



**Southern California Association of
Marine Invertebrate Taxonomists**

3720 Stephen White Drive
San Pedro, California 90731

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SCAMIT Newsletter

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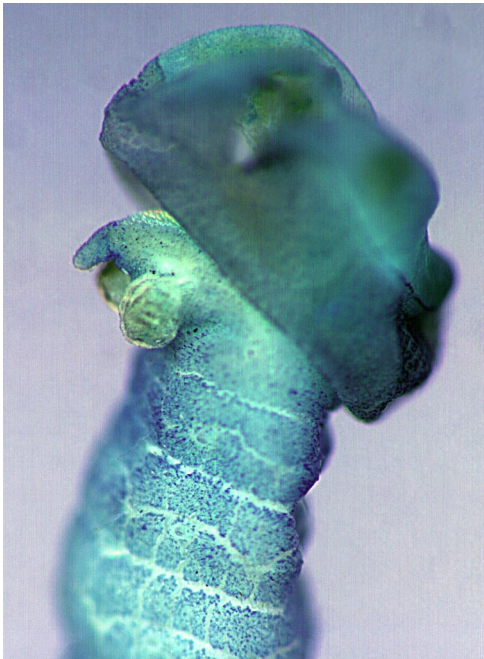
SUBJECT: Polychaeta: End of Volume 7 Discussions

GUEST SPEAKER: Led by Leslie Harris

DATE: 11 June 2001

TIME: 9:30 a.m. to 3:30 p. m.

LOCATION: Worm Lab, Collections Room
LACMNH



Notomastus "latericeus" - Ant. Detail Methyl Green Stained
City of San Diego ITP I-2 Rep. 1 2Jan2001 108ft.
Tissue behind proboscis (last abdominals shredded) removed in
Photoshop to emphasize size of proboscis
R. Rowe
Max width 1.1mm & Length of thorax 4.5mm

For the next meeting, bring specimens of the as yet unfinished groups, Oweniidae, Trichobranchidae, and Terebellidae (in part), and any problematic specimens of other polychaete families. As usual, the polychaete type resources of the Allan Hancock Foundation, now at the Natural History Museum, will be available for consultation. The meeting will actually be held in the Collections Room, so late arrivers should go directly there (turn to the right at the "T" hallway intersection rather than to the left).

NEW LITERATURE

The sea-pansys, octocorals of the genus *Renilla*, were revised by Zamponi and Pérez (1995). Although their primary interest is in the fauna of the southwestern Atlantic and the sub-Antarctic, they did a world-wide revision. Our local species, *Renilla koellikeri* (note the unlauded ö is no longer admissable in nomenclatural use and must be translitterated to oe) is not discussed, but is included in the

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SCAMIT Newsletter is not deemed to be valid publication for formal taxonomic purposes.

key to the genus. It is instructive to follow their review of the characters within the group. Zamponi et al (1997) provide another similar overview (and adopt the transliteration mentioned above), which is further supplemented in Pérez & Ocampo (2001) with a cladistic analysis.

Cladistic analysis of the Octocorallia as a whole is undertaken by Berntson, Bayer, McArthur & France (2001) based on 18S rRNA data. Unfortunately the data included were not sufficient to resolve the branching order of the major clades, or alternatively, the existing morphological classification was not supported by the molecular data. Further attempts using different sequences seem indicated.

That plenty of room for reconsideration of morphological data seems to exist, is evident in Brinckmann-Voss (2000). She describes a new species of *Sarsia* in the paper, and clarifies an earlier representation of the hydroid stage as *Polyorchis penicillatus* (see Brinckmann-Voss 1977). Especially in forms with complex life-history, such misinterpretations of the relationship of a given life stage are difficult to avoid. As more and more species are cultured through both the hydroid and medusoid generations in the laboratory (as in Mills 2000), such misallocations based on inferential connection of field collected forms will gradually be eliminated from the picture, allowing further rectifications. In several groups (see for instance Brinckmann-Voss & Arai 1997) the hydroid stages of most species are either unknown or virtually indistinguishable, and the basis of classification remains the medusoid generation.

The 18SrRNA gene which proved unable to provide the data necessary to resolve relationships within the Octocorallia, was more successfully applied to the phylogeny of the Hydrozoa by Collins (2000). Perhaps differences in the individual sequences chosen did the trick, or perhaps other factors were of

importance, but the analysis provided both expected and surprising results. The monophyly of the Hydrozoa as a whole was well supported by comparison with outgroups which included Anthozoa, Scyphozoa, Porifera, Ctenophora, Brachiopoda, Hemichordata, and Placozoa. A second data set with Anthozoa and Scyphozoa as outgroups was used to examine relationships within the Hydrozoa more closely. Collins, in a careful discussion, examines the results in light of the phylogenetic hypotheses they either support, refute, or incompletely address. Use of such molecular data provides a path around the morass of confusion resulting from competing systems based on the morphology of one or the other of the generations in the complex cnidarian life-cycle.

Pleijel 2001 provides a revision of the polychaete taxon *Amphiduros* which provides parallel treatments of the results of his investigation using both traditional Linnean classification, and the rankless nomenclature he champions. He finds *Amphiduros pacificus* Hartman 1961, our local species, to fall into the synonymy of *Amphiduros fuscescens* (Marenzeller 1875). So do all other nominate species in *Amphiduros*. Pleijel indicates he can find no characters which will define the various local "species" populations well enough to allow their separation. He points out that this finding of a single "cosmopolitan" taxon is against much current practice. It is indeed at variance with the usual perceptions of most SCAMIT members, that local species which have at one time been identified with European described forms, or forms from other distant locales, nearly always prove to be separable once examined in detail. Such cosmopolitanism is demonstrable in some groups which have been examined with molecular methods and found to be genetically identical or to vary only slightly in genetic makeup. Most SCAMIT members remain Missourian in this regard, only accepting cosmopolitan explanations when proof is "as plain as the nose on your face". Our approach



is in harmony with that espoused by J. L. Barnard, that oversplit taxa can be combined if shown to be inseparable without loss of information, while the reverse is not true.

Although we have attempted to concentrate on more adult individuals, at least in regional monitoring activities, the early juvenile development of ophiuroids remains a matter of interest. Sumida, Tyler & Billett (2001) cover a similar topic (asteroids rather than ophiuroids) from the Northeast Atlantic. Although none of the taxa considered occurs in our area, several of the genera are represented both here and in their area. Their discussions of developmental patterns in small juveniles of these species is of interest to us here.

ELECTIONS

Oh!, for malfunctioning machinery and hanging chads to give some excitement to this process! Voter participation in the current election has hit a new low. Fortunately for us, even zero votes would have yielded the same result; continuation of the same slate of officers. This is not really a failure of democracy, but rather a triumph of lethargy (which the lateness of the Newsletters hasn't helped). I urge readers to immediately make plans to run for office in the next election. This is not intended as a move to pursue an ideologically more attractive set of policies, but rather as a method of bringing choice back into the process. Ann Dalkey has indicated [Ann correct me if I am wrong] that this will be the final year of her service as treasurer. Fortunately we do have a member who has stated a willingness to work with her this year so that she can fill the large gap left by Ann's retirement from office. Other officers seem willing to continue (so far) but the process would benefit from at least a little competition. Think it over, then act for the benefit of us all - including yourself.

BACK FROM THE COLD

On 30 March Larry Lovell assembled a group of taxonomists in the SIO Invertebrate Collection to examine material returned from his recent cruise, and other Antarctic materials in the Scripps collection. This was Antarctic Play Day #1, although the main objective was work. Work got done, but there was plenty of enjoyment to go around. Doug Diener and Don Cadien worked on peracarids and pycnogonids, respectively; John Ljubenkov worked the cnidarians; Megan Lilly tackled ophiurans; Ron Velarde, Kelvin Barwick and Larry worked on various polychaetes; Kent Trego continued on mollusks; and Tony Phillips spread himself thinly over a number of taxa. Robin Gartman similarly played the taxonomic field.

Larry had everything well prepared for this visitation, and treated his guest workers well. He had assembled some of the pertinent literature from sources within the invertebrate collections area and from the adjacent Scripps Library. This was supplemented with literature brought by the participants. Inevitably, some bits of the diffuse literature were missing. Enough was available to allow identification or confirmation of prior identification on a number of taxa. We broke for lunch and resumed a bit later after a wonderful Thai meal. The day ended all too soon, with much material yet to be addressed. Larry and the other participants were enthusiastic about making this only the first of a series of forays into the Scripps collections. A second "play day" is currently scheduled for the 2nd of June. Any SCAMIT members interested in attending are welcome, as are other workers who can assist with the taxonomy of this interesting and exotic fauna. If you plan to attend please contact Larry at llovell@sio.ucsd.edu so he can figure how much coffee to brew, how many donuts to buy, and how many microscopes will be needed.



MINUTES MARCH 19 MEETING

The meeting was held at the San Diego Marine Biology Laboratory. President Ron Velarde opened the business portion of the meeting. He announced that the next meeting will be May 14 at the Natural History Museum in Santa Barbara. The topic will be problem bivalves. There are 3 upcoming meetings. On May 4-5, the Southern California Academy of Sciences meeting will be held at California State University, Los Angeles. On June 20-24 the Western Society of Malacologists are meeting in San Diego. On November 9-12 the Western Society of Naturalists will meet at the Ventura Beach Hotel in Ventura, California.

The guest speaker for today's meeting was Karen Green of MEC Analytical Systems, Inc. She went to Thailand a few years ago with Kirk Fitzhugh, Larry Lovell, and other polychaetologists to collect and identify the worm fauna. Karen was selected for her Maldanidae expertise, and volunteered to identify the Capitellidae. To improve the Capitellidae identifications and prepare for publication, Karen reviewed the literature and attempted to clarify the definitions of Capitellidae morphological characters. This presentation to SCAMIT is a summary of her Thailand Capitellidae identification work and a review of general external Capitellidae morphology.

Karen started with the review of morphology. She distributed two packets of handouts; the text handout, "Notes on Morphology of Capitellids" (which is the next section of this newsletter), described the morphology of capitellids, and the other handout consisted of illustrations of characters (see attachments at the end of this newsletter). These very informative handouts are included in this newsletter, and they are part of a manuscript that is in press. Karen found inconsistencies in

the morphological terminology used in the literature. Her SCAMIT presentation and handouts define and consequently clarify the usage of several important terms.

After an interesting slide show presenting her "Notes on Morphology of Capitellids" and illustrations, we examined some specimens that Karen brought. Karen used the specimens to demonstrate the appearance and location of some of the structures that have been confused in the literature. Particular attention was directed to familiarizing attendees with the position of genital pores and lateral organs.

The first specimen was *Promastobranthus* sp. The methyl green stain encircled the intersegmental genital pores making them easier to see. On the first specimen there were 4 pairs of genital pores; however, on a juvenile specimen, there were only 2 pairs of genital pores. Caution must be used whenever identifying the smaller specimens of Capitellidae. We then looked for the lateral organs which occur on all thoracic segments in the Capitellidae. They are usually larger than genital pores, and are interramal and positioned closer to the notosetae than neurosetae. The lateral organs on this specimen did not stain with methyl green which is typical of the Capitellidae material Karen has examined.

We were able to view these interesting and difficult to detect structures using a digital camera mounted on a dissecting scope with images displayed on monitors. This City of San Diego system was operated by Kelvin Barwick and will be used at most future SCAMIT meetings. This set-up was an excellent way for all meeting attendees to view specimens and provides the additional benefit of capturing images for inclusion in future SCAMIT voucher sheets or other identification aids. The City of San Diego archives the collected images. In the near future a multimedia project will be added to the system to facilitate high resolution viewing by a larger audience.



Next we examined a specimen of *Notomastus latericeus* that Karen had identified from the Thailand material, to view the location of pores in the anterior abdominal setigers. The abdominal lateral organs were located posterior and ventral to the notosetae with the genital pores just behind the lateral organs (but actually at the anterior edge of the next segment). This posterior shift of the lateral organs is associated with the posterior shift of the setal fascicles in the abdomen (they are mid parapodial in the thorax). On this specimen the proboscis was protruding and was covered with small papillae.

The next worm we viewed was *Notomastus hemipodus*. Karen showed us two specimens; one had methyl green paired ventral stripes on the abdomen, and one did not. She found a few specimens in the same sample lacking the ventral paired “racing stripes” found on the majority of her Thailand specimens (and typically found on specimens in the Southern California Bight). Except the variation in ventral stripes, other staining patterns were consistent. (See the discussion about *Notomastus hemipodus* that follows in the review of the *Notomastus* key from the MMS Taxonomic Atlas.)

Karen put out a request for specimens of *Notomastus*. She wants larger specimens (at least 1.5mm in width) that include the thorax and some anterior abdominal setigers. All species of *Notomastus* are welcome. She can be reached by e-mail at, green@mecanalytical.com.

The next specimen under the microscope was *Dodecaseta*. The proboscis was everted, flaring, and had multiple lobes around the periphery. In this species, the lateral organs do not uptake stain, but the surrounding tissue does, making the organs easier to detect. In the transitional (setigers ~10-13) and abdominal regions, the lateral organs protrude. Karen noted that *Notomastus* does not have transitional segments, but changes abruptly in

segment structure between the thorax and abdomen. In the genera with a set of transitional segments, Karen suggested dissecting the specimen to see where the last septum occurs and determine the position of the last thoracic segment.

We subsequently viewed specimens of *Notomastus lineatus*, *Rashgua*, and *Notomastus tenuis*.

This newsletter summary of Karen’s presentation represents a small part of the material she provided. Her preparation and knowledge was apparent to the attendees and the information she shared was appreciated. Thanks Karen.

Rick Rowe handed out Provisional Species Voucher Sheets of *Armandia* sp SD 1 and *Nephtys squamosa*. We had examined the specimen of *N. squamosa* at a previous SCAMIT meeting and identified it as such. These two handouts have been added to the SCAMIT website. Rick commented that all voucher sheets should be posted on the SCAMIT website as pdf’s (Portable Document Files). Adobe Acrobat and especially Adobe PageMaker provide the best distillers for producing pdf’s although other software includes distiller capabilities.

Following a quick lunch, we began the review of the Capitellidae Chapter 4 in the MMS Taxonomic Atlas Volume 7.

Using suggestions from Karen’s presentation, some corrections were made in the Morphology section and in the key. On page 47, in the 2nd paragraph under Morphology, last sentence, change “nephridial openings” to “genital pores”. It was noted that the key on page 54 was constructed for adult animals and may not be suitable for juveniles. In couplet 11A, change “Thorax with 15 setigers” to “Thorax with 13 setigers”. In couplet 8B, change “Thorax with 15 or more setigers” to “Thorax with 13 or more setigers”. In couplet 10, add “asetous post peristomial segment” for



Scyphoproctus. Couplet 6A, genus *Notomastus*; Karen commented that there are problems within the genus *Notomastus*, and the key in this chapter is of limited utility because it works for only some of our local species.

We then discussed the species in the order they occurred in the chapter:

Barantolla: We were disappointed in the limited discussion of characters and the lack of additional figures since this description was based on a single, juvenile specimen.

Capitella: We decided to continue with the SCAMIT use of *Capitella* “*capitata*” complex which includes the variation of 4 anterior setigers with capillary setae which SCAMIT members encounter commonly.

Decamastus: We questioned the last sentence on page 61. We believe that the specimens Blake is referring to in the Remarks section are most likely juvenile specimens. It has not been acceptable historically to modify a generic description based on juvenile characters.

Dodecamastus mariaensis Blake, new genus, new species was described from two incomplete specimens. There was some discussion on where the thorax ends and the abdomen starts, since it was not clear from the illustration although clearly defined in the written description. A dissection to locate the septa would be advised. Also, the location of the lateral organs is not discussed or illustrated. If a lateral organ is present on the second of the peristomial biannulations, then that becomes an anterior asetiger and adds to the thoracic segment count.

Heteromastus filobranchus: Tony Phillips noted the different staining patterns of adults and juveniles in this species. Because these different staining patterns exist, caution should be used when identifying smaller individuals. Additional characters should also be used.

Leiochrides: There were no confirmed identifications from the members present.

Mediomastus: Larry Lovell commented that there is much variation in the staining patterns of *Mediomastus ambiseta* and *M. californiensis*. We will continue to use *M. acutus* as differentiated in the key on page 73. This species occurs in shallow water. For other specimens of *Mediomastus*, we will continue to use *Mediomastus* sp. There was a question about couplet 2B in the *Mediomastus* key on page 73. In the first line, should “thoracic and abdominal capillaries” be changed to “thoracic and abdominal hooks”?

Notomastus: On page 81, on the title line of *Notomastus hemipodus*, change it to *Notomastus hemipodus* not Hartman, 1945. Add to the synonymies list: *Notomastus* sp A and *Notomastus tenuis* not Moore 1909. According to Leslie Harris (see SCAMIT Newsletter Vol. 18, No.1, page 5), the animals that we have been identifying as *N. tenuis* (methyl green staining pattern of double ventral stripes in the abdomen) might be the same as this *N. hemipodus* described by Blake, but *N. hemipodus* was described by Hartman, 1947 from “intertidal zones to a few fathoms” from North Carolina. To avoid additional confusion and to reflect skepticism the disparate distributions introduce, SCAMIT will use the provisional *Notomastus* sp A for our common, offshore “double ventral staining stripes” form. Rick Rowe has completed a voucher sheet for this animal and it is posted on the website.

Notomastus tenuis: This is a shallow water species. Tony Phillips has recorded this species. On page 85, list *Notomastus* sp 1 as a synonymy of *N. tenuis*. In this species, the last thoracic segments are constricted. We will now use *N. tenuis* for our shallow water species. Leslie Harris has reviewed specimens and clarifies the usage of *N. tenuis* in the SCAMIT Newsletter, Volume 18 No. 1, page 5.



On page 86, Figure 4.15.A, change the label “nephridial pore” to “lateral organ”. Make the same change to Figure 4.16 on page 88. These changes result from terminology usage suggested by Karen Green.

Notomastus magnus: We will continue to use *N. magnus* for our offshore specimens; however we need to look closer at setal types to determine whether they are the same species as Blake’s *N. magnus*.

Neoheteromastus: This is a deep water species, and we have not reported it.

Neomediomastus: This is a deep water species, and we have not reported it.

The following genera are listed in the SCAMIT species list but were not covered in this chapter: *Anotomastus*, *Dasybranchus*, *Dodecaseta*, and *Scyphoproctus*.

NOTES ON MORPHOLOGY OF CAPITELLIDS By Karen Green

The following notes are excerpts from a recent manuscript prepared on capitellids from the Andaman Sea off Thailand. That paper provides an overview of regional studies, morphology, keys to genera and species, and descriptions with illustrations for over 30 species representing 15 genera. Publication of the paper will be in a special volume of the Phuket Marine Biological Center Research Bulletin, which is being edited by Dr. Danny Eibye-Jacobsen.

Review of Morphological Characters:

The primary key characters that have been widely adopted to identify capitellids are the number of thoracic setigers and setal distribution. Although Fauchald’s (1977) key and definition of capitellid genera followed the traditional system based on setal distribution, he considered the subdivision of capitellids in need of revision. The need for revision of the family has been echoed by recent authors (Ewing 1991; Blake 2000), who point out that

the high percentage of monotypic genera and use of thoracic segmental and setal distributions as the basis of the generic descriptions is unsatisfactory.

Several authors have pointed out that setal distribution, particularly in the posterior thorax, may change with age. Ewing (1982, 1984) and Blake (2000) have pointed out that juveniles may have fewer setigers with capillary setae than observed in the adult condition. Warren (1991) and Warren et al. (1994) conducted recent reviews of *Capitella* and *Mediomastus* and discussed the relative usefulness of various hard and soft characters in defining capitellids. These authors considered the number of thoracic setigers (rather than segments) with capillary setae occurring in adults a reliable generic character, particularly when the distinction between the thorax and abdomen is clear, but caution against stating the total number of thoracic setigers when the distinction between the thorax and abdomen is indistinct.

Other features such as appearance of thoracic and abdominal segments, body shape and size, branchia, lateral organs, genital or nephridiopores, number of aetous segments, proboscis, pygidium, shape and appearance of the prostomium, structure of setae, and more recently methyl green staining patterns have been used to differentiate species. Warren et al. (1994) considered setal structure the most decisive character for distinguishing *Mediomastus*. Several of the above-mentioned features have been considered unreliable, difficult to assess, or diagnostic only at the species level.

The following review of morphological characters is based on assessment of characters that were used to identify a couple of hundred specimens from Thailand.

Head. The prostomium has few forms in capitellids. The shape may be rounded, conical, or elongated at the tip in the form of a palpode. The shape may vary among species.



However, the palpode may be retracted and frontal view of rounded prostomiums should be done to verify whether a retracted palpode is present or absent. The prostomium may or may not have eyespots, which may be paired or may form a diffuse pattern. They occur anterior to nuchal organs, and do not occur on the peristomium as indicated by Warren et al. (1994). They may not be visible in all specimens of a collected species, and use of this character should be with caution. Nuchal organs occur in slits at the base of the prostomium and may be everted in some specimens as a result of preservation. They may be impossible to see in small specimens, and may be difficult to see in larger specimens if the prostomium is somewhat retracted into the peristomium.

The proboscis often is retracted, but when everted varies from being globular or sac-like to lobed. The surface may appear smooth or papillated, and the degree of papillation may vary between distal and proximal regions. While it has been observed that several genera share similar proboscideal characteristics, sufficient variation in this part of the anatomy occurs to warrant additional investigation regarding taxonomic usefulness. Members of *Dodecaseta* were found to share a similar lobed proboscis, which clearly differs in appearance from the proboscis seen in *Notomastus*. This as well as other morphological differences argue against the synonymy of *Dodecaseta* with *Notomastus* as proposed by Blake (2000).

The peristomium typically lacks setae. However, the occurrence of setae on the peristomium has been reported for a few genera, and has been considered a generic-level character. Subsequent review has clarified that this probably is not the case. For example, Warren (1991) reported that the peristomium in some species of *Capitella* may be difficult to see in preserved specimens and so indistinct as to be easily interpreted as being fused with the first thoracic setiger. Although *Capitellethus*

has been reported to have setae on the peristomium (Hartman 1947, Fauchald 1977, Amaral 1980), it is believed this was misinterpreted from the drawing by Ehlers (1907). Review of several species of *Capitellethus* from Thailand indicates that the peristomium lacks setae. *Nonatus* Amaral (1980) is another genus that was described as having setae on the peristomium. However, it is suspected that Amaral (1980) misinterpreted the first thoracic setiger as being the peristomium. Review of his illustration shows the prostomium to be partially retracted into the peristomium, which is clearly illustrated as being anterior to the first setiger with setae.

Thorax. The junction between the thorax and abdomen in capitellids typically has been defined based on a change in the type of setae, change in the development of the parapodia, change in body width, or occurrence of a more distinct intersegmental groove. With the exception of Eisig (1887), who included meticulous illustrations of internal anatomy, the thorax has not been defined relative to correspondence to internal anatomy. For some species, the change in segment appearance between the thorax and abdomen is obvious. However, for many others, there is no apparent change in body appearance. In those cases, a change from capillary setae to hooded hooks or from one type of hooded hook to another type typically has been used to define a thorax/abdomen junction.

In some taxa, there are transitional segments that have capillary setae in the notopodia and hooded hooks in the neuropodia or setigers with mixed fascicles of both capillary setae and hooded hooks. In a few cases, a change in body appearance occurs on a different segment than a change in setae. In these cases, the definition of the thorax has depended on the interpretation by the author, and there are differences in how different authors have interpreted these changes in appearance.



Without reference to internal anatomy, descriptions of the thorax/abdomen junction will continue to be problematic, particularly for species that lack correspondence of an obvious change in body appearance with a change in setae. Characters that may vary between the “thorax” and “abdomen” include setae type and appearance, position of setae within a segment (e.g., more central in thorax, more posterior in abdomen), development of parapodia, location of genital pores, and methyl green staining patterns. None of these characters are foolproof, and must be considered in combination.

Lateral organs. Many species descriptions lack reference to the lateral organs or indicate that they were not observed. Lateral organs occur in the interramal space between the noto- and neuropodia, closer to the notopodia, on most segments. They do not occur on the peristomium. In specimens with an uniramous first setiger, they occur ventral to the notopodia in line with the lateral organs on subsequent setigers. In species with an asetous post-peristomial segment (e.g., *Scyphoproctus*), they occur in the same position on that segment as they do on subsequent setigers. In some genera they are obvious in both the thorax and abdomen, in others they are apparent only on the thorax. In small specimens (including some genera), they are not detectable at all.

Lateral organs typically are flush with the body wall, but may protrude from the abdomen in some species. Some descriptions have erroneously referred to protruded abdominal lateral organs as branchial vesicles.

Methyl green stain is useful for distinguishing lateral organs either because they do not stain or they stain a lighter color than the surrounding segment. Methyl green stain is not an aid for identifying lateral organs on the abdomen when there is no uptake of stain in that part of the body.

Intersegmental genital pores. Paired pores may occur between the segment boundaries of several setigers in the thorax and/or abdomen. The pores occur nearly in line, but slightly ventral and posterior to the lateral organs. These pores were referred to as genital pores by Eisig (1887), genital or nephridiopores by Hartman (1947), and have been variously referred to by these terms by subsequent authors. These pores may not be detectable on all specimens of a species, even those of the same size and in the same collection. It has been hypothesized that they become apparent in sexually mature individuals. Limited dissections examining the relationship between the pores and nephridia have only been presented by Eisig (1887).

The term genital pore is preferred to avoid confusion with nephridia, which may occur in more segments than indicated by genital pores. For example, Eisig (1887) indicated that *Notomastus lineatus* has genital pores between the segmental boundaries of setigers 8/9, 9/10, and 10/11 and illustrated that nephridia also occur in abdominal segments without enlarged exterior pores. Similarly, he illustrated that *Dasybranchus* has paired nephridia on more segments than indicated by the genital pores.

Paired genital pores may occur in the intersegmental grooves of the last several setigers of the thorax, also occur in the intersegmental boundaries of the first few abdominal setigers, or may be restricted to the abdomen. Abdominal genital pores occur at the anterior region of the segment posterior to the lateral organs of the preceding segment. Methyl green stain may enhance the detection of genital pores. The area around a pore may stain darker or lighter than the surrounding portion of the segment.

Setae. The appearance and location of different types of setae have been the main diagnostic features in capitellids. The number of setigers with capillary setae has formed the basis of most taxonomic keys of the group.



Terminology used by Hartman (1947) and Warren et al. (1994) is useful for describing features of the hooded hooks. Key features include the dentition above the main fang, the development of the shoulder, length of shaft, development of node and constriction, and length and appearance of the hood.

Hooded hooks may vary between the thorax and abdomen, and between notopodia and neuropodia. These potential differences are not mentioned in most species descriptions, which may include only an illustration of an "abdominal hooded hook" without reference to setiger or location relative to noto- or neuropodia. An important exception is Warren et al. (1994), who contrasted thoracic and abdominal hooks in their review of *Mediomastus*. Other exceptions also occur, however, critical review of genera and species associations is severely hampered by existing literature, in which there is a general lack of illustrations of hooded hooks in different parts of the body, views of hooks in only lateral profile, or views of only the distal portion of the hooks without illustrating the node or posterior shaft. There also are numerous examples of papers that include species descriptions without any illustrations of setae.

The dentition of hooded hooks and features of the hood have been demonstrated with scanning electron microscopy (SEM) to be much more complicated than possible to discern with light microscopy. Some authors recommend SEM over the light microscope for evaluation of setae. Although SEM is unquestionably valuable, it is this author's opinion that it should be used to augment and not replace drawings of setae made using light microscopy. Several features of the hooks that have diagnostic value and that are visible with light microscopy include the overall appearance of the exposed and embedded parts of the setae, relative lengths of shaft and shoulder, development of node and constriction, and relative length of hood. Due to the small size of capitellid setae, slide

preparations often are required and must be examined using high magnification and oil immersion to adequately evaluate their characteristics.

The number of teeth above the main fang is difficult to assess with light microscopy and can only be assessed with a frontal view of the hook, which can be difficult to obtain. The number of teeth seen in profile view may not accurately indicate the number of rows of teeth since in most slide preparations the hook is actually slightly rotated; in that case, teeth that occur in the same row may appear separate above the main fang, and may give the false impression of different rows.

Some authors have pointed out that setae may change during ontogeny, and that specimens of the same species have the potential to be identified as different genera during immature or adult stages using current generic definitions based on the number of thoracic segments and setal distribution (Warren 1991, Blake 2000). Some species have a fixed number of setigers with capillary setae from juvenile to adult stages. Other species have a variable number of setigers with capillary setae between juvenile and adult stages. In some species, the number of setigers with capillary setae is variable among adult specimens. There has been an inconsistency in the literature regarding the taxonomic importance of the variability in setal distribution. Numerous monotypic genera have been erected to accommodate species that vary in the number of setigers with capillary setae. In this author's opinion, this convention should be discontinued, and all generic diagnoses based on setal distribution should be critically reviewed.

Branchiae. Branchia may occur on abdominal segments of some species. Branchiae have been used as a differentiating character to define some genera. Other genera may include both species with and species without branchia. Branchiae may include branched or simple



digitate protruberances, or in some cases parapodial lobes have been referred to as branchia. The respiratory function of parapodial lobes has been largely inferred in existing literature without reference to blood vessels or physiological investigation. Branchiae may or may not be associated with noto- or neuropodia. The location and appearance of branchiae are diagnostic at the species level. The use of branchiae as a generic level character deserves additional evaluation.

Pygidium. Most species descriptions have been based on anterior fragments. Key features of the pygidium include presence or absence of caudal cirri, anal plate, aetous pre-pygidial segments, and/or occurrence of spines. Examination of several species of *Scyphoproctus* from Thailand indicates that the number of spines in the anal plate is not a fixed character for species of this genus and may be somewhat size dependent.

Glands. Methyl green stain has been used to highlight the distribution of gland cells in the epidermis in malidanids (Green 1987, 1991, 1997), and this technique also has been used to stain capitellids (Ewing, personal communication; Warren et al. 1994; Blake 2000). Methyl green stain was found to be useful for evaluating characters such as lateral organs and genital pores and for discriminating species represented in the Thailand material. However, variations in methyl green stain was found to occur among specimens of the same species and similarities in stain were observed among different species. Therefore, staining patterns should never be used as the sole method of identification and should be used in addition to conventional character analyses. To increase the utility of this method, it is important that staining patterns, including their variations, be illustrated for a species.

The method used by this author consisted of placing specimens in a shallow dish of 70% alcohol darkly pigmented from methyl green granules (e.g., shallow dish must be picked up to detect worm). Worms were immersed for about one minute, then placed in a dish of clean alcohol to leach excess stain. After leaching the stain (about one minute), the specimen was placed in another dish of clean alcohol for evaluation of the staining pattern. Staining patterns were evaluated when the stain was only retained by gland cells and had leached from non-glandular parts of the body. This author has found that immersion in a concentrated methyl green solution permits a shorter immersion time than more weak solutions and speeds the stain evaluation process.

NORTHERN NEIGHBORS M. Lilly

On St. Patrick's day I had the luck of the Irish in being able to attend a meeting of our northern sister association, NAMIT. The meeting was held at the Poulsbo Marine Science Center in the town of Poulsbo, Washington. The day began at 10:00 a.m. with approximately 20 people present. Michael Kyte was the opening speaker for the day and covered many aspects of ophiuroid biology and taxonomy. Initially he passed around a hand-out from the ophiuroid web-site, entitled "The Ophiuroids: What are they?". It gave an overview of the anatomy, physiology and biology of the group. You can visit this site at:

<http://home.att.net/~ophiuroid/what.htm>

He then discussed some available and useful ophiuroid literature. The most recent book is by Hendler et al 1995, but deals almost exclusively with Caribbean species. There are some ecology papers being published and there is an echinoderm list server which at the moment has some running discussions concerning ophiuroid feeding behavior. The bulk of the literature dealing with systematics is fairly old. One well known paper in this



category would be Lyman, T. 1882, Ophiuroidea. Report of Scientific Results Challenger. There are also two papers by H. L. Clark, the first being Clark, H.L. 1911, North Pacific Ophiurans in the Collection of the United States National Museum, and, Clark, H.L. 1914, Growth-Changes in Brittle-Stars. Two other pieces of literature mentioned were, Clark, A.M. 1970, Notes on the Family of Amphiuroidae (Ophiuroidea) and D'yakonov, A.M. 1954, Ophiuroids of the U.S.S.R. Seas. – Keys to the Fauna of the U.S.S.R.

Michael believes that one of the most valuable keys to the ophiuroids is unpublished and was produced by Jack Word in 1983. He had a copy of it with him and stated that few people possess it or can obtain a copy. If you have access to this work, consider yourself lucky. Overall, Michael felt that the taxonomy and systematics of the group was fairly stable.

We then moved away from the literature and into the animals. There are approximately 13 species of ophiuroids on the inner continental shelf of Puget Sound. As depth increases so does species diversity, with new families appearing below 200m.

A question arose concerning some ophiuroids seen in the shallow waters near a member's home. This prompted a lively discussion about some of the more common local species witnessed by people present. Michael talked about seeing "forests of arms" belonging to *Amphiodia periercta*. The animals have their disks buried 20 cm down in the substrate and their arms come up through holes in the mud to facilitate their detrital suspension feeding style.

Michael then handed out his key and species checklist for us to peruse, and began speaking to the ecology and feeding behaviors of the groups. He started with *Gorgonocephalus* which is a suspension feeder. It has a double hook arrangement on its arms which capture zooplankton. The jaw structure has spines and teeth which the arms are periodically dragged across, thus freeing the zooplankton caught on

the arm hooks. Michael likened the action to someone licking the food off their fingers. He discovered the hard way that these animals don't like to be tagged and will use their arms to reach around and pull a tag out of their disk, damaging themselves in the process.

The life history of the gorgonocephalids is interesting. They are broadcast spawners with planktonic larvae. The larvae eventually metamorphose into small *Gorgonocephalus* with initially only one branch per arm. The juveniles prefer to sit on soft coral but have been seen using hydroids or other animals that provide vertical relief from the bottom. The question was then raised as to whether they preferred cnidarians? The answer was that they seemed to, but no one was certain. When they are a little larger, but still not mature, Michael has seen them attached to adults.

The next genus up for discussion was *Ophiopholis*. The members of this group spin a mucus net between their tube feet and arm spines. Detrital suspension feeding then takes place with the tube feet forming a bolus of material and passing it down the arms to the jaws.

Members of the Ophiuridae are considered a typical, common brittlestar for the area. They live on sandy bottom habitats and are distinguished by their arm combs. Michael felt that they used a combination of techniques for feeding, one being predatory using an arm loop system to capture prey, as well as being detrital suspension feeders.

The Amphiuroids, it was noted, contain the most commonly found species and inhabit a wide range of habitat and substrate types. They are the most difficult family taxonomically to deal with in that there are many relative descriptors ("smaller than" etc) in much of the literature dealing with the group. In addition there is a wide range of variation for which to allow.



We then moved on to the “nitty-gritty” and reviewed the oral structure of the different families. There was much discussion and confusion in regards to certain patterns and what exactly defines “infradental papillae”, etc. Once that was relatively straightened out, Michael cautioned against the practice of storing ophiuroids in formalin. The acidity eventually dissolves the animals. He recommended either ethanol or simply drying them. (As a personal note, I find that many of the structures that need to be seen for identification purposes are much more clearly viewed if the animal is dried prior to examination).

In closing for the morning, Michael began a discussion on the general ecology of the area. Charles Birkeland conducted a survey of the fauna of Puget Sound in 1964. At that time there was a “bath tub ring” of *Ptilosarcus gurneyi* completely surrounding the Sound. In the mid 1990’s a second survey was done by Michael who discovered that most of the sea pens had disappeared from Birkeland’s study areas. From the 100 - foot contour to the intertidal, almost no *P. gurneyi* were found. There are still a few, small spotty populations in some areas, but nothing compared to the original density. Many suggestions were given for why this could have happened, but the bottom line was that it still remained a mystery. Michael also pointed out that with the loss of the sea pen population, many of the species which depended on *P. gurneyi*, whether for food or habitat, have also seen major decreases in density. Brian Gregory (of NAMIT) has been studying *Stylatula* and *Virgularia* in Hood Canal and has also noted a large decline in those sea pens.

Roland Anderson, from the Seattle Aquarium, then mentioned a trend he’s been noticing. There seems to be a large influx of *Pisaster ochraceus* into the area, which represents a

shift from the commonly seen asteroid, *Evasterias trochelli*. Roland also noted the increased presence of an introduced clam, *Nuttalli obscura*.

So, although I have always thought of our northern neighbors and their habitats as more pristine and undisturbed than our beleaguered water ways here in Southern California, I must acknowledge that the problems we are seeing today in many of our marine habitats are more widespread than I’d previously cared to believe.

At this point pizza was brought in from a local restaurant and was heartily consumed by all. Val MacDonald took advantage of our captive, chewing state and distributed a simple, but wonderful hand-out to aid in the identification of juvenile bivalves encountered in Puget Sound. She had quietly and efficiently been setting up viewing stations around the lab while people were eating, so that by the time we finished we could wander from table to table and examine the specimens she had put forth on display. The hand-out proved quite useful in trying to identify some of these tiny bivalves.

All in all, I have to say that I thoroughly enjoyed myself and wish that I could visit our northern sister association more often. The members present were enthusiastic and hard working, and I’m hoping to maintain contact with many of them for future specimen and idea exchange.

MY LIFE AS A BIOLOGIST

Donald J. Reish

Chapter 22: I look back-I look forward

Obviously at the age of 76 at the time of writing, there are more years behind me than ahead of me. How does one evaluate one’s contributions to biology and science? I am no



different from anyone else—I think of myself as being more important than I actually am. I think that I made important contributions in two areas: teaching and research.

As far as teaching is concerned, let us first consider the numbers. I taught 175 students in high school, 325 as a TA at Oregon State in general zoology, invertebrate zoology and parasitology. I had 30 students as a TA and instructor at Oregon Institute of Biology, 40 students as an instructor at USC in general biology, and approximately 2800 at CSULB where I taught general biology (107), general zoology (86), nature study (361), marine natural history (846), invertebrate zoology (686), algae (68), invertebrate systematics (226), polychaetes (46), oceanographic techniques (35), interns (64), seminars (90) and an estimated 200 student teachers. There were 57 who completed their masters degree under my direction as I had named earlier.

What was the impact of my teaching on these students? As my high school student said one time to me, "Mr. Reish is this your first year of teaching?" I said yes. She replied, "I thought so." I saw two of my high school students at my wife's sorority reunion in 2000. I had not seen them for 53 years. They remembered me and we had a pleasant time talking about our times 53 years ago.

At Oregon State I got at least two interested in marine biology both of whom made a name for themselves—John McGowan at Scripps and Bill Burns who was head of the Zoology Dept. at Wisconsin.

CSULB is where I believe I had the greatest impact. Over the years of setting through probably at least 1000 classes in junior and senior high school science classes, I wondered what makes a good teacher. I came to realize that teaching is an art—it is a product of one's personality, his interest in people, his love of the subject matter, and desire to do something truly worthwhile. He must exhibit enthusiasm and sometimes be a bit of a ham. A few of the

techniques I employed were singing marine biology songs, running over the rock jetties, having snail races in invert zoology classes. These devices were done with a purpose in mind—another way of showing my enthusiasm for biology and teaching. As I discovered in supervising student teachers, not all people can become good teachers. You must work at it. In labs, I tried to spend a little time with each student on a one to one basis so that I got to know them better. I wasn't 100% successful—no one is, but I believe that I had some lasting effect on many as indicated by their interest in my story.

What was my impact on science, in biology, in invert zoology, polychaetology? I think that I am perhaps the primary person to scientifically popularize polychaetes. My work on polychaetes as indicators of pollution lead to the necessity of including polychaete identification on all marine monitoring programs. The impact of the importance of sieve size in screening benthic samples facilitated this. I think that speaking up for polychaetes also helped to make people polychaete conscious. The earlier benthic studies look primitive by today's standards, but the principles were established by then. As I demonstrated with my students, you do not have to attend a marine biology station to be able to culture marine animals. Polychaete cultures are now being established in marine countries. I get reprint requests and advice for culturing polychaetes even today. In fact, some colleagues have suggested that I go back to it. I probably will not.

I was trained as a classical zoologist, and I have described some 20 new species of polychaetes, some of which are not considered valid today. I think that my impact on polychaete systematics is minor. However, I believe that polychaete systematics is important and I will continue to support it.



Jerry [Barnard] and I did the first toxicity tests with polychaetes with *Capitella* in the harbor. It was nearly 10 years later before I did my second one. This led to the EPA grant that I described earlier and led to the establishment of the many cultures including *Neanthes arenaceodentata*.

I began writing toxicity test procedures for Standard Methods, ASTM, EPA, US Army Corps of Engineers and the Food and Agriculture Organization of UN. I plan to continue this activity as long as I can make worthwhile contributions.

What does the future hold for me? What would I like to do? What would I like to accomplish? At age 76 health is of prime importance in dictating what one can and can not do. I attempt to keep my weight steady, Janice and I try to walk 2 miles a day (running is a past effort for me—my joints lack sufficient cartilage). One fortunate thing is that we have enough savings and earnings so that we can do many things. We'd like to do more traveling to foreign places as long as we can. We would like to visit the Amazon, New Zealand and Australia again, we always enjoy Europe, we would like to do a land/garden tour of Japan. Hawaii is always calling; I can not remember how many times we have been there, but it is always great when we do. US and Canada have lots of great places to see again or for the first time. I will continue to garden and Janice will continue to knit. What about Science? My contributions to original research will be minimal if at all. I will continue to help others. My role as editor of the polychaete proceedings has been valuable to others. I am looking

forward to editing the proceedings of the 7th polychaete conference to be held in Iceland this July. I will continue working with Standard Methods at least through the 2002 edition and maybe the 2006 edition. I will continue with the help of 4 others to do the annual marine pollution review for the Water Environment Research journal. I am assisting a colleague in Japan and England which may or may not result in any publication. Janice and I plan to continue to live where we do until we move to our final residence overlooking the 605 freeway.

A final note: This has been fun for me and I may write an up date of my happenings from time to time.

[Editor's Note - This is the last installment of a rather remarkable living documentation of the life of Dr. Donald J. Reish, mentor to many SCAMIT members, and conspicuous member of the scientific community in southern California and the world. He is still very much alive, and this final chapter may yet be superseded if he chooses to comment further on what has or will transpire in his life. SCAMIT is grateful for the opportunity to run this series of reminiscences, and looks forward to events yet to come.]

AND ANOTHER...

Dean Pasko has created a voucher sheet for *Rhabdozoela* sp A. You will find it attached to this newsletter (paper version) or in the Taxonomic Tools section of the website (electronic version).



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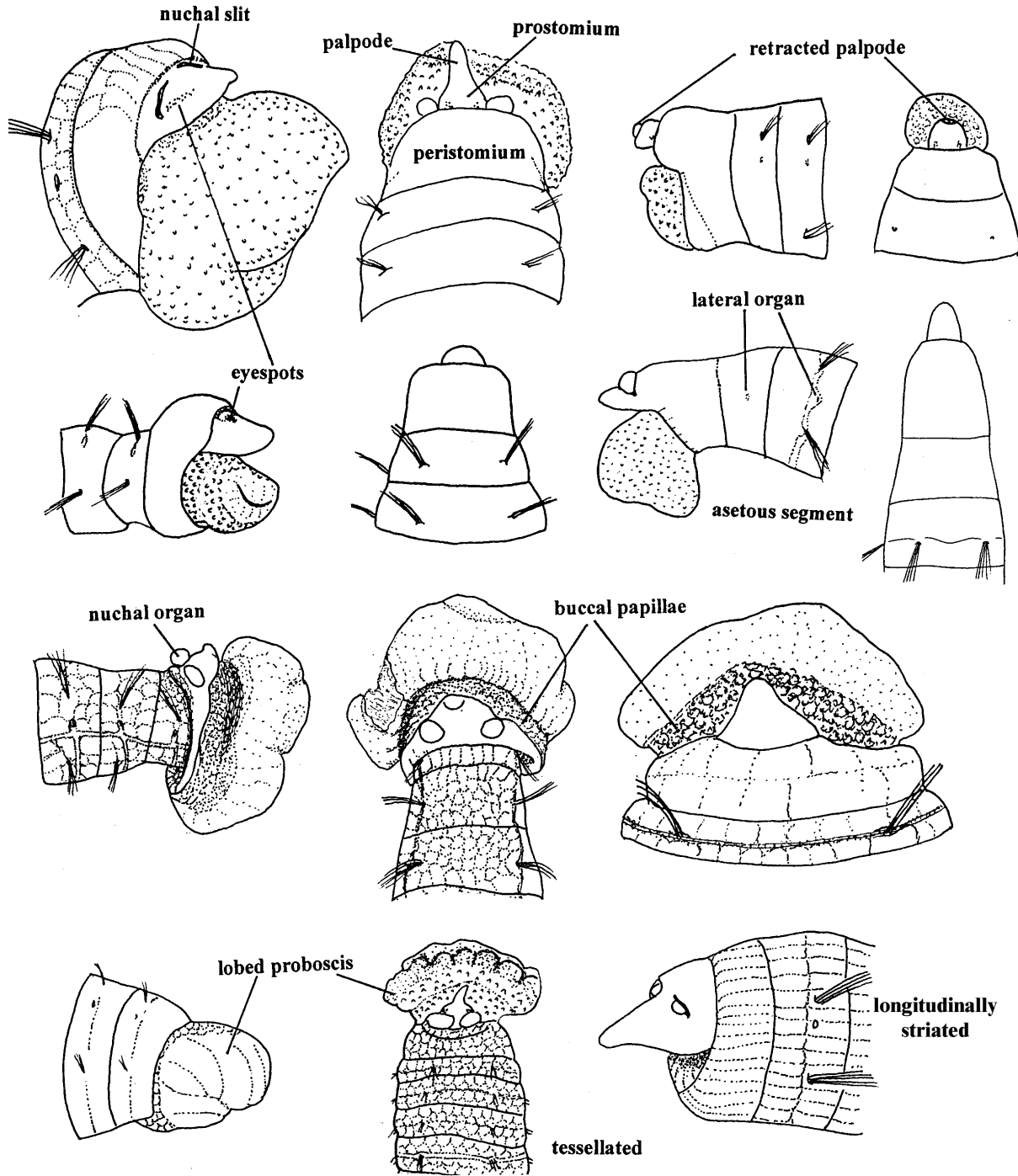
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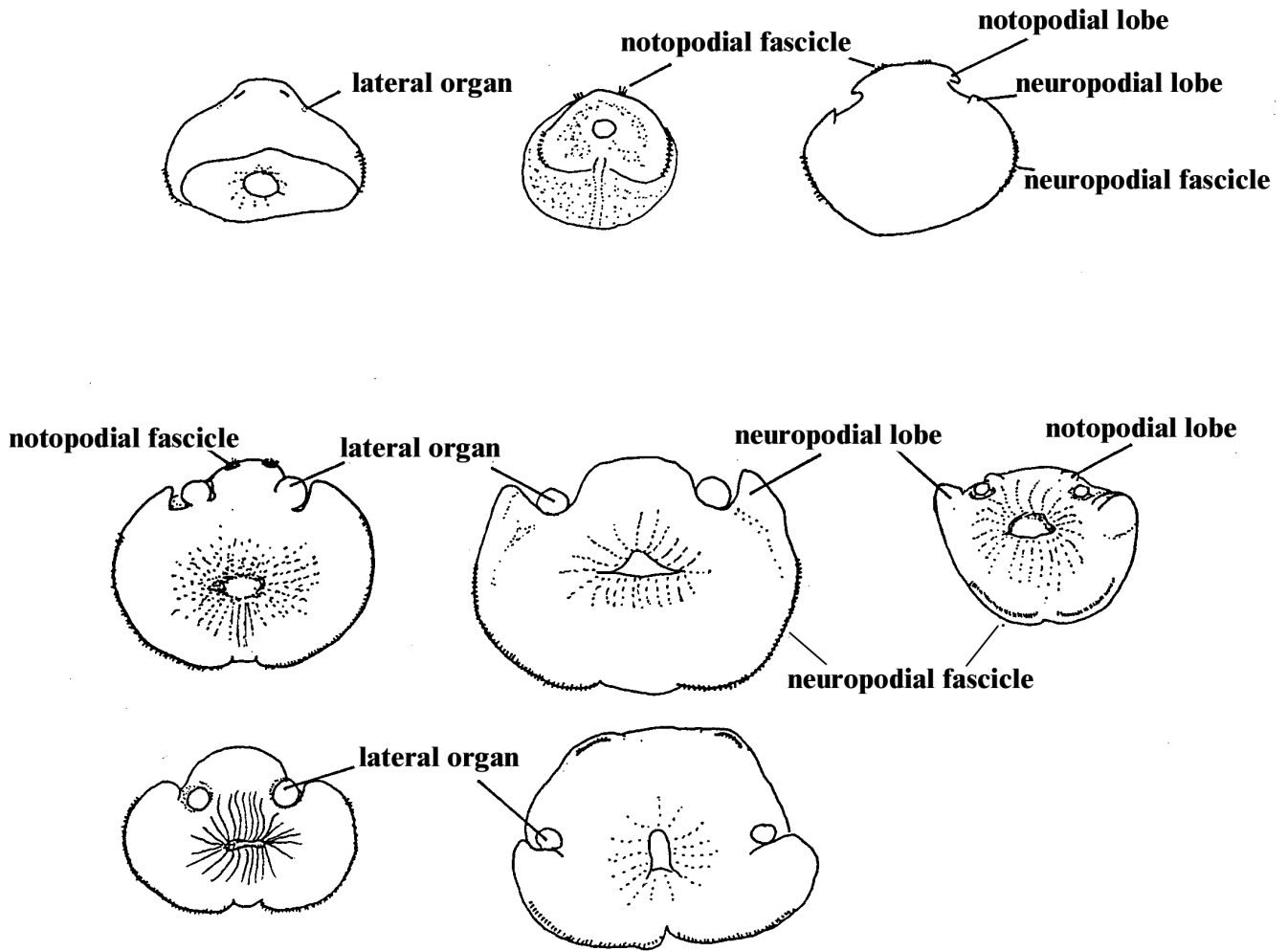
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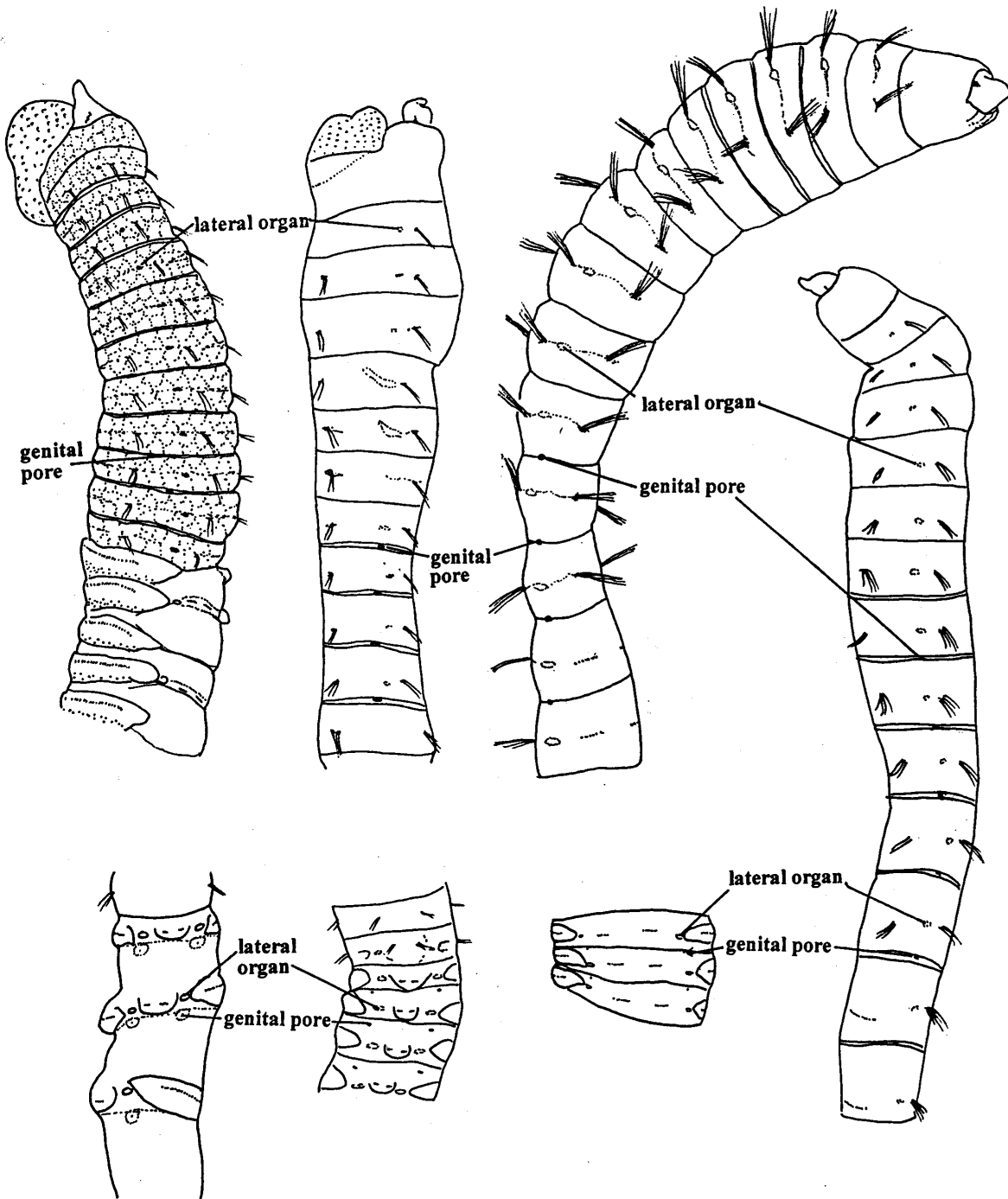
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