

On the Circulatory System of Spatangus purpureus.

By M. R. KÖHLER.

The buccal aperture of *Spatangus purpureus* is surrounded by two vascular rings—an outer one, belonging to the blood-vascular system, and an inner one, belonging to the ambulacral system. The same arrangement recurs in the ambulacra.

Hoffmann's branch of communication, which connects the intestinal vessel with the only peribuccal ring described by that author, really divides at the level of the mouth into two branches, one of which opens into the sanguiferous ring, and the other into the ambulacral ring.

In the same way the sand-canal is double in that part of it included between the opening of the mouth and the extremity of the œsophagus; it is formed of two canals placed close together, each of which opens into the corresponding peribuccal ring. At the level of the extremity of the œsophagus (first curvature) these two canals unite in one, which continues simple as far as the point where the second convolution of the digestive tube joins the third. Beyond this region it becomes partitioned off again into several secondary cavities, four or five in number, at the moment of its arrival at the organ commonly called the heart, in which it loses itself. It becomes reconstructed after having traversed this organ, and reaches the madreporic plate in the form of a slender canal of peculiar structure.

The supposed heart is a spongy organ, the interstices of which become completely filled when the sand-canal is injected. It is composed of connective tissue supporting numerous nuclei and elements like those of the blood and of the general cavity. Are we to regard this organ as a sort of blood-vascular gland? or simply as an organ of secretion? The so-called membrane which surrounds the extremity of the sand-canal and unites it with the madreporic plate also appears rather to be a gland in connexion with that canal. It presents a structure analogous to that of the heart.

The digestive tube receives the blood from the inner and outer marginal vessels. It only possesses vessels in the region included between the first orifice of the siphon and the origin of the third convolution; the œsophagus, the third convolution, and the rectum do not receive a single one. Moreover, where the vessels exist, their distribution is far from being so regular as figured by Hoffmann. The ventral surface of the second convolution receives no vessel, except in the neighbourhood of the orifice of the diverticulum and on each side of that organ; it is the dorsal surface that receives the greater part of the vessels. The intestinal vessel of Hoffmann, which, according to him, furnishes vessels to the stomach, the third convolution, and the rectum, really dies out a little beyond the origin of the branch of communication without reaching the stomach, the vessels of which present the following arrangement:—The two marginal vessels of the second convolution form a very close plexus around the orifice of the diverticulum; and from this originate

two other vessels, which are continued on each side of the stomach as far as the siphon, and are united here and there by transverse anastomoses, on both the dorsal and ventral surfaces. Moreover the vessel which skirts the right border of the stomach* furnishes several small vessels which ramify over the mesenteric lamella extending from the diverticulum to the digestive tube. All these vessels afterwards unite in one trunk, which follows the diverticulum to the heart, between the sand-canal and the marginal vessel of the diverticulum, giving off to the right and left transverse branches, which place it in communication at once with the sand-canal and this marginal vessel.—*Comptes Rendus*, October 24, 1881, p. 651.

Jurassic Birds and their Allies. By Prof. O. C. MARSH†.

About twenty years ago, two fossil animals of great interest were found in the lithographic slates of Bavaria. One was the skeleton of *Archæopteryx*, now in the British Museum; and the other was the *Compsognathus* preserved in the Royal Museum at Munich. A single feather, to which the name *Archæopteryx* was first applied by Von Meyer, had previously been discovered at the same locality. More recently, another skeleton has been brought to light in the same beds, and is now in the Museum of Berlin. These three specimens of *Archæopteryx* are the only remains of this genus known, while of *Compsognathus* the original skeleton is, up to the present time, the only representative.

When these two animals were first discovered, they were both considered to be reptiles by Wagner, who described *Compsognathus*; and this view has been held by various authors down to the present time. The best authorities, however, now agree with Owen that *Archæopteryx* is a bird, and that *Compsognathus*, as Gegenbaur and Huxley have shown, is a Dinosaurian reptile.

Having been engaged for several years in the investigation of American Mesozoic birds, it became important for me to study the European forms; and I have recently examined with some care the three known specimens of *Archæopteryx*. I have also studied in the continental museums various fossil reptiles, including *Compsognathus*, which promised to throw light on the early forms of birds.

During my investigation of *Archæopteryx*, I observed several characters of importance not previously determined; and I have thought it might be appropriate to present them here. The more important of these characters are as follows:—

1. The presence of true teeth, in position, in the skull.
2. Vertebrae biconcave.
3. A well-ossified, broad sternum.
4. Three digits only in the manus, all with claws.
5. Pelvic bones separate.
6. The distal end of fibula in front of tibia.

* The animal supposed to be placed on the ventral surface.

† Read before Section D, British Association for the Advancement of Science, at York, Sept. 2, 1881.



Koehler, R. 1881. "On the circulatory system of *Spatangus purpureus*." *The Annals and magazine of natural history; zoology, botany, and geology* 8, 451–452.
<https://doi.org/10.1080/00222938109487492>.

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