林久美子（はやしくみこ）

【研究課題名】タンパク質モーターによるオルガネラ輸送への非平衡統計力学関係式の応用

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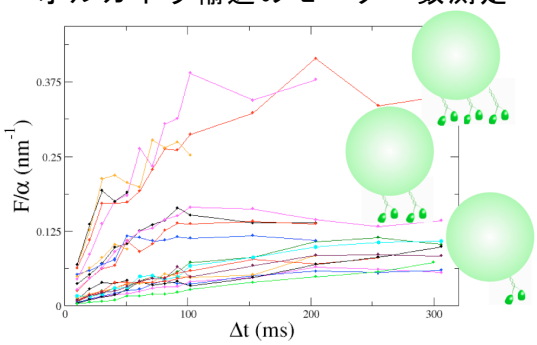
【専　門】非平衡統計力学、生物物理学

【キーワード】分子モーター、１分子実験

神経細胞軸索ではオルガネラ（細胞小器官）は、複数のタンパク質モーターに協同的に輸送される。非平衡統計力学の揺らぎ解析でオルガネラを運ぶモーターの力と数を測定し、細胞内の輸送メカニズムを解明する。

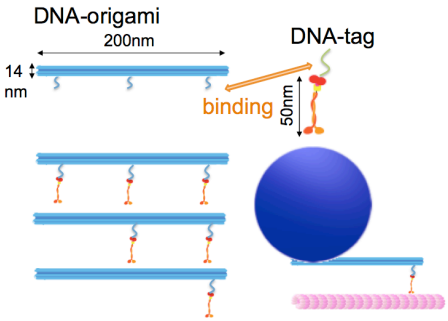
〈研究グループアクティビティー〉

揺らぎ解析による神経細胞軸索のオルガネラ輸送のモーター数測定



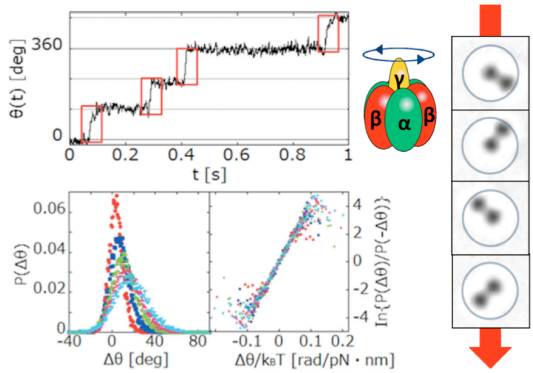
非平衡統計力学の揺らぎの定理を応用し、ミトコンドリア重心位置の軌跡を解析

DNA オリガミでキネシンの個数を制御した *in vitro* １分子実験



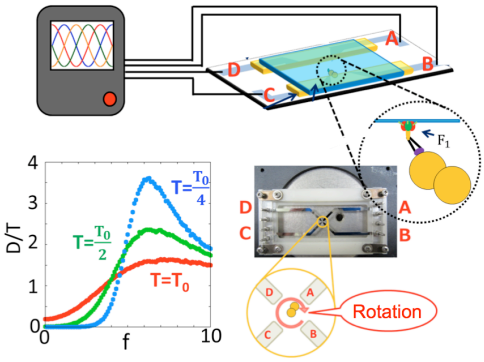
in vitro 実験で神経細胞(*in vivo*)の実験結果を再現

揺らぎ解析による回転タンパク質モーターのトルク測定



非平衡統計力学の揺らぎの定理を利用し、回転モーターのトルクを測定

回転タンパク質モーターの１分子実験による拡散の Giant Acceleration の観察



回転電場系を用いて外部トルクを印可し、拡散係数の外部トルク依存性を研究

Kumiko Hayashi

【Research Subject】Application of non-equilibrium statistical mechanics to intracellular cargo transport by motor proteins

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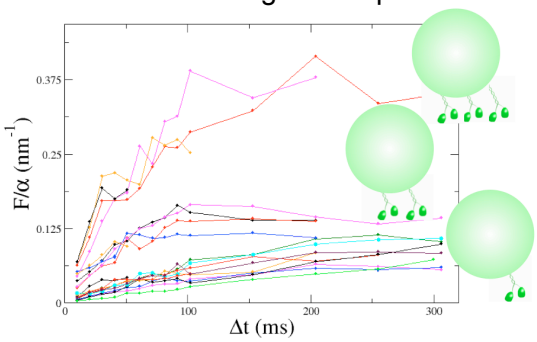
【Speciality】non-equilibrium statistical mechanics, Biophysics

【Keywords】motor proteins, single molecule experiment

An organelle in a cell is transported by multiple motor proteins along microtubules. By using the fluctuation analysis of non-equilibrium statistical mechanics, we measure force exerted by motors. From the measured force distributions, we investigate the number of motors that cooperatively carry an organelle.

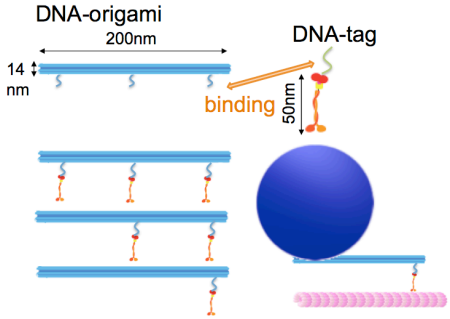
Research Group Activity

Numbers of motor proteins on neuronal cargo transport



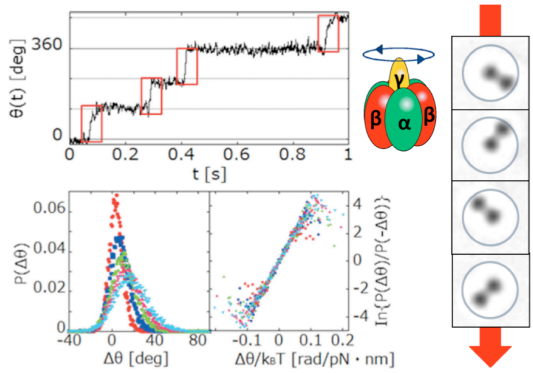
Analysis of organelle's center position by using the fluctuation theorem

Single molecule experiment of kinesin controlling the number with DNA origami



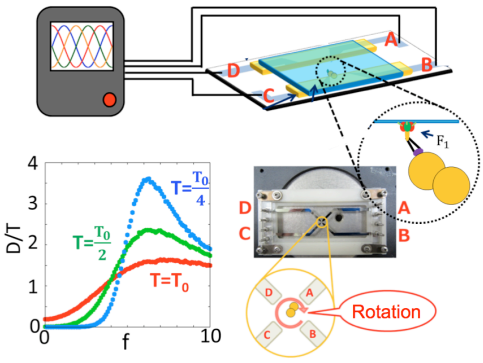
Verification of the *in vivo* results using *in vitro* single molecule experiments

Torque measurement of rotary motors by using the fluctuation theorem



The new measurement method based on non-equilibrium statistical mechanics

Observation of giant acceleration (GA) of diffusion in single molecule experiments



GA observed in a rotary motor applying an external torque by an rotating field