Cells Might Actually Communicate with Each Other Using LIGHT!

This is a magnified image of a paramecium like those used in the experiment.

I was reading an article on Dr. Cornelius Hunter's blog the other day, and he mentioned a 2009 study of which I was not aware. I was surprised by what Dr. Hunter wrote, so I read the study myself and became even more surprised. Quite frankly, I nearly fell off my chair. I try to stay relatively informed on major advances in the sciences, but somehow, I missed this one entirely.

What am I talking about? It involves cellular communication. Biologists have been studying how cells communicate with one another for quite some time. In order for any multicellular organism to survive, the cells must cooperate with one another.

As a result, they must communicate. Generally, this is done through chemical means: one cell releases a chemical into the environment, and other cells interact with that chemical, producing an effect. In the human body, for example, your insulin-producing cells (technically called the islets of Langerhans) release insulin into your bloodstream. When cells in your liver, muscle, and fat tissues detect the insulin, they respond by absorbing sugar from the blood. This regulates your blood sugar levels.

Even when not part of a multicellular creature, cells in groups often communicate with one another. When bacteria group together in a colony, for example, they communicate with one another so that they can do things like forage for food as a group and form coherent structures such as biofilms. Once again, however, most of the research that has been done on how this communication takes place focuses on chemicals that the cells release into their environment. The study to which Dr. Hunter referred looked at an entirely different means of cell-to-cell communication, and if its conclusions are correct, the method is nothing short of amazing.

Dr. Daniel Fels decided to see if single-celled organisms of the species Paramecium caudatum (pictured above) could communicate with one another by some means other than releasing chemicals. He put a colony of the organisms in a small cuvette (a straight-sided glass or quartz container) and another colony into a larger cuvette. He then nested the smaller cuvette into the larger one. As a result, the two colonies were close to one another, but from a chemical standpoint, they were pretty much isolated. Any chemicals released by one colony could not get through the cuvette to the other colony. He then put the cuvettes in complete darkness to see if
the two colonies could affect each other in any way. He also varied the number of organisms in each colony, to see if that would produce any effect.

In order to control his experiment, he put demineralized water with no organisms in one cuvette and a colony of organisms in the other cuvette. In addition, he put the liquid in which he grew the organisms (called the culture medium), without any organisms, in one cuvette and a colony in the other cuvette. Finally, he put used culture medium (once again without organisms) in one cuvette and a population in another cuvette. He put them in total darkness as well. After two days, he measured the number of organisms in all cuvettes. In a separate experiment, he measured their feeding rate. He found that both the number of organisms and the feeding rate:

...depended significantly on (i) the presence or absence of a neighbouring population, (ii) the number of cells in the neighbouring population and (iii) the material (glass or quartz) separating these populations.

So it really does seem like the organisms in one population affected the other population, even though there was no way to transfer chemicals between them. How does Dr. Fels interpret these results? He thinks that the organisms are communicating with one another using light! He says that’s why the material of the cuvettes was important. Glass and quartz transmit different frequencies of light, so the composition of the cuvettes would be important if the communication was being done with light.

Is this definitive proof that the organisms were communicating with light? Of course not. However, it is the most likely explanation for the results. In addition, low-level light has been detected coming from other microorganisms\(^4\), animal tissues\(^5\), and plant tissues.\(^6\) Communication using light would at least explain why cells emit it in the first place. In addition, a talk given at a recent scientific conference indicates that the patterns of light emitted by cells have the characteristics of binary data that are being sent over a noisy channel.

Obviously, a lot more work has to be done on all of this, but if it turns out that cells really do communicate using light, it is just another example of how complex life really is. Even at the cellular level (which is supposed to be relatively simple), it still holds many surprises for us. The more I learn about life, the more I stand in awe of its Creator.