Geometry in sea life

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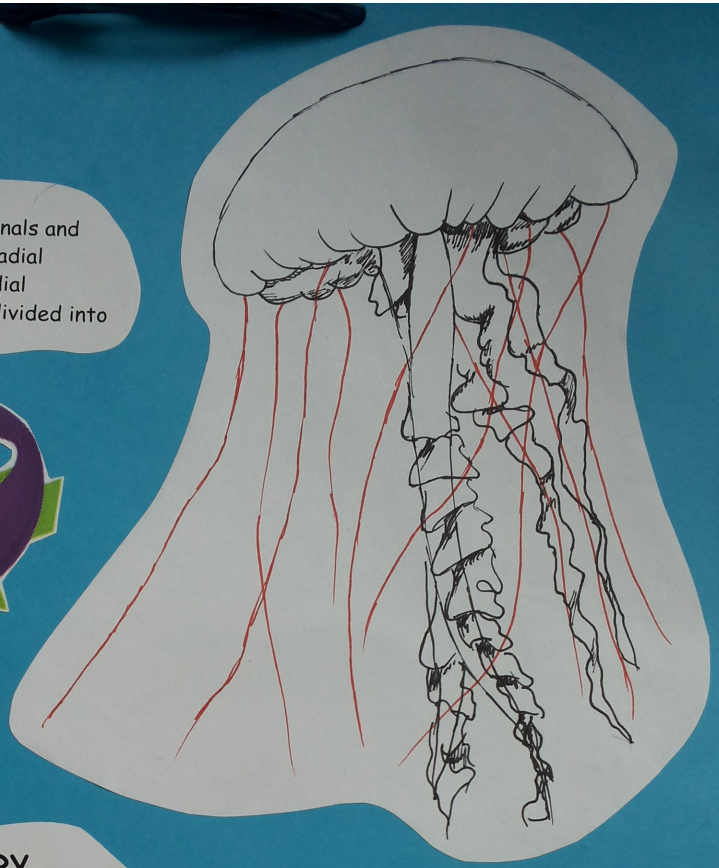
TETRAMERISM

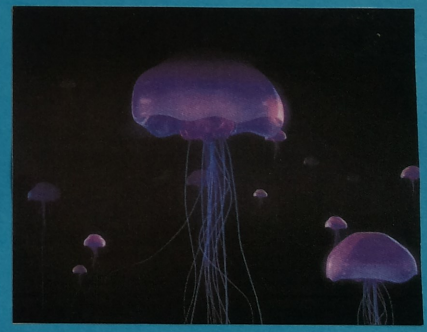
JELLYFISH

Many jellyfish have four canals and thus exhibit tetramerous radial symmetry. This form of radial symmetry means it can be divided into 4 equal parts.



RADIAL SYMMETRY

Most radially symmetric animals are symmetrical about an axis extending from the center of the oral surface, which contains the mouth, to the center of the opposite, or aboral, end. This type of symmetry is especially suitable for sessile animals such as the sea anemone, floating animals such as jellyfish, and slow moving organisms such as sea stars. Animals in the phyla cnidaria and echinodermata exhibit radial symmetry, although many sea anemones and some corals exhibit bilateral symmetry defined by a single structure. The echinodermata however have bilaterally symmetric larvae, and are thus classed as bilaterians.

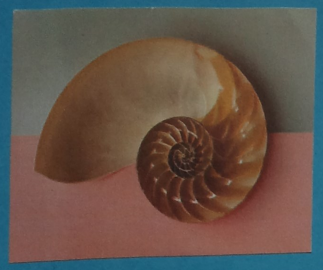


PENTAMERISM

STARFISH

With their appealing symmetrical shape, starfish have played a part in literature, legend, design and popular culture.

The larvae of echinoderms have bilateral symmetry but this is lost during metamorphosis after which they develop radial symmetry, typically pentamerism. This variant of radial symmetry (also called pentaradial and pentagonal symmetry) arranges roughly equal parts around a central axis at orientations of 72° apart. It can also be seen at the other members of the phylum Echinodermata such as sea urchins and sea lilies.



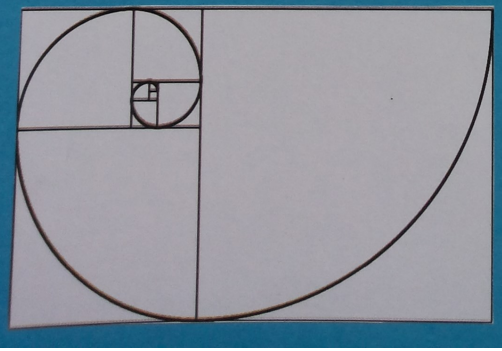
Shells

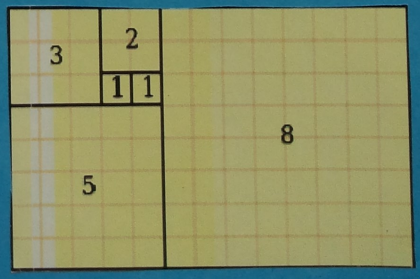
Fibonacci sequence is a series of numbers:

0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377...

The first two numbers are 0 and 1 and others are the sum of the previous two (1=1+0,2=1+1,3=2+1,5=3+2...).

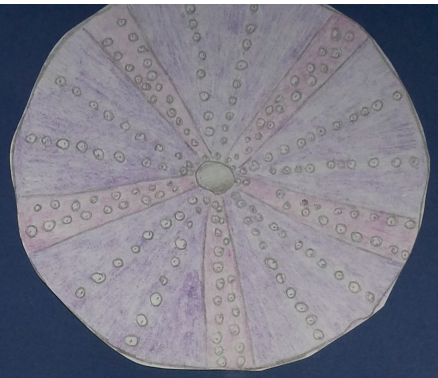
In nature, Fibonacci number pattern occurs frequently. One of the best examples is a seashell. It is a fractal and it is defined by Fibonacci numbers. The spiral of the shell can be easily created by drawing two side-connected squares and adding a square to the rectangle's longest side in every step. The opposite corners of the squares can be connected by quater-circles and the result is a spiral curve.





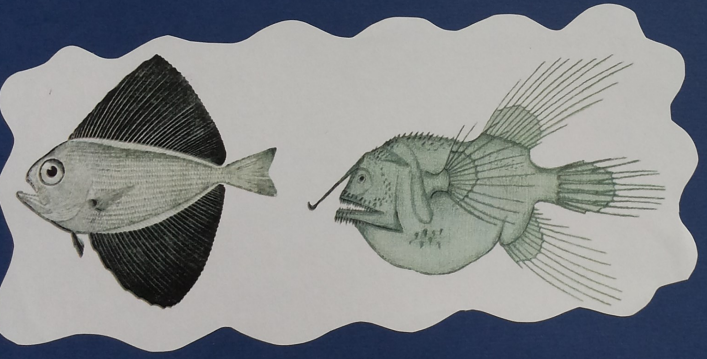
SEA URCHIN

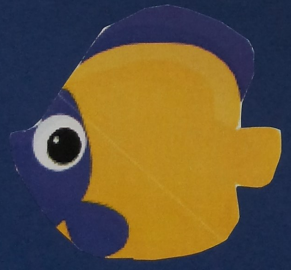
Like other echinoderms, sea urchins are bilaterans. Their early larvae have bilateral symmetry, but they develop fivefold symmetry as they mature. This is most apparent in the "regular" sea urchins, which have roughly spherical bodies, with five equally sized parts radiating out from their central axes.

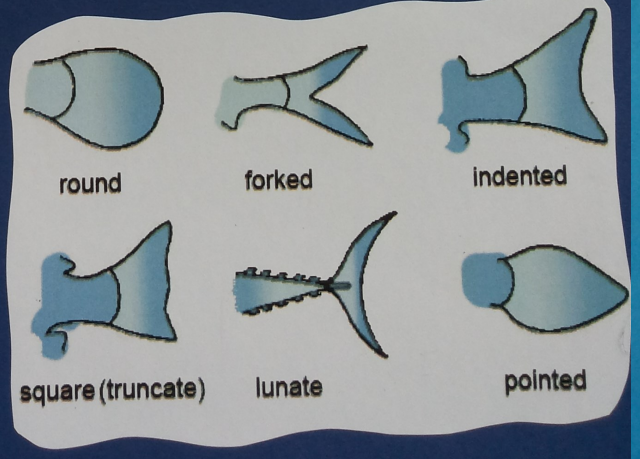


Fish

The most recognizable part of the fish is a fin. Fish use fins while swimming so the structure of fins must be very strong. Fins are composed of many parallel body spines. Fins can be in different shapes: rouned, forked, pointed, indented, lunate or square.

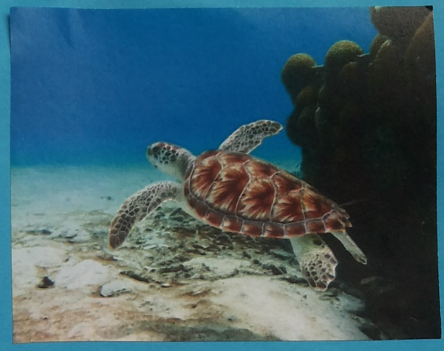






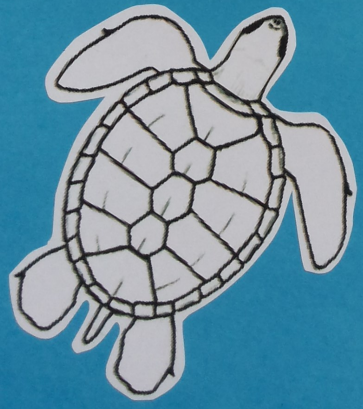
Sponges

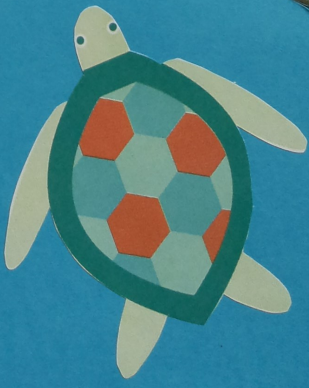
There are sponges that have specific tube shape. The tubes can be one to two meters tall with 30 cm diameter.



Sea turtles

Sea turtles have symmetry as well. Their shells have many different geometric figures, especially polygons. Most sea turtles have a few hexagons in the center of the armor. Rectangles surround the shell and form a border.





HEXSAMERISM & OCTAMERISM

CORALS & SEA ANEMONES

Corals and sea anemones are divided into two groups based on their symmetry. The most common corals have a **hexameric** body plan; their polyps have sixfold internal symmetry and the number of their tentacles is a multiple of six.

Other group of Corals have polyps with eight tentacles and **octameric** radial symmetry. The octopus, however, has bilateral symmetry, despite its eight arms.