

Chapter 15

Theories of the Origin of Species before Darwin

15.1 Homework

Readings – Larson, *Evolution*, chap. 1-2

Study Question :

1. What were Cuvier's views on the origin of species? Did he believe in the possible transmutation of species? Did he believe that some species got extinct? What was his evidence for these beliefs?
2. What does the Genesis say about the creation of animals and humans? How did the early Christians view the Bible: did they advocate a literal reading? How does Aristotle's science fit with the Christian view?
3. Explain the social and political context which explain Cuvier's will to maintain the traditional Aristotelian view of species.
4. Explain Cuvier's arguments against evolution.
5. How was Cuvier's theory received within the English Christian community?
6. Explain how the discovery of the existence of dinosaurs favors the idea of a form of progress through the history of species.
7. How does Buckland reconcile his views on the history of species with his religious view?
8. Explain Lamarck's theory of evolution.
9. What are Owen's "homologies"? How does the existence of homologies speak against the idea of intelligent design? Was Owen an advocate of the theory of evolution?

10. Was Lyell an advocate of the theory of evolution? In which field was Lyell working? What is naturalism? What is uniformitarianism? How did his ideas help make the case for Darwinism?

15.2 Introduction

In this chapter, we want to get a precise idea of the theories concerning species that were available before Darwin's publication of the *Origin*, as well as the evidence available to scientists of the time. All these can be seen as the background from which Darwin's theory of evolution emerged. Most important are:

- The French Enlightenment and the idea of methodological naturalism
- The discovery of fossils, including the ones of dinosaurs
- Georges Cuvier's Catastrophism, and the idea of a succession of species
- Jean-Baptiste Lamarck's Theory of Adaptation, and the idea of transmutation between species
- Richard Owen's idealism, and the idea of branching
- Charles Lyell theory of geology, and the idea of uniform causes

15.3 The French Enlightenment: A Naturalist View of the World

The French Enlightenment – we have talked about this before:

Rationalism – Trust in reason and empirical evidence by contrast to authority

Naturalism – Commitment to natural causes in science by contrast to supernatural causes – Two options here :

- Methodological naturalism: the proper method in science is to appeal only to natural causes
- Metaphysical naturalism: only natural things and natural causes exist: nothing supernatural exists.

Note that committing to (1) does not imply committing to (2)!

Buffon *Natural History*

- Formation of the Earth
- Apparition of Life (cooling Earth) by spontaneous generation

- Limited evolution of species due to environment (weaker bears and cats in the States !)
- Eternal and universal “molds” of life – guides for the subsequent generation and evolution of species
- Buffon: committed to methodological naturalism only

The materialists – committed to metaphysical naturalism

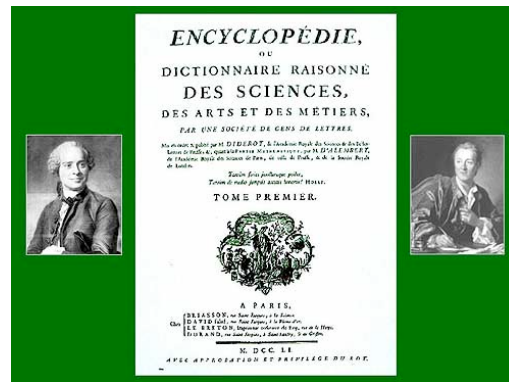


Figure 15.1: The Encyclopedia

The Encyclopedia – See Figure 15.1 Diderot, D’Alembert, Montesquieu, Voltaire, Rousseau etc. More than 140 participants, 11 volumes, and more than 70,000 articles. The first encyclopedia including all the findings of science and technology. Also a controversial book: manifesto for the new way of viewing the world (against the authoritarian and hierarchical view of the “ancien régime”).

Denis Diderot – Materialist: nothing exists but matter, all of the natural world can be satisfactorily explained with natural causes acting upon matter. Matter is kind of alive though.

Baron d’Holbach – self-organization of matter into complex structures

Evidence for spontaneous organization :

- Animals that regenerate: worms etc.
- Electricity and muscles: no need for a soul

→ *It is not clear how much influence did the ideas of the Enlightenment have on the history of the idea of evolution. That said, the definition of the scientific stance, i.e. methodological naturalism, is an important aspect of the times.*

15.4 Cuvier’s Catastrophism: The Succession of Species

Georges Cuvier – See Figure 15.2



Figure 15.2: Georges Cuvier

- bourgeois, protestant family
- outside of the French “elite”: stood on the side of the movements of Enlightenment humanism / scepticism, Revolutionary Atheism and Restoration hard core Catholicism. But sincere believer.
- held the most prestigious position in the Museum of Natural History of Paris – world’s premier museum, amazing collection of fossils and animals due to Napoleon’s travels

The Evidence –

- Geology : the Earth has an history
- Fossils : Species have an history

Anatomical types – proposed that there are four basic anatomical types : vertebrates, molluscs , articulates, radiates – *differs from the linear chain of beings coming from Aristotle.*

Cuvier’s acceptance of the idea of extinction :

- worked on comparative anatomy of vertebrates, in particular mammals
- From his study, he *comes to the new idea that all fossilized animals are from different species than the species alive, and that they have died out*

The theory of Catastrophes – Cuvier explained the extinction of species as due to a series of catastrophes on the scale of Noah’s flood, with new species created by God or migrating from other regions after each catastrophe.

- after each catastrophe: more complex species are created
- hence the younger the layer of rock, the more the fossils in it resemble living species.

Cuvier’s rejection of the idea of transmutation :

Religious beliefs : while early Christians did not seek scientific truth in the Bible, it was the case for the modern naturalists. Associating a literal reading of some parts of the Genesis, with the theories of Aristotle (for whom a species always breeds true to its form), he believed that species were fixed.

Social Reasons : The idea of transmutation of species was associated with the naturalism of the Enlightenment, and the ideas of the Enlightenment were associated with the turmoil of the Revolution.

Scientific Reasons :

1. “Irreducible Complexity”: For Cuvier, the correlation of the parts of an animal together with the way they adapt the animal to its environment was evidence of their having been designed and created that way – no partial change is possible without ruining the whole: gradual evolution is impossible
2. Jumps in the fossil record: the geologic column appeared to Cuvier as a layered cake, not as a linear gradation – no intermediate forms – hence the catastrophes
3. Stability of species: organisms as described in the oldest tombs in Egypt resemble living organisms

Cuvier’s Theory’ reception :

- Widely welcome by the radical Christians intellectuals in Great Britain and the United States
- Tried to reconcile Cuvier’s views with the Genesis : “gap theory”
- Abandoned the idea of migration in favor of multiple creations
- Abandoned the idea that the geological catastrophes were to be understood in Noah’s flood model.
- The resulting theory became the mainstream view until Darwin’s publication of the *Origin*
- The irony is that the idea of a succession of species served the idea of progress, and then of the evolution of species, even if Cuvier never conceived it as such.

→ *Cuvier was all but trouble maker. That said, he was a serious scientist. The discovery of fossils has to be accounted for. Cuvier’s catastrophism introduces a first breach in the view of fixed, eternal species. Cuvier indeed introduces the ideas of an history of species, featuring some extinctions and creations of species. While he never endorsed the idea of evolution, he contributed to it in important ways.*

15.5 Re-interpretating Cuvier: The idea of Progress

The Evidence – Dinosaurs

- First is identified by Cuvier: Mosasaurus (Lizard of Meuse) in 1795

- Buckland, 1824, Megalosaurus (Great Lizard)
- Mantell

→ *speaks in favor of an age of reptiles, against Cuvier's idea of a succession from sea-animals to land-animals.*

Buckland (Oxford) and Sedgwick (Cambridge) :

- Buckland: Successive creations corresponding to the best species given the changing conditions of living on a ever cooling Earth
- Sedgwick: Successive creations with progress:

“I say, we have successive forms of animal life adapted to successive conditions (so far, proving design), and not derived in natural succession in the ordinary way of generation” (Larson, p.37)

15.6 Lamarck's adaptationism: Transmutation



Figure 15.3: Jean-Baptiste Lamarck

Lamarck :

- Impoverished noble family
- Gets a job at the Museum (below Cuvier)
- Working on the classification of invertebrates, he encountered great difficulty in distinguishing species from varieties of species and concluded that there is no difference and that species could be transformed into new species
- Developed the first comprehensive evolutionary theory – but was a complete failure in his times

Lamarckism – the mechanism of evolution is as follows

Spontaneous Generation – throughout history, new simple organisms constantly arise through spontaneous generation

Strife to improvement – all living organisms are striving to improve themselves and naturally achieve higher levels of complexity

—→ *If this were the only factor at work, all the animal species could be arranged in a progressive series, but the effects of the environment on animals creates anomalies*

Adaptation to the environment – theory of subtle fluids: the more an animal uses an organ, the more fluid goes towards the organ, and the more the organ develops. Conversely, a non-used organ degenerates for lack of fluid.

Inheritance of adaptation – The new traits are passed to the next generation

The example of the Giraffe – grows a longer neck in reaching for higher located food.

Problems with Lamarck's theory :

- No extinction: yet the fossil records speaks in favor of extinction
- Theory not applicable to lower animals and plants
- Lack of evidence : highly speculative

—→ *Lamarck was the first to formulate a comprehensive theory of evolution. Due to the lack of evidence, Lamarck's ideas were ridiculed. This had an important impact on Darwin: the lesson was that, in order to defend a theory against the mainstream, one had better to be cautious: in particular, one would have to follow a rigorous scientific method (by contrast to the speculations of Lamarck) and provide strong empirical support. This is what Darwin aimed to do.*

15.7 Owen: from Progress to Branching

Richard Owen :

- British “counterpart” of Cuvier
- Director of the British Museum's natural history collections
- fervent anti-evolutionist

Influence of German Idealism – Forms, Ideas and Archetypes – Rational order of the world mirrors the rational order of ideas

Branching species – in the realm of ideas: “branching pattern of directional development in species outward from a common archetype” (p.44)

Evidence – Dinosaur as developed as we are: highly complex. There is no linear progress but rather branching structure!

Humans and Apes – made a special effort to find a fundamental difference between men and apes

→ *Of course, the idea of branching will be implemented in Darwin's theory. That said, while Owen see such a branching as a branching between ideas in God's mind, Darwin makes the whole thing purely material*

15.8 Lyell: Uniformitarianism

The common view – The common view in Geology was that earlier times of the history of the Earth featured tremendous forces now disappeared.

James Hutton – steady state vulcanism

1. Empiricism: good scientific explanations must be supported by empirical evidence – i.e. the causes and processes must be observable
2. Actualism: good scientific explanations must only appeal to causes and processes that are still currently at work, i.e. actual (and hence observable)

Lyell's Uniformitarianism – *Principles of Geology*

Charles Lyell :

- looking for fame
- choose a controversial view
- aimed at destroying the idea of evolution
- will have to fight the idea of progress
- in the end, great impact on Darwin's thinking, and will accept Darwin's views

Method :

1. Methodological Naturalism : appeal to natural forces
2. Empiricism: appeal to observable forces
3. Actualism: appeal to forces still currently at work
4. Gradualism: nature does not make jumps !

Theory :

1. Gradual changes in Geology
2. Extremely long process: allow enough time, and small forces will do anything
3. No progress in the process

—→ *In short, the idea of uniformitarianism is that good science appeals to uniform, currently at work, and observable forces. It is not legitimate to speculate about ancient forces in ancient times, for which we do not have any direct empirical evidence. Another important idea for Darwin: the cumulative power of small changes over very long periods of time.*

15.9 Conclusion

As we have seen, many fervent opponents to the idea of transmutation of species developed either scientific views, or views on the proper scientific methodology, which happened to be instrumental in the development of Darwin's theory.

In short:

- From the methodological point of view: naturalism, empiricism, actualism, gradualism
- From the theoretical point of view: succession, progress, adaptation, branching, cumulative power of small changes over time