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Captions for colour figures online

Figure 5.1 Schematic representation of the origin and relationships of multicellular cyanobacteria and macroalgae. Key fossil evidence and estimates of calibrated molecular phylogenies (darker grey boxes), showing the geological time scales by which the green algae (Chlorophyta, Viridiplantae), red seaweeds (Rhodophyta), brown seaweeds (Phaeophyceae) and Glaucophyta arose relative to cyanobacteria are indicated. Note that *Rafatazmia* and *Ramathallus*, putatively regarded as red algal fossils, predate molecular clock estimates of the red algal origin, since the latter typically rely on *Bangiomorpha* as a calibration point so far. Created by the authors after Xiao et al. (1998), Tomitani et al. (2006), Parfrey et al. (2011), Schirrmeister et al. (2013), Bengtson et al. (2017), Del Cortona et al. (2020), Yang et al. (2023) and Choi et al. (2024). ES = Endosymbiosis.

Figure 7.1 Photosynthetic electron transport in organisms with intrinsic light-harvesting complexes. See text for details (created by author).

Figure 7.2 Photosynthetic electron transport in organisms with an extrinsic light-harvesting complex serving Photosystem II. See text of section 7.3 for details (created by author).

Figure 10.2 Schematic summary of the processes involved in osmotic acclimation in algae after hypersaline and hyposaline stress leading to a new steady state. (Figure created by author).

Figure 12.1 Schematic indicating trait allocations in different protist functional types. Developed from Anschütz and Flynn (2020).

Figure 16.1 Wavelength regions of UVAR (green, 315–400 nm), UVBR (blue, 280–315 nm) and UVCR (violet, 100–280 nm) radiation in the standard solar spectrum (black line) and the solar spectrum at the Earth's surface after atmosphere effects (red line). The inset shows the total solar spectrum, with the UVR region highlighted (grey shading). Reproduced from Rodrigues et al. (2016).

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Figure 16.2 Global map showing the average UVR penetration depth (in meters) based on neural network estimates. Reproduced from Vasilkov et al. (2022), MDPI, under the terms of the Creative Commons Attribution License http://creativecommons.org/licenses/by/4.0/.

Figure 16.4 Effects of solar UV radiation on biomolecules, cellular components and physiological responses as well as mitigating strategies and repair mechanisms. Reproduced from Häder et al. (2015) under the Creative Commons Attribution 3.0 Unported License. Copyright © 2014, The Royal Society of Chemistry and Owner Societies.

Figure 16.8 Impact of solar UVR on photosynthetic carbon assimilation. Percent values weighted by UV irradiance and depth of mixing for five cyanobacterial species and natural phytoplankton communities (blue triangles) from five lakes as a function of water column transparency expressed as K_{PAR} (m^{-1}). The effect is expressed as the difference in UVR inhibition under fluctuating radiation within the epilimnion and the integrated UVR inhibition calculated from static samples under three fixed irradiance levels. The shaded areas around the regression lines represent 95% confidence interval; the shaded areas at the bottom of each panel represents lower photosynthetic inhibition under mixed, as opposed to static conditions. Taken from Helbling et al. (2015a) with permission under the terms of the Creative Commons CC BY license.

Figure 16.9 Overview of the major positive and negative feedback mechanisms of climate change signals and how they affect UVR stress in algae, as discussed in the text. Red arrows indicate decreases, green arrows indicate increases. Yellow boxes express primary, orange boxes secondary climate change signals.

Figure 17.4 Changes in nutrient status in Esthwaite Water UK. (A) Fluxes of geochemical phosphorus and diatom-inferred total phosphorus concentration (Dong 2010, with permission). (B) Observed changes in nutrient concentration and phytoplankton chlorophyll *a*. The lines show a five-year moving average to make trends clearer.

Figure 17.5 Global and continental changes in human populations and agricultural fertiliser use. (A) Size of human population. (B) Percent of human population that is urban. (C)

Nitrogen fertiliser use. (D) Phosphorus fertiliser use. (E) Use per person of nitrogen fertiliser. (F) Use per person of phosphorus fertiliser. In F, data for Oceania are shown on the right-hand axis for clarity. Data derived from the FAO on 28/2/2023: www.fao.org/faostat/en/#data under Creative Commons.

Figure 17.6 Cascades of major ecological consequences resulting from nutrient enrichment in aquatic environments. Red shaded boxes and font denote an increase and blue shaded boxes and font denote a decrease in the variable. Notes are indicated by numbers: 1, Smith et al. 2006; 2, Maberly et al. 2016; 3, Molinari et al. 2021; 4, Carey 2023; 5, Kirk 2010; 6, Smith et al. 2018; 7, Jones et al. 2005; 8, Kirk 2010; 9, Jankowski et al. 2006; 10, Woolway et al. 2016; 11, Kim et al. 2019; 12, Carey et al. 2022; 13, Salmaso 2010; 14, Sand-Jensen and Sondergaard 1981; 15, Smetacek and Zingone 2013; 16, Zhang et al. 2017; 17, Sand-Jensen 1977; 18, Fabricius 2005; 19, Jeppesen et al. 2000; 20, Wang et al. 2007; 21, Jeppesen et al. 2006; 22, Scheffer et al. 1993; 23, Thronson and Quigg 2008; 24 Anderson et al. 2002; Harke et al. 2016; 25, Carpenter et al. 1998. Figure created by author.