A Nobel Prize-worthy question: How do we sense heat, cold, touch?

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For centuries, understanding the basis for how we detect, process and react to light, sound, temperature, pressure and other environmental signals has been a scientific focus. Science has advanced, and new understanding at the cellular level of ion channels—which are fundamental to these sensations and our bodies' functions—has contributed to important advancements, including the development of new and effective drugs. An indication of the significance of this science and research came with the awarding of the 2021 Nobel Prize in Physiology or Medicine, which honored the discovery of the fundamental ion-channel sensors for temperature and pressure.

The Nobel Prize was awarded jointly to David Julius of the University of California, San Francisco and Ardem Patapoutian of Scripps Research and Howard Hughes Medical Institute.

To commemorate their achievement, *Physiological Reviews*, published by the American Physiological Society, invited Scott Earley, professor of pharmacology at the University of Nevada, Reno School of Medicine, to provide perspective on the science. Earley joined with colleagues Fernando Santana at the University of California, Davis and Jonathan Lederer at the University of Maryland School of Medicine for the project and their seminal editorial, "The Physiological Sensor Channels TRP and Piezo: Nobel Prize in Physiology or Medicine 2021," was published in February 2022.

The authors note the popular press has tended to describe the Nobel-prize-winning breakthroughs as relating to the conscious perception of pain, heat and touch. Instead, they write, the impact of the findings transcends the sensory nervous system and gets to the essence of how all cells sense rapid changes in their internal and external environment, shifting the paradigm of how scientists think about biological signaling in all tissues.

As Earley explains, everything in physiology and our bodies' functions happens because ions cross cellular membranes: brain activity, heart beating, breathing, digestion, movement … everything.

"I've always been very excited about this," said Earley, who began to pursue an interest in ion channels early on in graduate school.

Top-cited breakthroughs by Earley and his research group include discovering roles for specific ion channels in the regulation of cerebral blood flow. These crucial findings have wide-ranging implications for the development of treatments to improve cerebral blood flow in conditions such as stroke, hypertension, diabetes, Alzheimer's disease and traumatic brain injury.

Building on the groundbreaking work of Julius and Patapoutian, Earley envisions future implications for treating chronic pain and diseases such as Alzheimer's disease. In his lab, they explore the connection between bodily systems; for example, how dementia connects to blood flow.

In the *Physiological Reviews* article, the authors note the broad impact of Julius and Patapoutian's breakthroughs and go on to write, "For physiologists, the [Nobel Prize] award serves as a celebration of elegant and thoughtful work that has excited, encouraged, and delighted all. When juxtaposed against current questions, it also makes clear how much remains to be done. … For all scientists, this Nobel Prize represents an important landmark along the way."

"Many outstanding scientists study ion channels, and it's important to commemorate the field as a whole with the award and to have the work recognized in this way. It was quite an honor to be asked to write this editorial," Earley said.

More information: Scott Earley et al, The physiological sensor channels TRP and piezo: Nobel Prize in Physiology or Medicine 2021, *Physiological Reviews* (2022). DOI: 10.1152/physrev.00057.2021