Life Sciences 2012

"I believe that unless basic research is supported and recognized in our country, we'll have nothing to translate into technologies. So I'm very happy that this Prize (Infosys Prize) is being given to us for the basic research that we do."

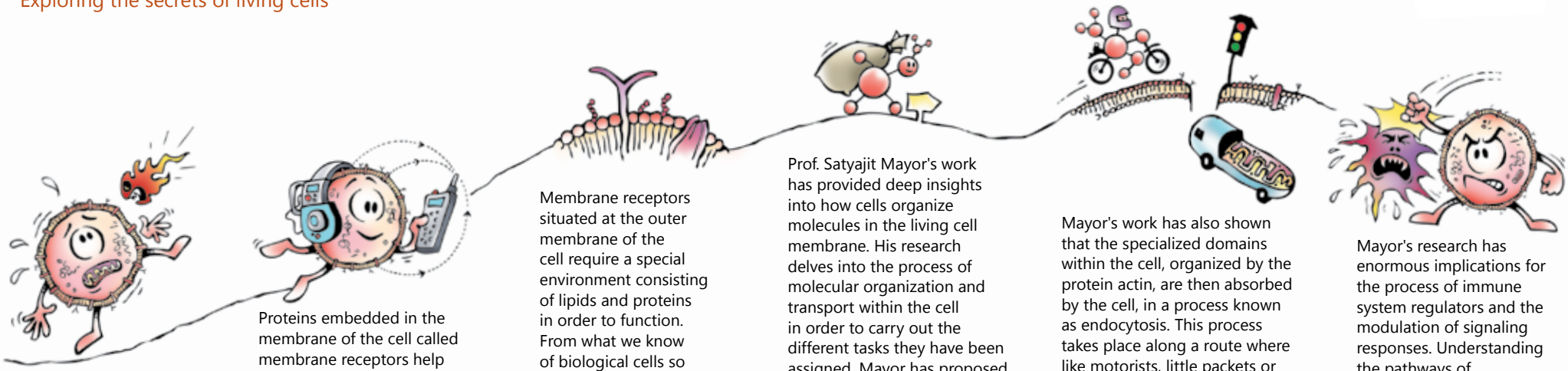
Satyajit Mayor

Director of the National Centre for Biological Sciences, Bangalore

- M.Sc. in Chemistry from the Indian Institute of Technology, Bombay
- Ph.D. in Life Sciences from the Rockefeller University, New York

Prof. Satyajit Mayor defined the nanoscale organization of GPI-linked proteins using fluorescence anisotropy, showing that these proteins exist in small (tens of nanometers) clusters. He showed that these microdomains are organized by actin and are endocytosed by a novel pathway that is clathrin- and dynamin-independent and regulated by CDC42 — a newly discovered pathway that is also responsible for a significant fraction of the micropinocytosis (fluid-phase uptake) by cells.

Exploring the secrets of living cells



Have you ever wondered how the cell senses and responds to its environment? How a virus such as HIV that enters the human body, knows where to go and how to get there? How is it able to beat the body's defense systems?

Proteins embedded in the membrane of the cell called membrane receptors help cells sense the external environment and respond to it. These receptors send messages to the inside of the cell. Each second, several molecules and, inadvertently, a virus, may enter and exit the cell by homing in on these receptors.

Membrane receptors situated at the outer membrane of the cell require a special environment consisting of lipids and proteins in order to function. From what we know of biological cells so far, the cell membrane is organized as a fluid bilayer. Given the complexity and fluidity of this environment, it is difficult to understand how such a special environment may be created for these receptors to function.

Prof. Satyajit Mayor's work has provided deep insights into how cells organize molecules in the living cell membrane. His research delves into the process of molecular organization and transport within the cell in order to carry out the different tasks they have been assigned. Mayor has proposed a mechanism that could generate specialized domains around membrane receptors and at the same time provide local control on membrane protein and lipid composition. The mechanism utilizes short filaments of the protein called actin that pairs up with motor proteins to engage with molecules on the cytoplasmic side of the cell surface.

Mayor's work has also shown that the specialized domains within the cell, organized by the protein actin, are then absorbed by the cell, in a process known as endocytosis. This process takes place along a route where like motorists, little packets or vesicles try to find their way to a destination through traffic inside the cell. The molecules that enter the cell need to find the correct pathways to their destinations within the cell just as the motorists in a traffic jam try to find roads that are easy to negotiate. How do they do this? The cell has many proteins that could be compared to maps or GPS that a motorist would use to find the easiest routes to their destination.

Mayor's research has enormous implications for the process of immune system regulators and the modulation of signaling responses. Understanding the pathways of endocytosis may lead to a means to combat viruses such as HIV and other pathogens that attack the body's immune system by piggy backing on these routes that the cells have created for their own survival.