Ostracod grazing edge in Hunter’s Hot Springs

Ostracods grazing on *Pleurocapsa*
Ostracods on *Pleurocapsa*

- Orange colored eggs of ostracods
The effects of high light and UV radiation on cyanobacteria in hot springs and elsewhere

• High solar radiation (and especially UV) can cause severe inhibition of photosynthesis and growth, in addition to direct damage of DNA.

• To prevent undo damage, carotenoid to chlorophyll ratios increase dramatically. Carotenoids quench (neutralize) damaging, reactive oxygen molecules [e.g. \(^1\text{O}_2\) (singlet), peroxides, \(\cdot\text{OH}\) (hydroxyl radical)] that result from reception of more light than can be processed photosynthetically and from UV radiation.

• In addition, cyanobacteria have efficient DNA repair mechanisms, and rapid protein resynthesis abilities.

• Low light (e.g. winter light), however, allows cyanobacterial chlorophyll and phycobilin light-harvesting pigments to increase relative to carotenoids; thus, allowing the cells to capture more of the low flux of photons.
Octopus Spring, YNP

90°C
SUMMER

High carot./low chl
HTF Synechococcus

Octopus Spring, YNP
WINTER

Low carot/high chl
HTF Synechococcus

Octopus Spring
A low light condition can be attained in summer by using filters that transmit \( \sim 18\% \) light.
Cells can be harvested by syringe for experiments
Cells from shade are inhibited by high light; cells from sun are not, except at 100% full solar radiation (~ 800-1000 Wm$^{-2}$).
Alkaline hot springs in North America usually have two or more species of phototrophs below 70°C.

- *Synechococcus* sp. (a cyanobacterium) is the highest temperature (to 74°C in N. America) photoautotroph (light for energy, CO₂ for cell carbon), but below 70°C there are other phototrophs.

- *Chloroflexus* & *Roseiflexus* are photoheterotrophs (C. up to 68-70°C), using light for energy, but organic carbon for cell building. This carbon may come directly from *Synechococcus* spp. (above ~64°C) or other cyanobacteria at lower temperatures.
*Synechococcus* (S) and *Chloroflexus* (C) in co-culture
Octopus Spring, YNP, 55°C, pH 8

Photo from Ward et al. (1989) Microbial Mats, Chapt. 1, pp. 3-15.
PE = phycoerythrin (in some cyanobact.)
PC = phycocyanin (in all cyanos)
Ca = chlorophyll $a$ (in all cyanos)
Bc = bacteriochlorophyll $c$
Ba = bacteriochlorophyll $a$

Complementary absorption by Synechococcus & Chloroflexus in this spectral region
The real situation in the mat at 55°C (Octopus Spring) during midday (Chloroflexus rate not measured--since it does not produce O₂)

Triple micro-electrodes in piece of hot spring mat (sulfide, $O_2$ & pH)