COMPUTER INDEPENDENTLY SOLVES 120-YEAR-OLD BIOLOGICAL MYSTERY

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For the first time ever a computer has managed to develop a new scientific theory using only its artificial intelligence, and with no help from human beings.

Computer scientists and biologists from Tufts University programmed the computer so that it was able to develop a theory independently when it was faced with a scientific problem. The problem they chose was one that has been puzzling biologists for 120 years. The genes of sliced-up flatworms are capable of regenerating in order to form new organisms -- this is a long-documented phenomenon, but scientists have been mystified for years over exactly what happens to the cells to make this possible.

By presenting the computer with this problem, however, it was able to reverse engineer a solution that could explain the mechanism of the process, known as planaria. The details discovered by the computer have been published in the journal *PLOS Computational Biology*, along with the artificial intelligence method used to develop the theory.

The significant thing that the two researchers Daniel Lobo and Michael Levin were hoping to discover was not how new tissue is generated, but how it knows what shape and proportions to grow in. That sacred information is locked away in our genes

"Most regenerative models today derived from genetic experiments are arrow diagrams, showing which gene regulates which other gene. That's fine, but it doesn't tell you what the ultimate shape will be. You cannot tell if the outcome of many genetic pathway models will look like a tree, an octopus or a human," says Levin. "What we need are algorithmic or constructive models, which you could follow precisely and there would be no mystery or uncertainty. You follow the recipe and out comes the shape."

The implications for decoding this information are huge, both for evolutionary biology and potentially for humans. Medical practitioners like John Barker, who performs high-risk face transplant surgery, believe that harnessing the knowledge around the genes that allow us to grow and develop, could eventually be used for regenerative medicine. It would allow doctors like Barker, who help patients who have suffered scarring and traumatic injuries, to regrow body parts from the patient's own cells.

To get to the root of planaria frameworks, Levin and Lobo programmed the computer to crunch through the big data gathered from the many studies performed in this area. It simulated the network formed by a worm's genes many times over until its results matched those from real-life experiments. Every time it managed to match the results, the computer modified the random genetic network it had created in line with the results and kept honing it until it created a core genetic network that matched the results of all the studies. This took three days of trial and error guessing and tweaking -- an approach that would be unfathomably inefficient if it were implemented by humans.

What the computer discovered was that the process requires three known molecules and two proteins that were previously unknown. This discovery, says Levin, "represents the most comprehensive model of planarian regeneration found to date".

"One of the most remarkable aspects of the project was that the model it found was not a hopelessly-tangled network that no human could actually understand, but a reasonably simple model that people can readily comprehend," he adds. All this suggests to me that artificial intelligence can help with every aspect of science, not only data mining but also inference of meaning of the data,"

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