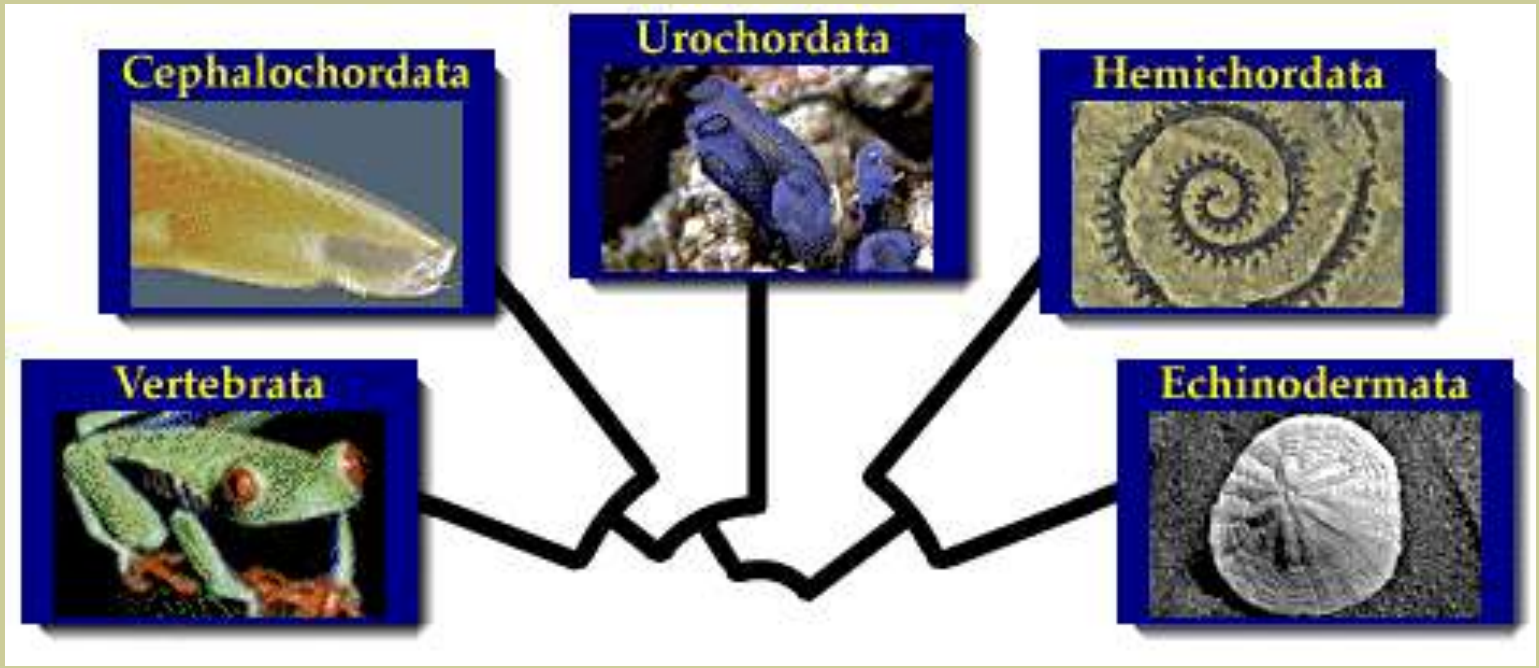
Phylum Echinodermata

“piel espinosa”

- Celomados marinos, tripoblásticos, no segmentados
- Espículas o placas de calcita en el tegumento
- Sistema hidrovascular
- Colágeno modificable
- Cámbrico-Reciente


Cephalochordata
Urochordata
Hemichordata
Vertebrata
Echinodermata

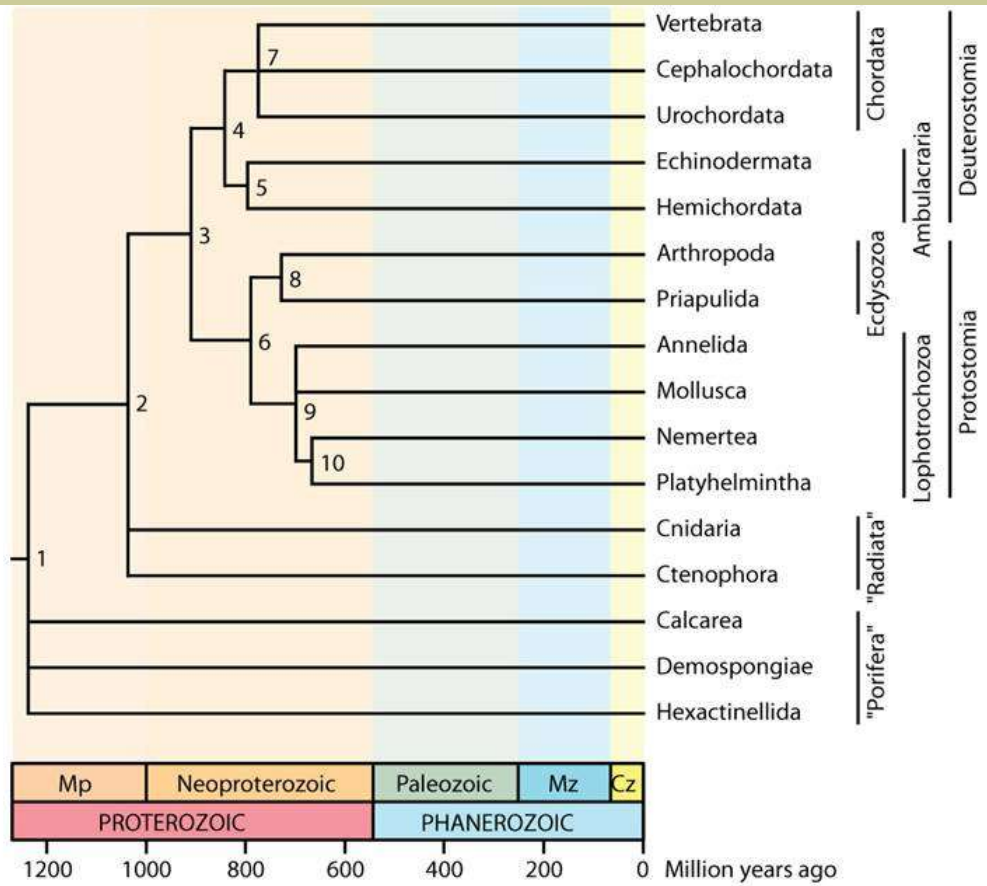


Fig. 2 A timetree of metazoan phyla. Divergence times are shown in Table 1. *Abbreviations*: Cz (Cenozoic), Mp (Mesoproterozoic), and Mz (Mesozoic).

J. E. Blair. Animals (Metazoa). Pp. 223–230 in *The Timetree of Life*, S. B. Hedges and S. Kumar, Eds. (Oxford University Press, 2009).

Subphylum PELMATOZOA
Class EOCRINOIDEA

- Globular or flat theca with 2–5 ambulacra bearing brachioles
- Cambrian (Lower) to Silurian

Class PARACRINOIDEA

- Irregularly arranged plates comprising globular to lenticular theca; 2–5 ambulacra commonly with pinnules. Hydropore adjacent to mouth. Stem attached to three basal plates
- Ordovician (Darriwilian to Hirnantian)

Class BLASTOIDEA

- Flask-shaped theca commonly with three basal plates; ambulacra with elongate lancet plate and rows of side plates
- Ordovician (Katian) to Permian (Tatarian)

Class DIPLOPORITA

- Globular theca with many plates in an irregular to regular pattern; 3–5 food grooves with brachioles. Diplopores perforate thecal plates
- Cambrian (Middle) to Devonian (Eifelian)

Class RHOMBIFERA

- Globular theca with 2–5 ambulacra extending from the mouth to, commonly, the edge of the upper surface. Pore structures cross adjacent thecal plates arranged in a rhomboid pattern, and comprise the respiratory system
- Cambrian (Upper) to Devonian (Frasnian)

Class CRINOIDEA

- Calyx with lower cup and upper tegmen. Sea lilies and feather stars
- Ordovician (Tremadocian) to Recent.

Subphylum ELEUTHEROZOA
Class EDRIOASTEROIDEA

- Disk-shaped thecae with straight or curved ambulacra with the mouth situated centrally and the anus sited on the interambulacra
- ?Precambrian (Ediacaran), Cambrian (Lower) to Carboniferous (Gzelian)

Class ASTEROIDEA

- Between 5 and 25 arms with large tube feet extend from a central disk. Starfishes or sea stars
- Ordovician (Floian) to Recent

Class OPHIUROIDEA

- Five long, thin, flexible arms, consisting of vertebrae and with small tube feet, extend from large, circular central disk. Brittle stars or basket stars
- Ordovician (Floian) to Recent

Class ECHINOIDEA

- Test is usually globular with plates differentiated into ambulacral and interambulacral areas. Mouth on underside, anus on upperside or sited posteriorly. Sea urchins, heart urchins and sand dollars
- Ordovician (Katian) to Recent

Class HOLOTHUROIDEA

- Body is cucumber-shaped with leathery skin with muscular mesoderm and spicules. A ring of modified tube feet surround the mouth. Sea cucumbers
- Ordovician (Floian) to Recent

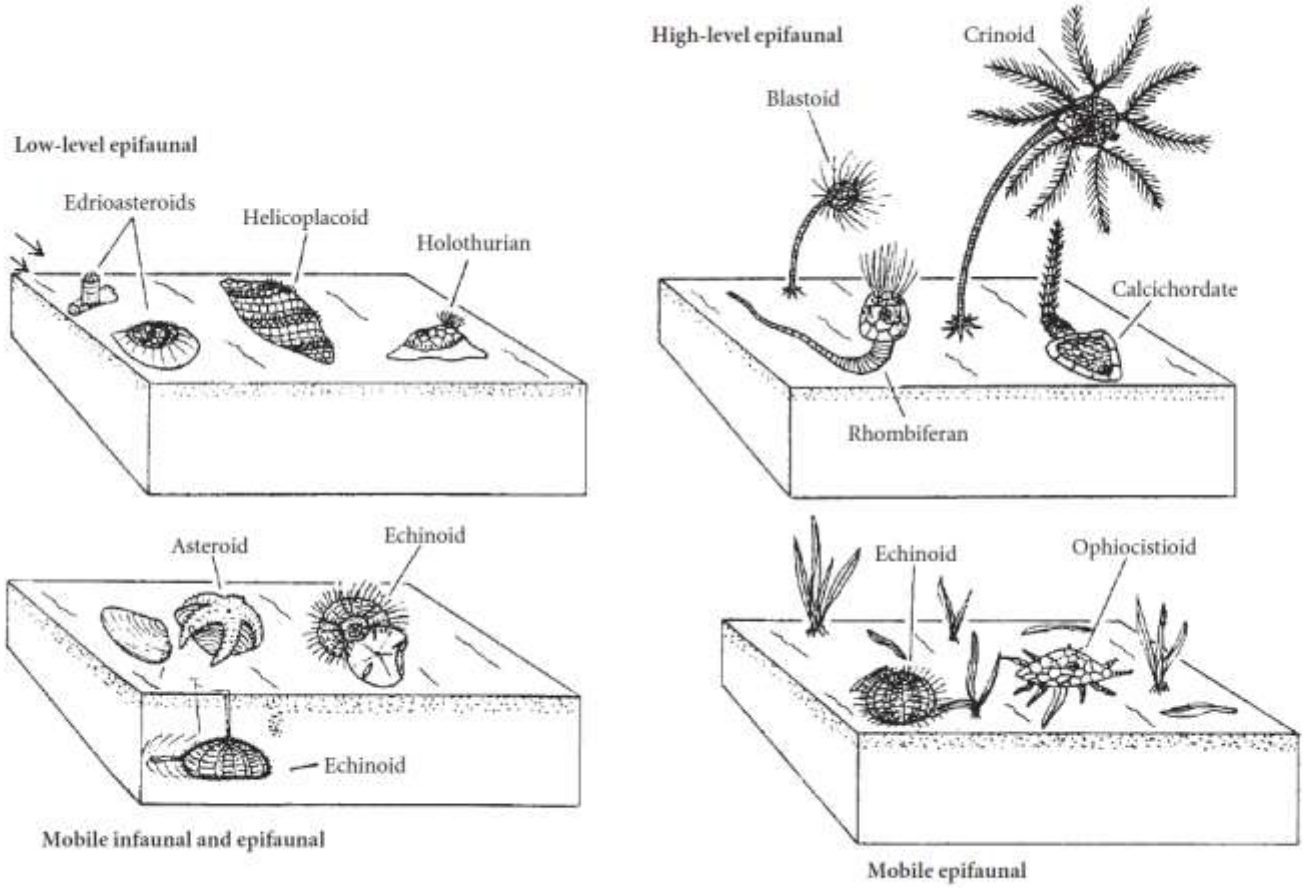


Figure 15.1 Life modes of the main echinoderm body plans. (Based on Sprinkle 1980.)

Box 15.2 Origin of the echinoderms and the status of the helicoplacoids

During the major Early Cambrian radiation of echinoderms, many rather bizarre forms appeared suddenly with very different morphologies. At least nine genera were present, of which about half had pentameral symmetry, but the others were not pentameral at all. One such non-pentameral group, the helicoplacoids (Fig. 15.2), is unique in having only three ambulacral areas with tube feet wrapped around their spindle-shaped bodies. Moreover, the group lacked appendages and individuals probably lived with their shorter ends anchored to the sediment. However, helicoplacoids have many plates with the distinctive stereom structure, ambulacra and a mouth sited laterally together with an apical anus. The helicoplacoids have thus been interpreted as primitive echinoderms, surviving by suspension feeding in the sessile benthos. *Helicoplacus* may be very close to the stem group of all subsequent Echinodermata, and something like this animal might have given rise to the pelmatozoan and eleutherozoan body plans. Other groups of echinoderms were already diverse and widespread during the Early Cambrian, but the helicoplacoids were apparently restricted to western North America, where they were very abundant during only the Early Cambrian. Their extinction may have been a very important ecological signal. Such groups of unattached "sediment stickers" were well adapted to the algal mat substrates of the Neoproterozoic. Perhaps they could not cope with the increased bioerosion and bioturbation of soft substrates that were part of the move away from seafloors covered by microbial mats that prompted the Cambrian substrate revolution (Bottjer et al. 2000).

Figure 15.2 *Helicoplacus* from the Lower Cambrian (×10). (Based on *Treatise on Invertebrate Paleontology*, Part S. Geol. Soc. Am. and Univ. Kansas Press.)

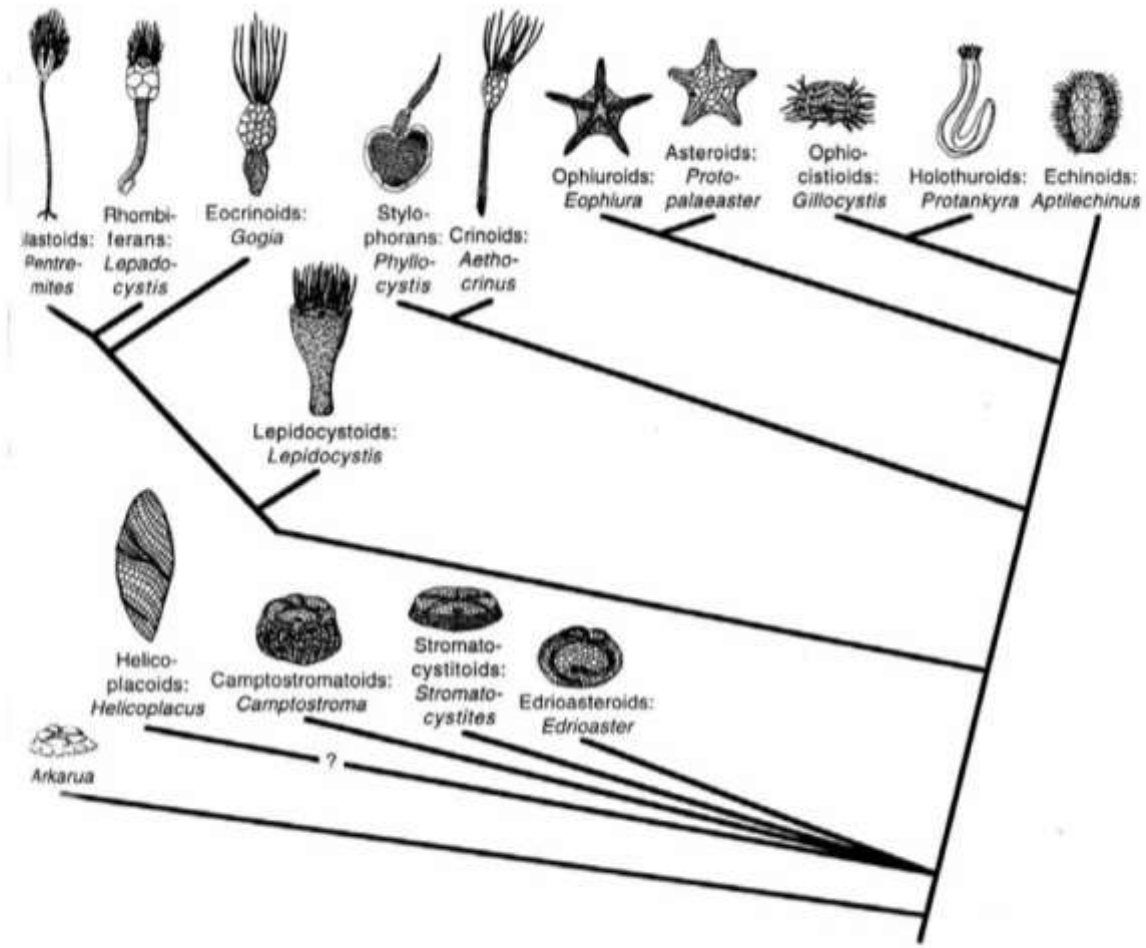
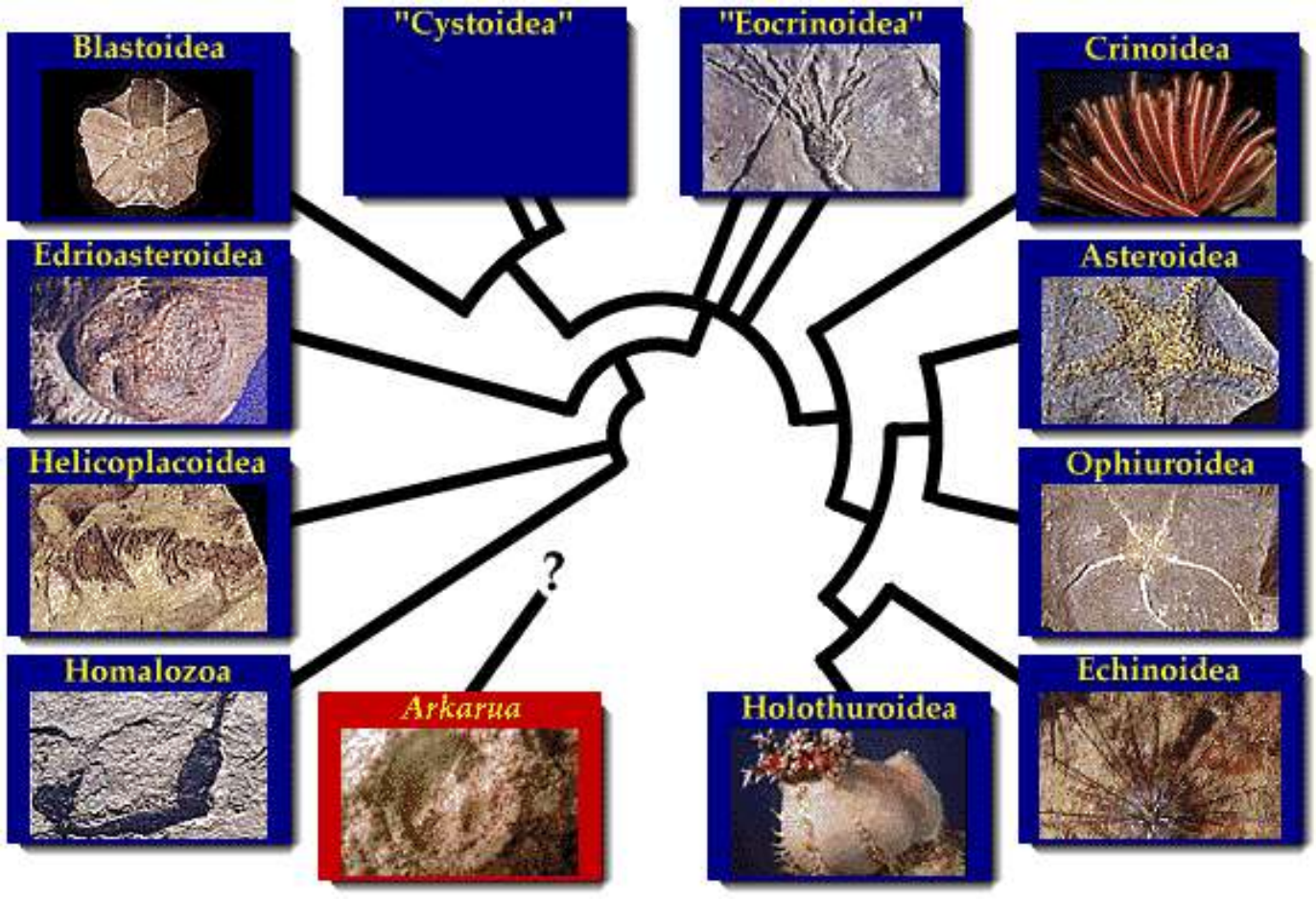
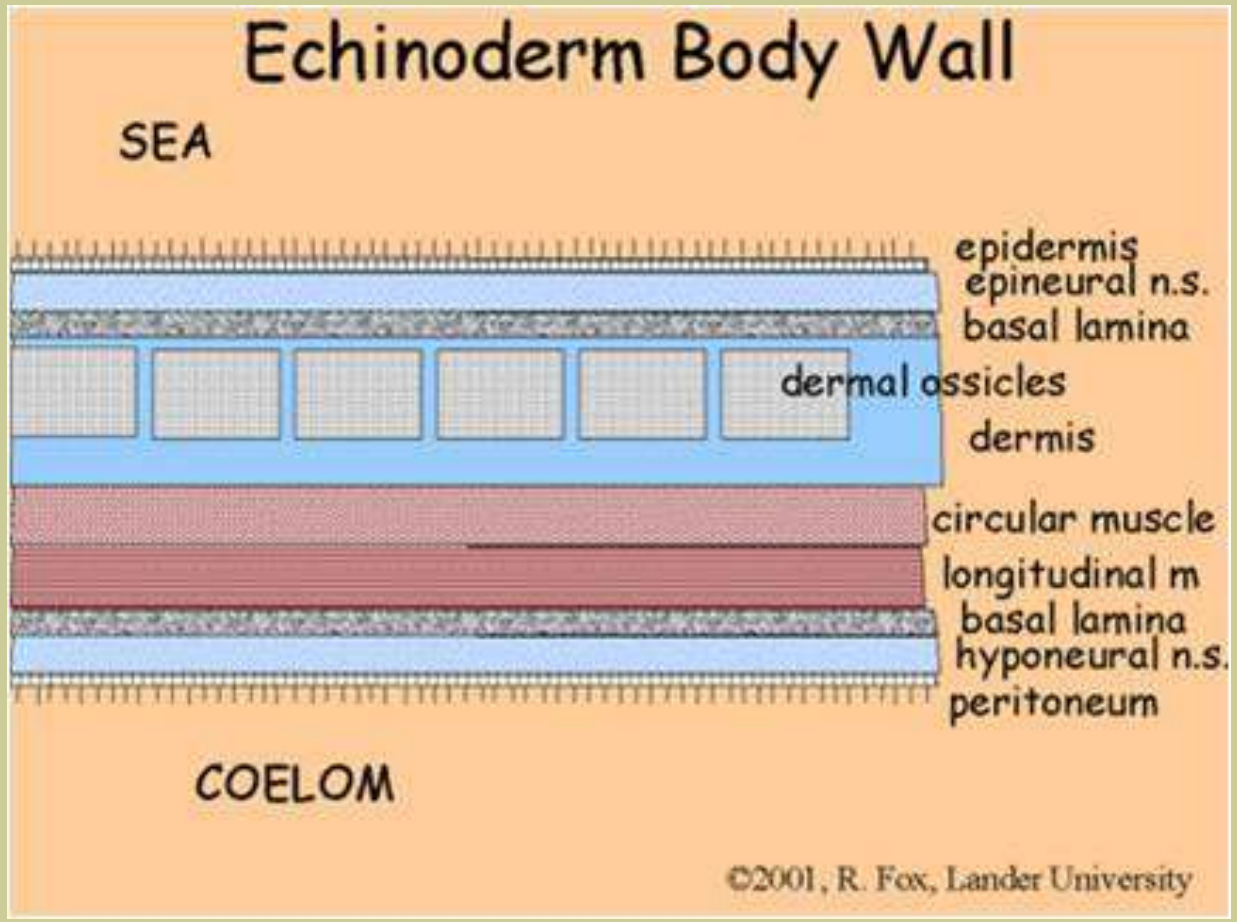


FIGURE 3. Phylogenetic hypothesis of fossil and extant echinoderms. From Mooi (2001), *q.v.* Published with permission.

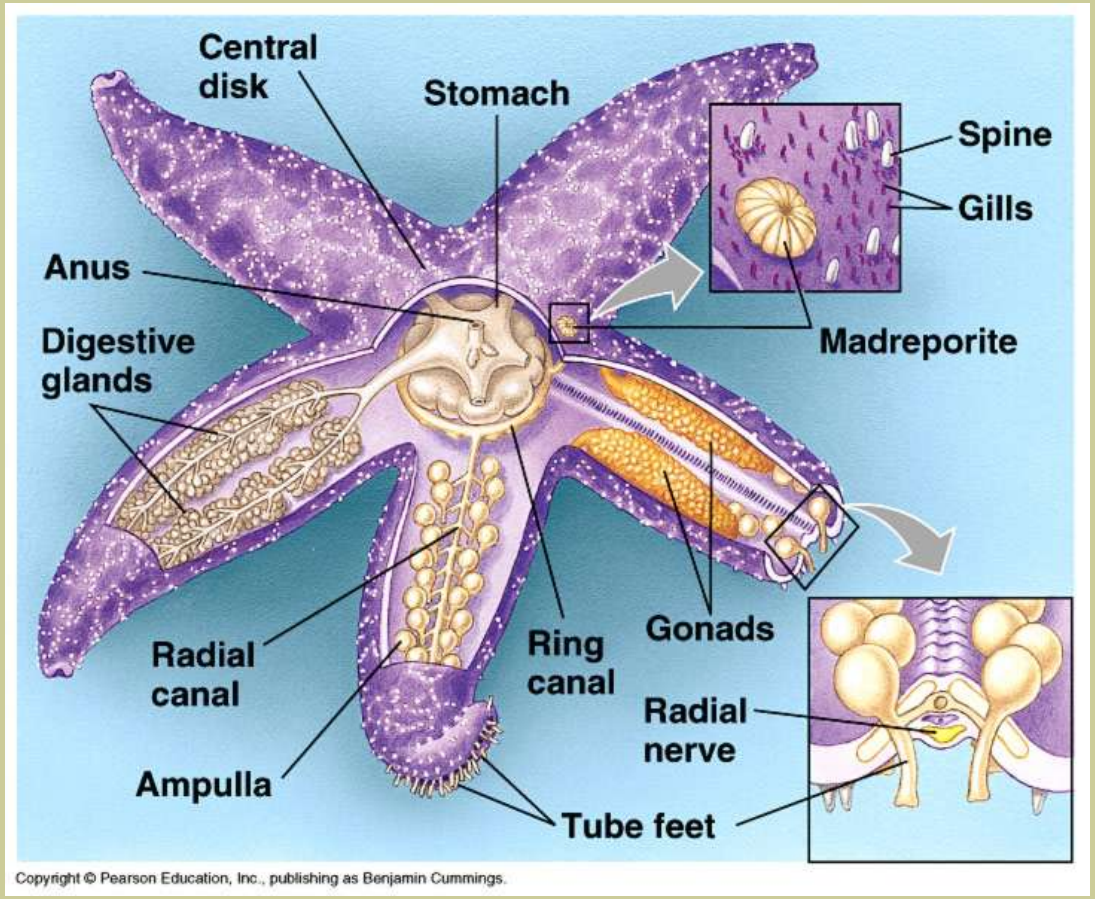

Blastoidea
"Cystoidea"
"Eocrinoidea"
Crinoidea
Edrioasteroidea
Asteroidea
Helicoplacoidea
Ophiuroidea
?
Homalozoa
Arkarua
Holothuroidea
Echinoidea

Esqueleto dérmico



Sistema hidrovascular

- Modificación del celoma.
- Sistema complejo de canales.
- Internamente ciliado
- Podios



Podios

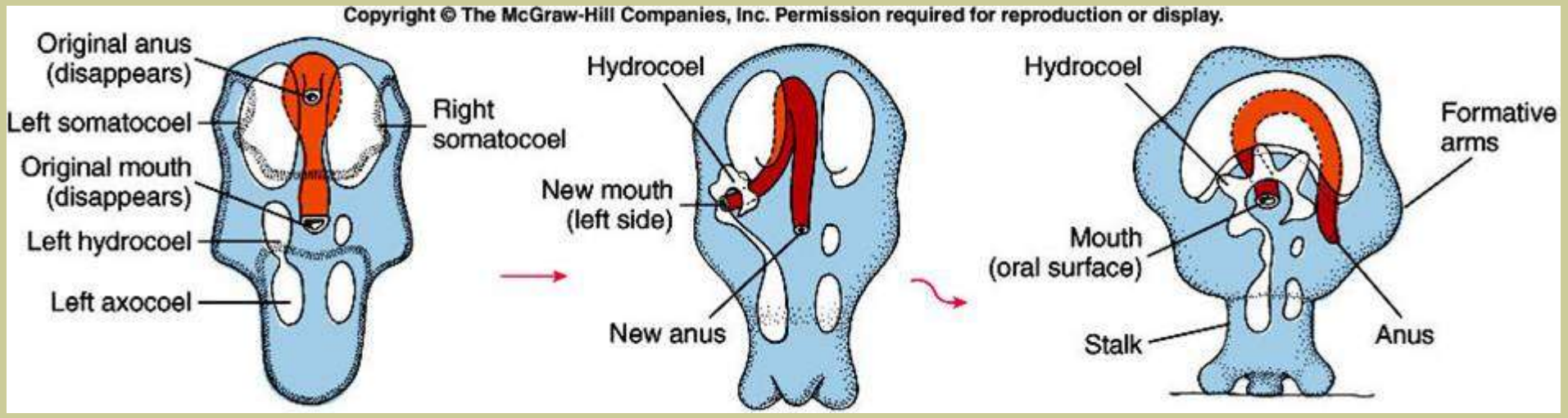
- Ambulacrales
- Respiración
- Funciones sensoriales

Madreporito

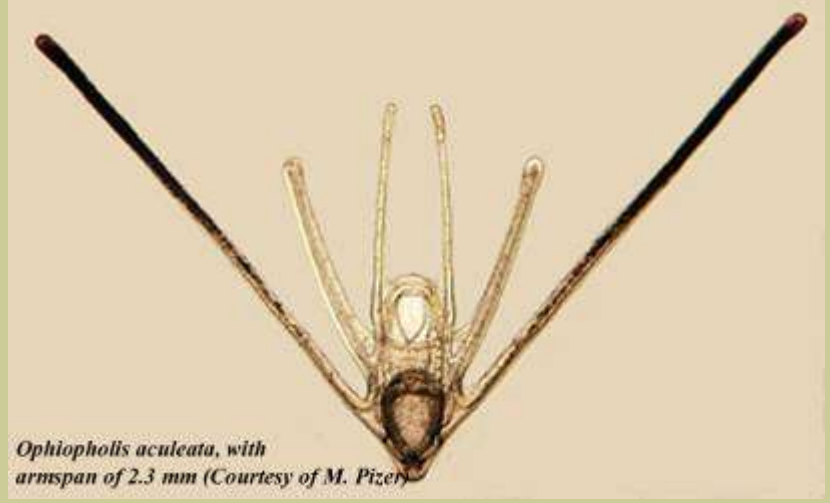
- Relleno y equilibrio de presión del SHV
- A veces ausente (Crinoideos)
- Si se lo bloquea experimentalmente parece no haber cambios muy dramáticos ¿¿¿¿¿?????

Desarrollo

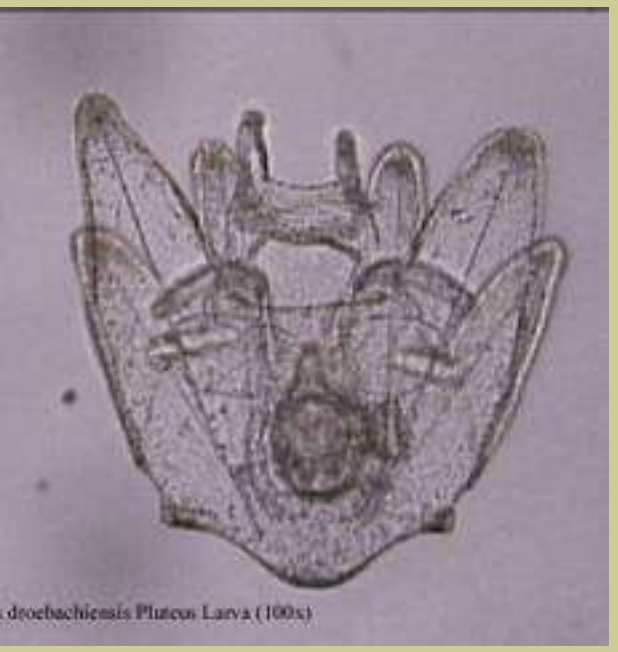
Metamorfosis de larvas bilateralmente simétricas a adultos pentarradiales.



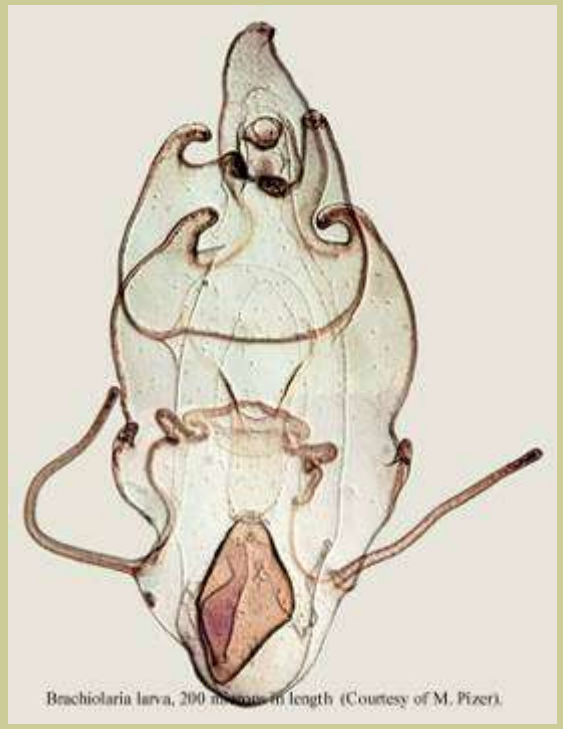
ster excentricus pluteus larva (100x)



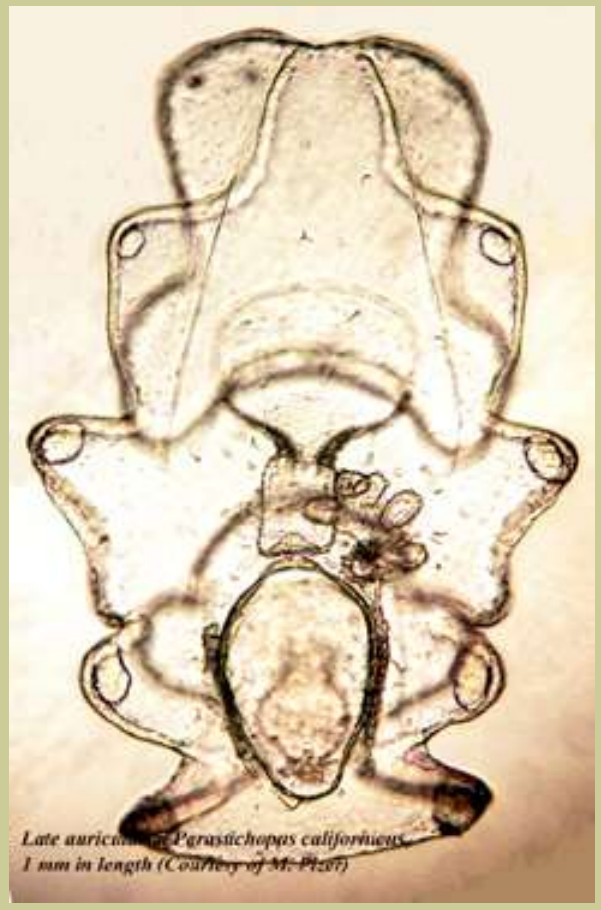
Ophiopholis aculeata, with armspan of 2.3 mm (Courtesy of M. Pizer)



deobachiensis Pluteus Larva (100x)



Brachiolaria larva, 200 microns in length (Courtesy of M. Pizer).



Late auricularia of Pgrastichopus californicus, 1 mm in length (Courtesy of M. Pizer)

Blastoideos

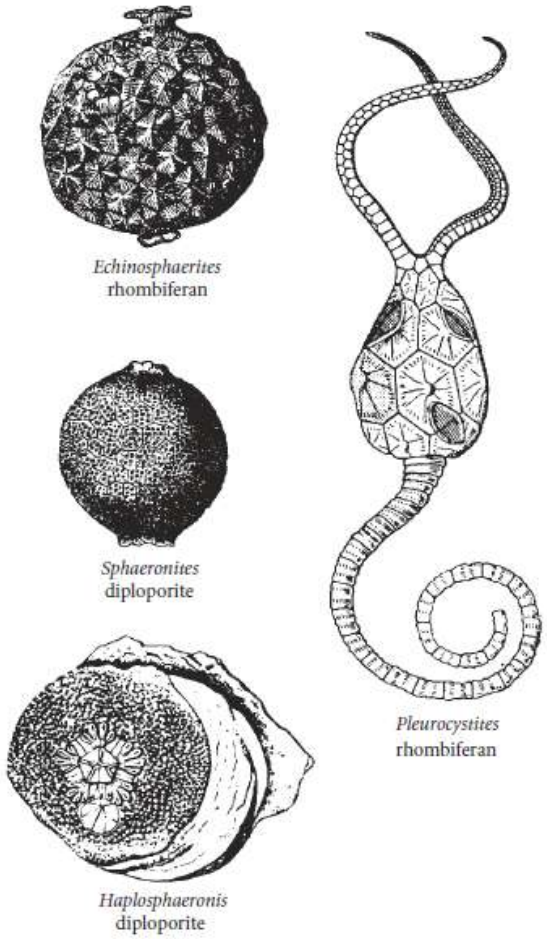


Figure 15.7 Some Ordovician cystoid genera: *Echinosphaerites* and *Sphaeronites*, (×0.75), *Haplosphaeronis* and *Pleurocystites* (×1.5). (Based on *Treatise on Invertebrate Paleontology*, Part S. Geol. Soc. Am. and Univ. Kansas Press.)

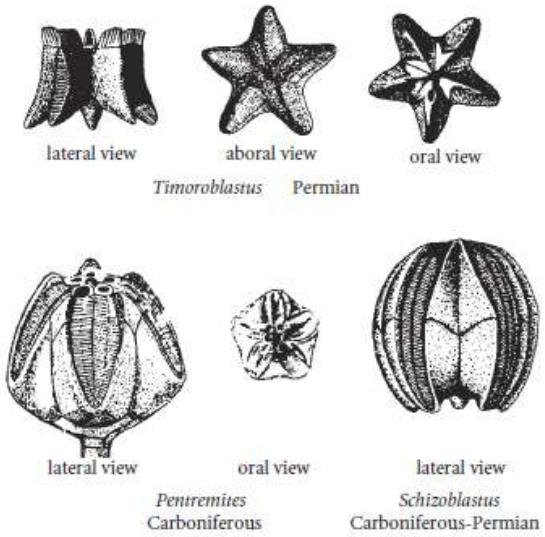


Figure 15.8 Some blastoid genera. Magnification ×0.6 for all. (Redrawn from various sources.)

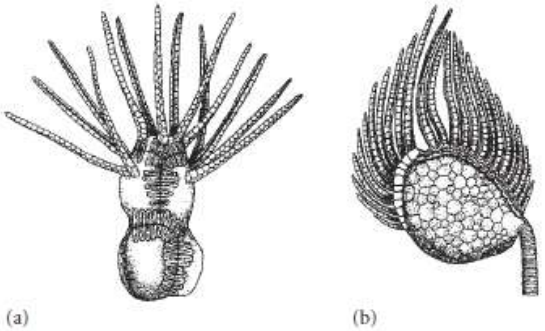


Figure 15.9 (a) An eocrinoid, and (b) a paracrinoid. (Based on *Treatise on Invertebrate Paleontology*, Part S. Geol. Soc. Am. and Univ. Kansas Press.)

Cistoideos

Eocrinoideos

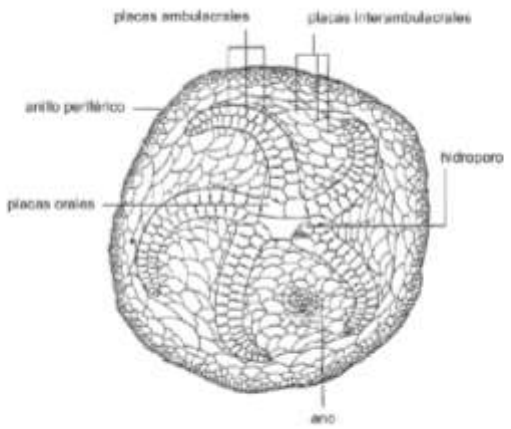


Figura 24. 28. Clase Edrioasteroidea. Superficie adoral de *Carnegiella*, Ordovícico (modificado de Sprinkle y Kier, 1987).

Edrioasteroidea

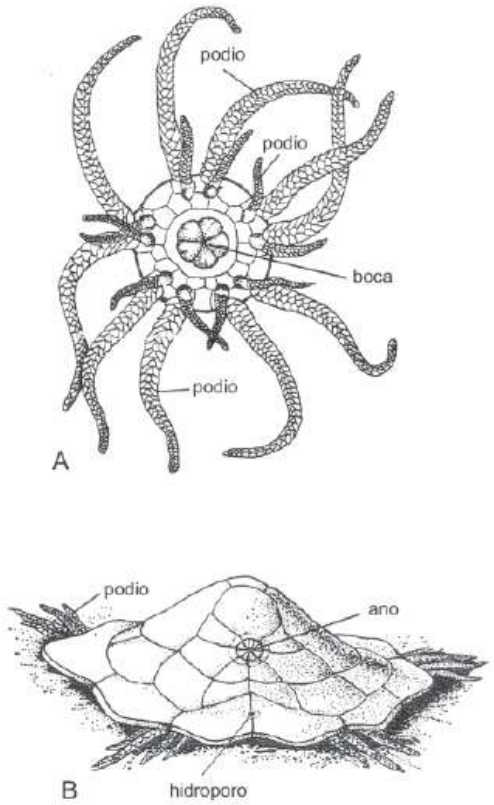
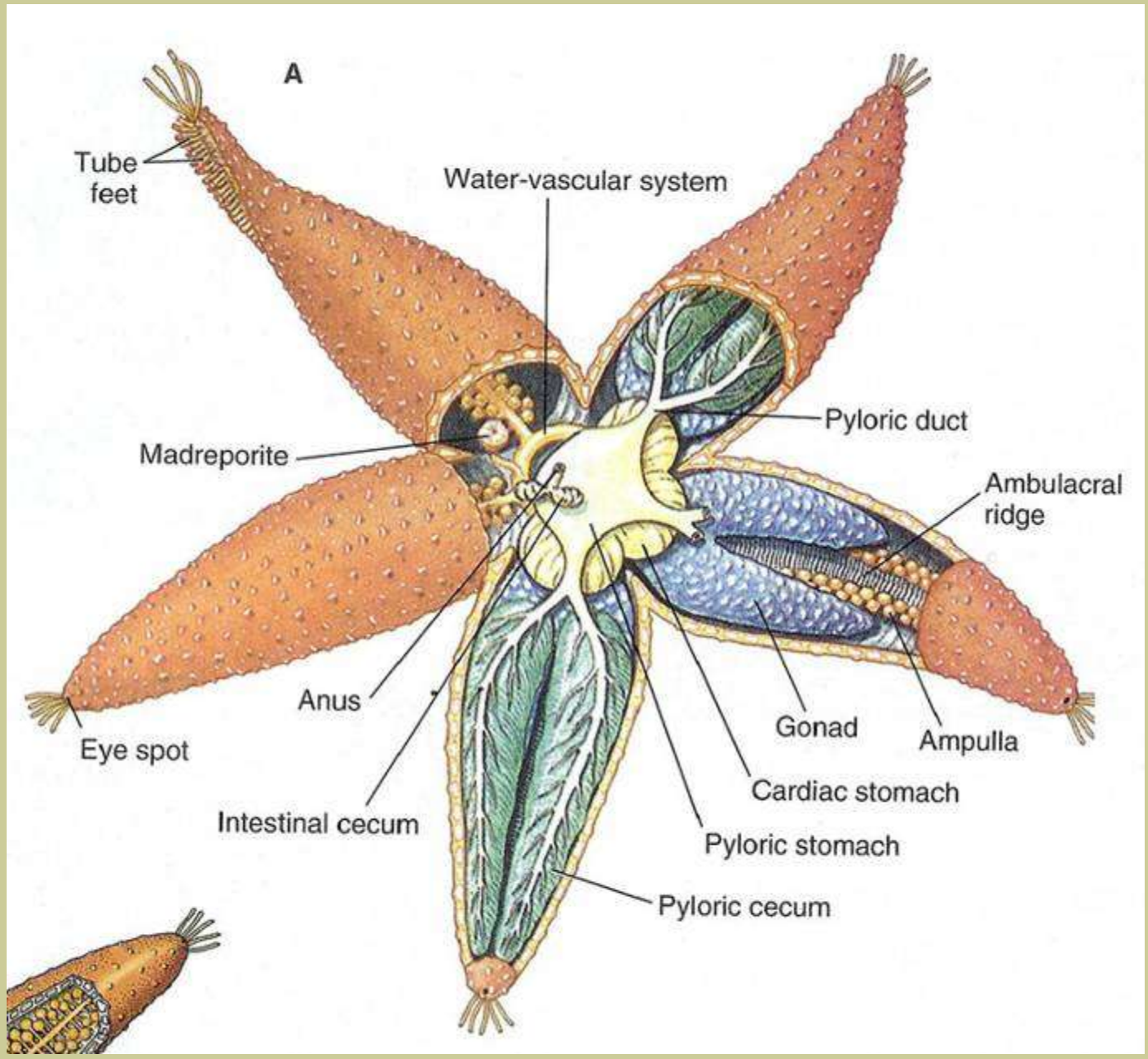


Figura 24. 29. Clase Ophiocistioidea. A. reconstrucción de la cara oral de *Euthemon*, Silúrico Superior; B. reconstrucción de *Volchovia*, Ordovícico Inferior (modificado de Meléndez, 1982).

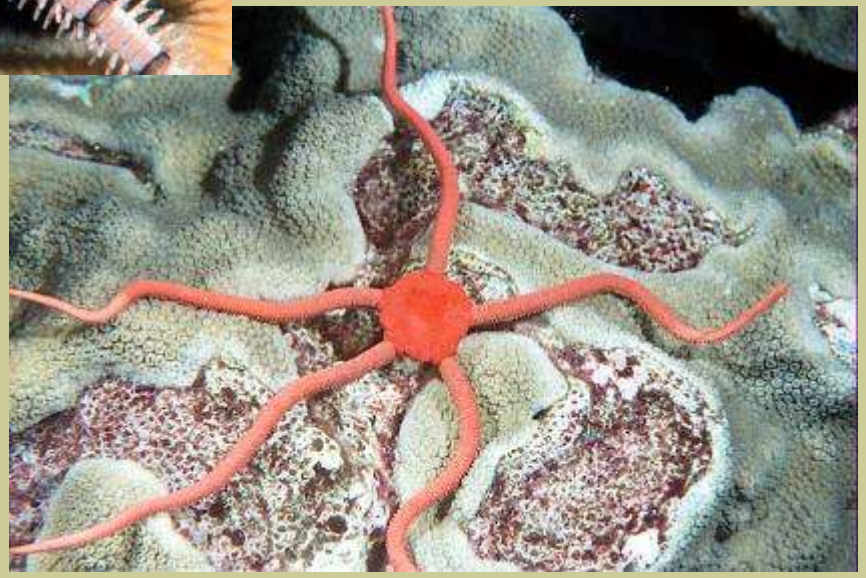
Ophiocistoidea

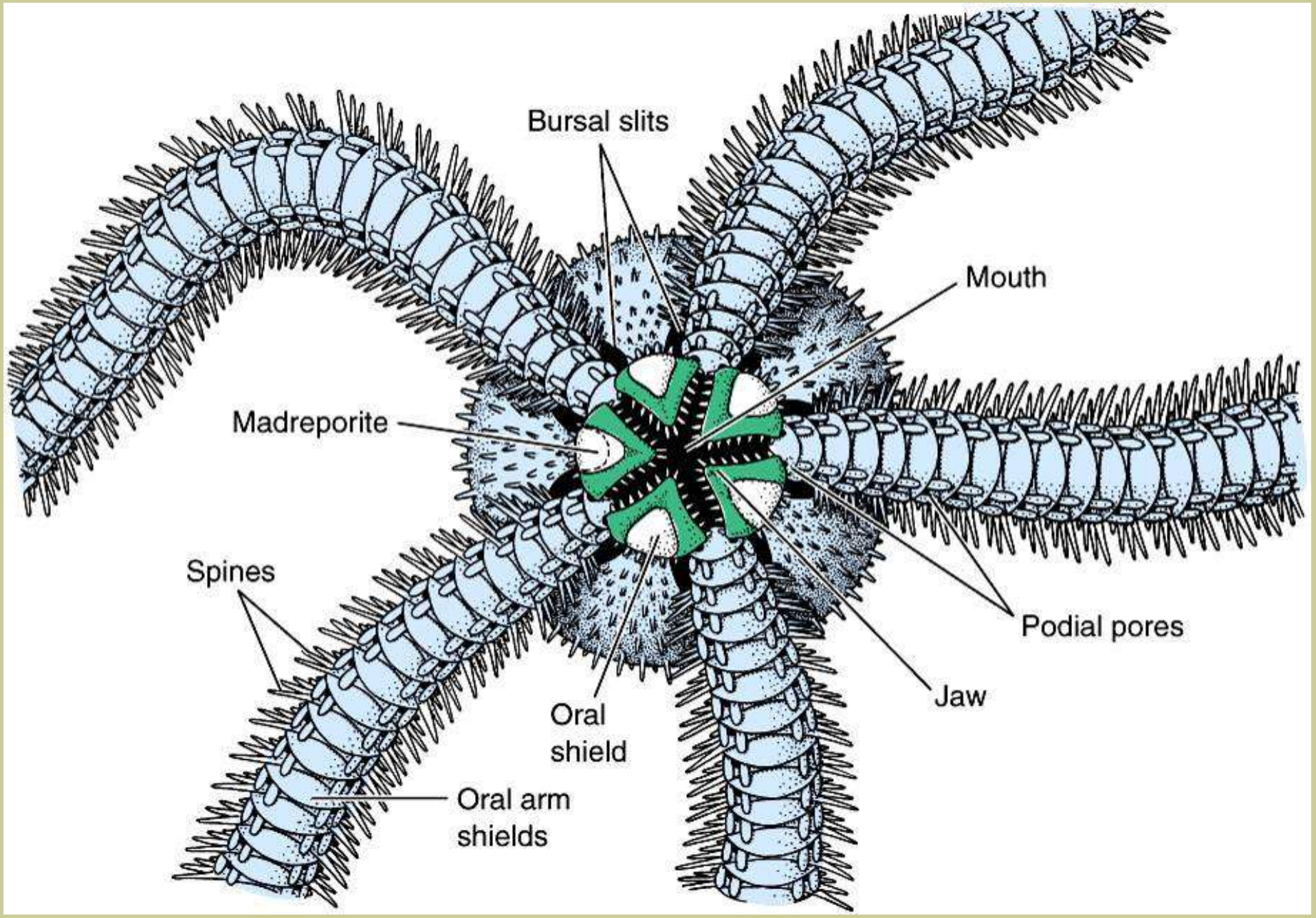
Clase Asteroidea


A
Tube feet
Water-vascular system
Pyloric duct
Madreporite
Ambulacral ridge
Anus
Eye spot
Gonad
Ampulla
Cardiac stomach
Intestinal cecum
Pyloric stomach
Pyloric cecum

Regeneración

Clase Ophiuroidea




Bursal slits
Mouth
Madreporite
Spines
Podial pores
Jaw
Oral
shield
Oral arm
shields

Clase Echinoidea

Regulares

Irregulares

BEWARE OF
SEA
URCHINS

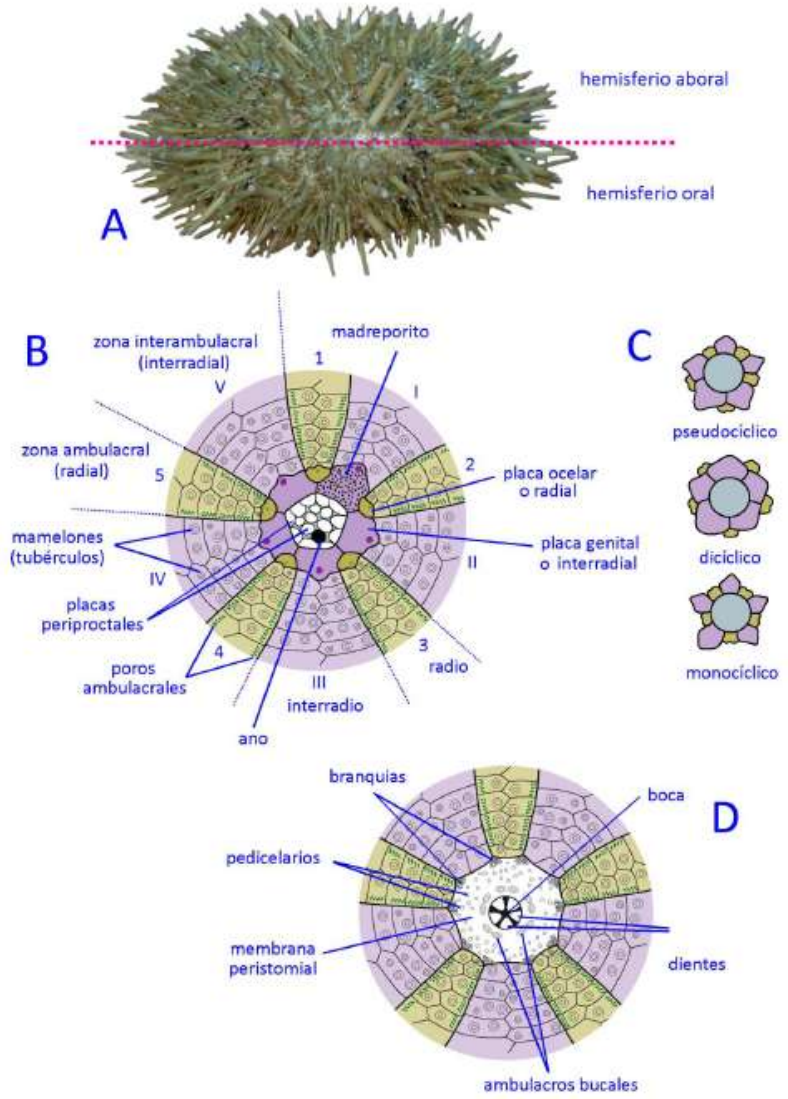
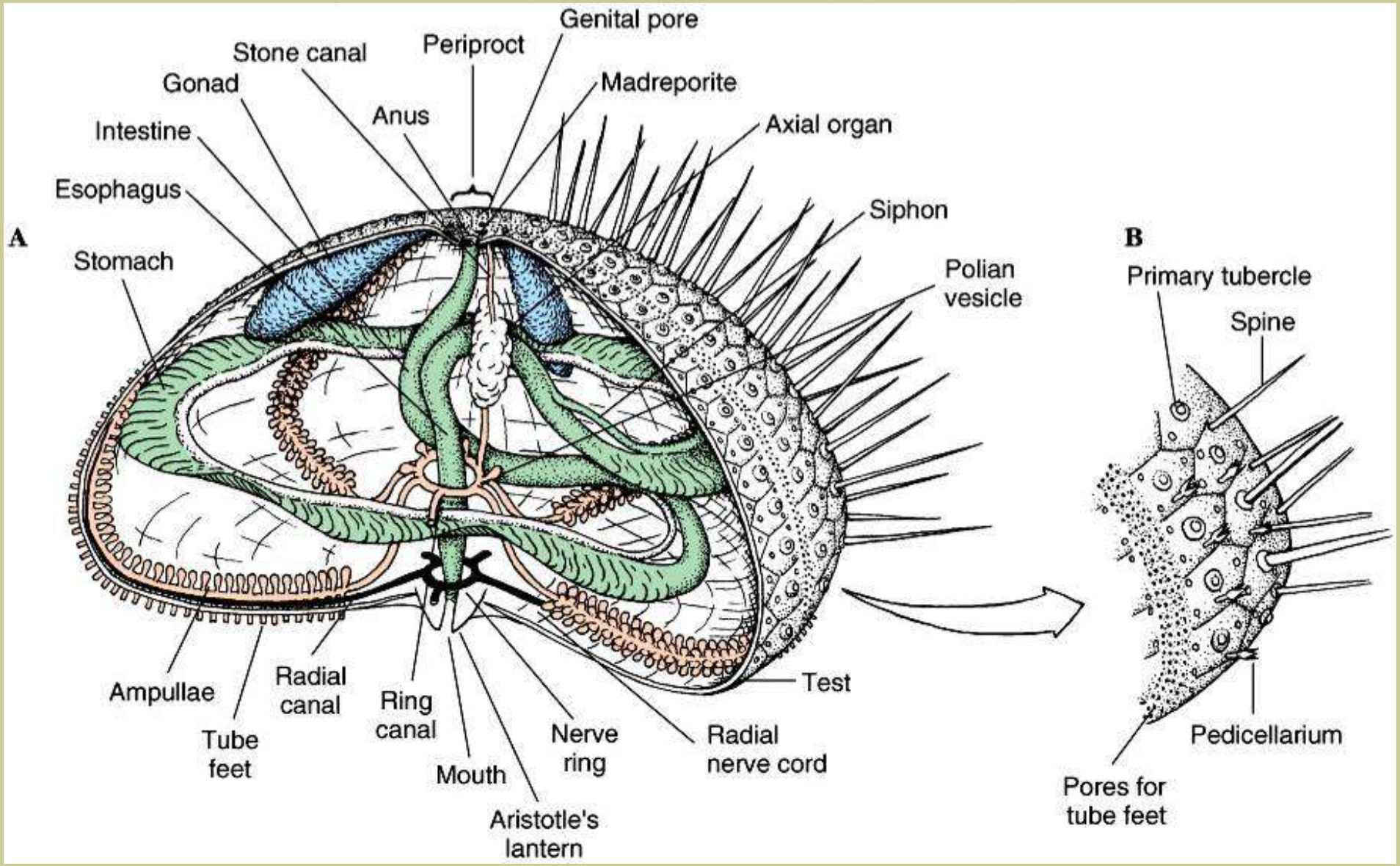
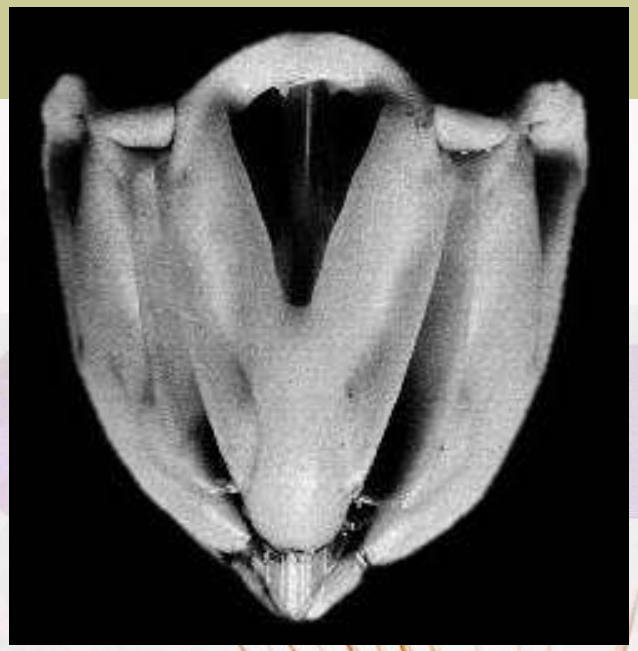
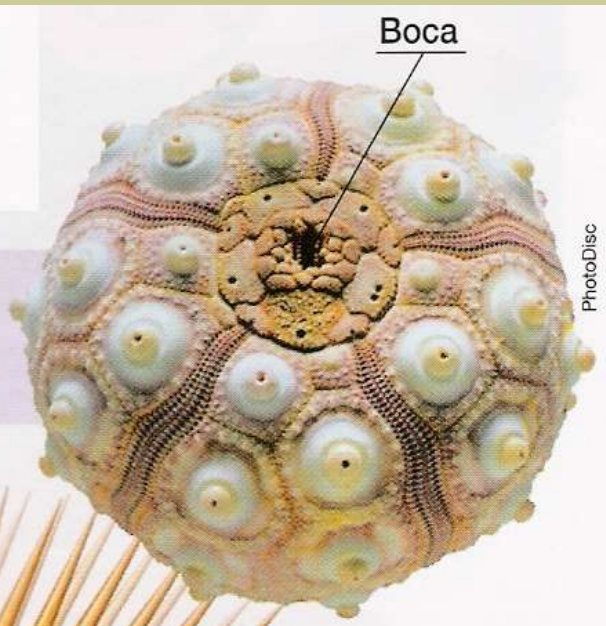
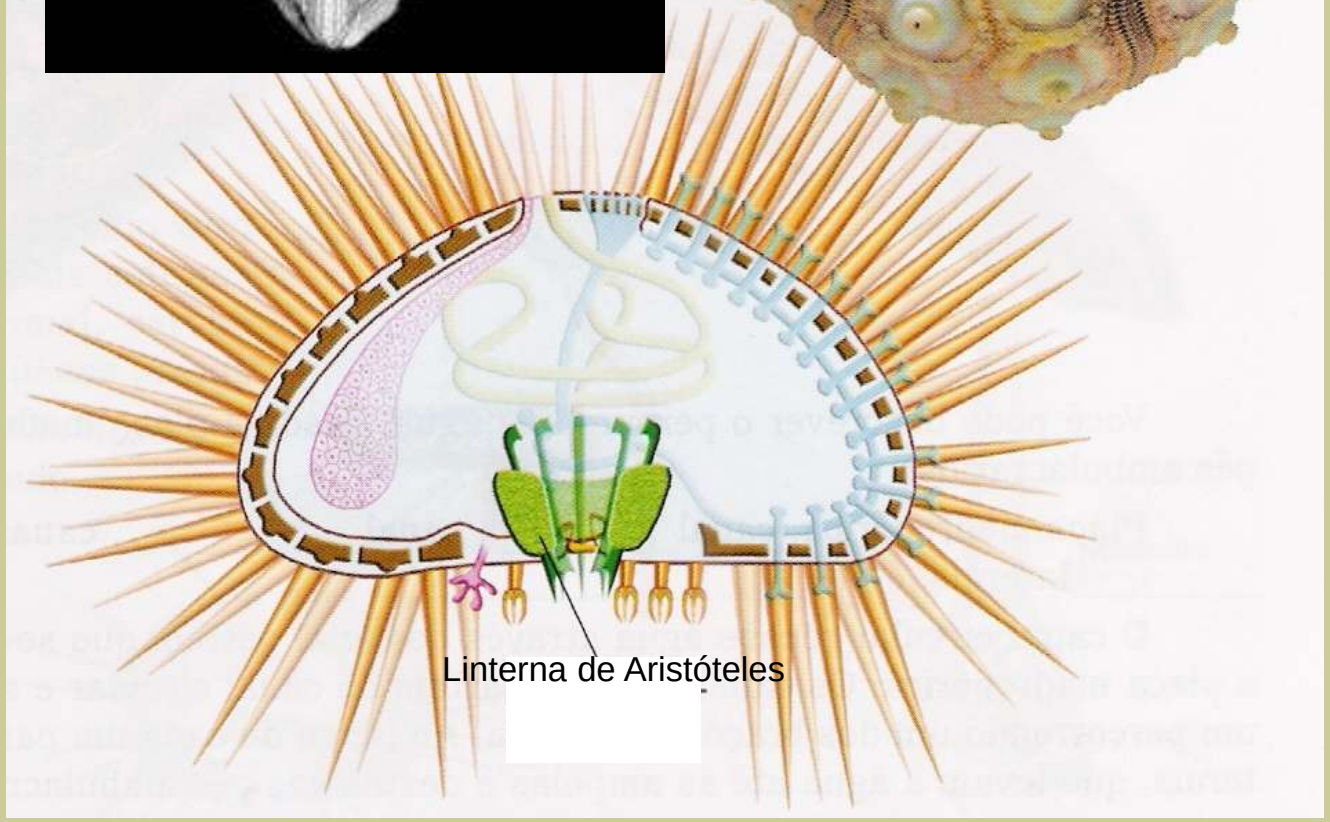


Figura 1. Estructura de un Equinoideo regular. A. Fotografía de un ejemplar en vista radial. B. Esquema del esqueleto del hemisferio aboral. C. Tipos de sistema apical. D. Esquema del esqueleto del hemisferio oral.


A
Genital pore
Periproct
Stone canal
Gonad
Madreporite
Anus
Intestine
Axial organ
Esophagus
Siphon
Stomach
Polian vesicle
Ampullae
Radial canal
Ring canal
Tube feet
Mouth
Nerve ring
Radial nerve cord
Test
Aristotle's lantern
B
Primary tubercle
Spine
Pedicellarium
Pores for tube feet




Boca
PhotoDisc


Linterna de Aristóteles

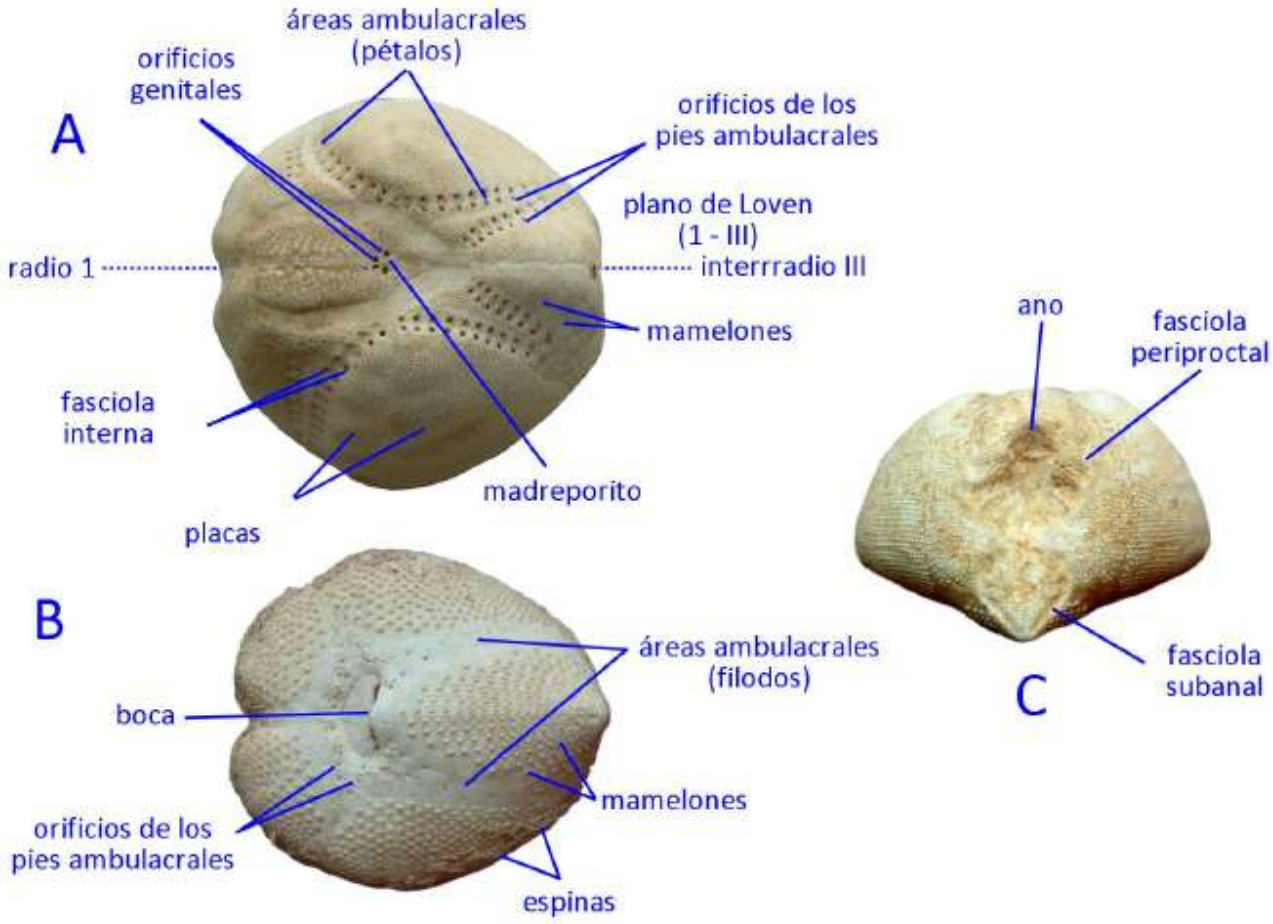


Figura 3. Fotografías del esqueleto de *Echinocardium*. A. Vista aboral. B. Vista oral. C. Vista anal.

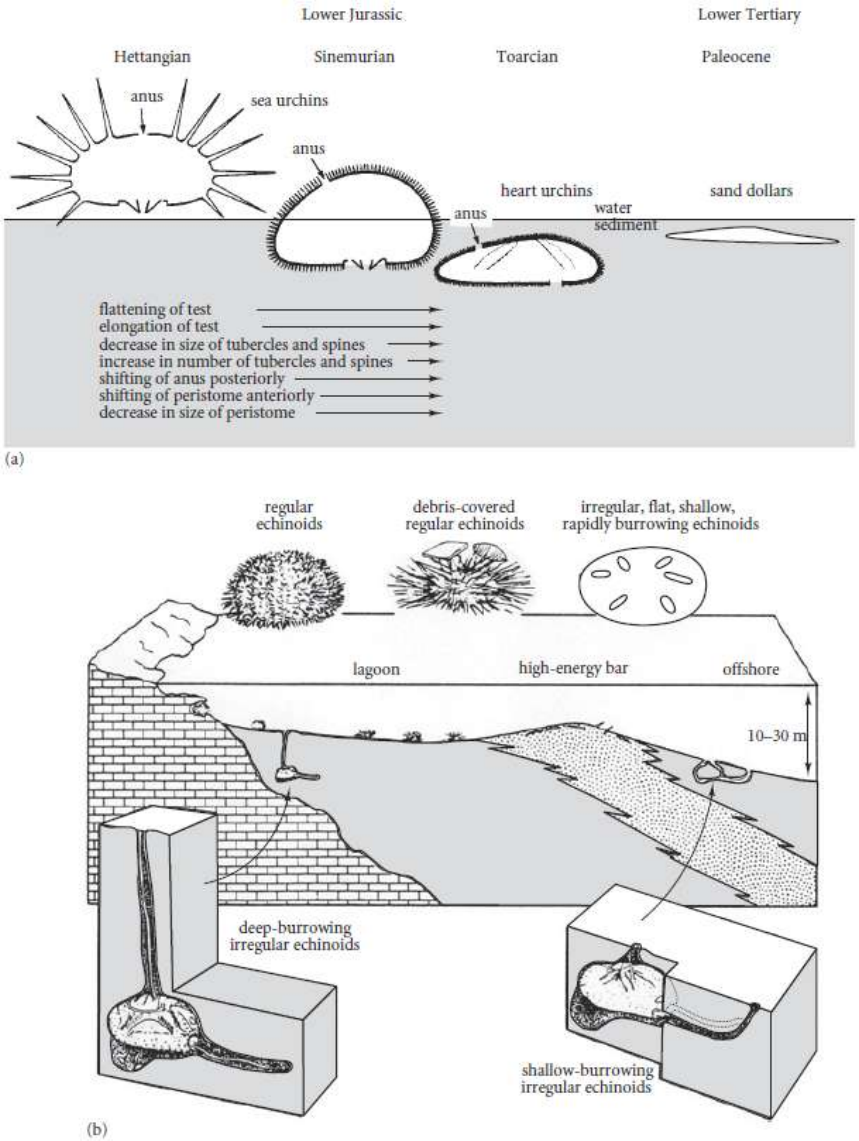
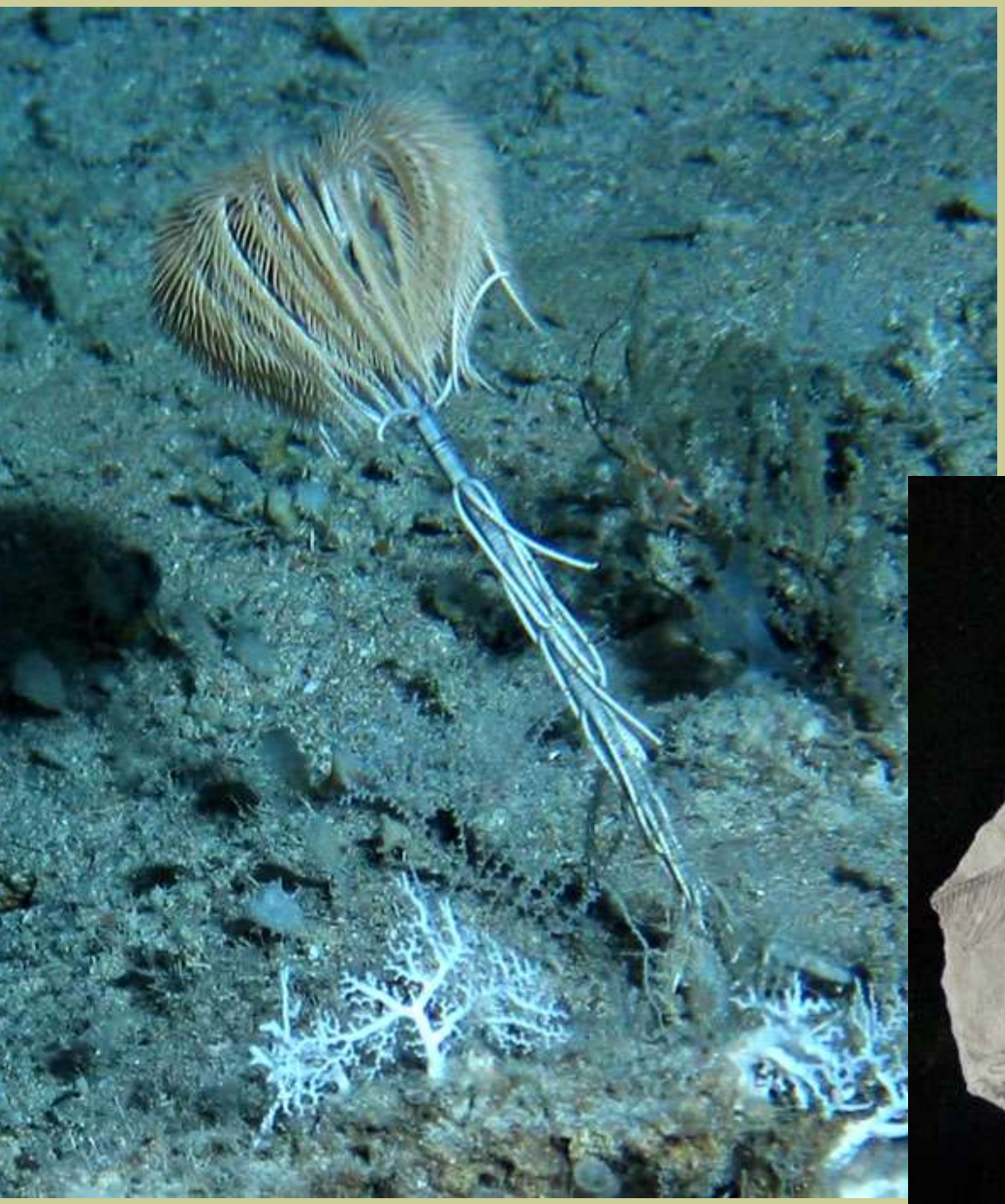


Figure 15.12 Echinoid life modes: (a) transition from the sea urchins through the heart urchins to the sand dollars; (b) habits and modes of life of echinoids. (a, based on Kier, P. 1982. *Palaeontology* 25; b, based on Kier, P. 1982. *Smithson. Contr. Paleobiol.* 13.)

Clase Crinoidea



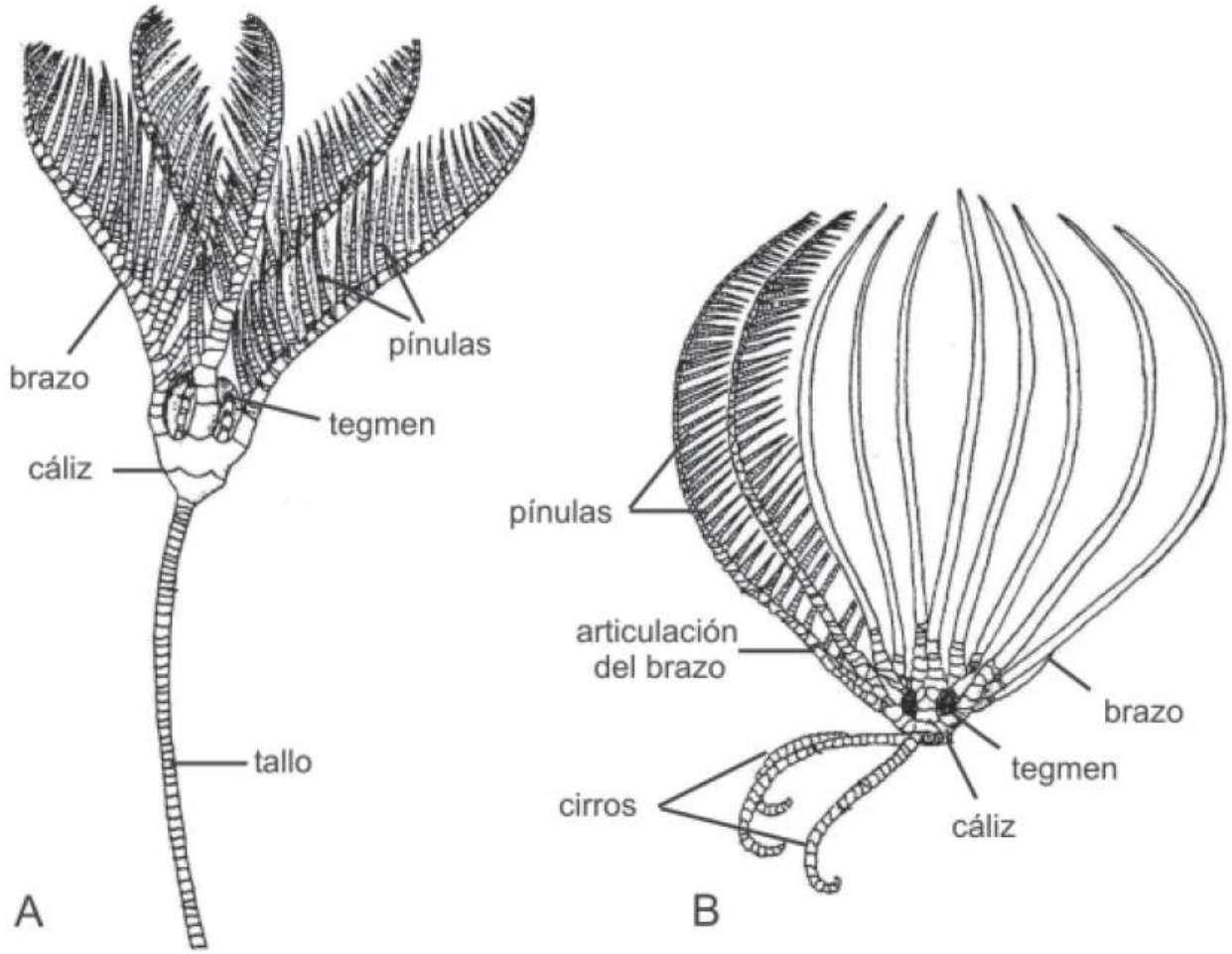


Figura 24. 9. Clase Crinoidea, Subclase Articulata. A. *Ptilocrinus*, lirio de mar con tallo y 5 brazos; B. *Neometra*, estrella plumosa sin tallo y con 30 brazos (no se muestran todos los brazos) (modificado de Barnes, 1992).

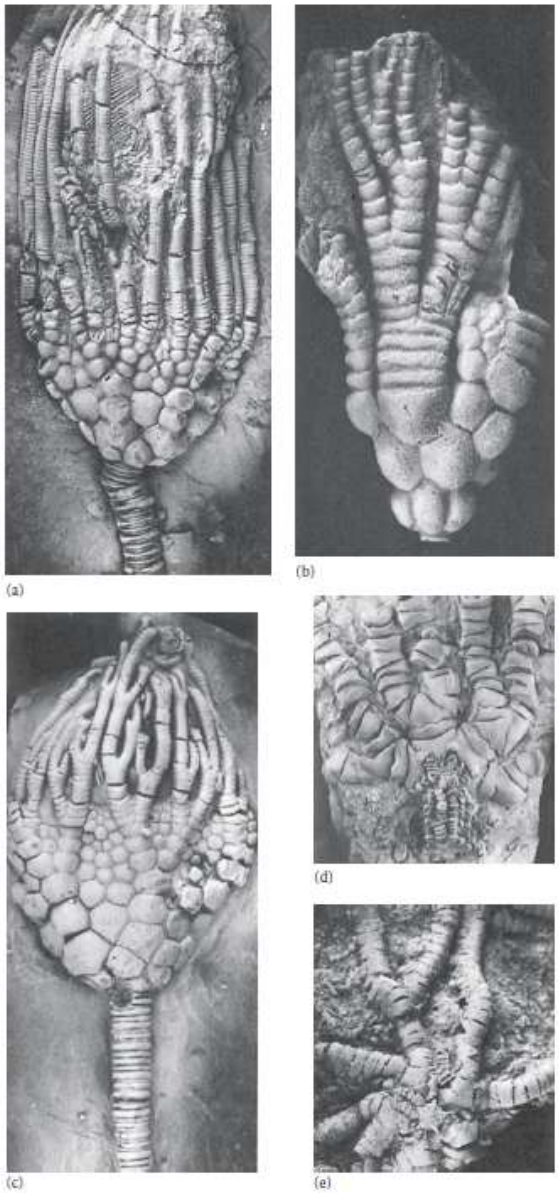
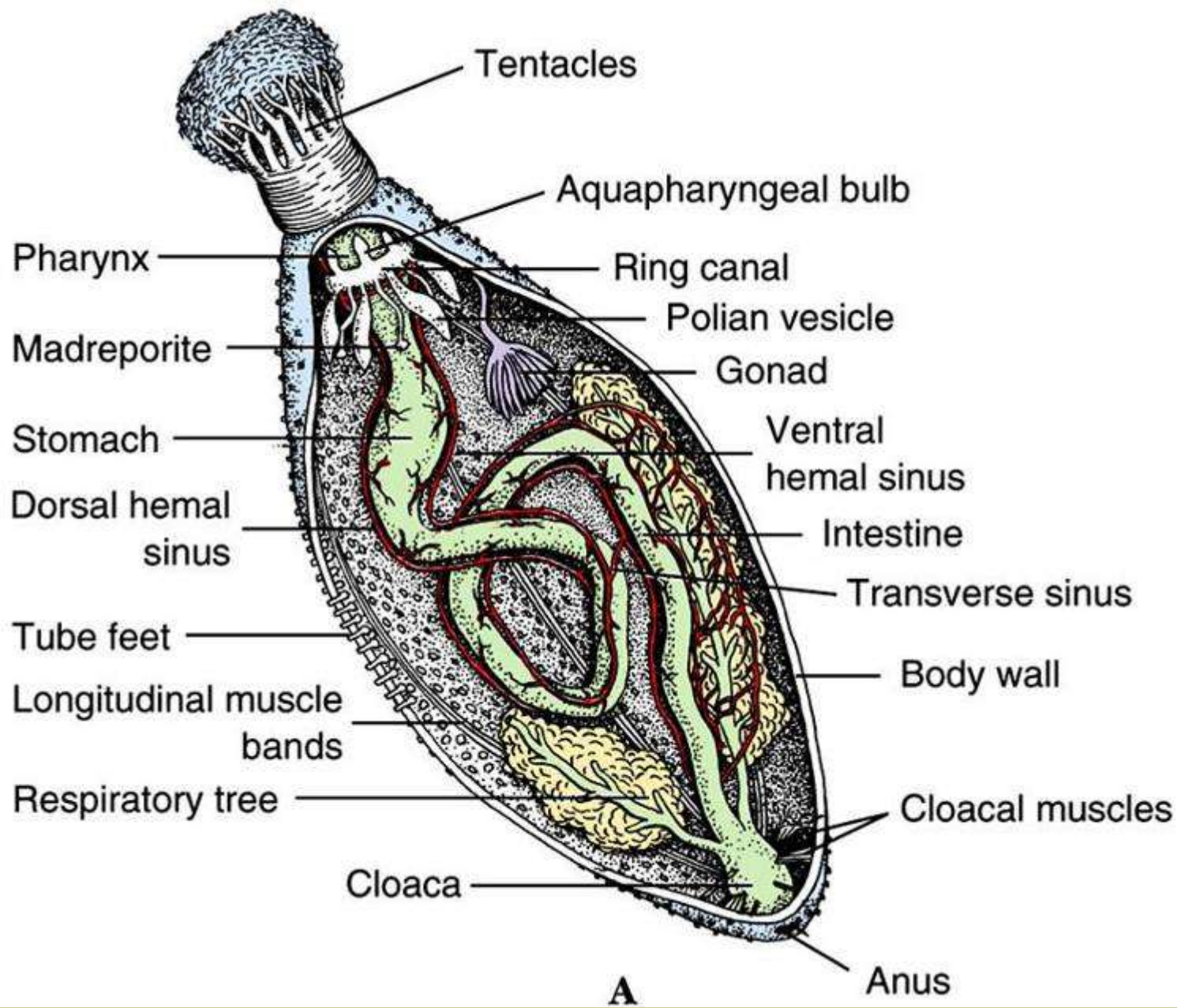


Figure 15.5 Some crinoid genera: (a) *Dimerocrinites* (Silurian; Camarata), (b) *Cupalocrinus* (Ordovician; Indunata), (c) *Sagenocrinites* (Silurian; Flexibilia), (d) *Chladocrinus* (Jurassic; Articulata) and (e) *Paracomatula* (Jurassic; Articulata comatulide). Magnification approximately ×1 (a, c), ×2 (b, d, e). (From Smith & Murray 1985.)

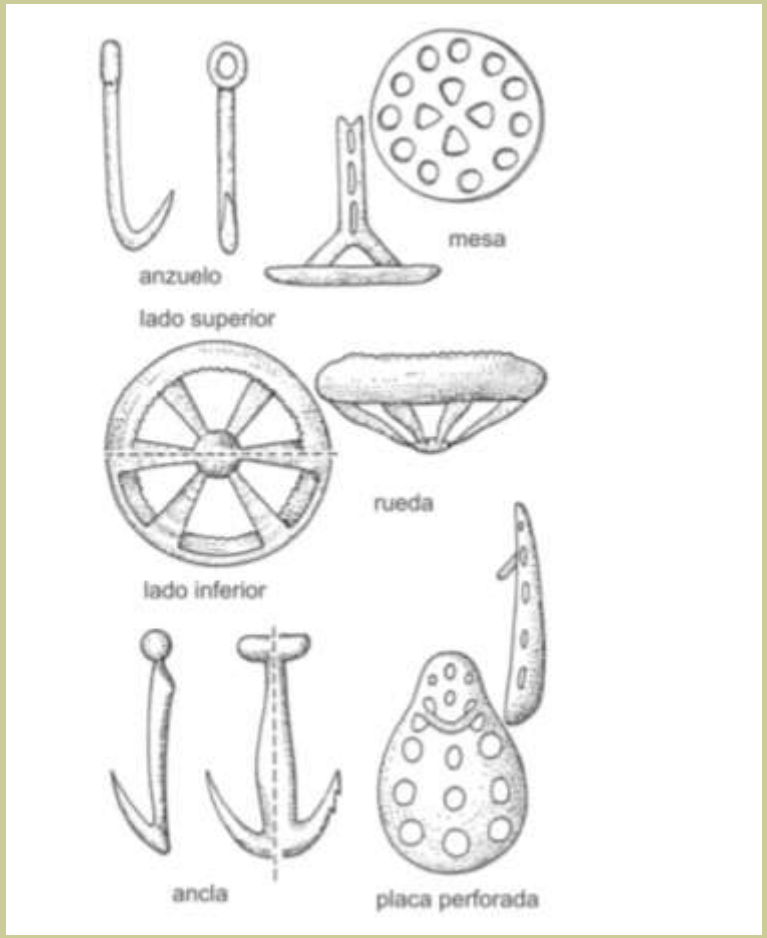
Clase Holothuroidea

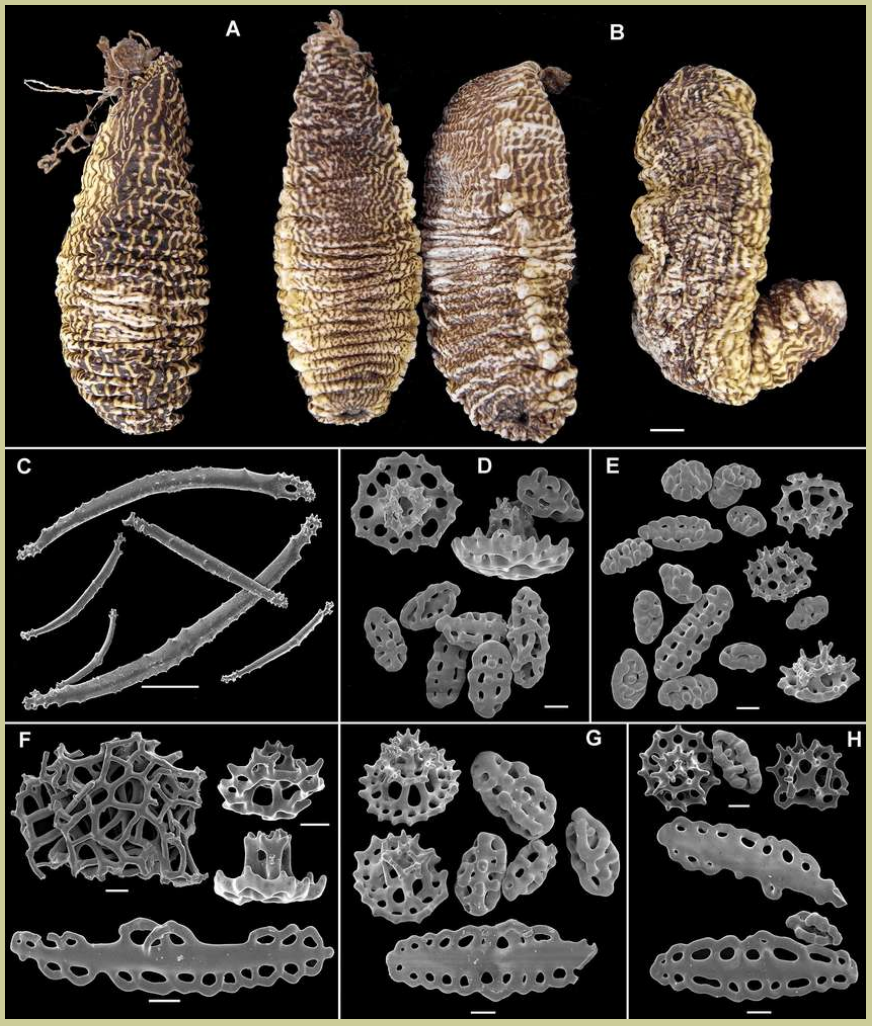
Simetria bilateral secundaria

Holothuroidea Anatomy

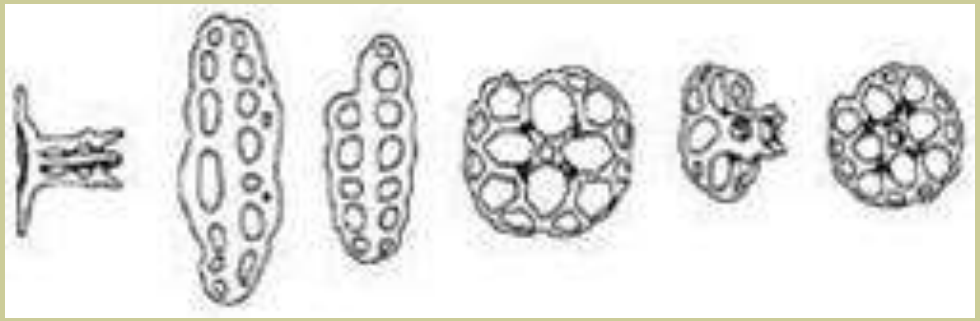


Osículos





Samyn & Vandenspiegel 2016



Uruguay

Formación Cordobés - Devónico

Crinoideos

Formación Camacho- Mioceno Tardío

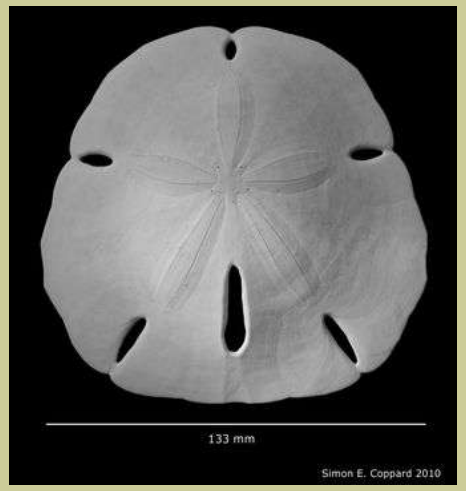
Monophoraster

Amplaster

Formación Chuy

Formación Villa Soriano

Cuaternario Marino



Encope

Mellita

ACTUALES

Martínez (2012)

- Holothuroidea. 2-3 spp.
- Asteroidea. 5 spp.
- Ophiuroidea. 24 spp.
- Asteroidea. 5 spp.
- Echinoidea. 5 spp.
- Crinoidea. 0 sp.

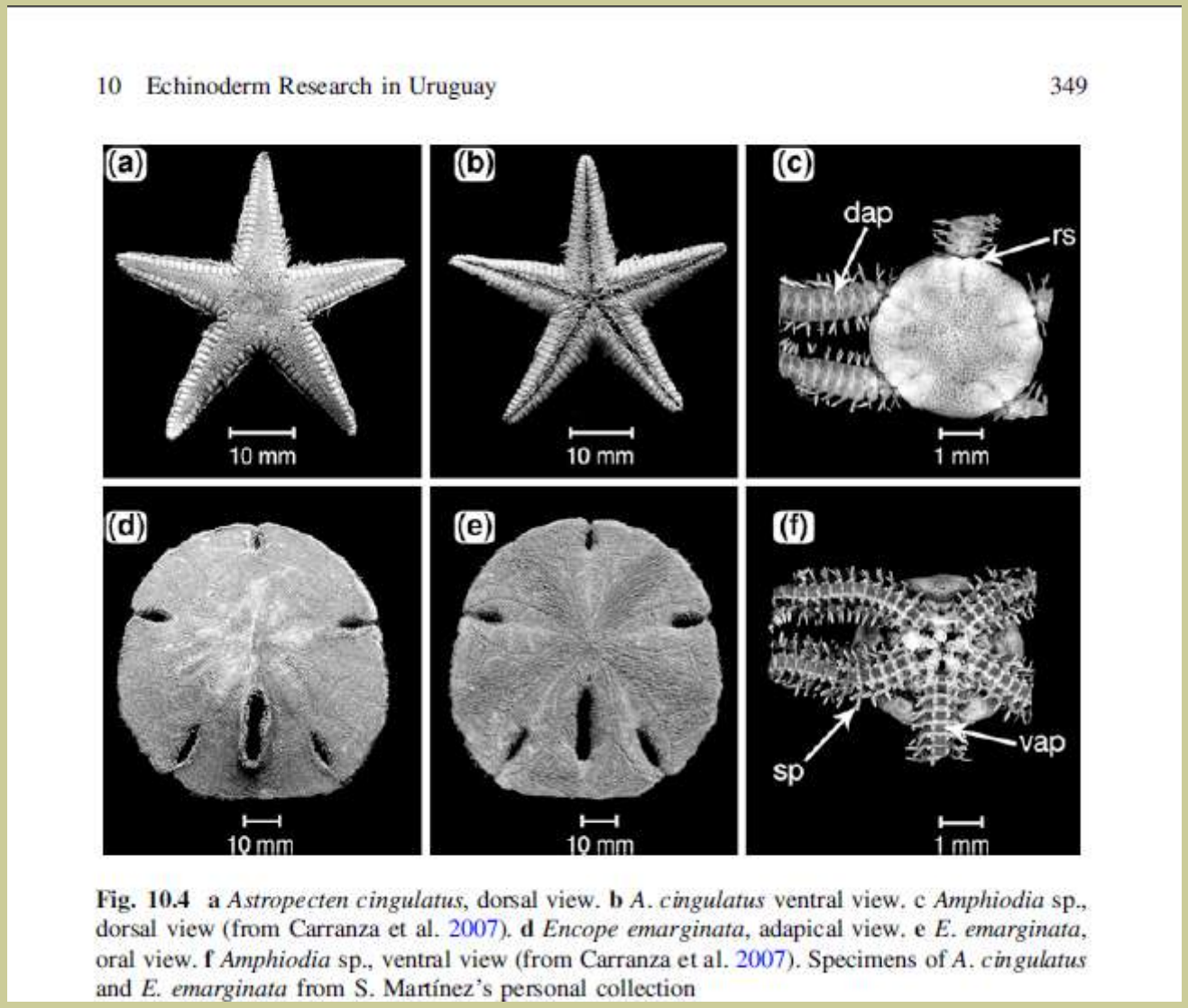


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Fig. 10.4 **a** *Astropecten cingulatus*, dorsal view. **b** *A. cingulatus* ventral view. c *Amphiodia* sp., dorsal view (from Carranza et al. 2007). **d** *Encope emarginata*, adapical view. **e** *E. emarginata*, oral view. **f** *Amphiodia* sp., ventral view (from Carranza et al. 2007). Specimens of *A. cingulatus* and *E. emarginata* from S. Martínez's personal collection

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