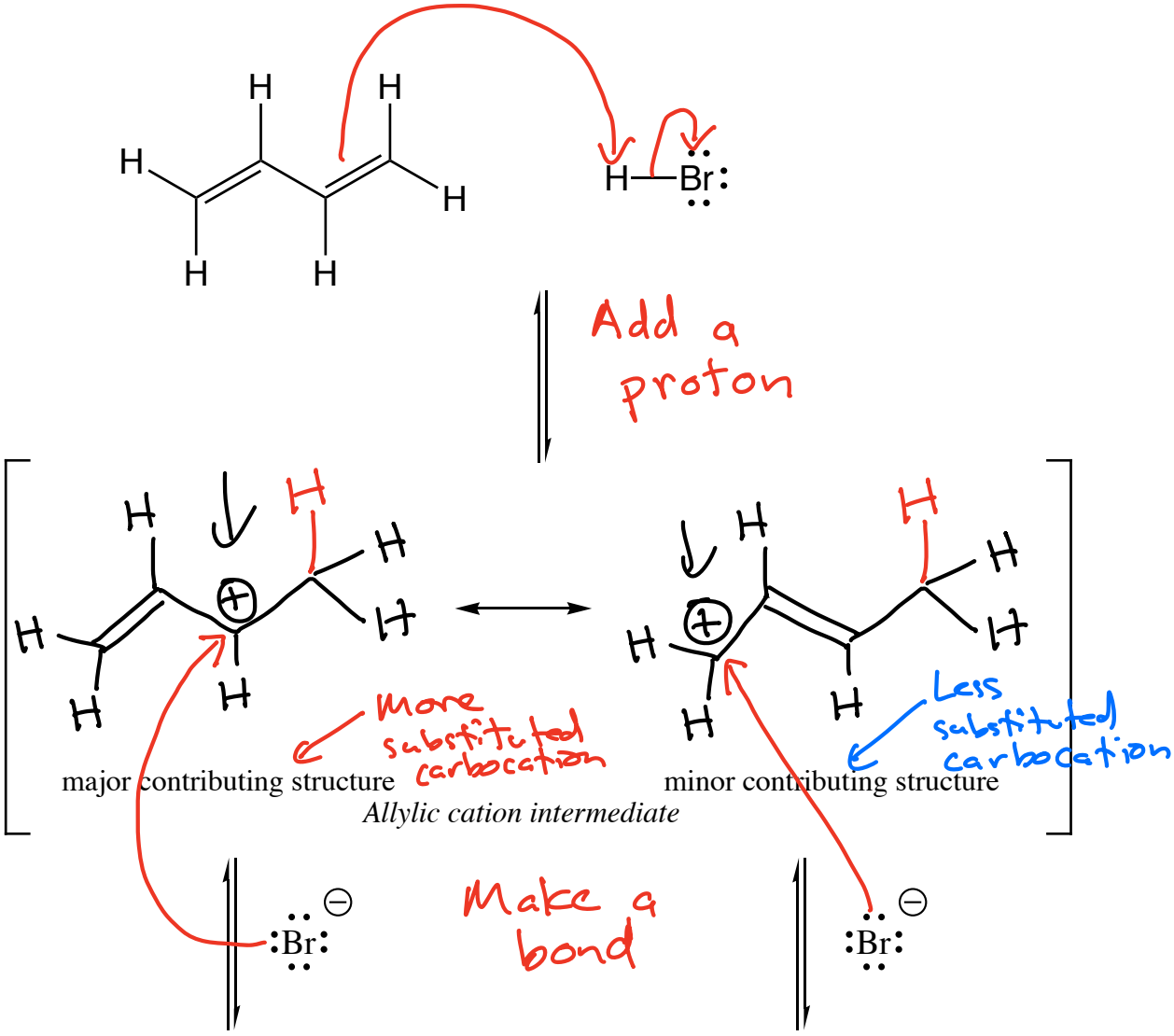
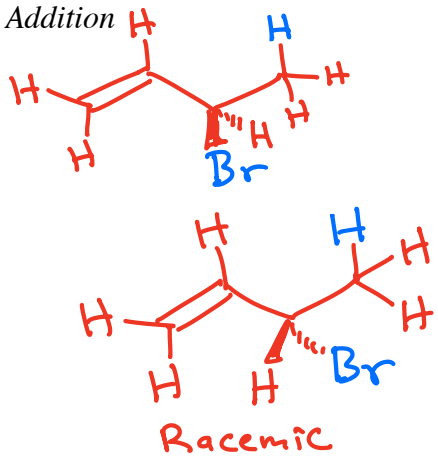
H-X reacting with conjugated dienes

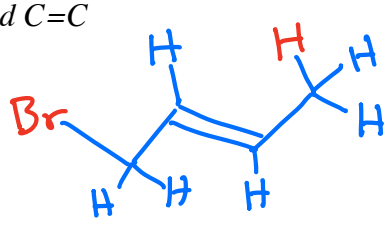


1,2 Addition



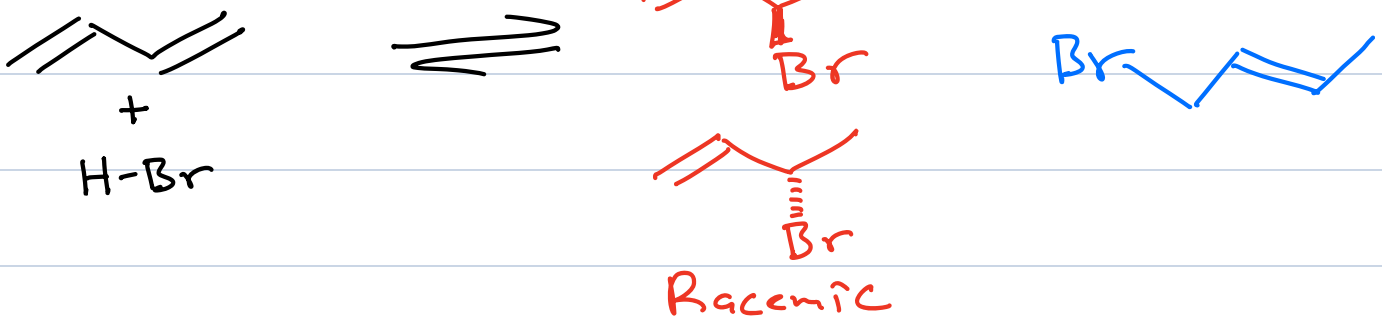
Products

1,4 Addition - more stable, more highly substituted C=C



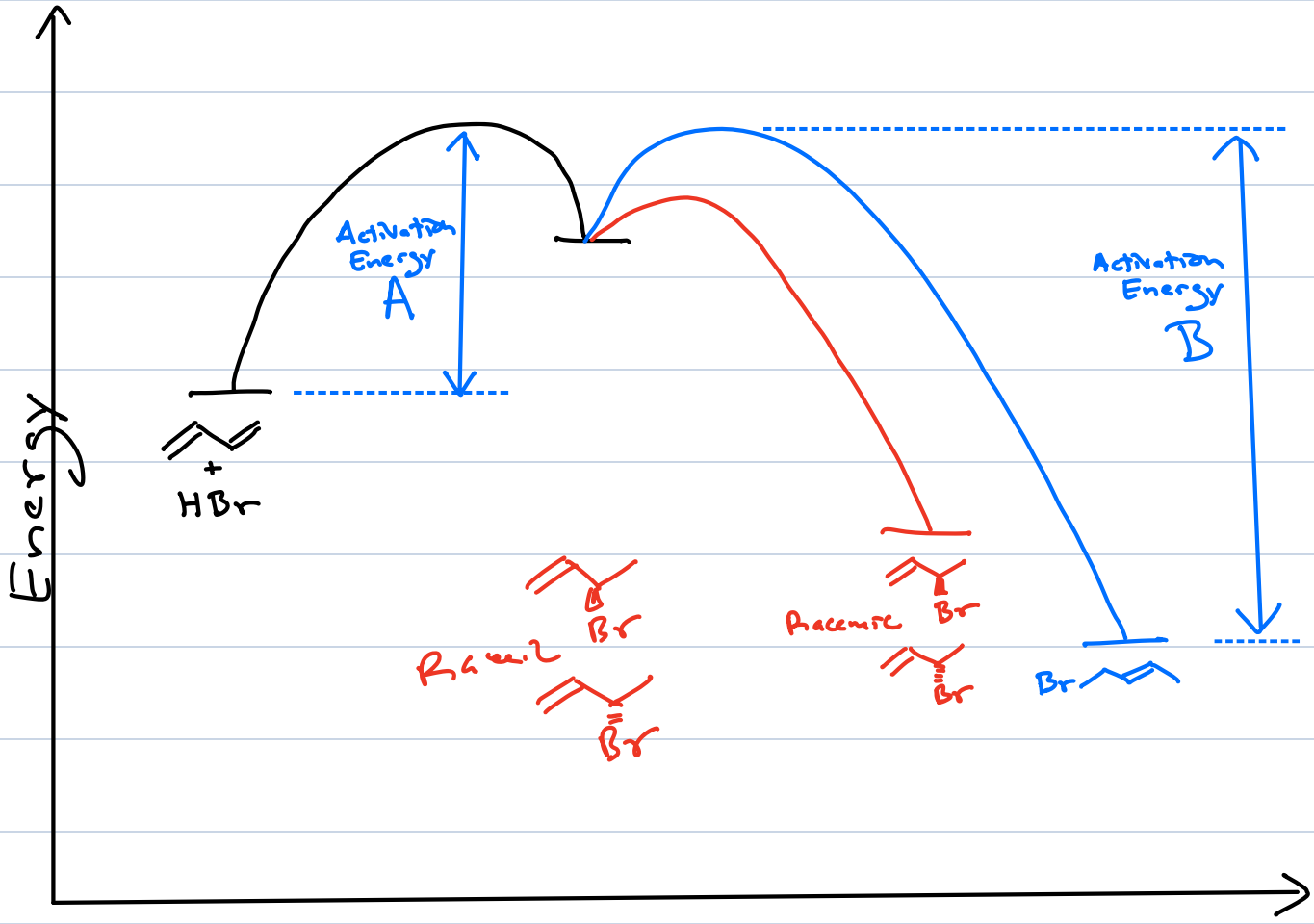
Products

1,2 addition 1,4 addition



Racemic

Temperature of Reaction		
-78°C	90%	10%
+40°C	15%	85%



Low temperature → Molecules have enough energy to get over activation energy A, but not enough energy to get over activation energy B.

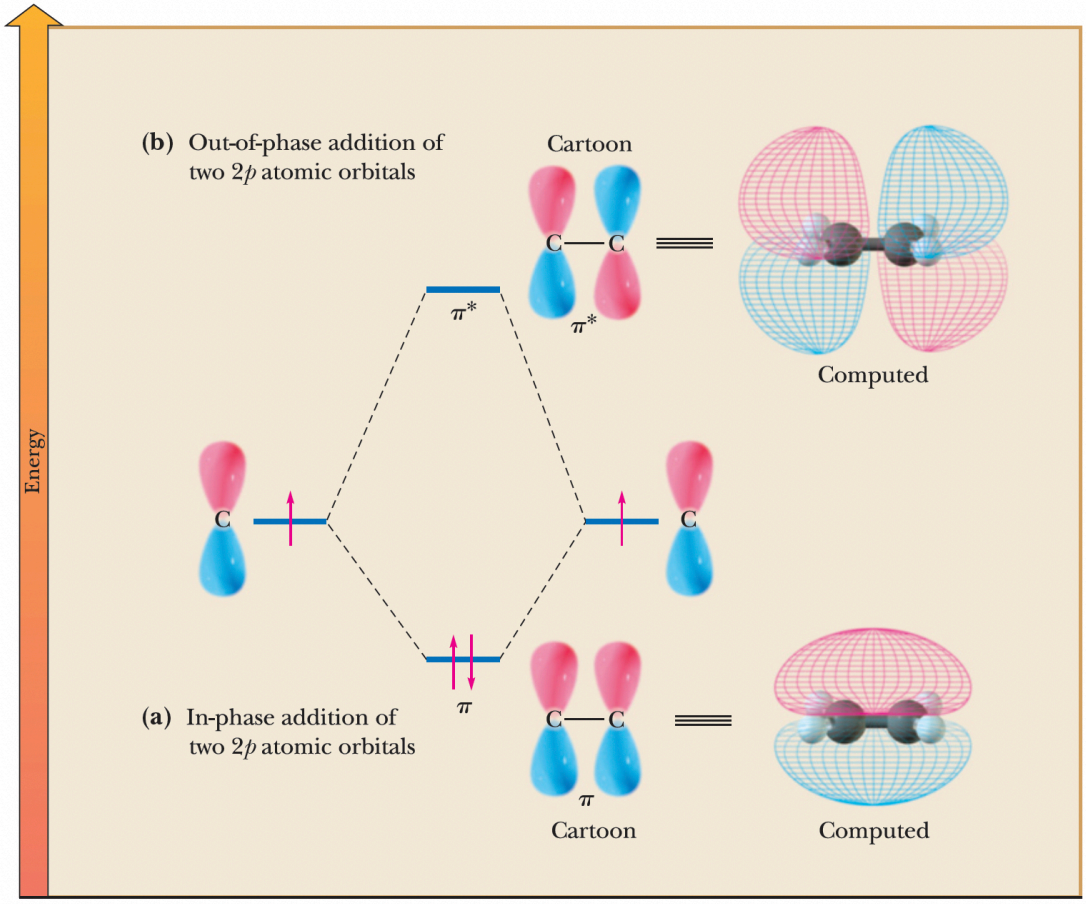
Kinetic Control

"Fastest" wins

High temperature → Molecules have enough energy to get over activation energy A and activation energy B

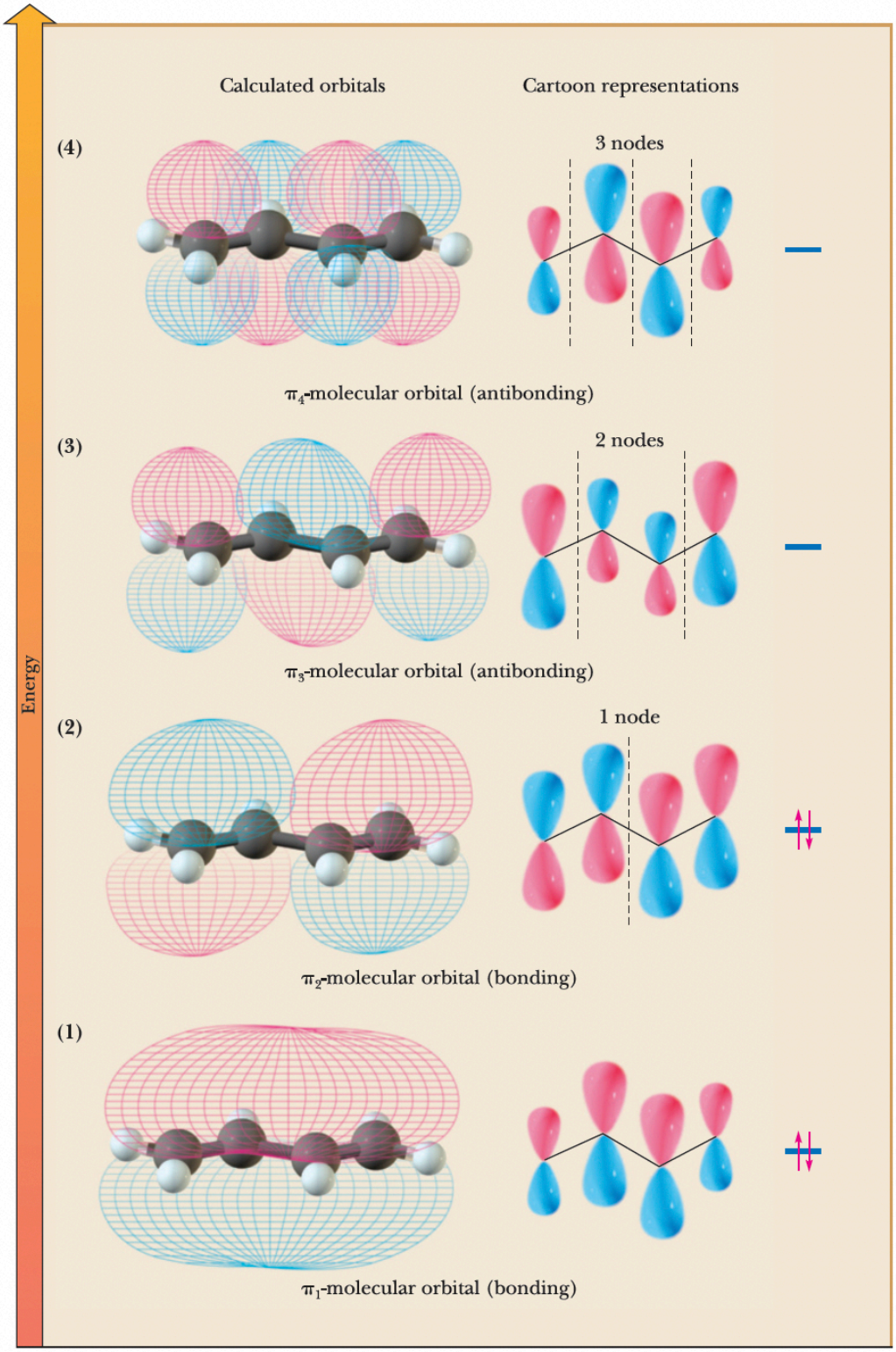
Thermodynamic Control

Most stable product wins



Watch a video explanation

FIGURE 1.21
Molecular orbital mixing diagram for the creation of any C—C π bond. (a) Addition of two p atomic orbitals in phase leads to a π orbital that is lower in energy than the two separate starting orbitals. When populated with two electrons, the π orbital gives a π bond. (b) Addition of the p orbitals in an out-of-phase manner (meaning a reversal of phasing in one of the starting orbitals) leads to a π^* orbital. Population of this orbital with one or two electrons leads to weakening or cleavage of the π bond, respectively.



Watch a video explanation

FIGURE 20.2 Structure of 1,3-butadiene—molecular orbital model. Combination of four parallel 2*p* atomic orbitals gives two π-bonding MOs and two π-antibonding MOs. In the ground state, each π-bonding MO is filled with two spin-paired electrons. The π-antibonding MOs are unoccupied.

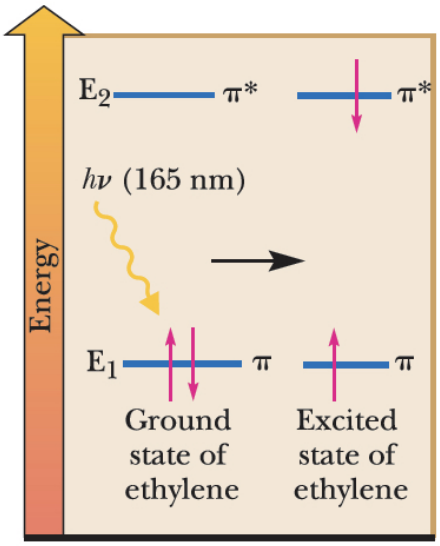


FIGURE 20.6 A $\pi \rightarrow \pi^*$ transition in excitation of ethylene. Absorption of ultraviolet radiation causes a transition of an electron from a π-bonding MO in the ground state to a π-antibonding MO in the excited state. There is no change in electron spin.

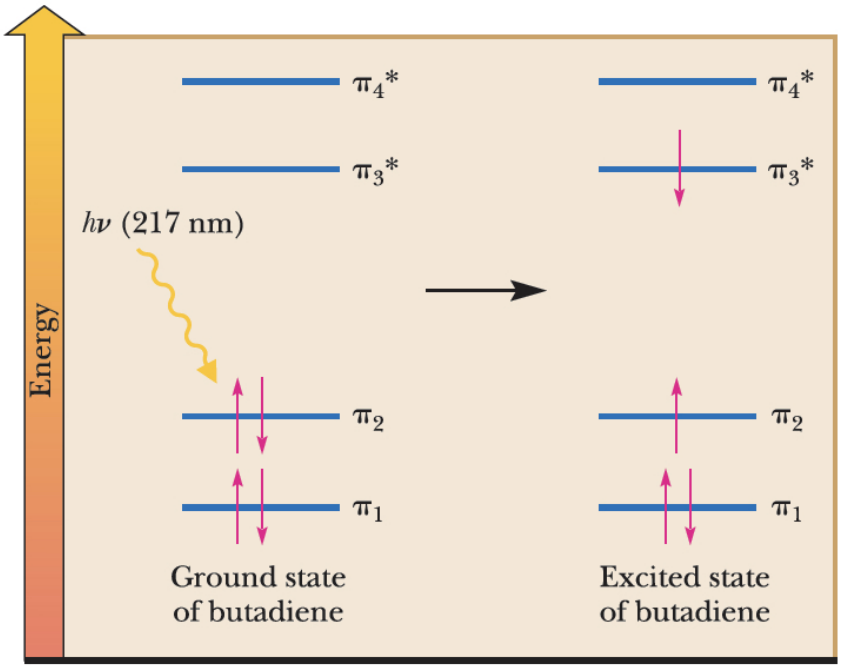


FIGURE 20.7 Electronic excitation of 1,3-butadiene; a $\pi \rightarrow \pi^*$ transition.

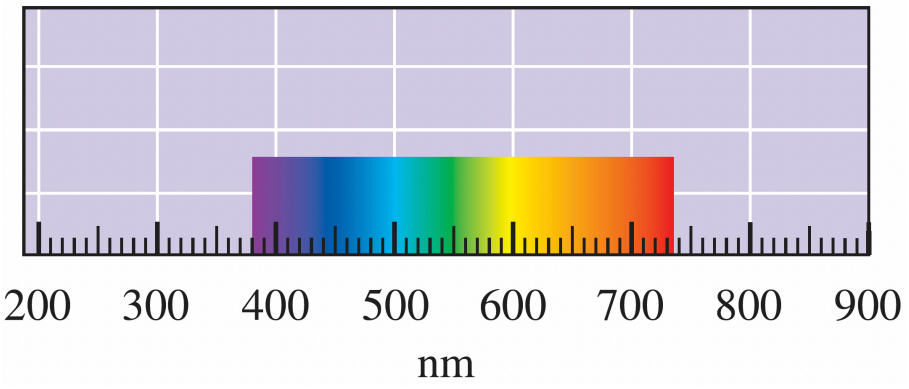
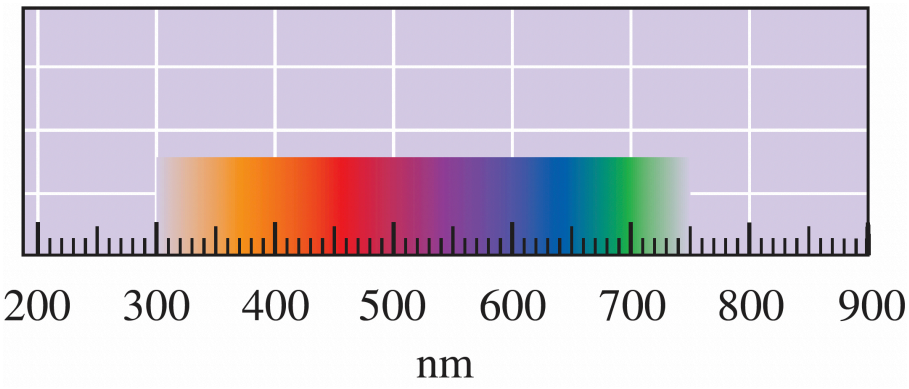
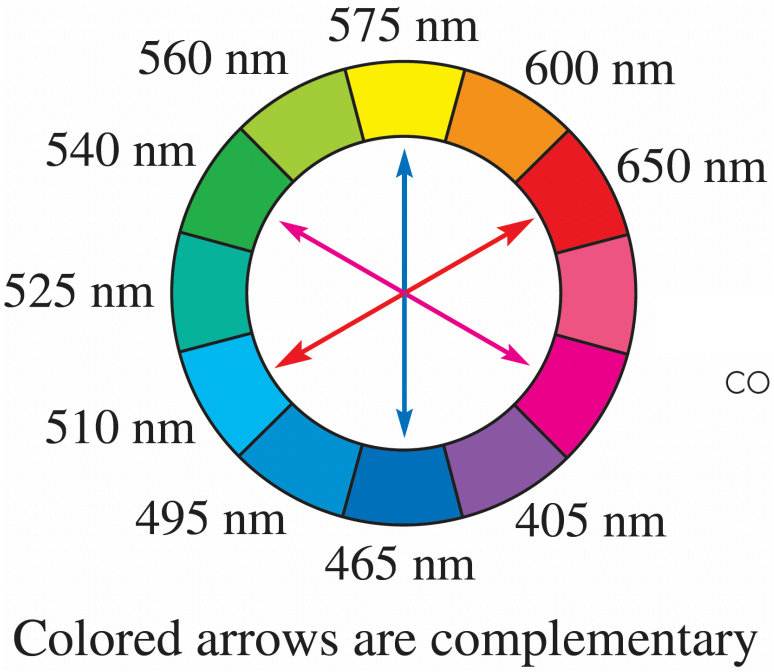


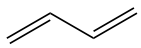
FIGURE 20.5 (a) Visible light color-wavelength correlation.



(b) Approximate color of substance (reflected light) if a single wavelength (i.e., the wavelength listed on the numerical scale of the *x*-axis) is absorbed.

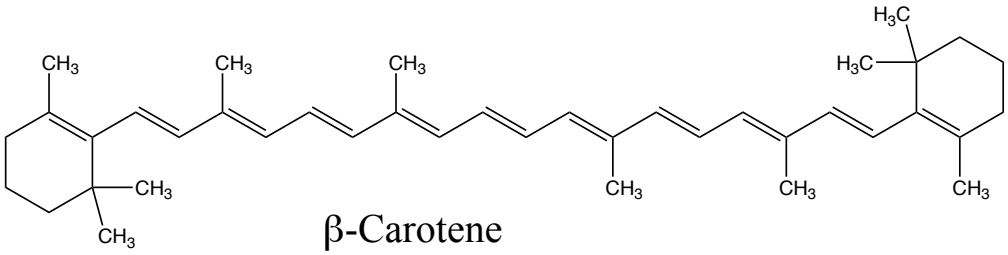


(c) Complementary colors on a color wheel.



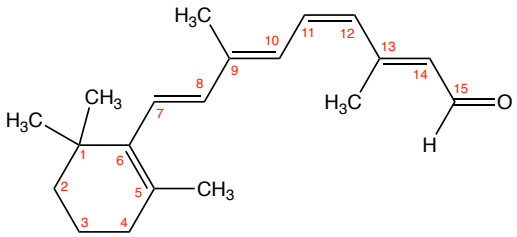
Butadiene

λ_{max} = 217 nm



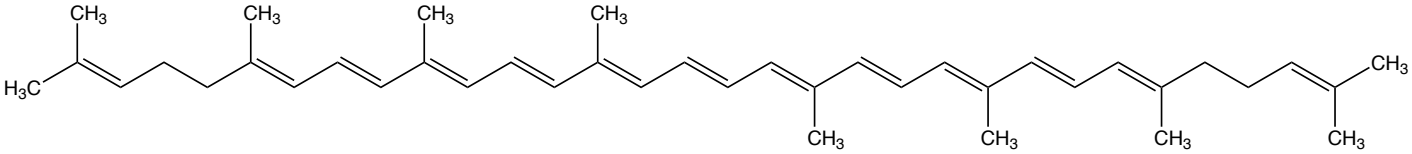
β-Carotene

λ_{max} = 455 nm, 483 nm



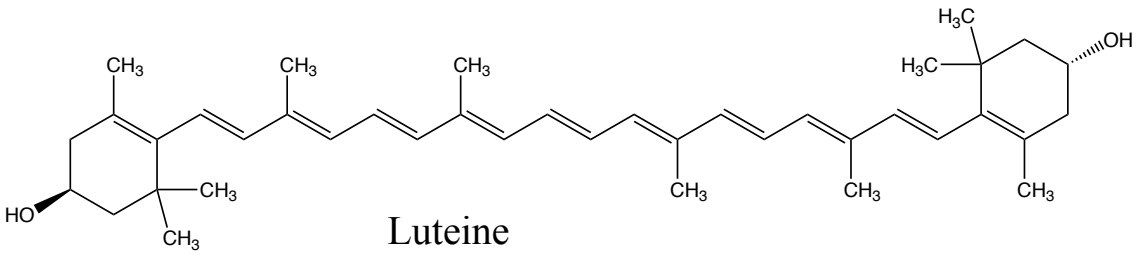
11-*cis*-Retinal

λ_{max} = 380 nm



Lycopene

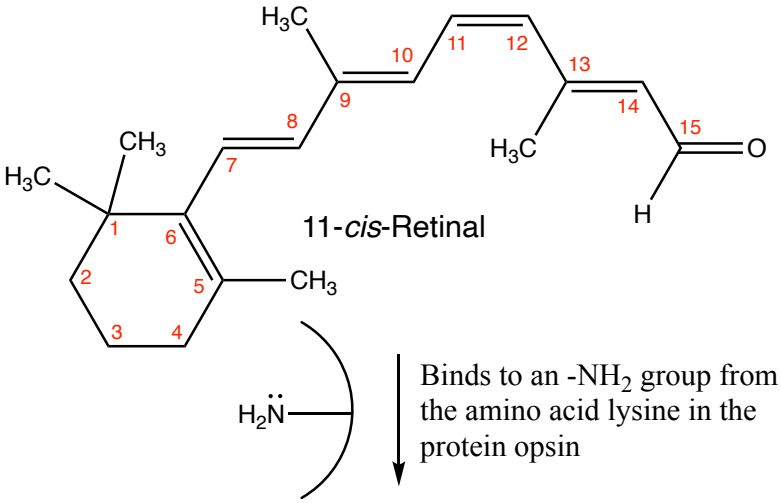
λ_{max} = 443 nm, 471 nm, 502 nm



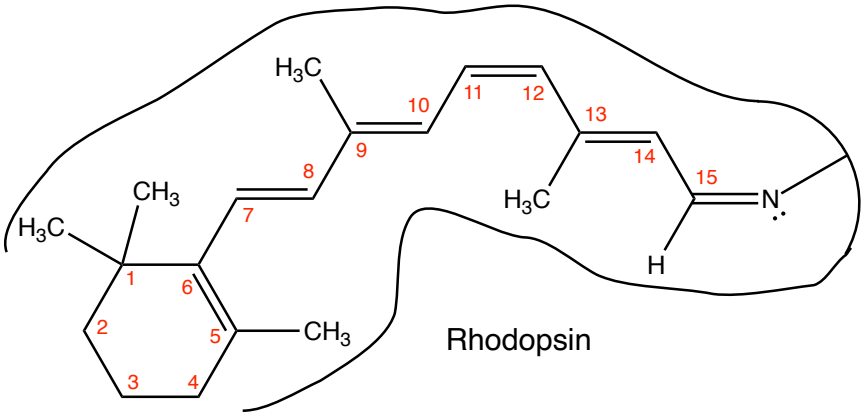
Luteine

λ_{max} = 445 nm, 474 nm

How vision works

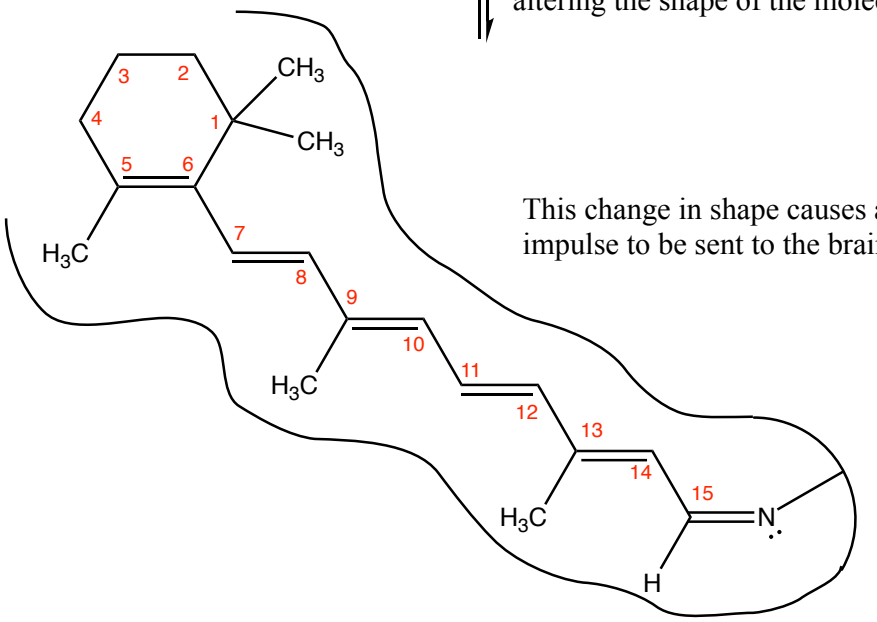


Binds to an -NH_2 group from the amino acid lysine in the protein opsin



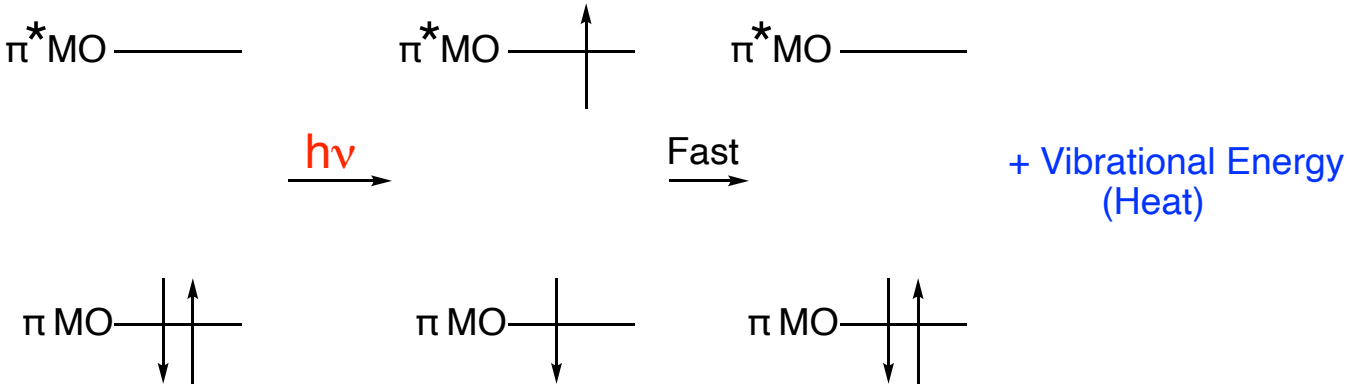
Molecule resets

A photon of visible light is absorbed by the retinal, isomerizing the *cis* bond to *trans*, dramatically altering the shape of the molecule

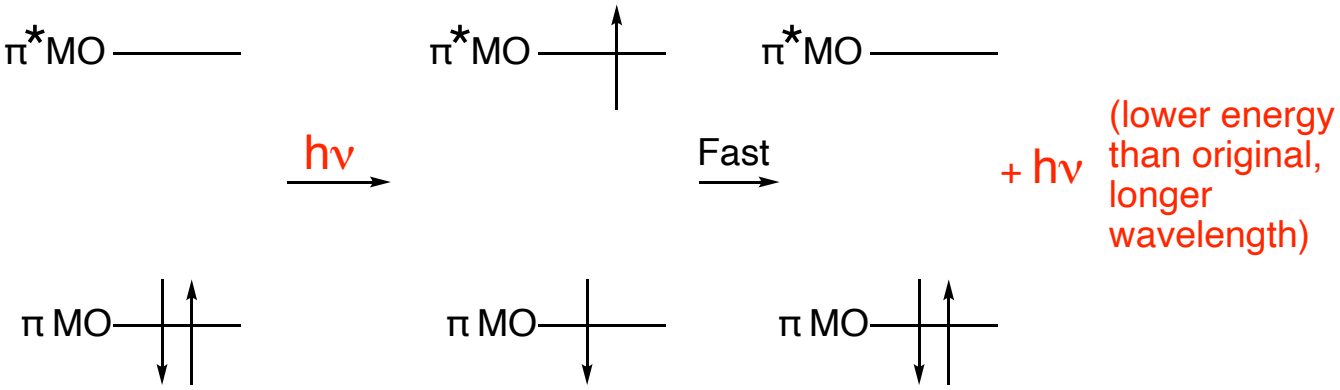


This change in shape causes a nerve impulse to be sent to the brain

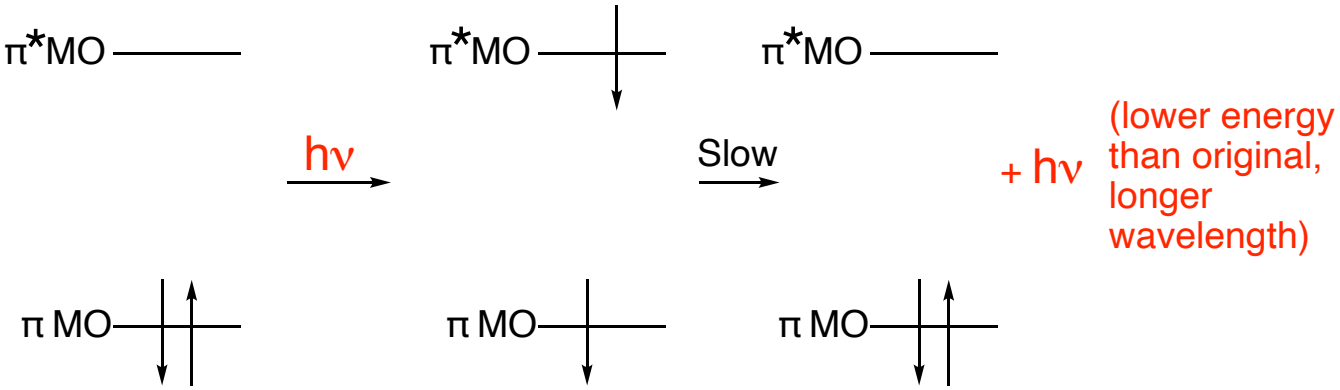
Generation of heat, Most molecules



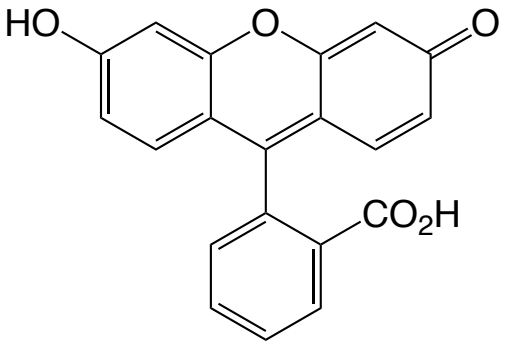
Flourescence - Rigid Molecules, Not uncommon



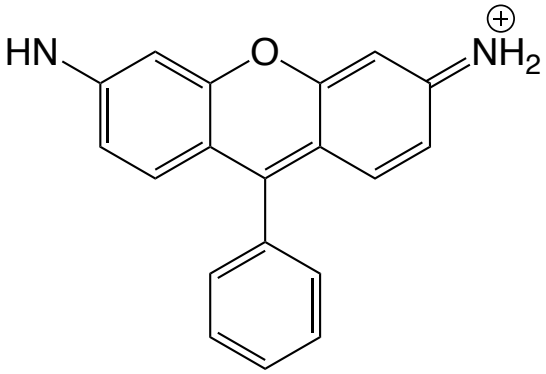
Phosphorescence - “Glow in the Dark”, Rare



Flourescence - Rigid Molecules, Not uncommon

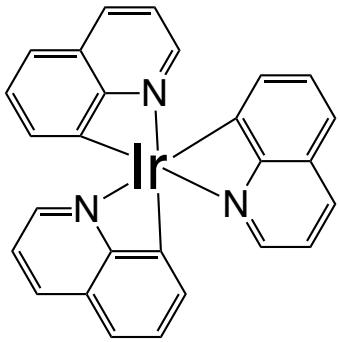


Fluorescein

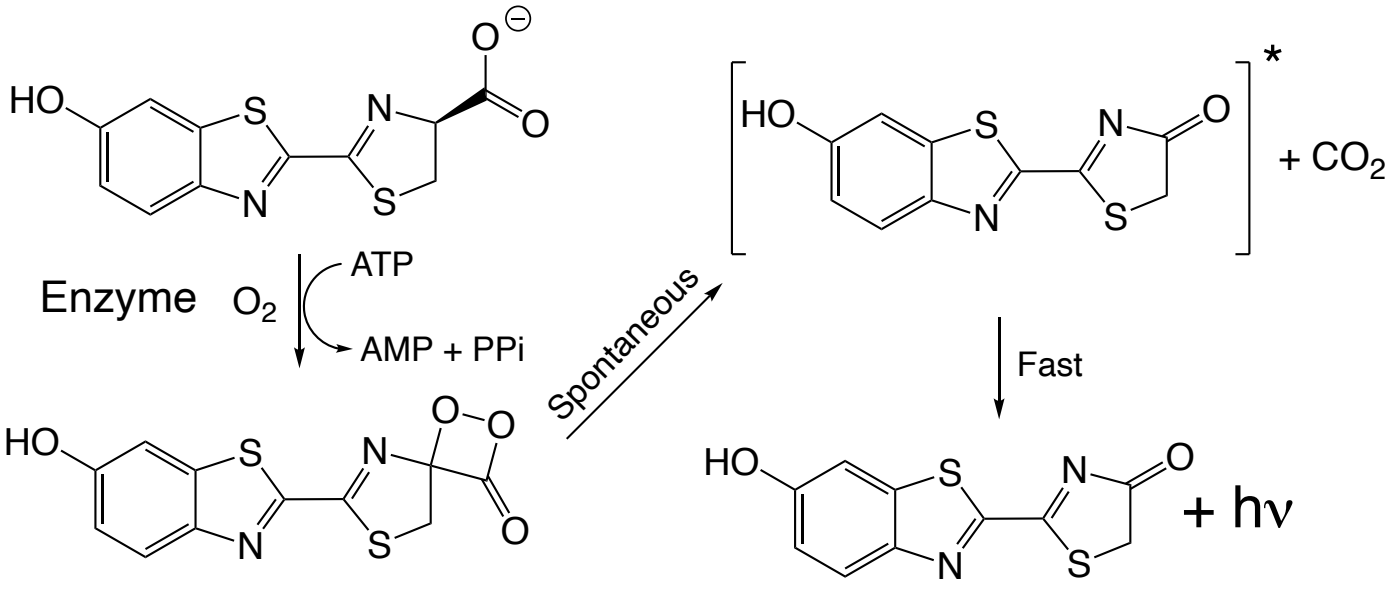


Rhodamine

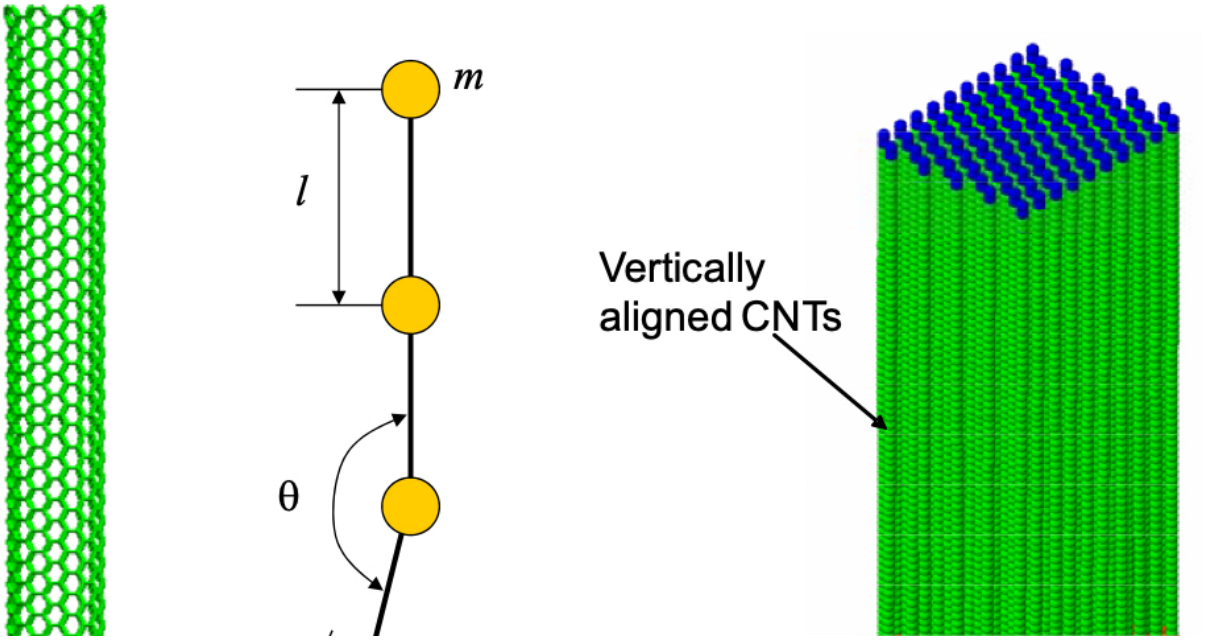
Phosphorescence - "Glow in the Dark", Rare

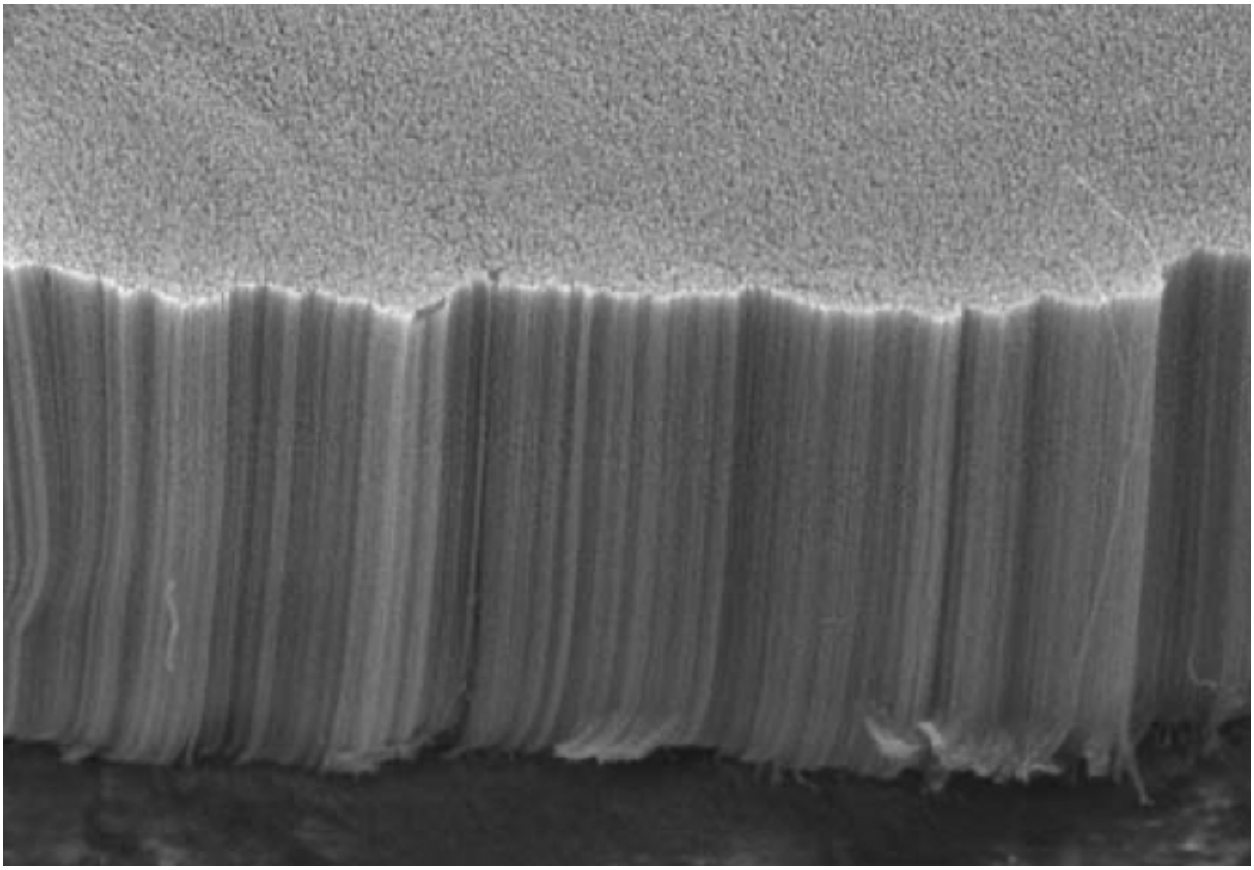


Bioluminescence - Fireflies, Deep Sea Creatures - Chemical Reactions



http://photobiology.info/Branchini2.html





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