Plants and photosynthesis

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Biological process to convert light into chemical energy Composite image showing the global distribution of photosynthesis, including both oceanic phytoplankton and land vegetation. Dark red and blue-green indicate regions of high photosynthetic activity in the ocean and on the earth, respectively. The overall equation for the type of photosynthesis that occurs in plants photosynthesis is a process used by plants and other organisms to convert light energy to chemical energy that, through cellular breathing, can then be released to feed the activities of the organism. This chemical energy is stored in carbohydrate molecules, such as sugars and starches, which are synthesized by carbon dioxide and water – hence the name photosynthesis, by the Greek phōs (φως,) light, and the soletesis (σύνθεσις,) "put together". [1][2][3] In most cases, oxygen is also released as a waste product. Most plants, algae and cyanobacteria perform photosynthesis; Such organisms are called photo-trophies. Photosynthesis is largely responsible for the production and maintenance of the oxygen content of the Earth's atmosphere and provides most of the energy needed for life on Earth. [4] Although photosynthesis is performed differently from different species, the process always begins when energy from light is absorbed by proteins called reaction centers containing green chlorophyll (and other colored pigments) / chromophores. In plants, these proteins are kept within organelles called chloroplasts, which are more abundant in foliar cells, while in bacteria they are incorporated into the plasma membrane. In these light-dependent reactions, some energy is used to strip electrons from suitable substances, such as water, producing oxygen gas. Hydrogen released from the water division is used in the creation of two additional compounds that serve as short-term energy deposits, allowing its transfer to drive other reactions: These compounds are reduced nicotinamide adenine dinucleotide phosphate (NADPH) and triphosphate adenine (ATP,) the "energy balance" of cells. In plants, algae and cyanobacteria, long-term storage of energy in the form of sugar is produced by a subsequent sequence of reactions independent of light called Calvino cycle. In the Calvino cycle, atmospheric carbon dioxide is incorporated into existing organic compounds, such as ribulous biphosphate (RuBP). [5] Using ATP and NADPH produced by light load reactions, the resulting compounds are then reduced and removed to form additional carbohydrates, such as glucose. In other bacteria, different mechanisms such as the reverse Krebs cycle are used to achieve the same end. The first photosynthetic organisms probably evolvedin the evolutionary history of life and most likely used reducing agents such as hydrogen or hydrogen sulfide, rather than water, as sources of electrons. [6] Cyanobacteria appeared later; the excess oxygen they produced contributed directly to oxygenation the Earth,[7] which made the evolution of complex life possible. Today, the average rate of capture of energy from photosynthesis is about 130 terawatts,[8][9][10] which is about eight times the current energy consumption of human civilization.[11] The photosynthetic organisms also convert about 100 115 billion tons (91 104 petagrams) of carbon per year into biomass.[12][13] The phenomenon for which plants receive energy from light “besides air, soil and water” was first discovered in 1779 by Jan Ingenhousz. Photosynthesis is fundamental for climate processes, since it captures carbon dioxide from the air and then binds carbon in plants and soils and products collected. It is estimated that the only cereals leghino 3825 Tg (ther grams) of carbon dioxide every year, that is 3,825 billion tons[14]. Scheme of photosynthesis in plants. The carbs produced are stored or used by the plant. Overview Photosynthesis transforms sunlight into chemical energy, divides water to release O_2 and fixes CO_2 in sugar. Photosintetic organisms are photo-autotrophic, that is, they can synthesize food directly from carbon dioxide and water using light energy. However, not all organisms use carbon dioxide as a source of carbon atoms to make photosynthesis; photoheterotrophies use organic compounds, rather than carbon dioxide, as a carbon source.[4] In plants, algae and cyanobacteria, photosynthesis releases oxygen. It is called oxygenic photosynthesis and is by far the most common type of photosynthesis used by living organisms. Although there are some differences between oxygenic photosynthesis in plants, algae and cyanobacteria, the general process is quite similar in these organisms. There are also many varieties of anoxygenic photosynthesis, mainly used by certain types of bacteria, which consume carbon dioxide but do not release oxygen. Carbon dioxide is converted into sugars in a process called carbon fixing; photosynthesis captures energy from sunlight to convert carbon dioxide into carbohydrates. Carbon fixing is an endothermic redox reaction. In general, photosynthesis is the opposite of cellular breathing: While photosynthesis is a process of reducing carbon dioxide in carbohydrates, cellular breathing is oxidation of carbohydrates or other nutrients in carbon dioxide. The nutrients used in cellular breathing include carbohydrates, amino acids and fatty acids. These nutrients are oxidized to produce carbon dioxide and water, and to release chemical energy to drive the body's metabolism. Photosynthesis and cellular breathing are distinct processes, as they occur through different sequences of chemical reactions and in different cell compartments.general for photosynthesis as initially proposed by Cornelis van Niel is therefore:[15] CO_2carbon dioxide + 2H2Electron donor + photonic energy Â" [CH2O]carbohydrate + 2electron donor oxidized + H_2OWater H_2OWater water is used as an electron donor in the oxygenated photosynthesis, the equation for this process is: CO_2 carbon dioxide + 2H2OWW + photonic light energy [CH2O]carbohydrate + O_2 O_2 O_2 O2OW Water This equation emphasizes that water is both a reagent in the reaction dependent on light and an independent light-reaction product, but cancelling water molecules on each side you get the net equation: CO_2 carbon dioxide + water H_2O + photonic energy [CH2O]carbohydrate + O_2 oxygen Other processes replace other compounds (such as arthenes) for water in the role of electron supply; for example some microbes use sunlight to oxidize Equation for this reaction is: carbon dioxide + (AsO3â ¢3) arsenite + energy of photonic light « (AsO3â ¢4) arsenate + carbon monoxide (used to build other compounds in later reactions) [17] Photosintesis takes place in two stages. In the first phase, light-dependent reactions or reactions capture light energy and use it to produce ATP and NADPH energy storage molecules. During the second phase, light-independent reactions use these products to capture and reduce carbon dioxide. Most organisms using oxygenated photosynthesis use visible light for light-dependent reactions, although at least three use infrared radiation or, more specifically, red radiation.[18] Some organisms use even more radical variants of photosynthesis. Some archaea use a simpler method that uses a pigment similar to those used for viewing in animals. The bacteriorhodopsin changes its configuration in response to sunlight, acting as a protonic pump. This produces a protonic gradient more directly, which is then converted into chemical energy. The process does not involve the fixing of carbon dioxide and does not release oxygen, and seems to have evolved separately from the most common types of photosynthesis.[19][20] Cloroplast and Tilacoide Ultrastructure Cloroplast:externalmembrane membrane inner membrane (1+2+3: casing) stroma (aqueous liquid) tilacoide lumen (inside the tilacoide) tilacoide membranegranum (tilacoids steak) tilacoide (lamella) starchy DNAplastoglobul (pox lipid gulet) In photosynthetic bacteria, the proteins that collect light for photosynthesis are incorporated into the cell membrane. In its simplest form, this involves the membrane surrounding the cell itself.[21] However, the membrane can be rigidly folded into cylindrical sheets called tilacoids,[22] or grouped into round vesicles called intracytoplasmic membranes. [23] These structures can fill most of the inside of a cell, giving the membrane a very wide surface and thus increasing the[22] In plants and algae, photosynthesis occurs in organelles called chloroplasts. A typical plant cell contains 10 to 100 chloroplasts. The chloroplast is enclosed by a membrane. This membrane is is is of an internal phospholipid membrane, an external phospholipid membrane and an intermembrane space. Closed by the membrane is a watery liquid called stroma. Embedded inside the stroma are tilakoidi batteries (grain), which are the site of photosynthesis. Tilakoids appear as flattened discs. The tilakoide itself is enclosed by the tilakoide membrane, and within the closed volume is a lumen or tilakoide space. Embedded in the tilakoide membrane are integral and peripheral protein complexes of the photosynthetic system. Plants absorb light mainly using pigment chlorophyll. The green part of the light spectrum is not absorbed, but it is reflected that is why most plants have a green color. In addition to chlorophyll, plants also use pigments such as carotene and xanthophylls. [24] Algae also use chlorophyll, but there are various other pigments, such as phycocyanoin, carotene and xanthophylls in green algae, phycoerithrin in red algae (rodofitis) and fucoxanthin in brown algae and diatomas that result in a wide range of colors. These pigments are incorporated into plants and algae in complexes called antenna proteins. In such proteins, pigments are willing to work together. Such a combination of protein is also called a light collection complex. [25] Although all cells in the green parts of a plant have chloroplasts, most of them are in specially adapted structures called leaves. Some species adapted to conditions of strong sunlight and aridity, such as many species of Euphorbia and cactus, have their main photosynthetic organs in their stems. The cells in the internal tissues of a leaf, called mesofilla, can contain between 450.000 and 800.000 chloroplasts for each square millimeter of leaf. The surface of the leaf is covered with a water resistant wax cuticle that protects the leaf from excessive evaporation of water and reduces the absorption of ultraviolet or blue light to reduce heating. The layer of transparent epidermis allows light to pass through the cells of palisade mesofillo where most photosynthesis occurs. Light-dependent reactions Main article: Dependent light reactions Light-dependent photosynthesis reactions to the tilakoide membrane In light-dependent reactions, a molecule of chlorophyll pigment absorbs a photon and loses an electron. This electron is passed to a modified form of chlorophyll called pheophytin, which passes the electron to a quinone molecule, beginning the flow of electrons down a chain of electron transport that leads to the final reduction of NADP to NADPH. Moreover, this creates a proton gradient (energy gradient) through the chloroplast membrane, which is used by the ATP syntax in the synthesis of ATP. The chlorophyll molecule regains the electron thatlost when a water molecule is divided into a process called photolysis, which releases an oxygen molecule (O_2) as a waste product. General equation for light dependentUnder non-cyclic electron flux conditions in green plants is:[26] 2 H_2O + 2 $NADP^+$ + 3 ADP + 3 Pi + light 2 NADPH + 2 H^+ + 3 ATP + O_2 Not all wavelengths of light can support photosynthesis. The spectrum of photosynthetic action depends on the type of accessory pigments present. For example, in green plants, the action spectrum is similar to that of chlorophylls and carotenoids with absorption peaks in blue-violet and red light. In red algae, the action spectrum is blue-green light, which allows these algae to use the blue end of the spectrum to grow in deeper waters that filter the longest wavelengths (red light) used by green plants above ground. The unabsorbed part of the light spectrum is the one that gives colour to photosynthetic organisms (e.g. green plants, red algae, purple bacteria) and is the least effective for photosynthesis in the respective organisms. Scheme Z The “scheme Z” In plants, light-dependent reactions occur in the thylacoid membranes of chloroplasts where they drive the synthesis of ATP and NADPH. Light-dependent reactions are of two forms: cyclical and non-cyclical. In the non-cyclic reaction, photons are captured in the light-collecting antenna complexes of the photosystem II by chlorophyll and other ancillary pigments (see diagram on the right). Absorption of a photon by the antenna complex releases an electron through a process called photo-induced charge separation. The antenna system is located at the center of the chlorophyll molecule of the reaction center of photosystem II. The released electron is transferred to the primary molecule of the electron receptor, pheophythin. Since electrons are transported through an electron transport chain (the so-called Z-pattern shown in the diagram), it initially works to generate a chemiosmotic potential by pumping proton cations (H^+) across the membrane and into the thylachoid space. An ATP synthase enzyme uses that chemiosmotic potential to produce ATP during photophosphorylation, while NADPH is a product of the terminal redox reaction in the Z pattern. The electron enters a chlorophyll molecule in Photosystem I. There it is further excited by the light absorbed by that photosystem. The electron is then passed along a chain of electron receptors to which it transfers some of its energy. The energy supplied to the receptor electrons is used to move hydrogen ions through the thylachoid membrane into the lumen. The electron is then used to reduce the coenzyme NADP with an H^+ to NADPH (which has functions in the light-independent reaction), at which point the path of that electron ends. The cyclic reaction is similar to that of the non-cyclic but differs in that it generates only ATP and no reduced NADP (NADPH) is created. The cyclic reaction occurs only in photosystem I. that the electron is moved from the photosystem, the electron is passed through the receptor molecules and returns to photosystem I, from where it was issued, hence the cyclic reaction name. cyclical.Photolysis Main articles: Photodissociation and Oxygen evolution Linear electron transport through a photosystem will leave the reaction center of that oxidized photosystem. Lifting another electron will first require re-reduction of the reaction center. The excited electrons lost from the photosystem's reaction center (P700) are replaced by plastocyanin transfer, whose electrons come from electron transport through photosystem II. Photosystem II, as the first step of the Z-scheme, requires an external source of electrons to reduce its oxidized chlorophyll a reaction center, called P680. The source of electrons for photosynthesis in green plants and cyanobacteria is water. Two water molecules are oxidized by four successive charge separation reactions from photosystem II to produce a diatomic oxygen molecule and four hydrogen ions. The collected electrons are transferred to a rettox-active tyrosine residue which then reduces the oxidized P680. This resets the capacity of P680 to absorb another photon and release another electron dissociated from the photo. Water oxidation is catalyzed in photosystem II by a rectified-active structure containing four manganese ions and a calcium ion; This complex involving oxygen binds two molecules of water and contains the four oxidizing equivalents that are used to drive the oxidizing reaction of water (S-state of Dolai). Photosystem II is the only known biological enzyme that performs this oxidation of water. Hydrogen ions are released in the tilakoide lumen and thus contribute to transmembrane chemosmotic potential leading to ATP synthesis. Oxygen is a product of light-type reactions discard, but most organisms on Earth use oxygen for cellular breathing, including photosynthetic organisms. Calvino Cycle Main articles: Light and independent reactions and carbon fixing In "dark" (or "dark") reactions, the RuBisCO enzyme captures CO_2 from the atmosphere and, in a process called Calvino cycle, uses the new NADPH format and releases the three-carbon sugars, which are then combined to form sucrose and starch. The overall equation for light-dependent reactions in green plants is[26]: 128 3 CO_2 + 9 ATP + 6 NADPH + 6 H^+ → $C_3H_6O_3$-phosphate + 9 ADP + 8 Pi + 6 $NADP^+$ + 3 H_2O Carbon and Calvino cycle fixing produces the intermediate product of three-carbohydrate sugar, which is then converted into the final products of carbohydrate. The simple carbon sugars produced by photosynthesis are then used in the formation of other organic compounds, such as cellulose of building material, precursors of lipid and amino acid biosynthesis, or as fuel in cellular breathing. The latter occurs not only in plants but also in animals whenFrom the plants it is passed through a food chain. Fixation or reduction of carbon dioxide is a process in which carbon dioxide combines with a five-carbon sugar, five-carbon, 1.5-bisphosphate, to produce two molecules of a three-carbon compound, 3-phosphate glycerated, also known as 3-phosphoglycerated. The 3 phosphate glycetries, in the presence of ATP and Nadph produced during the light slope phases, is reduced to 3phosphate glycerin. This product is also indicated as 3FoSfogliceraldehyde (PGAL) or, more generically, as a trio phosphate. Most (5 out of 6 molecules) of the product Gliceraldehyde produced is used to regenerate ribulous 1.5-bisphosphate so that the process can continue. The triosis phosphates not so "recycled" often contain to form phosphates exagi, which eventually produce sucrose, starch and cellulose. The sugars produced during carbon metabolism produce carbon skeletons that can be used for other metabolic reactions such as the production of amino acids and lipids. Carbon concentration mechanisms Main items: C4 Carbon Fixation, Cam photosynthesis and alarm photosynthesis Carbon fixation panoramic in warm and dry conditions, plants close their stomens to prevent water loss. In these conditions, CO_2 decrease and oxygen gas, produced by the light reactions of photosynthesis, will increase, causing an increase in photorespiration from the activity of oxygenase of ribulous-1.5-bisphosphate carboxylase / oxygenase and decrease in carbon fixation. Some plants have evolved mechanisms to increase the concentration of CO_2 in the leaves under these conditions. [29] The plants that use the process of fixing the C4 carbon chemically fix the carbon dioxide in the mesophilla cells by adding it to the phosphoenolpyruvate (PEP) three-carbon molecule, a reaction catalyzed by an enzyme called PEP carboxylase, creating acid Oxaloacetic four-carbon organic acid. Oxaloacetic acid or the patient synthesized by this process is then moved to specialized beam sheath cells in which the enzyme rubiso and other Calvine cycle enzymes are located, and where the CO_2 released from the decarboxylation of four-carbon acids comes Then set by the activity of stealing to tri-carbonifoglymeric acids. The physical separation of stealing from light reactions that generate oxygen reduces photorespiration and increases the fixation of CO_2 and, therefore, the photosynthetic ability of the leaf. [30] Plants C4 can produce more plant sugars C3 in conditions of high light and temperature. Many important culture plants are C4 plants, including corn, sorghum, sugar cane and mile. Plants that do not use pep-carboxylase in carbon setting are called Plants C3 because the primary carboxylation reaction, catalyzed by stealing, produces three-carbon 3fosphoglyceliceric acids directly in the Calvin-Benson cycle. Over 90% of the plants use carbon fixation C3, compared to 3% using the fixation of C4;[31] however, the evolution of C4 in over 60 plant lines makes it a striking example of convergent evolution. [29] Xerophytes, like cacti and most succulents, also use PEP carboxylase to capture carbon dioxide in a process called Crassulacean acid Crassulacean acid (CAMERA). In contrast to C4 metabolism, which spatially separates CO_2 fixation at PEP from the Calvin cycle, CAM separates these two processes temporally. Cam plants have a different leaf anatomy than C3 plants and fix CO_2 at night when their stomata are open. Cam plants store CO_2 mostly in the form of malic acid through the carboxylation of phosphoenolpyruvate to oxaloacetate, which is then reduced to the Malate. Decarboxylation of the Sick during the day releases the CO_2 inside the leaves, thus allowing the fixation of carbon to 3 phosphoglyceric from Rubisco. Sixteen thousand species of plants use cams. [32] Calcium oxalate storage plants, such as Amaranthus Hybridus and Colobanthus Quitensis, have shown a variation of photosynthesis in which calcium oxalate crystals function as pools of dynamic carbon, providing carbon dioxide (CO_2) to photosynthetic cells when the stomata are partially or totally Used. This process was called photosynthesis alarm. Under stress conditions (e.g. water deficiency) oxalate released from calcium oxalate crystals is converted to CO_2 by an oxidase enzyme oxalate and the CO_2 produced can support the reactions of the calvin cycle. Reactive hydrogen peroxide (H_2O_2), the oxalated oxidase by-product, can be neutralised by catalase. The photosynthesis alarm represents an unknown photosynthetic variation to be added to the already known C4 and CAM paths. However, alarm photosynthesis, in contrast to these pathways, works like a biochemical pump that collects carbon from inside the organ (or from the soil) and not from the atmosphere. [33] [34]. In water cyanobacteria have carboxyomas, which increase the concentration of CO_2 around Rubisco to increase the rate of photosynthesis. An enzyme, carbonic anhydrase, located inside the carboxium releases CO_2 from the dissolved hydrocarbonate ions (HCOÃ¯'3). Before the CO_2 diffuses it is rapidly sponge by Rubiscus, concentrated inside the carboxysomes. HCOÃ¯¯3 ions are made with CO_2 outside the cell by another carbonic anhydrase and are actively pumped into the cell by a membrane protein. They cannot cross the membrane as they are accused, and within the cytosol they return to CO_2 very slowly without the help of carbonic anhydrase. This causes the HCO3 ions to accumulate inside the cell from where they spread into the carboxysomes. [35] Pyrenoids in algae and hornworts also act to concentrate CO_2 around Rubisco. [36] Order and kinetics The overall process of photosynthesis takes place in four steps: [13] Stage description Time scale 1 Energy transfer in chlorophyll antenna (thylakoid membranes) femtosecond to picosecond 2 Electron transfer in photochemical reactions (thylakoid membranes) Picosecond nanosecond 3 ATP transport and synthesis chain (Membrane Thylakoid) MicrosCond a millisecond 4 Carbon Fisscation and export of stable products Millisecond according to efficiency Main article: Photosinthetic Efficiency Systems usually convert light into chemical energy3.6% photosynthetic efficiency. [37] [38] The unsuccessed absorbed light is dissipated mainly in the form of heat, with a small fraction (1-2%) [39] re-emitted in the form of chlorophyll fluorescence at longer wave lengths (red). This fact allows to measure the luminous reaction of photosynthesis using chlorophyll fluorometers. [39] The actual photosynthetic efficiency of the plants varies with the frequency of the conversion of light, the bright intensity, the temperature and the percentage of carbon dioxide in the atmosphere, and can vary from 0.1% to 8%. [40] In comparison, solar panels convert light into electricity with a efficiency of about 6.20% for panels produced in series and more than 40% for laboratory devices. Scientists are studying photosynthesis in the hope of developing plants with yield increments. [38] The efficiency of light and shadow reactions can be measured, but the relationship between the two can be complex. [41] For example, ATP and NADPH energy molecules created by the light reaction can be used for carbon setting or for photorespiration in C3 plants. Electrons can also flow to other electrons heat sinks. [42] [43] [44] For this reason, it is not rare that the authors make a distinction between the work carried out in non-photorespiratory conditions and that carried out in photorespiratory conditions. [45] [46] [47] The chlorophyll fluorescence of photosystem II can measure the light reaction, and infrared gas analyzers can measure the obscure reaction. [48] It is also possible to study both simultaneously using an integrated chlorophyll fluorometer and a gaseous exchange system, and using two separate systems together. [49] Infrared gas analyzers and some moisture sensors are sufficiently sensitive to measure the photosynthetic assimilation of the CO_2 and the H_2O using reliable methods [50] CO_2 is commonly measured in Ãž1â "4mol / (m2 / s), parts per million or volume per million and the H_2O is commonly measured in mmol / (m2 / s) or mbar [50].] Measuring the assimilation of CO_2, the H_2O, the temperature of the leaves , the barometric pressure, the area of the leaves and the photosintetically active radiation or par, it becomes possible to estimate â â â «a" or the assimilation of carbon, Â «andÂ» or perspiration, Â «Gâ» or stomatic conductivity, e We or CO_2 intracellular. [50] However, it is more common to use the chlorophyll fluorescence for measuring plant stresses, if appropriate, since the most common measuring parameters fv / fm and y (ii) or f / fm 'can be measured in a few seconds, Allowing the measurement of larger vegetable populations. [47] The gas exchange systems that allow the control of CO_2 levels, above and below the environment, allow the common practice to measure the A / CI curves, at different levels of CO_2, to characterize the Photosynthetic properties of a plant.[50] Integrated gas exchange systems “chlorophyll” fluorometer allow a more accurate measurement of photosynthetic response and mechanisms.[48][49] While standard gas-exchange photosynthesis systems can measure levels of Ci, or substomatal CO_2, the addition of integrated chlorophyll chlorophyll fluorescence measurements A more precise DC measurement to replace us. [49] [51] The Estimate of the CO_2 on the carboxylation site in the chloroplast, or DC, it becomes possible with the measurement of the conductance of the mesophone or GM using an integrated system [48] [49] [52] Measurement systems of photosynthesis They are not designed to directly measure the quantity of light absorbed by the leaf. But the analysis of chlorophyll-fluorescence, P700- and P515-absorbance and gas exchange measurements reveal detailed information on E.G. Photosystems, quantum efficiency and CO_2 assimilation rates. With some tools, it is also possible to analyze the wavelength dependence of photosynthetic efficiency. [53] A phenomenon known as quantum journey increases the efficiency of energy transport of light significantly. In the photosynthetic cell of a alga, bacterium or plant, there are light sensitive molecules called chromophores arranged in an antenna-shaped structure called a photocompless. When a photon is absorbed by a chromophore, it is converted into an encircler called Exciton, which jumps from the chromophore chromophore towards the fotocomplex reaction center, a collection of molecules that drill its energy into a chemical form that makes it accessible for the Metabolism of the mobile phone. Exciton wave properties allow you to cover a larger area and try different paths at the same time, allowing it to "select" instantly the most efficient route, where you will have the maximum probability of arriving at your destination as possible. Since that quantum walk takes place at much higher temperatures than quantum phenomena usually occur, it is possible only for very short distances, due to obstacles in the form of destructive interference entering the game. These obstacles cause the particle to lose the property of the wave for an instant before it deems them once again after being released from its position blocked through a classic "hop". The movement of the electron to the photo center is then covered by a series of conventional hops and quantum walks [54] [55] [56] Evolution Main article: Evolution of photosynthesis Life Timelinethis Box: viewtalkeditÂ'4500 Ã ¢ Â, ¬ "Ã ¢ â,¬ "Ã ¢ â,¬ "Ã ¢ â,¬" Ã ¢ '4000 Ã ¢ â,¬ "Ã ¢ â,¬" Ã ¢ â,¬ "Ã ¢ â,¬" Ã ¢ '3500 Ã ¢ â,¬ "Ã ¢ â,¬" Ã ¢ â,¬ "ã," Ã ¢ â,¬ "Ã ¢ â,¬" Ã ¢ â,¬ "Ã ¢ â,¬" Ã ¢ Â , ¬ "Ã ¢ â,¬ "Ã ¢ â,¬ "" Ã, â,¬ "Ã ¢ â,¬" Ã ¢ â,¬ "Ã ¢ â,¬" Ã ¢ â,¬ "Ã ¢ Â, ¬ "Ã ¢ â,¬" Ã ¢ â,¬ "Ã ¢ â,¬" Ã ¢ â,¬ "Ã, Ã, 0ã, Watera Unicellular LifeÂ ¢ photosynthesisÂ, eukaryotesÂ ¢ photosynthesis, eukaryotesã, multicellular LifeÂ ¢ Plantsã, Arthropods MolluscsFlowersDinosaursã, MammalsbirdsprimateshadeanarcheanproterozoicphanerozoicÂ, Â, Â, earth formed (4540 million years ago) is, the first watera the first life ¢ lhb meteorites ¢ the first oxygena â € glaciation of pongola * ã, â € oxergen atmospheric â € glaciation huronian * ã, â € â € € Sexual reproduction, â € the before sexual reproduction, â € the oldest multi-life cell phone â € the first mushrooms first plants â € ¢ Ã,â € ¢ eâ € â € ¢ Eggsheck Jersory ¢ â â â â Price * Karoo Ice * κa, © County Prime Sats / Humans â € ™ giver quaterzio f. quaternary *Ice Ages The first photosynthetic systems, such as green and purple sulfur and green and purple nonsulfur bacteria, are believed to have been anoxigenic, and used various molecules other than water as electron donors. Green and purple sulfur bacteria are thought to have used hydrogen and sulfur as electron donors. Green nonsulfur bacteria used various amino acids and other organic acids as electron donors. Purple nonsulfur bacteria used a variety of non-specific organic molecules. The use of these molecules is consistent with the geological evidence that the Earth’s early atmosphere was shrinking at that time. [57] The fossils of what are thought to be filamentous photosynthetic organisms have been dated to 3.4 billion years ago.[58] [59] Other recent studies, reported in March 2018, also suggest that photosynthesis may have begun about 3.4 billion years ago.[60][61] The main source of oxygen in the Earth’s atmosphere comes from oxygen photosynthesis, and its first appearance is sometimes referred to as the oxygen catastrophe. Geological evidence suggests that oxygen photosynthesis, like that in cyanobacteria, became important during the Paleoproterozoic era about 2 billion years ago. Modern photosynthesis in plants and most photosynthetic prokaryotes is oxygen. Oxygen photosynthesis uses water as an electron donor, which is oxidized to molecular oxygen (O_2) in the photosynthetic reaction center. Symbiosis and the origin of chloroplasts Plant cells with visible chloroplasts (from a moss, similar to Plagiomnium) Several groups of animals have formed symbiotic relationships with photosynthetic algae. These are most common in corals, sponges and sea anemones. It is assumed that this is due to the particularly simple body planes and the large surfaces of these animals compared to their volumes. [62] In addition, some marine molluscs Elysia viridis and Elysia chlorotica also maintain a symbiotic relationship with chloroplasts which they capture from the algae in their diet and then store in their bodies (see Kleptoplasty). This allows the molluscs to survive only by photosynthesis for several months at a time.[63][64] Some of the genes in the plant cell nucleus have been transferred to the slugs, so that the chloroplasts can be supplied with proteins that must survive. [65] An even narrower form of symbiosis can explain the origin of chloroplasts. Chloroplasts have many similarities to photosynthetic bacteria, including a circular chromosome, prokarytic ribosome-type, and similar proteins in the photosynthetic reaction center.[66][67] Endosymbiotic theory suggests that photosynthetic bacteria were acquired (by endocytosis) from the initial eukaryotic cells to form the first plant cells. Therefore, chloroplasts can be photosynthetic bacteria that adapt to life within vegetable. Like mitochondria, chloroplasts own their DNA, separated from the nuclear DNA of their host cells and genes in this chloroplast DNAthose found in cyanobacteria.[68] DNA in chloroplast codes for redox proteins such as those found in photosynthetic reaction centers. The CoRR hypothesis proposes that this co-location of genes with their genes is necessary for redox regulation of gene expression, and represents the persistence of DNA in bioenergetic organelles. [69] Eukaryotic lines photosynthetic organisms symbiotics and kleptoplastics excluded: The red and green algae and glaucophytes—clade Archaeplastida (unicellular and multicellular) Cryptophytes—Cryptist Clades (unicellular) Haptofiti — Haptist laclade (unicellular) Dinoflagellate and chrome in the superfilum Myzozoa—clade Alveolata (unicellular) Ocrophytes—heterokonta cleave (unicellular and multicellular) Chloraracniophyte and three species of Paulinella in the filum Cercozoa—clade Rhizaria (unicellular) The heuglenids—excavated cleaves (unicellular) Except for the heuglenids, which are located within the Excavated, all belong to the diaphoretics. Archaeplastida and Paulinella photosyntetica have obtained their plastides, which are surrounded by two membranes, through the primary endombiosis in two separate events swallowing a cyanobacteria. The plastides of all other groups have red or green algae origin, and are called "red lineages" and "green lineages". In the dinophlaggetes and heuglenids the plastides are surrounded by three membranes, and in the remaining lines of four. A nucleomorf, remains of the original algal nucleus located between the internal and external membranes of the plastid, is present in the cryptopathies (from a red algae) and chloracniophites (from a green algae). [70] Some dinoflaggelati that have lost their photorhectic ability have then regained through new ersimbiotic events with different algae. While able to perform photosynthesis, many of these Eucharistic groups are mixotrophies and heterotrophy practice at various degrees. Cyanobacteria and the evolution of photosynthesis The biochemical ability to use water as a source for electrons in photosynthesis has evolved once, in a common ancestor of extensive cyanobacterias (previously called blue-green algae), which are the only prokaryotes that perform oxygenous photosynthesis. The geological record indicates that this transformation event took place early in Earth's history, at least 2450–2320 million years ago (Ma), and is speculated much earlier.[71][72] Since the Earth's atmosphere did not contain almost oxygen during the estimated development of photosynthesis, it is believed that the first photosyntetic cyanobacteria did not generate oxygen. [73] Proofs available from geobiological studies of Archean sedimentary rocks (>2500 Ma) indicate that life existed 3500 But, but the question of when oxygenous photosynthesis evolved is still inexorable. A clear paleontological window on the cyanobacteric evolution open about 2000 But, revealing an already differentcyanobacteria. The cyanobacteria remained the main primary producers of oxygen during the Proterozoic Eone (2 500 543 Ma), partly because the redox structure of the oceans favoured photo-trophies able to fix nitrogen. Green algae joined the cyanobacteria as the main primary oxygen producers on the continental platforms towards the end of Proterozoic, but it was only with the mesozoic radiation (251-66 Ma) of dinoflagellate, pamperedphorids and diatomae that the primary oxygen production in the marine waters of the platforms took modern form. The cyanobacteria remain critical for marine ecosystems as primary oxygen producers in the ocean ranges, as biological nitrogen fixing agents and, in a modified form, as plastides of marine algae.[74] Although some passages of photosynthesis are not yet fully understood, the overall photosynthetic equation has been known since the 19th century. Portrait of Jan Baptist van Helmont of Mary Beale, about 1674 Jan van Helmont began searching for the process in the middle of the 17th century, when he carefully measured the mass of the soil used by a plant and the mass of the plant during its growth. After noting that the mass of the soil changed very little, he hypothesized that the growing plant mass should come from water, the only substance he had added to the potted plant. His hypothesis was partially accurate “many of the mass obtained also comes from carbon dioxide as well as from water. However, this was a point of signalling for the idea that most of the biomass of a plant comes from the inputs of photosynthesis, not from the soil itself. Joseph Priestley, a chemist and minister, discovered that when he isolated a volume of air under a twisted jar and burned it inside a candle (which emitted CO_2), the candle burned very quickly, long before the wax ended. He also found that a mouse could likewise “low” air. He then showed that the air that had been “wounded” by the candle and the mouse could be restored by a plant.[75] In 1779, Jan Ingenhousz repeated Priestley's experiments. In 1796, Jean Senebier, Swiss pastor, botanist and naturalist, demonstrated that green plants consume carbon dioxide and release oxygen under the influence of light. Soon after, Nicolas-Théodore de Saussure showed that the mass increase of the plant as it grows could not only be due to the absorption of CO_2, but also to the incorporation of water. Thus, the basic reaction with which photosynthesis is used to produce food (such as glucose) was outlined.[77] Cornelis Van Niel refinements made important discoveries explaining the chemistry of photosynthesis. Studying purple and green sulphur bacteria, he was the first to demonstrate that photosynthesis is a redox reaction dependent on light, in which hydrogen reduces (donaits carbon carbon «electron»)Robert Emerson discovered two light reactions by testing plant productivity using different light wavelengths. With only red, light reactions were suppressed. When blue and red were combined, the output was much more substantial. Thus, there were two photographic systems, one absorbing up to 600 nm wavelengths, the other up to 700 nm. The first is known as PSII, the latter is PSI. PSI contains only chlorophyll a, PSII contains mainly chlorophyll a with most available chlorophyll b, among other pigments. These include phycobilines, which are red and blue algae pigments red and blue respectively, and fucoxanthol for brown algae and diatomas. The process is more productive when the absorption of the amount is equal in both PSII and PSI, ensuring that the input energy from the antenna complex is divided between the PSI and PSII system, which in turn feeds the photochemistry. [13] Robert Hill thought that a complex of reactions consisted of an intermediate at the cytochrome b6 (now a plastoquinone,) and that another was from the cytochrome f to a step in the mechanisms of carbohydrate generation. These are connected by plastoquinone, which requires energy to reduce cytochrome f because it is a sufficient reducer. Further experiments to prove that oxygen developed during the photosynthesis of green plants came from water, were performed by Hill in 1937 and 1939. He showed that isolated chloroplasts give oxygen in the presence of unnatural reducing agents such as iron bone, ferricyanide or benzoquinone after exposure to light. The Hill reaction[78] is as follows: 2 H_2O + 2 A + (light, chloroplasts) → 2 AH_2 + O_2 where A is the electron receptor. Therefore, in light, the electron receptor is reduced and oxygen evolves. Samuel Ruben and Martin Kamen used radioactive isotopes to determine that oxygen released in photosynthesis came from water. Melvin Calvin works in his photosynthesis lab. Melvin Calvin and Andrew Benson, along with James Bassham, emphasised the path of carbon assimilation (the photosyntetic carbon reduction cycle) in plants. The carbon reduction cycle is known as the Calvino cycle, which ignores the contribution of Bassham and Benson. Many scientists refer to the cycle like the Calvin-Benson Cycle, Benson-Calvin, and some even call it the Calvin-Benson-Bassham Cycle (or CBB). The Nobel Prize winner scientist Rudolph A. Marcus was later able to discover the function and meaning of the electron transport chain. Otto Heinrich Warburg and Dean Burk discovered the reaction of I-quantum photosynthesis that divides CO_2, activated by breathing. [79] In 1950, the first experimental evidence for the existence of in vivo photophosphorylation was presented by Otto Kandler using intact chlorella cells and interpreting hisAs ATP training depending on light. [80] In 1954, Daniel I. Arnon et al. Discovered in vitro photophosphorylation in isolated chloroplasts with the help of P32. [81] [82 Louis N.M N.M and Jan Amesz discovered that chlorophyll "a" will absorb a light, will obsess the cytochrome f, while chlorophyll "a" (and other pigments) will absorb another light, but will reduce this same oxidized cytochrome, stating that the two light reactions are in series. In 1893, Charles Reid Barnes proposed two terms, photyntax and photosynthesis, for the biological process of synthesis of carbon compound complexes of carbon acid, in the presence of chlorophyll, under the influence of light. Over time, the term photosynthesis has entered common use as the term of choice. The subsequent discovery of photosyntetic anoxyl bacteria and photophosphorylation required the term redefinition.[83] C3: C4 Research photosynthesis After World War II at the end of 1940 at the University of California, Berkeley, the details of the photosynthetic carbon metabolism were ordered by chemical Melvin Calvin, Andrew Benson, James Bassham and a score of students and researchers using hisotopoa techniques and paper chromatography. [84] The path of fixing CO_2 by algae chlorella in a fraction of a second in light has led to a carbon molecule 3 called phosphoriceric acid (PGA). For this original and innovative work, a Nobel Prize in Chemistry was awarded to Melvin Calvin in 1961. In parallel, plant physiologists have studied leaf gas exchanges using the new method of analysis of infrared gas and a leaf chamber in which the net photosynthetic rates varied from 10 to 13 μmol $CO_2 \cdot m^{-2} \cdot s^{-1}$, with the conclusion that all terrestrial plants have the same photosynthetic capacities, which are saturated to less than 50% of sunlight. This higher rate of maize was almost double than those observed in other species such as wheat and soybean, indicating that there are large differences in photosynthesis among the highest plants. At the University of Arizona, detailed research of gas exchange on more than 15 species of monocot and dictate discovered for the first time that differences in leaf anatomy are crucial factors in the differentiation of photosynthetic capacities among species. [89] [90] In tropical herbs, including corn, sorghum, sugar cane, Bermuda herb and amaranthus dictate, the photosintetic rates of the leaves were about 38−40 μmol $CO_2 \cdot m^{-2} \cdot s^{-1}$, and the leaves have two types of green cells, i.e. outer layer of mesofille cells surrounding a narrow vascular sheath cells. This type of anatomy was called Kranz's anatomy in the 19th century by the botany Gottlieb Haberlandt while studying the anatomy sugar cane leaf. [91] The plant species with the largest photosynthetic rates and the Kranz anatomy showed no apparent photorespiration, very low CO_2 compensation point, optimum high temperature, high stomatal and lower resistancesresistances for gas diffusion and rates never saturated in full sunlight. [92] Research in Arizona was designated Citation Classic by ISI 1986.[90] These species were subsequently named C4 plants as the first stable CO_2 fixation compound in light has 4 carbon as diseased and aspartate.[94][95] Other species lacking Kranz’s anatomy have been called C3 type such as cotton and sunflower, as the first stable carbon compound is the 3-carbon PGA. At 1000 ppm CO_2 in the measurement air, both C3 and C4 plants had similar photosynthetic rates around 60 Î1⁄4mol CO2Â·mâ2Â·sâ1 indicating suppression of photorespiration in C3 plants.[89][90] Factors The leaf is the primary site of photosynthesis in plants. There are three main factors affecting photosynthesis[clarification needed] and several corollary factors. The three main ones are:[citation required] Light radiation and wavelength carbon dioxide concentration Temperature. Total photosynthesis is limited by a number of environmental factors. These include the amount of light available, the amount of leaf area a plant needs to capture light (sharing other plants is a major limitation of photosynthesis), the rate at which carbon dioxide can be delivered to chloroplasts to support photosynthesis, the availability of water, and the availability of water. temperatures suitable for photosynthesis.[96] See also: PI (photosynthesis-irradiance) curve Absorption spectra of free chlorophyll a (blue) and b (red) in a solvent. The action spectra of chlorophyll molecules are slightly modified in vivo depending on the specific pigment-protein interactions. The process of photosynthesis provides the main input of free energy into the biosphere, and is one of the four main ways in which radiation is important for plant life. [97] The radiation climate within plant communities is extremely variable, with time and space. In the early 20th century, Frederick Blackman and Gabrielle Matthaei investigated the effects of light intensity (irradiance) and temperature on the rate of carbon uptake. At constant temperature, the rate of carbon uptake varies with irradiation, increasing as irradiation increases, but reaching a plateau with increased irradiation. At low irradiation, increasing the temperature has little influence on the rate of carbon absorption. With a constant high irradiation, the rate of carbon absorption increases as the temperature increases. These two experiments illustrate several important points: First, it is known that, in general, photochemical reactions are not affected by temperature. However, these experiments clearly show that temperature affects the rate of carbon uptake, so we must Two series of reactions in the process complete with carbon assimilation. These are the "photochemical" thermal dependency phase depending on the light, and the phase dependent on light, depending on the temperature. Second, Blackman experiments illustrate illustrate Concept of factors limitation. Another limiting factor is the wavelength of light. The cyanobacteria, which reside different meters under water cannot receive the right wavelengths necessary to cause the separation of photo-induced charge in conventional photosynthetic pigments. To combat this problem, a series of proteins with different pigments surround the reaction center. This unit is called phycobilisome. Levels of carbon dioxide and photorespiration with the increase in carbon dioxide concentrations, the rate to which sugars are made from light-type reactions increases until they are limited by other factors. Rubiso, the enzyme that captures carbon dioxide in light reactions, has a binding affinity both for carbon dioxide and oxygen. When the concentration of carbon dioxide is high, stealing carbon dioxide. However, if the concentration of carbon dioxide is low, steal oxygen instead of carbon dioxide. This process, called photorespiration, uses energy, but does not produce sugars. Rubis The activity of CO oxygenase is disadvantageous for plants for several reasons: a product of oxygenase activity is phosphigiclate (2 carbon) instead of 3-phosphoglycerate (3 carbon). Phosphogliclate cannot be metabolized from the Calvin-Benson cycle and represents the carbon lost from the cycle. A high oxygenase activity, therefore, drains sugars that are required to recycle ribulous 5-bisphosphate and for the continuation of the Calvin-Benson cycle. Phosphogliclate is quickly metabolized to glycolate that is toxic to a high concentration plant; Inhibits photosynthesis. Save the glycolate is an energetic process that uses the path of the glycolate, and only 75% of carbon is returned to the Calvin-Benson cycle as 3-phosphoglycetrical. The reactions also produce ammonia (NH_3), which is able to spread from the plant, leading to a loss of nitrogen. A highly simplified summary is: 2 Glycolato + ATP â † '3-phosphoglycerate + carbon dioxide + ADP + NH_3 The recovery path for rubiso oxygenase activity products is most commonly known as photorespiration, as it is characterized by an oxygen consumption dependent on the light and the release of carbon dioxide. Environment Portal Ecology Portal Earth Sciences Portal Metabolism Portal Jan Anderson (Scientist) Artificial Photosynthesis Cycle Calvin-Benson Carbon Fixation Breathing Cell Chemosynthesis Daily Light Full Light Hill Reaction Integrated Fluometer Light-Depending Organic Reaction Photobiology Photoinbizione Heading Center Photosynthetic Radiation Photographic System II Photosystem II Quantum Biology Radiosynthesis Red Edge Vitamin D References

^ synthesis dictionary of online etymology. Filed by the original 2013-03-07. URL consulted on 13 2012. ^ ÎÏÍ. Liddell, Henry George; Scott, Robert; A GreekâEnglish Lexicon at the Perseus Project ^ ÎÏÍ½Í¸Î¸ÎµÏÎ¹Ï. Liddell, Henry George; George; Robert; Greek-English lexicon at the Perseus Project ^ a b Bryant DA, Frigaard NU (Nov 2006.) “Prokaryotic photosynthesis and illuminated phototrophy.” Trends in Microbiology. 14 (11:) 488â496. doi:10.1016/j.tim.2006.09.001 PMID 16 997 562. ^ Reece J, Urry L, Cain M, Wasserman S, Minorsky P, Jackson R (2011.) Biologia (International ed.) Upper Saddle River, NJ: Pearson Education. pp. 235, 244. ISBN 978-0-321-73 975-9. This first incorporation of carbon into organic compounds is known as carbon fixation. ^ Olson JM (May 2006.) “Photosynthesis in the Archaic Age.” Photosynthesis Research. 88 (2:) 109â117. doi:10.1007/s11 120-006-9040-5 PMID 16 453 059. S2CID 203 647. ^ Buick R (Aug 2008.) “When did oxygen photosynthesis evolve”? Philosophical Transactions of the Royal Society of London, Series B. 363 (1504:) 2731â2743. doi:10.1098/rstb.2008.0041 PMC 2 606 769. PMID 18 468 984. ^ Nealson KH, Conrad PG (Dec 1999.) “Life: Past, Present and Future.” Philosophical Transactions of the Royal Society of London, Series B. 354 (1392:) 1923â1939. doi:10.1098/rstb.1999.0532 PMC 1 692 713. PMID 10 670 014. ^ Whitmarsh J, Govindjee (1999). In Singhal GS, Renger G, Sopory SK, Irrgang KD, Govindjee (eds.) Concepts in photobiology: photosynthesis and photomorphogenesis. Boston: Kluwer Academic Publishers. pp. 11â51 ISBN 978-0-7923-5519-9. 100Ã1015 grams of carbon/year fixed by photosynthetic organisms, which is equivalent to 4Ã1018 kJ/yr = 4Ã1021 J/yr of free energy stored as reduced carbon. ^ Steger U, Achterberg W, Blok K, Bode H, Frenz W, Gather C, Hanekamp G, Imboden D, Jahnke M, Kost M, Kurz R, Nutzinger HG, Ziesemer T (2005). Sustainable development and innovation in the energy sector. Berlin: Springer. p. 32 ISBN 978-3-540-23 103-5. Archived from the original on 2016-09-02. Retrieved 2016-02-21. The global average rate of photosynthesis is 130 TW. ^ “World primary energy consumption by type of energy and selected country groups, 1980-2004.” Management of energy information. 31 July 2006. URL accessed 9 November 2006 (archived from the original URL (XLS). Retrieved 19 February 2007. ^ Field CB, Behrenfeld MJ, Randerson JT, Falkowski P (Jul 1998.) “Primary production of the biosphere: integration of terrestrial and oceanic components.” Science. 281 (5374:) 237-240. Bibcode:1998Sci...281..237F doi:10.1126/science.281.5374.237 PMID 9 657 713. Archived from the original on 2018-09-25. Retrieved 20 September 2018. ^ a b c Photosynthesis. McGraw-Hill Encyclopedia of Science & Technology. 13. New York: McGraw-Hill. 2007. ISBN 978-0-07-144 143-8. ^ Frankelius, Per (July/August.) “A proposal to rethink agriculture in climate calculations.” Agronomy Journal. 112 (4:) 3216â3221. doi:10.1002/agj2.20 286 S2CID 219 423 329. Check the date values in: |date= (help) ^ Whitmarsh J, Govindjee (1999.) “Chapter 2: The Basic Photosynthetic Process.” In Singhal GS, Renger G, Sopory SK, Irrgang KD, Govindjee (eds.) Concepts in and photomorphogenesis. Boston: Kluwer Academic Publishers. p. 13. ISBN 978-0-7923-5519-9. ^ Anaerobic Photosynthesis, Chemical & Engineering News, 86, 33, 18 August 2008, p. 36 ^ Kulp TR, Hoeft SE, Asao M, Madigan MT, Hollibaugh JT, Fisher JC, Stolz JF, Culbertson CW, Miller LG, 2008 Oremland “Arsenic (III) fuels anoxygen photosynthesis in hot spring biofilms of Mono Lake, California.” Science. 321 (5891): 967â970. Bibcode:2008Sci...321..967K. doi:10.1126/science.1 160 799. PMID 18 703 741. S2CID 39 479 754. ^ “Scientists discover unique microbe in California’s largest lake.” Archived from the original on 2009-07-12. Retrieved 2009-07-20. ^ Plants: Diversity and Evolution Archived on 2016-09-01 at Wayback Machine, page 14, Martin Ingrouille, Bill Eddie ^ Oakley T (December 19, 2008). “Evolutionary News: Opsins: An Extraordinary Evolutionary Convergence.” Archived from the original on April 17, 2019. Retrieved 17 April 2019. ^ Tavano CL, Donohue TJ (December 2006). “Development of the bacterial photosynthetic apparatus.” 9 (6): 625â631. doi:10.1016/j.mib.2006.10.005. PMC 2 765 710. AMPD 17 055 774. ^ a b Mullines CW (1999). “Tilakoid membranes of cyanobacteria: structure, dynamics and function.” Retrieved 28 June 2015. ^ Sener MK, Olsen JD, Hunter CN, Schulten K (October 2007). Sener MK, Olsen JD, Hunter CN, Schulten K. “Atomic-level Structural and Functional Model of a Bacterial Photosynthetic Membrane Bladder”. 104 (40): 15 723â15 728. Bibcode:2007PNAS..10 415 723S. doi:10.1073/pnas.0 706 861 104. PMC 2 000 399. AMPD 17 895 378. ^ Campbell NA, Williamson B, Heyden RJ (2006). Biology that explores life. Upper Saddle River, New Jersey: Prentice Hall. ISBN 978-0-13-250 882-7. Archived from the original on 2014-11-02. Retrieved 2009-02-03. ^ Ziehe D, DÃ1⁄4nschede B, SchÃ1⁄4nemann D (December 2018). “Molecular mechanism of SRP-dependent light-harvesting protein transport to the thylakoid membrane in plants”. 138 (3): 303-313. doi:10.1007/s11 120-018-0544-6. PMC 6 244 792. PMID 29 956 039. ^ a b Raven PH, Evert RF, Eichhorn SE (2005). Plant Biology (7th ed.). New York: W. H. Freeman and Company. pp. 124â127. ISBN 978-0-7167-1007-3. ^ “Yachandra/Yano Group.” Lawrence Berkeley National Laboratory. Archived from the original on 2019-07-22. Retrieved 22 February 2008. ^ Pushkar Y, Yano J, Sauer K, Boussac A, Yachandra VK (February 2008). “Structural change in Mn4Ca cluster and the mechanism of photosynthetic water splitting.” Proceedings of the National Academy of Sciences of the United States of America. 105 (6): 1879-1884. Bibcode:2008 PNAS..105.1879P. doi:10.1073/pnas.0 707 092 105. PMC 2 542 863. PMID 18 250 316. ^ a b Williams BP, Johnston IG, Covshoff S, Hibberd JM (September 2013). “The inference of the phenotypic landscape reveals multiple evolutionary pathways to C4 photosynthesis.” Elife. 2: e00 961.PMC 3 786 385. PMID 24 082 995. ^ Taiz L, Geiger E (2006). Plant physiology (4th ed.). Sinauer Associates. ISBN 978-0-87 893-856-8. ^ Monson RK, Sage RF (1999). “The Taxonomic Distribution of C4 Photosynthesis.” Plant Biology C4. Boston: Academic Press. pp. 551â580. ISBN 978-0-12-614 440-6. ^ Dodd AN, Borland AM, Haslam RP, Griffiths H, Maxwell K (April 2002). “Crassulacean acid metabolism: plastic, fantastic.” Experimental Botany Journal. 53 (369): 569â580. doi:10.1093/jexbot/53.369.569. AMPD 11 886 877. ^ Tooulakou G, Giannopoulos A, Nikolopoulos D, Bresta P, Dotsika E, Orkoula MG, et al. (August 2016). “Photosynthesis Alarm: Calcium Oxalate Crystals as an internal source of CO2 in plants.” Plant physiology. 171 (4): 2577â2585. doi:10.1104/pp.16.00 111. PMC 4 972 262. AMPD 27 261 065. ^ GÃ3mez-Espinoza O, GonzÃ¡lez-RamÃrez D, Bresta P, Karabourniotis G, Bravo LA (October 2020). “Decomposition of calcium oxalate crystals in Colobanthus quitensis under CO2 limiting conditions.” Plants. 9 (10): 1307. doi:10.3390/pianti9 101 307. PMC 7 600 318. PMID 330 238. ^ Badger MR, Price GD (February 2003). “CO2 mechanisms of concentration in cyanobacteria: molecular components, their diversity and evolution.” Experimental Botany Journal. 54 (383): 609â622. doi:10.1093/jxb/erg076. PMID 12 554 704. ^ Badger MR, Andrews JT, Whitney SM, Ludwig M, Yellowlees DC, Leggat W, Price GD (1998). “The diversity and co-evolution of Rubisco, plastids, pyreneids and chloroplast-based CO2 concentration mechanisms in algae.” 7.6: 1052â1071. doi:10.1139/b98-074. ^ Miyamoto K. “Chapter 1 â Biological Energy Production.” Renewable Biological Systems for Alternative Sustainable Energy Production (FAO Agricultural Services Bulletin â 128). Food and Agriculture Organization of the United Nations. Archived from the original on September 7, 2013. Retrieved 4 January 2009. ^ a b Ehrenberg R (2017-12-15). “Photosynthesis runs.” Magazine note. Annual reviews. doi:10.1146/conscious-121 917-115 502. Retrieved 13 April 2018. Maxwell K, Johnson GN (April 2000). “Chlorophyll fluorescence â a practical guide.” Experimental Botany Journal. 51 (345): 659â668. doi:10.1093/jexbot/51.345.659. AMPD 10 938 857. ^ Govindjee R. “What is photosynthesis?.” Biology at Illinois. Archived from the original on 27 May 2014. Retrieved 17 April 2014. ^ a b Rosenqvist E, van Kooten O (2006). “Chapter 2: Chlorophyll” Fluorescence: a general description and nomenclature.” In DeEll JA, Toivonen PM (eds.). Practical applications of chlorophyll fluorescence in plant biology. Dordrecht, The Netherlands: Kluwer Academic Publishers. pp. 39â78. ^ Baker NR, Oxborough K (2004). “Chapter 3: Chlorophyll fluorescence as a probe of photosynthetic productivity.” A Papaqeorgiou G, Govindjee (eds.). Chlorophyll Fluorescence a signature photosynthesis. ^ Flexas J, Escalnona JM, Medrano H (January 1999). “Stress of waterdifferent levels of photosynthesis and adjustment of the electron transport speed in the screws". Plant, cell phone and environment. 22 (1): 39–48. doi:10.1046/j.1365-3040.1999.00371.x. Fryer MJ, Andrews JR, Oxborough K, Blowers DA, Baker NR (1998). "Relation between the assimilation of CO2, the transport of photosynthetic electrons and the active metabolism of O2 in corn leaves in the field during periods of low temperature". Plant physiology. 116 (2): 571–580. doi:10.1104/pp.116.2.571. PMC 35114. PMID 9490760. "By extinguishing the photosyntetic transport of the electron through chlorophyll fluorometry without the light saturation of Photosystem II". Search photos. 82 (2): 177–186. doi:10.1007/s11120-004-1454-3. PMID 16151873. S2CID 291238. "The relationship between the quantum yield of photosintetic transport of electrons and the quenching of chlorophyll fluorescence". Biochemistry et Biophysica Acta (BBA) - General subjects. 990 (1): 87–92. doi:10.1016/s0304-4165(89)80016-9. ^ a b Baker NR (2008). "Chlorophyll fluorescence: A live photosynthesis probe." 59: 89–113. doi:10.1146/annurev.arplant.59.032607.092759. AMPD 18444897. S2CID 31451852. "Mesofilla conductance temperature response. Implications for the determination of the enzyme Rubisk and for limitations to photosynthesis in vivo". Plant physiology. 130 (4): 1992-1998. doi:10.1104/pp.008250. PMC 166710. AMPD 12481082. ^ a b c d Ribas-Carbo M, Flexas J, Robinson SA, Tcherkez GG (2010). "In vivo measurement of the breathing of plants." University of Wollongong Research Online. ^ a b c d Long SP, Bernacchi CJ (2003). "Gas exchanges measures, what can they tell us about the limits below photosynthesis? Procedures and sources of error." Official Journal of the European Communities 54 (392): 2393–2401. doi:10.1093/jxb/erg262. AMPD 14512377. Bernacchi CJ, Portis A (2002). "R., Nakano H., von Caemmerer S. and Long S.P. (2002) Response of the temperature of the nesofill conductance. Implications for the determination of the enzyme Rubisk and for limitations to photosynthesis in vivo". Plant physiology. 130 (4): 1992-1998. doi:10.1104/pp.008250. PMC 166710. PMID 12481082. "Theoretical reconsiderations when the mesofill conductance is estimated at the diffusion of CO2 in leaves of plants C3 by combined gas exchange analysis and chlorophyll fluorescence measurements". Plant, cell phone and environment. 32 (11): 1513–1524 [1524]. doi:10.1111/j.1365-3040.2009.02016.x. PMID 19558403. "Evaluation of wavelength parameters-dependent of the transport of photosynthetic electrons with a new type of multicolored PAM chlorophyll fluorofyl". Search photos. 113 (1–3): 127–144.J (June 21, 2013). "Plants" "Plants"doing quantum physics.Â" BBC News. Archived from the original on October 3, 2018. Retrieved 21 June 2018. ^ Lloyd S (10 March 2014). Â"Quantum Biology: Living Better with Quantum Mechanics.Â" The Nature of Reality. Nova: PBS Online; WGBH Boston. Archived from the original on July 3, 2017. Retrieved September 8, 2017. ^ Hildner R, Brinks D, Nieder JB, Cogdell RJ, van Hulst NF (June 2013). Â"Coherent quantum energy transfer on variable paths in individual light-collecting complexes.Â" Science. 340 (6139): 1448-1451. Bibcode:2013Sci...340.1448H. doi:10.1126/science.1 235 820. PMIDEO 23 788 794. S2CIDe 25 760 719. ^ Gale J (2009). Astrobiology of Earth: The emergence, evolution and future of life on a planet in turmoil. Oxford University Press, pp. 112 113. ISBN 978-0-19-154 835-2. ^ Davis K (2 October 2004). “Photosynthesis started very early”. New scientist. Archived from the original on May 1, 2015. Retrieved 8 September 2017. ^ Hooper R (19 August 2006). “Reveal the dawn of photosynthesis”. New scientist. Archived from the original on May 24, 2015. Retrieved 8 September 2017. ^ Cardona T (March 2018). Â"Origine archea of the heterodimeric Photosystem I.Â" Heliyon. 4 (3): e00 548. doi:10.1016/j.heliyon.2018.e00 548. PMC 5 857 716. PMIDEO 29 560 463. Archived from the original on April 1, 2019. Retrieved 23 March 2018. ^ Howard V (March 7, 2018). Â"Photosynthesis originated a billion years earlier than we thought, a study exhibition.Â" Journal of Astrobiology. Retrieved March 23, 2018.[Permanent link] ^ Venn AA, Loram JE, Douglas AE (2008). “Photosynthetic symbiosis in animals”. Journal of Experimental Botany. 59 (5): 1069 Â"1080. doi:10.1093/jxb/erm328. PMIDÃ© 18 267 943. ^ Rumpho ME, Summer EJ, Manhart JR (May 2000). Â"Solar-powered sea slugs. Symbiosis of molluscs/algae chloroplast.Â" Plant physiology. 123 (1): 29Â"38. doi:10.1104/pag.123.1.29. PMC 1 539 252. PMID 10 806 222. Muscatine L, Greene RW (1973). Chloroplasts and algae as symbionts in molluscs. International Journal of Cytology. 36. Page 137 169. doi:10.1016/S0074-7696 (08) 60 217-X. ISBN 978-0-12-364 336-0. PMID 4 587 388. ^ Rumpho ME, Worful JM, Lee J, Kannan K, Tyler MS, Bhattacharya D, Moustafa A, Manhart JR (November 2008). Â"Horizontal transfer of the nuclear gene of psbO algae to the photosynthetic sea snail Elysia chlorotica”. Proceedings of the National Academy of Sciences of the United States of America. 105 (46): 17 867-17 871. Bibcode:2008PNAS..10 517 867R. doi:10.1073/pnas.0 804 968 105. PMC 2 584 685. PMID 19 004 808. ^ Douglas SE (December 1998). Â"Evolution Plastic: origins, diversity, trends.Â" Current opinion in Genetics & Development. 8 (6): 655Â"661. doi:10.1016/S0959-437X (98) 80 033-6. PMID 9 914 199. ^ Reyes-Prieto A, Weber AP, Bhattacharya D (2007). “The origin and settlement of the plastid in algae and plants.” Annual genetics. 41: 147 Â «168. DOI: 10.1146 / Annurev.genet.41.110 306.130 134. PMIDÂ, 17 600 460. S2CIDÂ, 8 966 320. [Permanent fault connection] ^ Raven Ja, Allen JF (2003). Â «Genomics and development development Evolution: what have cynobacteria done for plants? Biology of the genome. 4 (3): 209. Doi: 10.1186 / GB-2003-4-3-209. SMP 153 454. PMID 12 620 099. ^ Allen JF (December 2017).” The short hypothesis for genes in organelles”. Journal of Theoretical Biology. 434: 50 – 57. Bibcode: 2017Jthbi.434 ... 50a. DOI: 10.1016 / J.JTBI.2017.04.008. PMIDÃ©8 408 315. ^ The Endosymbiotic Origin, Diversification and Destiny of Plastids – NCBI – NIH ^ Tomitani A, Knoll Ah, Cavanaugh cm, Ohnol T (April 2006). “The evolutionary diversification of cyanobacteria: molecular-phylogenetic and paleontological perspectives.” Procedure of the National Academy of Sciences of the United States of America. 103 (14): 5442 – 5447. Bibcode: 2006PNAS..103.5442T. DOI: 10.1073 / PNAS.0 600 999 103. PMC, 1 459 374. PMIDi 16 569 695. PMID. EDU. Archived from the original 2010-08-24. Retrieved 2010-08-26. ^ Smith A (2010). Plant biology. New York: Garland Science. P.e. 5. ISBN 978-0-8153-4025- 6. ^ Herrero A, Flor ES E (2008). Cyanobacteria: molecular biology, genomics and evolution (1st ed.). Caistra Academic Press. ISBN 978-1-904 455-15-8. ^ a b Martin d, Thompson A, Stewart I, Gilbert E, Hope K, Kawai G, Griffiths A (September 2012). "A paradigm of fragile earth in the Priestley bell jar." Physiology and extreme medicine. 1 (1): 4. DOI: 10.1186 / 2046-7648-1-4. PMC_ 3 707 099. PMIDi 23 849 304. ^ Gest H (2000). “Bicentenary tribute to Dr. Jan Ingen-Housz, MD (1730-1799), pioneer of photosynthesis research.” Research Photosynthesis. 63 (2): 183 â ¬ “190. DOI: 10.1023 / A: 1 006 460 024 843. PMID. 16 228 428. S2CIDe 22 970 505. ^ Rabinowitch Ei (1945). Photosynthesis and related processes. 1 â ¬” through the Biodiversity Heritage Library. ^ Walker from (2002). “And whose luminous presence” is â¯ ¬ “an appreciation of Robert Hill and his reaction” (PDF). Research Photosynthesis. 73 (1 – 3): 51 â ¬ “54. DOI: 10.1023 / A: 1 020 479 620 680. PMID. 16 245 102. S2CID 21 567 780. Archived from the original (PDF) on 2008-03-09. Retrieved 2015-08-27. ^ Otto Warburg â¯” Biography archived 2010-12-15 at the car for travel. Nobelprize.org (1970-08-01). Retrieved on 2011-11-03. ^ Kandler O (1950). “About Relationships and fotosintese. I. I. Phosphatspiegelschwankungen Bei Chlorella Pyrenoidosa als folge des licht-dunkel-wechsels” [on the relationship between phosphate metabolism and photosynthesis I. Changes in phosphate levels in Chlorella Pyrenoidosa as a result of light – Dark changes] (PDF). Zeitschrift fÃÂ1⁄4 nature research. 5b (8): 423 – 437. DOI: 10.1515 / ZNB-1950-0806. S2cida 97 588 826. Archived (PDF) from the original on 2018-06-24. Retrieved 2018-06-26. ^ Arnon di, whatley fr, Allen MB (1954). “Photosynthesis from isolated chloroplasts. II. Photophosphorylation, the conversion of light into phosphate energy.” Journal of American Chemical Society. 76 (24): 6324 â ¬ “6329. DOI: 10.1021 / JA01 653A025. ^ Arnon of (1956). Phosphorus metabolism and photosynthesis. Annual plant physiology. plant. 325 - 354. doi: 10.1146 / annuev.pp.07.060156.001545. 73 (1 â € "3): 7 â € " 10. doi: 10.1023 / a: 1020419417954. calvin m (July 1989.) "forty years of photosynthesis and related activities." 21 (1): 3 - 16. doi: 10.1007 / bf00047170 (inactive 31 October 2021.) pmidâ 24424488.cs1 maint: doi inactive from 2021 October (link) ^ verduin j (1953.) "a chart of photosynthesis rates under optimal conditions, near natural conditions." are. j. bot. 40 (9): 675 â€ "679. doi: 10.1002 / J.1537-2197.1953.tb06540.x. jstorâ 2439681. ^ verduin j, whitwer ee, cowell bc (July 1959.) "maximum photosynthetic books in nature." science. 130 (3370): 268 â € "269. bibcode: 1959sci ... 130..268 v. doi: 10.1126 / Science.130.3370.268. pmidâ 13668557. s2cidâ 34122342. ^ hesketh jd, musgrave r (1962.) "photosynthesis in field conditions iv. clear studies with individual corn leaves." 2 (4): 311 - 315. S2cidâ 83706567. ^ hesketh jd, musk dn (1963) "variation in the response of photosynthesis to light." 3 (2): 107 110. doi: 10.2135 / CropSCI1963.0011183x000300020002x. ^ a b el-sharkawy, but, hesketh jd (1965.) "photosynthesis among the species in relation to the characteristics of the anatomy of the leaves and the resistances of diffusion of co2 cultivation ski. 5 (6): 517 - 521. doi: 10.2135 / CropSCI1965.0011183x000500010x. ^ a b c el-sharkawy ma, hesketh jd (1986.) "classic-photosynthesis quote among the species in relation to the characteristics of leaf anatomy and resistances of diffusion of co2" (pdf.) cur. Cont./agr.biool.environ. 27: 14. [link dead permanent] merceria g (1904.) physiologische pflanzanatomie. "El-sharkawy but (1965.) factors limiting the photosynthetic rates of the different species of plants (Ph.D. thesis.) the university of the arizona, tucson, oa. karpilov ys (1960.) "the distribution of radioactity in carbon-14 among the products of the photosintesi in maize." 209 â € "213. doi: 10.1104 / PP.40.2.209. pmc â 550268. pmid. 16656075. ^ hatch md, slack cr (1966.) "photosynthesis from sugar cane leaves. a new reaction of carboxing and the path of sugar formation." biochem. j. 101 (1): 103 - 111. doi: 10.1042 / bj1010103. pmc. 1270070. pmidâ 5971771. ^ chapin fs, matson pa, mooney ha (2002.) principles of ecology of the Earth ecosystem. new york: springer. PP. 7 - 104. isbnâ 978-0-387-95443-1. ^ jones hg (2014.) plants and microclimate: a quantitative approach to physiology of the environmental system (third and ed.) cambridge: Cambridge university press. isbnFurther reading of library resources on photosynthesis resources in books of the library Bidlack Je, Stern Kr, Jansky S (2003). Biology of introductory plants. McGraw-Hill.Blankenship King (2014). Molecular mechanisms of photosynthesis (2ndÃ ¢ ed.). John Wiley & Sons. IsbnÃ, 978-1-4051-8975-0. Govindjee, Beatty JT, Gest H, Allen JF (2006). Discoveries in photosynthesis. Advances in photosynthesis and breathing. 20. Berlin: Springer. IsbnÃ, 978-1-4020-3323-0. REECE JB, ETÃ ¢ al. (2013). Campbell biology. Benjamin Cummings. IsbnÃ, 978-0-321-77565-8. Gupta RS cards, Mukhtar T, Singh B (Jun 1999). "Evolutionary relationships between photosinthetic prockyotes (Heliobacterium Chloride, Chloroflexus Aurantacus, cyanobacteria, chlorobium tepidum and proteobacteria): implications concerning the origin of photosynthesis". Molecular microbiology. 32 (5): 893 Ã ¢ â,¬ "906. doi: 10.1046 / j.1365-2958.1999.01417.x. PmidÃ, 10361294. S2CIDÃ, 33477550. Rutherford AW, FALLER P (GEN 2003)." Photosystem II: Evolutionary perspectives ". Philosophical transactions of the Royal Society of

London. Series B, Organic Sciences. 358 (1429): 245 Ã ¢ â,¬" 253. DOI: 10.1098 / RSTB.2002.1186. PMC Ã, 1693113. PMIDÃ, 12594932. External links A collection of photosynthesis pages for all levels from a renowned expert (Govindjee) in depth, advanced photosynthesis treatment, also from Govindjee Science AID: photosynthesis appropriate article for science metabolism of high school, cellular breathing and photosynthesis Ã ¢ â,¬ "The virtual library of biochemistry and cell biology examine photo-intermediate-level intermediate level of photosynthesis produced by photosynthesis interactive animation, a text tutorial Marshall J (2011-03-29). "The first practical artificial leaf makes its debut". Discovery news. Filed by the original 2012-03-22. Recovered 2011-03-29. PhotosInthesis Ã ¢ â,¬ " Light employees and independent stages from the archived light 2011-09-10 at the Wayback Machine Khan Academy, video introduction recovered from " HP? Title = PhotosInThesis & Oldid = 1053697185 "" "

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