are united into a colony.

4. Like the axis cylinder processes the protoplasmic processes have an indubitable nervous nature and are not related with either the blood vessels or glia cells.

5. The body as well as the fibres of the nerve cells consists of a fibrous and interfibrillary substance and part of the fibres of a cell pass into its axis cylinder.

---

[1] A. S. DOGIEL. Zur Frage über den Bau der Nervenzellen und über das Verhaltniss ihres Axencylinder-Fortsatzes zu den Protoplasma-fortsätzen. *Archiv für Mikroskopische Anatomie* XLI, 1.

6. The nerve cells possess higher nervous functions as well as nutritive processes.

7. The nerves are not to be regarded as completely isolated individuals (in the sense of Waldeyer's neuromes.)

The figures accompanying the paper are excellent and seem to establish his positions. It may be remembered that Herrick has described the connection of the nerve cells in the retina by a reticulum. (See Festschrift for Leuckart.)

The Vital Node.

Gad and Marmescoy, according to Brown-Sequard, have been studying the respiratory centre and have shown that the spot which it has been customary since Flourens to speak of as the vital node may be removed without destroying the respiratory rhythm. There is, however, a mass of cells lower in the medulla which has the respiratory function. There has been something improbable in the statements given in our text books and we are prepared to find that the relations are less simple than we have been told.

Studies upon the Head of Craniate Vertebrates.[1]

The first number of this most valuable monograph is chiefly devoted to the development of the head of Acipenser sturio. We reserve an account of the details for another occasion and glance simply at some of the theoretical conclusions which make up a large part of the work.

One important result has been the discovery of a dorsal neuropore situated in a thickened epidermal plate. This pore is obviously the homologue of the similar organ found in the larval amphioxus. The projection resulting from the separation of the brain from the epidermis, i. e. due to the separation at the neuropore, constitutes the lobus olfactorious impar, and this represents permanently the very front of the brain. [The dorsal front, it would seem, for the origin of the pore is obviously from the dorsal aspect of the tube.] The author finds himself in agreement with Van Wijhe who found the point of connection of skin and brain in the bird embryo between the epidermal thickenings or fundaments of the olfactory. Kupffer, however, finds in Acipenser a median olfactory plate. He considers it

---

[1] C. von Kupffer. Studien zur Vergleichenden Entwicklungsgeschicte des Kopfes der Kranioten. Munich and Leipzig. J. F. Lehmann. 1893. Price 10 marks.

very probable that all vertebrates have a single olfactory lobe and identifies it unquestioningly in the human embryo. Another conclusion which may be recognized as conforming to views expressed in this journal is that there is no secondary prosencephalon but the hemispheres constitute a dorsal appendage which the author calls epencephalon despite the use of the term by most authors for the cerebellum. The three embryonic vesicles remain the distinctive regions of the brain. There is no subsequent longitudinal partitioning but, on the other hand, the prosencephalic vesicle suffers many secondary modifications. Dorsally is the pallium of the cerebrum, that of the diencephalon, the paraphysis, and the epiphysis, and ventrally the optic vesicles and the infundibulum with its appendages. The eye vesicles develop from a single median vesicle.

The enormously developed infundibular region is termed "Hypencephalon."

Kupffer agrees with Osborn that the cerebellum is primarily a commissure but he does not accept his conclusions respecting the intersegmental value of the commissures and accepts Burckhardt's position respecting the roof of the diencephalon. It cannot be doubted that the pineal proper always arises caudad of the supra-commissure. This the present writer has conclusively observed in amphibians. The whole matter has been well cleared up by Edinger and Burckhardt. The olfactory plate is regarded as homologous with the olfactory pit of amphioxus. The hypophysis arises from a distinct fundament ventrad of the olfactory plate.

The hypophysis is regarded as a "palæostoma" or rudiment of the primitive mouth. If this is accepted we do not see why this should not be regarded as evidence that the related cerebral region is the actual front of the brain. The paper is well illustrated and absorbingly interesting.

Open Pharyngeal Clefts in the Human Embryo.[1]

Although it has been recognized since the time of Rathke that amniates as well as anamniate vertebrates posess well defined visceral or gill arches during part of their life it would seem that the occurrence of open clefts in the former groups, in which the gills never develop, must have simply an ontogenetic significance. In the work

[1] EUGEN TETTENHAMER. Ueber das Vorkommen offener Schlundspalten bei einem menschlichen Embryo. *Münchener medicinische Abhandlungen*, VII. 2. J. F. Lehman, Munich, 1892. Price, 1 mark.

before us the history of the animated discussion as to the normal or general occurrence of the clefts is given at length. The evidence seems adequate to prove that in reptiles, birds and certain mammals more or fewer of the clefts actually break through.

The specimen described was a human embryo with at least 34 protovertebræ. It seems to have been quite carefully preserved and every precaution was taken to preserve any traces of a membrana abturatoria. The second, third, and fourth clefts were found open and the ectoderm continuous with the lining membrane of the clefts. It cannot fail to be of interest that even in man these clefts, whose significance lies only in the common vertebrate ancestry, occasionally or temporarily occur.

The paper contains other points of interest to the morphologist and is illustrated by 11 figures in half-tone.

Peripheral Distribution of the Fibres of the Posterior Nerve Roots.

Professor Sherrington[1] has given an interesting account of his experimental attempt to determine the segmental relations between the several areas of distribution of the sensory roots.

The field of skin belonging to each sensory spinal root he terms the segmental skin field. Although in a plexus each posterior spinal root gives separate contributions to many nerve trunks, the cutaneous distribution of the root is composed of patches so joined that the distribution of the entire root forms one continuous field. Each segmental skin field, however, spreads over adjacent ones so that each region of the body is supplied by at least two dorsal roots.

The unmodified shape of a skin field is band-like (as in the thorax or neck) wrapping around the sides of the body. In the limb these areas are greatly distorted and apparently dislocated. The mid-dorsal line of the body may be said to be folded laterally at the origin of the limbs as is also the ventral region. Upon these axes the cutaneous segments are arranged.

The edges of the foot and hand are in the segmental fields of the limb about midway between the mid-dorsal and mid-ventral lines and, accordingly, correspond to the lateral line of the trunk from which the digits are buds. Vulva, anus, and umbilicus lie in the mid-ventral line. The nipple is in the 4th thoracic field. Six segments (3d–8th cervical) contribute to the anterior aspect of the fore limb ; the 1st to 4th thoracic contribute to the posterior part. The 1st–6th post-thoracic

[1] *Proc. Roy. Soc.* LII, 318.

segments supply the anterior aspect of the hind limb and the 6th–9th the posterior aspect.

The joints do not correspond to segmental limitations.

The segmental law rather than functional co-ordination is the basis of distribution.

Peyer's statement of the correspondence of locality of the muscular and cutaneous distributions of a spinal nerve does not apply to the monkey.

Muscles and Nerves in Mermis and Amphioxus.

Rhode[1] sharply criticises Retzius, and attempts to show that the latter has been mislead by appearances and that the supposed nervous fibrillæ which have been described as passing from the motor roots into the cord are not nervous. A hyaloplasm is supposed to exist where it has not been demonstrated. In any event, the supposed nerve fibres are neuroglia or connective tissue and consequently non-conducting.

The radiating fibres described by Retzius in the cord are simply spongioblasts.

The Cerebrum of Ornithorhynchus paradoxus.

Dr. Alex Hill[2] interestingly describes the cerebrum of the duck-bill platypus. The brain is truly mammalian, but has a remarkable development of the rhinencephalon, hippocampus and the cerebral commissures.

The olfactory bulb is quite free from the frontal portion of the hemisphere. Its stalk is quite thin and connected with the under surface of the hemisphere near the median line. The portion of the mantle which receives it is separated from the general surface by a deep ectorhinal fissure which nearly reaches the mesal surface. The pyriform thus blends with the hippocampal fold. The latter is enormously developed and is continued forward to the extreme anterior end of the brain, forming with the rhinencephalon a loop open in front.

No fibres cross the incisura pallii longitudinalis dorsally to the hippocampus and the callosum is therefore considered to be absent. A strong commissure or decussation lies within the concavity

[1] *Math. u. naturw. Mittheil. Preus. Akad. Berlin*, July, 1892.

[2] *Proc. Roy. Soc.*, June, 1892.

of the rhinencephalic loop, but its fibres are restricted to the hippocampal fold. We trust a complete monograph may soon be published.

Goltz and the Cerebral Hemispheres.

Professor Goltz still continues his experiments upon the brain of the dog and has succeeded in removing the entire cerebrum without destroying the vital functions, one animal living about 18 months after complete extirpation. The animal was demented and devoid of memory, intelligence and reflection, but far from being an insensible reflex mechanism. He could be awakened from sleep by tactile irritation. Hearing was preserved to some extent. He closed his eyes at a sudden flash of light. Taste was present, but smell seemed completely destroyed.

He resisted removal from his cage, growling and barking and even attempting to bite, as if normal. When left to himself he kept up a continuous circuit and, though he frequently slipped, he recovered without assistance and did not step on the dorsum of the foot. Any attempt to move his legs aroused symptoms of displeasare. The decerebrated dog is neither paralyzed nor affected with anæsthesia. Many of the symptoms immediately following extirpation are supposed to be due to inhibitory excitements due to the operative shock or subsequent irritation. The results are startling and serve to open questions which were supposed to have been permanently settled. It will be seen that the cases now reported present great if not insuperable difficulties to the theories proposed by Munk.

Application of Golgi Process to Worms.

We copy from "Science" the details of the process by which M. von Lenhossek demonstrates the existence of nerve cells in the skin of the earthworm. Pieces of an earthworm each three quarters of a millimeter long are placed for three to five days in about ten cubic centimeters of the following mixture: bichromate of potash 3.5 per cent, four parts; osmic acid, one per cent, one part. The pieces are dried on filter paper and placed in .75 per cent nitrate of silver to every 200 cubic centimeters of which a drop of formic acid is added. The pieces are then hardened rapidly in absolute alcohol and sectioned in elder pith, after which they are mounted without cover glass in benzole balsam. It may be added that the facts published by Lenhossek may also be made out by over-staining with hæmatoxylin and, in fact, were seen in such preparations by Mr. Turner, of Cincinnati, before the publication of the former's paper.

Development of the Ear of Amblystoma.

H. W. Norris describes the origin of the auditory vesicle in *Amblystoma jeffersonianum* and *A. punctatum.*[1] He finds no indication of a connection between the cavities of the saccus and the cranium such as has been described by Haase. In the primary utricular region three sensory patches are developed: the cristæ of the anterior and horizontal canals and the macula of the utricle. From the saccus five sensory patches develop: the crista of the posterior canal, the macula neglecta, macula sacculi, the papilla lagenæ, and the papilla basilaris. The paper is illustrated by two plates.

Skin Sensations of Central Origin.[2]

This interesting paper illustrates the existence of pruritic and other sensations whose cause is strictly central. Such subjective sensations are common in neurasthenia and only occur in neurotics. The author finds the cause in morbid changes in cerebral nutrition. Sometimes the pruritis announces itself suddenly and after intolerable local itching for some time ends as abruptly with the particular phase of the malady it accompanies. If toxæmic, the natural remedies would be such as might correct faulty nutrition but it is admitted that the actual results are not in conformity with the hypothesis. The paper suggests a field worthy of more attention than it has thus far received.

Nerve Terminations in Taste-buds.

Lenhossek[3] has reached conclusions very similar to those recently published by Retzius. The nerve fibres always end free in the bud. In the rabbit two sorts of nerve termini are encountered. The perigemmal and intergemmal branches, the former being probably a subepithelial plexus which contains a large number of small fusiform or multipolar cells. The author hesitates to regard these as nerve cells but withholds judgment. Respecting the gustatory cells the author says "they represent short nerve cells devoid of processes, the function of the processes being assumed by those of other cells." Except in the olfactory regions vertebrates afford no illustration of the structure described in the earth worm where the epithelium cell sends its processes into the central nervous system.

---

[1] *Journ. Morph.* VII, I.

[2] BREMER, L. Itching of Central Origin. *Review of Insanity and Nervous Disease.* Dec. 1892.

[3] Der feinere Bau und die Nervenendigung der Geschmaksknospen. *Anat. Anzeiger VIII, 4.*

Intrinsic Nerves of the Kidney.[1]

The following conclusions were reached: "That the renal nerves enter with the vessels at the hilum, and that with their multifarious ramifications and ganglionic enlargements they form a not in considerable portion of the kidney's entire substance. From the vascular nerves--which we may call the primary ones—come secondary-divisions, distributed throughout all the cortical and medullary-cortical regions in the form of a vast open network. That the glomerules are surrounded by a wide meshed plexus of fibres having terminal and end-knobs approximated closely to the Bowman capsule, but that no finer nerves can be seen penetrating that membrane; and end-terminations within the capsule upon the convoluted vessels, either in the form of knobs, or in the finer pointed terminations cannot be discovered. That fibres pass off singly and separately from the vascular nerves, and are distributed on the convoluted tubules, not only with end-terminations in the form of the well-known globular ending, but also in fine, delicate threads that penetrate the membrana propria of the tube and presumably enter the cement substance between the epithelial cells, and that the function of these divisions to the tubuli contorti is probably one concerning the urinary secretion. Lastly, that ganglionic enlargements occur widely, but that, strictly speaking, no nerve cells provided with nucleus, body, and protoplasmic areas are to be found; and that all renal nerves belong to the sympathetic system. The work was done by a modification of the rapid process of Gogli which has not been made public.

Nervous Endings in the Mucous Layer of the Ileum.

Dr. Henry J. Berkley[2] has applied the rapid Golgi method to the ileum with good result within the musoca, while the plexi of Auerbach and Meissner were not well differentiated. From the ganglionic masses of Meissner's plexus numerous non-medulated nerve fibres run in groups to the mucous layer. Many of the bundles encircle the arterioles and branch upon them. The other branches pass more directly to the mucosa where they branch and with the others form a subplexus in the muscularis mucosæ. Some of the branches supply curious globular masses which are regarded as homo logous with the motor end plates. Four or more fibres enter each

---

[1] BERKLEY, H. J. *Bul. Johns Hopkins Hospital.* IV. 28.

[2] *Anat. Anzeiger, Vol. III, 1.*

bulb which consists of a capsule filled with deeply staining particles in a highly refracting substance. A second form of end organ has the terminal knobs of the fibres more separately disposed among the fibres.

The granular zone at the base of the follicles of Lieberkühn is devoid of nervous structures while the bundles passing through it divide into those destined to the plexuses of the vlllous and Lieberkühn portions. The latter ramify in the adenoid tissue between the follicles forming an open plexus. The fibres to the villus are usually distinct in origin and pursue a zigzag course, often twisting about each other and terminate in end bulbs. The author does not regard these bulbs as cells but as homologues of the tactile corpuscles of the skin. The nervous supply of the mucosa is wholly derived from the plexus of Meissner. Free aborescent terminations were not found.

Circulatory Changes in Hypnosis.[1]

Dr. Kraup has shown that in hypnotic states the portions of the brain which have their function reduced are those which are supplied by the internal carotic arteries, while those parts which are functionally more excitable are supplied by the vertebral arteries. He believes that the carotid arteries are contracted and the vertebral arteries dilated during deep hypnotic sleep and finds the symptoms—such as the flushed face and changes in masseters, glands, eyes, etc. in harmony with the hypothesis. Hyperæmia of the pons and cord may account for the cataleptic state of the muscles.

Mirror Writing.[2]

It is shown that among left-handed imbeciles there is a more or less apparent tendency to write backward in such a way that it can only be read when reversed by reflection in a mirror.

Those who have practiced mirror writing find it easier with the left hand. An experiment was tried with a class of sixty children who were told to write their names with their left hands. Out of the number five wrote in mirror writing and these were the only left-handed pupils in the school.

The Ms. codex Atlanticus of Leonardo da Vinci, which is in mirror writing, is supposed to be the result of paralysis of the right side, which forced him to write with the left hand. The author believes that the image or localized changes is inverted in these cases.

---

[1] *Hospitals-Fidende.* 1892, p. 777.

[2] IRELAND, W. W. *Alienist and Neurologist*, XIV, 1, Jan., 1893.

Dr. Bianchi concludes that in hemiplegia of the right side the image not calling forfh, on the left hemisphere, any centrifugal motion of the muscles of the right hand, will oblige the extensor cellular groups of the sound right hemisphere to write from the left, because of the preserved remembrance of the muscular combination associated with the image of the word. Hence there will be an identical centrifugal motion and the reversed lithographic writing.

Revue Neurologique.

A new journal which comes to our table, published under the direction of Wm. E. Bressaud and P. Marie and bearing the above title, is intended to offer synopses of the important articles in neurology as well as some original matter.

The journal, which is printed on thick opaque paper and illustrated with process cuts, is to appear on the 15th and 30th of each month and contains summaries of the recent papers on anatomy, pathology, physiology, psychiatry and therapeutics of the nervous system.

Society reports and programs are included and the first number gives promise of usefulness.

Each number contains 24 pages and the supscription is 22 francs. The original article of the first number is entitled *Sept cas di polyneurite*, by Dr. Dutil, being derived from the clinics of Professor Charcot.

An index of current literature is devoted chiefly to the pathology and therapeutics of the nervous system.

The Universal Medical Journal,

This is the name under which the "Satellite" which has revolved so usefully about the annual of the Universal Medical Sciences for six years or more, now appears. It promises to become even more representative and useful under its new name than it has been hitherto. The corps of editors contains widely known specialists from most European countries.

RECENT LITERATURE.

ADAMKIEWICZ, A. Tafeln zur Orienterung an der Gehirnoberfläche des lebenden Menschen bei chirurgischen Operationen. 4 plates. Text in English, French and German. Vienna and Leipzig. W. Braunmüller.

ADOLPHI, H. Ueber Variationen der Spinalnerven und der Wirbelsäule anurer Amphibien. *Morpholog. Jahrb.*, XIX, 3, 1893.

ANTONINI, A. La corteccia cerebrale nei mammiferi domestici. Seconda nota preventiva. *Mon. Zool. ital.*, III, 11, 12.

ASSHETON, R. On the Development of the Optic Nerve of Vertebrates and the choroidal Fissure of embryonic life. *Quart. Journ. Microsc. Science*, XXXIV, 2, 1892.

BAYLISS, W. M. On some points in the innervation of the mammalian heart. *Journ. of Phys.*, XIII, 5, 1892.

BAYLISS, W. M., and STARLING, E. H. On some Points in the Innervation of the Mammalian Heart.

BECHTEREW. Ueber die Rindcentra sphincteris ani et vesicæ. *Neurolog. Centralblatt*, Feb., 1893.

BERTELLI, D. Sulla membrana timpanica della Rana esculenta. *Mon. zool. ital.*, III, 10.

BRANS, H. Die Rami ventrales der vorderen spinalnerven einiger Selachier. Jena, H. Pohle. *Med. Inaug. Diss.*

BURCHARDT, R. Ueber des Centralnervensystem der Dipnoer. *Verhandlg. d. Deutsch. zool. ges. auf. 2. Jahresvers. zu Berlin*, 1892.

BURCKHARDT, R. Das Centralnervensystem von Protopterus annectens. Eine vergleichend-anatomische Studie. Berlin, Friedländer u. Sohn, 1892.

CAJAL, S. R. El nuevo concepto de la histologia de los centros nerviosos. *Revista de cienc. med. de Barcelona*, XVIII, 1892.

CAPOBIANCO, F. Ulteriori ricerche sulle alterazioni istologiche del midollo spinale sequite alla tiroidectomia. *Bol. della societa de naturaliste in Napoli*, Ser. I, VI, 1892, 1.

CHIARUGI, G. Sullo sviluppo del nervo olfattivo nella Lacerta muralia. *Mon. zool. ital.*, Anno 3, N. 10.

DARKSCHEWITSCH, L. Ueber die Veränderungen in dem centralen Abschnitt eines motorischen Nerven bei Verletzung des peripheren Nerven. *Jahrb. f. Psychiatrie*, XI.

D'EVANT, T. Sopra un ganglio sfenopalatino accessorio nell' uomo. *Giorn. d'Assoc. napolit. di med. e natural*, III, 1, 1892.

DONALDSON, J. W. Involuntary Recollection. *Science*, XXI, 528, March 17, 1893.

EBNER, V. VON. Ueber die Beziehungen der Wirbel zu den Urwirbeln. *Sitzungsberichte Akad. d. Wissensch.*, CI, 1-2. Vienna, 1892.

EBERTH, C. J., und BUNGE, R. Die Endigungen der Nerven in der Haut des Frosches. *Anat. Hefte.*, Abt, 1 H., 5.

EDINGER, L. Modell des oberen Rückenmarksteiles und der Oblongata. *Anat. Anzeiger*, VIII, 5, 1893.

EISLER, P. Der Plexus lumbosacralis des Menschen. *Abhandl. d. naturforsch. Ges. Halle.*, XVII.

EICHBAUM, F. Ueber die Bewimperung der Augenlider des Pferdes. *Oesterr. monatsechr. f. Tierheilk.*, XVI.

EPSTEIN, L. Abnorme Faserbündel der Medulla oblongata. *Ungar. A. f. Med.*, I.

FRORIEP. Zur Frage der sogenannten Neuromerie. *Verh. der Anat. Gesellsch. auf. der sechsten Versamml. in Wien.*, 7-8 Juni, 1892.

FUSARI, R. Contribution à l'etude du dèveloppment des capsules surrènales et du sympathique chez le poulet et chez les mammiferes.

FUSARI, R. Caso di mancanza quasi totale del cervelletto. *Mem. d. R. Accad. d. sc. d Bologna*, 1892.

GAULE, J. Spinalganglien des Kaninchens. *Centralblatt f. Phys.*, VI, 11.

GEBERG, A. Ueber die Endigung des gehörnerven in der Schnecke der Säugetiere. *Anat. Anzeiger*, VIII, 1.

GEHUCHTEN, A. VON. Contribution a l' etude des ganglions cerebrospinaux. *Cellule*, VIII, 2.

GEHUCHTEN, A. VON. De l' origine du nerf oculo-moteur commune. *Bul. de l'acad. r. d. Scienc. de Belgique.* XXIV, 11, 1892; also *Cellule*, VIII, 2.

GEHUCHTEN, A. VON. Les elements nerveux moteurs des racines posterieures. *Anat. Anzeiger*, VIII, 6-7.

GEHUCHTEN, A. V. Contributions à l'etude des ganglions cèrèbro-spinaux. *Bull. Ac. r. de Belg.*. S. 3, XXIV, 8.

GOEPPERT, E. Untersuchungen über das Sehorgan der Salpen. *Morph. Jb.*, XIX, 2.

GOODALL, E. Description of the motor Area of the Cortex Cerebri of an Infant. *Am. Jr. of Insanity*, Utica, N. Y., 1892-3.

GRADENIGO, G. Sulla conformazione del pacliglione dell' orecchio presso le donne delinquenti. *Arch. di psichiat sc. pen.*, XIII, 1, 1892.

GRIFFITHS, A. B. Sur les tissus nerveux de quelques invertebres. *Compt, rend.*, CXV, 16.

GUILTCHENKE, N. Le poids du cerveau chez quelques peuples du caucase.

GUDDEN, HANS. Beitrag zur Kenntniss des Trigeminusnerven, Berlin, 1891. *Inaug. Diss. von Würzburg.*

HEIBERG, J. Schema über die wirkungsweise der Hirnerven, 2d edit., Weisbaden, 1892.

HELD, HANS. Ueber eine directe akustische Rindenbahn und den Ursprung de Vorderseitenstranges beim Menschen, Leipzig. *A. Anat. u. Entw.*, 1892, 314.

HERRICK, C. L. Notes upon the Histology of the Central Nervous System of Vertebrates. *Festschrift zum siebenzigsten Geburtstage Rudolph Leuckart's.*

HIS, W. Zur allgmeinen morphologie des Gehirnes. *Archiv. f. Anat. u. Phys.* [Anat. Abth.] 1892, 4-6.

HIS, W. Zur Nomenclatur des Gehirnes und Rückenmarkes. *Archiv. f. Anat. u. Phys.* [Anat. Abth.] 1892, 5, 6.

HIS, W. SEN. Eröffnungsrede. (Ueber die allgemeine Morphologie des Gehirns.) *Verh. der Anat. Gesellschaft der sechsten Versamml. in Wien.*, June, 1892.

HIS, W., JUN. Ueber die Entwickelung des Sympathicus bei Wirbeltieren mit besonderes Berücksichtigung der Herzganglien. *Verh. der Anat. Gesellsch. auf der sechsten Versamml. in Wien vom* 7-9, June, 1892.

HILL, ALEX. The Hippocampus. Abstract. *P. R. Soc*, V. 52, No. 315.

———. The Cerebrum of Ornithorhyncus paradoxus. Abst. *P. R. Soc.* V. 52, No. 315.

HOLM, H. Die Anatomie u. Pathologie des dorsalen Vaguskerns. *Arch. f. path. Anat. u. Phys.*, CXXXI, 1.

HORSLEY, V. The Structure and Functions of the Brain and Spinal Cord. Being the Fullenan Lectures for 1891, Philadelphia, Blakiston, Son & Co.

HORSLEY, V. The Structure and Functions of the Brain and Spinal Cord. London, 1892.

HOESEL, O. Die Centralwindungen ein Centralorgan der Hinterstränge und des Trigeminus. *A. Psychiatrie*, XXIV, 2.

KATZENSTEIN, J. Ueber die Innervation des M. crico-thyreoideus. *Archiv. path. Anat.*, CXXX, 2.

KESSEL, G. Die Histologie der Ohrmuschel, des äuszeren gehörganges Trommelfells und mittleren Ohrs. *Handb. der Ohrenheilkunde.*

KIRILZEW, S. Zur Lehre vom Ursprung und centralen Verlauf des Gehörnerven. *Neurol. Centralb.*, XI, 21.

KRONTHAL, P. Von der Heterotypie der grauen Substanz im Rückenmark. Nach ein Vortrag geh. im psych. Ver., Berlin. *Neurol Centralblatt* XI, 23.

KUHN, A. Vergleichende Anatomie des Ohres. *Handb. der Ohrenheilkunde.*

KUPFFER, C. V. Studien zur vergleichenden Entwickelungsgeschicte des Kopfes der Kranioten. Munich and Leipzig, J. F. Lehmann.

LANGLEY, J. N. On the larger medullated Fibres of the Sympathetic System. *Journ. of Physiology*, XIII, Suppl., 1892.

LENHOSSEK, M. V. Die Nervenursprünge und Endigung im Jacobson'schen Organ des Kaninchens. *Anat. Anzeiger*, VII, 19-20.

LENHOSSEK, M. V. Der feinere Bau des Nervensystems im Lichte neuester Forschungen. *Fortschritte der Medicin*, X, 1892, 18.

LUCIANI. L. Das Kleinhirn. Neue Studien zur normalen und pathologischen Physiologie. *Deutsche Ansg.* von M. O. Fraenkel, Leipzig, 1893.

MAGINI, G. Sui filamenti dell' epitelio ependimale nel bulbo dell' uomo. *Bollett d. R. accadem. medica di Roma*, XVII, 1892, 4 and 5.

MALME, GUSTAV, O. A. N. Studien über das Gehirn der Knockenfische. Stockholm, 1892. *Inaug. Diss. von Upsala.*

MARCHESINI, R. Sopra alcune speciale cellule nervose dei lobi ottici della Rana.

MARSHALL, JOHN. On the Brain of the late Geo. Grote with Comments and Observations on the Human Brain and its parts generally. *Journ. Anat. and Phys.*, XXVII, 1.

MEYER, A. Ueber das Vorderhirn einiger Reptilien. *Z. f. wiss. Zool.*, LV, 1892, 1.

MEYNERT. Neue Studien über die Associationsbündel des Hirnmantels. *Sb. der K. Ak. d. wiss.. Math..nat. Cl.*, B. 101, 6 u. 7, Abt. 3.

METROPHANOW, P. Note sur la signification metamerique des nerfs craniens. *Congrès international d'archiologie prehistorique et d'anthropologie*, 11 session à Moscow.

MINGAZZINI, G. Sulle origini e connessioni delle fibræ arciformes e del raphe nella porzione distala della oblongata dell' uomo. *Intern. Monatschr. f. u. Phys.*, IX, 10, 1892.

MINGAZZINI, G. Intorno alla morfologia dell' "Affenspalte." *Anat. Anzeiger*, VIII, 6, 7.

MINGAZZINI, G. Contributo alla localizzazione dei centri corticali del linguaggio. *Annali di' freniatria*, III, 3.

MINGAZZINI, G. Sulla fina struttura del midollo spinale dell' uomo. *Riv. sperim. di fren. e. med. leg.*, XVIII, 2.

MONAT, J. P. Origines et centres trophiques des nerfs vaso-dilatateurs. *Gazette medicale de Paris*, Annee 63, 1892, 42.

MUELLER. ERIK. Zur Kenntniss der Ausbreitung und Endigungsweise der Magen, -Darm, -und Pankreassnerven. *Arch. f. mik. Anat.*, XL, 3.

NOTHAFT, A. V. Neue Untersuchungen über den Verlauf der Degenerations-und Regenerations-processe am verletzten periphern Nerven. *Zeits. f. wis. Zool.*, LV, 1, 1892.

OTT, ISAAC. Thermotaxis in Birds. The relation of the tubercula quadrigemina to the circulation and thermotaxis. *Journ. Nerv. Diseases*, Jan., 1893.

REDLICH, E. Die hinteren Wurzeln des Rückenmarkes und die pathologische Anatomie der Tabes dorsalis. *Arbeiten aus dem Instit. f. Anat. u. Phys. des Centralnervensystems an der Weiner Universität*, 1892.

RETHI, L. Die Nervenwurzeln der Rachen-und Gaumenmuskeln. Wien, F. Tempsky.

RETHI, L. Die Nervenwurzeln der Rachen-und Gaumenmuskeln. *Sb. der R. Ak. d. wiss. math.-nat. Cl. B.*, 201 H. 6 u. f.

ROSSI, U. Sui rapporte tra cervelletto edosso occipitale alla nascita.

ROSSI, U. Nuova osservazione di mancanza del verme cerebellare. *Sperimentale*, 1892.

ROSENBACH, O. Bemerkungen zur Mechanik des Nervensystems. *Deutsch. Med. Wochenschrift*, 43, 1892.

PALADINO, G. Contribution à une meillevae connaissance des èlèments des centres nerveux par la mèthode de l'iodure de palladium. *Journ. micrögr.*, XVI, 4.

Poniatowsky, A. Ueber die Trigeminus-wurzeln im Gehirn des Menschen nebst einigen vergleichend-anatomischen Bemerkungen. *Arbeiten aus dem Instit. f. Anat. u. Phys. des Centralnervensystems an der Weiner Universität*, 1892.

Preobrajenski, J. S. Ueber die Innervation des Nierengefasse.

Ptitzin, A. Beobachtungen über die Entwickelung des peripherischen Nervensystems des Hühnchens. Univ. Warchau. [Russian.]

Ptitzine, A. Note sur la formation du germe du système nerveux pèriphèrique. *Congres internat. d'archiologie prehistorique et d'anthrop* , 11 Session à Moscow.

Sarbo, A. Ueber die normale structur der Ganglienzellen des kaninchen rückenmarks und über deren pathologische Veränderungen by Vergiftung mit Phosphor und Morphium. *Ungar. Arch. f. Med.*, I, 1892.

Saint-Remy, G. Contribution à l'histologie de l'hypophyse. *Arch. de Biol.*, XII, 3.

Scervini, P. Anatomia dei centri nervosi. Napoli, Jovene & Co., XV.

Schaffer, Karl. Vergleichende anatomische Untersuchungen über Rückenmarksfaserung. *Mathem. u. naturwissensch. Berichte aus Ungarn*, IX, 1892.

Schoenemann, A. Hypophyses und Thyreordea. Berlin, 1892.

Sherrington, C. S. Experiments in Examination of the Peripheral Distribution of the Fibres of the Posterior Roots of some Spinal Nerves. *Proc. Roy. Soc.*, LII, 318.

Sherrington, C. S. Notes on the Arrangement of some Motor Fibers in the lumbosacral plexus. *Journ. of Physiol.*, XIII, 6.

Staurenghi, C. Contribuzione alla ricerca del decorso delle fibre midollate nel chiasma ottico. *Mems. R. sc. mat. e natur.*, XVII, 3.

Stieda. Ueber cranio-cerebrale Topographie. *Biol. Centralblatt*, XIII, 1.

Symington, J. The cerebral commissures in the Marsupialia and Monotremata, *J. Anat. and Phys.*, XXVII, 1,

Tenchini, L. Sui cervelli di delinquenti. *Archiv. di psich. sc. pen. ed anthropol. crim.*, XIII, 4, 5, 1892.

Thanhoffer, S. v. Ueber die Nervenendigung der quergestreiften Muskelfasern uud über Re- and Degeneration derselben. *Anat. Anzeiger*, VII, 19-20.

Thilenius, G. Ueber den linsenförmigen Gefässkörper im auge einiger Cypriniden. *Archiv. f. mikroskop. Anat.*, XI, 3, 1892.

Tooth, H. H. The Destination of the antero-lateral ascending tract- *Brain*, 59:60, 1892.

TOOTH, H. H. On the Relation of the Posterior Root to the Posterior Horn in Medulla and Cord. *Journ. of Phys.*, XIII, Suppl., 1892.

TUKE, D. HACK. A Dictionary of Psychological Medicine. P. Blakiston, Phila.

KOELLIKER, VON. Ueber die Entwickelung der Elemente des Nervensystems, contra Beard and Dohrn. *Ver. der Anat. Gesellsch. auf der sechsten Ver. samml. in Wien*, June, 1892.

———. Demonstration einer Reihe von Präparaten vom centralnervensystems. *Ver. der Anat. Gesellsch. auf der sechsten Versamml. in Wien.*, June, 1892.

WALDEYER. Die Modelle zur Darstellung der Topographie des Gehirnes nach Präparaten von D. J. CUNNINGHAM in Dublin von CASCIANI augefertight.

WALLER. A. D. On the Functional Attributes of the Cerebral Cortex. *Brain*, 5, 9, 60, 1892.

WIJHE, J. W. v. Ueber Amphioxus. *Anat. Anzeiger*, VIII, 5, 1893.

WILHELM, E. Materiaux pour servir à l'etude anthropologique du pavillonde Poseille. (Suite.) *Revue biologique du Nord de la France*, IV, 10, 1892.

WILLEY, A. On the Development of the Hypophysis in the Ascidians. *Zoologischer Anzeiger*, XV, 1892, 400.

WLASSAK. Die centralorgane der statischen Functionen des acusticus. *Centralblatt. f. Physiol.*, VI, 16, 1892.

ZEISSL, M. v. Experimentelle Untersuchungen über die Innervation der Blase. *Prager med. Zeitung*, XVII, 41, 1892.

PATHOLOGY.

ANDREWS, E. Removal of the Gasserian ganglion. *Journ. Amer. Med. Assoc.*, XX, 7.

BARDOL, A. De l'hysterie simultrice des maladies organique de l'encephale chez les enfants. Thesis, Paris, 1893.

BERNHEIM. Poliomyelites anterieures subaige et chronique del' adulte greffees sur la paralysie infantile. *Revue de medicine*, I, 1893.

BERRY, J. Case of Brain Injury. *New England Medical Monthly*, XII, 5.

BOURNVILLE. Recherches clinques et therapeutiques sur l' epilepsie, l'hysterie et l' idiotie. *Progress medical*, Paris, 1892.

BROWNING, WM. The Nervous Affections that may arise from Malaria. *Brooklyn Med. Journal.*

BRUNO, L. Zur Pathologie der isolirten Lähmung. *Neurol. Centralblatt*, 2, 1893.

CHABBERT, L. De la maladie des tics. *Arch. de neurol.*, 73, Jan., 1893.

CHARBOT, J. M. Le Somnabulisme hysterique. *Gaz. hebd. de med. et de chirugie*, Jan. 7, 1893.

HALLION, L. Des Deviations vertebrales neuropathiques. Theses, Paris, 1892.

MERZ, C. H. The Surgical Treatment of Injuries of the Brain. *St. Louis Clinique*, VI, 2, 1893.

MOYER, H. N. Alcoholic Insanity as Illustrated by the Case of John Redmond. *Journ. Amer. Med. Assoc.*

NAGEL, W. Bemerkung über auffalend starke Einwerkung gewisser substanzen auf die Empfindungsorgane einiger Tiere. *Biologische Centralblatt* XII, 1892.

NAECKE, P. Die Rumination, ein seltenes und bisher kaum beachtete, Symptom der Neurasthenie. *Neurol. Centralblatt.*

OLIVER, C. A. Cases of Symmetrically-placed Opacities of the corneæ occurring in mother and son. *Ophthalmic Review*, XI, 134.

RILEY, W. H. Contribution to the study of Progressive Muscular Atrophy. *Modern Medicine*, II, 1.

ROGER, H. Contribution a l'etude die choc nerveux d'origine cerebrale. *Archiv. de physiol.*, Jan., 1893.

SCHLESSINGER, H. Ueber die klinischen Erscheinungsformen der Syringomyelie. *Neurol. Centralblatt*, 3, 1893.

SCHULZE. Zur Lehre von den Nervenkrankheiten nach Unfällen. *Deutsh. med. Wochenschrift*, 1 Jan., 1893.

TAYLOR, JAMES. Case of syringomyelia with necropsy. *The Lancet*. Jan. 1893.

TOURETTE ET DAMAIN. Un danseur monomane. *Progres med.* 2, 1893.

WICKMANN, R. Ein Fall von Myxoedem gebessert durch injectionem mitschilddrüsensaft. *Deutsch. med. Wochenschrift*, 2 Jan., 1893.

ORGANS OF SENSE.

BUDDE, K. Ueber dehiscenzen in der unteren Wand der Pankenhöhle. Göttingen, 1891. *Inaug.-Diss.*

CAJAL, S. RAMON Y. La retina de los Teleósteos, etc. *Madrid*, 1892.

CIRINCIONE, G. Sui primi stadi dell' occhio umans. *Giornale d. assoct. napol. di med.*, II, 1891-92.

EDINGER L. Ueber die Entwickelung unserer Kenntnisse von der Netzhaut des Auges. *Bericht über die Senckenbergische naturf. Gesellsch. zu Frankfort a. M.*, 1892.

FORRESTER, J. Eyes of different color. *Med. Recorder*, N. Y., 1892.

GROFSKOPFF, W. Die Markstreifen in der Netzhaut des Kaninchens und des Hasen. Marburg. *Anatom. Hefte*, 1892, Abt. 1, Band. 1.

ANDREWS, E. A. On the Eyes of Polychætous Annelids. *Jour. of Morphology*, VII, 2.

BARABASCHEW, P. Beitrag zur Anatomie der Linse. *Archiv. f. Ophthalmologie*, 38, 1892-3.

BAUMGARTNER, H. Beiträge zur Entwickelungsgeschichte der gehöreknöchelchen. Berlin, 1892. *Inaugural Dissertation.*

BORYSICKIEWICZ. Netzhautpräparate. Demonstration. *Verhand. der Anatom. Gesellsch. auf der sechsten Versamml. in Wien*, June, 1892.

BUETSCHELI, O. Einige Bemerkungen über die Augen der Salpen. *Zoolog. Anzieger.*, XV, 1892, 401.

BURCKHARDT. Das Randschlingennetz der Hornhaut beim Lebenden sichtbar. Aus der Abteilung f. Augenkranke. *Charite-Annalen*, XVII, 1892.

GRUENHAGEN, A. Ueber den sphincter papillæ des Froches. *Arch. f. d. ges. Phys.*. LIII, 910.

HEATON, G. Remarks on congenital Malformations of the Auditory Apparatus. *Journ. of Laryngology*, London, LI, 1892.

JOHANSEN, H. Ueber die Entwickelung des Imago-auges von Vanessa. Vorläufige Mittheilung. *Zoolog. Anzeiger*, XV, 1892, 401.

KOHL, C. Das Auge vom Petromyzon Planeri und von Myxine glutinosa, Leipzig-Rendnitz, 1892. *Inaug.-Diss.*

KOHL, C. Rudimendäre Wirbeltieraugen. *Bibl. Zool.*, XIII.

KOPSCH, FR. Iris und corpus ciliare des Reptilienauges nebst Bemerkungen über einige andere Augenteile. Berlin, G. Schade.

LENHOSSEK. M. v. Die Nervenendigung in den Endknospen der Mundschleimhant der Fische. *Verh. d. naturf. Ges. zu Basal.*, X, 1, 1892.

LENHOSSEK, M. v. Der feinere Bau und die Nervenendigung der Geschmacksknospen. *Anat. Anzeiger.* VIII, 4.

NIEMACK, J. Maculæ and Cristæ acusticæ mit Ehrlich's Methylenblau Methode. *Anat. Hefte*, 5, 1892.

NIEMACK, J. Der nervöse Apparat in den Endscheiben der Froschzunge. *Anat. Hefte.*, 5, 1892.

MERKEL, FR. Ueber des Jacobson'sche Organ der Erwachsenen und die Papilla palatina. Wiesbaden, I. F. Bergmann.

METCALF, M. M. On the eyes, subneural gland and central nervous system in Salpa. *Zool. Ang.*, Jg. 16 N. 409.

MIESSNER, H. Die Drüsen des dritte Augenlides beim Schweine. *Deutsche z. f. Tiermed. u. vergl. Path.*, XVIII, 6.

MOLDENHAUER, W. Die Missbildungen des menschlichen Ohres.

ORTMANN. Die Würdigung des Fettpolsters der lateraten Tubenwand. Ein Beitrag zur Frage der Autophonie. *A. f. Ohrenheilk*, XXXIV, 3.

OTTO, F. Casuistischer Beitrag zur Lehre von der Residuen embryonaler Glaskörperstränge. *Beitr. f. Augenheilk.* 5.

PREOBASCHEUSKY, S, Beiträge zur Lehre über die Entwickelung der Geruchsorganes des Huhnes. *Mitteil. aus dem embryolog. Instit. der Univ. Wien.* XII, Zweite Folge, Heft. V, 1892.

PURCELL. Bau der Phaladgidenaugen. Demonstr. *Verhlg. d. Deutsche. zool. Ges. auf der 2 Jahr. zu Berlin.*

PURCLLL, F. Ueber den Bau und die Entwickelung des Phalangiden-auges. *Zool. Anzeiger*, XV, 428.

RANVIER. Des vaisseaux et des clasmatocytes de l'hyaloide de la Grenoille. *Comp. rend de l'acad. des sci.*, CXV, 26, 1892.

RAWITZ. Retina von Sepia officinalis. Demonstr. *Deutsche. zool. Ges. auf. d. 2 Jahr. zu Berlin.*

RETZIUS. Die peripherische Endigungsweisse des gehörnerven. *Verh. der Anat. Gesellsch auf der sechsten Versamml. in Wien*, June, 1892.

RICHARD, J. Sur l'oeil lateral des copepodes du genre Pleuromma. *Zool. Anz.*, XV, 404.

SARASIN, P. U. F. Ueber das Gehörorgan der Caeciliiden. *Anat. Anzeiger*, VII, 25-26.

SHAEFFER, O. Ueber die fötale Ohrentwickelung, etc.

SCHIMKEWITSCH, WL. Die Ohrmuschel der Wirbeltiere. *Revue d. sc. nat. soc. St. Petersb.*, II, 9.

SCHULZE, F. E. Freie Nervendigung in der Epidermis der Knockenfische.

SPENGEL. Modell des zusammengesetzten Auges. Demonstr. *Vhalg. d. Deutsch. zool. ges. auf. d. 2 Jahr. zu Berlin.*

STEINBRUEGGE, H. Die Histologie der Hörnerven und des Labyrinthes. Handb. der Ohrenheilk. Leipzig.

STEVENSON, S. A. A peculiar Form of Retinal Pigmentation. *Trans. Opthalmal. Society of the United Kingdom*, London. XI, 1890-91.

TUCKERMAN, F. Further Observations in the gustatory organs of the Mammalia. *Journ. Morph.*, VII, 1.

ZUCKERKANDL, E. Makroskopische Anatomie. *Handb. der Ohrenheilkunde.* Leipzig.

INVERTEBRATES.

LEWIS, R. T. On the Use of the Compound Eyes of Insects. *Science*, XXI, 526. March 3, 1893.

VIALLANES, H. Contributions a l'histologie du systeme nerveux des invertebrates. *Ann. d. sc. nat. Zool.*, XIII, 6.

COMPARATIVE PSYCHOLOGY.

STEVENSON, A. Speech of Children. *Science*, XXI, 526. March 3, 1893.

CORNELIUS, C. S. Zur Theorie des Hypnotisms. *Zeitsch. f. exacte Philosophie*, XIX. 3.

GOLDSCHNEIDER. Zur Physiologie und Pathologie der Handschrift. *Arch. f. Psych.*, XXIV, 2.

LEHMANN, A. Die Hauptgesetze des menschlichen Gefühlsleben. Leipzig, 1892, (From Danish.)

MUENSTERBERG, H. Beiträge zur experimentellen Psychologie. 4, Freiburg, i. B.

WULFF. Die geistigen Entwickelungshemmungen durch schädigung des Kopfes vor, während oder gleich nach der Geburt der Kinder. *Allgem. Zeitschr. f. Psychiatrie*, II, 1, 2.

WIENER, CHR. Die Empfindungseinheit zum Messen der Empfindungsstärke. *Wiedemann's Annalen*, XLVIII, 3.

WUNDT, W. Hypnotismus und Suggestion. *Philos. Studien*, VII.

LITERARY NOTICES.

Simultaneous Tactile Impressions.[1]

Professor Krohn has carried on, in connection with Mr. Bolton, of Clark University, a series of interesting experiments "to determine the relative sensitiveness of different portions of the skin, to find the nature and direction of the errors in localization, to study the influence of attention upon the localization and interpretation of the simultaneous touch stimulations, also the investigation of the problem of attention, with special reference to the question of how many sensations of touch the the mind can attend to, or grasp, at one time, and to examine the effect of practice." The stimuli were applied by pointed corks attached to tambours which connected by separate pipes with a common air chamber. Pressure brought to bear on the confined air in the chamber caused the cork points to strike the skin of various parts of the body practically synchronously. It was shown (1)that the skin over the joints is more sensitive than elsewhere, and permitted greater accuracy of localization; (2) that touches on the back are more distinctly felt and more clearly remembered, and thus better localized than on the front of the body; (3) localizations are more correct near the median line; (4) that the localization is more accurate on the right side; (5) piliferous parts are more sensitive; (6) exposed surfaces are better localized.

It is suggested that the superior sensitiveness of the dorsal surface sustains some relation to a previous quadrupedal attitude.

"The localizing power is delicate in proportion as the skin covers a more moveable part of the body and is also more acute when the pressure stimulation is only strong enough to cause an appreciable sensation than when it is more powerfully impressed."

After images are pronounced in some cases, but still more interesting is the fusion of two or more stimulations into a single sensation and the localization of this sensation at a point removed from either of those at which the stimulations were received; thus, in one case, there were three touches, one on each nipple and one over the breast-bone

---

[1] WILLIAM O. KROHN. An Experimental Study of Simultaneous Stimulations of the Sense of Touch. *Journ. Nerv.* and *Mental Disease.* March, 1893.

in the plane of the nipples. These were felt as two sensations three inches nearer the median line than the nipples. Subjective sensations and translocation of sensations are also illustrated. Professor Krohn has opened a new and profitable field.

The Cerebellar Cortex of the Dog.[1]

Dr. Berkley, favorably known for his researches upon the visceral nervous system, undertakes, in the present paper, a resume of what he had been able himself to see in the cerebellar cortex prepared by a variety of methods. The hardening process chiefly employed seems to have been the use of Flemmings fluid. This the present writer has long discarded for brain tissue. The results with Golgi's sublimate method were inferior to carbolic fuchsin with Flemming. Serial sections were made in only a single instance.

So far as can be gathered from the paper itself it was written without familiarity with the works of Golgi, Cajal and Koelliker which have revolutionized our knowledge of the histology of the cerebellum. Thus the axis cylinder fibre is said to pass directly from the base of Purkinje's cell without giving off any branches, there is no suggestions of nodes in the fibres, which are said to be all medullated, though the methods employed would seem to be adapted to such investigation.

Six varieties of cellular bodies are described in the granular layer. The granules (hæmatoxylin cells) each with a small zone of protoplasm make up more than half. Only few fibres passing from these cells could be made out, and these with great difficulty in teased preparations.

Sparingly distributed among these are round or oval nuclei with a deeply staining central nucleolus, with no protoplasm. These are regarded as glia cells. Three varieties of Glia nuclei are distinguished chiefly by variations in size. These are most abundant near the cells of Purkinje.

The most important section of the paper is that devoted to the so-called eosin cells. These consist of spindle, triangular or quadrangular cells confined entirely between the central white and the "limitans interna," i. e., layer beneath the cells of Purkinje. They stain with satisfaction only with Flemming-copper-hæmatoxylin and modification of Weigert's method. The cell body is formed in large

---

[1] HENRY J. BERKLEY. The Cerebellar Cortex of the Dog. Johns Hopkins Hospital Report, Pathology, III, 1893.

proportion of coursely granular particles, with here and there a larger one of round or rod shape, No nucleolus or nucleus is visible.

Although closely related with nerve fibres, actual connection can nowhere be demonstrated.

A considerable number of multipolar, pyramidal and bipolar nerve cells also exist whose processes soon become lost among the granule cells.

The granules are supposed by the author to have a nervous function, as diseases of the cerebellum frequently produce an atrophy of these elements. The eosin cells are likewise probably nervous.

The description of the capsule of the Purkinje cells is so at variance with the "baskets" of Koelliker that it seems useless to compare them.

The last paragraph is remarkable in the light of recent studies. "The nerve elements of the cerebellum viewed as a unit bespeak a sensory and not a motor organ." "Lesions of the cerebellum, with the exception of the middle lobe, are without objective symptoms. It is conceivable that an involvement of the cortex of the middle lobe may also be symptomless and that the true reason of the perversion of the sense of equilibrium in disease of this part is because the multiform crossings of fibres to and fro from one part of the organ to another are intersected, and that symptoms arise, not from lesion of the cortex of the vermis or middle lobe, but from the destruction of the function of these crossing fibres, which then produce a loss of function, not of the middle lobe solely, but of the whole cerebellum."

We trust the author may be able to institute detailed comparisons between his preparations and the published results of Cajal and Koelliker.

A New Method of Coloring Neuroglia.

Professor Kultschitzky[1] describes a process for staining neuroglia which seems to have proven very useful. The author very properly lays great weight upon the previous treatment which, in this case, consists in fixation with a mixture consisting of a solution of potassium bichromate and cupric sulphate in 50 per cent. alcohol saturated (in the dark) after addition of one half to one per cent of acetic acid. The fixation takes place in the dark as does the hardening in strong alcohol, at first. For large fragments 2–3 months are required for fixation. Sections are cut in paraffin.

---

[1] *Anat. Anzeiger*, VIII, 10.

The stain is essentially an acid solution of "Patentsaures Rubin," as furnished by the "Berliner Anilinfarben Actiengesellschaft." The formula recommended, in case an aqueous solution is desired, is as follows:

2 per cent acetic acid, 100 parts.
"Patentsaurem Rubin," 0.25 parts.
Saturated picric acid solution in water, 100 parts.

The staining requires but a few seconds, after which sections are washed in 96 per cent alcohol. The rubin is almost insoluble in alcohol. Washing in water is to be avoided. If overstained, there is differentiation of neuroglia from nerve cells, the latter staining yellowish red, the former red-violet. An alcoholic solution of the rubin (100 parts 96 per cent alcohol and 3–5 ccm. of the above solution) is also recommended, but it stains very slowly.

Anatomical Nomenclature.

In a recent paper[1] Howard Ayres remarks as follows: "As the years go by the movement for a thorough and scientific revision of the biological nomenclature gains in depth and strength, and we have every reason to believe that great and lasting benefits will accrue to science as a result of these attempts to increase the precision and fitness of our scientific language." "No broad-minded anatomist will desire to retain names in human anatomy that are inapplicable to all other vertebrates possessing the homologous arrangement of the parts under consideration." To these statements we heartily agree. It becomes the duty of every one employing the language of science to select from the many candidates for favor those terms which are neither ambiguous nor morphologically inaccurate. The great reform which has practically prevailed in the terms of direction in anatomy during the last few years is an evidence that the movement is a general one. Although well aware that such a course would expose us to criticism and alienate much needed support in some direction, this Journal has from the first, striven consistently to employ the briefer and more accurate terms ventral, ventrad, caudal, caudad, ventral ventrad, mesal, mesad, etc., and such of the topographical mononyms as seemed unambiguous and likely to survive. We are conscious of many inaccuracies and irregularities but trust that our motives may not be misconstrued or misinterpreted and that the result in the long run may compel the respect of even the unwilling reader.

[1] *Science*, XVI; 531; Apr. 7, 1837.

Recently objection has been made to the use of the terms pero and pes as applying to the peripheral and central parts of the olfactory bulb. The grounds upon which we first adopted the terms were very explicitly indicated, i. e., the belief that the ectal part of the organ is very distinct in structure and origin from the ental structures. This conviction which was at first a feebly supported hypothesis has received the most important confirmation from the standpoint of histogenesis and phylogeny. There seems at present no reason to doubt that the pero is largely derived from without. The fibres from the olfactory epithelium grow toward the part or parts of the cerebrum which are to become their temporary hosts, and adhere, for a time slightly, and afterwards enter into a more or less complete association with the modified cortex at that point. The resulting structure is the pero, while the ventricular and unmodified parts constitute the pes. If it were otherwise we should expect that the tuber would always arise from a constant locus of the cerebrum, which is far from being the case. In serpents the point where the olfactory fibres impinge on the cerebrum is far laterad and the tuber of serpents is not fully homologous with that of birds, for example.

The changes proposed by Dr. Ayers relate to the auditory nerve. "The terms, N. vestibuli and N. cochleæ, are ill-chosen, from the fact that the morphology of the 'vestibule' and its parts as conceived by the anatomists who first proposed this term has no real existence. On the other hand, the term N. cochlearis is unsuitable, not to say inadequate, from the fact that this nerve is not solely a cochlear nerve since it trunk contains nerves to the 'vestibule' as well, viz., the sacular and posterior ampullar nerves wherever these are not provided with separate foramina. The central relation of these two nerves is always with the mass of cochlear fibres in those forms possessing an enlarged cochlear apparatus, as well as in the more primitive condition of the auditory organ.

"While engaged in reconstructing our anatomical nomenclature it is very desirable that we choose those terms which express the present condition of our knowledge and give promise of being adequate for the future as well, for, I take it, the recent movement for a betterment of biological nomenclature is dominated by the universal desire for as simple, short, and expressive a terminology as shall be adequate not only to the science as it exists today, but also to its expanded condition in the not distant future. None of these conditions are fulfilled by any of the terms yet applied to the ear-nerve except the two, utricularis and saccularis."

"Not all vertebrates, not even a majority of them, possess a cochlea, consequently we should have to provide another name for same nerve in lower forms or else have the anomaly of an animal without a cochlea provided with a 'cochlear nerve.' In every aspect of the matter the sense-organ must be present before its nerve can have a separate existence. The terms 'utricularis' and 'saccularis' are in all respects suitable and descriptive of the things to be named. Both of the nerves to which they are applied supply parts of the same organ complex which forms a well differentiated structure, and since both parts must have very similar functions it is certainly unadvisable to leave out of the designation all reference to the accepted idea as to the function which they subserve. Consequently, I hold that the names which I used in my memoir on the ear are the most suitable and the best grounded terms yet proposed for a revised nomenclature. The names may be used in full as Nervus acusticus utricularis and Nervus acusticus saccularis, or abbreviated to N. ac. utric. and N. ac. sac., or, since they are not liable to become confused with other nerve names, we may write simply N. utric. and N. sac. For the branches of each of these nerves we may write respectively:

N. utric. { ramus cristæ anterioris.
" " externæ.
" maculæ utriculi.

N. sac. { ramus cristæ posterioris.
" " cochlearis.
" maculæ sacculi."

"Sense of Boundary."

In a note in Science (April 7, 1893), Mr. F. Tuckerman gives an interesting instance where two dogs belonging to adjacent estates and which were implacably hostile, showed a very accurate knowledge of the dividing line between the two properties where it was indicated simply by two inconspicuous stone posts. The only explanation the writer offers is "that dogs possess a very acute sense of boundary." In the interests of accuracy we protest against the use of this term. Sense of direction is bad enough, while no one probably believes in the existence of such a sense in the meaning of "sense" applied to the sense of smell or of hearing. It would be almost as accurate to ascribe a sense of "setting" or a sense of herding to dogs with these acquired instincts as to refer to a "sense of boundary."

Influence of the Nervous System on the Skin.[1]

The action of the vaso-motor nerves on the muscular fibres of the blood vessels explains a large number of affections of the skin which are manifested by inflamatory symptoms and trophic changes which have no real connection with real inflamations of the skin, but may be due to toxic influences upon the vaso-motor centres.

The eruptions of this class, such as exanthemia and erythemata have been called by Auspitz angioneurotic eruptions.

The author, however, deals with another sort of nervous affections of the skin, which are accompanied by actual alteration of the histological elements of the skin.

In one case, a young lady 22 years old, the disease was indicated by maculæ of an ivory white color surrounded by a border of pink. The edge is not elevated neither is there evidence of inflamation or itching, but instead a numbness and anæsthesia. This case of lioderma has a history of corea at 4 years, epilepsy at 12 and subsequently cephlagia and dizziness.

A case of leucodermia consequent on melancholia and hysteria is also noted. A third and distressing case was one of scleroderma in which the extremities became encased in thick and brittle skin preventign the impairing motion, and causing muscular atrophy. Microscopic examination not having been possible in any of these cases, it may be a question whether specific agents were absent. This case calls to mind another, reported by Dr. Louis Bauer:[2]

A little boy suffered from violent paroxysms of hyperæsthesia of the feet without much change of temperature, color or appearance otherwise. The attacks set in suddenly, lasting two or three weeks, and were exceptionally accompanied by the appearance of light red maculæ on the parts affected. On the return of the trouble, after about a week's intermission, it would invariably change its seat to the opposite side in a symmetrical locality. The last instance was an exception when the right accessory nerve area was affected. After a few days, hearing was totally lost. During the entire period the patient was excessively irritable and excitable. After thirteen months the boy, then about thirteen years old, recovered his hearing as suddenly and unexpectedly as he had previously lost it. There was no pain, even during the period of acerbation, except when the parts were touched. The author is unable to suggest a diagnosis, though confident that the trouble was of central orlgin.

---

[1] A. Ravogli. *Journ. Am. Med. Assoc.*, XX, 18.

[2] A Neurotic Disease without a Prototype. *St. Louis Clinique*, VI, 4.

Dr. J. T. Duryea (in the *Brooklyn Medical Journal*, VII 4, 1893) gives an account of hysterical blue œdema affecting the breast and accompanied by anæsthesia and variable paralytic symptoms. No disease of the pelvic viscera was present.

Distance and Color Perception by Infants.[1]

At the age of nine effort was made to determine the color preferences and ability to estimate distances. The colors were blue, red, white, green and brown, in order of preference. The child refused to reach for anything put 16 inches or more away from her, at 15 inches she refused 91 per cent. of all cases.

It is concluded that there is a very fine estimation visually of the distance represented by the arm-length, thus emphasizing the element of muscular sensation in the perception of distance generally, and that there is a great uniformity at this age of the phenomenon of sensori-motor suggestion upon which this method of child study is based. It is to be regretted that a more complete color series was not employed.

Origin of the Electric Nerves in the Torpedo, Etc.[2]

Professor Fritsch gives a popular summary of his studies in the elecrical fishes from which the following points are selected.

In the different kinds of electric skates (Torpedinidæ) the electric organs are developed from muscles, which originally belonged to the branchial arches, and the arch of the lower jaw. In every case, we find wonderfully developed ganglion cells from which the impulse is transmitted directly to the electric batteries. There are, however, the most striking differences in the number and appearance of these nerve centres. The number of cells (54,000, in Torpedo) is found to coincide in a general way with that of the electric nerves. Professor Fritsch repeats his statement that the protoplasmic processes anastomose and concludes that these must have a conducting rather than simply a nutritive function. The remarkable chiasm or decussation of the electric nerves outside the cord, in *Mormyurus*, is regarded as unique. Professor Fritsch considers the development of such a structure a difficulty in the way of the current transformationism, though why it is more difficult than the development of nerve decussations within the neuraxis is not apparent. The electric shad of the Nile,

---

[1] J. MARK BALDWIN, *Science*. Apr. 28, 1893.

[2] *Nature*. Jan. 19, 1893.

Malaptaurus electricus, differs from all the others in the fact that the electric organs are developed from cutaneus structures, probably the glands. Only two electric nerves exist, which divide into over two million branches. These nerves resemble an electrical cable, enveloped in an enormous mass of insulating material. These fibres arise in two cells situated much as are Clarke's columns. These cells have no axis cylinder, but their branched protoplasmic processes join and form a kind of perforated plate beneath the cell from which the nerve fibre starts, with a large base. Professor Fritsch thinks the physiology of the electric nerve proves that Nansen is mistaken in regarding the function of motor nerves as trophic simply.

The Suprarenal Capsules.[1]

Experiments of MM. Abelous and Langlois have thrown new light upon these much discussed bodies.

The operations were first carried on upon frogs. Destruction of both capsules (by means of actual cautery) proves fatal in from two to thirteen days. Incoordination of muscular movements and finally motor paralysis ensues—in short, general paresis, terminating in paralysis. That the disturbance affects the blood is shown by the fact that if the lymph of the operated frog, when about to die, be injected into a healthy frog the latter is quickly paralyzed. On the other hand, if a part of the kidney, with the adherent capsule, be introduced into the dorsal lymph sac of an operated frog the life of the latter is prolonged. It was found that the blood of an animal deprived of its capsules produces symptoms analogous to those resulting from the administration of curare. Much the same result is obtained by injecting the blood of an acapsulated guinea pig into a frog. It is obvious that some toxic substance accumulates in the blood as a result of the removal of these organs. It is known that the extract of the suprarenal capsules produces symptoms of poisoning and neurin has been suggested as the toxic element, but apparently upon insufficient evidence.

The Functions of the Frontal Lobe.

Bianchi has experimentally shown that destruction of the frontal lobes in the monkey cephalad of the excitable area produce no loss of motor function, though there are temporary visual disturbances.

---

[1] On Internal Secretions and the Functions of the So-called Blood Glands. *British Medical Journal:*

There are, however, profound and permanent psychical disturbances, such as incoherence of motions, absence of curiosity, indifference, lack of affection. The social instincts are impaired, as are the sexual instincts. There is increased impulsiveness and emotional agitation, particularly of fear and diminished attention and reflection. He doubts the existence of tactile centres in the Rolandic region.

Expression in the Insane.[1]

The author believes that when we meet with forms of emotional expression, habitual to many different individuals, and, as seen in the adult stage, only occurring in cases of mental disorder, it is more satisfactory to seek some explanation of such expression than to regard it as accidental and of no significance. The doctrine of evolution, he concludes, enables us to give a perfectly intelligible and rational description of insane expression, and to account for all its numerous peculiarities and divergencies from expression in the sane.

Symmetrical forms of morbid expression are referred to the dissolution of the nervous system.

He first discusses the snarling or sneering expression in the light of Darwin's attempt to explain it as the survival of the animal trait of uncovering the canine teeth before fighting. Yet, as met with in the insane, it may have little evident relation to the states of mind with which it is associated in the sane. He says, "I have in the last year or two come across twenty-two instances of the asymmetrical elevation and protrusion of the upper lip, on the right side in ten cases, on the left in twelve. All my most marked cases occur amongst idiots, imbeciles and general paralytics." If of any significance, it seems to him that some of these can only be explained as a return to a more or less primative state, in which such action was habitual and useful.

Pouting is also common among the imbecile. Darwin notices that it is universal among human races, but is developed most largely in lower peoples. The author regards the prevalence of this expression among the insane, although it is practically absent in European adults and not very common among children, as evidence that inherited tendencies are never eradicated, so that each individual contains latent instincts of the whole series of his progenitors. Under the influence of dissolution he first reverts to infantile and then to savage and animal customs. The more rapid and superficial the culture the more ready the reversion.

---

[1] JOHN TURNER. Some Further Remarks on Expression in the Insane. *Journ. of Mental Science.* April, 1893.

A very common result of congenital impairment of the higher parts of the nervous system is that we often get inharmonious action of the muscles of the two sides, perhaps owing to imperfect development of commissures.

The Limits of Animal Intelligence.[1]

Any moment of consciousness embraces a psychical wave with a summit or crest of full consciousness, a short rising slope of dawning consciousness, a longer falling slope of waning consciousness and a considerable base of subconscious elements. We may fairly suppose that in the dog the wave of consciousness is of like general nature to that in man, no matter how different may be the states of consciousness which go to its formation.

What in terms of wave-analogy are impressions of relation? They are states of consciousness accompanying the transition of the psychical wave from one phase to another. If the transitions are of certain kinds we predict the relation of similarity or dissimilarity. According to Morgan, the great difference between merely feeling or sensing relations and cognizing them, is that in the latter case the relations are focussed in consciousness when both have been given in consciousness and the process involves introspection and reflection.

The *sensing* of complex relations is the foundation of practical skill. The *cognition* of relations underlies knowledge. Provisionally it is claimed that this distinction is a valid one and that animal consciousness is limited to the former.

The Sensibilities in Women.[2]

The author shows that if woman were relatively as sensitive to pain, physical and psychical, as man, she would possess a less instead of a greater average longevity. He believes that her sensibility is really much less, adducing the testimony of physicians, surgeons and dentists, who agree that in general woman is capable of enduring the pain of an operation with greater fortitude than man. The suggestion that she has a stronger control of her emotional expressions or has habitually schooled herself to suppress such expression does not seem to apply equally to the experiments made by the author himself. He

---

[1] Morgan, C. Lloyd. Intern. Cong. Exp. Psychology, Rep. London Meeting, 1892.

[2] Lumbroso, Cesare. La Sensibilite de la Femme. International Congres of Experimental Psychology. Report of London Meeting, 1892.

finds that, except in young girls, who have a very fine sense of touch, women in general are almost twice as obtuse as men when tested by Weber's æsthesiometer, which measures the distance, in millimeters, between two points, which can be determined as distinct on the skin of the index finger. In women of the lower classes, 2.6 mm.; for women of the upper classes, 2.0 mm.; for men, 1.5 mm.

It is interesting to notice the general fact that persons with degenerate physiognomic characters are much less acute. The sense of taste and of smell is, if anything, more acute in women. Sensitiveness to pain as tested by the electric algometer is much less in women.

The inferior sensitiveness of woman is further indicated by her greater immunity from the various sexual psychopathies so frequent in men, her readiness to believe in Platonic love, and her greater restraint in the sexual relations. He quotes with approval the saying, "A man loves a woman for her sex, a woman loves in a man the husband and the father."

It would be interesting to see whether the statements quoted respecting the results of æsthometric tests would apply to the educated and sensitive women of the better classes in this country.

Experiments made in the perception of the rate of vibration of a violin string, seem to show a suggestive relation between the number of vibrations perceivable and the quickness of mental processes and stands in favor of men so far as the writer has carried the comparison.

Agitation for Paralysis Agitans.

Charcot has applied the observation of the beneficial results of a railroad journey in the above disease by devising a shaking arm chair and vibrating helmet, the use of which relieves the trembling and stifness characteristic of the disease and permits quiet sleep.

Dr. Kellogg, of Battle Creek, Mich., has employed the vibratory chair for some time with useful results. It remains for physiologists to explain the undoubted therapeutic value of these rapid vibrations, which may after all owe their value chiefly to the anæsthesia or localized fatigue produced.

Origin of the Will.[1]

The first exhibition of desire and will in the child appear in persistent imitation. The characteristic things about will are deliberation and feeling of effort. Deliberation is a state of plurality of represen-

[1] BALDWIN, J. M. Suggestion and Will. *Intern. Cong. Exp. Psychology.* London session, 1892.

tations. Desire is the motor aspect of one element of representation as it is partially inhibited by other elements. Feeling of effort expresses the tendency of consciousness to pass from this plurality of motor content into a state of motor synthesis.

All so-called efforts of infants belong in the categories of suggestion and are involuntary. Persistent imitation is an advance on simple imitation, in that it involves comparison, this implying a state of motor complexity which we call interest or desire or will stimulus, and it involves the feeling of effort accompanying the resolution of this complexity into a new reaction—" the trial."

Evidence of the effect of suggestion in creating the imitative desire is obtained by comparing the number of trials which a student will make when given given a figure to copy and allowed to attempt it with open eyes or closed, or after the lapse of some time since the removal of the pattern. It is found that the attempt is repeated much more frequently if the object is present to view.

The author recognizes three stages in the development of will: (a), perception of stimulus with imitative impulse, (b), recognition of muscular instrumentality, (c), reducing the muscular activities to a subconscious state subordinate to pictured end. Troubles of speech faculty pursue the converse course of the development of the faculty. This view seems to afford a basis for the development of the will other than the pleasure or pain which Professor Bain and his school assume. The nature of the imitative impulse does not seem to be rendered much more clear by the employment of the term " suggestion" for its operative cause.

The Visual Path and Visual Centre.[1]

The visual path is divided into three portions, frontal, middle, and occipital. The frontal stretches from the bulb to the external geniculate. The fibres are arranged in separate bundles for the different quadrants.

Though the optic fibres ramify without immediate connection with the cells of the geniculatum the later is supposed to be necessary to sight. Other bundles pass to the pulvinar and nates, but there is no clinical proof that destruction of these structures produce hemanopsia. [This statement seems remarkable to the reviewer, particularly respecting the nates.] Neither is there clinical ground for the belief that a lesion of the posterior part of the internal capsule will pro-

---

[1] HENSCHEN, S. E. On the Visual Path and the Visual Centre. *Internat. Congress of Experimental Psychology.* Second session, 1892.

duce hemianopsia. The *occipital portion* starts from the external geniculate body, forms a small bundle of fibres and lies in the optical radiation as high as the second temporal gyrus, the second temporal sulcus and the calcarine fissure. Lesions of any other segments of the optical radiations do not produce any form of hemianopsia. The angular gyrus does not belong to the visual centre in man, but the optical bundle terminates in the cortex of the calcarine fissure. The visual centre is limited to the calcarine cortex. The cortical macula lutea probably lies 3–4 cm. in front of the occipital tip. Both retinal halves are represented in the limited space, elements from corresponding points of the retinas side by side.

Natural Selection and Music.

Dr. Richard Wallaschek, in a paper read before the International Congress of Experimental Psychology, at its second session, remarks that primitive music has no necessary connection with a higher training and evolution of the sense of hearing and the whole development of music has not changed the human ear in any respect. Music is primarily a rhythmical movement and it must be considered in its connection with the dance.

The dance of the savage is not regarded so much the result of a "surplus of vigor," in the sense employed by Herbert Spencer, as a prolongation of or preparation for warlike efforts which it serves to preserve and develop.

The purpose of music in these cases is to make possible evolution *en masse* as in the march, etc. A tribe which could not practice concerted action will have less chance of success in battle than others which have this custom. The progress in art is (as suggested by Weisman) through direct imitation and tradition ("objective heredity") rather than through heredity in the usual sense.

The General Morphology of the Brain.[1]

Professor His gives a general summary of the development of the brain, accompanied by numerous illustrations of median longitudinal sections of the head and brain of all groups of vertebrates at various stages in development.

The paper cannot fail to contribute substantially to a clearing up of the hazy concepts which seem still to prevail in this important

---

[1] HIS, WILHELM. Zur Allgemeinen Morphologie des Gehirns. *Arch. f. Anat. u. Phys.* Anat. Abth., 1892.

field. It is with no small satisfaction that we observe that Professor His still insists upon the sufficiency of the views which he has long advocated, and which were independentiy reached by the writer and have been used in this Journal, particularly regarding the morphological front of the vertebrate head. The simplest fundamental condition of the arched neuraxis is presented by very early stages of Petromyzon, frog, Pristiurus, etc. Fig. 4 of the paper illustrates a torpedo embryo, in which the neuroporus is wide open and occupies the place of the future terma. The dorsal limit of the latter in man coincides with the origin of the plexus, the ventral limit being the recessus opticus. The recessus infundibuli and recessus opticus form the fundus basilaris, which is funnel-shaped, but divided by the chiasm. The problem as to the point which should be selected as the front of the brain will be answered in accordance with one's conception of the position of the brain axis. Professor His choses the base of the tube and accordingly the front of the brain is for him in the middle of the basilar ridge; i. e., in the infundibulum. If the axis be taken in the middle of the tube its termination will fall in the region of the recessus opticus—if in the roof of the tube the end would coincide with the summit of the terma or velum transversum.

It seems to us that nothing in the recent writings of Professor Kupffer or Van Wijhe undermines the positions taken. Mr. Bawden and the writer have elsewhere brought forward fresh evidence in favor of the above view. For example, we have shown that, in the duck, the chorda dorsalis terminates in a special pharyngeal sac which lies caudad of the pharyngeal velum. It is found that in the subsequent development the sac atrophies and converges to unite with the hypophysis rudiment before the stalk of the latter entirely disappears. The actual communication of the chordal tube with the pharynx seems to us strong evidence that the front of the head cannot be far distant.

To return to the paper before us, the eminentia interpeduncularis or locus of the ganglion of that name is regarded with Burckhardt as the limit of the mesencephalon. The cephalic diverticle of the digestive epithelium or Seessel's pouch, with the corresponding diverticle of the ectodermal invagination or Rathke's pouch lie cephalad of the cinereum at first, but reteat to a point caudad of it. The hypophysis is a diverticle of the latter [and we may add, the pharyngeal pouch is a similar diverticle of the former.]

One result of the above consideration on which we have also insisted is the inappropriateness of attempting to distinguish a præchordal from an epichordal segment of the brain.

It does not follow from the excessive development of the recessus infundibuli in the amphibia that the axis has suffered a greater flexure than in higher vertebrates. [May it not be suggested that the greater development of the brain, while the axis of the jaws, and hence of the cranial base, is retained in the vertebral plane, causes a flattening of the infundibular region which makes necessary a retrogrowth of the infundibular parts, thus producing a spurious flexure scarcely homologous with the "hook-flexure" of higher brains. Something similar exists in the later fishes.]

In the base of the diencephalon and mesencephalon the following parts are recognized:

Within–tegmental eminence, recessus mammillaris, saccus vasculosus, entrance to infundibulum, recessus infundibuli or rec. basilaris; on the outside–fossa supra-mammillaris, eminenta mammillaris, tuber cinereum, infundibulum, field beneath the infundibulum and basilar ridge.

The discussion of the epiphysis seems to be an endless theme and it is here that we are compelled to disagree with the distinguished author in several particulars.

He insists that epiphyses may develop from various segments of the roof of the primitive fore-brain. Of course there may be wide range of difference in the use of the term epiphysis, but assuredly no fact is more capable of proof than than that the conarium or pineal epiphysis is a structure *sui generis* and not to be compared with the other projections of the fore-brain. Not to anticipate a paper now in preparation by one of the writer's students, it may be simply stated that in all groups of vertebrates the essential relations are identical. Although Stieda and others have identified the projecting plexus (paraphysis) as the pineal in reptiles, all groups of reptiles agree in the fact that the pineal proper arises from a point *immediately caudad* of the supracommissure and is essentially tubular. When it is largely developed it bocomes lobate, but even in *Phrynosoma* does not develop an epiphysal vesicle distinct from the pineal as stated by Ritter.

In birds it has a tubular lobate form in early stages and does not entirely lose its character. In tailed Amphibia some of these lobes appear to become distinct and form a flattened vesicle but this is a spurious appearance or a retrograde process.

The parietal nerve arises from the supra-commissure and passes alongside the pineal, adhering to its cephalic aspect and can be traced (in *Phrynosoma*) to the parietal organ in the skull with complete certainty. The segment following the supra-commissure is often highly complicated forming a variously modified paraphysis (post-paraphysis, Herrick) while a paraphysis may also be developed in front of the velum transversum (præ-paraphysis). The post-pineal segment is composed of two parts; first, a relatively thin and little modified part which may form a pineal recess, second the post-commissural segment. This, in fishes, is sharply folded upon itself and associated with the torus and in other groups is frequently imbedded in the front of the optic lobes. The transformations of the above mentioned segments account for the variations in extent of the post-pineal roof of the diencephalon discussed by Kupffer.

It will be seen from the above that we cannot agree with Professor His that the parietal eye of reptiles belongs to the middle set of epiphyses. These questions, however, will soon be discussed at length. The latter part of the paper is occupied by a recapitulation of much which has appeared in the earlier paper on the "Rautenhirn" and descriptions of the mesencephalon, thalamus, and external morphology of the hemispheres. The paper must form the starting point for the student of brain topography.

The Development of Human and Animal Physiognomy.[1]

This paper appropriately follows that on the morphology of the brain by the same writer and does not permit a resume. The treatment is broad and comprehensive rather than detailed and will therefore be of great pedagogic value. The most obvious hiatus in our knowledge—a comparative study of the nasal passages and Jacobson's organ—is still unfilled.

The Functions of the Temporal Cerebral Lobes.[2]

The paper quoted gives a series of most instructive data upon a subject which has more often been theoretically than practically investigated.

Flechsig and Bechterew claim that the temporal lobes are connected with the posterior tubercle of the carpora quadrigemina via the internal geniculata. Monakow, as shown elsewhere in this number, extirpated the temporal lobes in new-born rabbits and found the internal geniculata atrophic. Zacher[3] found secondary degeneration of the

[1] HIS, WILHELM. Die Entwickelung der menschlichen und thierscher Physiognomien. *Arch. f. Anat. u. Phys., Anat. Abth.*, 1892, p. 385,

[2] SEPPILLI, G. *The Alienist and Neurologist*, XIV, 2.

[3] *Arch. f. Psychiatrie*, XXII, 3.

internal geniculate bodies and testes in cases of lesions of the temporal lobes. There have been a number of cases where deafness has been found associated with degeneration of the temporal lobes.

Mills, in 1889, described the case of a man who had been deaf for thirty years and whose brain presented atrophy of the two superior temporal convolutions.

The present paper describes the case of a woman 43 years old, who had been a deaf-mute from infancy. In both hemispheres there was a symmetrical lesion destroying the first and second temporal convolutions. It was suggested that encephalites in infancy may have been the occasion of deaf-mutism. The close association between deafness and muteness is discussed. When the temporal lobes which preside over the acoustic functions of language are injured in early infancy the formation of verbal acoustic ideas is prevented. Deaf-mutism of cerebral origin is frequently accompanied by epileptic convulsions and imbecile or idiotic conditions, all of which are ordinarily due to infantile encephalites.

The author concludes that "a lesion of the right temporal lobe gave origin in left-handed people to verbal deafness and that this was not caused in right-handed individuals; and that left-handed people were not the subjects of verbal deafness unless [when ?] the left temporal lobe were [was ?] affected."

A case of Dr. Banti is cited—a man 67 years old suffering with verbal deafness, whose brain exhibited a focus of yellow softening in the posterior two-thirds of the first and second temporal convolutions.

The author describes the case of an old man suffering with pellagrous mania who was left-handed, but exhibited no speech disturbance or disturbance of motion or sensation, but whose brain was found to contain an old destructive lesion of the left sylvian fossa and insula which had destroyed the medullary fibres of the first and second temporal convolutions. Thus it appears that positive and negative evidence agrees respecting the auditory speech centre.

Cause of Epilepsy.[1]

To those who have followed the recent discussions respecting the role which uric acid retention plays in epileptiform disease (see Vol. II, p. cxli), the present paper cannot fail to prove interesting. Recognizing epilepsy as rather a symptom than a disease, and discarding

[1] FERGUSON, JOHN. Some Remarks on Epilepsy. *Alienist and Neurologist* XVI, 3.

the term "functional," the author seeks an irritant which may adequately explain these symptoms which are referred to the disturbance of the grey matter of the cortex.

Epilepsy may be artificially produced by injecting absinthe into the blood, which proves that a toxicant may produce these symptoms. Uric acid in the blood, even in very small quantities, may act as a convulsant in sensitive cases.

Dr. Haig has showed with apparent conclusiveness that the presence of excess of uric acid in the urine is proof of its existence in the blood. The author gives experimental evidence that a nitrogenous or meat diet favors and a vegetable diet retards the formation of uric acid.

The method used in determination is as follows: To 25 cc. of urine is added one grm. sodic bicarb., then add 2–3 cc. ammonia to precipitate ammonia-magnesic phosphates. Now add 1–2 cc. of a solution of 5 grm. silver nitrate in 100 cc. water, to which enough ammonia is added to clear the solution. This gives a gelatinous precipitate which is filtered through asbestos and the precipitate dissolved in 30 per cent. of nitric acid. Add to the solution a few drops of saturated solution of potash alum. Eight grms. ammonia sulphocyanate in one litre of water, diluted before use with 9 vols. of water, are placed in a burrette and allowed to drop into the solution. A whitish precipitate is formed which becomes permanently red after sufficient sulphocyanate has been added. Multiply the number of cc., sulphocyanate solution used by 0.00168, and the result is the uric acid in grammes. To examine blood, add it to ten times its volume of boiling water, boil for ten minutes and decant off the fluid and treat as above. Uric acid exists in the human body and circulates in the form of quadriurates, these are converted by sodium compounds to biurates, which are difficultly soluable, and are precipitated in the tissues in the form of star-like crystals, capable of exciting irritation. The author thinks this precipitation may go on in the brain or meninges, as well as in the joints.

It should be noticed that the change to a non-abumenous diet may at first aggravate the symptoms, for, by increasing the alkalinity of the blood, the deposited urates may be washed out and produce their peculiar convulsive symptoms. If persisted in, however, the amount of uric acid is lessened and great and lasting amelioration of the symptoms results. The writer does not question the usefulness of bromides or make a roseate prognosis in such cases.

The Activity of the Cortex in Reproduction and Hallucination.[1]

The author claims that the prevailing view implies that garnered concepts remain immanent, but unconscious, in the cortex. Natural analogies, however, indicate that the concepts are stored in quite other forms than those by which consciousness recognizes them.

Practice teaches the ganglion cells to work co-ordinately (in the motor sphere of the cortex, for example). This co-ordinated process becomes associated with optic centres. Repetition of a given set of optic excitements renews the recollection of the result of associated previous activity.

Consciousness in the form of a verbal concept is nothing but a result of the association of various cortical areas.

Hallucination is not different in origin from reproduction. Acoustic stimuli are more likely to become hallucinations because when outwardly projected they are less subject to competition with new impressions. The content of hallucination is associonally awakened.

Bad Medical Advice.

Under the above heading Dr. Kellogg speaks some plain words which ought to be heard by every practitioner and teacher.

He cites the custom of a Professor in an eastern medical college who introduced his lectures by explaining the best methods of avoiding venereal disease and admitted that he supposed such exposures were to be expected.

Many physicians make it a part of their business to teach young men that continence is injurious and occasional indulgence the best safeguard.

It is a mistaken analogy which attributes the function of the reproductive organs to the glands, and forgets that it is also nervous and that impotence results from changes in the cord more often than in the glands. The system may be permanently injured before the age of puberty. In the words of the editor of the *Medical Age*, "Vice is voluntary; and it is only by the exercise of a resolute self-will that virtue is maintained."

Those members of the medical profession who palliate or encourage vice in these forms have much to account for and the corruption, which reigns in some of our larger universities through the vile and

[1] *Bikeles, G.* Die Thãtigkeit der Grósshirnrinde bei der Reproduction und Hallucination. *Centralblatt f. Physiologie.* VI, 26.

seductive influence emanating from the medical department may well give the parent pause in selecting a home for four formative years in a son's life.

Notes on Spider Habits.

Mr. H. H. J. Bell, in a letter to *Nature*, April 13, 1893, gives an interesting description of a case of mimicry in spiders, observed on the West coast of Africa, a part of which we quote:

"It was about three in the afternoon and I was being leisurely carried along by my bearers, when I noticed in the bushes that bordered the path something which appeared to me to be a sort of white flower.

I stopped and examined it. Instead of being a flower, I found it was the web of a spider, and it was hanging between the branches of a shrub about three feet from the ground.

The outer lines of the web were of considerable strength and were stretched between points from eight to to ten inches apart. From these lines, supported by a few radii, hung a beautiful rosette-shaped centre, much resembling a delicate pattern in white silk lace. The central space was open and measured about a quarter of an inch in diameter. The notched space was adorned by three circular zig-zag cords of thick, white flossy silk. I did not notice any of MacCook's so-called "ribbon braces." The spiral space was very open and the threads composing it were so slight as to be almost invisible. So thin were they that the ribboned centre appeared to be hanging in the air without any support whatever. The appearance of this web was almost exactly similar to that of the web of *Uloborus*, shown in Fig. 57, p. 58, of MacCook's "American Spiders." I did not notice any "fenders" or protective wings on the outer side of the web; there were, however, a few strengthening strands on the side turned towards the bush.

The web, however, especially bore a strong resemblance to a flower, the more so as in the exact centre of its outward side was stationed a spider with a light blue body. This light blue color gave one the impression that it was the centre of the flower, while the yellow legs spotted with brown were symmetrically disposed in the shape of an X across the ribboned hub, thus dividing it into the semblance of petals. The illusion was remarkable.

The spider remained motionless until I touched the web. She then fell into the net which I was holding under the snare.

As soon as she touched the net (a white gauze one) she changed color. From blue she became white and then, on being shaken, her body turned a dark greenish brown. I then placed her in a glass tube and gradually she resumed her blue tint. Whenever shaken, however, she turned a greenish brown. I placed her in spirits and her color remained a grey brown.

On the same road later in the day, I noticed another strange web which bore even a stronger resemblance to a flower.

The "foundation space" was the same as in the other, but somewhat larger and stronger. The white silk ribbon, however, instead of being disposed around the centre in circular zig-zag lines, was extended in two thick white ribbons stretched crosswise along four of the radii. In this instance also the spiral space was very open and the spirals very delicate.

The spider inhabiting this web was considerably larger than the foregoing specimen, but appeared to be otherwise exactly similar to it. Her body was very light blue, placed exactly in the centre of the cross, head downwards, while her long legs were disposed in pairs over the four arms of the white silk pattern. The whole thing bore a great resemblance to an orchid, and the legs of the spider gave it just sufficient stability for it to be taken for a flower.

When I touched the web the spider immediately darted through two strands in the spiral space and placed herself on the reverse side of her web, being almost completely concealed by thick flossy white ribbons.

I captured this spider, and her body, like the other specimen's, immediately turned a dark greenish brown. I did not, however, see her turn white. I placed the insect in a glass tube, and five days later put her in a cage.

I also took the web and succeeded in fastening the centre of it on to a black card, where it remains in exactly the same shape as when it was hanging on the bushes. I have this web, and also a photograph of it.

The day after the spider was placed in the cage she made a web. It was spun during the night, and I did not observe the operation. The web was of the same pattern as the one on which I discovered her on the bush. It did not have any circular zig-zag cords.

This spider remained in her cage for four or five weeks, and then I placed her in spirits. She was fed principally with flies.

On one occasion I put a very large blue-bottle fly into the cage. The spider seized it immediately, violently vibrated her web, and at the same time rolled the fly round and round between her legs. In the space of three or four seconds the fly was completely swathed in an envelope of white silk, and was motionless. The spider then fastened her fangs into the body, and sucked it for about two hours.

I have since seen several of these spiders on their webs, and have noticed that the pattern of the snare appears to depend on the size of the insect, the smaller specimens making the circular rosette-shaped snare, while the larger insects weave the cross orchid-like flower. I saw one small web composed of two little rosettes, joined side by side, but I did not notice whether it was inhabited by two spiders. I frequently found wings and other debris of insects hanging to the rosettes of the webs, and in one case saw a wing of what must have been a butterfly of considerable size.

When does the spider alter the pattern of her snare? Can it be that, when the spider attains to full growth, finding that the rosette shape, becoming too large, no longer deceives butterflies and other insects, she adopts the orchid-like pattern which has more *vraisemblance*, and over which she can dispose her long legs with a better chance of successful trickery.

The web of this spider being so like a flower would appear to be intended as a veritable "snare." The insect by assuming its bright blue color increases the resemblance and the mimicry is probably practised not so much for the protection of the spider herself, but rather for the attraction it presents to butterflies and other flower-frequenting insects."

The Diseases of the Nervous System.[1]

This well-printed and copiously illustrated volume of 688 pages is one of the rare illustrations of really good German text book.

The prolixity and sporadic minuteness characteristic of many, perhaps a majority of European handbooks, is conspicuously absent, while, on the other hand we find logical arrangement, concise statement and simple, almost popular style. It is hard to say how much of the admirable lucidity of the book is due to the translators whose work is obviously excellently done.

It is evident that the practical needs of the medical student and practitioner have been foremost in the author's mind. Little space is devoted to anatomical conjectures and none to the pathological histology. The great extent of the subject precludes treatment of all sub-

[1] Hirt, Ludwig. Translated by Hoch and Smith and with an introduction by William Osler. New York, 1893. D. Appleton and Co.

jects *in extenso*. The discussions of apoplectic attacks and tabes are especially good, while general paralysis and allied neuroses are summarily handled.

The order of treatment is as follows : Diseases of the meninges, of the cranial nerves, of the brain proper, of the spinal cord, of the general nervous system (a) functional, (b) organic.

The presence of a full index completes the usefulness of a very satisfactory work.

The Soul of Man.[1]

The subject of this work, a neatly printed volume of 450 pages, is, of course, vitally important to all classes of students, and the spirit and obvious earnestness which have characterized Dr. Carus' work must compel respectful attention from those who most sharply dissent from his results and deprecate his point of view.

When the author claims to present all the facts from psychology, physiology and anatomy, treating "the problem of the human soul scientifically in its philosophical, ethical, and religious importance," we may grant something to the enthusiasm resulting from a plucky struggle with a large and difficult subject.

The standpoint of the book is, of course, monistic positivism. Every natural process is animated with the elementary germs of psychic life. Nature is alive throughout and every process of objective activity must be supposed to be animated by the elements of that subjective phase of life which in the human brain appears as consciousness.

The author admits that the mode of molecular combination which is accompanied by feeling is unknown. So far as we can observe a process of nerve-activity, there is no change of motion into feeling and of feeling back into motion. Yet in a certain part of the chain of mechanical causation, the motions are accompanied by feeling.

Matter and mind are one—they are as inseparable as two sides of a sheet of paper. This is, of course, simply Fechner's view, who said in 1858, that mind and matter are related as the concave and convex aspects of one and the same curved line.

States of consciousness are but one aspect of a process, the other aspect of which is a certain physiological activity. A definition of

---

[1] CARUS, PAUL. The Soul of Man. The Open Court Publishing Co. Chicago, 1891. $3.00.

mind has long been a desideratum and is here furnished in the following terms: "The organized totality of deduced facts, as it is developed in feeling substance, is called mind."

Mind is the necessary outcome of a combination of feelings, as a triangle is the product of the combination of three lines.

The author admits that agnosticism means a half concealed confession of bankruptcy in philosophy. It is important to make sure that positivism offers other than the forged securities which delay the crash. Positivism denys the separate existence of the subject which is considered but a collective term designating a certain group of sense-impressions, perceptions, ideas, and volitions which form, simultaneously as well as successively, the elements of the soul life.

The author considers the preservation of form in living substance as equivalent to memory.

"The brain preserves certain impressions, the forms of which remain, though the nervous substance may change. If these forms happen to be stimulated or irritated we experience the same feelings over again." What the author means by "irritating the form" of impressions is difficult to see. If he means that the same type of molecular combination produced by one stimulus will persist during metabolic changes of the cell and predispose the cell to a similar discharge when next irritated, the thought is not new nor does its acceptance serve to explain the definition which is next given: "The soul is the form of an organism."

After the introductory chapters, including a discussion of such topics as above indicated, there follows a resumè of comparative neurological anatomy and physiology along familiar lines. The illustrations are from excellent sources and well reproduced. Edinger has been laid under large contribution. In connection with a discussion of localization we meet a return to the old idea of a "seat of consciousness." This time it is the striatum which poses as the seat of the soul, the cortex being simply a store-house of old experiences. The former is the seat of consciousness, the latter of intelligence—two processes radically different. The function of consciousness is the stimulation of different ideas registered in the hemispheres.

The unity of consciousness is no intrinsic quality of mind, it is imposed upon the mind by the object of attention which acts in a way analogous to a magnet.

The brief discussion of comparative psychology serves to indicate its existence.

A discussion of sex results in the conclusion that the stronger of the parental influences tends to reproduce the opposite sex.

The author agrees with Lichtenberg that we should say "it thinks" rather than "we think," and draws a contrast between the peripheral and central soul. Several chapters are devoted to hallucinations, hypnotism and the like. The author rejects the hedonism of Bain, but it is difficult to make out just what he substitutes for it.

With more metaphysical portions of the book we need not here concern ourselves, though the positions are far enough from recognixed tenets of conservative philosophy or orthodox theology. It is noticeable, however, that the writer is powerfully influenced by the indirect effects of religious training and association which impart a moral flavor to the book and serve in many cases to modify the phraseology very materially, while in others it seems to the reviewer they have led to conclusions which otherwise would not have been derived from the premises. The style is catchy and rendered simply piquant by an occasional hint of its step-motherly English. The arrangement is faulty, but it is fairly indexed.

Cannibalism Among Insects.[1]

We have been familiar for some time with a habit of self-mutilation prevailing among certain insects in confinement. In 1891 William Brodie described the cannibalism of crickets in confinement.[2] an observation which was confirmed by Mr. Philip Laurent.[3]

It remained for Dr. Berg to discover the same habit in insects in a state of nature and to call attention to the laws governing its appearance. During a visit to Southern Patagonia, he observed repeatedly that caterpillars of various lepidoptera, particularly *Heliothis armiger*, eagerly devoured their fellows.

The remarkable development of this "contrary instinct" in Patagonia was explained as an incident to the dry and arid climate, which so limits the vegetation that only a small number of vegetarian insects could be supported by it.

At another time in Eastern Uragua, during a severe drought, cannibalism was found to prevail among the locusts, *Pezotettix*, to an enormous extent, the viscera being devoured by the strongest or most

---

[1] BERG, CARLOS, Canibalismo entre Insectos. *Anales de la sociedad cientifica Argentina*, XXXIV, 5, 1892.

[2] *Canadian Entomologist*, XII, p. 137.

[3] *Entomological News*, p. 180.

active individuals. The development of such an instinct and its perpetuation by natural selection in cases of insufficiency of food is not inexplicable.

It is remarkable that such a taste, when once acquired, seems to overcome the normal instinct entirely, and the morbid appetite craves animal diet, even when the natural food is abundant. We are prepared to hear of rogue caterpillers, as well as rogue elephants or tigers.

The Sense Organs of the San Diego Blind Fish.[1]

The interesting little fish described lives beneath stones or buried in the sand. As a result of its subterranean habits the eyes and whole frontal region of the skull have been profoundly changed and the skin has become highly sensitized. The paper contains much suggestive material and a full resume of the literature. We have space here for simply a reproduction of the author's summary :

"1. In the smallest examples studied the eyes, though very small, are distinctly visible even in preserved specimens,—so distinctly that the lens is plainly seen. In the largest examples, on the other hand, they are so deeply buried in the tissue as to appear even in the living animals as mere black specks, while in preserved ones they are in many cases wholly invisible.

2. Neither in small nor in large specimens does the epidermis over the eye differ in thickness or structure from that of adjacent regions. In the large individuals the much greater thickness of the tissue here is brought about by an increase in the sub-epidermal connective tissue, the growth of which can be seen taking place in the embryonal connective-tissue cells that are found here.

3. As in the case with rudimentary organs generally, the eye is subject to great individual variation in size, form, and degree of differentiation.

4. The only parts of the normal teleostean eye no traces of which have been found are the argentea, the lamina suprachoroidea, the processus falciformis, the cones of the retina, the vitreous body proper, the lens capsule, and in one specimen the lens itself.

5. In the parts present the rudimentary condition of the organ is seen in the very slight development of the choroid, no cellular elements being present in this excepting in the chorio-capillaris, and here

---

[1] RITTER, W. E. On the Eyes, the Integumentary sense Papillæ, and the Integument of the San Diego Blind Fish (*Typhlogobius californiensis.*) *Bul. Mus. Comp. Zool.*, XXIV, 3, Apr., 1893.

to a quite limited extent, the rest of that layer being composed exclusively of pigment; in the fact that the choroid gland is composed entirely of pigment; in the fact that the iris, though of fully the normal thickness, is almost devoid of pigment, there being on its outer surface in some specimens a small amount of cellular material, which probably represents the ligamentum annulare; in the great proportional thickness of the pigment layer of the retina and the entire absence in it of anything excepting pigment; in the incomplete differentiation of the layers of the retina, there being in some individuals scarcely more than a trace of the external reticular layer separating the two nuclear layers, and there being in no specimen studied a retina sufficiently developed to enable one to homologize with certainty the layers marked out; in the minute size of the optic nerve, and the fact that it is ensheathed in a thick layer of pigment for nearly its entire course through the retina; and, finally, in the small size of the motores oculi.

6. The surest evidences of actual degeneration are found, first, in the greatly augmented quantity of pigment in all the portions that are at all pigmented in the normal eye; and, secondly, in the presence of pigment in regions where none is found in the normal eye, as in the hyaloid membrane.

No undoubted instances of degeneration through the breaking down and dissolution of the tissue without the formation of pigment, such as have been described particularly by Looss, have been found, though in a single specimen (the one in which no lens is present) a process of this nature may be taking place.

7. On comparing the eyes of all blind vetebrates that have been most carefully studied, we find that, in the several degrees of incompleteness of development represented by the different species, all may, in a general way, be said to be passing along the same degenerative road. There are apparently, however, a few interesting exceptions to this. The most marked of these exceptions is found in the entire lack of pigment in the eyes of the Myxinidæ, whereas in all other rudimentary eyes an increase of this substance over what exists in normal eyes is found.

8. The eyes of blind vertebrates furnish very little evidence on the question whether structures in undergoing actual degeneration in ontogeny follow the reverse order of their phylogeny. The little that may be regarded as bearing on this point is without much doubt of an affirmative character. This is found in the breaking down and resorption of the lens,—habitually in Proteus, and probably occasion-

ally in Typhlogobius,—possibly in the excess of pigment in the iris and pigment layer of the retina, and particularly in its occasional presence in the hyaloid membrane of the Typhlogobius eye, while no evidence of actual degeneration in the retina appears in connection with these. The possible case of a degenerating retina in Typhlogobius is neglected in this consideration, since, as pointed out, the lens being absent in the same eye, it is immaterial whether it be considered or not.

THE INTEGUMENTARY SENSE PAPILLÆ.

1. These have been considered only so far as pertains to the question whesher they have been developed to compensate the rudimentary condition of the eyes; and it is concluded that such is not the case.

2. The facts that lead to this conclusion are the presence in several closely related genera—four at least—of the tactile papillæ with the same distribution as those of Typhlogobius, and in addition to this, on parts of the body where they are not found at all in Typhlogobius, excepting in the smallest specimens and that the papillæ that are present in Typhlogobius are not more highly developed than those of corre sponding regions in related genera.

3. In comparing the several species of blind fishes with a view to determining under what conditions the tactile sense does become developed to compensate the loss of sight, it is concluded that, while the greater activity of the cave blind fishes might explain their more highly developed tactile papillæ, this cannot be affirmed as a general law, since other blind fishes (as some at least of the deep-sea forms and probably also the blind Silurids) are without tactile papillæ, while we have no reason to suppose them less active than the cave fishes. It is necessary to have more knowledge than is yet possessed of the mode of life of the various blind forms before this question can be fully answered.

THE INTEGUMENT.

1. This structure has been studied with reference to the pigment contained in it, and the pink color of the living fishes.

2. Very nearly if not fully as much pigment is present tn the largest as in the smallest specimens, the lighter color of the former being due to the obscuration of the pigment by a thickening of the sub-epidermal tissue between the pigment and the epidermis.

3. The pink color of the living animals is due, in great part at least, to a highly abnormal development of blood-vessels in the subepidermal portion of the integument.

4. So far as it has been possible to determine, this vascularity of the skin is unique in this fish.

5. The most probable explanation found of this condition is that it is for the purpose of cutaneous respiration."

Cerebral Localization.

In a paper read at the International Congress for 1892, Professor Horsely places himself distinctly among those who admit that the removal of a given motor area of the cortex alters the sensory, as well as the motor reactions of the part of the body of which this area is the "centre." Dr. Ransom reported, in the same connection, a case where epilepsy began with tingling and spasm of the left hand which resulted in slight tactile anæsthesia and diminution of motor power. Operation revealed a cyst compressing the cortical centre of the left hand. After recovery from the operation of removal, the area was faradized without an anæsthetic. The results were contraction of groups of muscles of arm and hand if the current was moderate. A still weaker current produced sensation in those parts. After strong induced contraction the voluntary power was weakened.

Professor Ferrier, in his reply, cited several cases to prove that there is no necessary relation between cortical paralysis and impairment of sensation in any of its forms in the paralyzed parts. When such an impairment occurs, it is a separable accident. He admits that there is an intimate functional and probably an organic connection between the two kinds of centres.

Professor Schäfer has experimentally investigated the question whether the removal or injury of the frontal lobes impairs the intelligence, and has reached a negative conclusion. By destroying continuity without removal of substance it found that the initial shock was largely obviated, and in monkeys a removal of the pre-frontal lobes was nearly devoid of symptoms.

A New Theory of Color Vision.

Mrs. C. L. Franklin at the International Congress of experimental Psychology, London Session, proposed a theory of color vision which, it is claimed, avoids the difficulties of the Young Helmholtz theory on the one hand, and the Hering theory on the other. In the earliest stage of development, vision consisted of nothing but a sensation of grey which was brought about by the action upon the nerve ends of a certain chemical substance set free in the retina by the influence of light. In process of development of vision the decomposable molecule became differentiated to such an extent that it reacted differently to red, green and blue rays, although when all these vibrations are present the substance is transformed, producing a sensation of grey (i. e. the white-black series). The state of total color-blindness is considered a case of atavism.

When red light, for example, has been acting upon the retina for some time many of the photo-chemical molecules have lost that one of their constituents which is the exciter of the red sensation; but in this mutilated condition they are extremely unstable and their other two constituents (exciters of green and red) are gradually set free.

Experimental Investigation of the Relation between Respiration and Attention.[1]

Münsterberg has proposed the theory that the muscles of sensory accommodation are involuntarily innervated simultaneously with the muscles of respiration in cases of momentary registration. This theory was rendered necessary to explain the variations of attention detected by N. Lange.

The author instituted a series of experiments where the respiratory curve was registered upon the same kymograph cylinder as the registration of the observer. He concluded that the periodic increment of sensation during constant irritation appeared as frequently during expiration as inspiration, but occurs rarely in the respiratory pause or maxima. He explained this fact on the assumption that there is slightly less blood pressure in the brain during the pause and a relatively greater expenditure of energy in other directions at the maxima and both these conditions interfere with the normal development of the sensation. Thus the so-called variation in attention is explained, through fatigue of accommodation apparatus may also enter.

Muscular Sense of the Blind.

Dr. Goldschneider claims that the blind exhibit a higher development of the sensations of passive motion in the hand and finger joints, the cause being psychical and consisting in an increased power of attention. The sense of position is not noticeably improved. In the recognition of form by tactile methods the sensations of motion are more important than the sensations of the skin. Children have a more delicate sense of passive movements than adults.

---

[1] LEHMANN, H. Experimentelle Untersuchung über die Beziehung zwischen Respiration und Aufmerksamkeit. *Internat. Congress Exp. Psych.*, 1892.

The Law of Perception.[1]

Professor Lange shows that each act of perception is composite, consisting, first, in a simple unqualitative shock in consciousness producing the perception that *something* has happened. In the second instant there is a recognition of the modality of the stimulus, e. g. that it is optic or auditory. In the third instant the specific peculiarities (particular color, etc.) enter consciousness. The rapidity with which these processes replace each other makes necessary experimental means to separate them and this is secured by using the psychometric apparatus. In the first place the time of the simplest reaction is determined. The simple motor reaction was considered until quite recently as homogenous, but in 1886 Ludwig Lange showed that two forms of such responses occur, depending on whether the attention was directed chiefly to the reaction or to the excitation, i. e. muscular or sensory reaction. The former requires much less time than the latter. Thus, with acoustic stimuli the muscular reaction lasts 152*s* and the sensory 209*s*; with tactile stimuli the muscular reaction occupies 171*s* and the sensory 207*s*; with optic stimuli the muscular reaction occupies 229*s*, the sensory 297*s*.

According to the view here presented the difference is to be interpreted thus: The muscular reaction takes place when the perception of some sort of stimulus is reached while the sensory only occurs when the kind of reaction is distinguished.

Ludwig Lange, however, explained the difference by supposing that a pre-existing motor innervation was a prerequisite to the shorter reaction time, while the present writer affirms that the sole prerequisite is the absence of attention to the kind of stimulus.

In the determination of the next stage it is necessary to select proper subjective and objective conditions of experiment. One must have his attention directed to the stage of complication of perception for which he is to react and the stimuli must be so interspersed with those of a different nature to which he should not respond that the act of perception may not drop to a lower state.

The perception of acoustic stimuli as distinguished from tactile occupied 192*s*, as distinguished from other acoustic, 246*s*. In the optic sense the "muscular" reaction, i. e. immediate response to the light irritation occupied 229*s*, the recognition of it as optic occupied 270*s*, and the perception of the stimulus as a given color occupied 321*s* The author attempts to show that the act of judgement is of a

[1] Professor N. Lange in *Intern. Congress of Experimental Psyehology.*

similar nature, the subject corresponding to the simpler, the object of the judgement to the more complex act of perception. The sequence of words in all languages substantiates this view, for each word forms a psychological subject for the next following.

The usual methods of determining the discrimination time are imperfect. We should not attempt to measure the time required to distinguish the expected from the received impression but rather to determine the time necessary to become conscious of the difference between two simultaneous objects and compare this with the time required to recognize the objective similarity. The act of choice occupies a longer time because in its simplest form at least four concepts are necessary—that of two sensations and of two motor responses. This time has, therefore, no relation to the act of volition.

The above theory corresponds well with the facts of comparative psychology. In a single act of perception man passes in hundredths of a second through stages which have required for their development unnumbered ages in the evolution of the animal consciousness.

The Olfactory Apparatus and Hippocampus.[1]

It will be remembered that Edinger, in 1888, identified a part of the free mantle of reptiles as Ammons cortex or homologue of the hippocampus. A similar position was taken by Köppen, Schulgin and Herrick, although Edinger curiously misunderstands the position of the last.[2]

In discussing the connections with the olfactory apparatus Dr. Edinger says: "Anatomy has revealed a large number of fibre tracts which spring from the olfactory lobes and end in the lobus pyriformis. These tracts, the olfactory nerve roots, have usually been interpreted, as long as the pero of the tuber was considered a true cortex, as long associational bundles which connect the olfactory cortex with distant caudal parts of the cortex. Recently, however, Cajal, Gehucten, Koelliker, Retzius and others have shown that the first centres of the olfactory nerve lie in the pero of the bulb. The fibres connecting this grey matter with the cortex, i. e. the so-called "roots," acquire an entirely new significance. They must be called projection fibres for the olfactory sense and are analogous with the

---

[1] EDINGER, L. Vergleichend-entwickelungsgeschicliche und anatomische studiem im Bereiche der Hirnanatomie, 3, Riechapparat und Ammonshorn. *Anat. Anzeiger*, VIII, 10, 11.

[2] See elsewhere in this number.

optic radiations which connect those centres of the di- and mesencephalon with the occipital cortex. I propose to call these tracts passing caudad from the olfactory bulbs olfactory radiations.

The psychical processes of olfactory sensation may be referred with considerable certainty in mammals to the gyrus arcuatus and particularly its caudal region including the regio ammonis. If it is possible to show that the first cortex to appear is really Ammons' cortex it becomes extraordinarily probable that the first psychical function of cortical nature corresponds to the appreciation of olfactory sensations."

[The reader is referred to a discussion of these questions in volume II of this Journal, p. 2–7, in which a similar view is taken respecting the independence of the pero of the olfactory tuber from the cortex. It was there shown that the so-called olfactory branch of the præcommissura is not connected with the pero.

The radix pedis lateralis is there described as passing caudad along the fissura radicis to the pyriform lobe, thence for the most part to cross mesad and entad into the hippocampus. In Bulletin of Denison University VI, C. Judson Herrick confirms this statement. In the first paper above quoted it is suggested that the olfactory ganglion may have fused with the brain forming an apparent organic unity and that the adhesion of the pero to the pes is a comparatively subordinate character.]

Dr. Edinger agrees with the writer that the cortex of reptiles is connected with the olfactory tubers by strong tracts and also makes the suggestion that the concentrically rolled part of the axial lobe (his "nucleus sphaericus"—our "occipito basal lobe") is directly continuous with the hippocampal cortex and is to be regarded as an inrolled part of it.

This view is remarkably similar to the suggestion made in 1890[1] and subsequently that the caudal part of the axial lobe is a proliferating area from which there is increase of the mantle "as though the material were pushed up around the margins of the ventricle by a rapid growth within."

In the turtle Dr. Edinger finds the olfactory composed of the root bundles of the olfactory arising from the epithelium of the nasal cavity and which subdivide in the glomerules, of the central cells of the bulb which send their processes to the bulb, and of a portion passing caudad, which in part consists of processes and axis cylinders of these

[1] Notes on the Brain of the Alligator.

same cells. From these bundles tracts develop to pass to the cortex and mingled fibres to precommissure. There are also associational fibres. [We still believe the precommissure fibres belong to a distinct category.]

Dr. Edinger describes the structure of the cortex as displayed by the Golgi method and finds it analgous to that of higher vertebrates. He accepts the writer's suggestion that the cortex has gradually been transferred from the axial lobe to the cortex and has verified the statement that in mammals the radix lateralis may be traced into the Ammon's horn. The general results of this very important paper are given by the author as follows: The olfactory tract connects with higher centers at an earlier stage phylogenetically than any other nerve. It ends, in the fish, in a part of the axial lobe but even in amphibians it passes to the rudimentary mantle cortex which in reptilia acquires a rather complicated cortical structure. This has the characters and portion of the Ammons horn formation as recognized in mammals. In the latter group the olfactory cortex attains a remarkable development and complication. We are today justified in assuming that the cortex is the bearer of higher psychical functions. From the preceding it is evident that the earliest cortical activity, phylogenetically, was associated with perceptions of the sense of smell."

The argument by which Dr. Edinger gathers all the various anatomical, embryological, and histological data into a consistent theory of psychogenesis is a masterly example of modern scientific generalization.

Therapeutic Value of Nerve Stretching in Mixed Neuralgia.[1]

The symptoms of pain, an almost inseparable accompaniment of every infirmity, attain in cases of neuritis and neuralgia an intensity and obstinacy that anaesthetics afford but a temporary relief and antineuralgic remedies fail to effect a cure.

The operative proceedure, neurotomy and neurectomy, which afford relief in the case of pure sensory nerves, cannot be applied in case of mixed neuritis without producing paralysis of the muscles supplied by the associated motor fibres.

A new operation which cures the malady without compromising the function of the tissue has been adopted under the name of nerve

[1] Calvo, Manuel. Elongacion o alargamiento de los nervios, su valor therapeutico en las neuralgias mistas. (Thesis.) Anales de la Universidad Santiago Chili, LXXXII. 2. Kindly translated for this Journal by Professor G. F. McKibben.

stretching. The investigations of Valentine and notably Schleich, confirmed by Tutschèke, Vogt, Laborde and Brown Sequard, showed that sensibility is exalted by a slight elongation, but diminished when the traction is more violent. Conrad demonstrated that the motor fibres preserve their function after stretching, and Quinquand observed the process of nervous transference after the operation. These labors in experimental physiology were long in being applied clinically, till Nussbaum, in 1872, performed the operation to combat a traumatic contraction of the left arm and of the adjacent parts of the thorax. By stretching of the last cervical nerve the affection was definitely cured and the lost sensibility of the affected region restored. The operation was not wholly empirical for in 1860, during resection of the elbow, his assistant accidentally stretched the cubital nerve causing a removal of convulsions which had existed in the muscles supplied by it.

In 1874 P. Vogt performed the operation by the non-surgical method for ischiatic neuralgia resulting in recovery. Afterwards the same operation was performed by Czerny, Küster, Quinquand, and others, in sciatic neuralgia and by Polaion, Ledentu and Badal, in neuralgia of the trigeminus, especially of the nasal branch. Lagembuck employed nerve stretching to combat the lightning pains of ataxia and was followed by Leyden, Nocht and Gussenbaur.

Meanwhile the success attained by Nussbaum, in his first operation, in a case of contraction, indicated the employment of distention whenever there existed functional disorder of the motor fibres: the lengthening of the facial in *tic doloreux* of the face gave very good results to Baum, Southam and Gray; in case of tetanus Verneuill, Clarke and Smith believe that they have obtained successes; some cases are cited of peripheral paralysis cured by elongation; and in the midst of their enthusiasm some go so far as to declare cases of the cure of *lepra anesthesica*, an infirmity essentially microbian which can not be modified by that operation. Declarations of this sort bring into discredit an operation that is indicated in certain infirmities of the nervous system and especially in cases of neuritis and neuralgia.

The operation, ordinarily very simple, has much analogy to ligating arteries and is composed of three stages:

1. The incision of the soft parts until the nerve is exposed.
2. The isolation of the latter, and
3. Its lengthening.

The incision must be made, whenever it is possible, parallel to the direction of the nerve in order to facilitate the lengthening and to avoid a chance wound across it which is always much graver than a longitinal section. The lengthening should be performed upon the member when extended in order to prevent the nerve sheath of the nervous cord from becoming much loosened. If the limb is not placed in extension the bending of the joints will allow the formation of a rather long loop in the course of the nerve and all that portion will remain isolated from the sheath and, consequently, will receive very little nutrition.

In some nerves, as the sciatic, the same operation may be employed without incision of the soft tissues, or a section of any sort. The performance of this operation is more simple than the preceding one: it is enough to chloroform the patient, to extend the leg over the thigh and produce the flexion of the thigh over the pelvis until the right angle is passed.

Trombetta is very partial to this operation, which is very easy of execution and which, if it fails, allows the surgical operation.

Verneuill has desired to replace stretching by nerve friction (neurotripsia) which consists in rubbing the nerve after its isolation between the finger and a resisting instrument ; but this operation has not yielded the results that its inventor expected.

Experiments and clinical observations have demonstrated that the stretching of a mixed nerve produces functional disturbances of the sensitive fibres, in such a manner that anesthesia may intervene in the region innervated by the nerve while motor power remains intact; a very violent stretching naturally suppresses all the function of the nerve.

As Vogt has shown, every stretching is accompanied by a separation of the sheath and by very trifling hemorrhages. He concludes that disturbances of nutrition of the nerve are produced by rupture of its veins. Nevertheless, the nervous fibres themselves are changed by even slight stretchings; many of them break and afterwards there comes a double process of degeneration and of regeneration which has been studied by Withowski, Quinquand, Schewing and various others; in rare cases has a scleroris been observed of the connective tissues, an interstitial neuritis.

The real difference between stretching and neurotripsia is met in the influence which the stretching of a nerve has upon the nerve centers, as Tarchanoff, Laborde, Brown-Sequard, and Quinquand have proved.

Thus authors experimented upon animals and have observed: (1), that the stretching of the right iciatic nerve produces anesthesia in both sides, even when in the left side it is only transitory; (2), if by the stretching of the right sciatic the limb on this side is rendered anesthetic, sensibility returns if the left sciatic be operated on, (phenomenon of nervous transfer discovered by Quinquand.) On the other hand, Brown-Sequard showed that the right lateral hemisection of the cord produces an anesthesia in the left leg and a hyperesthesia in the right. Now, the stretching of the left iciatic caused the lost sensibility to reappear.

These observations of experimental physiology demonstrate plainly the influence that the stretching of the nerve has upon their centers of origin, and are corroborated by the anatomical lesions observed in cases of unsuccessful stretching.

In 421 observations that have been published, 42 complications are mentioned, that is to say, 10 per cent. Among these complications are epileptiform attacks, myelites, hemorrhagic myelites, purulent cystitis, paralysis of the rectum. In one case of miliary sclerosis nerve stretching was speedily followed by death. Paralysis of the parts supplied may follow. Trophic disturbances are very common results. These results plainly indicate that nerve stretching is much more dangerous when spinal affections exist. In 89 cases of operation upon mixed nerves all but 8 cases evidenced some improvement and in most more or less prominent cures resulted. Its nonsurgical application, in the leg, for example, is very simple.

The author concludes with a description of five cases in which surgical stretching was employed with success upon patients suffering from traumatic lesions of the nerves of the leg as a result of wounds recived in the late Chilian war. One of these is illustrative of all. The patient was wounded at La Placilla by a projectile which penetrated behind the *trocanter*, 6 centimetres from its vertex, and after traversing the rear portion of the member went out 14 centimetres from the genito-crural crease in the rear-inner part of the thigh. After reciving the wound he suffered very acute pains that spread to all the lower limb and absolutely hindered his walking; in this condition he spent two months at Valparaiso, where his wounds were attended to, healing in 15 days, but without relief of his pains; morphine alone afforded him some relief. Transferred to Santiago, he was placed, Nov. 9, under the attendance of Dr. San Cristobal, in San Vicente Hospital.

The patient can execute with his leg all movements and preserves his muscular power, but suffers constant pains with very intense exacerbations, completely hindering his walking; at the local examination he mentions intense pain following the course of the sciatic, hyperesthesia in the lower part of the leg and foot, without there being any sensitive perversion or trophic disorder.

The condition of the patient allowed no hope of benefit from internal remedies, since morphine alone had produced transient relief; and as his sufferings were very acute, there was performed on Nov. 11, the stretching of the sciatic with the purpose of affording relief. Between the major *trocanter* and the *ischium* there was made an incision of 12 centimetres, parallel to the axis of the thigh, which allowed easy access to the nerve, its isolation and its stretching. For this purpose Dr. San Cristobal employed the index finger and thumb, with which he exerted traction in the direction of its two extremeties. The operation concluded with the application of sutures and a Lister bandage. Scarcely had the effect of the chloroform ended, when the patient told us that the acute pain had disappeared and he refused morphine; but the hyperesthesia persists without troubling the patient. This condition persisted.

The following are the author's conclusions:

1. Nerve stretching is indicated in mixed neuritis which does not yield to therapeutic agents.

2. The operation is simply, requiring no special instruments. If the surgical method is used the wound should heal by first intention.

3. The non-surgical method should be preferred where practicable.

4. Complete cure cannot always be expected; many cases evince only slight amelioration, while in others, rupture or confirmed neuralgia may be produced.

5. Complications which are rare if the cord is healthy are relatively frequent and serious if myelitis is present.

6. The specific action of nerve stretching must be explained by the effect of the operation upon the nerve centres.

The Objective Symptoms of Neurasthenia.[1]

In spite of the current opinion that neurasthenia or nervous exhaustion has no symptomatic complex peculiar to itself, the author

---

[1] LÖWENFIELD, L. Die objectiven Zeichen der Neurasthenie. *Münchener med. Abhandl.* VI, 3, 1892. J. Lehmann. Price, 1 mark.

justifies himself in speaking of "objective symptoms." The patient very generally experiences little or no alteration in general appearance and his complaints are frequently met by incredulity. It becomes important, therefore, to familiarize ourselves with those objective indications, which may be called in evidence. Among the symptoms discussed, conjestion of the head and face, concentric limitation of the visual field and pupil reflexes, motor insufficiency manifesting itself in incomplete closure of the eyes, imperfect convergence motions, fibrillary twitching and muscular twitching, hyphraesthesia, modification of tendon and other reflexes, increased mechanical and electrical irritability of nerves, disturbances of speech and writing, circulatory changes, among them abnormal complications of the temporal arteries of young patients, digestive disturbances, and of the glands, kidney troubles of great variety. The paper, which contains 55 pages includes copious references to literature and cannot fail to be useful if its materials are conservatively employed.

The Early Development of the Pineal Eye.[1]

The author, came into possession of embryos of *Iguana tuberculata* 7, 14, 18, 24 and 26 days old and others probably 30 to 40 days. The material were fixed in Kleinenberg's picrosulphuric acid, stained in toto in borax carmine and sectioned in paraffin. Models in wax were reconstructed from the sections. The results thus obtained, like those of Strahl and Martin show conclusively, if other proof were needed, that the view presented elsewhere in this number by Mr. Sorensen, respecting the relations of plexus, epiphysis and parietal organ is the correct one. The parietal vesicle is clearly shown to be derived from an outgrowth of the epiphysis which is formed quite independent of the paraphysis. The nerve is formed independently of the epiphysis from a mass of cells just cephalad of the epiphysis. It is shown that in Iguana, Lacerta and Anguis there is no reason to doubt the origin of the parietal eye from the pineal vesicle.

---

[1] KLINCKOWSTROM, A. DE. Le primier development de l'œil pineal, l'epiphyse et le nerf parietal chez Iguana tuberculata. *Anat. Anzeiger.* VIII, 8–9, March, 1893.

LITERARY NOTICES.

Habits of Scorpions.[1]

Observations on *Parabuthus capensis* and *Euscorpius carparthicus* in captivity. The observations of Prof. Lankester on *Euscorpius* are confirmed and considerably amplified. The habits of Parabuthus have never before been recorded.

"All scorpions appear to be carnivorus, and there seems to be little doubt that they live principally upon insects or other articulated animals. My specimens of Euscorpius would eat blue-bottles and small flies, small cockroaches (*E. germanicus*), wood-lice, small spiders and centipedes (*Lithobius* and *Geophilus*). The Parabuthus were fed principally upon the common house-cockroach and upon blue-bottles." "Although usually trusting to their heels for escape, cockroaches occasionally resort to a method of self-defense which is sufficiently curious to be described. Advancing upon an adversary rear end formost, and at the same time wagging from side to side this region of the body, they deliver vigorous backward kicks with their spiny hind legs. This novel and humiliating mode of fighting, although not likely to prevail long against jaws and stings, is sufficient, nevertheless, to gain sometimes for the insect a temporary reprieve. I have indeed seen a fine female Madeira tarantula spider retreat in discomfiture before a big cockroach of the same sex, which assaulted her in the way described.

"As soon as a cockroach is seized the use of the scorpion's tail is seen; for this organ is brought rapidly over the latter's back, and the point of the sting is thrust into the insect. The poison instilled into the wound thus made, although not causing immediate death, has a paralyzing effect upon the muscles, and quickly deprives the insect of struggling powers, and consequently of all chance of escape. If the insect, however, is a small one, one in fact that can be easily held in the pincers and eaten without trouble while alive, a scorpion does not always waste poison upon it. Thus I have seen a Parabuthus seize a blue-bottle fly, transfer it straight to its mandibles, and pick it to pieces with them when still kicking." "Unlike spi-

[1]Pocock, R. J. Notes upon the Habits of Some Living Scorpions. *Nature*, Vol. XLVIII, pp. 104-107, June, 1893.

ders, which are notoriously thirsty creatures, scorpions never seem to need anything to drink. At least none of mine was ever seen to touch water, although a supply of it was at first always kept in their box."

"With regard to the higher sense, the only one that seems to be highly developed is that of touch. Mons. L. Becker declares that sight and hearing are excessively developed; but I cannot substantiate this statement in either particular. With regard to hearing, my observations agree entirely with those of Prof. Lankester, who could not detect the existence of any sense of this nature. None of my scorpions ever gave the slightest response to any kind of sound, although they were tried with tuning forks of varying tone and with shouts of both high and low pitch. These animals, in fact, resemble the hunting spiders in being apparently devoid of auditory organs. They further resemble them in the developmont of their visual powers, being able to see a moving body, like a living cockroach, at a distance of only about three or four inches. Even at a distance less than this they do not seem able to distinguish form. Thus a specimen of Parabuthus, excited by the presence of cockroaches in the box, was seen to rush at one of its fellows that crossed its line of vision about two inches off, evidently not recognizing by sight a member of its own species, for directly the pincers came in contact with the latter the mistake was discovered, the pugnacious attitude dropped, and no further notice was taken. This last observation shows that more is learnt from the sense of touch than from that of sight, an inference which is further supported by the habit above referred to, of carrying the pincers well in front of the head, as if to feel the way. There is no doubt that the external organs of touch in scorpions are the hairs which thickly or sparingly cover various parts of the body. The tail is often very thickly studded with setæ, and the poison vesicle always has some upon it. Their use upon this latter organ is very plainly seen during the act of stinging. For this act is not by any means a random thrust delivered indiscriminately at any part of the captured insect. On the contrary, a scorpion generally feels carefully for a soft spot, and then with an air of great deliberation delicately inserts its sting into it."

The pectine or ventral combs are thought to be not merely tactile sexual organs, but to serve the purpose of general tactile organs as well. In particular, they seem to be used to discover the nature of the ground over which the animal is walking.

Habits of Warblers.[1]

Dr. J. Lowe gave an account (Linnean Society, June 1) of a newly-observed habit of the blackcap, *Sylvia atricapilla*, in puncturing the petals of certain flowers (*Hebiscus Rosa-sinensis* and *Abutilon frondosum*), specimens of which he exhibited, thus causing the exudation of a viscid secretion which proved attractive to insects upon which the bird preyed. The observations in question were made at Orotave, Teneriff, during the month of March last.

Amitotic Cell-Division.[2]

The latest of Professor Frenzel's papers is a very careful study of the histology of the mid-intestine of the crayfish which seems to afford strong proof of his previous claim that the substituting cells, i.e. those which are periodically formed to take the place of the rapidly decomposing ferment cells, are produced by a subdivision of mother cells without karyokineses.

The question as to whether it is possible for cells to multiply otherwise than by means of the wonderful process of mitosis has long been mooted and seems to develop a great deal of needless acrimony in its discussion. The plates accompanying the paper are drawn with painful acuracy and most scrupulous care as we have had personal opportunity to know. The peculiar difficulty in this instance grows out of the possibility of optical illusion in the case of cells which may have their axes inclined to each other and to the plane of section, thus throwing the nucleus into unexpected juxtaposition and making it hard to determine whether they belong in a single cell or in two adjacent cells.

Professor Frenzel concluded with the generalization that in invertebrates there are two distinct methods of cell production; first, cell-increase, always by mitosis, occuring in cases where the organ or part is in actual growth; second, cell-renewal or regeneration, a process which occurs in the amitotic manner.

This problem is germain here in so far as it indirectly strengthens a tentative suggestion made several years ago that in certain parts of the brain cell increase continues late in life where mitosis cannot be demonstrated. Especially is it apparent that in various parts of the

---

[1] *Nature*, June 15, 1893.

[2] Frenzel Johann. Die Mittledarmdrüse des Flusskrebses und die amitotische Zelltheilung. *Arch. f. Mikrosk. Anatomie* XLI. 3. 1893.

brain a certain amount of substitution must be possible. The evidence that such amitotic cell multiplication goes on in the axial lobe of reptiles is very strong and will be treated *in extenso* in another place.

[C. L. H.]

Effects of Removal of Cerebro-spinal Fluid.[1]

Dr. George Halley gives details of several operations which involved the loss of much of the cerebro-spinal fluid and decides that the result is practically the same upon the general health as that of great losses of blood. We observe that the psychical disturbance, especially loss of memory and mental habitude, are pronounced and that these symptoms appear very promptly. It might seem that a result of suddenly lowering the pressure within the cavities would be corresponding hyperæmia of the brain tissue itself; this, however, the Doctor denies. May it not be that the cerebro-spinal pressure is an essential element in filling the minute spaces and that the turgidity of this system is a prerequisite to perfect nutrition, and thus to function? It seems probable from the results of injection as well as of metalic impregnation of the brain that such fine sinuses—far too small to convey corpuscles—are very numerous in the cerebrum. The great development of plexuses, paraphyses, epiphyses and hypophyses in the brain and their close relation to the blood capillaries suggests a vital connection between the cerebro-spinal fluid and cerebral function. It may not be too much to suggest that many of the most essential elements for brain nutrition find their way to the neurons only by this indirection. The function of the so-called blood-glands is rightfully claiming a large share of our attention at present and in their chemical and vital processes may be found an explanation of the remarkable effects of the vital extracts now in vogue.

The Influence of Psychical Phenomonon on Brain Temperature.[2]

Professor Mosso has investigated the heat production of the brain by means of delicate thermometers which register changes of .001 degrees centigrade. Tracings of the temperature variations in the blood of the brain, carotids and uterus are compared. When partially narcotized, a noise produces a slight elevation of temperature, while a much greater variation will be produced by the induced cur-

---

[1] *Journ. Am. Med. Soc.*. XXI, 3.

[2] Mosso, A. Les Phenomenes Psychiques et la Temperature des Cerveau. Turin. 1892.

rent. The author believes that consciousness involves active metabolism in the cells. These results were embodied in the Croonian Lecture, March, 1892. (*Philos. Trans.*, CLXXXIII.)

Cerebrine in the Treatment of Ataxia.

Dr. G. M. Hammond reported before the New York Medical Society a case of locomotor ataxia which had been treated with hypodermic injections of cerebrine prepared by Dr. W. A. Hammond. The symptomatic complex was apparently unmistakable and after ten weeks' treatment almost complete restoration resulted.

Clincal Investigations of Epilepsy, Hysteria, and Idiocy.[1]

This volume by the physicians of the Bicetre Asylum is largely devoted to idiocy and related phenomena. The cases are classified under (a), Idiocy with traumatism or malformation; (b), Idiocy with arrested development of convolutions and cerebral atrophic sclerosis; (c), Idiocy due to simple atrophic sclerosis of the convolutions; (d), Idiocy associated with cerebellar tumor; (e), Idiocy with meningo-encephalitis; (f), Idiocy with epilepsy. The reports of cases are very full and clear.

The author states that the pathology of meningo-encephalitis differs from that of general paralysis of the insane, which it greatly resembles, in that the cortical vessels are degenerated and the degeneration of the nerve cells is secondary to that of the vessels, while in general paralysis the reverse is the case.

It would appear from numerous examples that the heredity of cerebral malformations is total; like that of the color of the eyes, for example. Thus Dr. Bourneville says that he has never observed any attenuation in the course of degeneration in families by well-selected alliance or intermarriage with the normal; in such cases the children are healthy or degenerate, but, if degenerate, rarely less so than the diseased parent.

In microcephalic idiocy the antecedents are usually pathological on one side or the other and frequently there are convulsions in infancy. The patients are not necessarily undersized or deficient in sexuality. The theory that the premature ossification of the cranium is the cause of restricted brain development is certainly not universally applicable.

The work is comprehensive and conservative.

---

[1] Recherches Clinique et Therapeutiques sur l'epilepsie, l'hysterie, et l'idiotie. Par M. Bourneville. Paris: Vve Babe et Cie., 1891.

The Peripheral Relations of the Auditory Nerve.[1]

The author is continuing his studies on the Morphology of the Vertebrate Ear,[2] using the method of Golgi. This method in the hands of Retzius and Van Gehuchten lead to the conclusion that the nerve-endings in the Organ of Corti are intercellular. This author, however, considers that these results were derived from preparations which had been imperfectly colored. His own preparations show unmistakable instances of direct continuity of nerve fibres and hair cells. His conclusions are summoned up as follows:

A. The hair cells and the ganglion cells in connection with them constitute a single morphological unit—an acoustic element—which effects connection between superficial and central points.

B. No fundamental distinction exists between acoustic and olfactory elements.

C. The so-called "spiral fibres" are only short portions of radial fibres which reach their destination by a circuitous path.

D. All fibres of the eighth nerve, so far as is definately established, originate in the hair cells.

E In the embryos of all mammals the eighth nerve is made up at one stage of nerve fibres which arise from the Sauropsida-organ, and at the disappearance of this and the simultaneous formation of the Organ of Corti the acusticus passes over to the latter, thus altering its connections.

Statistics of Dreams.

Under this title Mary W. Calkins[3] records the results of extended observations upon dream phenomena and makes interesting observations upon their psychological significance. Tables are given of the number of recorded dreams in which representations of the various senses are included and, as would be expected, the visual greatly exceed all others; thus in 298 dreams there were 240 visual, 157 auditory, 21 dermal, 4 olfactory, and 1 general representations of sense. The psychological analysis might have been closer but the statistics cannot fail to be useful.

---

[1] AYERS, H. Ueber das peripherische Verhalten der Haarzellen des Gehörorganes. *Anat. Anzeiger*, VIII, 1893, No. 12 and 13.

[2] Journal of Morphology, Vol. VI, 1 and 2, 1892.

[3] *Am. Journ. Psychology*. v. 3.

The Brain of Myxine.[1]

The brain was exposed by direct preparation of the hardened subject or by teasing specimens macerated in 20 per cent. nitric acid, a method which often affords beautiful views of the entire brain and connected fibres in minute detail.

The olfactory organ is so enclosed by annular cartilages that the whole structure is inseparably connected with the brain and is preserved in the author's figures. The detailed histology is not described while the external features are very carefully and minutely recorded. From the absence of histological data several points are left undecided by the author which could otherwise be readily determined. Thus the author doubttully identifies a segment of what seems like the mesencephalon as the cerebellum and is uncertain as to the homologies of the parts of the forebrain. No trace of the mantle of the cerebrum was encountered, which gives the author occasion to express much surprise. If we were to attempt an explanation upon the basis of Professor Retzius' figures it would seem to be furnished by the relatively enormous extent of the olfactory tuber and the compactness of the brain and its obvious conduplication through shortness of the cavity of the cranium. It would appear that the whole free portion of the hemispheres, so far as present at all, is covered by the glomerules. In Fig. 7, Plate XXIV, *hv* seems to be the recessus præopticus, the habena and Meynerts' bundle are very large and the infundibulum and hypophysis are in the usual relations. It is not a little remarkable that, although the habenæ are all well developed, no trace of the epiphysis was discovered in the dissections or slides.

The aqueduct is closed anteriorly apparently by the obliteration of its connecton with the third ventricle, which is also closed, with the exception of the infundibulum and recessus præopticus.

The structure of the glomerules was studied by the Golgi method and found to correspond with that in vertebrates at large.

The Rudimentary Jacobson's Organ of the Crocodile.[1]

Dr. Rose describes the development of the common nasal ampulla by the closing of the gum processes and the subsequent separation into two chambers by the union of these processes with each

[1] RETZIUS, G. Das Gehirn und das Auge vohn Myxine ; 3 plates, *Biolog. Unters.*, v. 9, 1893.

[1] ROSE, C. Ueber das rudimenträre Jacobsonscche Organ der Crocodile und des Menschen. *Anat. Anz.*, VIII, 14, 15, June, 1893.

other and the septum. "As a result of the slight development of Jacobson's organ Stetson's ducts do not develop. These develop elsewhere through separation of an epithelial duct during the closing of the gum processes and almost uniformly lie about at the place where the primitive choana open into the mouth cavity." As a result of the peculiar formation of the nasal passages it is natural that in crocodiles they should stand in close relations to the rudimentary fundaments of Jacobson's organ. The organ after assuming the form of a considerable sac-like appendage to the passage occupying an excavation in the vomer, it undergoes retrogression. The highest stage of development is reached when the embryo is 9½ mm. long in Crocodilus porosus. The author thinks it, on the whole, improbable that the predecessors of Crocodilia had a completely developed Jacobson organ. The old idea that Jacobson's organ and Jacobson's cartilage are to be correlated is an error. This cartilage (Luschka's or Jacobson's) is simply the basal part of the primitively simple cartilaginous nasal capsule. It correspond's apparently to what Gaup called solum nasale in the frog. The Jacobson's organ of man lies high up, far above the basales narium cartilage, which has its usual positton.

Infantile Nucleary Degeneration.[1]

In this paper a series of observations are collected bearing on the perplexing problem involved in paralysis of the eye-muscles of central origin. The first section embraces opthalmoplegia exterior with or without paralysis of the facialis. The second section relates to bilateral abducens-facialis paralysis, the third with congenital bilateral abducens paralysis, the fourth with bilateral oculomotor paralysis, the fifth with bilateral ptosis, and the sixth and seventh with unilateral abducens paralysis and ptosis. Curiously enough no cases are known of congenital bilateral facialis paralysis unaccompanied by abducens paralysis.

The development of the degeneration may be gradual but the result is persistent and beyond amelioration. The differential diagnosis especially as against tertiary syphilitic and labitic ophthalmoplegia is discussed, but the confession is made that nothing is known of the pathological anatomy.

---

[1] MOBIUS, P. J. Ueber infantilen Kernschwund. *Münchener Med. Abhandlungen*, VI, 4.

Restricted Hemiatrophy of the Face.[1]

A case of limited atrophy of the face in a child of seven years who had no family history of neuritis or other nerve lesion is reported by Dr. Gulland. No assignable cause could be found and the general health was good. The atrophy is confined to the left side of the face, beginning in the middle of the forehead by a well-defined ridge gradually disappearing in the region of the coronal suture. On the side of the face the atrophy extends to the outer canthus and upper border of the zygoma. The skin and subcutaneous tissue as well as the bones are affected. The skin is slightly reddened and glossy and the hair of the scalp is thinned. The sensation and motions of the face, tongue, etc. are unimpaired, an occassional pain running down the affected side of the nose is the only subjective symptom. The author regards the cause as peripheral rather than central.

Effects of the Pneumogastric and Sympathic Nerves on Disgestion.[2]

The vagus nerve of the batrachia supplies motor fibres to the stomach, especially to the longitudinal fibres and sphincters, also inhibitory fibres for reflex motions. Under the influence of curare after double vagotomy, the fluids of the mouth can not be swallowed on account of the contraction of the cardiac sphincter which continues for hours to pulsate rhythmically. The stomach continues for days its peristaltic motions. These motions are due to the loss of the inhibitory influence of the vagus leaving the muscles hyperexcitable.

If not curarized the loss of motor function is most prominent. The air cannot pass the glottis during inspiration by reason of paralysis of the extensors of the glottis and thus is swallowed.

The sympathic fibres affect chiefly the circular muscle fibres. Irritation of the sympathic, the ganglion cœliacum or the lumbar cord when separated from the higher regions have the same effect. The contraction begins at the pylorus. Removal of the cæliac ganglion in the toad causes the stomach to perform diastole and systole. Besides vasoconstrictor fibres the vagus supplies to the stomach vaso-dilators while the sympathic is chiefly vaso-constrictor in function.

The secretion of the stomach is directly dependent on the vagus

---

[1] GULLAND, G. L. A Case of Hemiatrophy of the Face, Confined to the Area of Distribution of the first Division of the Fifth Nerve. *Edinburgh Hosp. Rep.*, vol. 1, 1893.

[2] CONTEJEAN, C. Action des nerfs pneumogastrique et grand sympathique sur l'estomas chez les batraciens. *Arch. de phys.* [5] IV, 4.

and sympathic, the former being excitory the latter antagonistic. There is, however, an intrinsic plexus, so that the vagus and sympathic are simply regulators.

Forked Nerve Endings on Hairs.[1]

The authors have contributed a number of extended papers on the nerve termini in the skin[2] and Mrs. Hoggan now collects data from their combined labors.

In 1872 Jobert discovered the coil about the hair follicle which bears his name. Schön, in 1871, had found a medullated nerve passing to each hair follicle and forming a nerve ring about it and also describes a nerve coil below the bulb which is not reidentified by later writers. Arnstein[3] finds, in the mouse ear, a terminal nerve brush subdividing in the skin about the follicle.

Bonnet, in 1878, (*Morph. Jahrbuch.*) describes the tactile hairs in various animals, and figures, in a vibrissa from the dog muzzle, a large forked fibre. Richardi, in 1884, describes, in similar hairs of the ox, medullated nerves passing into non-medullated tortuous fibres which again divide, forming ovoid or fusiform irregular nerve tufts extending to about the middle of the follicle.

Mrs. Hoggan states that Joberts' coils exist in all hairs and are the most superficial of the nerve structures of the follicle and are found just below the openings of the sebaceous glands, external to the forked terminations, between them and the basement membrane. These coils receive nerves horizontally from the side of the follicle, and a connection was traced between some of these fibres and the branched cells lying perpendicularly below them.

The forked terminations lying between the lower layer of epidermic cells lining the follicle and the basement membrane are not very easily seen on large vibrissæ, but they are found on the smaller feelers, where they show, as Bonnet has shown, a row of short, broad, spade-like bodies, just above the end bulbs or the branched nerve

---

[1] HOGGAN, G. AND MRS. F. F. E. *Journal of Anatomy and Physiology* XXVII, 2, Jan., 1893.

[2] On some Cutaneous Nerve Terminations in Mammals. *Linnean Soc. Journ.* XVI, 1893. Des Formes nouvelles de Terminaisons nerveuses dans la Peau des Mammiferes, XX, 1884. Neue Formen von Endigungen in der Haut von Saugethieren, 1884. New Forms of Nerve Terminations in Mammalian Skin. *Journ. Anat. Phys.*, XVIII, 1884.

[3] Die Nerven der behaarten Haut. *Sitzungsb. a. k. k. Akad.*, 1876.

cells. On the ordinary hair follicles the branched processes are the most prominent of all the nervous elements. The author regards this fact as favoring the belief that these divided endings are organs of general tactile sensibility. Various modifications of these forks are said to occur in all known kinds of tactile bodies from the two or three-pronged fork, through the Browne and Hoggan bodies, the Pacinian and Meissner corpuscles, etc. "The complicated organ of Eimer is but the survival of the nerve elements belonging to an original clustre of hairs, dragged out, in the course of evolution, by the digging habits of the mole, and in this organ the homologies of the forked endings may be distinctly traced." The peripheral endings of the forks varies from spade- or hoof-shaped (horse) to lance-shape (mouse) or club-shaped (seal). The variations do not appear, however, to be significant.

The Eye of Myxine.[1]

The careful descriptions of Müller and Krause are summarized and compared with data derived by the author from his own chromic-acid and Golgi preparations. The homologies suggested by those earlier writers are for the most part sustained, though the structure of the retina is found to be considerably simpler than that described by either. He concludes: "The eye of Myxine, as I look at it, is far more rudimentary than those investigators supposed. The prevailing irregularity of form, as well as its alterations, bespeak a degenerate structure. That no traces of cornea and lense are present, Johannes Müller has already recognized. I then agree with W. Krause—contrary to W. Müller—that 'the rudimentary retina therefore cannot be used in construing the phylogenetically complete retina.' This is much to be regretted because the lowest stages of the development of the sense-organs are of the highest significance for Biology and for Morphogenesis."

Brain Surgery.

An interesting series of operations is reported by Dr. F. C. Schaefer in the Journal of the American Medical Association (xxi, 5.) These cases emphasize the importance of surgical action and minute attention to aseptic proceedure.

In the same number Dr. Emory Lanpeear reports a number of

---

[1] Retzius, Gustaf. Das Auge von Myxine. *Biologische Untersuchungen*, V. Band, No. 9, pp. 64-68, with one plate. Stockholm, 1893.

cases of brain surgery from which the following suggestions are copied:

1. When there has been a blow upon the head and hemiplegia, aphasia, or hemianopsia follows, there is nearly always a hemorrhage which may be cured by opening the cranium at the point indicated by the cerebral localization.

2. Paralysis of the third, fourth or sixth pairs of nerves indicates a lesion in the pons and contraindicates operation.

3. A slight premonitory attack, affecting speech temporarity, or producing a heaviness of hand or foot for a few moments, if followed by hemiplegia, may be taken as a good point in favor of operation, as the bleeding vessel is probably on the surface or very superficial.

4. Paralyses of very limited extent, especially if complete, are not often due to hemorrhages—being local palsies rather than the peripheral indicatives of cerebral desease.

5. A very severe headache, followed by gradually but rapidly deepening coma and hemiplegia becoming more and more complete, means a hemorrhage into the great basal ganglia—probably beyond surgical help.

6. When the case presents a history of moderate loss of power or complete hemiplegia without unconsciousness, followed in a few hours by sudden appearance of coma, marked fall of temperature succeeded by some fever, a hemorrhage has broken into the ventricles or beneath the membranes, is still progressing, and indicates immediate trephining.

7. Very sudden and complete hemiplegia and coma usually means embolism; heart lesions, endoarteritis and syphilis enhances the probability.

8. Bilateral hemianopsia appearing suddenly probably indicates hemorrhage in the occipital lobe of the oposite side and justifies exploratory operation.

9. Profound coma and relaxation without any hemiplegia usually depend upon injury to the pons and decide against operation.

10. Vomiting, severe occipital headache and vertigo, with or without a distinct paralysis render a cerebellar hemorrhage probable; ocular symptoms, like nystagmus and strabismus are apt to accompany these symptons of cerebellar lesion. Exploratory operation is justifiable.

11. According to Hughlings Jackson, convulsions, early rigidity and conjugate deviation of the eyes of a splastic form are conclusive

evidence of hemorrhage. Convulsions always accompany hemorrhage in young persons.

An interesting portion of the paper deals with results of craniotomy for psychical improvement in idiocy. The results on some of the cases are exceedingly promising.

Current Views of the Structure of Olfactory Organs and Taste-bulbs.[1]

(*With Plate XIV, Figs. 6, 7, and 8.*)

The application of Golgi's method to the peripheral nervous system, especially to the sense-organs, has proven of late a very productive field of investigation. The uncertainty formerly existing in the minds of many investigators as to the exact nature of the termini of the olfactory nerve in the nazal cavity and in Jacobson's organ seems now to be quite satisfactorily removed. The concurrent testimony of so skillful investigators as Cajal, Van Gehuchten, Lenhossék, Brunn, and Retzius, leaves but little doubt that the so-called olfactory cells of the olfactory epithelium and of Jacobson's organ are real nerve cells and that there is actual nervous continuity between the cilia at one pole and the fibre of the olfactory nerve springing from the other pole of these cells. In fact the relations here are very like those commonly described for the organs of the lateral line of the lower vertebrates and more recently for the skin of some of the worms.

When we come to the nerve-termini in the taste-bulbs, the recent authorities are by no means so harmonious. Whether the taste-cells are really connected with the adjacent nerve-fibres may fairly be considered an open question, in spite of the recent striking results of Retzius[2] and of Lenhossék.[3] I quote from the latter paper: "The results of Fusari and Panasci, so often quoted recently, that they [the taste-cells] pass directly into nerve-fibres at the basal pole, are incorrect. On the contrary they all end obtusely. This is not a case then of typical, well-developed nerve-cells, which give rise to peripheral nerve-fibres, as is the case with the olfactory cells and the sensory cells of the epidermis of Lumbricus, but of sensory epithelial cells which are related to the nerve-fibres by contact only."

In this author's preparations from the rabbit the nerve-termini are of two kinds: 1. Intergemmal fibres previously described (by Ser-

---

[1] Abstract by C. Judson Herrick.

[2] Biologische Untersuchungen, N. F., Bd. IV and V.

[3] Anat. Anzeiger, VIII, No. 4.

toli, in 1876, and others) which pass up between the taste-bulbs and end free at the surface. They probably are not concerned with the sense of taste. 2. Perigemmal fibres (one to three in number) pass to the base of the bulb and rise up, branching freely and enveloping the bulb completely. They do not anastomose but each branchlet ends free in a little tuberosity. These relations are shown in the figure (Plate XIV, Fig. 7) copied from Lenhossék's. In the fish (Barbus) intergemmal fibres cannot be demonstrated and the perigemmal fibres are much more regularly arranged, all ending in a ring at the apex of the bulb (Plate XIV, Fig. 8.) In this fish to a slight extent (Plate XIV, Fig. 8, *c*) and much more conspicuously in Conger vulgaris, these fibres give off, just as they separate at the base of the bulb, numerous short, exceedingly varicose fibrils which form a cup-shaped body ("cupula") enveloping the base of the bulb. In the latter type, too, there are fibres loosely enveloping the neck of the taste-bulb which are probably homologous with the intergemmal fibres of the rabbit.

As to the morphological significance of the taste-cells, the author continues: "By their characteristic reactions with stains, their form, their cilia, and above all their functional significance, they ally themselves directly with nerve-cells, from which they are distinguished only by the lack of a nervous process. They represent as it were *short nerve-cells without processes*, nerve-bodies in which the function of the process has been supplanted by projections which pass to them from other distant cells.

"From the results recently brought out as to nerve-termini in the auditory organ[1] (Retzius), in the skin of vertebrates (Fr. Eilh. Schulze, van Gehuchten, Retzius), in addition to the present contributions, we are in a position to assert that *that relation which the author and Retzius have shown in the skin of the earthworm prevails in the vertebrates in no place except in the olfactory mucous membrane.*"

Retzius, in the work cited above, agrees perfectly with the results of Lenhossék, except that in his earlier paper (Vol. IV) he found branches of the perigemmal fibres penetrating into the taste-bulbs between the taste-cells. This however he does not find in the fish. In his later paper (Vol. V) he says: "I have recently in Golgi preparations of the mucous membrane of the mouth of Salmo salar been

[1] It will be noticed that this does not agree with the recent results of Ayers on the connections of the hair-cells of the auditory organ, as noticed elsewhere in this number (p. lxxxviii.)

able to examine many hundred end-bulbs and affirm that I have never certainly seen one nerve-fibre penetrating into the interior of these structures, but only the arrangement described by Lenhossék."

If these results can be relied upon, the organs of taste must morphologically be more widely separated from those of smell than has hitherto been customary. The familiar fact that sapid substances must be present in fluid solution in order to be perceived and that odorous substances, in air-breathing animals at least, must be present in gaseous media, may point to physiological differences in the end-organs involving profound structural modifications. But it is more probable that the difference, if difference there be, finds its basis in Organogeny rather than in Physiology. Thus, the processes of the olfactory cells do not connect with any other cells centrally. Preparations recently made by my brother, both by Golgi's method and by the hæmatoxylin process and figured in this number (Plate XIX, Figs. 1, 2, and 3; plate XX, Fig. 3) prove conclusively, if additional proof were necessary, that the fibres of the olfactory nerve as they pass into the olfactory tuber break up into terminal brushes ("end-bäumchen") in the glomerules without coming into relations with any cells at this end of their course. In accordance, then, with the current morphological ideas of nervous structure,[1] the peripheral neuron of the olfactory system would consist of the olfactory ganglion cell in the nasal membrane, its axis-cylinder process which forms one of the constituent parts of the olfactory nerve,[2] and its terminal brush in the glomerule.

The nerves supplying the taste-bulbs, on the other hand, unquestionably spring from nerve-cells in the ganglion at the root of their proper nerve-trunk. Since, then, the ganglion cell is at the central end of the fibre, the terminal brush must be sought at the peripheral end; viz. in the "perigemmal fibres." It is obvious that the neuron is complete without the taste-cell; in fact, the latter would be an inexplicable structure if it were found in direct continuity with the nerve-fibre.

The views of Lenhossék and Retzius, though concordant with each other and with the most recent morphological ideas of nervous structure, are so different from those commonly held that it is not sur-

---

[1] Compare Obersteiner in Jour. Comp. Neurol., May, 1892, pp. 73-84.

[2] According to views current in some quarters the fibre of the olfactory nerve does not run continuously from the nasal epithelium to the glomerule, but consists of several nerve-units in moniliform connection. This, however, if true, would not materially affect the question now in hand.

prising that they should not find ready acceptance in all quarters. Frederick Tuckerman, in a note recently contributed to the Anatomischer Anzeiger, commenting on these views, calls attention to the fact that he had in 1889 discovered the "intragemmal" fibres described in Retzius' earlier account of the taste-bulbs of Mammals. He, however, seems unwilling to admit that the question as to the nervous connections of the taste-cells is closed. Further investigation in this interesting field promises much of value and it may be confidently expected that corroborative evidence will soon be forthcoming. As an aid to such investigations the following bibliographical notes are appended. Only the more recent titles are included.

DESCRIPTION OF FIGURES.

The figures here presented are copied from Lenhossèk's Der feinere Bau und die Nervenendigungen der Geschmachsknospen, *Anatomischer Anzeiger*, VIII, No. 4.

PLATE XIV.

Fig. 6. Taste-bulb from the papilla foliata of the rabbit. Impregnated taste-cells and a single supporting cell. Under the bulb a "subgemmal cell."

Fig. 7. Taste-bulb from the papilla foliata of the rabbit. The nerve-termini on and between the bulbs, *p*, perigemmal fibres ; *i*, intergemmal fibres.

Fig. 8. Taste-bulbs from the epithelium of the palate of *Barbus vulgaris*. *a*, taste-cells and one supporting cell ; *b*, and *c*, the termini of the nerve-fibres interwoven about the bulbs ; at the base of *c* are traces of a "cupula."

BIBLIOGRAPHY.

OLFACTORY END-ORGANS.

BARTH, A. Bericht über die Leistungen und Fortschritte im Gebiete der normalen und pathologischen Anatomie und Histologie sowie der Physiologie die Gehörorganes und Nasenrachenraumes in der ersten Hälfte des Jahres 1891. *Zeitschrift f. Ohrenheilkunde*, Bd. XXII, 1892, Heft 3-4, pp. 323-335.

VON BRUNN, A. Ueber die Ausbreitung der menschlichen Riechschleimhaut. *Naturforsch. Geselleschaft zu Rostock*, 26 June, 1891. Also, *Rostocker Zeitung*, No. 317, 1891.

VON BRUNN, A. Die Nervenendigung im Riechepithel. *Naturforsch. Gesellschaft zu Rostock*, 30 July, 1891.

VON BRUNN, A. Zwei Mikroskopische Präparate vom Riechepithel eines Hingerichteten. (Demonstration). *Verhandl. der Anatom. Gesellschaft*, auf der 3. Versammlung, 1889, pp. 133-134.

VON BRUNN, A. Beiträge zur Mikr. Anat. der menschlichen Nasenhöhle. 1 plate and 2 figures. *Arch. f. Mikr. Anat.* Bd. 39, 1892. Heft 4, pp. 632-651.

Burckhardt, Rud. Untersuchungen am Hirn und Geruchsorgan von Triton und Ichthyophis. 2 plates. *Zeitsch. f. wiss. Zool.* 52 Bd. 3, Heft, pp. 369-403.

Cajal, R. y. Terminaciones del nervio olfactorio en la mucosa nasal. *Barcelona*, 1889.

Cajal, R. y. Origen y terminacion de las fibras nerviosas olfatorias. *Gaceta Med. Catalona*, 1890.

Grassi, Battista and Castronova, A. Beitrag zur Kenntnis des Geruchsorgans des Hundes. 1 plate. *Arch. f. Mikr. Anat.*, Bd. XXXIV, 1889. Heft 3, pp. 385-390.

Van Gehuchten, A. Contributions à l'ètude de la muqueuse olfactive chez les Mammifères. *La Cellule*, T. VI, 1890, pp. 393-407.

v. Lenhossek, M. Die Nerven-urspruenge und endigungen im Jacobson'schen Organ des Kaninchens. 1 fig. *Anat. Anzeiger*, VII, No. 19 and 20, pp. 628-635, Sept., 1892.

Preobraschensky, S. S. Zur Kenntnis des Baues der Regio olfactoria. Aus dem Embryologischen Institute in Wien. Vorläufige Mitth. *Wiener klinische Wochenschrift*, VI, 1891, No. 7, p. 123-124.

Retzius, G. Die Endigungsweise des Riechnerven. *Biologische Untersuchungen*, N. F. III, 1 plate.

Suchannek, Hermann. Beiträge zur feineren normalen Anatomie des menschlichen Geruchsorganes. 1 plate. *Archiv f. Mikr. Anat.* Bd. XXXVI, Heft 3, 1890, pp. 375-403.

Suchannek, Hermann. Beiträge zur normalen und pathologischen Histologie der Nasenschleimhaut. *Anat. Anzeiger*, VII, No. 2, 5 Feb. 1892, pp.55-59. 1 fig.

Suchannek, Hermann. Beiträge zur Frage von der Specifizität der Zellen in der tierischen und menschlichen Riechschleimhaut. *Anat. Anzeiger*, VI, No. 7, pp. 201-205, April, 1891.

Suchannek, H. Beiträge zur Mikr. Anatomie der menschlichen Nasenhöhle, speciell der Riechschleimhaut. 18 schemat. Zeich. *Z. Ohrenheilk.* Bd. 34, Heft 1-2, pp. 93-102.

Wilder, H. H. Die Nasengegend von Menopoma alleghaniense und Amphiuma tridactylum nebst Bemerkungen über die Morphologie des Ramus ophthalmicus profundus trigemini. 2 plates. *Zool. Jahrbücher* Abtheilung f. Anat. und Ontogenie der Tiere, Bd. V, 1892, Heft 2, pp. 155-176.

TASTE-BULBS.

Arnstein, C. Die Nervenendigungen in den Schmeckbechern der Säugethiere. 1 plate. *A. Mikr. Anat.*, Bd. 41, Heft 2, pp. 195-218.

Bruns, L. Erwiderung an Herrn Dr. Ziehl in Lübeck, die Innervation des Geschmachs betreffend. *Virchow's Archiv*, Bd. 119, Folge XI, Bd. IX, pp. 185-191.

FUSARI, R. and PANASCI, A. Sulla terminazione dei nervi nella mucosa della lingua dei mammiferi. *Atti della reale Accad. dei Lincei*, Vol VI, p. 266. Also *Atti della R. Accad. della science di Torino*, Vol. XXV, pp. 835-857. 1 plate, cf. also *Estr. d. Monitore Zoolog. Italiano*, Anno I, No. 4, 30 April, 1890, 4 p.

GOTTSCHAU, M. Ueber Geschmacksorgane der Wirbelthiere. *Biol. Centralbl.*, 1882, pp. 240-248.

GUITEL, FRED. Sur les organes gustatifs de la Baudroie (Lophius piscatorius). *Revue Scientifique*, Tome 47, 1891, No. 18, p, 569.

GUITEL, FRED. Recherches sur les boutons nerveux bucco-pharyngiens de la Baudroie (Lophius piscatorius.) *Arch. de Zool. Expèr.*, IX, 4, p. 671.

HINTZE, K. Ueber die Entwickelung der Zungenpapillen beim Menschen. Inaug.-Disc. Strassburg, 1890.

HOWELL, W. H. and KASTLE, J. H. Notes on the Specific Energy of the Nerves of Taste. *Johns Hopkins Univ. Studies from Biol. Lab.*, Vol. 4, No. 1, pp. 13-19, June, 1887.

KOELLIKER, A. Zur Entwickl. d. Auges u. Geruchsorganes menschl. Embryonen. *Grat.-Schrift f. die Züricher Universität*, 1883.

v. LENHOSSEK, M. Die Nervenendigungen in den Endknospen der Mundschleimhaut der Fische. *Vhdlg. d. Naturf. Ges. zu Basel*, Bd. 10, 1892, Heft 1, 17 pp., 1 plate.

v. LENHOSSEK, M. Der Feinere Bau und die Nervenendigung der Geschmacksknospen. Preliminary contribution. *Anat. Anzeiger*, VIII, No. 4, 18 Jan., 1893, pp. 121-127. 3 figs.

NAGEL, W. Der Geschmackssinn der Actinien. *Zoologischer Anzeiger* XV, No. 400, 12 Sept., 1892, pp. 334-338.

PREOBASCHENSKY, S. Beiträge zur Lehre über die Entwickelung des Geruchsorganes des Huhnes, 1 plate. *Mitteilungen aus dem embryologischen Institute der Universität Wien*, Heft XII, Zweite Folge, Heft V, 1892.

RETZIUS, GUSTAF. Die Nervenendigungen in dem Geschmacksorgan der Säugethiere und Amphibia. *Biologische Untersuchungen*, N. F. Bd. IV.

RETZIUS, GUSTAF. Ueber Geschmacksknospen bei Petromyzon. *Biologishe Untersuchungen*, N. F. Bd. V, No. 10, Stockholm, 1893. 1 plate.

SERTOLI, E. Beiträge Zur Kenntnis der Endigungen der Geschmacksnerven. *Moleschott's Untersuchungen zur Naturlehere*, Bd. XI, 1876, p. 408.

TAVERNARI, L. Contributo all' Anatomia degli organi del gusto. La lingua del Cercopithecus diana. *Atti della società dei naturlisti di Modena, Memorie originali*, Serie III, Vol. X, Modena, 1891, 16 pages, with one plate.

TUCKERMAN, FREDERICK. On the Gustatory Organs of Sciurus Carolinensis. *The Microscope*, Vol. IX, No. 7, July, 1889, pp. 193-196. 1 plate.

TUCKERMAN, F. On the Gustatory Organs of the Mammalia. *The Proceedings of the Boston Society of Natural History*, Vol. XXIV, 1890, pp. 470-482.

TUCKERMAN, F. The Development of the Gustatory Organs in man. *American Jour. of Psychology*, Vol. III, No. 2, 1890.

TUCKERMAN, F. Gustatory Organs of Procyon lotor. 1 plate. *Journal of Anatomy*, Vol. XXIV, New Series, Vol. IV, Part 11, Jan. 1890, pp. 156-160.

TUCKERMAN, F. On the Gustatory Buds of some of the Mammalia. *Journal of Morphology*, Vol. IV., No. 2, Oct., 1890.

TUCKERMAN, F. On the Gustatory Organs of Some Edentata. *Internat. Monatsschrift f. Anat. u. Phys.* Bd. VII, 1890. Heft 9, pp. 335-339.

TUCKERMAN, F. On the Gustatory Organs of Sciurus hudsonius. 1 plate. *Internat. Monatsschrift f. Anatomie und Physiologie*, Bd. VIII, 1891. Heft 4, pp. 137-139.

TUCKERMAN, F. Observations on some Mammalian Taste-Organs. *The Journal of Anatomy and Physiology*, Vol. XXV, New Series, Vol. V, Part IV, pp. 505-508, 1891.

TUCKERMAN, F. The Gustatory Organs of Belideus ariel. 1 plate. *Jour. of Anatomy and Physiology*, Vol. XXIV, P. 1., pp. 85-88.

TUCKERMAN, F. Further observations on the Gustatory Organs of the Mammalia, *Jour. of Morphology*, V. 7, Part 1, pp. 69-94.

TUCKERMAN, F. An Undescribed Taste Area in Perameles nasuta. 1 fig. *Anat. Anzeiger*, 4 Jahrg., No. 13, pp. 411-412.

TUCKERMAN, F. The Gustatory Organs of Ateles ater. *The Journal of Anat. and Phys.*, Vol. XXVI, New Series, Vol. VI, Part III, 1892, pp. 391-393,

TUCKERMAN, F. On the Terminations of the Nerves in the Lingual Papillæ of the Chelonia. With 1 plate. *Internationale Monatsschrift f. Anatomie und Physiologie*, Bd. IX, 1892, Heft 1, pp. 1-4.

TUCKERMAN, F. Note on the Structure of the Mammalian Taste-Bulb. *Anat. Anzeiger*. VIII, No. 10 and 11, Apr., 1893, pp. 366-367.

ZIEHL, F. Einige Bemerkungen zur der Erwiderung des Herrn Dr. L. Bruns in Hannover, meinen aufsatz über die Innervation des Geschmacks betreffend. *Virchow's Archiv f. patholog. Anatomie*, Bd. 120, Folge XI, Bd. X, 1890, pp. 192-194.

POSTSCRIPT.—While these pages are going through the press the paper by Professor Arnstein, mentioned in the preceding bibliography, on the nerve-termini in the taste-bulbs of Mammals has come to hand. He applies a modification of Ehrlich's methyl blue to the papilla foliata of the rabbit. After injection with methyl blue the papilla is cut into thin sections with a razor. The color is fixed in ammonium picrate and the preparation may then be mounted in glycerine. But preparations thus made are not conclusive as to the terminal relations of the nerve-fibres. Ammonium picrate is an excellent macerating fluid and herein lies the great advantage of this method over the chrome-silver method, which so often produces deceptive appearances. By the addition of a suitable proportion of picro-carmine to the ammonium picrate a solution is obtained which at the same time fixes the methyl blue, giving the nerve-fibres a brown-violet color, macerates the epithelium, stains the cells light yellow and their nuclei bright red. After treatment with this fluid and mounting in glycerine, light pressure on the cover-glass is sufficient to separate the elments. Preparations in which the cells have not been isolated after maceration show varicose nerve-fibres ramifying over the surface of the taste-bulbs and ending in little tuberosities around the pore, very much as in Lenhossék's figures (cf. Plate XIV, fig. 7.) After isolation of the elements these fibres are seen to envelop the supporting cells, branching freely and apparently anastomosing, though the latter is not certain. The axial cells or "taste-cells" are similarly enveloped throughout their whole length by varicose fibres which end free at the distal end of the cells. The fibres are plainly strictly superficial and *do not enter the cells or their nuclei.* The cell-bodies are not usually colored by the methyl blue so that the course of the fibres can be followed with great distinctness. The cilium of the taste-cell is not colored nor do the free ends of the nerve-fibres extend out beyond the wall of the pore. The fibres enveloping the axial cells probably come from the N. glossopharyngeus, those belonging to the superficial cells and the indifferent epithelium from the trigeminus.

Prof. Arnstein considers his preparations absolutely conclusive as to the nature of the nervous termini in mammalian taste-bulbs and appends to the record of his own observations an excellent historical sketch and critical review of the whole subject.

Variations in Spinal Nerves in Amphibia.

Dr. Adolph[1] has studied the variations in the spinal nerves of amphibia, comparing especially Bufo variabilis, Rana esculenta, and Pelobates fuscus. It appears that there is a definite tendency toward cephalization in the sacral and brachial plexus. Pelobates is more primitive in some respects than the others, for in 20 per cent of the cases the fifth spinal retains its connection with the brachial plexus, which is the case in no other anura yet studied.

The ninth vertebra is the sacral in all anura but in the above cases of Pelobates the tenth also frequently participated in the sacrum.

---

[1] *Sitzungsb. Naturf.-Gesellschaft Dorpat.*, 1892, p. 45.

Nucleary Division in Regenerating Nerves.

Professor G. Bizzozero calls attention to the fact that the priority of the discovery of the karyokinetic division of the nuclei of Schwann's sheath during regeneration of nerves belongs neither to Huber nor Büngner, but to Dr. A. A. Torre who, while working in Bizzozero's laboratory, described the mitotic division not only in cases of degeneration, but during normal growth.[1]

Influence of Music.

Professor Dogiel has studied the effect of music upon man and animals. The arm of the subject was enclosed in a glass cylinder filled with water which communicated with a delicate manometer and registering apparatus. The frequency of the pulse and the variations in blood pressure are thus registered at the same time.

In the experiments with animals the manometer is applied directly to the vessels. In dogs and rabbits a remarkable increase in pulse rate and pressure is shown in each case during whistling.

Strychnia and other poisons increase the irritability of the auditory nerve, while spirituous liquors and opium decrease the effect of music upon the circulation. It might seem probable that these changes are due to contractions of the voluntary muscles, but it was found that even after curare poisoning, by which the voluntary muscles are paralyzed, the reaction continued.

It is a fact familiar to all that dogs and, to a less extent, cats are very susceptible to musical sounds. Many dogs are strongly affected by the ringing of bells.

Lewin on Nicotinism.[2]

The functional disturbances caused by the excessive use of tobacco, have been fully studied in appreciation of their social importance. The deleterious influence of tobacco may be observed after its use in any form; smoking, chewing, snuffing. Typical nicotinism occurs, as a rule, after a long continued abuse of tobacco, sometimes not until after twenty years and more. The human organism is capable of a certain degree of accommodation to the tobacco poison,

---

[1] *Giornale della R. Accad. di med. di Torino.*, Nov. 28, 1884.

BIZZOZERO. Ueber die Regeneration der Elemente der Gewebe unter pathologischen Bedingungen. *Centralblt. f. d med. wissenchaft*, 1886, 5. *Archiv. f. mik. Anatomie*, XLI, 2, p. 338,

[2] *Internationale Klinische Rundschau*, No. 24.

but it can never be perfectly immunized—no period of tolerance is long enough to exclude the final appearance of intoxication. It is a fact that many smokers reach old age, but it is probably equally true that many people do not live to old age because they are smokers.

The disturbances of nicotinism may be observed in almost all organs of the body. On the skin we see itching and erythema; the nerves of taste are blunted; in the throat an *angina granulosa* develops; leukoplakia is probably a consequence of the abuse of tobacco; loss of appetite, fullness and pain in the epigastrium are quite common, as is matutinal vomiting and disturbed function of the intestine; the secretion of urine is usually increased; in smoking women disturbances of menstruation are the rule; in female cigar-makers abortion appears to be frequent; diminished sexual appetite and power, even impotency, have been observed.

The most frequent pathological effect of nicotine is a disturbance of the action of the heart, palpitations, rapid heart-beat, intermissions, præcordial anxiety, weakness, fainting spells and collapse. Sclerosis of the coronary arteries, hypertrophy of the left ventricle, perhaps myocarditis and fatty degeneration of the heart seems to be favored by the abuse of tobacco. The smoking of cigars, and more so of cigarettes, produces an irritation of the nasal mucous membrane (the so-called vasomotor catarrh) and diminishes olfactory sensibility. There usually is chronic hyperæmia of the epiglottis and larynx, sometimes even of the trachea and bronchi.

The use of tobacco in any form may produce disturbances of the sight. This may be favored by general debility, excessive heat, mental overwork, etc. The most common form of optic disturbance is bilateral nicotine amblyopia. There usually is central disturbance of the field of vision, a central horizontal elliptic scotoma for red and green, sometimes also for blue, in a lesser degree; the external limits of the field of vision are normal, as a rule.

In the auditory organ a swelling of the tubes and congestion of the tympanum is often observed in higher degrees of nicotinism; also paresis of the auditory nerves or the disturbances consequent upon this, such as noises in the ears, etc.

The functions of the central nervous system may be affected too. It has been observed that in higher schools the non-smokers get along better than the smokers, and that children from nine to fifteen years that were addicted to smoking, showed dimished intelligence, laziness and a craving for spirits. Adult persons given to excess in smoking often complain of cephalic pressure, sleeplessness, in some cases sleepiness, melancholic disposition, aversions to labor and *dizziness.* The latter is most disagreeable; the patient has a peculiar sensation of emptiness, is afraid of losing consciousness, is unable to concen-centrate his attention, in spite of all efforts; his movements get incoherent, and everything seems to be in motion. In those smoking excessively there have also been observed symptoms of ataxia, paretic weakness of the sphincters, trembling and spasms.

The nicotine-psychoses that have lately been reported, are said rarely to affect smokers and to be more common in those that snuff, and most so in chewers. The prodromal stage, which lasts about three months, shows general uneasiness, restlessness, anxiety, sleeplessness, depression of mind, often of a religious character; after this follows præcordial anxiety, and finally the psychoses proper, consisting of three stages: 1, hallucinations of all senses, tendency to suicide, depression of spirits, attacks of fright with a tendency to violent acts, sleeplessness; 2, exhilaration, slight maniacal exaltation, agreeable hallucinations: after from two or four weeks' relaxation, again followed by a maniacal condition; 3, the intervals between exaltation and depression get shorter, the patient becomes irritable, but otherwise does not pay much attention to his surroundings; perception and attention are diminished.

It is claimed that the patient is curable in five or six months if he stops the use of tobacco during the first stage; if he does so during the second stage, he may be cured in a year or so; after the third stage is reached, the disease seems to be incurable.

Of the therapeutic measures against nicotinism, withdrawal of the tobacco is the most important. Iodide of potassium, laxatives, warm baths, are said to hasten the elimination of the poison that accumulated in the system. Against the dizziness, subcutaneous injections of ether have been recommended; against the disturbances of hearing, pilocarpin; against the amblyopia, strychnine, hyoscyamus, biniodide of mercury, pilocarpin, etc.

The Respiratory Centre.

In the case of a child whose head was crushed during parturition, destroying the whole cerebrum and cerebellum, Dr. Kehrn reported that respiration continued rythmically six to the minute. Hand and foot reflexes were also present. All spontaneous movement was of course absent. The medulla was cut across one centimeter above the calamus but no change in respiration or reflexes followed. A section made at the apex of the calamus caused both to be permamently destroyed. This observation offers support to the older view as to the respiratory centre.

The Cephalic Extremity of the Brain Tube.[1]

Professor His discusses at length the relation between the views presented by Kupffer in his "Studien zur vergleichenden Entwicklungsgeschicte des Kopfes der Kranioten[2] and his own summarized in the Archiv in 1892.[3]

His objects to the term *lobus olfactorius impar* proposed by Kupffer for the point where the lamina terminalis closes last, claiming, as we have done, that it has nothing to do with the olfactory, and substituting the term *angulus terminalis*. The difference between the two positions is, in a word, that Professor His considers the whole terma from olfactory recess to angulus terminalis the neuropore (Hirnnabel) while Professor Kupffer includes only the angulus. Professor Kupffer has called in question the existence of a frontal suture line upon which the theory of His is founded while the latter claims to have demonstrated its existence in Selachians and the rabbit. The figures given by Professor His seem to us to favor our own view in accordance with which the recessus infundibuli should be considered the primitive cephalic extremity of the tube. The point where the brain tube closes last will sustained no necessary relation to the morphological front but will be determin by the rate of growth and index of curvature.

Subdivision and Nomenclature of the Brain.

In the same periodical and in connection with the above topic Professor His offers suggestions as to the subdivisions of the brain tube.[4] We are permitted to become slightly accustomed to the use of one set of terms when we have our equinimity destroyed by seeing the familiar names replaced by others more formidable in polysylabic and barbaric splendor than the preceeding, or, what is still worse, we see the familiar terms doing duty for an entirely different segment of the brain with no more reason than to form a pleasantly alliterative

[1]HIS, WILHELM. Ueber das frontale Ende des Gehirnrohres. *Archiv f. Anat. u. Physiologie* p. 157, 1893.

[2]See March number of this Journal p. xxiii.

[3]See review in June number of this Journal p. ivi.

[4]Vorschläge zur Eintheilung des Gehirns. l.c. p. 172.

background for the newly invented ones. Thus it is difficult to speak patiently of Professor Kupffer's application of the term epencephalon to cerebral hemispheres.

In the paper before us Professor His has stated his reasons for adopting the system suggested which combines much that is familiar with a number of new usages. As would be expected, these suggestions are based on embryological data and are free from the ambiguity of purely topographical terminology. They have much to recommend them.

The following table indicates the system:

I.	Medulla oblongata	*Myelencephalon* (1)	Rhombencephalon (Rautenhirn).		
II 1.	Pons	*Metencephalon* (2)			
II 2.	Cerebellum				
III.		*Isthmus-rhombencephali* (3)			
IV 1.	Pedunc. cerebri	*Mesencephalon* (4)			Cerebrum.
IV 2.	Corp. quadrig.				
V 1.	Pars mamillaris hypothalami		*Diencephalon* (5)	Prosencephalon	
V 2.	Thalamus	*Thalamencephalon*			
V 3.	Metathalamus				
V 4.	Epithalamus				
VI 1.	Pars optici hypothalami		*Telencephalon* (6		
VI 2.	Striatum	*Hemisphærium*			
VI 3.	Rhinencephalon				
VI 4.	Pallium				

One might feel disposed to critcise the system as making too large concessions to anthropotomy in the use of such major groups as rhombencephalon and cerebrum, for, however convenient this may be in the superficial description of the mammalian brain, it expresses false morphology. On the other hand the six prominent divisions are morphological. Even here it may be questioned whether the older terms Prosencephalon, Mesencephalon and Metencephalon are not more nearly in accord with morphology and embryology. The recognition of a separate segment known as the isthmus has its advantages but, on the other hand, serves to separate the niduli of eye-muscle nerves whose close connection scarcely admits of doubt.

The separation of the pars mamillaris and pars optica hypothalami in two different major divisions causes some inconvenience.

While this system certainly recognizes the close relationship of the diencephalon and the hemispheres one could wish that the genetic subordination of the latter to the former could be made more prominent. It is by repeated attempts that we shall secure a system commensurate to the needs of descriptive as well as theoretical anatomy.

Synæsthesia.

This peculiar form of association which consists in the spontaneous application of the data of one sense or group of sensations to another without appreciable cause has recently received considerable attention. When President Jordan described the fact that he discovered that he was in the habit of associating certain colors with the concepts of various letters or symbols probably few outside the technical students were aware of the existence of pseudo-chromæsthesia or "photism." Sometime since, M. Claparede sent out 3600 circulars of inquiry respecting this phenomenon and received 694 answers over half of which were positive. The results have been studied by Flournoy.[1] Associate Professor Mary Calkins, of Wellesley College, has recently given the subject a statistical study.[2] Curiously enough the possession of such associations is regarded by these subjects as of assistance in various ways.

One says "If I hear an opera I can come home and play it by colors; I know what chords make a certain combination of colors." One subject, in speaking of the way the arbitrary form came to be associated with number, said "the other forms have arisen from the ways that I have used to remember." The present writer is aware of a faint instance of such association which grew out of the arrangement of the spots on dominoes—a mental trick to assist in keeping a few numbers, particularly 5, in mind. Doubtless many of the mental forms have grown up in the same way and are simply ideographs. One of Miss Calkin's students said: "Colors do not look right unless a word is spelled right. For instance I spelled permanent, the other day, with two *a's*, and it did not look pale enough,

It appears that the statistics do not prove that the color associations can be shown to have arisen from primitive associations of colored objects though this is inherently most probable for almost all color associations date back to childhood The color may be associated with the sound or sight of a word or letter but more frequently with both.

Some uniformity was noted, thus: *i* was black or blackish in 15 cases out of 21 and positively colored in only one instance, *o* was white or whitish in 18 cases out of 22. But otherwise very little constancy is observed.

---

[1]Des Phenomenes de Synopsie, Paris, 1893.

[2]*Am. Journ. Psychology* v. i.

Influence of the Cerebral Hemispheres upon the Circulatory Apparatus.

Tsherevhoff[1] conducted experiments on dogs to determine the nature of this influence and states that: 1. The maximum effect (increase of blood-pressure and modification in the heart's action) was obtained by stimulation of the gyrus sigmoideus and sulcus cruciatus region were of three kinds, (a) increase of blood pressure without acceleration of the heart's action, (b) increase of pressure and acceleration of cardiac action, lasting, however, but a short time, (c) considerably accelerated action and increase of pressure. All changes in the action of the heart and vessels are obtained in animals through the spasm induced by the current. He showed that the spasmogenic portion of the cortex may be removed in case of epilepsy.

Innervation of the Ciliary Body.

Dr. Agababou, working under the direction of Professor Arnstein of Kasan, has studied the nerves of the ciliary body of the eye in the rabbit, cat and man.

An albino cat is killed with chloroform and a three percent solution of methyl blue is injected into the carotid, after quarter or half an hour the blued eye ball is excised and, removing the retina and teasing away the tapetum from the tractus uvealis, the ciliary body may be studied with a low power.

The circular course of the nerve stems of the orbiculus gangliosus is easily seen. These stems divide and form a nerve mat with scattered ganglion cells chiefly of nonmedullated fibres and form the vasomotor tracts for the vessels of the ciliary body. The medullated bundles form free "end-brushes" of a peculiar form. The terminal fibres are varicose and relatively thick and end with a knob.

The fibres lie at various depths. There is also a superficial "nerve lattice" of anastomosing fibres. This lies upon the serous surface of the ciliary body. It could not be determined whether this reticulum is in continuity with that described by Meyer on the front of the iris or not. On the bundles of the ciliary muscles fine varicose fibres appear with the usual arrangement of nerves of involuntary muscles.

Thus four kinds of nerves are represented: 1. vaso-motor, 2. motor end organs of the ciliary muscle, 3. a diffuse lattice on the scleral surface of the ciliary body, 4. terminal tufts in the intermuscular connective tissue.

---

[1] *Inaug. Dis.* Harkoff. 1892.

No. 3, is obviously sensory, the terminal tufts of No. 4, are supposed by the author to serve to supply muscular sensation and thus to play an important part in accommodation. (*Anatomischer Anzeiger*, VIII, 17, p. 555. July, 1893.

The Pineal and Parietal Foramen in Recent Fish.

Professor Klinckowström of Stockolm embraced the opportunity afforded by a visit to Surinam to study the parietal foramen in the curious armored fishes *Callichthys asper* and *littoralis*. The foramen had already been described in the genera *Dorcas*, *Clarias*, *Loricaria* and others by Bashford Dean. The resemblance between these structures and those found in the Paleozoic placoderms is startling.

The author succeeded in sectioning the whole head in young specimens which were completely decalcified and stained *in toto* with borax carmin. The epiphysis consists of three parts: 1. a proximal tubular part communicating with the third ventricle, 2. a middle thread-like portion connecting with 3. and spheroidal mass which generally looses its cavity. No true parietal nerve was found. The terminal organ may be compared with the frontal fleck of Anura.[1] (*Anatomischer Anzeiger*. VIII. 17.)

Pacini's Corpuscles in the Trunk of the Tibial Nerve.

It has been known for some time that these bodies occur not only in the superficial regions but also in the nerves in the bones and joints, in sympathic nerve plexi and in the arterial walls. Dr. Askanzy[2] now describes them from the upper part of the tibial region of an amputated human limb. They lie in the epineureum, either superficially or in a deeper part of the stem.

The Sensory Nerves in the Skin of the External Genital Organs.[3]

This author, who is continually adding to the remarkable evidences of his skill and industry, has given us a beautifully illustrated and detailed description of the marvelous nerve-endings in the ex-

---

[1]Compare also *Bashford Dean*. The Pineal Fontanelle of Placodermata and Catfish. 19. Rep. Comm. of Fish, New York. HECKSHER, W. Bidrag til Kundskapen om Epiphysis cerebri udvikings historie. Kopenhagen, 1890.

[2]Vater-Pacini'sche Körperchen im Stamme des menschlichen Nervus-tibialis. *Anat. Anz.* VIII. 12, 13.

[3]DOGIEL, A. S. Die Nervenendigungen in der Haut der äuseren Genitalorgane des Menschen. *Archiv. f. mikr. Anat.*, XLI, 4.

citory areas of the skin. His method is that which he has used so successfully in other areas.

The mucous membrane in pieces 2x3 cm. or less, were treated on the slide with one-sixteenth per cent methyl blue solution and fixed with a saturated solution of ammonium picrate or mixture of ammonium picrate and osmium. In most cases the epithelium was removed carefully from the surface, which latter was arranged on the slide and imbedded in glycerin. After a few days the preparation became perfectly transparent. Sections from the glans penis were stained and embedded between pith and cut with the freezing microtome.

Three sorts of end-organs were recognized: 1, genital nerve bodies; 2, nervous end organs, (end kolben); and, 3, Meissner's tactile bodies. The differences between these bodies is not an essential one. In all cases the axis cylinder enters the cavity of the bulb and divides into a certain number of varicose branches and threads which, during their course, form a number of spiral turns and anastomose and interblend in the most various manner, and finally form a complicated system of loops and meshwork. The differences between the several varieties consists chiefly in the details of combination and ramification of these fibres in the cavity of the bulb, The genital bodies are the most complicated of these structures. The Meissner's bodies are next in complexity. All these terminal bodies have this in common that from the nervous apparatus of the body in each type a certain number of fibres are separated, which penetrate the epithelium and end free with knob-like tuberosities. The non-medullated fibres pass to the blood vessels about which they form a close network. Separate nerve bulbs are connected by fine fibres with each other, though each end bulb receives several branches. It would appear that the genital bulbs particularly are combined into a close system.

Regeneration of Nerve Fibres.[1]

This paper adds to the long list of ambiguous data and does not include references to the latest literature. We fail to find any recognition of the paper by Howell and Huber and other important contributions to this difficult subject.

The nuclei of Schwann's sheath could not be discovered to have any part in the regeneration process. New growths spring from the central tips of the severed fibres and gradually become encased in a

[1] KOLSTER, R. Zur Kenntniss der Regeneration durchschnittener Nerven. *Archiv. f. mikr. Anat.*, XLI, 4.

new sheath. When the nuclei begin mitotic multiplication a strong connective tissue sheath is formed about the persistent axis cylinder. A protoplasmic sheath appears inside the sheath of Schwann, this begins to grow peripherally about the axis cylinder. This process is supposed to introduce the formation of the sheath. In the vicinity of the regenerating axis cylinders granulation tissue appears, in which the nuclei arrange themselves in longitudinal series. These nuclei are not only products of the neurilemma nuclei recognized by their long form, but oval and spherical nuclei also occur. The nuclei are not found to have any part in the restoration of the fibre. The fibre bundle finally reaches the peripheral stump which, at this period, consists only of decomposed clumps of myelin within the shrunken sheath. No traces of axis cylinders are found in it.

A New Fixing Fluid.

Gustav Man deseribes a fluid composed of Absolute alcohol 100 ccm. picric acid 4 grm. corrosive sublimate 15 grm. Pieces should not exceed 1 cm. in thickness and are left 12-24 hours. Then wash in running water and place in 30 per cent. alcohol with tincture of iodine sufficient to produce a brown color, for 12 hours, after which the tissue is hardened gradatim in alcohol and imbedden in paraffin.

A shorter method is to wash in absolute alchohol for 10 hours, changing the fluid at least once and then, after sectioning, treat the sections with iodine and iodide of potash solution. It is stated the plasma and nuclei are well fixed with slight shrinkage and the cell outlines are well brought out. *Anat. Anzeiger. VIII, 12-23.*

The Brain of Birds.[1]

The two installments of Dr. Brandis' investigations which have thus far appeared are characterized by a painstaking thoroughness which wins for them a very high place in the literature of this difficult field. The brains were hardened in Müller's fluid and imbedded in celloidin. Sections were stained by Weigerts' hæmatoxylin method and Wolter's modification of Kultschitzky's method, together with carmine and nigrosin. The results secured seem to surpass by far any illustrations of bird brains hitherto published.

---

[1]BRANDIS, F. Untersuchungen über das Gehirn der Vögel. I. Theil: Uebergangsgebiet vom Rückenmark zur Medulla oblongata. 1 plate *Archiv f. Mikroskopische Anatomie*, Bd. XLI, Heft 2, April, 1893, pp. 168-195. II. Theil: Ursprung der Nerven der Medulla oblongata. 1 plate. *Do.* Heft 4, July 1893, pp. 623-649.

The first part deals with the transition between the cord and the medulla and opens with a detailed description of the histological structure of the cervical cord. As the cord passes into the medulla, the first significant alteration is the presence of more numerous medullated fibres in the grey matter. The ventral commissure increases in size, more fibres passing to the lateral columns and some even to the dorsal columns. The dorsal commisure also becomes stronger, sending part of its fibres laterally and dorsally in such a way as to isolate the dorsal cornu from the rest of the grey matter. Other fibres of the dorsal commissure pass further ventrad to the lateral columns.

The alterations in the white substance appear first laterad of the dorsal cornu and dorsad of the lateral cerebellar tracts, where the longitudinal fibres begin to turn ventro-laterad. Gradually the lateral columns begin to assume the same direction, until finally they reach the ventral surface and cross the median line under the ventral columns, thus closing the ventral fissure. Some of these fibres enter the ventral columns and there assume a longitudinal direction again. Meanwhile the dorsal columns have diminished in size and in density and part of their fibres have gradually turned laterad and pursued the course followed by the fibres of the lateral columns. At this level the ganglion cells of the ventral cornu begin to send their fibres to the hypoglossus instead of to the first cervical nerve, and the nidulus of the vagus appears.

The lateral columns receive contributions from almost all of the other columns and present a very complicated aggregation of fibres. After crossing either in the ventral commissure or beneath the ventral columns, they take up their former axial direction somewhat ventrad of the position occupied by the uncrossed fibres. Some of these crossed fibres, however, pass farther dorsad and enter the restiform tracts. The latter also receive some fibres from the uncrossed portion of the lateral columns of the same side. The lateral columns supply the optic lobes; from them also pass at least a part of the fibres of the pedunculi cerebri. The exact course of the pyramidal bundles in birds is still an open question.

The dorsal columns send a great part of their fibres either crossed through the ventral commissure or directly to the lateral columns. Of the remainder which retain their dorsal position, the lateral part enters into relations with the ascending trigemimus root and, after crossing, apparently with the fasciculus solitarius; the median part is connected with the cerebellum and the acusticus group.

The lateral cerebellar columns pursue a very simple course up to the outer part of the cerebellar crus.

The ventral columns are made up largely of the dorso-median fasciculus.

The second part presents detailed descriptions of the internal origins of the cranial nerves.

I. Hypoglossus. The first cervical nerve sends its fibres chiefly to the ventral cornu of the same side, but that some fibres cross to the opposite side in the ventral commissure is shown by degeneration effects after section of the first cervical in the dove. Farther cephalad the fibres of the hypoglossus take a similar course, the crossed fibres entering the raphe. Recent methods of investigation have negatived the tract formerly described as descending along the raphe from the cerebrum.

The cells of the nidulus of the hypoglossus are connected with the higher centres by fine fibre tracts, which passing mesad enter the ventral bundles. Only rarely could they be traced to the neighborhood of the raphe and commissural fibres passing transversely through the raphe between the two niduli could not be demonstrated.

This relation was found chiefly in the gallinaceous birds and is regarded as primitive, because here the resemblance is closer to a motor root of the cord. In most other birds there is also a second nidulus for the hypoglossus, composed of large multipolar cells lying dorsad and cephalad of the first. When both niduli are present the ventral is smaller in proportion as the dorsal is larger. Fibres of the hypoglossus cannot be traced to the cephalic end of the dorsal nidulus. This end lies beneath the dorsal vagus nidulus and appears to serve also the ventral vagus root. No crossed fibres from the dorsal niduli were observed. Both niduli correspond to cells of the ventral cornu of the cord, and in all cases the hpyoglossus is to be compared with the motor root of the spinal nerves.

II. Vagus Group. (a) Accessorius. Emerging fibres of the accessorius lie just dorsad of the dorsal cornu in the cervical region of the cord, cephalad of the exit of the dorsal roots of the first cervical nerve. They are directed mesad, then ventrad to a cell-cluster lying at the base of the dorsal cornu near its lateral border. Scattered cells apparently belonging to this cluster are found farther cephalad in the medulla, though the nerve fibres cannot be followed to them. Farther cephalad, these cells become more numerous and constitute the ventral nidulus of the vagus, which, as above mentioned, is so closely related to the dorsal nidulus of the hypoglossus.

(b) Vagus. The large dorsal nidulus of the vagus lies close to the ventricle on each side, extending for a considerable distance from the end of the cord cephalad. Its cells are of two kinds, large, bladdery cells, deeply staining with carmine, and small, faint multipolar cells. The fibres passing from this nidulus, emerge in a line which passes from a point just cephalad of the emergence of the dorsal root of the first cervical ventro-cephalad to the lateral aspect of the medulla, just caudad of the emergence of the glossopharyngeal.

In addition to this dorsal nidulus there is the ventral nidulus already mentioned in connection with the accessorius. The fibres of the vagus upon entering the medulla pass to the dorsal nidulus, and divide into two tracts. One terminates in this nidulus, the other contributes some fibres to the ventral nidulus, while others pass farther mesad to the dorsal part of the raphe in which they cross and pass ventrad until they reach the ventral bundles of the opposite slde. None of these crossed fibres could be traced to cells.

There is a small but distinct bundle of fibres which passes ventrad from the dorsal nidulus, part to join the dorsal end of the raphe, part however, crossing the dorsal fibres of the latter and going over into the formatio reticularis. The connection of the dorsal nidulus of the vagus with the higher centres is to be sought in these fibres.

Thus the vagus proper consists of three parts, the largest of which arises from the dorsal nidulus. The origin from this nidulus was demonstrated experimentally by two methods. (1) In two doves just hatched the vagus was cut on one side in such a way as to leave the ganglion. After six and eight weeks respectively, the vagus root was found in both cases to be thinner, and the dorsal nidulus much smaller than on the other side. Moreover, the cells were less sharply defined, were less susceptible to carmine, their nuclei were smaller and the intervening fibres were more sparse and presented a pale and varicose appearance. (2) The coloring of degeneration products by Marchi's method was applied to the crow. Two adult specimens were deprived of the nerve on one side without destroying the ganglion. After six weeks they were killed and the medulla, together with the vagus ganglion, was cut into serial sections and stained. Peripherally from the ganglion the fibres were degenerated and filled with black lumps. A few degenerate fibres passed through the ganglion. The cells of the latter seemed to be intact. Centrally from the ganglion the degenerate fibres again were plainly visible and could easily be followed to the point where the vagus tract divides. From this point on, the fibres which pass to the dorsal nidulus were very frequently filled with black lumps, while of the more ventral fibres passing toward the median line, only occasionally one was found degenerate and that too only near the point of separation of the two divisions of the vagus.

The fibres passing from the raphe to the vagus were demonstrated with equal certainty. In the experiments above mentioned these fibres were unaltered, but were strongly affected in a dove whose vagus and glossopharyngeus together with their ganglia had been removed. From this we conclude that these fibres arise from the cells of the ganglion and, after crossing in the raphe, pass to the higher centres via the ventral bundles of the opposite side.

That vagus fibres originate from the ventral nidulus is much more difficult to prove, from the fact that the cells are scattered, that the fibres passing to the raphe pass between them, and that cells of this nidulus undoubtedly send fibres into the hypoglossus. But the experiments on doves mentioned above seem to show that this is the case. When the vagus had been destroyed, the ventral nidulus of that side was plainly smaller than the other, the outer cells being wanting, while the inner ones which are related to the hypoglossus remain.

These points and the relation of this common vagus-hypoglossus nidulus to the nidulus of the accessorius, lead to the view that in birds the latter has a single continuation cephalad, the common vagus-hypoglossus, while in mammals it has two such continuations, the "nucleus ambiguus" and the major nidulus of the hypoglossus.

(c) Glossopharyngeus. In the dorsal commissure of the cervical cord are numerous fibres directed mesad and strongly cephalad which are larger than the others. Passing caudad, they arch under the dorsal columns and disappear in the dorsal cornu; a smaller bundle of fibres, however, passes ventrad and disappears in the lateral columns. Passing cephalad, after crossing in the commissure, they follow the ventral surface of the diverging dorsal columns, corresponding to the funiculi solitarii of mammals. Diverging as the fourth ventricle widens this fibre-complex gradually separates on each side into a dorsal and a ventral part. From the latter rather numerous nerve fibres pass ventrad, cross over the vagus tract, and disappeared in the formato reticularis. The other fibres of the ventral part, now constituting the glossopharyngeal root, take up a direction parallel to the emerging vagus root and thus pass to their point of exit. After the ventral part of the solitarius is almost spent, the fibers of the dorsal part turn ventrad and appear to join the glossopharyngeal root, except those lying farthest dorsad which continue in the original direction.

It is worthy of note that after the disappearance of both vagus niduli there remains a strong tract continuing the glossopharyrngeal root dorso-mesad of the dorsal end of the raphe. It may correspond to that part of the glossopharyngeal which has its centre in the ganglion, since after the removal of the glossopharyngeal ganglion it suffers the same alterations as the corresponding tract of the vagus after the removal of that ganglion.

There is no sharp boundary between the glossopharyngeal and the vagus in most cases. There is no separate nidulus which sends its fibers to the glossopharyngeal alone. On the other hand experiments suggest that the cephalic part of the vagus nidulus sends its fibres to the glossopharyngeal, for when the vagus alone was extirpated these cells were altered much less than those of the caudal part, while if both vagus and glossopharyngeal were extirpated these cells were affected like the others.

That portion of the funiculus solitarius which does not enter the glossopharyngeal goes forward to enter the sensory root of the trigeminal. No part of this bundle has been observed to pass farther cephalad in birds. Probably some of its fibers enter the acusticus. After extirpation of the glossopharyngeal and its ganglion, degeneration of the solitarius of the same side could be followed down to its crossing, though beyond that point it is very obscure. The portion passing to the fifth was not affected. [C. Judson Herrick.]

Dr. Berkley on the Cerebellum.

In the notice of Dr. Berkley's Paper on the Cerebellum of the Dog in the Johns Hopkins Hospital Reports, Vol. III, which appeared early in 1893, the reviewer failed to observe that the paper was prepared in March, 1891, which sufficiently explains the absence of reference to the important papers of Koelliker, etc. We are glad to learn that a supplementary paper by Dr. Berkley is soon to appear.

Recent Literature.

Ambialet, J. L'encephale dans les cranes deformes du Toulousain. *L'anthropologie.* IV, 1.

Ayers, H. Ueber das peripherische Verhalten der Gehörnerven und den Wert der Haarzellen des Gehörorganes. *Anat. Anzeiger*, VIII, 12, 13.

Baker, F. Recent Discoveries in the Nervous System. *New York Medical Journal*, 1893; *Alienist and Neurologist*, XIV, 3.

Bechterew, W. Tracts of the Brain, (Russian). Publications of University of Kasan No. 6. 1892.

Beevor, Charles E. and Horsley, Victor. A further Minute Analysis by Electrical Stimulation of the so-called Motor Region (Facial Area) of the Cortex Cerebri in the Monkey (*Macacus sinicus*). *Royal Society*, London, May 18, Abstract in *Nature*, June 8, 1893.

Benedikt. Zur vergleichenden Anatomie der Gehirnoberfläche. *Wiener med. wochensch.* LIII, 7. *Intern. Klin. Rundschau*, VII, 8.

Berkley, H. J. The Intrinsic Nerves of the Kidney. *Bul. Johns Hopkins Hospital.* IV, 28.

Berkley, H. J. The Golgi Silver stain with the Central Nervous System; a Collective Review. *Johns Hopkins Hospital Bulletin*, No. 20, March, 1892.

Bianchi, S. Sul nodulo Kerckringiano e sua relazione con la fossetta occipitale mediana. *Monit. zool. ital.*, IV, 3.

Brandis, F. Untersuchungen über das Gehirn der Vogel. I. Uebergangsgebiet vom Rückenmark zur Medulla oblongata. *Archiv. f. mik. Anat.* XLI, 2.

Brazzola, F. Sul decorso endocranico delle vie di senso nell' uomo e piu specialmente dei fasci spinali posteriori. *Boll. sc. med. di Bologna.* III, 2.

Bruce, A. Illustrations of the Nerve Tracts in the Mid- and Hind-Brain, and the Cranial Nerves arising therefrom. Y. J. Pentland, Edinburgh and London.

Cajal, S. R. Estructura del asta de Ammon y fascia dentata. Estructura de la corteza occipital inferior de los pequenos mamiferos. *Ann. de la Soc. Esp. de Hist. Nat.* XXII. 125 p. 22 fig.

Charles, R. H. Contributions to the Craniology and Craniometry of Panjab Tribes. *Journ. of Anat. and Phys.* Vol. XVII, 1, 1892.

Charpy. L'evolution du fasceau pyramidal. Toulouse, 1892.

Clark, T. E. The Insula in the Pig. *Journ. Comp. Neurology*, III, March, 1893.

CUNNINGHAM, H. W. Displacement of the Ulnar Nerve. *Brit. Med. Journ.* 1673.

DAVIES, A. T. The Inferior Laryngeal Nerve; A Reply. *The Lancet*, I, 13, 1893.

DAVID, J. J. Die Lobi inferiores des Teleostien und Ganoidengehirnes. Basel, 1892. Inaug. Dis.

EDINGER, L. Vergleichend-entwickelungsgeschictliche und anatomische Studien im Bereiche der Hirnanatomie, 3. Riechapparat und Ammonshorn. *Anat. Anzeiger*, VIII, 10.

FAGAN, P. J. Note on an irregular distribution of Nerves in the Dorsum of the Foot. *Trans. R. Acad. of Med. in Ireland.* X, 1892.

FAWCETT, E. Relations of Dura-Mater surrounding Maxillary Nerve to Temporo-Maxillary Articulation. *Journ. Anat. Phys.*, XXVII, 2, 1893.

FRITSCH, G. On the Origin of the electric Nerves in the Torpedo, Gymnotus, Mormyrus and Malopterurus. *62 Meeting Brit. Assoc.*, 1892.

FUSARI, R. Sopra un caso di mancanza quasi-totale del cerveletto. Rend. R. accad. di Bologna (in) *Boll. sc. med.*, III, 11, p. 712.

GAGE, S. P. A Preliminary account of the Brain of Diemyctylus viridescens based on sections made through the entire Head. *Pr. Am. Assoc. Adv. Sci.*, 1892.

GALLERANI, G. and BORGHERINI, A. Sezione mediana antero-posterior del verme del cervelletto. *Revista Sper. di Freniatria e di Med. legale*, XVIII, 1892.

GOODALL, E. Note upon a New Method of Preparing Microscopical sections from the Fresh Spinal Cord. *Medical Chronicle*, Manchester, 7, 1892-93.

GOLGI, C. Intorno all' origine del quarto nervo cerebrale, e di una questione di isto-fisiologia generale che a questo argomento si college. *Atti R. acc. dei Lincei.* Anno 290.

GOTSCH, F. Recent Research on the Spinal Cord. *Liverpool Med. Chirurg. Journ.*, XIII, p. 150.

GRIFFITHS, A. B. Nervous Tissues of Invertebrates. abs. in *Journ. Royal Micro. Soc.*, April, 1893, p. 162.

HART, C. P. Demonstration of a recently discovered cerebral porta. *Proc. Am. Assoc. Ad. Sci.*, 1892.

HEYMANS. Ueber Innervation des Frosch-herzens. *Arch. f. Anat. u. Phys.* 1893, 3-4.

HOSEL. Ein weiterer Beitrag zur Lehre vom Verlauf der Rindenschleife und centraler Trigeminusfasern beim Menschen. *Arch. f. Psychiatrie Nervenk*, XXV, 1.

IZQUIERDO, S. V. Los progresos de la histolojia de la medula espinal y de bulbo raquindeo. Santiago.

KRONTHAL, P. Zur Histologie der arbeitenden Nerven. *Centralb. f. Phys.*, VII, 1.

LANGLEY, J. N. Preliminary Account of the Arrangement of the Sympathetic Nervous System based chiefly on Observations upon Pilo-motor Nerves. *Proc. Roy. Soc.*, LII, 320.

LOEWENTHAL, N. Neuer experimentell-anatomischer Beitrag zur Kenntnis einiger Bahnen im Gehirn und Rückenmark. *Internat. Monatsch. Anat. u. Phys.*, X, 5.

LWOFF, B. Ueber den Zusammenhang von Markrohr und Chorda beim Amphioxus und ähnliche Verhältnisse bei Anneliden. *Zeitschr. f. wiss. Zool.* LVI, 2.

MACALISTER. On the Brain of the Australian. *62 Meeting Brit. Assoc. Sci.* 1892.

MANN, G. A New Fixing Fluid for Animal Tissues. *Anat. Anzeiger*, VIII, 12.

MANOUVRIER, L. On a fronto-limbic formation of the human cerebrum. *62 Meeting Brit. Assoc. Adv. Sci.*

MARCHAND, FELIX, Die Morphologie des Stirnlappens und der Insel der Anthropomorphen. *Arbeit aus dem path. Inst. zu Marburg*, II, 1.

MARCHESINI, R. Sul decorso delle vie psicomotorie della Rana. *Boll. soc. roman. studi zool.*, II, 1-3.

MARSHALL, J. The Brain of the late George Grote, with Comments and Observations on the Human Brain and its Parts Generally. *Journ. Anat. Phys.* XXVII, 1, 1892.

MATELL, M. Ein Fall von Heterotopie der grauen Substanz in dem beiden Hemisphären des Grosshirnes. *Arch. f. Psych. u. Nervenk.*, XXV, 1.

MEEK, A. On the Occurrence of a Jacobson's Organ, with Notes on Development of Nasal Cavity, Lachrymal Duct, and Harderian Gland in Crocodilus porosus. *Journ. Anat. Phys.*, XXVII, 2, 1893.

MEYER, AD. Das Vorderhirn einiger Reptilien. Leipzig 1892, Inaug. Dis.

MINGAZZINI, G. Alteriori ricerche intorno alle fibræ arciformes ed al raphe della Oblongata nell' uomo. *Intern Monatsch. Anat. u. Phys.*, X, 4.

MINOT, CHARLES. Structural Plan of Human Brain. *Popular Science Monthly*, XLIII, 3, July, 1893.

MITROFANOW, P. J. Eine Bemerkung über den Bau und die Entwickelung der elemente des Nervensystems. *Arbeiten a. d. zool. Lab. d. Univ. z. Warschau*, 1892, 7.

MOSSO, A. Les Phenomenes Psychiques et la Temperature du Cerveau. Turin; Loescher, 1892.

MUCHIN. Der Nucleus dorsalis und der sensorische Kern des Nervus glossopharyngeus. *Centralb. Nervenheilk. u. Psychiatr.*, XVI, 4.

NISSL. Mittheilungen zur normalen und pathologischen Anatomie der Nerven-zelle. Jahresversammlung des Vereins deutscher Irrenärzte zu Frankfurt a M. *Berlin. Klin. Wochenschr*, XXX, 26.

OBERSTEINER, H. Anatomie des centres nerveux. Translated from the 2d. German edition by J. de Corvenne, Paris.

OSLER, L. Experimentelle Beiträge zur Innervation des Magens. Klin. u. exper. Studien v. Basch 1892, II.

PAL. Ueber Totaldurchschnitte durch das menschliche Gehirn. *K. K. Gesel d. Aertzte. in Wien.* Intern. klin. Rundschau, VII, 17.

PELLIZZI, G. B. Intorno alle granulazioni ependima ventricolare. *Riv. sper. fren. e. med. leg.*, XIX, 1.

SALENSKY, W. Morphologisches Studien an Tunicaten. *Morpholog. Jahrb.* XX, 1.

SCHAK, F. P. Ueber den Nervus Vagus beim Aal (Anguilla.) *Arbeiten a. d. zool. Lab. d. Univ. z. Warschau*, 1892, 5.

SCHÆFER, E. A. The Nerve Cell considered as the Basis of Neurology. *Brain* 61-62, 1892.

SHERRINGTON, C. S. Further Experimental Note on the Correlation of Action of Antagonistic Muscles. *Royal Society*, London, May 4. Abstract in *Nature*, June 8, 1893.

STAURENGHI, C. Note di anatomia comparativa intorno al velum medullare ant. ed al tuber cinereum. *Atti Assoc. med. Lomb*, I, 1892.

STROEBE, H. Experimentelle Untersuchungen ueber Degeneration und Regeneration peripherer Nerven nach Verletzungen. *Ziegler's Beiträge z. path. Anat.*, XIII, p. 160-278.

POPOFF, N. On the structure of the optic chiasm in man. (Russian) Wratsch.

PTIZYN, A. W. Untersuchungen über die Entwickelung des peripherischen Nervensystems bei Hühnschen. *Arbeiten aus d. zool. Lab. d. Univ. z. Warschau*, 1892, 3.

ROBINSON, A. Observations on the Development of the Posterior Cranial and Anterior Spinal Nerves in Mammalia. *Rep. 62 meeting Brit. Assoc.*, 1892.

RUSSELL, J. S. R. An Experimental Investigation of the Nerve Roots which enter into the Formation of the Brachial Plexus of the Dog. London.

RUSSELL, J. S. An Experimental Investigation of the Nerve Roots which enter into the Formation of the Lumbo-Sacral Plexus of *Macacus rhesus*. *Royal Society*, London, May 18. Abstract in *Nature*, June 8, 1893.

SACHS, H. Das Hemisphaerenmark des menschlichen Grosshirns, 1. Der Hinterhauptslappen. Leipzig. G. Thieme, 1898.

SALA, L. Sur la fine anatomie des ganglions der sympathique. *Arch. ital. Biol.*, XVII, 3.

SMITH, W. R. The Course of the Inferior Laryngeal Nerve. *The Lancet*, I, 10, 1893.

STORRS, C. B. The Internal Capsule. *American Lancet*, XVII, 2.

STSCHERBAK, A. E. Ueber den Flockenstiel und die innere Abteilung des Corpus restiforme. *Neurol. Centralb.*, XII, 7.

SURBO, A. Ueber die normale Structur der Ganglien-zellen des Kaninchenrückenmarkes und deren mit Phosphor und Morphium. *Ungar. Arch. f. Med.*, I, p. 264.

SYMINGTON, J. On the Cerebral Commissures in the Marsupialia and Montremata. *62 Meeting Brit. Assoc. Adv. Sci.* 1893.

THANHOFFER, L. V., Neuere Berträge Zur Nervenendigung der quergestreiften Muskelfasern. *Math.-naturw. Ber. aus Ungarn.* XI. 4.

TORNU, E. Contribucion al estudio de la anastomosis de los nervios cubital y mediano en la palma de la mano. *Anaes e Circ. med. Argentina.* Buenos Aires, 1892.

TRNOWSKY, P. Sur les organes des sens des femmes criminelles et des prostituees. *Arch. de psich., scienze pen. ed antropol crim.*, XIV, 1.

WARNOTS, L. and LAURENT, O. Les localisations cerebrales et la topographie cranio-encephalique. *Jour. Med. Chirurg. et pharmacol*, Brussels. 1892.

WHITAKER, J. R. Anatomy of the Brain and Spinal Cord.

WINDLE, B. A. C. The Myology of the Anencephalous Fœtus. *Journal Anat. Phys.* XXVII. 2. 1893.

ZOJA, R. Sur quelques particularites de structure de Hydre. *Arch. ital. d. Biol.*, XVIII, 3.

SENSORY ORGANS.

ADELUNG, N. VON. Tibial Auditory Apparatus of Locustidæ. Abs. in *Jour. Royal Micro. Soc.* April, 1893, p. 177.

AGABABOW, (ARNSTEIN). Die Innervation des Ciliarkörpers. *Anat. Anz.* VIII. 17.

ARNSTEIN, C. Die Nervenendigungen in den Schmeckbechern der Säugetiere. *Arch. f. Mikrosk. Anat.* XLI. 2.

ASKANAZY, M. Vater- Pacini'sche Körperchen im Stamme des menschlichen Nervus tibialis. *Anat. Anz.* VIII. 12.

BAUMGARTEN. Development of Auditory Ossicles. Abs. in *Journ. Royal Micro. Soc.* April 1893. p. 154.

BEAUREGARD, H. Recherches sur l'appareil auditif chez les mammiferes. (Prise Bondin) *Jour. Anat. Phys.* XXIX, 2.

BERANECK, ED. Etude sur l'embryogenie et sur l'histologie de l'oeil des Alciopides. *R. Suisse de Zool.* I. 1893.

BERTELLI, D. Sur la membrane tympanique de la Rana esculenta. *Arch. ital. d. Biol.*, XVIII, 13.

CAJAL, R. S. La retine des Vertebres. *La Cellule.* IX, 1.

CHIARUGI, G. Sur le developpement du nerf olfactif chez la Lacerta muralis. *Arch. ital. Biol.* XVIII. 3.

DREYFUSS. Beiträge zur Entwickelungsgeschicte des Mittelohres und des Trommelfeldes des Menschen und der Säugetiere. *Morph. Arbeit.* II. 3.

EYCLESHYMER, A. C. The Development of the Optic Vesicles in Amphibia. *Jour. Morph.* VIII, 1.

FRIEDENWALD, H. Congenital Cranial Deformity and Optic Nerve Atrophy. *Am. J. Med. Sci.* CV. 5.

FROMAGET, C. Recherches sur l'histologie de la retine. *Arch. d'ophth.*, XII 1892, Paris.

GAHAN, C. J. Sensory Nature of "Appendix of Antennæ of Coleopterous larvæ. Abs. in *Jour. Royal Micro. Soc.* April, 1893, p. 176.

GANIN, M. A Few Facts on the Question as to Jacobson's Organ in Birds. (Russian), Charkow.

GAUBERT. Nerve-ganglion in Legs of Phalangium opilio. Abs. in *Journal Royal Micro. Soc.* April, 1893, p. 181.

GEHUCHTEN, A. VON. Les terminaisons nerveuses intra-epidermiques chez quelques mammiferes. *Cellule*, IX. 2

GÖPPERT, E. Optic Organ of Salpa. Abs. in *Jour Royal Micro. Soc.* April 1893, p. 168.

HOGGAN, G. Forked Nerve Endings on Hairs. *Journal Anat. Phys.* XXVII. 2, 1893.

KLINCKOSTRŒM, A. de. Le primier developpment de l'oeil pineal, l'epiphyse et le nerf parietal chez Iguana tuberculata. *Anat. Anzeiger*, VIII, 8, 9.

KOLLER, C. Remarks Accompanying the Demonstration of Corneal Nerves. *Trans. Am. Ophth. Assoc.* VI. Hartford, 1892.

KRAUSE, W. Die Retina, IV. Die Retina der Reptilien. *Internat. Monatsch. f. Anat. u. Phys.*, X, 2.

LEYDIG, F. Besteht eine Beziehung zwischen Hautsinnesorganen und Haaren. *Biol. Centralb.* XIII, 11, 12.

METCALF, M. M. Eyes and Central Nervous System of Salpa. Abs. in *Journal Royal Micro. Soc.* April, 1893, p. 167.

MUSGROWE, J. The Blood vessels and Lymphatics of the Retina. *Brit. Assoc. Adv. Sci.* 1892.

ONODI, A. Die Nasenhöhle und ihre Nebenhöhlen. Vienna. J. Hölder.

PURCELL, F. Eye of Phalangiidæ. Abs. in *Jour. Royal Micro. Soc.* April, 1893, p. 181.

RITTER, W. E. On the Eyes, the Integumentary Sense Papillae, and the Integument of the San Diego Blind Fish (Typhlogobius Californiensis, Steindachner). *Bulletin of the Museum of Comparative Zoölogy at Harvard College*, Vol. XXIV, No. 3, 101 pages and 4 plates.

SCHAPER, A. Zur Histologie der menschlichen Retina. *A. mikr. Anat.*, LI, p. 147.

STUDNICKA, F. CH. Sur les organes parietaux de Petromyzon planeri. *Vestril Kral. del Ceskl. Spol. Nauk. Tr. math.prir*, 1893.

VALI, E. Untersuchungen an Verbrechern über die morphologischen Veranderungen der Ohrmuschel. *Arch. f Okrenheilk.* XXXIV, 4.

VIALLANES, H. Compound Eye of Arthropods, Abs. in *Journal Royal Micro. Soc.* April, 1893, p 170.

VILLANES, H. Ganglionic Lamina of Palinurus. Abs. in *Journal Royal Micro. Soc.* April, 1893, p 182.

WASMANN, E. Sounds made by Ants. Abs. in *Journal Royal Micro. Soc.* April, 1893, p 177.

PATHOLOGY.

ALEXANDER, H. C. B. Insanity in Children, *Alienist and Neurologist*, XIV, 3.

BABINSKI, H, Association of Hysteria with Organic Diseases of the Nervous System, Neuroses, and other Affections. *Universal Medical Monthly Journal*, VII, March, 1893.

BASTIAN, H. C. Various Forms of Hysterical or Functional Paralysis. London, 1893,

DESARLO, Psychology of Queen Christina of Sweden. *Alienist and Neurologist*, XIV, 3.

FERE. CH. La Pathologie des Emotions, Paris, 1892.

FLOURNOY, T. Des Phenomenes de Synopsie. Paris, Alcan, 1893.

FRIEDMANN, M, Ueber die neurasthenische Melancholie. *Deutsche Med. Wochenschrift*, XIX, 31.

FRY, F. R. The Sensory Symptoms in three Cases of Syphilitic Spinal Cord Disease, *Alienist and Neurologist*, XIV, 3.

HALLEY, GEO. Some Effects of the taking off of the Cerebrospinal pressure. Anemia of the Brain and Wounds of the Sinuses, *Journal Am. Med. Assoc.* XXI, 3, July, 1893.

LANGDON, F. W. Surgical Anatomy of the Brain, *Cincinnati Med. Journal* July, 1893.

LANGDON, F. W. Applied Anatomy of the Brain. *Cincinnati Med. Journal*, August 15, 1893.

MANN, E. C. Medico-Legal and Psychological Aspect of the Trial of Josephine Mallison Smith. *Alienist and Neurologist*, XIV, 3.

MARIE, PIERRE. Lecons sur les Malades de la Moelle. Paris, 1892.

MOLL, A. Der Rapport in der Hypnose, Untersuchungen über Thierischen Magnetismus. Leipzig, 1892.

NORDAN, MAX. Entartung, Berlin, 1892.

PACE and MIRAGLIA, Contribution to the Study of Transitory Mania. *Alienist and Neurologist*, XIV, 3.

RANDOLPH, R. L. A Clinical Study of Forty Cases of Cerebro-spinal Meningitis, with reference to the Eye Symptoms. *Bul. Johns Hopkins Hospital*, IV, 32, July, 1893.

RILEY, W. H. Three Cases of Multiple Neuritis, *Modern Medicine.* II, 6.

ROBINSON, W. F. Electro-therapeutics of Neurasthenia, G. G. Davis, Detroit, 1893, 25 cents.

SCHANZ, F. Ueber das Zusammenvorkommen von Neuritis optica und Myelitis acuta.

STARR, M. A. Brain Surgery, Wm. Wood & Co, N. Y. $3.00.

STEARNS, H. P. Lectures on Mental Diseases. Philadelphia, 1882.

STEFANOWSKI, D. Morbid Jealousy, *Alienist and Neurologist*, XIV, 3.

TOURTETTE, GILLES DE LA. Traite Clinique et Therapeutique de l'Hysterie. Paris, 1891.

TUTTLE, A. H. Report of Cases of Trephining and Cerebral Injury. *Journal Amer. Med. Assoc.* XX, 13.

WILLIAMSON, R. T. and M. R. C. P. The changes in the Optic Tracts of Unilateral Optic Atrophy. *Brain* LVIII, 1892.

WOLFA, S. Pachymeningitis-Myxedema. *American Therapist*, I, 11 May, 1893.

PHYSIOLOGICAL PSYCHOLOGY.

BALDWIN, J. MARK. A New Method of Child Study. *Science*, XXI, 533.

CALKINS, MARY W. Statistics of Dreams. *American Journal of Psychology.* V, 3.

CALKINS, MARY W. A Statistical Study of Pseudochromesthesia and Mental Forms. *Am. Journal Phychology.* V. 1.

HERRICK, C. L. The Evolution of Consciousness. *Science*, XXI, 543, June, 1893.

KREIDL, A. Weitere Beiträge zur Physiologie des Ohr Labyrinthes. *Sitzb. d. k. Akad. d. Wiss. in Wien.*, CII, III, also CII, III.

MUELLER, G. E. Berichtigung zu Professor Münsterberg's Beiträgen zur experimentellen Psychologie, Heft 4. *Zeitsch. f. Psych. u. Phys. d. Siunesorgane*, IV.

MUELLER, F. Ein Beitrag zur Kenntniss der Seelenblindheit. *Arch. f. Psychiatrie*, XXIV, 3.

PETREN, K. Untersuchungen über den Lichtsinn. *Skand. Arch. f. Phys.* IV.

SANFORD, E. C. Some Practical Suggestions on the Equipment of a Psychological Laboratory, *Am. Journal Psychology*, V, 1.

WALLIAM, S. S. Sound and Color. *Science*, XXI, 543, June, 1892.

SUPPLEMENTARY.

FAGAN, P. J. Report upon the Communication between the Ulnar and Median Nerves in the Forearm. *Tr. R. Acad. Med. Ireland*, X, 1892.

FEIST, B. Ein Fall von Heterotopie und aufsteigender Degeneration sensibler Lumbarnervenwürzeln im Rückenmark eines Paralytikers. *Arch. f. path. Anat.*, CXXXI, 3.

JABOVLAY and VILLARD. Sur un de l'anatomie des nerfs dentaires postereures. Lyon med., 1892.

KAES, T. Ueber den Faserreichtum der II, und III, Meynert'schen Schicht sowie über vergleichende Messungen der gesamten Hirnrinde und deren einzelner Schicten. *Neurol. Centralb.*, XII, 4.

KOLISKO, A. Beiträge zur kenntnis der Blutversorgung der Grosshirnganglien. *Wiener klin. Wochensch*, VI, 11, 1893.

LEONOWA, O. v. Zur pathologischen Entwickelung des Centralnervesystems. Ein Fall von Anencephalie, combinirt mit totaler Amyelie. *Neurol. Centralb.*, XII, 7.

MORPURGO, B. and TIRELLI, V. Sur le developpement des ganglions intervertebraux du lapin. *Arch. ital. Biol.*, XVIII, 3.

BECHTEREW, W. V. Ueber die Geschwindigkeitsveränderungen der psychischen Processe zu verschiedenen Tageszeiten. *Neurol. Centralb.*, XII, 9.

BOURDON, B. Recherches sur la succession des phenomenes psychologiques. *Rev. Philos.*, XVIII, 3.

FERE, Ch. La pathologie des emotions. Etudes physiologques et cliniques, Paris, Alcan.

LITERARY NOTICES.

Alcohol Inebriety.

The marked interest recently awakened in scientific circles respecting the pathology of alcoholism and particularly its hereditary lesions of the nervous system warrant us in quoting quite fully from a recent leader in the *Universal Medical Journal*, by NORMAN KERR, M. D.

"Prominence has been given to it in medical journals, and I have already had occasion to call the attention of our readers to it in this journal. In a series of articles[1] the question has been moderately and dispassionately considered. Twenty years ago it was rare to see a woman drinking at the bar of a public-house in Britain. Now it is a common sight. At an inquest held recently in London on the body of a woman who had died suddenly on the threshhold of her home, after returning from a public-house where she had gone for liquor by 6 o'clock in the morning, I had occasion to testify that I had never seen so much female drunkenness before. Morning, noon, and night such houses had been thronged, largely by women; many with infants at the breast, who were treated by the wretched mothers to sips of rum or gin. On the streets were groups of from three to six women (many of them young), going about from public-house to public-house to expend in liquor all the money they could jointly provide for their weekly dissipation. The coroner, Dr. Danford Thomas, in confirming this evidence, said that he had lately held an increased number of inquests on intemperate females. In London, during 1891, there had been an increase of 500 apprehensions of females for drunkenness. In Glasgow[2] there were 10,500 women arrested for drunkenness and allied offenses in one year. Four thousand women were responsible for this long tale of convictions, no fewer than 450 of whom having been sent to jail for from six to thirty-four separate terms. Of some female inebriates in England and Ireland there have been hundreds of drunken commitments. Of criminals convicted over ten times (these are

---

[1] *Brit. Med. Jour.*, Oct. 1 and 8, 1892, and other journals.

[2] *Ibid*, Oct. 1, 1892.

chiefly habitual drunkards) the women in England and Wales were, in 1884, three times as many as the men. In other ranks of life drunkenness (often secret among the cultured and and the wealthy) has also markedly increased. In many other countries, though England surpasses all other lands in this shocking pre-eminence, there has also been a similar increase. T. D. Crothers, of Hartford,[1] does not think that indulgence among women has progressed in America, but this is not in accord with my own experience. For one drunken woman in the United States whom I knew thirty years ago, I know at least twenty; and of later years women in some parts of America have broken fresh inebriating ground in the cultivation of inordinate consumption of strongly-spirituous preparations of ginger. Apart, however, from the mere number of drunken women, there can be little doubt that the proportion of intemperate females, who may fairly be regarded as diseased individuals, has largely grown. This is a more serious matter. The inhibitory power of such sufferers has been practically lost, and compulsory seclusion with appropriate treatment is essential to a cure in the majority of cases. T. D. Crothers, of Hartford,[2] holds that the women charged in American police-courts with drunkenness and associated offenses are profoundly degenerate in body as well as in mind. The same may truly be said of only about one-sixth of the corresponding class of offenders in England, Englishwomen being, in the main, much more robust than their American sisters. Lawson Tait[3] asserts that an intelligent and educated woman never becomes a drunkard but from some deep-rooted and often carefully-concealed cause. The indulgence may be from physical suffering or mental distress, but there is always a reason for it. Scores of his cases of suffering from inflammatory affections of the appendages have been cured of their drunkenness by the same proceedings as have cured their physical misery.

M. Lancereaux, of Paris,[4] holds that in alcoholic delirium the real chance of recovery lies in sleep. He isolates the alcoholic deliriate in a quiet, dark, and, if necessary, padded room, no physical restraint being employed. To procure sleep the patient receives 1 to 1½ drachms of chloral hydrate, with ½ grain of hydrochlorate of morphine, in an infusion of limes. If sleep does not come on in about ten

[1] *Brit. Med. Jour.*, December 11, 1892.

[2] *Ibid.*, December 31, 1892.

[3] *Ibid*, October 15, 1892.

[4] *Bulletin general de therapeutique*, Feb, 15, 1893.

minutes, from 1/6 to 1/3 grain of morphine is injected hypodermatically. After the alcoholic disturbance has subsided, strychnine or nux vomica is given, followed by hydro-therapeutic measures. If there should be gastric complication an antacid such as sodium bicarbonate is administered. The heroic doses of these narcotics, with the cardiac depression apt to follow their exhibition, call for deliberation in their administration to aged and infirm inebriates, and I prefer as a hypnotic a simple febrifuge frequently repeated, such as liq. ammon. acet. Sleep, thus quietly and safely induced, has proved much more curative than the sleep for which I formerly resorted to narcotics.

M. J. Arnaud, of Marseilles,[1] describes various forms of alcoholic paralysis. There are attenuated alcoholic paralyses, evidenced by tremors on awaking from a drunken sleep. The inebriate has recourse to alcohol to dissipate for the moment these tremblings, a repetition of which injurious habit tends to induce a graver form of paresis. The matutinal tremors are permanent though highly-curable forms, with but slight local loss of power. Then there are paralyses affecting the extensors of the upper and lower limbs, still very amenable to treatment. Contrary to general experience, the author finds the upper limbs not less disturbed than the lower, and, indeed, the disease is frequently confined to the former. In addition to these fleeting paralyses, there is a group of permanent chronic paralyses which may be classified as progressive and non-progressive. Both forms creep on slowly, with prodromata of some weeks' or months' persistence. The progressive is the most intense and fatal variety, and is often complicated with agonizing pain, insomnia, maniacal paroxysms, and other highly-intensified symptoms. M. J. Arnaud cites the case of a female domestic, aged 27, who suffered from the gravest form of alcoholic paresis complicated with albuminuria, and yet made a complete recovery. The explanation of this unexpected recovery, advanced by the author, is that the lesions were peripheral, the axis-cylinder remaining intact or nearly so, while there was wanting that degeneration so frequently found in the more acute and aggravated forms. Dr. Lardier, of Rambervillers,[2] states that the children of alcoholic inebriates present from their birth a particular degeneration. Alcoholism does not cease with the individual, but continues in the progeny in various degrees, and forms, from a slight tendency to drinking to complete physical degeneration. In the Vosges he has

---

[1] *Gazette des hopitaux*, March 2, 1893.

[2] *Bulletin mèdical des Vosges*, January, 1893.

seen families beginning with wine and going on to brandy, the children from 2 years of age receiving it from their parents. The father, mother, and children dip their bread in brandy, and absorb in this fashion notable quantities of the poison. By imitation the young tread in the footsteps of their progenitors. The offspring of inebriates ought to be taken from them. In the case of such children, who are the subjects of the inebriate inheritance, there should be firm inculcation of the dangers of drinking, with hygienic training and development. Hydrotherapy is strongly recommended as a prophylactic.

By the withdrawal of the *privilege des bouilleurs de cru* the French government hope to restrict drunkenness. In Sweden, after a similar step, the distilleries decreased from 170,001 to 300, with a diminution in the consumption of liquor. Formerly drunkenness in France[1] existed principally in cities and large factory and commercial towns, the rural population being comparatively temperate. Now there is an alarming increase of intemperance in country towns and villages. From the Atlas by M. Tarquau, drawn up under the direction of M. Claude, reporter on the Commission of Enquiry of Consumption of Alcohol in France,[2] the average consumption of alcohol in 1850 was 1 litre 60 centilitres for each person, which increased in 1870 to 2 litres 81 centilitres, and in 1885 to 3 litres 85 centilitres. The varieties as well as the quantities of strong liquors have increased. Less alcohol has been distilled from fruits, more from beet-root, molasses, and seeds, these latter being dangerously toxic. The Commission procured samples of alcoholic drinks from the most luxurious and most squalid wine-shops and restaurants in Paris. All the samples analyzed were labeled "bad," "dangerous," and were reported to have been imperfectly rectified.[3] The liquors supplied in dining-rooms frequented by workmen were declared to be three-sixths impure, and containing aurylic acid. In haunts of ill-fame, among the noxious adulterants was methylene, though these beverages were not more so chemically than certain brandies sold at 7½d and 10d the glass in several first-class restaurants. Legislative measures have been urged to check the falsification of fermented drinks.

T. D. Crothers, of Hartford,[4] computes that there are 1,600,000

[1] *British Medical Journal*, February 4, 1893.

[2] La normandie médicale, Rouen, March 15, 1893.

[3] *British Medical Journal*, February 25, 193.

[4] *Journal of the American Medical Association*, October 8, 1892.

excessive drinkers in the United States, in addition to the victims to morphine, chloral, and other narcotic drugs,—all centres of degeneration and the most unsanitary physiological and psychical conditions. There are over a million unrecognized inebriates who are the most defective, dangerous, and degenerate classes. The superstition of personal freedom permits this army of inebriates to go on increasing the burden of their families and building up centres of physical and mental degeneration. Public sentiment should not permit one to become an inebriate, or tolerate him after that stage, unless under legal guardianship and restriction until he recovers.

M. Féré[1] describes as mechanical drunkenness a state, corresponding in its symptoms to alcoholic drunkenness, developed in certain subjects under the influence of forced movements and muscular exertions. He observed this in a person who had since died from general paralysis, and that prior to any other psychical or motor phenomena. The individual was taken for the first time with this apparent drunkenness in an accession of excitement after hunting. Afterward, consequent on every fresh day with the hounds, the drunken symptoms reappeared. Are these motory intoxications important in the early diagnosis of general paralysis?

Morphinomania and Cocainomania.—J. L. Maxwell, of London,[2] recalls the conclusions of Dr. Valentine, after thirty-one years of practice in India, that to opium is due a large per centage of mortality among children, crime, murder, and disease. More than three-fourths of between 800 and 900 prisoners in Jeypore Central Prison, fully twenty-five years ago, used opium, quite one-half of them to excess. Maxwell says 100,000 persons commit suicide by opium every year in China. McReddie, of Hardoi,[3] states that, in that limited district, of the 180 suicides in three years, 97 were from opium, 80 per cent. of these being women. Opium inquests are common in Calcutta now;[4] there is one almost every day. W. B. Brooks, of Dallas, Tex.,[5] argues that the morphine habit is sometimes the only cause of some severe forms of hysteria, neuralgia, chorea, asthma and other nerve disorders; that morphinists, however confident of

[1] *Le Bulletin-médical*, October 8, 1892.

[2] *London Lancet*, January 28, 1893.

[3] *Indian Medical Gazette*, June, 1891.

[4] *London Lancet*, January 28, 1893.

[5] *Texas Courier-Record*, September, 1892.

cure, are liable to relapse; that physicians are more prone to relapse than other morphinomaniacs, from generally having morphine in their possession and administering it, as well as from the despondency and excitement of their irregular life; that cured morphinomaniacs are less apt to relapse the second than the first time. One physician patient, who became addicted to morphine through having recourse to opiates for the relief of cough, returning home too soon (on the eighth day), relapsed, but made, on a second trial, a permanent cure, after then remaining twenty-seven days. J. H. de Wolff, of Baltimore,[1] gives 20 grains of sulphonal for sleep, with auri et sodii chlor. Stephen Lett, of Guelph,[2] narrates a case of double addiction (morphine and cocaine) whose daily ration was 60 grains morphin. sulph. and 70 grains cocain. hydrochlor. hypodermatically; and one of laudanum, 16 fluid ounces being taken daily. Amenorrhœa and sterility are generally present, these functions resuming vigor on discontinuance of the opiate. J. B. Mattison[3] relates the case of a physician's wife, aged 34, who, after 40 grains hypodermatically and one or two 5-grain doses daily by the mouth, advanced to 60 to 75 grains daily of morphine by the mouth only, and at one dose. Afterward she resumed the hypodermatic injection of 40 to 50 grains a day. Three women, dismissed cured, each took 30 grains daily for years Two were sisters; one had indulged for ten, the other for seventeen years. Administered by the skin, the narcotic action is double of that by mouth. He has generally found female morphinomaniacs neat and tidy. One laudanum-taker of twenty-two years' standing had reached nearly a pint a day. J. B. Mattison, of Brooklyn,[4] attributes nearly all his cases of narcotic inebriety to the medical prescription of the drug, in the first instance; though he recognizes the peculiar narcotic status, ancestral and acquired. It should be made felony for retail druggists to sell morphine, chloral, or cocaine, or to repeat a prescription containing either drug, except on order of a physician.

Tobacco.—Francis Dowling, of Cincinnati,[5] dwells on the influence of tobacco in causing amaurosis. He found in 3,000 tobacco workers in Cincinnati, 150 with impaired vision. A woman of 40

[1] *Medical Brief*, March, 1893.

[2] *Times and Register*, October 18, 1893.

[3] *Ibid*, October 22, 1892.

[4] *Weekly Med. Review*, St. Louis, February 11, 1893.

[5] *Medical and Surgical Reporter*, October 22, 1892.

had amblyopia. She had not used tobacco, but had been working in it from five to six years. Few of the men drank. The men were mostly flabby and anæmic. The majority of the 150 had both pupils contracted; 45 showed amblyopia, 30 being well-marked; 30 had gradual failure of vision. Some smoked 20 cigars a day. Three-fourths were over 35, the oldest being 61. Those affected had disturbed sleep, their muscles were easily tired, and their hands trembled on holding a book or pen. One young man of 19 was affected. Noyes has recorded the case of a boy of 15 who exhibited similar symptoms from cigarette-smoking. With chewing the effects were more intense. On ophthalmoscopic examination the papillæ of the optic nerve were seen to be abnormally reddened at first, later anæmic, ending finally in atrophy of the disc.

Running Amuck.[1]

A Malay who runs amok is always in a state of furious homicidal passion, and runs armed through the most crowded street or village stabbing right and left at man, woman, or child, relation, friend, or stranger. So common was this habit or mania that sixty years ago long poles with prong-like ends were kept in all villages, with which the amoker should be pinned to the ground when the dread cry, "Amok" was raised. When caught the amoker was either ruthlesely slaughtered, like a mad dog, or judicially executed, or, if wealthy and not sold into slavery, he was sometimes ransomed and set at liberty.

The author shows that an idea, in some quarters prevalent, that the amok is an institution of the Mohamedan religion, is false. It is confined to the Malay and must be regarded as a race perversion.

The diseased condition is essentially a depressed state of vitality, giving rise to a species of emotional exaltation comparable to that which in other races gives rise to suicide. The religious beliefs and traditions of the Malay oppose suicide and his passion leads him to seek death at the hands of others. After the amok the person is confused and describes the period as a blank preceded by deep depression. Very often everything turns black or red and memory ceases. The author believes the amok to be a genuine impulsive insanity—a "fulminating neurosis," with its predisposing cause in racial idiosyncrasies. Malays are disposed to a form of melancholia called "sakit

---

[1] ELLIS, W. G. The Amok of the Malays. *The Journ. of Mental Science*, XXXIX, 166, July, 1893.

hati," which is often a premonitory symptom of the amok. The analogies are with various forms of masked epilepsy though, as a race, the Malays are not subjects of epilepsy, neither are they prone to alcoholism.

Insanity in Greece.

Dr. F. B. Sanborn, late Inspector of Health, Lunacy and Charity of the Massachusetts Board of Health, contributes to the Journal of Mental Science a suggestive article on the comparative frequency of mental diseases in Greece and America. He shows that while the population of Greece is about that of Massachusetts, the estimated number of insane in the former is 2,000, while in the latter there are over 7,500. The proportion of those under treatment in the two countries is as 1 to 15.

As one reason for this difference Dr. Sanborn assigns the much less alcoholic insanity in Greece. Something must doubtless be attributed also the less density of population and the genius of the race.

While the Greeks are prone to shocking crimes there is less of vice than in northern Europe or the United States. Vice is a frequent cause of insanity. General paralysis is terribly prevalent in America and is much less common in Greece. "General paralysis almost always proceeds from vice and most generally from debauch."

Colors Dependent on Food.

E. B. Poulton, in Proceedings of the Royal Academy for June 8, 1893, offers facts to substantiate his theory that colors of certain Lepidopterous larvæ are made up of modified chlorophyll derived from the food plant. Larvæ from one batch of eggs of *Tryphæna pronuba* were divided into three lots fed (in darkness) throughout their whole life upon (1) green leaves, (2) yellow etiolated leaves and (3) white mid-ribs of cabbage. The larvæ of (1) and (2) acquired their normal green or brown colors as in nature, while those feed on white plant tissue, containing neither chlorophyll or etiolin were unable to produce the green or brown ground color, though the production of dark superficial pigment was unchecked.

The Spanish Inquisition as an Alienist.

Mr. H. C. Lea presents several characteristic pictures of religious monomania during the Fifteenth Century, and the action taken in the matter by the church, (Popular Science Monthly, XLIII, 3.) It is a question whether future generations will find our treatment of alienism much more reasonable than the lurid procedure which blackens the records of the Roman Church.

The Origin and Distribution of the Nerves of the Lower Limb.

Under the above title, Dr. A. M. Paterson begins an exhaustive study of the sacral plexus and the peripheral distribution, in the Journal of Anatomy and Physiology, XXVIII [N. S. VII] 1, Oct. 1893. Although notice of the paper is deferred until it is completed, we observe that the author found much assistance in dissecting the nerves from the use of 5-10 per cent. of nitric acid solutions, which dissolve the connective tissue and harden the nerves. He regards it as doubtful whether any spot of the skin or muscle in the limb is supplied by but a single nerve.

Glass Models of Brains.

Professor His exhibited[1] at the meeting of the Anatomical Society at Göttingen, May, 1893, a model of the brain of a human embryo, made up of about 50 separable glass plates. The sections were photographed and drawn upon rectangular glass plates of equal size, with an amplification corresponding to the thickness of the plates (1.2 mm). If all of the plates are put together it produces a solid model of the object, which renders all the inner details visible at once. To investigate separate parts, the corresponding part of the system of plates can be detached; thus, for instance, the passage of the Nervus Intermedius from the Ganglion Geniculi to the Medulla and its annexation to the tractus solitarius can be very plainly demonstrated.

Methods of Brain Preservation.[2]

This useful paper contains a full compendium of methods for preparing dried or wet preparation and impregnation models. All of the methods result in considerable shrinkage but have their place in the technology of neurology.

Any one who has seen Dr. Blackburn's preparations must admit that with the exception of shrinkage they leave little to be desired. Our own experience proves that great pains must be taken to dehydrate carefully in absolute alcohol before using the Japan wax as a "filler" and a rather long time in the wax at a temperature of 50° C.

---

[1] *Anat. Anz.* Ergänzungsheft. VIII, 1893.

[2] Fish, P. A Brain Preservation, with a resume of some old and new methods. The Wilder Quarter-Century Book.

is required. We have also seen good preparations by the paraffin method made by Dr. Burckhardt of Berlin but one would always fear lest when exposed to unusual heat they would deform.

Mr. Fish himself recommends a mixture of water 400 cc.,

95 percent alcohol	400 cc.,
glycerin	250 cc.,
zinc chlorid	20 grams, and
sodium chlorid	20 grams.

Afterwards the brain is dehydrated in alcohol and is passed into turpentin, 3 parts, with castor oil, 1 part, for one or two weeks. After drying on absorbent cotton it is varnished with bleached shellac.

Another process substitutes for the last mentioned a mixture of glycerin 100 cc., castor oil, 100 cc., gum arabic or tragacanth, 50 grams. The specimen may be shellaced. Attention may be called to a series of papers by Professor J. Frenzel of Berlin who has made some very permanent and useful pliable preparations of entire bodies of fish and reptiles.[1]

Myxœdema and Cretinism Treated by Thyroid Grafts and Extracts.[2]

The extended article mentioned gives a comprehensive view of the efforts to apply the thyroid gland and its extracts to the treatment of the obscure diseases of that gland. In February of 1890 Professor Horsley suggested the possibility of grafting upon the human body the thyroid of a sheep with the view of arresting the progress of the disease. M. Lannelongue of Paris is thought to have been the first to carry out the operation in 1890.

The effects were prompt—too prompt perhaps to be attributed to the slow changes of nutrition incident to a new generation of the secretion and suggest that the improvement is due to the absorbtion by the system of the secretion at the time in the gland. Dr. George Murray, accordingly, prepared a fluid extract of the fresh thyroid of the sheep with glycerine and injected subcutaneously. The result has in almost every case proven satisfactory. Passing from the complex to

[1]Verfahren zur Einbalsamirung von Fischen ünd ähnlichen Objecten. *Naturw. Wochenschrift.* VII, 12, 14, et. seq. 1892. Verfahren zur Herstellung von zoolog. und anatomischen Preparaten mittelst der Glycerindurchtränkung. *Zool. Jahrbücher* I, 1, 1886.

[2]BEADLES, C. F. The Treatment of Myxœdema and Cretinism, being a Review of the Treatment of these Diseases with the thyroid gland, with a table of 100 published cases. *The Journal of Mental Science*, XXXIX, 166, [N. S., 130-131.]

the simple, the next step was reached when Dr. Mackenzie adopted the plan of feeding patients suffering with myxœdema with the thyriod itself. In order to be made more easy of administration Dr. Arthur Davies employed a powdered extract of the active principle with glycerin which was dried by heat and administered by way of the mouth.

Thus far the cures have not been permanent, though a relatively small dose may be necessary to continue the improvement. The disease is more common in females but both sexes are benefited, nor is there an age limitation. Chronic cases seem quite as amenable as others.

The treatment is invariably followed by marked improvement in bodily condition, the general puffy swelling subsides, the coarse dry skin becomes smooth and moist, the thick, blunted features become natural, hair begins to grow on scalp and eyebrows, the special senses improve. Body and mind become more active, the temperature rises. The majority of cases of myxœdema are accompanied by grave mental disturbance, often acute melancholia. It seems certain that the treatment serves to improve mental as well as bodily conditions and if employed early enough should forestall the insanity of myxœdema. Even in the congenital cases (Cretinism) much improvement has been noted. The numerous cases enumerated and the table referred to make the article a very useful one.

An Instrument for Reaction-Time Determination.[1]

On a square standard of pine supported by a tripod with leveling screws is screwed a rectangular piece of hard wood 3 feet above the floor at a convenient height to permit the registration of falling rods, which serve to indicate the time. The hand of the subject rests on a table while powerful electro-magnets in the circuit opened by the finger serves to clamp in position the falling rods. At the summit of the vertical standard is a device for releasing the rods, which in the improved instrument are four in number and made of box-wood graduated into hundreds of a second. The complete fall of a rod occupies 3-10 of a second. After falling a short distance a brass plate which rides astride the top of the rod encounters a diaphragm so producing a sound signal, an electric bell being rung by a current broken at the same time. A visual signal is given by a slit and diaphragm

[1] Lewis, Bevan. An Improved Reaction-time instrument. *Journ. Mental Science.* Oct., 1893. XXXIX, 167. [N. S. N*o.* 131.]

device by which a beam of light is obscured at a proper moment in the fall of the rod. The observer sits with his finger on the key which opens the current, clamping the rod as it falls, and presses the key when the signal selected is made by the falling rod. It is only necessary to read off the time upon the rod, for the figure at the clamp gives it directly.

In the improved instrument the release of the rods is silently accomplished by electro-magnets. The rods fall on sand bags and each rod in its fall strikes a key, releasing the next, and thus continues the record for a length of time, greater than could be conveniently be recorded by the fall of a single rod. The mechanism depends upon the familiar laws of falling bodies. It is not stated what degree of accuracy may be expected.

Arrangement of the Sympathic Nervous System.[1]

Using the cat as a subject, the author traces the pilo-motor nerves. The spinal nerves containing pilo-motor nerve fibres in their roots are usually the fourth thoracic to the third lumbar inclusive. The spinal pilo-motor fibres run into the sympathic trunk, there they become connected with nerve cells; on leaving the sympathic chain they run to their peripheral endings. In the body they accompany those dorsal cutaneous branches of the spinal nerves which supply the skin near the vertebræ. In general, the fibres issuing from any ganglion are connected with nerve cells in that ganglion and with no other sympathic nerve cell. Each ganglion supplies in any individual a definite area of skin. The areas supplied by the ganglia from above downward are successive with some overlapping.

The details must be sought in the paper, which is illustrated. The author thinks it probable that the fibres of the gray ramus of a nerve (viz. the postganglionic sympathic fibres of a spinal nerve) have in the main the same distribution as the sensory fibres of the nerve. He finds less overlapping than Sherrington did in the sensory fibres.

Record of Brain Examinations.

Dr. Goodall of West Riding Asylum has composed a table for guidance in the superficial examination of the brain which seems well-adapted for use in autopsies where brain lesion is expected. See *Journ. Mental Science*, CLXIV, N. S. 130, p. 437.

---

[1]LANGLEY, J. N. Preliminary account of the arrangement of the sympathic nervous system, based chiefly on observations upon pilo-motor nerves. *Proc. Roy. Soc.* LII, 320.

Subdural Membranes and Intercranial Pressure.[1]

Cerebral atrophy is of common occurrence with membrane formation, and the loss of support thus caused is given by many as the occasion of the engorgement and rupture of the vessels. The compensating hypertrophy of the skull in chronic insanity is another result. In cases of cerebral atrophy the cerebrospinal fluid tends to increase in a compensating manner.

On account of being contained in rigid walls the brain needs special arrangements to permit of shrinkage and expansion. The brain is essentially erectile tissue and the adjustment is affected by the cerebro-spinal fluid which exists normally in the meshes of the pia-arachnoid and the ventricles and does not exceed four ounces in the healthy adult. The source of the fluid is the plexuses. From the fourth ventricle "it passes by the foramen of Magendie to the inferior cerebellar lake, and round the cerebellum and crura cerebri to the superior cerebellar lake. This communicates along the peripeduncular and basilar canals with the great central lake at the base of the brain. From the sides of the central lakes there arise the two Sylvian lakes, which are extended into the Sylvian and Rolandic rivers. From these rivers tributaries extend along the minor sulci and by these means, though somewhat circuitous, cerebro-spinal fluid is carried to every part of the surface of the brain." The fluid is absorbed by the Pacchionian glands and is secreted into the veins and sinuses. The rate of absorbtion is more rapid than that of secretion and seems to depend on the pressure of the fluid.

The blood and not this fluid plays the active part in regulating intercranial pressure.

It is found that the size of a blood vessel varies greatly within a brief time in paralytics. Now with atrophied brain and increased fluid it would appear reasonable that a sudden engorgement followed by constriction of the vessels might produce a demand for increase of cerebro-spinal fluid greater than could be met and the vessels of the dura would become gorged and ruptured. The seat of "false-membranes" is limited to the parietal bone; this the author explains as due to the habitual position which leads the brain to tend to fall away from the vault by gravitation, enhancing the tendency to tear in this region.

---

[1] Robertson, G. M. The Formation of Subdural Membranes or Pachymeningitis hemorrhagica. *Journ. Mental Science*, XXXIX. N. S. 130, July. 1893.

The middle meningial artery is most liable to disease and its superficial distribution is in this same area.

Pachymeningitis hemorrhagica, then, is due, according to the author, to passive engorgement of a compensatory nature, caused by a process analogous to dry-cupping. This is brought about by a shrinkage of the brain, which, owing to its suddenness, and to a deficiency of cerebro-spinal fluid, has not been compensated for.

The Knee Jerk.[1]

The knee-jerk is largely produced by reflex contractions of the vastus internus and crureus muscles. The centre was located in the 4th and 5th lumbar segments of the cord in the Rhesus monkey (3d and 4th of man). The efferent path is in the anterior roots of the 4th and 5th lumbar nerves and was traced along the anterior crural nerve to the muscles mentioned. The afferent path was found in the posterior root of the 5th lumbar of Rhesus (4th of man, 6th of cat). The afferent fibres arise within those muscles to which the efferent fibres concerned with the "jerk" belong.

It was found easy to abolish the conductivity of the afferent root by cold, cocain, carbon dioxid, etc. for the "jerk" while reflex stimuli from the skin were still transmitted. Perhaps the fibres for the former are more delicate.

The knee jerk is exaggerated by section of afferent branches below those producing the jerk, which is explained as due, not simply to the resulting relaxation of the muscles but to the interrupting of a stream of afferent stimuli that passes from the ham-string muscles which would exert an inhibitory influence. Excitation of the afferent fibres coming from one set of antagonistic muscles induces reflex tonic contraction of the opposite set very readily.

Some Suggestions Concerning Methods of Psychological Study.

An interesting paper under the above caption appears in the Transactions of the Wisconsin Academy IX, 1, from the pen of Professor J. J. Blaisdell. The suggestions are good and new, and whether one shall say, as in another case, "what is good is not new, and what is new is not good," or otherwise will depend very largely upon one's prepossessions or prejudices or, as we say more euphemistically, one's point of view.

---

[1]SHERRINGTON, C. S. Note on the Knee-Jerk and the correlation of Antagonistic Muscles. *Proceed. Roy. Soc.* LII. 32 a.

The first suggestion is that psychology should be a science and a science of observation. But he insists that physiological psychology is but physiology masking behind a high-sounding name. He well says, "Certainly any possible science of physiological psychology is conditioned upon the authenticity of consciousness, for its 'cortical irritations' are only disjecta membra, to whose disclosure consciousness holds the key of witness."

"There is no apparent justice in arrogating to physiological psychology exclusively the designation empirical psychology, as has been strangely done of late. It seems like the forwardness of unripe intellegence, the crudity of a late arrival in the realm of metropolitan science."

What physiological psychology may claim to be is the elementary instructor whose work is essential to a proper approach to the study of mind as such. If empirical psychology is to sit in judgment upon the sanity of this mind of ours it at least ought to learn to understand the elements of the language the mind speaks. In the teaching of psychology the author depreciates the restriction of the term laboratory practice to practice in a laboratory, but wishes to enlarge it to include experiments where consciousness only is employed. But the present writer fails to see that the fact that Garfield and a certain college president on a log constitutes a college compels us to convert a Plato plus Socrates into a laboratory, unless, indeed, an older method well loaded with honor is jealous of the untested laurels green on the brow of experimental science.

Again Professor Blaisdell objects to the conventional order of presentations—intellect, sensibilities, will. He says: "The preliminary question ought to be fairly discussed, which one of the two conceptions ought to rule the teaching of science.

Mr. Hebert Spencer would, no doubt, answer that the various sciences ought to be taught entirely in the interests of one comprehensive natural procedure of the universal. . . . There is but one science in this view, that of evolution. Some others of us believe in the reality of final causes, and that man's being is determined by referance to that moral final cause. . . . We think him disengaged from the tyrannic current of natural processes, and that he has in himself, and not in nature, the law by which he is to be studied and held responsible."

With more of this sort the author ignorantly or disingenuously seeks to array in hostile ranks the laws of nature as expressed in evolution and the laws of God as expressed in human freedom. One is oppressed by a feeling of hopelessness that such a view can still be seriously presented as the only alternative to the reign of chance, How one can fail to see in the course of evolutionr evealed by science, with its wonderful coincidences touching human nature at every point, any less of final cause than that which we are forced to postulate in the destiny of man is a problem too great for the writer. From such a standpoint one must deny the validity of natural law or the evidence of his own consciousness—how much better to combine them with the same divinity immanent in both. The question as to order of treatment may then be left to convenience. Will the author regards as the main constituent of personality and to it, therefore, the first place should be given. After a discussion of the proper order of presentation, the paper closes with a plea for a psychology of social personality—"the empirical psychology of the social mind."

Peripheral Neuritis Following Alcoholism.

Arthur Maude in the British Medical Journal, Feb. 18, 1893, describes a case of peripheral neuritis resulting from alcoholism in which a prominent symptom was the exaggeration of the patellar reflexes. After a period of abstinence these symptoms disappeared.

Spinal Muscular Atrophy.

Thompson and Bruce (Edinb. Hospit. Reports, 1893) report the case of a child in which at the age of two years a weakness of the legs became apparent and continued until all the muscles of the body became involved in the weakness and atrophy. After death at six years autopsy revealed simple idiopathic dystrophy. The nerve-centres contained degenerated fibres and the cells of the ventral cornua of the cord particularly in the lumbar region exhibited signs of simple, non inflammatory atrophy.

Cerebrine.

The curious dispute respecting the virtue of the cerebral extracts continues. Dr. G. Hammond reports cases where subcutaneous injection has produced marked improvement in tabes. The patient in one case regained control over bowels, bladder and sexual organs, and was able to run up and down stairs. The knee jerk, however, had not returned.

J. Collins has used Gibier's preparation in locomotor ataxia with similar results.

The Functions of the Pituitary Body.

Vassale and Sacchi[1] have published the results of experimental extirpation of hypophysis. They were able to destroy that body without grave operative complications. The complete destruction of the organ is fatal in dog or cat, but partial injury may exist for a long time though it is impossible to say whether regeneration follows. Though the symptoms of injury to the pituitary are similar to those arising from extirpation of the thyroid the authors do not admit that the interrelations are such that one may substitute for the other. These functions show that the hypophysis belongs to the class of glands destruction of which occasions the accumulation of toxic substances.

American Lampreys.

Neurologists will be grateful for the descriptive information on the habits and specific characters given by Professor S. H. Gage in the Wilder Quarter Century Book, published in September, 1893. The paper is fully illustrated and is provided with map and bibliography.

The Brain of the Spotted Newt.[2]

The author is already well known as a skillful scientific artist and by reason of several anatomical papers. The present contribution is a bulky monograph fully illustrated and dealing with the topographical rather than histological relations. The incitation to the study seems to have been the suggestion that striking structural changes might accompany the remarkable change in habit which has already formed the subject of an interesting paper by Professor S. H. Gage.[3]

The descriptions of the regional anatomy is painstaking and shows familiarity with the literature. While admitting that in the finer structure of the nerve cells, in the path of nerve tracts, and their exact processes of growth, determined by finer methods, a more complete correlation of brain structure with the crises of the life history may be found, there are no marked changes in morphology revealed by methods employed corresponding to these crises. There is, however,

---

[1] *Rev. Sperimentale,* XVIII, 3, 4, Dec., 1892.

[2] GAGE, SUSANNA PHELPS. The Brain of Diemyctyus viridescens from Larval to adult Life and comparisons with the Brain Amia and Petromyzon. Wilder Quarter Century Book. Sept., 1893.

[3] Life History of the Vermillion-spotted Newt. *Amer. Naturalist,* XXV, 1891.

a marked general growth at about the time of final transformation so that the brain much more nearly fills the skull than in the late red forms.

The morphological suggestions about which questions would naturally be raised are those associated with the callosal commissure and the hippocampal structures. While apparently recognizing a hippocampal lobe by implication the whole mass of the commissure is called callosum and no fornix or hippocampal commissure is recognized. We have already suggested a question as to this homology and think it most probable that the highly osmatic brain would have a structure comparable to the hippocampal or fornix commissure of reptiles. A brief preliminary discussion of the structure has appeared in the September number of this journal, p. 124-128. From the illustrations accompanying this article reasons may be gathered for comparing at least a greater part of the so-called callosum with the fornix commissure. If analogies with other groups can be employed, it is hard to see how one can neglect the obvious necessity for limiting the region of origin of the callosum to parts lying far cephalad in an osmatic brain.

The second part of the paper institutes comparison with Amia and the lamprey. Among the interesting observations may be mentioned the existence in Diemyctylus of a metapore—an opening through the metaplexus into the subarachnoid space. Morphologically considered, the improbability is so great that repeated investigation is well worth making. The section on the cerebral commissures is interesting, especially in the discovery of two commissural bands for the fore brain in Amia. We, however, would regard the ventral one (*cm* Fig. 103) if actually a commissure, as a homologue of the pre-commissure and the so-called pre-commissure the representative of the dorsal system (callosum, etc.) Fig. 104 strongly re-enforces this conjecture, for in that figure *pcm* cannot be tortured into an homology with the precommissure of other vertebrates.

Lying in the "crista," Mrs. Gage finds suggestions of fibres such as the writer has figured on Plate XV, Fig. 5 *call*, in Menopoma and which might from their position prove a part of the fibres of the callosum or the homologue of the fibres, so-called in fishes. The summary given at the close is repeated here.

1. A true metapore exists in adult Diemyctylus and indications of it appear in the larvæ. In the lamprey and Amia at a corresponding part of the metaplexus a sac communicating with the metacœl protrudes over the myel.

2. The callosum and callosal eminence [intra-ventricular lobe] are only beginning to develop in early larvæ of Diemyctylus, and the position of the cerebral commissures differs in early stages more from the anurous type than does the adult, the aula being much larger proportionally. The type in urodeles and fishes may be one of an arrested embryonic development. [Cf. *Journ. Comp. Neurol.*, p. 136, Sec. 4.] In the Diemyctylus there is evidence, in the adult, of a caudal growth of the terma which if continued would bring the commissures in the same relation to the terma as in the frog and higher forms.

3. The crista in Diemyctylus and Amia is shown to be a definite structure beyond which the cerebrum develops cephalad and from over which the auliplexus is reflected, and thus is a landmark in discussing the relations of the aula and cerebral commissures. [These considerations might seem to suggest that the callosum might be cephalad to the reflected plexus as in Opossum.]

4. The paraphysis of Diemyctylus is traced through different stages of development and homologies discussed in Amia and the lamprey, and a possible use in the nourishment of the brain is suggested.

5. Sulcus is proposed as a general term for the furrows on the endymal surface, which have a morphological significance and lophius for the ridges between sulci. [If anatomists would agree to thus apply a term which is certainly as much used as "fissure" for cortical grooves, it might be well, but meanwhile the ambiguity which is charged to the descriptive terminology introduced by the writer is not removed. Moreover those fissures which are due to the deformation of the cerebrum as a whole (i. e. to flexures of its axis, etc.) may impress themselves upon the axial lobe and, if the view suggested by the writer that the axial lobe of fishes is but the undeveloped "proton" of the whole cerebrum and not, as often represented, homologous with the hemispheres minus the cortex, there might still be a sort of reasonableness in a terminology which should suggest the homology, however distant. These remarks apply particularly to the sylvian and rhinalic depressions of the fish.]

6. In the discussion of the geminums it is shown that homologies are not dependent upon the membranous or solid condition of the roof nor the angle at which parts unite.

7. The morphological relations of the pallium are considered in Amia and its homolog in amphibia and the lamprey suggested.

8. The cerebrum of Amia and other fishes is not to be consid-

ered from its recurved position as different from other types. The sulci upon its endymal surface are compared with those of Diemyctylus. The pallium is considered as a plexus much stretched, not as an undeveloped part representing the dorsal and mesal walls of other brains.

[This is in effect a restatement of a theory frequently stated and implied by the writer in several papers during the past four or five years. In a paper in the *Festschrift zum siebenzigsten Geburtstage Rudolf Leuckart's*, p. 279, occurs the following passage: "In those portions of the primary nerve tube which are to form plexiform structures the spongioblasts retain their primitive structure. In cases where the development is delayed the original simplicity is retained long after other regions have acquired a complicated neurologia. Thus in very young *Amblystoma* (Plate XXVII, Fig. 1) the temporary pallium which ultimately becomes the median walls of the prosencephalon remains single-layered and exhibits only an occasional neuroblast."

In other places it has been clearly stated that the axial lobe of teleosts and ganoids is supposed to contain the elements which otherwise would enter the cortex; thus the pallium would correspond in position and nature to the thin median walls of the ventricle. The author of the paper before us takes a step farther in seeking to definitely homologize the pallium with a specially modified part of this wall—the plexus. This is probably a form of statement unsusceptible to proof or disproof, because of the lack of means to determine whether a tela-form membrane might not be directly converted into plexus.]

9. Arguments and facts are given for considering the rhinencephal as equal to other segments having a tripartite arrangement. [From a strictly morphological point of view it would seem necessary to settle the preliminary question as to the front of the brain tube before one could venture to ascribe regional independence to the olfactory lobe. The term rhinencephalon is now so generally used for the whole limbic region as to seriously compromise its availabilty.]

We venture to express regret at the increasing custom of spelling generic names without capitals, which seems an offense only second to the capitalizing of specific names. In the present paper Diemyctylus is uniformly spelled without capitals, while other genera referred to are capitalized (viz. Cryptobranchus, p. 264).

The paper is a welcome addition to the anatomy of the brain and affords evidence of the hold morphology is taking in America. The compliment to Professor Wilder implied in the volume dedicated to him is augmented by the character of the work by his students and collaborators.

Edinger's Lectures upon the Structure of the Central Nervous System.[1]

No better testimony to the value of the book before us is needed than the repeated necessity for new editions. It is but a year since the appearance of the third edition in Germany and not a much longer time since the second edition was made available to the American public through the excellent translation of Vittum and Riggs. The present edition is considerably extended and has been in some parts rewritten. To those who are acquainted only with the second or the English edition the volumn is now practically new.

There have been many good works on the anatomy of the brain but among them this little book of Edinger's stands preeminent in virtue of two excellencies, clearness and a comparative method. We can be no longer blind to the fact that the way to study the human brain successfully is to spend the first moiety of time at disposal upon that of lower animals and a good share of the remaining time upon the embryonic stages. Dr. Edinger enjoys the great advantage of basing his descriptions very largely upon personal investigation of a wide range of subjects.

We notice that considerable use has been made of the results of the methyl blue and Golgi methods and the rather meager statements upon the histogenesis of the nervous system have been considerably augmented by reference to the recent work of Retzius, VanGehuchten and Cajal. Colored plates of excellent workmanship enrich this section. The embryological portion is still insufficient to give a clear idea of the instructive correspondences between ontogeny and phylogeny.

The interpolation of new matter has, we think, disturbed the unity of presentation in several cases. One would think that it would now be safe to admit a reference to the parietal nerve in connection with the parietal vesicle. The writer is not yet prepared to admit the association of the habenulæ with the olfactory function, in spite of the admitted close connection of the tænia with the lateral radix.

The account of the regional anatomy of the mammalian cerebrum

[1] EDINGER, L. Vorlesungen über den Bau der Nervösen Centralorgane. Für Aerzte und Studirende. (Fourth Revised Edition) Leipzig, F. C. W. Vogel, Price 7 marks.

is as before clear and usually satisfactory. The statement on page 58 that all marsupials so far studied lack a callosum ignores the description of it by Osborn and the writer. [See elsewhere in this number.] The treatment of the olfactory apparatus and limbic lobe is a decided advance over any anatomical discussion so far.

The new portions on the thalamus are especially valuable and are elucidated by the new figures 66, 67, 69, 70 very satisfactorily. The author has seen no reason to admit a recently advocated idea that the cerebellar functions are chiefly sensory.

The discussion of the medulla has been completely remodeled and the result of the phenominal activity in the study of this region are largely included.

The last chapter is devoted to a very brief discription of the technical methods of studying the nervous system.

While the exigencies of publication do not permit as careful a review as the work deserves we can give it the warmest praise and consider that it will prove a necessity to every neurologist whether he has access to the earlier editions or not.

Kolliker's Histology, Sixth Edition.[1]

The part of this well known work relating to the nervous system has been awaited with a degree of impatience, for it has been evident from numerous occasional papers that the distinguished author has been giving himself to the cultivation of this special field by the recent technological methods with marked diligence and his usual success. The papers in the Zeitschrift f. wiss. Zoologie during the last few years have been among the most beautiful illustrations of the possibilities of the Golgi method. The present instalment of 372 pages includes but half of the nervous system, including a discussion of the medullated and non-medullated fibres, nerve cells in general, the spinal cord, medulla and cerebellum.

The work begins by presenting the neuron theory, thus revealing on its first page the tendency of the whole. Professor Kölliker, however, discards the word neuron from linguistic reasons and substitutes "neuro-dendridien" (neuro-dendrits), which is open to a still greater objection that not all neurons are provided permanently with dendritic processes.

The sympathetic system is not seperated from the "animal"

[1] KOELLIKER. A. Handbuch der Gewebelehre des Menschen. Wilh. Engelmann, Leipsig, 1893.

nervous system, but forms a peculiarly modified portion of the peripheral system.

The section on the structure of the nerve fibre is quite full and the author retains the old position, that the Schwann's sheath with its corpuscles is derived from connective tissue and has no direct relation with the formation of the nerve. To the writer, it seems that the evidence from experimental and pathological, as well as histological sources, is overwhelmingly opposed to this view, which rests on unsupported assumption. The above position is the more remarkable in view of the description of the olfactory which follows. The latter, however, simply retains a structure much like that of the earlier stages of all nerves. The section on the spinal cord is practically exhaustive. Following the general description of the spinal cord is a comparative section from which the following data are collected:

In Amphioxus the cord consists of a folded plate with the edges approximated in such a manner that the ventricle is a mere slit which is clothed with a layer of gray matter composed of epyndyma cells with a few nerve cells. The cell walls of the epyndyma pass from ventricle to surface in the form of thin tubes and frequently collect in clustres. Aside from these fibres the stroma of the cord is composed of nerve fibres only, there being no neuroglia. In this as well as other respects the cord of Amphioxus resembles the nerve-axis of worms. The nerve fibres are all non-medullated. Those of the dorsal region are smaller than those of the ventral region and in various regions there appear colossal fibres whose origin can be traced to enormous nerve cells of the dorsal part of the tube. The smallest nerve cells lie with the epyndyma along the ventricle, the intermediate type of cells occurs in a row along either side the ventricle and are bipolar or multipolar. The colossal cells lie across the ventricle one third its height from the dorsal surface. The cephalic cell of this series lies immediately behind the sixth left sensory root and gives rise to an enormous fibre which lies ventrad of the canal and sends another fibre into the seventh sensory root. Then follow eleven others each of which sends a fibre caudad. From the last of these and the 39th sensory root there are none of the colossal cells, but from that point they reappear and the 14 caudal cells send fibres cephalad. In all cases the colossal fibres cross ventrally to the opposite side before assuming their definitive position. The small nerve cells, according to Retzius, send fibres into the sensory roots.

Of general interest is the suggestion afforded by the relations of the nerve cells that all the nerve cells arise form the epyndyma.

Kölliker remarks respecting the origin of the dorsal nerves from cells within the cord and the absence of ganglia on the roots that if these nerve cells are found to be the most dorsal in the cord there would be a correspondence with the ganglionic ridge of higher vertebrates which would make it still more probable that this ridge pertains to the neural tube rather than the adjacent ectoderm. No reference is made to the fact that while there are no ganglia yet the dorsal root contains ganglion cells to a point lying near the skin, as shown by Hatschek, a fact which suggests a very different interpretation of the spinal ganglia.

Professor Kölliker compares the caudal colossal fibres to commissural fibres and those of the cephalic cells with the pyramids, (p. 159.) In the later sections the discussion is limited more strictly to the human subject and we cannot select from the vast amount of carefully elaborated material special portions for notice at this time. The work will serve as the neurologist's vade mecum for years to come.

The Superstition of Necessity.[1]

The author uses the term in the way indicated by its etymology: as a standing-still on the part of thought; a clinging to old ideas after those ideas have lost their use. He endeavors to show that the doctrine of necessity is a survival which holds over from an earlier and undeveloped period of knowledge; that as a means of getting out of and beyond that stage it had a certain value, but having done its work, loses its significance. That judgment uses the idea of necessity as a crutch by means of which it steps up out of uncertainty upon solid ground of fact, and then discards it as unnecessary and only a hindrance to further progress. As he says: "We learn (but only at the end) that instead of discovering and then connecting together a number of separate realities, we have been engaged in the progressive definition of one fact." "The progress of judgment is equivalent to a change in the value of objects—that objects as they are for us, as known, change with the development of our judgments" "It is the necessary influence which one exerts upon the other that finally rubs away the separateness and leaves them revealed as elements of one unified whole. This done, the determining influence—necessity—has gone too."

"Contingent and necessary are thus the correlative aspects of one and the same fact."

---

[1]DEWY, JOHN. "*The Monist*," April, 1892, Vol. III, No. 3.

"Chance stands for the irrelevancy as the matter at first presents itself to consciousness; necessity is the required, but partial negation of this irrelevancy."

Our separation of one side from the other, for instance, of cause from effect, of means from end, gives rise to the superstition of necessity. We have committed the error of taking a part for the whole. The idea of necessity marks only a certain stage in the development of judgment. Its whole value consists in the impulse which it gives toward the 'is' in contradistinction from the 'must.'

The Lumbo-Sacral Plexus.[1]

The above paper is a very detailed and elaborate account of the root bundles and distribution of the nerves entering the plexus. Most of the anatomical facts brought out are in confirmation of similar work by Professor Sherrington. The plates are very clear.

In the experimental part, the peripheral stump of a cut root was first excited, then the integral fibres were separated as far as possible and each irritated by a minimal current. The tendons of the muscles then moved being cut, the experiment was repeated to determine whether others remained in connection with the nerve. As a control experiment, a nerve root was divided and general epilepsy was induced by intravenous injection of the essential oil of absinthe, and the resulting deficient participation in the fit of the limb in relation with the divided root or roots carefully observed.

The first two lumbar roots did not produce movement of the limb. The third produced slight flexion of the hip.

General excitation of the 4th lumbar produced flexion of the hip, adduction of the thigh and extension of the knee. The three parts isolated, each produced one of the above motions.

Stimulation of the whole 5th root caused extension of the whole limb with adduction and internal rotation of the thigh and dorsiflexion of the foot. The separated fascicles reacted as follows: (1) adduction of the limb, (2) extension at the knee, (3) dorsiflexion of the foot, (4) extension of the digits, (5) extension of the hallux.

The 6th lumbar caused extension of the hip, and adduction and outward rotation; flexion at the knee with the foot at right angles and everted at the ankle, the digits and hallux being flexed at the distal phalangeal joints. The several fascicles reacted as follows: (1) ex-

[1] RUSSELL, J. S. R. An Experimental Investigation of the Nerve Roots of the Lumbo-Sacral Plexus of Macacus rhesus. *Proc. Roy. Soc.*, LIV, 327.

tension at the hip, (2) flexion at the knee, (3) dorsi-flexion at the ankle, (5) eversion of the foot, (6) extension of the digits, (7) flexion of the digits, (8) flexion of the hallux, (9) extension of the hallux.

The 7th lumbar caused extension at the hip, flexion at the knee, with the plantar surface of foot looking inwards, flexion of the digits at their metacarpo-phalangeal joints, flexion of the hallux and its adduction into the sole of the foot beneath the flexed digits.

The several fascicles reacted as follows: (1) extension at hip, (2) flexion at knee, (3) extension at ankle, (4) flexion of digits, (5) flexion of hallux, (6) adduction of hallux. The 1st sacral produces interossal flexion of the digits with flexion and adduction of the hallux and three parts were isolated, each having one of the functions named.

The muscles were exposed during life and the nervous connection established directly, as follows: *2d lumbar*, psoas magnus; *3d lumbar*, psoas parvus, psoas magnus, sartorius; *4th lumbar*, psoas magnus, iliacus, sartorius, adductor longus, quadriceps extensor, gracilis; *5th lumbar*, iliacus, gluteus minimus, adductor magnus, adductor longus, quadriceps extensor, gracilis, tibialis anticus, tibialis posticus, extensor long. digitorum, flexor long. digit., peroneous longus, p. brevis, ext. long. hallucis, gluteus medius, pyriformis, obturator externus, o. internus, gemellus superior, g. inferior, quadratus femoris, propliteus, plantaris; *7th lumbar*, hamstrings, gastrocnemius, soleus, flexor long. digitorum, peroneus longus, p. brevis, flexor long. hallucis, adductor hallucis, interossei, and the last ten of the list under the 6th lumbar; *1 sacral*, intrinsic muscles of the foot.

The author concludes that a single bundle of nerve fibres, representing a single simple movement may remain distinct during its course to the muscle it supplies, without inosculation with other motor nerve fibres, and that where more than one nerve supplies a given muscle, any given muscle fibre is suppled from but one nerve.

The advantage of the anastomoses of the nerve fibres is shown by the observation that the section of no single nerve root was sufficient to produce a visible alteration in the climbing or running movement.

The paper closes with a comparison with the results of the experiments of Sherrington, and Ferrier and Yeo.

A New Hypothesis Concerning Vision.

In the Proc. Roy. Soc., Vol. LIV, No. 827, Dr. Haycraft offers a new theory of color vision based on evolutionary data. He regards the fact that colored surfaces, when highly illuminated, appear white as a special case of the law of maximal stimulation that, when a stimulus is increased beyond a certain amount, it is not followed by any increased sensory effect. The upper limit of retinal excitation, however, corresponds to the sensation white.

When common natural pigments are observed spectroscopically, they are seen to transmit broad bands of spectral rays, generally extending to parts of the spectrum other than that part which corresponds in color to that of the pigment. Thus a yellow natural pigment transmits a flood of red, yellow and green spectral rays. When mixed with red and green, yellow spectral rays do not produce a sensation of their own proper color, but intensify the yellow sensation, which would be produced to a less extent by the intermediate yellow ray, when acting alone. It is a fact, beyond which we cannot go that the combination, red plus green spectral ray, stimulating the eye whenever we regard a yellow pigment, produces the sensation we call yellow; an artificial mixture of such spectral rays gives rise to the same sensation. In color mixing experiments, as when you mix a blue and yellow on the discs and produce grey, the blue paper transmits to the eye one-half the spectrum, viz., violet, blue, and some green, and the yellow paper transmits the other half, viz., some green, yellow and red. You are, therefore, looking at what is physically the same stimulus as that given by a piece of white paper seen in half light.

The statement of the theory is, in its present form, too obscure for criticism, and manifestly brings us no nearer a solution of the physological problems involved.

Adiposis Dolorosa.[1]

This was reported as a new disease in June, 1892, at the meeting of the American Neurological Association. In many respects it simulates myxœdema, from which it would seem premature to differentiate it until the pathology has been more fully studied. While presenting the appearance of ordinary obesity, it was found that the enlargement was very unequally distributed. Shooting pains were present in all cases at some time. There was diminished cutaneous sensibility in some regions and soreness over nerve trunks in some stages. The connective tissue is largely increased and of an embryonic character, and interfiltrated with fat. The most significant change seems to have

---

[1] Dercum, F. X. in Supplement to Wood's Reference Handbook of the Medical Sciences.

been an induration of the thyroid gland. The author speaks of the disease as a connective-tissue dystrophy, a fatty metamorphosis of various stages of completeness, occurring in separate regions, with symptoms suggestive of an irregular and fugitive irritation of the nervous trunks—possibly a neuritis.

Wood's Reference Hand-book Supplement.

The Supplement embraces 1076 quarto pages of closely printed matter which, on the whole, is of excellent quality and will serve to bring the work down to date. Several neurological articles have already been noticed. It is obviously impossible to offer even a summary of all. The following jottings may, however, prove useful:

Articles on the Brain in the Reference Hand-Book.

Among the many useful articles in the supplement to Wood's Reference Hand-book of the Medical Sciences are two by Professor B. G. Wilder, on the brain. The first of these is a supplement to his paper in the eighth volume of that work. After illustrating the principle enforced in his article in an earlier volume of this journal, that it is each author's duty to correct his own mistakes as soon as discovered, he enters upon questions of nomenclature. Among other suggestions are these: Neuron might better be associated with axon and enteron as a name for the whole neural axis and neuraxis would be appropriate instead of axis cylinder.

Professor Wilder suggests that the bulbs, their crura, the olfactory portion of the precommissure and a part of the aula might be recognized as constituting a sixth definitive segment (Rhinencephalon); but—unless the word encephalon in composition is to be shorn altogether of segmental significance—it should no more be used for a ventral portion of a region than for a dorsal portion, *e. g.* the cerebellum, without the supporting preoblongata. Very naturally he objects to the use of the term "Rhinencephalon," by Sir William Turner in a third sense. We may add that the confusion in nomenclature is here absolutely intolerable. One who is indisposed to apply a term of his own coinage for all parts of the olfactory apparatus may have a choice and varied assortment of names for every part. The German usage seems to embrace under the term olfactory lobe, a projecting bulbus, a connecting peduncle and an eminence on the cerebrum, the tuber. Others use lobe as restricted to the tuber, which is also termed the tract. In other cases the word tuber is applied to the bulb.

An instructive summary of the gray masses of the cerebellum follows.

It seems strange that it should still be necessary to insist that the thalamus does not form a part of the wall of the lateralventricle. If this remains necessary it simply illustrates the crying need for some elementary work in embryology on the part of our descriptive anatomists. The paper closes with an extended abstract of recent work on the surface topography of the cerebrum.

The second article referred to deals with methods of removing, preserving, dissecting and drawing the brain. It would be impossible to compile from this article, which we would gladly reproduce entire. We must content ourselves with recommending it to all practically concerned with neurological manipulation and teaching and an especial emphasis on the well-deserved strictures upon the book-makers who insert diagrams with now the dorsal and now the ventral aspects uppermost.

Tumors of the Brain.

This subject is presented with a full tabulation of the eighty-five operations attempted since 1884 by Dr. Mary Putnam-Jacobi. The percentage of success is not large enough to be very flattering, yet it affords data under the guidance of which the indications for operation may be made out.

The cases of recovery include only one of operation on the cerebellum. The great majority of successful cases have been where the tumor exists in the motor convolutions (29 out of 39 cases.)

A conservative position is taken with reference to trephining for non-traumatic epilepsy.

Acromegaly.[1]

Dr. O. T. Osborn gives a full and interesting account of this rare disease which is characterized as a chronic affection evidenced by an abnormal increase in the extremities due to hypertrophy of the bones and soft parts in these regions. The disease was first noticed by P. Marie in 1886. Pain in the head is the first subjective symptom and is often exceedingly intense and may be accompanied by joint pains and tingling in the extremities.

The reflexes and special senses are not necessarily involved. The

[1]Article under this head in Supplement to Wood's Reference Handbook of the Medical Sciences. p. 2.

intelligence, particularly memory, is frequently lowered. One of the most constant symptoms is hypertrophy of the pituitary body. There is often some abnoxmal enlargement of the sympathic nervous system. The disease is obviously closely related with Myxœdema from which it is distinguished by the following points:

Both sexes are about equally affected; it begins most frequently between the ages of twenty and forty; bones are always enlarged; the face is oval or elliptical; the ends of the fingers are of the same size as the base (not club-shaped); the skin is yellowish, wrinkled, and hairy (not puffy and shiny.)

Up to the present time the disease remains incurable. A full bibliography accompanies the article.

Ear Operations.

The report on this subject by Dr. E. B. Dench is unusually full and contains admirable digests of the recent work.

The Emotions, The Physiological and Psychophysical Basis of.

A rather abstruse paper by C. L. Herrick, editor of this Journal.

The Care of Epileptics.

A very interesting paper by Dr. Frederick Peterson, an authority on the subject, who makes a plea for a more rational attempt to provide for such unfortunates conditions suitable to their peculiar state. The proportion of epileptics who are insane is shown to be small (less than ten per cent.), and very many are entirely able to fill positions of usefulness, except for the occasional seizures. Epileptic colonies have proven efficient in providing for the adjustment to these conditions, and association, so far from increasing, rather diminishes the number of seizures. Out of door employment and all manner of trades and avocations are provided, as also means of amusement. We failed to notice any allusion to the effect such social seggregation might be expected to have upon the hereditary propagation of the disease—a point worthy of careful attention. Embracing, by implication at least, among the epileptics such names as Handel, Moliere, Petrarch, Cæsar, Napoleon, Mahomet and St. Paul, it is little wonder that the author finds a place for the class.

Heredity.

The article on this subject by Professor H. F. Osborn is essentially a revision of the third Cartwright Lecture before the Alumni of the College of Surgeons, and has largely appeared in papers in the American Naturalist. It goes without saying that the interesting modern theories are accurately and graphically stated. In fact, the article is one of the most convenient compends within reach, and contains valuable hints as to the lines along which research should be prosecuted. The physician, more than any other professional man, is in a position to answer the questions which Weismann has addressed to science.

Blood Vessels of the Brain.

The paper under this caption is by Dr. William Browning and is in the form of critical notes rather than a connected description. The illustrations—one a beautiful lithograph after Adamkiewicz—are very useful.

Cranial and Spinal Nerves.

Dr. Frank Baker gives an interesting summary of recent results respecting the nerve roots. Considerable attention is given to the histogenetic problems. In the discussion of the internal relations of the roots the old and new views are stated and illustrated for comparison. We regret that the ingenious theory of Gaskell (if mentioned at all) should have been so briefly put as to be quite unintelligible even with the figures, to one not already familiar with it. Cajal, Lenhossék and Kölliker are laid under contribution and the material is well though too briefly used. We think the article would have been of vastly more value if it could have been doubly as extended. An excellent bibliography accompanies. (See also an excellent summary of modern histological results by the same author in a recent number of the Alienist and Neurologist.)

Histological Formulæ.

Prof. Fish's article is a very useful compilation of the recent methods and is particularly valuable for its formulæ for the nervous system.

In this connection we may add that Herrick's permanent hæmatoxylin, as described in 1891, proves not only permanent in the slide but the solution is unalterable so far as observed. It is essentially Delafield's, with the addition of a small amount of the antiseptic (one tablet to a pint) and the solution may be used at once if diluted with alum water, which is all that is necessary to "ripen" it. Acid in the section is of course fatal.

The Meninges.

Dr. Wilder described with numerous illustrations the membranous envelopes of the brain and card. We are struck with a conservativeness of statement and reservation of judgement upon many points upon which those who have given the subject less study are prone to positiveness. The present writer must admit that it seems impossible to expect the same uniformity or consistency in the development of the connective envelopes as one must logically postulate of a morphologically primitive wall like that of the brain tube. Collected by a process of accretion around the brain, these envelopes will obey mechanical rather than morphological principles and the existence of one or more layers in a given case is a matter to be settled in that case by itself without reference to any canon of interpretation. A perforation through the tela requires explanation and may justly be viewed with suspicion until its origin is discovered; a perforation through the meninges is a fact of observation. We fail accordingly to understand the significance of the analogy suggested between the fontanels and the tela (p. 609.)

Professor Wilder carefully reviews the evidence for the existence of the metapore (foramen of Legendie) with new material and formulates the following: "In the normal adult human brain there is a considerable orifice in the roof of the metacœle whereby the liquid of of the encephalic cavities may escape into the post-cisterna." In reply to the obvious morphological inconsistency he refers to the solution of membranous integrity in the case of the septum between the stomodeum and œsophagus (the oral plate.) Figure 422 seems to make the matter very clear from the standpoint of gross dissection though the writer must admit that he puzzled a long time as to the significance of a curious unnamed body near the base of the figure before it dawned upon him that it represented the thumb of a manipulator and still longer before he felt sure that an outline above indicated a finger tip. A label or reference in the description would make all clear. Though probably a valueless suggestion, it would be interesting to make sure that there is not in man *an elaborate eversion of tela from the edges of this and other openings far beneath the dura.* The degree of modification to which the tela is susceptible is in some cases very remarkable. No final decision is reached as to the lunulate foramina described by Dr. Langdon.

The Physical Expression of Insanity.

Dr. Charles P. Bancroft whose article in the Handbook is characterized throughout by scientific thoroughness, very truly says that, while it is true that the expression of the emotions receives its most perfect and frequent demonstration in the facial region, it must not be forgotten that the entire periphery is likewise a participant. Three factors enter into the mechanism of expression: I. The storage and discharge of nerve-force from the central nervous system. II. The power of inhibition possessed by the cerebral cortex. III. The trophic changes consequent upon the processes of waste and repair that are constantly occurring in the cerebral cells. As the chief inhibitory centres seem to lie within the cortex so cortical disturbance or insufficiency is especially likely to produce uncontrolled and spasmodic reflexes.

The author gives a careful analysis of the manifestations accompanying different forms of mental disease with numerous half-tone portraits and closes by recommending that a suitable photographic outfit be made a part of the equipment of every insane hospital.

Other articles of neurological interest in the Hand-Book are on Meningitis, by Dr. James T. Whittaker; Myelitis, by Dr. Leopold Putzel; Regeneration of Nerves, by E. T. Reichert; Comparative Anatomy of the Nervous System, by C. L. Herrick; Histogenesis of the Elements of the Nervous System, by C. L. Herrick; Recuperative Power of Old Age. The last mentioned paper by T. L. Stedman gives interesting evidence of the great vitality and resisting power of the aged which, however is not to be explained as due to a measure of independence of the several organs so that local trouble does not affect the system at large but to the fact that the aged have undergone a process of natural selection and therefore have unusual vitality and recuperative power. Pott's paralysis in children, by J. H. Huddleston; Surgery of the Spinal Cord, by W. W. Keen (a very useful and interesting summary of recent progress in operations on the brain is given;) Sympathetic Nervous System, by Dr. Hand Baker; Development of the Organs of Taste, Frederick Tuckerman ; Thought Transference; Richard Hodgson ; Development of the Thymus Gland, by F. P. Mall ; Development of the Thyroid Gland, by F. P. Mall; Pathology of the Thyroid Gland, by Wyatt Johnston ; Waller's Law, by C. L. Herrick.

The Innervation of the Chromatophores.[1]

The difficulties attending the investigation of the innervation of the chromatophores have been partially overcome by Professor Eberth

[1] EBERTH. Anat. Anz., Ergänzungsheft VIII, 1893. BALLOWITZ. Do.

by treating Golgi preparations with chlorine water to bleach the pigment. One to several medullated fibres pass toward the chromatophore. Small ones are innervated by a single fibre, which divides into two or more fine varicose branches, which terminate in tuberosities on the surface of the chromatophore. Lower down these branches anastomose. From this anastomosis are given off numerous fine fibres which end in dendrites and constitute the specific termini of the nerves of the chromatophores.

E. Ballowitz has investigated the same problem by the same method, with essentially similar results but with important additions. The chromatophores contain two kinds of pigment, usually brown and black. It is a common belief that the pigment cells possess amœboid motions by which they are able to contract or expand the pigment diffused through their bodies, the latter being effected by thrusting out protoplasmic processes into adjacent intercellular spaces.

It has, however, been recently shown that these protoplasmic processes are permanently expanded and that the pigment granules migrate within the cell. These granules are radially arranged about a central "attraction sphere." All chromatophores are in nervous connections with each other and with their nerves by anastomoses, very much as described above. The anastomosing, varicose branchlets of the terminal dendrites, however, from an extensive nerve-complex both upon and within the cells.

In cells with extended pigment masses nerve fibrillæ can be seen spread out on both upper and lower walls of the cell, with some branches passing clear through the cells to join the reticulum of the opposite side, sometimes branching within the cells and terminating in tuberosities. These inter-cellular termini are very numerous in all parts of the cell. They, however, are in no way related to the "attraction sphere" nor to the nucleus of the cell. The cell protoplasm, then, is the medium of innervation of the pigment granules.

In the "contracted" pigment cells the pigment granules are all massed at the centre of the cell, obscuring the nerve termini in that region but leaving those in the other parts of the cell very clear and unobstructed.

Ganglion Cells and Nerve Termini in the Ventricle of the Heart.[1]

Dr. Berkley has been applying the rapid Golgi and picric-acid-osmium-bichromate methods to the study of the nervous structures of

---

[1] BERKLEY, A. J. On Complex Nerve Terminations and Ganglion Cells in the Muscular Tissue of the Heart Ventricle. *Anat. Anzeiger* IX 1, 2.

the ventricle in the mouse and white rat with results of a brilliancy characteristic of his recent work.

A fine interlamellar net-work is spread through the whole thickness of the heart muscle and extends from the auriculo-ventricular groove to the extreme apex of the ventricle with fibres of medium and very small size. The main fibres extend generally in the direction of the axis of the muscular bundles, spreading out and giving off branches dichotomously as they proceed. These branches either join other fibrillæ or send out terminal filaments with knob-like extremities either between the muscle fibres or on the bundle. In addition to the above are fibres of a larger calibre without varicosities or connections with the net-work. They follow undulating courses between the muscular spindles and end in large and intricate figures. In the path of these fibres, not far from the termination, is a ganglion cell of ovoid form. The author inclines to regard these as sensory termini. Between the sarcous elements are bipolar nerve cells. Their rami ramify between the muscular elements, in some cases with curious arborescent termini. Axis cylinders were not seen. These are regarded as sympathetic elements.

A large plexus of coarse ganglionic thickenings occurs among the nerve fibres between the muscular bundles of the ventricle, comparable to the plexus of the Auerbach in the intestine.

The Primer of Philosophy.[1]

Among the results of scientific progress during the last decade or two has been the dawning of the idea that everything is not explained by a few natural laws, an indefinite quantum of matter and time ad libitum. Thus we enter upon a period of reconciliation of philosophy and physical science, of religion and evolution. Whatever we may think of the early stages of the process, it is satisfactory to realize that monism is the recognition of the supremacy of the metaphysical and a proof that the human mind will not long remain content with a God-less or disarticulated universe. In the book before us we have an attempt to prepare the way for a reconciliation. Without sharing altogether in the author's optimism respecting the immediate future of philosophy, or more particularly this philosophy, we do find much to commend, especially in the vigorous disillusioning respecting sundry bits of hoary nonsense which are bruskly kicked out of the way. Translating the

---

[1] Carus, Paul. Primer of Philosophy, Open Court Pub. Co., Chicago, $1.00.

Kantian Anschauung by "at sight" (that which we receive directly by sensation, our meaning-endowed feelings) the author has no use for intuition in the conventional sense. The data of experience exhibit three elements (1) the feelings—the element of awareness simply, (2) the forms of feeling—the various sensations, etc., (3) the meaning of feelings—representations and the objective world.

The influence of Lotze may be seen in such a statement as "The peculiarity of existences, consists in affecting other existences and this constitutes its objectivity." The thinking subject appears to other thinking subjects as an object in an objective world. We are feelings, but we appear to other subjects as material bodies moving about in space. Admitting that it is difficult to conceive what the subjectivity of a flame or stone amounts to, he claims that "we know that in inorganic nature there must be something analogous to our feelings on a lower scale." While this is the basis of positivistic monism it is just this for which the critic seeks in vain for proof.

Truth is defined as the adequateness of a mental relation—an agreement of a representation with the object representation. It is of the nature of mind to attempt to satisfy the conditions of relation and the mind therefore yearns after truth, which is the deepest impulse of the mind, for truth is the fulfilment of the mind.

We are glad to agree with the author in his summary dismission of the axiom, than which a more abused word can scarcely be found, Very reasonably the childish quibble of some modern mathematicians as to the possibility that the sum of the angles in a triangle should be greater or less than 180 degrees is dismissed with the remark that this class of necessary formal truth rests on construction, i. e. definition. Defining space as the possibility of motion, he proceeds to lay the foundation for a new system of geometry as to the success of which there will be a variety of opinion. [More logical to us is a method which defines a point as the negation of motion i. e. as zero; all motions therefore become plus quantities and n-dimentional space is possible until zero is given a value, $o\ n$. This is done by defining the position of zero with respect to some other zero, o', when $o'\,o$ or $o'\,n$ becomes a line. Any given motion or direction once postulated becomes a line of reference and n-dimentional space is then excluded. This empirical element in human geometry is gravitation.]

The three-dimentional space we, like the author, regard as involved in the system by definition and not an arbitrary necessity of thought or nature. Upon the basis above suggested it would be easy to construct a geometry ignoring the tridimentional element.

Reason originates by a differentiation of the formal and the sensory in experience; it is the method of our experience. Human reason is the reflection of the world reason, the former is rational only in so far as it agrees with the latter; it is a mental picture of certain qualities of reality. We do not find the treatment of reason wholly intelligible.

The distinction insisted on between cause and reason on one hand and effect and consequent on the other is one which might well be more carefully observed. Causes are motions or happenings. Cause is not equal to the effect but the total amount of matter and energy is not altered. Cause is not mere succession it is the transformation of energy from one form into another, it is another statement of the law of conservation of energy.

"A world of which all events are factors of causation is necessarily a teleological world—a world of law, an orderly arranged universe, a cosmos. The actions of a free man are the immediate expressions of his character. The actions of a man that is not free are not the expressions of his character. The ultimate springs of reality are spontaneous forces and their manifestations are a true exhibit of the nature of his being. The spontaneity of nature is analogous to the action of a free will. Free will, then, is the uncoerced natural output of a man's being under the given conditions. To the last section, that on psychology, we shall not, at present, refer. Enough has been quoted to show that there is much suggestive and some really valuable matter in the book, which, like others from the same pen, is characterized by an earnestness and directness which convince us of sincerity back of it. With the ultimate applications we cannot agree but trust that the system may serve to hasten the total collapse of that which passes for metaphysics in many of our colleges. [C. L. H.]

Injuries of the Temporal Lobe.[1]

"It has been shown by clinical and experimental investigations that deaf-mutism may be caused not only by lesion of the peripheral organs either before or after the birth of the individual, but also by disease of the cerebrum, i. e. of the regions of the temporal lobe.

---

[1]Seppilli, Guiseppi. Affections of the Temporal Lobe, (1) a case of deaf-mutism, (2) of lesion of the left temporal lobe without verbal deafness in a left-handed man. *Alienist and Neurologist*, XIV, 2.

Anatomical researches on the central nervous system seem also to support this theory, an internal course for the auditory roots, similar to that of the optic nerves being demonstrated by the observations of such investigators as Flechsig, Bechtereu, Monakow, Zacher, &c.

Ferrier cites two cases which confirm these researches, the conclusion being that the acoustic nerves have their terminations in the temporal lobes and that bilateral lesions of these same lobes cause complete deafness."

Seppilli then reviews these observations and presents a new case which came under his direct observation—a case of a woman who was a deaf-mute from infancy. Lesion and atrophy were discovered upon autopsy, the medullary substance of the temporal lobes being almost entirely transformed into cicatricial tissue. Other adjacent parts were normal. The patient showed evidences of having been the victim of an encephalitic process from birth. In such cases the relation of deaf-mutism to lesions of the temporal lobes is evident.

Now it is natural that when the temporal lobes which preside over the acoustic functions of language undergo a destructive lesion in early infancy, the formation of verbal acoustic ideas is entirely prevented, and in consequence of thus lacking the elements which serve for the development and elaboration of motor verbal ideas, mutism is necessarily produced.

It has been affirmed with regard to motor aphasia that spoken language is a function of the left cerebral hemisphere, that is, a man in the act of speaking, as far as his brain is concerned, is *left-handed.*

This theory is justified by the results of the investigation into several cases which can not be here detailed. Two sets of facts have been thus established:

First, that a lesion of the right temporal lobe gives origin in left-handed people to verbal deafness, and that this is not caused in right-handed individuals.

Second, that left-handed people are not the subjects of verbal deafness unless the right temporal lobe is affected.

From all which observations we may conclude that in left-handed people the acoustic center of language has its seat, not in the left, but in the right hemisphere.

Nerve-endings in the Auditory Organ[1]

Professor Lenhossèk has applied Golgi's method to the Maculæ

---

[1] M. v. LENHOSSEK. Die Nervendigungen im Gehörorgan. *Anat. Anz. Ergänzungsheft*, VIII, 1893.

and cristæ acusticæ of the mouse with results which confirm those of Retzius, that the nerves end free upon the hair-cells without entering their substance. The histogenetic, as well as the trophic centre of the acoustic fibres lies in the auditory ganglion, from whose bipolar nerve-cells one process passes mesally to break up in a terminal dendrite within the so-called acusticus nidulus, another passes peripherally and ends similarly in intimate contact with the hair-cells.

Spinal Ganglia in Amphibia.[1]

The discovery of His that in the spinal ganglia the sensory nerves pass both centrally and peripherally from the neave-cell in the ganglion and the motor nerves originate within the cord and effect no connections in the ganglion accounts for the fact that in the adult ganglia no cells are found with more than two processes. Yet cells of the sympathic ganglia, which originate from the spinal ganglia, possess well-developed dendrites. This fact has led to the study of frog-larvæ. In young stages, before the hind legs have appeared, numerous cells are found which possess several proceses, some provided with small but typical terminal dendrites. Further investigations are promised in the near future.

Notes Upon Hysteria.

From a series of important articles in the Archives de Neurologie we abstract such portions as may be of service to the theory and practical treatment of these too frequent maladies of an over differentiated society. We owe the greater part of these abstracts to Mr. Charles B. White. First, then, definitions, as supplied by M. Pierre Janet in an article On some Recent Definitions of Hysteria.[2]

Lasègue says: Under the name of hysteria is designated provisionally a uniform number of nervous manifestations preferredly in young women, encountered very rarely in young men, and not dependent upon any known lesion of nervous centers.

M. Babinski shows that it is possible to make this diagnonsis in studying hysteria:

1.—Symptomatic aspect. 2.—Evolution. 3—Aetiology. 4.—The influence of various treatments. 5.—The insight furnished by experimentation upon the hypnotics.

---

[1] DISSE J. Ueber die Spinal-ganglien der Amphibien. *Anat. Anz., Ergünzungsheft,* VIII, 1893.

[2] Archives de Neurologie, Vol. XXX, No. 76. June, 1893.

M. Pitres refused to give a definition, but enumerates certain common characteristics, viz:

1. Hysterical accidents are the result of purely functional derangements of the nervous system.

2. They can be abruptly provoked, modified, or suppressed by psychic influences or by psychic causes which have no effect upon similar accidents dependent upon organic lesions.

3. They rarely occur isolated, in the immense majority of cases certain latent *stigmates* coexist with the striking manifestations of the disorder.

4. They have no regular evolution; the occur without pre-established order and follow one another under different forms and at different periods in the same subjects.

5. They do not habitually have, upon the general health and upon the mental state of the subjects overtaken by hysteria, the deep *retentissement* which accidents, similar but dependent upon another causes, would have.

Brachet said: Hysteria is a disorder of the cerebral nervous system which is manifested more or less abruptly by the crisis of general convulsions and by the sensation of an ascending ball in course of the æsophagus, at the superior extremity of which it becomes fixed, threatening suffocation.

These definitions which consider hysteria an essentially convulsive malady were more comprehensive than those which sought to explain it as dependent upon uterine disorders.

M. Charcot has shown that hysterical paralysis could be produced by suggestion. "In certain circumstances," says he, "a paralysis could be produced by an idea. . . . This idea, once installed, fixed in the spirit and, reigning there without control, would be developed and would acquire sufficient force to be realized under the form of paralysis. . . . He showed especially the importance of the fixed idea which produced and sustained the accident, reproduction of identical facts by suggestion, the treatment by isolation and the moral influences which modified, not the physical state, but the pathological mental state of the patient."

After much controversy, this doctrine has finally prevailed.

There is no longer an author who absolutely denies the existence of hysterical accidents, produced by imitation, by suggestion, by idea.

M. Guinon shows how, in certain cases, we can arrive at the fixed idea which determines the hysterical accident. The patient broods upon his accident, he thinks about it incessently, and this thought can be interpreted as follows: "I can no longer feel my hand, I can no longer move it, my arm is heavy," etc. These ideas have the greatest importance and determine not only the hysterical malady in general but also the particular form which the accident takes.

M. Moebius says, an opinion tends more and more to become established; hysteria is a psychical disorder and the modification which characterizes it is a diseased state of the mind.

Moebius says: We may consider as hysteria all the pathological modifications of the body which are caused by representations.

M. Strumpell says:—What is called nervousness from a scientific point of view is a disposition essentially spiritual and not corporeal, certain very strong representations, certain associations of ideas very easily become the starting point of accidents corporeal in appearance.

Instead of purely physical definitions, then, a new definition is substituted which seeks to group symptoms about a moral phenomena "hysteria is a uniform group of maladies by representation."

THE DUALISM OF PERSONALITY.

M. Oppenheim and Jolly have very justly criticised the attempt of Moebius to make an inclusive definition of hysteria by extending the explanation that hysterical accidents depend upon certain fixed ideas to all hysterical accidents.

1. A great number of hysterical accidents clearly indicating the existence of hyperaesthesia, of tic douloureaux, of paralysis, of spasms seem to have no relation whatever with any idea or imagination of the subject. There are, in reality, two categories of hysterical accidents, which are easily differentiated from tic douloureaux or spasms. The one occurs *when the subject thinks* upon them; they disappear *when the subject* is inattentive or asleep; they can easily be attached to an idea, but the other are produced even *when the subject does not think* upon them; the spasm persists in spite of preoccupation, sometimes in spite of sleep.

2. Hysteria presents an attack. This attack affords complex *ensemble* of convulsions, cries and words. These regularly occurring attacks seem to depend upon some physical phenomenon, for they are independent of the thought of the subject.

3. The more distinctly moral accidents, somnambulism and delirium, are not the result of a fixed idea, clear and simple. The subject does not know what passes in his delirium, and he does not think upon them.

Somnabulists have two different psychological existences which are alternately successive. They do not know what occurs during the attack of the disorder. The most simple somnambulism ought to be considered as identical with the great phenomena of double existence which are sometimes so manifest ; it is always the result, the manifestation of dualism of personality.

This state is produced in different ways. Sometimes the first personality, the first group of psychological phenomena disappears by sleep, by the exhaustion of attention, and the second group is easily developed.

In other cases a sort of periodic alternation is established by habit and the second group is regularly reproduced when the first has endured for a length of time.

More often still, some little fact; e.g., a definite sensation, is found associated with the group of phenomena which constitute somnambulism, and when this sensation is provoked it introduces automatically all the systems of which it is a part.

M. Charcot has established the fact that definite relations exist between the somnambulistic state and the hysterical attack.

He has shown that the attack included often phenomena of a somnambulistic nature, and that on the other hand natural or provoked somnambulisms were often preceded, or even accompanied by a great number of symptoms belonging to the attack.

Sometimes the attack is spontaneous. But most frequently it is provoked by a psychological phenomenon associated with the emotic state, the fixed idea.

An hysterical patient who, in his attacks, is a pray to dispair caused by the death of his child or to terror produced by a conflagration, if he think only of his child, or even of some other child, if he watches a little flame or simply a piece of red paper, it is sufficient to cause an attack.

Touching hysterogenic points, i.e., provoking a definite sensation belonging to a group of psychological phenomena of the crisis,is sufficient to bring about the attack of convulsions.

That which strikes most observers in the development of the attack is the absolute, mathematical, regularity of the attacks in the same patient. Here always the same movements, gestures, cries, words.

We can predict every minute what is about to take place. The automatic regularity characteristic of all these stated can be easily explained, according to Janet. The second existence is often a rudimentary psychological existence in which the sensations and ideas do not control or modify the one the other. Probably all hysterical crises are of the same nature, they consist in the reproduction, more or less complete, of an emotion, of an adventure, of a former idea in a second existence which is analogous to a more or less rudimentary somnambulism.

In hysterical persons, because of the easy disassociation of their mental unity, certain centres can be put into play without the other regions of the psychic organ being informed or taking part in the process. "This fact," Mr. Janet used to say "ought to play in hysteria, a role as important as that of association in normal psychology." "The essential character of this disease of disaggregation (degeneration) was the formation in the mind of two groups of phenomena, one constituting the ordinary personality, the other an abnormal personality, different from the first and entirely unknown to it." These views have been confirmed by Brener and Freud. They show by numerous examples that the various symptoms of hysteria are not spontaneous, idiopathic manifestations of the disease but are in direct connection with the provoking *trauma*. The relation between the provoking idea and the accident may be more or less direct; but it always exists. They say that the disposition to this disassociation and at the same time to the formation of states of abnormal consciousness, constitutes the fundamental phenomenon of this desease.

The mimicing of other affections, which is recognized as a frequent element in hysteria, is carefully treated in an article by Dr. F. F. Gilarducci.[1]

That hysteria can faithfully reproduce the appearance of partial epilepsy, is an established fact.

The study of the development and of the affiliation of the accidents have permitted us to explain the mechanism with which the attack has been established in two cases and we have drawn from it means for the *diagnosis*, In a third case, the hysterical character of stammering, of stuttering and of femoral monoplegia, have been explained by us upon the nature of the cephalagia and the crises in whose train these phenomena have appeared. Finally, the study of the evolution, of symptoms, their amelioration and disappearance, their transitory and intermittent character, have furnished valuable proof in confirmation of the diagnosis of hysteria.

---

[1] Contribution au Diagnostic Differential entre l'Hysteria et les Maladies Organiques du Cerveau; *Archives de Neurologie*, Vol. XXV, No. 73, Jan., '93.

The specific hysterical character of some phenomena presented by our patients, has given us most decisive arguments. These we group in three classes:

(a) Permanent symptoms. These comprise—the hysterical *stigmates* present in all the cases; the paraplegia, femoral paralysis, stammering and stuttering.

(b) Transitory symptoms which manifest themselves during the attack and in the intervals. They comprise paresthesia, slight paralysis, trembling of the arm, cephalalgia, giddiness and diplopia.

(c) Transitory symptoms which are manifested only on occasion of the attacks. They include hysterical *aura*, *ebauche du delire*, psychical *aura*.

The absence of persistent phenomena of organic diseases has furnished us a useful sign for all the cases. This has served us as an added argument for the diagnosis, never as a basis; because we know that some cases of organic diseases of the brain have been observed which have remained latent for some time and have given only very vague manifestations.

The mental state of our four patients is quite characteristic of hysteria; of all the particulars which demonstrate it and which it seems useless to repeat, the following are worthy of note: In all the attacks is shown the reproduction of sensory troubles, motives, or emotions, which have marked the appearance of the disorder, such as paresthesia, trembling of the arm and terror. This shows that the memories of these tronbles occupy the patients' minds with a persistency and intensity quite characteristic of a hysterical mental state.

The following interesting conclusion may be drawn: In all cases of partial epilepsy, before proceeding to the trepanning of the skull, it will be necessary to assure one's self that hysteria is not the cause of the morbid accidents; for we have seen, in our observations, that it can resemble, perfectly, partial epilepsy.

Observations upon a case of hysterical hemiplegia presenting characteristics not generally belonging to it. The patient is 43 years of age. No diseases worthy of mention in early youth. By trade a bricklayer; at 19 years of age was caught in a falling structure and covered by debris; received an extensive fracture of right parietal bone; jaws locked for several days. After a year and one half in the hospital, the wounds closed, he convalesced and returned to work. Health perfect; no functional trouble resulted, save occasional dazzling of the sight, accompanied by slight and transient dizziness. While lifting a heavy burden, his dorsal spine was injured. Intense weakness in lumbar region succeeded the shock. After some time in bed could walk a little with crutches, with great pain in his back. Legs very feeble, especially the left. Left hand and fingers also lacked force. Was treated in Paris hospital. Lumbar pains diminished, but weakness of arm und leg increased until, in six months, left hemiplegia became complete. In attitude, a slight spinal curvature; incapable of standing erect more than a few seconds; unable to retain equilibrium of posture with his eyes closed. In walking, body bent to the right and step irregular. Muscular force almost nil in left limbs, which seem almost lifeless. Thermic sensibility entirely destroyed on entire left side; dolorific sensation quite absent on left, as also tactile sensation. Reflexes greatly deranged, especially on left side. Odor and taste absent on left side and hearing feeble. Visual apparatus quite unaffected. Upon diagnosis, at first sight, we considered the patient's hemiplegia of organic nature. But more careful examination brought the conviction that some of the phenomena were due to hysteria. This conviction has several elements; based on objective examination -

1st. Total hemianesthesia of the left side, with entire loss of muscular sense, which, in hemianesthesia of capsular origin is usually preserved.

2nd. Bilateral anesthesia of the conjunctiva and bilateral loss of taste and odor.

3rd. The absence of facial paralysis.

4th. The contradictory character of the hemiplegia. In fact, though the olecranian and patellary reflexes were exaggerated, the arm, when lifted up, fell back heavily like an inert mass.

5th. The deformation of the vertebral column can be imputed to hysteria. It may be explained with the unconscious positions taken by the patient as a result of rachialgia of which he suffered for four years.

The conclusion solidly supports the condition that these phenomena were caused by hysteria alone. The following arguments verify our diagnosis:

1st. Hemianesthesia has always confined itself to the region of the shoulder.

2nd. The inferior left member has reacquired muscular force and normal mobility. The improvement began immediately after the patient in question entered the hospital. The superior member improved more slowly, but not less really and progressively.

3rd. The crisis of rachialgia and the paralysis of the right leg, are clearly hysterical phenomena. Moreover, developments show that a return of the attacks of hysterical rachialgia resulted from the influence of a persistant and suggestive idea referring to the initial attack, this suggestive idea or force culminating in paralysis of the right leg.

The logical conclusion is: In the diagnosis between hysteria and organic maladies, one must not be contented with considering the symptoms and nothing else; but it is necessary to interpret them by studying their relation with the mental state of the patients. Only on this condition will the diagnosis be complete and fruitful in results useful for therapy.

We append also notes upon three cases of hysterical brachial monoplegia, by Dr Kinnosuke Miura. *Archives de Neurolgie*, XXV, 75.

Case I. Hereditary antecedents of the patient favoring development of nervous disorders. Patient broke his right clavicle. Continued to work three and a half months after his accident. Finally went to have his condition treated and in a short time was much improved and resumed work. For two years used his right hand the same as his left. The right arm was suddenly and inexplicably paralyzed; the patient had had good health; no troubles; had made no violent effort. But, a few days previous, he had assisted in burying a nephew who had *crushed his arm* in a factory. He had visited his nephew in the hospital and the event had strongly impressed him. The patient's muscular sense was intact; sensibility entirely intact. Reflexes slightly stronger than normal but equal on both sides. Special senses only slightly modified.

The question here concerns an individual, tainted by neuropathic heredity, in whom a vivid emotion seems to have provoked the development of brachial monoplegia on the side where, two years before, he had a clavicle fracture.

The absence of troubles of the sensibility in this patient is quite singular,—a fact not yet observed, to our knowledge, in similar cases of hysterical monoplegia. After a few days of treatment the patient recovered, to some extent, the use of his hand, fingers and arm.

Case II. Right brachial monoplegia. Patient, a painter by trade; overworked; while painting a ceiling, was taken with a sensation of vertigo, then with general trembling, finally resulting in paralysis of the right arm. Sensibility entirely destroyed, from finger tips to shoulder. No hemianesthesia. After four months' treatment left the hospital, able to move elbow and shoulder, the wrist and fingers, however, remaining paralyzed. Like the preceding, this patient was treated first by faradisation, then by psychial education, then by exercises upon the dynamometer. He slowly regained control of fingers and elbow and sensibility returned to hand and fingers, only one anesthesiatic zone being left, the wrist. This is a case of hysterical monoplegia developed *chez un saturnine.*

Case III. Hystero-traumatic left brachial monoplegia, *selerose en plaques.* Organic lesion of the nerves of the deltoid and infraspinal muscles.

Patient's health was undermined by very trying labor. One day he felt very feeble. This feebleness continued. Two years later the first symptoms of *selerose en plaque* appeared, commencing by titulation. His legs were not stiff but feeble. In 1889 he received a violent shock upon the left shoulder from a falling window shutter. His left arm was instantly and completely paralyzed. After three weeks' treatment, he recovered slowly some slight movements of the fingers and forearm. Treated by tonic baths, electrization and exercises requiring movements of fingers and portions of left arm.

The co-existence of paralysis and *selerose en plaque* makes this case somewhat complicated. This monoplegia, complex in character and contradictory in appearance, is due in part to the traumatic shock and to organic lesions which it produced in the brachial plexus and in part to local hysterical troubles which the traumatism produced. To the lesion of the plexus ought be referred to the paralysis of movement and sensibility which immediately followed the shock and consequent nervous degenerative muscular atrophy. To hysteria alone ought to be attributed the special anesthesia and perhaps the inertness of the movement of flexion in the forearm. This interpretation being accepted, we shall easily understand why the movements of the elbow returned rapidly under influence of psychic treatment, (exercises and suggestions), while the shoulder remained incapable of motion because of the organic nature of the lesions with which the paralysis of its muscles was connected.

The Hypoaria or Lobi Inferiores of Fishes.[1]

The paper before us is based on a large number of preparations by different methods made in Professor Hertwig's Laboratory in Berlin, under the immediate direction of Dr. Burckhardt.

---

[1] David, J. J. Die Lobi inferiores des Teleostier und Genoidengehirns Inaugural Dissertation. Basel, 1892.

After an historical resumè, which gives a brief statement of the most important theories and observations, the author discusses the morphological problems which are abundantly suggested by this difficult region.

Like nearly all authors, David considers the lobi as evaginations of the third ventricle with which their own ventricles communicate. He recognizes the recessi which Herrick first described and homologized with the mammillaria. The homology he is unwilling to accept, objecting, in the first place, because of the absence of nuclei and, in the second, because of their ventral position, and, finally, because of the irregularity of occurence. Herrick, however, states that he never fails to find indications of it in a much wider range of observation and recognizes cellular contents within and about the organ. Herrick also finds the region in amphibians and reptiles.

From a series of comparative measurements no general conclusions proved educable. The histological portion contains the results of Golgi impregnations and Weigert preparations; the results being quite similar to those printed in this journal, May, 1892. Histogenetic conclusions are drawn for which our readers will not be entirely unprepared.

"The axis-cylinder of the older cortex cells of the lobi inf. which are derived from the epithelial layer, are at first radiately disposed, and subsequently, in the course of further development and changes in the position of the cell-bodies are turned transversely. In fact we might conceive of the change of position as a natural and necessary mechanical result of the migration of the cortical cells from the epithelial layer." Precisely similar suppositions have been made with respect to the cerebral cortex.

Under the discussion of the adjacent niduli the observations of Herrick are verified and new details added. It is noted that the blood-vessels of the "rotundus" (ruber) are largely derived from the saddle cleft, a fact fitting well with the homology with the ruber as also the fact that a part of the dorsal-longitudinal fasciculus ends there.

David is inclined to homologize the dorsal peduncles with Edinger's "mantle bundle." We find no evidence that the author succeeded in finding the embryonic origin of the ruber from a ventricular layer, but in general the results favor the hypothesis of His.

While the paper before us does not say the last word on the hypoaria, it is sufficient to produce an attitude of expectancy for the work which may follow it.

The Cerebrum of Ornithorhynchus.[1]

Although containing, as the author modestly puts it, "little more than a series of detached observations," these are a welcome addition to the meagre literature of this subject.

The olfactory bulb seems to be as in *Didelphys*, though Hill says it differs, without specifying how, in the relations of the fossa. So far from being an exceptional thing, the olfactory fossa is found generally in reptiles, having been described by the writer in Alligator and many other types; it is less pronounced but obvious in many rodents. Generally the cavity is filled with glomerulary aggregates. The ventricle is obliterated in Ornithorhynchus. The external form of the brain has been described by Sir W. Turner.[2]

A considerable portion of the paper is devoted to an historical discussion of the callosum, which is said, on anatomical and morphological grounds, to be absent. Elsewhere in this number reference is made to the same organ as seen in the oppossum. The method of preservation was evidently such as to prevent determining fine histology. The figures, being for the most part quite devoid of reference letters, make it difficult to follow the discussion in some cases. From the figures it would be inferred that the fascia dentata is quite disassociated from the cornu ammonis and we are reminded that the author does not accept the former as a convolution. There is the greatest simplicity in the arrangement of the fimbria and fornix.

Descriptions are given of the central gray matter and cortex, for which see the original.

The descending pillars of the fornix are said to divide into two bundles, one of which extends along the upper surface of the thalamus (tænia?) while the other descends to the large corpus mammillare. We trust that Dr. Hill may not be disappointed in his hope to be able to secure well-preserved material for future study.

The Hippocampus.[3]

In this monograph, Dr. Hill gives an interesting summary of the history of this much-discussed organ. He denies, though without presenting evidence, that the lateral striæ of the olfactory reach the surface of the region in lamina nuclearis and fascia dentata and also

---

[1] Hill, Alex. The Cerebrum of Ornithorhynchus paradoxus. *Philos. Trans. Roy. Soc., London.* Vol. 184 B, p. 367-387.

[2] *Journ. Anat. Phys.* XXVII, April, 1892.

[3] Hill, Alex. *Philos. Trans. Roy. Soc. London.* 184.

denies that the latter is homologous with a convolution. [See elsewhere in this number.] He also rejects the interpretation of Zucker-Kandl, and "fails to see any indication of the return of the fascia dentata to the under side of the splenium in order that it may round the splenium and sweep forward in the nervus Lancisii in the manner required by the theory."

He emphatically states that the fascia dentata does not shade into the cortex. Evidently some arbitrary criterion is used for the cortex and the present writer is quite unable to agree with the statement of fact.

The original parts of the paper are devoted to a description of the hippocampus of Hyperoodon, Phocæna, Monodon and Phoca. The very valuable studies are summarized as follows:

1. The fascia dentata is absent from the brains of *Hyperoodon rostratus* and *Monodon monoceras.* It is but slightly developed in *Phocæna communis* and is small in *Phoca vitulina.*

2. The extension of the fascia dentata in the several members of the mammalian class varies as the relative development of their olfactory apparatus.

3. The column of large cells known as the nucleus fasciæ dentatæ is the extreme margin of the general cortex.

4. The granular and molecular layers of the fascia dentata belong to a separate portion of the wall of the fore-brain which has undergone this characteristic development.

5. In osmatic brains the fascia dentata ends in the mesal surface of the brain, slightly in front of the anterior end of the ventricular slit. Towards its anterior extremity its mesal and external portions meet below at an acute angle. At its extreme anterior end the two limbs of the V are opened out into a flat band which lies on the surface.

6. At its posterior or upper end the fascia dentata terminates abruptly. It is therefore a long riband, folded into a trough; if laid out flat, the riband would be found to have a nearly uniform width and a very regular and uniform structure.

7. The stratum granulosum contains granules and small pyramids (in about the ratio of 8 to 1 in the ox.)

8. The anterior commissure and fornix vary in thickness with the development of the rhinencephalon.

9. There is no reason for associating the fascia dentata with the striæ Lancisii, gyrus supracallosis, and gyrus geniculatus, or for supposing that these four structures belong to a single organ which forms

a part of the cortical centre for smell. The fascia dentata is a subcallosal structure, it alone disappears in completely anosmatic animals. The striæ longitudinalis lateralis and the supracallosal and geniculate convolutions are found in animals destitute of olfactory bulb and tract.

10. The relative representation of olfaction in brains of different species is shown by the ratio which the length of the hemispheres bears to its other dimensions.

Several suggestions are made respecting the terminology, for which see the original.

We are constrained to believe that the morphological conclusions reached would have been greatly modified by further embryological studies and that their acceptance would be a step backward.

For the careful elaboration of the valuable material we must express great obligation to the author.

Diseases of Personality.[1]

Among the numerous interesting monographs produced by M. Ribot, none has a more practical interest than the present volume, which is issued in authorized translation and in a neat and convenient form.

The book is already too familiar to require an extended notice here. It may be noticed in passing that the author, perhaps reflecting the influence to Maine de Bivan, never wholly falls into the error which is so glaring in the modern physiological psychology, of regarding consciousness as a mere epiphenomenon—a shadow which is cast by neuroses, but unavailing as a determinant of subsequent psychoses. Although there are many passages which ignore the great, even dominant effect of consciousness upon the psychical life, yet the author is sufficiently explicit in abrogating the view.

"It is probable that consciousness has been produced like any other vital manifestation, at first in a rudimentary form, and apparently without great efficacy. But from the moment it was able to leave behind a vestige, to constitute in the animal a memory for the psychical sense, utilizing its past for the profits of the future, from that moment a new chance of survival was created."

This is the point of view, and carrying it out consistently, the author elaborates a rich material in a way suggestive alike to physician and psychologist.

---

[1] RIBOT. The Diseases of Personality. *The Open Court Publishing Co.* Chicago, 1891.

Recent Literature.

ALTHAUS, JULIUS. On Psychosis after Influenza. *The Journal of Mental Science*, April, 1893. Vol. XXXIX, No. 165. New Series, No. 129.

ANDRICZEN, W. L. The Neurolgia Elements in the Human Brain. *Brit. Med. Journ.* No. 1700, p. 227.

APPLEGARTH, E. CAREY. The Latent Time of the Knee-Jerk. "*Studies from the Biological Laboratories of Johns Hopkins Univ.*" V. 2, 1893.

ARREAT, LUCIEN. Psychologie du Peintre. *The Journal of Mental Science*, April, 1893. Volume XXXIX, No. 165. (N. S., No. 129.)

BABINSKI, H. Association of Hysteria with Organic Diseases of the Nervous System, Neuroses and Other Affections. *Alienist and Neurologist.* XIV, 2, 1893.

BAKER, FRANK. Cranial and Spinal Nerves. *Reference Hand-Book of the Medical Sciences.* Vol. IX. Supplement.

BALLOWITZ, E. Die Innervation der Chromatophoren, mit Demonstration von Zeichnungen und Präparaten. *Anat. Anz. Ergänzungsheft.* VIII, 1893.

BANCROFT, CHARLES P. Insanity, the Physical Expression of. *Reference Hand-Book of the Medical Sciences.* Vol. IX. Supplement.

BEADLES, C. F. The Treatment of Myxoedema and Cretinism. *Journ. Mental Science.* XXXIX, 166-167 (N. S., 130), 1893.

BEDDARD, F. E. On the Brain of the African Elephant. *Proc. Zool. Soc.* 1893, 2.

BENEDIKT, M. Vergleichende Anatomie der Gehirnoberfläche. *Real-Encyclop., Encyklop, Jahrb.* III.

BERGONZINI, C. Le scoperte recenti sulla istologia dei centri nervosi. *La Rassegna di sc. Med.* VIII, 7.

BINET, ALFRED. The Problem of Colored Audition, Translated for the Pop. Sci. Monthly from the Revue des Deux Mondes. *Pop. Sci. Monthly.* XLIII, 6. Oct. 1893.

BLAISDELL, J. J. Some Suggestions Concerning Methods of Psychological Study. *Transactions of the Wisconsin Academy of Sciences, Arts and Letters.* IX, Part I, 1892-93.

BREGLIA, A. Sulla possible provenienza e funzione delle fibre a mielina della commessura grigia posteriore nel midollo spinale dell' uomo. *Giorn. Assoc. Napolit. de Medic. e Natur.* III, 3-4.

BRISTOWE, H. C. Two Cases of Pachymeningitis Interna. *Journ. Mental Science.* XXXIX. N. S., 131. Oct., 1893.

BRISSAND, E. Anatomie du Cerveau de l' homme; morphologie des hemispheres cerebraux ou cerveau proprement dit. *G. Masson: Paris, with Atlas fol.*

BROWN-SEQUARD. Questions relatives à la physiologie de l' encéphale. *Arch. de Phys.* 2; 1893. Abs. in *Revue Neur.* I, 9, 15 May, 1893.

BULLEN, F. ST. JOHN. Inquiries into a variation of Type in General Paralysis. *The Journal of Mental Science.* April, 1893. Vol. XXXIX, No. 165. New Series, No. 129.

CALDERWOOD, HENRY. Evolution and Man's Place in Nature. *MacMillan & Co.* 1893.

CALENTONI. Gliosarcoma del cervelletto. *Giov. Internaz. delle Sci. Med.* 4, 1893. Abs. in *Revue Neur.* I, 9, 15 May, 1893.

CATTELL, JAMES MCK. The Progress of Psychology. *Pop. Sci. Monthly.* XLIII, 6. Oct., 1893.

CHATIN, J. Sur les noyaux cerebraux des Myriopodes. *Compt. R. Acad. Sc.* CXVII, 5.

CHIEWITZ, J. H. Oversigt over de nyere Untersogelser om Nervensys temets Sammensætning. *Biblioth. f. Læger,* Kjobenh., IV, 7.

CLAUS, A. AND STRICHT, O. VON DER. Contribution à l'étude anatomique et clinique de l' accomégalie. *An. et Bul. de la Soc. de Med. de Gand.* 71 and 72, 1893. Abs. in *Revue Neur.* I, 9, 15 May, 1893.

COCHE. Hysteria and Chorea. *Thesis, Paris,* 1892.

COHN, T. Klinischer Beitrag zur Kenntniss des Faserverlaufs im verlängerten Mark. *Berlin. Klin. Wochenschrift.* XXX, 33.

COLELLA, R. Sulla istogenesi della neuroglia nel midollo spinale. *G. Med. di Pavia.* II, 2.

GOMEGYS, C. G. A Healthy Brain is Necessary to a Free Will. *Journal of the American Medical Association.* Sept. 17, 1892.

COWAN, J. J. Two Cases of Abnormal Development of the Scalp. *Journal Mental Sci.* XXXIX. N. S., 131, Oct., 1893.

COX, CHARLES N. The Treatment of Atrophic Rhinitis. *The Brooklyn Medical Journal.* VII, 9, 93.

DARKCHEVITSCH AND VEIDENGAMMER. Replacement of the Disc of the Cranium after Trephining. *Vratch.* 27-29, 1892.

DELBŒUF, M. J. The Psychology of Lizards. *Pop. Sci. Monthly.* XLIII, 5. Sept., 1893.

DISSE, J. Ueber Die Spinalganglien der Amphibien; 2 Figs. *Anat. Anz. Ergänzungsheft.* VIII, 1893.

EBERTH. Die Nerven der chromatophoren. *Anat. Anz. Ergänzungsheft.* VIII, 1893.

ELLIS, W. G. The Amok of the Malays. *The Journal of Mental Science.* XXXIX, 166 (N. S., 130). July, 1893.

EXNER, SIGNI. Die Innervation des Musculus Cricothyroideus. *Archiv* *für Path. Anat. und Phys. und für Klin. Med.* 11 March, 1893. Abs. in *Revue Neur.* I, 9, 15 May, 1863.

FALCONE, C. Sopra una particolarita della corteccia del cerveletto nel Thymnus vulgaris. *Monit. Zool. Ital.* IV, 6.

FERE, CH. La Pathologie des Emotions. *Journ. Mental Science.* April, 1893. XXXIX, 165.

FERE, CH. Troubles de la Motilité des Organes de la Voix et de l'articulation chez les Sourds Muets. *Revue Neur.* I, 9, 15 May, 1893.

FERREO, GUILLAUME. Criminal Festivals. *Popular Science Monthly.* XLIII, No. 6, Oct., 1893.

FERGUSON, JOHN. Some Remarks on Epilepsy. *Alienist and Neurologist.* XIV, 2, 1893.

FOY, G. Hypertrophy of Scalp. *Journ. Mental Sci.*, XXXIX, 131, Oct., 1893.

GALTON, F. Hereditary Genius. Second Edition.

GIANELLI, L. Nuovo processo di topografia della scissura di Rolando con una cenno storico ed esame critico dei processi noti di topografia cranio-cerebrale. Sienna. 88 p.

GOODALL, EDWIN. The effect upon Mental Disorder of Localized Inflammatory conditions. *The Journal of Mental Science*, April, 1893, Vol. XXXIX, No. 165. New Series, No. 129.

GORONOWITSCH, N. Untersuchungen über die Entwickelung der sogenannten Ganglienleisten im Kopfe der Vögelembryonen. *Morph. Jahrb.* XX, 2.

GRADL, H. Eye symptoms, diagnostic significance of; and etiology of eye diseases. *Reference Hand-Book of the Medical Sciences*, Vol. IX. Supplement.

HAMMOND, G. Subcutaneous Injections of Cerebrine in Tabes. *New York Med. Journ.*, April, 1893.

HANDFORD, H. Muscular Atrophy following Peripheral Neuritis. *Brit. Med. Journ.*, Nov. 19, 1892.

HART, ERNEST. Hypnotism, Mesmerism, and the New Witchcraft. *N. Y. D. Appleton & Co*, 1893.

HAYCRAFT, J. B. A New Hypothesis Concerning Vision. *Proc. Roy. Soc.*, LIV, 327, Oct. 28, 1893.

HELD, H. Die centrale Gehörleitung. *Arch. Anat. u. Entwicklungsg.*, 1893, 3, 4.

HERRICK, C. JUDSON. Recent Advances in the Study of the Nervous System. *Trans. 24th and 25th Annual Meetings of Kansas Acad. Sci.*, 1893.

HERRICK, S. S. Heredity. *Reference Hand-Book of the Medical Sciences*, Vol. IX. Supplement.

HIS, W. Ueber das frontale Ende und über die natürliche Eintheilung des Gehirnrohres. *Verhandl. Anat. Gesellsch.* 7 Versam. Göttingen.

HIS, W. Ueber das frontale Ende das Gehirnrohres. *Arch. f. Anat. u. Entwickel.*, 1893, 3, 4.

HIS, W. Vorschläge zur Eintheilung des Gehirnes. *Arch, f. Anat. u. Entwickl.*, 1893, 3, 4.

HOMEN, E. A. A case of sarcoma of the pituitary gland. *Finska Läkaresallskapets Handlingar*, XXXV, 1893. Abs. in *Revue Neur.*, I, 9, May 15, 1893.

HILL, ALEX. The Hippocampus. *Philos. Trans.*, Vol. 184, 1893, B, pp. 389-429.

HILL, ALEX. The Cerebrum of Ornithorhynchus paradoxus. *Philos. Trans.* Vol. 184, 1893, B, pp. 367-387.

HOUGBERG, E. A case of hemorrhage in the corpus callosum. *Finska Lăkaresallskapets Handlinger*, XXXV, 4, 1893. Abs. in *Revue Neur.*, I, 9, May 15, 1893.

HUGHES, C. H. Address of the President of the Section on Neurology and Psychiatry of the First Pan-American Medical Congress. *The Alienist and Neurologist*, St. Louis, Oct., 1893.

HUGHES, C. H. Erotoparthia—Morbid Erotism. *The Alienist and Neurologist*, St. Louis, Oct., 1893.

HUXLEY, THOMAS H. Evolution and Ethics. *Pop. Sci. Monthly.* XLIV, Nov., 1893.

JAMIESON, G. A New Psychology. An Aim at Universal Science. Edinburgh, 1890.

JANET, PIERRE. Etat Mental des Hysétriques. *The Journal of Medical Science*, Vol. XXXIX, No. CLXVII. New Series, No. 131.

JANET, P. Etat Mental des Hystérique les Stigmates Mentaux. Paris, 1892.

JHOMSON and BRUCE. Spinal Muscular Atrophy. *Edinburgh Hosp. Rep.*, 1893.

JACOBSON, D. E. Some singular cases of hemiplegia without corresponding cerebral foci. *Hospital-Stidende*, 1893. Abs. in *Revue Neur.*, I, 9, May 15, 1893.

JURY, J. O. Nervous Phenomena exhibited consequent to Dental Operations. *St. Louis Med. Journ.*, LXV, 2, Aug., 1893.

KOCH, J. L. A. Die Psychopathischen Minderwertigkeiten. *The Journal of Mental Science*, Vol. XXXIX, No. CLXVII. *New Series*, No. 131.

KOLLMANN, J. Ueber Spina bifida und Canalis neurentericus. 6 Figs. *Anat. Anz. Ergänzungsheft*, VIII, 1893.

KREIDL, A. Weitere Beiträge zur Physiologie des Ohrlabyrinthes. *Sitz. d. Akad. d. Wissensch. Wien.*, CI, 8-10, 1892,

KUFFNER, CHARLES. Contribution to the Pathologic Anatomy of the Idiotic. *Casopis lékaru ceskych*, 6–13, 1893, Abs. in *Revue Neur.*, I, 9, 1893.

LANGLEY, J. W. Prelimary Account of the Arrangement of the Sympathetic Nervous System, based chiefly on Observations upon Pilo-motor Nerves. *Proceedings of the Royal Society*, Vol. LII, No. 320.

LEA, HENRY CHARLES. The Spanish Inquisition as an Alienist. *Pop. Sci. Monthly*, XLIII, 3, July, 1893.

LEGGE, F. Contribuzione allo studio della connessioni esistenti fra le diverse cellule della sostanza nervosa centrale. *Boll. d. R. Accad. med. di Roma*, XIX, 2.

v. LENHOSSEK, M. Die Nervenendigungen im Gehörorgan. *Anat. Anz. Ergänzungsheft*, VIII, 1893.

LEWIS, Dr. BEVAN. An improved Reaction-Time Instrument. *The Journal of Mental Science*, Vol. XXXIX, No. CLXVII. *New Series*, No. 121.

LOMBROSO, C. and FERRERO, G. La Donna Delinquents la Prostituta e la Donna Normale. *The Journal of Mental Science*, Vol. XXXIX, No. CLXVII. *New Series*, No. 131.

LYMAN, H. L. Nervous Dyspepsia. *The Review of Insanity and Nervous Disease*, III, 3 and 4 March and June, 1893.

MACDONALD, A. Criminology. New York. Funk and Wagnals. 1893.

MACFARLANE, A. The Duty of the State to the Insane. *Popular Science Monthly*. Vol. XLIII, No. 6. Oct. 1893.

MANOUVRIER, L. Description du cerveau d' un Tabitien. *Assoc. Franc. pour l' avanc. d. Sc.* 21st Session, 1893.

MARKWALD. Ueber einen Fall von Pachymeningitis haemorrhagica. *Bericht der Oberhessischen Gessellschaft*. XXIX, 1893.

MARRACINO, A. Contributo all' istologia comparata della corteccia cerebrale. *Giovnale della Associazione Napoletana di Medici naturalisti*. IV, 1, 1893.

MAUDE, A. Peripheral Neuritis following Alcoholism. *Brit. Med. Journ.* Feb. 8, 1893.

MAYER, C. Beitrag zur Kenntnis der aufsteigenden Degeneration motorischer Hirnnerven beim Menschen. *Jahrb. f. Psychiatrie*. XII, 1.

MINGAZZINI, G. The Finer Structure of the Spinal Cord in Man. *Revista Sperimentale*. XVIII, III and IV. Dec. 1892.

MINGAZZINI, G. Descrizione di un cervello umano anomalo. *Ric. f. nel labor. di Anat. norm. d. R. Univ. di Roma*. III, 2.

MINOR, JAMES LANCELOT. Eye Diseases, Nomenclature and Statistics of. *Reference Hand-Book of the Medical Sciences.* Vol. IX. Supplement.

MINOT, CHARLES SEDGWICK. Structural Plan of the Human Brain. *Pop. Sci. Monthly.* XLIII, 3. July. 1893.

MEYNERT, T. Neue Studien über die Associationsbundel des Hirnmantels. *Sitzb. d K. Akad d. Wissensch. Wien.* CI, 6-7, 1892.

NORDAN, MAX. Entartung. *The Journal of Mental Science.* April, 1893. Vol. XXXIX, No. 165 N. S. No. 129.

ORD, W. M. Muscular Atrophy following Peripheral Neuritis. *The Clinical Journal.* Feb. 8, 1893.

OSBORN, HENRY FAIRFIELD. Heredity in the Ovum and Spermatozoön. *Reference Hand-Book of the Medical Sciences.* Vol IX. Supplement.

PALADINO. Della continuazione del nervoglio nello scheleteo mielinico della fibre nervose e della costituzione pluricellulare del cilindrasse. *R. Accad. di sci. fis. e nat.*, Napoli, 1893. Abs. in *Revue Neur.* I, 9, 15 May, 1893.

PATERSON, A. M. Origin and Distribution of the Nerves of the Lower Limb. *Journ. Anat. and Phys.* XXVIII (N. S., VIII), 1. Oct., 1893.

PATTEN, W. On the Morphology and Physiology of the Brain and Sense Organs of Limulus. *Quart. Journ. Micros. Science*, XXXV, 137.

PENZO, R. Ueber das Ganglion geniculi und die mit demselben zusammenhangenden Nerven. From Anat. Instit. University in Padua. *Anat. Anzeiger*, VIII, 21, 22.

PIGCHINI. Grosso tumers cerebrale nella regione rolandica sinistra senza corrispondenti fenomeni paralitici. *Arch. ital. di clin. med.*, 1893. Abs. in *Revue Neur.*, I, 9, 15 May, 1893.

PITRES, A. Gangrine Spontanie des Orteils chez un Tabetique. *Revue Neur.*, I, 9, 15 May, 1893.

PONS, CL. SALARY. La corteza cerebral de las aves, Madrid, N. Moya.

POPOFF, N. M. Contribution à l'Etude de la Structure du Chiasma des Nerfs Opticus chez l'homme. *Wratch*, 1-3, 1893. Abs. in *Revue Neur.*, I, 9, 15 May, 1893.

RABL-RUCKHARD, H. Der Lobus olfactorus impar der Selachier. *Anat. Anzeiger*, VIII, 21, 22.

RENZI. Diabetic Neuritis. *Universal Med. Journ.*, VII, Sept., 1893.

REID, E. W. The process of secretion in the skin of the common eel. *Proceedings of the Royal Society*, Vol. LIV, No. 326.

RICARDI, P. Antropologia e Pedagogia. *Modena*, 1892.

RIEGEL. Ueber Lähmung der Glottiserweiterer bei multipler Hirn-und-Rückenmarkssklerose. *Bericht d. Oberhesseschen Gesel. f. Nat. u. Heilk.*, XXIX, 1893.

ROBERTSON, G. M. The Formation of Subdural Membranes, or Pachymeningitis Haemorrhagica. *Journ. Mental Sci.*, XXXIX, 166 (N. S. 130) July, 1893.

LE ROSSIGNOL, J. E. Malevolence in lower animals. *Ohio Univ. Bulletin*, I, 1, 1893.

ROSSI, U. Sui rapporti tra cervelletto ed ossa occipitale alla nascita. *Arch. l'anthropol. e la etnolog.*, XXIII, 1.

RYDER, JOHN H. The growth of Euglena viridis when constrained prin. cipally to two dimensions of space. *Contributions from the Zoological Laboratory of Univ. of Pennsylvania*, I, 1, 1893.

RUSSELL, J. S. R. An Experimental Investigation of the Nerve Roots which enter into the formation of the lumbo-sacral plexus of Macacus rhesus. *Proc. Roy. Soc.*, LIII, 325.

SALA, LUIGI, Ueber den Ursprung des Nervus acusticus. *Arch. mikrosk. Anat.* XLII, 1.

SANBURN, F. B. Insanity in Greece. *Journal Mental Sci.*, XXXIX, 166. (N. S. 130), July, 1893.

SARBO, A. Beitrag zur Localization des Centrum für Blase, Mastdarm und Erection beim Menschen. *Arch. f. Psych. u. Nervenkrankheiten*, XXV, 2.

SCHAFFER, C. Beitrag zur Histologie der Ammonshorn formation. *Mathem. u. Naturw. Berichte aus Ungarn*, X, 1891-92.

SCHAPER, A. Zur feineren Anatomie des Kleinhirns der Teleosteir. *Anat. Anzeiger*, VIII, 21-22.

SCHULZE, FR. EIL. Vorschläge zur Bezeichnung des Lage und Reichtung im Tierkörper. 4 Figs. *Anat. Anz. Ergänzungsheft.* VIII, 1893.

SEPPILLI, DR. GUISEPPI. Affections of the Temporal Lobe. *The Alienist and Neurologist.* XIV, 2, 1893.

SHERRINGTON, C. S. Note on the Knee-Jerk and the Correlation of Action of Antagonistic Muscles. *Proceedings of the Royal Society.* Vol. LII, No. 320.

SIMPSON, W. G. A Chronicle of Infant Development and Characteristics.

SPENCER, HERBERT. The Inadequacy of "Natural Selection." *Pop. Sci. Monthly.* XLII, 6. April, 1893.

STADERINI, R. Anomalie congenite di conformazione del sistema nervoso centrale. *Sperimentale.* XLVII, 3.

STAURENGHI, C. Corpi mammillari laterali nel oervello umano. *Atti d. Assoz. Med. Lomb.* 2.

STEARNS, H. P. Lectures on Mental Diseases Designed for Medical Students and General Practitioners. *The Journal of Mental Science.* Vol. XXXIX. No. 165. New Series, No. 129.

STEDMAN, HENRY R. Insanity of Puberty and Adolescence. *Reference Hand-Book of the Medical Sciences.*

STEVENS, GEO. T. Les Muscles moteurs de l' oeil et l' expression du visage. *Annales d' oculistique.* Oct., 1892.

STSCHERBACH, A. E. On the localization of the taste center in the rabbit. *Neurolog. Centralbl.* 8, 1894. Abs. in *Revue Neur.* I, 9, 15 May, 1893.

TEDING VAN BERKHOUT, HENRIETTE. Experimentell-anatomische Beitrag zu Kenntnis d. secundären Degeneration im Rückenmarke. *Inaug. Diss. Bern.*

THOMPSON, A. H. The Descent of Facial Expression. *Trans. 24th and 25th Annual Meetings Kansas Acad. Sci.* 1893.

TOURETTE, GILLES DE LA. Traite clinique et Therapeutique de l' Hysterie. *The Journal f Mental Science.* April, 1893. Vol. XXXIX, No. 165. (N. S., 129).

TURNER, JOHN. Some Further Remarks on Expression in the Insane. *The Journal of Mental Science.* April, 1893. Vol. XXXIX. No. 165. (N. S., No. 129.)

VASSALE AND LACCHI. The Pituitary Gland. *Rev. Sperimentale.* XVIII, III and IV. Dec., 1892.

XENTURI, S. Le Degenerazioni Psico-sessuali nella Vita degli individui e nella storia delle societa. *Turin.* 1893.

VIALET. Not sur l' existence, à la partie inferieure du lobe occipital, d'un faisceau d' association, distincte, le faiseau transverse du lobule lingual. *C. R. Soc. Biol.* S., 9, V, 28.

VITZOU, A. Sur les effets de l' ablation totale en un temps d' un hémisphére cérébral sur le chien. *Arch. de Phys.*, 2, 1893. Abs. in *Revue Neur.* I, 9, 15 May, 1893.

WADDELL, N. Some clinical notes on a case of tumor of the pituitary body. *The Lancet.* 22 April, 1893. Abs. in *Revue Neur.* I, 9, 15 May, 1893.

WENDT, EDMUND C. Ear: Operations upon Middle Ear. *Reference Hand-Book of the Medical Sciences.* Vol. IX. Supplement.

WENDT, EDMUND C. Ear Diseases, Nomenclature and Statistics of. *Reference Hand-Book of the Medical Sciences.* Vol. IX. Supplement.

WEISMANN, A. The Germplasm, a Theory of Heredity. Trans. by W. N. Parker. London, 1893.

WILDER, BURT G. Meninges (the Envelopes or Membranes of the Brain and Spinal Cord.) *Reference Hand-Book of the Medical Sciences.* Vol. IX. Supplement.

WILDER, BURT G. Brain. *Reference Hand-Book of the Medical Sciences.* Vol. IX. Supplement.

WILSON, J. T. On the Closure of the Central Canal of the Spinal Cord in the fœtal lamb. *Trans. Intercolonial Med. Congress.* Sydney, 1892.

WILSON, GEO. R. Druukenness. London, 1893.

ZIMMERMANN. Reconstructionszeichnung des Abducens, der ventralen Wurzelen des Glossopharyngeus und Vagus und des Hypoglossus eines menschlichen Embryo Anfangs des zweiten Monats. *Anat. Anz. Ergänzungsheft.* VIII, 1893.

------------------ Il Romanzo di un Delinquente Nato Milan, Chiesa e Guindoni, 1893. *The Journal of Mental Science.* Vol. XXXIX, No. CLXVII. New Series, No. 131.

The Disease of Inebriety from Alcohol, Opium and other Narcotic Drugs, Arranged and Compiled by the Amer. Assn. for the study of Inebriety. N. Y.