

New theory sheds light on how the environment influences human health

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Researchers at Mount Sinai have proposed a groundbreaking new way to study the interaction between complex biological systems in the body and the environment. Their theory suggests the existence of 'biodynamic interfaces,' an intermediate entity between the two realms, as opposed to

conventional approaches that analyze individual aspects of the interaction between the environment and humans in isolation, according to a paper published in *BioEssays* in October.

The environment impacts [human health](#) in profound ways, yet few theories define the form of the relationship between human physiology and the environment. The Mount Sinai scientists believe that such complex systems cannot interact directly, but rather that their interaction requires the formation of an intermediary 'interface.' The scientists believe that this theory will lead to the establishment of a new field, 'environmental biodynamics,' that will advance the way the environment and human health are studied.

The basis of their theory arose when they compared the [time period](#) when autistic children were exposed to toxins to how the children's brains functioned afterward. At the same time, they found distinct patterns in the intake and metabolism of essential elements and toxins, which were dependent not only on the timing and magnitude of the environmental exposure but also on what was happening within the [biological systems](#) of the child's body.

"These rhythms were driven by the properties of both the biological and environmental systems, but exhibited properties independent of either system," said Manish Arora, Ph.D., the Edith J. Baerwald Professor and Vice Chair of Environmental Medicine and Public Health at the Icahn School of Medicine at Mount Sinai. "They supported the existence of an interface mediating the interaction of biological and environmental systems. The interface itself, which applies constraints and passes information between interacting systems, must be the subject of inquiry because without refocusing the attention on biodynamic interfaces, how the environment impacts health cannot be discerned."

The study of the interface will allow scientists to better understand how

complex systems like the environment and human physiology affect each other. Current methods using plain analysis are incomplete, the scientists say.

"The standard course of inquiry measures some aspect of the environment like lead in the water, and we'd link this to some aspect in [human development](#) like IQ," said Paul Curtin, Ph.D., Assistant Professor of Environmental Medicine and Public Health at the Icahn School of Medicine at Mount Sinai, an author on the paper. "We've learned a lot from environmental health using this approach, but it has its limits."

This interface also considers social, behavioral, and cultural dynamics to be a particularly fruitful avenue of research. This new theory would allow scientists to assess the interface between income and other processes, including [health outcomes](#) using dynamical systems methods. It would also define how human activities could negatively influence the [environment](#) and negatively influence their own health outcomes and further environmental impacts over time.

Dr. Arora's work was funded by a prestigious Revolutionizing Innovative, Visionary Environmental Health (RIVER) Award from the National Institute of Environmental Health Sciences, totaling \$8 million over eight years to complete research on the biodynamic [interface](#). Alessandro Giuliani, Ph.D., Professor of Environmental Health at the University of Rome, has made a significant contribute to the development of the theory.

"Arora, Giuliani, and Curtin's conjecture is potentially a major breakthrough, as knowing the factors that influence biological time may be the key to understanding why people age or mature at different rates, and how our early life experiences can influence our [health](#) as adults," said Robert O. Wright, MD, MPH, Ethel H. Wise Professor and Chair of

Environmental Medicine and Public Health and Director of the Institute for Exposomic Research at the Icahn School of Medicine at Mount Sinai.

More information: Manish Arora et al, Biodynamic Interfaces Are Essential for Human–Environment Interactions, *BioEssays* (2020). [DOI: 10.1002/bies.202000017](https://doi.org/10.1002/bies.202000017)

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