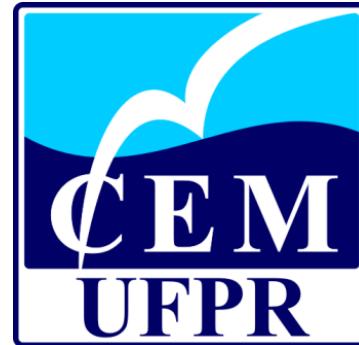




BITMaB – 2 Workshop



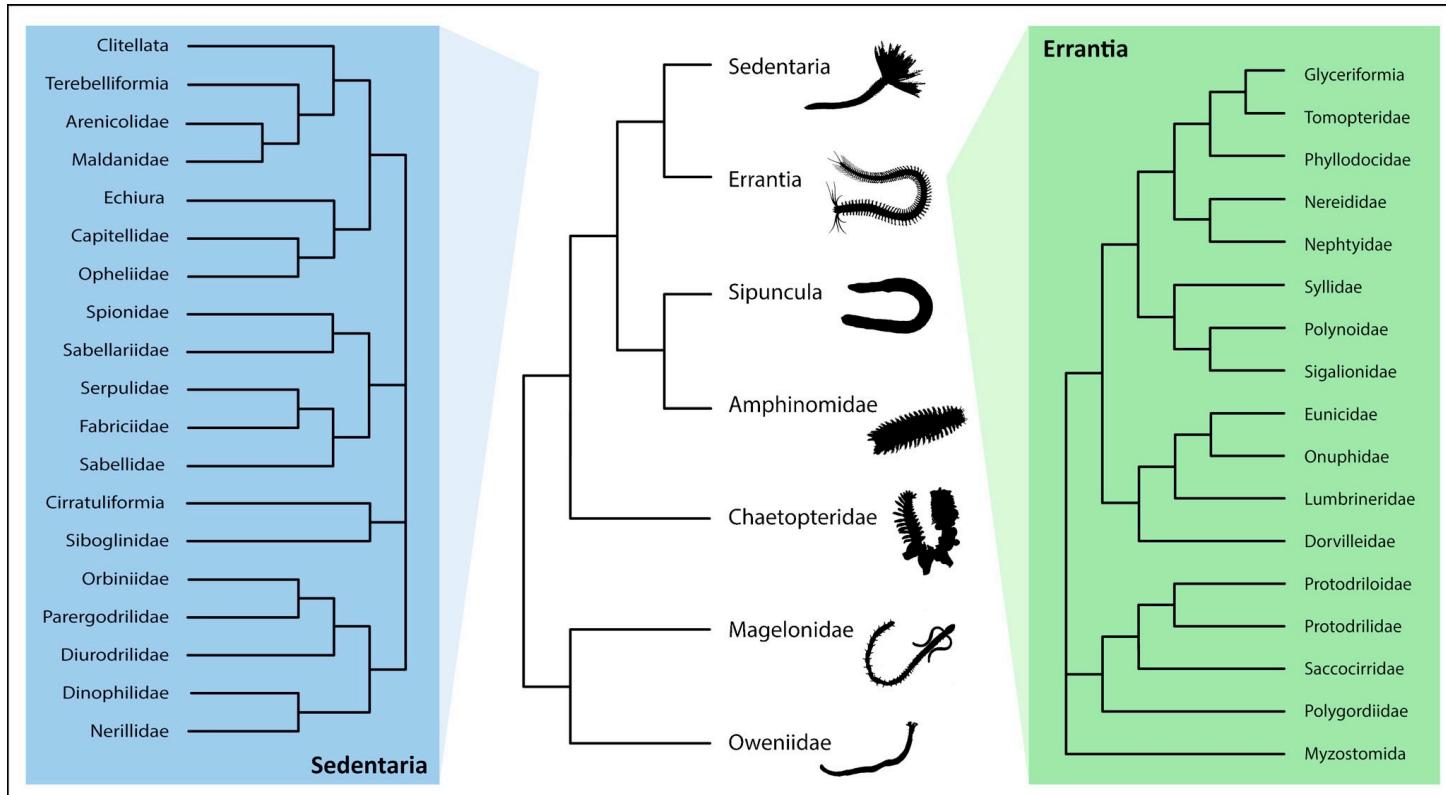
Overview of marine clitellates/ oligochaetes

Alessandro Lívio Prantoni
Collaborator researcher

Center for Marine Studies, Federal University of
Paraná, Brazil

Annelida

- ✓ Polychaeta and Clitellata (Rouse & Fauchald, 1997; Brusca & Brusca, 2003)
- ✓ Polychaeta, Oligochaeta and Hirudinea (Marshall & Williams, 1972; Ruppert et al., 2005).



Source: Weigert & Bleidorn, 2016

➤ Where are clitellates/oligochaetes found?

≈5700 spp.

Soil (earthworms)

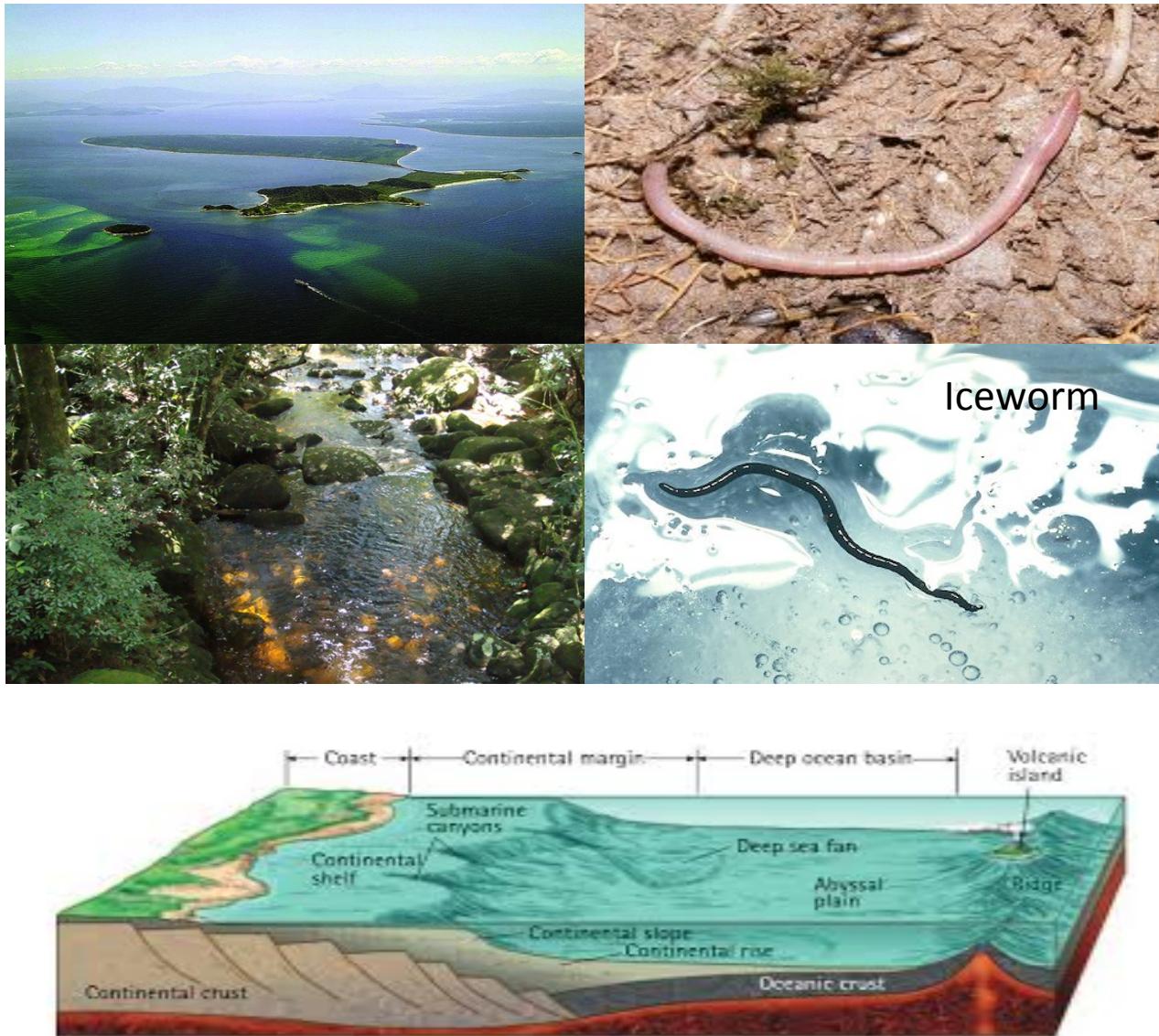
Freshwater (≈1700 spp.)

Glaciers

Estuaries

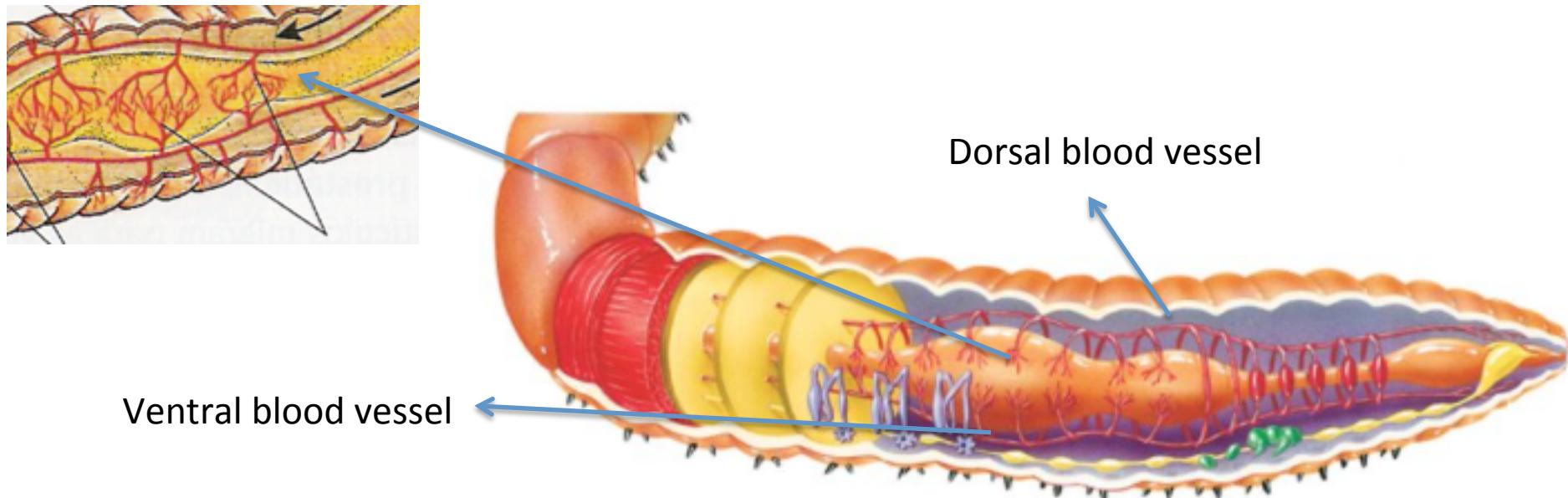
Sea

} ≈ 600 spp.



General features of clitellates

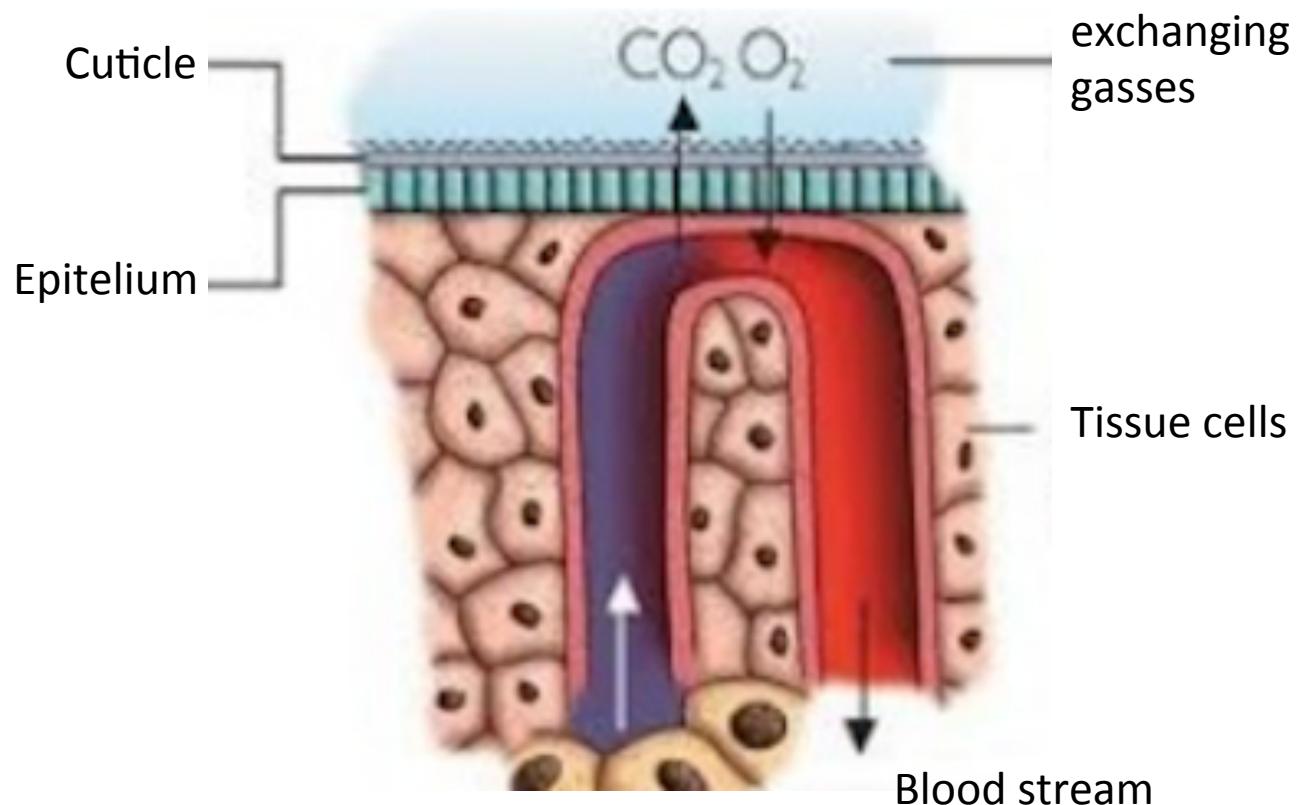
- ✓ Closed circulatory system
- ✓ Capillarity network connected to the dorsal and ventral blood vessels
- ✓ Blood goes to the posterior end through the ventral blood vessels and returns through the dorsal vessels



General features of clitellates

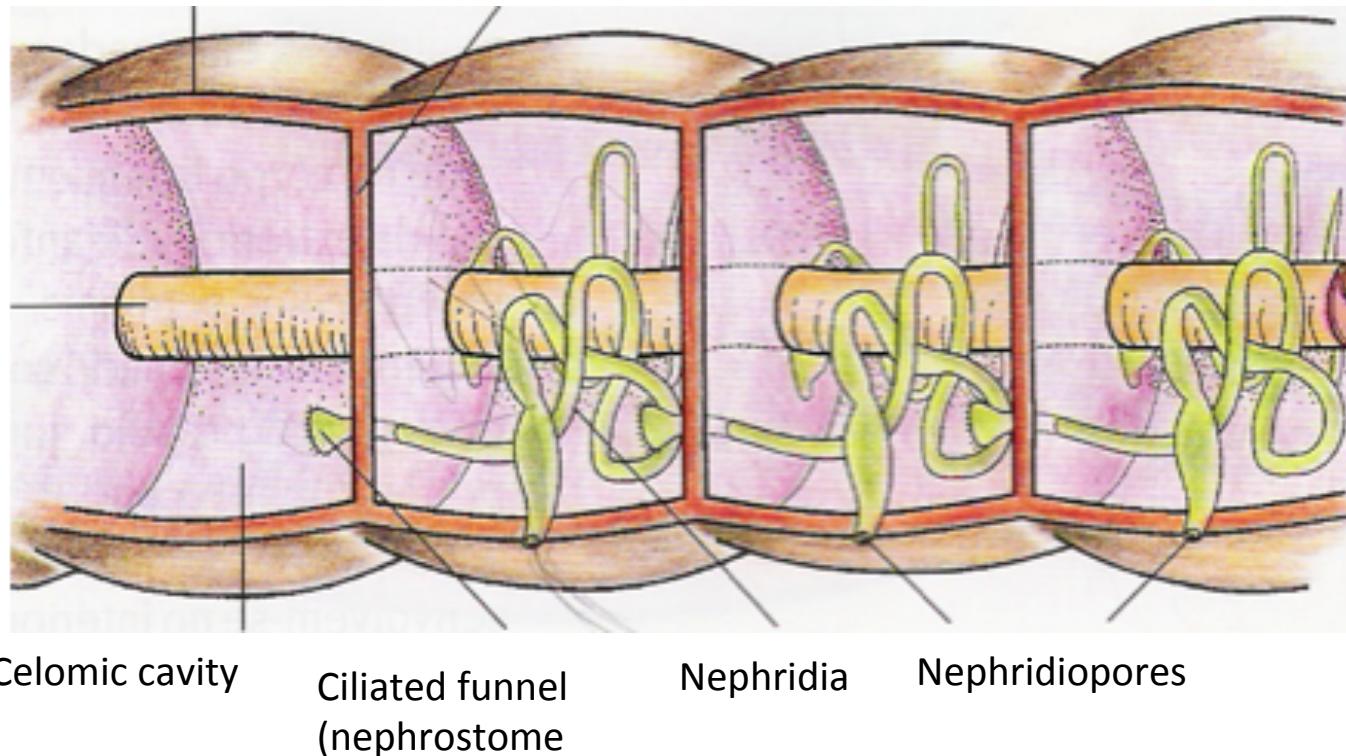
- ✓ No respiration organs or parapodia like polychaetes
- ✓ Respiration through the skin (cutaneous)
- ✓ Extensive capillary vessels in the epidermis

few freshwater forms have guills



General features of clitellates

- ✓ Metanephridial excretory system
- ✓ Ammonia (NH_3) is the main nitrogenous compound excreted by oligochaetes (aquatic forms), urea (terrestrial forms)



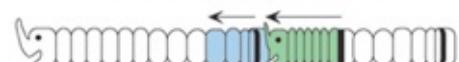
Reproduction

- ✓ Sexual (in most of the marine) and asexual (some estuarine and freshwater)
- ✓ Direct development: no larval dispersion like polychaetes



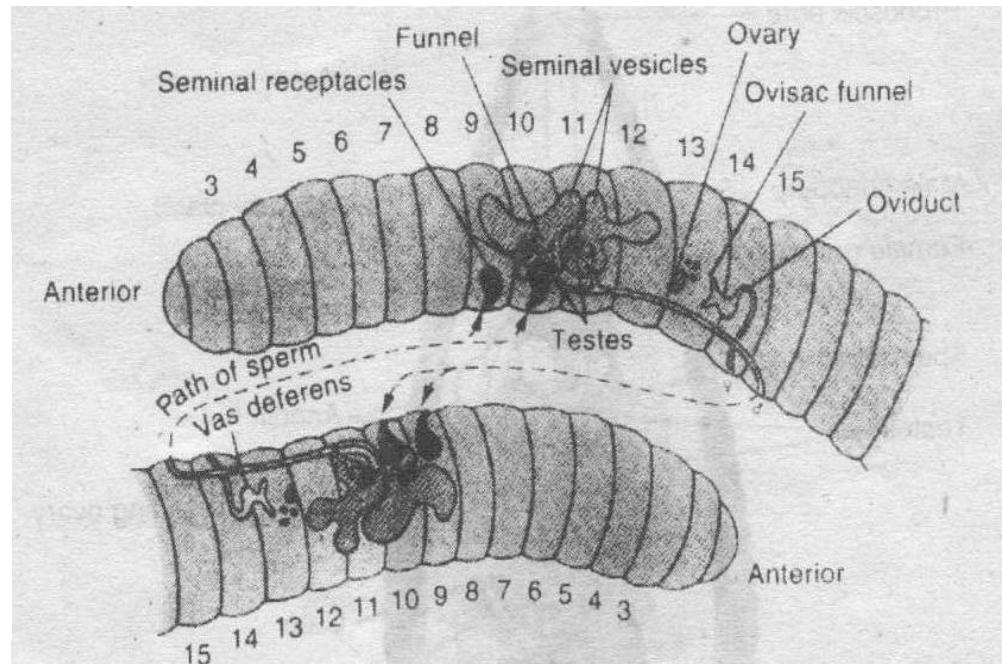
Paraphys sp.

paratomic fission



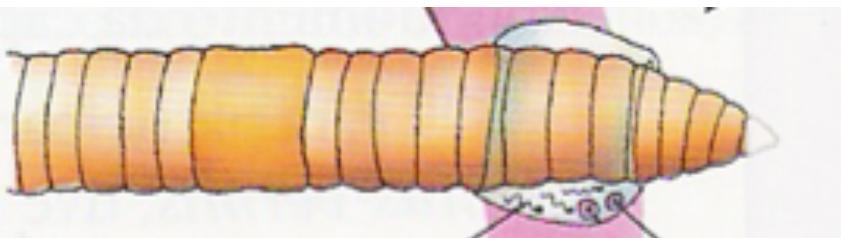
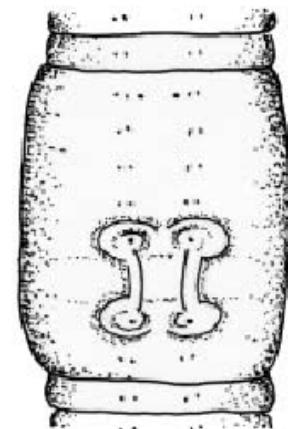
Limited capability of dispersion

Mutual cross-fertilization



Sexual reproduction

- ✓ Mature clitellates - Clitellum
- ✓ After mating they produces a cocoon
- ✓ Young worms hatch out into the sediment



spermatozoa eggs



Eggs



Cocoon



Worm
emerging

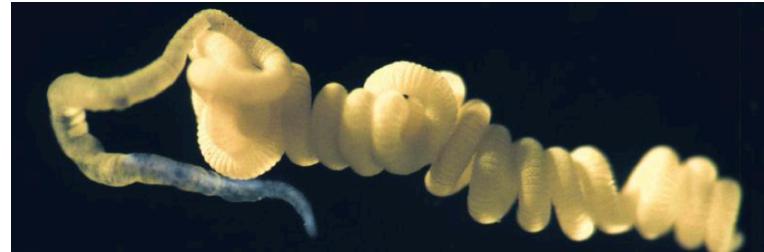
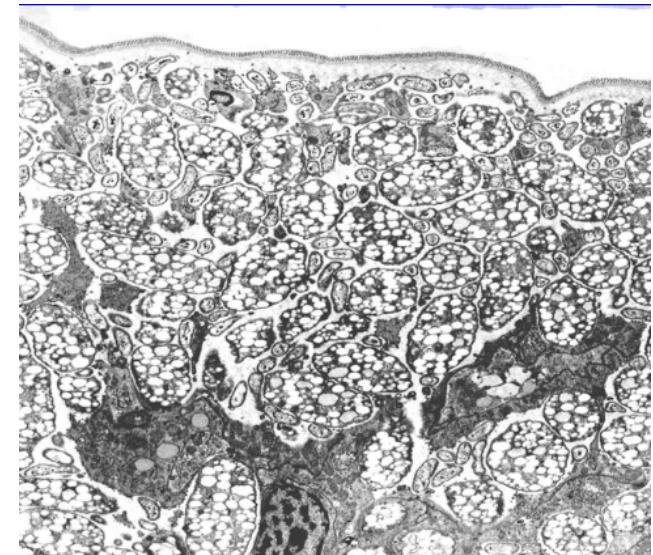
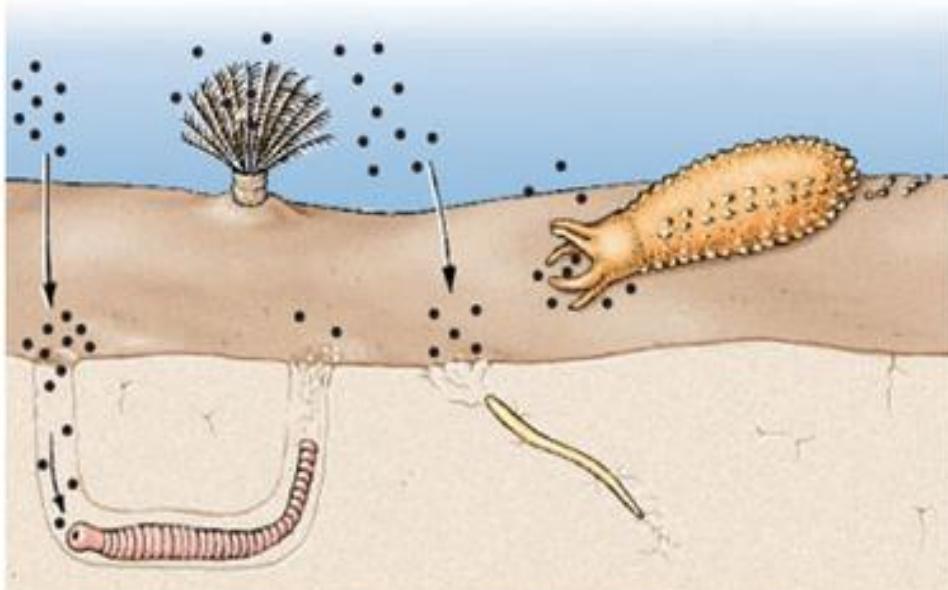
1

Feeding

- ✓ Non selective deposit feeding (exception of gutless worms)
- ✓ Without mouth and gut system, instead dependent on chemo- autotrophic, symbiotic bacteria

DEPOSIT FEEDING

Feeding on particulate organic matter that settles on the bottom



➤ What do marine clitellates/oligochaetes like?

Any marine sediment, from beach to deep sea, and in brackish water (highest diversity in sand with lots of interstices)

Decaying algae and seaweed on beaches

Mangroves (mud and sand)

Coral sand

Intertidal rock pools (sand pockets)

(Not so common in compact fine sand, or clay)



➤ Collection and sorting

sieve 250 µm mesh



- Whole mounts of stained and cleared specimens on microscope slides

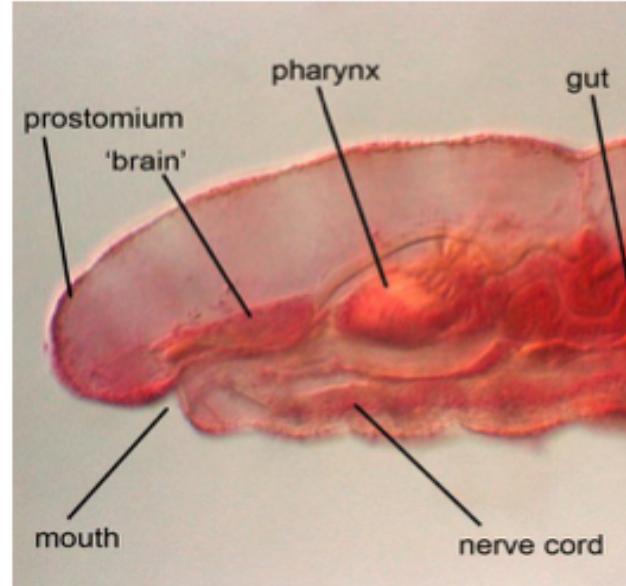
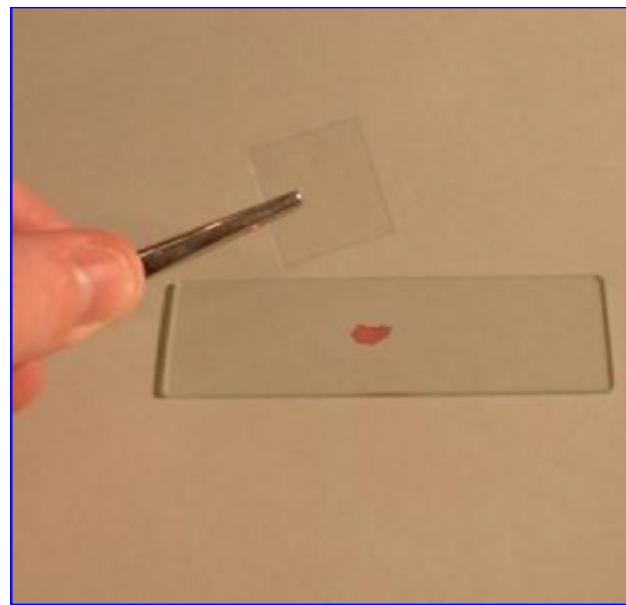
Worm in ethanol (80% anterior end, 95% posterior end DNA)

Worm stained in, e.g., alcoholic paracarmine, a nuclear staining dye

Destaining (to get rid of excess dye)

Dehydration, to enable penetration of mounting medium

Compression of worm, in mounting medium (e.g., Canada balsam), under a coverslip, on a slide



- A typical whole-mounted marine (naidid) oligochaete



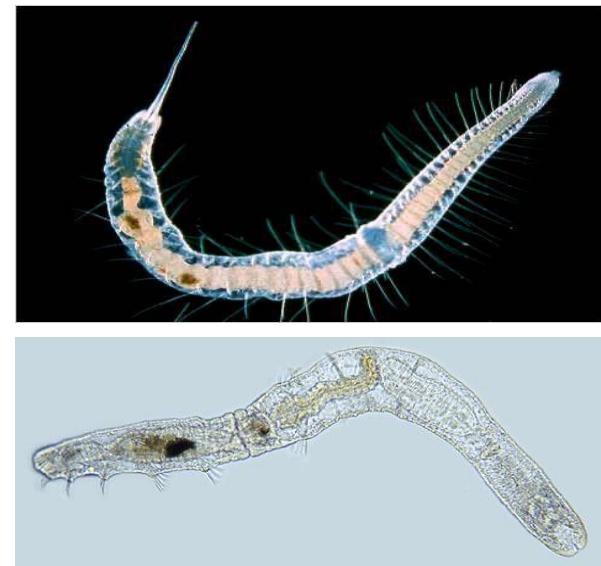
Family Naididae

Traditional classification of Tubificidae/Naididae

Tubificidae



Naididae (older name)



About 800 species

Sexual organs in segm X-XI

Dorsal bundles in all segment

Sexual reproduction the rule

Freshwater & marine

About 200 species

Sexual organs in segm IV-V to VII-VIII

Dorsal bundles missing in some segm

Asexual reproduction predominates

Freshwater, a few in brackish water

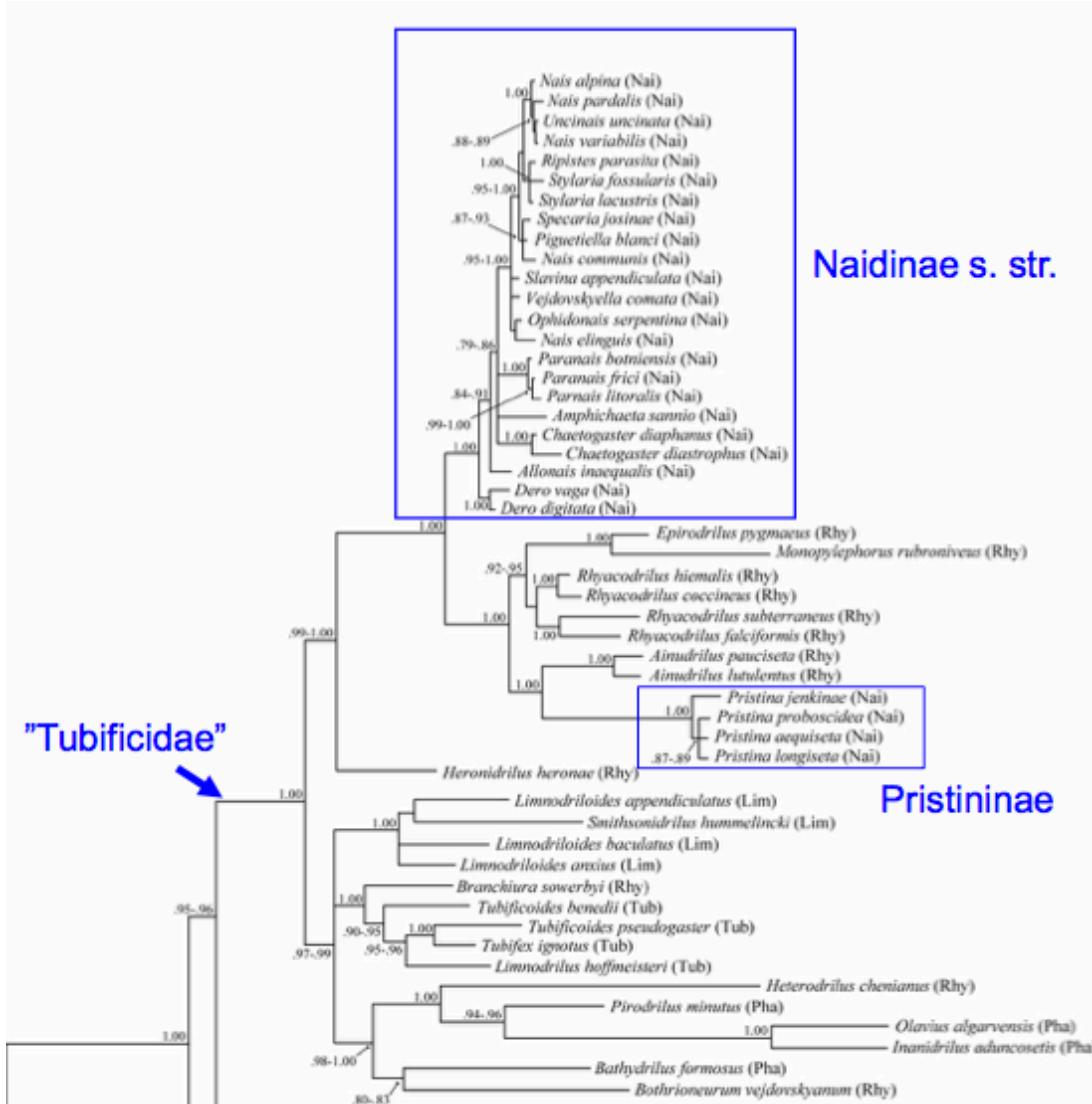
- Naididae in its old sense polyphyletic, and derived within former Tubificidae

Envall, Gustavsson & Erséus,
2006: 12S, 16S, 18S rDNA

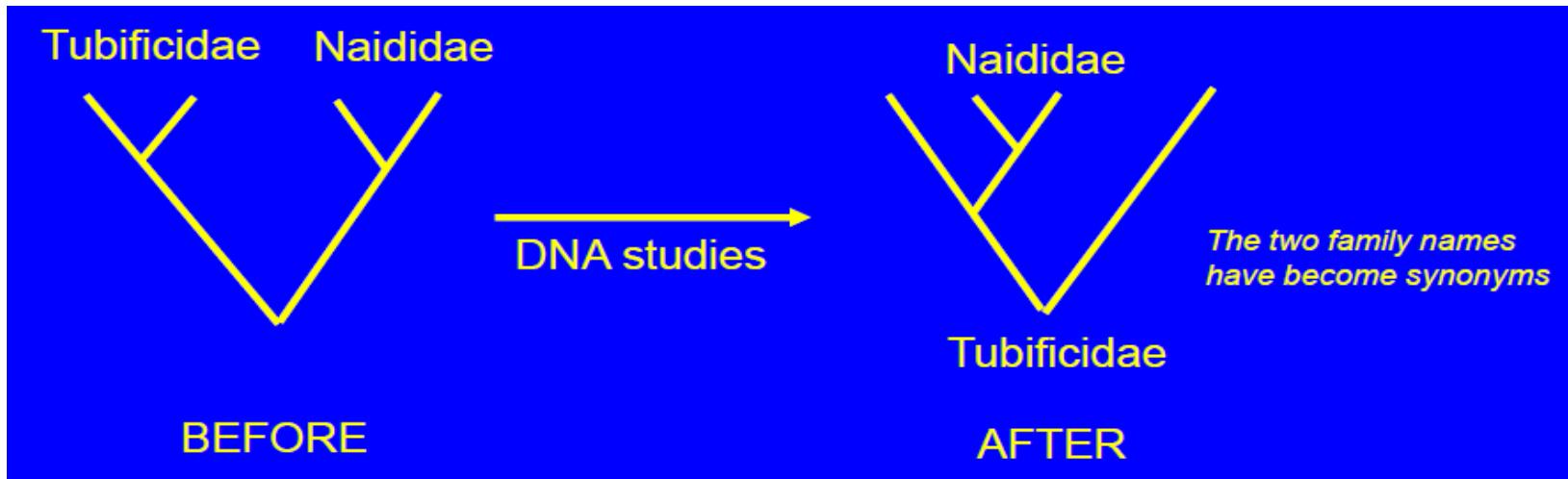
To summarize:

Former family Naididae is
nested as a polyphyletic
group within former family
Tubificidae

That is: one family is part of
another family, which is
hierarchically not acceptable!



➤ Proposed solution: to treat them as ONE family



It was first suggested that the former Naididae should be regarded as a subfamily, Naidinae, within Tubificidae.



Hydrobiologia 485: 253–256, 2002.
© 2002 Kluwer Academic Publishers. Printed in the Netherlands.

Short note

A proposal to regard the former family Naididae as a subfamily within Tubificidae (Annelida, Clitellata)

However, Naididae is older (1828) than Tubificidae (1876), and has priority over the latter. Therefore, now the (single) family must be named Naididae.

Bulletin of Zoological Nomenclature 64(1) March 2007

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OPINION 2167 (Case 3305)

NAIDIDAE Ehrenberg, 1828 (Annelida, Clitellata): precedence over TUBIFICIDAE Vejdovský, 1876 maintained

Abstract. The Commission has ruled that precedence is maintained for NAIDIDAE Ehrenberg, 1828 over TUBIFICIDAE Vejdovský, 1876 for a well-known group of aquatic oligochaetous clitellates.



Contents lists available at ScienceDirect

Molecular Phylogenetics and Evolution

journal homepage: www.elsevier.com/locate/ympev



Molecular data reveal a tropical freshwater origin of Naidinae (Annelida, Clitellata, Naididae)

Christer Erséus^{a,*}, Ida Envall^{b,c}, Pierre De Wit^d, Lena M. Gustavsson^c



➤ Current classification of Naididae

The family is now divided in 6 subfamilies

Naidinae: **FEW MARINE**

Tubificinae: **SOME MARINE**

Pristininae: **ONLY ONE GENUS *Pristina*, FRESHWATER**

Limnodriloidine: **MARINE**

Phalodrilinae : **MARINE**

Rhyacodrilinae : **NOT A NATURAL GROUP (needs a revision)**

Taxonomically important features of Naididae

Chaetae

Bifid (normal type)

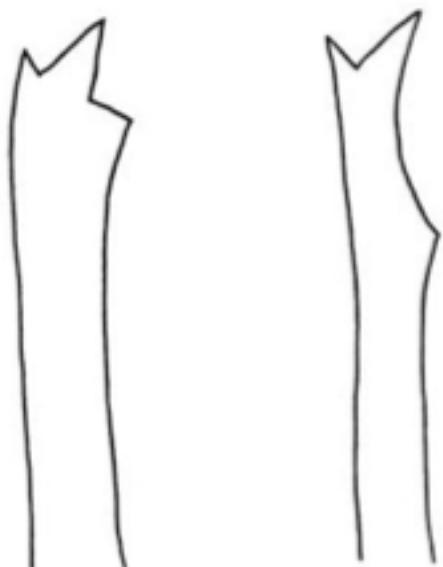


Pectinate chaetae (dorsal)

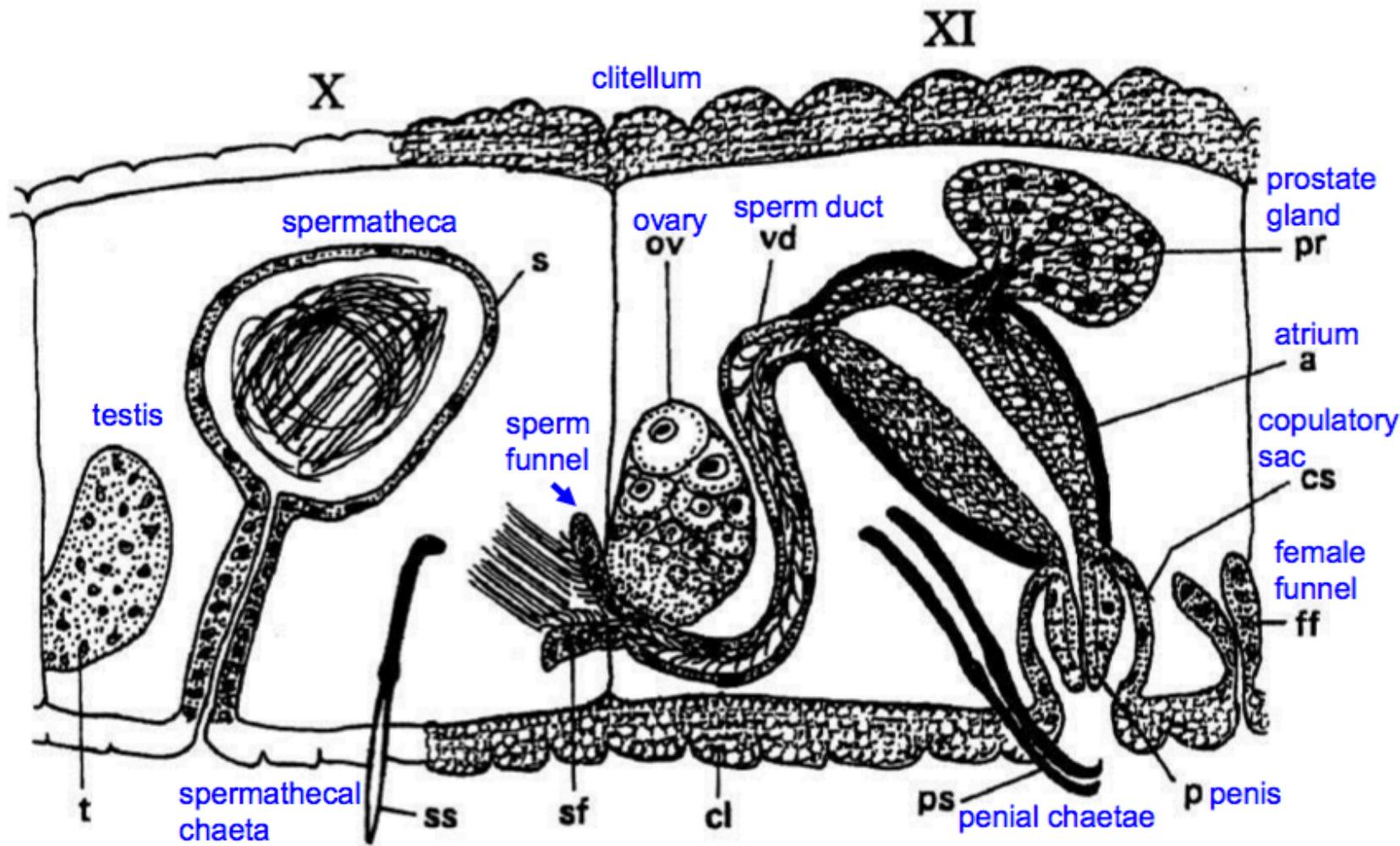
Not so common in marine
taxa



Trifid chaetae
(*Heterodrilus* spp.)

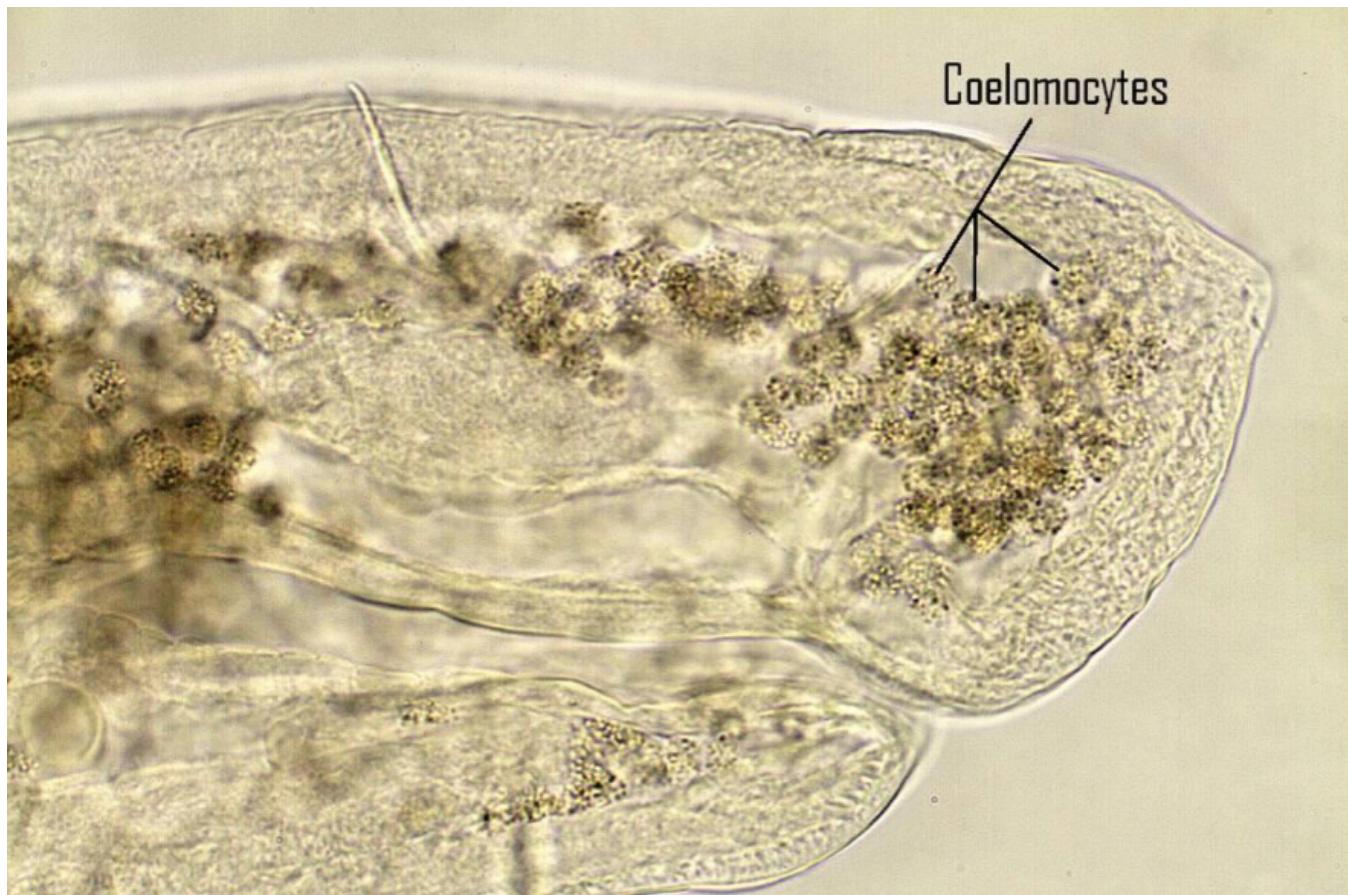


Genital organs of Naididae



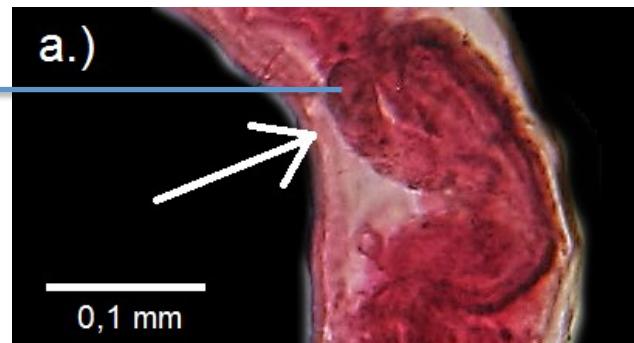
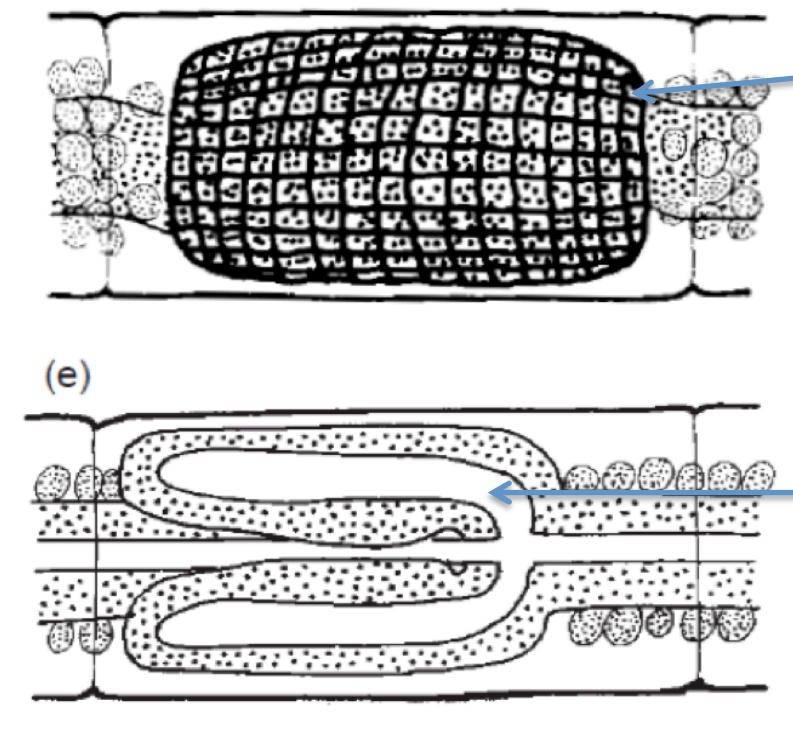
Free-floating coelomocytes in the coelomic fluid diagnostic of some naidid genera (osmoregulation)

Monopylephorus, Ainudrilus e Heronidrilus



Oesophageal modifications in segment IX (characteristic of Limnodriloidinae)

Barrel-shaped formation with tall esophageal epithelium, with reticulate blood plexus



Esophageal diverticula

Some marine naidid taxa have cuticular papillation

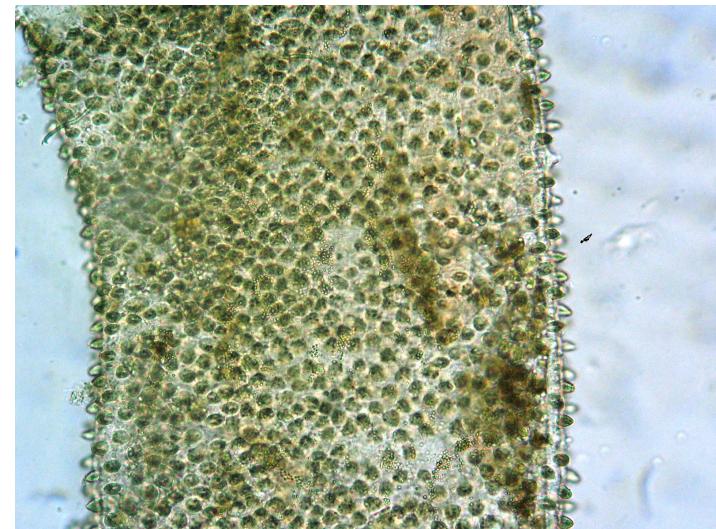


Prostomium withdrawn
into peristomium



Tubificoides spp.
Tectidrilus spp.
Duridrilus spp.

(all different
subfamilies)



➤ Typical appearances of live marine naidids



Heterodrilus sp.



Tectidrilus gabriellae

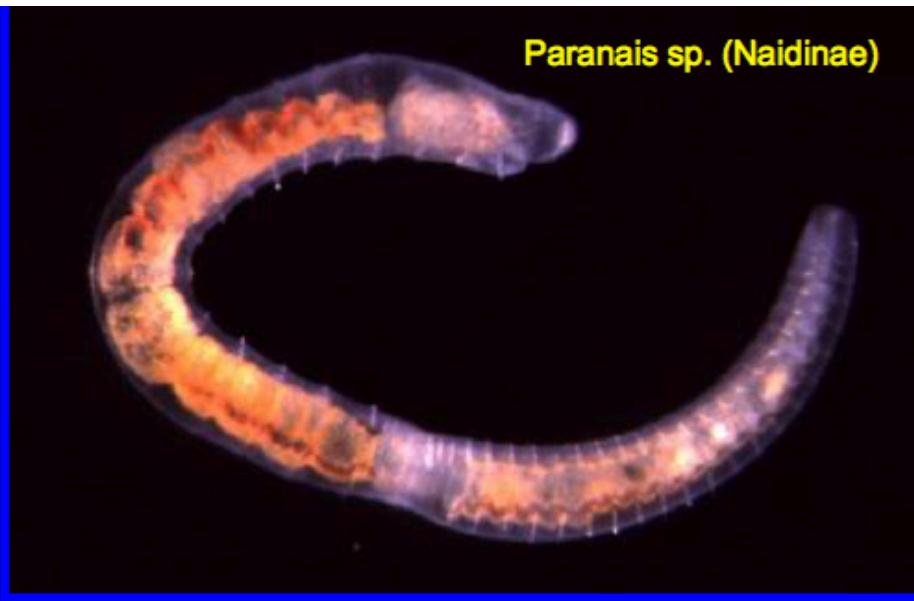


Freshwater worms, but just the same...



Limnodriloidinae sp.

➤ Marine Naididae when preserved



✓ Family Enchytraeidae

About 650 species

Majority terrestrial, but in “all” kinds of habitats

1-60 mm long

Rather uniform morphology - Smooth, thick cuticle

Simple chaetae



Grania chilensis Foto: Per Sundberg



Some important taxonomic characters used for small Enchytraeids

Coelomocytes

Brain shape

Clitellar gland arrangement

Nephridia

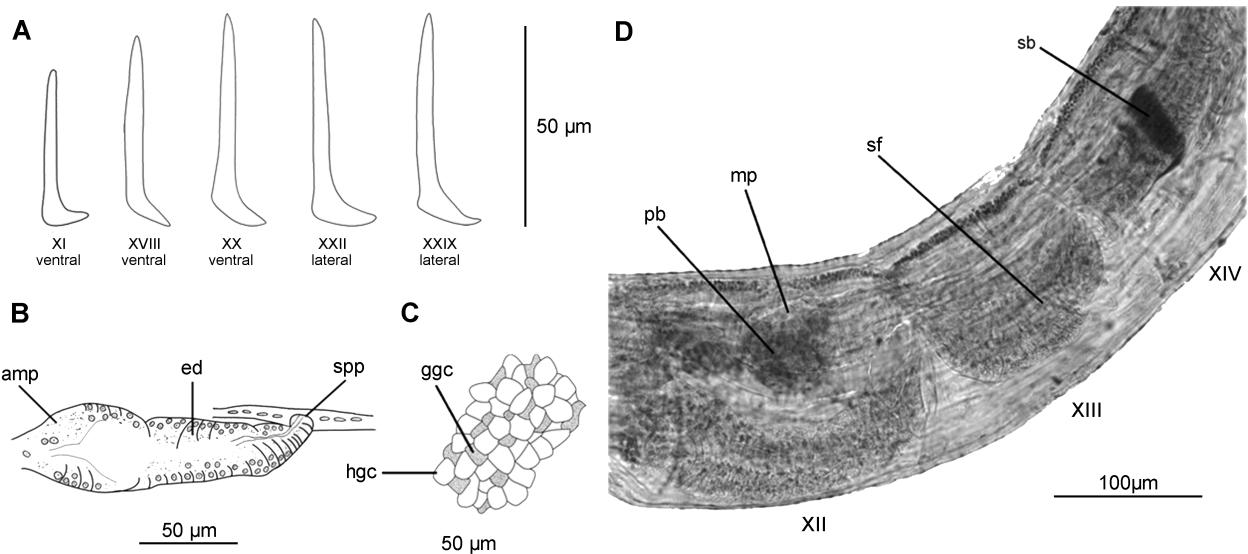
Spermatheca

Number and shape of chaetae

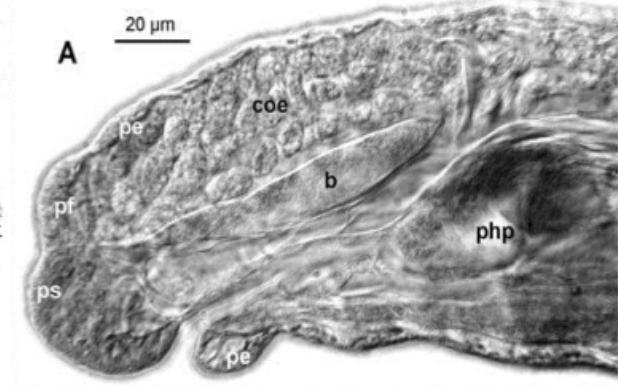
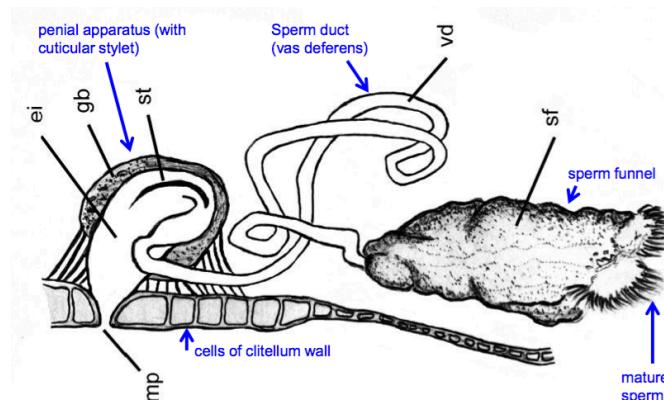
Sperm funnel

Vas deferens

Penial apparatus

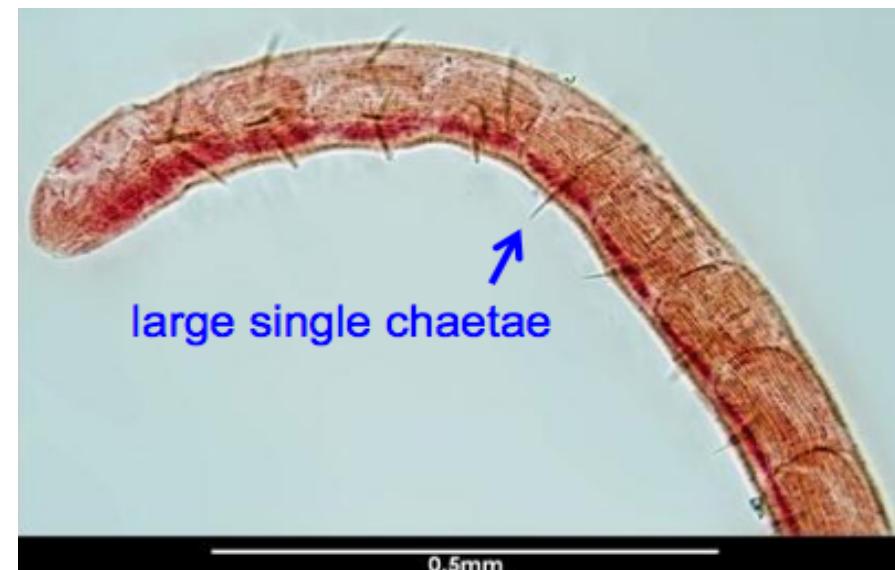


Prantoni et al., 2016



Whole mounts of *Grania* sp., a typical marine enchytraeid

Some species in the deep sea



Whole mounts of marine
Lumbricillus sp.



✓ Family Randiellidae

Marine, rarely seen

Four named species (Atlantic and Pacific Oceans)

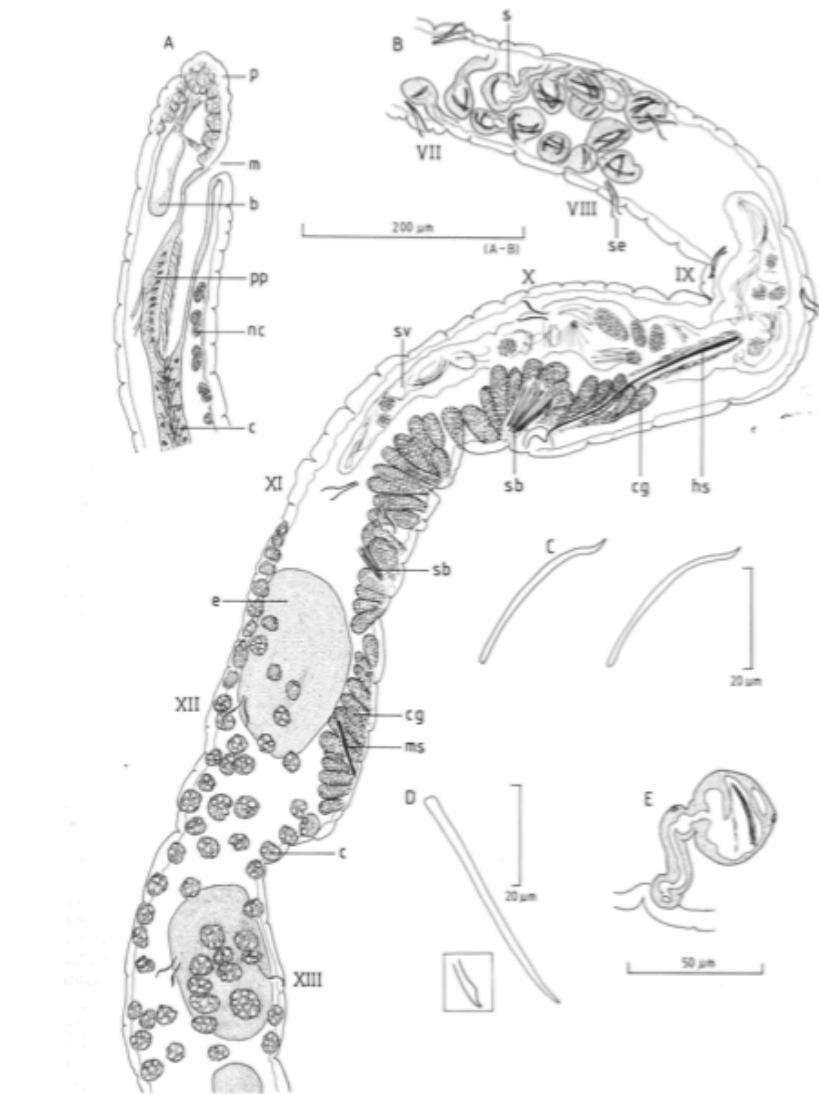
Small worms, 1-6 mm long

No visible gonoducts

Multiple spermathecae

Complex genital chaetae

Possibly survivors of an old lineage in the clitellate tree



Thank you

Special thanks
to the
organizing
committee

