PLATE XIII.

Fig. 1. *Cytheridea spinulosa*, from left side.
Fig. 2. The same, from above.
Fig. 3. The same, from below.
Fig. 4. The same, from front.
} ×40.

Fig. 5. The same, hinge-margins.
Fig. 6. The same, ventral contact margins.
} ×84.

Fig. 7. *Cythere plana*, left valve, from side.
Fig. 8. The same, from above.
Fig. 9. *Pontocypris Davisoni*, from left side.
Fig. 10. The same, from below.
Fig. 11. *Loxoconcha Lilljeborgii*, from left side.
Fig. 12. The same, from above.
Fig. 13. The same, from below.
Fig. 14. The same, from front.
Fig. 15. The same, from behind.
} ×40.

XVII.—*On the existence of Capillary Arterial Vessels in Insects.* By JULES KÜNCKEL*.

ZOOLOGISTS supposed that the circulation of the blood in insects was limited to certain currents detected by Carus in transparent larvæ, when in 1847 M. Blanchard proved that the tracheæ of these animals fulfilled the function of arteries, by conveying, in a peripheral space, the nutritive fluids to all the organs. He ascertained, by means of delicate injections, the existence of a free space between the two membranes composing the tracheæ: the injected fluid expelled the blood and replaced it.

After having verified and confirmed M. Blanchard's discovery, M. Agassiz insisted upon the evidence of the demonstration. Seeking afterwards to complete this discovery, he paid particular attention to the termination of the tracheæ. In a memoir published in 1849†, this naturalist distinguished the ordinary tracheæ terminating in little ampullæ and the tracheæ terminated by little tubes destitute of a spiral filament, which he named the *capillaries of the tracheæ*. M. Agassiz expresses himself as follows:—"In the grasshoppers which I injected by the dorsal vessel I found in the legs the muscles elegantly covered with dendritic tufts of these vessels (the capillaries of the tracheæ) all injected with coloured matter; and in a portion of a muscle of the leg of an *Acridium flavovittatum*, submitted to a high magnifying-power, I observed the distribution of these little vessels, which has a striking resemblance to the

* Translated from the 'Comptes Rendus,' July 27, 1868, tome lxvii. pp. 242–244.

† Proc. American Association, 1849, pp. 140–143; translated in Ann. des Sci. Nat. 3e sér. xv. pp. 358–362.

distribution of the blood-vessels in the bodies of the higher animals."

Nearly twenty years have passed since the period when M. Agassiz announced these facts, which appear to have been but little understood; for the authors who have written on the anatomy and physiology of insects have not even mentioned them.

The direct observation of the phenomenon of circulation was wanting: no one had succeeded in detecting the movement of the blood either in the peritracheal space or in the capillaries; and M. Milne-Edwards indicated as a fact to be regretted that "the existence of currents in the tubiform lacunæ had not yet been ascertained." Having been led, by general researches upon the organization of the Diptera, to study the apparatus of circulation and respiration, I have frequently examined the tracheæ. I always saw, without difficulty, the globules between the two coats; but, the animals being dead, the blood was motionless. In pursuing my investigations of the distribution of the tracheæ in the muscles, I was too much struck by the character of this distribution not to dwell upon it. Having succeeded in removing a muscular bundle from a living *Eristalis*, without tearing it, and brought it quickly into the focus of a powerful microscope, I had the surprise of seeing the blood imprisoned between the two membranes of the tracheæ running in this peritracheal space, and penetrating into the finest arterioles. I observed the course of the blood-globules with the same facility as in the capillaries of the mesentery or the membrane uniting the digits of a frog. I was, therefore, fortunate enough to see the circulation of the blood in the capillaries of insects.

I have been able to convince myself of the existence of a system of arterial capillaries in all insects: the most delicate arterioles creep not only through the muscles, but also over the other organs. In general the blood thus observed by transmitted light presents a rosy tint very favourable for observation. When the blood abandons the tracheæ and its arterioles, which I have frequently seen, they lose their coloration. The trachea, recognizable by its spiral filament, may always be perceived; but it is very difficult to distinguish the arterioles, so delicate and transparent are their walls.

The difficulties of the experiment are great. The insect must be quickly opened, a muscular bundle must be taken from the living animal, and this bundle conveyed under the microscope; and then, under favourable conditions, the blood is seen flowing rapidly through the arterioles. For these investigations a considerable magnifying-power is necessary. I

have been singularly aided by the very perfect immersion-objectives which M. Nachet was kind enough to place at my disposal.

It is necessary to give a precise explanation of the structure of the arterioles and their mode of distribution.

The tracheæ, as is well known, are composed of two coats: the inner coat forms the envelope of the aëriferous canal; the outer coat, or peritracheal membrane (*peritoneal membrane* of the Germans), surrounds the former envelope, leaving an interval, the peritracheal space. But at the point where the tracheæ penetrate between the muscular fibres, the inner coat disappears, and the aëriferous canal terminates cæcally, whilst the outer coat or peritracheal membrane becomes the wall of the blood-vessels or arterial capillaries. It is not only the spiroid thickening of the inner coat, or spiral filament, that disappears, it is the inner coat itself that stops and suddenly closes the aëriferous canal. In this way we see, starting from a more or less voluminous tracheal stem, very delicate blood-vessels, in larger or smaller number, which divide and subdivide regularly to their extremities.

The blood retained in the peritracheal space remains throughout its course in contact with oxygen; it reaches the capillaries perfectly vivified, and is a true arterial blood. The capillaries are not in communication with venous capillaries; the blood diffuses itself through the tissues, nourishes them, and falls into the lacunæ; the lacunar currents convey it again to the dorsal vessel.

Thus, to sum up, the tracheæ of insects, which are aëriferous tubes in their central portion and blood-vessels in their peripheral part, become at their extremities true arterial capillaries.

XVIII.—*On* Aranea lobata, *Pallas* (A. sericea, *Oliv.*).

By T. Thorell*.

This large and well-marked Epeirid, which Pallas described and figured in 1772 (in 'Spicilegia Zoologica,' t. i. fasc. 8. p. 46, tab. 3. figs. 14, 15) under the name of *Aranea lobata*, and of which arachnologists have hitherto possessed only doubtful or incorrect notions, is, as the following remarks will render evident, identical with the form known under the appellation *Argiope* l. *Epeïra sericea* (Oliv.), which, by its size and beauty, its unusual aspect, and its general occurrence, attracts notice more than any other species of spider, except

* Translated from the 'Öfversigt af Kongl. Vetenskaps Akademiens Förhandlingar,' 1867, No. 9, by Arthur W. E. O'Shaughnessy.