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Materjały do poznania rodziny *Lymnaeidae*.

I. Stanowisko systematyczne i rozmieszczenie geograficzne rodzaju *Myxas* J. Sowerby [1])

Contributions to the Study of the Family *Lymnaeidae*.

I. On the Systematic Position and the Geographical Distribution of the Genus *Myxas* J. Sowerby [1]).

[Pl. VII — XI].

In 1838 P. J. van Beneden (6) had raised the question as to how far it is justifiable, on account of the anatomy of the internal organs of *Myxas glutinosa* (Müller), to separate this species from the genus *Lymnaea* into a special genus *Amphipeplea* established by Nilsson (Fauna Sueciae 1822 i. e. 1823), ignoring, however, the fact that the name *Myxas* J. Sowerby 1822 has priority (70). „L'anatomie spéciale semble le moyen le plus puissant pour faire marcher d'un pas sûr la malacologie. En se bornant à la coquille ou à l'étendue plus ou moins grande d'une

[1]) This paper was together with part II and III of „Contributions" read before the Academy of Sciences of Petrograd by the late Prof. Zalenskij, member of Academy, and was to be published in the Transactions of the Academy. Various circumstances independent of myself greatly delayed the printing; the publishers changed also; they are now the Polish Museum of Zoology. The paper appears as it was written 1917, however, with some changes and additions. A Polish version of this paper has been published in 1925 (58).

partie, on laisse le champ libre à l'arbitraire, si on ne consulte point l'organisation interieure dans l'établissement des genres" (J. P. Beneden 6, p. 3). However, after studying the internal structure of the animal he could not decide definitely as to its systematic position. On one hand he finds that there is no harm for science in the subdivision of the systematic groups into smaller units, on the other hand he could not take the resolution to change the name *Limnaeus glutinosus* for the new name *Amphipeplea glutinosa* in the title of his work. The study of the anatomy did not provide him with sufficient material for the support of J. Sowerby's and Nilsson's views, and finally he chiefly sets forth in favour of the separation of this form into a special genus the same character that served as a foundation for Sowerby's and Nilsson's views; namely, the strong development of the mantle covering the shell from the exterior, to which he adds the corresponding development of the nervous system.

At present the genus *Myxas* is firmly established in science and nobody doubts the correctness of its separation from the genus *Lymnaea*. But the controversy did not end in this. When most of the malacologists placed the genus *Myxas* (= *Amphipeplea*) in the family *Lymnaeidae*, Wł. Dybowski (22) separated this genus into a special family *Amphipeplidae*, placing it in his system immediately after the family *Limnophysidae* — established by himself, according to the following table:

„*Pulmonata Basommatophora Inoperculata Aquatica.*

Fam. 1. *Limnaeidae.*
„ 2. *Limnophysidae.*
„ 3. *Amphipeplidae.*
„ 4. *Planorbidae.*
„ 5. *Ancylidae.*
„ 6. *Physidae*".

At the same time W. Dybowski remarks: „diese Art (*Myxas glutinosa*) ist so eigentümlich und charakteristisch, dass sie zu keiner anderen Familie gestellt werden kann".

Thus, at present, when systematic groups are being usually broken up into smaller taxonomical units, the question arises not of the establishment of a new genus, but of a whole family, the material being in fact nearly the same that existed in the time of van Beneden. The only addition was made by the studies

on the radula in *Myxas* by Wł. Dybowski, and by the same author and others in *Lymnaeidae*; but it is just in the structure of the radula that *Myxas* resembles other *Lymnaeidae* as it is acknowledged by Dybowski himself (contrary to the opinion of F. H. Troschel) — this fact can nowise be in favour of the separation of the genus *Myxas* into a separate family,

New investigations are needed to solve this question. The object of this paper is to verify the existing facts and to add some new data, which may be, in my opinion, of some importance in this question. As it will be noted again below, this work contains only a part of the investigations; the remaining part will appear together with a similar investigation on the representatives of the Family *Lymnaeidae*.

The material was taken in the neighbourhood of Petrograd (Leningrad), at Lakhta (Łahta), in the river Yuntalovka (Juntałovka), owing to the kind directions of V. A. Lindholm who found this form in that place several years ago. I am also indebted to him for many informations concerning the literature, especially relating to the geographical distribution of *Myxas*. I am taking the opportunity of expressing again my sincere gratitude to him for the kind permission to make use of the unpublished data obtained by him regarding the habitat of this interesting form. Further supplementary and veryfying investigations have been performed upon specimens of *Myxas glutinosa* from the surroundings of Warsaw.

The Shell.

The shell of *Myxas* is built after the same type as in *Lymnaeidae*, especially as in the genus *Radix* Montf. However, it differs in its frailty, thinness, great transparency and its brightness. There are not many windings, 3—4, which form a short spire. The opening of the shell is wide and oviform. The spire is not very acute and protrudes but slightly above the last whorl of the shell. On the surface of the shell the lines of growth form hardly visible continuous ribs, the depressions between which are very shallow, owing to which the shell appears to be quite smooth under weak magnification. Only near the shallow suture these lines become more visible. A more detailed description of the shall may be found in any manual of conchology.

These characters, the general form and especially the thinness, transparency and brightness of the shell in *Myxas* allow easily to distinguish it from the shells of other *Lymnaeidae*. However, B. Dybowski (12, Pl. IV, fig. 6) described and represented a shell belonging to *Gulnaria ampullacea* West. (which he named var. *baicalinella*) resembling the shell of *Myxas glutinosa* exceedingly in the general form. On account of the shell having been found empty, without the animal, it might be doubted whether it really belonged to the species named. B. Dybowski refers it to the genus *Radix* (= *Gulnaria* Leach) chiefly owing to the fact that until the present *Myxas* has not yet been found in Siberia, and he considers its presence in the lake Baikal improbable. It must also be noted, according to B. Dybowski, that „der Farbe und der Konsistenz der Schale nach ist es einem Gehäuse von *Gulnaria* sehr ähnlich", which, certainly, speaks in favour of this author's view. But at any rate, if this shell belongs to the genus *Radix* indeed, the demarcation between this genus and *Myxas* (certainly, as far as it concerns the shell) looses a great degree of its meaning, and the shell of the latter may be considered as a particular fluctuation from the *Radix*-like form, which was rendered possible on account of a great development of the mantle covering it from outside as well.

The External Habitus of the Animal.

In the external habitus *Myxas glutinosa* differs from the representatives of the *Lymnaeidae* only in the development of the mantle. The structure of the head, form of the tentacles, arrangement of the eyes, and in general the form of the rest of the body are more or less similar to the same parts in *Lymnaeidae*.

The mantle, on the other hand, resembles closer the same organ in *Physa* Drap. and *Aplexa* Fleming, as its margin does not terminate on the edge of the shell as in *Lymnaeidae*, but grows wider and becomes reflected upwards covering the external surface of the shell. On account of this, the shell is nearly from all sides enveloped by the mantle, with the exception of a small portion in the middle; however, the mantle may as usual contract in some degree, according to which a greater or smaller part of the surface may become free. In the greatest

contraction of the mantle its edge still remains at a certain distance from the edge of the shell on its external surface. The margins of the mantle are continuous, not incisured in separate lobes as in *Physa*. The characteristic features of the shell, like its thinness and brightness, are evidently due to its being enclosed in the mantle, on account of which it looses to a great extent its significance of an outer protective covering. It is possible that this case presents a transitory stage to the internal shell completely enclosed under the mantle.

It is difficult to decide the question as to what had evoked such a development of the mantle, and it can only be answered hypothetically meanwhile.

I may remind that in my work on *Lymnaeidae* of the Léman-lake (54) I have paid attention to the significance of the free edge of the mantle overlapping the head in the respiration of these animals. It is known that the aquaceous respiration through the skin in *Lymnaeidae* is much more important than respiration by means of lungs, and it is in many cases quite sufficient for the maintenance of life. It seems to me that in this mode of respiration a great rôle is played by this free portion of the mantle as well as by the tentacles, which are all the time washed by fresh water. If such is the case, there is nothing surprising in the fact that in some representatives of this genus this part extends in growth, on account of which the surface of gaseous interchange between the blood and water-medium increases.

Such a development of the mantle presents a characteristic feature and, as it shall be seen further, it presents the most important distinguishing character from other *Lymnaeidae*.

The colour of the animal does not differ from that of *Lymnaeidae*, the colour of the dorsal surface resembling that which is peculiar to *Radix* with ist „marble" yellow - black pattern, which it is unnecessary to describe, as it is so familiar to everybody.

The Jaws.

In 1839 Troschel (71) pointed out to the absence in *Myxas glutinosa* of lateral jaws which brings this form closer to the genus *Physa*: whilst „beim gänzlichen Mangel der beiden seitlichen Kiefer, findet sich der Oberkiefer nur in Rudiment, als ein ebenfalls schmaler, brauner Saum von horniger Beschaffen-

heit". As a matter of fact, however, the lateral jaws are present, although they are very thin and frail, and the upper jaw can nowise be called rudimentary. It is quite well developed, although much thinner than the same in other *Lymnaeidae*. In general the jaws differ from the jaws of other *Lymnaeidae* not only in their thinness (and — in connection with that — in colour, which is never the black-brown colour that is found in the thick jaws of the *Lymnaeidae*), but partly in form as well. The uper jaw is more bent in *Myxas* forming a regular horse-shoe when viewed frontally, which surrounds the mouth opening not only from above, but partly from the sides as well (I must draw attention to the fact that my description does not agree altogether with that of Lehmann (43), according to which „Mittelstück wenig bogig"; this shows that the given character is very variable); it is probable that the partial reduction of the lateral jaws is in connection with this. The anterior margin is reduced to three not sharply expressed lobes, all the three being rounded, the median lobe slightly protruding. The colour is light yellowish-brown.

The lateral jaws are thin and narrow — „linienförmig", as Lehmann terms them (43) — of the same colour on the exterior margin, and quite colourless further.

It is quite understandable that Troschel could not observe the lateral jaws, as he used only the needle in preparing. In such rough treatment he must have torn them, he also adds that he never succeeded in isolating the upper jaw, but owing to its size, it did not escape attention. In using caustic potash it is always possible to obtain a good preparation of both the upper and the lateral jaws.

The Radula (Pl. VII—VIII, fig. 1—7).

As it is known, systematists have placed great hopes in the radula, thinking that the differences in its structure will enable them to distinguish not only families and genera, but even species. Personally I think that the facts have not justified such hopes, and the importance of the radula as a systematic character is greatly exaggerated. Of course, I do not mean to deny the importance of the radula in systematics altogether as I believe it presents a well-defined character in families. Therefore, in the

matter of separating *Myxas* from the family *Lymnaeidae* I consider it necessary to make a closer examination of its structure.

This is the more necessary that in the literary data there exists much controversy. Troschel (71) in his work on *Myxas* (= *Amphipeplea*) does not find it possible to connect *Myxas* closer to *Lymnaeidae* on account of the structure of their radula. On the contrary, he maintains that the structure of this organ allies *Myxas* to *Physa*. On the other hand, W. Dybowski after having studied the structure of the radula in detail both in *Myxas* (21), and in *Lymnaeidae* (17 — 20) and *Physa* (15) definitely states that the structure of the radula of the first genus is quite similar to that of *Lymnaeidae*, and has nothing in common with *Physa*.

We shall now pass to my personal observations.

The general form of the radula resembles that of *Lymnaeidae* presenting an elongated plate pointed toward the anterior end, with nearly parallel edges (of course when straightened), and rounded at the posterior end. The general form of this plate differs sharply from the form of same in *Physa acuta* Drap. examined by me in several specimens, and from that described by Dybowski in *Physa fontinalis* (L.) (15). The central tooth (fig. 1—3, c) resembles that of *Lymnaeidae* (although Lehmann (43) finds that it is not so narrow as in *Lymnaeidae*). It is narrow and long (although in all my specimens somewhat shorter and wider than in the figure of W. Dybowski (21, Pl. VII). Usually it bears one cusp which is small and pointed, but, as the case is in *Lymnaeidae* as well, there are sometimes two (fig. 4, c) of them, or even three (fig. 5, c); two were stated by Dybowski, and three by Lehmann. Several figures illustrate the variations of this tooth. To some interesting variations I shall return below. The lateral teeth (fig. 1_{1-12}, 3_{1-2}, 4_{1-2}, 5_{1-2}, 6_{1-12}, 7_1) resemble those figured by Dybowski. They are all tricuspid. The entocone is long, longer than in many *Lymnaeidae*, rather wide and pointed. Sometimes there is a swelling (fig. 4_2, 5_2) on its margin. It sometimes reaches the same width as the mesocone. The latter is long, pointed, and usually divided from the entocone by a shallow incisure. A peculiar incisure divides the mesocone from the ectocone, sometimes entering at a right angle into the plate of the mesocone (fig. 1_6, 3_2, 4). However, I have rarely observed any incisure of that kind either on the

first lateral tooth, or on the posterior ones. In these teeth the incisure is mostly „normal", such as it is found in all *Lymnaeidae*. The ectocone is always shorter than the two preceding cusps, in some cases it is very wide, short and blunt, but in most cases it is rather narrow and pointed. The marginal teeth (fig. 1_{13-32}, 3_{14-15}, 6_{13-31}) are distinguished by a great number of cusps. Usually new cusps arise between the entocone and mesocone. The extreme marginal teeth (fig. 1_{30-32}, 6_{29-31}), which are narrow and long, bear a small number of cusps, whilst the extremest have the form of a rod more or less wide at the top and narrowing to the bottom.

In general, from my description and the figures illustrating it, I conclude, in accordance with Dybowski, that the radula is constructed in *Myxas* after the same type as in *Lymnaeidae*, whilst with the radula of *Physa* it shows no resemblance either in general form, or in the arrangement of the teeth and their shape. In examining the figure of the radula represented by Troschel in his work (71), notwithstanding the absence of many necessary details, we shall also come to the conclusion that the radula which was examined and illustrated by this author resembles too the radula of *Lymnaeidae*, contrary to the statements in the text. Unfortunately, Troschel gave no figures either of the radula of *Lymnaea*, or of *Physa*, therefore it is difficult to judge how he looked upon their structure, and why he allied *Myxas* to *Physa*. It seems to me that in the given case this author, later a distinguished investigator of radulae, had studied them insufficiently in *Lymnaeidae* and *Physa*, and that is the reason of his error.

There remains another point to be considered. Dybowski (21) has found some essential difference in the structure of the radula between the Lithuanian and Lifland specimens of *Myxas glutinosa*, and says: „der Unterschied ist so gross, wie er bei zwei sog. guten Arten nicht sehr oft zu finden ist". Unfortunately, however, the author did not explain in what the difference consisted. It would be in vain to try to guess, and the question will remain unsolved. But in connection with the difference spoken of by Dybowski I shall mention some fluctuation in the structure of the central tooth which I found in *Myxas glutinosa* from Lakhta. Out of nine radulae examined by me two of them

differed very sharply from the rest. The central tooth of the first (fig. 6 c) was distinguished by its width — it was even wider than the lateral ones — and possessed three well expressed cusps the middle one of which was larger than the lateral ones. Out of the two lateral ones the left one was wider than the right. The second radula (fig. 7 c) is distinguished by the apparent presence of two central teeth both very wide. The left denticle is bicuspid. Both cusps are short and wide. The second central tooth is provided with 4 sharp cusps. Both these teeth seem to be set somewhat lower than the latter ones, as the case is usually with normal, narrow central teeth. In this case it is probable that the second central tooth corresponds to the first lateral of the row of the normal teeth, but, as I have just mentioned, it is set somewhat lower than the rest of the lateral ones.

These two radulae are of especial interest to us. These two individuals exhibited no difference from the others either in the shell or in anatomical structure; therefore it is difficult to regard them as representatives of another species. I suppose that this case is simply an individual variation of the radula, which we have already observed in the representatives of *Lymnaeidae* (55, 57). On the other hand, if we based the classification chiefly on the structure of the radula, such striking deviations would compel us — in my opinion without sufficient grounds — to divide the species *Myxas glutinosa* into several species. I am sure that an examination of a large number of radulae would reveal to us a much greater number of similar variations, and, quite likely, without any intermediate forms between them. Therefore it is not surprising, that Dybowski also discovered some difference, but, on account of his views on the constancy of the structure of the radula and its importance in systematics, he could not decide as to their actual taxonomic value, at the same time declining to regard them as individual variations.

The formulae of the radulae examined by me are as follows:

1) $\frac{20}{5-1}\ \frac{12}{3}\ \frac{C}{1}\ \frac{12}{3}\ \frac{20}{5-1} = 32-1-32.$

2) $\frac{21}{5-2}\ \frac{12}{3}\ \frac{C}{1}\ \frac{12}{3}\ \frac{21}{5-2} = 33-1-33.$

3) $\frac{19}{5-1}\ \frac{13}{3}\ \frac{C}{1}\ \frac{13}{3}\ \frac{19}{5-1} = 32-1-32.$

4) $\frac{21}{5-3}\ \frac{13}{3}\ \frac{C}{1}\ \frac{13}{3}\ \frac{21}{5-3} = 34-1-34.$

5) $\frac{17}{5-1}\ \frac{10}{3}\ \frac{C}{1}\ \frac{10}{3}\ \frac{17}{5-1} = 27-1-27.$

(probably a young specimen).

6) $\frac{18}{5-1}\ \frac{13}{3}\ \frac{C}{2}\ \frac{13}{3}\ \frac{18}{5-1} = 31-1-31.$

7) $\frac{19}{5-2}\ \frac{12}{3}\ \frac{C}{3}\ \frac{12}{3}\ \frac{19}{5-1} = 31-1-31.$

The formula of a radula with a wide tricuspid central tooth is as follows:

8) $\frac{18}{5-1}\ \frac{13}{3}\ \frac{C}{3}\ \frac{13}{3}\ \frac{18}{5-1} = 31-1-31.$

and lastly the radula with two central teeth is as follows:

9) $\frac{21}{5-1}\ \frac{12}{3}\ \frac{C}{2}\ \frac{C}{3}\ \frac{12}{3}\ \frac{21}{5-1} = 33-2-33.$

The Nervous System.

Van Beneden (6) has investigated the central nervous system in *Myxas glutinosa* and has found that it differs from that of *Lymnaeidae* „par le développement extraordinaire". However, a comparison of his figures with the description shows that both forms differ only in the presence of a small ganglion lying between both buccal ganglia. In the remaining details both nervous systems resemble each other. It is true that Troschel (71) states that the nerve ganglia are much better differentiated in *Myxas* than in *Lymnaeidae*. In the latter, according to Troschel, the central nervous system appears to form a compact circumoesophageal ring in which it is difficult to distinguish the separate ganglia. It is obvious that Troschel did not make a satisfactory preparation of the nervous system in *Lymnaeidae*, and that is the reason, why it had the aspect of a more or less continuous

mass, and he was lead to make an incorrect statement. When the nervous system is prepared accurately no such difference is visible.

A more important character is presented by van Beneden's observation of the presence of one accessory buccal ganglion in *Amphipeplea*, which is absent in *Lymnaea*. Unfortunately, I could not confirm this statement in any of the 9 specimens of *Myxas* from Lakhta investigated by me for this purpose. In all these specimens I found only two small normal ganglia, which are also present in *Lymnaeidae*, as it is known; no third ganglion could be observed in any of them. Altogether, at an external examination of the nervous system I could not find any essential difference, which would be visible between *Myxas* and *Lymnaeidae* and therefore it is difficult for me to say anything with regard to van Beneden's observations. It would be interesting to know — in how many specimens did this author investigate the nervous system. It may be that the presence or absence of a third buccal ganglion also presents an individual deviation [1]); but it may be that this feature presents a constant difference between the Belgian and Middle- and East-European *Myxas*. Van Beneden does not mention in his paper in how many specimens he has found that third ganglion, although an indication of the number of studied specimens could throw some light upon this pending question. We can not clear it up definitively without new studies of West-European specimens of *Myxas*. In view of the fact, however, that such an additional, abnormal ganglion has been found also in *Radix auricularia*, it seems scarcely possible at present to attribute to the observation of van Beneden any greater importance; we have thus to eliminate this third ganglion from the list of characters which distinguish the genus *Myxas* from other *Lymnaeidae*.

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[1]) 1918 I occupied myself once more with this problem, studying the material captured in the surroundings of Warsaw; here also in the 14 specimens examined I have not seen the additional ganglion; instead I found it in one specimen of *Radix auricularia* (L). On sections I got the conviction that such an additional ganglion consists of several great nervous cells, probably separated abnormally during the development from the buccal ganglia. So we come to the conclusion that the existence of this ganglion as noted by van Beneden, is an anomaly for *Myxas* as well as for *Radix*.

Anatomy of the Genital Apparatus[1]) (Pl. IX — X, fig. 8 — 17).

The works of F. C. Baker, particularly his excellent monograph of the American representatives of the family *Lymnaeidae* (2) and my own modest investigations on European *Lymnaeidae* (54 — 58) have proved the importance of the genital apparatus in the classification of this family[2]). It is not surprising, therefore, that I have directed most of my attention on the study of the genital apparatus in *Myxas glutinosa*. In the literature there exists a fairly good, but in many respects insufficient, description of it by J. P. Van Beneden (6); and a less detailed by Lehmann (43) accompanied by obscure figures which are altogether of no use.

The hermaphrodite gland of *Myxas* lies, like in *Lymnaeidae*, in the liver, surrounded by the latter nearly from all sides, so that it is very difficult, and mostly even impossible to isolate it. However, in some cases (as it also happens in other *Lymnaeidae*) I found in individuals killed with boiling water the hermaphrodite gland separated from the liver tissue surrounding it. I cannot state the reason exactly, but, probably, in such cases the gland was situated superficially in the liver. This gland is of a creamy white colour. The most striking feature is the difference in the form of this gland between the *Lymnaeidae* and *Myxas*. It is sufficient to compare the figures of the present paper (Pl. IX, fig. 8 and 10, GH) with those in one of my preceding paper — bearing on the genera

[1]) In describing the genital apparatus of molluscs one encounters on each step difficulties evoked by the absence of a general and well defined anatomical nomenclature. This circumstance must receive attention, as it often leads to disagreable misunderstandings. The fact alone that the same organ bears different names with various authors seriously encumbers reading and orientation. This is, however, of minor importance, if we take into account that often the same term is applied to organs that have nothing in common, either in origin, or in function.

[2]) During the last years have appeared several interesting papers dealing with *Lymnaeidae* published by L. Sóos, H. Wagner, M. de Larambergue and other authors. These papers confirm the opinion expressed above as to the importance of the anatomic structure of the genital organs for the systematics of this family. Only N. Annandale and H. S. Rao have arrived to contrary results, but, as I think, without sufficient justification. I do not quote all these papers here, for they are not directly connected with the question of *Myxas*.

Lymnaea, *Radix* and *Stagnicola* (54) — to see that. In *Lymnaeidae* the gland has the shape of an elongated body with numerous small follicles which are in general not very much separated from the general mass. On the other hand, in *Myxas* the whole gland has a form approaching that of a star (Pl. IX, fig. 8, GH); its surface directed to the convex surface of the shell (towards the columella), to which it is immediately adjacent, having the form of a flat (Pl. IX, fig. 8, GH), smooth plate with dentated margins [1]) whilst on the opposite side it is covered with numerous follicles, which penetrate among and are intermixed with the follicles of the liver (Pl. IX, fig. 10, GH). However, when the hermaphrodite gland is inserted very deep into the liver, the former surface looses its smooth aspect. Such shortening ot the hermaphrodite gland is, in my opinion, closely connected with the diminution of the shell-spire, which is in its turn due to its mantle envelopment.

From the hermaphrodite gland is given of a hermaphrodite canal (Pl. IX, fig. 10, CH), which is whitish, semi-transparent when empty, not very long, in general slightly winding, although in this respect there exists great individual variation. Besides that the shape and appearance of this duct depends greatly upon its physiological state, upon that whether it is empty or filled up with spermatozoa or eggs respectively. This duct soon divides into the male and female sexual ducts.

The female duct, oviduct, begins by a winding part known under the name of the uterus, into the very beginning of which enters the albuminiparous-gland (Pl. IX, fig. 8, A) of the form usually met in *Lymnaeidae*. The uterus is normally, *in situ*, folded and pressed between the albuminiparous-gland, the nidamental gland and the pyriform body (Pl. IX, fig. 8, U) but in expanded state it presents a wide winding band composed of glandular tissue (Pl. X, fig. 12, U). In its upper part, on the side, it is accompanied, like in other *Lymnaeidae*, by a nidamental gland, „second accessory albuminiparous gland", according to Baker (Pl. IX, fig. 8 and Pl. X, fig. 12, NG). Further the female duct does not differ at all from that of *Lymnaeidae*.

[1]) It must be noted, however, that Jacobi (38) also figures the hermaphrodite gland in the Japanese species *Lymnaea okinawensis* Ehrm. very shortened I am showing also in one of my papers (on Caucasian *Lymnaeidae*, the paper is now under press) that at least in young specimens of *Radix auricularia* the hermaphrodite gland is distinctly shortened.

The oviduct widens forming a pyriform body, the „first accessory albuminiparous gland" of Baker (Pl. IX—X, fig. 8, 9, 13—16, CP) which narrows to the end and passes into the vagina (Pl. IX—X, fig. 8, 9, 13—16, V). The vagina receives on its ventral side the canal of the bursa copulatrix.

The bursa copulatrix (hitherto in my works I named this organ „receptaculum seminis", but now, following the example of Simroth (65) I have decided to apply the above-named term, which is more correct) presents a pyriform body of moderate size (Pl. IX—X, fig. 8, 9, 13—16, BC), situated at the end of a short duct (Pl. X, fig. 13—14, C). Usually both the canal and the bursa copulatrix itself are covered above by the pyriform body (Pl. IX—X, fig. 9, 13—16), sometimes, however, the bursa slightly protrudes outside (Pl. IX, fig. 8). When empty, the bursa copulatrix is semitransparent, of whitish colour; when filled with sperm, it assumes a yellowish-brown colour. The length of the bursa is 1—1.25 mm., length of the canal 1.75—2.5 mm.

The colour of the uterus, nidamental gland and pyriform body is creamy white (slightly yellowish), whilst the vagina and the duct of the bursa copulatrix are more or less covered with black pigment, the bursa itself also being provided with a certain amount of pigment, but usually much less than in the duct.

The female genital aperture lies, as in *Lymnaeidae*, on the right side of the body, anteriorly to the opening of the lung.

The male genital duct also differs in no essential points from the same duct in *Lymnaeidae*. Immediately after the division of the hermaphodite canal it widens, and flattens, passing in the form of a creamy-white coloured band on the ventral side of the pyriform body (Pl. IX—X, fig. 9, 15—16, P1). Then it distends forming a characteristic more or less elongated formation, with which we are already familiar in the family *Lymnaeidae* in the form of a swelling (Pl. IX—X, fig. 8, 9, 15—16, P). In *Myxas glutinosa* this distended portion of the prostate is pyriform. All the difference between *Myxas* and other *Lymnaeidae* consists in the existence in *Myxas* of a somewhat sharp demarkation between the proximal, flattened part of the prostate, and the distal distended part. This difference is further augmented by difference in colouring. The flat part of the prostate is creamy white, as I have mentioned, while the distended portion is thickly covered with black

pigment (Pl. IX, fig. 8 — 9, P). However, it is probable that this difference in colour is not very constant[1]). At any rate in other *Lymnaeidae*, according to my observations, the colour of these organs is subject to considerable individual variation. The form of the prostata in *Myxas*, like in the different representatives of the family *Lymnaeidae*, is very constant, but the position of the distended portion in situ may sometimes vary, of course. This organ becomes partly displaced, although in an insignificant degree, owing to greater or smaller extension of the rest of the body of the animal. Therefore, there is nothing surprising in the fact that sometimes the prostate (its distended portion) lies nearly straight (Pl. X, fig. 15, P), whilst in other cases it is more or less bent and curved (Pl. IX—X, fig. 9, 16, P). On its left side, under the pyriform body lies the bursa copulatrix, a canal passing between the prostate and the pyriform body.

The vas deferens is given off from the end of the prostate, and runs first freely in the body-cavity, and further, near the female genital aperture (sometimes pretty far from it, in the anterior part of the body), it penetrates into the musculature of the body-wall, from which it is liberated only near the male genital aperture. It then again lies freely in the cavity near the pharynx, and finally enters into the second penis-sac forming the penis inside the latter.

Both penis - sacs are of the same structure as in *Lymnaeidae*. The first (Pl. IX, fig. 11, 1 P) narrows slightly towards the free end (i. e. to the point of junction with the second penis - sac), but again widens at the very end into a swelling, on account of which it assumes the shape of a bottle. The second penis - sac (Pl. IX, fig. 11, 2 P) presents a long thin tube, separated from the vas deferens (Pl. IX, fig. 11, VD) by a bulb-like swelling. As the relative dimensions of the sacs are important in the classification, some measurements are given below:

Length: I sac	and II sac
4.25 mm.	6.0 mm.
4.0 „	5.75 „
3.75 „	6.0 „
3.75 „	5.0 „
3.0 „	5.0 „

[1]) In accordance with this assumpion I found in the specimens of the surroundings of Warsaw lesser difference in colouring of both parts of the prostata.

In average the ratio of length of the first sac to the second is 1 : 1,5 (more exactly: 1 : 1,48).

The muscles attached to the penis-sacs are greatly reduced. However, I have not yet studied this musculature. Only in the dissection of five specimens did I pay attention to it. In all the five specimens the retractors of the first (Pl. X, fig. 17, R 1) and second (Pl. X, fig. 17, R 2) sacs, at first united together into one muscle, soon separate. The retractor of the first sac (Pl. X, fig. 17, R 1) is a strong, thick muscle and is attached to the sac usually by two branches, into which it divides, although this is not always observed. The retractor of the second sac is thinner, and never divides. In three caces I did not succeed in discovering any protractors, but in two cases I observed one small muscle attached to the dorsal surface of the body (Pl. X, fig. 17, PR).

I must add several remarks with regard to the figures of the genital apparatus accompanying the present paper. Hitherto I have represented in the *Lymnaeidae* the genital organs after having separated and isolated them completely, while now I am drawing them as they lie in the animal, retaining their mutual relations. Both these methods have their advantages and disadvantages. Of course, in order to have a clear conception of the organs, it is necessary to separate them, but, on the other hand, when we are already acquainted with all the parts of the genital apparatus, there is no need of repeating this difficult and in many cases impossible operation each time. The fact is that in dissection of preserved animals these organs loose the softness and elasticity which they have in the fresh state. In the former case it is possible to cut them into pieces, but very often impossible to prepare well. That is, however, unnecessary. Nearly all important details are easily discernible in these organs without separating them, but removing them *in toto*, that it may be possible to examine them from the ventral surface as well. It is not difficult to remove them in this way. But in order that they might be compared easier with the description and figures, it is necessary that the latter would represent them exactly in the same position, not separated. This, of course, leads to the necessity of producing two figures — the dorsal and ventral aspects, but that does not matter much. It is needless to add that in studying the anatomy

of the genital organs for the present article, I have previously examined all their constituent parts in detail in completely separated preparations.

Structure of the Penis-sacs and of the Prostate.

All the facts exposed above do not, as I shall try to demonstrate below, support Wł. Dybowski's view regarding the separation of the genus *Myxas* into a distinct family. At present it remains only to examine the question as to how far the histological data do not disagree with this conclusion. For this purpose it would be necessary to compare the histological structure of all the organs of *Myxas glutinosa* with that of the same organs in the representatives of other *Lymnaeidae*. Unfortunately, we do not possess sufficient data on the structure of *Lymnaeidae* themselves, as only *Lymnaea stagnalis* has been studied more or less in detail, while with respect to the structure of other representatives of this family we possess detailed data only relating to one organ, viz.: both penis-sacs (59). On account of this, I shall treat only this organ in *Myxas* here, leaving the comparison of the remaining genital organs till the time, when further investigations on *Lymnaeidae* will have been published [1]).

We shall first make brief mention of the anatomy of this organ. At the point, where the second penis-sac passes into the first the latter embraces the former, as it is seen in the schematic figure (Pl. XI, fig. 18) representing the transverse sections through the first penis-sac. Thus at the beginning the walls of the second fuse with the walls of the first (Pl. XI, fig. 18, B, C, D — the walls of the first penis-sac are black, those of the second — gray), but soon they again separate and form a small papilla protruding freely into the cavity of the first penis-sac (Pl. XI, fig. 18, E), just as it is obtained in other *Lymnaeidae* (and, as a matter of fact, in mamy other genera). Near this papilla the interior folds of the first penis-sac form massive lips (Pl. XI, fig. 18, E, F, G, H). Both interior folds are, in general, less developed than in most *Lymnaeidae* and overlap one another, giving to the lumen the

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[1]) In the part VII-th of my „Contributions" (56) the reader will find observations on the structure of the prostata (*Lymnaea, Radix, Stagnicola* and *Myxas*).

typical form of „S" only on a limited distance not far from the head (Pl. XI, fig. 18, I, K, L, M), while further this form disappears altogether, as both folds come to lie one opposite the other (Pl. XI, fig. 18, N — V).

The histological structure of the penis-sacs in *Myxas glutinosa* resembles the structure of the same in the subgenus *Radix* (*R. auricularia*, *ovata*), therefore I shall not examine the whole organ here, but shall bear only on such characteristic features which distinguish this genus from the others.

At the end of the second penis-sac, not far from its entrance into the first, there begin to appear on its walls numerous mucous glandular cells, which were encountered only singly, in small quantities above, beginning from about half the length of the penis-sac. These cells staining intensely in blue colour with Delafield's haematoxylin eject their secretion into the lumen of the second penis-sac. They fill up to a considerable degree the walls of the penis-sac. Very soon, however, the walls of the first penis-sac embrace with their tissue the walls of the second; this tissue again being to a considerable degree composed of unicellular mucous glands, amongst which are distributed in all directions muscle fibres. These cells also stain with Delafield's haematoxylin, but more intensely than the preceding ones, on account of which they are always recognizeable in sections, even when both layers of these cells (those of the first and second penis-sacs) are so close to each other. These cells, as in *Radix*, are elongated and open ejecting their secretion not into the lumen of the second penis-sac, but into that of the first; on the lips surrounding the papilla we find numerous ducts of these cells. Further, in the folds of the first penis-sac and in the other parts of its walls we find at first still a great number of glands, which were filled in my preparations with eosinophile granules. Already with respect to *Lymnaeidae* it has been proved (59) that these granules present the material from which the mucin is later formed, which does not stain with eosin, but with haematoxylin. At about the middle of the length of the first penis-sac, and even higher, the glandular cells diminish in number, and soon disappear altogether.

From these data it may be concluded that *Myxas* is in close affinity with the genus *Radix* with respect to the structure

of its penis-sacs. And indeed, this genus is characterised by the presence in the head of the first penis-sac of two layers of glandular cells — an inner one belonging th the walls of the second penis-sac, and the other — outer one belonging to the walls of the second. In *Lymnaea* as in *Stagnicola* we find only one layer in the head of the first penis-sac (59).

It is true that the ratio of length of the first penis-sac to the second is different in *Radix*: 1 : 1, while in *Myxas* it is equal to 1 : 1.5. I may remark that in *Myxas* we observe the longest second penis-sac of all the European *Lymnaeidae* known to us, as in *Stagnicola* (*St. palustris*) this ratio is: 1 : $^1/_2$, and in *Lymnaea* (*L. stagnalis*) — 1 : $^1/_3$. However, from these figures we see that the ratio of length of both penis-sacs is variable in the limits of this family, and therefore the ratio met with in *Myxas* cannot serve as a distinctive character of a new family.

The internal structure of the prostate in *Myxas* was studied in one of my former papers (56), where I have shown that in this regard *Myxas* does not differ from *Radix*. In *Myxas* we meet too only one strong fold, not divided into secondary folds, projecting from the dorsal side into the cavity of the gland (see fig. 1 in the quoted paper).

The histological structure of the prostate in *Myxas* does not differ in any way from that in other *Lymnaeidae*. As this structure has been already described in the paper mentioned above, I consider it unnecessary to give here any details concerning it. I would like only to draw special attention to the absence of any differences in that regard between the genera *Myxas* and *Radix*.

The Systematic Position of the Genus *Myxas*.

From all the facts exposed above we may now conclude that *Myxas* differs from others *Lymnaeidae* in the following characters:

1. Its shell shows an abbreviated spire, and it is thin, transparent and shining.

2. The mantle is strongly developed, turned out on the exterior surface of the shell and covers it.

3. Thinness of the upper jaw and weak development of the lateral ones.

4. The presence of a third buccal ganglion (according to van Beneden [1]).

5. Abbreviation of the hermaphrodite gland.

However, as we have seen, not all these characteristic features are equally important for our question. Thus, the shell of the *Lymnaeidae* (*Radix ovata*) sometimes approaches that of *Myxas* in form, thereby destroying, or diminishing the importance of this character. The lateral jaws in *Lymnaeidae* are generally more or less atrophied, therefore their atrophy in *Myxas* is also of no importance to us. It is possible, as it follows from the difference between my description and that of Lehmann, that they probably vary (as it is obtained in *Lymnaeidae* as well) in fairly wide limits. The presence of a third buccal ganglion is not confirmed. The abbreviation of the hermaphrodite gland, is observed, according to Jacobi (38) in *Lymnaea okinawensis* [2]). The only remaining character is the development of the mantle.

Are these distinctive characters sufficient to justify the separation of *Myxas* into a distinct family?

Before answering this question, we shall see what are the differences between the other groups of molluscs, which were previously referred to the family *Lymnaeidae*, and the independence of which is hardly disputed by anybody at present — viz.: *Planorbidae*, *Physidae* and *Ancylidae*. Of course, a much greater number of distinctive characters, than I have set forth, could be found between the *Lymnaeidae* and these groups in the literature, however poor it may be; however, even those that are enumerated will suffice our purpose. I am naming here such characterestic features of these families by which they differ from the *Lymnaeidae*.

Planorbidae:

1. Shell spiral winding nearly in one plane.
2. Body extremely elongated.
3. Genital and respiratory orifice always to the left.

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[1]) As it was shown above, it is an anomaly found also in *Radix*.

[2]) In the part IV of my „Contributions" the reader will find my observations on the abbreviation of the hermaphrodite gland in *Radix*.

4. Small surface of foot as compared with the bulk of the body.

5. Thin, filiform tentacles.

6. Radula fairly long, band-shaped, central tooth wide, bicuspid.

7. The liver has not got the form of a compact mass, but that of a flat gland in the shape of deer horns.

8. The elongated hermaphrodite gland does not lie in the liver mass, but protrudes far from it, alone filling up the ultimate whorls of the shell.

9. Weak differentiation (and in small species even total absence of same) of the oviduct into separate portions, as uterus, nidamental gland, pyriform body.

10. The prostate does not embrace the male genital duct, but is suspended to one side of the duct in the form of a supplementary gland, having the shape of a comb or bunch of grapes.

11. The penis is sometimes armed with a stilette, mostly with a lateral aperture (although not always).

12. The laid eggs are gathered into cocoons in the form of flat, round mucous plates.

Physidae:

1. The shell is twisted leftwards.

2. Strong development of the mantle partly covering the upper surface of the shell.

3. The tentacles are long, thin, filiform.

4. Absense of lateral jaws.

5. The posterior end of the radula is divided into two bands.

6. There are only two kinds of teeth on the radula, their form and arrangement being different to those in *Lymnaeidae.*

7. The absence of the nidamental gland (Sługocka, requires verification).

8. Absense of the distal swelling of the prostata.

9. The absense of the unicellular glands in the first penis-sac, except a cluster of such cells in one species (named prostata by Sługocka; requires verification).

Ancylidae:

1. The shell has the form of a hood („mützenförmig").
2. There is one horse-shoe-shaped jaw, covered with denticles on the exterior margin.
3. The radula is long, band-formed.
4. Reduction of the musculature (muscles of penis, tentacles). Two retractors of the foot (instead of one musculus columellaris).
5. Absense of pulmonary cavity.
6. The spermoviduct into which the hermaphrodite canal and albumiferous gland open.
7. Extreme differentiation of the oviduct.
8. The prostata situated at the very beginning of the male duct is rather peculiar.
9. Only one penis-sac present.
10. Presence of the flagellum.
11. The eggs laid accumulate in flat and round mucous cocoons.

An examination of all these differences gives evidence that the separation of these familes from the *Lymnaeidae* is fully justified. Indeed, each of these families differs from the *Lymnaeidae* not only in clearly expressed important separate characters (e. g., the non-complicated structure of the oviduct and peculiar prostata in *Planorbidae*, the structure of the radula in *Physidae*, the structure of the genital apparatus, and especially the presence of a flagellum in *Ancylidae*), but besides these we observe a whole complex of other distinctive characters, which, taken separately, could not serve to separate their bearer into a special family, but taken together with all the others, in their whole complexity, are without any doubt in favour of such a separation. In *Myxas* the chief distinctive character is presented by the development of the mantle. I consider this insufficient for the establishment of a new family.

We have already seen that both the external morphology (the form of the shell, colour of the mantle), and the histological structure of the first penis-sac have demonstrated to us that *Myxas* has, probably, originated from the genus *Radix*, as I tried to show it in another paper (57). The cause that had evoked the development of the mantle is in my opinion presented by

cutaneous respiration of the *Lymnaeidae*. Let us now suppose that the same cause has evoked a similar development of the mantle in some representatives of other genera, in *Lymnaea* and *Stagnicola*. In such an event we should have to refer these hypothetical animals to the same family of *Amphipeplidae* Wł. Dybowski (if such were adopted), and then we would have to deal with a curious family, each member of which stands nearer to the members of another family (*Lymnaeidae*), than to the members of its own family. Such considerations would have brought us to systematic nonsense, to avoid which we should be compelled to divide *Amphipeplidae*, into several families, and, as a logical sequence, this would lead to the division of *Lymnaeidae* into similar families. It is true that already Wł. Dybowski has transformed the genus *Stagnicola* (= *Limnophysa*) in the family *Lymnophysidae*, but Baker has clearly proved that their were no foundation for this.

This imaginary hypothetical case was set forth by me as an illustration of the impossibility of establishing large systematic units on some single character (as the development of the mantle in the given case), as such a method may lead to an unnatural system of classification. According to this opinion of mine, I deny the possibility of creating the new family for *Myxas* as there do not exist sufficient distinctive characters of any importance for this purpose.

Baker had also come to the same conclusion on the data of literary material alone. In his monograph on the North-American *Lymnaeidae* (2) he divides the whole family of *Lymnaeidae* into two subfamilies:

„Family *Lymnaeidae* Broderip 1839. Subfamily *Lymnaeinae* Dall 1870.

Mantle margins retained within margin of the shell.

Subfamily *Amphipepleinae* Dybowski 1903.

Mantle margins enlarged, covering a portion of the shell" (2, p. 125).

Into the second subfamily Baker includes two genera: *Myxas* J. Sow. and *Cyclolimnaea* Dall.

What we have said above concerning the hypothetical impediments, which do not allow to create a family, may, of course,

be applied now to Baker's proposition, and serve for the refutation of his subfamily. In this case, however, we are dealing with a smaller systematic unit, for the establishment of which fewer dinctinctive characters are sufficient. Therefore, it seems to me that we may temporarily adopt Baker's proposition. If my objections prove to be not hypothetical, if, e. g., it may be stated that *Cyclolimnaea* (which could not, unfortunately be investigated by me[1]) is in closer affinity to some representative of *Lymnaeinae*, than to *Myxas*, then the subfamily will be annuled *eo ipso*.

In all my discussion of the genus *Myxas* I have born in mind only one representative of that genus, viz.: *Myxas glutinosa* Müll., which, on my view, presents the only species composing this genus. I am sure that upon a more detailed study of the Australian molluscs referred to this genus it will be proved that they have nothing in common with the European representatives of this genus. If my supposition is incorrect, they will also be found to bear the clearly expressed features of the family *Lymnaeidae*.

The Geographical Distribution of the Genus *Myxas*.

I have mentioned above that the only representative of the genus *Myxas* is *Myxas glutinosa* Müll.[2]), apparently exclusively a European species, or more accurately — North European; the area of its distribution extends throughout the whole length of Europe, from West to East.

In the West *Myxas glutinosa* seems to be absent in Iceland, but is found in Ireland an in South and Middle England [according to Ellis (24) it reaches Westmoreland]. On the Continent it is found in South and Middle France extending on the Western borders of France far to the South, right to the Pyreneans [according to Moquin-Tandon (49) it reaches the department of Basses Pyrenées]. Further to the East it occurs in Luxembourg, Belgium, Holland, apparently in all Germany and Denmark.

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[1]) I was utterly unable to obtain in Warsaw the paper dealing with anatomic structure of *Cyclolimnaea*.

[2]) The species described by Bourguignat I refer to the species *glutinosa* (till the time, when its independence will have been definitely established) following the example of Germain (26).

For Poland it was established by Radoński (51, surroundings of Poznań), Ślósarski (67 — 68, Milejów), Poliński (50, Drewnica and Pruszków near Warsaw, lake of Borzymów, lake Wązowiec near Suwałki), Bąkowski and Łomnicki (5, surroundings of Pieniaki, Rzeszów, Piotrów near Poznań) Król (40, pound in Zalesie near Janów, and Olszanica near Jaworów), Geyer (29 — 32, lakes: Wigry and Okunin, near Suwałki; Białowieża), Wł. Dybowski (16, Lubcz: „Altwasser, kleine Seen und Tümpel im Alten Bett der Niemans, sehr häufig"). Personally I have found this species in great numbers in large pools at the Vistula near Warsaw, at the lake of Czerniaków, in the Skaryszewski-Park, and in lakes near Poznań.

For the surroundings of Danzig this species is established by Schumann (62, „in einem Graben neben der Mottlau bei Danzig, in der Weichsel bei Heubude und nach Hensche im Sasper See"). In Eastern Prussia *Myxas glutinosa* is found by Hilbert (34 — 37), Protz (75) etc.

In the Scandinavian Peninsula it seems to be absent in Norway, whilst it is found in the southern parts of Sweden; im Finland it is widely spread and reaches the extreme North, as (according to the data collected by Luther, 46) it is found in Lapponia Inarensis. On the East of the Kola Peninsula Luther marks its presence in the riker Varsuga (Lapponia Varsugae, to the South - East of the Kola Peninsula in the government of Archangelsk). It is interesting to trace the distribution of this species in East Europe, as many authors limit its distribution only to North-West and Middle Europe, whilst Zykov (74) on the contrary, places *Myxas* amongst the genera spread „through the whole European Russia". It occurs that both opinions are wrong. I am giving below all the localities in which this species is known by me to occur:

Latvia: Ricklefs 1898 (76) „im Bullsee, gross und bräunlich" (p. 49).

Esthonia: Gerstfeld, 1859 (28). „bei Pernau nicht sehr selten" (p. 111).
Dybowski Wł. 1874 (13) „Elva-Fluss bei Hellenorm" (p. 432).
Id. 1878 (14) „bei der Age-Mühle hinter Haselau (p. 259).

Braun M. 1884 (8) „bei Hellenorm in Cabbina“ (p. 456).
Luther 1901 (45): in the neighbourhood of Tallin (Reval) he found it in great numbers „bei der Mündung des Moikschen Baches“.

Russia:

Leningrad govt.: Siemaschko 1848 (64): „in Petersburg selbst, auf der Insel Petrowskoi im Bache (kleinen Newa) in einer Tiefe von 1 Fuss gefunden. Im September und Ende Novembers entdeckte ich diese, für Russland ganz neue Schnecke, in Menge unter dem Eise sitzend“, (p. 230).
Gerstfeld 1859 (28, p. 111).
V. A. Lindholm. Several years ago already (for the first time in 1908) he found it in the river Yuntalovka near Lakhta (not published), from where I obtained the material for the present note.
V. A. Lindholm 1911 (44, p. 293). Morja-Fluss.
Skorikov 1910 (66). In the Ladoga lake (p. 117).

Olonetz govt.: Kessler 1868 (39): „in considerable numbers in the Yalgubsk and Kondobojsk bays of the Onega lake“ (p. 73).

Archangelsk govt.: I have already mentioned above, according to Luther's compendium of the molluscs of Finland, that *Myxas glutinosa* was found in the river Varsuga, in the South-Eastern part of the Kola Peninsula (46, p. 89—90).

Tver govt.: Molčanov L. A 1912 (48). In the lake of Seliger it is „frequently encountered“ (p. 147).

Moscow govt.: Milashevich 1881 (47). „Etang du Monastère Novodevitchi près de Moscou“.
Rossinkij 1892 (53). „Encountered only once in the lake Ditiatko near the village of Ostrov on slimy bottom“. (p. 17).
Rosen O. 1905 (52, p. 80).
In the collections of V. A. Lindholm from the Klin district, lake Sinesh (not published).

Tambov govt.: Fokin and Demin, 1928 (25): In tributaries of the river Voronež: Lesnoi Voronež and Ilovaj, and

in stagnant waters of the surroundings of the town Kozlov, not farther than 20 km. from it; also in similar waters in the vicinity of Tambov, not farther distant than 35 km., and around the village Piterskoje, district Moršansk.

Yaroslavl govt.: Sabanějev 1880 (61). „In the vicinity of Yaroslavl" (p. 84).

Vladimir govt.: In the collections of V. A. Lindholm there is *Myxas glutinosa* from the Pereyaslavl dept., Zabolotskoë lake.

Shadin (Žadin) 1923 (63): In the lake Sviato-Diedovskoje, in the pound of Veletminsk and in other waters of the Murom region.

Kazan govt.: Krulikovskij 1891 (41). In the vicinity of Kazan and in the Kaban lake (p. 19).

Ruzskij 1916 (60). Lakes: Bolshoj Martyn, Malyj Martyn (p. 55 and 58).

Viatka govt.: Krulikovskij 1891 (41): In the lists he mentions *Myxas glutinosa* as a form common to the governments of Kazan and Viatka (p. 3).

Perm govt.: Boettger 1890 (7). Kungur, 5 expl.

Ufa govt.: In the collection of V. A. Lindholm from the Ufa dept., village Yabalakly (not published).

From this list it can be seen that *Myxas* is far not everywhere spread through Russia in Europe, as it had not hitherto been found further to the South than the Tambov government, whilst, on the other hand, on the East it reaches up to the very Ural mountains, to the governments of Perm and Ufa. In due time, when the basins of Russia are better investigated the number of localities in which this form occurs will certainly be widened, especially to the North, and will be found in the entire northern part of Russia in Europe, but it is doubtful whether it is spread wide to the South; on account of the fact that in the numerous southern basins that have been more or less investigated it has not been hitherto found, it is difficult to suppose that the future will reveal it there.

From the distribution of this mollusc it is obvious that it positively avoids mountains. I think that its absence in North

Sweden and Norway, in Austria and Switzerland [1]), is due to this peculiarity. Therefore it is quite possible that it is really absent in Siberia as well (although, on the other hand, it is quite possible that the absence of any data concerning its occurence in Siberia is due simply to insufficient exploration of the Siberian basins), as the Ural must present a serious bar to its distribution. However, on the South (in East Europe) there exist no topographical bars for its distribution, and if it really does not penetrate far to the South, this may be due to climatic conditions. In Western Europe *Myxas glutinosa* reaches far southwards along the Atlantic coast, that is along a zone characterised by sea-climate, as far as the feet of the Pyreneans, while in the East, where the climate is continental, it is restricted to more northern regions. The continental character of the climate, with its hight summer temperatures, forms probably the factor which does not allow *Myxas* to extend southwards its area of distribution. This is the more possible that if this form inhabited East Europe during the glacial period, it must have lived more to the South from the present boundary of its distribution at the epoch of the greatest expansion of the Scandinavian glacier, i. e. after the glacial period it must have died out in the southern area of its habitation.

At the conclusion mention must be made of two more discoveries. One was mentioned by me before, in the discussion about the shell of *Myxas glutinosa*: this is *Gulnaria ampullacea* var. *baicalinella* B. Dyb. found in the Baikal lake (one empty shell); the form of it shell is very similar to that of *Myxas glutinosa*; however the author himself (B. Dybowski) joins it with *Radix*, and not with *Myxas*, both on account of zoogeographical considerations, and the colour and consistence of the shell (12). The other discovery was made by Ehrenberg (33), who found emply shells in Syria, near Beyrout which he referred to the species *glutinosa* (*Amphipeplea glutinosa syriaca* Ehrenb.) Since then in all the general compendia we meet with the following strange area of distribution of this species: „Nordwest

[1]) It is true, that Eder quotes this species for Unterwalden in Switzerland (23), but he states also that the shells of his collection were not labelled; I am almost sure, that the shells do not derive their origin in Switzerland.

Europa, Syrien" (Westerlund 72; Clessin 10). From the zoogeographical point of view such a distribution rouses suspicion and doubt as to the correctness of determination.

Owing to the kindness of Dr. B. Rensch from the Zoological Museum of Berlin I was able to examine the shells of Ehrenberg's collection, and I could state, that they belong undoubtedly to *Myxas* and not to *Radix*, as I suspected in my paper 58. It is, however, astonishing that the numerous explorers of Syria never found that species later. L. Germain (27) who mentions in his monograph of Syrian Mollusca the species *Myxas glutinosa* in the historial review as found by Ehrenberg does not include it in the systematic part of his work and thus cancels it from the list of Syrian Mollusca.

As the presence of *M. glutinosa* in Syria has never been confirmed by other explorers, and as the existence of such an isolated standpoint, not connected with the remaining area of distribution, seems to be of very little probability, I think it most justified to suppose that the specimens of Ehrenberg were placed by some mistake among the Syrian collection of this explorer.

In any case we have now to exclude both the Baical and Syria from the limits of the area occupied by *Myxas glutinosa*; I would like, however, to draw upon this question the attention of future explorers of Syria. It may be that, against all exspection, the discovery of Ehrenberg will be confirmed by future field investigations.

LIST OF LITERATURE QUOTED.

1. André E. Contributions à l'anatomie et à la physiologie des *Ancylus lacustris* et *fluviatilis*. Rev. suis. de zool. I. 1890.
2. Baker F. C. The *Lymnaeidae* of North and Middle America. Chicago Acad. Sc. Spec. Publ. Nr. 3. 1911.
3. Baudelot M. Recherches sur l'appareil générateur des mollusques gastéropodes. Ann. Sc. nat. Zool. 4 Ser. XIX. 1863.
4. Bąkowski J. Mięczaki zebrane w r. 1879 w okolicy Rzeszowa. Spraw Kom. Fiz. Ak. Um. Kraków. XIV. 1880.

5. Bąkowski J. i Łomnicki A. M. Mięczaki Muzeum Im. Dzieduszyckich. Lwów. 1892.
6. Beneden P. J. van. Mémoire sur le *Limnaeus glutinosus*. Nouv. Mem. Acad. roy. Sc. Bruxelles. XI. 1838.
7. Boettger. Zur Molluskenfauna des russischen Gouvernements Perm und des Gebietes südöstlich von Orenburg. Nachrbl. d. d. mal. Ges. 22. 1890.
8. Braun M. Beiträge zur Kenntnis der Fauna baltica II. Arch. f. Naturk. Liv.-Esth. u. Kurlands. II Ser. IX. 1884.
9. Buchner O. Beiträge zur Kenntnis der einheimischen Planorbiden. Inaug. Diss. Stuttgart. 1890.
10. Clessin S. Deutsche Excursions-Mollusken-Fauna. Nürnberg. 1884.
11. — Excursions-Mullusken-Fauna Oesterreich-Ungarns und der Schweiz. Nürnberg. 1887.
12. Dybowski Benedykt. Bemerkungen und Zusätze zu der Arbeit von Dr. W. Dybowski „Mollusken aus der Uferregion des Baikalsees". Ann. Mus. Zool. Acad. Sc. St.-Petersburg, XVII. 1912.
13. Dybowski Władysław. Die Sammlung inländischer Mollusken. Sitzungsber. d. Naturf. Ges. Dorpat. III. 1874.
14. — Ueber *Spongilla fluviatilis*, *Helix arbustorum*, *Amphipeplea glutinosa*. Sitzber. Naturf. Ges. Dorpat. IV. 1878.
15. — Studien über die Mundwerkzeuge der *Physa fontinalis*. Sitzber. Naturf. Ges. Dorpat. VII.
16. — Zur Molluskenfauna Lithauens. Sitzber. Naturf. Ges. Dorpat. VII.
17. — Studien über die Zahnplatten der Gattung *Limnaea*. Bull. Soc. Nat. Moscou. 59. 1884.
18. — Studien über die Mundwerkzeuge der *Limnaea palustris*. Sitzber. Naturf. Ges. Dorpat. 1886.
19. — Studien über die Mundwerkzeuge der *Gulnaria peregra*. Sitzber. Naturf. Ges. Dorpat. 1886.
20. — Ueber die Zahnplatten der *Gulnaria*-Arten. Bull. Soc. Nat. Moscou. 61. 1886.
21. — Studien über die typischen Formen der Zahnplatten der lithuanischen lungenatmenden Binnenschnecken. Malakozool. Bl. N. F. VIII.
22. — Bemerkungen über die gegenwärtige Systematik der Süsswasserschnecken. Nachrbl. d. d. Malak. Ges. 35. 1903.
23. Eder L. Zur Gastropodenfauna Unterwaldens. Arch. f. Mollusk. 1921.
24. Ellis A. E. Britisch Snails. Oxford. 1926.
25. Fokin A. and Demin H. Некоторые данные по фауне пресноводных *Gastropoda* Тамбовской губернии. Русск. Гидробиол. Журн. VII. 1928.
26. Germain L. Mollusques de France et des regions voisines. Vol. II. Paris. 1913.

27. — Mollusques terrestres et fluviatiles de Syrie. 2 vol. Paris. 1921—1922.

28. Gerstfeld G. Aufzählung der in Esth-Liv.-u. Kurland beobachteten Land- u. Süsswassermollusken. Correspondenzbl. Naturf. Vers. Riga. XI. 1859.

29. Geyer D. Zur Molluskenfauna des Urwaldes von Bialowies. Nachrbl. d. d. Malakozool. Ges. 49. 1917.

30. — Zur Molluskenfauna Polens. Nachrichtsbl. d. d. Malakozool. Ges. 49. 1917.

31. — Die Weichtiere. Bialowies in deutscher Verwaltung. Berlin 1918. II Auflage.

32. — Die Mollusken des Urwaldes von Bialowies. Abhandl. Senckenberg. Naturforsch. Ges. 37. 1919.

33. Hemprich et Ehrenberg. Symbolae physicae. 1831. Animalia evertebrata. Mollusca.

34. Hilbert R. Zur Kenntnis der preussischen Mollusken. Schrift. Phys.-ökon. Ges. Königsberg. XLVI 1905.

35. — Weitere Beiträge zur Preussischen Molluskenfauna. Schrift. Phys.-ökon. Ges. XLVII. 1907.

36. — Neues zur altpreussischen Molluskenfauna. Schrift. Phys.-ökon. Ges. L. 1909.

37. — Ergebnisse neuer Feststellungen zur Molluskenfauna Alt-Preussens. Schrift. Phys.-ökon. Ges. LI. 1910.

38. Jacobi A. Japanische beschalte Pulmonaten. Journ. Coll. Science. Imp. Univ. Tokyo. XII. 1898—1900.

39. (Kessler K.) Кесслеръ К. Матеріалы для познанія Онежскаго озера и Обонежскаго края. Приложеніе къ Труд. I съѣзда русск. естественн. С.-Петербургъ. 1868.

40. Król Z. Mięczaki lądowe i słodkowodne ze stoków głównego działu wód etc. w Galicji Wschodniej. Spraw. Kom. Fiz. Ak. Um. Kraków. 12. 1878.

41. (Krulikowskij) Круликовскій Л. Матеріалы для познанія малакозоологической фауны Россіи. Прилож. къ LXVI тому Запис. Импер. Акад. Наукъ. Nr. 10. 1891.

42. Lacaze-Duthiers H. de. Des organes de la reproduction de l'*Ancylus fluviatilis*. Arch. Zool. Exp. et Gen. (3) VII. 1899.

43. Lehmann R. Die lebenden Schnecken und Muscheln der Umgegend Stettins und in Pommern. Cassel. 1873.

44. Lindholm W. A. Ueber Mollusken aus dem Ladogasee und der Nevabucht. Ann. Mus. Zool. Ac. Sc. Petersb. XVI. 1911.

45. Luther. Verzeichnis der Land- und Süsswassermollusken der Umgebungen Revals. Acta Soc. pro faun-flor. Fenn. XX. 1901.

46. — Bidrag till kännedomen om Land- och Sötvattengastropodernas Utbredning i Finland. Acta Soc. faun-flor. Fenn. XX. 1901.

47. Milachevich. Etudes sur la faune de Mollusques vivants terrestres et fluviatiles de Moscou. Bull. Soc. Natur. Moscou. 56. 1881.

48. (Molčanov) Молчановъ Л. Матеріалы по фаунѣ безпозвоночныхъ оз. Селигера. Труды прѣснов. біол. Ст. С.-Петербург. О-ва Ест. III. 1912.

49. Moquin-Tandon. Histoire naturelle de Mollusques terrestres et fluviatiles de France. Paris. 1855.

50. Poliński Wł. Materjały do fauny malakozoologicznej Królestwa Polskiego, Litwy i Polesia. Prace Tow. Nauk. Warsz. Nr. 27. 1917.

51. Radoński P. Spis mięczaków W. ks. Poznańskiego. Rocznik Tow. Przyj. Nauk. Poznań. XIX. 1892.

52. (Rosen O.) Розенъ О. Моллюски Окской Экспедиціи. Изв. Импер. О-ва Люб. Е. А. Э. XCVIII 1905.

53. (Rossinskij) Россинскій. Матеріалы къ познанію фауны безпозвоночныхъ Москвы рѣки. Изв. Импер. О-ва Люб. Е. А. Э. LXVII.

54. Roszkowski W. Contribution à l'étude des Limnées du lac Léman. Rev. Suis. Zool. 22. 1914.

55. — Przyczynek do znajomości anatomji narządów płciowych u błotniarek podrodzaju *Gulnaria* Leach. Spraw. Tow. Nauk. Warsz. 1914.

56. — The Structure of the Prostata of the *Lymnaeidae*, Annal. Mus. Polon. Hist. Nat., V, 1926.

57. — The Genus *Pseudosuccinea* from South Brasil. Annal. Mus. Polon. Hist. Natur., VI, 1927.

58. — Z badań nad Otułką (*Amphipeplea* Nils.) Disputationes Univ. Varsov Nr. 1. 1925.

59. Roszkowski W. i Żebrowska A. O budowie pochewek prącia u błotniarek. Prace Tow. Nauk. Warsz. Wydz. III. Nr. 9. 1916.

60. (Ruzskij) Рузскій М. Лимнологическія изслѣдованія въ среднемъ Поволжьи. Изв. Имп. Томскаго Унив. LXV. 1916.

61. (Sabanějev) Сабанѣевъ. Списокъ сухопутныхъ и прѣсноводныхъ слизняковъ водящихся въ Ярославской губ. Тр. О-ва для изслѣдованія Ярославской губ. Выпускъ I. 1880.

62. Schumann. Die Binnen-Mollusken der Umgebung von Danzig. Schriften d. Naturf. Ges. Danzig. V.

63. (Shadin W. I.) Жадинъ. Пресноводные моллюски Муромского края. Рабомы Окской Биол. Станц. II. 1923.

64. Siemaschko. Bemerkungen über einige Land und Süsswassermollusken Russlands. Bull. Cl. phys.-math. Ac. Sc. St.-Petersburg. VII. 1849.

65. Simroth H. Mollusca. Bronns Klassen und Ordnungen. III.

66. (Skorikov) Скориковъ. Зоологическія изслѣдованія Ладожской воды какъ питьевой. Ст. Петерб. 1910.

67. Ślósarski A. Przyczynek do fauny malakologicznej Królestwa Polskiego. Warszawa 1877.

68. — Materiaux pour la faune malacologique du Royaume de Pologne. Bull. Soc. Zool. France. 1877.

69. Sługocka M. Recherches sur l'appareil génital des Gasteropodes pulmonés du genre *Physa*. Rev. Suis. Zool. 21. 1913.

70. Sowerby J. The Genera of Recent and Fossil Shells. Nr. 7. 1822.

71. Troschel. Ueber die Gattung *Amphipeplea*. Arch. Naturgesch. V. 1839.

72. Westerlund. Fauna der in d. paläarktischen Region lebenden Binnenkonchylien. 1884—90.

73. — Synopsis moïluscorum extramarinorum Scandinaviae. Acta Soc. pro faun.-flor. Fenn. XIII.

74. (Zykov) Зыковъ. О географическомъ распредѣленіи наземныхъ и прѣсноводныхъ слизняковъ Европ. Россіи. Вѣстникъ Естеств. I. 1890.

75. Protz A. Zur Binnenmolluskenfauna der Provinz Ostpreussen. Nachrbl. d. d. malak. Ges. XXXV. 1903.

76. Ricklefs. Zur Molluskenfauna von Curland. Nachrbl. d. d. Malak. Ges. XXX. 1898.

EXPLANATION OF PLATES.

Plates VII — VIII.

Figures 1 — 7. Radula; c = dens centralis.

Plate IX.

Figure 8. Genital apparatus from the dorsal side.
„ 9. Anterior portion of the genital apparatus from the ventral side.
„ 10. Hermaphrodite gland and herm. canal.
„ 11. Copulative organs.

A = albuminiparous gland; B = bursa copulatrix; C = canal of the bursa; CH = hermaphrodite canal; CP = pyriform body; GH = hermaphrodite gland; NG = nidamental gland; P = prostata; P 1 = proximal flattened part of the prostate; 1 P = first penis-sac; 2 P = second penis-sac; U = uterus; V = vagina; VD = vas deferens.

Plate X.

Figure 12. Uterus and nidamental gland.
„ 13 — 14. Bursa copulatrix with the canal of the bursa.

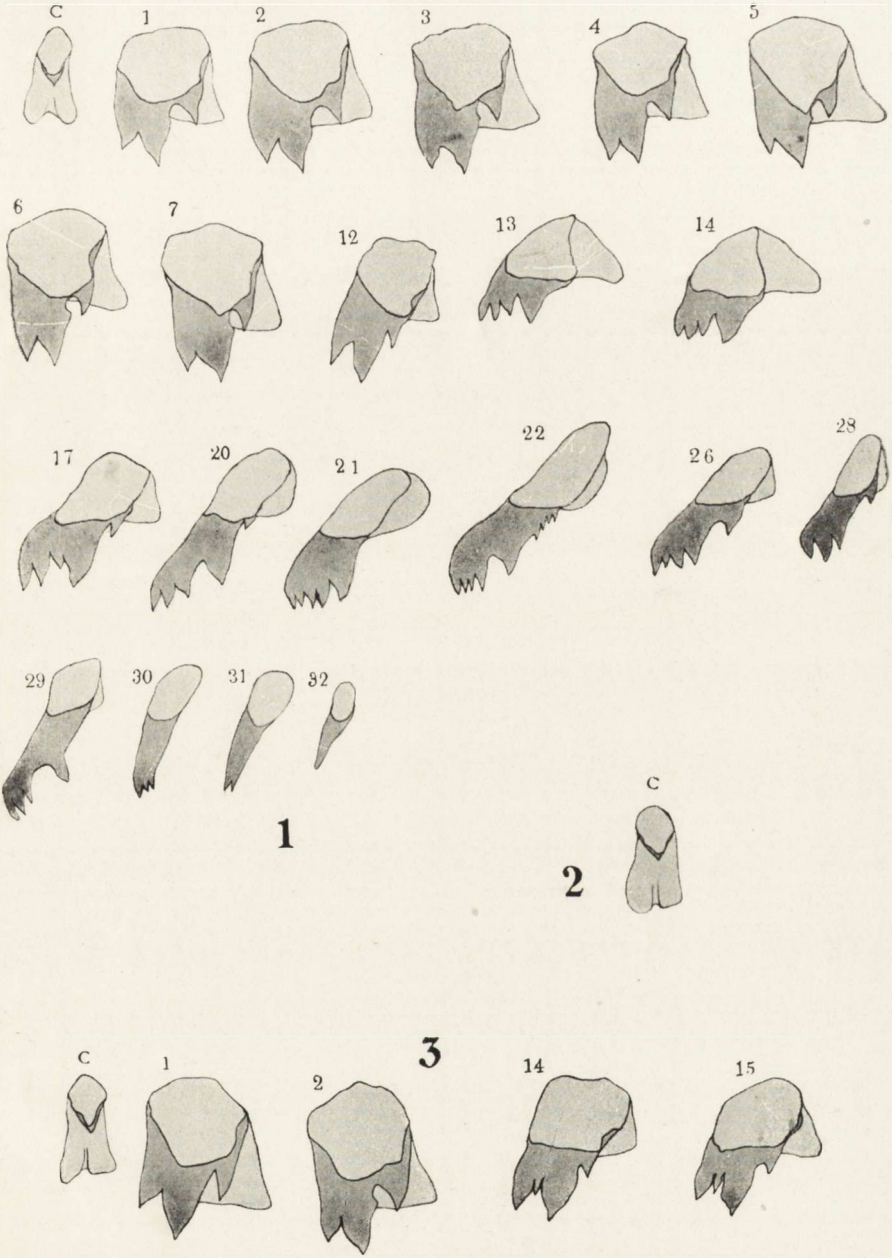
„ 15 — 16. Ductus genitalis from the ventral side.
„ 17. Musculature of the copulative organs.
P R = protractor penis; R 1 = retractor of the first penis-sac; R 2 = retractor of the second penis-sac; other signes as in the preceding plate.

Plate XI.

Figure 18. Transverse sections through the anterior end of the second penis-sac (A), the head (B — G), and the corpus (H — V) of the first penis-sac.

STRESZCZENIE.

Autor po zbadaniu morfologji zewnętrznej, szczęki i tarki, układu nerwowego, a szczególniej narządów płciowych otułki (*Myxas* J. Sowerby = *Amphipeplea* Nilss.), nie znalazł między nią a pozostałymi przedstawicielami rodziny błotniarek (*Lymnaeidae*) tak daleko idących różnic, aby pozwoliły na wydzielenie rodzaju *Myxas* w rodzinę odrębną, jak to proponował Wł. Dybowski. Ostatni rozdział jest poświęcony zobrazowaniu rozmieszczenia otułki ze specjalnem uwzględnieniem Europy środkowej i wschodniej. Praca niniejsza ukazała się w języku polskim w wydawnictwach Uniwersytetu Warszawskiego (p. spis literatury № 58) — tekst obecnie ogłaszany zawiera jednak pewne uzupełnienia i poprawki.



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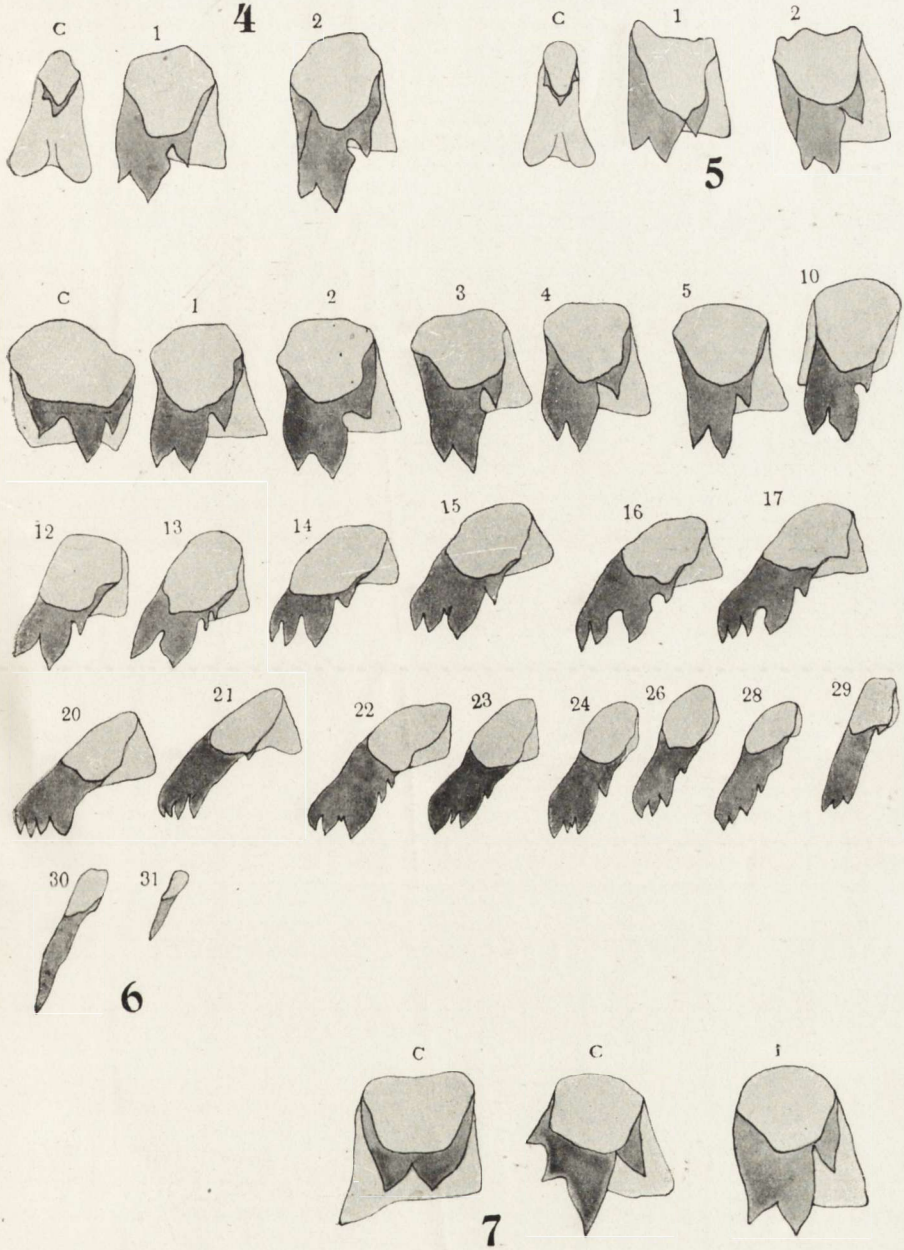

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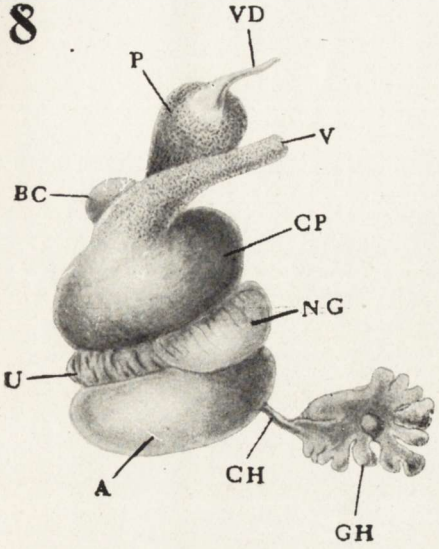

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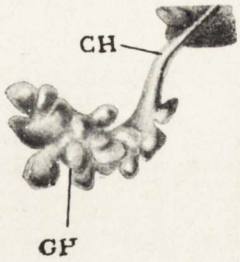

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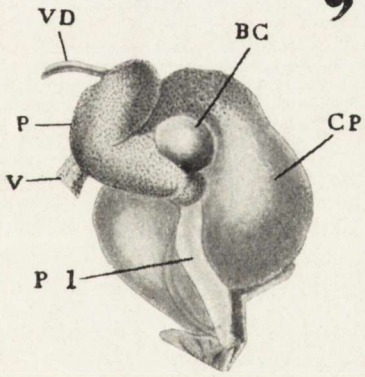

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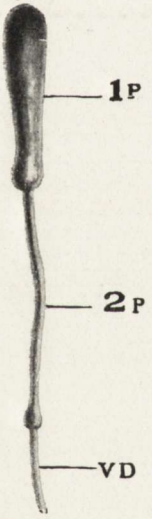

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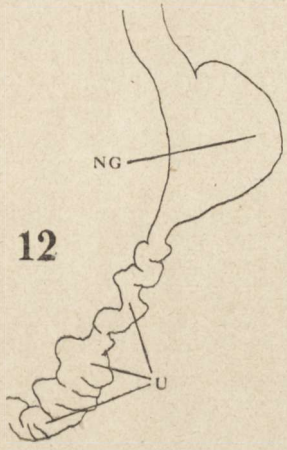

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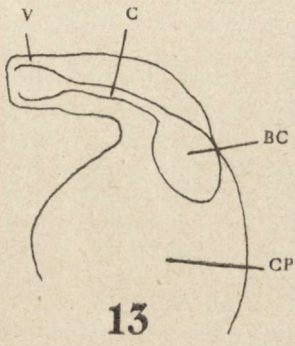

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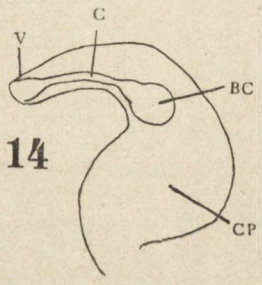

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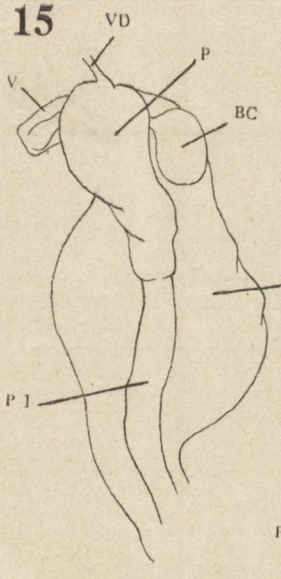

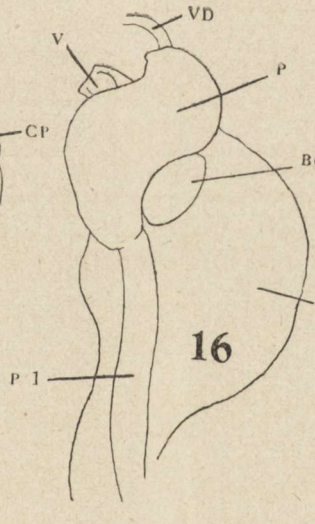

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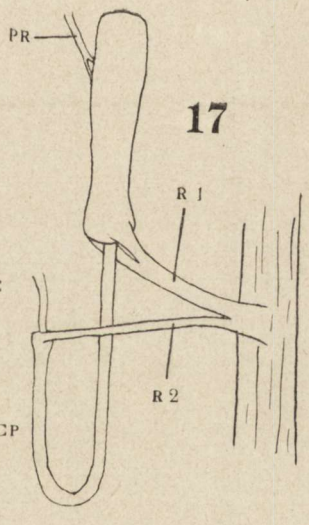

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