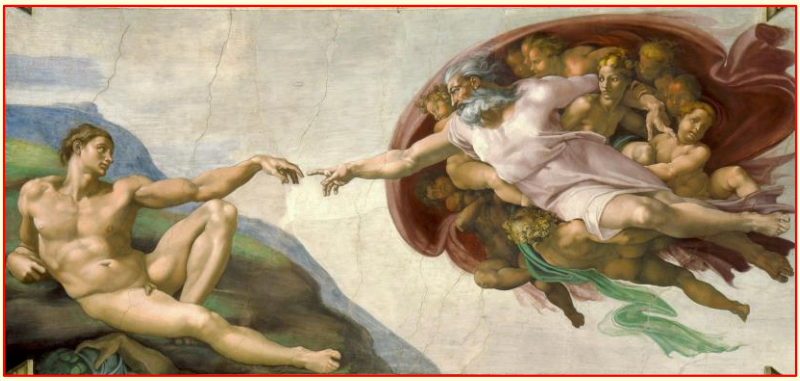
The History of Humanity



Michelangelo, *Creation of Adam*, Sistine Chapel, 1512

Last week we considered the origins of the universe. Today we shall talk about the origins of human beings.

This is Michelangelo's representation of the creation of Adam. Everyone focuses on Adam and the hand of God. But who is the woman?
The woman in the cloud with God has been interpreted in various ways. She may be Eve, or the Virgin Mary, or Sophia (Wisdom).

Genesis 1: 26

So God created man in his own image, in the image of God created he him; male and female created he them.

Genesis 2: 7

וייצר יהוה אלהים את־האדם עפר מן־האדמה ויפח באפיו
נשמת חיים ויהי האדם לנפש חיה:

way-yiser Yahweh elohim et ha-adam apar min ha-adamah way-yippah be-appaw nismat hayim wayhi ha-adam lenepes hayyah

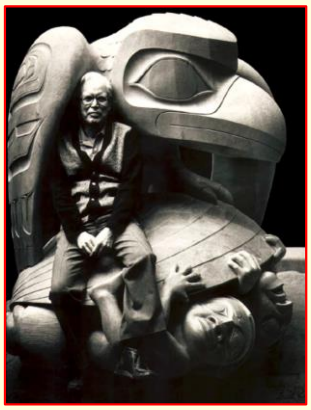
And the LORD God formed man of the dust of the ground, and breathed into his nostrils the breath of life; and man became a living soul.

Genesis contains two quite different versions of the creation of man. These are attributed to two different authors. The second version is the more striking and is probably more ancient. It was written by the author called J because he or she referred to God as Jehovah. In this second story Eve is made out of Adam's rib.

Of note in the Hebrew recitation, the name YHWH (the tetragrammaton) is not spoken but replaced with *Adonai* – Lord.
Also the word *adam* – Adam or man – is probably derived from the word *adamah* or dust.

The story of Adam and Eve is just one of many creation myths. This slide shows Bill Reid's carving of *Raven and the First Men*. The Raven opens a giant clam-shell to release the Haida people.

The Raven and the First Men



Bill Reid (1920-1998)

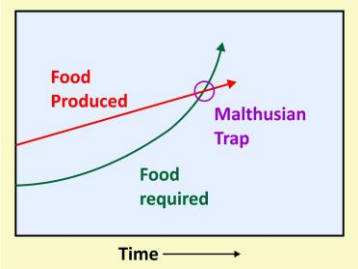
...It wasn't long before one, then another of the little shell brothers, timidly emerged. Some of them immediately scurried back when they saw the immensity of the sea and the sky and the overwhelming blackness of the Raven. But eventually curiosity overcame caution and all of them crept or scrambled out. Very strange creatures they were, two-legged like the Raven. There the resemblance ended. They had no glossy feathers, no thrusting beak, their skin was pale and they were naked except for their long, black hair on their round, flat-featured heads. Instead of strong wings they had stick-like appendages that waved and fluttered constantly. They were the original Haidas, the first humans.

The quotation is from Reid's 1984 book *The Raven Steals the Light*.

Thomas Robert Malthus (1766-1834)
mezzotint by John Linnell, 1834

An Essay on the Principle of Population (1798)

"The power of population is so superior to the power of the earth to produce subsistence for man, that premature death must in some shape or other visit the human race."



Science proposes that human beings evolved from lower life forms via a process of evolution. This idea originated with Charles Darwin and Alfred Russell Wallace. Before we consider their theories, we should look briefly at what contributed to their thinking. The first is the problem of population growth.

Malthus proposed that population increases geometrically until it exceeds the ability of the Earth to sustain it. At this time (the Malthusian trap) war, famine, and pestilence (cf the apocalypse) intervene to decrease the population. Darwin was impressed by Malthus' ideas. The theory of evolution was based on the competition for limited resources. Because of this competition, only the fittest survive to reproduce a subsequent generation.

Malthusian predictions have actually not yet come to pass because of improvements in agriculture (mechanization, fertilizer, genetics) and a decrease in fertility.

The other main contextual development leading to evolution was the idea that the world had existed much longer than the time described in the Bible. These long times were necessary to explain the findings of geologists like Hutton and Lyell that we discussed last week. These long times made it possible for multiple small inherited changes to accumulate leading to the differentiation of species.

William Paley (1743-1805)
Portrait by George Romney

Natural Theology, 1802

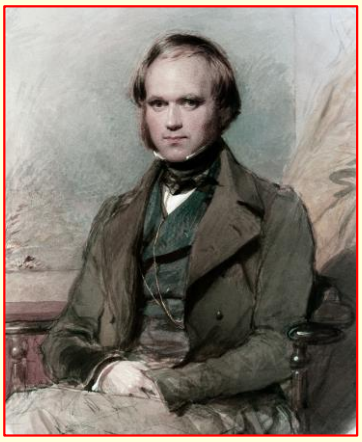
Paley imagined finding a watch upon the ground and discovering its intricate workings, so clearly different from a simple stone

"… the inference, we think, is inevitable, that the watch must have had a maker: that there must have existed, at some time, and at some place or other, an artificer or artificers who formed it for the purpose which we find it actually to answer; who comprehended its construction, and designed its use"

At the beginning of the 19th Century, science was rapidly increasing our understanding of the world. Many of the natural scientists (botanists, biologists, etc) were supported by the church, which provided them with livings in return for Sunday sermons. Natural theology – the scientific analysis of religious thought – became prominent. Paley proposed that the universe was so well designed and regulated that it could only have been created by a supreme intelligence. Darwin was excited by the idea that one might examine the divine processes underlying the world using science.

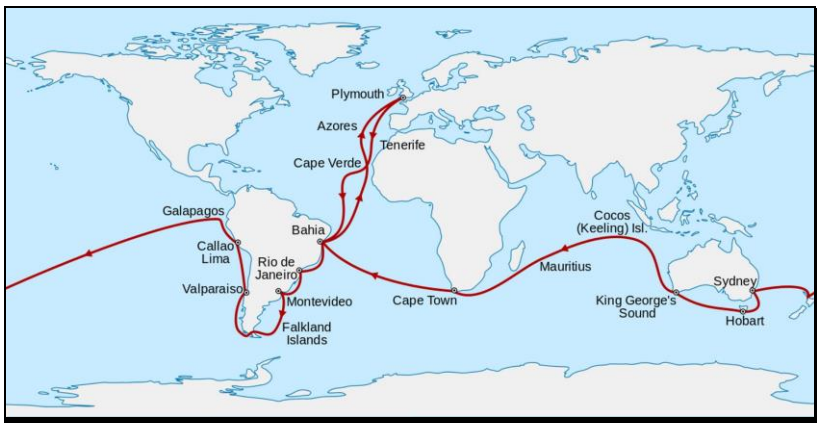
Charles Darwin (1809-1882)

Darwin was born into a prominent family – his grandfathers were the abolitionist Erasmus Darwin and the industrialist Josiah Wedgewood. He initially studied Medicine in Edinburgh, but found science more interesting. His father then sent him to Christ's College in Cambridge to study for a career in the Church. Darwin was impressed with recent work explaining God through the world He had created – *Natural Theology*. He spent almost five years as a naturalist on HMS Beagle on its voyage around the world (1831-1836).



Watercolor Portrait by George Richmond, about 1837

Darwin was initially intrigued by this "natural theology" but later realized that marvelously complicated things can evolve through forces that are acting without regard to the ultimate ends. His studies led him around the world and away from god.



The Voyage of the Beagle, 1831-1836

The voyage of the Beagle took almost five years from 1831 to 1836. The main goal of the voyage was to provide the admiralty with more accurate charts of the sea and coastline, particularly around South America. Charles Darwin was taken on as a supernumerary naturalist and geologist. He had just graduated and wanted to travel before settling down to be a parson. The voyage changed his life completely and provided him with observations that would lead to the Theory of Evolution.

Plankton

from Darwin's
journal
January, 1832

Polyps, plankton, jellyfish. Sea butterflies, the pteropods.
'So low in the scale of nature, so exquisite in their forms!
You wonder at so much beauty – created,
apparently, for such little purpose!'

Ruth Padel

Ruth Padel, the great-great-grandchild of Charles Darwin, wrote a book of poems based on the writings of her ancestor: *Darwin: A Life in Poems* (2009). These are basically just the words of Darwin, broken up into lines of poetry. The following is the complete poem:

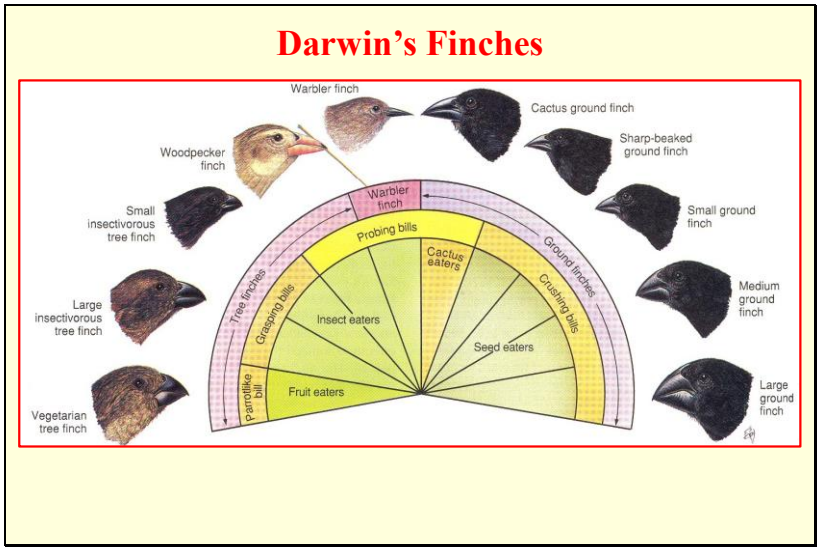
> The deck is dazzle, fish-stink, gauze-covered buckets.
> Gelatinous ingots, rainbows of wet flinching amethyst

and iridescent cream. All this
means he's better; and working on a haul of lumpen light.

Polyps, plankton, jellyfish. Sea butterflies, the pteropods.
'So low in the scale of nature, so exquisite in their forms!
You wonder at so much beauty – created,
apparently, for such little purpose!' They lower his creel

to blue pores of subtropical ocean. Wave-flicker, white
as a gun flash, over the blown heart of sapphire.
Peacock eyes, beaten and swollen,
tossing on lazuline steel.

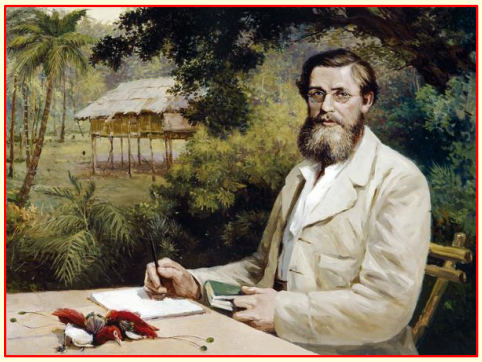
The pteropods are free-swimming sea snails also known as sea butterflies.
Darwin had experienced sea sickness for the first part of the voyage and this episode occurred near the Caped Verde Islands when he was finally feeling better.



One of the foundations of the theory of evolution is the idea of natural selection. One of the clearest demonstrations of this concept involves the finches of the Galapagos Islands. "Darwin's finches," as they are now called, are similar except for their beaks, some of which are long and narrow and others short and strong. Recent research has shown how the beaks are specifically adapted to the diets available on the different islands. Some of the finches eat insects, others open seeds, and others suck the nectar from cactus flowers. Given the variation in the shape of the beak and the differential benefit to survival of different beaks in different ecologies, natural selection has made the beaks more and more appropriate to the islands on which the finches reproduce.

Although Darwin collected samples of the different finches, he did not actually use them as an example of natural selection.

Alfred Russel Wallace (1823-1913)



Wallace was a naturalist who became interested in the way in which different species developed. He worked in the Malay Archipelago – islands are wonderful laboratories for studying speciation.

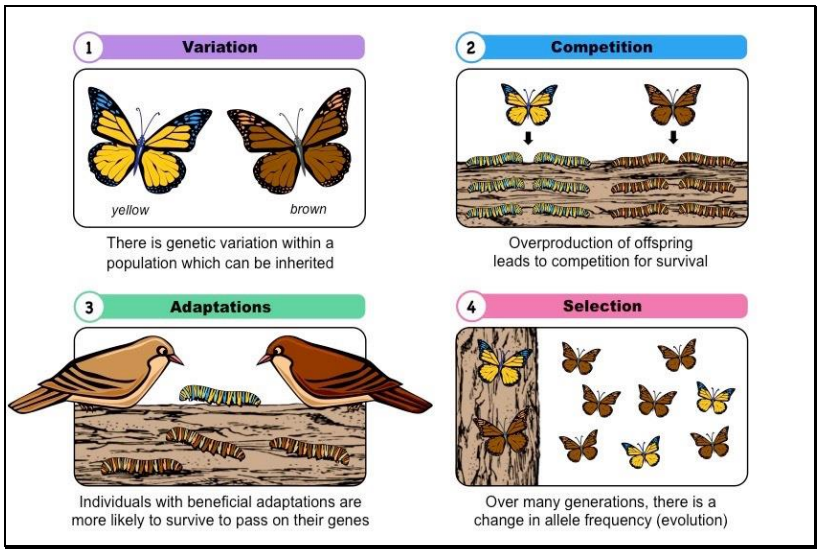
Wallace corresponded with Darwin and they realized that they had come to similar conclusions about the origin of different species. They both gave talks at the Linnaean Society in 1858. These were published as *On the tendency of species to form varieties; and on the perpetuation of varieties and species by natural means of selection.* This motivated Darwin to finish his book.

The picture shows Wallace with two Birds of Paradise. The plumage of the male birds of these species develops into quite striking forms due to sexual selection. Wallace was not rich. He had to make his living by selling biological samples to rich collectors. Wallace never became as famous as Darwin. Most likely this was due to Darwin's writing – his two books *On the Origin of Species* (1859) and *The Descent of Man* (1871) are easy to read and speak of general principles. Wallace's *The Malay Archipelago* is far more specific. However, part of Darwin's fame may also have been due to his connections through his aristocratic and academic family. Towards the end of his life Wallace became a believer in spiritualism, something which was very common in the early 1900s but something that detracted from his scientific prestige.

The title of the paper by Darwin and Wallace provides the two main factors underlying evolution: variation and selection.

This is a part of the Wallace collection of golden birdwing butterflies in the Natural History Museum in London. These specimens show the individual variations that provide the raw material for natural selection. Photograph by Robert Clark in an article by David Quammen "The Man Who Wasn't Darwin"
http://ngm.nationalgeographic.com/2008/12/wallace/quammen-text

The first requirement for evolution is the spontaneous variation in the characteristics of offspring. Neither Darwin nor Wallace understood how this occurred. The main cause of variation is mutation in the gene sequence in the chromosomal DNA in the germ cells (sperm and ova).



In summary the four essential aspects of evolutionary theory are

- variation in the characteristics of a population
- competition for resources such that only some of the population can be supported
- the selection of characteristics allowing their possessors to produce further offspring
- the inheritance of these selected characteristics.

The illustration shows the increase in the preponderance of brown butterflies who are less easily recognized by predatory birds than yellow ones. An actual example is the change in the Manchester moths in the 19th Century. As the industrial revolution progressed the trees became covered with soot. The moths which had originally been a light-pepper color changed to a dark color.

http://www.bbc.co.uk/manchester/content/articles/2008/06/04/040608_peppered_moth_feature.shtml

Both Darwin and Wallace had been impressed by Malthus' ideas on population growth. He had proposed that population increases geometrically until it exceeds the ability of the Earth to sustain it. At this time (the Malthusian trap) war, famine, and pestilence intervene to decrease the

population. In the theory of evolution this idea became the competition for limited resources. Because of this competition, only the fittest survive to reproduce a subsequent generation.

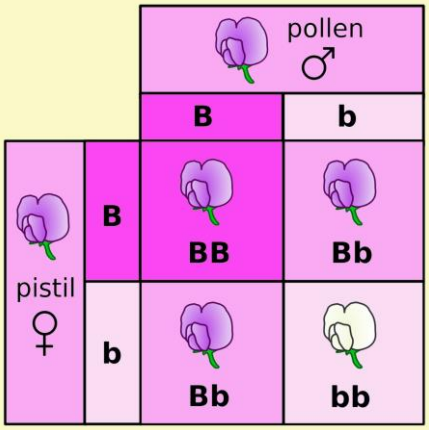
Natural selection is not creative. It is a negative force. The fecundity of nature leads to more life forms than can survive in a hostile world. Only those species that can generate more offspring continue into subsequent generations. Nature's very abundance leads to the widespread death of individuals and the continual extinction of species that cannot compete: "Mother Nature is a wicked old witch." (G. C. Williams)

The creativity of evolution comes from the spontaneous variation in the characteristics of the offspring.
Variation creates. Competition selects.

Inheritance

The Austrian monk Gregor Mendel (1822-1884) worked out the patterns by which characteristics were inherited.

Cross fertilizing blue peas with white peas gave all blue peas (dominant inheritance). Cross fertilizing the resultant blue peas gave 1/4 white peas (recessive inheritance) as shown in the diagram.



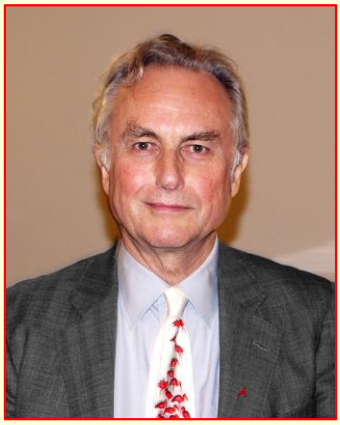
The diagram shows what happens when heterozygotes (seeds from the fertilization between one white and one purple flower) are fertilized with heterozygotes. The color of the flower shows that only one out of four of the offspring are white. The shading of the box suggested the effect of the dominant or recessive gene.

A major requirement for evolution is the process whereby offspring inherit traits from their parents. The general idea of inheritance was well known, but the actual process was unknown to Darwin and Wallace. Mendel published his results in 1865 but they were completely ignored. Other researchers recognized the importance of his results in 1900.

Note that for this particular trait (flower color) the heterozygote Bb is the same as the homozygote BB. Sometimes, the heterozygote may show some aspects of the non-dominant gene.

The Origin of Species

"Thus, from the war of nature, from famine and death, the most exalted object which we are capable of conceiving, namely, the production of the higher animals, directly follows. There is grandeur in this view of life, with its several powers, having been originally breathed by the Creator into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being evolved."

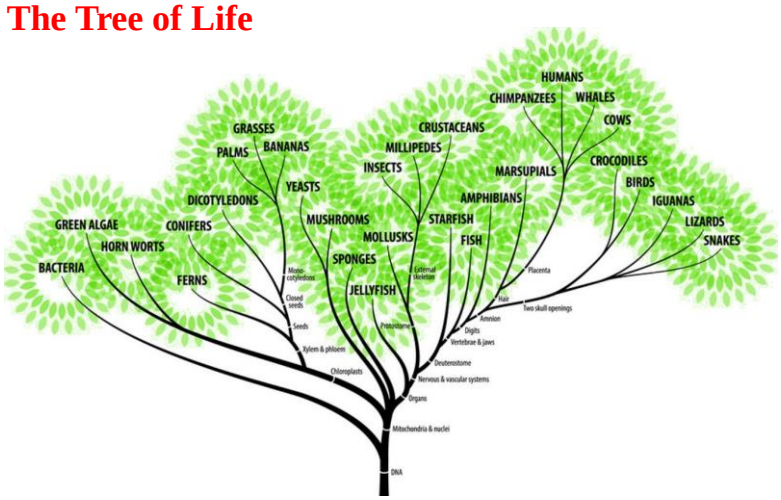


Richard Dawkins, 2010

The reading is by Richard Dawkins, whose pink-flamingo tie is by his wife Lalla Ward. He also wears an atheist-pin in his lapel.

The phrase "by the Creator" was not present in the first edition, but only added in the subsequent editions. Richard Dawkins suggests Darwin bowed to religious pressure and quotes a letter wherein Darwin regretted the addition. However, the expression "breathed by the Creator into" echoes the wording of Genesis 2, and suggests some creative force more than spontaneous generation. Nevertheless, the laws of survival in the natural world seem a far cry from the purpose of a divine creator.

The Tree of Life



Evolution has resulted in a great variety of life forms from bacteria to plants to animals. Within the animal there are branches that are as disparate as the octopus, which is one of the mollusks, and the human being, which is one of the mammals.

Over the years the tree has formed and lost many different branches. The branch of the dinosaurs has long since dropped off the living tree.

Emma Darwin (1808-1896)

In 1839 Darwin married Emma Wedgwood, a devout Christian. The marriage was a very loving one. Darwin's investigations into the evolution of species led him away from Christianity. His religious skepticism was reinforced by his grief at the deaths of several of his children, which he could not reconcile with a loving God. Emily wrote her husband a note worrying about his salvation:

I thank you for all the affection, which makes
my happiness more and more each day.
But everything that concerns you concerns me.
I should be most unhappy if I thought
we would not belong to each other for eternity.

watercolor portrait of Emily, George Richmond, 1840

The text of the note was made into a poem by Ruth Padel. The full text follows:

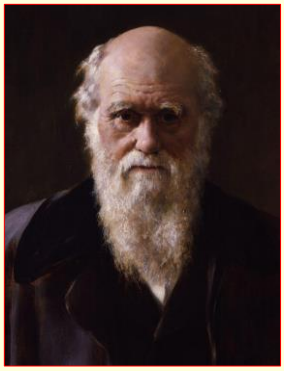
'When I talk to you face to face I cannot say
exactly what I wish.' Her back aches all the time;
she never goes out. His friend's wife has died
in childbirth. 'You say you are uncertain
about Christian Revelation but your opinion
is still not formed.' He's told her his discoveries:

she'd love him to be right in everything. She's very afraid
he's not. 'Faith is beyond our comprehension,
not provable in the scientific way you like.
I believe you sincerely wish to learn the truth.
But there are dangers in giving up Revelation
and Christ's offer of eternal life. And in the sin —

I know you will have patience with your own
dear wife — of ingratitude for His suffering,
casting off what has been done. For you,
for everyone. I do not wish an answer.
It is satisfaction for me just to write. My fear
is for the afterlife. I cannot say how happy

you make me in this one, nor how dearly I love you.
I thank you for all the affection, which makes
my happiness more and more each day.

But everything that concerns you concerns me.
I should be most unhappy if I thought
we would not belong to each other for eternity.'



Charles Darwin (detail)
John Collier 1881

He kept her note all his life. He must have said
something then, but he wrote to her too
on the outer fold. (No one knows when.
He was maybe quite old. He wasn't blind
to where his thought led, what she thought
she'd lose.) 'When I am dead, know
I have kissed and cried over this many times.'

Bishop Samuel Wilberforce (1805-1873)

Thomas Henry Huxley (1825-1895)

Samuel Wilberforce was the son of William Wilberforce, who campaigned against slavery. Samuel graduated from Oxford and rose through the ranks of the Anglican Church and became Lord Bishop of Oxford in 1845. He was an esteemed orator. "Ape" (Italian for "bee") was the pseudonym of Carlo Pellegrini. Samuel Wilberforce was known as "Soapy Sam" and Huxley as "Darwin's Bulldog"

Thomas Huxley left school at the age of 10 years and taught himself geology, logic and biology. He attended medical school in London but did not take his final MB exams. He became an expert on comparative anatomy, and was quite taken by Darwin's *On the Origin of Species* (1859). He became a popularizer of the theory of evolution, and became known as "Darwin's Bulldog." He was the grandfather of the novelist Aldous Huxley (*Brave New World*) and the scientist Andrew Huxley (nerve biophysics).

In 1860 Wilberforce and Huxley participated in a discussion of Darwin's theories at the Oxford University Museum. Others also participated, but the most memorable interchange was between Wilberforce and Huxley. No minutes were taken and we only know of what was said through various recollections. This is how Mrs. Isabella Sidgwick remembered it:

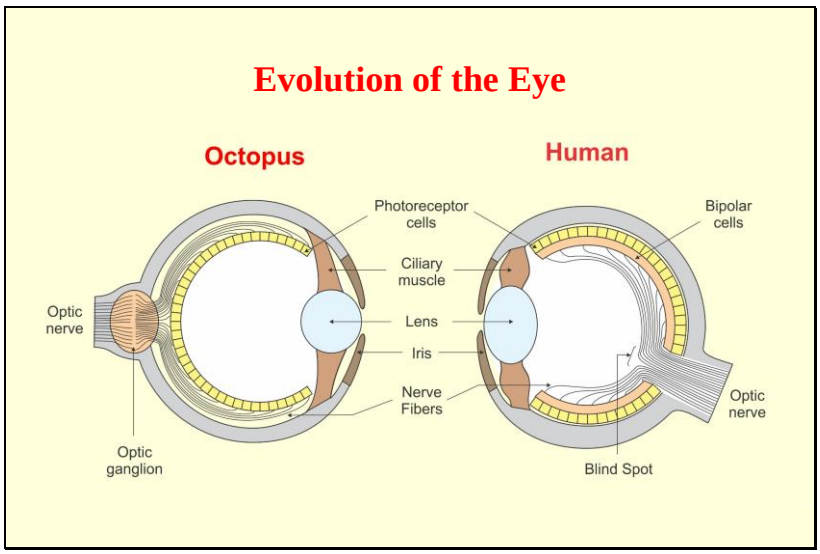
The Bishop rose, and in a light scoffing tone, florid and he assured us there was nothing in the idea of evolution; rock-pigeons were what rock-pigeons had always been. Then, turning to his antagonist with a smiling insolence, he begged to know, was it through his grandfather or his grandmother that he claimed his descent from a monkey? On this Mr. Huxley slowly and deliberately arose. A slight tall figure stern and pale, very quiet and very grave, he stood before us, and spoke those tremendous words — words which no one seems sure of now, nor I think, could remember just after they were spoken, for their meaning took away our breath, though it left us in no doubt as to what it was. He was not ashamed to have a monkey for his ancestor; but he would be ashamed to be connected with a man who used great gifts to obscure the truth.

Sexual Selection

Evolution requires variation and selection. One of the difficulties with attributing variation to spontaneous changes of the genetic material is that most genetic mutations are not beneficial and many are lethal. Sexual selection whereby material is combined across the two parents provides a much safer means for variation.

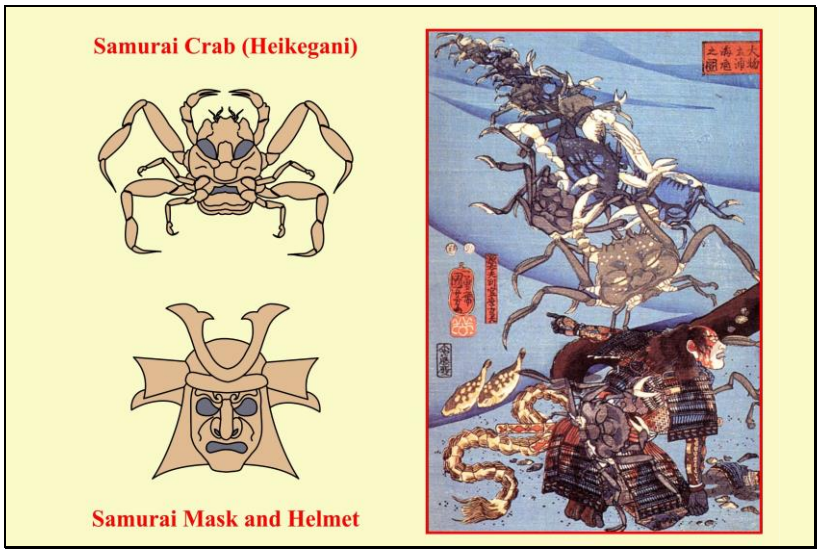
Sexual selection brings another factor – desire – into evolution. Females can choose to mate with males who fulfill certain qualifications. This can lead to strange and wonderful effects, such as the tail of the peacock. However, it can lead to consciousness having an effect on evolution. Human females may choose males who are intelligent and considerate of others, thereby promoting the survival of those qualities in our species.

The peacock's tail may not just be beautiful to the eye. It may indicate that the male who can flaunt such a tail has sufficient strength and health to overcome the burden of a tail which in itself decreases his ability to escape predators and requires great metabolic support.



The octopus eye is remarkably similar to the human eye even though the two species are really far apart on the evolutionary tree. They both act as pinhole cameras to focus images on the photoreceptors. The octopus eye has a pupil, lens and muscle to operate the lens just like the human eye. However, the light falls directly on the photoreceptor cells in the octopus eye. It does not have to go through the nerve cells as it does in the human eye. The embryological development of the two eyes is different. The octopus retina develops from an invagination of the skin whereas the human retina develops from an outpouching of the brain.

There are two fascinating conclusions.
First, evolution can settle on a good design even in completely different species – "parallel evolution."
Second, we are not sure whether there is any benefit to the backward structure of the human eye (or whether it is a design-flaw).

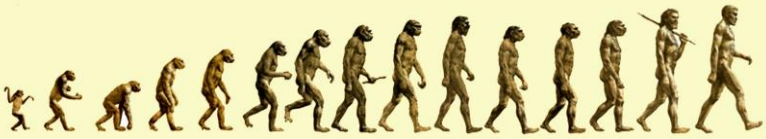


One must beware of evolutionary just-so stories – post hoc explanations for why animals develop in the way they did. Kipling wrote many of these tales – such as how the elephant got its trunk: The curious baby elephant asked the crocodile what he ate for dinner. "I think today I shall begin with an elephant child." And grabbed onto the elephant's nose. A tremendous tug of war ensued. The elephant's nose got longer and longer, until finally the crocodile let go.

A flagrantly false just-so story was the explanation for why flamingos were pink. Supposedly this color camouflaged them when seen against the setting sun and thus preserved them from attack by predators who came in the evening to drink at the lake. Yet a flamingo of any color standing in front of the setting sun will appear black.

Another evolutionary just-so story is the explanation for the patterns on the shell of the samurai crab found in the Inland Sea of Japan. The dorsal shell looks very similar to the face of an angry samurai. A local myth is that these crabs contain the souls of the samurai warriors who drowned in a great sea battle in 1185. On the right is a print showing a drowning warrior changing into a crab. Evolutionary biologists have claimed that samurai crabs evolved to have this facial pattern because fisherman would not eat those that looked like samurai for fear they might disturb the ghosts. These crabs were therefore thrown back into the bay. These rejected crabs then survived to reproduce more crabs with human faces on their shells. This explanation is completely false. Since samurai crabs are only 1 to 2 cm in body size, they are too small to eat, and fishermen throw all the crabs back into the bay. There is no selection.

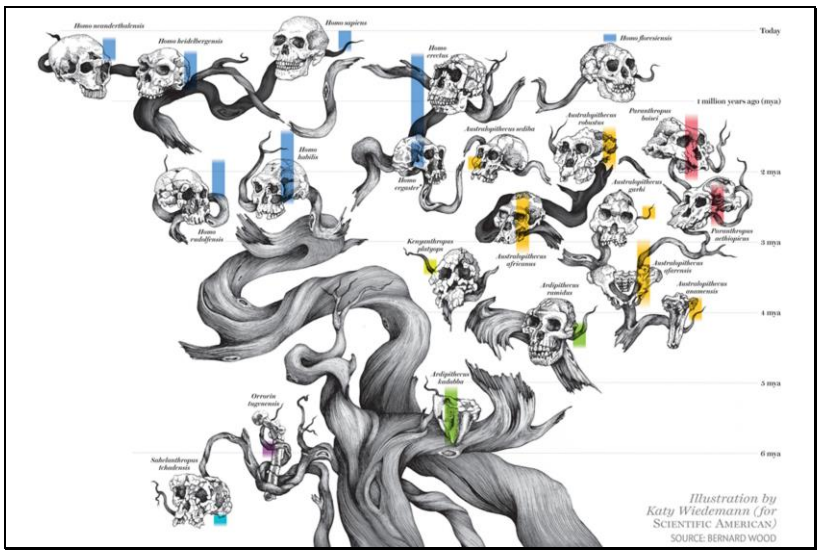
The March of Progress



A great misconception about the evolutionary origins of humanity is that there is a simple linear descent from ape to man. This has led to multiple problems: where are the missing links? why is the process not continual with more and more human beings developing from earlier versions?

The evolution of man actually involved a very complicated pathway with many branches that died off or were assimilated, and with several different groups of hominids developing over time.

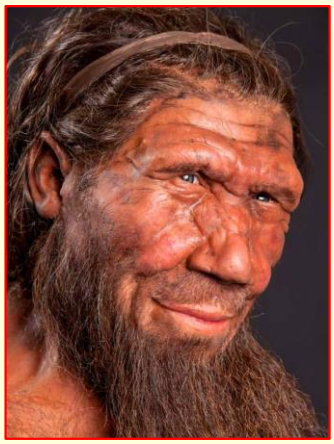
The *March of Progress* was an illustration by Rudolph Zallinger for the Time-Life book by F. Clark Howell *Early Man* (1965).



This shows some of the Homo species that developed over time and how they might be related. The time scale is on the right. The period wherein the species existed are shown by the colored bars.

see
https://www.scientificamerican.com/article/the-origin-of-humans-is-surprisingly-complicated/
https://www.aclu.org/files/images/asset_upload_file577_23137.pdf

Recent evidence from a dig in Morocco suggest that Homo sapiens may have existed as long ago as 400,000 years and may have been more widely distributed in Africa than we thought.
http://www.nature.com/news/oldest-homo-sapiens-fossil-claim-rewrites-our-species-history-1.22114



Reconstruction, Natural History Museum London

Neanderthals

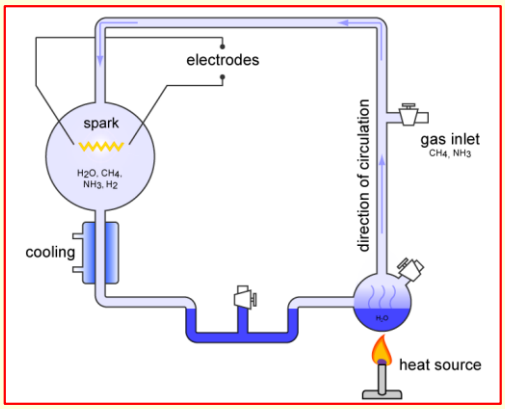
The first fossils of *Homo neanderthalis* were found in the Neander valley near Düsseldorf in 1856. Similar fossils had been discovered before but not attributed to an early hominin species. Initial views were that the Neanderthals were an extinct ancestor of Homo sapiens. Recent DNA research has shown that the human evolutionary tree is much more complex than originally believed. Neanderthals and modern humans diverged from an earlier ancestor some 450,000 years ago. Neanderthals became extinct by about 40,000 years ago but not before interbreeding with their human cousins.

Early modern humans, Denisovans and Neanderthals all interbred with each other on multiple occasions over the past 100,000 years.
The idea that different species cannot interbreed and produce fertile offspring is a misconception. The original idea of species involved animal groups that were distinctly different and did not (not could not) interbreed.

Specifically Neanderthal genes are not present in the genome of Africans, but they are present in European and Asian human beings.

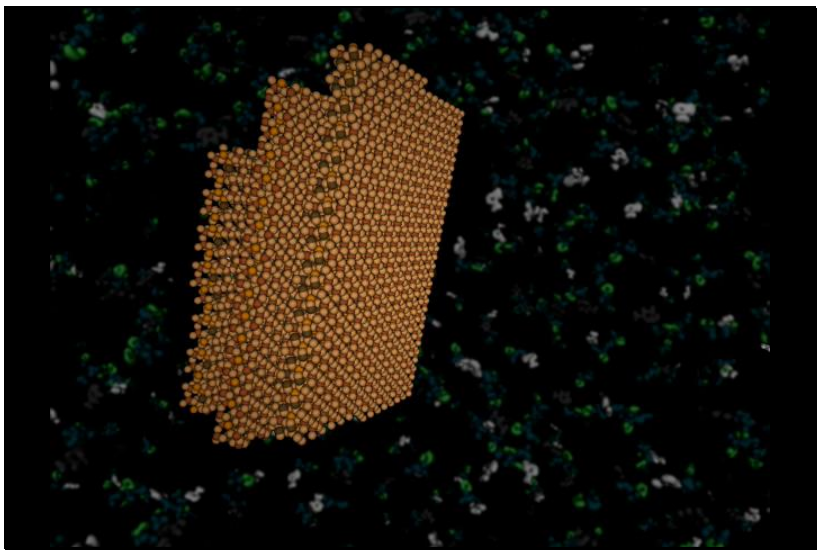
Abiogenesis

Alexander Oparin, a Russian biochemist proposed in 1924 that the chemicals necessary for life came together in some primordial soup activated by volcanic heat and atmospheric lightning.

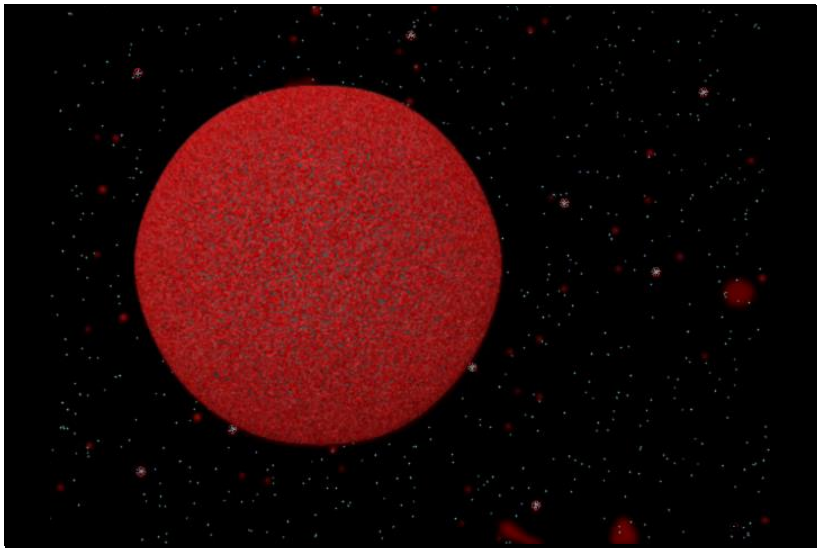


In 1952 Stanley Miller and Harold Urey showed how amino acids, the building blocks of proteins, could be produced by passing an electric current through a gaseous mixture of hydrogen, methane, ammonia, and water.

In 1859 Pasteur had found no evidence for the growth of microorganisms in bottles that had been sterilized. He then proposed that life could never be spontaneously generated, but must always derive from pre-existing life. Darwin's theory of evolution, however, would entail that in the beginning simple life forms must have somehow been generated from inanimate precursors. How this occurred is unknown. Creationists point to this as a major flaw in the theory of evolution.



Alexander Cairns-Smith proposed in 1985 that long chain molecules like RNA and phospholipids (essential to cell membranes) might form by aligning themselves on the surface of clay.
http://exploringorigins.org/



Once a phospholipid membrane had formed around an RNA molecule we have the basis for cell reproduction.
http://exploringorigins.org/

The 20th Century has thus increased our understanding of evolution
However, it also brought a backlash against the theory of evolution.
This was led by fundamentalist Christianity.

Fundamentalism

The five pillars of the Protestant Reformation were:

sola scriptura
sola gratia
sola fide
solus Christus
soli Deo gratia

At the end of the 19th and beginning of the 20th Century, Protestants found themselves challenged by the new developments in science and art. They found comfort in a return to basics – "old-time religion." Between 1910 and 1915, the Bible Institute of Los Angeles published a series of essays on the basic beliefs of Protestant Christianity entitled *The Fundamentals*. These essays affirmed that the Bible was inspired by God and should be accepted as literal truth.

Like heliocentrism, evolution questioned our belief that humanity was special. The Christian church had great difficulty accepting that human beings had not been created by God but had developed from other animals. This was especially true of that branch of Protestantism that had decided to return to the fundamentals of the Reformation.

Lyman Stewart, founder of Union Oil, and his brother Milton supported the publication of *The Fundamentals*. The chapters of the first volume concern virgin birth, deity of Christ, incarnation, trinity, etc.

The five pillars were:
by scripture alone – Biblical inerrancy
by grace alone – salvation is granted by God not earned by man
by faith alone - not by good works nor by indulgences
through Christ alone – Christianity is the only path to salvation
for the glory of God – not for any temporal power

The song "Give me that old time religion" is sung by Leslie Uggams. It is used at the beginning of the movie *Inherit the Wind.*

In 1925 the state of Tennessee passed the Butler Act which made it unlawful for public school teachers "to teach any theory that denies the Story of the Divine Creation of man as taught in the Bible, and to teach instead that man has descended from a lower order of animals." The law was challenged by the teacher John Scopes (left). The trial was held in Dayton, Tennessee. Clarence Darrow was with the defense and William Jennings Bryan with the prosecution.

Scopes was a 24-year old unmarried teacher. He volunteered to be the test case for the American Civil Liberties Union to challenge the Butler Law.

Clarence Darrow was the most famous trial lawyer in the United States. He was 68 years old. William Jennings Bryan was three times a candidate for the Presidency. He served as Secretary of State under Woodrow Wilson. He was 64 years old. The two opponents knew each other. They had both supported progressive causes. However, Bryan was a fundamentalist Christian and Barrow as a confirmed atheist.

The trial was held in July and the temperature in the courthouse was extremely high. The judge allowed the lawyers to take off their coats.

The trial lasted ten days. The judge ruled that defense expert-witnesses on the theory of evolution were irrelevant to the issue of the trial – whether the government could tell teachers what they

should teach. The only way that Darrow could make his points clearly was to examine Bryan as a witness on the Bible. Due to the heat and the crowds, the judge adjourned the trial to the lawn in front of the courthouse for Darrow's examination of Bryan.

Jerome Lawrence and Robert E. Lee wrote *Inherit the Wind*, a fictionalized account of the Scopes Trial in 1955. The title comes from *Proverbs* 11:29

> He that troubleth his own house shall inherit the wind: and the fool shall be servant to the wise of heart.

The authors were concerned more with the right to think than with the rightness of evolution. The political context of the time the play was written was McCarthyism and the persecution of those who had supported communism.

Nevertheless the play does reasonable justice to the trial and often quotes from the transcripts. I shall present two clips from the 1960 movie version starring Spencer Tracy as Drummond (Darrow) and Frederick Marsh as Brady (Bryan). Gene Kelly portrayed the reporter (based on Henry Mencken), Dick York the character based on Scopes and Harry Morgan the judge.

The first clip presents an imagined scene of Darrow and Bryan talking on the front stoop of the hotel. The two had actually been friends and the scene plays well. Bryan says that religion provides comfort. Darrow tells how one becomes disillusioned when what we realize that our treasured beliefs are not true.

The second clip is from the trial. Much of this is actually from the transcript. The comments of Darrow about what might have happened had Joshua actually enjoined the sun to stand still make no sense at all. But then miracles do not have to make sense.

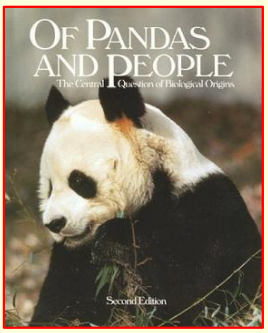
Science is a magnificent force, but it is not a teacher of morals. It can perfect machinery, but it adds no moral restraints to protect society from the misuse of the machine. It can also build gigantic intellectual ships, but it constructs no moral rudders for the control of storm-tossed human vessel. It not only fails to supply the spiritual element needed but some of its unproven hypotheses rob the ship of its compass and thus endanger its cargo. In war, science has proven itself an evil genius; it has made war more terrible than it ever was before (Bryan's concluding comments, not allowed at the trial).

At the end of the trial, the judge did not allow Bryan to give his summation to the jury. He handed out his speech to the newspapers. His comment are forceful. The trial was in the aftermath of World War I. No one had yet understood the moral responsibility of science. The problem returned in World War II with the development of the atomic bomb.

The comments in the slide continued:

Man used to be content to slaughter his fellowmen on a single plane, the earth's surface. Science has taught him to go down into the water and shoot up from below and to go up into the clouds and shoot down from above, thus making the battlefield three times as bloody as it was before; but science does not teach brotherly love.

Aftermath of the Scopes Trial



Scopes was found guilty and fined $100. Because of technicalities, the supreme court of Tennessee set aside the verdict. The Butler Act was not repealed until 1967.

Many states enacted similar laws against teaching evolution. In the 1980s these came to trial, and were defeated on the basis of the Establishment Clause of the First Amendment to the US Constitution forbidding the government from establishing any one religion.

In the 1990s the idea of intelligent design was proposed as an alternate, scientific non-religious theory of the origins of man. The School Board of Dover County, Pennsylvania, proposed that students be made aware that evolution was not fully proven and that intelligent design (as described in the book *Of Pandas and People*) was another way to look at the origins of life.

The actual text of the First Amendment is
Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof; or abridging the freedom of speech, or of the press; or the right of the people peaceably to assemble, and to petition the Government for a redress of grievances.

In Dover County teachers were required to read the following to their students:
Because Darwin's Theory is a theory, it is still being tested as new evidence is discovered. The Theory is not a fact. Gaps in the Theory exist for which there is no evidence. A theory is defined as a well-tested explanation that unifies a broad range of observations. Intelligent design is an explanation of the origin of life that differs from Darwin's view. The reference book *Of Pandas and People*, is available for students to see if they would like to explore this view in an effort to gain an understanding of what intelligent design actually involves. As is true with any theory, students are encouraged to keep an open mind. The school leaves the discussion of the origins of life to individual students and their families.

The idea of the title of the book *Of Pandas and People* is basically that the red panda and the giant panda are biologically very distinct – the giant panda is a bear and the red panda is related to racoons. However, they have similar facial appearance, they both feed on bamboo and they both have a strange “false thumb” (helpful for holding bamboo shoots). (We have already considered a far more striking example of parallel evolution in the eyes of the octopus and the human.) The main argument of the book is that, since the analogies between the “thumbs” of the red and giant panda are not due to common descent, all anatomical arguments in favour of common descent should be regarded as suspect.

Further discussion is at
https://paulbraterman.wordpress.com/2014/07/05/the-problem-with-pandas/

Intelligent Design

Arguments for intelligent design are

1. the low probability of benevolent mutations.
2. the "irreducible complexity" of evolved systems

The Dover School Board was challenged in 2005 in the Kitzmiller vs Dover trial. The final judgment was that

(i) Intelligent design is not a science in that it is based on supernatural intervention, it is not based on observation or experiment, and its claims are not testable.

(ii) Intelligent design is simply another name for creationism, and is basically the restatement of the Christian story of human origins. As such its mandatory teaching is against the Establishment Clause.

The full transcript of the trial judgment in Dover County is available at https://www.aclu.org/files/images/asset_upload_file577_23137.pdf

One of the witnesses for the defence was Professor Behe who proposed
By irreducibly complex I mean a single system which is composed of several well-matched, interacting parts that contribute to the basic function, wherein the removal of any one of the parts causes the system to effectively cease functioning. An irreducibly complex system cannot be produced directly by slight, successive modifications of a precursor system, because any precursor to an irreducibly complex system that is missing a part is by definition nonfunctional . . . Since natural selection can only choose systems that are already working, then if a biological system cannot be produced gradually it would have to arise as an integrated unit, in one fell swoop, for natural selection to have anything to act on.

The Special Creation of the Human Soul

In the Encyclical *Humani Generis* of 1950, Pope Pius XII stated that "the origin of the human body from pre-existing and living matter" may be considered by the faithful, but was not yet proven by the facts. He affirmed that "the Catholic faith obliges us to hold that souls are immediately created by God."

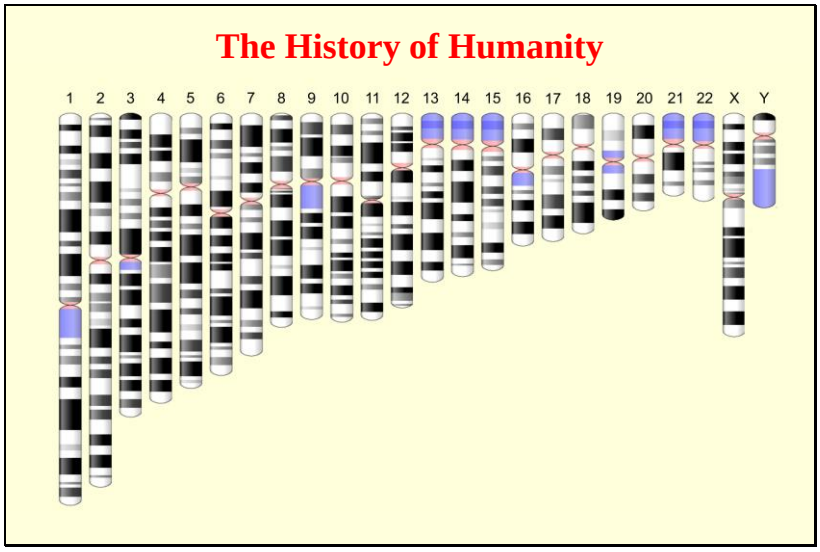
In 1996, Pope John-Paul II recognized evolution as "more than a hypothesis." In 2004, he reaffirmed that "the emergence of the first members of the human species … represents an event that is not susceptible of a purely natural explanation and which can appropriately be attributed to divine intervention."

Pius XII (1876-1958)
elected pope in 1939

A longer excerpt from the 2004 address of Pope John-Paul II entitled *Human Persons Created in the Image of God:*

> The structures of the world can be seen as open to non-disruptive divine action in directly causing events in the world. Catholic theology affirms that that the emergence of the first members of the human species (whether as individuals or in populations) represents an event that is not susceptible of a purely natural explanation and which can appropriately be attributed to divine intervention. Acting indirectly through causal chains operating from the beginning of cosmic history, God prepared the way for what Pope John Paul II has called "an ontological leap...the moment of transition to the spiritual." While science can study these causal chains, it falls to theology to locate this account of the special creation of the human soul within the overarching plan of the triune God to share the communion of Trinitarian life with human persons who are created out of nothing in the image and likeness of God, and who, in his name and according to his plan, exercise a creative stewardship and sovereignty over the physical universe.

We shall return to the church's concept that the soul is specially created by God next week.



The history of humanity is written in the human genome. Or as Francis Collins has proposed the genetic code is the language of God. I cannot give the complete genome (from the Greek *gen* offspring) but we can consider the *karyotype* (from the Greek *karyon*, seed), which displays the different chromosomes in order of decreasing size (with the sex chromosomes excepted). The gene locations on these chromosomes is indicated by counting the number of bands and sub-bands away from the centromere (red) on either the short p-arm (petit) or the long q-arm. The bands are shown by different staining processes (black, grey and blue shading) . The human being has 22 pairs of autosomal chromosomes and 2 sex chromosomes. A person with both X and Y chromosome is typically male, and a person with two X chromosomes typically female. The diagram shows only one of each autosomal pair and one of each sex chromosomes. This type of illustration provides a map of where our genes are located. Our genes tell the history of our origins.