financial responsibility in acting as an agent in this exchange of teachers.

SCIENTIFIC BOOKS

Comparative Anatomy of Vertebrates. Adapted from the German of Dr. Robert Wiedersheim, Professor of Anatomy in Freiburg, by W. N. PARKER, Professor of Zoology in the University of Wales. Royal octavo, pp. 576, 372 figures. Macmillan and Co., 1907. Third edition, founded on the sixth German edition (pp. 800, 416 figures).

As indicated in the preface and upon the title-page, this is not a literal translation, but a reduced "adaptation," a more difficult task which also throws a greater responsibility upon the adapter. Although former editions have been—and this will doubtless be—consulted by investigators and teachers, that it was prepared chiefly for students is stated upon the title-page of the original and in the preface of the adaptation; its substance and form, therefore, may fairly be judged from the standpoint of those who seek information and who expect a text-book or reference-book to be not merely correct, but well arranged, clear, consistent and approximately complete. Furthermore, while the fact that a technical work of this size has reached a sixth edition in one language and a third in another constitutes a presumption of its general acceptability, it is likewise warrant for what, under other conditions, might seem hypercriticism. The reviewer takes the ground that there is no excuse whatever for lack of clearness or coordination, and that for inaccuracy the only valid excuse is the advance of knowledge since the volume went to press. He holds, also, that rigid and unsparing criticism of works like the present is required if biology is to compete educationally with the more exact sciences and with the languages. Recognizing his own limitations, the reviewer hopes that others may contribute, to the end that future editions in both languages may be beyond criticism in all respects.[1]

Like its predecessors in both languages, this volume excludes the Tunicates and the other lower Chordata; students would welcome some account of these comparatively recent recruits from the "invertebrate mob," or at least references to their treatment elsewhere.

The preface states that "this edition has been almost entirely rewritten." That the changes have not always been for the better is exemplified in the omission of the essential qualification mentioned later in connection with the brain of *Amphioxus*. Careful revision would have averted the need of the following comment. The discussion of the nature and origin of the limbs opens with a paragraph in which the problem is said in the original to have been "seit einer Reihe von Jahren im Vordergrund." In the second English edition this was rendered "attacked vigorously during the last thirty years." In the present edition the entire paragraph is reproduced, *verbatim;* its literal interpretation would eliminate the first third of the period named in its predecessor. The paper and press-work are creditable to the publishers; many of the cuts are original and most of them, whether pictures (Fig. 134), schemas (Fig. 339) or colored diagrams (Fig. 306), are artistic, clear and correct. The least commendable purports to represent the "placoid scales" (Fig. 30). Admittedly "semi-diagrammatic," it need not so nearly resemble a segment of a rather roughly constructed harrow. Among figures in the original that are omitted from the adaptation are the skeletons of the pterodactyl (Fig. 37), *Archæopteryx* (Fig. 19) and *Stegosaurus* (Fig. 30). Among those added to the original are the meroblastic ovum (Fig. 4) and the "diagrammatic longitudinal section of a vertebrate" (Fig. 11).

Respecting this last, criticism is mainly from the pedagogic standpoint, bearing in mind that it occurs at the threshold of a work intended primarily for students. It faces the original's "diagrammatic transverse section." This is very simple and purely schematic,

[1] Some suggestions as to the improvement of the previous edition were made by the reviewer in *The Nation* for October 28, 1886, and an indication of his disappointment may be found in the same periodical for February 13, 1908.

omitting even the heart or a ventral venous trunk representing it. The other is comprehensive and complicated, yet omits the great veins, dorsal and ventral, and even the aorta, the only viscus in the transection besides the enteron; in brief, the two sections are not correlated. Finally, the spleen and the pancreas are so represented as to give the distinct impression of a single continuous organ with a hole at the smaller end. As in most works of the kind, comparable figures are often reversed in direction. Without insisting unduly upon conformity with the practise of the elder Agassiz,[2] for students such reversals are often confusing, especially where different sets of abbreviations are used for the same parts, as in Figs. 149 and 150, 160 and 161, 172 and 173.

In the introduction of sixteen pages, after definitions and general considerations, vertebrate ontogeny is outlined, all too briefly for the student; indeed, only one already familiar with the facts would comprehend either the conversion of the blastula into the gastrula, or the formation of the notochord and neural tube. And what impression would be made upon the average reader as to the dependability of biologic science by the statement (p. 5) that "In all vertebrates the blastophere passes—or did so in earlier times—into," etc., with no "probably" or corresponding German word to indicate that, however well founded, our belief is pure hypothesis, unproven and unprovable? The "general classification of the principal vertebrate groups," although occupying more space than in the original, and with two thirds of page 15 left blank, absolutely ignores extinct forms, even some that are discussed in the text, *e. g., Archæopteryx* (p. 60), *Hesperornis* and *Ichthyornis* (123, 318), *Stegocephali* (142, 148), *Pleuracanthus* (145), *Ichthyosaurus* and *Plesiosaurus* (163). The introduction closes with a full-page "Table Showing the Gradual Development of the Vertebrata in Time." Like the original, it is said to be "modified from H. Credner," but there is no explanation of the further changes, especially the inclusion of the Amphibia and Reptilia in a single column.

The statement on page 63 as to the persistence of the human tail up to a certain embryonic size is undesirably condensed from the original (p. 65); it lacks the two instructive figures there given, and—like the original—it fails to note the presence of a perfectly distinct caudal appendage at a considerably later stage, even though it may not contain the original prolongations of the neural and enteric cavities. The several kinds of tails among fishes might well have received fuller treatment. The figure of *Protopterus* in the original is omitted from the adaptation, and neither portrays a typical heterocercal tail (sturgeons and most sharks), nor the very instructive developmental stages of the gar and some teleosts so fully made known by the younger Agassiz thirty years ago. The account of the relations of the ovaries to the oviducts in teleosts is not clear in the original (p. 559), and still less so in the adaptation (p. 466).

Some of the following features may not commend themselves to all, but they afford the reviewer considerable gratification: The distinct recognition of the importance of the olfactory portion of the brain (pp. 200 and 220); the omission of the "Isthmus rhombencephali" from the encephalic segments; the retention of the correct spelling, *Lepidosteus;* the use of coele and its compounds for the cavities of the brain, and of postcaval and precaval; and the avoidance of "*Anlage.*"

The following statements as to the brain are more or less defective, misleading or erroneous.

Page 201—"The middle commissure is present in mammals only." It exists in the alligator and in all turtles so far as the reviewer is aware. The succeeding paragraph as to the corrugations of the cerebral surface is worded even more loosely than the original; it implies that only the lateral aspect is so modified and that *pallium* and *cortex* are synonymous; fails to distinguish between total and partial fissures, and omits the concluding phrase of the

[2] See American Association for the Advancement of Science, *Proceedings*, 1873, p. 274.

original as to the concomitant increase of the conducting fibrous constituent.

Page 203—The original of the following sentence is characteristically German, but it might have been rendered into more straightforward English: "A series of unpaired ventricles lying in the longitudinal axis of the brain, as well as paired ventricles, can be distinguished."

Page 204—Without the figure that surely should have accompanied this very brief account of the brain of the lowest vertebrate an imperfect idea would be conveyed by the phrase, "kegelförmigen Auftreibung," rendered "conical and enlarged." The presence of an olfactory bulb, mesal at its base, but deflected to the left, never would be inferred from the statement that "the brain cavity opens freely to the exterior dorsally by a neuropore." In the previous English edition this free rendering of the original is properly qualified by the phrase, "in the larva," the omission of which from the present volume conveys an error as radical as would be embodied in the declaration, "man has a short triangular tail," without the qualification, "at a certain stage of development."

Page 210—The account of the selachian forebrain is not clear as to either the developmental stages or the various adult conditions; see also the commentary upon Figs. 157 and 158.

Page 213—As to the olfactory bulbs of teleosts, the original merely remarks (p. 249) in effect that they may be either sessile or pedunculate. The adaptation says "they are either closely applied to the telencephalon [forebrain] and contain a small ventricle, or they become differentiated into tract and bulb, as in elasmobranchs [selachians]." In the absence of any representation of the alleged olfactory ventricles the reviewer, recalling the artifact figured by him in the perch (A. A. A. S., *Proceedings*, 1875, Pl. 3, Fig. 14), apprehends that they may be as insignificant as those discussed the following year (p. 258), and scarcely deserving of the title; certainly, in neither form is there a patent cavity as in sharks and rays.

Page 214—The teleostean cerebellum is by no means always "extremely large"; and while in some, as the salmon (Fig. 160), it is "bent upon itself and overlies the medulla oblongata," in others, *e. g.*, perch, it is erect, and in still others, *e. g.*, catfish, it tilts forward upon the midbrain.

Page 227—The midcommissure may be "large" in most mammals, but in man it is notably small.

Page 228—In both the original and the adaptation it is assumed that the carnivoral cruciate fissure is homologous with the primatial central or Rolandic, but their comparable relation to the chief motor areas of the cortex by no means proves their morphologic identity.

Page 236.—In connection with the ordinary cranial nerves the original devotes two figures and the larger portion of pages 276 and 277 to the new "Nervus terminalis" of Locy (SCIENCE, Aug. 11, 1905, and earlier papers there cited). This was none too much in the opinion of the reviewer, whose appreciation of what he regards as an "epoch-making" series of observations has been briefly expressed in SCIENCE, May 26, 1905, p. 813. Yet the subject is disposed of in the present volume in a foot-note of six lines; the words "in the region of" are superfluous and misleading in respect to both the origin of the nerve in the terma ("lamina terminalis") and its distribution to the olfactory mucosa; worse yet, through a misprint for *Amia* (*Amiatus*) which does not occur in the original, the adaptation credits the nerve to the Anura, notwithstanding Locy's declaration that he searched for it in vain in the frog and toad.

Fig. 145—The uniform line between the two halves of the frog's brain fails to indicate the exceptional coalescence of the olfactory lobes, and there is no reference to the later figure, 164, *B*. In some respects Ecker's figure (145) is less satisfactory than those published in 1853 by Jeffries Wyman, apparently unknown to both author and adapter.

Fig. 148—Without challenging the usefulness of this schema of the three primary "cerebral vesicles" (*encephalic* is the natural equivalent of "Hirnbläschen" as well as more

correct in itself), surely in this connection should at least be mentioned the suggestive observations of Charles Hill as to the eleven neuromeres in teleosts and birds.

Fig. 149—Unless otherwise stated, a "longitudinal" section is assumed to be mesal, or sagittal and parallel with the meson, or at least in one and the same plane. Here the cerebral and olfactory regions are not in the same plane with the rest. No one would be more pleased than the reviewer to find a brain with a single olfactory tract and bulb on the middle line as—in the absence of qualification—is the case in this figure, the "ideal" key to the "real" brains that follow it. The dotted ellipse marked *Tho* ("optic thalamus") might fairly represent the midcommissure connecting the two thalami, but hardly those bodies themselves; see also under Fig. 152.

Fig. 150—In neither the original nor the adaptation is it stated what brain serves as the basis of this diagram.

Fig. 151—Here are five diagrams "illustrating the structure of the hypophysis" (pituitary body). They are not adequately explained in either the general text or the description, and the latter contains words, "chromophilous" and "chromophobic," which, like "chromaffin" (pp. 495–6) are neither defined nor included in the index. Even orientation of these diagrams is difficult since more complete figures with which they might be compared (150, 154, 161, 165, 172) head in the opposite direction.

Fig. 152—This diagram of the "ventricles," as if their roofs were removed, should be coordinated with Fig. 149. Here the side walls of the "third ventricle" might properly be designated *thalami*.

Fig. 153—In a diagram to illustrate the several flexures of the brain there is perhaps no great harm in representing the midbrain as if it were a flattened "lump" suggesting no organic relation with the adjoining segments. This figure, or some other, should exhibit the definite topographic relation of the principal (mesencephalic or cranial) flexure to the cephalic end of the notochord.

Figs. 157 and 158—To these representations of the dorsum, venter, left, and exposed cavities of a shark brain should have been added a midsection. The foramen so conspicuous on the venter is not named or even accounted for in the description or text; yet, as figured and described by the reviewer in 1876 (*Amer. Jour. Science,* Vol. 12, pp. 103–5) it is very significant in connection with the embryonic condition with most sharks and the permanent condition of the more primitive forms.

Fig. 159—From this brain of the gar, as usual with ganoids and teleosts, the telas are omitted, and their absence is hardly accounted for with sufficient clearness in the text. More serious is the lack of qualification respecting the interpretation of the cephalic portion. It is probable that the conditions are essentially the same as in the Teleosts with sessile olfactory bulbs, viz., the wider pair of solid lobes marked *prs.* are the striata, the smaller ones beyond (hollow in ganoids but practically solid in teleosts), the olfactory bulbs, and the so-called olfactory lobes merely the slightly enlarged beginning of the nerves. It is a reproach to the comparative anatomists of this country that the brain of this exclusively American form should not have been fully elucidated. The reviewer frankly accepts his share and admits the erroneousness of certain interpretations of 1875 (A. A. A. S., *Proceedings,* p. 179 and pl. 2); but in respect to the then prevailing non-recognition of the "morphological importance of the membranous or other thin portions of the parietes of the encephalic cavities" he made a general confession and promise of reform in a paper under the title quoted above, read before the Association of American Anatomists and published in the *Journal of Comparative Neurology,* October, 1891, pp. 201–3.

Fig. 163 represents the dorsum of the brain of *Ceratodus* (*Neoceratodus*), taken by the adapter (unaccountably the author gives no dipnoan brain) from Parker and Haswell's "Zoology." In that work it is said to be "chiefly from Sanders"; it is defective in several unspecified respects and bears no close resemblance to the only figure by that anatomist known to the reviewer, viz., in the

Annals and Magazine of Natural History, March, 1889, Pl. VIII.; a more satisfactory figure was published by Bing and Burckhardt in 1905 (*Jenaische Denkschrift,* Vol. IV., p. 518).

Fig. 164, *A, B, C, D*—From the originals these four views of the frog's brain are reduced somewhat, darker and less clear, especially as to the intercerebral fissure. The midsection (*D*) was taken by the author from the paper in the *Morphol. Jahrbuch,* Vol. XII., p. 239, by H. F. Osborn, who was careful to delimit the cut surface resulting from the division of the secondarily coalesced olfactory lobes; the dorsal part of this boundary is omitted in both the original and the adaptation.

Figs. 166 and 167—In all six of the figures of the brains of *Hatteria* and the turtle the slender tracts connecting the cerebral hemispheres with the olfactory bulbs are designated by I, the first of the cranial nerves, as if in the obsolete and misleading anthropotomic sense. The original has a midsection of the *Hatteria* brain, omitted from the adaptation. Both should have included midsections of the bird's and of the rabbit's or other simple eutherian mammal.

Fig. 170—On the ventral and lateral aspects of the rabbit's brain the primary fissure (*r. f.*) demarcating the olfactory tract and hippocampal lobe from the pallium ceases much sooner than in nature.

Fig. 171—In the dorsum of the dog's brain the olfactory bulbs are represented as if coalescent, as in frogs and toads. In the side view the bulb is inadequately demarcated from the tract. On the venter the trapezium is indistinguishable. On both sides the cruciate fissure is made continuous with another; if such a junction really existed in the specimen from which these pictures were made the exceptional feature should have been specified.

Fig. 172—This midsection of a marsupial brain is not in the original, the author of which dismisses with a brief foot-note the vexed question as to the representation of the callosum in implacental mammals. The adapter accepts the negative view of Elliot Smith, but is apparently so impressed by the resemblance of the "hippocampal or dorsal commissure" to the true callosum as to apply the title "splenium" to the rounded junction of the two component laminæ. Neither the original nor the adaptation represents the entire brain of any marsupial or monotreme.

Fig. 173, *A*—In both works this is the only representation of the mesal aspect of a eutherian brain. It is designated simply "human" and "Gehirn des Menschen." In the absence of qualification it would naturally be regarded as of natural size and adult.[3] It is, however (in the adaptation, not the original), said to be "mainly after Reichert." In that anatomist's "Der Bau des menschlichen Gehirns," 1859–61, as to dimensions and certain features it coincides with Fig. 38, a fetal brain estimated at 24–26 weeks; but there are omitted the occipital and calcarine fissures, always deep at that and even earlier stages; the shading is misleading as to the difference between ectal and ental areas, and whereas the cut surfaces of the fibrous pons and callosum are left blank the nearly fiberless midcommissure is conspicuously dotted.

Fig. 173, *B*—This lateral aspect of the adult human cerebrum reproduces Ecker's imperfect fissural schema of forty years ago upon a scale too small for usefulness; the faculty of articulate speech is, by implication, located in the orbital region rather than in the subfrontal ("Broca's") gyrus; there is no glimpse of the insula or hint of its existence under that name, now almost universally employed to the exclusion of the ambiguous "central lobe."

The climax of pictorial misrepresentation is reached in connection with the pons. This is rightly stated to be characteristic of mammals. As such, one would naturally expect it to be fully and clearly described and accurately portrayed. "In mammals the floor [of the oblongata] gives rise anteriorly to a transverse

[3] Compare, in the original of the "B. N. A." (*Archiv für Anat. u. Physiol.,* Anat. Abth., Suppl. Band, 1895), the designation by His of Fig. 20 as "fötales . . . aus dem dritten Monat." It might possibly be at term, but is more probably adult.

band of fibers (pons Varolii)" (p. 203). "The two lateral lobes of the cerebellum are connected by a large commissure, the pons Varolii; this extends round the medulla oblongata ventrally and is more largely developed the higher we pass in the mammalian series" (p. 229). From this and from the subjoined "diagram of the chief systems of fibers of the human brain" there would be gained the impression that the pontile[4] fibers all cross from one cerebellar hemisphere to the other, whereas at least an equal number decussate and either end in pontile cinerea or become deflected to a sagittal direction. In further diminishment of the usefulness of this figure to the uninformed, the fibrous connections of the cerebellum are called "crura" in the description but "peduncles" in the text. Granting, however, that histology is subordinate in a work of this kind, are macroscopic features of the part in question more satisfactorily dealt with? In Fig. 171, the dog's brain, the area corresponding with the pons is fairly well defined, but the line shading gives the impression of a longitudinal direction of the fibers. On the preceding page the figure of the rabbit's brain embodies not only a *suppressio veri,* but a *suggestio falsi.* There is not the least indication of a pons; on the contrary, the mesal furrow is even more marked than in the pons-less bird on the opposite page, and at either side is a longitudinal line as if the lateral margin of an "anterior pyramid." This same figure occurs in former German and English editions, and in the author's "The Structure of Man," with no intimation of its defects; it is also reproduced in both the "Text-book" and the "Manual" of T. J. Parker and Haswell, although correct —if less artistic—pictures of the rabbit's brain are given in T. J. Parker's "Zootomy" and other elementary treatises. The repetition of such a travesty is susceptible of three explanations, viz., either (*a*) the author and the adapter are unaware of the existence of the pons in the rabbit, or (*b*) they have overlooked its omission by the artist, or (*c*) they are indifferent to the just claims of the student for reliable information upon a feature that distinguishes the mammals from all other vertebrates.

The extensive and well-arranged bibliography of the previous edition has evidently been augmented and probably embraces the six hundred additional titles of the last German edition; but there are signs of carelessness in, *e. g.,* the inclusion in the literature of the brain of mammals (p. 528, fifth from foot) of a title referring exclusively to the amphibian brain.

An inserted slip disposes of twenty-six errata. As indexes go, perhaps this volume is not conspicuously deficient; yet probably the following are not all the omissions that might be found: appendix (vermiformis), 311; bends (flexures) of the brain, 204; callosal fissure, 225; central lobe, 227; central sulcus, 228; chromophilous and chromophobic, Fig. 151; chromaffin, 495, 496 and 247; cirri, 312; cortex and olfactory cortex, 220; cruciate sulcus, 228; crura cerebelli, 229; diacœle, 210; flexures of the brain, 204; hippocampal fissure, 225; insula (central lobe), 227; mantle, 200; mesocœle, metacœle and myelocœle, 210; ossa mentalia, 135; paracœle, 210; peduncles of cerebellum, 229; pineal cushion, 201; piriform lobe, 228; postcaval and precaval, 426; rhinal fissure, 225; telocœle, 210; thorax, form of, 70; Zirbelpolster, Fig. 150; about thirty, far too many for either a text-book or a work of reference.

Notwithstanding the deficiencies above enumerated, the present is the best English treatise upon vertebrate anatomy, as the original is the best German. The reviewer sincerely hopes to greet a later faultless edition.

Burt G. Wilder

[4] This is the regular English form (Anglo-paronym) of the Latin *pontilis,* the only correct adjective from *pons;* yet certain medical and scientific writers persist in using *pontal, pontial, pontic, pontine* and *pontinal.*

SCIENTIFIC JOURNALS AND ARTICLES

The April number (volume 9, number 2) of the *Transactions of the American Mathematical Society* contains the following papers: