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The Photoblepharon palebrautes has light the shines from the pockets under their eyes, using this light as if it were headlights (BIOLUMINESCENCE). This fish harbors the bioluminescent bacteria in their body in highly concentrated areas, the pockets under their eyes, and this high density will cause the bacteria to light up. Angler fish use the light for hunting by luring other fish to see where the light is coming from, then attacks and eats its prey. Bioluminescence is also used to facilitate mating in the firefly, fish, and click beetle of Venezuela. Brittle stars of the Caribbean and the polynoid worm will use its light-producing abilities in order to draw attention away from itself so it will not be eaten by its predator. By using the piece of its body that was bitten off by a crab or other predator, this piece will begin to glow, or flash as for the brittle star, and draw attention away from the worm or brittle star as it runs away for safety. This wonder of nature, the ability to produce light is all due to a simple chemical reaction.  A bioluminescent organism will use ATP (adenosine triphosphate), oxygen, luciferin, and luciferase in order to produce light. Luciferin is the chemical that produces light when oxygen and the catalyst, luciferase, is added to yield oxyluctiferin, the light. In order to continue the cycle, energy, in the form of ATP, must be added to cause oxygen and luciferin to bind. For the organism to obtain luciferin to bioluminesce, it acquires it through digesting it or synthesizing it (DETECTING). Either way, for an organism to light up, it must have luciferin. When the reaction takes place, the result is called "cold light" (BIOLUMINESCENCE) because it is produced with very little heat radiation.  **Pollution in our Modern World**  Modern technology has brought about a rise in the pollution of our natural environment.  Fortunately, we are getting smarter about realizing when we are posing too great a threat to ourselves and the ecology of our world.  We know now that it is important to obtain tools with which we can quickly and accurately assess and monitor our effect on our environment. (Naval Command, Control and Ocean Surveillance Center, San Diego)  **Bioassays -- Can Bioluminescence Be Used to Measure Pollution?**  Bioassays are biological organisms which may be used as gauges, in our case for pollution.  Recent studies have shown that the light output of certain light-producing (bioluminescent) organisms may be used to measure the level of pollutants in certain media.  This idea is a relatively new one.  All of the studies we managed to find involving the usage of bioluminescent organisms to gauge pollution have been conducted within the last decade.  The earliest of these that we could find was carried out in 1993 by a group of scientists at Philadelphia College of Pharmacy and Science led by Kenneth W. Thomulka, David J. McGee, and John H. Lange.  They determined that the light output of the bioluminescent bacteria Vibrio harveyi and Photobacterium phosphoreum varied in response to the presence of certain biohazardous materials.  This was done by adding certain materials to grown bacteria until the light output was reduced by 50% and recording how much was added to achieve this reduction.  Because V. harveyi and P. phosphoreum responded differently to different pollutants, they were both needed in the development of a two-assay system to be used as an initial screening test for toxicity. (Thomulka et al. 1993)  More recently, an article published on November 24, 1999 in the San Diego Union-Tribune describes a study being conducted by Dimitri Deheyn of the Scripps Institute of Oceanography at the University of California at San Diego.  The study, which has not yet been concluded, is designed to determine whether the light output of bioluminescent brittlestars (Amphipholis squamata) accurately reflect the toxicity of the water they are in.  This experiment is designed to detect the presence of �pollution� as a general term, rather than chart the organisms� responses to individual pollutants as in the previous example.  Also unlike the previous example, this experiment is being carried out in the field.  The brittlestars are transplanted from a natural reserve to seven polluted areas in San Diego Bay, where they are kept in cages on the bottom sediment for 12 weeks.  Samples are collected every three days to measure bioluminescence.  The results of this study, which are still pending as I write this, will help determine if these brittlestars could serve as a viable means of monitoring environmental quality. (Deheyn 1999)    The US Navy Control and Ocean Surveillance Center, also located in San Diego, has developed what they call the QuikLite Bioassay System, which uses bioluminescent dinoflagellates to measure water pollution.  Test media is mixed with the bioluminescent dinoflagellates in a plastic cuvette, which is then kept in the dark for several hours to allow the dinoflagellates time to fully respond to the pollutants in the media and reach their maximum bioluminescence potential.  The cuvette is then placed in the specially designed QuikLite Test Chamber, which uses a stirrer to keep the organisms luminescent while the light output is detected by a photomultiplier tube.  This system is now being marketed as an fast, inexpensive, and accurate way to gauge environmental contamination. (Naval Command, Control and Ocean Surveillance Center, San Diego)  **Of Tap Water and the Arroyo Del Valle -- Our Purpose**  Bioassays are used to gauge pollution all over the world.  However, of particular interest to us is the pollution in our little corner of it; specifically, in our both our local creek, the Arroyo Del Valle, and the tap water which we drink.  The purpose of our experiment is to measure this pollution using bioluminescent bacteria.  We had originally intended to use V. harveyi, which was used in the experiment conducted by the team in Philadelphia.  However, we had trouble growing it properly and have decided to instead use V. fischeri, another strain of bioluminescent bacteria.  As far as we know, V. fischeri has never been tested as a bioassay, making us the first in the world to attempt to use it to measure pollution.  **Abstract**  Does water pollution have a detectable effect on the light output of bioluminescent bacteria? If water pollution has a detectable effect on the light output of bioluminescent bacteria, then bioluminescent bacteria placed in media of varying pollution levels will have varying light outputs. Using light sensing equipment and a computer to log data, the varying levels of light intensity are measured. By finding the rate of change of the light output by the bacteria over time, it can be determined how much an effect certain pollutants have on the bioluminescent bacteria. In this experiment, Vibrio fischeri was used as the light source, which was subjected to media of varying levels of pollution - creek water, tap water, distilled water, and bleach. However, due to electrical problems, inconclusive data was collected. Steps to run this experiment again with an improved protocol are being planned. Hopefully this procedure will be perfected for future experimentation, in order to determine if bioluminescence is a viable means of measuring pollution in water.      [[Top]](#gjdgxs) |