

## The Essence of Darwin's Theory of Descent with Modification

(or "Evolution", as it has come to be known)

paraphrased by P. Bird from Stephen Jay Gould, The Structure of Evolutionary Theory, 2002

### FACTS:

Overproduction: Collectively, the organisms in every species attempt to produce more offspring than are needed to replace themselves.

Variation: Many offspring are different from their parent(s) in small ways.  
(sexual reproduction, conjugation\*, mutation\*, infection\*)

Heritability: Many of these differences can be passed on to succeeding generations.  
(RNA\*, DNA\*, symbionts\*, infections\*, culture)

Environmental Change and Diversity: The physical environment for life has changed many times at any given place. At all times, the environment has included large spatial variations.  
(ice ages, plate tectonics\*, solar cycles\*, impacts\*, non-solar ecosystems\*)

### LOGIC:

Natural Selection: Organisms that happen to be better adapted to their environment and ecosystem will, on average, enjoy greater reproductive success, and will pass their favored traits to a greater number of offspring by inheritance.

### TESTABLE CLAIMS:

Agency: Natural selection acts only at the level of individual organisms. ("Internal harmony" of ecosystems is either an illusion, or an indirect result. "Progress" over time is an illusion based on an anthropocentric viewpoint.)

[Note: Gould argued that selection also operates at the species & higher levels.]

Efficacy: Natural selection, acting in a setting of environmental change, is a sufficient cause to explain the origin of any organ, tissue, or instinctive behavior.

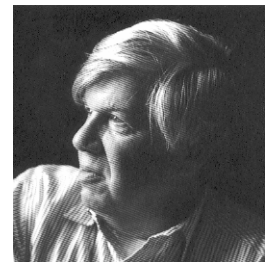
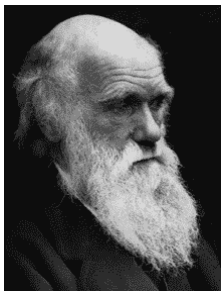
(The adaptive utility or "function" of an organ/tissue/behavior may change.)

(\*Abandoned adaptations may persist as pseudogenes, increasing chances for rediscovery.)

Scope: Acting continuously for the age of the Earth, natural selection can explain all the diversity of present life, and of ancient life represented by fossils. If the meaning of "organism" is extended to include autocatalyzing molecules, natural selection can also explain the origin of life.

(\*age of Earth approximately 4,500,000,000 years, prions\*)

[Note: Within this framework, Darwin emphasized gradual change, but Gould emphasized "punctuated equilibrium" with variable net rates.]



(\*mechanism discovered since Darwin's time which plays an important role)