On a New Species of Malacobdella (M. japonica).

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With Pl. VII.

Since last April I have devoted myself to the investigation of a *Malacobdella*, which lives in the mantle cavity of *Mactra sachalinensis*, Japanese name, "*Ubagai*" or "*Hokkigai*", and have found out that notwithstanding a close resemblance of its external form to that of *M. grossa*, Müller, its internal structure presents some features sufficiently different from that of the latter species, to justify its separation into a distinct species.

M. japonica, as I propose to call our species, lives in the mantle cavity of *Mactra sachalinensis*, which is found in the northern part of our country. The specimen I used were all collected on the shore of Kujūkuri on the Pacific coast of the province Shimousa. Almost every individual of *Mactra* from that locality contains the parasite. Of the 56 shells, which I examined, 54 were found to be infected. As v. KENNEL found in *Cyprina islandica*, adult worms live always single in one shell, while if two or more live together in one shell these are invariably young individuals. Of the 54 shells, which contained the parasite, one was infected by 7, and two by 4, individuals which were all very young.

The longest specimen of *M. japonica* is about 45 mm. long and 4 mm. broad when fully extended, and the œsophageal region is broader than the posterior. When contracted, its length is reduced to nearly one-half, and the posterior part of the œsophageal region is slightly concave. The ground color is dark yellow.

In the epithelium are found flasc-shaped glandular cells, whose contents stain with hæmatoxylin. They are generally numerous on the ventral side, while they are often entirely absent on the dorsal surface and on the very tip of the head. Under the muscular layer of the body-wall in the anterior region, numerous groups of glandular cells are imbedded within the parenchymatous tissue. In most specimens, these groups are found in the œsophageal region, but sometimes they extend far behind that part. Generally they are found in a great number on the dorsal side. The ducts of these glands can not be clearly observed, but it seems probable that the streaks of fine granules, which are visible among the epithelial cells of the body-wall and which appear to have the same nature as the secretion of the glands, indicate their external ducts. At the anterior upper and lower edges of the mouth, their external ducts can distinctly be observed passing through the basal membrane to the exterior. In a greater part of the dorsal and ventral sides of the flattened lateral portion of the œsophageal region these glands are much developed, but few of them are met with in the anterior. Along the margins of such lateral portion, a voluminous aggregation of them is situated on each side, and their external ducts open at the lateral edge. These glands are abundant in the acetabulum as in *M. grossa*, especially on its ventral side.

The wall of the œsophagus is folded into finger-like processes, which v. KENNEL and others have already noticed; when fully extended they become rather slender, and those of the anterior part are protruded out of the mouth opening, and are moved to and fro like tactile organs. These processes, however, become short in the posterior and vanish in the narrow region, which connects the œsophagus with the intestine. The epithelium of the oesophagus is provided with a thin *tunica propria*, as BÜRGER observed, and the sub-epithelial glands are loosely imbedded on the outside of it, deeply within the body parenchyma. They are most numerous a little in front of the end of the œsophagus. The intestine, which is clearly distinguished by a narrow constriction from the œsophagus, makes about 10 windings, not

having diverticula. The anus opens dorsally nearly at the center of the acetabulum.

The rhynchocœlom of the present species differs greatly from that of *M. grossa* by being short (pl. VII, fig. 1). v. KENNEL says : the structure in the latter species "bis zum letzten Drittel des Köpers deutlich sichtbar bleibt," and "sondern jene (Biegungen des Darmes) manchmal schneidend bis gegen das Hinterende des Thieres hin, wo sie sich bei macroscopischer Betrachtung verlieren." BÜRGER remarks also : "Malacobdella ist mithin eine Angehörige der Holorhynchocœlomier." Thus in *M. grossa* it is obvious that the rhynchocœlom reaches the posterior end of the body, but the Japanese species is never a "Holorhynchocœlomier." The rhynchocœlom extends in the first two-thirds of the body and its posterior extremity is macroscopically distinctly observed. Different from *M. grossa*, a microscopical examination shows that it does not extend further backward than can be observed from the surface. It is slightly winding, being situated on the dorsal side of the digestive canal, but does not follow the curvature of the latter precisely (fig. 1). The proboscis, which has nearly the same length as the sheath, is distinguished into the anterior long glandular portion and the posterior short bulb-like cavity, followed by a strong retractor. The wall of the bulb is much thinner than that of the anterior division. The inner epithelium consists of low cylindrical cells, without glandular elements, and is not "ganz flaches Pflasterepithel" as v. KENNEL noticed. The retractor muscle is a strong bundle of longitudinal muscle fibres, which reaches the hind end of the rhynchocœlom. Its posterior extremity not only reaches the narrow end of the latter, but passing through its wall enters the parenchymatous tissue surrounding it and is soon reduced in bulk. Of the termination of the retractor fibres of *M. grossa*, it is said that they, after passing through the end of the rhynchocœlom, rise dorsad to be affixed to the muscular body wall, but the case is quite different in the present species. Instead of proceeding dorsad, they bend rather ventrad, and no connection with the muscular body wall is observed, except their crossing the dorso-ventral fibres, and

they terminate freely in the parenchymatous tissue (fig. 2). BÜRGER noticed the undoubted existence of the proboscis nerves between both longitudinal muscle layers, but he did not enter into further detail. As far as my investigation goes, it is most probable that the " Bindegewebe mit zelligen Elementen," which is alluded to by v. KENNEL represents the nervous layer of the proboscis. It has no definite form as in other Metanemertini, and is sometimes swollen and sometimes constricted, and often gives off several processes between bundles of muscle fibres. Numerous oval nuclei are imbedded within, or in the peripheral part of, the granular looking substance, which would be the fibrous part of the nervous layer. Such granular portion presents similar appearances as the fibrous part of the nervous system and has the same affinity for hæmatoxylin or eosin.

The circulatory system shows very complex anastomoses, and approaches the condition described by BLANCHARD[1] and HOFFMANN,[2] yet differs from them in some points. In young specimens it consists of only three vessels, one dorsal and two lateral, as in other Metanemertini, and has already been noticed by several authors (fig. 1). The two lateral vessels are connected in the head by a transverse canal and joined in the anal portion to two branches of the dorsal vessel (fig. 1). The dorsal vessel arises anteriorly a little behind the ventral commissure of the brain, by the fusion of two branches from the lateral vessels. At this stage there is not yet any branch to be found. But in the adult, the circulatory system reaches a degree of complication never found in other nemerteans, by giving off numerous branches, which come to anastomose with one another, especially in the anterior region. Figs. 3, 4, and 5, which have been reconstructed from sections, show respectively the circulatory system in the œsophageal, the middle, and the anal region. The vessels invariably show a complex system of anastomoses and are very asymmetrical, although there seems to be a great deal of individual variation. The dorsal vessel (fig. 3, *d. v.*) does not appear to be

1) & 2). I have not had access to the works of BLANCHARD and HOFFMANN, but I gather the above from the references made by v. KENNEL.

derived directly from the laterals as in the young specimen, but there seems to be various interplaced canals. It gives off in its course several anastomosing branches of various sizes, and such branches are connected laterally to those, which are derived from the laterals and occupy the lateral portions of the body (fig. 3, *net. v.*). In the anterior and middle regions the vessel can more or less distinctly be discriminated from its branches by its position under the rhynchocœlom, though it is often obscured in the middle region, where it makes strong windings and have large branches. In the anal region, however, it is impossible to trace the vessel as a single canal as in the anterior region, for it becomes slender connecting canals, traversing between the two large vessels (fig. 5, *d. v.*) above the intestine, and does not take the median position. These two vessels are continuations of those which are observed in other portions on the side of the dorsal vessel, being fused together with the latter at several points (fig. 4, *d. v.*). Laterally these two vessels are continued to a network of small canals, situated in the lateral part of the body, as in the anterior part (fig. 4 & 5, *net. v.*). At the end of the body they are united into a single canal and the lateral networks nearly disappear. Such a single canal divides, however, into two, immediately in front of the anus, and each branch enters the acetabulum to communicate with the lateral of its own side, and forms two curved vessels (fig. 4, *ac. v.*), which run along the edge of the acetabulum. Besides the horizontal windings, the two large vessels above stated make in their posterior portion strong vertical undulations along the sides of the digestive canal, approaching very near the lateral (fig. 4, *l. v.*), which is situated on the ventro-lateral edge of the intestine, yet there are only a few direct connections between the laterals and the large vessels in consideration. In the anterior region, some of the branches of the dorsal vessel always run among the muscular fibres of the proboscis sheath, and communicate at several points with the dorsal itself. These branches already exist in young specimens, whose vascular system is furnished with only a few anastomosing branches in the tip of the head. The

lateral vessels (*l. v.*) are generally recognized everywhere, by their greater sizes and paucity in branches except in the œsophageal region. They are situated on the ventro-lateral sides of the digestive canal, except in the head, where they gradually shift their positions dorsad and finally take the lateral position. In the œsophageal region, various anastomosing branches are separated off towards the outer and inner sides and spread in the flat lateral edges of the body. It is through these canals that they are indirectly connected with the dorsal vessel. At the tip of the snout, the numerous branches also form networks, which are posteriorly continued to those in the lateral edges. Some branches from the vessels form a canal system which occupies the ventral side of the body. In fig. 3, this ventral canal system is shaded. Sometimes ventral connections under the œsophagus join the canals of the opposite sides (*v. c.*), a fact hitherto not noted in Metanemertini. The system is connected in several points to that (not shaded in the figure) situated on the dorsal side. In the middle region, the lateral vessels have only a few branches (fig. 4, *l. v.*). Unlike those of *M. grossa*, they have no branch at the posterior region, and in the acetabulum no trace of a complicated vascular system, as described by v. KENNEL, is found.

Of the excretory system no essential difference can be detected in the present species, except that the external opening is not situated ventrally, but dorsally to the lateral nerve stem and opens at the dorso-lateral side of the body.

The peculiar feature of the nervous system is the position of the posterior commissure of the lateral nerve-stems. There is no trace of the anal commissure above the anus, but posterior to it, along the posterior margin of the acetabulum, a strong commissure is distinctly observed as shown in figs. 1 & 6 (*a. c.*). At the points, from which the lateral nerve-stems enter the acetabulum, they slightly become larger, as v. KENNEL observed, and between these points a slender commissure runs along the anterior side of the acetabulum (*ac. c.*). This

commissure gives off numerous branches internally and externally, and together with the several big twigs from the larger commissure innervate the acetabulum. The ganglionic cells are found in the larger acetabular commissure.

Thus the Japanese species of Malacobdella mainly differs from M. grossa by its short rhynchocœlom, by its possessing the acetabular, instead of an anal, commissure, and by some differences in the vascular system. These data, I think, are enough to separate the present species from *M. grossa*.

July 1897.

LITERATURE.

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(5) O. BÜRGER—Die Nemertinen des Golfes von Neapel, 1895.

EXPLANATION OF FIGURES.

AC. large acetabular commissure. *ac.c.* small acetabular commissure. *ac. v.* acetabular vessel. *an.* anus. *b.v.* blood vessel. *d. v.* dorsal vessel.

D'.V. large branches of the dorsal vessel. *in.* intestine. *l.v.* lateral vessel. *net. w.* net-work of canal system.

Oes. œsophagus. *Pr.* proboscis. *Rh.* Rhynchocœlom.

Ret. Retractor muscle of the proboscis.

Fig. 1. Dorsal view of young *M. japonica.*

2. Vertical section of the end of the rhynchocœlom.

3. Blood vessels in the head of the adult, reconstructed from sections; *Md* median line. The vessels on the ventral side are shaded.

4. Blood vessels in the middle region of the adult, reconstructed from sections.

5. Blood vessels in the anal region of the adult, reconstructed from sections.

6. Vertical section of the anal region, showing the acetabular commissures of the lateral nerve stems.

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Fig. 2.

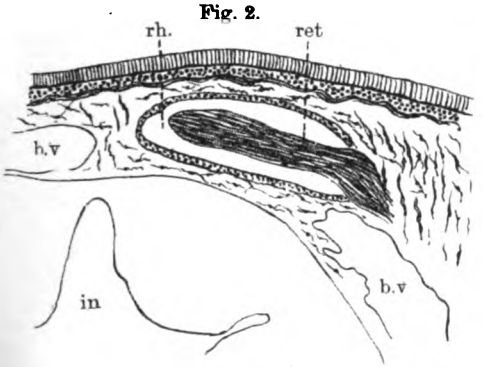

Fig. 3.

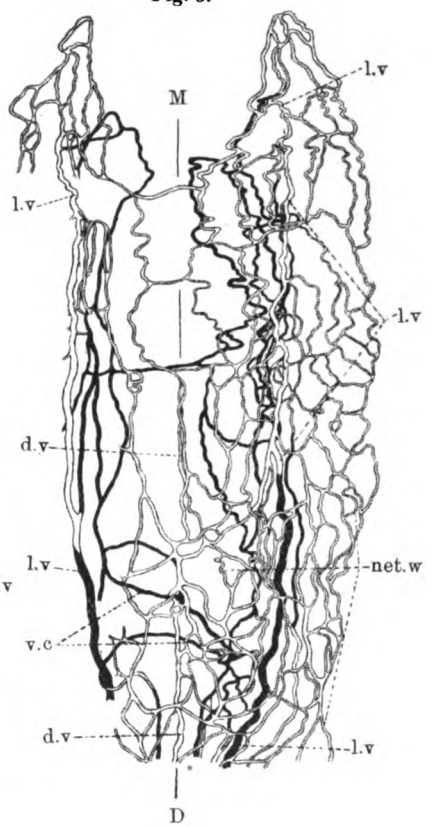

Fig. 5.

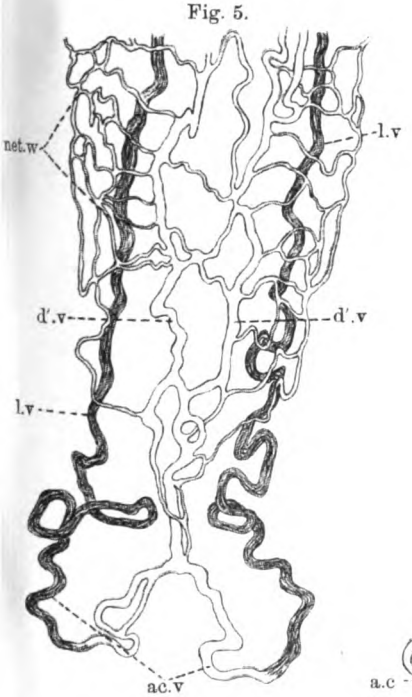

Fig. 1.

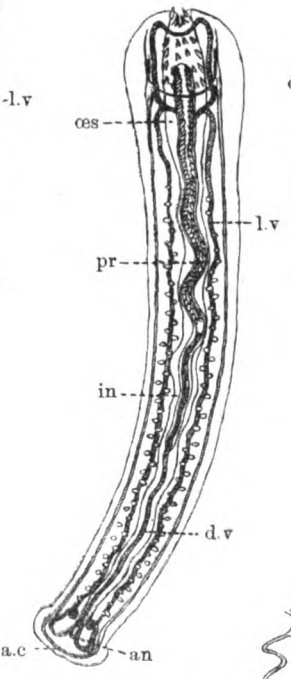

Fig. 4.

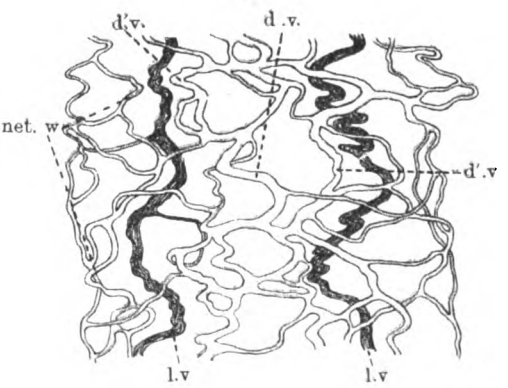

Fig. 6.