

Evolution by natural selection

Evolution

Natural selection

The nature of adaptation

Outline

Evolution

- Change through time

- Relationships between species

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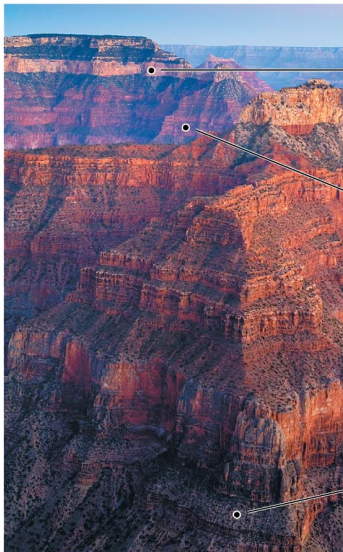
The nature of adaptation

Fossils

Younger rock layers



Older rock layers



Tracks from
a mammal-
like reptile

~275 mya

Fern

~280 mya

Trilobite

~510 mya

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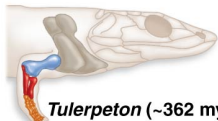
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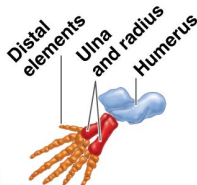
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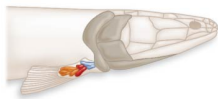
***Tulerpeton* (~362 mya)**



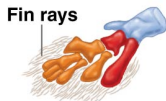
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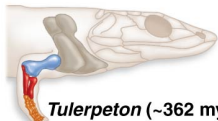


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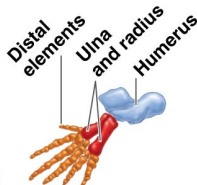


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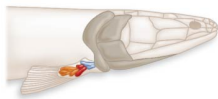
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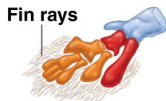
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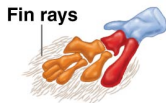
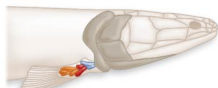
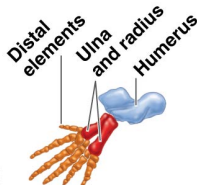
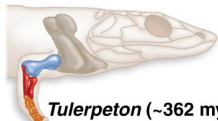


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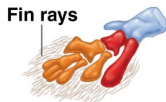
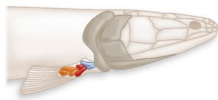
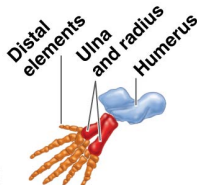
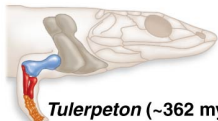
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Tuberculosis

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

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



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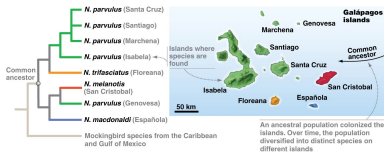
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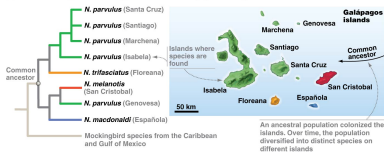
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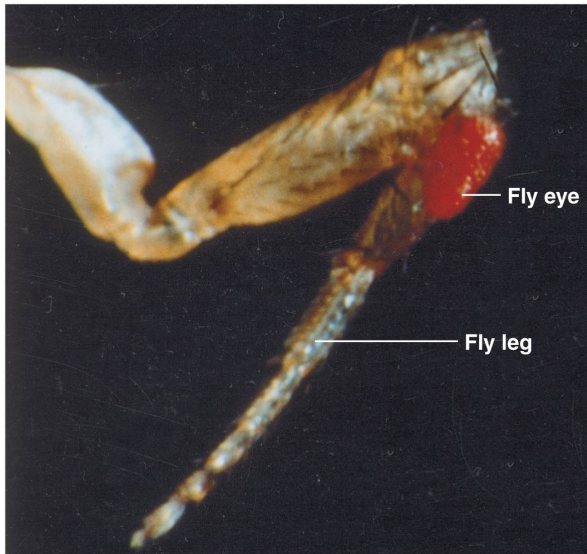
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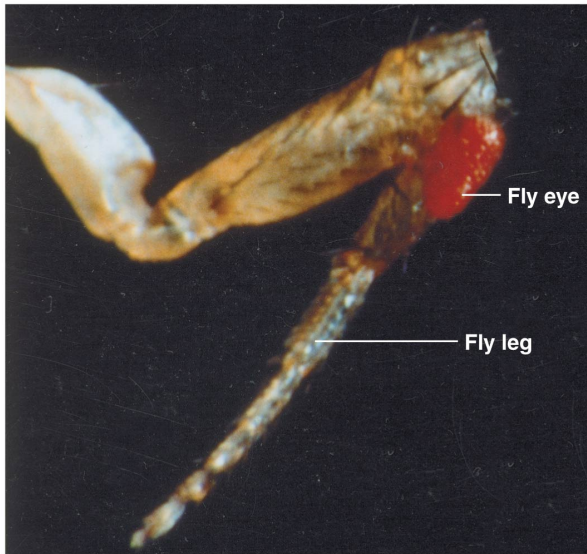
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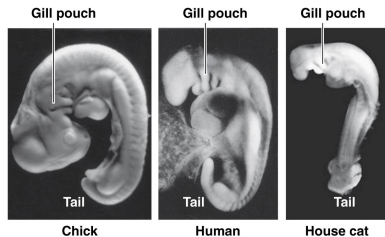
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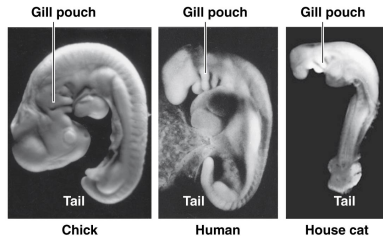
Developmental homology



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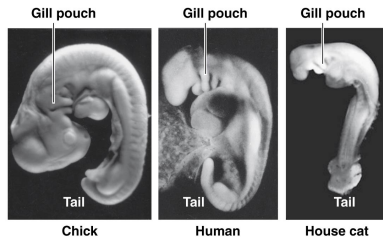
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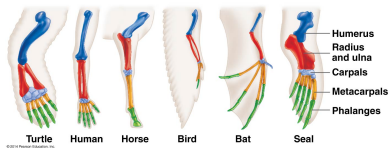
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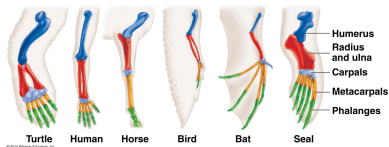
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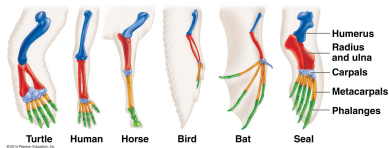
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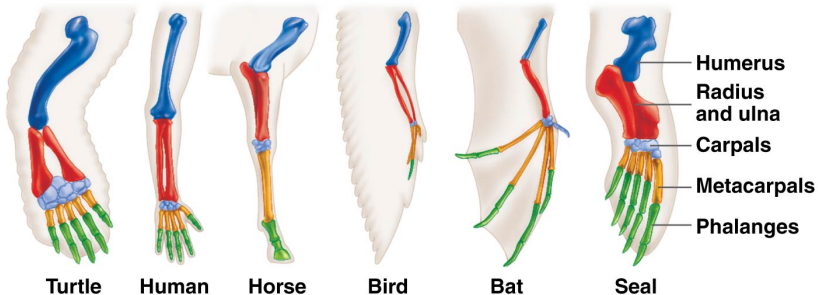
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 - ▶ **Differential reproductive success:** In each generation, some organisms leave more offspring than others
 - ▶ **Selection:** Reproductive success is not random, but is influenced by differences in traits, including heritable traits
- ▶ If all four of these assumptions hold, we expect evolution to occur:
 - ▶ Traits associated with good reproductive success will become more common

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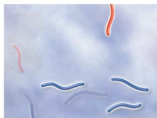
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Tuberculosis

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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Example: Tuberculosis

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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:

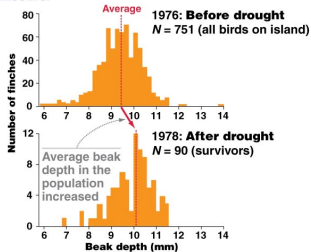


Weigh and measure all birds in the population before and after the drought.

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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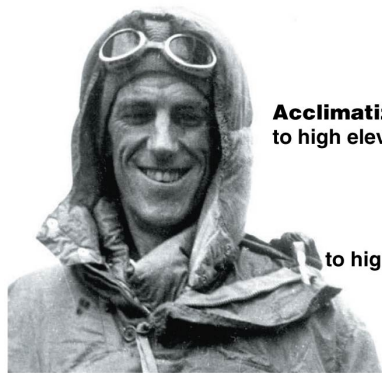
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Adaptation and acclimation



Acclimatized
to high elevation



Adapted
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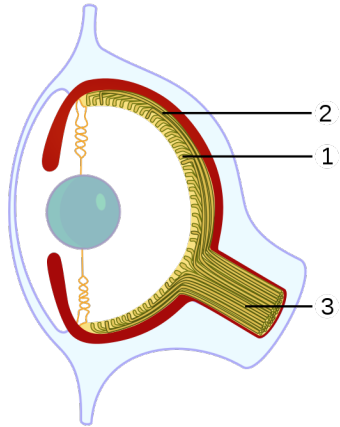
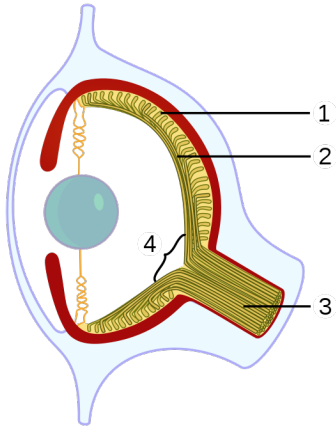
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