

Glossary

WE ARE WHAT WE ATE: THE DIETS THAT FUELED HUMAN EVOLUTION

12C/13C Isotope Ratio: Due to their different photosynthetic pathways, C3 and C4 plants have different ratios of 12C and 13C **stable isotopes** in their tissues. This ratio difference allows researchers to derive diet information from the fossilized tissue of animals, including human ancestors. Isotope ratios indicative of C3 plants suggest browsing from foliage while C4 isotope ratios suggest grazing.

Please note: this information does not differentiate between a diet of eating C3 and C4 plants, eating the meat of an animal that consumed those plants, or a combination of the two.

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

Alpha-amylase 1 (AMY1) gene: A **gene** that encodes salivary **amylase**, an enzyme produced primarily in the salivary glands that begins the digestion of starch in the mouth by breaking it down into smaller **carbohydrates**. Humans vary considerably in the number of copies of the AMY1 gene they carry, and higher AMY1 copy number is generally associated with greater salivary amylase production. This variation has been investigated as a possible adaptation to differences in dietary starch consumption.

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.

Amylase: An **enzyme** that breaks down starch into glucose. It is the reason why starchy foods such as bread and potatoes have an appealing taste during chewing. Amylase is made by salivary glands (salivary amylase) and the pancreas (pancreatic amylase).

Anti-nutritional factors (ANFs): Plant-derived compounds (e.g., **phytates**, **oxalates**, **protease inhibitors**, **lectins**, and **tannins**) that bind nutrients or inhibit digestive enzymes, reducing nutrient absorption.

Apes: A branch of "old world" **primates** characterized by the lack of a tail due to a mutation of the TBXT gene. Apes consist of the families, *Hylobatidae* ("lesser apes": gibbons and siamangs) and *Hominidae* ("**great apes**": orangutans, gorillas, **chimpanzees**, **bonobos**, and humans).

Atherosclerosis: Build-up of cholesterol (plaque) and inflammation in the lining of blood vessels. Plaque can narrow or block arteries and may rupture, causing blood clots that restrict blood flow. Named after its gruel-like appearance (athero = gruel).

Atherosclerotic cardiovascular disease (ASCVD): A group of diseases caused by **atherosclerosis**. ASCVD includes coronary heart disease, heart attack, ischemic stroke, and peripheral artery disease.

Australopithecines: Literally meaning "southern apes," Australopithecines are early African **hominins** (ca. 4–2 million years ago) with endocranial volumes comparable to those of extant chimpanzees.

Australopithecus: A **genus** of extinct **hominins** dating ~4 mya to 2 mya, and found primarily in eastern and southern Africa. **Homo** may have evolved from a late australopithecine. Australopithecine brain size is ~35% of the size of the modern human brain. Most species were short in stature, although sexual dimorphism was pronounced. Some examples of australopithecines:

A. anamensis: Kenya and Ethiopia. ~4 mya.

A. afarensis: Eastern Africa. Most famous example is "Lucy." ~3.9 mya to 2.9 mya.

A. bahrelghazali: Central Africa. ~3.6 mya

A. africanus: Southern Africa. ~3.3 mya to 2.1 mya.

A. garhi: Ethiopia. Possible transitional stage between *Australopithecus* and **Homo**. ~2.5 mya.

A. boisei: East Africa. Robust australopithecine. There is debate as to which genus they belong, *Australopithecus* or *Paranthropus*. ~2.4 to 1.4 mya.

A. sediba: South Africa. Possible transitional stage between *Australopithecus* and *Homo*. ~2 mya.

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.

Bioavailability: The proportion of an ingested nutrient that is absorbed and made available for physiological use.

Bonobos (*Pan paniscus*): One of the two **species** comprising the **genus**, *Pan*, having branched from **chimpanzees** ~1 million years ago. Sometimes referred to as "pygmy chimpanzee." Bonobos, compared to chimpanzees, are more gracile, have female social dominance, relatively long legs, pink lips, a dark face, a "tail-tuft" through adulthood, and parted long head hair. The species is omnivorous and inhabits primary and secondary forests, including seasonally inundated swamp forests. The bonobo is found in a 500,000 km² (190,000 sq mi) area of the Congo Basin, only south of the Congo River, in the Democratic Republic of the Congo. Due to political instability, little field work in their natural habitat has been performed. Most behavioral knowledge is a result of studies of captive bonobos.

Cancer: A disease caused by an uncontrolled division of abnormal cells in a part of the body. Cancer is considered "normal development spun out of control" – Steve Frank, from CARTA's May 2025 symposium, Mismatch: Human Origins and Modern Disease.

Carbohydrate: A class of organic molecules composed primarily of carbon, hydrogen, and oxygen that includes sugars, **starches**, and dietary fiber. Carbohydrates serve as an important source of energy and, in plants, also function as structural and energy-storage compounds.

Carnivore: An organism that derives its energy and nutrient requirements from a diet consisting mainly or exclusively of animal tissue, whether through predation or scavenging.

Carnivore guild: A group of carnivorous species in an ecosystem that share similar ecological roles by hunting, scavenging, or consuming similar animal prey. Species within a carnivore guild may compete for food and may differ in their hunting strategies, body size, habitat use, and preferred prey.

Chimpanzee (*Pan troglodytes*): One of the two species comprising the **genus**, *Pan*, having branched from **bonobos** ~1 million years ago. Sometimes referred to as "common chimpanzees". Native to sub-Saharan Africa, chimpanzees are found in and around the Congo Basin (north of the Congo River) and throughout West Africa. Chimpanzees are divided into four subspecies, based on appearance and distribution. Compared to bonobos, chimpanzees are somewhat larger, more aggressive, and exhibit male social dominance.

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

Chromosome: A discrete strand of tightly packaged **chromatin**.

Cognition: The mental action or process of acquiring knowledge and understanding through thought, experience, and the senses.

Cooking hypothesis: The evolutionary hypothesis proposed by Wrangham and Carmody that habitual cooking played a major role in human evolution by making food easier to digest, increasing the amount of energy available from food, and reducing the time and effort required to process and consume it. The hypothesis proposes that these energetic and nutritional advantages may have contributed to changes in human anatomy, physiology, behavior, and life history, including the evolution of our relatively large brains.

Cranial capacity: The volume of the interior of the cranium. Cranial capacity is used as a rough indicator of brain size and is typically measured in cubic centimeters (cc or cm³).

Culture: Behavior and norms that are shared, learned, and socially transmitted.

Cumulative culture: The process by which social learning allows for the accumulation of modifications over generations, leading to tools, beliefs, or behaviors that are more complex than any single individual could invent alone. See **culture**.

Cytidine monophospho-N-acetylneuraminic acid hydroxylase (CMAH) gene: The human lineage lost the function of the CMAH gene over 2 million years ago that caused human cells to both lack **Neu5Gc** and carry an excess of **Neu5Ac**.

Denisovans: An extinct hominin population contemporary with **Neanderthals** that hybridized with ancient humans and Neanderthals. Knowledge of Denisovan morphology is limited

to two small fossils found in Siberia, a jaw in Tibet, a skull in China, a mandible in Taiwan, and an arm bone from southern China.

Dental Calculus: Calcified dental plaque, provides information on diet, disease, health, microbiome and protects the genetic information within the tooth from degradation.

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

Digestive system: The organs of the body that are involved in the breakdown and absorption of food, and elimination of wastes. This includes the mouth, pharynx (throat), esophagus, stomach, small intestine, large intestine, rectum, and accessory digestive organs such as the salivary glands, liver, gallbladder, and pancreas.

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**.

Enzyme: **Proteins** that catalyze chemical reactions inside and outside cells.

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

Evolution: The process by which populations change over time through random mutation and natural selection. Evolution occurs at the level of populations, not individuals, and involves genetic changes that are passed down through generations.

Expensive Tissue Hypothesis: The proposal (Aiello & Wheeler, 1995) that reductions in metabolically costly tissues, particularly the gastrointestinal tract, can contribute to the energetic budget required for brain expansion. Current work treats this as one of several compensating factors, alongside dietary shifts, fat storage, extended life history, and cooperative provisioning, rather than a strict one-for-one trade-off.

External fermentation: Microbial breakdown of organic matter occurring outside the body, prior to ingestion, in contrast to fermentation within the digestive tract.

External fermentation hypothesis: An evolutionary hypothesis proposing that humans gained an important energetic advantage by fermenting foods outside the body before consuming them. Fermentation can partially break down complex carbohydrates and other food components, potentially improving digestibility, nutrient availability, preservation, and palatability while reducing some of the metabolic costs of digestion. The hypothesis suggests that external fermentation may have complemented other forms of food processing, including cooking, and may have been particularly important in human evolution because humans lack the extensive internal fermentation chambers found in many other mammals. The hypothesis is particularly associated with David A. S. Lieberman

Food abundance: A situation in which food is plentiful and easily available in a particular area, region, or society.

Foregut fermentation: A digestive process in which plant materials are fermented in a specialized combination of stomach compartments together called the reticulorumen. In ruminants, the fermented cud of the reticulorumen is regurgitated and chewed again to further break down the plant material, a process called rumination. After rumination, the food and bacteria are finally digested in other stomach compartments, the omasum and abomasum (true stomach). Foregut fermentation also exists in some species that do not ruminate, such as leaf monkeys (colobines).

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

Gene: A DNA sequence which encodes a specific function.

Gene expression: The process by which the information contained within a **gene (nucleotide sequence)** is used to direct **RNA** and/or **protein** synthesis and dictate cell function. Nearly all of the cells in the body contain identical genes, but only a subset of this information is used or expressed at any time. The genes expressed in a cell determine what that cell can do.

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.

Genus: A taxonomic rank used in biological classification of living and fossil organisms to group closely related **species**. In binomial nomenclature, the genus name plus species name forms the binomial species name (e.g. *Homo sapiens*).

Glycans: One of the four classes of major biomolecules. Glycans consist of varying numbers of sugars (**monosaccharides**) attached to **proteins** or **lipids** or secreted as free glycans. Glycans are essential biomolecules whose functions can be divided into three broad categories: structural and modulatory properties (including nutrient storage and sequestration), specific recognition by other molecules, and molecular mimicry of host glycans.

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.

Gram-Negative and Gram-Positive Staining: A characterization of **bacteria** based on how they differentially react with a chemical stain (crystal violet) based on their cell wall constituents.

Great apes: A taxonomic family denoting the extant **chimpanzees**, **bonobos**, gorillas, and orangutans. This is biologically invalid grouping given that chimpanzees and bonobos are more closely related to humans than to gorillas or orangutans.

Gut microbiome: The ecosystem of **microbes** that live in the intestines.

Heme: An **iron**-containing molecular group found in **proteins** such as **hemoglobin** and **myoglobin**. Its iron atom can bind

oxygen, allowing heme-containing proteins to transport or store oxygen and participate in other biological processes. In nutrition, heme iron refers to the form of dietary iron found primarily in animal tissues and is generally absorbed more efficiently than non-heme iron.

Heme iron: A form of dietary iron bound within **heme** groups, found primarily in animal tissues, particularly meat, poultry, and seafood. It is generally absorbed more efficiently and is less affected by other dietary factors than non-heme iron.

Hemoglobin: A **protein** complex within **red blood cells (RBCs)** that binds to oxygen molecules in the lungs for delivery to tissues throughout the body. The same complex also binds carbon dioxide (CO₂) and carries it back to the lungs.

Hindgut fermentation: A digestive process in which cellulose and other polysaccharides are broken down by symbiotic bacteria residing the colon of some mammalian species.

Hominid: A classification comprising all living and extinct "Great Apes" and humans.

Hominin: A classification of **species** comprising humans and our extinct relatives following the divergence from the common ancestor with **chimpanzees**.

Homo: The **genus** that comprises the **species *Homo sapiens***, as well as several extinct species classified as ancestral to, or closely related to, humans.

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.

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

Human brain expansion: Since the evolutionary split between the human lineage and other great apes (6–7 million years ago), the human brain more than tripled in volume and increased in complexity. While early **hominins** such as *Australopithecus afarensis* (3.9 to 2.9 million years ago) had brain volumes of roughly 400–500 cubic centimeters, similar to modern **chimpanzees**, it was with the emergence of genus *Homo* around 2–2.5 million years ago that brain size began to increase more rapidly. *Homo habilis* (2.4 to 1.4 million years ago) had a cranial capacity of about 600–700 cc and *Homo erectus* (1.9 million years ago to 110 thousand years ago) reached 900–1100 cc. In modern humans, average brain volume is approximately 1,300–1,400 cc. This expansion involved disproportionate growth of the cerebral cortex, particularly regions associated with language, abstract reasoning, planning, and social cognition. Changes in brain organization, connectivity, and prolonged developmental periods (including extended childhood) were also crucial. Together, these evolutionary modifications supported increasingly complex tool use, symbolic thought, culture, and social structures.

Human predatory pattern: The characteristic ways in which humans locate, pursue, capture, and process animal prey for food. Unlike most other great apes, humans employ a highly flexible combination of cooperative hunting, tracking, persistence, projectile and other technologies, ecological knowledge, and food processing to exploit a wide range of

animal resources. These behaviors vary substantially across environments and cultures and have played an important role in human subsistence and evolution.

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.

Infection: The invasion of an organism's organs or tissues by **pathogens**, their multiplication, and the reaction of the **host** tissues to the pathogens.

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

Internal (gut) fermentation: **Microbial** metabolism of dietary substrates within the gastrointestinal tract, predominantly in the colon, yielding short-chain fatty acids and other absorbable products.

Iron: An essential trace mineral required for oxygen transport, energy production, **DNA** synthesis, and normal immune and neurological function. Most of the body's iron is found in hemoglobin, the protein in red blood cells that carries oxygen, and in **myoglobin**, which stores oxygen in muscle. Dietary iron occurs primarily as heme iron in animal foods and non-heme iron in plant foods and animal foods. The human body contains iron equivalent to a single 2-inch nail.

Lactobacillus: A **genus** of **Gram-positive**, rod-shaped **bacteria** that convert sugars to lactic acid. In humans, they are a significant component of the **microbiome** and can survive in the harsh pH conditions of the digestive and genital systems. *Lactobacillus* **species** are normally a major part of the **vaginal microbiota**. While receiving nutrients from their human host, **Lactobacilli** protect the host against certain **pathogens**, even helping to treat diarrhea, vaginal **infections**, and skin disorders such as eczema. Lactobacillus is also utilized for many traditional food fermentations and as a probiotic, perhaps most notable for its use in yogurt.

Lectin: A **protein** that can bind to a **glycan** without catalyzing a modification of the glycan.

Lipids: 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.

Macronutrient: A substance required in relatively large amounts by living organisms: Fats, **proteins**, **carbohydrates** in an animal diet or chemical elements such as potassium, magnesium, calcium as required by plants.

Malnourished: A condition resulting from inadequate, excessive, or imbalanced intake or absorption of energy and nutrients, leading to impaired physical or physiological function. Malnutrition can include undernutrition, deficiencies of specific nutrients, and, in some contexts, excess intake that contributes to overweight or diet-related disease.

Malnutrition: A condition resulting from deficiencies, excesses, or imbalances in a person's intake or absorption of energy and nutrients. It encompasses undernutrition, micronutrient deficiencies, and overweight or obesity associated with an unhealthy diet.

Mammals: A vertebrate animal belonging to the class *Mammalia*, characterized by hair or fur, three middle-ear bones, and mammary glands that produce milk to nourish offspring. Most mammals are warm-blooded, breathe air with lungs, and give birth to live young, although there are exceptions such as the egg-laying monotremes.

Marrow: The soft fatty substance in the cavities of bones that produces **red blood cells** and white blood cells and platelets.

Metabolism: The conversion of food into energy and the chemical building blocks for proteins, lipids, nucleic acids, and glycans as well as the elimination of metabolic wastes.

Microbe: A microorganism, especially a **bacterium** causing disease or fermentation.

Microbiome: The aggregate community of microorganisms that live on and in the body, such as those inhabiting skin surface, the gastrointestinal tract, and the vagina.

Micronutrients: A chemical element or substance required in trace amounts for the normal growth and development of living organisms that the organism cannot synthesize itself.

Molecules: 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.

Monosaccharide: A simple sugar; the most basic unit of a **carbohydrate** or **glycan**.

Mutation: Change in a **DNA** or **RNA** sequence.

Myoglobin: An oxygen-binding **protein** found primarily in muscle cells that stores and facilitates the delivery of oxygen for use in muscle metabolism. It contains an **iron**-containing **heme** group, which gives muscle tissue its characteristic reddish color.

N-acetylneuraminic acid (Neu5Ac): The most common **sialic acid** in most vertebrates and was first discovered in animal saliva and brains.

N-glycolylneuraminic acid (Neu5Gc): A common variant of **sialic acid** in many vertebrates that is not made by humans but can be incorporated from diets rich in red meat. Neu5Gc is derived from **Neu5Ac** by enzymatic addition of a single oxygen. In humans, the **CMAH gene** encoding the enzyme responsible for this conversion underwent a loss of function mutation over 2 million years ago.

Neanderthals: An extinct Eurasian **hominin species** that existed from 500-30 kya and interbred with ancient humans and **Denisovans**.

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.

Nucleotides: 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.

Omnivore: An organism that derives its energy and nutrient requirements from a diet of plant, animal, and fungal origin.

Oxalates: Naturally occurring compounds found in many plants that can bind minerals, particularly calcium, to form poorly absorbed compounds. High levels of dietary oxalate can reduce the absorption of calcium and, in susceptible individuals, contribute to the formation of calcium oxalate kidney stones. Cooking methods such as boiling can substantially reduce oxalate levels in some foods.

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.

Pathogenicity: The absolute ability of an **infectious** agent to cause disease or damage in a **host**.

Phytate (phytic acid): A storage form of phosphorus in seeds and grains that can bind dietary minerals such as iron, zinc, calcium, and magnesium, reducing their bioavailability.

Plant underground storage organs: Some plants put **starch** in swollen, underground structures to survive seasonal challenges. Botanists recognize four types of underground storage organs: bulbs, corms, tubers, and rhizomes. Common examples are potatoes, yams, carrots, and onions.

Primates: A group of mammals that include humans, apes, monkeys, and prosimians.

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**.

Protease inhibitor: A substance that blocks or reduces the activity of proteases, enzymes that break down proteins into smaller peptides and **amino acids**. Protease inhibitors occur naturally in many plants, particularly legumes and grains, where they may help protect the plant against herbivores and pathogens. When consumed, some protease inhibitors can interfere with protein digestion and nutrient absorption; cooking can substantially reduce their activity.

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.

Proteome: The complete set of **proteins** produced by a cell, tissue, organism, or biological system at a given time and under specific conditions. Unlike the **genome**, which is relatively stable, the proteome can change in response to

development, environment, diet, disease, and other factors.

Red blood cells (RBCs): The most common type of blood cell and the vertebrate's principal means of oxygen delivery from lungs or gills to all tissues of the body. RBCs of most mammals do not contain a nucleus with chromosomes.

Regulatory elements: Binding sites on **chromosomes** for **transcription factors**, which are involved in **gene** regulation.

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**.

Saliva: A complex exocrine fluid mainly produced by the parotid, submandibular, and sublingual salivary glands, as well as to a lesser degree by the multiple minor salivary glands lining the oral cavity. Whole mouth saliva also contains plasma exudates, cellular debris, and food remnants. The components of saliva play important roles in the dietary preprocessing of food, the lubrication of the mouth, the protection and remineralization of teeth, and in host defense.

Salivary proteins: **Proteins** and **glycoproteins** secreted primarily by the salivary glands that perform a range of functions in the mouth, including lubricating and protecting oral tissues, initiating digestion, binding and transporting molecules, maintaining tooth mineral balance, and contributing to antimicrobial defense. Some salivary proteins also interact with dietary compounds and influence taste and the perception and processing of food.

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

Short-chain fatty acids (SCFAs): Carboxylic acids (principally acetate, propionate, and butyrate) produced by microbial fermentation of dietary fiber in the colon; serve as energy substrates for colonocytes and contribute to systemic metabolism.

Sialic acids: A family of acidic sugars with a nine-carbon backbone. They are found at the outermost fringes of the sugar chains (**glycans**) that cover all vertebrate cells. The two most common sialic acids in mammals are **N-acetylneuraminic acid (Neu5Ac)** and **N-glycolylneuraminic acid (Neu5Gc)**.

Species: A 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.

Stable isotopes: Versions of a chemical elements that differ slightly in mass due to different numbers of neutrons in atoms. They differ from radioactive isotopes in that they don't decay into other elements or give off radiation; they simply stay as they are indefinitely. These isotopes are found in biological material, including fossils, and can be used to study paleo-diet and ecology.

Starch: A plant storage molecule in the form of a polysaccharide. Starch is obtained chiefly from cereals, tubers, and potatoes. It is an important constituent of the human diet due to its digestibility, unlike many other polysaccharides, such as plant cellulose, pectins, and xylans (polyxylose).

Symbiont: An organism that lives in a **symbiosis** providing benefits to its **host**.

Tannins: A diverse group of naturally occurring plant polyphenols that can bind to proteins and certain minerals, potentially reducing their digestion or absorption. They are found in foods such as tea, coffee, legumes, nuts, fruits, and whole grains and contribute to the astringent or drying sensation of some foods. In nutrition, tannins are sometimes considered antinutritional compounds, although their effects depend on the type and amount consumed and they may also have beneficial antioxidant and other biological effects.

Trace element: An essential mineral required by the body in very small amounts, generally less than about 100 mg per day. Trace elements support essential biological processes including enzyme activity, metabolism, hormone production, immune function, and antioxidant defense. Examples include iron, zinc, copper, iodine, selenium, manganese, and molybdenum.

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.

Vaginal microbiome: The totality of all organisms (microbes) that colonize the vagina.

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.

White blood cells (WBCs): A type of immune cell involved in protecting the body against **infectious disease** and foreign invaders. WBCs are also called leukocytes.

This glossary is the product of the symposium speakers, anthropogeny faculty, and CARTA staff.