

Darwin's Case (TB 15-3, p. 378)

When Darwin returned to England and compared his collections to the archives, he noticed that all the organisms he collected on his island journey did not exist anywhere else on Earth.

He was firmly convinced that his observations were the result of species changing slowly over time as a result of being isolated on islands.

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Darwin was aware of the controversial nature of his findings, and chose not to publish his work for years.

It wasn't until Darwin received work from a fellow scientist, Alfred Russel Wallace, that he was prompted into publishing his work.

It was in 1859 that Darwin published his groundbreaking book, *Origin of Species*.

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Darwin's Conclusions

In Darwin's day, it was known that:

- Variations within species existed in domestic and wild animals
- Plants also showed variations within species as well

It was also believed that these variations were considered unimportant (each was just a "minor defect" in the organism).

However, breeders actively used the heritable variations to improve their livestock (ex: breed only the cows that give the most milk).

Darwin termed this practice artificial selection.

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By using artificial selection, we have been able to create many species we enjoy today

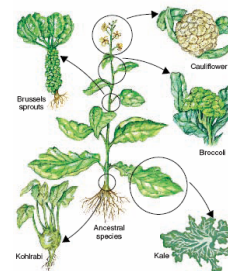


Figure 15-10, p. 379

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If change can be induced by humans, can it be induced by natural processes?

Thinking back to Malthus' studies of populations, Darwin assumed that there is a natural competition for survival among organisms of a same species.

He termed this the struggle for survival.



Figure 15-12, p. 381

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The variation within a species gives certain organisms the power to get more food than others, avoid predators more easily or reproduce more efficiently.

These organisms have a high fitness level.

According to Darwin, fitness was a result of adaptations (inherited characteristics that increases the chance of survival for a specific environment).

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Darwin summarized these points, and termed them survival of the fittest.

- Organisms that are better adapted to their environment live long and / or produce many offspring.
- These organisms pass of their advantageous traits to their offspring.
- This process is known as natural selection.

Evolution, he argued, was dependent on natural selection through survival of the fittest.

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Descent with Modification

Darwin continued by saying that natural selection could, over time, lead to organisms having different behaviours, habitats and food supplies, and would thus have a different appearance than their ancestors.

He termed this descent with modification.

Working back, he assumed that if correct, this would mean that all organisms have a common ancestor.

Closely related organisms would be the result of common descent.

ex: wolves, dogs, coyotes, foxes, etc...

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Supporting Evidence

Darwin used 4 main arguments to support his theories:

- 1) The fossil record
- 2) The geographical distribution of organisms
- 3) Homologous body structures
- 4) Embryology (early development)

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The Fossil Record

- Fossils act as a history book of living species on Earth.
- Darwin said they could be used to show how species change over time.



Figure 15-3, p. 382

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Geographical Distribution of Organisms

- Darwin postulated that the reason he found so many different (but similar) finches on the Galapagos Islands was they had each evolved independently from a common ancestor.

- Similar ecosystems would give similar pressure for natural selection, and the result would be similar, but different, organisms.

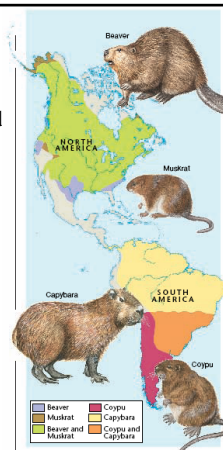


Figure 15-14, p. 383

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Homologous Body Structures

Vertebrate animals share many similar bone structures, even though their uses and appearance vary greatly.

More recently, scientists have proven that vertebrate limbs, for example, all develop from the same cell structures in embryos.

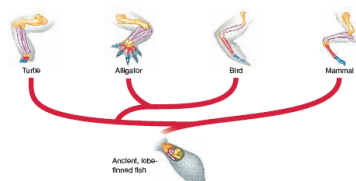
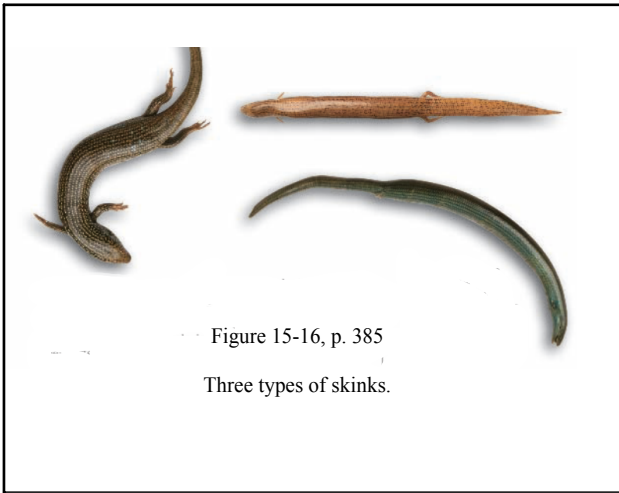


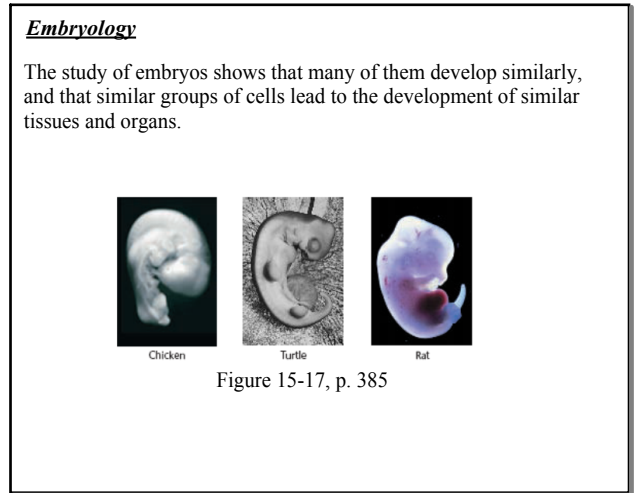
Figure 15-15, p. 384

Scientists explain the lack of homologous body structures in some organisms, such as snakes, by the presence of vestigial organs, or evolutionary leftover organs with little or no purpose.

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Summary of Darwin's Theory

- Organisms from the same species vary, and these variations can be inherited by their offspring.
- Organisms produce more offspring than can survive, others don't reproduce. This leads to competition within species. Those who survive have a high level of **fitness**.
- Organisms best **adapted** to their environment survive longer and produce more offspring that have their beneficial genes. **Natural selection**, then, leads to changes over time.
- Species alive today are **decended with modification** from common ancestor, tying together all living organisms.

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