

Behrens and Samassa describe for the Salmonidæ, exists in the egg of the catfish.

3. After horizontal cleavage occurs, the lower cells resulting from this division retain their continuity with the yolk, as has been described by Kowalewski, Hoffman and Berent (Teleosts) and Dean (Ganoids). These partial cells (merocytes) continue to divide by mitosis both horizontally and vertically. In the former case, the upper of the products of division is added to the germ-disc. This process of supplementary cleavage continues until a late segmentation stage, cells being added to the whole lower surface of the germ-disc.

4. The periblast arises from the residual portion of the merocytes after supplementary cleavage has ceased, being thicker under the margin of the germ-disc, but present elsewhere from the beginning.

5. The periblast is trophic in its function, playing only an indirect part in cell-formation. Normal mitosis soon gives place to abnormal and this in turn to amitosis. Transitional forms occur.

6. The subgerminal space (segmentation cavity) does not appear till about time of origin of germ-ring. At close of segmentation, yolk and blastodisc are in close contact in well-preserved specimens, although no longer continuous with one another. Clefts which early appear between blastomeres or below them are probably artifacts. If not, they disappear later.

7. The germ-ring (mesentoderm) arises primarily as a marginal ingrowth due to cell-proliferation from germ-wall (Randwulst). The germ-ring also receives abundant additions from the overlying primary germ-layer, even at considerable distance from the periphery. (See Reinhard, Arch. f. Mikr. Anat., 1898.)

8. The whole germ-ring, extra-embryonic as well as embryonic, contains both entodermal and mesodermal elements (*contra* H. V. Wilson and Samassa).

9. Kupffer's vesicle arises, as in the Salmonidæ, as a cavity completely shut in by cells from the first. It is at first much compressed horizontally and distinctly bilobed. In embryos with a short tail it is still to be seen near tip of the latter, strongly suggesting neurenteric canal of Selachii. A second vesicle, situated in yolk under the posterior end of the embryo, appears slightly in advance of Kupffer's vesicle and reaches a size exceeding the latter. It is bounded by periblast and perhaps contains more fluid yolk for service of the growing end of embryo.

Respiratory and Breeding Habits of Polypterus Bichir. N. R. HARRINGTON.

ON physiological grounds *Polypterus* is as fully qualified for a 'lung-fish' as are any of the Dipnoans; it has also striking resemblances in its circulatory and respiratory system to the *Urodela*. These points were demonstrated by means of mounted preparations, the injecting of which had been done in the field principally by Dr. Reid Hunt.

Beside the blood-supply to the lungs (which is from the last branchial arch), the dissections showed the very large *glottis*, or ductus pneumaticus, by which the lungs open ventrally from the œsophagus. Unlike the swimming-bladder of fishes in another respect, both the lungs are entirely invested with peritoneum, although one of them, the right, does occupy the normal position for an air-bladder, viz., between the aorta and kidneys, on the one hand, and the alimentary canal, on the other. The mesentery, however, in which the left lobe should be suspended, has almost entirely degenerated, and this somewhat smaller lobe lies entirely free in the body-cavity.

It was pointed out that, while the strongest disproof of the Dipnoan ancestry of the Amphibia lies in the paleontological evidence which indicates that they are a parallel line, the same conclusion may be in-

ferred from the life habits of a form which encysts during periods of drought. For the ability to undergo suspended animation necessitates such specialization that it is improbable that evolution operated through such an encysting form (which is absolutely helpless and inactive until it is set free into the water), in bringing about a vertebrate which breathed air the year around.

Reference was also made to the breeding habits of *Polypterus*, and an accessory copulatory organ in the male—a modified anal fin—was described. The breeding season follows the inundation of the Nile.

The general collections, some of which were exhibited, brought back by the Senff zoological expedition, are intended for general distribution to qualified investigators, who can work up the material within a reasonably short time. Aside from a large collection of Nile fishes, there is material preserved for researches in embryology, electric organs, pseudo-electric organs, neurology and Plankton.

The Coronary Vessels in the Hearts of Fishes.

G. H. PARKER and F. K. DAVIS.

THE muscular substance of the heart in mammals receives its blood from a pair of coronary arteries which connect with coronary veins opening into the right auricle. The inner surfaces of the four chambers of the mammalian heart have upon them openings which lead into vessels connecting with the coronary capillaries, and especially with the veins. These vessels are the veins of *Thebesius*. Is there a similar system of vessels in fishes? Coronary arteries were identified in the common skate, the sand shark and the mudfish (*Amia*). In the skate they may come from various combinations of the efferent branchial arteries of the second to the fifth gill cleft; in the sand shark, from combinations reaching from the first to the fifth

clefts; in the mudfish, from the second branchial arch. In these three species coronary veins occur, all of which open into the venous sinus. On inflating these, bubbling was observed from the natural inner surfaces of the auricles and sometimes from those of the ventricles. These fishes, therefore, have veins of *Thebesius*.

Longitudinal Fission in Metridium marginatum. G. H. PARKER.

TEN animals with double mouths were studied. Two had each two mouths on one oral disc, and the pedal ends of their oesophageal tubes were united. Eight had each completely separate oral discs and oesophageal tubes. In six the mouths were monoglyphic; in three one mouth was monoglyphic and one diglyphic, and in one one mouth was monoglyphic and one aglyphic. There were about twice as many pairs of complete mesenteries as in single-mouthed individuals. Double specimens are not the result of fusion, for the two partial individuals are strikingly similar in color, etc., a condition unlikely of occurrence in chance combinations of so variable a species. They may be monstrosities or dividing animals. One specimen nearly divided was kept under observation two months, but showed no advance in the process. In good collecting localities isolated pairs agreeing in color, marking and sex may be found. This evidence favors the view that *M. marginatum* reproduces, by longitudinal fission, a process slowly accomplished, but it does not exclude the possibility of some double specimens being monstrosities.

Additional Characters of Diplodocus. HENRY F. OSBORN.

THIS is one of the three types of herbivorous Sauropoda or Cetiosauria, represented by a very considerable portion of the skeleton of one individual found by Barnum Brown and the writer in 1897. The scapula, ilium, ischium and femur are associated with