Chapter 11

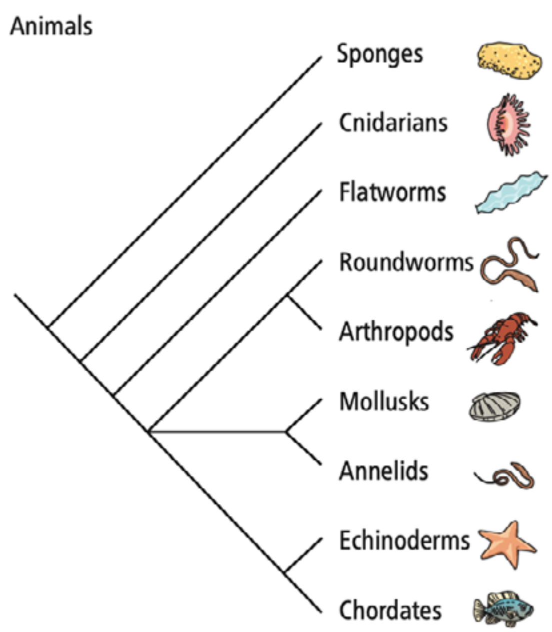
Diversity of Life 2

11.6 Life Is Interconnected

Placing living organisms into distinct branches of an evolutionary tree provides a broad overview of how these living organisms, ourselves included, are related. This has value. Probing deeper, however, we find that all living organisms here on Earth are deeply interconnected, even those within separate branches.

For example, vital components of eukaryotic cells have a bacterial or archaeal origin. Specifically, the mitochondria and chloroplasts found in eukaryotic cells are remnants of bacteria or archaea that were captured by an early eukaryotic cell that later evolved a mutually beneficial relationship with them. Mitochondria and chloroplasts now provide eukaryotic cells with the means to carry out cellular respiration and photosynthesis respectively, helping eukaryotic cells obtain energy.

Similarly, soon after the human genome was sequenced in the early 2000's, it was discovered that about 8 percent of the nucleotide sequences in our DNA is of viral origin. This is viral DNA that passes down from one generation to the next in our human lineage. Our very genetic identity is about 8 percent viral. But it gets even more profound: This viral DNA within us has been found to play a key role in the development of the placenta. This suggests that a viral infection many years ago eventually allowed for the evolution of pregnancy as we know it in placental mammals. If true, we can thank a virus for allowing us to give birth to mature young.



Horizontal gene transfer (HGT) describes the movement of genetic material from one organism to another through a path other than the usual transmission of DNA from parent to offspring. Both the examples above describe important past instances of HGT.

HGT also explains one way bacteria can become resistant to antibiotics fairly quickly. Answer: One bacterium that through mutations has become resistant to the drug can transfer its drug resisting genes to a neighboring bacterium, even if it is of a different species. Horizontal gene transfer occurs in nature regularly and can play an important role in evolution.

The CRISPR technology described in Chapter 7 shows how humans can use technology to transfer genes horizontally from one organism to another as well. This technology is revolutionary as it allows us to manipulate our own genome within a single generation to a variety of ends we might desire. It may allow us to cure genetic diseases such as sickle cell anemia, cystic fibrosis, or muscular dystrophy. It can also potentially include designing new traits for future generations—from higher IQ's to greater athleticism, which is fraught with ethical issues.

So zoom closer into any evolutionary tree and you'll find innumerable tangled relationships among seemingly unrelated branches. We may seek simplicity when it comes to classifying life. But when it comes to life itself, the name of the game is complexity with a heavy dose of interconnectedness. There is still much we have yet to learn about the fundamental nature of life. But what we have discovered so far is beyond fascinating.

READING CHECK

Zooming into the branches of any evolutionary tree, what would one find?

CHECK YOUR ANSWER

One would find that those branches have connections between them, especially given the ability of DNA to transfer between different life forms.

To learn about the history of the evolutionary tree and the development of our understanding of Horizontal Gene Transfer, consider reading "The Tangled Tree" by David Quammen.

https://www.simonandschuster.com/books/The-Tangled-Tree/David-Quammen/9781476776637