Updating Darwinian Evolution Part III: Evolutionary Theory Before Darwin

Science Circle
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Stephen Gasior, Ph.D.
a.k.a. Stephen Xootfly
Reformed College Biology Instructor
Updating Darwin
Did we really go from this to evolution?
Organisms within a species vary in their genes.

Reproductive capacity always hits limits of environment, and predation and disease remove some.

Best reproducers (with their more fit genes) leave more offspring (with those fit genes).

Over time, favorable traits accumulate in the population.

Different enough to be distinct species.

1859 *On the origin of species by means of natural selection, or the preservation of favoured races in the struggle for life.* London: Murray. [1st ed.]
Vitalism

"living organisms are fundamentally different from non-living entities because they contain some non-physical element or are governed by different principles than are inanimate things“ ➔ Elan

Organisms emerge by the actions of a vis essentialis (an organizing, formative force). Which is has a “preformed” template

Theoria Generationis (1759), Caspar Friedrich Wolff (1733–1794) ie homunculus
PreFormation
From Nicolaas Hartsoeker, Essay de dioptrique, Paris: Jean Anisson, 1694
Classification of Organisms

John Ray (1686) “In order that an inventory of plants may be begun and a classification established, we must try to discover criteria of some sort for distinguishing what are called “species.” …distinguishing features that perpetuate themselves in propagation from seed.”

Carl Linnaeus (1751) “that at the beginning of the world there was created only a single sexual pair of every species of living things” … except hermaphrodites in which case only 1 was made.

invented binomial nomenclature

→ Species are constant
More on Taxonomy

Systema Naturae (1735)
6,000 plants and 4,236 animals.

- Mammalia
- Aves
- Amphibia
- Pisces
- Insecta
- Vermes
Scala naturae
Chain of being from lowest to highest
Strictly followed increasing complexity order established by
- Vermes
- Insecta
- Pisces
- Amphibia
- Aves
- Mammalia
- Humans
Before Darwin

Georges-Louis Leclerc, Comte de Buffon (1707-1788)

*Histoire Naturelle* (36 quartos)

along with numerous other works, formed the basis for modern biological classification.

- pointed out the continuity between species and established the donkey/horse infertile offspring criterion for distinct species “Unity of Type”

  - argued for improvement and degeneration of species

- among first to incorporate aged earth

- broke from *scala naturae* tradition by categorizing organisms into higher groups but not by not ranking them according to increasing complexity
Before Darwin

THE HORSE.

THE ASS.

THE SHEPHERD'S DOG.

THE GREYHOUND.
Before Darwin

Georges-Louis Leclerc, Comte de Buffon (1707-1788) 

_Histoire Naturelle_ (36 quartos) 

-proposed a theory of “epigenetics” that ran counter to the prevailing theory of pre-existence: “that there exists in Nature an infinite number of living organic particles, that organized beings are composed of these organic particles, [and] that their production costs Nature nothing, since their existence is constant and invariable“ -still relied on an “interior mold”
Erasmus Darwin (1731–1802)

- *Zoonomia* (1794–1796) “warm-blooded animals have arisen from one living filament, which THE GREAT FIRST CAUSE endued with animality, with the power of acquiring new parts, attended with new propensities, directed by irritations, sensations, volitions, and associations; and thus possessing the faculty of continuing to improve by its own inherent activity, and of delivering down those improvements by generation to its posterity, world without end!”
2 Generations Before Darwin

Erasmus Darwin (1731–1802)

- Zoonomia (1794–1796) “the strongest and most active animal should propagate the species, which should thence become improved.”
- "three great objects of desire" for every organism: "lust, hunger, and security."
James Hutton (1726 - 1797)

- Geologist
- *Investigation of the Principles of Knowledge* (1794)

**Principle of Variation**

- "...if an organised body is not in the situation and circumstances best adapted to its sustenance and propagation, then, in conceiving an indefinite variety among the individuals of that species, we must be assured, that, on the one hand, those which depart most from the best adapted constitution, will be the most liable to perish, while, on the other hand, those organised bodies, which most approach to the best constitution for the present circumstances, will be best adapted to continue, in preserving themselves and multiplying the individuals of their race."

- In context, he was still a creationist
Age of the Earth
Commonly held belief to be ~6000 yo. (Bishop Ussher calculated by generations in Genesis)
Created perfect and as is and unchanging

Coming of Geology
Basalt is ancient lava
Geological strata are sedimentary deposits
  Buffon (1779) earth is at least 168,000 years old
  Fossils are dead animals
Lyell-uniformitarianism: the geology of the earth can change
Hutton dated earth as millions of years old
Jean-Baptiste Lamarck (1744 – 1829)

- first cohesive theory of biological evolution
  - alchemical complexifying force drove organisms up a ladder of complexity, and
  - a second environmental force adapted them to local environments through use and disuse of characteristics
Adaptive variation: interaction with environment was driving force for variation
Believed in branching evolution

Nonetheless, believed the origin of species was spontaneous generation

TABLEAU DU RÈGNE ANIMAL (1809).

1°. Série des Animaux Inarticulés.
- Infusorios.
  - Polypes.
  - Radiaires.
  - Ascidiens.
  - Acéphales.
  - Mollusques.

2°. Série des Animaux Articulés.
- Vers.
  - Épizoaires.
  - Insectes.
  - Arachnides.
  - Annelides.
    - Poissons.
    - Reptiles.
    - Oiseaux.
    - Mammifères.

This later conception of Lamarck’s of the tree of life as branching, not as radiating from a single
Georges Cuvier (1769 – 1832)

- Studied strata of geologic formations
- Included fossils in taxonomy
- *Essay on the Theory of the Earth* (1813)
  - periodic catastrophic flooding events → extinctions
  - named the mastodon, Pterodactylus

- Fierce ANTI-Evolutionist
  - In fact, similar species in different periods were not related, just similarly recreated each time
Georges Cuvier (1769 – 1832)

- Cuvier’s Principle of Correlation of Parts
  - The characters of an animal are interrelated
  - The important essentials of some traits can tell you more about the rest of the animal’s characters: teeth!
  - Distinguished homology (identity of parts by descent) versus analogy by what’s now called convergent evolution (similarity of parts for functionality: wings!)

Cuvier categorized into four embranchments and argued against steady increase in complexity
- vertebrates
- mollusks
- articulates
- radiates
Franz Unger (1800 – 1870)

- *Attempt of the History of the Plant World* (1852)
- Plants derived from the germ of thallophytes (algae)
- Plant species originate from other plant species
- The whole plant kingdom becomes an organic unit
Contemporary to Darwin

Robert Chambers (1802–1871)

- *Vestiges of the Natural History of Creation* (1844)
  - outsold Origin of Species in 1st 10 years, 24,000

- Principle of Progressive Development
  - Fauna have evolved through time
  - Catastrophes are unnecessary to explain life
    - Unity of bodily organization seen in taxonomy is ancient body plans that have progressed to modern forms
    - Embryonic development reflects ancient body types (von Baer)
  - Not a scientist: so professionals criticized his details and thoughts without recognizing the big picture ((could only imagine his twitter feed...))
Here the upright lines, 1, 2, 3, 4, 5, may represent the comparative height and grade of organization of both the five sub-kingsoms, and the five classes of each of these; 5 being the vertebrata in the one case, and the mammalia in the other. The difference between the height of the line 1 and the line 5 gives an idea of the difference of being the head type of the aves (corvidæ,) and the head type of the mammalia (bimana;) \(a, b, c, d, 5\), again, represent the five groups of the first order of the mammalia; \(a\), being the organic structure of the highest simia, and 5, that of man. A set of tangent lines of this kind may yet prove one of the most satisfactory means of ascertaining the height and breadth of the psychology of our species.
Updating Darwin

Darwin Did Not Have to start from: Garden of Eden was just a story

- Species are well adapted to their environments
- Offspring are consistently formed
- Variation within species
- Species are related to each other
  - Wolves – Canidae – Mammals
  - Progression with variation of body plans
- Extinct species are related to extant species
- Calamities pressure populations (the Malthus angle)
Darwin, by clarifying the mechanism of speciation, reinforced the structure of evolutionary theory. Analogous to Watson and Crick:

structure →

clarifies mechanism →
Thank you!
Wiki entries for scientists

https://en.wikipedia.org/wiki/Carl_Linnaeus
https://en.wikipedia.org/wiki/James_Hutton
https://en.wikipedia.org/wiki/Georges_Cuvier
https://ucmp.berkeley.edu/history/lamarck.html
https://en.wikipedia.org/wiki/Franz_Unger

Works on Archive.org

https://archive.org/details/systemofnaturalh01buffiala/page/n6
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Misc

https://evolution.berkeley.edu/evolibrary/home.php
https://www.thoughtco.com/people-who-influenced-charles-darwin-1224651
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