Lesson 9: The Definition of Life

What makes something alive? It sounds obvious: a dog is alive and a rock is not. But the closer you look, the trickier the question becomes. Is a virus alive? It can reproduce, but only by hijacking another cell. Is a crystal alive? It grows. Is a fire alive? It consumes fuel, grows, and responds to the wind. Drawing a careful line between living and non-living turns out to require real thought, and scientists have spent a great deal of effort getting this right.

The answer they have agreed on is a set of shared characteristics. Every living thing is made of one or more **cells**, tiny enclosed packages of chemistry, each one sealed from the outside world by a membrane. Every living thing has **metabolism**: all the chemical processes that turn food into energy and keep the organism running. Every living thing grows and develops. Every living thing responds to its environment. Every living thing **reproduces**, passing its traits forward. And all of this is directed by instructions encoded in a molecule called **DNA**, which every living cell contains.

DNA is one of the most important molecules ever discovered. It is found inside the cells of every living thing on Earth, from the smallest bacterium to the largest blue whale, and it carries the recipe for building and running the organism. Remarkably, all life uses the same DNA code. The same four chemical letters spell out the instructions for a bacterium, a mushroom, a fish, and a human. This shared code is one of the most powerful pieces of evidence that all life on Earth descended from the same ancient ancestor.

All life is one family. No matter how different a whale looks from a dandelion, no matter how alien a deep-sea bacterium seems from a butterfly, they share the same fundamental chemistry, the same molecule carrying their instructions, the same cellular architecture. Life is not a collection of separate inventions. It is one long, branching, interconnected story, and we are part of it.