

The models were wrong

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The models explaining what everyone knew about sugar uptake in bacteria [are fundamentally flawed](#) [1]. New models correct those flaws. It turns out that bacteria regulate their sugar uptake mechanism not just by looking at the sugar available. The old models said that if sugar was scarce, bacteria made more sugar processing mechanisms to go after more of the scarce resources. What bacteria actually look at is the ratio of sugar to other nutrients to determine how much to invest in sugar processing.

"This is one of the most studied processes in molecular biology; it's in every textbook," says Terence Hwa, a professor of physics and biology at UC San Diego, who headed the team of scientists. "We showed that this process doesn't work the way most people thought it did for the past several decades, and its purpose is different from what had generally been assumed."

The basic phenomenon, Hwa says, is analogous to a balanced diet: To reduce an individual's sugar uptake, common wisdom is to reduce the availability of sugar. This strategy backfires on bacteria because they would increase their appetite for sugars -- the process of catabolite repression would direct the bacteria to increase the production of their sugar uptake system to counteract the scarcity of sugar in the environment. However, by figuring out that catabolite repression actually works by sensing the difference between the influx of sugar and that of other essential nutrients such as nitrogen, it is possible to drastically lower the bacteria's appetite for sugar by simply rationing the supply of nitrogen.

Hwa and his team arrived at their surprising finding by employing a new approach called "quantitative biology," in which scientists quantify biological data and discover mathematical patterns, which in turn guide them to develop predictive models of the underlying processes.

Biologists having to get numerically proficient? What is the world coming to? I had a

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similar problem in the design of a soldering tool which I describe at [DIY hot-air iron](#) [2]. The model in my head didn't match reality. I corrected that by doing experiments. I covered not only the territory the model in my head suggested. I also covered territory that the model I had suggested was the wrong way to go. The experiments I did gave me a clue. And that enabled me to solve the problem.

This happens often in engineering. Things don't work as planned. And you have to find out why. The first thing to do is to empty your head of everything you know. Forget how it should work. Or as I recently said to a friend when discussing a similar topic, "The Zen mind is an empty mind." You can't learn new things if you already know it all. Do tests and measurements to find out how the matter at hand actually works. And then use that knowledge to build a model that matches reality.

Believers in catastrophic global warming due to "excess" CO2 emissions, [are you paying attention](#) [3]? And one thing I can say for sure, if you have 73 different models (mentioned in the article), at least 72 of them must be wrong. Some more wrong than others. If we look at the actual data there appear to be quite a few minds that need emptying.

M. Simon's e-mail can be found on the sidebar at [Space-Time Productions](#) [4].

Engineering is the art of making what you want from what you can get at a profit.

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[1] <http://www.sciencedaily.com/releases/2013/08/130807155154.htm>

[2] <http://www.ecnmag.com/blogs/2013/06/diy-hot-air-iron>

[3] <http://www.providencejournal.com/opinion/commentary/20130805-steve-goreham-why-the-climate-models-of-global-warming-are-wrong.ece>

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