Ages of Sand:

Described as the four main breakthroughs in science of the 16-20st centuries.
First: Telescope (1608)
Second: Microscope (1678)
Third: Computer chip (1961)
Fourth: Fiber optics (communication) (1980s)
It seems as if Douglas Adams wrote a book on this phenomenon.

Analogy:

A traight or an organ that appears similar in two unrelated organisms. You could also call this homoplasy, greek for same form. They are usually the result of convergent evolution.
The classical example of analogy would be between birds and bats and flying insects. They adapted in the same way , to solve similar situations and thus formed similar bone structures to do so.
Binomen:
A scientific name for species containing two parts In latin, always italisized.
It is a system of naming species of organisms devised by Linneaus
Name can either be binomial or binomen. First letter capitalized, second letter lower case.
Binomial Nomenclature:
Basically the sequence which created binomial and binomen names, it is the formal way to name species.
Same points of binomen.
Nomenclature means a classified system of names, as of anatomical structures, organisms, etc. e.g. *Apis mellifera* (Honey bee)

Biogeography:
Study of the distribution of plants, animals and microorganisms around the planet.
Was studied when scala was questioned (in the beginning of time)
It is important for the stability of ecosystems.

Catastrophic Theory:

Each layer of fossils represents the remains of organisms that died in a catastrophe (volcanoes,earthquakes etc)
Each layer of fossils represents different catastrophies that built on top of each other.
People assumed fossils were monsters of old time that were outside the scala.
Lyell was known for his study about different strata of rock.

Cell theory:
All organisms are made up of one or more cells
Individual cells have the characteristics of life
All cells come from the division of other cells. Schleiden and Schwann shared their observations and concluded that all living things have and originate from cells.

Chronological Prediction:

A form of telling the future in biology. It is already known that natural scientists would use a chronological prediction to explain trends in the future, such as extinction; not logical prediction which would be used by physical scientists.
Based on the information obtained in the time of studying a specific part of the earths composition, a chronological prediction can be made to observe possible trends like extinction again.

Cladogram:

A tree diagram where the end points of the branches represent different species of organisms
Illustrates phylogenic relationships
A function of cladistics used to show relations among organisms Based on molecular observations as well.

Common Ancestry:

A group of organisms that share a common descent.
Evidence regarding common ancestry include: comparative anatomy, comparative embryology, vestigial structures, biogeography, and molecules.
Divergent and Convergent evolution are examples of common ancestry, mostly divergent, convergent in some cases can be completely different.

Constancy of species

One of darwins five theories after his research at the Galapagos islands.
Gradual changes, natural selection, and other factors will change the constancy of species. There will never be a base where the scala holds true; evolution is in effect in all organisms. Therefore there is no constancy of species.
Proof that there is no constancy of species: fossils, extinction, transitional forms, vestigial structures.
Every individual within a species is genetically different, even slightly.

Control:

A set of individuals in which during an experiment will not be subject to the treatment.
For experimental components of research in natural or physical science, controlled variables must be in the lab in order to measure the different parts of all the tests they perform with regards to the same controlled variable being the same for everything, except for the independent variable.

Convergent Evolution:

The evolution of similar adaptations in distantly related organisms that live in similar environments.
A solution to a problem for the species, thus breeding evolution. The fact that they came up with the same solution for their problem indicates that they are a factor of convergent evolution. For example: anthropods and dinosaur birds.
Main evident causes would be the similarities in ecological niches, which would make sense.

George Cuvier:

came up with catastrophic theory through the "deer model" which was assumed to be a mythical monster of the past.
goes against laws of scala saying that animals have disappeared over the years. There should be no reason for change; noah's flood explained the extinction and fossils found in that time.

Charles Darwin:

established that all species descended over time from common ancestors
came up with natural selection, artificial selection and selective breeding.
Drew the majority of his information from the Galapagos islands and through animal breeding and cross breeding.

Erasmus Darwin:

Grandfather of Charles Darwin.
He was a philosopher, inventor and poet.
His poem included a statement of evolution and related it to forms of life.
He also translated Linnaeus' nomenclature binomen for all animals into English.

Descent with modification:

Evolutionary alteration and diversities of all ancestral species. Basically the key term title speaks for itself.
Basically a condition where a species will alter itself in order to survive in the niche it lives in. E.G. insects that changed colour over time become more abundant in the sequence of seen species.
Mostly a defense mechanism; some will argue it is just for the same of changing colour: no meaning.

Divergent evolution:

Homology is divergent evolution. Divergent evolution suggests a common ancestor is present in the equation, the bone structure is the indication of natural selection with regards to where the organism is present
A great example of this is the horse and it's evolution.
All species must have a common ancestor. The weak will die off if they had not adapted to the natural selection required to survive.

Domain:

-You could say this is the first level on classifiying an organism. In a domain, you have a kingdom, phylum,class order family genus and species.
-Domains of life are separated into 3 main groups. Bacteria, archea, and eukarya

Empirical observation:

This is what physical sciences are based of. They are not made up stories or theories of some sort without an equation to back up the theory behind it.
It also means a variable or also proven by experiment.
Physical scientists thrived on experimentation.

Essentialism:

It is a view where the chemical composition of the being is essential to the organism. The essence of a thing is conceived as the totality of its essential properties. Thus there could be no evolution because you would always keep your essence and your level on the scala naturae.
Highly favoured theory in the years of 400 BCE-450 : Greek and Roman ages.
All species are unchanging throughout time, according to essentialists.

Eukaryotes

Multi cellular organisms with a nucleus in the genome of the cell.
Includes sex, specific functions, DNA replication,
An organism whose cells contain complex structures enclosed within membranes. Many organelles in the sequence.

Evolutionary tree:

-Can be related to Darwin's theory and many other trees made by other biologists; Darwin suggests that animals will adapt to where it is at a specific moment. The ones with the ideal gene will survive. It is called the branching part of Darwin, but also can be seen as a evolutionary tree. (Essentialists had a tree of some sort, not really a tree)
- Also called a phylogenic tree; It Is actually a good explanation of the 3 domains of life: Bacteria, Archaea, and eucaryota.
- A sequence that represents the domains of life.

Extinction:

-A factor in the "no constancy of species" proposed by Darwin.
- Extinction can occur because of catastrophic events, and also can occur because of failure to adapt to the ecological niche the organism is located in.
- An avoidance of extinction is evolution.

Fact:

A proven (usually with calculation) hypothesis that can hold true in all aspects of experimentation and theory. It has no flaws and is right in every situation thus it is a fact. Physical scientists strive for this in all their observations.
Huge difference between theory and fact.

Fitness:

The ability to both survive and reproduce
Can be calculated with a derived formula.
If differences between alleles at a given gene affect fitness, then the frequencies of the alleles will change over generations; the alleles will higher fitness and become more common. Highly seen in bugs and small organisms. Several defense mechanisms are made by all types of organisms.

Fossil record:

Fossil records indicate that there is no constancy of species as well. Fossils are usually not filled with soft bodied animals. Fossils can be really old or "new"
They come in several shapes and forms. Flys are known to get trapped in the amber of a tree, Layer of wood or rock may have traces of an extinct animal, and a caracass (rare) like the mammoth's would be a fossil as well.
Germ Theory:

-Theory that assumed that parasites (microorganisms) were the root of all diseases and pathogens that may enter the body and make the person sick. Germ theory has long been considered proved; its full implications for medical practice were not immediately apparent.
- Because of this, Louis Pasteur (prime theory inventer) insisted all hospitals take extra precaution with whatever they do, and they must change their procedures in accordance to the germ theory.

Historical narrative:

A scientific story describing the findings of the natural scientist in his many observations. This is how they explain their findings, there are no calculations of any sort, or derivations because they had to assume a portion of the theory.
It is the practice of writing history in a story based form. Can be divided into two subgenres: traditional narrative and modern narrative.
Natural science is based on historical narratives.

Homology:
Describes characteristics that are shared by a group of species; it is inherited from a common ancestor. Used in cladistics to determine the evolutionary relationships between species.
Homoplasy: Characteristics that certain species share, usually because they live in similar environments. Characteristics not present in common ancestor; often the product of convergent evolution

Huxley (Julian): English biologist, philosopher, educator, greatly influenced the development of embryology, systematic and studies of behavior and evolution. Best known by biologists for coming up with the term "evolutionary synthesis" (refers to unification of taxonomy, genetics and Darwinian theory)

Hypothesis: A "functioning observation" of observed facts.

Induction: From the specific to the general. A method used by natural scientists to explain observed phenomenons. You will do the experiment over and over and over until you can come up with a concluding statement that may be missing some calculations in its equation, thus cannot be proven with math/physics. If 5500/1million organisms were observed and all 5500 observed have wings, it will be assumed that all organisms of the type will have wings. (this is an example)

Lamarck (Jean Baptiste): Tried to understand how change could occur. Famous for the giraffe/long neck observation. Proposed the first comprehensive theory of biology evolution based on specific mechanisms. Proposed the "perfecting principles" = causes organisms to get better and be better.

Law: The enforceable body of rules that govern any society. In biology, we can interpret laws as a concept of old times when certain theories weren't accepted. Theories weren't accepted, or laws of evolution that governs an organisms population for example.

Leclerc (George Louis-Buffon): World traveller, notices morphology of cats in different regions. Hypothesizes organisms adapt to where they live= Buffon's law. His theory conflicts scala naturae. Proposed theory of vestigial structures.

Linnaean Taxonomy: arranges organisms into ever more inclusive categories. Domain,Kingdom, Phylum, Class,Order,Family,Genus,Species. He also proposed the binomial and binomen nomenclature; i.e. The latin name

that describes an organism with reference to its classification in the Linnaean taxonomy.

Linnaeaus: Also developed phylogenies based on characters such as chromosomal anatomy. (1707-1778) His naming system developed by himself is still used today.

Logical prediction: A rigourous, often quantitative statement forecasting what will happen under specific conditions. Tests statements that are logical consequences of scientific theories. If the theory is contradictory to your observation and evidence, the theory is rejected. Physical scienttists.

Lyell (Charles): Argued that geological processes that sculpted Earth's surface over long periods of time, are exactly the same processes we see today. (Volcanoes, earthquakes,erosion.) Uniformitarianism proposes it must have taken millions of years to mould the landscape. Lyell notices erosion in all parts of the earth, and how they connect with each other (the different hemispheres) Millions of fossils prove that all rocks could not have formed within 6000 years, thus including everything else in this timeline.

Mendel (Gregor): Gave the world a mechanism to observe traits in organisms. Introduced variation in organisms. He could predict mathematically the traits of organisms, if they were packages of genes. Austrian monk, work got discovered after death. Called founder of genetics, his famous experiment on peas.

Modern Biology: Cellular respiration, ATP and mitochondria (1930-50) Ecology (40's), DNA is the genetic material of life (43') DNA structure (53') Gene regulation (61') Genetic code (60's) Recombinant DNA experiments (70's) Cloning of a mammal (77') Human genome sequence (2000) Fiber optics (80's). Biology has really developed greatly in the past 150 years or so.

Natural Sciences: Deals with animate objects only. It is more physical and chemical laws (Genetics), and it is not universal. It is a branch of science

that seeks to elucidate the rules that govern the natural world using scientific methods (Natural world= nature)

Natural selection: Proposed by Darwin. Based on the location of an organism may be, individuals within populations vary in size, form, colour, behavior and other characteristics. Favourable traits will allow organisms to survive, Thus more common in next generations. Many of these variations are hereditary. Darwins best example would be the beak of a finch.

Null Hypothesis: A statement of what would be seen if the hypothesis tested was wrong. Basically, when an observation and a question is present to ponder, the null hypothesis gives no differed answer as opposed to why this happened. It is null.

Organicists: believe that the functioning of living organisms can be determined by having certain organs working together as an integrated system.

Pasteur (Louis): Pasteur inferred that life of organisms come from another life, (in other words, an ancestor), rather than spontaneous genereation which had to have occurred once in the beginning of time anyhow. He also proposed the germ theory, developed a vaccine for rabies.

Physical Sciences: Inanimate objects, Physical +chemical laws, universal, based on empirical observations. Experimentation preferred method. Single theory falsification enough to abandon theory.

Physicalists: A philosophical position holding that everything which exists is no more extensive than its physical properties; there are no kinds of things other than physical things. According to this theory, physics is the universal language of science. They do not consider the mind, but rather the brain in organisms.

Prokaryotes: Organism in which the DNA is suspended in the cell interior without separation from other cellular components by a discrete membrane.

Lacks a nucleus in its composition. Nucleoid contains DNA, e.g. bacteria, archaea.

Proximate causes: (physical science like biology)
Examples of proximate causes: phenotype, mechanical, here and now, Genes in action, experiments. Proximate cause is also the immediate cause/trigger for behavior= instinct. An alarm in an organisms essence.

Sampling error: Amount of inaccuracy in estimating some value that is caused by only a portion of a population Rather than the whole population. It is an amount of inaccuracy measured. A repeat of the test is usually issued.

Scala Naturae: Created by Aristotle. First list of organisms; Basically a ranking system. It represents the importance of being: God, Angels archangels supr. Being, assist., sub ast., humans, birds, fish, mammals, plants, roots, worms, devil.

Schleiden and Schwann: Two men discussing their studies inferred that all organisms originate from the cell. All cells have the characteristics of life. Cells come from the mitosis of an other. Schleiden speculated the nucleus had the source of development. In larger organisms, the cell has a life of its own.

Scientific revolution: Throughout the 16-18th century. Includes the following scientists: Copernicus, Kepler,Newton, Gallileo, Boyle, Pascal, Descartes, Van Leeumehoek,Harvey,Linnaeaus. Science really began to unfold with regards to the magnitude of discoveries being made.

Special Creation: There is a pattern that follows this sequence. Species do not change. All species were created Oct 23, 4004 BCE. Species are not old. It is believed a designer of some sort makes all this. The sequence is called the pedigree of man.

Taxon (taxa): A name that gives a group of organisms included within a category in the Linnaeus taxnonomic hierarchy. The two described names infer what "section" if you will, of the taxonomic hierarchy, with reference to

their specific characteristics. The first is a noun, second adjective. E.g. Apis mellifera (honey bee) always write in italics.

Taxonomy: Also referred to as taxonomic hierarch. It is a system of classification based on putting organisms into ever more inclusive categories. It is said that Linnaeus created this method of classification with his detailed content. Binomen and binomial nomenclature is used to classify these organisms.

Theory: Basically a scientific explanation. There are generally two parts to a theory. If a pattern is observed and if a mechanism or process is observed, it is a theory to be proposed. Questions asked in a theory:what? (what is the theory, what does it entail to, etc.), How/proximate cause/ and why (ultimate causes). It is a well-substantiated explanation of some aspect of the natural world, based on repeated scientific facts.

Transitional forms: The non-constant development of a specific species adapting to its immediate habitat. A great example would be the horse, and the change in its ligament structure and size of molar teeth. Teradactyls are also a great example. These transitional forms are found in ancestors. They show the intermediate states of what the species is going through.

Transmutation: Refers to the essence, and how it could change along with the environmental changes that occurred. Basically the essence sends a signal to the new generation in warning of the need of adaptation. This is how essentialists explained diversity. (Might have a few points that belong to transformation. Lamarck only covers the environmental side of transmutation.

Transmutation of species: This is lamarck's theory. The essence responding to environmental change causes them to send signals of some sort to adapt and survive in the next generation. It must be considered though that phenotype can be changed, but genotype cannot change. Genotype is referred to as preserved DNA. Set aside germ cells, pristine copies, for the next generation.

Ultimate causes: It is a natural science- like biology. Deals with genes and history, variables (probablistics, evolutionary past, changes in genetic programs, historical narratives. Basically for example, if a zebra is scared, it runs because it wants to survive instead of running out of instinct. This is ultimate cause. Behaviour can change based on evolution or survival.

Uniformitarian theory: The theory that proposes that the geologic processes that sculpted Earth's surface are the exact same natural disasters that we see today. (earth quakes, volcanic eruptions, erosions, etc.) This disregarding the 6000 year theory (lyell)