

Special Program in Applied Mathematics and Applied Mechanics

Modeling of electrical conduction involving ion channels

2014 - 05 - 09 (Fri.)

15:00 - 16:00

308, Mathematics Research Center Building (ori. New Math. Bldg.)

In this seminar, I will present three ion-channels related questions, which require mathematical modeling and calculation. First, saltatory conduction is a type of nerve impulse that helps signals travel from one place to another in a fast and efficient fashion. From scanning ionic conductance microscopy, we have learned that ion channels mostly clustered in T-tubule in cardiac myocytes. Thus, it is likely that the electrical conduction is also transmitted in a saltatory way in the heart muscle. We would like to learn whether a saltatory conduction in the heart has any effects on the synchronization and propagation of electrical conduction in the heart. Second, ion channels receive various physical and chemical stimuli and convert them into electrical signals. Could we build a self-rechargeable biobattery by assembling few ion channels/pump? Third, temperature-sensitive ion channels are highly sensitive to temperature changes. However, the underlying mechanism remains unknown. One hypothesis states that the heat capacity of the channel changes as temperature varies. We would like to propose a potential way of determining heat capacity by constructing a Hill plot and then determining the Hill slope, which has been mentioned to be equal to the heat capacity. To do this, we need to verify the statement by performing the mathematic calculation before conducting the experiments.

