

TERMS IN PLANT BIOLOGY/PHYSIOLOGY

algae: Single-celled organisms, once considered plants (though it's now known they aren't). As aquatic organisms, they grow in water. Like green plants, they depend on sunlight to make their food.

atom: The basic unit of a chemical element. Atoms are made up of a dense nucleus that contains positively charged protons and uncharged neutrons. The nucleus is orbited by a cloud of negatively charged electrons.

ATP: Short for adenosine triphosphate. Cells make this molecule to power almost all of their activities. Cells use oxygen and simple sugars to create this molecule, the main source of their energy. The small structures in cells that carry out this energy-storing process are known as mitochondria. Like a battery, ATP stores a bit of usable energy. Once the cell uses it up, mitochondria must recharge the cell by making more ATP using energy harvested from the cell's nutrients.

bond: (in chemistry) A semi-permanent attachment between atoms – or groups of atoms – in a molecule. It's formed by an attractive force between the participating atoms. Once bonded, the atoms will work as a unit. To separate the component atoms, energy must be supplied to the molecule as heat or some other type of radiation.

Calvin Cycle: Named for Melvin Calvin, the man who discovered it, this cycle is the process by which plants and algae turn carbon dioxide into basic carbohydrates.

carbohydrates: Any of a large group of compounds occurring in foods and living tissues, including sugars, starch and cellulose. They contain hydrogen and oxygen in the same ratio as water (2:1) and typically can be broken down in an animal's body to release energy.

carbon dioxide: (or CO₂) A colourless, odourless gas produced by all animals when the oxygen they inhale reacts with the carbon-rich foods that they've eaten. Carbon dioxide also is released when organic matter burns (including fossil fuels like oil or gas). Carbon dioxide acts as a greenhouse gas, trapping heat in Earth's atmosphere. Plants convert carbon dioxide into oxygen during photosynthesis, the process they use to make their own food.

cell: The smallest structural and functional unit of an organism. Typically too small to see with the unaided eye, it consists of a watery fluid surrounded by a membrane or wall. Depending on their size, animals are made of anywhere from thousands to trillions of cells. Most organisms, such as yeasts, molds, bacteria and some algae, are composed of only one cell.

cellulose: A type of fibre found in plant cell walls. It is formed by chains of glucose molecules.

chemical: A substance formed from two or more atoms that unite (bond) in a fixed proportion and structure. For example, water is a chemical made when two hydrogen atoms bond to one oxygen atom. Its chemical formula is H₂O. The word 'chemical' also can be an adjective to describe properties of materials that are the result of various reactions between different compounds.

chemical reaction: A process that involves the rearrangement of the molecules or structure of a substance, as opposed to a change in physical form (as from a solid to a gas).

chlorophyll: Any of several green pigments found in plants that perform photosynthesis – creating sugars (foods) from carbon dioxide and water.

chloroplast: A tiny structure in the cells of green algae and green plants that contain chlorophyll and creates glucose through photosynthesis.

electromagnetic: An adjective referring to light radiation, to magnetism or to both.

excite: (in chemistry and physics) To transfer energy to one or more outer electrons in an atom. They remain in this higher energy state until they shed the extra energy through the emission of some type of radiation, such as light.

fructose: A simple sugar. Along with glucose, fructose makes up half of each molecule of sucrose (also known as table sugar).

glucose: A simple sugar that is an important energy source in living organisms. As an energy source moving through the bloodstream, it is known as 'blood sugar'. It is half of the molecule that makes up table sugar (also known as sucrose).

glyceraldehyde 3-phosphate or G3P: A molecule created as part of the chemical steps that form simple carbohydrates. Two molecules of G3P are made in plants and algae as part of the Calvin Cycle of photosynthesis. Animals and bacteria also create G3P as part of their own steps in making carbohydrate.

hydrogen: The lightest element in the universe. As a gas, it is colourless, odourless and highly flammable. It's an integral part of many fuels, fats and chemicals that make up living tissues. It's made of a single proton (which serves as its nucleus) orbited by a single electron.

ion: an atom, carrying either a positive or negative charge (where the charge is a (positive) electron (in which case the charged atom is referred to as a cation) or a (negative) proton (in which case the charged atom is referred to as an anion).

mass: A number that shows how much an object resists speeding up and slowing down – basically a measure of how much matter that object is made from.

membrane: A barrier which blocks the passage (or flow through) of some materials depending on their size or other features. Membranes are an integral part of filtration systems. Many serve that same function as the outer covering of cells or organs of a body.

molecule: An electrically neutral group of atoms that represents the smallest possible amount of a chemical compound. Molecules can be made of single types of atoms or of different types. For example, the oxygen in the air is made of two oxygen atoms (O_2), but water is made of two hydrogen atoms and one oxygen atom (H_2O).

NADPH or NADP⁺: Short for nicotinamide adenine dinucleotide phosphate (but no one calls it that). This molecule is a way for cells to store and transfer energy. When the NADP⁺ molecule is transformed to NADPH, it contains energy, which it can then use to power other reactions in a cell.

organelle: Specialised structures, such as mitochondria, found within a cell.

oxygen: A gas that makes up 20.9% of Earth's atmosphere. All animals and many microorganisms need oxygen to fuel their growth (and metabolism).

particle: A minute amount of something.

photon: A particle representing the smallest possible amount of light or other type of electromagnetic radiation.

photosynthesis: (verb: photosynthesise) The process by which green plants and some other organisms use sunlight to produce foods from carbon dioxide and water.

protein: A compound made from one or more long chains of amino acids. Proteins are an essential part of all living organisms. They form the basis of living cells, muscle and tissues; they also do the work inside of cells. Among the better-known, stand-alone proteins are the hemoglobin (in blood) and the antibodies (also in blood) that attempt to fight infections. Medicines frequently work by latching onto proteins.

reduction: (v. reduce) A chemical reaction that adds one or more electrons. It's also viewed as the opposite of oxidation. As rust oxidises iron, the process reduces those nearby oxygen atoms. That means that they gain electrons, which have a negative charge.

ribulose 1,5-bisphosphate: (RuBP) A carbon receptor molecule that completes the first and last steps of the Calvin Cycle, which creates sugar out of carbon dioxide. This molecule contains five carbons and binds to the enzyme rubisco. Rubisco

hooks up RuBP with carbon dioxide from the air, the first step in making a carbohydrate.

rubisco: This acronym stands for ribulose biphosphate carboxylase/oxygenase. It is the most common protein on Earth. In its role as an enzyme, it plays a pivotal role in photosynthesis.

starch: A soft white chemical made by all green plants. It's a relatively long molecule made from linking together a lot of smaller, identical building blocks – all of them glucose, a simple sugar. Plants and animals use glucose as an energy source. Plants store glucose, in the form of starch, as a reserve supply of energy. Animals that consume starch can break down the starch into glucose molecules to extract the useful energy.

stroma: (in botany) The colourless fluid inside a chloroplast, where the Calvin Cycle portion of photosynthesis takes place.

synthesis: (verb: synthesise) The production of a substance by the combining of simpler chemical building blocks.

thylakoid membranes: An internal system of connected membranes inside a chloroplast. The membranes contain not only the green pigment chlorophyll, but also proteins. These membranes are where the light reaction portion of photosynthesis takes place, producing oxygen and energy to power the sugar-making portions of photosynthesis.

wavelength: The distance between one peak and the next in a series of waves, or the distance between one trough and the next. It's also one of the 'yardsticks' used to measure radiation. Visible light – which, like all electromagnetic radiation, travels in waves – includes wavelengths between about 380 nanometers (violet) and about 740 nanometers (red). Radiation with wavelengths shorter than visible light includes gamma rays, X-rays and ultraviolet light. Longer-wavelength radiation includes infrared light, microwaves and radio waves.

Adapted from text by Dr Bethany Brookshire, at:
<https://www.snexplores.org/article/explainer-how-photosynthesis-works>