Hooker Huxley Haeckel: Darwin’s Apostles

Kevin Zelnio
Department of Biology, PSU

Victorian English Science

Social Dimension:
- Transition to Industrial Revolution
- Working class uprisings
- Huge gap between rich and poor
- Scientific elitist attitude
- Mechanics Institute

Scientific Dimension
- Catastrophism
- Literal Biblical Interpretations (i.e. Genesis, floods, young Earth)
- “Natural Theology” of Paley
- Lamarckian Evolution
- Owen’s “Archetype” concept

Catastrophism

Premise: Earth’s features were created by cataclysmic forces

Lyell 1830:
Uniformitarianism → Landscape was formed by gradual geologic & geomorphic processes over long periods of time

Evolution Before Darwin

Anaximander 609-547 BCE

- Man and animal came into being by “like transmutations”
- Man sprung from some other animal, likely aquatic

Evolution Before Darwin

John Ray 1628-1705
- Wrote on plant systematics
- Developed the idea that the wisdom and power of God can be understood by studying His creation, the natural world
- Adaptations to environment was evidence of God’s design
- Fossils were once living organisms
- Used total morphology in classifying organisms

Evolution Before Darwin

Robert Hooke (1635-1703)
- Compared Fossil wood and shells to living wood and shells
- The fossil record documents changes among organisms on Earth
- Species have both appeared and gone extinct throughout the history of life on Earth.
Evolution Before Darwin

• **Nicholas Steno** (1638-1686)
  - Law of superposition → able to give a sense of time to rock layers
  - Fossils were once living organisms that were chemically altered without altering their form

• **Georges-Louis Leclerc, Comte de Buffon** (1707-1788)
  - Described similarity and considered common ancestry between apes and humans
  - Earth’s age is greater than 6,000 years (75,000)
  - Noted vestigial/useless structures in animals and suggested they didn’t appear there spontaneously
  - Believed in organic change, but provided no mechanism
  - Environment acted directly on organisms through “organic particles”

Evolution Before Darwin

• **Erasmus Darwin** (1731-1802)
  - Physician, Inventor, Poet, Scientist
  - Zoönomia; Or, The Laws of Organic Life (1794-96)
  - Life on Earth “had risen from one living filament”

Evolution Before Darwin

• **Jeanes Baptiste Pierre Antoine de Monet, the Chavalier de Lamarck** (1744-1829):
  - Change in environment → change in needs of organisms → change in behavior → change in use of structure → loss use = shrinkage of structure while greater use = growth of structure
  - Acquired traits were inherited...

Evolution Before Darwin

• **William Paley** (1743-1805)
  - Natural Theology: or, Evidences of the Existence and Attributes of the Deity, Collected from the Appearances of Nature (1802)
  - Every watch has a watchmaker, therefore every creation has a Creator
  - The creator is of course God

Evolution Before Darwin

• **Georges Cuvier** (1769-1842)
  - Passionately opposed organic evolution
  - Form and function were tightly integrated in the entire body, hence no part can be modified
  - Similarities were due to common function NOT common ancestry
  - Established extinction as a fact
  - 4 distinct branches of life: Vertebrata, Articulata, Mollusca and Radiata
Evolution Before Darwin

Étienne Geoffroy St. Hilaire (1772-1844)

- Idea of the Archetype & Homology

“"The external world is all-powerful in alteration of the form of organized bodies... these modifications are inherited, and they influence all the rest of the organization of the animal, because if these modifications lead to injurious effects, the animals which exhibit them perish and are replaced by others of a somewhat different form, a form changed so as to be adapted to the new environment." (Influence du monde ambiant pour modifier les formes animales, 1833)

Evolution Before Darwin

Robert E. Grant (1793-1874)

- Marine Invertebrate Zoologist at Edinburgh
- Tutored Darwin in dissection techniques and Lamarckian evolution
- Moved to London College and became England’s 1st academic comparative anatomist
- Darwin’s first paper (at the Plinian Society Meeting): black spores found in oyster shells were the eggs of a skate leech and observations on sea-urch larvaes

Evolution Before Darwin

Robert Chambers (1802-1871)

Vestiges of the Natural History of Creation (1845)

- Evolution steadily progressed towards increased complexity (Humans of course the apex) under unknown laws
- Opened up the evolution debate and popularized the concept
- Showed Darwin what he must overcome to get his theory accepted

Darwin’s Evolution

- Advanced natural selection as evolution’s mechanism 1858 with Alfred Russel Wallace
- Introduced the Principle of Divergence
- Had many supporters and equally many opponents

Development of Darwin’s Theory

- 1836 - “Red” and “B” notebooks – tenancy of varieties to diverge, homology
  “...instincts alter, reason is formed, & the world peopled with Myriads of distinct forms from a period short of eternity to the present time, to the future—How far grander than idea from cramped imagination that God created warring against those very laws he established in all organic nature? the Rhinoceroses of Java & Sumatra, that since the time of the Sinurians, he has made a long succession of vile Molluscous animals—How beneath the dignity of him, who is supposed to have said let there be light and there was light...”
- 1839 – Notebooks “D” and “E” - reads Malthus and determines natural selection as mechanism
Development of Darwin’s Theory

- 1842 - “Sketch of My Theory” (= evolution by natural selection) – first attempt at writing his theory
  - 10 chapters – 3 on the theory and 7 on applications
- 1844 - “Essay”
- 1856-1858 - “Big Species” and Natural Selection
- 1859 – The Origin of Species (6 eds. + US ed.)

“As there is grandeur in this view of life.”

Asa Gray (1810-1888)

- Harvard Botanist
- Described Western & Northern American Flora
- Helped Darwin sell 2500 copies of Origin’s 1st ed in USA (£636, 13 shillings, 4 pence)
- Darwin’s 1855-57 outline
- Strong supporter and close friend of Darwin in USA

Asa Gray

- Preached coexistence of religion and evolution (theistic evolutionism)
  “Serious it would be rash and wrong for us to declare that this conception is opposed to theirs. Our idea of Nature is that of an ordered and fixed system of forms and means working to ultimate ends. If this is our idea of inorganic nature, shall we abandon or depreciate it when we pass from mere things to organisms, to creatures which are themselves both means and ends?”
  (Natural Science and Religion: Lecture II, 1860)

Joseph D. Hooker (1817-1911)

- Erebus Voyage
- Director of Kew Gardens (after his father)
- First (with Charles Lyell) to see Darwin’s 1844 Essay

  “I should be the happiest boy alive if ever I would see that wonderful arched rock, and knock penguins on the head”
  (Huxley L., 1918)

Joseph D. Hooker: Erebus Voyage (1839-43)

- Sir James Clarke Ross’ Antarctic Seas Expedition, as assistant surgeon and botanist
- Described the flora of the Antarctic, New Zealand, Tasmania
- Read Darwin’s Voyage of the Beagle very enthusiastically

Joseph D. Hooker

- Congratulations!
- Debated plant distributions – Rejected “multiple centres of creation” theory and looked for general laws (adopted Darwin’s explanation of migration in 1866, as opposed to islands connected by landmasses now sunken)
- First to see hear of Darwin’s theory
- First to cite the Origin

India and Himalayan Adventures (1847-51)

- Culminated in the description of Indian, Himalayan, Bengal and Nepal flora and fauna
Thomas Huxley (1825-95)

- Wanted to be an engineer but settled on being a medical student instead… at the age of 12
- Received the Gold Medal at 26 for working on Hydrozoans
- Raised Evangelical though rejected any form of state-sponsored religion
- Very much concerned for working poor, frequented London’s slums
- Education Reformer
- "unity in diversity"

Thomas Huxley: Rattlesnake Voyage (1846-50)

- Purpose: to survey the Great Barrier Reef of Australia
- Signed on as Assistant Surgeon and Naturalist
- Sought to find "unity of diversity" in marine invertebrates

Thomas Huxley: Dedicated to Evolution

"I do most heartily thank you for the great store of new views you have given me… As for your doctrines I am prepared to go to the Stake if requisite. I trust you will not allow yourself to be in any way disgusted or annoyed by the considerable abuse & misrepresentation which unless I greatly mistake is in store for you. And as to the curs which will bark and yelp – you must recollect that some of your friends at any rate are endowed with an amount of combative ness which (though you have often & justly rebuked it) may stand you in good stead – I am sharpening up my claws and beak in readiness" (Letter to Darwin, Nov, 1859)

Bishop Wilberforce Debate

- British Association Meeting 1860
- Bishop Wilberforce attempted scorn of biblical proportions on Darwin's theory (primed by Owen) and insulted Huxley "Is it on your grandfather's or your grandmother's side that you claim descent from a monkey?"
- Huxley's Reply (earning him the title "Darwin's bulldog"): "... would I rather have a miserable ape for a grandfather or a man highly endowed by nature, such as yourself, and possessing great means and influence, and yet who employs those faculties for the mere purpose of introducing ridicule into a grave scientific discussion—then I still unhesitatingly affirm my preference for the ape"
- Main arguments: 1) why can't we see transmutations in rapidly reproducing invertebrates, 2) insulted Darwin's grandfather Erasmus, 3) paucity of fossils
- Hooker was most vociferous about the technical details in terms of Botany and accused the Bishop of never having read the book

Ernst Haeckel (1834-1919)

- Professor of Zoology at Jena
- HUGE fan of everything about Darwin
- Trained and worked as a physician but quit after reading Origin in 1859
- Propagated Darwinismus throughout German-speaking countries and had it translated
- Used the Origin mostly for socio-political ends
- Pilgrimage to Down House in 1866

"ontogenesis is a brief and rapid recapitulation of phylogenesis, determined by the physiological functions of heredity (generation) and adaptation (maintenance)" (1899)

Ernst Haeckel (1834-1919)

- Extremely talented artist
- Brilliant invertebrate zoologist
- Had a habit of being extraordinarily speculative and a "data-fudger"
- Haeckel did not really believe in natural selection yet extended it and the "struggle for existence" to society
- Believed that the environment acted directly on organisms to produce new races
- Generelle Morphologie (1866) rearranged all biological knowledge along Darwinian lines
Sources and Further Reading

- All images shamelessly pilfered from the internet using Google
- Fantastic Websites:
  - University of California Museum of Comparative Palaeontology
    http://www.ucmp.berkeley.edu
  - Wikipedia
    http://en.wikipedia.org/Main_Page
  - The Victorian Web
    http://www.victorianweb.org/
- Desmond & Moore (1992) *Darwin: The Life of a Tormented Evolutionist*