EVOLUTION AND HUMAN NATURE

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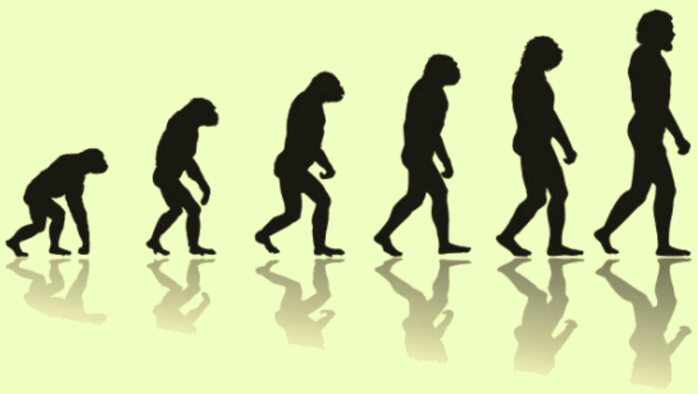
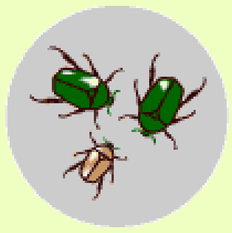


BIOLOGICAL EVOLUTION

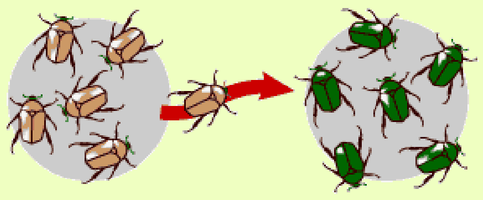
"Descent with modification"

Genetic variation

- **Mutations** are permanent changes in the DNA sequence of organisms.
- **Gene flow** is any movement of genes from one population to another.
- **Sexual reproduction** can introduce new gene combinations from both parents.

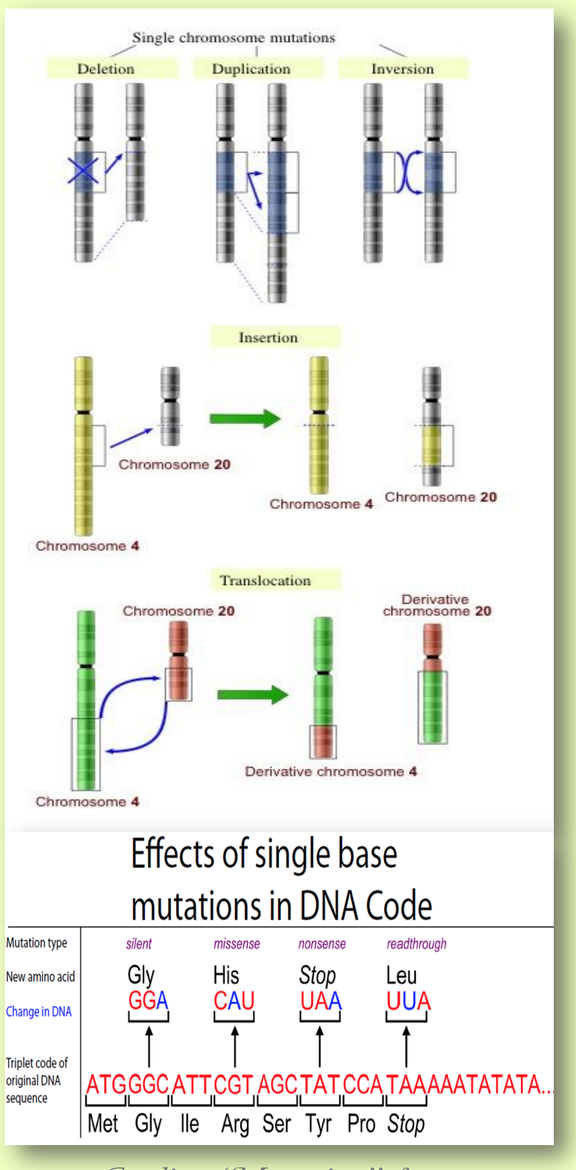


A **mutation** could cause beetles with genes for bright green coloration to have offspring with a gene for brown coloration.



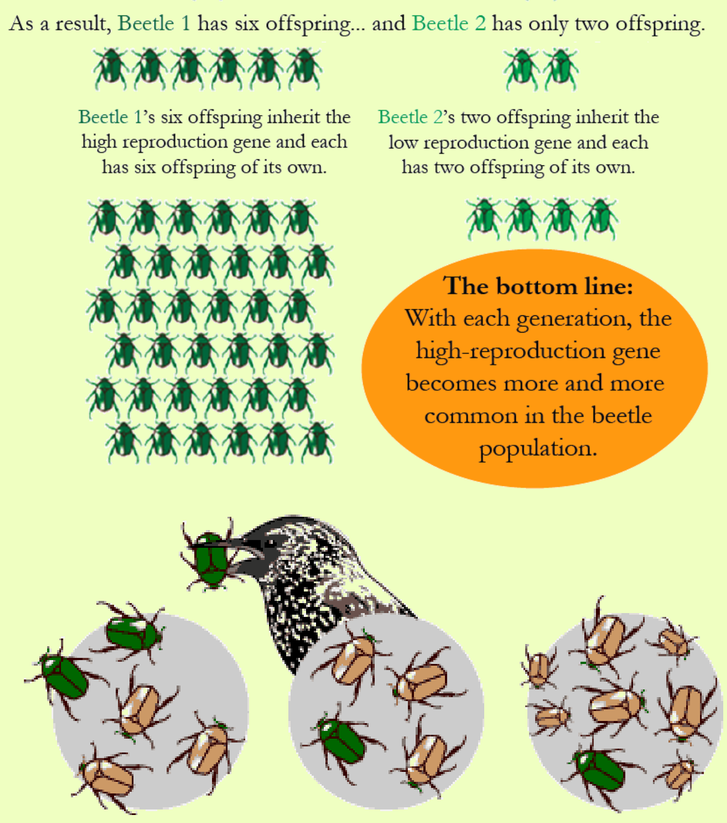
Gene flow could result from individuals of a population of brown beetles joining and breeding with a population of green beetles.

Different types of mutations:
Chromosomal changes and point mutations



Credits: "Mutation" from Wikipedia and Bio-book

Natural selection



Genetic variations can result in offspring that are more "fit", with **better potential for survival and more successful at reproducing**. These new genes may be passed on to the next generations and become dominant through a natural selection: **survival of the fittest.**

- **Fecundity selection** acts if the new gene increases the **rate of reproduction**.
- **Viability selection** acts if the new gene improves the **probability of survival** of the organism till adult age; for example bright green beetles may be spotted more easily by predators.

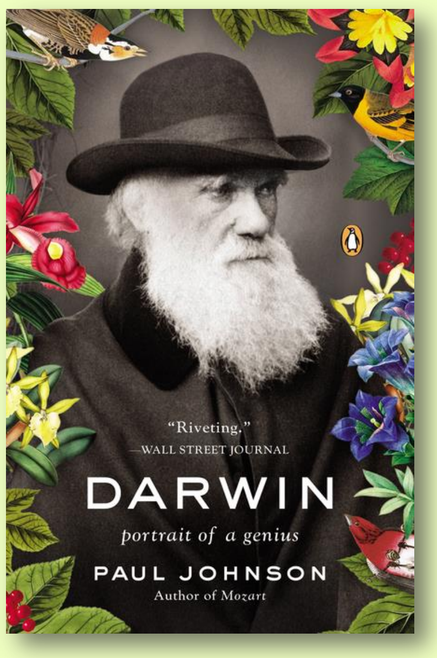
Does evolutionary theory need a rethink?

It is difficult to explain species complexity using only the classical theory of evolution. More recent theories suggest that some other processes should be considered fundamental:

- **Epigenetics:** gene activation as a result of environmental factors can be hereditary.
- **Evolutionary developmental biology (evo-devo):** genetic mutations can happen at an early development stage, "arrival of the fittest" as opposed to the "survival of the fittest".
- **Natural cooperation:** evolution is based on competition between individuals and should therefore reward only selfish behavior. However, "natural cooperation" -groups of organisms working together for common benefits, sometimes to the detriment of the single individual- appears to be a fundamental aspect of the evolutionary process.

CHARLES DARWIN (1809 – 1882)

Based on the P. Johnson biography

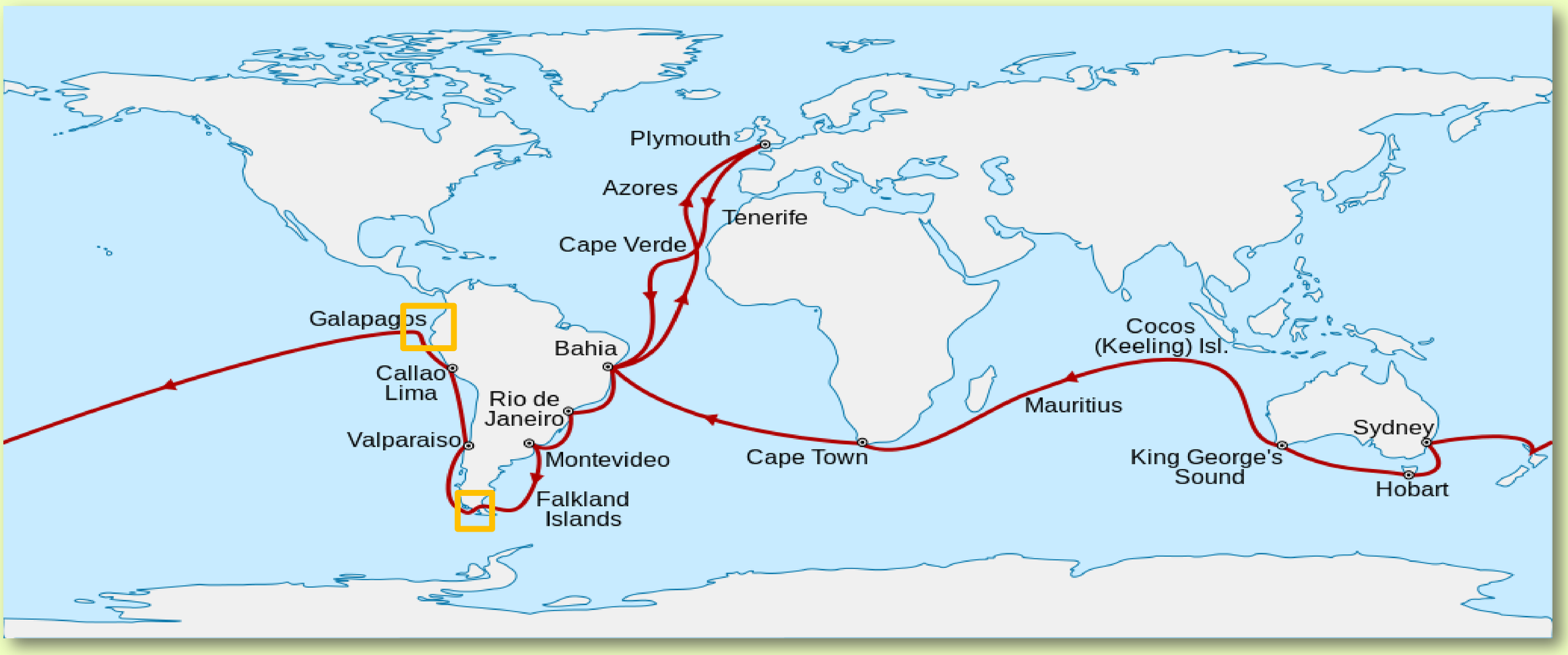


12 February **1809**: Born in UK
1831-1836: trip on the HMS Beagle
1839: marriage with his cousin Emma Wodgwood (10 children)
1859: "The Origin of Species"
1871: "The Descent of Man and Selection in Relation to Sex"
1872: "The Expression of the Emotions in Man and Animals"
19 April **1882**: Darwin's death

In **1830** Charles Lyell published "The Principles of Geology" in which it was demonstrated that the Earth was millions of years old. Darwin understood that there had been sufficient time for existing species to emerge gradually.

Between **1831 and 1836**: Darwin took a five-year voyage around the world for scientific purposes. The publication of his journal ***"The Voyage on the HMS Beagle"*** made him a famous author.

This voyage has been *"the most important event in my life"*. Darwin kept a comprehensive record, of both a descriptive and speculative nature, and collected many specimens which were shipped to the UK.



Galapagos Islands

Darwin studied "*a most singular group of finches*" peculiar to the Galapagos, with small but significant variations in their beaks. He wrote:

- ***"Seeing this gradation and diversity of structure in one small, intimately related group of birds, one might really fancy that from an original paucity of birds in this archipelago, one species had been taken and modified for different ends"***
- ***"We seem to be brought near to that great fact – the mystery of mysteries – the first appearance of new beings on this earth".***

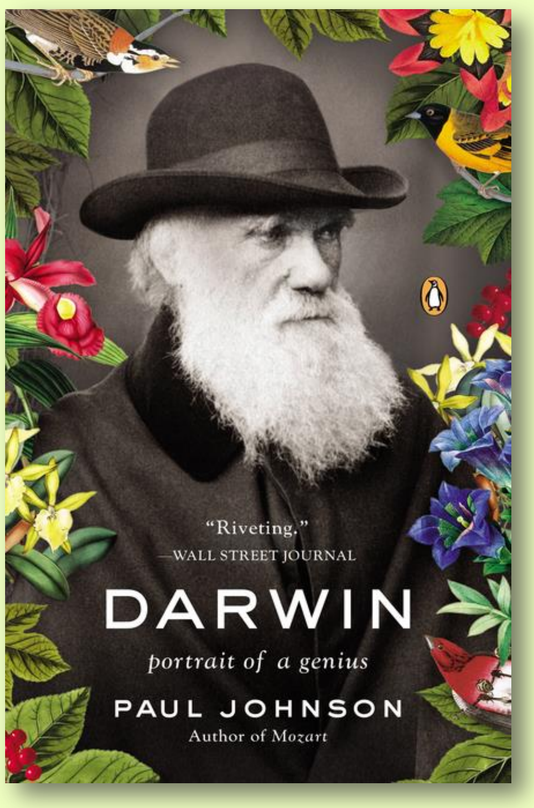
Tierra del Fuego

Darwin was impressed by the natives of Tierra del Fuego. ***"I could not have believed how wide was the difference between savage and civilized man: it is greater than between wild and domesticated animals".*** This conclusion was mostly based on the gossip of the Beagle's sailors, which Darwin believed to be true, but that was contradicted by later explorers.

CHARLES DARWIN (1809 – 1882)

Based on the P. Johnson biography

BACK FROM THE VOYAGE



- Darwin became a celebrity.
- He wrote many papers based on data and specimens collected during the voyage.
- He worked on new material (plants, birds, mammals), developing/testing what was to be his great "idea".
- Darwin had already accepted evolution but he missed the "how". Thomas Malthus's "Essay on Population" suggested an answer. Malthus's law (not demonstrated) states that population grows geometrically while food supply grows arithmetically, leading to unavoidable struggles. Darwin called this "struggle" **Natural Selection**. **Species evolve in order to survive.**

Marriage

He married Emma Wodgwood in 1839. Emma was clever, educated, sensitive, and a sincere Christian. Darwin was at that time indifferent to religion, and very much opposed to the doctrine of everlasting punishment. He wrote to Emma on this matter before the marriage, and her reply showed her appreciation for his sincerity. They had great respect and love for each other.

The Death of Annie Darwin

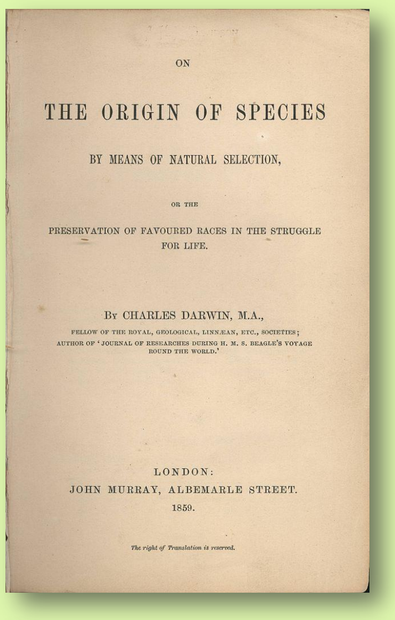
Annie was Darwin's favorite child: ***"a perfect angel"***. She died in 1851.

Darwin spent a lot of time with Annie while she was being treated far from home, and wrote many letters to Emma. When Annie was close to death, those letters became a long prayer to God for her recovery. Her death caused the final collapse of Darwin's belief in God.

Evolution and Human Nature

THE ORIGIN OF SPECIES

"There is a grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one"


ON

THE ORIGIN OF SPECIES

BY MEANS OF NATURAL SELECTION,

OR THE

PRESERVATION OF FAVOURED RACES IN THE STRUGGLE FOR LIFE.

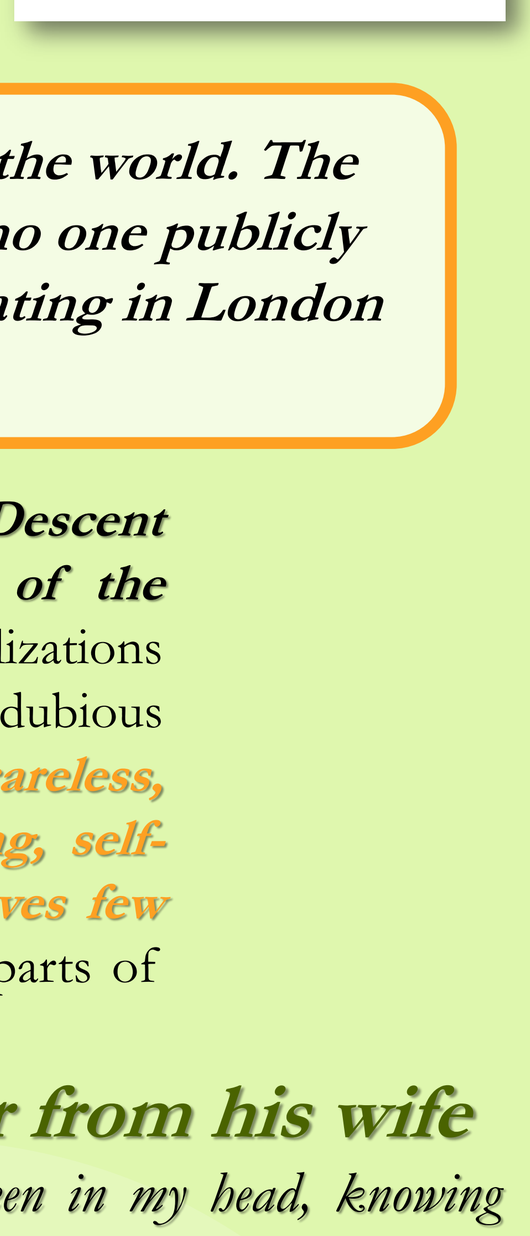
By CHARLES DARWIN, M.A.,

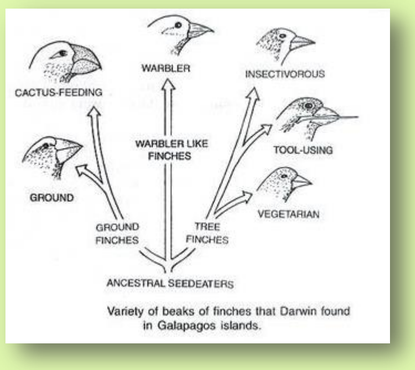
FELLOW OF THE ROYAL, GEOLOGICAL, LINNEAN, ETC., SOCIETIES; AUTHOR OF 'JOURNAL OF RESEARCHES DURING H. M. S. BEAGLE'S VOYAGE ROUND THE WORLD.'

LONDON:
JOHN MURRAY, ALBEMARLE STREET.
1859.

The right of Translation is reserved.

- Darwin exerts great effort to explain his theory to the general public
- Shares his reasoning so readers could join him in a great adventure
- The book pursues a single argument from beginning to end
- Many examples from botany and zoology
- Deals with God in a very careful way ***"higher probability of…"***
- It almost entirely avoids the issue of man's descent





Variety of beaks of finches that Darwin found in Galapagos islands.

The Origin of Species is full of "horror scenarios" triggered by Darwin's misunderstanding of the Fuegan natives, by Malthus' book, and by his shortcomings in math and anthropology. He firmly believed that nature operates through "horror scenarios", although he was never able to demonstrate it.

In a very short time the Origin of Species was well known and read all over the world. The intellectual elite supported the argument. Despite objections and debates, no one publicly presented Darwin as an enemy of religion. Darwinism became a term circulating in London society and was greeted enthusiastically in Germany.

He attempted to address the problem of human origin in two later books: ***The Descent of Man and Selection in Relation to Sex*** **(1871) and** ***The Expression of the Emotions in Man and Animals*** **(1872).** The books contain important generalizations unsupported by evidence, mostly derived from W. Greg, a social statistician of dubious reputation and Darwin's friend. Many statements are racist and sexist: ***"The careless, squalid, unaspiring Irishman multiplies like rabbits: the frugal, farseeing, self-respecting, ambitious Scot, stern in his morality … marries late and leaves few behind"…. "Man has ultimately become superior to woman" .*** The best parts of the books are the ones focused on animals and non-human behavior.

Charles Darwin was an outstanding scientist and a true genius, but he was also weak in social science, anthropology, and mathematics. His description of human nature was based on his very sheltered life. "The Origin of Species" had a tremendous intellectual impact throughout the world. It made Darwin one of the critical thinkers of the Twentieth century. It affected and changed the views not only in natural sciences but also in social sciences and humanities in general. Social Darwinism, for instance, and later, eugenics - first proposed by his half cousin F. Galton, with Darwin's support - were part of that influence Toward the end of his life, Darwin was a very different man: **"I have everything to make me happy and contented, but life has become very wearisome to me".**

A letter from his wife

"I will write down what has been in my head, knowing that my own dearest will indulge me. Your mind & time are full of the most interesting subjects & thoughts of the most absorbing kind, following up your own discoveries — but which make it very difficult for you to avoid casting out as interruptions other sorts of thoughts which have no relation to what you are pursuing (…).

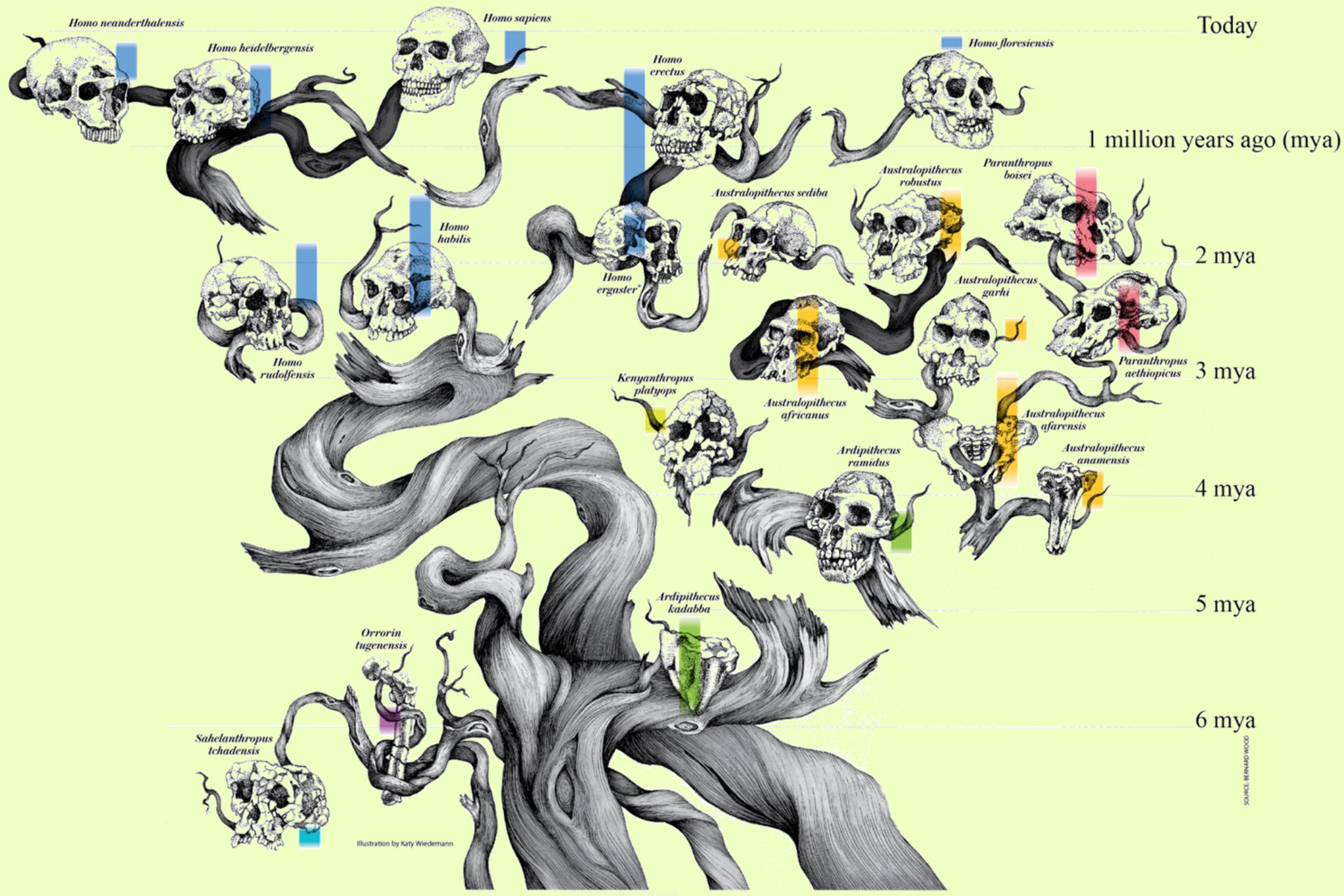
May not the habit in scientific pursuits of believing nothing till it is proved, influence your mind too much in other things which cannot be proved in the same way, & which if true are likely to be above our comprehension."

Emma

"When I am dead, know that I have many times kissed and cryed over this" C.D.

WHERE DID WE COME FROM?

The human family tree is full of dead branches, cousins to modern humans that went nowhere.



Homo sapiens key physical features

- **Body size and shape:** Bodies with short, slender trunks and long limbs.

- **Brain** size at nearly 1500 cubic centimeters which makes up 2.2% of our body weight.

- **Skulls** with a short base and a high braincase. Unlike other species of *Homo*, the skull is broadest at the top. The back of the skull is rounded and indicates a reduction in neck muscles.

- **Jaws and teeth:** Jaws are short which results in an almost vertical face. There is usually no gap between the last molar teeth and the jaw bone. The jaws are lightly built and have a protruding bony chin for added strength. *Homo sapiens* is the only species to feature a protruding chin.

- **Limbs and pelvis:** Limb bones are thinner and less robust than earlier human species. Legs are relatively long compared with the arms. Finger and toe bones are straight. Pelvis is narrower from side-to-side and has a deeper bowl-shape from front-to-back

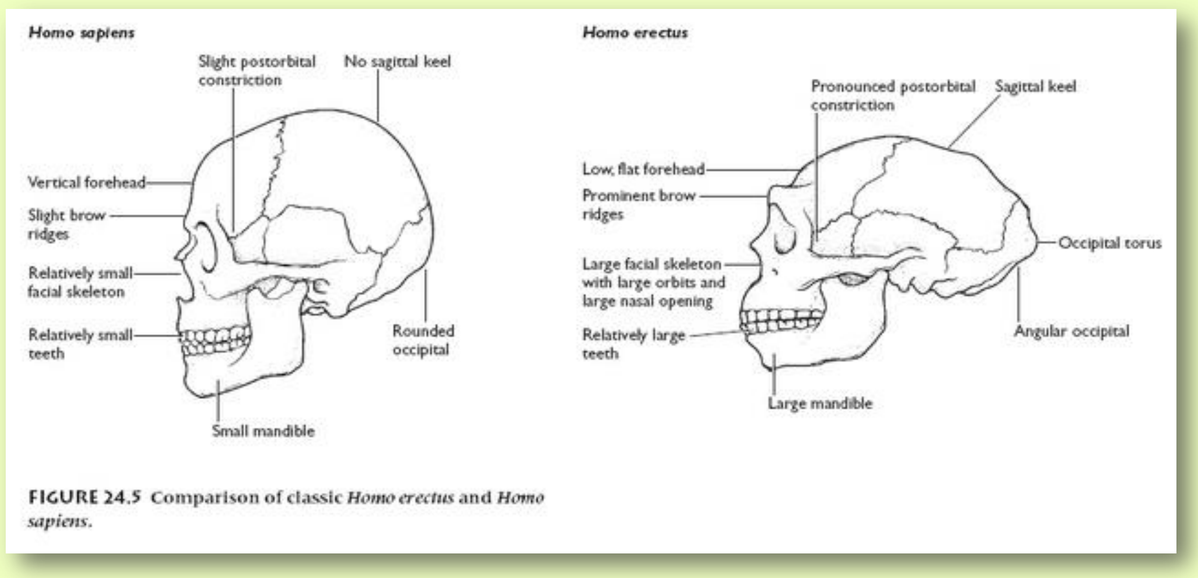


FIGURE 24.5 Comparison of classic *Homo erectus* and *Homo sapiens*.

OPEN QUESTIONS

- What enabled Homo Sapiens to arise and persist?

- Do the branches of Homo belong to different species or, rather, correspond to different morphological stages?

A SYMPHONIC UNITY

In order to address the question: "who am I"? a key point is that we have a "firsthand", non-mediated knowledge of what being human actually is from our own experience. In other words, we are both the subject and the object of the research.

Paleontology
Physics
Psychology
Chemistry
Theology
Genetics
Arts
Sociology
Evolution
Philosophy
Anthropology
Biology

"Human beings stepped rather quietly into the world, because the moment they were noticed, they had already become a crowd" (Teilhard de Chardin).

This is why it is so difficult to trace human origins back to the beginning. The question to be addressed is What is the notion of "human nature?" Three distinctive features can be identified:

- **Biological identity:** there is a biological continuity between human beings and the animal world. However, no other primates currently living on Earth resort to bipedal locomotion and the development of the human brain is a unique phenomenon in the living world.
- **Cultural identity:** Human beings have the capacity to cast their minds into the future, to plan, innovate, and preserve. Those are also signs of self-determination and freedom. Symbolism, i.e. the capacity to attribute to a sound or an object a meaning or a value which goes beyond the sign itself, is another unique characteristic of human beings. It is at the root of the development of language and art. And we are the only creatures on Earth capable of unveiling and admiring the laws of nature.
- **Ecological identity:** Human beings have a capacity of adaptation which goes beyond any biological mechanism. Indeed culture is a decisive element in the process of adaptation.

The last two features imply activities connected to the extra-biological sphere. Therefore, it is imperative to use a variety of methods to develop a comprehensive view of human nature

DOES EVOLUTION EXPLAIN HUMAN NATURE?

Eva Jablonka is an evolutionary biologist and a professor at the Cohn Institute for the History and Philosophy of Science and Ideas at Tel Aviv University. Her books include Animal Traditions (with Eytan Avital) and Evolution in Four Dimensions (with Marion Lamb).

YES, BUT…

(…) what set us apart is symbolic systems, our capacity to think and communicate using language. (…) The question is tractable and answerable within an evolutionary framework. (…) We have to think about more than genes. I have suggested that evolution should be redefined as the "set of processes that lead to changes in the nature and frequency of heritable types in populations over time." Heritable types include: genotypes, types of transmissible epigenetic (…) variations, types of socially learned animal behavior, and types of symbol-based transmitted information. (…) Can an expanded evolutionary framework account for the specifically human features that set us apart from chimpanzees and that most of us recognize as constituting human nature? The answer is "yes."

Robert Wright is the author of The Moral Animal: Why We Are the Way We Are and Nonzero: The Logic of Human Destiny. His new book, The Evolution of God, will be published in June.

YES

(…)Maybe the biggest accomplishment of post-Darwin Darwinians has come in explaining the mushy side of human nature (…). Even the sense of justice (…) now makes sense as a product of natural selection. The evolutionary roots of human nature have not been "proved" in the sense that theorems are proved (…) but they grow increasingly plausible (…). One chemical alone – oxytocin - has been implicated in maternal bonding, romantic bonding, and the trust that undergirds friendship. (…) I have said that natural selection readily explains emotions like compassion and indignation. Strictly speaking, it does not. (…) Why these behaviors and this neural governance should have emotional correlates - why there is subjective experience *at all* - is actually a mystery. (…) What Darwinism tells us is how natural selection gave human life its distinctively rich texture of meaning. Darwinism can also give us guidance as we try to better ourselves and make that meaning richer still. What Darwinism does not tell us is why there is meaning at all.

Martin Nowak is professor of biology and mathematics at Harvard University, where he directs the Program for Evolutionary Dynamics. He is the author of over 300 scientific publications and two books, Virus Dynamics (with Robert May) and Evolutionary Dynamics: Exploring the Equations of Life.

IN PART

I am deeply fascinated by evolution, and I wish to expand the boundaries of the evolutionary explanation as far as possible. Yet I do not think that all aspects of human nature can be explained by evolution. (…). Language, (…) the thoughts and ideas that are expressed in the languages of the world, (…) music, (…) and the ability to do some basic math seem to be part of human nature. Yet the great theorems of mathematics are statements of an eternal truth that comes from another world (…). The great symphonies of Beethoven and Mahler capture glimpses of a beauty that is absolute and everlasting. (…).

My position is very simple. Evolution has led to a human brain that can gain access to a Platonic world of forms and ideas. This world is eternal and not the product of evolution, but it does affect human nature deeply. Therefore evolution cannot possibly explain all aspects of human nature.(…)

There is an unchanging reality beneath the world of change; this reality is also at the core of every human existence; and the purpose of life is to discover this reality. In the context of my own Christian faith, the fundamental aspect of human nature is our relationship with God and our participation in God's love and eternity. This particular aspect of human nature is also not a product of evolution.

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DOES EVOLUTION EXPLAIN HUMAN NATURE?

Francisco J. Ayala is University Professor and Donald Bren Professor of Biological Sciences at the University of California, Irvine. A former president of the American Association for the Advancement of Science and a winner of the National Medal of Science, he is the author of Darwin's Gift to Science and Religion

ONLY UP TO A POINT

Evolution explains human origins. We know that humans share recent ancestors with the apes. (…) Over the past decade, evolutionary geneticists have started to decipher the genomes of humans and chimps. Surprisingly, in the genome regions shared by the two species, nearly 99 percent of the DNA is identical. (…) Evolutionary neurobiology has made similar advances. We now know a great deal about which parts of the brain have become more differentiated in humans than in apes, and what functions they play in memory, speech, hand articulation, and so on. (…) Still, despite all this progress, the field remains in its infancy. Those questions that matter the most to us remain shrouded in mystery: how physical phenomena (the chemical and electric signals by which neurons communicate) become feelings, sensations, concepts, and all the other elements of consciousness, and how the mind, a reality whose properties include free will and self-awareness, emerges from the diversity of these experiences.

Humans also have opened up a new mode of evolution: adaptation by technological manipulation and culture. (…) But culture includes much more than adaptation to the environment and much more than science and technology. Culture includes art and literature; history and political organizations; economic and legal systems; philosophy, ethics, and religion. These all-important components of human nature transcend evolutionary biology and every other science. Science has nothing decisive to say about values, whether economic, aesthetic, or moral; nothing to say about the meaning of life and its purpose; and nothing to say about religious beliefs - except, of course, in those cases when these values and activities transcend their proper scope and make demonstrably false assertions about the natural world. Science is a way of knowing, but it is not the only way. Evolution tells us much, but certainly not everything, about human experience and the human predicament. (…) there can be no doubt that we learn about human nature by reading Shakespeare's *King Lear*, contemplating the self-portraits of Rembrandt, and listening to Tchaikovsky's *Symphonie Pathétique* (…).

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