

HISTOLOGY MANUAL FOR *Tripneustes gratilla*

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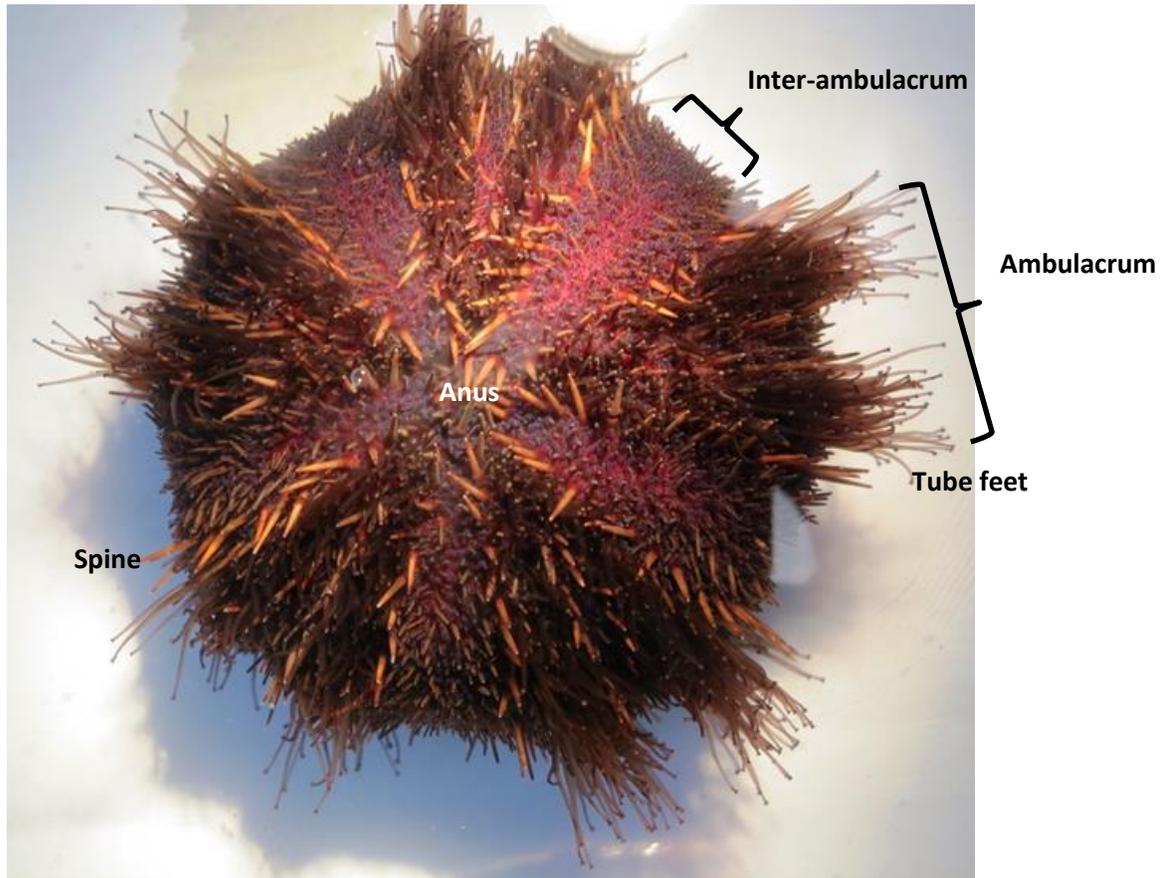
National Wildlife Health Center



Histology manual for *Tripneustes gratilla* (collector urchin)

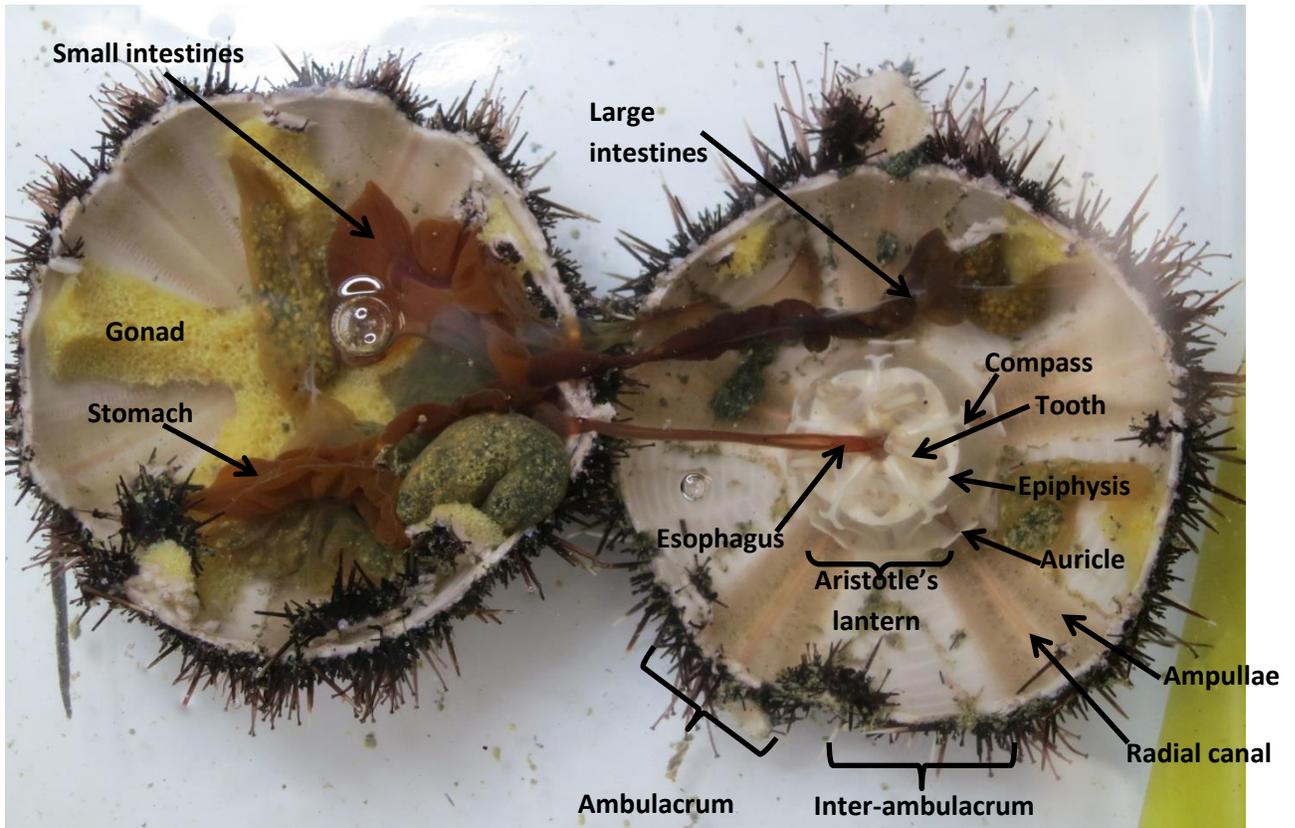
This manual is intended to familiarize the reader with basic anatomy and histology of sea urchins for purposes of diagnostic investigations. It is not intended to be comprehensive or all encompassing. For greater detail on particular topics, please consult the following references (1, 2) and available literature.

External anatomy



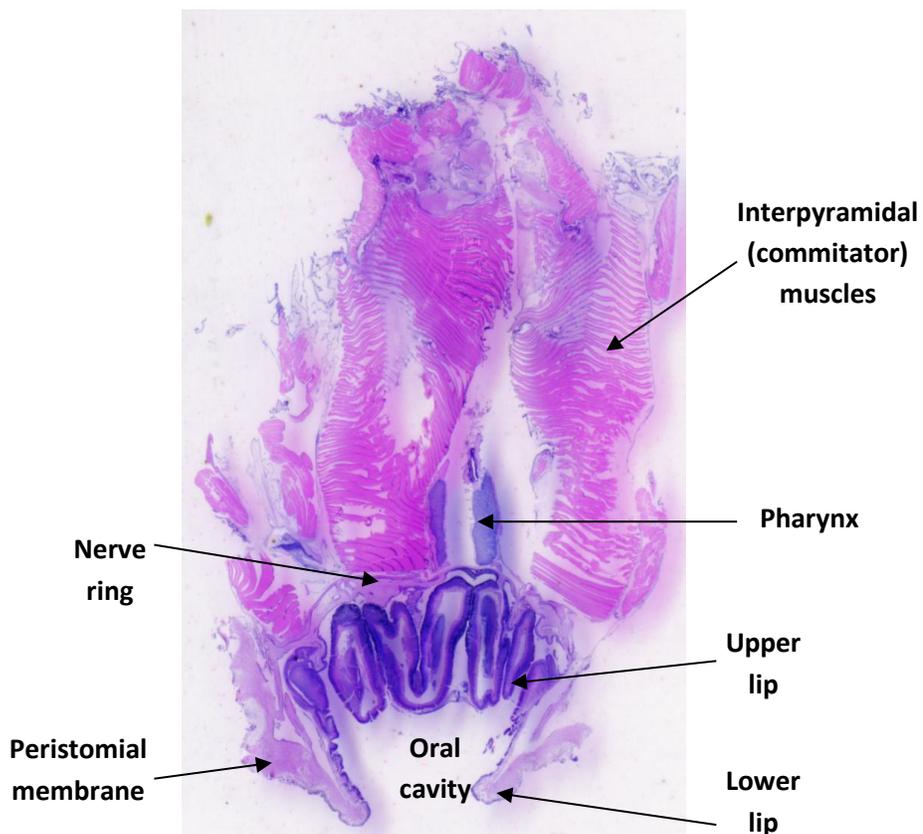
Dorsal view: Urchins consist of a calcium carbonate skeleton (test) enclosing fluids and organs. The test is covered in spines that are also mineralized and articulate at the base by muscles. Tube feet project through the portion of the test called the *Ambulacrum* and *inter-ambulacrum* are portions of test between ambulacra with no tube feet. Tube feet are what urchin uses to move around and are powered by muscles and an elaborate hydrostatic system called the water vascular canal. The test is covered by epidermis and is covered by small prehensile structures called pedicellariae. *Anus* is dorsal and opposite the mouth that is ventral and consists of a set of 5 teeth that animal uses to graze substrate. Urchins are herbivores.

Internal anatomy

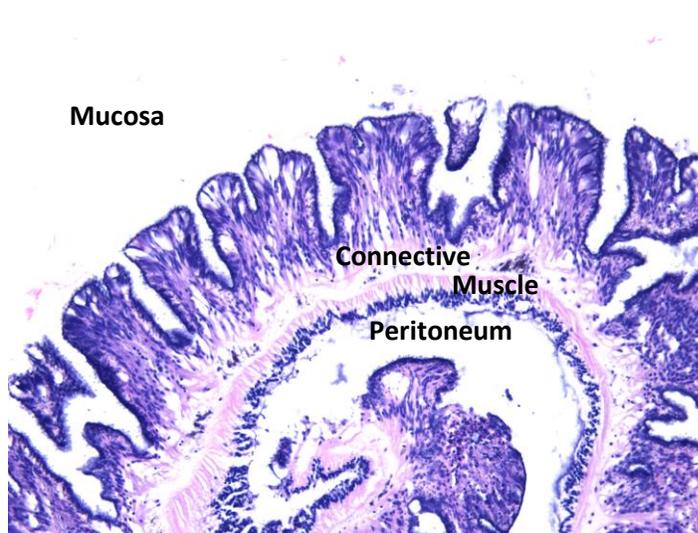


Radial section of urchin with dorsal (left) and ventral (right) test. *Aristotle's lantern* is an elaborate complex of 40 skeletal structures and associated muscles including 5 teeth that the urchin uses to graze the substrate. Some of the structures visible here include *compass*, *tooth*, and *epiphysis*. *Auricles* project from the test and serve for muscle attachments; they enclose the perignathic space. *Radial canal* and *ampullae* are part of the water vascular system that moves the tube feet.

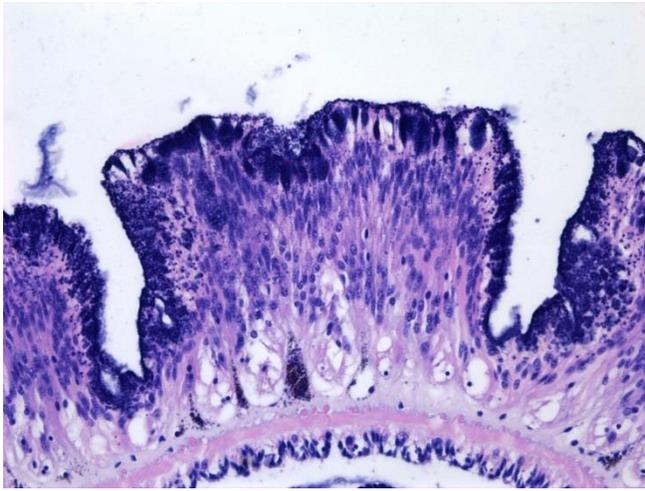
Histology digestive



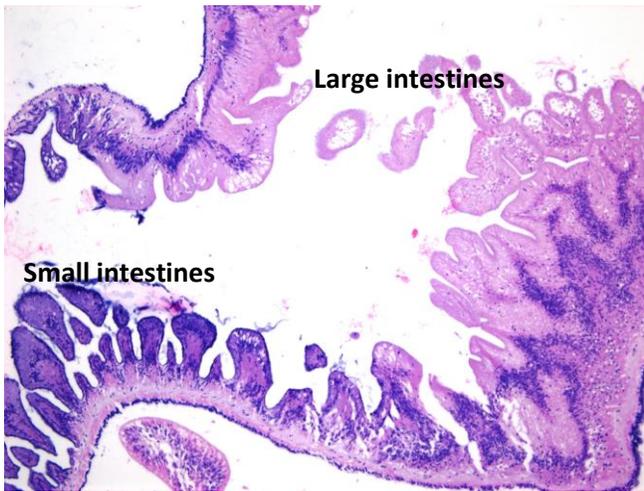
Histology of muscles surrounding Aristotle's lantern. *Commitator muscles* articulate between teeth. Nerve ring surrounds the lantern. *Peristomial membrane* is connective tissue that surrounds lantern externally. It is overlaid by cuboidal epidermis.



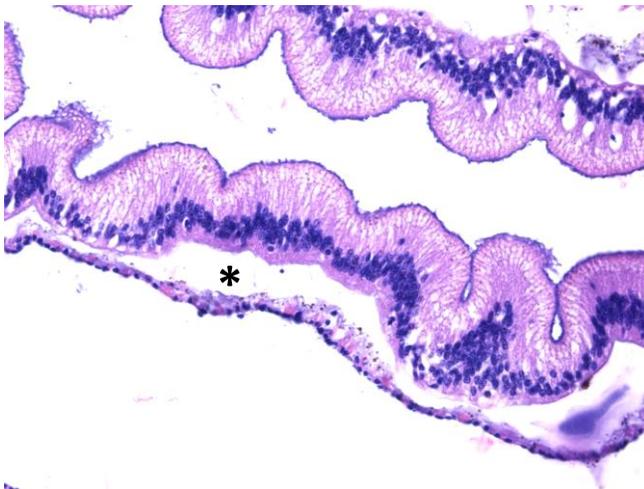
Esophagus: Mucosa consists of ciliated columnar epithelium separated from circular muscles by connective tissue; cuboidal cells overlay serosa (peritoneum).



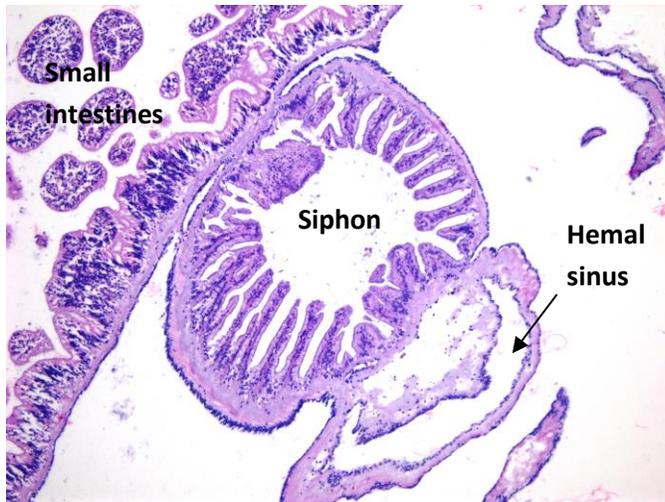
Stomach: Ciliated columnar epidermis comprises mucosa with structure similar to esophagus.



Small and large intestines junction. Note more eosinophilic aspect of large intestinal mucosa in contrast to small intestines with prominent villi. Structure similar to esophagus.

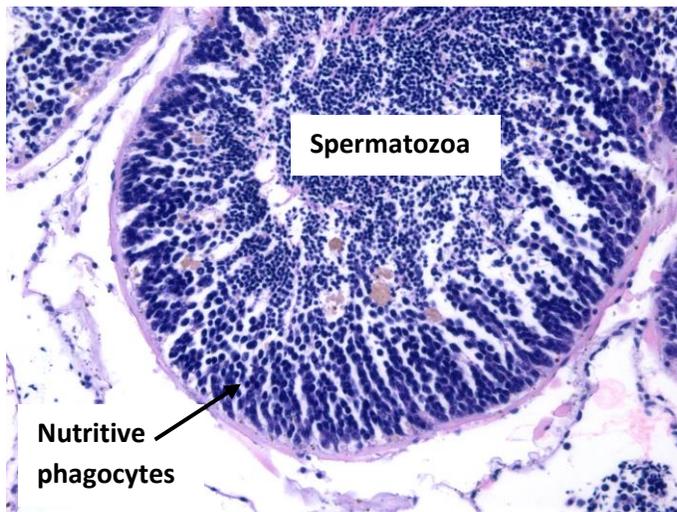


Large intestines junction. Note more eosinophilic aspect of large intestinal mucosa. Structure similar to esophagus.



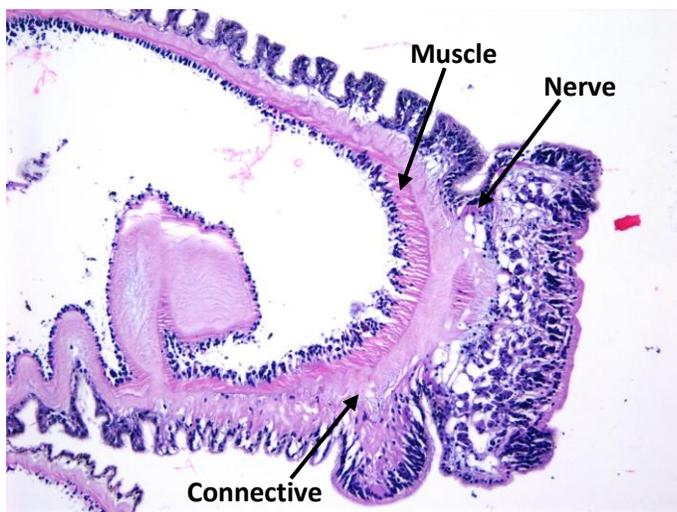
Siphon: Tubular structure that runs along small intestines and presumably reabsorbs water. This is attached to the *hemal sinus* (part of the animal's open circulatory system).

Histology gonad

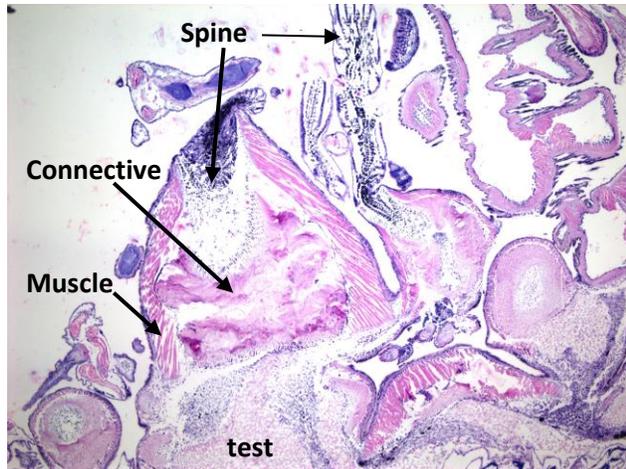


Testes: Comprise multiple lobules each consisting of connective tissue capsule enclosing nutritive phagocytes surrounding spermatozoa.

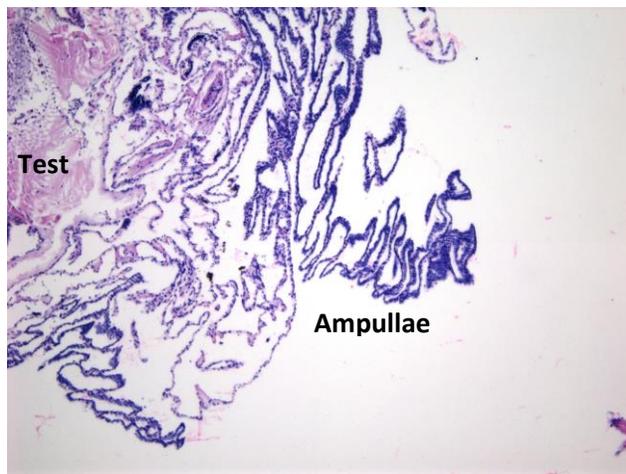
Histology test



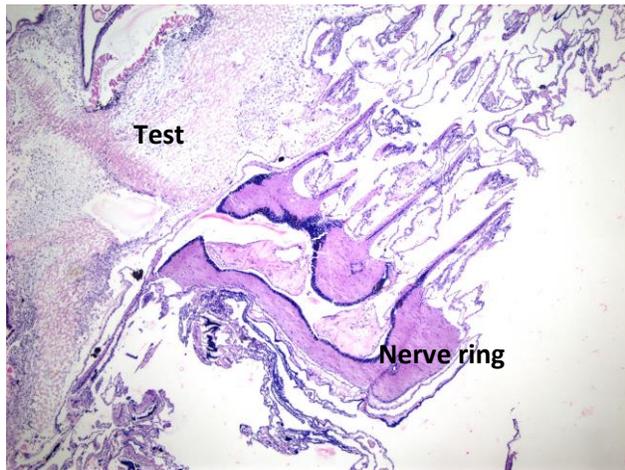
Podium (tube foot): is fluid-filled sack with muscle and connective tissue that allows animal to ambulate about.



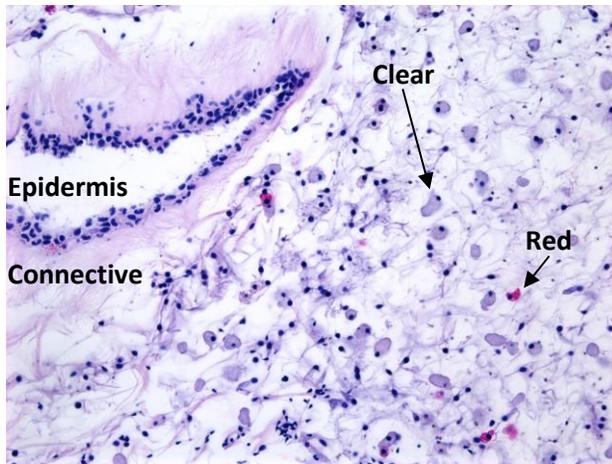
Test: comprises connective tissue and cells within a mineral matrix with appendages including *spines* that articulate from a base consisting of *connective tissue* and *muscle* all of which are covered by a cuboidal epithelium (epidermis). Spines are also covered by cuboidal epithelium.



Ampullae: form part of the water vascular canal and which is connected to tube feet. These are on the ambulacral portion of the test.



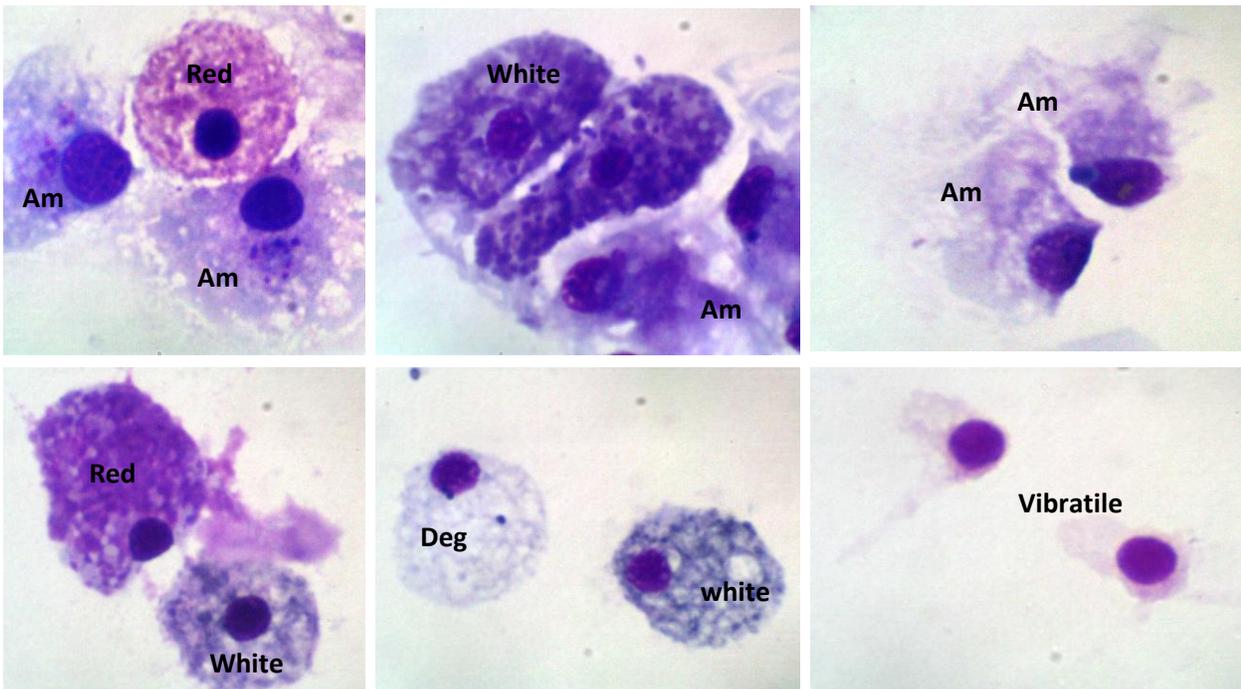
Nerve ring: forms part of the nervous system of urchin and is closely apposed to test.



Test: Close up of test showing epidermis overlying connective tissue with deeper mineralized matrix with connective tissue trabeculae containing various cells including clear and red spherule cells.

Cytology

Ceolomocytes: Urchins have an open circulatory system with blood cells including amoebocytes (Am), red (Red) and white (White) spherule cells, vibratile cells and degranulating granulocytes (Deg).



Tissues to collect for histology and frozen*

- 1) Ventral and dorsal test (ambulacral and interambulacral)
- 2) Esophagus, stomach, intestines

*Tissue for histology collected in 10% neutral buffered formalin.

References

1. Hyman, L. H. 1955. *The Invertebrates: Echinodermata*. McGraw Hill, New York.
2. Cavey, M. J., and K. Markel. 1994. Echinoidea. In *Microscopic anatomy of the invertebrates: Echinodermata*. F. W. Harrison, and F.-S. Chia, eds. Wiley-Liss, Ne York. 345-400.

See also- sea urchin dissection manual:

<http://www.whoi.edu/science/B/students/kwhalen/Sea%20Urchin%20Dissection%20Protocol.pdf>