Original Text

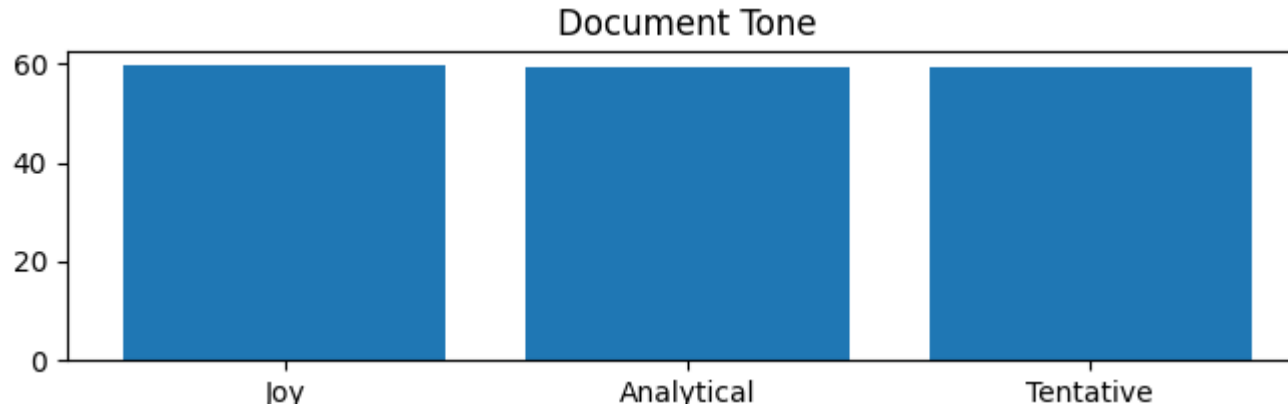
Plant - Wikipedia Plant From Wikipedia, the free encyclopedia Jump to navigation Jump to search Kingdom of mainly multicellular, predominantly photosynthetic eukaryotes For other uses, see Plant (disambiguation). For an explanation of similar terms, see Viridiplantae and Green algae. PlantsTemporal range: Mesoproterozoic–present Pha. Proterozoic Archean Had'n Scientific classification Domain: Eukaryota (unranked): Diaphoretickes (unranked): Archaeplastida Kingdom: Plantaesensu Copeland, 1956 Superdivisions Chlorokybophyta Mesostigmatophyta Spirotaenia Chlorobionta Kenrick & Crane 1997 Chlorophyta Streptobionta Kenrick & Crane 1997 Klebsormidiophyceae Charophyta (stoneworts) ?Chaetosphaeridiales Coleochaetophyta Zygnematophyta Embryophyta Engler, 1892 (land plants) Marchantiophyta (liverworts) Bryophyta (mosses) Anthocerotophyta (hornworts) †Horneophyta †Aglaophyta Tracheophyta (vascular plants) Synonyms Viridiplantae Cavalier-Smith 1981[1] Chlorobionta Jeffrey 1982, emend. Bremer 1985, emend. Lewis and McCourt 2004[2] Chlorobiota Kenrick and Crane 1997[3] Chloroplastida Adl et al., 2005 [4] Phyta Barkley 1939 emend. Holt & Uidica 2007 Cormophyta Endlicher, 1836 Cormobionta Rothmaler, 1948 Euplanta Barkley, 1949 Telomobionta Takhtajan, 1964 Embryobionta Cronquist et al., 1966 Metaphyta Whittaker, 1969 Plants are mainly multicellular organisms, predominantly photosynthetic eukaryotes of the kingdom Plantae. Historically, plants were treated as one of two kingdoms including all living things that were not animals, and all algae and fungi were treated as plants. However, all current definitions of Plantae exclude the fungi and some algae, as well as the prokaryotes (the archaea and bacteria). By one definition, plants form the clade Viridiplantae (Latin name for "green plants"), a group that includes the flowering plants, conifers and other gymnosperms, ferns and their allies, hornworts, liverworts, mosses, and the green algae, but excludes the red and brown algae. Green plants obtain most of their energy from sunlight via photosynthesis by primary chloroplasts that are derived from endosymbiosis with cyanobacteria. Their chloroplasts contain chlorophylls a and b, which gives them their green color. Some plants are parasitic or mycotrophic and have lost the ability to produce normal amounts of chlorophyll or to photosynthesize, but still have flowers, fruits, and seeds. Plants are characterized by sexual reproduction and alternation of generations, although asexual reproduction is also common. There are about 320,000 species of plants, of which the great majority, some 260–290 thousand, produce seeds.[5] Green plants provide a substantial proportion of the world's molecular oxygen,[6] and are the basis of most of Earth's ecosystems. Plants that produce grain, fruit, and vegetables also form basic human foods and have been domesticated for millennia. Plants have many cultural and other uses, as ornaments, building materials, writing material and, in great variety, they have been the source of medicines and psychoactive drugs. The scientific study of plants is known as botany, a branch of biology. Contents 1 Definition 1.1 Current definitions of Plantae 1.2 Algae 1.3 Fungi 2 Diversity 2.1 Evolution 2.2 Embryophytes 2.3 Fossils 3 Structure, growth, and development 3.1 Factors affecting growth 3.1.1 Effects of freezing 3.2 DNA damage and repair 3.3 Plant cells 4 Physiology 4.1 Photosynthesis 4.2 Immune system 4.3 Internal distribution 5 Genomics 6 Ecology 6.1 Distribution 6.2 Ecological relationships 7 Importance 7.1 Food 7.2 Medicines 7.3 Nonfood products 7.4 Aesthetic uses 7.5 Scientific and cultural uses 7.6 Negative effects 8 See also 9 References 10 Further reading 11 External links Definition All living things were traditionally placed into one of two groups, plants and animals. This classification may date from Aristotle (384 BC – 322 BC), who made the distinction between plants, which generally do not move, and animals, which often are mobile to catch their food. Much later, when Linnaeus (1707–1778) created the basis of the modern system of scientific classification,

these two groups became the kingdoms Vegetabilia (later Metaphyta or Plantae) and Animalia (also called Metazoa). Since then, it has become clear that the plant kingdom as originally defined included several unrelated groups, and the fungi and several groups of algae were removed to new kingdoms. However, these organisms are still often considered plants, particularly in popular contexts.[citation needed] The term "plant" generally implies the possession of the following traits: multicellularity, possession of cell walls containing cellulose, and the ability to carry out photosynthesis with primary chloroplasts.[7][8] Current definitions of Plantae When the name Plantae or plant is applied to a specific group of organisms or taxon, it usually refers to one of four concepts. From least to most inclusive, these four groupings are: Name(s) Scope Description Land plants, also known as Embryophyta Plantae sensu strictissimo Plants in the strictest sense include the liverworts, hornworts, mosses, and vascular plants, as well as fossil plants similar to these surviving groups (e.g., Metaphyta Whittaker, 1969,[9] Plantae Margulis, 1971[10]). Green plants, also known as Viridiplantae, Viridiphyta, Chlorobionta or Chloroplastida Plantae sensu stricto Plants in a strict sense include the green algae, and land plants that emerged within them, including stoneworts. The relationships between plant groups are still being worked out, and the names given to them vary considerably. The clade Viridiplantae encompasses a group of organisms that have cellulose in their cell walls, possess chlorophylls a and b and have plastids bound by only two membranes that are capable of photosynthesis and of storing starch. This clade is the main subject of this article (e.g., Plantae Copeland, 1956[11]). Archaeplastida, also known as Plastida or Primoplantae Plantae sensu lato Plants in a broad sense comprise the green plants listed above plus the red algae (Rhodophyta) and the glaucophyte algae (Glaucophyta) that store Floridean starch outside the plastids, in the cytoplasm. This clade includes all of the organisms that eons ago acquired their primary chloroplasts directly by engulfing cyanobacteria (e.g., Plantae Cavalier-Smith, 1981[12]). Old definitions of plant (obsolete) Plantae sensu amplo Plants in the widest sense refers to older, obsolete classifications that placed diverse algae, fungi or bacteria in Plantae (e.g., Plantae or Vegetabilia Linnaeus,[13] Plantae Haeckel 1866,[14] Metaphyta Haeckel, 1894,[15] Plantae Whittaker, 1969[9]). Another way of looking at the relationships between the different groups that have been called "plants" is through a cladogram, which shows their evolutionary relationships. These are not yet completely settled, but one accepted relationship between the three groups described above is shown below[clarification needed].[16][17][18][19][20][21][22] Those which have been called "plants" are in bold (some minor groups have been omitted). Archaeplastida + cryptista Rhodophyta (red algae) Rhodelphidia (predatorial) Picozoa Glaucophyta (glaucophyte algae) green plants Mesostigmatophyceae Chlorokybophyceae Spirotaenia Chlorophyta Streptophyta Charales (stoneworts) land plants or embryophytes Cryptista groups traditionallycalled green algae The way in which the groups of green algae are combined and named varies considerably between authors. Algae Green algae from Ernst Haeckel's Kunstformen der Natur, 1904. Main article: Algae Algae comprise several different groups of organisms which produce food by photosynthesis and thus have traditionally been included in the plant kingdom. The seaweeds range from large multicellular algae to single-celled organisms and are classified into three groups, the green algae, red algae and brown algae. There is good evidence that the brown algae evolved independently from the others, from non-photosynthetic ancestors that formed endosymbiotic relationships with red algae rather than from cyanobacteria, and they are no longer classified as plants as defined here.[23][24] The Viridiplantae, the green plants – green algae and land plants – form a clade, a group consisting of all the descendants of a common ancestor. With a few exceptions, the green plants have the following features in common; primary chloroplasts derived from cyanobacteria containing chlorophylls a and b, cell walls containing cellulose, and food stores in the form of starch contained within the plastids. They undergo closed mitosis without centrioles, and typically have mitochondria with flat cristae. The chloroplasts of green plants are surrounded by two

membranes, suggesting they originated directly from endosymbiotic cyanobacteria. Two additional groups, the Rhodophyta (red algae) and Glaucophyta (glaucophyte algae), also have primary chloroplasts that appear to be derived directly from endosymbiotic cyanobacteria, although they differ from Viridiplantae in the pigments which are used in photosynthesis and so are different in colour. These groups also differ from green plants in that the storage polysaccharide is floridean starch and is stored in the cytoplasm rather than in the plastids. They appear to have had a common origin with Viridiplantae and the three groups form the clade Archaeplastida, whose name implies that their chloroplasts were derived from a single ancient endosymbiotic event. This is the broadest modern definition of the term 'plant'. In contrast, most other algae (e.g. brown algae/diatoms, haptophytes, dinoflagellates, and euglenids) not only have different pigments but also have chloroplasts with three or four surrounding membranes. They are not close relatives of the Archaeplastida, presumably having acquired chloroplasts separately from ingested or symbiotic green and red algae. They are thus not included in even the broadest modern definition of the plant kingdom, although they were in the past. The green plants or Viridiplantae were traditionally divided into the green algae (including the stoneworts) and the land plants. However, it is now known that the land plants evolved from within a group of green algae, so that the green algae by themselves are a paraphyletic group, i.e. a group that excludes some of the descendants of a common ancestor. Paraphyletic groups are generally avoided in modern classifications, so that in recent treatments the Viridiplantae have been divided into two clades, the Chlorophyta and the Streptophyta (including the land plants and Charophyta).[25][26] The Chlorophyta (a name that has also been used for all green algae) are the sister group to the Charophytes, from which the land plants evolved. There are about 4,300 species,[27] mainly unicellular or multicellular marine organisms such as the sea lettuce, Ulva. The other group within the Viridiplantae are the mainly freshwater or terrestrial Streptophyta, which consists of the land plants together with the Charophyta, itself consisting of several groups of green algae such as the desmids and stoneworts. Streptophyte algae are either unicellular or form multicellular filaments, branched or unbranched.[26] The genus Spirogyra is a filamentous streptophyte alga familiar to many, as it is often used in teaching and is one of the organisms responsible for the algal "scum" on ponds. The freshwater stoneworts strongly resemble land plants and are believed to be their closest relatives.[citation needed] Growing immersed in fresh water, they consist of a central stalk with whorls of branchlets. Fungi Main article: Fungi Linnaeus' original classification placed the fungi within the Plantae, since they were unquestionably neither animals or minerals and these were the only other alternatives. With 19th century developments in microbiology, Ernst Haeckel introduced the new kingdom Protista in addition to Plantae and Animalia, but whether fungi were best placed in the Plantae or should be reclassified as protists remained controversial. In 1969, Robert Whittaker proposed the creation of the kingdom Fungi. Molecular evidence has since shown that the most recent common ancestor (concestor), of the Fungi was probably more similar to that of the Animalia than to that of Plantae or any other kingdom.[28] Whittaker's original reclassification was based on the fundamental difference in nutrition between the Fungi and the Plantae. Unlike plants, which generally gain carbon through photosynthesis, and so are called autotrophs, fungi do not possess chloroplasts and generally obtain carbon by breaking down and absorbing surrounding materials, and so are called heterotrophic saprotrophs. In addition, the substructure of multicellular fungi is different from that of plants, taking the form of many chitinous microscopic strands called hyphae, which may be further subdivided into cells or may form a syncytium containing many eukaryotic nuclei. Fruiting bodies, of which mushrooms are the most familiar example, are the reproductive structures of fungi, and are unlike any structures produced by plants.[citation needed] Diversity The table below shows some species count estimates of different green plant (Viridiplantae) divisions. About 85–90% of all plants are flowering plants. Several projects are currently

attempting to collect all plant species in online databases, e.g. the World Flora Online and World Plants both list about 350,000 species.[29][30] Diversity of living green plant (Viridiplantae) divisions Informal group Division name Common name No. of living species Approximate No. in informal group Green algae Chlorophyta green algae (chlorophytes) 3,800–4,300 [31][32] 8,500 (6,600–10,300) Charophyta green algae (e.g. desmids & stoneworts) 2,800–6,000 [33][34] Bryophytes Marchantiophyta liverworts 6,000–8,000 [35] 19,000 (18,100–20,200) Anthocerotophyta hornworts 100–200 [36] Bryophyta mosses 12,000 [37] Pteridophytes Lycopodiophyta club mosses 1,200 [24] 12,000 (12,200) Pteridophyta ferns, whisk ferns & horsetails 11,000 [24] Seed plants Cycadophyta cycads 160 [38] 260,000 (259,511) Ginkgophyta ginkgo 1 [39] Pinophyta conifers 630 [24] Gnetophyta gnetophytes 70 [24] Magnoliophyta flowering plants 258,650 [40] The naming of plants is governed by the International Code of Nomenclature for algae, fungi, and plants and International Code of Nomenclature for Cultivated Plants (see cultivated plant taxonomy). Evolution Further information: Evolutionary history of plants The evolution of plants has resulted in increasing levels of complexity, from the earliest algal mats, through bryophytes, lycopods, ferns to the complex gymnosperms and angiosperms of today. Plants in all of these groups continue to thrive, especially in the environments in which they evolved. An algal scum formed on the land 1,200 million years ago, but it was not until the Ordovician Period, around 450 million years ago, that land plants appeared.[41] However, new evidence from the study of carbon isotope ratios in Precambrian rocks has suggested that complex photosynthetic plants developed on the earth over 1000 m.y.a.[42] For more than a century it has been assumed that the ancestors of land plants evolved in aquatic environments and then adapted to a life on land, an idea usually credited to botanist Frederick Orpen Bower in his 1908 book The Origin of a Land Flora. A recent alternative view, supported by genetic evidence, is that they evolved from terrestrial single-celled algae,[43] and that even the common ancestor of red and green algae, and the unicellular freshwater algae glaucophytes, originated in a terrestrial environment in freshwater biofilms or microbial mats.[44] Primitive land plants began to diversify in the late Silurian Period, around 420 million years ago, and the results of their diversification are displayed in remarkable detail in an early Devonian fossil assemblage from the Rhynie chert. This chert preserved early plants in cellular detail, petrified in volcanic springs. By the middle of the Devonian Period most of the features recognised in plants today are present, including roots, leaves and secondary wood, and by late Devonian times seeds had evolved.[45] Late Devonian plants had thereby reached a degree of sophistication that allowed them to form forests of tall trees. Evolutionary innovation continued in the Carboniferous and later geological periods and is ongoing today. Most plant groups were relatively unscathed by the Permo-Triassic extinction event, although the structures of communities changed. This may have set the scene for the evolution of flowering plants in the Triassic (~200 million years ago), which exploded in the Cretaceous and Tertiary. The latest major group of plants to evolve were the grasses, which became important in the mid Tertiary, from around 40 million years ago. The grasses, as well as many other groups, evolved new mechanisms of metabolism to survive the low CO_2 and warm, dry conditions of the tropics over the last 10 million years. A 1997 proposed phylogenetic tree of Plantae, after Kenrick and Crane,[46] is as follows, with modification to the Pteridophyta from Smith et al.[47] The Prasinophyceae are a paraphyletic assemblage of early diverging green algal lineages, but are treated as a group outside the Chlorophyta: [48] later authors have not followed this suggestion. Prasinophyceae (micromonads) Streptobionta Embryophytes Stomatophytes Polysporangiates Tracheophytes Eutracheophytes Euphyllophytina Lignophyta Spermatophytes (seed plants) Progymnospermophyta † Pteridophyta Pteridopsida (true ferns) Marattiopsida Equisetopsida (horsetails) Psilotopsida (whisk ferns & adders'-tongues) Cladoxylopsida † Lycophytina Lycopodiophyta Zosterophyllophyta † Rhyniophyta † Aglaophyton † Horneophytopsida † Bryophyta (mosses) Anthocerotophyta (hornworts)

Marchantiophyta (liverworts) Charophyta Chlorophyta Trebouxiophyceae (Pleurastrophyceae) Chlorophyceae Ulvophyceae



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