The Theory of Evolution

Fiji Ministry of Education Text Book (MoE) with additions by Beacon Media

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The Theory of Evolution

What is Evolution? (MoE)

The word 'evolution' means 'change'. In Science, evolution is a change in the gene pool of a population over time.

- A gene is a hereditary unit that can be passed on, unaltered for many generations.
- The gene pool is the set of all genes in a species or population.

Source: http://www.talkorigins.org/faqs/faq-intro-to-biology.html

Types of Science (Beacon Media)

It is important to note that there are three types of science: operational science, historical science and consensus science.

Operational science, (also known as experimental science or empirical science) relates to knowledge of how the world works, which is gained by making observations and recording data in the present. A hypothesis, (an idea), is put forward and it only becomes scientifically valid if proved to be true using the Scientific Method. This means testing the hypothesis through an observable experiment, analysing the results and drawing conclusions. The experiment must be observable and repeatable, getting the same results each time.

Historical science is different. Instead of seeking to determine how the world works in the present, it asks questions about what happened in the past – for example, 'How did the earth form?' or 'How did life begin?' For answers to these questions there are no human eye-witnesses to the events surrounding the origin of the earth and its plants and animals. Historical science includes the fields of paleontogy (dinosaurs) and archaeology. It also includes 'evolutionary biology'. As explained by Professor Ernst Mayr:

Evolutionary biology, in contrast with physics and chemistry, is a historical science where the evolutionist attempts to explain events and processes that have already taken place. Laws and experiments are inappropriate techniques for explaining such events and processes. Instead, one constructs a historical narrative, an unproven idea, that led to the events one is trying to explain.

A characteristic of operational science is that it doesn't change. For example, Newton's laws of motion are found to be the same today as when they were discovered. In contrast to this, historical science is constantly changing, which indicates that it is not really science in the strict sense of the term. For example, geologist Professor Derek Ager remarked:

"It must be significant that nearly all the evolutionary stories I learned as a student have now been 'debunked'.?

The third type of science previously mentioned is **Consensus science**. This is also known as group thinking. It can be defined as scientific ideas that are accepted by a majority. However numerous cases of 'consensus science' have been proved wrong. Dr Michael Crichton rightly stated, "the greatest scientists in history are GREAT because they broke with the consensus". Note Galileo (1564-1642) who invented the telescope and proved that the earth is not the centre of motion. (Prior to this the consensus was that planets revolved around the earth.) Because evolutionary science is accepted by the majority, it does not automatically follow that it is true. Evolutionary science is popular because it attempts to explain the beginning of the universe and life, without a creator. If there is no creator, then people think they can live as they please with no moral laws or rules to follow. Creation scientists on the other hand know the author of the book (the Bible) that explains the beginning of the universe and the world as we know it. The author of the book, (God Himself), was there at the beginning, and Christians know that what God says is true.

Secular explanations of the theory of evolution

The theory of evolution is based on the idea that all species are related and gradually change over time.

Charles Darwin's theory of evolution states that evolution happens by natural selection. Individuals in a species show variation in physical characteristics. This variation is because of differences in their genes.

Individuals with characteristics best suited to their environment are more likely to survive, finding food, avoiding predators and resisting disease. These individuals are more likely to reproduce and pass their genes on to their children.

Individuals that are poorly adapted to their environment are less likely to survive and reproduce. Therefore, their genes are less likely to be passed on to the next generation. As a consequence, those individuals most suited to their environment survive and, given enough time, the species will gradually evolve.

https://www.yourgenome.org/theme/what-is-evolution/

All life on Earth shares a common ancestor, just as you and your cousins share a common grandmother. Through the process of descent with modification, this common ancestor gave rise to the diverse species that we see documented in the fossil record and around us today. Evolution means that we're all distant cousins: humans and oak trees, hummingbirds and whales.

https://evolution.berkeley.edu/evolution-101/an-introduction-to-evolution/

What do Creation Scientists say?

Creation Scientists would agree that the characteristics of a species can change over time. However, this is nothing to do with one species changing into another. God created different kinds of plants and animals, which reproduce "after their own kind". Therefore, a fish could never develop into a frog, nor could a tiger develop into a horse. However, a tiger and a lion can interbreed in captivity, (not in the wild), because they are of the same kind (feline or cat family), The same goes for a horse and a donkey or zebra. They can interbreed because they are of the same kind, (Equus family). The notion that all living things are distant cousins in nonsense and cannot be proved. Humans have a common ancestor – Adam, but we are not related to animals or plants.

Creation Scientists would agree that the population of a species can change its characteristics over time, because some members of that species die out and the gene pool is diminished. For example, white rabbits may survive in artic regions better than black rabbits, because white rabbits are more easily camouflaged against the snow and safer from predators. Over time, all the black rabbits would disappear. This is not evolution but merely reduction in the gene pool of Arctic rabbits. **(Beacon Media)**

Darwin and Lamark **(MoE)**

The theory of evolution is interlaced with the works of two famous scientist named Charles Robert Darwin and Jean Baptiste de Lamarck. However, their inference on how evolution occurred is based on conflicting ideas.

Darwin's Theory (Darwinism)

Darwin's book "On the Origin of Species" in 1859, first documented the theory of evolution by natural selection whereby organisms change over time as a result of changes in heritable physical or behavioural traits. Changes that allow an organism to better adapt to its environment will help it survive and have more offspring.

Darwin supported his theory with two sets of observations:

OBSERVATIONS

1. Individuals in a population vary in their inheritable characteristics.
2. Organisms produce more offspring than the environment can support.

INFERENCES

1. Individuals in a population vary in their inheritable characteristics.
2. Overtime, favourable traits accumulate in the population.

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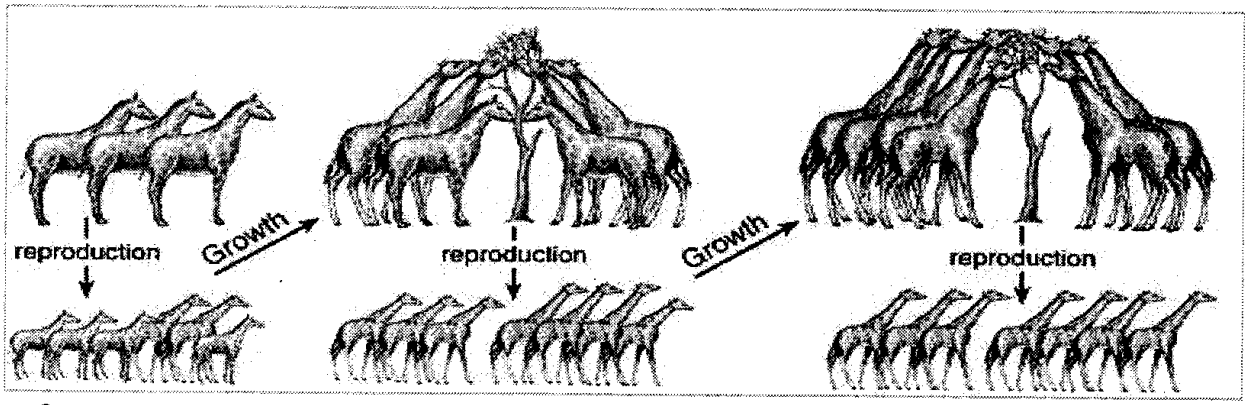


Some individuals born happen to have longer necks

Over many generations, longer-necked individuals are more successful, perhaps because they can feed on taller trees. These successful individuals have more offspring and pass the long-neck trait on to them.

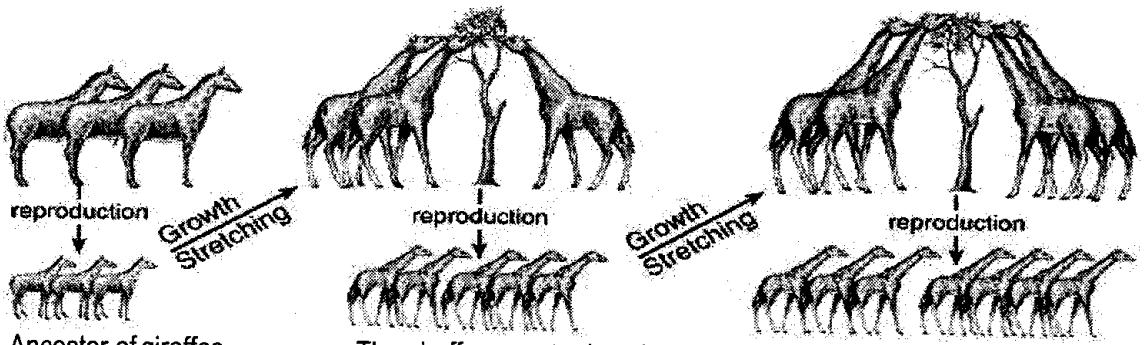
Lamarck's Theory (Lamarkism)

Lamarck's theory proposed positive evolutionary changes that resulted from changing needs or changes to the environment. He based his theory on two principles.

1. Use and disuse
2. Inheritance of acquired traits

- The law of 'use and disuse' explains why entire species lose functions and organs they do not need or use. In other words, they only develop characteristics that are useful.
- The human appendix, for example, is just the vestige of an organ which once was useful while the function of standing and moving with an upright posture helped our immediate forefathers survive and thrive.
- Inheritance of acquired traits is the aspect of Lamarckian evolution that has caused the most controversy over two centuries.
- Lamarck believed that tiny changes in an organism could be triggered by an environmental event.
- These tiny changes were passed on to subsequent generations, benefiting entire populations and creating new species.
- Lamarck felt that there was a pattern in nature imposed from outside; that animals were constantly striving to be better.
- He believed in the idea of continuous progress, that somehow nature had arranged things so that we kept on improving.

(Source: http://lamarcksevolution.com/evolution-an-introduction/)



The giraffe ancestor lengthened its neck by stretching to reach tree leaves, then passed the change on to the offspring
Source: http://www.zo.utexas.edu/

What do Creation Scientists say? (Beacon Media)

Lamark's theory of animal's striving to become better, (and therefore somehow becoming better), and the idea that nature is continually improving, is not scientifically supported. Over time, living things develop genetic flaws called mutations which are passed on to the next generation.

There are documents that reinforce the persistent belief that the appendix is a useless organ, leftover from our evolutionary past, by claiming the appendix has no real function.

However it is now known that the appendix is a highly specialized organ with a rich blood supply, not what you would expect from a degenerate, useless structure. The appendix contains lymphatic tissue and has a role in controlling bacteria entering the intestines. (See Frederic H. Martini, Fundamentals of Anatomy and Physiology, 1995).

A clue to the appendix's function is its strategic position where the small bowel meets the colon. The colon is loaded with bacteria that are useful there, but which must be kept away from other areas. The appendix's main role is likely to be in early childhood. The organ's highly concentrated lymphoid follicles, which play an important role in the immune system, develop about two weeks after birth, at the same time that the colon begins to be colonized with the necessary bacteria.
https://creation.com/en/articles/human-appendix-just-cant-get-no-respect 2006

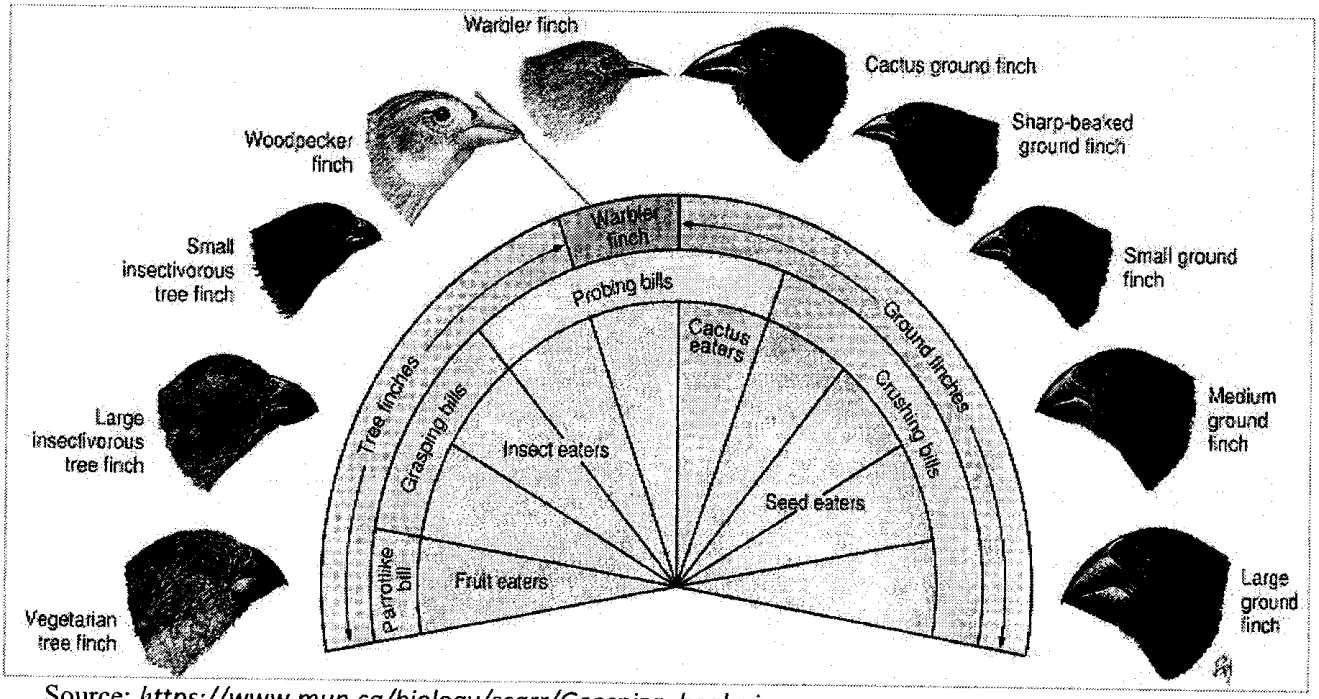
This discovery counteracts Lamark's theory of 'use and disuse'.

Darwin's theory versus Lamarck's theory

Darwin	Lamarack
Theory of natural selection	Theory of use and disuse
Inheritance and variation	Transmission of acquired traits
Differential survival	Increasing complexity
Extinction	No extinction

Adaptive Radiation (Adaption) **(MoE)**

- Adaptive radiation is an evolutionary process which results in the diversification of a single ancestral lineage.
- Adaptive radiation takes place when members of a single species occupy a variety of niches with different environmental selection pressures.
- Members of a common species evolve into different morphological adaptations resulting in speciation.
- The process of adaptive radiation may be further enhanced by reproductive barriers such as habitat isolation.
- An excellent example of adaptive radiation are the Galapagos finches (shown below), also known as Darwin's finches.
- About 14 - 15 species of finches derived from a common ancestor, occupy individual adapted ecological niches due to the size and shape of their beaks in relation to the food they eat.



Source: *https://www.mun.ca/biology/scarr/Geospiza_beaks.jpg*

What do Creation Scientists say?

Adaptations help an organism survive and/or reproduce in its current environment. Adaptations can take many forms: a behaviour that allows better evasion of predators; woodpeckers with strong, pointed beaks allow them to access insects inside trees. It does not involve the addition of genetic information. It just means that those with less pointy beaks died out because they could not access enough food. This is the same with Darwin's finches. There is no new genetic information involved. Therefore, adaption is not proof of evolution. (No change in genes – just varied species within the same gene pool). **(Beacon Media)**

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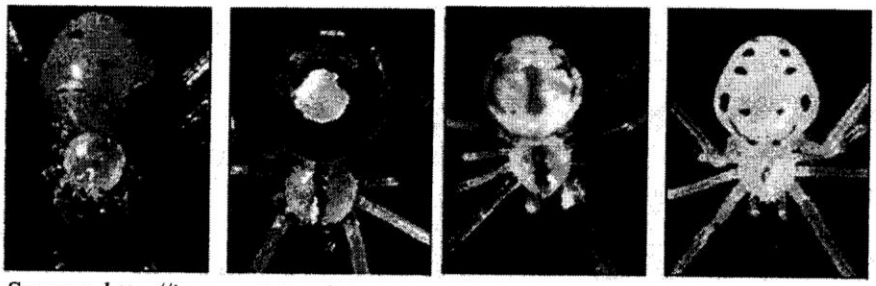
SPECIATION (MoE)

To understand the concept of speciation one must first understand what species means.
A species;

- Is a group of living organisms comprising of similar characteristics and having the potential to exchange genes or interbreed to produce fertile offspring under natural conditions.
- Members of a species have a common gene pool.
- Members of a species can interbreed with the members of their own species only.
- Therefore, it can be said that a population of species is reproductively isolated from a population of another species.

Example:



Source: *http://images.tutorvista.com*

The 'happy face spiders' shown above are different in appearance but they have potential to interbreed. Therefore, they are considered as belonging to one common species of *Theridion Grallator*.

Speciation

- Speciation is the evolutionary process that leads to the formation of new species.
- Species originate by the process of speciation.
- When members of a population diverge, they evolve in two or more different directions.
- They may become so different that they can no longer interbreed.
- At this point of divergence, they are separate into different species.
- Divergence to the point of speciation occurs under a number of circumstances.
- Geographic isolation is one of the major causes of speciation.

What do Creation Scientists say? (Beacon Media)

The evolutionist gives an example of speciation (breeding isolation) happening, such as loss of flight in beetles and breeding isolation of flighted and flightless beetles, and assumes that this is an example of evolution.

Creationists would hold that the two species which diverge are likely to have previously formed from a single ancestral population by way of non-evolutionary (that is, non-information-gaining) speciation.

Therefore, speciation is not evidence for evolution. It is just evidence of a diminished gene pool.

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Speciation can occur in two major ways which is dependent on how gene flow is interrupted between populations of the existing species.

These two methods of speciation are:
1. Allopatric Speciation is where a population forms a new species due to a geographical barrier that has separated the initial original population into two separate populations which cannot interbreed. This is phenomenon is also known as geographical isolation.

2. Sympatric Speciation is where geographical isolation and thus reproductive barrier occurs in populations living within the same population. The reproductive barrier forms due to factors like polyploidy, habitat differentiation or sexual selection.

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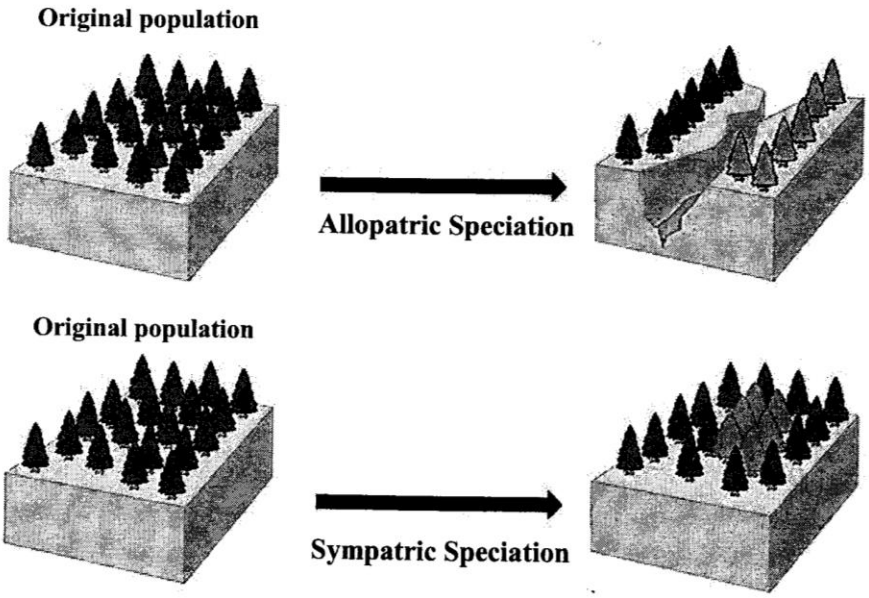

Evolution is a biological phenomenon common to all living things, even though it has led to their differences.

- The theory of evolution is supported by many pieces of evidence ranging from similarities at DNA level to similarities within the structure of the organisms.

Evidence to support the theory of evolution has come primarily from:

- fossil record
- comparative studies of structure and function
- studies of embryological development
- biochemical evolution

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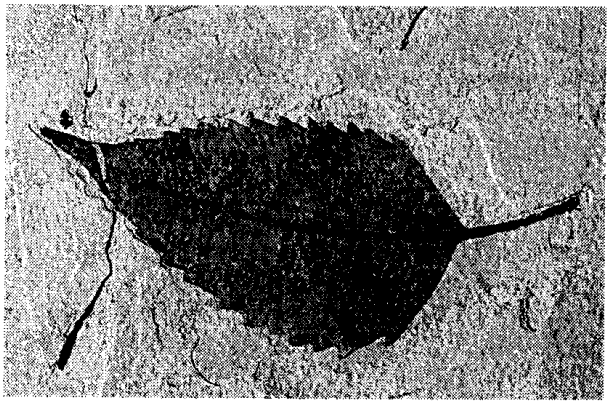
1. Fossil Record **(MoE)**

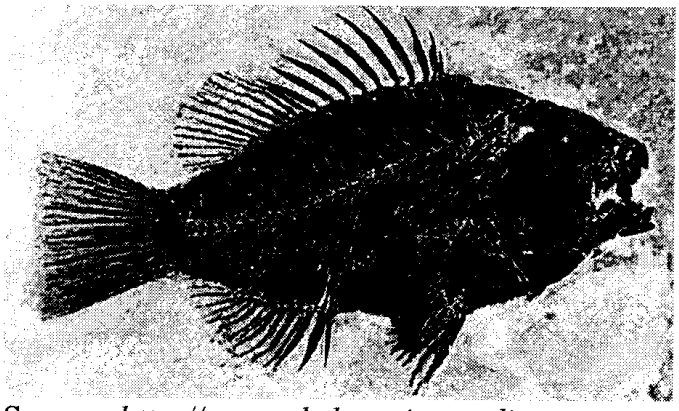
- Fossils are the preserved remains or traces of animals, plants, and other organisms from the past.
- Fossils provide important evidences for evolution by reflecting the difference in life forms during previous life on earth in comparison to today.
- Normally, only a portion of an organism is preserved as a fossil, such as body fossils (bones and exoskeletons), trace fossils (faeces and footprints), and chemofossils (biochemical signals).

Fossilised leaf on rock



Source: *http://www.geology.com*

Fossilised Fish on rock



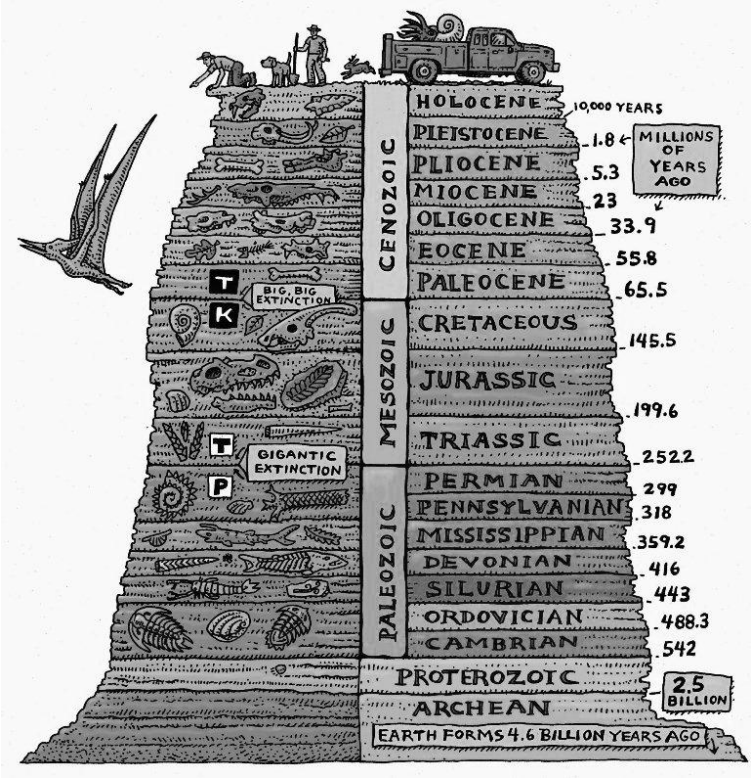
Source: *http://www.pbslearningmedia.org*

These anatomical structures are classified as; Analogous and Homologous structures.

Fossils do not prove evolution. They do not prove evolution of one kind into another. A number of evolutionary paleontologists have acknowledged this. For example, there are missing links. There are no transitional fossils.

Transitional fossils are the remains of those creatures which should be found 'in-between' one kind of creature and another kind. For example, evolutionists have long sought the 'missing link' between ape and human—some sort of half human/half ape intermediate form. None has ever been found, though many candidates have come and gone, such as the famous Piltdown Man which was later shown to be a hoax. In that case, a human skull was 'planted' with an ape's jaw which was crudely 'doctored'. The result fooled the world for decades into thinking this was proof of human evolution. **(Beacon Media)**

The Fossil Record according to biological evolutionists



What do Creation Scientists say about the Fossil Record? (Beacon Media)

All fossilized creatures appear suddenly and fully formed in the rock record, with no clear history of evolutionary transitions. This is consistent with the Bible's assertion that God created life forms to reproduce within their own kinds. Second, fossils formed very quickly, before the animal or plant completely decayed or was scavenged. This means that fossils formed through catastrophic circumstances. Most fossils can be attributed to the worldwide catastrophe of Noah's Flood, in which countless creatures were killed and then rapidly buried, or to its residual effects.

Fossils also serve as reminders of God's character. His righteousness and holiness obligated Him to cleanse the world of wickedness by drowning every land-dwelling, air-breathing creature that was not providentially preserved on the Ark. Fossils should be taken as reminders of the penalty of man's sin and should motivate people to prepare for death.

https://www.icr.org/creation-fossil/

2. Analogous structures (MoE)

- Analogous means having similar features to another thing
- Analogous structures are body structures that have evolved separately but serve the same function.
- They are not inherited from a common ancestor.
- Structures look similar and may have similar functions but they are a result of convergent evolution, i.e. they are not closely related on the tree of life.
- Convergent evolution is when two unrelated species undergo several changes and adaptations to become more similar.
- This evolution occurs when two species living in similar climates and environments in different parts of the world have similar selection pressures and hence, tend to develop similar adaptations

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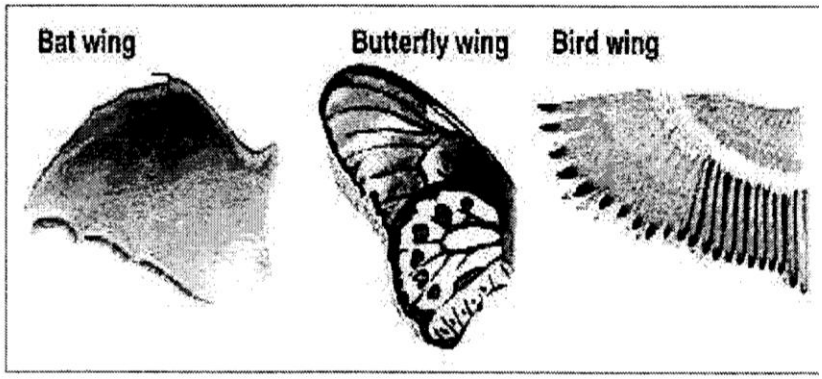
Example of Analogous Strictures

- Bats, flying insects, and birds are all adapted to their niches in their environments by developing wings.
- Their wings are ***not indicative*** of a close evolutionary relationship.



Source: *https://kozmopolitaydinlar.files.wordpress.com/*

Other Examples
Source: https://kozmopolitaydinlar.files.wordpress.com/

Several organisms have separately evolved similar body shape and structures which adapt them for swimming.

- Sharks inherited their streamlined body shape and fins from fish ancestors.
- Penguin's bird ancestors use wings to fly, but penguins, which evolved to fill a swimming and fishing niche, now use their wings like fins.
- Dolphins' ancestors used their limbs to walk around on land; today these mammals swim the seas with front legs that have evolved into a fin shape.

- Selection for fast swimming caused all three animals to evolve analogous structures.
- Selection pressures for escape and food gathering, for example, has caused wings to evolve at least three separate times, once in insects, once in birds and once in mammals (in bats).

3. Homologous Structures

Different species which share a common ancestry often have homologous structures:

- Structures which have the same form, inherited from a common ancestor, but which have since evolved to serve different functions.
- For example, all vertebrates have very similar bone structure in their two front limbs.
- Compare the bones in a human arm, a bird wing and a whale fin.
- The number and positions of the bones are very similar, yet the length and thickness of the bones have evolved to serve different functions whether using them as tools for flying or swimming.

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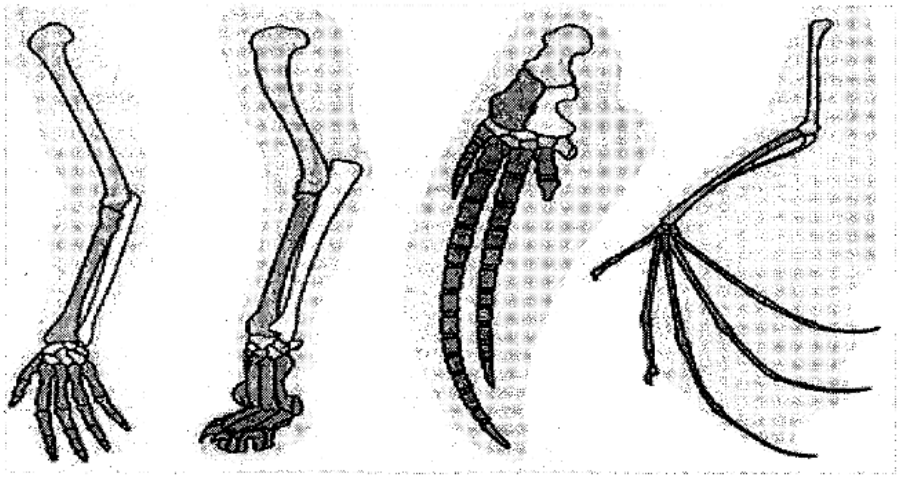
Example of Homologous Structures



Source: *http://www.bio.miami.edu/dana/pix/homologous.jpg*

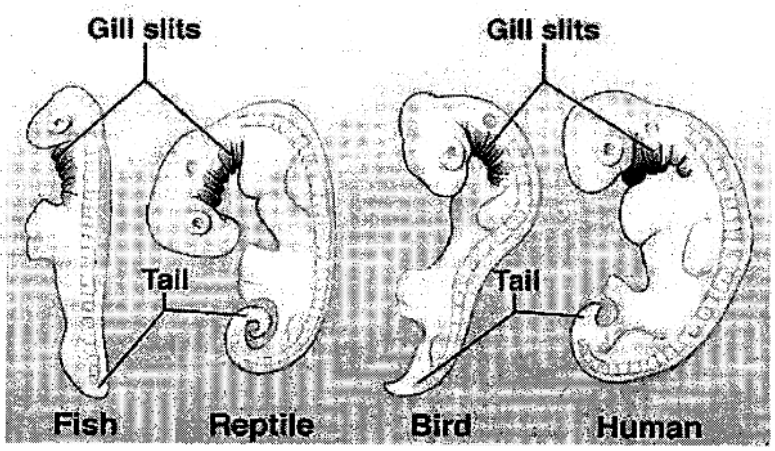
What do Creation Scientists say? **(Beacon Media)**

The argument that analogy (structures that look alike) is evidence for evolution is entirely a theory with no scientific evidence.

The argument that homology is evidence for evolution lacks scientific content. This particular lack has very serious implications. For the evolutionist, homology (similarities due to descent) cannot be known. The evolutionist's concept of homology is now shown to be entirely subjective.
https://creation.com/en/articles/does-homology-provide-evidence-of-evolutionary-naturalism

3. Embryology **(MoE)**

- Comparison of the early stages of development in the different animal species reveals additional homologies that are not visible for adult organisms.
- For example, at some point in their development, all vertebrate embryos have a tail located posterior to the anus as well as the structures called pharyngeal (throat) pouches.
- These homologous throat pouches ultimately develop into structures with very different functions, such as gills in fishes and parts of the ears and throat in humans and other mammals.



Source: *http://www.mhhe.com/*

What do Creation Scientists say? **(Beacon Media)**

Do human embryos go through evolutionary stages?
Short Answer: No. A human embryo is human from conception. Features once described as fish gills or a monkey tail are working parts of a developing human body. The whole notion is largely based on fake drawings.

Long Answer: The idea that an unborn child replays its evolutionary past, passing through fish and reptile phases on the way to becoming human, goes back to the German biologist Ernst Haeckel in the 1860s.
For decades his drawings of nearly identical embryos from different animals appeared in school textbooks. Some biology texts were still printing them in the 1990s.

Those drawings did not hold up. Within months of their publication in 1868, zoology professor L. Rütimeyer of the University of Basel showed that Haeckel had altered them to make the embryos look more alike. In 1997 evolutionary embryologist Michael Richardson and colleagues around the world photographed real embryos of the species Haeckel had illustrated. The actual embryos bore little resemblance to the drawings.

https://creation.com/en/answers/do-human-embryos-go-through-evolutionary-stages

4. Vestigial Structures

- Vestigial structures are body parts which now serve little or no function.
- These structures are homologous to functional organs of their evolutionary relatives.
- Vestigial structures are basically those body parts which an organism no longer needs in its niche.

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Example:

- Snakes have tiny, useless hind limb bones left from their four-legged lizard ancestors.
- Humans have an unused appendix, which maybe the vestige of a 'house' for a cellulose-digesting bacterium inherited from our leaf eating monkey ancestors.
- Many cave-dwelling organisms have eyes which, after generations of living in complete darkness, have lost its function for sight.
- Wings of flightless birds like the Kiwi and Penguin which are not used for flying.

What do Creation Scientists say? **(Beacon Media)**

'Vestigial' organs do not prove evolution. This is related to the homology argument. A vestigial organ has been long-defined as a now functionless leftover of evolutionary ancestry. The human appendix is a commonly claimed vestigial organ, but now known to have a function.
Furthermore, the pattern of occurrence of the appendix in various creatures does not fit any possible evolutionary pattern of ancestry and so is in fact a problem for evolution: The appendix is just an example of creation, and certainly no evidence for ape ancestry.

Biochemistry (DNA)

- Cytochrome c is a haemoprotein found in all aerobic organisms and which plays a vital role in cellular organisation in both plants and animals.
- The amino acid sequence in cytochrome c is the same in humans and chimpanzees (apes that we are most closely related to humans).
- The number of differences in the amino acid sequence becomes greater moving away to more and more distantly related species.
- A similarity in cytochrome c denotes a similarity in DNA strands.
- The fact that human DNA is very similar to ape DNA is a piece of biochemical evidence in the favour of evolution.
- If plant and animal species had been created separately then this progressive differentiation in DNA would not be seen.
- Another piece of biochemical evidence in favour of evolution is the following:
- Each amino acid in any organism is coded for by the various sequences of the same triplet of DNA bases.
- Complementary codons on the mRNA select the amino acids, and the sequence of codons determines the sequence of amino acids and, hence, the protein that is produced.
- The connection between codons and amino acids that are selected to produce a protein is called the genetic code.
- The genetic code is common to all living things.
- This common genetic code for the selection of amino acids is another piece of evidence in favour of the evolution.

What do Creation Scientists say? **(Beacon Media)**

It is conventionally held that humans and chimps differ only very slightly in their DNA. However, new evidence suggests that the difference might be much more drastic. An increasing number of functions are also being discovered for so-called 'junk DNA', suggesting similarity in such DNA is not necessarily due to common descent.

In a recent Science article, several evolutionary scientists openly admitted that the claim of 99% DNA similarity between humans and chimpanzees is a myth. Since 1975, this misleading statistic has been presented as clear-cut evidence that humans and chimps are closely related on the evolutionary tree of life. However, more and more genetic research has revealed that the percentage of DNA similarity has been vastly overstated.

Creationists have long maintained that the so-called similarity between human and chimp DNA is not all that it is said to be. A new study in the Proceedings of the National Academy of Sciences could help confirm this.

Evolutionary scientist Matt Ridley states that: "We are, to a ninety-eight per cent approximation, chimpanzees, and they are, with ninety-eight per cent confidence limits, human beings."

One creationist response to this argument is as follows:
'Regarding human/chimp DNA similarity, the 'Chimp DNA has not been anywhere near fully sequenced, so that a proper comparison cannot be made. Regarding DNA codes for structures and biochemical molecules, we should expect the most similar creatures to have the most similar DNA. Apes and humans are both mammals, with similar shapes, so both have similar DNA. We should expect humans to have more DNA similarities with another mammal like a pig than with a reptile like a rattlesnake. And this is so. Humans are very different from yeast but they have some biochemistry in common, so we should expect human DNA to differ more from yeast DNA than from ape DNA.'

https://creation.com/en/articles/human-chimp-dna-similarity-continues-to-decrease-counting-indels

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Natural selection (survival of the fittest)

- Charles Darwin, in his theory of natural selection, suggested that "survival of the fittest" was the basis for evolution (the modification of living things with time).
- The limited resources available in an environment give rise to competition whereby organisms of the same or different species struggle to survive.
- In the competition for food, space, and mates that occurs, the less well-adapted individuals must die or fail to reproduce, and those who are better adapted do survive and reproduce.

Selection pressures that drive towards evolution are divided into two factors:
i. Biotic factors include competition, predation, parasitism and diseases.

ii. Abiotic factors include natural disasters such as, flooding, draught, cyclones, tsunami etc.

- Darwin also proposed a theory of sexual selection, in which females chose the most attractive males as their mates; outstanding males thus helped generate more young than mediocre males.
- Other forms of selection pressures like spread of diseases and parasitism also lead to evolution where the weaker species got wiped out and those that developed resistance to diseases, survived and reproduced more and more offspring with genes that favoured survival.

Examples of evolution by Natural Selection

1. Peppered Moth

- Peppered moths in England have two forms, one speckled light grey and the other dark grey.
- Once, nearly all the moths were speckled and almost none were dark.
- During the day, peppered moths rest on tree trunks. Before the industrial revolution, light-grey speckled lichens coated the tree trunks in England.
- The speckled moths were well camouflaged from predatory birds when resting on these trunks.
- The dark moths stood out. Then, in the 1850's, pollution from factories began to kill the lichens and blacken the trunks changing the selection forces on moth colour.
- By the end of the 1800's, biologist could hardly find any light speckled moths.
- The vast majority of the moth population was dark. Birds, which could spot the light moths easily on dark trunks, probably picked them off the trees.

2. Antibiotic Resistance

Widespread use of antibiotics selects for the drug-resistant strains of pathogenic bacteria. Some new strains of tuberculosis, a previously curable disease, are not responding to the most powerful antibiotics that doctors have.

3. Pesticide Resistance:
Pesticide (or insecticide) application may kill most of the pests on a crop. However, a few insects will probably survive due to some feature that makes them more resistant. If these resistances are genetic, they will pass it on to their offspring. Then many insects in the next generation will survive the next spraying.

What do Creation Scientists say?

Natural selection does not equal evolution. Natural selection cannot create any new genes to make evolution progress. Natural selection can only sort existing genetic information, so demonstrations of it are not demonstrations of evolution.

Evolution needs to explain the **arrival** of the fittest, not just the **survival** of the fittest.

Even evolutionary biologists agree:
Evolutionary biologist John Endler said, "Natural selection must not be equated with evolution, though the two are intimately related," and "natural selection does not explain the origin of new variants, only the process of changes in their frequency."

Creationist biologists have recognized the role of natural selection in culling the 'unfit' since before the time of Darwin, so how can natural selection be the same thing as evolution? It is merely a decrease in the genetic pool of a species due to certain members of the species dying out for one reason or another.

Therefore, the Peppered Moth is not evidence for evolution.



If God says in Genesis 1 that His Creation was very good, how could there be millions of years of death and suffering before man came along?

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Self-test (MoE)

INHERITANCE

1. Which one of Mendel's laws relates to the:

i) Inheritance of allele as a single character?

ii) Inheritance of two characters in a dihybrid cross?

2. An organism with the genotype BbDD is mated to one other with the genotype BBDd. Assuming independent assortment of these two genes, write the genotypes of all possible offspring from this cross and use the rules of probability to calculate the chance of each genotype occurring?

3. If a man with blood type AB marries a woman with blood type O, what blood types would be expected in their children?

4. In cats, the dominant sex-linked gene (C) results in lack of pigmentation (white fur) and cross-eyed condition. Its recessive allele (c) produces coloured fur and normal eyes. If a normal eyed female with coloured fur is mated with a white fur and cross-eyed male; what phenotypic ratio of offspring should occur in the F1 and F2 generation?

5. During early embryonic development of female carriers for colour blindness, the normal allele is inactivated by chance in about half the cells. Why then, aren't 50% of the female carriers colour-blind?

VARIABILITY

1. Define variability and explain how it is related and/ important for evolution.
2. Explain how a mutation maybe beneficial.
3. List the four sources of genetic variation.
4. How would you identify Down Syndrome, Turner's syndrome and Klinefelter's syndrome from a karyotype?

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EVOLUTION (Answer these questions according to your own understanding.)

1. State the theory of evolution.

2. Before Darwin proposed his theory of evolution by natural selection, a naturalist named Lamarck suggested a very different idea of evolution. Compare the two theories and provide justification for which of the two theories is acceptable.

3. Explain how competition for limited resources creates natural selection pressure on organisms.

4. What was the main selection pressure which created the colour change in peppered moths over generations?

STRUCTURE AND LIFE PROCESSES

5. Give evidence which suggests that humans are related to apes (or not related).

6. What selection pressures probably caused the evolution of different beak shapes in the Galapagos finches?

7. Through evolutionary history, animals capable of increasingly greater speeds have evolved. Explain why speed may have been selected for.

8. What is a fossil? How do fossils provide evidence of evolutionary change?

9. What is the difference between homologous structures and analogous structures? Give an example of each.

Questions to think about **(Beacon Media)**

1. How can the Fossil Record be explained? (Think about how animals were buried quickly.)

2. The Fossil Record is designed to show how different species evolved from one another over millions of years. Why do you think the designers of the Fossil Record introduced the idea of millions of years into their theory? (Think about the lack of evidence we see (or have seen throughout known history) for one species truly developing into another, such as a bird to a mammal.)

3. How old is the earth and life upon it, according to the Bible?

4. Explain the different types of science: Operational, Historical, Consensus.

5. What is the difference between a theory and an actual proven scientific fact?

6. Why do you think many people in the world like to believe what the majority believe, according to consensus? What does the Bible say about following the majority? (Mat 7:13-14)

7. Write the Biblical historical record of the beginning of the universe and life, in your own words, (Genesis chapters 1-2).

8. What are mutations and what is the problem for evolutionists who use mutations as evidence?

Mutations are actually a huge problem for microbes-to-man evolution, due to the relentless genetic decay that mutations cause.

9. What do evolutionists really mean when they say that a species changes over time?

Biological evolution is not simply a matter of change over time. Many things change over time: caterpillars turn into moths, trees lose and regrow their leaves, mountain ranges rise and erode, but they aren't examples of biological evolution because they don't involve descent with inherited modifications.

The Tree of Life

Charles Darwin first sketched this concept in 1837 in a notebook, drawing a tree-like diagram, with lower forms of life like amoebas, through to the highest form of life: human beings. At the top of his sketch he wrote the words "I think."

10. What does this tell us about Darwin's certainty of his theory?



