A GRAND CHALLENGE-“CELL IS A MACHINE”

Engineering Principles of Cells

Adnan Akay
Bilkent University. Ankara, Turkey
Carnegie Mellon University. Pittsburgh, PA, USA

A cell may be considered like any other machine that uses energy to perform a task. Unlike human-made machines, a cell’s elegance is in its optimized performance. Just like machines for different tasks, different cells have different responsibilities in a body, except that they function collectively for a larger purpose.

As biology moves from a science based mostly on observations to one that also can be described through predictive models, there is an increasing need for the fundamental principles of engineering and sciences to be brought to bear on elements of biology.

Considering a single cell that uses energy, responds to external stimuli and produces signals, it is easy to depict it as a machine. To better understand such a machine requires knowledge from all engineering and science disciplines. The advances in our understanding of how cells and networks of cells function will lead to new sensors and actuators that mimic or are inspired by cell mechanics. Such an understanding will also pave the path for better understanding of various diseases and their mitigation.

The grand challenge posed here is to develop engineering principles that can relate external stimuli – energy processes – signals among the cells and the brain.