Cnidocytes

MBB College

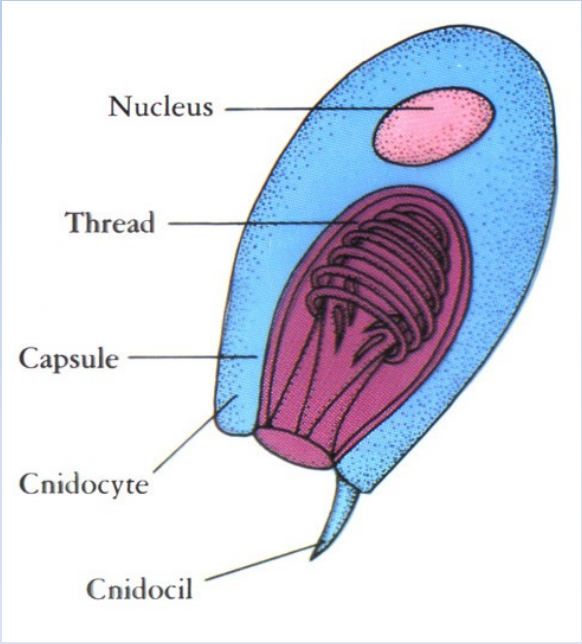
Agartala

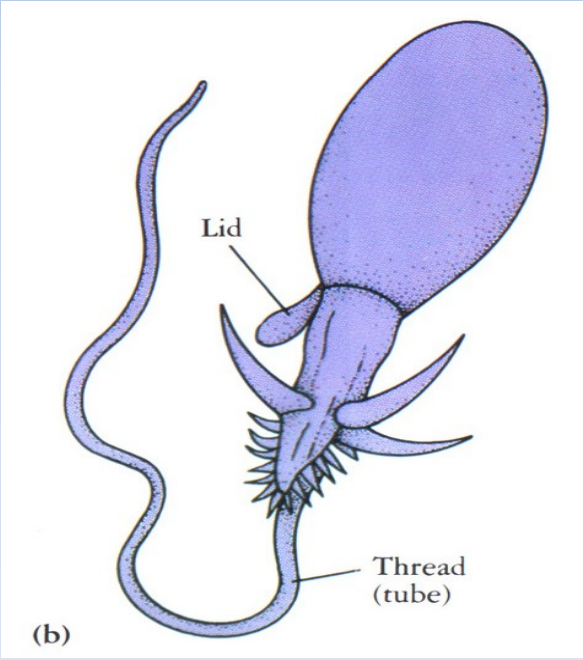
Cnidocytes: Structure

Cnidocytes are located throughout the epidermis and are lodged between or invaginated within epitheliomuscular cells. They are especially abundant on the tentacles. These specialized cells, which are unique to and characteristic of all cnidarians, contain organelles capable of eversion known as cnidae. The commonest type is the stinging structures called nematocysts. A cnidocyte is a rounded or an ovoid cell with a basal nucleus. In hydrozoans and scyphozoans one end of the cell contains a short, stiff, bristle-like process called a cnidocil, which has an ultrastructure similar to that of a cilium and is exposed to the surface. In anthozoans, the cnidocils are not present, although a ciliary cone complex of similar function is associated with at least some of the types of cnidocytes found in this class.

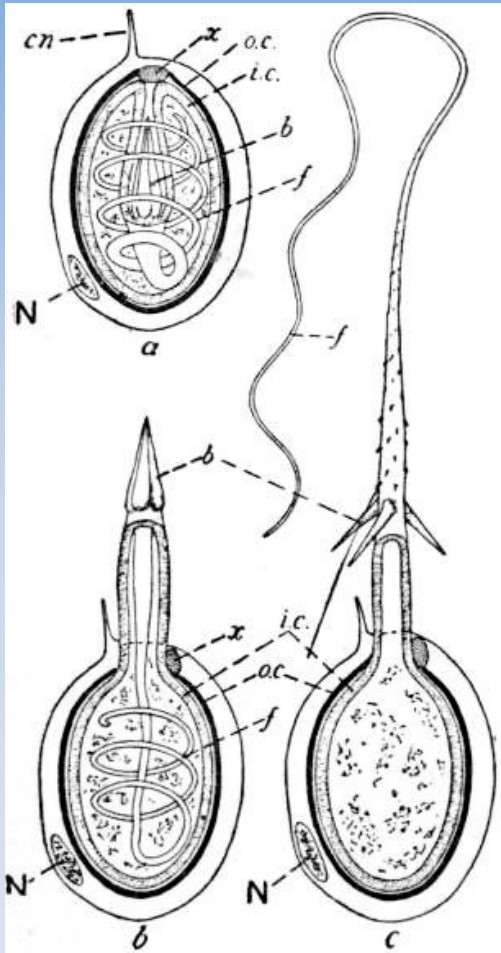
Cnidocytes: Structure

The interior of the cell is filled by a capsule containing a coiled, usually pleated tube and the end of the capsule that is directed toward the outside is covered by an operculum or by lidlike flaps. The base is anchored to the lateral extensions of one or more epitheliomuscular cells and may also be associated with a neuron terminal.





Cnidocyte: Diagram & Photograph



Diagrams to show the structure of Nematocysts and their mode of working. (After Iwanzov.) *a*, Undischarged nematocyst.

b, Commencing discharge.

c, Discharge complete.

cn, Cnidocil.

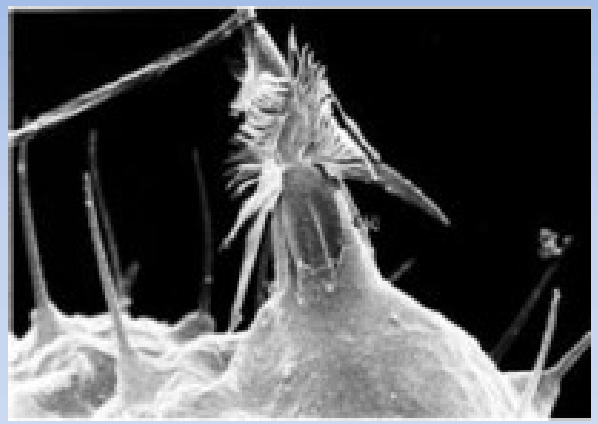
N, Nucleus of cnidoblast.

o.c, Outer capsule.

x, Plug closing the opening of the outer capsule.

i.c., Inner capsule, continuous with the wall of the filament, *f*.

b, Barbs.



Cnidocytes and Its Discharge

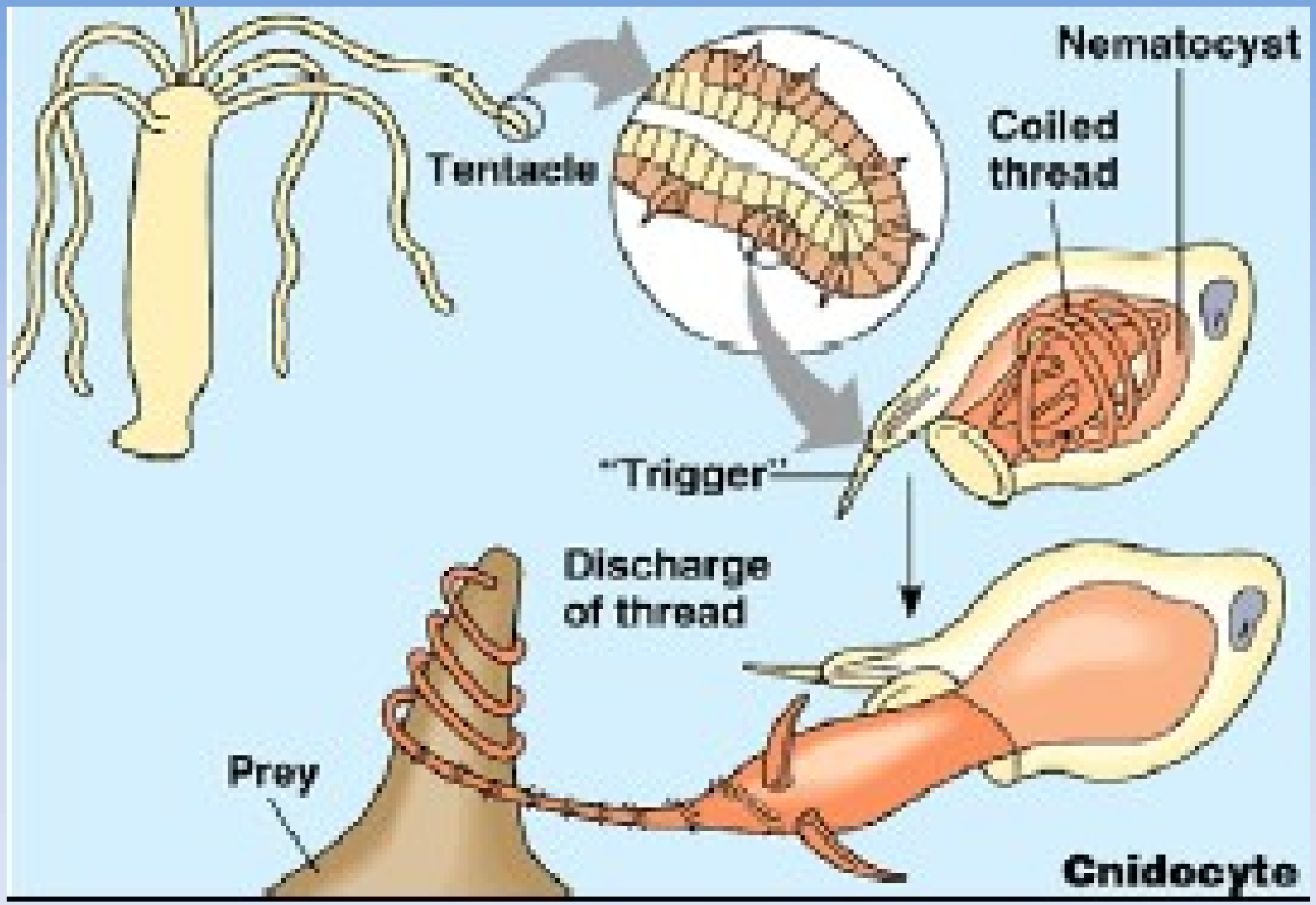
- **The discharge mechanism apparently involves a rapid change in osmotic pressure within the capsule.**
- **Under the combined influence of mechanical and chemical stimuli, which are initially received and conducted by the cnidocyte surface structure, there is possibly a sudden release of calcium within the capsule. Water rushes into the capsule and the intracapsular pressure rises. This pressure plus some intrinsic tension within the capsule structure itself causes the operculum or apical flaps of the cnida to open and the tube to evert (turns it inside out). In hydras the entire discharge process takes 3 ms. Studies on sea anemones have shown that chemical and mechanical stimuli may interact to discharge nematocysts.**
- **Although cnidocytes usually fire as independent effectors, discharge can apparently be affected by nerve impulses from an associated neuron terminal, and neuronal connections may serve to coordinate firing by a large number of nematocysts.**
- **A discharged nematocyst consists of a capsule and a threadlike tube of varying length.**
- **The tube or thread is commonly armed with Spines, particularly around the base and may be open or closed at the tip.**
- **Nematocysts function in prey capture and many can inject a toxin.**

Cnidocytes: Action

The thread is generally open at the tip and frequently armed with spines. Upon discharge, the thread bores its way into the tissues of the prey and injects a protein toxin that has a paralyzing action. At least in some types, the spines aid in puncturing the integument of the prey; Under high-speed microcinematography the eversion of a barbed nematocyst (stenotele) of hydras is seen to occur in two phases. In the rapid first phase, the capsule lid opens, and the evening barbed region with three stylets directed forward punches a hole in the prey‘s integument. In the second phase the stylets flip back, and the thread everts into the body of the prey through the opening created by the stylets.

Nematocysts and other cnidae are used but once; new cnidocytes are formed from nearby interstitial cells. About 25% of the nematocysts of *Hydra Iittoralis* are lost from the tentacles in the process of eating a brine shrimp. The discharged nematocysts are replaced within 48 h.

Mechanism

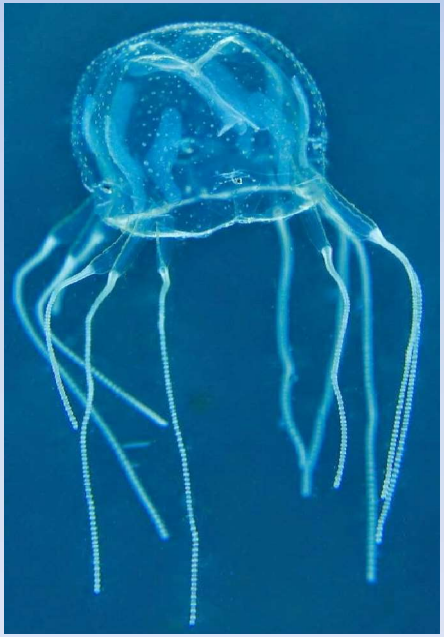

Nematocyst
Coiled thread
Tentacle
"Trigger"
Discharge of thread
Prey
Cnidocyte

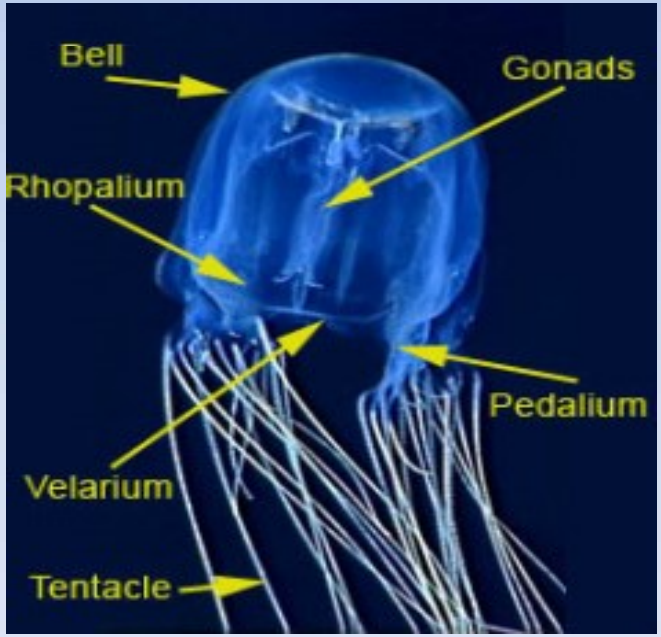
How does the stinging cell work?

- The tentacle is stimulated
  - Pressure on “trigger”
- Nematocyst is discharged
  - Thread uncoils
  - Entangles prey
- Some species produce toxins
  - Injects toxin into prey, paralyzing it!

Toxicity

The toxic effect of the nematocysts of most cnidarians is not perceptible to humans- However, some marine species have nematocysts that can produce a painful burning sensation and irritation or even death. Other nematocysts, such as the desmonemes, do not possess any known toxic properties; instead, they function by adhesion or by wrapping and entangling small prey. The thread is closed at the end and may be unarmed and coiled or have a long spiny shaft. The spines appear to be an adaptation for adhesion to the prey surface.





The cnidarians may be a relatively small group comprising the Animal Kingdom, but they play a major role in any marine habitat.