CEPHALOPODA

Shamil babu ps
MSc geology, 2nd sem
Central University Of Karnataka

Scientific classification

- Kingdom:Animalia
- Phylum:Mollusca
- Class:**Cephalopoda**
- **Subclasses**: **Nautiloidea**, **Ammonoidea**, **Coleoidea**

- A **cephalopod** is any member of the molluscan class **Cephalopoda**

- These exclusively marine animals are characterized by bilateral body symmetry, a prominent head, and a set of arms or tentacles (muscular hydrostats) modified from the primitive molluscan foot. Fishermen sometimes call them **inkfish**, referring to their common ability to squirt ink.

- The study of cephalopods is a branch of malacology known as **teuthology**.
- Cephalopods became dominant during the Ordovician period, represented by primitive nautiloids.
- . About 800 living species of cephalopods have been identified. Two important extinct taxa are the Ammonoidea (ammonites) and Belemnoidea (belemnites).

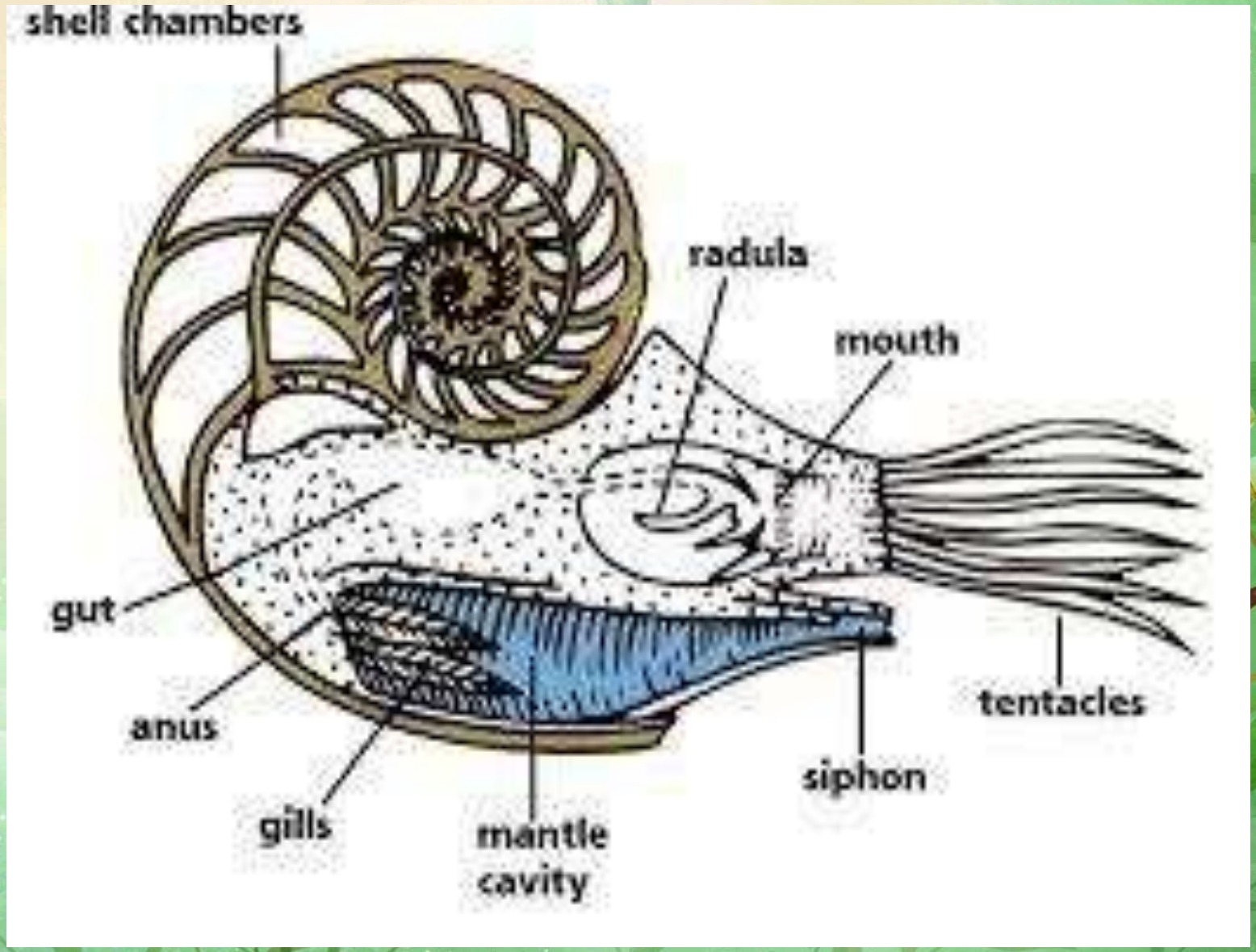
Distribution

A pair of Sepia officinalis in shallow water

Benthoctopus sp. on the Davidson Seamount

- There are around 800 extant species of cephalopod, although new species continue to be described. An estimated 11,000 extinct taxa have been described, although the soft-bodied nature of cephalopods means they are not easily fossilised.

- Cephalopods are found in all the oceans of Earth. None of them can tolerate freshwater, but the brief squid,*Lolliguncula brevis*, found in Chesapeake Bay, may be a notable exception in that it tolerates brackish water.


shell chambers
radula
mouth
gut
anus
tentacles
siphon
gills
mantle cavity

Nervous system and behavior

An octopus opening a container with a screw cap

Cephalopods are widely regarded as the most intelligent of the invertebrates, and have well developed senses and large brains (larger than those of gastropods).

- The nervous system of cephalopods is the most complex of the invertebrates. and their brain-to-body-mass ratio falls between that of endothermic and ectothermicvertebrates.The brain is protected in a cartilaginous cranium.
- The giant nerve fibers of the cephalopod mantle have been widely used for many years as experimental material in neurophysiology

- Some cephalopods are able to "fly" through the air for distances of up to 50 m. While cephalopods are not particularly aerodynamic, they achieve these impressive ranges by jet-propulsion; water continues to be expelled from the funnel while the organism is in the air.

Senses

- Cephalopods have advanced vision, can detect gravity with statocysts, and have a variety of chemical sense organs.Octopuses use their tentacles to explore their environment and can use them for depth perception.

Vision

Cephalopod eye and mollusc eye

- The primitive nautilus eye functions similarly to a pinhole camera.
- Most cephalopods rely on vision to detect predators and prey, and to communicate with one another.Consequently, cephalopod vision is acute: training experiments have shown that the common octopus can distinguish the brightness, size, shape, and horizontal or vertical orientation of objects

- The morphological construction gives cephalopod eyes the same performance as sharks'; however, their construction differs, as cephalopods lack a cornea, and have an everted retina. Cephalopods' eyes are also sensitive to the plane ofpolarization of light.Surprisingly—given their ability to change color—all octopuses and most cephalopods are color blind

Hearing

- Some squids have been shown to detect sound using their statocysts

Use of light

This broadclub cuttlefish (Sepia latimanus) can go from camouflage tans and browns (top) to yellow with dark highlights (bottom) in less than a second.

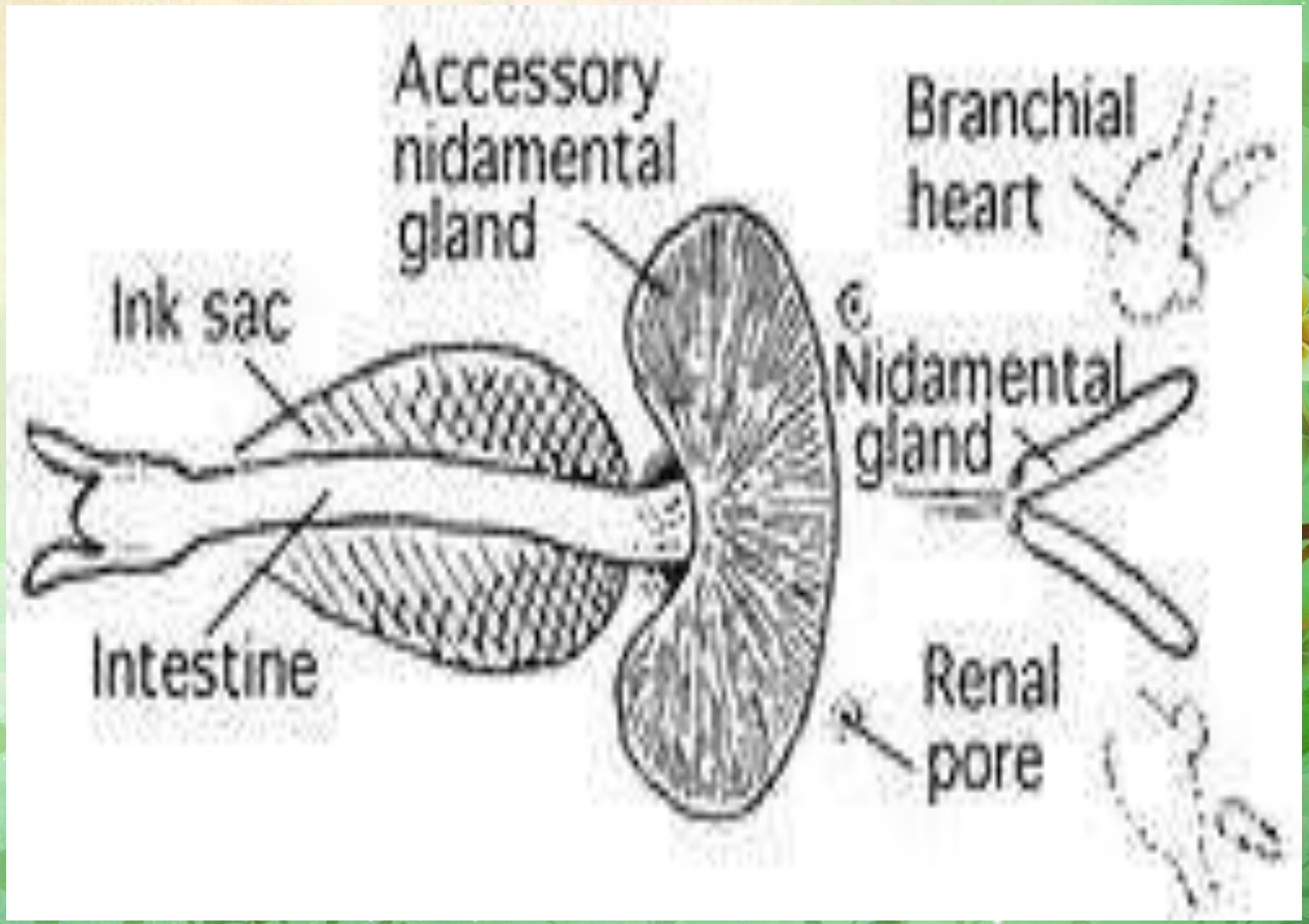
- Most cephalopods possess chromatophores - that is, coloured pigments - which they can use in a startling array of fashions. As well as providing camouflage with their background, some cephalopods bioluminesce, shining light downwards to disguise their shadows from any predators that may lurk

Coloration

- Cephalopods can change their colours and patterns in milliseconds, whether for signalling (both within the species and for warning) oractive camouflage, as their chromatophores are expanded or contracted . Coloration is typically stronger in near-shore species than those living in the open ocean, whose functions tend to be restricted to disruptive camouflage.

Ink

- With the exception of the Nautilidae and the species of octopus belonging to the suborder Cirrina, all known cephalopods have an ink sac, which can be used to expel a cloud of dark ink to confuse predators. This sac is a muscular bag which originated as an extension of the hind gut. It lies beneath the gut and opens into the anus


Accessory
nidamental
gland
Branchial
heart
Ink sac
Nidamental
gland
Intestine
Renal
pore

Circulatory system

- Cephalopods are the only mollusks with a closed circulatory system. Coleoids have two gill hearts (also known as branchial hearts) that move blood through the capillaries of the gills. A single systemic heart then pumps the oxygenated blood through the rest of the body.

Respiration

- Cephalopods exchange gases with the seawater by forcing water through their gills, which are attached to the roof of the organism. Water enters the mantle cavity on the outside of the gills, and the entrance of the mantle cavity closes.
- When the mantle contracts, water is forced through the gills, which lie between the mantle cavity and the funnel.

Locomotion and buoyancy

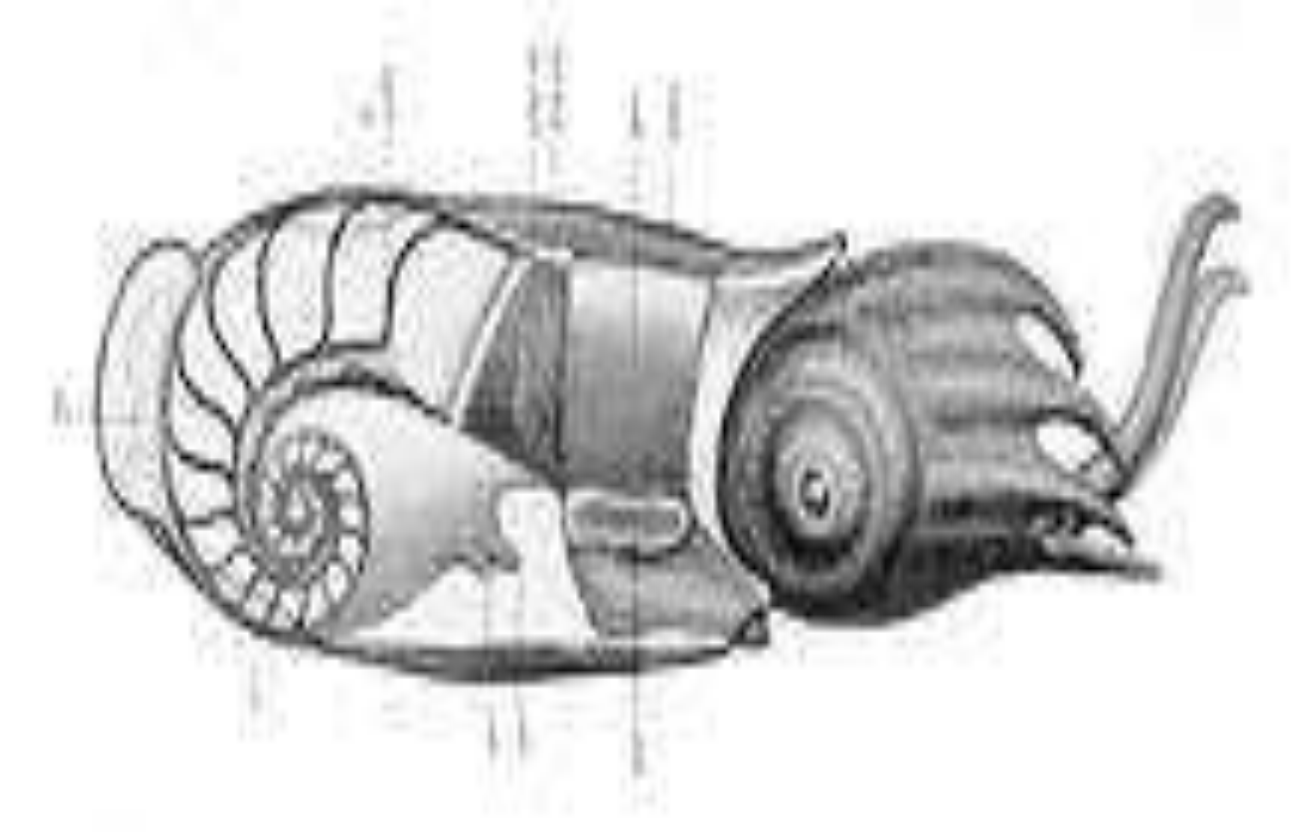
Octopuses swim headfirst, with arms trailing behind

- Since the Paleozoic era, as competition with fish produced an environment where efficient motion was crucial to survival, jet propulsion has taken a back role, with fins and tentacles used to maintain a steady velocity

Nautilus belauensis seen from the front

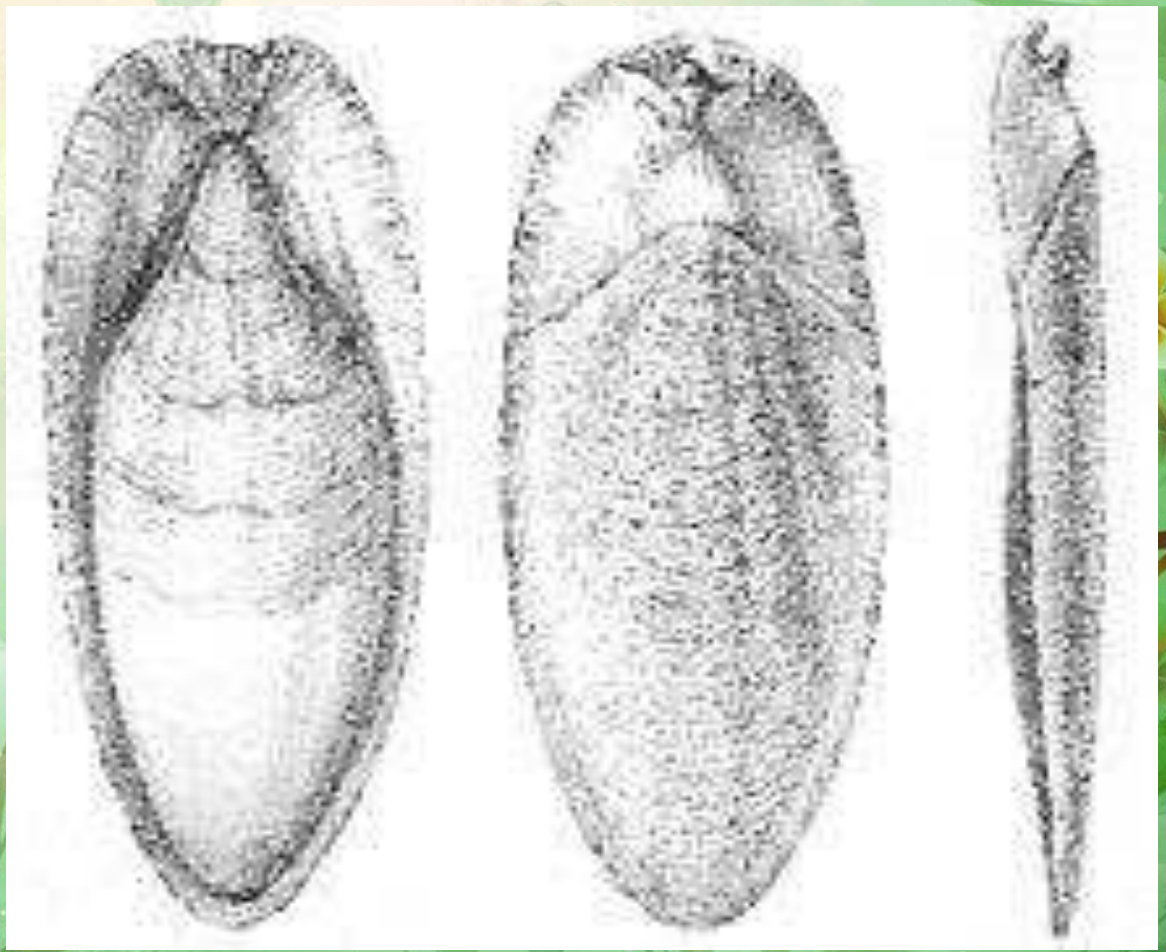
- Early cephalopods are thought to have produced jets by drawing their body into their shells, as *Nautilus* does today. *Nautilus* is also capable of creating a jet by undulations of its funnel; this slower flow of water is more suited to the extraction of oxygen from the water.

Shell



Cirrate shell, Cuttlebone, Gladius (cephalopod), and Mollusc shell

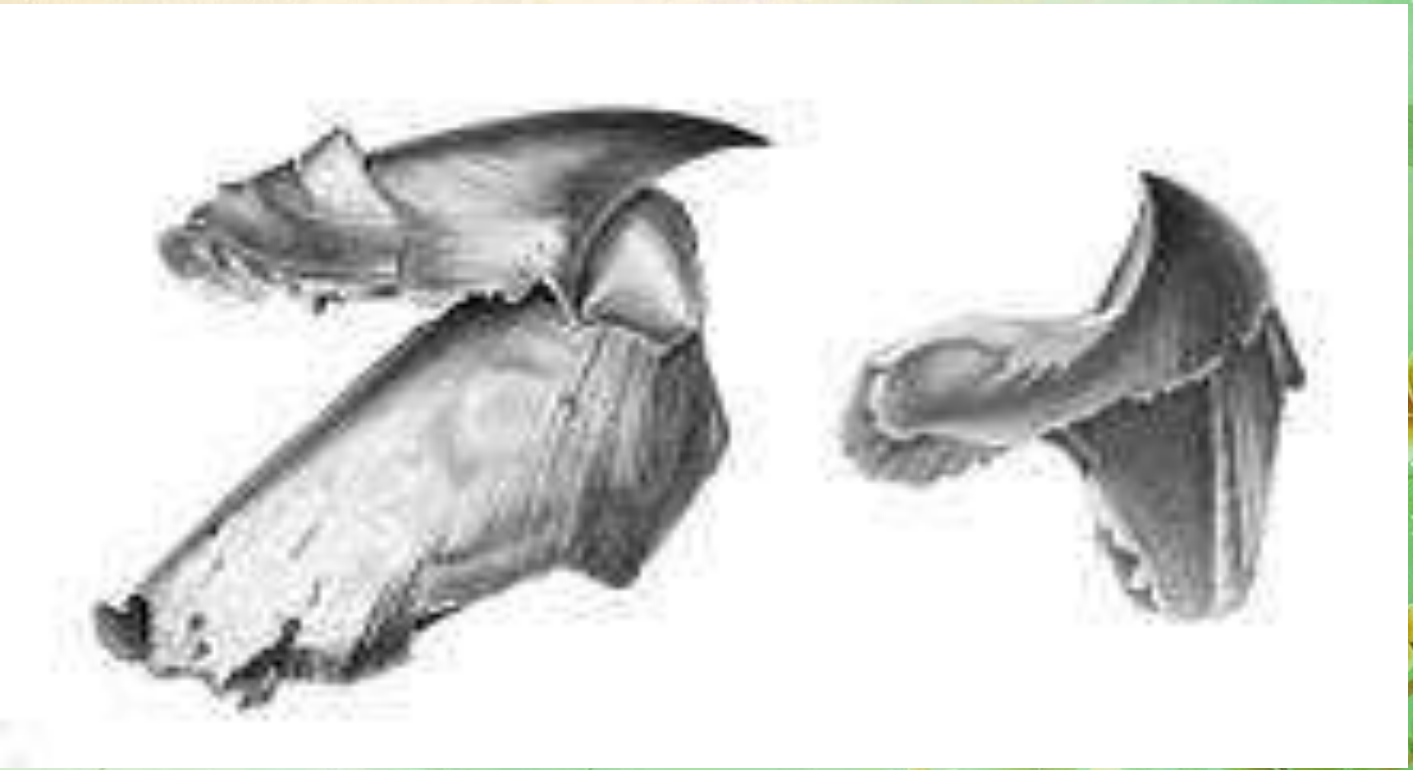
- Cross section of *Spirulaspirula*, showing the position of the shell inside the mantle



Head appendages

- Cephalopods, as the name implies, have muscular appendages extending from their heads and surrounding their mouths. These are used in feeding, mobility, and even reproduction. In coleoids they number eight or ten. Decapods such as cuttlefish and squid have five pairs.

Feeding



The two-part beak of the giant squid, Architeuthis sp.

- All living cephalopods have a two-part beak; most have a radula, although it is reduced in most octopus and absent altogether in*Spirula*. They feed by capturing prey with their tentacles, drawing it into their mouth and taking bites from it

Radula

- *Radula In cephalopods*

Amphioctopusmarginatus eating a crab

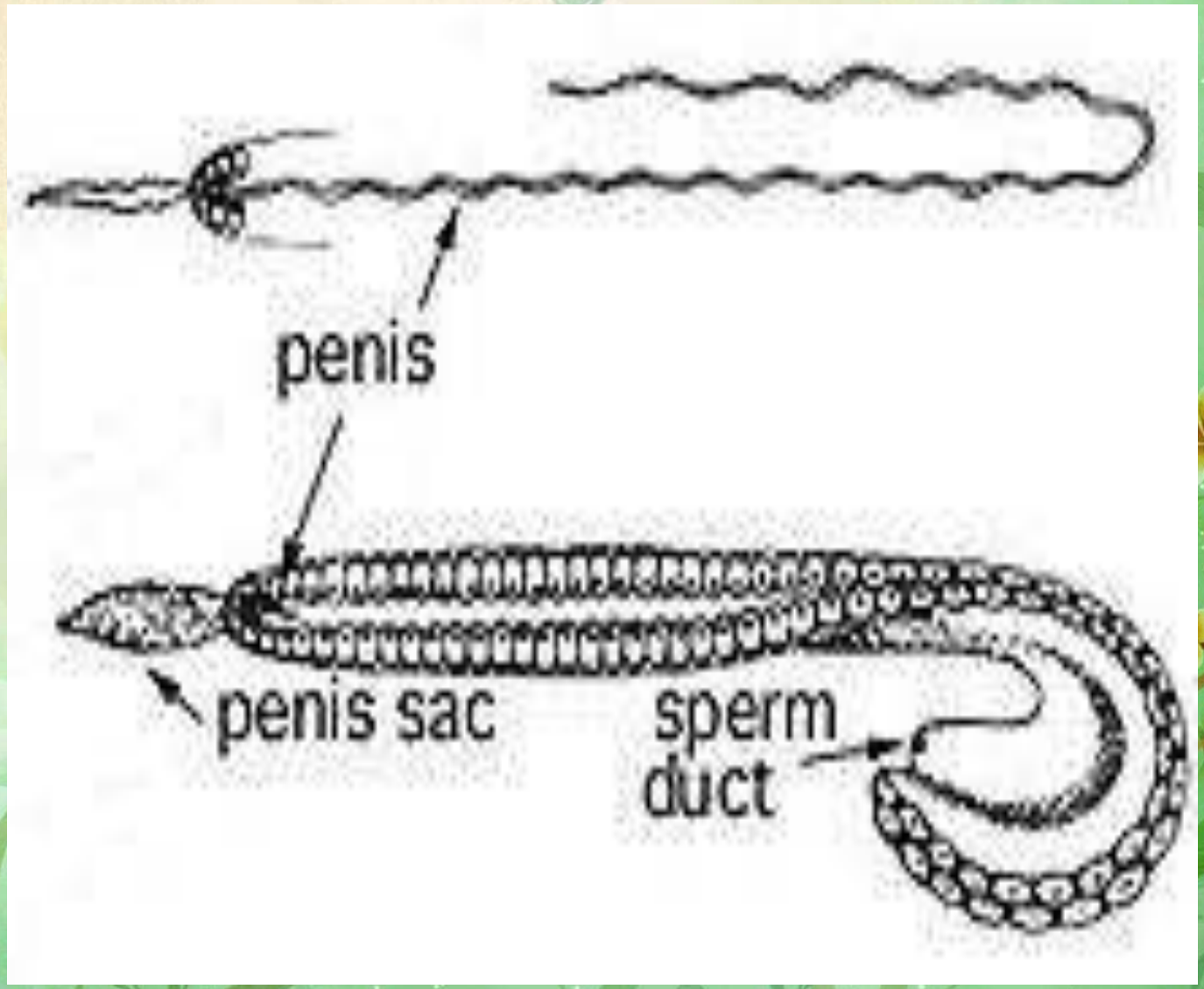
- The cephalopod radula consists of multiple symmetrical rows of up to nine teeth – thirteen in fossil classes. The organ is reduced or even vestigial in certain octopus species and is absent in *Spirula*.

Excretory system

- Most cephalopods possess a single pair of large nephridia. Filtered nitrogenous waste is produced in the pericardial cavity of the branchial hearts, each of which is connected to a nephridium by a narrow canal.
- The canal delivers the excreta to a bladder-like renal sac, and also resorbs excess water from the filtrate.

Reproduction and life cycle

- Female *Argonautaargo* with eggcase and eggs


penis
penis sac
sperm
duct

A specimen of the same species exhibiting elongation of the penis to 67 cm in length

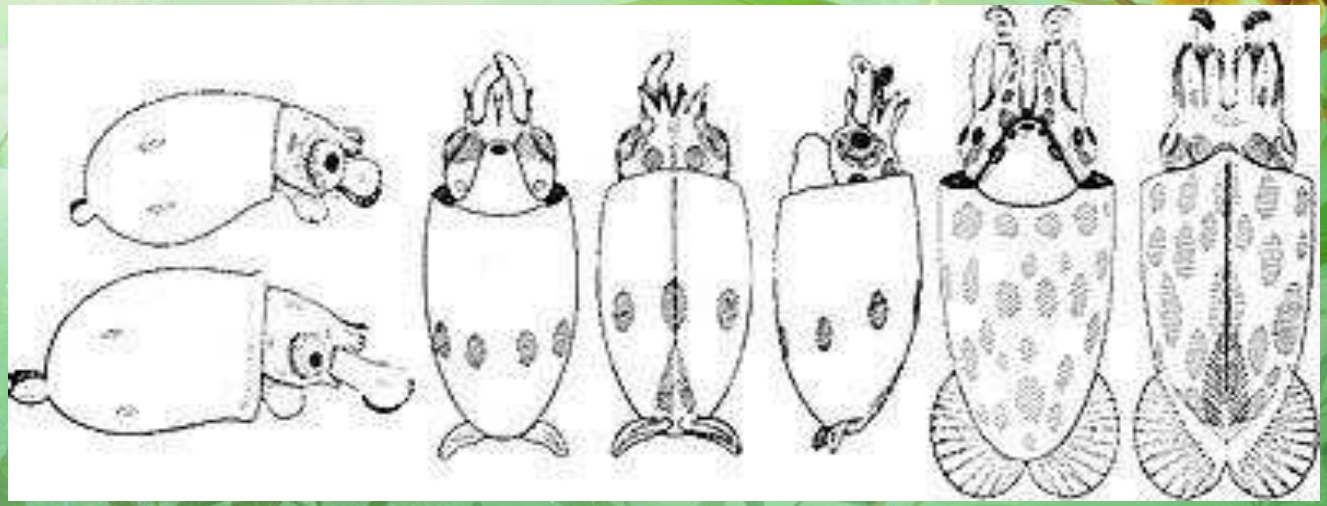
Phylogeny

- The internal phylogeny of the cephalopods is difficult to constrain; many molecular techniques have been adopted, but the results produced are conflicting. *Nautilus* tends to be considered an outgroup, with *Vampyroteuthis* forming an outgroup to other squid; however in one analysis the nautiloids, octopus and teuthids plot as a polytomy.

Embryology

- Cephalopod eggs span a large range of sizes, from 1 to 30 mm in diameter.[78] The fertilised ovum initially divides to produce a disc of germinal cells at one pole, with the yolk remaining at the opposite pol

Development



Evolution

- The traditional view of cephalopod evolution holds that they evolved in the Late Cambrian from amonoplacophoran-like ancestor with a curved, tapering shell, which was closely related to thegastropods (snails).

Taxonomy

- Chambered nautilus (*Nautilus pompilius*)

Chambered nautilus (*Nautilus pompilius*)

Common cuttlefish (*Sepia officinalis*)

Atlantic bobtail (*Sepiolaatlantica*)

European squid (*Loligo vulgaris*)


Thanks.....
• Department of geology.....
• Kc sir.....