The Norwegian Academy of Science and Letters has decided to award the Kavli Prize in Neuroscience for 2018 to

A. James Hudspeth
Rockefeller University, New York, USA

Robert Fettiplace
University of Wisconsin, Madison, USA

Christine Petit
Collège de France/Pasteur Institute, Paris, FRANCE

"for their pioneering work on the molecular and neural mechanisms of hearing."

Hearing is an important sense that contributes to human communication. The three Kavli Prize laureates used complementary approaches to unravel the mechanisms by which nerve cells transform sounds into electrical signals. This process is performed in the inner ear by sensory receptors called hair cells. The unique cellular, molecular and biophysical properties of these cells enable them to detect small air vibrations across a wide range of frequencies. The electrical signals generated by hair cells are then transmitted into the brain, allowing them to be interpreted as language, music, or noise.

James Hudspeth has provided the major framework for our understanding of the process that transduces sound into neural signals. Extending from each hair cell is a bundle of fine processes that act as sensors. Hudspeth used ingenious methods to reveal how sound-induced vibrations, which set the hair bundle in motion, evoke an electrical response in the hair cells through a direct mechanical connection between the hair bundle and ion channels. He also revealed how sound signals, which can be extremely small, are amplified within the inner ear.

Robert Fettiplace has made fundamental contributions to our understanding of sound transduction and demonstrated that each hair cell in the cochlea of the inner ear is sensitive to a specific range of sound frequencies. His experiments revealed that hair cells are organized along the cochlea in a pattern that reflects their frequency selectivity. Using sensitive physiological measurements and theoretical modeling, he discovered that this selectivity reflects an intrinsic electrical property of the cell, set by the density and kinetics of its ion channels that induce a resonance at a particular frequency.

Christine Petit has explored the genetics of hereditary deafness in humans and identified more than twenty genes that are required for hearing and inner ear development. She elucidated the mechanisms through which these mutations cause hearing deficits, thus illuminating the unique biology of hair cells and informing deafness diagnosis and counseling. Several of the genes she identified form major components of

the hair cell mechanotransduction machinery. Collectively the breakthroughs made by this year's Kavli Prize laureates have unveiled the molecular and cellular mechanisms that underlie hearing and deafness.