KEY TERMS – MIDTERM 1

Biology, Biologists and Bioscience

Ages of sand:
According to Douglas Adams, science has undergone four milestones of science that can be called the "four ages of sand", corresponding with glass. The first age is the invention of the telescope (1608) which allowed us to look farther into space, learn about planetary motion and the laws of physics, etc. The second age is the one of the microscope (1678) where humanity was allowed to look closer at things and to analyze smaller things, therefore the start of biology. The third is the computer chip (1961) which allowed us to look more closely in detail and to allow us to compute much more complex things (such as the genome). Last/fourth is fibre optics (1980s) which allowed us to communicate all of this information and to bring experts together. *Lecture I PI slide 9

Binomial nomenclature:
It's the system that Linnaeus created to name animals, using two Latin names. The first stands for the genus, the second specifies species. The first name is capitalized and always in italics. *see Lecture I slide 11 – 14

Cell theory:
First proposed by Matthias Schleiden for plants and Theodore Schwann for animals, it is composed of three main ideas: 1) everything is made up of cells, it is the basic unit of life, 2) cells carry out the fundamental functions of life, and 3) all cells come from pre-existing cells. see Lecture I slide 18

Chronological prediction:
A prediction into the future, predicting something will happen later on (not really scientific prediction). Ex: fortune teller. see Lecture I Part II slide 1

Cladogram:
A tree-like diagram that shows the descent of groups of organisms, demonstrating evolution.

Control:
A test carried out during an experiment to compare against experimental results, to demonstrate that the results are valid. Ex: for chilli peppers, hatch berries were control. *LIPIII slide 6 and 9

Deduction:
Method of logic going from the general to the specific. Example: All humans die, Bob is a human, therefore he will die. OR All insects have wings, this is an insect, therefore it will have wings. *see Lecture I Part II slide 5

Domain:
The highest level of Linnaean classification for biology. The three domains of organisms are the Bacteria, the Archaea and the Eukarya. * See Lecture I slide 13.

Empirical observation:
Observations most often used by the physical sciences (math and facts), raw proof. see Lecture I Part II slide 4

Essentialism:
The theory started by Plato that everything has an underlying vital force, eternal and internal which never changes. Main theory that stood against evolution.
see slide 5 of Lecture I and slide 3 of Lecture I Part II.

Eukaryotes:
Organisms from the Domain "Eukarya", they include organisms that have cell(s) a nucleus (membrane-bound nucleus with complex DNA with histones and organized into chromosomes). More sophisticated than prokaryotes. *see slide 13 of Lecture I.

Evolutionary tree:
A tree like a cladogram that shows the path of evolution

Fact:
A piece of known information that becomes part of human knowledge. Something that is solid, a theory can become a fact. *see slide 1 Lecture I Part II

Historical narrative:
Used by natural science more often, it is a way to explain something using history and an evolutionary origin. Example: how did the dinosaurs die? Where do certain mechanisms of behaviour come from? Answer is historical narrative. *see slide 4 Lecture I Part II

Hypothesis:
An explanation that is proposed to a set of observations that link to a certain question *see slide 1 Lecture I Part II

Induction:
Going from specific to general, most often used by natural science. Generalizing a set of common observations. For example: all the bugs I've seen have wings, all bugs have wings. *see slide 5 L I P II

Law:
A theory that becomes law is something that is proven right universally in all cases, more often applied to physics, chemistry and mathematics. *see slide 1 LIPII

Linnaean taxonomy:
A system of nomenclature (binomial nomenclature) established by the Swedish biologist Carl von Linne or Linnaeus. It goes through kingdom – phylum – order – family – genies - species*see slide 11 – 12 LIPII

Logical prediction:
The prediction most often used by science. It usually comes with a "if" and "then" statement, uses deduction and indction. *see slide1 LIPII

Modern biology:
Modern biology is the biology that has developed recently, from the 19th century onward. Before there wasn't a real study of biology, mostly medicine and pseudoscience. Only afterwards was there a gradual introduction to microbiology (since second age of sand), evolution, genetics, etc. see slides 15 – 19 LI

Natural sciences:
The branch of science that is related to biology, and is not completely based on empirical observations. It studies living, animate objects and is not universal, and is more than just physical and chemical laws. It uses historical narratives and induction, as well as multiple theories (not one theory can break it down). *see LIPII

Null hypothesis:
A hypothesis that describes what the results of an experiment would be like if the main hypothesis was wrong. For example: no difference between the two experimental groups *see LIPIII slide 8

Organicists:
The merge between physicalists and vitalists, which states that the vital force of the vitalists (essentialists) is replaced by a genetic program, therefore everything is not a machine yet there is no essence. *see slide 3 LIPII

Physical sciences:
Mostly physics and chemistry that is based on empirical observations. It corresponds to inanimate objects, is universal, uses experimentation instead of historical narratives and is based on SINGLE theory, it only takes one person to knock a theory down. *see LIPII

Physicalists:
Those who believe that, with the exception of humans, all living things are machines (example Descartes 17th century). Because no one knows what cells are, there is a mechanistic approach to living things. *see slide 3 LIPII

Prokaryotes:
A member of the domains Bacteria or Archaea, any unicellular organisms that do not have a nucleus and is less complex (fewer organelles)*see slide 13 LI

Proximate causes:
Causes mostly explained by physical science, it is mechanical, here and now, and based on experiments. For example: phenotypes come from morphology and behaviour, or genes in action. In biology, the immediate, mechanistic cause of a phenomenon (how it happens), as opposed to why it evolved. Also called proximate explanation. *see slide 9 LIPII

Sampling error:
Selecting accidentally a nonrepresentative sample from a larger population due to chance. Ex: drift occurs and allele frequencies change due to blind luck.

Scala naturae:
Created by Aristotle, it is used until the 19th century. It describes the world as a scale of importance of living things, God at the very top, followed by archangels, then the most important human beings to the least important, then birds, then complex animals (wild) to domesticated, then plants, then minerals, and then `bad guy`` *slide 3 LI

Scientific revolution:
Before there was not much development in science except for that in the Middle East. Between the 16th to 18th century there was a surge of scientific discovery, known as scientific revolution. However it was mostly the physical sciences that were developed during this time (earth not the center of the universe, planetary motion, laws of motion, gravity, behaviour of gases, etc) slide 8 – 11 LI

Taxon (taxa):
any named group of organisms at any level of a classification system *see slide 11 – 14 LI

Taxonomy:
the branch of biology concerned with the classification and naming of organisms *see slide 11 – 14 LI

Theory:
An explanation that is proposed to cover a broad range of observations and phenomenon. Theory is backed up by many hypothesis that are proven right. *see slide 1 LIPII

Ultimate causes:
Natural science uses this cause most often. The causes are variable, and use historial narratives and evolutionary past. For ex: genotype – history of genes and where they come from and why, *see slide 9 LIPII

Vitalists:
A belief that explained that all living things have a special force distinct from physical and chemical forces that drives them * see slide 3 LIPII

<u>Evolution, Ecology and Biodiversity</u>

Abiotic factors

Factors in an ecosystem that are non-living. This includes climate (temperature, moisture/water, winds, sunlight) or non-climatic factors (salts and pH). Species are limited in a biome by abiotic factors, preventing some from growing there. Ex: cheatgrass does not grow in wetlands because it can't compete with tall species, therefore it grows in dry temperature grasslands and habitats dominated by shrubs because it's not affected by fire (grows readily in soil depleted by fire) and is annual therefore no part of the plant is exposed during cold seasons. *see slides 39 – 44 LII PIII

Adaptation

It's a heritable trait that increases the "fitness" of an organism in a certain environment compared to those lacking the trait. Adaptation increases fitness – the ability to produce offspring. Ex: light-coloured wings in environment where most trees have gray bark.

Aphotic zone

Areas in an ocean or a lake/pond that do not receive sunlight. Because of this, very little photosynthesis can occur in these areas, and there's very little productivity. In oceans, organisms in these zones survive from the dead bodies of those from the photic zones. *see slide 59

Artificial selection

It's the manipulation (by humans) of the genetics in animal and plant breeding (usually to change appearance), where organisms of a population is manipulated so that only the ones with desirable traits reproduce. This is one of the proofs that demonstrate the mechanism of evolution. An example is horses and dogs. *see slide 27 LIIPII

Benthic zone

The bottom areas of an aquatic environment, such as oceans, lakes and ponds. It's usually where there are rich in nutrients because of the decomposition of dead organisms. In lakes and ponds, lake turnovers bring the nutrients from benthic zone up to the top. *see slide 59

Biodiversity

It is the diversity of living organisms that is considered at three levels by biologists: genetic diversity (variety of alleles in a population), species diversity (variety of species in an area), ecosystem diversity (variety of communities and abiotic factors in an area). *see slides 65 - 73

Biogeography

It's the study of how populations and species are distributed geographically. It is also another proof for Darwin's theory of evolution. Ex: birds on the Galapagos Islands. Birds from different but close islands, they are all very similar but yet they are different species. Darwin thought that perhaps they came from a common ancestor and they changed when they parted ways. *see slide 25 LI PII

Biomes

A big terrestrial ecosystem that has distinct vegetation and climate. The different biomes on the planet are the tropical forest, subtropic desert, grasslands, temperature forest, boreal forest, arctic tundra. Due to the climate, each one has a different level of productivity.

Biotic factors

Factors in an ecosystem or biome that are living. The distribution of a species is often limited by these factors, for example interactions with other organisms. For example: flies that carry diseases, plants, etc.

Catastrophe theory

The theory that worldwide catastrophes that are short-lived, violent and sudden have destroyed mass amounts of species and have changed the face of the Earth. It is often linked to Baron Georges Cuvier who deduced that the extinction of the animals of whose fossils he found (example Irish elk) was due to great catastrophes that destroyed these animals. The theory of "Noah's Ark" is an example, and is a way to back up the Earth as being young* slide 7

Climate

The long-term weather conditions in a particular area. Climate usually defines the biome and is a direct link to productivity in a region. Factors of climate include temperature, moisture, sunlight and wind. *slide 39

Common ancestry

This is the theory that describes the descendence of multiple species from a common ancestor, leading to similarity but difference between the species. According to Darwin's theory of evolution, species have common ancestry with each other. Each organism inherits the gene of the first organism, thus creates branched phylogenic tree. Proof to back this up are comparative anatomy, embryology, vestigial structures, biogeography and molecules *see slides 20 – 26.

Community ecology

Study of the species that interact with each other in a particular area. This includes studying species richness and succession (for example after a forest fire). Ex: salmon eat smaller fish and themselves are eaten by other organisms. *slide38

Constancy of species

The theory that species remain constant and have been constant since the time of Genesis. These philosophers believed there were as many animals living today as there were before. This is similar to essentialism, and it was one of the arguments against evolution. Linnaeus is an example. *slide 4

Continental shelf

The submerged portion of a continent underneath an ocean, that makes up the outermost edge of the neritic zone of oceans. The continental plates float on the earth's surface, and in this area there is high level of productivity (ex where cod fishery used to be) *slide 59

Cuvier (Georges)

Naturalist who found the first fossil of an extinct species (mammoths). He wrote a paper about extinction, and believed that it was due to a catastrophe that destroyed a mass amount of species, yet some stayed – Noah's flood. His example was the Irish elk, which was too big to escape notice yet was not present today. *slide 7

Darwin (Charles)

Went on a trip on the Beagle and toured the world for five years collecting specimens. When he came back he developed for 23 years the mechanism of evolution, and presented his theories with Wallace. His main theories were describes in five theories, and especially stretched the idea of descent with modification. He was the first to truly state that all animals have a common ancestry, everything changes gradually and that natural selection is behind it. His theories put an end to essentialism yet his theories were not completely accepted until later on, when more information about genetics was discovered. *slide 11+

Darwin (Erasmus)

Grandfather of Charles Darwin. He translated Linnaeus into English and wrote "The Temple of Nature", which was a great poem that describes small inanimate objects all the way to higher forms (a form of narrative history). *slide 6

Descent with modification

The phrase used by Darwin to describe his hypothesis of evolution by natural selection. The theory describes how all species existing today have descended from other pre-existing species and that species are modified through time. As organisms fight to survive to reproduce, the population changes genetically each generation (but slowly). *slide 11 - 12

Ecosystem biodiversity

It is the variety of biotic communities in an area as well as abiotic components. Biologists who try to save ecosystem biodiversity try to maintain protection outside in the ecosystem, instead of not focusing on a species. An example is protecting the habitat of gorillas instead of putting them in zoos. *slide 65

Ecosystem ecology

Extension of community ecology, it includes living and physical aspects of an ecosystem. Ex: salmon transports nutrients from one ecosystem to another. Also includes global patterns and the primary productivity of ecosystems, ex large forests that remove carbon dioxide. *38

Environmental transformation

(Lamarck) believed that the environment would be a factor in physically changing organisms. Did not include genetics. *10

Extinction

The disappearance or dying out of a species on Earth. Cuvier was the first to acknowledge extinction as a fact. Darwin expanded this idea by proving how the world changes and that the survival of species depends on natural

selection – species die out due to unfavourable traits or the environment selecting against them. Extinct species are studied with fossils. *19

Ferrel cell

The cell in between the Hadley and Polar cells. It is situated between 30 and 60 degrees latitude North and South. At 30 degrees latitude the wind blows to the pole, at the 60 degrees latitude the wind blows to the 30 degrees latitude. Not all winds make it because some go to the polar cell. This cell is affected by the winds from both other cells.

Finalism

Species are changing to move up in the Scala Naturae, to become more perfect organisms. One of the response backed up by essentialism to explain change.

Fitness

The ability for an organism to produce viable offspring compared to other individuals in the population (also called Darwinian fitness). Animals that survive and produce offspring are more "fit" than others. Another reference to natural selection.

Fossil record

All the fossils that have been found and have been described in scientific literature. These fossils are used to study organisms that are now extinct. Fossils were also used by Darwin to demonstrate his hypothesis of evolution by natural selection, and demonstrates how organisms have changed. The animals in fossils are often similar to those living today. *7, 8, 16

Genetic biodiversity

The traits and variations found in a population of a species. Ex: genetic variation in corn seeds of Mexico. One of the main types of biodiversity that biologists try to preserve. *65

Geological time scale

It is the sequence of eons, epochs and periods used to describe the geological history of Earth. It is used for finding fossils and helps to organize the fossil record.

Hadley cell

At the equator the air is heated and becomes less dense, so it rises and moves up until it cools down, then goes back down. It ranges from the equator to 30 degrees latitude. *44

Heritable traits

Traits that can be transmitted from one generation to the next. Often preferable traits that are favoured by the environment allow for the organisms that have the desired traits to pass it onto their offspring, ensuring their survival and a change in the allele population. The second postulate of Darwin's theory of natural selection. *31

Homology

It is a similarity that exists between species that are descended from a common ancestor. There are genetic, development and structural homology. Ex: the hand of man, leg of horse, wing of bat all have similar underlying structure but different purpose. Another proof of natural selection. *23

Intertidal zone

(Ocean) Rocky, sandy, muddy beach that has tides and wives. High productivity due to the level of sunlight and nutrients from estuaries, though organisms have to withstand tides. *60

Lamarck (Jean-Baptiste)

The scientist who theorized the "use it or lose it" theory for the change in animals. The use of a limb makes something larger, and is transferred to descendants. Ex: giraffes use neck more, it becomes larger. Transmutation of species. *9

Leclerc (George-Louis - Buffon)

The father/discoverer of biogeography, a very prestigious naturalist. He realized that cat species are very similar o each other, they seem to share a COMMON ANCESTOR. He believed that creation may have occurred in one spot, and then the organisms migrated to other areas. *5

Limnetic zone

In lakes and ponds, offshore, water that receives enough light for photosynthesis.

Littoral zone

(lake/pond) Shallow waters along shore where flowering plants are found. There is emergent vegetation there above the surface. *60

Lyell (Charles)

He created stratigraphy and the geological time scale, and credited the uniformitarian theory of geological change. He found "strada" and looked at the different animals in them. Because the layers take time, he believed that Earth had been changing for long periods of time, therefore with layers he could date the fossils that he found. *8

Morphology

The shape and appearance of an organism and the parts that make up its structure. The appearance of certain organisms can help figure out common ancestry.

Natural selection

It is the process by which individuals with certain heritable traits produce more offspring than those without the traits, leading to a change in the genetic makeup of the population. It's the major mechanism of evolution, developed by Darwin. It has four postulates. *14, 31 - 34

Neritic zone

Zone of ocean that extends from the intertidal zone to the depths of 200 m. Its outermost edge is the continental shift. Currents bring nutrients from benthic zone, therefore high productivity.

Oceanic zone

The deepwater region of an ocean.

Organismal ecology

It explores the morphological, physiological and behavioural adaptations that allow organisms to live in a certain area. Ex: how salmon travels hundreds of miles to lay eggs. Relationship between organism and world*38

Photic zone

The zone of a lake/pond or ocean that receives sunlight. Photosynthesis can occur here, and it has the most productivity. It is usually a narrow strip on top of the ocean. *59

Polar cell

Similar to the Hadley cell. Cool air from the poles moves downwards due to lower density and begins to spread southward up to 60 degrees latitude.

Population

Organisms of the same species that are living in the same area at the same time. Usually populations will have a genetic pool of alleles. Populations evolve, not organisms.

Population ecology

Number of individuals in a population over time, and how the population functions with biotic and abiotic factors. Ex: number of salmon during spawning season. *38

Population thinking

The view that the variation in a population is the key to understanding the nature of species. The idea of uniformitory, finding similarities, dominated scientific thought since Plato. Coined by Darwin *11

Primary productivity

Total amount of photosynthesis in an area and time period. Areas with more photosynthesis have more plants, more organisms, more activity. The most primary productivity is found in the tropical forests.

Rain shadow

The dry area on the side of the mountain range away from the prevailing wind. This is caused by the moist winds moving up the other side, releasing its water when it cools, and then swooping down on the other side. This side is very much like a desert. *56

Special creation

The theory that species don't change, and that each species was created by Oct 23, 4004 BCE. Basically, there is a designer of some sort. Opposed evolution, everything was created the way of genesis. *4

Species biodiversity

Preserving the actual species, or studying the variety of species on Earth. Ex: putting gorillas in zoos. *65

Thermocline

The gradient of temperature in a lake/bond. Usually the top in winter is 0 degrees, underneath is slightly warmer. During spring and fall there is lake turnover where the termperatures are dispersed.

Transitional forms

Fossil species with traits that are intermediate between older and younger species. It shows the link between species, and the transition as species evolve. Ex: whale, goes from land-dweller to sea-dweller with no limbs. *18

Transmutation

One of essentialism's explanations of change, unlike Lamarck's theory it is an actual mutation. A fixed type suddenly mutates and becomes another species.

Transmutation of species

The "use it or lose it" mechanism that Lamarck describes. If something was useful for a species, their offspring would inherit this modified trait to help survive, based on environment. *9

Uniformitarian theory

The theory that the processes that happened in the past to shape the Earth are the same processes that we see today (earthquakes, glaciers, wind, etc.). In other words, the world was shaped by slow-moving forces that are still in progress. Advocated by Charles Lyell, and the opposite of catastrophism.

Vestigial structures

Any structure of that is reduced or non-functioning that is similar to a functioning structure in other organisms. These structures are thought to reflect evolution. An example is the hipbone in whales and snakes. *slide 25 - 26

Hadean and Archean Eons

Adhesion

The ability for certain different molecules (like water) to cling together due to attractive forces. Water molecules may adhere to, for example, a bottle, thus slipping up the sides. This is necessary for plants, where water is drawn up plant due to adhesive forces. *16 - 17

Archaean eon

This is the moment in time where anaerobic bacterial life first appeared on the Earth. Most of the world's organisms that first emerged were prokaryotes. This was a very important step on Earth in the direction of living organisms on the planet. *2 - 5

Biomonomers

They are the monomers (subunits) of basic organic and biological molecules necessary for life. These monomers were necessary in the at the very beginning of the emergence of life on Earth (prebiotic soup) in order for life to actually emerge. No one is quite sure how each formed, though from Miller's experiment we can deduct that amino acids and simple carbon/organic molecules may have been formed. *26

Biopolymers

Macromolecules that make up the basis of life. They are proteins, nucleic acids, carbohydrates and lipids. No one knows exactly how all of them started first, but for example, we assume that RNA came before DNA and proteins as DNA is too complex and needs proteins for it to replicate, and RNA can act as a catalyst on its own. Lipids are used for cell membranes, carbohydrates are a main source of energy, and proteins make up the building blocks of life *26

Carbon

Element 6 which makes up all the organic matter on Earth, and is a vital component of life (from this we get all the other organic polymers). Carbon is so useful because it has four electrons, therefore it can form strong, evenly-distributed covalent bonds and in many shapes (rings, sheets, branched chains, etc.). LIFE ON EARTH IS CARBON BASED. Carbon monoxide/dioxide when the Earth first emerged were probably the sources of carbon for all these organic molecules. *12

Central dogma

The theory in biology that DNA replicates to make RNA and RNA makes protein (therefore DNA – RNA – protein). This was up for debate for a very long time, and it basically describes the acts of replication, transcription and translation. However, scientists are unsure which came first, but theorize that RNA, because it can store information and have catalystic properties, may have emerged before proteins and DNA. However, we do not know where mononucleotides came from *27.

Chemical evolution

The theory that simple chemical compounds found in the atmosphere and oceans of the early stages of Earth can combine by spontaneous chemical reactions to create the complex biopolymers and compounds, leading to the origin of life and start of biological evolution. This is very much based on Miller's experiment, using his "prebiotic soup". From this experiment, he proved that molecules like hydrogen cyanide, formaldehyde and other carbon-carbon molecules can form when exposed to kinetic energy. *22 - 24

Cohesion

The ability for certain similar molecules (like water) to cling together due to attractive forces. An example of this are the water molecules in the bottle that cohere to each other. This is necessary for surface tension, as well as the movement of water in plants. *16 - 17

Crystal lattice of water

The lattice structure of water that forms due to hydrogen bonding. This especially happens when ice is formed. Water molecules interact with each other and form hydrogen bonds in lattice structure. When the water molecules spread out, you have less molecules per unit volume, thus the water becomes less dense and is able to float. This is important because life can continue underneath the surface of floating ice. *18 - 18

Emergence

The idea that living things are more than the sum of their parts. This is one of the main dogmas of organicists (1930) where they believe the vital force is replaced by genetic programming and the importance of emergence. Though the genetic code is simply made up of molecules, the molecules can do a lot together. Ex: analogy of bees in beehive can do more than simply the sum of what bees can do separately. *33

Evaporation

The phase of change from liquid state to gaseous state that requires energy input. Due to water's specific heat capacity, it takes a lot of heat for water to evaporate, therefore it is stable for life to live in. It is the main component of heat loss in living organisms. *23

Geological time scale

The sequence of eons, epochs and periods used to describe the geological history of Earth. The major eons are hadean, archaean, proterozoic and phanerozoic. The Earth is billions of years old, and the geological time scale allows us to understand what transitions Earth has gone through during its history, and it allows us to understand the origins of life, etc. *2 - 4

Green house gases

The gases in the air such as carbon dioxide that absorb and reflect radiation so that heat radiated from Earth is trapped in the atmosphere of Earth. The first gases that made up the atmosphere on Earth created this greenhouse effect, allowing for the water to stay on Earth and to not escape, allowing for life to form (and creating oceans). *10

Hadean eon

This eon is the first eon of Earth, ranging from 4500 to 3800 mya. It characterizes the formation of the solar system and the planet. It is when the Earth is finally changed from a formless blob to a planet with crust, atmosphere and water. At the very beginning, Earth was molten due to the constant hits from meteors, then finally everything stabilized, the Earth cooled, creating a sterile planet with water and atmosphere. *2 - 9

Hydrogen bond

The bonds that are formed between hydrogen and electromagnetic atoms on a molecule with an extra pair of electrons (fluorine, nitrogen and oxygen). This is a very special characteristic of water that allows for it to have cohesive and adhesive forces, surface tension and high specific heat capacity. These characteristics allow for it to support life. *14

Hydrophilic

Something that is attracted to water (water loving). This is mostly anything that is polar or able to dissolve in water. An important example are the hydrophilic parts of the phospholipids of cell membranes, that allow for molecules to dissolve in and out of the membrane. *15

Hydrophobic

Something that is repelled by water (water-hating). This is mostly anything that is non-polar or has intermolecular forces different from water. An important example re the hydrophobic ends of phospholipids in the cell membrane which allow for the contents of the cell to be separated from the extracellular environment. *15

Hydrothermal vents

Volcanic vents on the ocean floor at great depths. Scientists have realized that molten rock comes out of the core of the planet from these "black smokers", and contain certain basic compounds. Therefore, not just lightning but also hydrothermal vents may have contributed to primary building blocks of life on Earth. In these areas are also bacteria that live without oxygen (first kinds of life forms that lived without oxygen). *25

Interstellar organic compounds

Organic compounds that came from outer space and landed on Earth. A theory that may demonstrate the origin of where some of the first organic compounds came from, that they came from meteorites. This theory is known as panspermia. *11

Interstellar space dust

The "space dust" that comes from the burning of helium in the red sun phases of other stars. When suns have gone through the red sun phase, they burn helium and make carbon. That carbon reacts with itself into acetate backbones. This stuff may have been another example of the origins of organics on Earth *25

Micelles

A hollow sphere-like structure that is formed by aggregates of different parts of a molecule (hydrophilic and hydrophobic, polar and nonpolar components). An example phospholipids that make up the cell membrane. If polar and nonpolar substances shaken together they can form micelles, and when these form a circle they allow for the space inside to hold reactions and to catalyze reactions (origins of life). If micelles contain too much matter they may divide. *30 - 32

Miller experiment

Miller created an experiment where the question was: Can simple molecules and kinetic energy lead to chemical evolution? He put simple compounds that are known on the Earth's beginning such as methane, hydrogen gas and ammonia in a flask system, boiled water and used electrode. Samples taken from liquid show that formaldehyde, hydrogen cyanide and several complex carbon-carbon molecules formed. Conclusion: chemical evolution can occur with simple molecules and kinetic energy. *22 - 24

Nonpolar compound

A compound that has electrons evenly distributed throughout the compound, and have only London dispersion forces for intermolecular forces. Ex: methane and carbon dioxide. These molecules do not mix with solvents like water. Important part of micelles and the plasma membrane of the cell. *15

Panspermia

The theory that life did not originate on Earth, but arrived in the form of bacterial spores or viruses from an extraterrestrial source. Some scientists believe that the bacteria may have arrived from meteorites. These molecules/bacteria dropped into the ocean and became life as we know it. *11

Phanerozoic eon

The most recent eon of geological time scale, represents the last 500 million years of Earth's history. It is the time where multicellular organisms emerge. *2 - 4

Polar compound

Compound that has uneven distribution of electrons and has negative and positive ends (examples water). Due to this, they are like little magnets that have properties of surface tension, cohesion, adhesion, etc. *15

Prebiotic soup

A hypothetical solution of sugars, amino acids, nitrogenous bases, and other building blocks of larger molecules that may have formed in shallow waters or deep-ocean vents of ancient Earth and given rise to larger biological molecules. Theory of origins of life. Miller experiment. *25

Proteins first hypothesis

Theory that proteins were first created *28

Proterozoic eon

The eon of Earth that goes from 2500 – 550 mya. This is when Earth developed an oxygen atmosphere and single-celled organisms appeared. Oxygen atmosphere maybe due to cyanobacteria. *2- 4

Protocells

The first cell that emerged. It is composed simply of RNA and the micelles that form a simple membrane. This membrane allowed for reactions to be centred and quicken (early forms of life). *31 - 32

Reducing atmosphere

A reducing atmosphere is an atmospheric condition in which oxidation is prevented by removal of oxygen and other oxidating gasses or vapours. In the beginning of time there was no oxygen on Earth.

RNA world

The theory that of DNA, RNA and proteins, RNA came first. At first RNA was simple and was used to store information and act out catalystic purposes (ribozymes). Then it passed on information storage to DNA and catalystic purposes to proteins. RNA retained ability to do what it does now. *28

Specific heat

The amount of heat per unit mass needed to raise the temperature to 1 degree C. It is a characteristic of water, it has a high heat capacity which allows it to support life (hard for temperature to change). *20

Spontaneous origins

One of the theories of the origins of life on Earth, where all of the elements on Earth were in play, chemists can put together chemicals on early Earth and able to create larger molecules. *11

Surface tension

Ability for water to react with each other on all sides of a surface (due to strong H-bonds). Because of this, organisms like spiders can walk on water without penetrating it. Earliest organisms first to appear on earth will need to break this tension to breathe air, some limited by this. *16 - 17

Surfactant

Wetting agents that lower the surface tension of a liquid, allowing easier spreading. "Surface acting agents". Example micelles

Vesicles

Pocket with a lipid bilayer, able to organize metabolism, enzyme storage and nutrient transport

Volcanic outgassing

Second atmosphere of Earth similar to molecules created by modern volcanoes (water, carbon dioxide, sulphur dioxide, etc.). No oxygen.