

Echinodermata

■ П/т Homalozoa (Camb.-Dev.)

- Ctenocystoidea
- Homostelea
- Stylophora
- Homoiostelea

• П/т Blastozoa

- Eocrinoidea (Camb.-Sil.)
- Blastoidea (Camb.-Perm.)
- Parablastoidea (Ord.)
- Cystoidea (Ord.-Dev.)
 - Rombifera
 - Diploporita

• П/т Crinozoa (Pelmatozoa)

- Paracrinoidea (Ord.-Sil.)
- Crinoidea (Camb.-pr.)

• П/т Echinozoa

- Camptostromatoidea (Camb.)
- Helicoplacoidea (Camb.)
- Edrioasteroidea (Camb.-Carb.)
- Edrioblastoidea (Ord.)
- Cyclocystoidea (Ord.-Dev.)
- Ophiocystoidea (Ord.-Carb.)
- Echinoidea (Ord.-pr.)
- Holothuroidea (Ord.-pr.)

• П/т Asterozoa (Stelleroidea)

- Somasteroidea (Ord.)
- Asteroidea (Ord.-pr.)
- Ophiuroidea (Ord.-pr.)





Macrotychaster sp.

Весит 1 кг и более



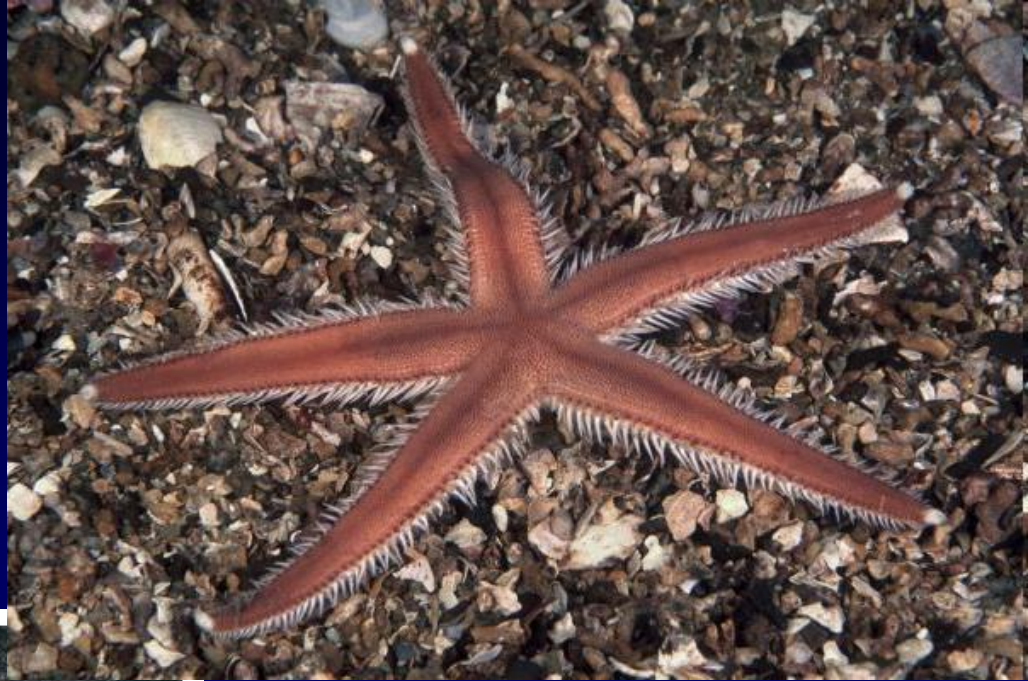
Hymenaster pellucidus



Находки на глубине 9990 м



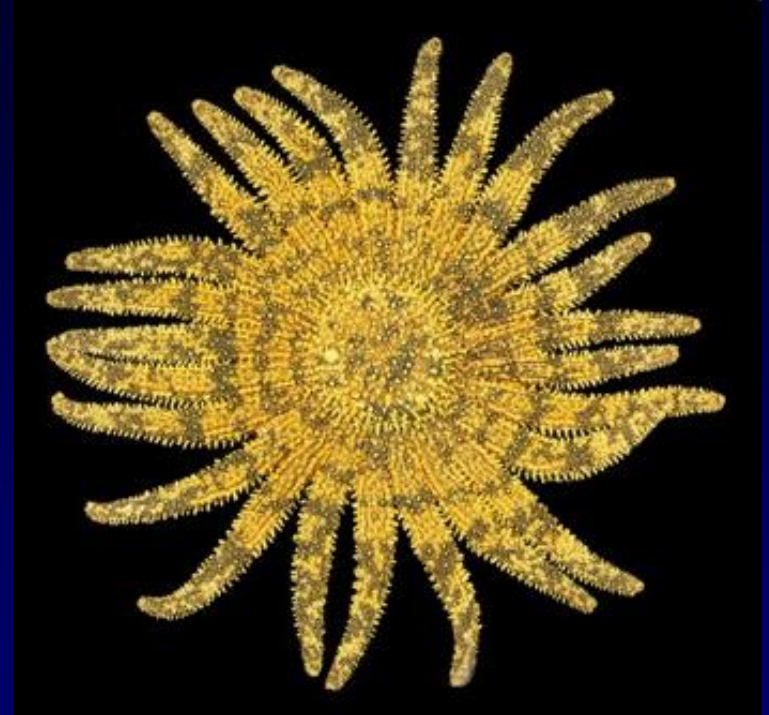
Luidia sarsi



Luidia ciliaris



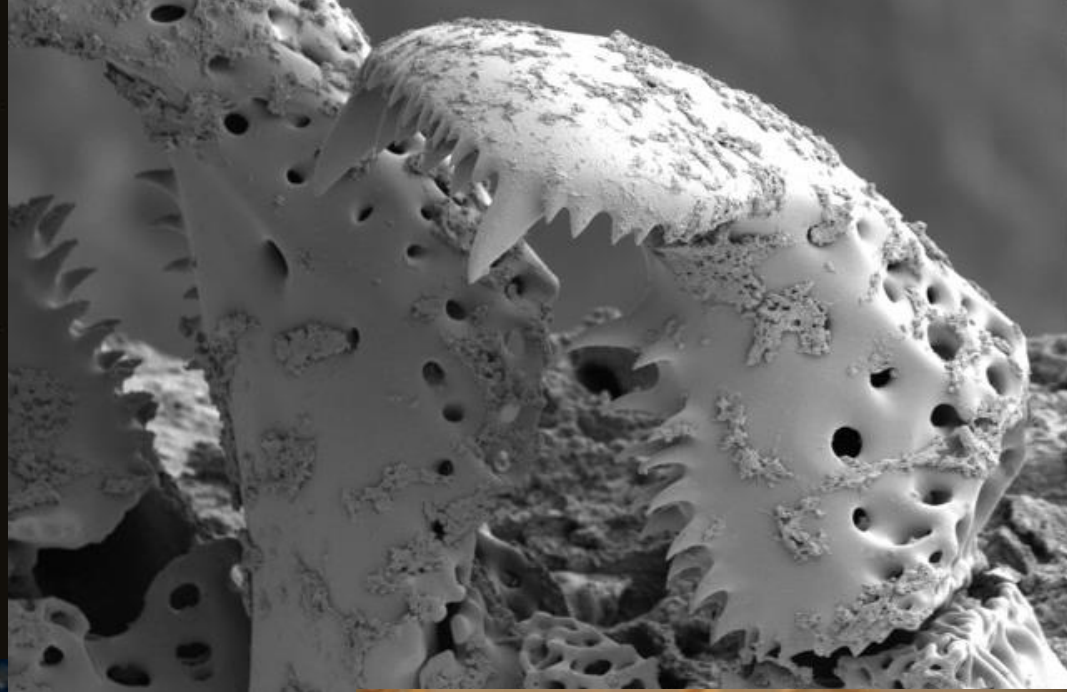
Heliaster helianthus



Heliaster solaris



*Heliaster
kubiniji*



Labidiaster spp.



Crossaster papposus





Solaster dawsoni



Solaster endeca



Solaster stimpsoni

Freyella remex



Whiting's Tongue Point

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*Pycnopodia
helianthoides*



Brisinga sp.



Podosphaeraster sp.



Patiria sp.



*Culcita
novaeguineae*



Asterias forbesi

Asterias rubens



Asterias vulgaris

Acanthaster planci



Astropecten irregularis





Culcita novaeguineae

Dermasterias imbricata





Henricia sanguinolenta

Echinaster sp.

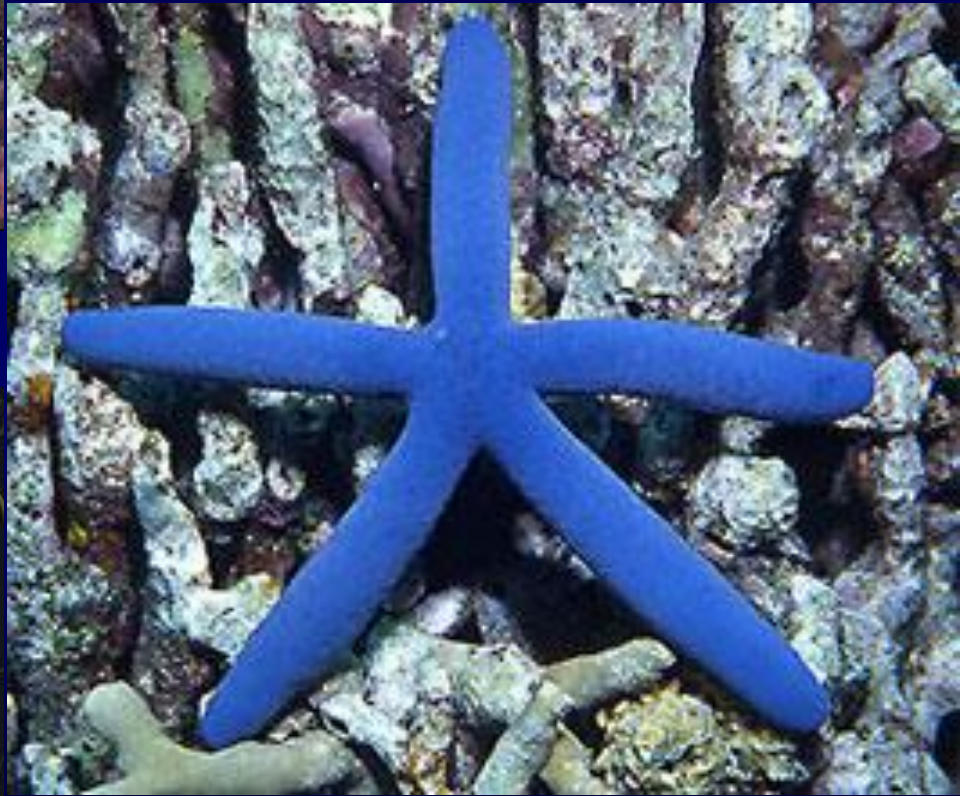


Henricia leviuscula



Leptasterias hexactis

Linckia laevigata



Mediaster aequalis



Oreaster reticulatus

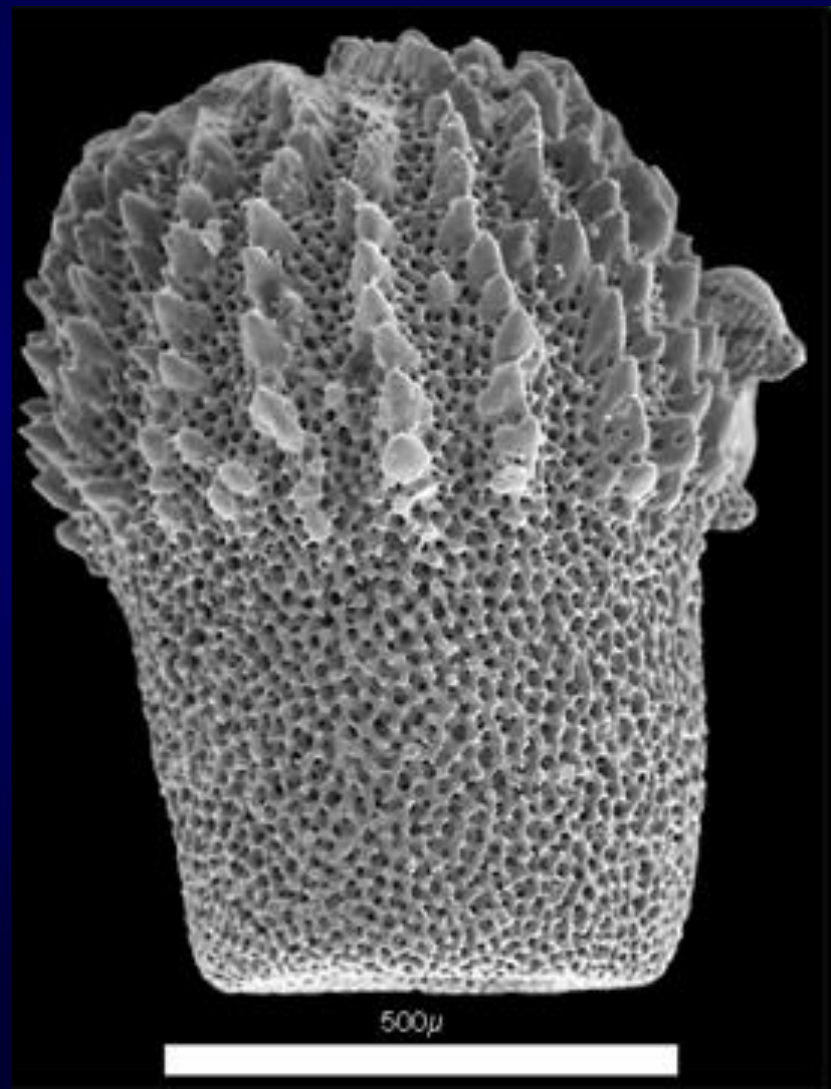
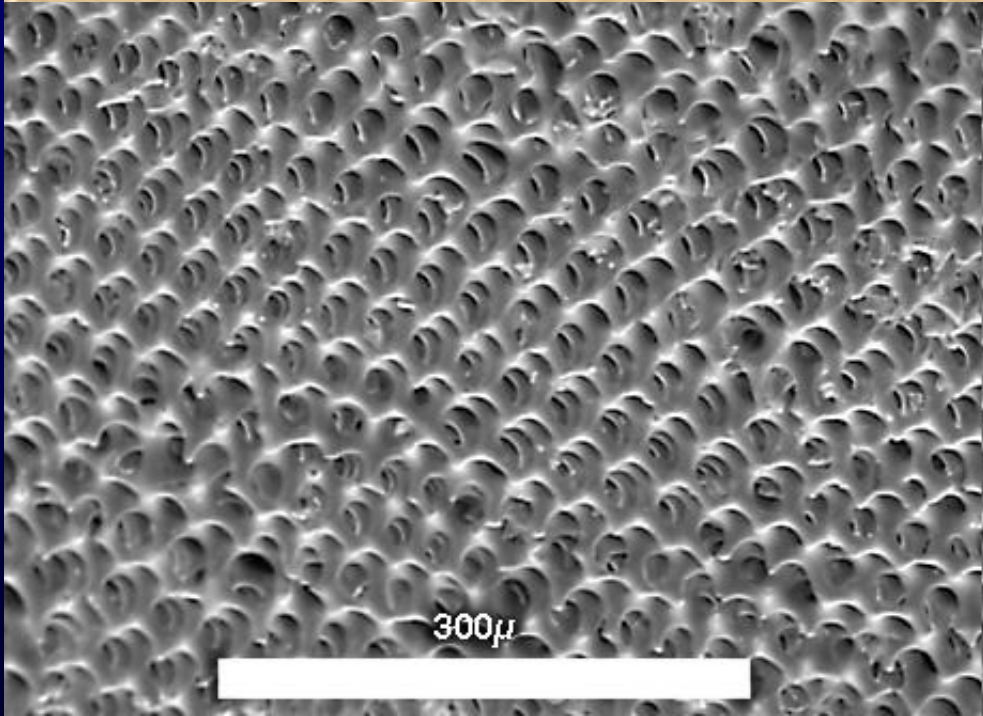
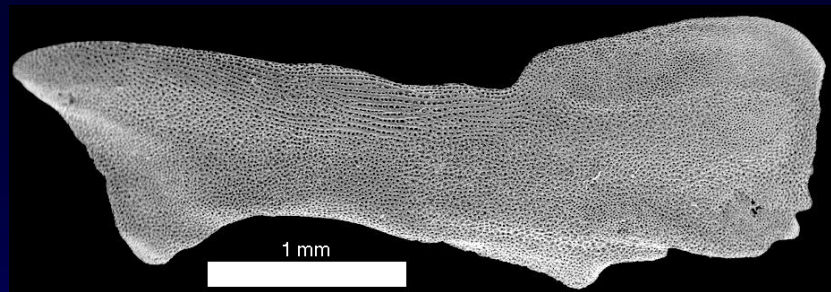


Patiria miniata

Pisaster brevispinus



Pisaster ochraceus



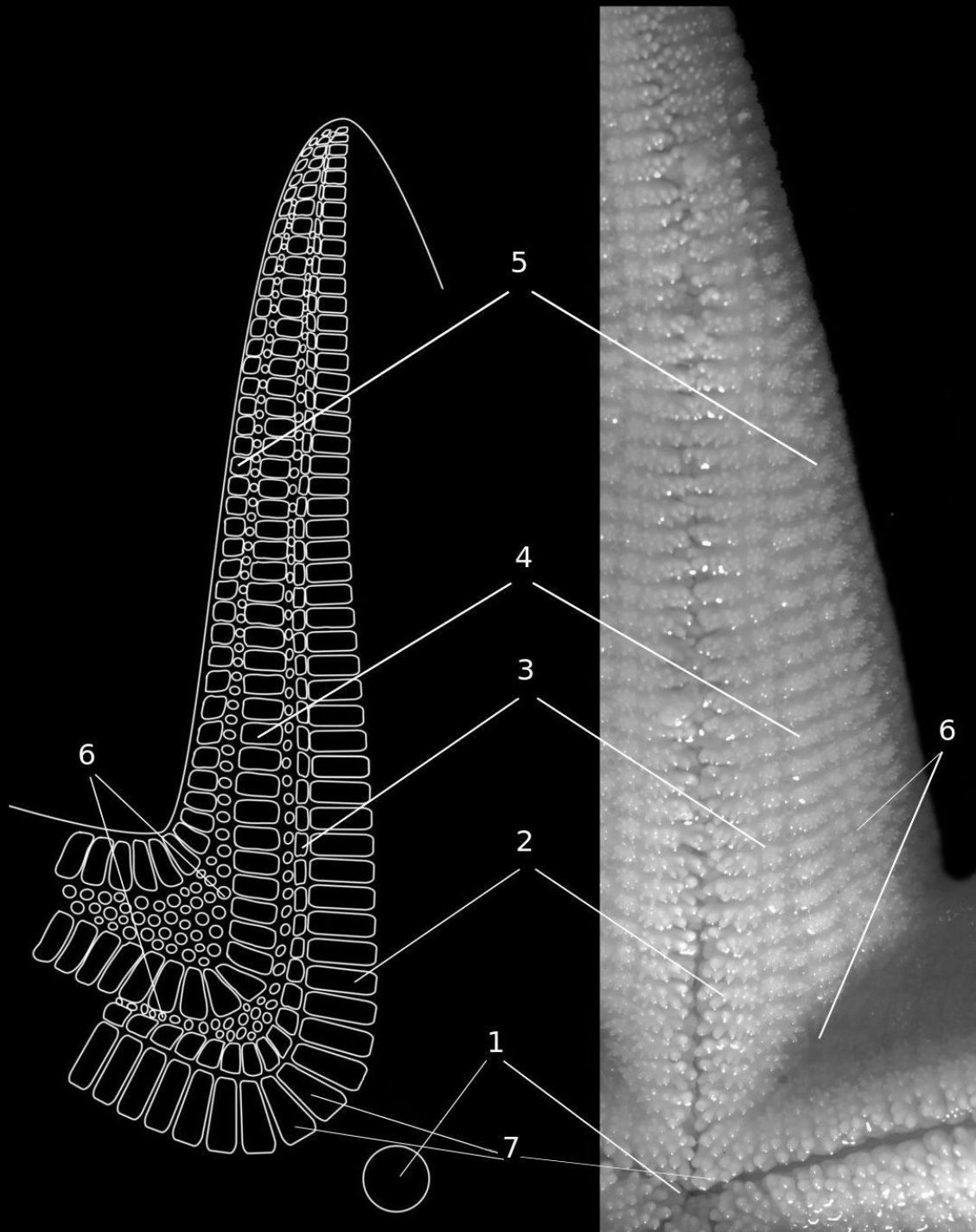


Схема строения вентрального
скелета морских звезд
(*Henricia sp.*):

- 1, место расположения ротового
отверстия;
- 2, адамбулакральные пластинки;
- 3, вентролатеральные пластинки;
- 4, нижнемаргинальные пластинки;
- 5, верхнемаргинальные пластинки;
- 6, вставочные пластинки;
- 7, угол рта, образованный двумя
оральными пластинками.

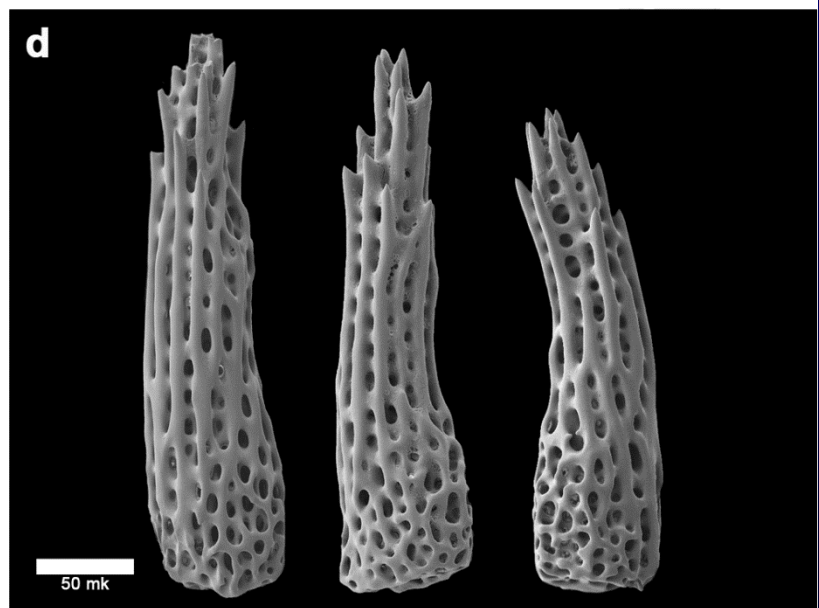
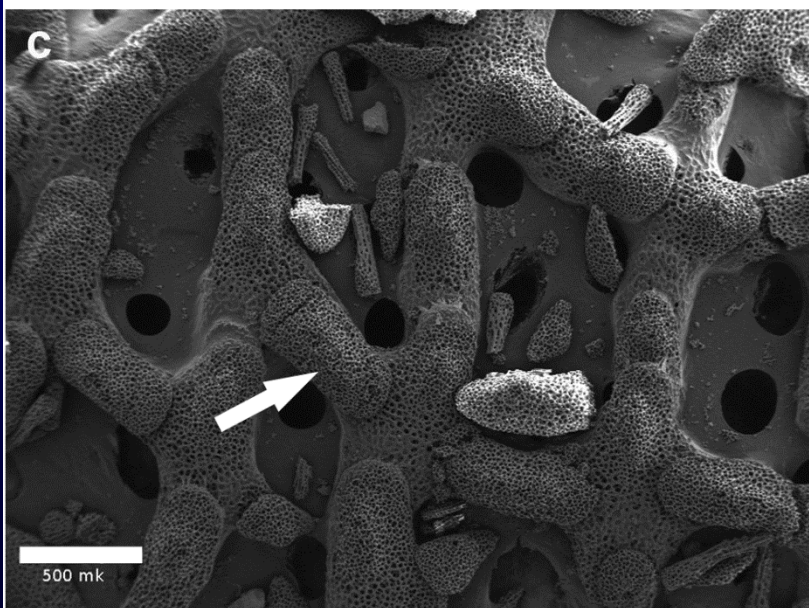
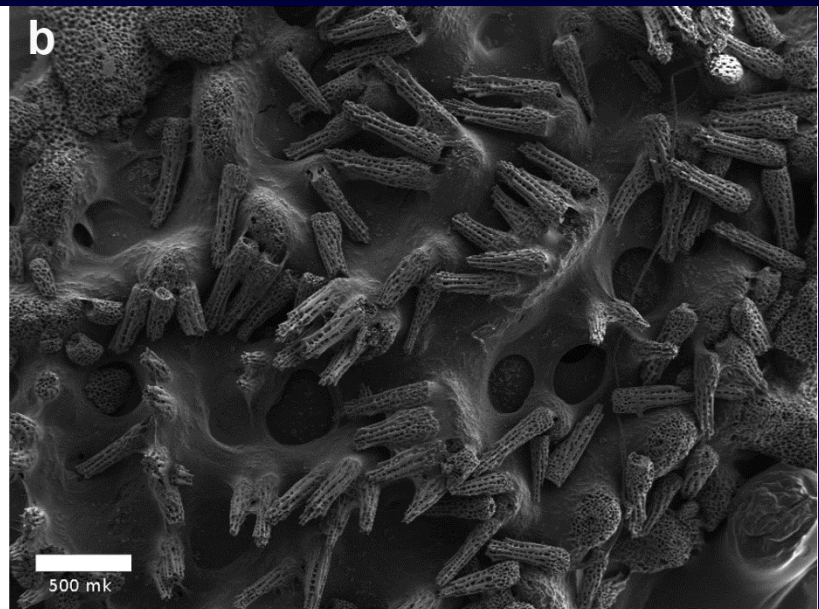
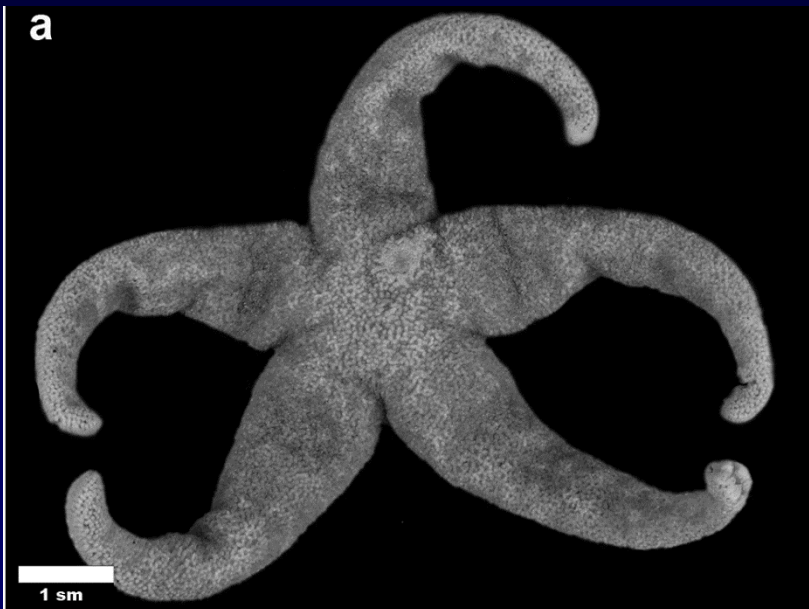
(Братова, 2010)

Перистомиальное скелетное кольцо

(вид с актиальной поверхности звезды)

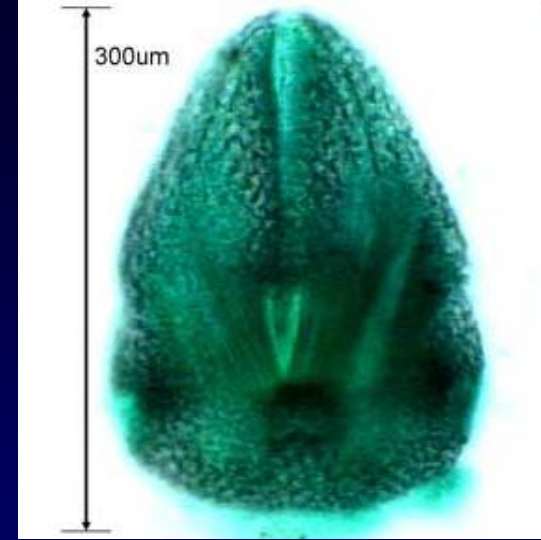


Дорзальный скелет морских звезд
рода *Henricia* (Братова, 2010)



Мадрепорит





Скелетные элементы

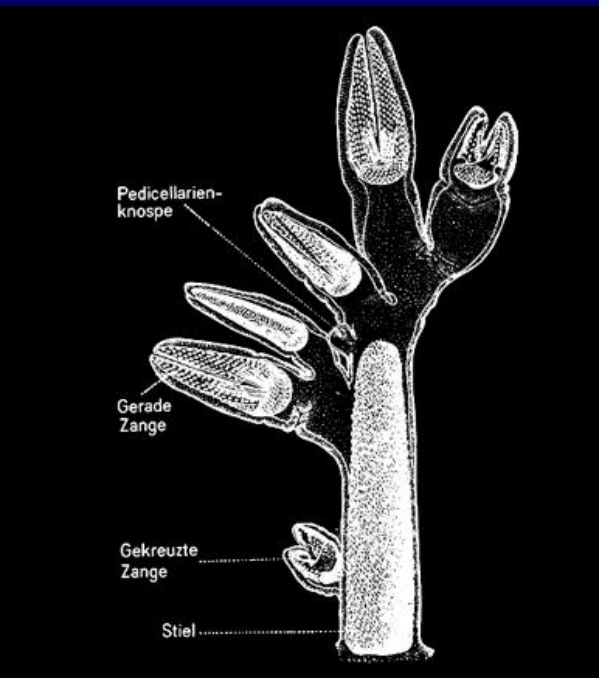
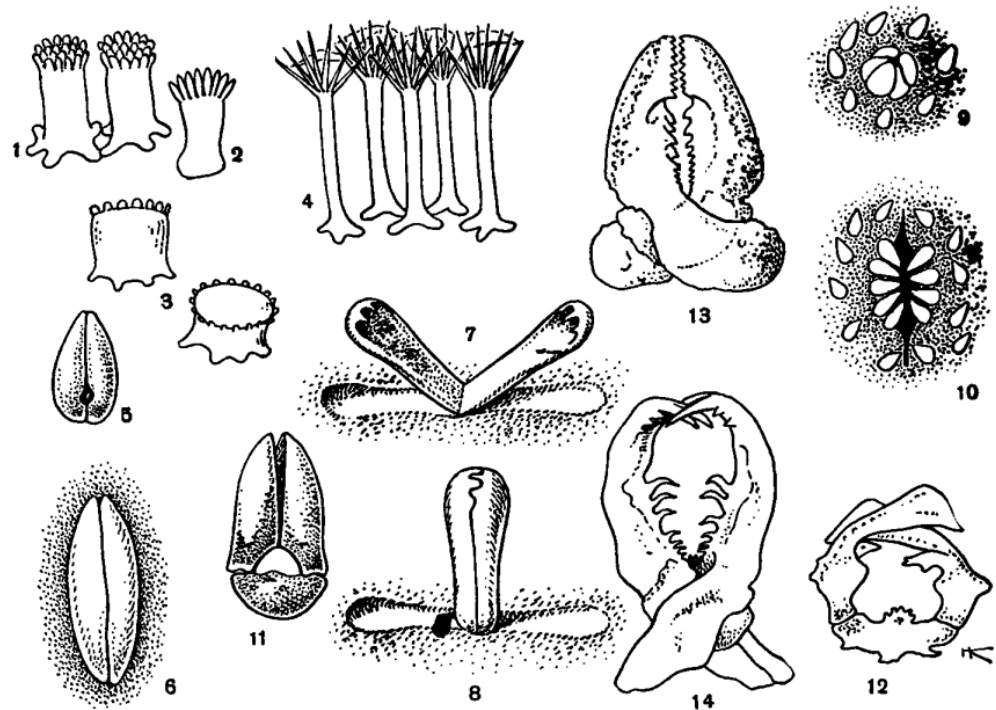
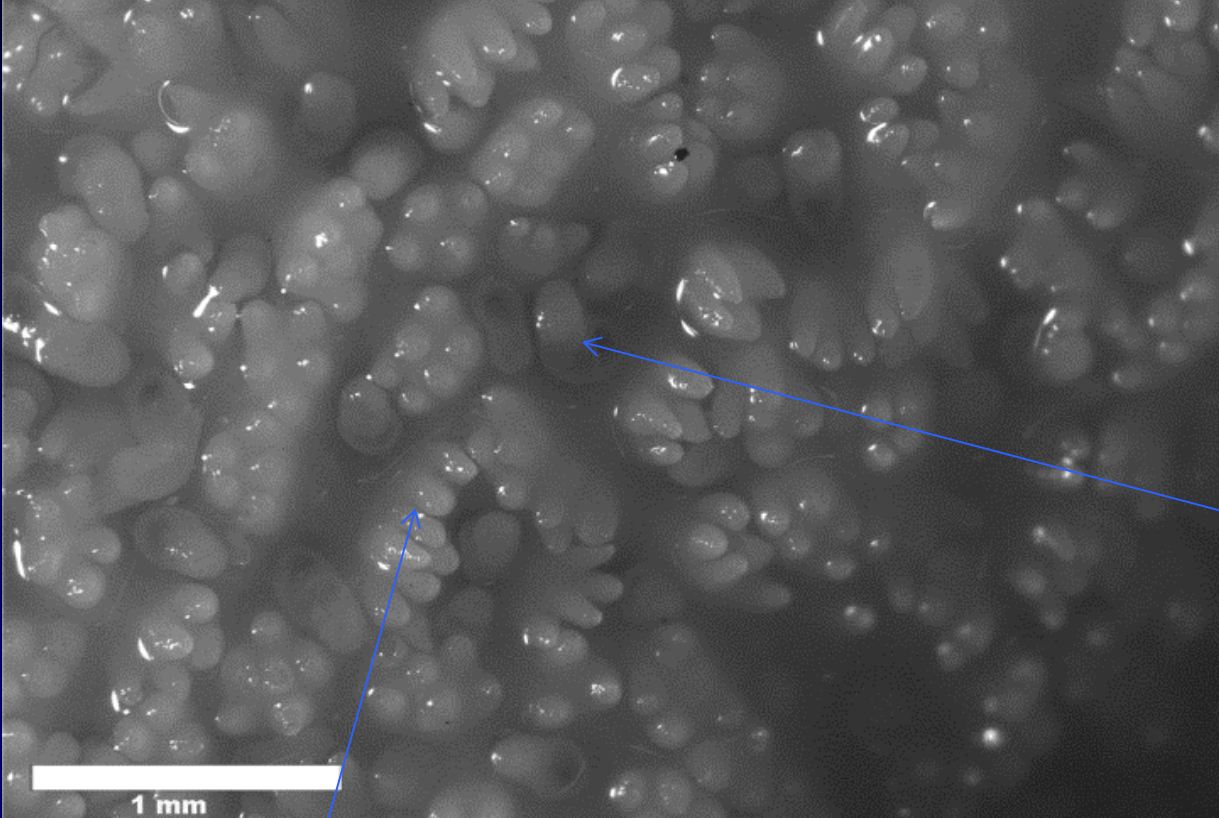


Рис. 142. Паксиллы и педицеллярии морских звезд:

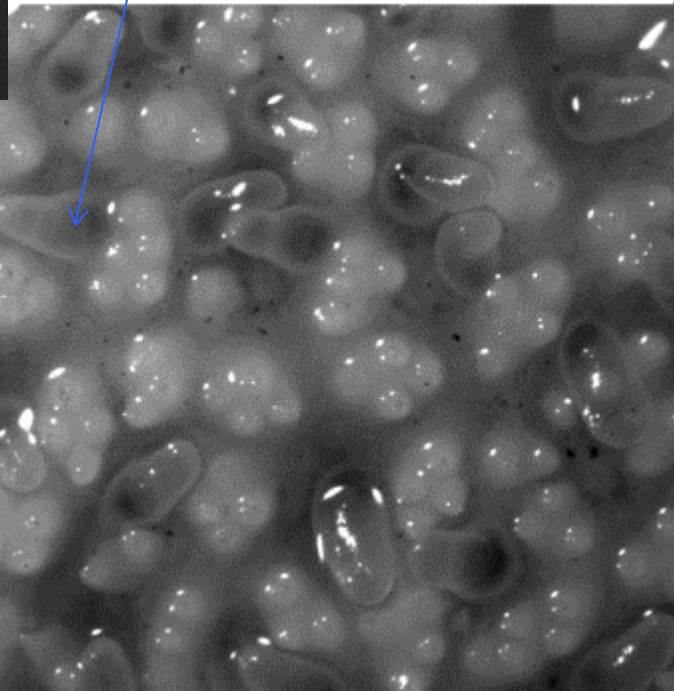
1 — 3 — паксиллы явнопластинчатых звезд; 4 — паксиллы игольчатых звезд из семейства Pterasteridae, поддерживающие супрадорзальную мембрану; 5 — 10 — педицеллярии явнопластинчатых звезд: 5 — *Luidia*; 6 — *Hippasteria*; 7 — 8 — открытая и закрытая педицеллярии *Nacelia* (семейство Linckiidae); 9 — пучковидная педицеллярия *Astropectinidae*; 10 — гребенчатая педицеллярия *Benthorestinidae*; 11 — 12 — прямые и 13 — 14 — скрещенные педицеллярии педицелляриевых звезд.



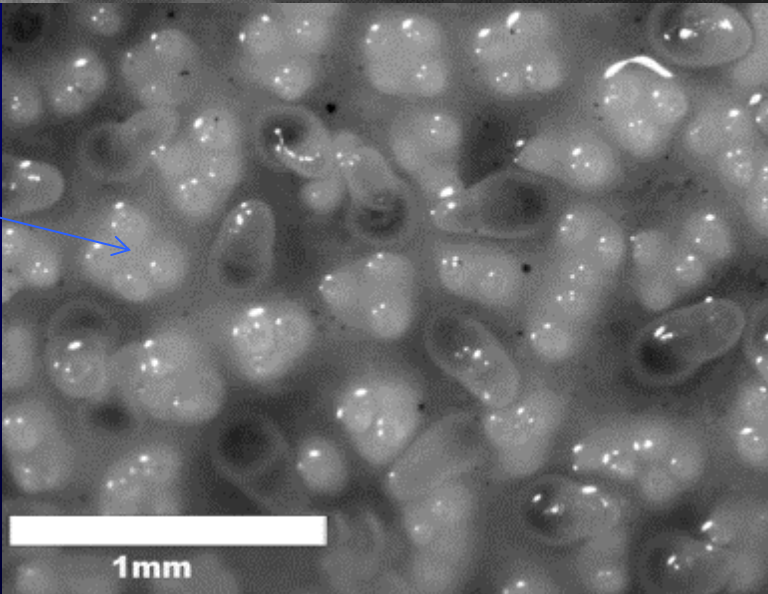


Дорзальная поверхность звезд
рода *Henricia* (Братова, 2010)

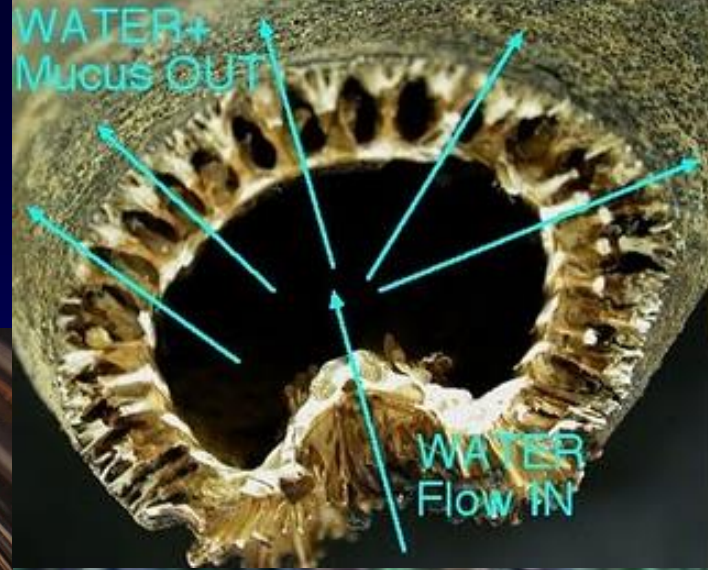
папула



ИГЛЫ

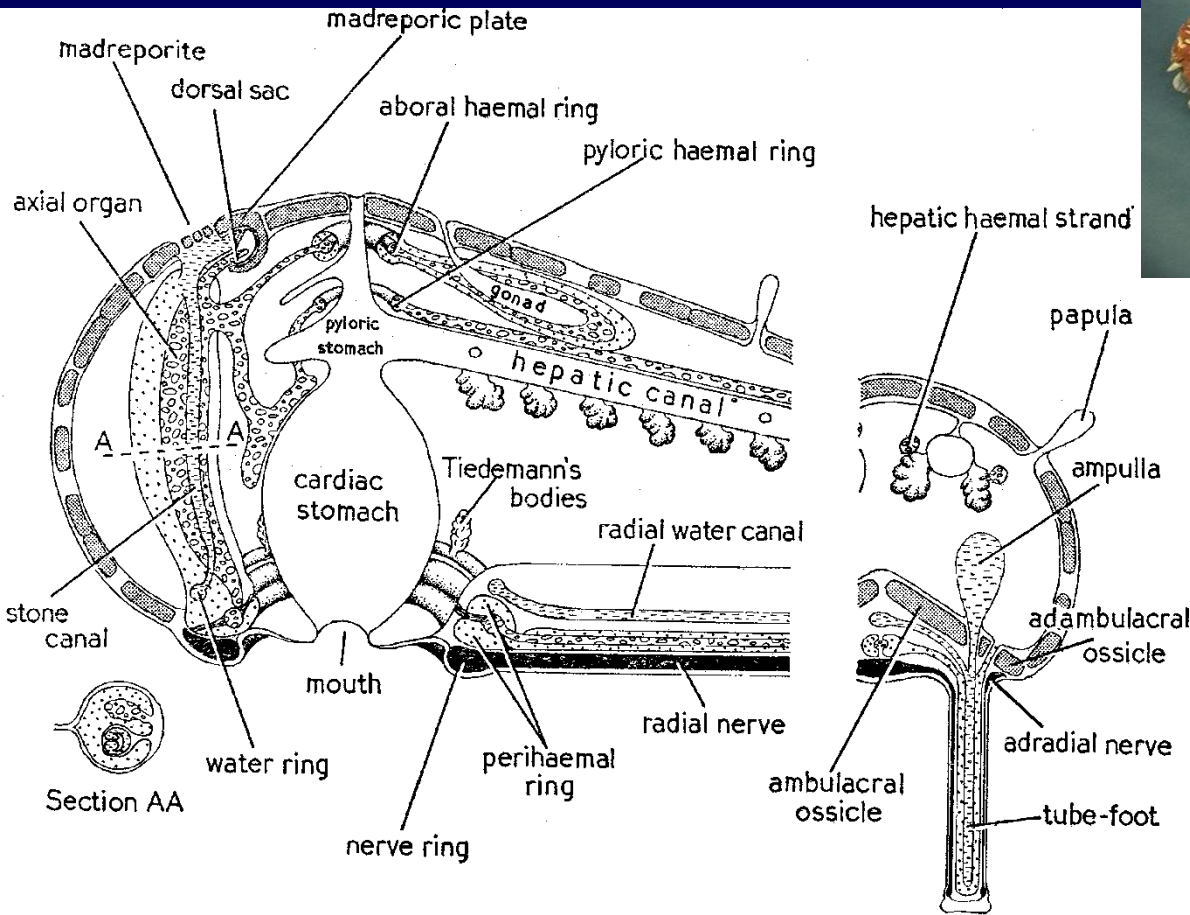


*Pteraster
tesselatus*

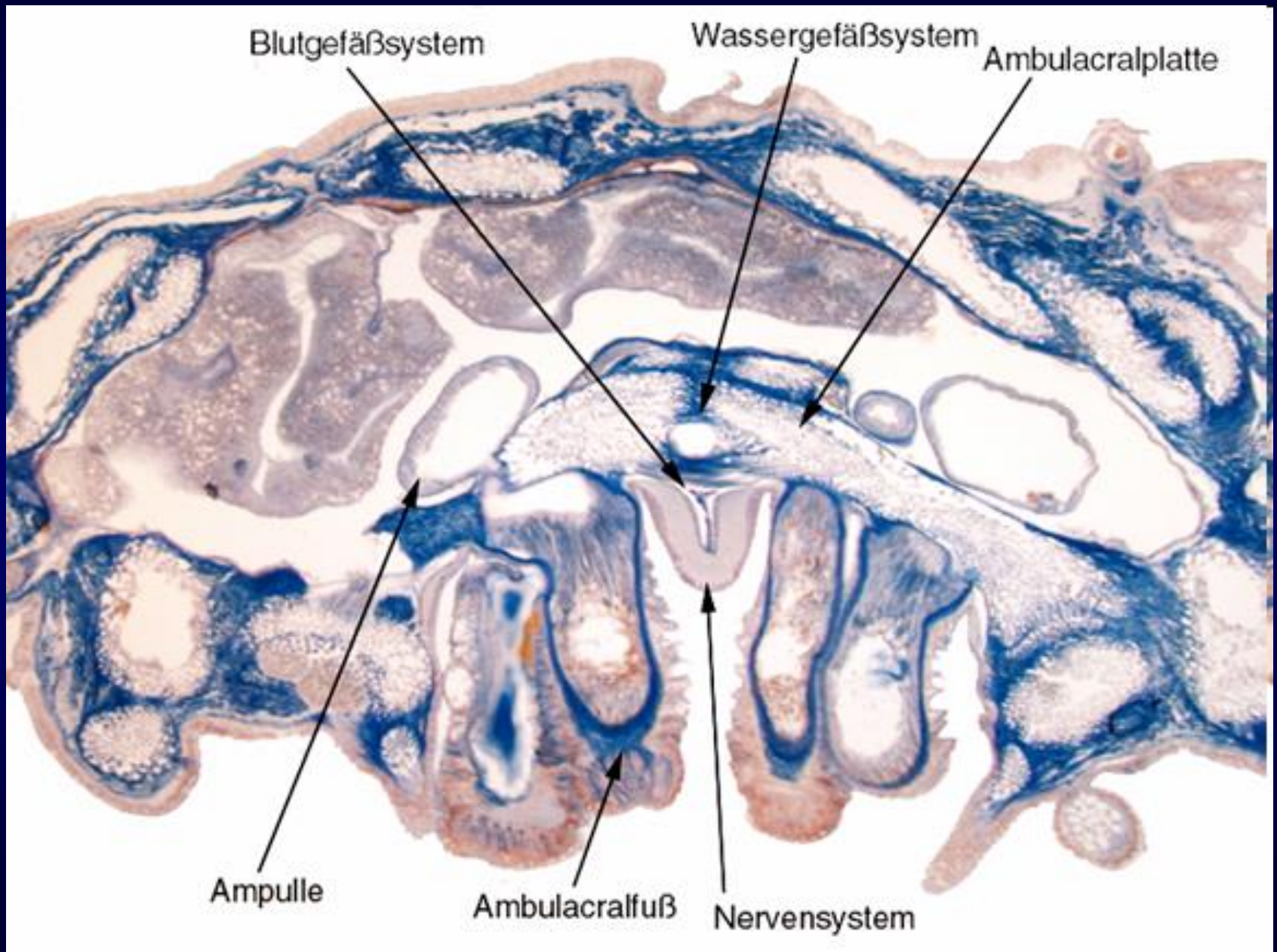


Вторичный покров тела =
супрадорсальная мембрана

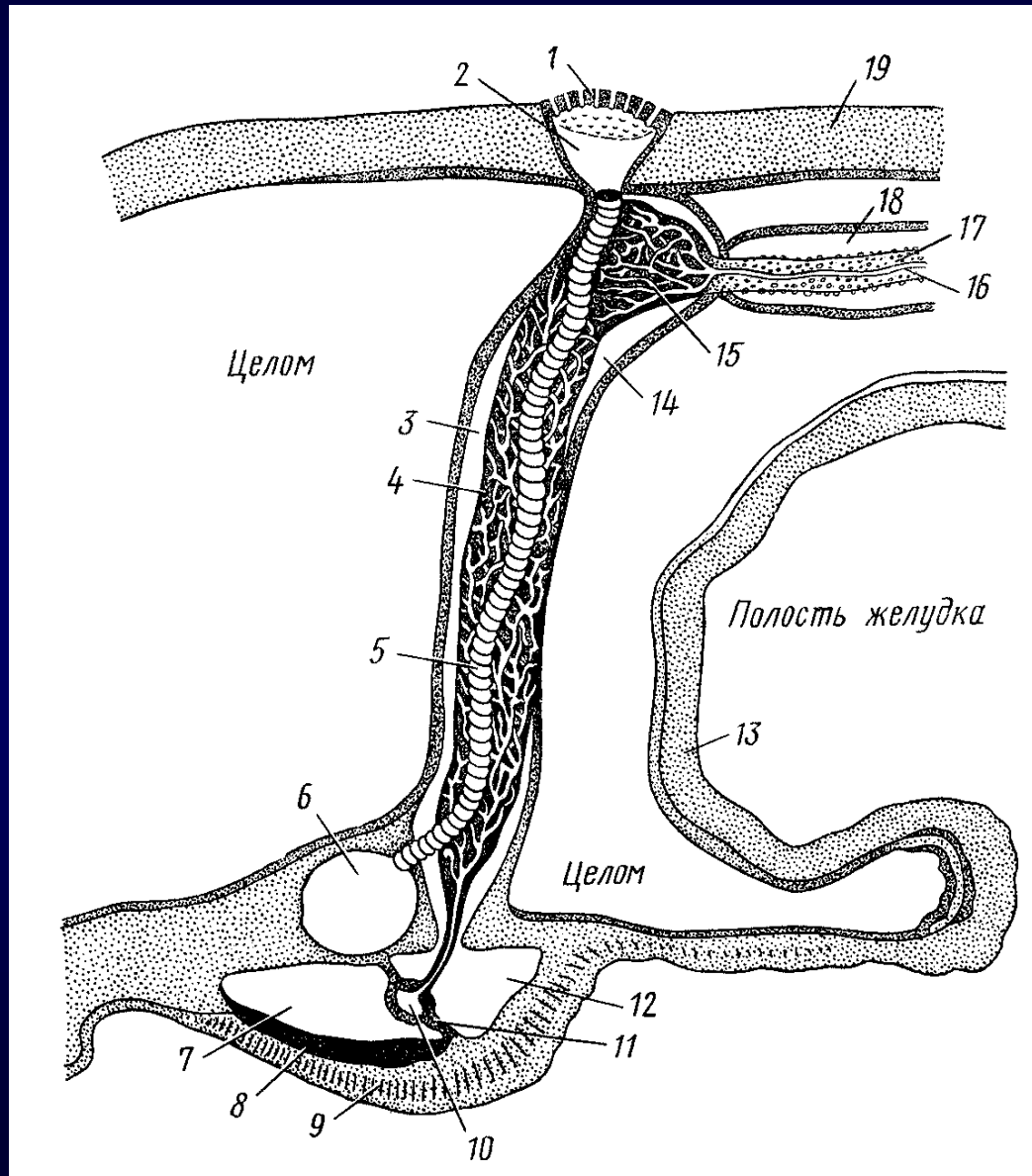
Anatomy of Asteroidea (Nichols, 1969)



Строение радиуса морской звезды

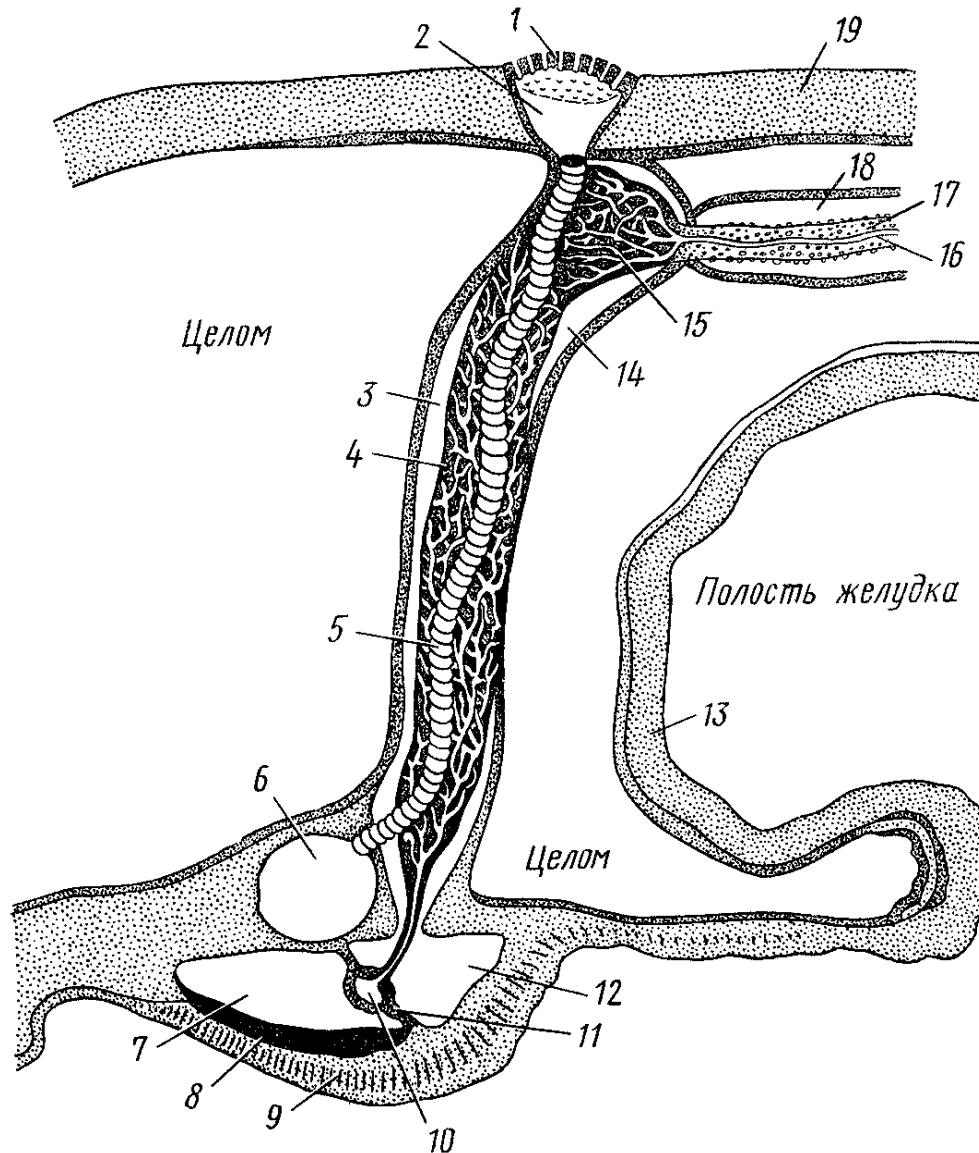


Осевой комплекс органов



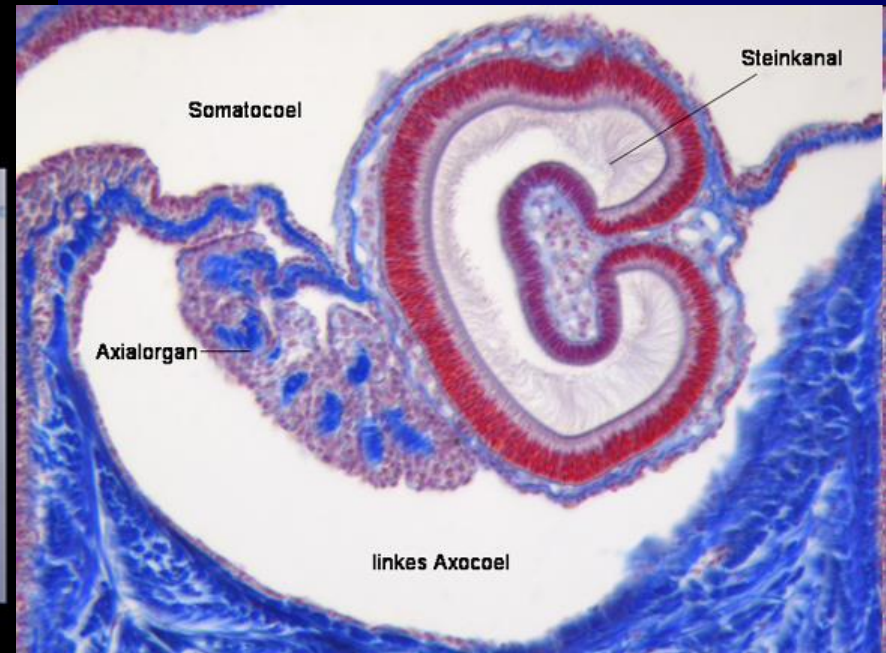
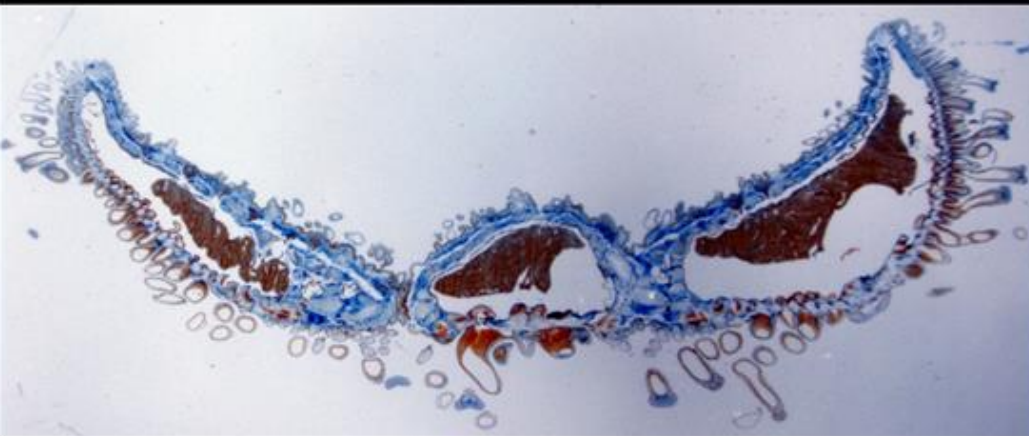
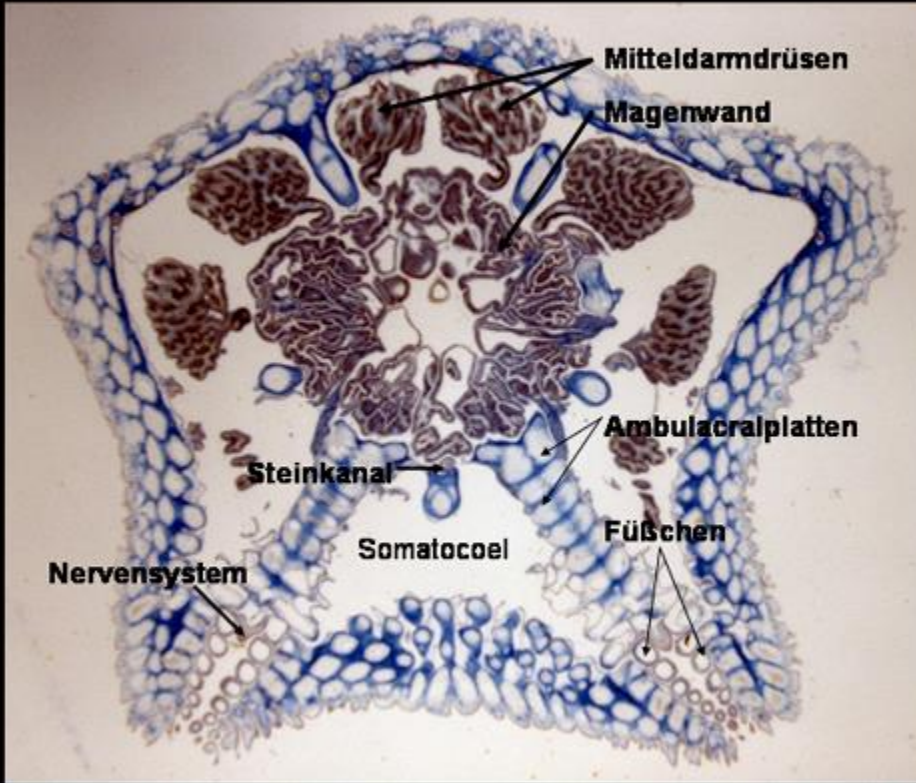
Осевой комплекс органов

На примере морских звезд

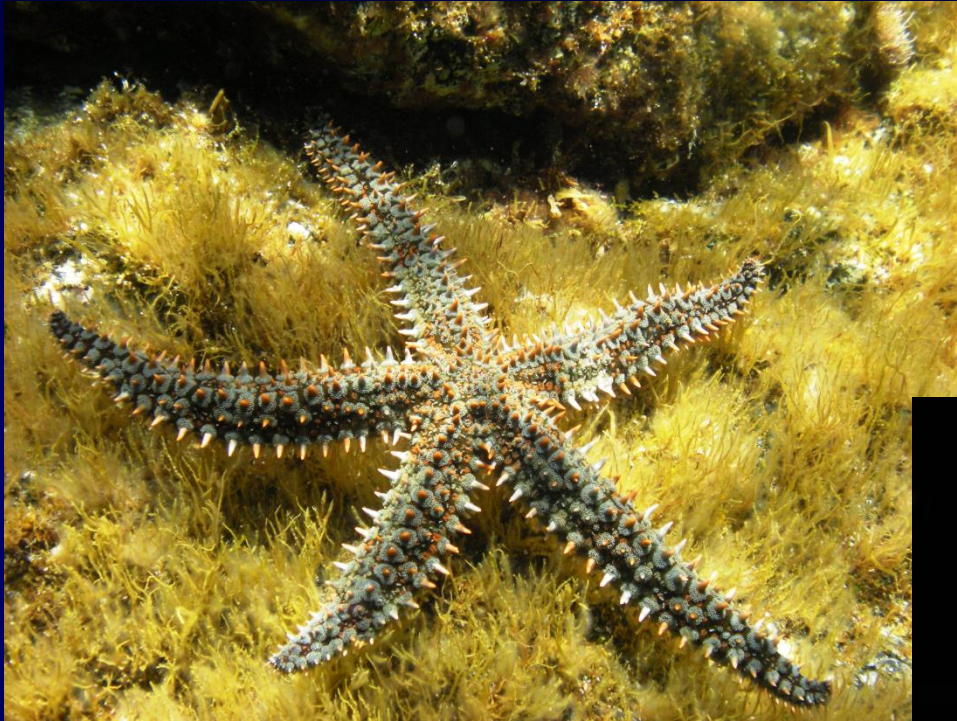


1 – madreporit; 2 – madreporитовая ампула; 3 – левый осевой синус (левый аксоцель); 4 – оральный отдел осевого органа (аксиальной железы); 5 – каменный канал (левый аксоцель); 6 – оральное кольцо амбулакральной системы (левый гидроцель); 7 – наружное перигемальное (гипоневральное) кольцо (левый соматоцель); 8 – оральное кольцо гипоневрального отдела нервной системы (левый соматоцель); 9 – оральное кольцо эктоневрального отдела нервной системы; 10 – оральное кольцо гемальной системы; 11 – мезентерий между наружным и внутренним перигемальными кольцами; 12 – внутреннее кольцо перигемальной (гипоневральной) системы; 13 – стенка желудка; 14 – правый осевой синус или аборальный отдел осевого органа (правый аксоцель); 15 – придаточный синус в дорзальном пузырьке (или мешке, «сердце») (правый аксоцель); 16 – аборальный кровеносный сосуд; 17 – половой (генитальный) тяж (левый соматоцель); 18 – половой (генитальный) синус (аборальный конец левого соматоцеля); 19 – стенка тела (по А.А.Стрелкову с изменениями).

Horizontalschnitt durch *Asterina gibbosa* (Kissenstern)



Гермафродитизм

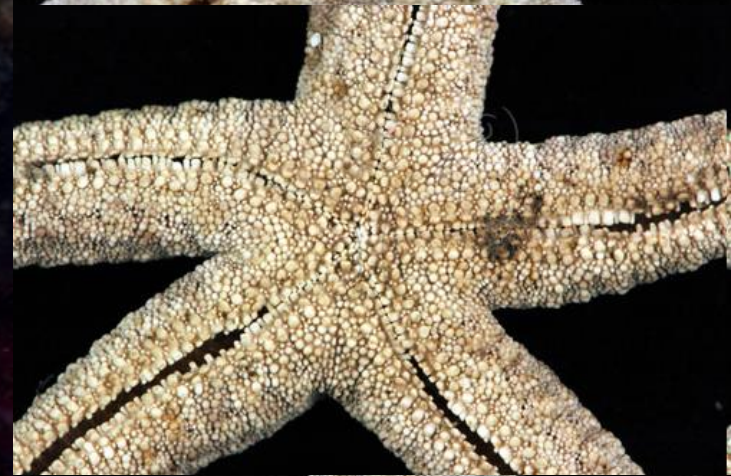


Marthasterias glacialis

Asterina gibbosa



Ophidiaster granifer
партеногенез

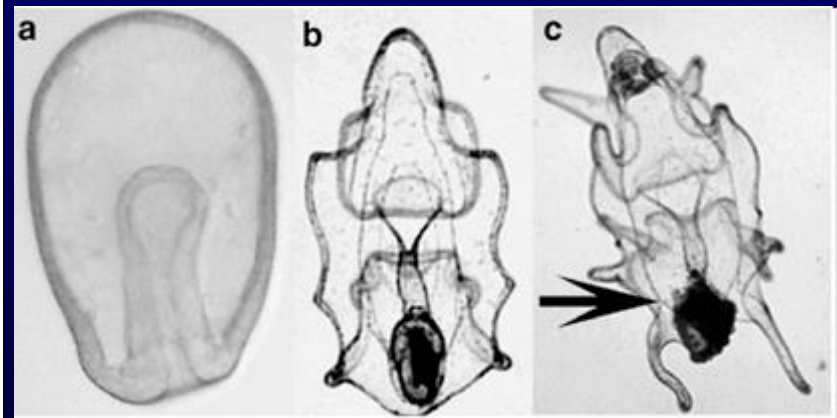
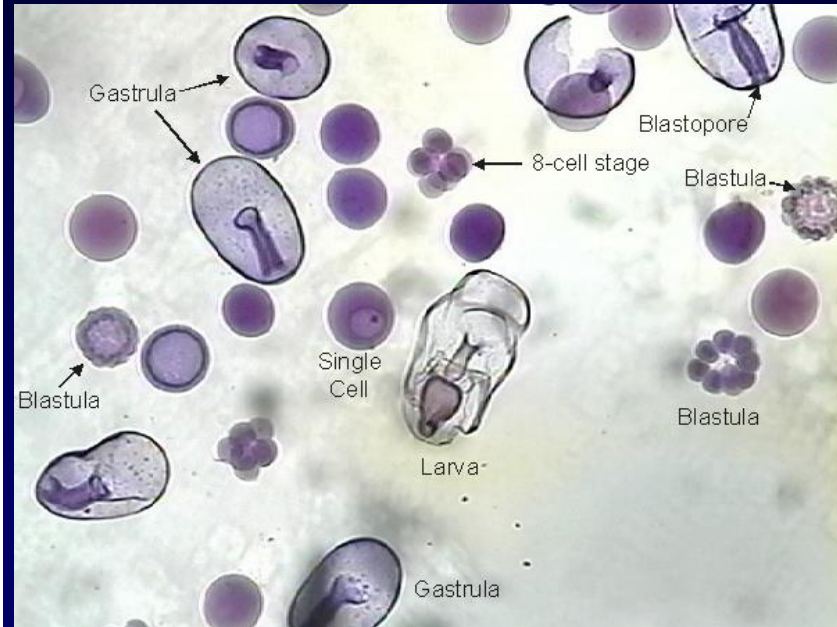
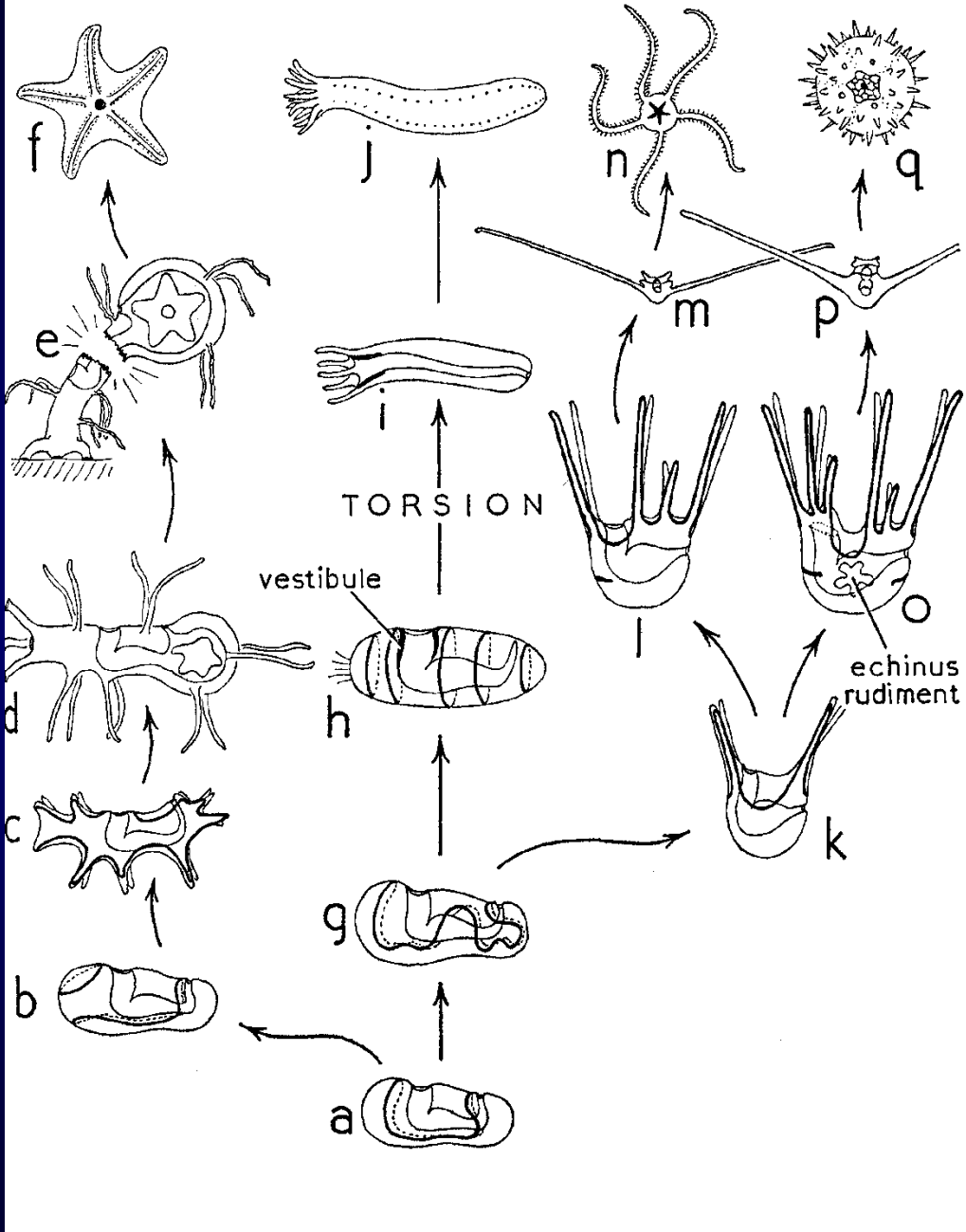




Linckia sp.

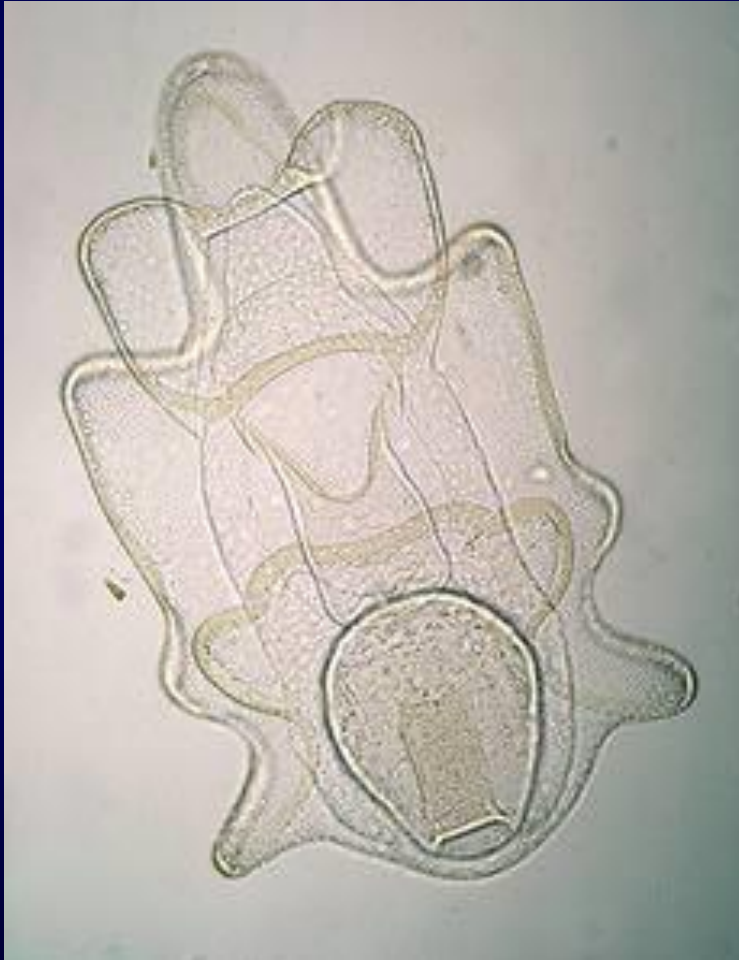


Развитие



Larvae of Asterozoidea

Bipinnaria

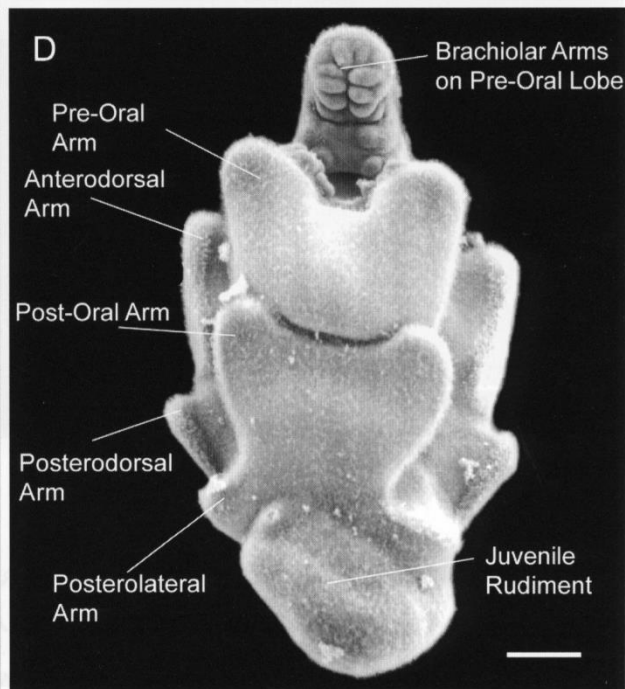
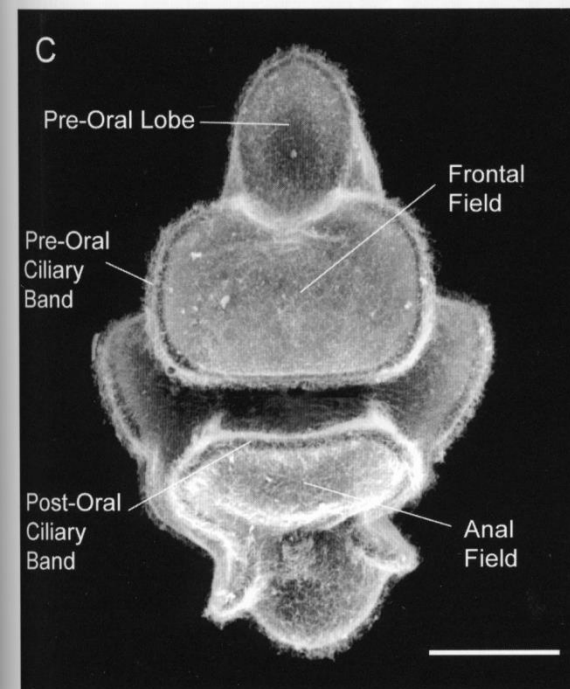
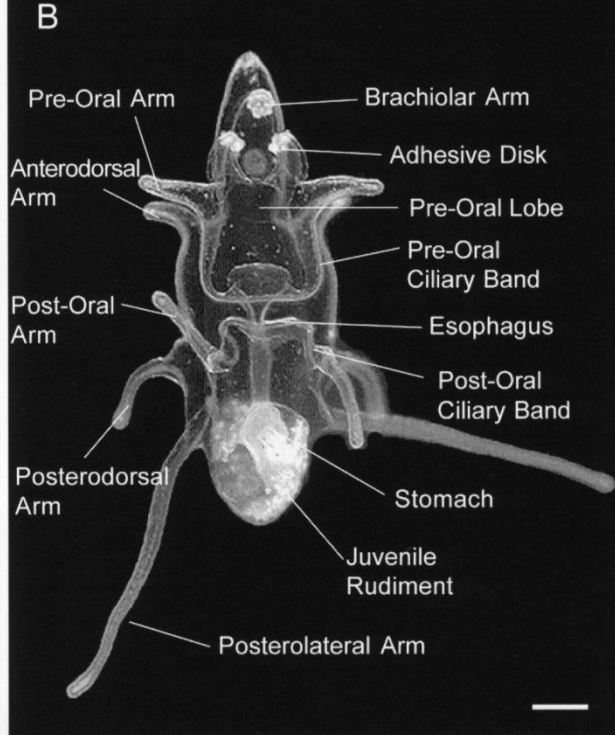
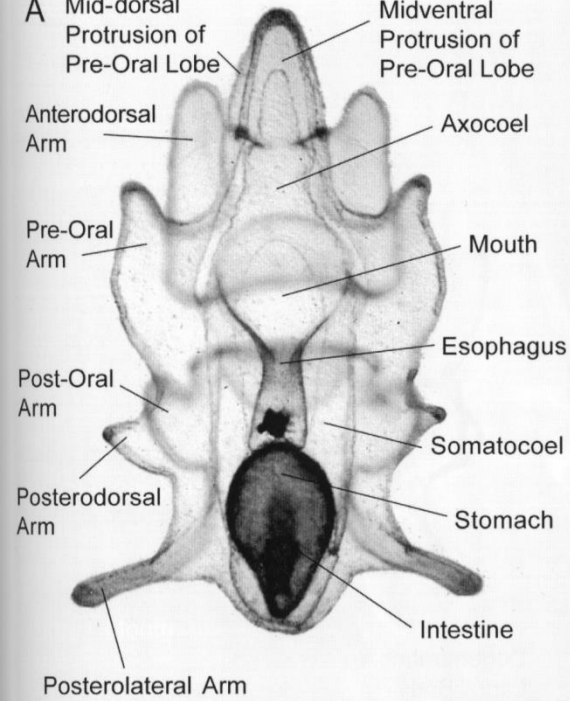


Brachiolaria



Bipinnaria of *Asterias rubens*

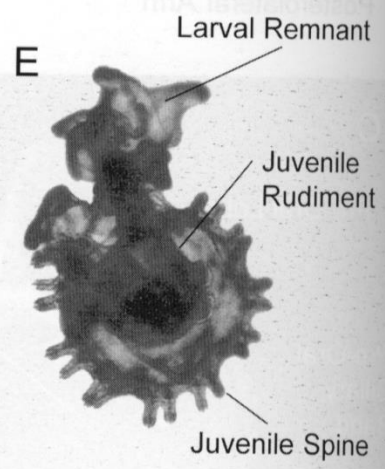
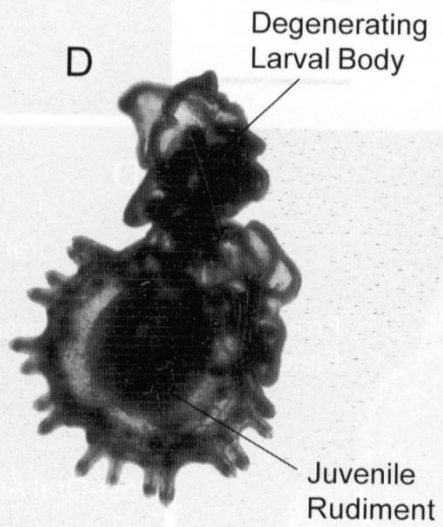
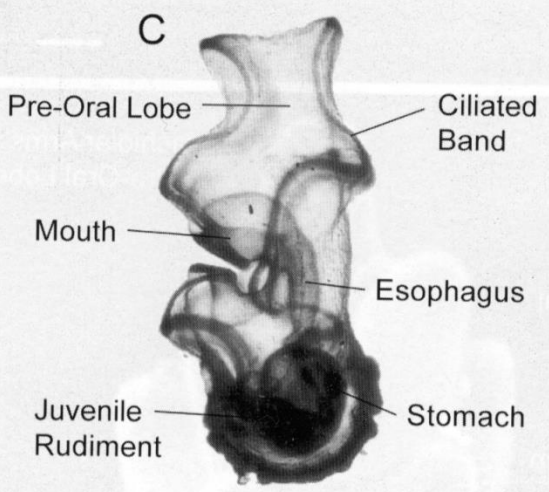
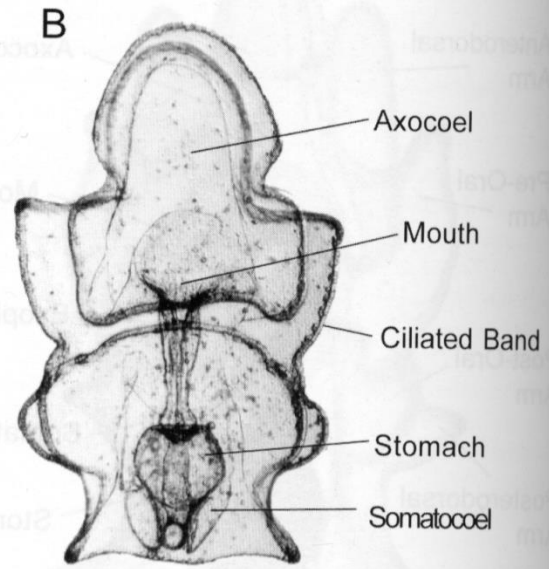
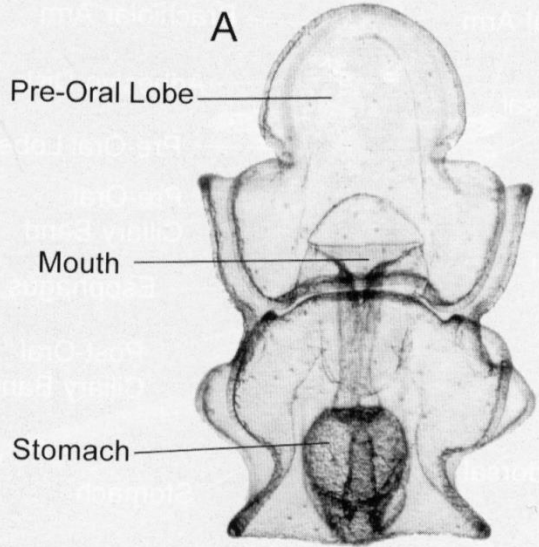




Bipinnaria and brachiolaria larvae.

- A. The pelagic, feeding bipinnaria larva of *Pisaster ochraceus* viewed from the ventral side and showing early development of bipinnarian arms, ciliated band, larval gut, and the conspicuous axocoel and somatocoels. This is a common intertidal sea star in the North-East Pacific. Scale bar: 100 μ m.
- B. Ventral view of the planktotrophic brachilaria of *Pisaster ochraceus* showing well-developed posterior bipinnarian arms and the brachiolar structures on the pre-oral lobe. Scale bar: 100 μ m.
- C. Ventral view of the planktotrophic bipinnaria larva of *Patiriella regularis*, an intertidal sea star from Australia, showing the ciliary band and the major lobes of the body. Scale bar: 100 μ m.
- D. Ventral view of the planktotrophic brachilaria larva of *Patiriella regularis* with conspicuous brachiolar arms on the pre-oral lobe. Scale bar: 100 μ m.

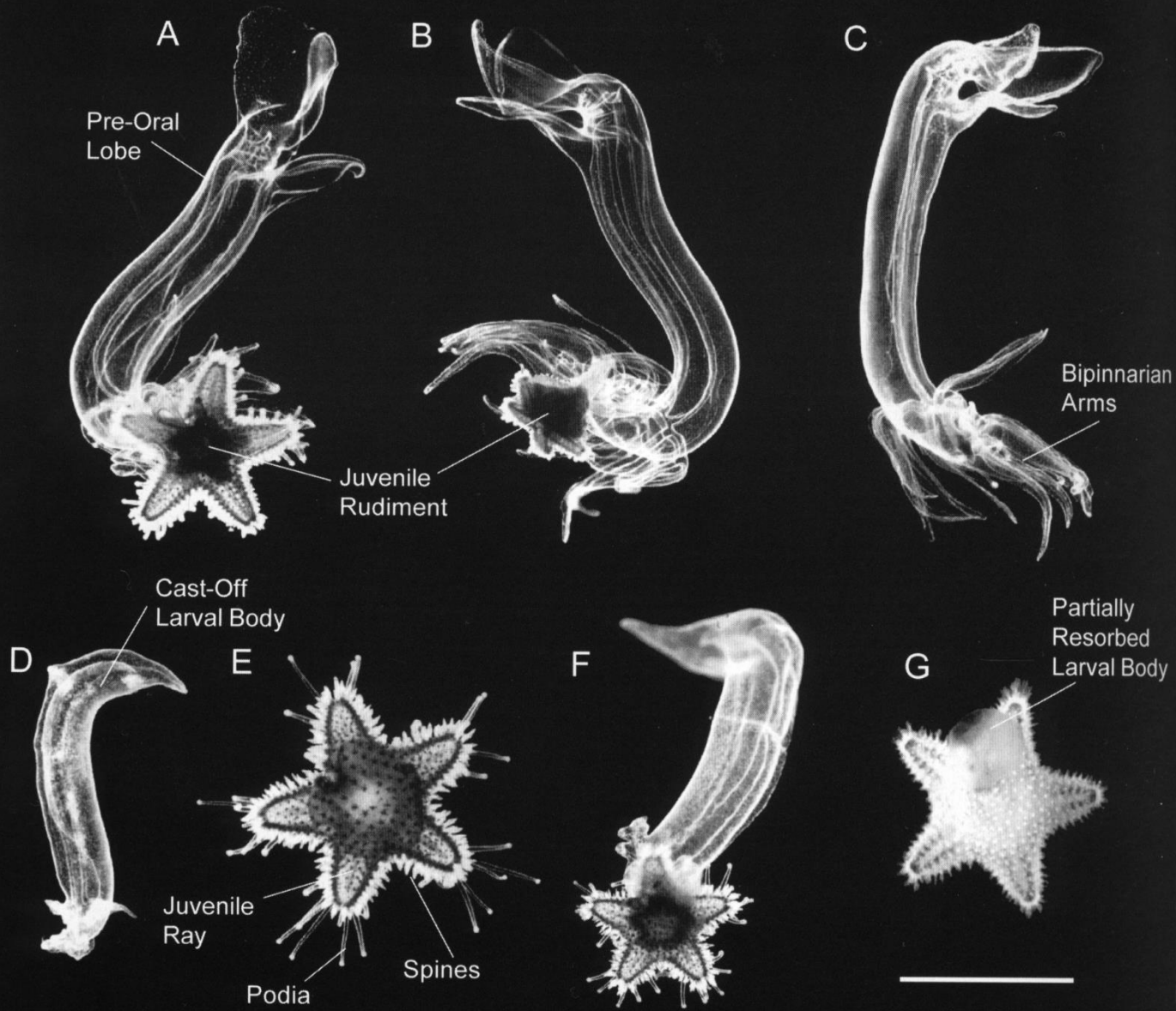
McEdward, Jaekle, Komatsu



McEdward, Jaekle,
Komatsu

Metamorphosis in the asteroid *Astropecten scoparius* from Japan.

A and B. Ventral views of a pelagic, feeding bipinnaria larva prior to the development of the juvenile rudiment. Scale bar: ?.
 C. Lateral view of a larva with a well-developed rudiment located in the posterior of the larval body on the left side.
 D and E. Degeneration of the larval body during metamorphosis to the juvenile stage.

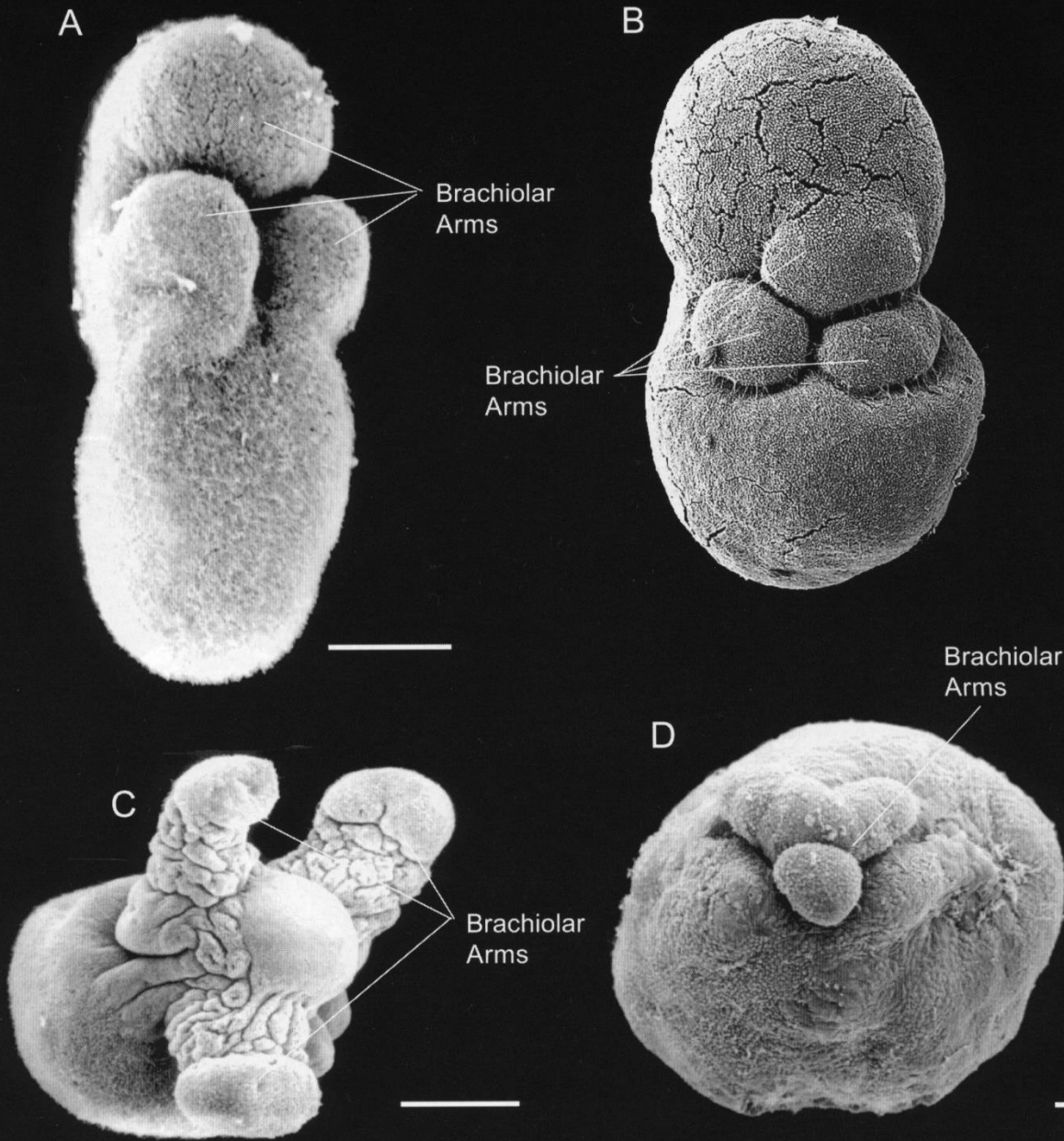


Giant larvae of *Luidia*
from the North Atlantic.

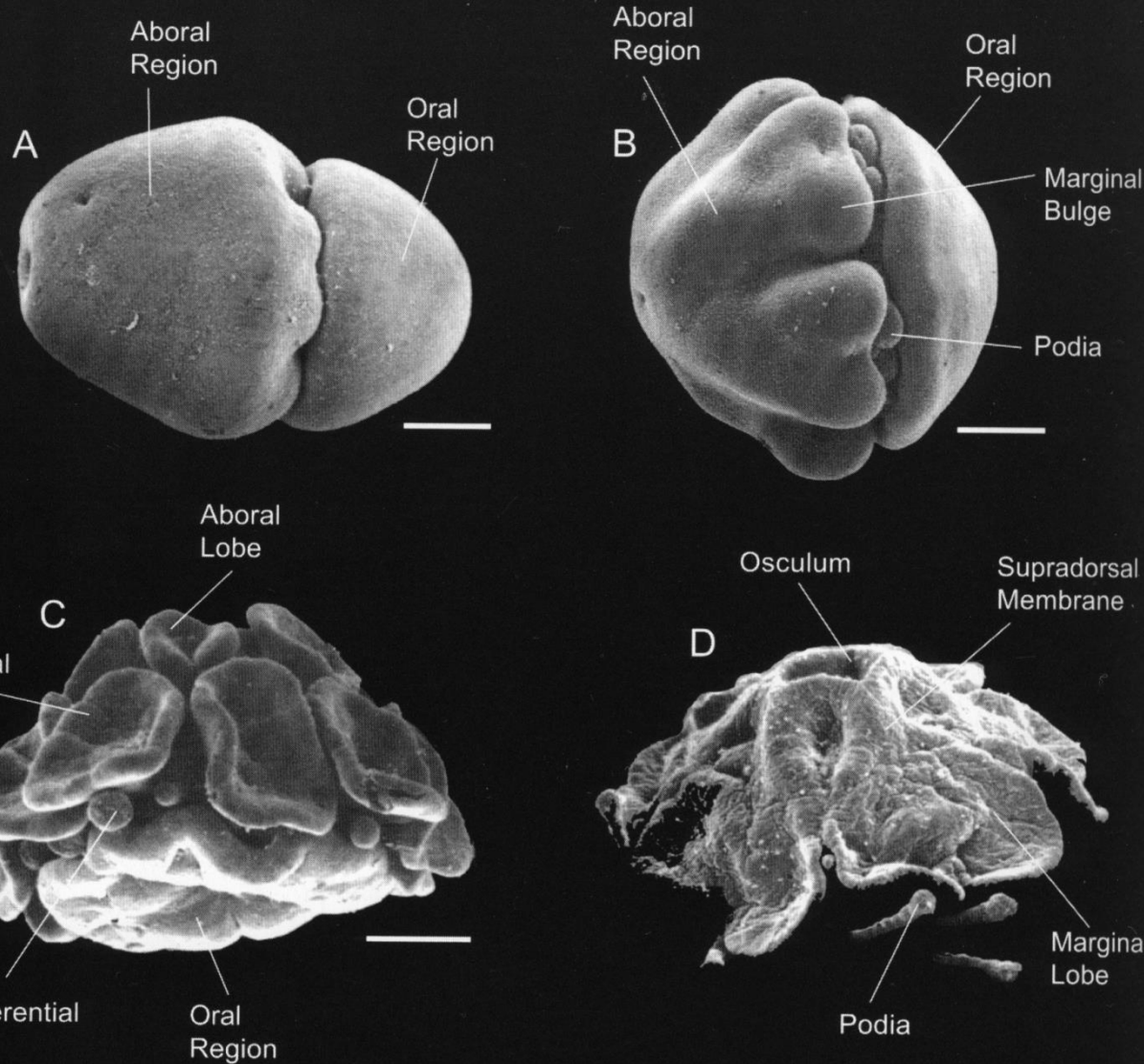
- A-B. Giant bipinnaria larva of *Luidia sarsi* from the plankton off Plymouth, England. The extensive pre-oral lobe contributes to swimming by muscular flexion. Scale bar: 5 mkm.
- C. Larval body of *L. sarsi* still swimming actively after the juvenile has dropped off. Scale bar: 5 mkm.
- D. Shrunken, cast-off body of *L. sarsi* bipinnaria shortly before it died. Scale bar: 5 mkm.
- E. Juvenile *L. sarsi* several days after settlement. Scale bar: 5 mkm.
- F. Late-stage larva of *L. sarsi* with well-developed juvenile rudiment. Scale bar: 5 mkm.
- G. The same individual as shown in F, with the larval body being resorbed by the juvenile rather than being cast off. Scale bar: 5 mkm.

Non-feeding brachilaria larvae.

- A. Pelagic, non-feeding larva of *Patiriella gunni* from Australia. Scale bar: 100 mkm.
- B. Pelagic, non-feeding larva of *Patiriella* sp. from Queensland, Australia. These pelagic species utilize the brachiolar arms for attachment to the substratum during metamorphosis.
- C. Non-feeding, benthic brachilolaria *Patiriella exigua* showing the well-developed brachiolar arms used for attachment to and movement over the substratum in the unattended egg mass. Scale bar: 100 mkm.
- D. Non-feeding brachilolaria of *Patiriella vivipara* is brooded within the ovary of the mother. Note the reduced brachiolar arms. In such "larvae", the larval body is greatly simplified and lacks mouth, ciliary bands, and bipinnarian arms. Scale bar: 20 mkm.



Direct development. Scanning electron micrographs of the mesogens and early juvenile stages of *Pteraster tessellatus*.



- A. Pelagic mesogen showing the region of the closed blastopore at the aboral end of the body. Oral region contains nutritive reserves and the posterior region is where the juvenile starfish develops. Scale bar: 200 mkm.
- B. The aboral region possesses marginal bulges that will form the supradorsal membrane of the juvenile. Podia are visible within the circumferential groove. Scale bar: 200 mkm.
- C. Pelagic, late-stage mesogen capable of reversible settlement to the benthos. Attachment is by means of the juvenile podia, since all larval structures, including the brachiolar settlement structures, are absent. Scale bar: 200 mkm.
- D. Juvenile stage showing the complete supradorsal membrane as a secondary covering over the aboral body wall. The nidamental chamber between the membrane and the body wall is ventilated by a flow of water that exits via the aboral osculum. Scale bar: 200 mkm.

Young Starfish

