

## Direct electron microscopic recording of the powerstroke in individual myosin heads in hydrated myosin filaments studied using the gas environmental chamber

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Although more than 60 years have passed since the monumental discovery that muscle contraction results from relative sliding between actin and myosin filaments, which is in turn produced by the powerstroke of myosin heads extending from myosin filaments, the mechanism of the myosin head powerstroke, coupled with ATP hydrolysis, still remains to be a matter for debate and speculation. As early as 1997, we started to directly record ATP-induced powerstroke in individual myosin heads in hydrated myosin filaments electron microscopically using the gas environmental chamber (EC), in which biological specimens are separated from high vacuum of electron microscope by a thin carbon insulating film, and established techniques for recording ATP-induced movement of individual myosin head, position-marked with antibody and gold particles using the EC (Sugi et al., PNAS 1997). With these techniques, we could record ATP-induced myosin head recovery stroke (amplitude ~7 nm) in hydrated myosin filaments in the absence of actin filaments. Recently, we have challenged to record the powerstroke of individual myosin heads in hydrated mixture of actin and myosin filaments, and have found that the amplitude of powerstroke is ~3 nm at the distal region, and ~2 nm at the proximal region of myosin head catalytic domain in the isometric condition, i.e. the condition in which gross myofilament sliding does not take place. This finding indicates flexibility of myosin head catalytic domain, contrary to the general view that the catalytic domain is rigid.

### Biography

Haruo Sugi has completed his Ph.D. at the age of 28 years from the University of Tokyo. He worked in Columbia University and the National Institutes of Health from 1965 to 1967. He was Professor in Physiology in Teikyo University from 1973 to 2004, when he became Emeritus Professor.

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