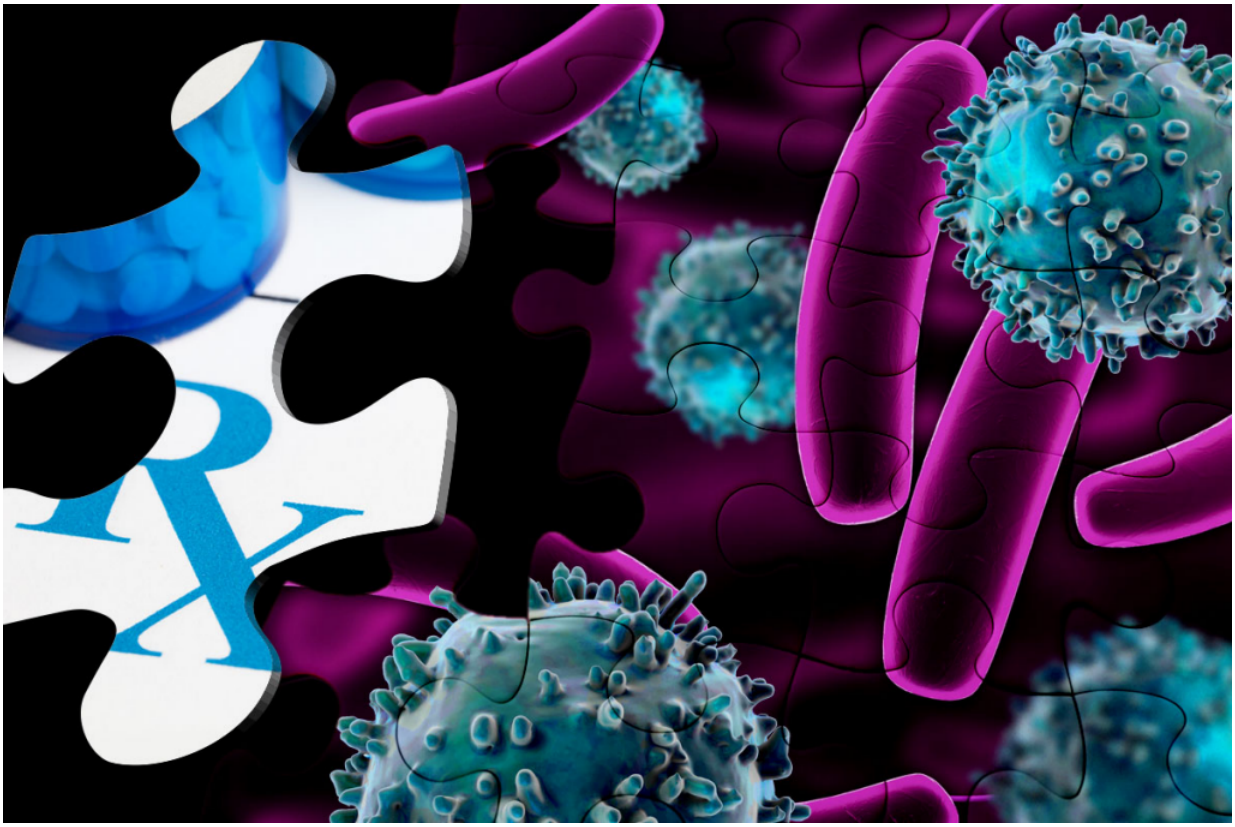
Medical Xpress

Solving the immunity puzzle takes collaboration among different fields

March 20 2017



Oral therapeutics developed as a result of modeling the immune system may help sufferers of infections like those caused by E. coli (pictured here in purple). Credit: Virginia Tech

Studying the human immune system is like trying to work a vast,

multidimensional jigsaw puzzle with pieces that are constantly changing shape. Billions of microbes interact with the host, shaping the processes that keep us healthy and protected from disease.

Sometimes, however, these interactions do not occur as one would hope, sending the immune system out of synch, causing chronic inflammation that can lead to conditions like inflammatory bowel bisease (IBD), diabetes, arthritis, or even cancer.

Millions of Americans suffer from such diseases and incidences are on the rise. Until recently it has been difficult to understand what occurs during these interactions and how they might trigger chronic inflammation.

More importantly, efforts to stop inflammation have produced drugs and treatments that have modest efficacy and side effects nearly as difficult to deal with as the disease itself.

Scientists need to understand how inflammation occurs at the systems level and what might best recalibrate an immune system that has been pushed wildly off course into chronic inflammation. A recent paper in *Trends in Immunology* explores how the field of immunology can apply modeling approaches to solve the puzzle of immunity.

"By combining computational modeling and immunology experimentation," said Josep Bassaganya-Riera, director of the Nutritional Immunology and Molecular Medicine Laboratory (NIMML) and professor at the Biocomplexity Institute, "we can ensure that we continue to make strides toward precision medicine that help streamline the process of clinical trials and move safer, more-effective therapies to patients more quickly."

In the past, different scientific fields have attempted to arrive at answers

in a multitude of ways, often with much disagreement. At the Biocomplexity Institute of Virginia Tech, NIMML is taking an integrative approach that transcends existing disciplines—and it's seeing some exciting results.

For instance, current models used by NIMML build on groundbreaking work to uncover new pathways leading to first-in-class therapeutics for IBD.

NIMML has integrated this approach with other forms of modeling and experimentation, allowing them to simulate inflammatory processes at an unprecedented scale. By applying this approach, researchers were able to model clinical responses to new IBD treatments with a high degree of accuracy for simulated patients using machine-learning algorithms.

"Applying modeling approaches to immunology can provide rigorously tested and efficient therapies very quickly with cost-effective use of resources," said Raquel Hontecillas, co-director of NIMML.

In a recent National Institute of Allergy and Infectious Disease workshop, Bassaganya-Riera presented about how solving immunity is a complex process requiring transdisciplinary solutions.

Bassaganya-Riera spoke about the advances precision medicine offers us during Virginia Tech's TEDx event. In his discussion, he explained how modeling and simulation of immunological systems offers clinicians and patients a more rapid pipeline between clinical trials and effective treatments and therapies.

This process also offers a chance for researchers to engage in "the art of the possible," using modeling to demonstrate the promise of new therapies even before they are tested in a living system. Building on these early successes, it is clear that collaboration between modelers and

experimentalists will be key to ushering in an era of precision medicine.

More information: Yoram Vodovotz et al. Solving Immunology?, *Trends in Immunology* (2017). DOI: 10.1016/j.it.2016.11.006

Provided by Virginia Tech