

# MORNING EARTH



Yearning To Be Round

## 6. All Lives Transform: Transformation in Lifetime Scale, Metamorphosis

Note: For a graphic-rich treatment of this material, go [Here](#)

Being is Becoming



Change is continuous everywhere



All life on Earth was originally stardust  
that transformed



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**Each Life changes form in its lifetime**



**The Forms of Lives change over time  
through Symbiosis and Adaptation**



**The Forms of Communities change over time  
through Coevolution & Succession**



**Each Life changes form in its lifetime**



## **Introduction**

### **Mutability: Everything Keeps Changing**

We each began as a single cell egg joined by a sperm cell, then we started dividing and growing, and from then on it's been change, change, change. All lives everywhere are always changing, always transforming into something new. You already know from your own experience that this is true of human life, and now we will explore the ways this is true for the entire system of life on Earth.

In all the universe, change is continuous. Everywhere we look, and in everything we see, there is change. At the enormous scale of the stars with telescopes we observe continuous change. At the even more enormous scale of the galaxies, we see the same thing. When we look at one-cell pondwater beings through a microscope, we see constant change. When we look at our own blood through a microscope, change is what is happening. It is the nature of things to change.

One thing people say to become more comfortable with the inevitability of change is *Being is Becoming*. Another thing we say is that we are all on a journey. And our very human question is, a journey to where?

Transformation and continual change is one of the fundamental facts of the universe, and especially of

the part of the universe we call Life.

To transform means to change shape, or form. Oak trees, frogs, humans, insects, stars, flowers, and everything else in the universe constantly changes its form or shape.

Physical and social transformations as we mature are central to our lives.

The theme of Change is one of the great themes of literature and drama. Ancient Roman and Greek dramas are very concerned with transformation and change, as are, of course, soap operas.

We sometimes make a distinction between form (outward shape) and essence (internal unchanging part).

Whether we have an unchanging part is beyond the scope of Morning Earth, but many think we do.

This is not only a religious question about the soul. It's an every day life question as well.

- a pregnant woman wonders whether her husband understands that her essence is still there, that she is not just her changing body.
- a balding man with a growing pot-belly wonders if anyone else knows that inside him is a little boy shooting hoops.

Transforming is alarming to us. We live in a society that makes some very strange demands on us. Impossible demands. It demands that we be eternally young and never grow up.

On most of Earth, through most of time, old people were valued—they were Elders, and looked to for wisdom and guidance. Here and now, by contrast, our fears of aging are hammered into us with commercials for adult diapers and denture adhesives.

But in many ways, human beings enjoy transforming.

Children become countless other beings during play—now a bird, now a monster, now a superhero—and adults and kids both dream (and daydream) that they are quite different characters with quite different lives than their own.

Whether we are watching a movie, a TV drama, a stage play, or reading a book, we identify with their imaginary characters and virtually become them—sometimes so strongly that we are surprised to return to our actual selves.

Our imagination transforms us in many ways, and one result is our ability to 'feel' ourselves into another person's skin, to 'wear another's shoes'. This ability is the wonderful human ability we call **empathy**.

## The Golden Rule

This imaginative ability to become someone else is at the root of the most universal rule of conduct of our species: *"Do to others as you would have others do to you,"* or *"treat others as you would like to be treated,"* often called the Golden Rule.

The Golden Rule is found in ancient writings from China, Israel, Greece, and Egypt as well as in the Christian Bible in the Gospel of Matthew (7:12): *"In everything, do to others what you would have them do to you. . ."*

If we could not think and feel ourselves into other persons' situations, and in a way briefly transform into them, we could not understand the Golden Rule. Psychologists suggest that some criminals, called sociopaths, are people who simply cannot make that imaginative transformation that can let us know what someone else is feeling. So **transformation by empathy** is a skill of great human value to us.

## Time-Scales

In the reading called *Thinking in Wholes* we talked about thinking in different size-scales, by thinking in terms of sub-wholes and wholes, where most wholes are themselves also sub-wholes of ever larger wholes.

Now we need to think in terms of time-scales. The wholes we are most interested in Time are usually our individual lifespans.

For the next pages, we will be talking in terms of wholes called lifetimes or single generations; for animals, less than a hundred years. We will later be talking in terms of enormously long wholes called geologic eras, which are millions of years long.

## Individual bodies transform during each lifetime

From the moment of conception, transformation is continuous. The fertilized egg of all animals divides

and becomes what we call an embryo.

Earlier we learned that we were once spherical, a hollow ball of cells called the blastula.

When the embryo of an animal develops different tissues with different jobs it becomes a fetus. As the fetus develops and grows, transformation continues.

For a brief time, the fetuses of mammals have gill slits that are like those of fish. For a time we also have tails. Transformation in human beings continues throughout life, but never so dramatically as we transform inside the womb.

Some kinds of lives, especially animal lives, go through dramatic, even bizarre, transformations. Insects are the familiar examples of **metamorphosis** (*meta* (big) *morphosis* (transform)).

A fly begins life as an egg, which hatches into a tiny worm-like maggot which looks nothing at all like a fly. This called the larva. When the maggot grows large enough, it develops a kind of leathery case around itself and becomes a pupa. Inside what used to be the maggot, all tissues break down and virtually liquefy, then begin to form an adult fly inside the protective casing. When the fly is fully formed inside the pupa it emerges into its new adult life.

It comes out of its casing soft and crumpled with a white skin. It spends a few hours swallowing air to expand and dry its body and wings into their final form, and as its color darkens, it flies off to make its living in an entirely new way in an entirely new habitat.

Butterflies and moths are the prime examples of metamorphosis in the media and in elementary school, because the change from larva (caterpillar) to adult is a transformation from a bizarre appearance to a beautiful appearance, and because we enjoy the whole idea of a beautiful creature making its living by drinking the nectar of flowers.

Some insects do not go through this complete change; in some, like grasshoppers, the babies look like tiny adults (much more so than humans) , and as they grow they must shed their skeletons over and over to make room.

## Metamorphosis in One Lifetime: Vertebrates

Frogs and toads and salamanders, the amphibians, begin as eggs floating in water which hatch into tadpoles or polliwogs which look nothing like their parents. They look like an oblong ball with a tail attached.

Tadpoles are vegetarians—they make their living by eating algae. Tadpoles breathe water—they have gills. As they grow, they go through an amazing transformation.

They gradually develop legs, first the front, then the rear, and absorb their tails, which becomes a point on their backside. Internally, they change from a vegetarian to a carnivore. Their intestine as a tadpole is long and coiled like a spring. As it transforms, it becomes short, like all carnivore guts.

In frogs and toads, the tadpole's mouth changes from a kind of algae-browsing mouth into one that opens to shoot out a long tongue that can capture food on the fly. Its gills turn into lungs that breathe air.

When it is done changing from a larva to an adult form, it hops out of the water as a tiny juvenile creature that looks just like the full-grown adult it will enlarge to be.

## Metamorphosis Over Generations

One of the most ancient kinds of animals on Earth is called a polyp.

Polyp animals are a kind of tube, with one end stuck to something solid, and the other end open and surrounded by a flowerlike circle of tentacles which have stingers. The tentacles grab passing prey which touches them and stuff it in the mouth. The polyp, to be a success in life, must be stuck to something solid where the prey is plentiful. So we find polyps in shallow ocean waters and shallow freshwater wetlands, where life is incredibly profuse.

Coral is one kind of polyp. Colonies of coral polyps slowly build coral reefs out of their shells.

Another kind of polyp is the sea anemone, which you may have seen in a tide-pool if you have been to an ocean beach.

A long time ago, **polyp animals invented metamorphosis.**

Their transformations are even stranger than the insects'.

A **polyp** sometimes reproduces by budding. It grows another polyp right out of its side, tentacles and all. When the new polyp is ready, it is released from its parent, then turns upside down in the water so its tentacles hang down and it floats away. It's a jellyfish, now, and its body grows into a bell shape called a **medusa**. It floats for the rest of its life. The jellyfish reproduces in turn, this time sexually.

The offspring of this male-female medusa mating look nothing like the jellyfish. They are blobby worm-like creatures called **planula**. A planula can swim by rowing itself around with a fringe of hairlike cilia. It swims until it come to a place that looks good for eating, attaches itself to something solid, and turns into a polyp, and begins the circle of transformation over again.

## Why Metamorphosis?

Why do polyps and insects transform in such an amazing fashion?



Metamorphosis is partly a way to disperse the species.



Spreading a species in space ensures the best possible chance that the species will reproduce and survive.



Dispersing also is a way of making sure that each generation born has a good prospect of getting enough food to thrive and reproduce.



In the corals' fixed polyp stage, the little animals create their own real estate (the coral reef) which many other creatures then find attractive and move into, providing the coral polyps with an excellent supply of food.



When a baby fly is a maggot, the rotting meat it eats is limited and quickly used up by decomposers such as bacteria. When it emerges from the pupa with wings, it can travel distances for food, and travel distances to find good dead meat for laying its eggs

When something happens in Nature, there is usually a reason, and that reason is usually connected to a species' survival and flourishing—food, reproduction, shelter.

# Molt: Transforming for Growth and Renewal

Most animals go through periodic changes in their bodies, even though most are not so extreme as metamorphosis.

**One strategy is to shed your skeleton** to accommodate new growth.

Many creatures, the arthropods (insects, spiders and crustaceans) have exterior skeletons and cannot grow without increasing their skeleton's size. Lobsters, crabs and crayfish shed their skeletons too. **This is called molting.** As insects grow, at each stage of growth they molt. Each of these stages is called an **instar**.

**Reptiles molt their skins.** Lizards molt their skin in patches. Snakes often shed their skins in one long tube. Before they shed their skins, snakes look dingy and worn. Their eyes are cloudy. After shedding their eyes are bright and clear, their skin colors are amazing, and they look brand-new.

**Birds molt too.** Usually once a year, birds lose and replace most of their feathers.

Sometime in August most ducks & geese go through a complete feather molt, and during this time cannot fly.

Some birds molt quickly, over a few weeks, and lose the ability to fly.

Some birds molt over a few months, and keep the power of flight.

Birds descended from the reptiles, which may be where they got their molting strategy.

**Mammals molt too.** In mammals, we call this process **shedding**. Hair wears out over time. Cats, dogs, and other furry mammals living in Northern climates tend to shed as the seasons change, growing more fur for winter and shedding excess hair in Spring.

This shedding molt is most noticeable seasonally, but it continues year-round.

**Humans molt also**, although our molt is less obvious. We each molt about 100 hairs from our heads every day. We continuously shed and replace our worn-out skin cells, many thousands per day. Every second of every day, humans shed about 100,000 skin cells. Much of the dust in our homes is our own shed skin! These shed skin-cells are what dust mites eat, an ecology of molt.

Some human beauty treatments focus on helping the skin shed and renew, so that we, like snakes, will look fresher and new again after our transformation. But because we shed skin all the time, one cell at a time, the effect can never be so strong in humans as in birds or snakes. So-called “Makeovers” are never very complete, but the name itself is good testimony to our human desire to transform.

## Some Sources for Transformation in Lifetime Scale

*Encyclopedia Britannica*

Thoreau, Henry David, *Walden and The Journals*

**Note:** For a graphic-rich treatment of the above material, go [Here](#)

Go to Chapter 7: [Transformation in Geologic Time Scale](#)

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