

Can newly discovered biology 'law' save lives?

November 2 2011, By Joel N. Shurkin



Physicians now use pattern recognition -- experience with prior patients and intuition -- to make predictions. Using a new formula, it may be possible to catch a patient who is deviating from what would normally be happening. Credit: Jo Naylor via flickr

What if doctors in the intensive care unit could predict if and when a patient was about to go into cardiac arrest? They could then be ready when it happened.

A group of researchers are working on just such a technique as they attempt to solve a profound philosophical question: Are there natural laws of biology just as there are for physics? It is a classic case of pure scientific research leading to practical solutions no one anticipated.



Even elementary students know some of the laws of physics, many of them going back to Isaac Newton in the 17th century, such as that for every action there is an equal and opposite reaction, better known as Newton's Third Law of Motion, not to mention Einstein's $E=mc^2$. Why doesn't biology?

"Biologists don't seek mathematical descriptions the way physicists do," said Michael Deem, of Rice University's BioScience Research Collaborative in Houston. Deem is part of a 20-team project funded by the Defense Advanced Research Projects Agency to change that.

He arrived at "Deem's Law" in 2007. Now, other researchers have demonstrated its potential in a cardiology clinic at Emory University School of Medicine in Atlanta. The law can be described as a formula, although one with less panache than Einstein's famous formula for relativity: PE=M'/R. In English, that means when parts of a complex biological system, such as proteins in a muscle fiber, interact with one another, how much interaction there is determines the system's ability to thrive or evolve in the face of environmental stress (PE). How much interaction is measured by a property called modularity, or M prime in the equation. R represents the system's ability to thrive.

The more stress, the more modularity is required to adapt and thrive. Deem said that the law not only applies to biology, but to such things as social networks, physiology and even economics, where he has tested it out in analyzing trade networks.

According to Deem, to measure modularity you could for instance measure whether proteins in a cell interact with each other. Every interacting protein pair could count as a one in a modularity chart; every one that did not would get a zero, a way of quantifying the degree of interaction. Simple systems would have very few interactions; complex ones would have many.



Environmental stresses would include such things as changes in temperature or pressure or acidity.

A beating heart is a complex system. At Emory, they plugged Deem's Law into a computer monitoring data from patients during a stress test on a treadmill. At regular intervals, they increased the speed of the treadmill and its angle, putting added stress on the heart.

The computer found modularity in the heartbeats and so was able to predict what the hearts would do a few minutes later. In theory, at least, that would work in an ICU.

"What Michael has done has given us the first wedge towards the type of predictive power we have for the weather," said Tim Buchman of Emory's Center for Critical Care.

Forecasts are generally accurate because meteorologists have huge amounts of data, powerful computers and several <u>laws of physics</u> to rely on. Physicians have the first two when treating a patient. It was the third thing they lacked.

Physicians now use pattern recognition -- experience with prior patients and intuition -- to make predictions. Using Deem's formula, Buchman said, it is possible to catch a patient who is deviating from what would normally be happening.

"Those are the ones that bear looking at," Buchman said.

Other researchers think the work is valuable but requires some caution.

"It is a rational scientific approach but will be tough to verify," said Tom Raffin, professor emeritus of medicine and biomedical ethics, and former director of the <u>intensive care unit</u> at Stanford University



Hospital. "It will require at least a decade of expensive clinical studies."

Deem's theory would have to be shown to do a better job than current techniques, Raffin said.

On the other hand, Raffin said, "It would probably help somewhat since not all physicians are highly skilled."

Source: Inside Science News Service

Citation: Can newly discovered biology 'law' save lives? (2011, November 2) retrieved 27 April 2024 from <u>https://phys.org/news/2011-11-newly-biology-law.html</u>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.