

Evolution by natural selection

Evolution

Natural selection

The nature of adaptation

Outline

Evolution

- Change through time

- Relationships between species

Natural selection

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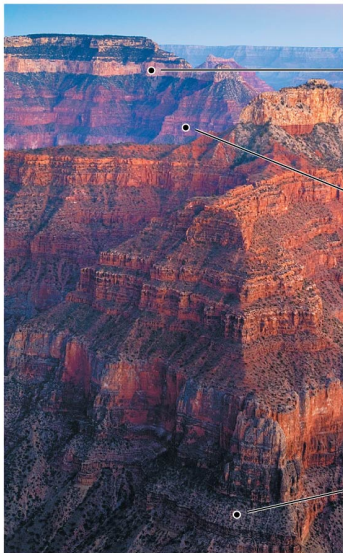
The nature of adaptation

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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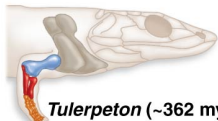
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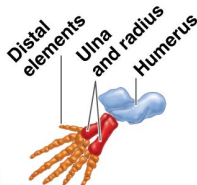
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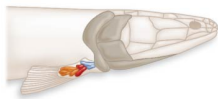
Tulerpeton (~362 mya)



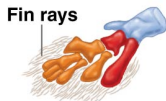
Acanthostega (~365 mya)



Tiktaalik (~375 mya)

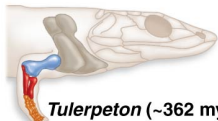


Eusthenopteron (~385 mya)

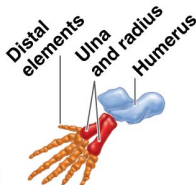


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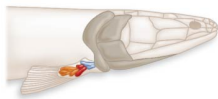
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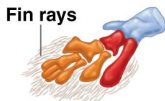
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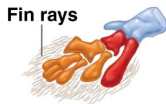
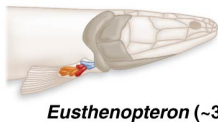
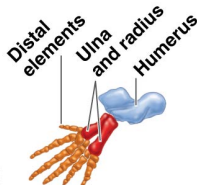
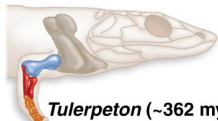
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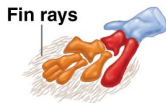
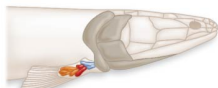
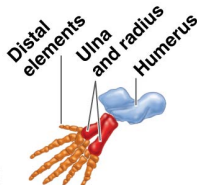
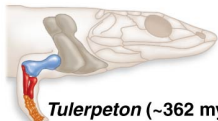
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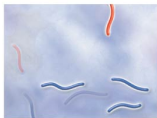
PROCESS: EVOLUTION OF DRUG RESISTANCE

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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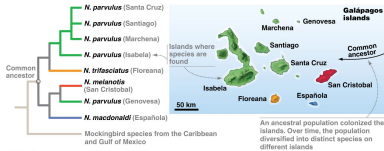
Geographic relationships

- 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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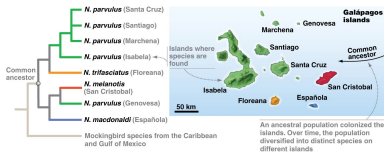
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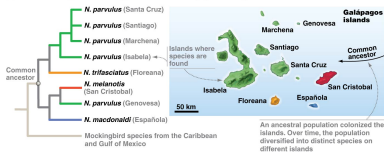
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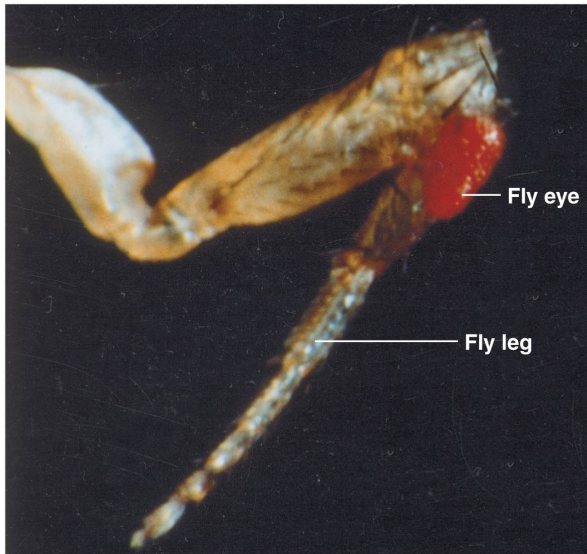
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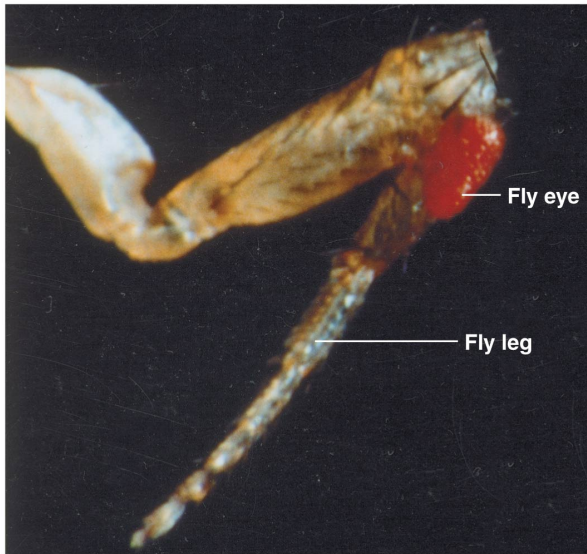
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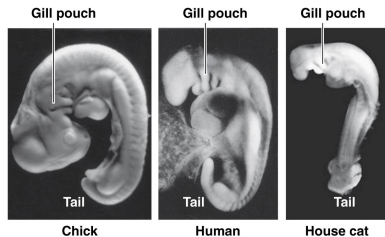
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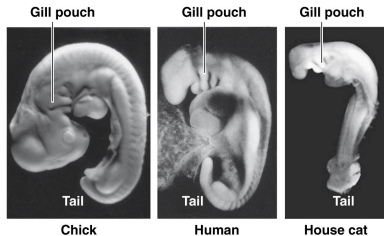
Developmental homology



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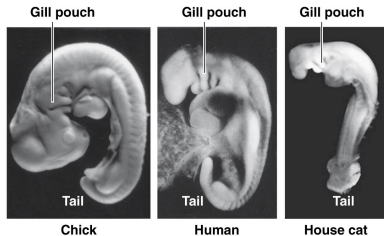
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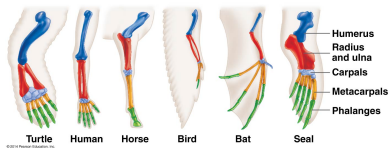
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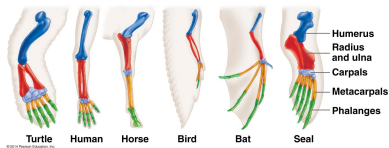
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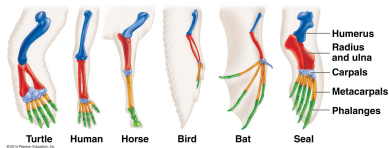
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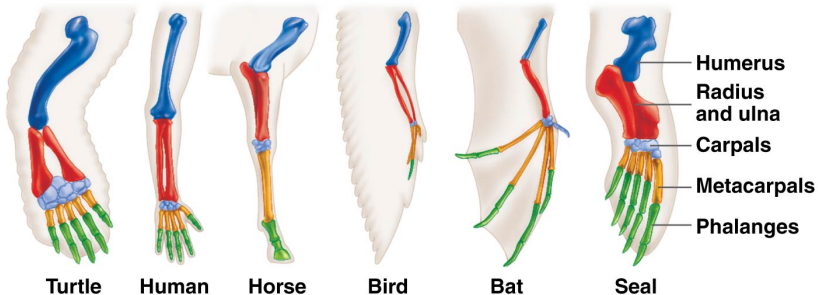
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Natural selection drives evolution

- ▶ Darwin's theory of natural selection can be explained using four logical steps:
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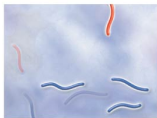
PROCESS: EVOLUTION OF DRUG RESISTANCE

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.

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:

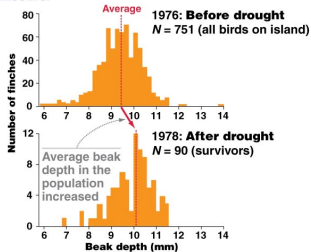


Weigh and measure all birds in the population before and after the drought.

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

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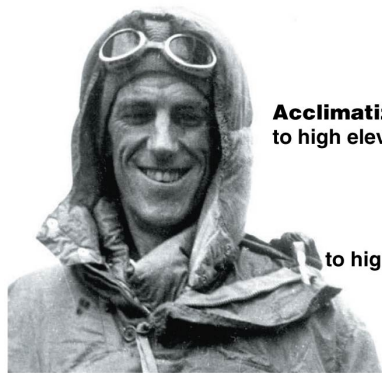
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Adaptation and acclimation



Acclimatized
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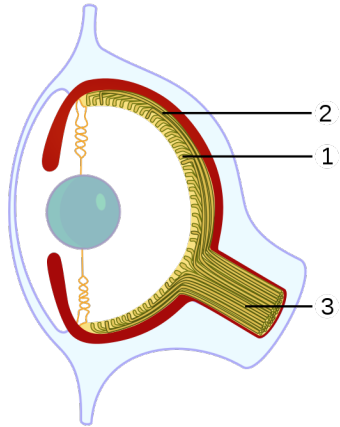
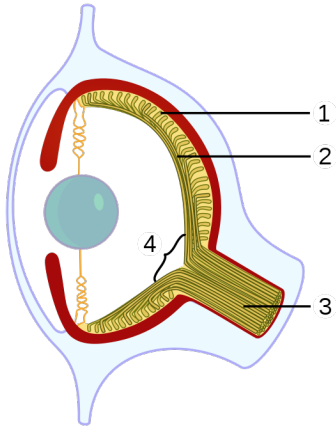
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