

Humans: Planet-Altering Apes

Glossary

Acute respiratory distress syndrome (ARDS): A serious type of **respiratory** failure characterized by rapid onset of widespread fluid buildup in the lungs, which limits oxygen uptake and causes shortness of breath, rapid breathing, and bluish skin coloration.

Agriculture: A subsistence strategy that relies on **domesticated** species instead of **hunting and gathering** wild species.

Agricultural nitrogen pollution: water and air pollution caused by excess **nitrogen**-based fertilizer use in crops and livestock production.

Agricultural revolution: The transition from **hunting and gathering** to settled **agriculture** starting ~12,000 years ago in Mesopotamia. The development of and transition to agrarian life ways and technology was piecemeal in different places and at different times instead of a full blown "revolution."

Allele: Alternative **DNA sequence** at the same **locus** (location on the **chromosome**).

Amino acids: organic compounds that are the building blocks of **proteins** and participate in a number of processes such as neurotransmitter transport and biosynthesis. Amino acids are encoded by the **genome** as different three **nucleotide** codes.

Ancient DNA: DNA that is extracted from ancient specimens (skeletons, mummified tissues, frozen specimens, archeological material, archival collections, sediments, and dirt). The current upper age limit for ancient DNA extraction and sequencing is 0.4-1.5 mya.

Anthropocene: The proposed geologic epoch defined by human influence on the Earth. There is yet to be consensus for when the Anthropocene began with suggestions ranging from the start of the **agricultural revolution** to the first atomic explosion.

Archaic admixture: DNA from ancient, divergent, and now extinct populations found in current people.

Bacteria: A type of **prokaryotic** microorganism. Unlike **eukaryotes**, bacterial cells do not contain a nucleus and rarely harbour membrane-bound organelles. Bacteria were among the first life forms to evolve on Earth, and can be found in most every habitat, including soil, water, acidic hot springs, radioactive waste, the deep biosphere of the earth's crust, and in and on other living organisms as **symbionts** and **parasites**. Bacteria can be beneficial, such as those comprising the gut flora, or **pathogenic** and cause **infectious** disease. However, the vast majority of the bacteria in the body are rendered harmless by the protective effects of the immune system.

Biologically available nitrogen: types of **nitrogen** (nitrate, nitrite, and ammonium) that are required by all plants except **legumes**. Legumes are able to utilize atmospheric N_2 due to their symbiotic association with rhizobia bacteria in their root nodules.

Chromatin: A complex of **DNA** and **proteins** (histone and adaptor proteins) forming **chromosomes**.

Chromosome: Discrete strands of tightly packaged **chromatin**.

Climate change: Long-term shifts in temperatures and weather patterns induced by natural phenomena or human activity.

Clotting: the process by which soluble proteins in blood crosslink to cause a change from liquid to gel, forming a clot. Also known as coagulation.

Contagious (disease): **infectious** diseases that can be spread from organism to organism by direct or indirect contact. Contagious disease is a subset of communicable, infectious, and transmissible.

Coronavirus: a member of the large, single-stranded **RNA virus** family (*Coronaviridae*) named for their ring ("crown") shape. They are also characterized by a fatty membrane envelope that is covered with club-shaped spike **glycoproteins**. Coronaviruses are known to infect many mammals (including us humans) and birds. Different coronaviruses are responsible for causing **MERS**, **SARS**, and **COVID-19**.

Coronavirus disease 2019 (COVID-19): An **infectious** disease caused by **severe acute respiratory syndrome corona virus 2 (SARS-CoV-2)** that was first identified in December 2019 in Wuhan, China, and then spread globally, resulting in a **pandemic**. Common symptoms include fever, cough, fatigue, shortness of breath, loss of appetite, sputum production, and muscle and joint pains, and loss of smell and taste. Severe cases may progress to **acute respiratory distress syndrome (ARDS)**, multi-organ failure, septic shock, and blood clots. Spread of the **virus** occurs between people during close contact, most often via small droplets produced by coughing, sneezing, and talking. Less commonly, people may become infected by touching a contaminated surface and then touching their face.

Cyanobacteria: a phylum of photosynthetic Gram-negative bacteria.

Dead zones: areas of bodies of water that are depleted of oxygen, rendering them uninhabitable by aquatic life. Agricultural runoff rich in nitrogen and phosphorus (**limiting nutrients**) are prime culprits. These nutrients contribute to **eutrophication** large blooms of algae which then die and are consumed by bacteria along with oxygen in the water.

Deleterious mutation: a genetic change that decreases an individual's fitness and increases susceptibility to or causes disease or disorder. Most deleterious mutations are recessive, i.e. selection can only act on them when an individual carries two copies of the same mutation.

Deoxyribonucleic acid (DNA): the molecule of inheritance, which consists of **sequences** of the four **nucleotide** bases: Adenine, Thymine, Guanine, and Cytosine.

Diploid: Organisms with two sets of each **chromosome** except for XY sex chromosomes in male mammals.

DNA sequence: the specific order of the **nucleotide** bases along a strand of **DNA**.

Domestication: the process of artificial selection by humans for desired traits of plants, animals, fungi, and microorganisms. This implies the complete control of the reproduction of those species.

Earth Microbiome Program (EMP): a crowd-sourced effort to characterize microbial life on Earth founded by Jack Gilbert (UC San Diego), Janet Jansson (PNL), and Rob Knight (UC San Diego).

Endangered species: a **species** that is very likely to become extinct in the near future, either locally or worldwide.

Endocrine disrupting chemicals (EDCs): substances that interfere with the normal function of the **endocrine system**. These can be present in the environment (air, soil, or water supply), food sources, personal care products, and manufactured products.

Endocrine system: a hormonal system comprising internal glands, such as the hypothalamus, pituitary, thyroid, and adrenal, that produce, store, and release **hormones** into the circulatory system to regulate the body's healthy development and function.

Epidemic: the rapid spread of a disease to a significant percent of a given population.

Epithelial cells: the cell type that lines the surfaces of the body, including skin, mucus membranes (airways, gastrointestinal tract, reproductive tract), urinary tract, and organs to provide protection.

Eukaryotes: organisms whose cells have a nucleus enclosed within membranes.

Eutrophication: excess nutrient accumulation in bodies of water that cause phytoplankton.

Foraging: searching for wild food or provisions as opposed to cultivating food crops or breeding livestock.

Gametes: mature **haploid** sex cells that can unite to form a **diploid** zygote.

Gene: a **DNA sequence** which encodes a specific function.

Gene pool: the total of all **genes** and their variants (**alleles**) of a population of a **species**.

Genetic diversity: the total of heritable traits within a **species**.

Genetic load: the presence of deleterious gene variants (including recessive variants) in a population.

Genome: the totality of **DNA** in a cell. Also refers to the **DNA sequence** that typifies an individual or **species**.

Genomics: the study of **genome** structure/function.

Global Nitrogen Cycle: the biogeochemical cycle by which **nitrogen** is converted by fixation (gaseous nitrogen is converted into ammonia, which can be taken up by plants), ammonification (organic nitrogen from decaying animal and plant matter is converted into ammonium by bacteria and fungi), nitrification (ammonium is converted into nitrate by soil bacteria), and denitrification (nitrate is reduced into gaseous nitrogen). This cycle is central to the biogeochemistry of the Earth. Oceans also have an enormous nitrogen cycle!

Glycoprotein: A class of **proteins** with covalently attached glycans. Glycoproteins play a part in important cellular functions like embryonic development, cell-to-cell recognition, cell adhesion, and immune functions.

Greenhouse effect: the entrapment of heat close to Earth's surface by **greenhouse gas emissions**.

Greenhouse gas emissions: the release of polluting gasses resulting from human activity, such as burning fossil fuels that contribute to **greenhouse effect**.

Green Revolution: the development and dissemination of crop variants and technology between the 1950s and 1960s that increased agricultural production around the world. Also known as the *third agricultural revolution*.

Haploid: One set of unpaired **chromosomes**.

Holocene: the current geological epoch, from about 11.7 kya (after the end of the last Ice Age cycle) to the present that is marked by globally warmer and more stable climates.

Hominin: a classification of **species** comprising humans and our extinct relatives following the split with the common ancestor with chimpanzees.

Homo erectus: an extinct **hominin species** with fossil evidence from at least 1.9 million years to 70 thousand years ago and found from Africa to Indonesia. *H. erectus* may have been the first hominin to leave Africa. *H. erectus* DNA may be retrievable from other species due to **archaic admixture**.

Homo sapiens: the **hominin** species comprising all living humans. Meaning "wise man" in Latin, the name was introduced by Carl Linnaeus in 1758. The earliest fossil evidence of *Homo sapiens* appears in Africa around 300 kya (see **Jebel Irhoud hominins**).

Hormone: a signaling molecule in multicellular organisms that contributes to the regulation of physiology and behavior.

Host: a living organism on or in which a **parasite**, **pathogen**, commensal or **symbiont** lives (see **Parasitism**).

Hunting and gathering: a subsistence strategy in which most or all food is obtained by **foraging** and is in contrast to **agriculture**, which rely mainly on domesticated species.

Industrial revolution: the transition from agrarian and handcraft manufacture of goods to large scale industrial production starting 1760 in Great Britain and the United States.

Infectious (disease): the capability of producing **infection** or spreading disease to others. Synonymous with communicable and transmissible.

Influenza: often referred to as "flu," this is a highly contagious viral **respiratory** illness. Symptoms include fever, severe body aches, and catarrh. Because it is so contagious, influenza often produces **epidemics**. There are several influenza viruses that affect humans (A, B, C) - all enveloped **RNA** viruses.

Inter-birth intervals: the time span between live births.

Invasive species: a non-indigenous organism that can destabilize ecosystems when introduced.

Jebel Irhoud hominins: the oldest known "early" human fossils

discovered, dating to roughly 300 kya from an archaeological site in Morocco. The location of this discovery suggests a "pan-African" origin of humans, with a dispersed interbreeding population, likely aided by climactic factors.

Kessler Syndrome: a state in which the accumulation of space-debris in low Earth orbit causes a cascade of collisions with space vehicles and other orbital objects (satellites) results in more space debris, rendering parts of space unusable for human purposes. Proposed by Donald J. Kessler in 1978.

Legumes: plants in the *Fabaceae* family that include beans, peas, chickpeas, peanuts, lentils, alfalfa, and clover, to name a few. Many legumes have a symbiotic association with nitrogen-fixing bacteria. They also tend to have large, protein-rich seeds.

Limiting nutrient: a chemical compound that causes a plant to grow faster when it is added. **Biologically available nitrogen** is a limiting nutrient for plants in almost all terrestrial ecosystems that have been studied. Other soil nutrients that are limiting include calcium, phosphate, magnesium and potassium.

Locus (pl. loci): a unique physical position on a **chromosome**.

Mass extinction: the widespread and rapid loss of biodiversity. five mass extinctions have been documented and human activity is causing the sixth.

Microbial systems: the process of using systems biology to understand microbes and their environment.

Microbiome: the totality of all organisms (microbes) that live on and in the body.

Middle East respiratory syndrome (MERS): a **contagious** and sometimes fatal viral **respiratory** sickness that can produce severe symptoms such as fever, cough, shortness of breath and in some cases death. The MERS **virus** originated in bats and was first reported affecting other species, camels and humans, in Saudi Arabia in 2012. Since then, it has been identified in many other countries, including the United States.

Molecule: a group of two or more atoms covalently bonded together to form the smallest fundamental unit of a chemical compound that can take part in a chemical reaction.

Nitrogen (N): a common chemical element with the atomic number 7. Most nitrogen on earth exists as inert gas (N₂)!

Novel (disease): a new strain of a disease that has not been previously identified in a **species**.

Nucleating sites: atmospheric areas that generate particulate matter **PM2.5** from dissolved ammonia from **agricultural nitrogen pollution**.

Nucleic acid: one of the four classes of major biomolecules. The overall name for **DNA** and **RNA**, which are composed of **nucleotides**. DNA is double-stranded and more stable while RNA is single-stranded and less stable.

Nucleotide: molecular building blocks for **DNA** and **RNA**. Specifically, they consist of three components: a 5-carbon sugar, a phosphate group, and a nitrogenous base. The type of sugar, either deoxyribose or ribose, determines if the resulting **nucleic acid** is DNA or RNA.

Obesity: excessive body fat that increases the risk of health problems. Defined as a Body Mass Index (BMI) of 30.0 or higher. Obesity rates in the US have reached 42%, up 12% in the last 10 years.

Pandemic: an **epidemic** that has spread across regions, including multiple continents or worldwide.

Parasite: an organism that lives on or in a **host** organism at the expense of the host.

Parasitism: a close relationship between two organisms where one benefits at the expense of the other.

Pathogen: a **bacterium**, **virus**, or other microorganism that can cause disease.

PM2.5: a fine particulate matter (particles or droplets less than 3 microns in width) air pollutant that causes haze, reduces air quality, and can cause short- and long-term negative health effects.

Population bottleneck: the dramatic reduction in population size, which often results in a loss of **genetic diversity**.

Prokaryotes: unicellular organisms that lack a membrane-bound nucleus, mitochondria, or any other membrane-bound organelle. This definition is now debated as some "prokaryotes," such as archaea ("extremophiles"), are more closely related to **eukaryotes**.

Protein: one of the four classes of major biomolecules. Proteins are molecules encoded by **DNA sequences** and composed of **amino acids** connected by peptide bonds. These range in size from a few amino acids (short peptides) to large molecules (long polypeptides) comprised of thousands of amino acids.

Respiratory: associated with the act of respiration or breathing.

Ribonucleic acid (RNA): a **molecule** essential in **gene** coding, decoding, regulation, and expression. RNA consists of **sequences** of the four **nucleotide** bases: Adenine, Uracil, Guanine, and Cytosine. Types of RNA include messenger RNA (mRNA), transfer RNA (tRNA), ribosomal RNA (rRNA), small nuclear RNA (snRNA), and other non-coding RNAs. Some **viruses** including **Influenza A** and **SARS-CoV-2** have **RNA genomes**.

Seed Bank: a seed repository, such as the Svalbard Global Seed Vault (Svalbard, Norway), specifically for the preservation of genetic diversity.

Sequence: the linear order of the **nucleotide** building blocks, which encodes individual form and function.

Severe acute respiratory syndrome (SARS): a contagious and sometimes fatal respiratory illness caused by the **severe acute respiratory syndrome coronavirus (SARS-CoV or SARS-CoV-1)**. SARS was first reported in China in November 2002 and was rapidly spread worldwide by international travelers. Symptoms first appear flu-like with a fever, chills, muscle aches, headache and sometimes diarrhea. This can progress to a dry cough and shortness of breath. A massive global response helped to contain the spread of the disease and no new cases of the original SARS have been reported since 2004.

Severe acute respiratory syndrome coronavirus 1 (SARS-CoV or SARS-CoV-1): a strain of **coronavirus** that causes

severe acute respiratory syndrome (SARS). It is a single-stranded **RNA virus** that infects the **epithelial cells** within the lungs and can infect humans, bats, and palm civets.

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2): a **novel** strain of **coronavirus** closely related to **SARS-CoV** that causes **coronavirus disease 2019 (COVID-19)**, which resulted in a **pandemic**. It is a naturally evolving virus that crossed to humans from another animal, mostly likely a bat. SARS CoV-2 is completely different from the family that includes **influenza viruses** though both can cause **respiratory** symptoms.

Sixth Mass Extinction: the loss of **species** as a result of human activity. It is also referred to as the **Holocene** extinction or the **Anthropocene** extinction.

Species: a biological population whose individuals can mate with one another to produce viable and fertile offspring. This is a debated definition and the concept is problematic for extinct fossil organisms for which **DNA** is not available. This definition is problematic in regard to bacteria as they can exchange genetic material across widely separate taxa.

Steller's sea cow (*Hydrodamalis gigas*): an extinct aquatic and herbivorous mammal, related to living manatees, described by Georg Wilhelm Steller in 1714 while shipwrecked on Bering Island. The species was hunted into extinction shortly after European discovery.

Symbionts: an organism that lives in a **symbiosis** providing benefits to its host.

Symbiosis: a close and long-term biological interaction between two different biological organisms, be it mutualistic, commensalistic, or **parasitic**.

Terra gram (Tg): a unit of measure equivalent to 1,012 grams. 1.0 Tg is the same as 1.0 metric ton (Mt). When applied to nitrogen, it refers to the mass of the element N.

The Microbiota Vault: a global non-profit aimed at conserving the biodiversity of microbiota through interactions with local collections and research efforts around the world by providing backup storage and a framework for data services and collaboration.

Type 2 Diabetes (adult on-set): a chronic metabolic disorder that affects the way the body processes blood sugar (glucose). It is characterized by high blood sugar, insulin resistance, and relative lack of insulin and primarily occurs as a result of **obesity** and lack of exercise.

Virus: a submicroscopic **infectious** agent 10 million times smaller than a human that relies on a living **host** cell for metabolic processes and replication. Like living organisms, viruses possess **genes** and evolve by natural selection. Unlike living organisms, viruses lack cellular structure, do not have their own metabolism, instead relying on a living host cell for production of materials, and replication through self-assembly inside a host cell.

Vitus Bering: the Danish cartographer and explorer who led expeditions to the north-eastern reaches of the Asian continent and north-western reaches of the North American continent. Numerous geological and oceanic features are named after him (examples include the Bering Strait, Bering Sea, Bering Island, Bering Land Bridge, etc.).

This glossary is the product of the Anthropogeny Graduate Specialization students, Anthropogeny faculty, and CARTA staff.