Biological Pigments



* Coloured compounds produced in living organisms
* Generally have extensive systems of alternating \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ carbon-carbon bonds

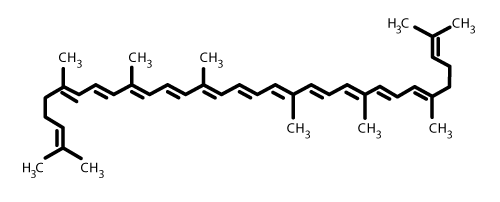


* Overlapping \_\_\_ electron clouds result in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ electrons (conjugation)

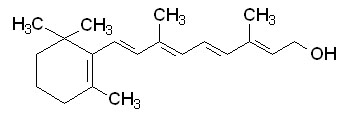


* Larger conjugated systems typically absorb light of lower energy (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ wavelength)

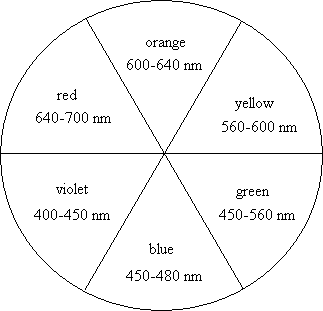


Examples:











* Colour we see is complementary (across the colour wheel) from the wavelength of light the pigment absorbs.



* Carotenes such as retinol and lycopene are fat soluble. Why might you expect this?



* Carotenes also play a role as anti-oxidants in living organisms



Porphyrins



* Complexes of metal ions with cyclic ligands



* Porphin – contains four nitrogen atoms in a conjugated heterocycle
* Nitrogen atoms in porphyrin bind to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ions, forming very stable chelate complexes.



* Iron complexes of porphyrins = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



* + Examples:



Hemoglobin

* Main oxygen transport protein in higher animals
* Made up of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ subunits



* Each subunit binds \_\_\_\_\_\_\_\_\_\_\_\_\_\_ oxygen molecule

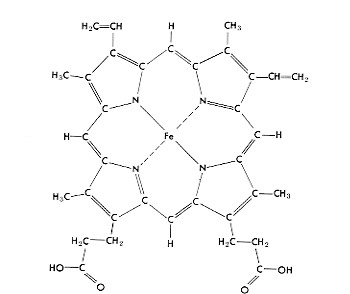
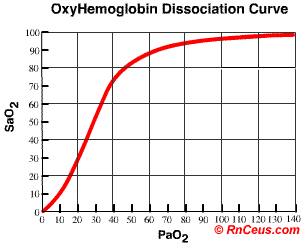


* Cooperative binding

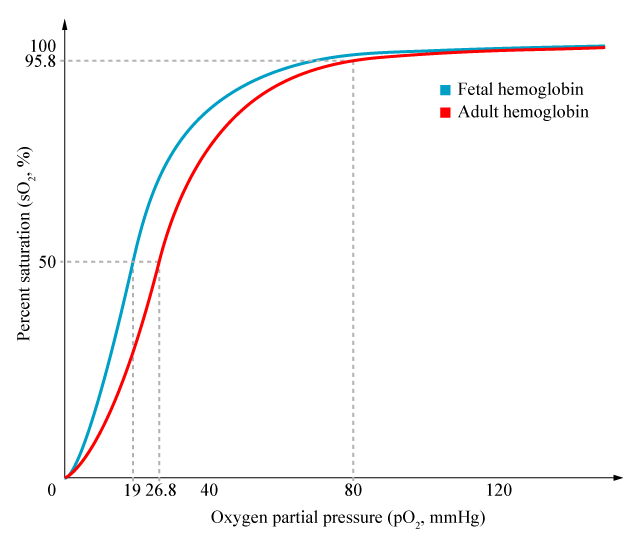


* + According to induced fit model, binding of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to deoxygenated heme changes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_of the whole molecule, thus increasing \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the molecule for oxygen



* 







* Carbon monoxide is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ inhibitor.



* + Why?



* + Predict the shape of the saturation curve in the presence of carbon monoxide.



Cytochromes –enzymes containing heme groups



* During redox reactions, iron ions in the heme groups convert back and forth between their \_\_\_\_ and \_\_\_\_\_\_\_ oxidation state (for example cellular repiration)



* Energy from cellular respiration is stored as ATP

**Chlorophyll**





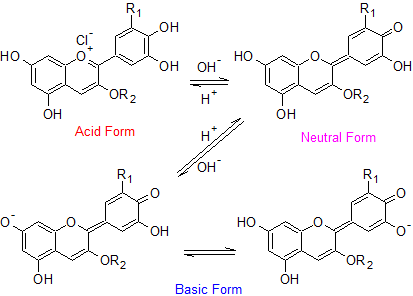
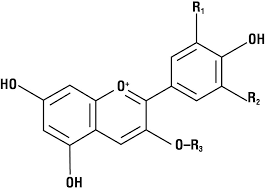
* Absorbs light energy in the visible region of the UV spectrum



* Ultimately, energy is passed through a series of intermediates in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ transport chain and results in the oxidation of water to oxygen and protons



* Protons produced are used in the synthesis of ATP
* Chlorophyll absorbs in the blue and red regions of the spectrum

**Anthocyanins**

