

ABOUT THE ICTP PRIZE SCULPTURE

The ICTP Prize sculpture consists of a plaque emerging out of stone, symbolizing the emergence of new, refined knowledge. The stone base is made of Aurisina marble, which has been quarried in the vicinity of Trieste for more than 2000 years. The special kind of stone and the waves represent Trieste's setting between the karstic hills and the sea.



2017 ICTP PRIZE CEREMONY

29 June 2018
Budinich Lecture Hall
14:30

PROGRAMME

ICTP, Strada Costiera 11, I-34151 Trieste, Italy www.ictp.it



The Abdus Salam
**International Centre
for Theoretical Physics**



THE 2017 ICTP PRIZE

ICTP has awarded its 2017 ICTP Prize to

Emilio Kropff

**National Scientific and Technical Research Council's
(CONICET) Instituto de Investigaciones Bioquímicas de
Buenos Aires (IIBBA), Leloir Institute**

for his outstanding contributions to neuroscience. His works address several aspects of memory and spatial cognition, combining both experimental and theoretical approaches. His theoretical work shows how the hexagonal geometry of spatial maps encoded in grid cells—the positioning system of the brain—can emerge from self-organization in networks of neurons. He participated in the experimental discovery of entorhinal border cells. Most importantly, Kropff discovered speed cells in the entorhinal cortex, neurons that encode a high-precision measurement of speed. Their discovery was crucial, as it provided the missing link in our understanding of how path integration, a mechanism contributing to spatial orientation based on self-motion rather than sensory cues, is implemented in the brains of rats.

Each year, the ICTP Prize is given in honor of a scientist who has made outstanding contributions to the field in which the prize is given. The 2017 ICTP Prize honors Daniel J. Amit, a theoretical physicist who pioneered statistical mechanics approaches to neural networks and was one of the founding fathers of modern theoretical and computational neuroscience.

2017 ICTP PRIZE CEREMONY

Programme

Welcome remarks, Fernando Quevedo, Director, ICTP

2017 ICTP Prize Lecture

Space, time, speed and acceleration in the brain's GPS

Emilio Kropff

**National Scientific and Technical Research Council's
(CONICET) Instituto de Investigaciones Bioquímicas de
Buenos Aires (IIBBA), Leloir Institute**

The Hippocampus and Entorhinal Cortex, two neighboring areas of the mammalian brain, are crucial for the processing of memory and spatial orientation. Both areas have specialized neurons that become active when an animal visits certain regions of space. The patterns formed by their electrical activity across space are called spatial maps. Such maps are thought to be the building blocks with which the memories of places that we visit are constructed. In addition to maps describing familiar environments, the GPS machinery also provides generic tools that allow an animal to navigate unknown or sensory deprived environments based only on the knowledge of its own movements. By integrating its own running speed, a rat could estimate its displacement and thus locate itself in space, an operation called path integration. I will present 10 years of research on different hypotheses regarding the way in which rodents implement path integration, including instances of frustration, puzzlement and eventual success. My talk will bring together computational models of neural networks and recordings of neural activity in behaving rats.