

Evolution defined

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Evolution

One of the most frequently miss-defined concepts in biology

Evolution All the changes that have transformed life on Earth from its earliest beginnings to the diversity that characterizes it today

Wrong

Campbell & Reece Biology

Definition of Evolution

Descent with Modification

Darwin

Lasting change in the mean phenotype of a population that transcends the life of an individual

Futuyma, Evolutionary Biology
Change in gene frequency

Maynard

Issues with Definition

Lasting change in the mean phenotype of a population that transcends the life of an individual

Futuyma, Evolutionary Biology

In complex systems this definition may not be adequate.

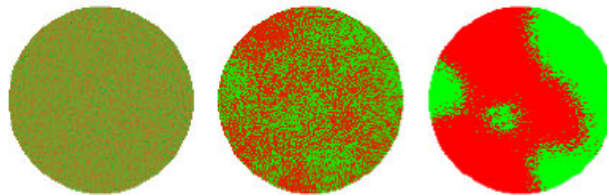


Figure from
Hiroki Sayama

Issues with Definition

Change in gene Frequency

Evolution is about changes in phenotype. Gene frequency is the *mechanism* of inheritance, not evolution itself.

Does not allow for non-genetic inheritance (e.g., culture)

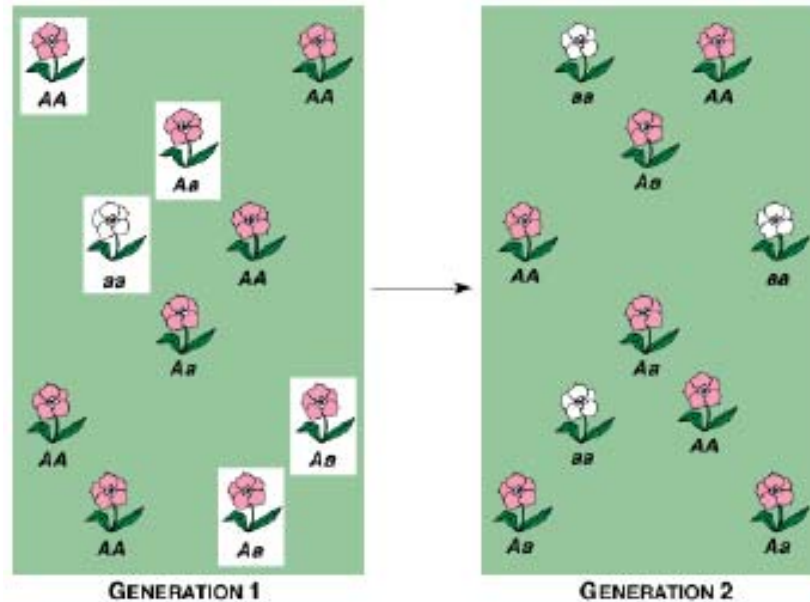
Expect the definition of evolution to change.

Evolutionary biology is in many respects the most philosophical of the fields of biology.

Our understanding of evolution is changing rapidly. This is a field of active debate, and active change.

Some Important Preliminary Ideas in Evolution

Populations Evolve, Individuals do not!

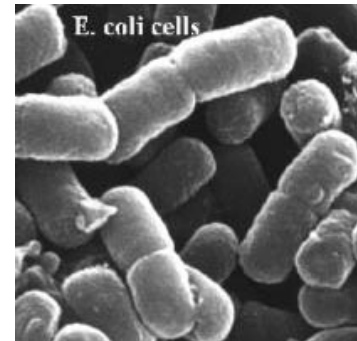
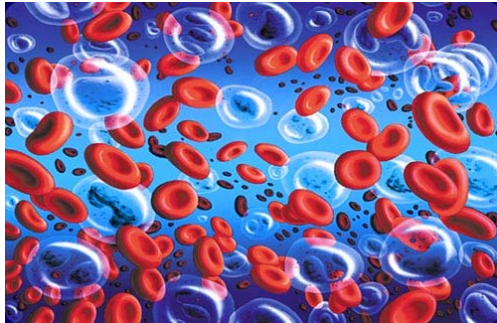


Each evolving system has a population level and an individual level

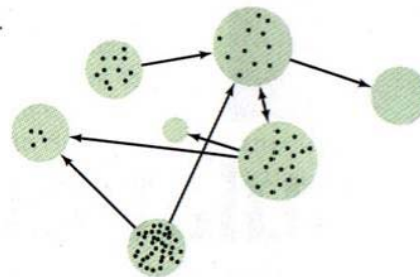
A population of (large) organisms:



Cells within an organism



A set of populations (a metapopulation)



The Four Horsemen of Evolution

A painting of four horsemen on a red circular background. The horsemen are depicted in dark silhouettes, riding horses of various colors (white, brown, and dark brown). They are moving from left to right across the red circle. The background of the entire slide is a textured, brownish-grey surface.

Under the mean field view there are
EXACTLY four forces of evolution:

Migration — Movement among populations or locations

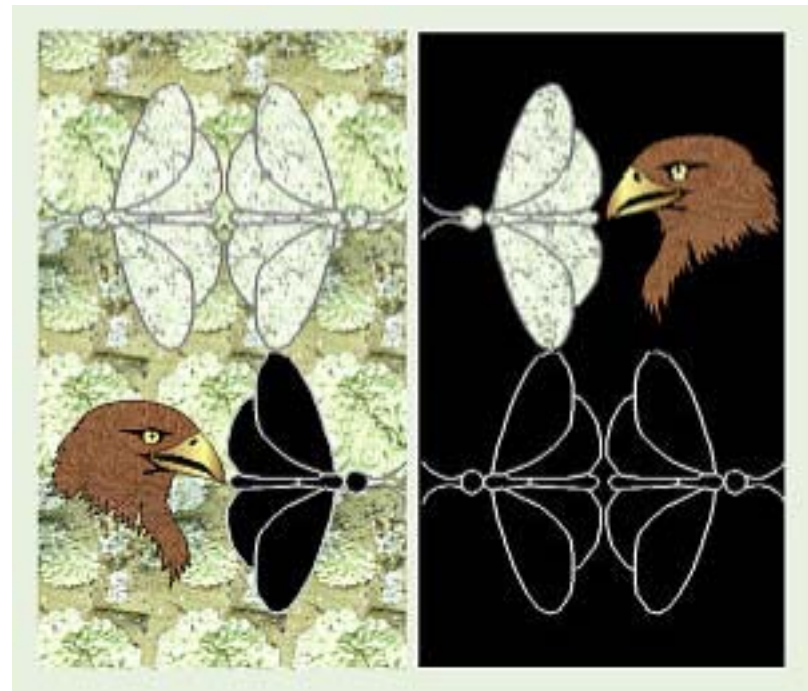
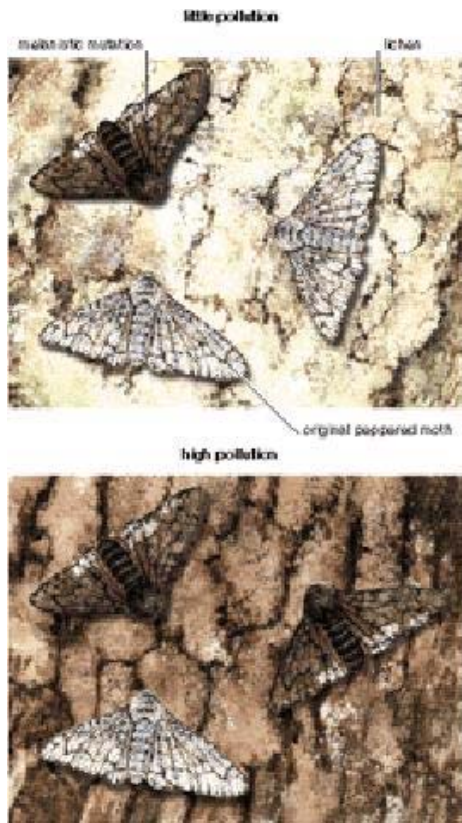
Mutation — Random conversion of one type to another

Genetic Drift — Random changes in frequencies of types

Selection — changes due to differential survival and reproduction

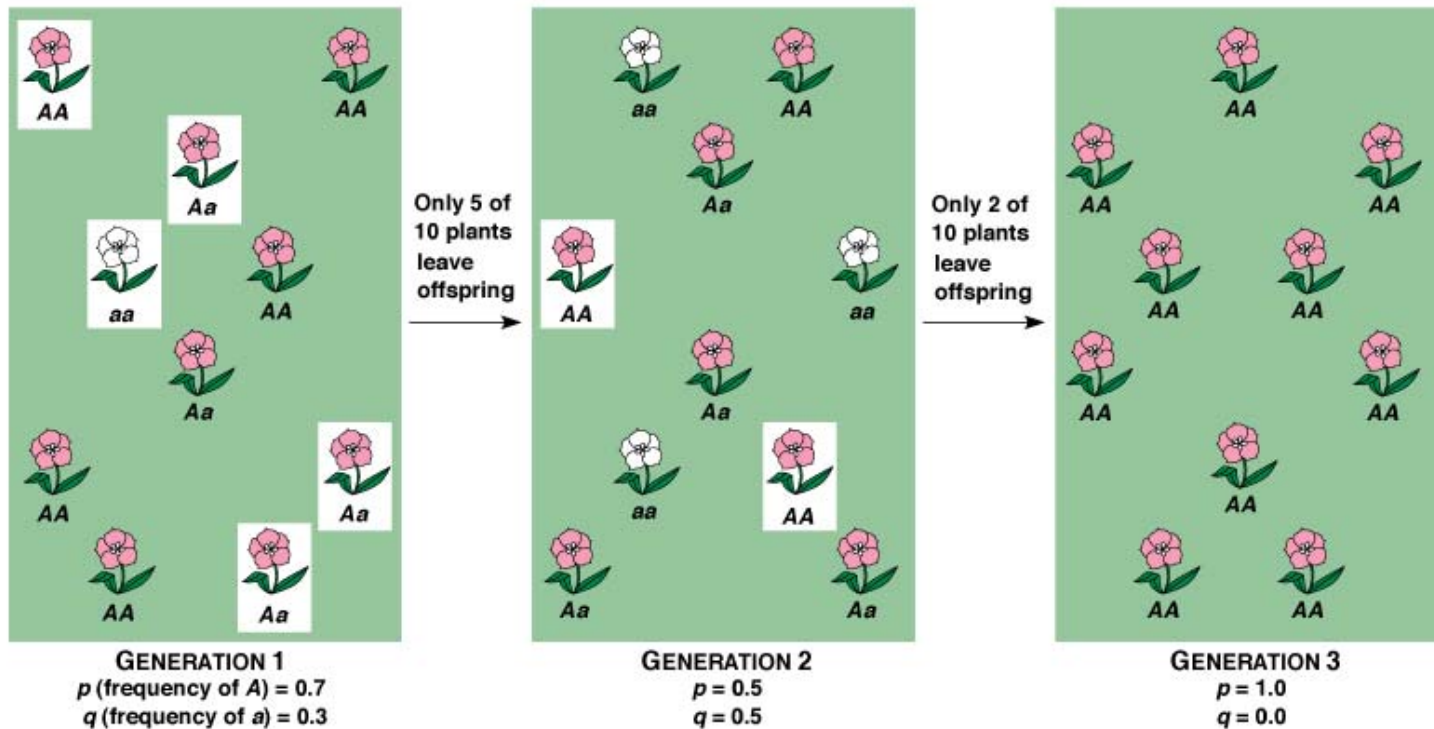
Selection

Adaptive change due to differential reproduction.



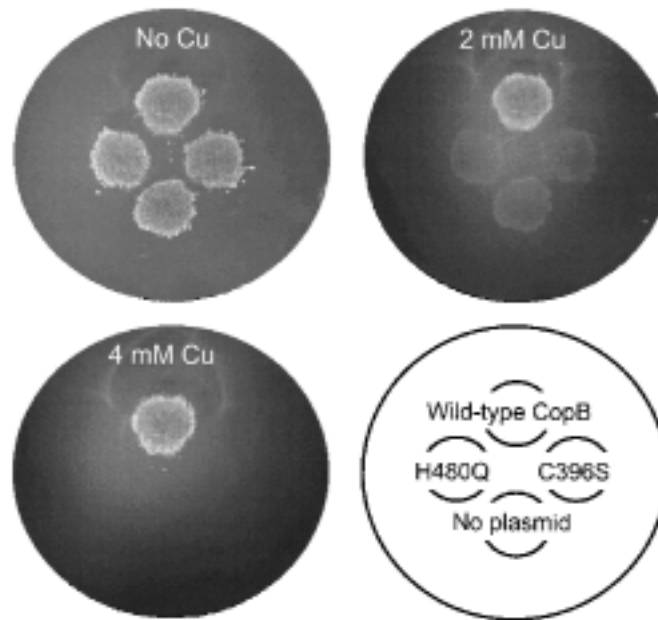
Drift

Random Changes in a population due to sampling and small size



Mutation

Changes in a population due to random changes in the individuals



Migration

Change in the makeup of a population due to the immigration or emigration of individuals

