

# Evolution by natural selection

Evolution

Natural selection

The nature of adaptation

# Outline

## Evolution

- Change through time

- Relationships between species

## Natural selection

## The nature of adaptation

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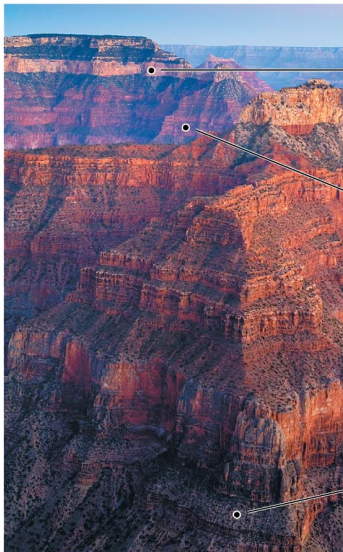
## The nature of adaptation

# Fossils

Younger rock layers



Older rock layers



Tracks from  
a mammal-  
like reptile

~275 mya

Fern

~280 mya

Trilobite

~510 mya

Younger fossils



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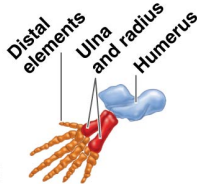
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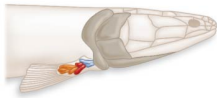
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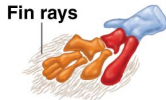
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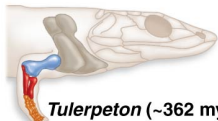


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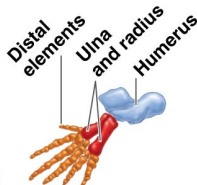


- ▶ When a species disappears from the fossil record, a similar species often appears

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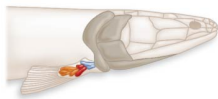
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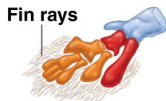
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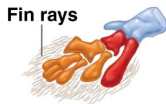
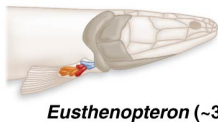
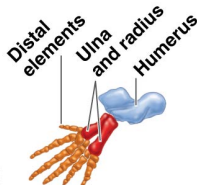
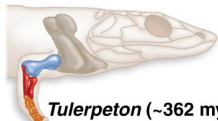
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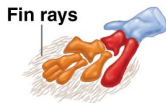
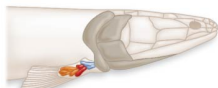
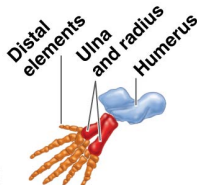
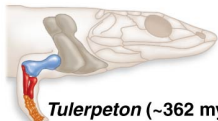
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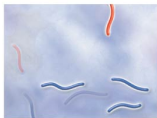
## PROCESS: EVOLUTION OF DRUG RESISTANCE

*M. tuberculosis* in lung tissue



**1. A chance mutation occurs.**

Mutant cell



**2. Drug therapy kills most bacteria without the mutation.**



**3. Mutant cells proliferate.**



**4. Drug therapy is ineffective against mutant cells.**

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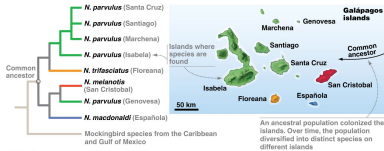
# Geographic relationships

- Species in the same geographic area (e.g., nearby islands) often seem to be closely related

(a) **Pattern:** Although the Galápagos mockingbirds are extremely similar, distinct species are found on different islands.



(b) Recent data support Darwin's hypothesis that the Galápagos mockingbirds share a common ancestor.



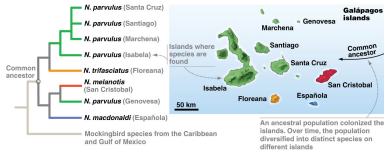
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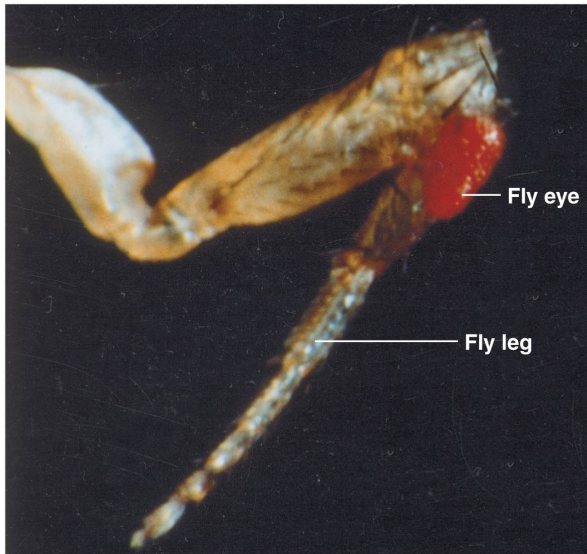
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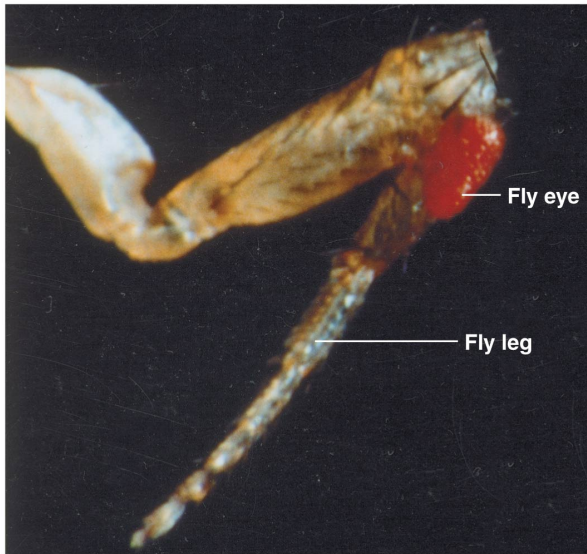
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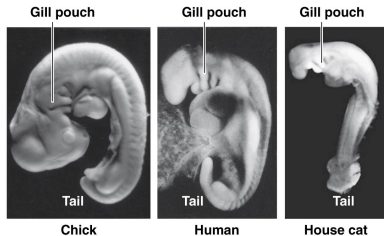


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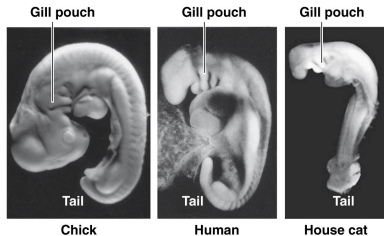


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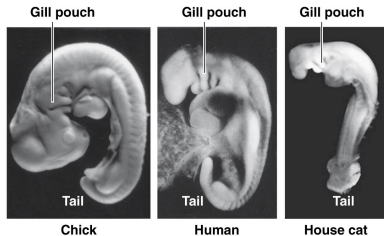
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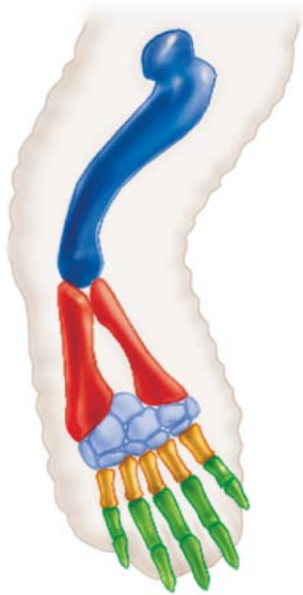


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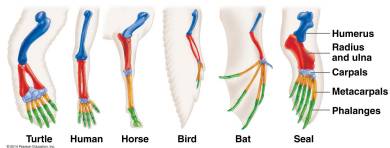
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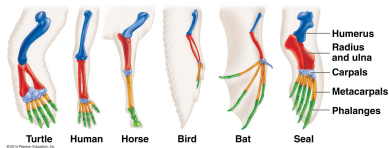


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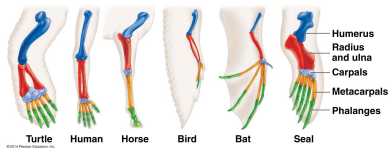
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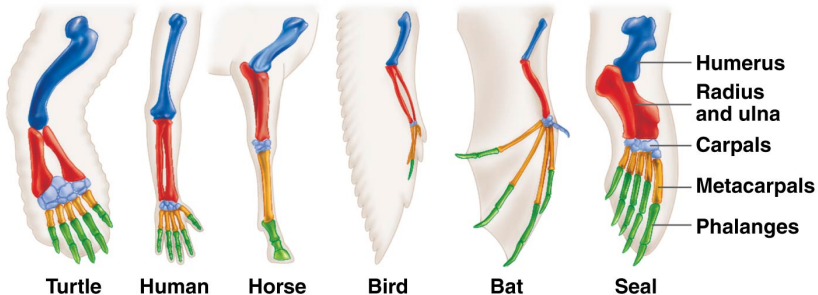
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  - ▶ **Selection:** Reproductive success is not random, but is influenced by differences in traits, including heritable traits

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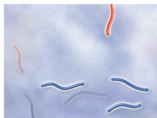
## PROCESS: EVOLUTION OF DRUG RESISTANCE

*M. tuberculosis* in lung tissue



**1. A chance mutation occurs.**

Mutant cell



**2. Drug therapy kills most bacteria without the mutation.**



**3. Mutant cells proliferate.**



**4. Drug therapy is ineffective against mutant cells.**

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# Finch beaks

## RESEARCH

**QUESTION:** Did natural selection on ground finches occur when the environment changed?

**HYPOTHESIS:** Beak characteristics changed in response to a drought.

**NULL HYPOTHESIS:** No changes in beak characteristics occurred in response to a drought.

### EXPERIMENTAL SETUP:

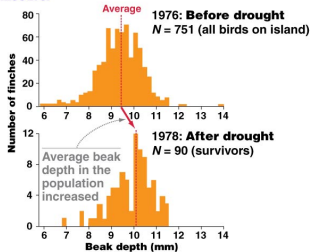


Weigh and measure all birds in the population before and after the drought.

### PREDICTION:

### PREDICTION OF NULL HYPOTHESIS:

### RESULTS:



**CONCLUSION:** Natural selection occurred. The characteristics of the population have changed.

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# Outline

## Evolution

Change through time

Relationships between species

## Natural selection

## The nature of adaptation

# Other models

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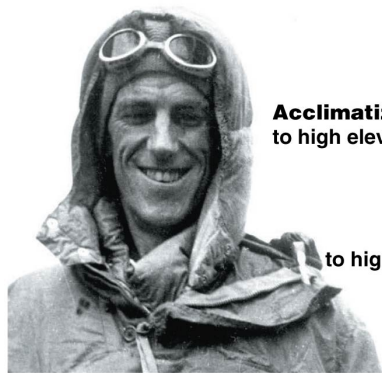
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# Adaptation and acclimation



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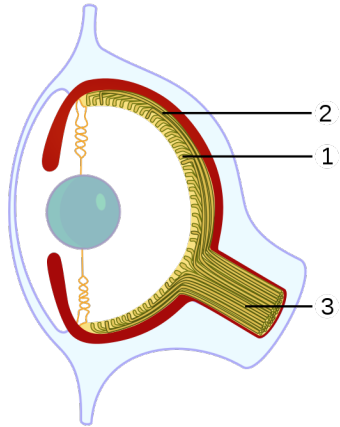
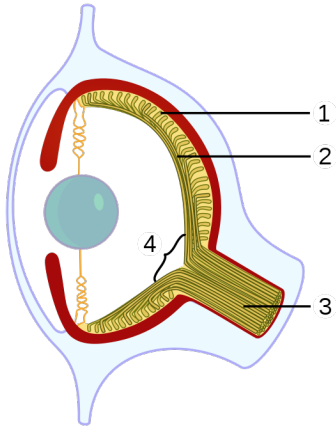
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