

Nobel Prize Awarded for Research About Temperature and Touch

David Julius and Ardem Patapoutian were honored for their discoveries about how heat, cold and touch can initiate signals in the nervous system.



Patrik Ernfors, right, of the Nobel Committee for Physiology or Medicine, announced the winners of the 2021 prize, David Julius and Ardem Patapoutian, during a news conference in Stockholm on Monday. Jonathan Nackstrand/Agence France-Presse — Getty Images

By Benjamin Mueller, Marc Santora and Cora Engelbrecht

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The Nobel Prize in Physiology or Medicine was awarded jointly on Monday to David Julius and Ardem Patapoutian, two scientists whose work identifying how people sense heat, cold, touch and their own bodily movements has opened the door to the development of non-opioid painkillers.

Dr. Julius, a professor of physiology at the University of California, San Francisco, used a key ingredient in hot chili peppers to identify a protein on nerve cells that responds to uncomfortably hot temperatures.

Dr. Patapoutian, a molecular biologist at Scripps Research in La Jolla, California, led a team that, in poking individual cells with a tiny pipette, identified a receptor that responds to pressure, touch and the positioning of body parts.

“This knowledge is being used to develop treatments for a wide range of disease conditions, including chronic pain,” [the Nobel committee said in a news release](#).

Neither winner was easy for the Nobel committee to reach before it announced the prize around 2:30 a.m. California time. Dr. Julius said in an interview that his phone pinged with a text message from his sister-in-law, who told him that she had gotten a call from the Nobel Assembly’s secretary-general but had not wanted to give the man Dr. Julius’s phone number.

Dr. Patapoutian said that the committee eventually reached his 94-year-old father on a landline, who in turn called Dr. Patapoutian to tell him, “I think you won the Nobel Prize.”

“I’m a bit overwhelmed,” Dr. Patapoutian said a few hours later, “but pretty happy.”

Why did they win?

The pair made breakthrough discoveries that began intense research activities that in turn led to a rapid increase in our understanding of how our nervous system senses heat, cold and mechanical stimuli. The laureates identified critical missing links in our understanding of the complex interplay between our senses and the environment.

The 2021 Nobel Prizes

- Prize for Medicine:** David Julius and Ardem Patapoutian were honored for their discoveries about [how heat, cold and touch can initiate signals in the nervous system](#).
- What to Know:** Here’s a [quick guide](#) to this year’s prizes.
- How Do the Nominations Work?:** Thousands of people, including university professors, can submit nominations. [Hundreds are submitted per year](#).

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Dr. Julius used capsaicin, a pungent compound from chili peppers that induces a burning sensation, to identify a sensor in the nerve endings of the skin that responds to heat.

Dr. Patapoutian used pressure-sensitive cells to discover a novel class of sensors that respond to mechanical stimuli in the skin and internal organs.

Why is the work important?

The Nobel committee said the two scientists helped answer one of the most profound questions about the human condition: How do we sense our environment?

“The mechanisms underlying our senses have triggered our curiosity for thousands of years, for example, how light is detected by the eyes, how sound waves affect our inner ears, and how different chemical compounds interact with receptors in our nose and mouth generating smell and taste,” the committee wrote.

In the 17th century, the philosopher René Descartes envisioned threads connecting different parts of the skin with the brain. In that way, when a flame touches the foot, a signal is sent to the brain. Subsequent research found that sensory neurons register changes in our environment.

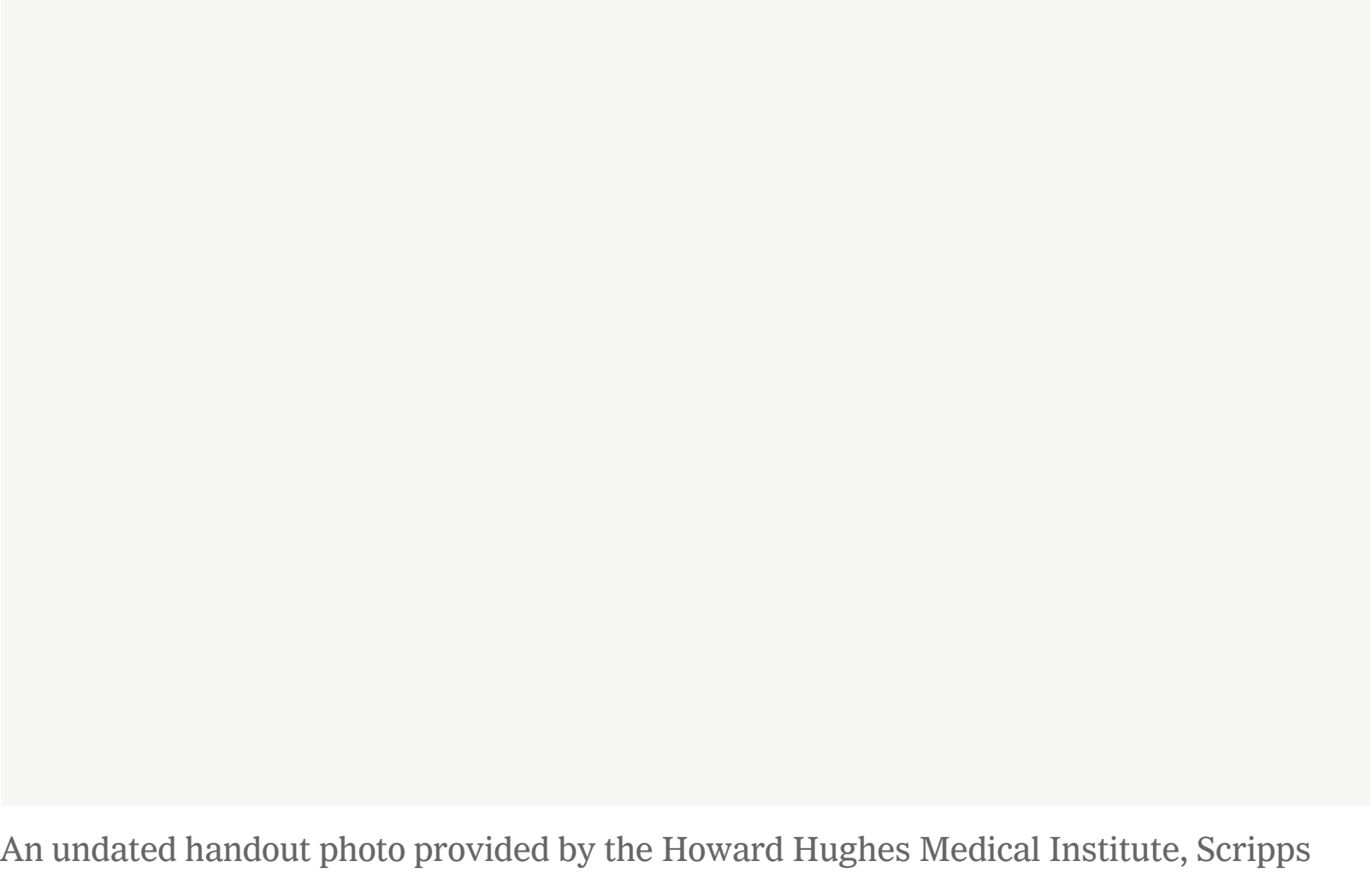
In 1944, [Joseph Erlanger](#) and [Herbert Gasser](#) received the Nobel Prize in Physiology or Medicine for their discovery of different types of sensory nerve fibers that react to distinct stimuli, for example, in the responses to painful and non-painful touch.

But a fundamental question has remained. How are temperature and mechanical stimuli converted into electrical impulses in the nervous system?

The work by Dr. Julius and Dr. Patapoutian, for the first time, allows us to understand how heat, cold and mechanical force can initiate the nerve impulses that allow us to perceive and adapt to the world around us.

Their work, the committee said, has already spurred intensive research into the development of treatments for a wide range of disease conditions, including chronic pain.

Who are the winners?



An undated handout photo provided by the Howard Hughes Medical Institute, Scripps Research shows Ardem Patapoutian of the Howard Hughes Medical Institute, Scripps Research, in La Jolla, United States. Sandy Huffak/Howard Hughes Medical Institute/Scripps Research/EPA-EFE, via Shutterstock

Dr. Patapoutian, who is of Armenian origin, grew up in Lebanon during the country’s long and calamitous civil war before fleeing to the United States with his brother in 1986 at age 18. Needing to establish residency in California so that he could afford college, Dr. Patapoutian worked eclectic jobs for a year, delivering pizzas and writing the weekly horoscopes for an Armenian newspaper.

At U.C.L.A., in the course of preparing to apply to medical school, he joined a research laboratory so that the professor would write him a good recommendation.

“I fell in love with doing basic research,” Dr. Patapoutian said in an interview. “That changed the trajectory of my career.”

He added: “In Lebanon, I didn’t even know about scientists as a career.”

Dr. Patapoutian said that he became interested in the nervous system, but gravitated to studying the sense of touch and pain sensation because he said it seemed like an easier target than the brain itself. The question of how sensory neurons pick up on physical forces like pressure and temperature, he said, was not well understood.

“When you find a field that’s not well understood,” he said, “it’s a great opportunity to dig in.”



An undated handout photo made available by the University of California, San Francisco shows David Julius in his office in San Francisco, California, USA. University of California, San Francisco/EPA, via Shutterstock

Dr. Julius, too, became fixated on the question of how the body’s sensory receptors worked. A native of Brighton Beach, Brooklyn, he said that he began considering a career in science while at nearby Abraham Lincoln High School, where a former minor league baseball player turned physics teacher spoke to students about calculating the trajectory of a baseball.

“He was the person who made me think, ‘Maybe I should do science,’” Dr. Julius said.

As a graduate student at the University of California, Berkeley, and later a postdoctoral scholar at Columbia University, he said he became interested in how magic mushrooms and LSD worked, and more broadly in how things from nature interact with human receptors.

No sensory system matters more to survival than pain, he said. And hardly any was as poorly understood. So his lab began investigating the workings of a wide range of unpleasant natural substances: toxins from tarantulas and coral snakes, capsaicin from chili peppers and the chemicals that make horseradish and wasabi so pungent.

Not that Dr. Julius himself was a glutton for heat.

“I’m one of those people who enjoys eating habaneros out of a jar,” he said, “but everything in moderation.”

In 2020, Dr. Julius and Dr. Patapoutian received the [The Kavli Prize in Neuroscience](#), which is presided over by the Norwegian government, for their groundbreaking discovery of proteins that help bodies sense pressure.

Who won the 2020 Nobel Prize in medicine?

Dr. Harvey J. Alter, Michael Houghton and Charles M. Rice received the prize for their [discovery of the hepatitis C virus](#). The Nobel committee said the three scientists had “made possible blood tests and new medicines that have saved millions of lives.”

Who else won Nobel Prizes in science in 2020?

- The physics prize went to Roger Penrose, Reinhard Genzel and Andrea Ghez for their discoveries — including work on black holes — that have [improved the understanding of the universe](#).
- The [chemistry prize was jointly awarded](#) to Emmanuelle Charpentier and [Jennifer A. Doudna](#) for their work on the development of Crispr-Cas9, a method for genome editing.

When will the other Nobel Prizes be announced?

- There are two more science prizes. Physics will be announced on Tuesday, and Chemistry on Wednesday, both in Stockholm.
- The prize in Literature will be announced in Stockholm on Thursday. Read about [last year’s winner, Louise Glück](#).
- The Nobel Peace Prize will be announced on Friday in Oslo. Read about last year’s winner, [the World Food Program](#).

- The Nobel in economic science will be announced in Stockholm on Oct. 11. Last year’s prize was shared by [Paul R. Milgrom](#) and [Robert B. Wilson](#).

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