Did you know that mathematical structures exist in nature?

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Here are some examples.

Fibonacci Numbers:
Notice that the number of petals in a flower is often one of the following numbers: 3, 5, 8, 13, 21, 34 or 55?
For example, buttercups flowers have five of them, the daisy has often 13, 34 or 55 petals. Marigolds have 3, or 5 petals. Jasmine has 5.

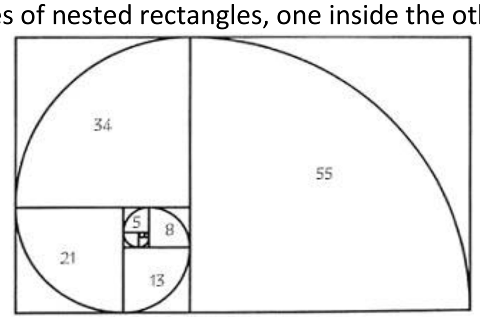



Furthermore, when one observes the heads of sunflowers, one notices two series of curves, one winding in one sense and one in another.

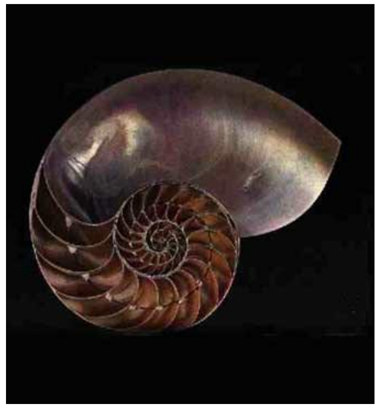
The number of spirals in general either 21 and 34, either 34 and 55, or 55 and 89, or 89 and 144? Are these numbers (flowers petals and sunflower spirals) the product of chance?

No! They all belong to the Fibonacci sequence: 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, etc. (where each number is obtained from the sum of the two preceding ones). Fibonacci sequence plays a critical role in Mathematics and Computer Science.

The Golden Mean:
The golden mean or ratio is approximately 1.61803. This magic number possesses the following unique and exceptional property. If one constructs what is called a golden rectangle, that is to say, a rectangle for which the ratio of the sides a/b is equal to the golden mean. If a square is removed from it, one obtains again a golden rectangle. This process can be repeated to obtain in this way a series of nested rectangles, one inside the other in the form of a spiral.



This very special spiral (called the logarithmic spiral) is exactly that of the nautilus shell and of certain snails (the planorbe or flat snail).



One finds it also in the horns of certain goats (markhor, girgentana), in the shape of certain spider's webs, as well as the takeoff line of certain colonies of bat.

Animal Coat Pattern Formation:
Some phenomena that one believed to be owing to chance or to the action of genes are revealed to be the consequence of mathematical dynamics. One example is that of the pattern on the coats of animals.
Why are the coats of certain types of animals such as the leopard spotted, whereas the coats of others are striped (tiger, zebra)? Why do some animals, such as the cheetah and leopard have spotted bodies and striped tails, but there are no animals with striped bodies and spotted tails?

All of these questions now have a mathematical answer.

The model in question describes the way in which two different chemical products react and are propagated on the skin: one which colors the skin, and one which does not color it; more precisely, one which stimulates the production of melanin (coloring the skin) and one which inhibits this production. This reaction has a simple mathematical expression.

Knots, Viruses and DNA:
In order to fight the action of viruses which cause so many diseases, biologists have started using the theory of knots, once thought of as a totally pure branch of mathematics (Topology). One of the goals of this theory is to classify all types of knots. Of course, one can easily differentiate visually the simple knots, but this task quickly becomes difficult with more complicated knots. Mathematics makes this study feasible and leads to better understanding of viruses and DNA's