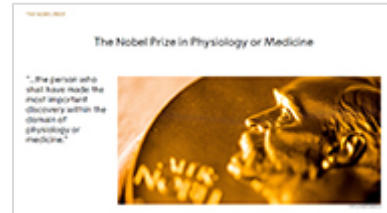


## Speaker's manuscript – Medicine prize 2021 Receptors reacting to temperature and pressure

### The Nobel Prize in Physiology or Medicine

- The Nobel Prize in Physiology or Medicine is one of the five prizes founded by Alfred Nobel and awarded on 10 December every year.
- Before Alfred Nobel died on 10 December, 1896, he wrote in his will that the largest part of his fortune should be placed in a fund. The yearly interest on this fund would pay for a prize given to "those who, during the preceding year, shall have conferred the greatest benefit to humankind."



### Who is rewarded with the medicine prize?

- The Nobel Prize in Physiology or Medicine is thus awarded to people who have either made a discovery about how organisms work or have helped find a cure for a disease.
- This is May-Britt Moser, 2014 medicine laureate. In 2005 she and Edvard Moser discovered a type of cell in the brain that is important for determining one's position. They also found that those cells cooperate with different nerve cells in the brain that help us to navigate. You can say that the laureates discovered and explained a kind of GPS system in the brain.
- Other Medicine Laureates include: Francis Crick, James Watson and Maurice Wilkins, who received the 1962 prize for their discoveries and descriptions about the structure of DNA molecules. Alexander Fleming, Ernst Chain and Howard Florey, who received the 1945 Prize for the discovery of penicillin and its curative effects on bacterial diseases.



### The 2021 medicine prize

- Imagine walking barefoot across a lawn on a hot summer's day. You can feel the heat of the sun, the caress of the wind, and the individual blades of grass underneath your feet. These impressions of temperature, touch and movement are what we usually call "the senses", and they are essential for our survival amidst changing surroundings.
- We often take our sensory impressions for granted. But how do our bodies translate sensory impressions into nerve signals that allow us to interpret and perceive the surrounding world? This is what the 2021 Nobel Prize laureates in physiology or medicine have explained.



- The two laureates' groundbreaking discoveries deal with how a certain specific group of receptors in our nerve cells react to temperature and pressure.

## The 2021 medicine laureates

- David Julius was born in New York City. Today he is a professor at the University of California in San Francisco. It was there in 1997 that he made the discoveries for which he was awarded the prize while he was studying how the stimulation of temperature receptors can be perceived as pain. At the time, Julius was forty-three years old.
- Ardem Patapoutian was born in Beirut, Lebanon and fled the war-torn city for Los Angeles, USA when he was a young man. Today he is a professor at Scripps Research in La Jolla, California. It was there in 2010 that he made his award-winning discoveries of how cells react to mechanical pressure. Patapoutian was forty-two years old at the time.



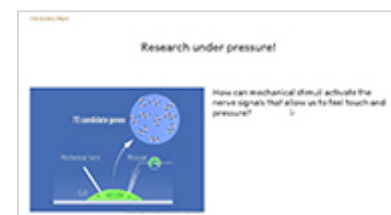
## Science heats up!

- David Julius wanted to study how it happens that a feeling of heat is produced when we eat chili peppers. At the time, he knew that a plant substance called capsaicin that is found in chili peppers activates nerve cells that normally register pain. But *how* capsaicin affects those cells was a mystery. To figure that out, he needed to study all the receptors in the cells to see which one capsaicin reacts with.
- Julius formulated a hypothesis and chose a method for studying that hypothesis. The method was to test millions of different receptors in cultivated cells in order to find the one that reacts to capsaicin. In the vast majority of cells, nothing happened, but in a few of them, Julius and his fellow researchers were able to detect a reaction. It was only in the cells that contained a specific receptor that a change could be observed. This receptor was given the name TRPV1.
- When the receptor is activated, a nerve signal is sent to the brain, which we perceive as heat, and we begin to sweat.



## Research under pressure!

- The other laureate, Ardem Patapoutian, also studied receptors. He wanted to find out how mechanical stimuli can activate the nerve signals that allow us to feel touch and pressure.
- Patapoutian started by identifying 72 genes in a single cell that all produce different specific receptors. In order to figure out which of these 72 receptors was reacting to the pressure and touch, their genes were inactivated one by one. Each time, the cell would then be subjected to pressure and the response measured. In each trial, the cell reacted to the pressure – until finally they identified the gene which if silenced would leave the cell unable to respond.



- Patapoutian’s conclusion was that as long as the active gene was present, the cell would react to pressure, but when the pressure-sensitive gene was inactivated, nothing would happen. With that, he had identified the gene that is responsible for the cell’s pressure sensitivity. It was given the name Piezo1. Piezo means pressure in Greek.
- Further research has concluded that the Piezo gene has an important function in several different organs, such as regulating blood pressure, breathing and the volume of red blood cells.

## For the greatest benefit of humankind

- The Nobel Prize-awarded discoveries have explained our vital ability to register temperature, touch and the position of our body parts in space (proprioception).
- The receptors identified by the laureates are important to a number of different biological processes, such as breathing, blood pressure, skeleton formation and chronic pain. They are also important for our perception of space and are linked to our sense of balance.
- The laureates’ discoveries can be used in further research as tools for studying the systems that maintain the body’s well being – like what happens in the body when someone gives us a hug – and for developing new treatments for various disease conditions, including chronic pain.



“In science, many times, it’s the things that we take for granted that are of high interest.”

- In an interview given in conjunction with the announcement of the 2021 medicine prize, laureate Ardem Patapoutian talked about his work and his research. According to Patapoutian, sometimes it’s the familiar that holds the biggest surprise.

