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Commentary and Perspective

Japan-US symposium on cytoskeletal motor proteins and their associated proteins

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Over the last decade, the Biophysical Society of Japan [1] has encouraged holding exchange symposiums among overseas countries. So far, such symposiums were held with Asian countries mainly because in-person meetings were preconditions and Asian countries are geographically close to Japan. Under the pandemic situation, this precondition can be released by the possibility of virtual meetings. It is easier for us to attend international conferences online. Considering this as a merit of the pandemic situation, this time, for the 59th Annual Meeting of the Biophysical Society of Japan, we plan to conduct a joint virtual symposium between Japan and the USA. We would like to state that the annual meeting was first thought to be held in person in Sendai, in 2021, commemorating the 10th anniversary of the Great East Japan Earthquake. Sendai was one of the areas affected by the disaster. The meeting will be held as a symbol of the recovery of our society from the earthquake and COVID-19 pandemic.

In the illustration of a cell for the webpage of the annual meeting (Fig. 1), one can see myosin fibers pulling actin filaments together, kinesin and dynein walk along microtubules transporting mitochondria and endosomes, and F_oF_1-ATP synthase rotates synthesizing ATP molecules inside the mitochondrion. Studies on these motor proteins are topics of the symposium. Speakers in this symposium are recognized internationally as experts in the field of motor proteins and their associated proteins. The symposium topics include multidisciplinary applications of genetics, bio-engineering, bio-chemistry, medical science, and physics of motor proteins, which will give us new insights into the motor proteins, as well as novel applications of existing single-molecule techniques.

We have invited three speakers from the United States. Dr. Zev Bryant (Stanford University) will talk about engineering biomolecular motors. He describes the work of his group and their findings by saying “Molecular motors lie at the heart of biological processes ranging from DNA replication to cell migration. We use single-molecule tracking and manipulation to characterize the structural dynamics of these nanoscale assemblies, and further challenge our understanding by designing and testing structural variants with novel properties that expand the functional range of known biomolecular machines. In the process, we are developing an engineering capacity for molecular motors with tunable and dynamically controllable physical properties, providing a toolkit for precise perturbations of mechanical functions in vitro and in living cells.” See details of the Bryant lab [2] and a recent publication [3].

Dr. Erika Holzbaur (University of Pennsylvania) will talk about deciphering the function of activating adaptors in the motor-driven transport of mitochondria and autophagosomes. She summarizes the work of her group by saying “The axons of neurons are maintained by the active transport of organelles along the microtubule cytoskeleton, driven by the molecular motors cytoplasmic dynein and kinesin. Organelles such as mitochondria and autophagosomes co-purify with both dynein and kinesin motors, which independently drive movement to either the microtubule minus- or plus-end. We are interested in how the activities of opposing dynein and kinesin motors are coordinately regulated on an organelle by

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adaptor and scaffolding proteins. Here, I will focus on the role of TRAK2 in regulating dynein and kinesin motors on mitochondria, and the role of HAP1 in regulating motors on autophagosomes, using single molecule assays and live cell imaging to better understand organelle transport in neurons." See details of the Holzbaur lab [4] and a recent publication [5].

Dr. Kristen Verhey (University of Michigan) will talk about a rogue kinesin that destroys microtubules in cells. She describes the breakthroughs made in her laboratory by saying "Recent work on kinesins has raised the possibility that the physical act of motors walking on microtubules creates stress in the microtubule lattice. Whether processive motility of kinesin and/or dynein motors creates stress and/or defects in the microtubule lattice in cells has not been determined. Here, we describe a kinesin-1 mutant that causes microtubule destruction when expressed in cells. Using in vitro assays, we show that the mutant motor is unable to promote rescues in microtubule dynamics assays and generates large defects in the microtubule lattice in microtubule repair assays. These findings suggest that the mutant is an unnatural or rogue motor whose activity would have been selected against during evolution." See the details of the Verhey lab [6] and a recent publication [7].

From the Japanese perspective, recent studies from three laboratories have been introduced. Dr. Ryohei Kobayashi from the Hiroyuki Noji lab [8] discusses the single-molecule experiment on IF_1, a regulatory protein of mitochondrial ATP synthase [9]; Dr. Jakia Jannet Keya from the Ryota Iino lab [10] talks about engineering hybrid kinesin with a synthetic linker [11]; and Dr. Shinsuke Niwa, sharing the talk with Dr. Kyoko Chiba from the Shinsuke Niwa lab [12], provides topics on genetics using *C. elegans* and single-molecule experiments with several types of kinesin [13,14]. Dr. Kumiko Hayashi [15], who is a member of both the Biophysical Society [16] and the Biophsyical Society of Japan [1], is the moderator and overall host of the joint symposium, promoting debates from an interdisciplinary point of view. We hope that the joint symposium will promote the exchanges of ideas between the research communities of Japan and the USA.

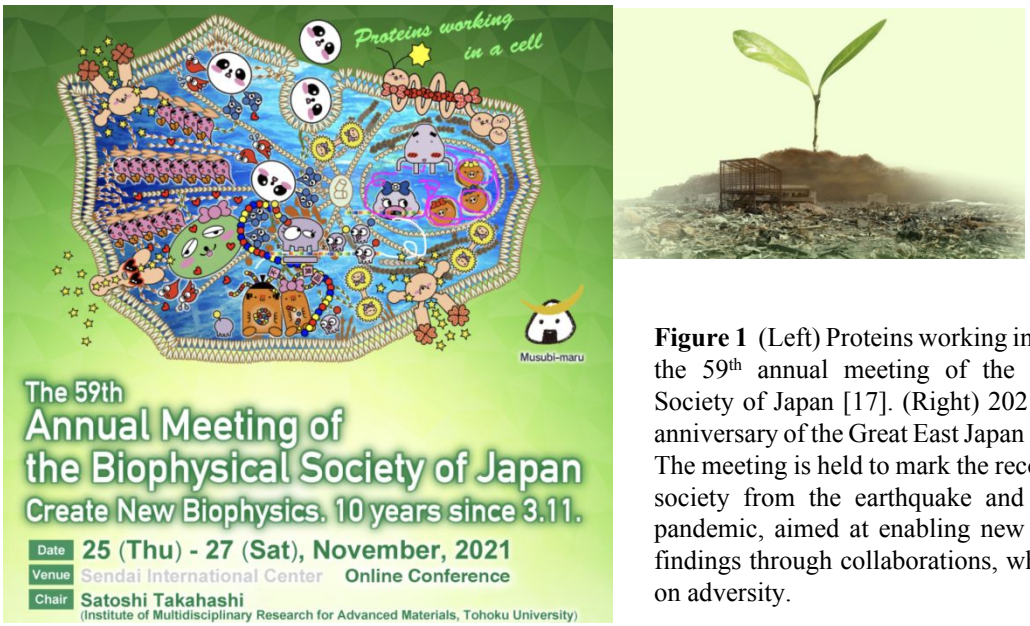

Figure 1 (Left) Proteins working in a cell, from the 59th annual meeting of the Biophysical Society of Japan [17]. (Right) 2021 is the 10th anniversary of the Great East Japan Earthquake. The meeting is held to mark the recovery of our society from the earthquake and COVID-19 pandemic, aimed at enabling new biophysical findings through collaborations, while thriving on adversity.

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