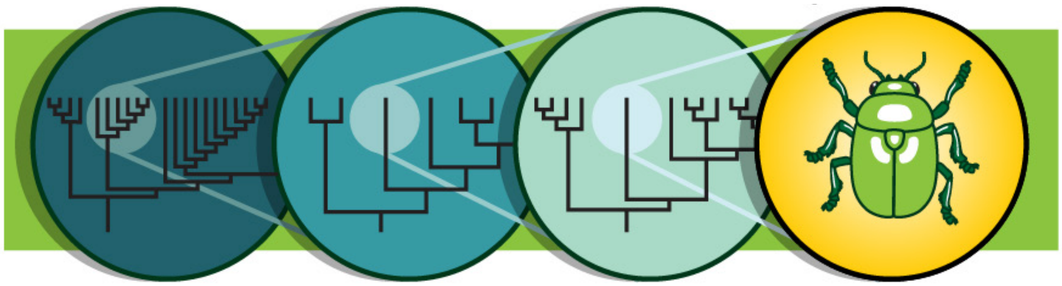
Microevolution

House sparrows have adapted to the climate of North America, mosquitoes have evolved in response to global warming, and insects have evolved resistance to our pesticides. These are all examples of microevolution — evolution on a small scale.



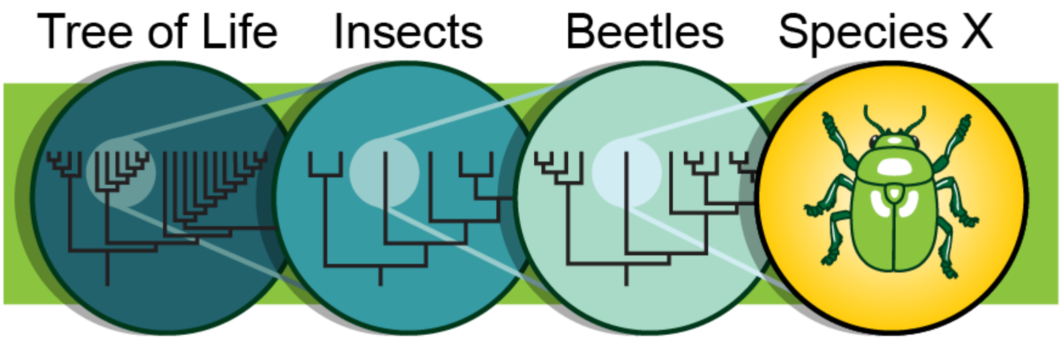
Here, you can explore the topic of microevolution through several case studies in which we've directly observed its action.

We can begin with an exact definition.

Defining microevolution

Microevolution is evolution on a small scale — within a single population. That means narrowing our focus to one branch of the tree of life.

If you could zoom in on one branch of the tree of life scale — the insects, for example — you would see another phylogeny relating all the different insect lineages. If you continue to zoom in, selecting the branch representing beetles, you would see another phylogeny relating different beetle species. You could continue zooming in until you saw the relationships between beetle populations.



But how do you know when you've gotten to the population level?

Defining populations

For animals, it's fairly easy to decide what a population is. It is a group of organisms that interbreed with each other — that is, they all share a gene pool. So for our species of beetle, that might be a group of individuals that all live on a particular mountaintop and are potential mates for one another.

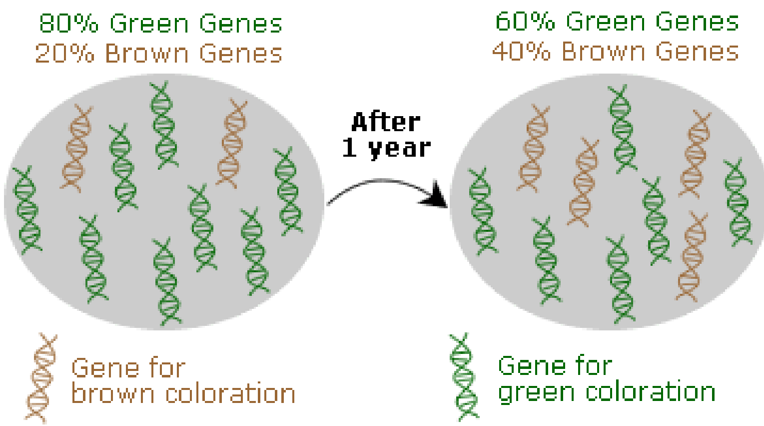
Biologists who study evolution at this level define evolution as a change in gene frequency within a population.

Two beetles mating. The potential to interbreed in nature defines the boundaries of a population. Image courtesy of Northern Prairie Wildlife Research Center, USGS.

Detecting microevolutionary change

We've defined microevolution as a change in gene frequency in a population and a population as a group of organisms that share a common gene pool — like all the individuals of one beetle species living on a particular mountaintop.

Imagine that you go to the mountaintop this year, sample these beetles, and determine that 80% of the genes in the population are for green coloration and 20% of them are for brown coloration. You go back the next year, repeat the procedure, and find a new ratio: 60% green genes to 40% brown genes.



You have detected a microevolutionary pattern: a change in gene frequency. A change in gene frequency over time means that the population has evolved.

The big question is, how did it happen?

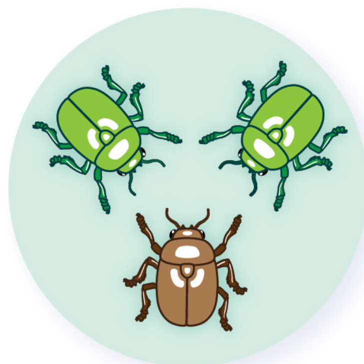
Mechanisms of microevolution

There are a few basic ways in which microevolutionary change happens. Mutation, migration, genetic drift, and natural selection are all processes that can directly affect gene frequencies in a population.

Imagine that you observe an increase in the frequency of brown coloration genes and a decrease in the frequency of green coloration genes in a beetle population. Any combination of the mechanisms of microevolution might be responsible for the pattern, and part of the scientist's job is to figure out which of these mechanisms caused the change:

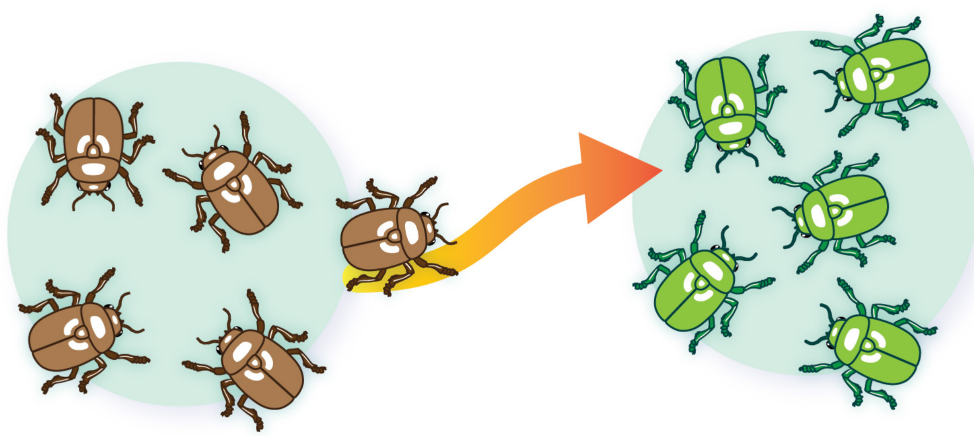
Mutation

Some "green genes" randomly mutated to "brown genes" (although since any particular mutation is rare, this process alone cannot account for a big change in allele frequency over one generation).



Migration (or gene flow)

Some beetles with brown genes immigrated from another population, or some beetles carrying green genes emigrated.



Genetic drift

When the beetles reproduced, just by random luck more brown genes than green genes ended up in the offspring.

Natural selection

Beetles with brown genes escaped predation and survived to reproduce more frequently than beetles with green genes, so that more brown genes got into the next generation.