



## Life Sciences Seminar

# Reversible Photo-Regulation of Motor Proteins Using Photo-Responsive Triphosphate Molecules

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**Host: Ryuichi Shigemoto**

Motor proteins including kinesin and myosin are very important bio-molecular motors which fulfill crucial cellular functions (e.g. intracellular transport, muscle contraction) in living system. Over the past decades, significant attempts have been made not only to understand the motile function of motor proteins for biomedical application, but also to develop precise controllable nano-devices using bio-molecular motors. In Tamaoki lab two approaches, namely controllable high-energy molecules and inhibitors for the motor proteins have been used to optically control the motor protein function in reversible manner with high spatio-temporal control.<sup>1</sup> Among other things, I will describe the noble non-nucleoside azobenzene-triphosphates (AzoTP and its analogues, Fig 1) as photoswitchable energy molecules for kinesin<sup>2</sup> as well as myosin<sup>3</sup> to optically regulate the motility of their associated cytoskeletal filaments in an in vitro motility assay. The usability of the photoswitchable energy molecules toward myosin-actin motile system at the macroscopic level, shortening of a glycerinated muscle fiber will be demonstrated. Furthermore, I will describe the discovery of the myosin selective azobenzene-triphosphate which enables the specific photocontrol of myosin with a reversible mode in a composite motility assay composed of both kinesin and myosin bio-molecular motors.<sup>4</sup> Besides that, I will discuss the photo-responsive azobenzene-triphosphate inhibitor (AzoMP-PCP/AzoMP-PNP) for kinesin and myosin, where the inhibitors were derived from replacing the -O- bridge in the  $\beta$ - $\gamma$  phosphate bond of the azobenzene-triphosphate with -CH<sub>2</sub>- and -NH- bridge.

#### References

- [1] A. S. Amrutha, K. R. S. Kumar and N. Tamaoki, *ChemPhotoChem*, **2019**, 3, 337-346
- [2] N. Perur, M. Yahara, T. Kamei and N. Tamaoki, *Chem. Commun.*, **2013**, 49, 9935-9937
- [3] H. M. Menezes, M. J. Islam, M. Takahashi and N. Tamaoki, *Org. Biomol. Chem.*, **2017**, 15, 8894-8903
- [4] M. J. Islam, K. Matsuo, H. M. Menezes, M. Takahashi, H. Nakagawa, A. Kakugo, K. Sada and N. Tamaoki, *Org. Biomol. Chem.*, **2019**, 17, 53-65

**Friday, October 25, 2019 10:00am - 11:00am**

IST Austria Campus Mondi Seminar Room 3, Central Building



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