On the development and morphology of the actual skeleton of vertebrates: Charles S. Minot.

The author reported observations upon the embryos of man and other mammals, of the chick, and of fishes, which demonstrate the existence of a continuous cartilaginous perichordal rod, for which the term *chondrostyle* is proposed. The chondrostyle is probably the primitive stage, out of which the chondrocranium is developed where there are no myotomes, and out of which vertebral arches, and later vertebral bodies are developed, where the myotomes are persistent.

The arrangement of the mammary glands in litters of unborn pigs: G. H. Parker and C. Bullard.

An examination of 1000 litters of unborn pigs showed that the numbers in the litters varied from one to fifteen, the most usual number being six. As there were in all 5970 pigs the average number per litter was 5.97. Of the 5970 pigs examined, 2947 were females and 3023 males, or for every 1000 females there were about 1026 males. In the males the nipples varied from nine to eighteen, the most usual number being twelve and the average 12.434. In the females the nipples varied from eight to eighteen, the most usual number being twelve and the average 11.908. Litters of eight or less would always find ample milk accommodations. Litters larger than eight might be too numerous for the best milk accommodations, and as the number of nipples is not significantly larger in litters of large size than in those of small size, this lack of adjustment must at times be realized.

In abnormal carapace in the sculptured tortoise: G. H. Parker.

An abnormal carapace of the common sculptured turtle showed at the posterior end of the series of marginal scutes, both right and left, two scutes in place of three, and in the middle of the carapace five bony segments in place of six. The variation in the bony segments is in mesodermic structures and lies anterior to the region of scute variation which is in ectodermic parts. As the ectoderm in tadpoles is known to migrate posteriorly over the mesoderm, it is possible that the same may occur in turtles and that the two regions of variation separated in the adult may have been in an earlier stage at the same transverse plane and induced by the same cause.

The trigemino-facial ganglionic complex of Gadus and Amiurus: C. Judson Herrick.

The details of the composition of this complex as worked out by the author in Menidia, differ in some respects from those given by most other recent students of the cranial nerves of fishes. He accordingly, for purposes of control, worked out microscopically on Weigert sections the composition of the trigemino-facial complex in the cod-fish very fully and of the cat-fish somewhat less exhaustively. In both of these cases the results of this examination show very clearly that the plan of these nerves, and indeed of the peripheral nervous system as a whole, is fundamentally the same as in Menidia, with only unimportant variations in detail.

In Gadus and Amiurus the trigeminus is as in Menidia, save that the Gasserian ganglion is intra-cranial. In all of these types the facialis has three roots, motor, lateralis and communis, the latter being large in Gadus than in Menidia, and much larger still in Amiurus. In Gadus the geniculate or facial ganglion is crowded close to the Gasserian, yet clearly separable from it. It is intra-cranial and gives rise to the same nerves as in Menidia, except that it contributes nothing to the hyomandibular trunk and does contribute to the r. mandibularis V. The sympathetic system

in this region is sharply separable from the cerebro-spinal, and there is no evidence that the facial ganglion is in process of transformation into a sympathetic ganglion. In Amiurus the geniculate is much larger and crowded still more closely up to the Gasserian. It can however be clearly shown that the r. lateralis accessorius in both Gadus and Amiurus is composed mainly of communis fibers and receives no fibers from the Gasserian ganglion.

From these results, and those of Strong, Kingsbury and others, it appears that the peripheral nervous system of Menidia presents us with a paradigm applicable in the broad view to the Ichthyopsida as a whole.

The Teleost gastrula and its modifications: F. B. SUMNER.

The prevailing view that the germ-ring alone furnishes the mesoderm and the entoderm must be revised, as well as the view that in teleosts, the periphery of the plastoderm represents the whole blastopore.

A specialized portion of the blastopore occurs at the posterior end of the embryonic shield a little anterior to the margin. In *Muræna* and probably some other fishes, this takes the form of an open invagination of the 'Deckschicht.' The cell thus invaginated becomes the gut hypoblast. The cavity persists for a while as that of Kupffer's vesicle. Thus Kupffer's original account, written in 1868, was very near the truth, although ignored or rejected by most of his successors.

In the cat-fish, trout and some others this blind sac is replaced by a solid ingrowth, such as Kowalewski described for the gold-fish. Kupffer's vesicle is formed in this mass of cells which, in the trout, at least, probably furnishes the whole gut epithelium.

In the case of *Scorpæna* and probably many other pelagic fish eggs, this reduction has still further progressed, and we find at the posterior middle point of the blastoderm a small nodule of cells, causing a thickening of the 'Deckschicht.'

The present writer finds a condition in *Amia* quite comparable to that in *Muræna*. Although the egg of the former is holoblastic, its gastrula is very like that of the Teleosts and far different from that of the Amphibia. Dean has already pointed out in *Amia* the homologue of Kupffer's vesicle. The present writer also finds a rudimentary syncytium or periblast with giant nuclei.

On the embryology and phylogeny of Chimæra: BASHFORD DEAN.

The embryology of a chimæroid throws interesting light on the relations of this doubtful group. By this means the characteristic structures of Holocephali are shown to have arisen from distinctly Selachian conditions: the palato-quadrate in *Chimæra colliei* is thus early separate from the cranium: the frontal clasper is to be regarded as the homologue of a spine of first dorsal fin, which in ontogeny, owing to the precocious growth of the enormous eyes, shifts into its anterior position: the dental plates arise from separate anlagen, which in general are in the adult represented by the tritoral areas.

C. colliei spawns near Monterey, California, throughout the entire year, in deeper water (about 75 fathoms, sp. gr. 1.027, 55° F.). It deposits two eggs almost simultaneously. First cleavage about 26 hours after egg is deposited: early cleavages separated by intervals of from 3 to 6 hours. The young escapes from the egg-case in about 250 days. Polyspermy occurs. Blastula and gastrula distinctly shark-like. Early embryo with broad medullary folds. After closure of folds embryo differentiates as chimæroid. Eye increases enormously in size, altering the shape of the head, and accompanies ventral displacement and ob-