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Some observations on spermatogenesis in spiders

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muscle-fibres and generally several blood-spaces. Although I have been unable to trace branches of the pallial nerves into these tentacles, I have traced them to their bases, and there can be little doubt that they are supplied by fibres from these nerves.

If, then, we consider the following points—1st, the specialized tentacle is marginal in formation, and is carried back with the siphons during their development, and more especially by their retraction; 2nd, it is placed sometimes on the right and sometimes on the left side, which may indicate that it is an organ of late specialization, not thoroughly settled in position; and 3rd, it receives its nervous supply as a branch of the same nerve which supplies the marginal tentacles—it may be justifiable to call attention to a possible homology between the specialized tentacle and a marginal tentacle which has become slightly modified in structure and very much enlarged and specialized.—*Johns Hopkins University Circulars*, June 1896, pp. 85, 86.

Some Observations on Spermatogenesis in Spiders.

By JULIUS WAGNER, of St. Petersburg.

My investigations in the course of last year have yielded results which differ so greatly from the observations of Gilson ('La Cellule,' t. i.) that I do not consider it superfluous to communicate them, although my studies are not yet completed. The main part of the work was carried out in the Zoological Institute at Heidelberg, and I feel impelled to avail myself of this opportunity of expressing to Hofrath Prof. Bütschli my best thanks for his constant attention and never-failing guidance.

(1) Cell-boundaries between the spermatogones do not exist during the earlier stages. The delimitation of the bodies of the cells takes place at different times according to the species, and in consequence of this the spermatogones of the last generation may be both uni- and multinucleate.

(2) The division of the nuclei of the spermatogones, while not following the ordinary plan of karyokinesis, is nevertheless not amitotic.

(3) In the transformation of the nucleus of the spermatogone into that of the spermatocyte the former network of linin gives rise to a linin-thread or to a few such threads. The nuclei come to assume an excentric position; the whole of the linin passes over with the chromatin granules into one half of the nucleus, namely into that which is adjacent to the periphery of the cell. The linin-thread (or the rows of the chromatin granules) forms loops, all of which are of the same length and have the same direction; in this way the linin-thread divides into portions of equal length. Simultaneously the formation of the nucleolus takes place.

(4) The granules of archoplasm collect in the narrow space which remains between the chromatin half of the nucleus and the surface of the cell. In the interior of the collection of archoplasm thus

produced lies a large lenticular centrosome. After the formation of the sphere of archoplasm a radiation proceeds from it.

(5) After the concentration of the linin and chromatin the membrane of the spermatogone nucleus disappears, and the nuclear fluid mingles with the cytoplasm. The threads of the chromatin granules lie close together.

(6) The nuclei of the spermatocytes are much smaller than those of the spermatogones of the last generation. The membrane of the former is constituted afresh.

(7) After the concentration of the archoplasm the larger portion of the cytoplasm passes over into the same half of the cell, so that the centrosome now lies in the plasmatic portion of the cell.

(8) The number of the centrosomes in the spermatocytes of the first generation is from one to three.

(9) The nucleolus always has an entirely peripheral position; in shape it is elliptical and compressed. The large chromatin granules represent (though not always) from one to two false nucleoli on the opposite side of the nucleus. The true nucleolus never lies in the interior of the linin-thread.

(10) In the division of the centrosome the archoplasm also divides before the nucleus, but immediately afterwards disappears from view.

(11) In the first spermatocyte division the nucleolus divides either in the plane of the equatorial plate, together with the chromosomes, or outside this near one of the poles of the spindle. In the latter case it passes out of the nucleus after the disappearance of the nuclear membrane, but before the completion of the concentration of the chromatin granules (or before the formation of the chromosomes).

(12) The achromatin spindles do not disappear after the first and second division of the spermatocytes. The second achromatin spindle is developed independently of the first. It is possible to isolate the entire achromatin spindle from the cell.

(13) In the division of the spermatocytes cytodieresis is not simultaneous with the division of the nucleus; in certain species of spiders spermatids with four nuclei are first formed.

(14) During cytodieresis the round "intermediate body" ("Zwischenkörperchen") usually arises from the middle portion of the spindle; it may migrate anew into the body of the cell or become constricted off from both daughter cells. The rest of the spindle always remains in the spermatids until their transformation into spermatozoa, forming a round body, which is not constricted off from the spermatozoa until later. These remnants of spindles (and intermediate bodies), which are always found in the testis between the ripe spermatozoa, represent the "granules séminaux."

(15) During the transformation of the spermatids into the spermatozoa the nucleus becomes entirely homogeneous. The whole of the chromatin gradually concentrates upon the nuclear periphery, and the nucleus itself becomes converted into a vesicle. Subsequently the chromatin passes to one side of the nucleus as a

homogeneous plate; the rest of the nucleus disappears, and so all that is left of it finally is this chromatin plate, which elongates and assumes a spiral curve. Simultaneously the "spike" ("Spieß") arises from the achromatin portion of the nucleus.

(16) The spermatozoa possess at certain stages in all species a typical tail with axial filament.

(17) The axial filament is formed in the protoplasm of the spermatocyte (or spermatid) in the first place as a short rodlet, close to which there sometimes lie a few granules of archoplasm. It does not unite with the nucleus until after the transformation of the latter into the chromatin plate.

(18) At the point at which axial filament and chromatin plate unite there lies at the margin of the latter a little tooth-like projection; the proximal end of the filament fits in between this projection and the chromatin plate itself. The portion of the axial filament near the projection is, judging by the readiness with which it takes a stain, a homologue of the end-tubercle in other Arthropods.

(19) The perfectly ripe spermatozoa, which have freed themselves from the remains of the spindle, are mobile (*Tarantula*).

(20) In the passage into the vas deferens the tail of the spermatozoon rolls up and lies upon the nucleus; the nucleus itself doubles up to such an extent that its anterior extremity touches the posterior, whereby it completely surrounds the rolled-up tail. The main portion of the axial filament probably becomes transformed into a homogeneous spherule. Thus in the vas deferens all spermatozoa form rodlet-like or elongate elliptical bodies, among which neither tails nor spikes ("Spiesse") can be distinguished.—*Zoologischer Anzeiger*, xix. Bd., no. 501 (April 27, 1896), pp. 188-190.

Note on *Phascologale flavipes*.

Mr. Edgar R. Waite exhibited a female and eight young of *Phascologale flavipes* obtained in a weathered hole in a sandstone block on the River Hawkesbury. The nest was entirely composed of dried Eucalyptus leaves. It was mentioned that although it is constantly stated that no true pouch exists in members of the *Phascologale*, this is scarcely correct. When very young the offspring are completely hidden by the outer wall of the pouch closing over them. As they increase in size the mouth dilates and no longer conceals the young. Mr. Oldfield Thomas evidently does not admit Krefft's statement that the species mentioned is provided with ten teats. Although eight is the usual number, Mr. Waite had seen several females with ten teats, and there is one in the Australian Museum with twelve and a young one on each teat. It would therefore appear that in *Phascologale* the number of mammæ is not a constant character, or three otherwise similar species would have to be admitted, characterized by the possession of eight, ten, and twelve mammæ respectively.—*Linn. Soc. New South Wales, Abstract of Proceedings*, July 29, 1896, pp. ii, iii.