

# The 51st iCeMS SEMINAR

CeMI Seminar Series 15

**Wed 21 Apr 2010**

**10:30-11:30**

## The Molecular Mechanism of Muscle Contraction

Lecturer: **Dr. Kenneth Charles Holmes**

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Heidelberg, Germany

Venue: 2nd floor Seminar Room (#A207), Main Building  
iCeMS Complex 1, Kyoto University

Skeletal muscle consists of fibre bundles. Each fibre consists of contracting units called sarcomeres in series with each other. The sarcomeres, each of which is about  $2.5\mu$  long are made of overlapping sets of thick and thin filaments composed of the proteins myosin and actin. During a contraction the filaments are forced past each other by large numbers of "cross bridges" that reach out from the thick filaments to interact cyclically with the thin (actin) filaments by a kind of rowing action. During this cyclic interaction ATP (adenosine triphosphate) is hydrolysed to ADP (adenosine diphosphate). The cross bridges, which contain the ATP-ase activity, are an N-terminal extension of the myosin molecule that can bind strongly (no ATP bound) or weakly (ATP bound) to actin and can alter shape by rotating a lever-like C-terminal extension (rather like the oar of a rowing boat) after hydrolysing ATP and re-binding to actin. X-ray crystallography, X-ray fibre diffraction and cryo-electron microscopy have yielded atomic structures of this process in a number of different states that have permitted the reaction paths between states to be calculated. As a result the myosin cross-bridge may be described as a four state motor with linkages that ensure that the contractile events (ATP-hydrolysis, actin-binding, power stroke and product release, ATP re-binding and actin release) follow each other in a defined sequence rather like a macroscopic motor.

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