Division of Mathematical and Physical Sciences	Research field	Biophysics	Lab. ID MP11
Laboratory web site	http://biophys.w3.kanazawa-u.ac.jp/index.htm		

Research subjects

Most of biological molecules show their vital activities through conformational changes. It has been one of dreams in biological sciences to directly observe biological macromolecules at work under physiological conditions, because such observation is straightforward to understanding their dynamic behaviors and functional mechanisms. To realize this observation, our group has been improving the imaging speed of atomic force microscope (AFM) and currently established high-speed AFM. We currently focus on application of high-speed AFM to study molecular mechanism of proteins at single molecular level while developing novel techniques such as high-speed AFM system combined with fluorescence microscopy/optical trap techniques. In addition, by increasing the scanning speed of scanning ion-conductance microscope (SICM), that can observe the surface characteristics of cells and organelles in a noncontact manner, we are also promoting applications of the microscope into the biological sciences.

Master/Doctor course: Education policy, curriculum, typical activity in the laboratory

Master course: The first grade students start their research projects which include technical development and imaging study of biological samples using high-speed AFM and high-speed SICM under the supervision of the staff members. For the technical developments, the students are required to learn broad knowledges about mechanical design, electronic circuit, software development and so on. For the imaging study, students need to gain knowledge about sample preparations for cells and proteins in addition to the skills of AFM and SICM operation.
Doctor course: Students have own research project with high impact about either single-molecule imaging or developments for novel microscopy techniques. They are highly encouraged to attend international or domestic conferences to give presentations.
Our group has the laboratory meeting every week. In the meeting, we have two sessions; progress report and journal club given by the lab members.

Daily life in the laboratory, etc.

Personal working desk with a personal computer is available for every student. Using a 3D printer, we can make model structures of proteins and prototypes of mechanical parts for high-speed AFM and high-speed SICM.
All relevant students of undergraduate, Master, Doctor and postdoc researchers share all laboratory rooms, and instruments.
We have some laboratory activities such as welcome party and farewell party.

Message or comments by the laboratory faculty staffs

"Biophysics" is a relatively new scientific field trying to elucidate the phenomena of life by using physical methods. Our laboratory has been promoting both technological developments and their application studies into biological sciences in a well-balanced manner. Thus, students who are interested in the both or either subjects have opportunities to learn them deeply. After obtaining the master's degree, students will get jobs at public officials, (junior) high-school teachers and private enterprises. After obtaining Ph.D., students became postdoctoral researchers and faculty members at institutes and universities including ones of overseas.

Recent Master theses in these 3 years (+ more if appropriate)

year.month	Thesis title (including English translation of Japanese thesis title)
2017.3	Development of Temperature Controlled High-Speed AFM and its application to FliI ATPase
2017.3	Development of tip-scan-type HS-AFM combined with optical tweezers
2017.3	Structural dynamics of MukB and MukB-DNA complex studied by HS-AFM
2016.3	High-Speed AFM imaging of dynamics of Dynamin 1 complexes
2016.3	Motor mechanism of myosin VI studied by high-speed AFM
2016.3	High-Speed Atomic Force Microscopy Observation of Dynamic Interaction Between Kai Proteins
2015.3	Observation of structural dynamics of MukB with high-speed AFM

Recent Doctoral theses in these 3 years (+ more if appropriate)

year.month	Thesis title (including English translation of Japanese thesis title)
2016.3	Development of high-speed atomic force microscope combined with single-molecular fluorescence microscope
2016.3	Development of wide-area scanner for high-speed AFM and applications

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