THE KAVLI PRIZE

KAVLI PRIZE IN NEUROSCIENCE 2020

The Norwegian Academy of Science and Letters has decided to award the Kavli Prize in Neuroscience for 2020 to

DAVID JULIUS
University of California, San Francisco (UCSF), US

and

ARDEM PATAPOUTIAN
Scripps Research, La Jolla, US

"for their transformative discovery of receptors for temperature and pressure"

The 2020 Kavli Prize in Neuroscience is awarded to David Julius and Ardem Patapoutian for their transformative discovery of receptors for temperature and pressure.

While neural mechanisms for sensing chemicals in olfaction and light in vision have been described, a molecular basis for how temperature and pressure are detected and encoded into electrical signals has been lacking. The two Kavli Prize laureates, Julius and Patapoutian, discovered receptors for temperature and pressure, two critical physical features of the environment. These findings revolutionized the field of neuroscience by providing a molecular and neural basis for thermosensation and mechanosensation.

David Julius used capsaicin, the compound in chili pepper that elicits the sensation of heat, to identify the gene encoding the first temperature sensor, the ion channel TRPV1. Julius further discovered that TRPV1 is activated by high temperature, high concentrations of protons found in ischemic tissues and chemical compounds generated during inflammation, thus providing a molecular integrator for both temperature sensing and inflammatory signals. Genetic experiments then showed that mutant mice deficient in TRPV1 have a deficit in heat sensitivity and a marked reduction in inflammatory and cancer pain. This discovery led to the identification of a family of channels involved in sensing specific ranges of warm and cold temperatures and irritants, some of which are mutated in familial pain syndromes. In other experiments, Julius and collaborators identified these channels as infra-red sensors in vampire bats and snakes, and as targets of spider and scorpion toxins, further validating their roles in temperature and pain sensation. TRPV1 and related channels are now targets for development of new analgesic drugs.

Ardem Patapoutian discovered a family of pressure-sensitive ion channels, the Piezos that are highly conserved throughout the animal kingdom. Piezos were soon confirmed by Patapoutian to be essential for pressure sensing in mammals. His work further showed that Piezos form pressure-sensing channels and that they are directly responsible for pressure sensing in skin by Merkel cells, proprioreceptors and touch sensory terminals. Piezos also act to sense pressure by nerve terminals in blood vessels and in the lungs and affect red blood cell volume, vascular physiology and underlie a broad range of human genetic disorders. The discovery of the Piezos opened the door to understanding mechanobiology in health and disease.

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See also:

The Kavli Prize
www.kavliprize.org

The Kavli Foundation
www.kavlifoundation.org

David Julius
University of California, San Francisco (UCSF), US
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Ardem Patapoutian
Scripps Research, La Jolla, US
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