Generating Patterns

It may go against an old saying, but leopards' spots can change as the leopards mature. How animal patterns develop from the cellular level is an important question for biologists and mathematicians. Differential equations governing how the pattern-related chemicals inside cells interact with one another explain how a collection of identical cells—which is how living things begin—can evolve into an animal with spots or stripes (and sometimes both). In fact, scientists used the equations to make the surprising prediction that stripes on adults of a certain species of angelfish move along the body, which was later confirmed by observation.

Another startling result came from researchers studying a species of lizard that begins life brown with white polka dots and then changes to a labyrinth-like pattern of bright green and black dots. The breakthrough is the discovery that changes from black to green and back again occur according to rules like those of a cellular automaton, an abstract model developed by mathematician John von Neumann. A black dot is more likely to switch to green when it's surrounded by other black dots than when it's among green dots. When the colors stabilize, black dots are surrounded by an average of three green dots, and green dots have an average of four black dots around them. Although cellular automata are well-known, e.g., the Game of Life, and often create interesting patterns, this is the first known instance of a cellular automaton being realized in a creature's skin pattern.

For More Information: "A living mesoscopic cellular automaton made of skin scales," Liana Manukyan et al., *Nature*, April 13, 2017.

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