*Jpn. J. Protozool.*, 39(1), 2006 pp. 104-106
Japan Society of Protozoology

# Structure and function of general motor proteins systems for motility, including the spasmoneme in Vorticellidae stalk

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We presents a concept for the contractile mechanism of the $Ca^{2+}$-driven motor protein (spasmin) and its receptor protein (spaconnectin) in the bundle of 3-nm filaments composing the Vorticellidae spasmoneme. The $Ca^{2+}$-binding protein, spasmin, belongs to the calmodulin superfamily and has an EF-hands structure of four or less. Any motor protein must have its own receptor protein for the transformation of ligand-binding or ligand-hydrolysis energy into work or force. It was recently revealed that the molecular weight of spaconnectin, tentatively the receptor protein of spasmin, is 190–200 kDa for the tetrameric form in the *Carchesium* spasmoneme, 90–100 kDa for the dimeric form in the *Zoothamnium* spasmoneme, and 50 kDa in the *Vorticella* spasmoneme. The large conformational change of the spasmoneme during its contraction and stretching is due to entropically elastic spaconnectin but not to spasmin. The concept of the $Ca^{2+}$-driven contractile mechanism of a Vorticellidae spasmoneme system as a bio-ratchet can be applied to the ATP-induced contractile mechanism of the myosin II and V systems, as well as the dynein-kinesin systems.