

Plant Pattern Formation as a Dynamical System

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Abstract

Phyllotactic patterns (from the Greek phyllo (leaf) and taxis (order)) arise whenever a vascular plant produces at its growing tip a series of similar botanical elements, such as leaves, scales or flowerets. The most common and well known of such patterns is one where the elements are arranged in two families of spirals winding in opposite directions. The numbers of spirals in each of these families are, remarkably often, successive numbers in the Fibonacci sequence 1, 1, 2, 3, 5, 8, 13, 21, ... where each term is the sum of the previous two. This phenomenon, observed for centuries, has not yet received a satisfactory explanation.

We propose a discrete dynamical system model for plant pattern formation which is compatible with most of the biochemical or biophysical mechanisms that have been conjectured as underlying these patterns. This relatively simple model offers an accessible explanation for the predominance of Fibonacci spiral patterns. It also affords a proof of the dynamical stability of these patterns.