

Lessons from the Earth: Past and Present
Lessons we learn from the Past
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“The essential quality of life is living; the essential quality of living is change; change is evolution: and we are part of it.” From *The Chrysalids* by John Windham

What lesson can we learn from the Earth and the “Story of Life”?

The phrase, “The Story of Life”, may bring forward different images for different people. When I think of **Life**,-- I view the immensity of life -- as it shares its roots with the origin of the universe, -- and, the formation of the earth we live on. This is the starting point for the “Story of Life”, a story I want to share with you today.

Life on earth is a product of the earth itself. That is,-- the elements that make up a living cell are all common elements found in our early earth. The potential for these elements to combine, to form complex organic molecules that formed the early “soup of life” is a natural phenomenon. This early capsule of life was fed with accreting organic molecules. These became the early simple cells that multiplied, and over millions and millions and millions of years, adding up to billions and billions of years, they diversified, and they became different species with different genetics and different abilities to cope with their environments.

Then-- Some thing wonderful, something special began to happen. Some cells went to live inside of other cells. These included cells that had developed special abilities, such as the ability to produce food (these became the chloroplasts that live today in the cells of green plants). Other cells had the ability to manage the business of the cell (these became the nucleus in cells today). Other cells had the ability to produce energy from food (these are known as the mitochondria in cells today). The incorporation of one cell into another cell, in which the original cell gives up part of its identity but continues to function with increased benefit to both cells, is called *Endosymbiosis*. It took life over 2 billion years of life before these co-operative events took place, that was about 1.2 billion years ago. When cells finally had nuclei, sexual reproduction became common and important. Sexual reproduction provided the tools important in genetic recombination.

This established the pattern of cellular organization for all life to follow. Cells began to cluster together, resulting in multicellular organisms that could develop complex systems to manage all aspects of their living. Then the pace of evolution increased dramatically and we see an explosion of diverse life forms about 500 million years ago.

The major events in the evolution of life is mostly a story of co-operation rather than the “tooth and claw” type evolution we have so often heard about and learned from text books. By 500 million years ago life had become so diverse throughout the world; it is so amazing, so vibrant and sometimes so fragile. It is appropriate to celebrate the “Story of Life” in all its diversity, and look at its past with a hope for its future on Earth Day this week.

Now, heeding the admonitions of the Bible in Mathew and Luke, “to consider the lilies of the field” --and in Proverbs to “Go to the ant, consider her ways and be wise” ---

let us consider a few examples of the cooperation of life through time. Remember, the major theme of evolution is *success through cooperation* in plants and animals.

Take the lichens that are commonly found growing on tree trunks in Florida or barren rocks in harsh environments--- Lichens are an ancient cooperative venture, where an alga and a fungus live together. The alga feeds the fungus and the fungus protects the alga.

Or consider land plants and fungal mycelia---The roots of most land plants do not have sufficient surface area or the ability to absorb water and the nutrients necessary for a plant to live. But the roots of nearly all land plants live in cooperation with fungi that spread out their mycelia into all the fine cavities holding water and nutrients between the soil particles and transport them to the root to be taken up by the plant. Without this cooperation between fungi and plants we would have very few plants living in our gardens today.

Flowering plants are a subject of my own research, and they are great examples of success through cooperation in the evolution of life. The bright and marvelous colors, the patterns of petals, the fragrances and the nectar rewards are all a flower's way of enticing an animal to visit them and to pick up and carry their genetic material to another population of the same species of plant. It is the plant's way of exchanging genetic material for successful reproduction.

One or two animal examples that I would like to share with you are--- In Africa there are birds that eat meat from between the crocodile's teeth while the crocodile holds its mouth wide open. The bird gets a meal and the crocodile gets its teeth cleaned. It takes a bit of trust on the bird's part to step into the open mouth of a crocodile, but ---- both win by cooperating.

Another example, that I've had personal experience with, is the Bull Horn Acacia and its ant protectors. The first time I met a bull horn acacia shrub was in Costa Rica, I went up to it and broke off a small branch in order to look at the leaves and thorns more closely. Immediately the ants swarmed out of the thorns, where they lived, and were all over my hands biting me fiercely. I learned a great lesson that day. That is-- that the ants protect the bull horn acacias from all intruders and also trim away all plants that grow under or too near their acacia bush--their home. The Acacia, in turn feeds the ants, producing special food bodies on their leaves and the inflated thorns provide shelter and a place for the ants to live. This is a plant--ant cooperative association that has great benefit to both the plant and the ant.

We, as humans, share our lives with some very important and essential organisms. We have human symbionts. The co-evolution of humans with their intestinal microflora -- the bacteria that live in our intestines, for example, has resulted in a cooperative relationship that has shaped our biology, as well as shaping the genetics of these symbiotic partners. We are part of this cooperation of life.

The story of life in the past and the present is one of cooperation. We are now major players in the management of life on this earth. We can see how fragile all life can be on this planet Earth and we need to take a lesson from the past evolution of life on this Earth. The greatest successes of life on earth have always been through cooperation. The important lesson that we should learn from the "Story of Life" is that cooperation always results in the greatest benefits to both partners.