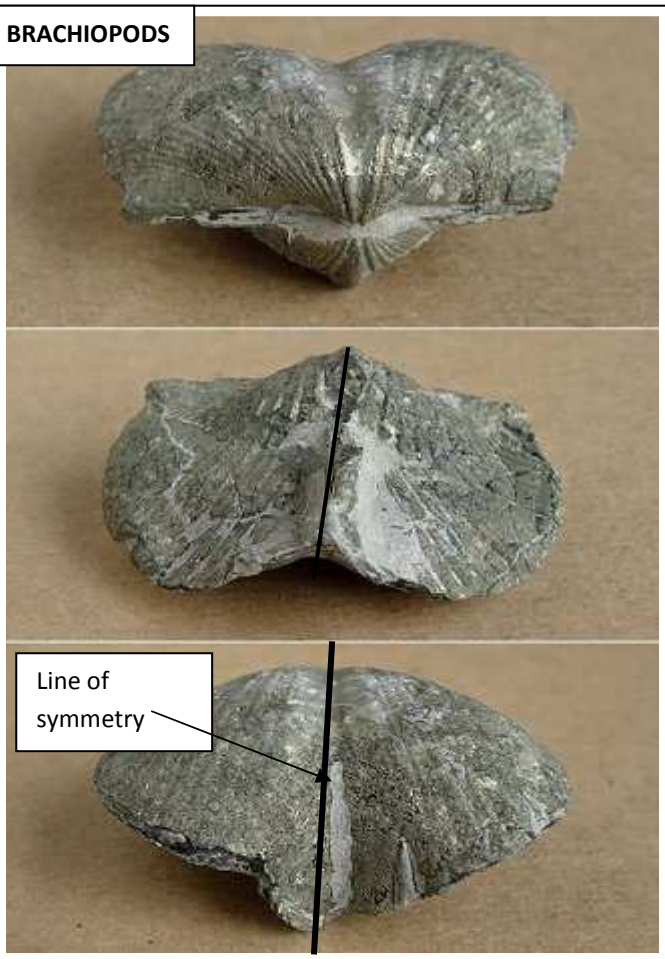
geographyjohn

A2 GEOLOGY

CASE STUDY REVISION BOOKLET

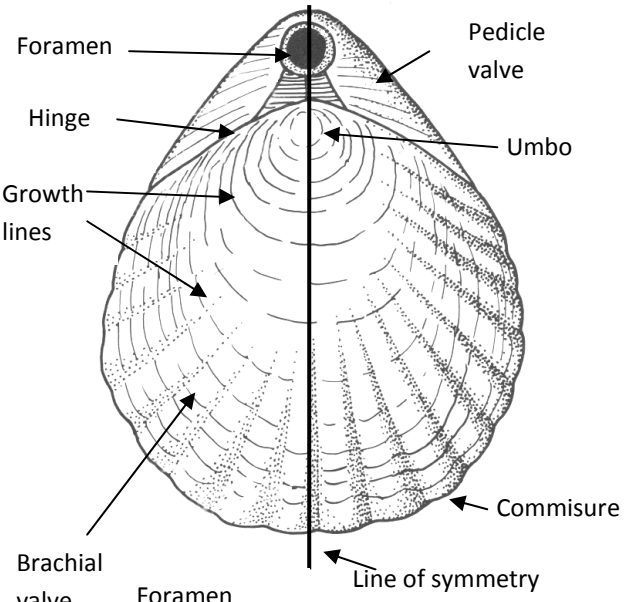
BRACHIOPODS AND BIVALVES

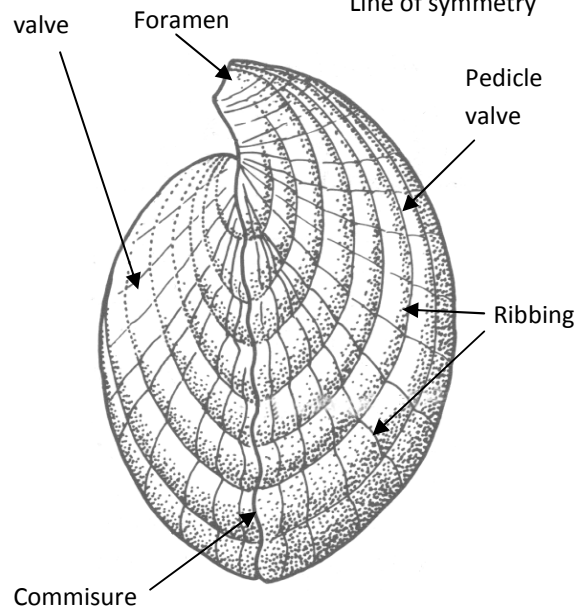
BRACHIOPODS

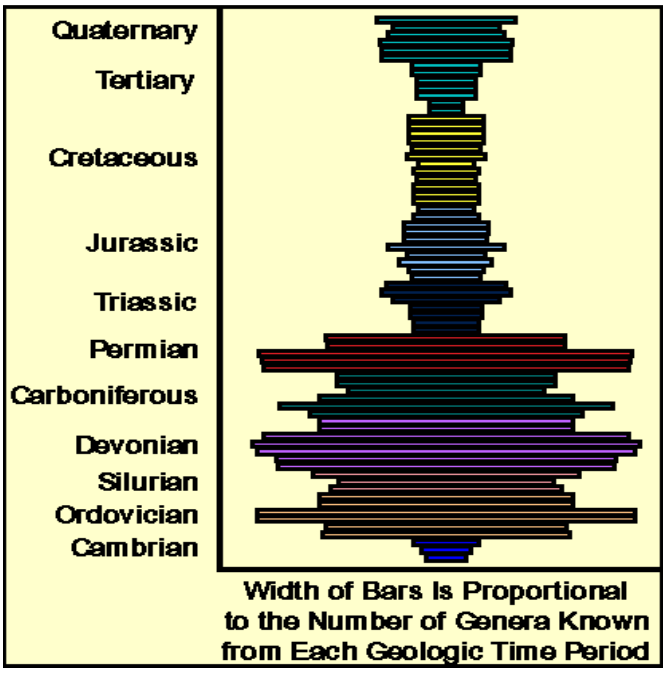


Brachiopods are **benthic** (bottom dwelling), **marine** (ocean), sessile (attached) organisms with two unequal sized valves or shells.They are not equivalved like bivalves but have bi-lateral symmetry. They are rare today but during the **Paleozoic Era** they dominated the sea floors. Numbers of Brachiopods decreased significantly both at the P/T and the K/T mass extinctions. They have their own Phylum : BRACHIOPODA.

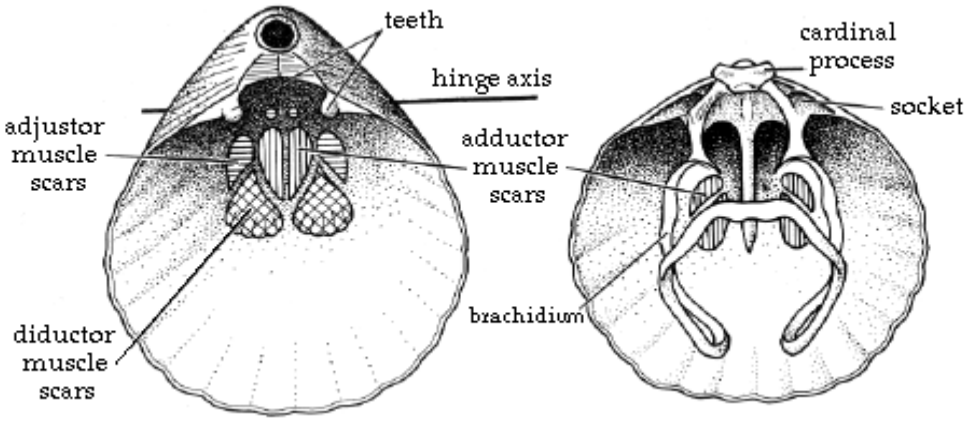
Their shells are usually made of calcium carbonate, and most are articulated with sockets and teeth. They are filter feeders, feeding on micro-organisms.

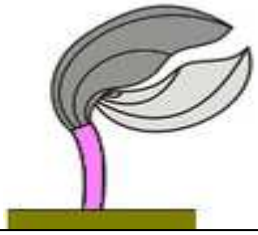






Umbo: Initial point of growth of a valve. It can be located by tracing radial ornamentation to its origin.
Commissure: The commissure is the juncture of the growing margin of the two valves. In some brachiopods the commissure is straight whereas in others it has a zig-zag trace.
Astrophic: Not having a well defined hinge line. A short curved hinge line.
Strophic: having an elongated well defined and straight hinge line.
Sulcus: In many brachiopod shells a "syncline" (sulcus) is found along the midline of one valve.
Pedicle Opening / Foramen: Aperture or slit from which the pedicle emerges. Some brachiopods do not have a functional pedicle and thus do not have any opening.
Teeth and Sockets: Knob-like protrusions (teeth) on the hinge of the pedicle valve fits into the small depressions (sockets) on the hinge of the brachial valve.
Adductor Scars: Mark the attachment sites of valve closing muscles. They occur as a small pair of impressions in the pedicle valve interior and as larger impressions on the brachial valve interior.
Diductor Scars: These mark the attachment sites of valve opening muscles. They occur as a large pair of impressions only on the pedicle valve interior where they are either outside or enclose the smaller adductor muscle scars.
Cardinal Process: A knob at the mid-line of brachial valve interior to which the diductor muscles attach.

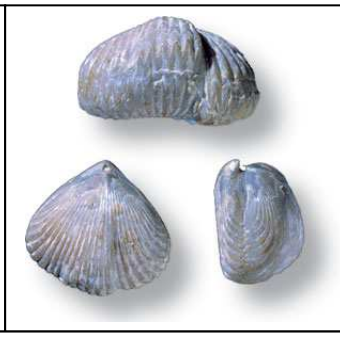




Brachiopods attach to the sea floor with a fleshy stalk called a **pedicle.** This is a muscular feature that allows the brachiopod to align itself into the current to aid feeding and respiration.

Adaptation to turbulent water

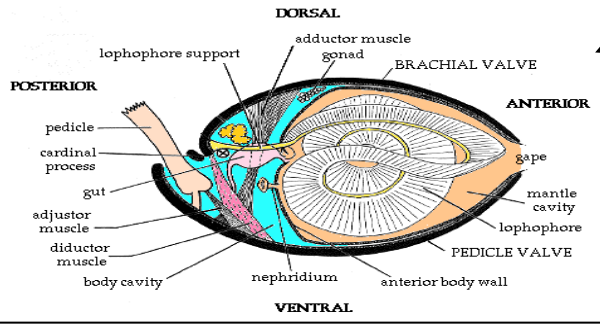
- Thick shell to increase stability, prevent rolling and give strength.
- Strongly ribbed to add strength
- Zigzag commisure and large sulcus to prevent sediment entering and separate inflow and outflow
- Large foramen to support large, thick pedicle to attach strongly to sea bed
- Astrophic, short curved hinge line



Adaptation to quiet water

- Strophic hinge and extended wings to valve to prevent sinking in mud
- Smooth valves, little ribbing needed in low energy environment
- May not habe pedicle or foramen as not attached to mud
- Distinct sulcus to separate water currents in and out
- May have spines to help anchor in the soft mud.

SPIRIFER

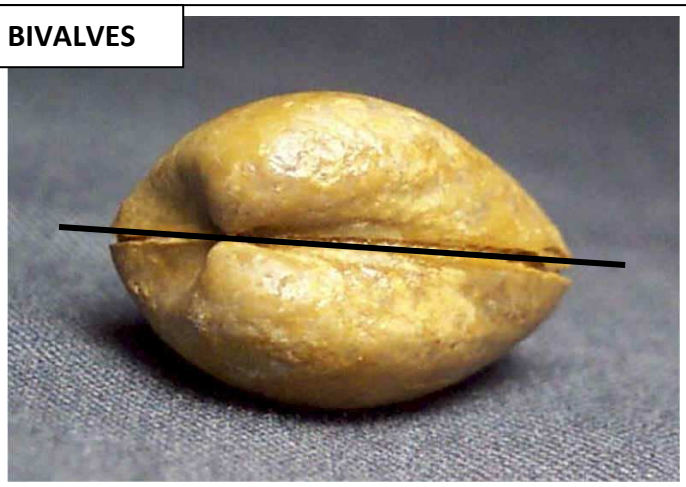


Footnotes on Brachiopods

You do not need to know all the details of the internal structure diagram opposite.

ONLY : How the diductor and adductor muscles are used to open and close the shell
AND : How the lophophore is used as a filter feeding mechanism

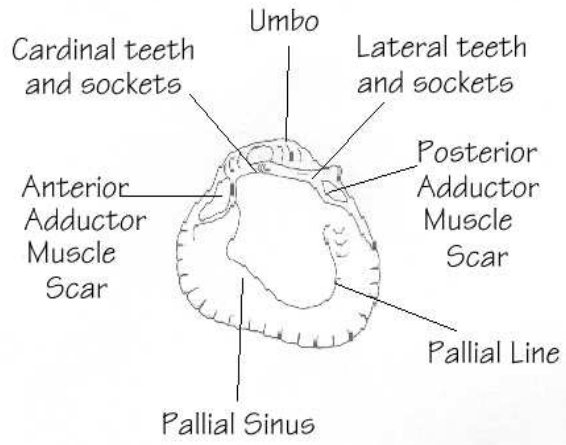
BIVALVES



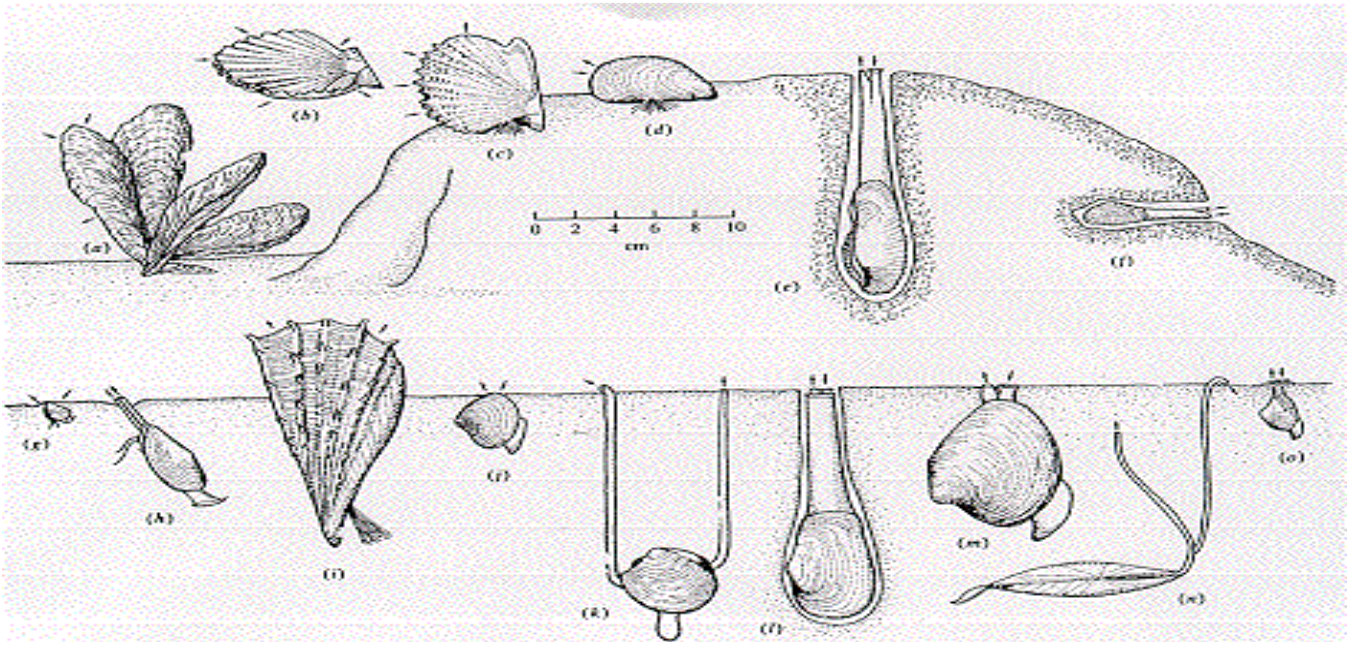
Bivalves belong to the Phylum MOLLUSCA and are still common today. Common present day bivaves are cockles, clams, scallops, mussels and razor shells. They have calcium carbonate shells and are usually EQUIVALVE, the valves (shells) are equal in size and the line of symmetry runs along the hinge line (see photo opposite). Gryphaea is one of the few with unequal valves (INEQUIVALVE).

The hinge has teeth and sockets that allow the shells to ARTICULATE (open and close).

The outside of the shell usually shows growth lines and may have ornamentation such as ridges.



The inside of the shell often shows:-
Pallial line – marking the limit of the atachment of soft tissue to the shell.
Adductor muscle scars (anterior and posterior) - which show where the muscles were attached to the shell to keep the shells closed.
Pallial sinus – an indentation in the pallial line to show the presence of siphons
FEEDING – Most feed by using siphons, inhalant and exhalent. This separates the oncoming fresh water which passes through the gills and is filtered to extract minute food particles from the outgoing used water. Deeper burrowing bivalves have longer siphons to reach the top of the burrow.
MOVING – Bivalves dig with a muscular foot, but may also be sessile (attached) to the seabed or even nektonic (free swimming).



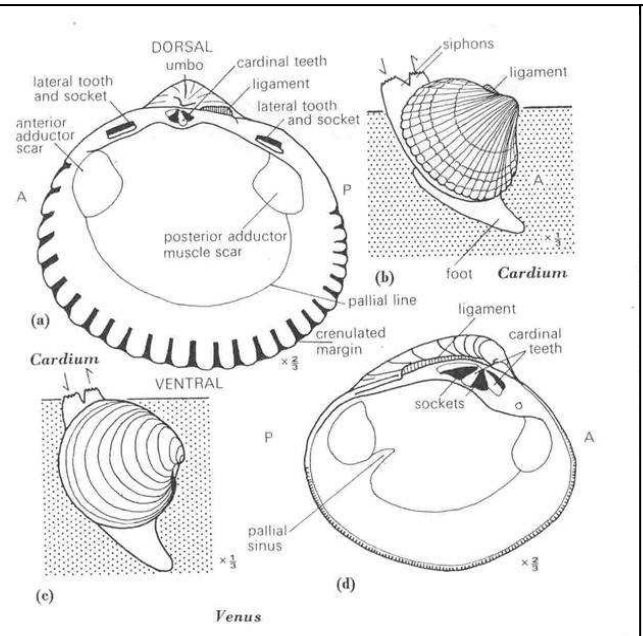
The diagram above shows that bivalves adapted to several modes of life, environments or ecological niches. Most are/were Benthonic, living on or in the sea bed in high energy shallow seas or calmer deeper waters; they also show freshwater forms. The mode of life led to adaptation to the morphology of the shell and variation in the internal structures. Common modes of life:-

SHALLOW OR DEEP BURROWERS – The length of the siphons and the size of the pallial sinus indicate depth of burrowing.

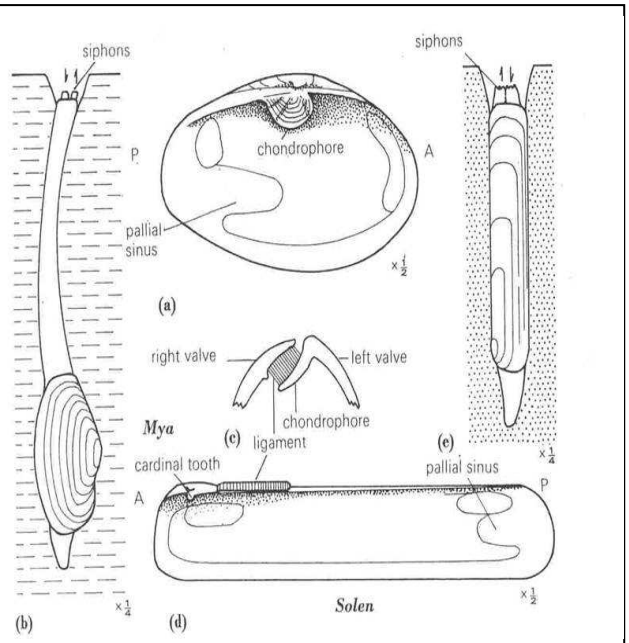
FREELYING - Gryphaea had unequal valves to lower its centre of gravity and rest on the muddy sea bed.

ATTACHED TO THE SEABED BY CEMENT OR A BYSUSS - Ostrea / oysters secrete cement to attach to the sea bed other bivalves attach by a byssal thread.

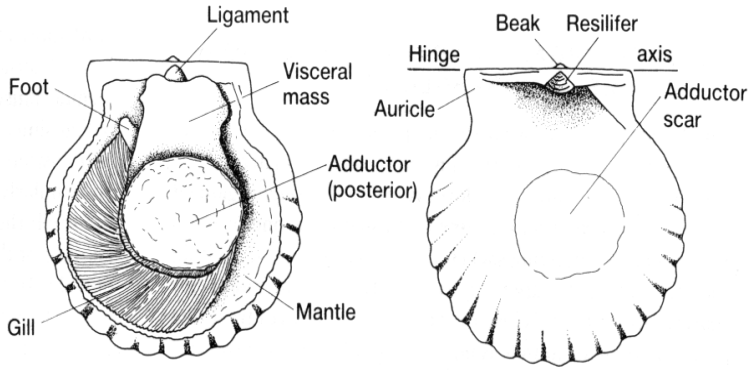
BENTHONIC VAGRANT (NEKTONIC) - Scallops can 'swim' in short bursts by clapping the two shells together.



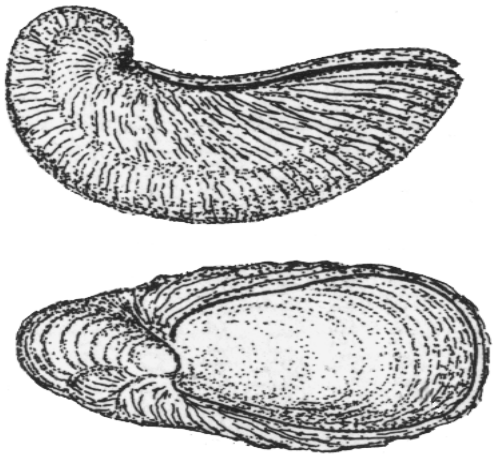
Shallow infaunal – short siphons, shallow sinus, round shell



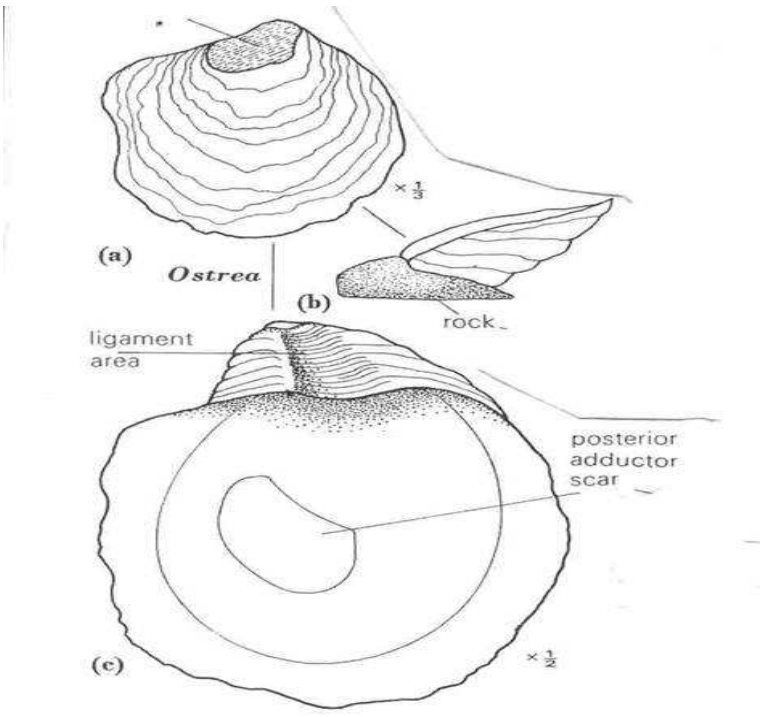
Deep infaunal – long siphons, deep sinus, elongated shell



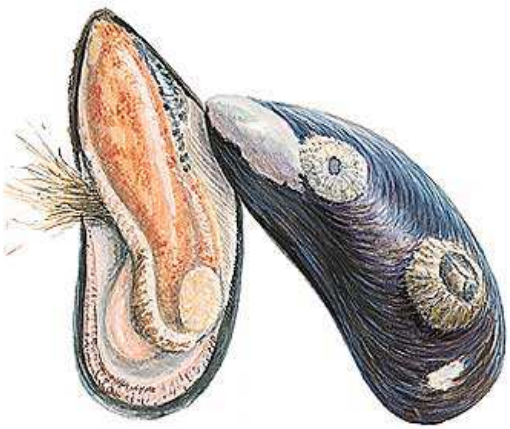
Nektonic : Pecten – flat valves to give hydrofoil effect, one large, strong muscle to open and close valves, thin ribbed valves.



Freelying : Gryphaea – strong, thick shell for high energy currents; curved rounded left valve to stop shell sinkung into mud (snowshoe effect); low centre of garvity aids stability.



Ostrea : strong, thick shell cemented to sea bed. One strong muscle due to high energy conditions and to keep shell closed at low tides. Unequal valves, but flattened to stay near sea bed.



Mytilus : byssally atached to the sea bed, which allows them to move around in currents to aid filter feeding. May have a byssal notch or gape.