

## HOW PURPLE WAS MY VALLEY?

**Purple life may once have covered the globe, before green plants won a primeval struggle for world domination.**

Ah, autumn in the country. The sky a deep blue, the leaves a bright gold, the grass a rich purple. Purple? Well, not in the world as we know it. But if things had evolved just a bit differently, the lavender lawn may have been perfectly commonplace.

Andrew Goldsworthy, a biologist at the Imperial College in London, recently began investigating why the chlorophyll that gives plants their color evolved in green and not some other shade. The answer, he already knew, wasn't in some life-giving property of greenness. Chlorophyll absorbs red and blue light and uses it to produce energy; the green is reflected away, giving plants their color. What stumped him was why plants would choose red and blue— colors from the edges of the visible spectrum—while ignoring the easier-to-target green in the middle.

The biologist thinks he has found a clue in the obscure bacterium *Halobacterium halobium*. What makes the organism unusual is that

Chlorophyll Over time, Goldsworthy believes green plants developed the ability to live without the steady supply of organic food their purple predecessors depended on; eventually the green upstarts became dominant.

Goldsworthy thinks his findings can lead to a whole raft of new evolutionary ideas. Since purple organisms evolved so early, their legacy could extend to countless forms of present-day life. It's already known that many green plants contain chemicals similar to bacteriorhodopsin called carotenoids, which give carrots and tomatoes their color. And even we may be evolutionary heirs of *H. halobium*: we can see be-cause our eyes use a chemical very similar to bacteriorhodopsin to detect light.

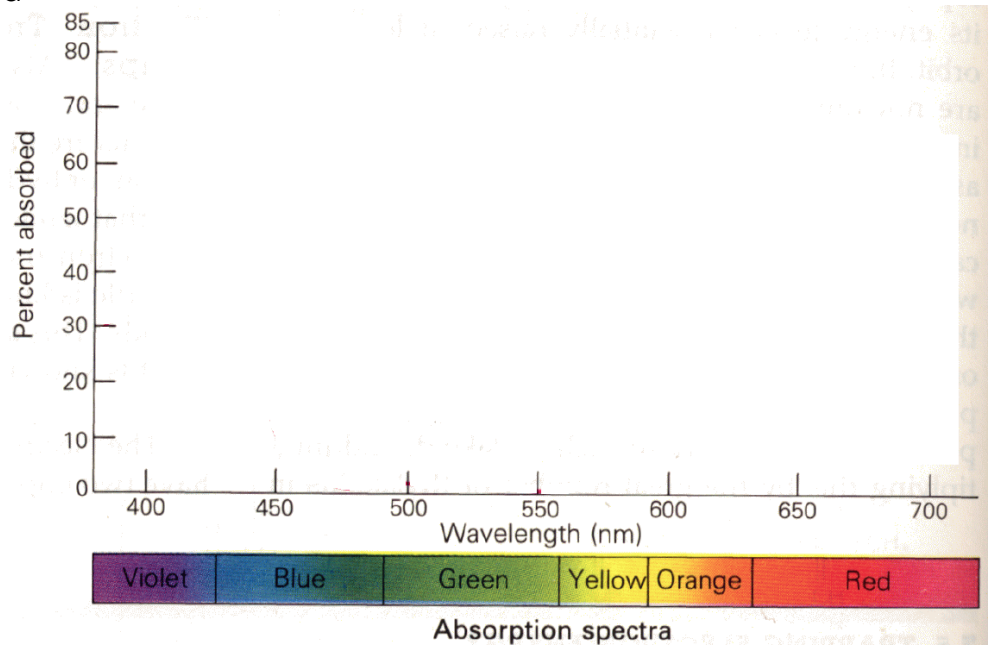
**What colors are absorbed by chlorophyll a?** \_\_\_\_\_  
**chlorophyll b?** \_\_\_\_\_

although, like a plant, it makes energy from light, it contains no chlorophyll. Rather, *H. halobium* uses a chemical called bacteriorhodopsin that feeds on green light and reflects away blues and reds. This phenomenon gives the bacterium a distinct purple complexion

Goldsworthy hypothesizes that long before green plants evolved, organisms like *H. halobium* may have ruled the world. When plants as we know them did arrive on the primitive, watery Earth, they had to get their start with the red and blue light that filtered through the life floating above them. Since bacteriorhodopsin couldn't absorb these colors, the new life-forms needed a new chemical. It was then they evolved.

**Make a line graph of the data below. Use one color for Chlorophyll a and one color for Chlorophyll b.**

Chlorophyll a	Wavelength	Chlorophyll b
55	400	0
70	425	15
10	450	35
5	475	85
5	500	10
7	525	10
0	550	12
8	575	12
10	600	10
15	625	9
10	650	30
50	675	10
49	680	0
45	690	0



## CHLOROPHYLL A AND WATER CLARITY

Excess algae growth is one of the main culprits of poor water quality in lakes and ponds. To monitor algae levels, scientists measure the amount of chlorophyll in the water column. Too much chlorophyll means poor water quality.

Chlorophyll is the pigment that allows plants—including algae—to convert sunlight into organic compounds in the process of photosynthesis. Chlorophyll a is the predominant type found in algae and cyanobacteria (blue-green algae), and its abundance is a good indicator of the amount of algae present in the water.

Excessive quantities of chlorophyll a can indicate the presence of algae blooms. These usually consist of a single species of algae, typically a species undesirable for fish and other predators to consume. Unconsumed algae sink to the bottom and decay, using up the oxygen required by other plants and benthic organisms to survive. The presence of too many nutrients, such as nitrogen and phosphorus, can stimulate algal blooms and result in reduced water clarity.

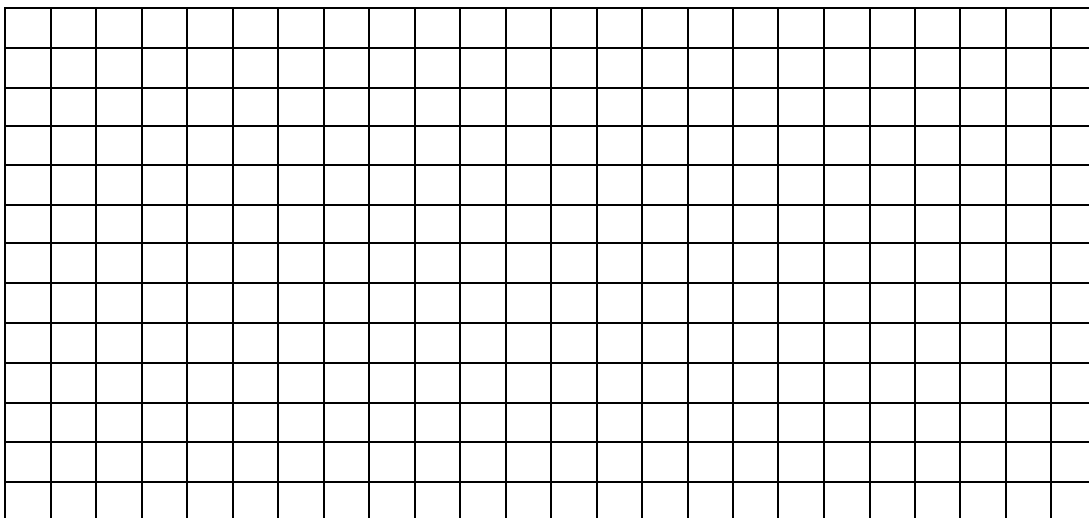
Chlorophyll a also plays a direct role in reducing the amount of light available to plants in shallow-water habitats. This directly impacts the ability of underwater bay grasses to thrive. Like their terrestrial cousins, grasses need sunlight to grow. As chlorophyll a levels increase, the amount of sunlight reaching underwater grasses declines.

Underwater grasses commonly referred to as submerged aquatic vegetation (SAV), needs sunlight to survive, albeit less than its terrestrial counterparts. The criteria would apply to depths up to two meters. Areas where SAV never occurred or where natural factors, such as currents and wave action, prevent its growth would be excluded.

In low salinity water, 13% of the light that hits the water surface must reach the underwater plants. In high salinity water, 22% of the light that hits the water surface must reach the underwater plants.

**From the data below create a graph**

% clarity	# of cells/ml
100	200
80	400
60	600
40	800
20	1000
0	1200



**What is the % clarity when the chlorophyll a count is 755? 350? And 535?**