PreDarwinian Biology

Ages of Sand:
- Douglas Adams' description of the technological changes humanity went through and how these changes broadened our understanding.
- Age 1 is of astronomy when we looked at the stars.
- Age 2 is microscopic where we could look at minute objects that make up life. Age 3 is computers.
- Age 4 is fibre optics (Internet).

Al-Dinawari:
- Considered the father of Arabic botany for his Book of Plants book.
- Classified numerous varieties of plants and also discussed the lifecycle of plants (phases).
- Also describes atmospheric phenomena such as wind and thunder and their applications to agriculture.

Al-Jahiz
- Formed a concept of evolution long before Darwin

Aristotle:
- Attempts to organize the organisms that are collected by the Greeks
- Classified based on Greek ideology of superiority with man being placed at the top and less superior organisms below
- Very first classification of the living world, known as Scala Naturae

Artificial Taxonomy:
- Written lists of classification rather than verbal
- Typically Aristotle is attributed with starting artificial taxonomy
- Was typically based on simple ideas such as form and shape to classify, therefore not based on biological principles

Avicenna
- Wrote a book on medicine which was relevant for hundreds of years
- Added medicines to his book from the Islamic world to the existing Greek medicines
- The book is famous for description of contagious diseases and the idea of quarantine to limit the spread of such diseases

Bionomen:
- A genus + species name used to describe organisms
- Designed by Linnaeus and in Latin because this is the ancient language of scholars
- Gave organisms predictability because the hierarchal system tells about their biology and history

Bionomial Nomenclature:

- How species are named
- Invented by Linnaeus
- Composed of genus + species. Genus is a small group of closely related animals. Species is a specific name.
- The first letter of genus is capitalized, the first letter of species is not. Italicized.

Biogeography:

- Studies past and present distribution of the world's species
- Started by Alfred Wallace
- Was started while Wallace studied the fauna and flora in the islands between Australia and Asia.

Chronological Prediction:

- Making a prediction about the future
- Typically non-scientific because they are not held to a high standard
- Example: I predict that France will win the next World Cup.

Cuvier:

- A French zoologist who worked with fossils
- Realized that the layers of fossils represent organisms that had lived at different times in the past
- Developed the theory of catastrophism where each layer of fossils represents a group of organisms who died in a catastrophe

Deduction:

- From general to specific. Used by physical scientists
- Example: All cats have fur. This animal is a cat. It has fur.
- When premise is broken then the general idea must be adjusted.

Empirical observation:

- Derived from observation/experiment
- Provable by observation/experiment
- Used by physical scientists not natural scientists

Essentialism:

- Each organism contains an essence that makes them what they are (humans contain essence that make them human)
- This essence is passed from generation to generation
- The general belief in the Greek and Roman age
- All species are unchanging

Extinction:
- The death of all species or lineages
- The sixth mass extinction is occurring right now as a result of human degradation of the environment
- The last great extinction was during the Cretaceous period when most dinosaurs went extinct

Fact:
- Something that is unchangeable
- Something is proved to be true
- In the natural sciences facts are not generally accepted because observations and theories could change

Folk Taxonomy:
- Categorized about 500 concepts into 3 or 4 categories. The first type of taxonomy.
- Transmitted orally between people
- Passed from generation to generation

Great Chain of Being:
- Concept derived by Aristotle during the Greek ages
- Religious hierarchal structure believed to be designed by God
- The most superior organisms at the top (humans) followed by less superior organisms

Harvey:
- An English physician
- Discovered how the circulatory system worked
- First to describe the properties of blood (heart is major pump, unidirectional flow)

Hierarchal system:
- Method of taxonomy to group organisms
- Originally started by Linnaeus who grouped species based on physical characteristics
- Based on shared descent from common ancestors

Hippocrates: (***)
- Referred to as the father of modern medicine
- Travelled the known world and collected known works of medicine
- Placed all this information in the Hippocratic Corpus
- This book suggested that human biology should have its own term

Historical narrative:
- Based on observations of the world
- Trying to make explanations for observations of the world
- Hope that observation will work in a different circumstance

Hypothesis:
- A proposed explanation for a phenomenon
- After being tested a hypothesis can become a theory
- One must be able to test it

Ibn al Baitar:
- An Arabic botanist
- Recorded the addition of medicines, drugs and their uses
- Complied of information from various authors

Induction:
- From specific to general. Used by natural scientists.
- This cat has fur. Therefore all cats have fur.
- Involves looking for patterns before making a hypothesis.

Industrial Melanism (***):
- Changes in gene frequency within a population gives you evolution
- Changed from white to dark because there was a selective advantage to being dark
- White moths stuck out on dark trees and were subject to predation therefore genes controlling coloration favoured dark moths, therefore more dark moths.

Lamarck:
- Proposed “perfecting principle” caused organisms to become better suited to their environment
- Believed acquired traits were passed on from generation to generation
- Body parts grow in proportion to how much they are used

Law:
- Something that is true anywhere in the universe
- Based on experimental observations
- Based on a hypothesis

Leclerc:
- A French scientist who was puzzled by the existence of unnecessary body parts
- Proposed that some animals have changed since their existence and originally needed these body parts (vestigal features)
- Could not explain how functional structures became vestigial structures

Linnaean taxonomy:
- Contains three kingdoms: animal, plant, mineral
- Used binomial nomenclature
- Did not contain phylum and family

Linnaeus:
- Invented the system for naming species
- Described species on the basis of their similarities and differences (outer appearance)
- Invented binomial nomenclature

Logical Prediction:
- A prediction based on facts and evidence
- Is like a hypothesis in that experiments must be applied to it for it to become a theory
- Cannot become a fact or law

Mechanical Taxonomy:

Middle Ages:
- Early middle ages (Dark ages): Collapse of Rome.
- High middle ages: Church begins to modulate civilization and culture. Black plague occurs in 1341 and kills 1/2-2/3 people. Crashes Europe's infancy, and all progress is lost.
- Late middle ages: Western civilization rebuilds. Exploration, science and culture return.

Natural Science:
- Based on observations of the world around and possible explanations for these observations. Physical science is equations and empirical observations.
- Not universal (unlike physical science) because it is unknown if Earth's principles are applicable elsewhere
- Works with animate objects (living things)

Null Hypothesis:
- A statement of what would be seen if the hypothesis was false
- There is no relationship between observed phenomena
- Always accompanies hypothesis

Organicists:

Physical Science:
- Based on empirical observations such as equations
- Is universal because they apply everywhere
- Experimentation is preferred
- Single falsification is enough to abandon a theory

Physicalists:
- Believed in equations (chemistry, physics) govern our world
- Believed that living things are small machines that we do not understand.
- Humans were not believed to be machines. Once we see the living world we will see that living things are no different to machines that are being created (engines)

Primary Reference:
- Scientist who did the work published the information
- Used as an academic source
- All facts will be credited with a reference

Proximate Causes:

Sampling Error:

Scala Natura:
- A classification of all the organisms collected by the Greeks, done by Aristotle
- Classified based on Greek ideology of superiority with man being placed at the top and less superior organisms below
- First known classification of the living world

Secondary Reference:
- Scientists who were involved in the work publishing the information (scientific review article)
- Can be used as an academic source
- All facts in the work will be credited with a reference

Special Creation:
- Concept that God, or a higher power put all organisms on the Earth
- Species are not subject to change
- All species were created on the same day a relatively short time ago (4004 BCE)

Taxon:
- A group of one or more populations of an organism forming a unit
- First used in the Linnaean taxonomic hierarchy

Taxonomy:
- The science of classifying the living world
- Classifying based on a set of rules (ex: the ability to give live birth)
- Aristotle was the first to organize the living world based on a set of rules

Tertiary Reference:
- The person who wrote the research may not have expertise in the field, and may have just read and researched
- No references for the information they are posting
- Cannot be used as an academic source

Theophrastrus:
- The first person to classify the plants
- His classification of plants BCE is still correct today
- Gave all the medicinal properties of the plants

Theory:
- Theory is the result of evidence and experiments indicating that a hypothesis is true
- In the natural sciences it is the highest on par with a law in the physical sciences
- Not called a fact because a fact cannot be changed, but there is a chance that a theory can change

Ultimate Causes:
- Looking at why something happens in terms of a longer history
- Based on historical narratives (stories)
- Natural science, like biology, that is variable and not definite

Van Leeuwenhoek:
- Created the first microscope during the scientific revolution
- Patented his microscope and sold them
- Advanced the field of biology because now it was possible to look at minute objects
- Worked with a glass bead

Vesalius:
- Considered the father of anatomy
- Created first book of internal organs in the human body

Vitalists:
- Agree in physical and chemical laws
- Life has something special, a vital force (essence)
- Essence makes living things function as they do
- Essence can not be quantified of measured

Darwinian Thought