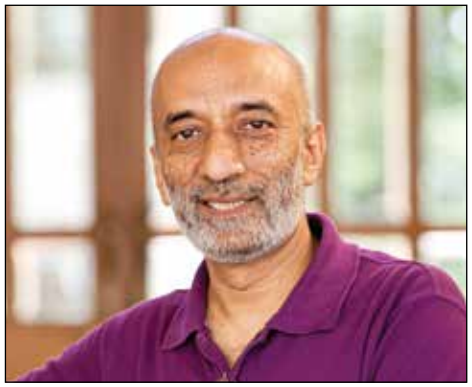
Physical Sciences 2011



"Eventually our work on active matter will be relevant to a complete understanding of the mechanics and statistical properties of cells, tissue and organisms. The field involved in this case is biology which is a fantastic source of problems for physicists to think about."

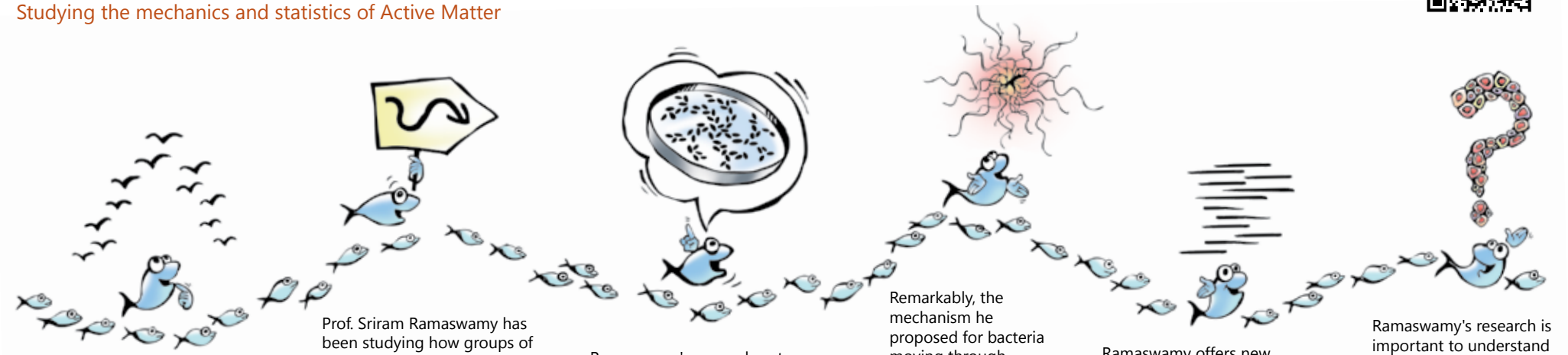
Sriram Ramaswamy

Senior Professor and Centre Director, TIFR Centre for Interdisciplinary Sciences, Hyderabad

- B.S. in Physics from the University of Maryland
- Ph.D. in Physics from the University of Chicago

Prof. Sriram Ramaswamy's work on the mechanics and statistics of active matter has given birth and shape to this rapidly growing field. He used simple yet powerful arguments based on symmetry and conservation principles to uncover the strange laws governing the collective behavior of active particles in a medium, which could be motor proteins walking on cytoskeletal filaments, or schools of fish swimming in an ocean and forming a pattern.

Studying the mechanics and statistics of Active Matter



In our everyday lives we often encounter natural phenomena that are symmetrical and follow interesting patterns. Flocks of migratory birds, schools of fish, tessellations in a honeycomb, and the wildebeest migration – all follow set patterns. These patterns are subject to a certain order that we often do not understand.

Prof. Sriram Ramaswamy has been studying how groups of living things move together. Specifically, he wanted to understand how groups of living things move together in a fluid. When groups of living matter move in a liquid medium, a disturbance is created, which then affects the movement of others in the group.

Ramaswamy's research not only explores the movement on a macroscopic scale as in the case of schools of fish but also microscopic movements as in the case of bacteria. In the latter, he discovered that the movement of bacteria created subtle ripples in the fluid in which they moved, which in turn led to the colony arranging itself in complex patterns.

Remarkably, the mechanism he proposed for bacteria moving through fluids applied on even smaller scales, to the filaments in a single living cell. In addition, he showed how to create artificial flocks in a layer of bits of metal wire.

Ramaswamy offers new insights into the collective movements of these self-propelled organisms using Active Matter physics. His research elucidates how Active Matter takes in free energy and is consumed at the level of each particle, leading to systematic movements. His research is attempting to uncover the laws that govern the collective movements of living creatures that seem to follow some sort of order.

Ramaswamy's research is important to understand how the collections of living cells and tissues develop and grow. It could also potentially help us understand how bacteria form colonies. If we understood these movements fully, we could even manufacture small objects that can move by themselves, such as little gadgets that follow chemical traces or scents.