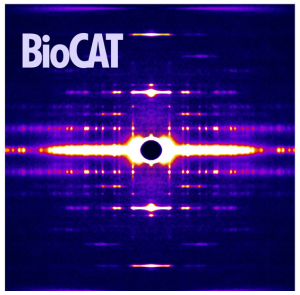

Upgraded and new capabilities for muscle diffraction

Weikang Ma

Jan 10th, 2025

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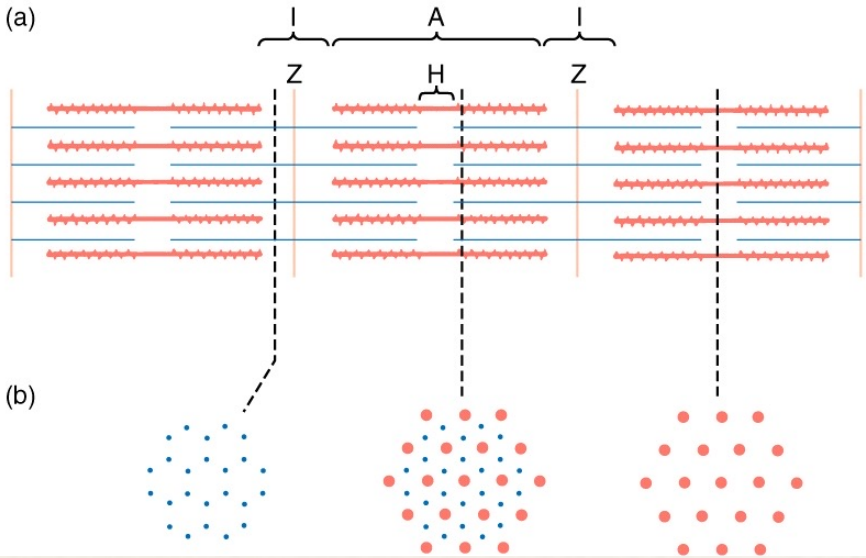
Muscle is “partially crystalline”



X-RAY ANALYSIS AND THE PROBLEM OF MUSCLE

By H. E. Huxley

Medical Research Council Unit, Cavendish Laboratory, University of Cambridge

[Plate 1]

The present-day picture of muscle is briefly as follows: muscle is a machine for converting chemical energy into mechanical work; the ‘moving parts’ of this machine are built up of two proteins, actin and myosin; the known energy-

X-ray Diffraction as a tool for "Structural Physiology of Muscle "

Can provide

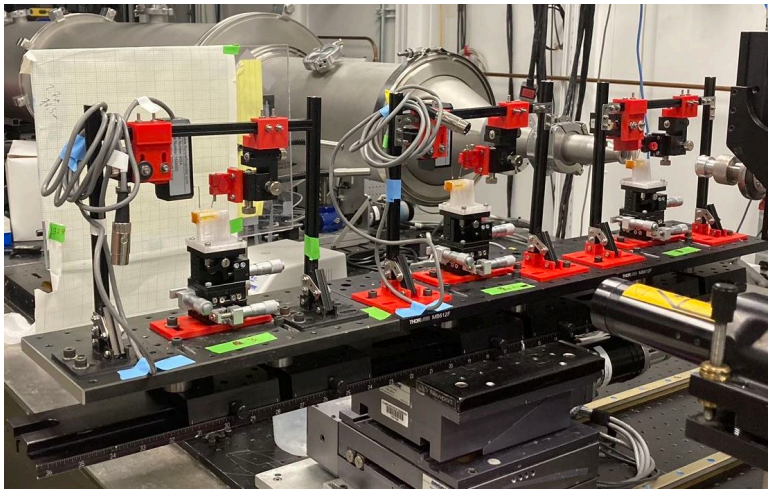
- molecular scale information (nm)
- under physiological state (live or permeabilized muscle)
- under physiological time scale (≤ 1 ms)

X-ray diffraction only technique that allows simultaneous collection of global structural and physiological information on this time scale

❖ *Can provide unique information to inform basic biophysical questions as well as the structural basis of myopathies*

Fully equipped for muscle X-ray diffraction

- 6-Aurora 400 and multiple-WPI KG series transducers
- 5-Aurora Motors
- 3-dual model muscle levers
- 4 Aurora DAQ systems
- Laser diffraction system
- 2-3D Printers allows



- Multiplexed rigs on all relevant systems

New Muscle Lab

- More sample preparation space
- Allows the collection of more physiological information from the same batch of samples by the same investigators.

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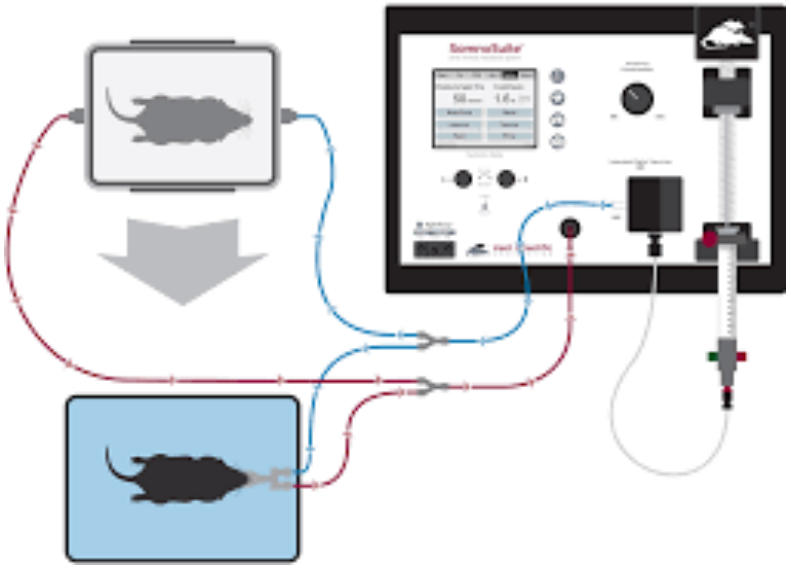
SomnoSuite isoflurane machine

Now ready to use

Will greatly reduce the animal usage for intact skeletal muscle project



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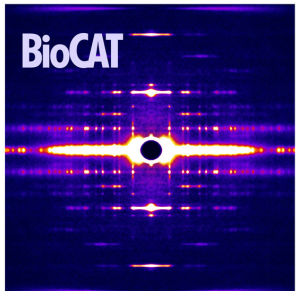
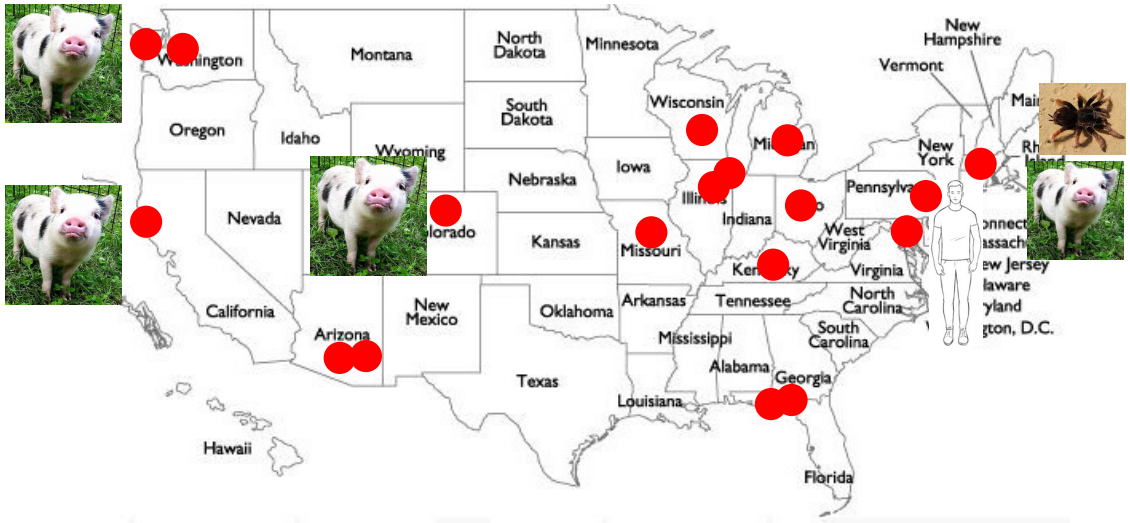


Current program

- ~20 active user groups
  - Netherlands (C. Ottenheijm, VUMC)
  - Germany (W. Linke, U. Muenster)



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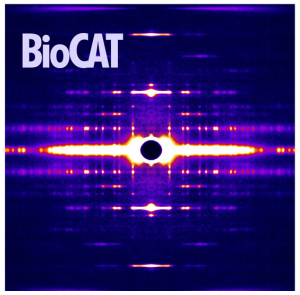

Access Modes

- Traditional mode

- Hybrid mode

- Fully remote collaborations
  - mostly used as a feasibility demonstration tool
  - Will have more capacity

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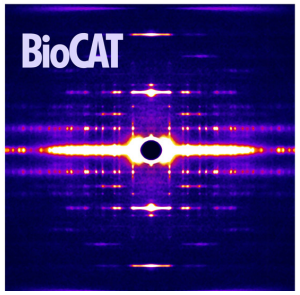
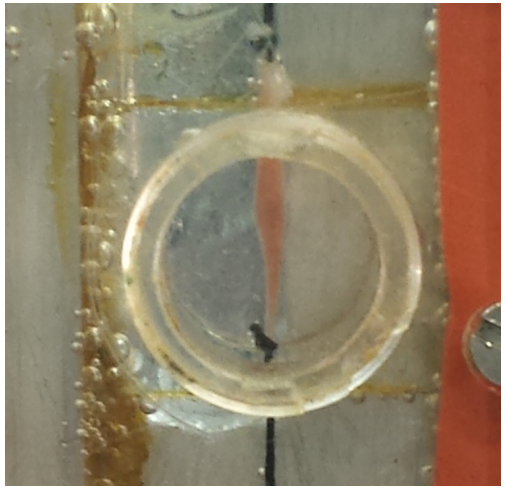
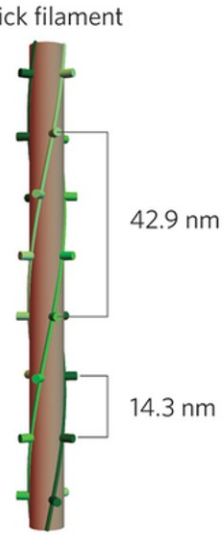


Pre-upgrade beamsize

FWHM





Vertical chamber

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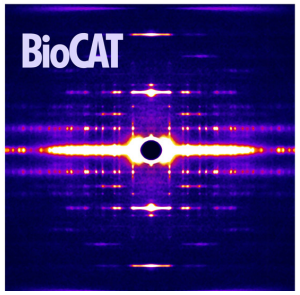
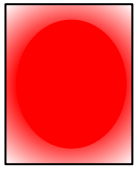


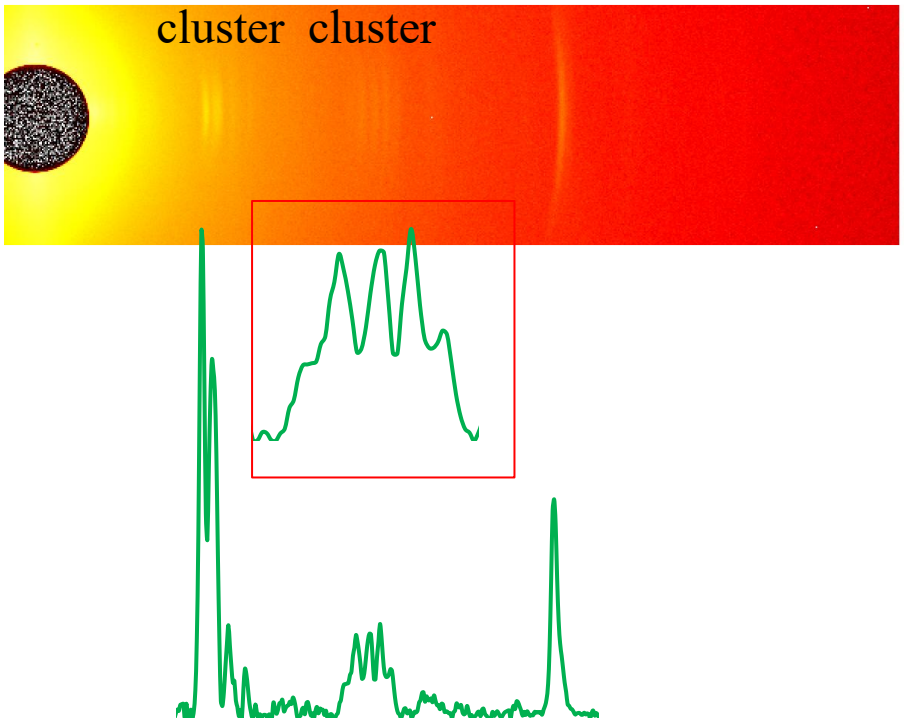
Post-upgrade beamsize

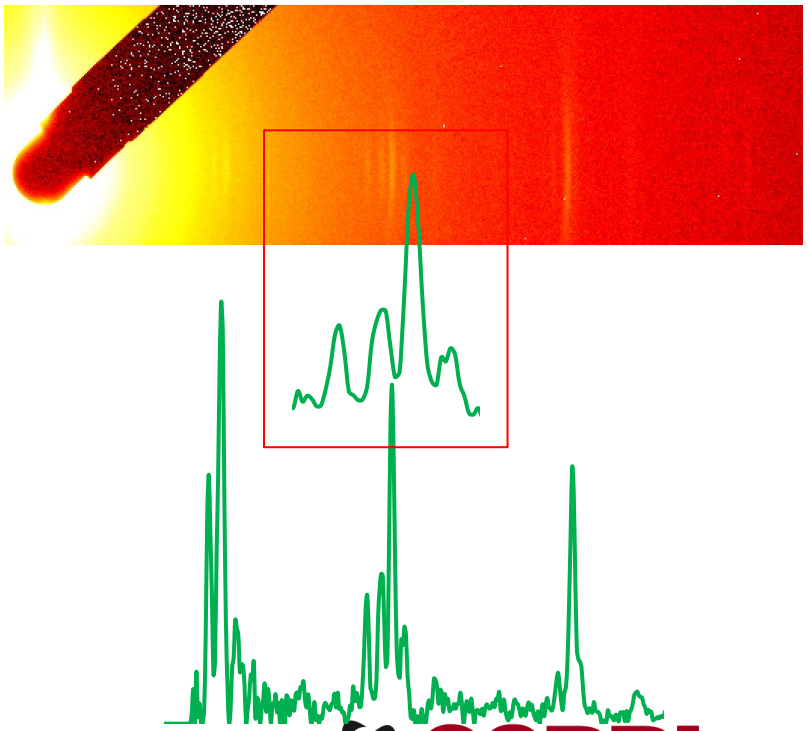


25 μm

<20 μm

M1 cluster M2 cluster M3





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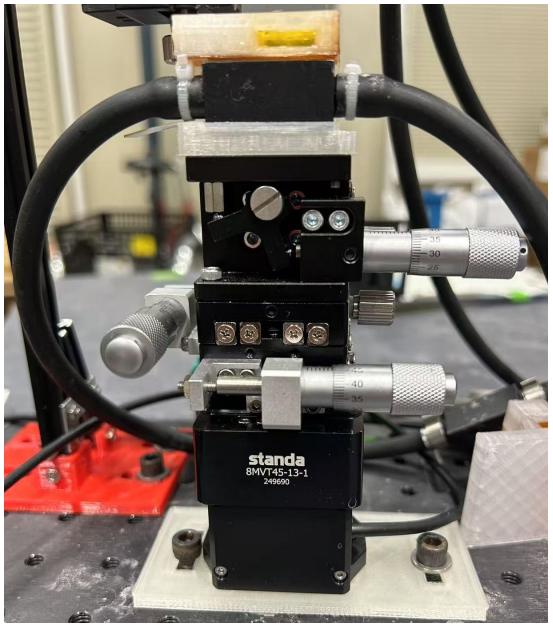
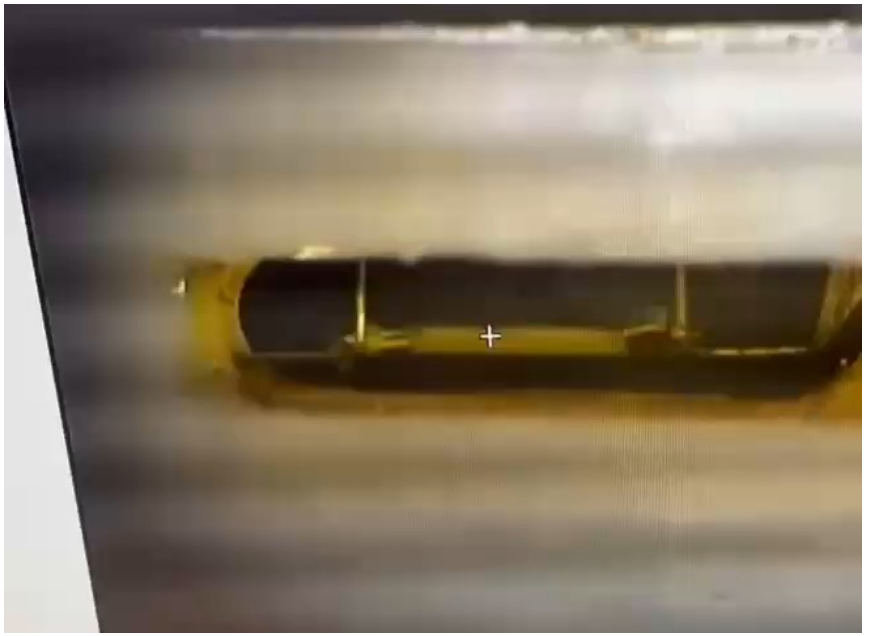
In air shot





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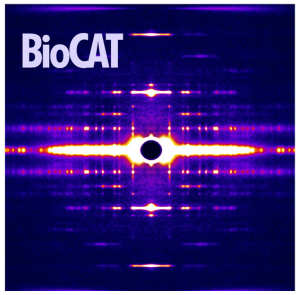
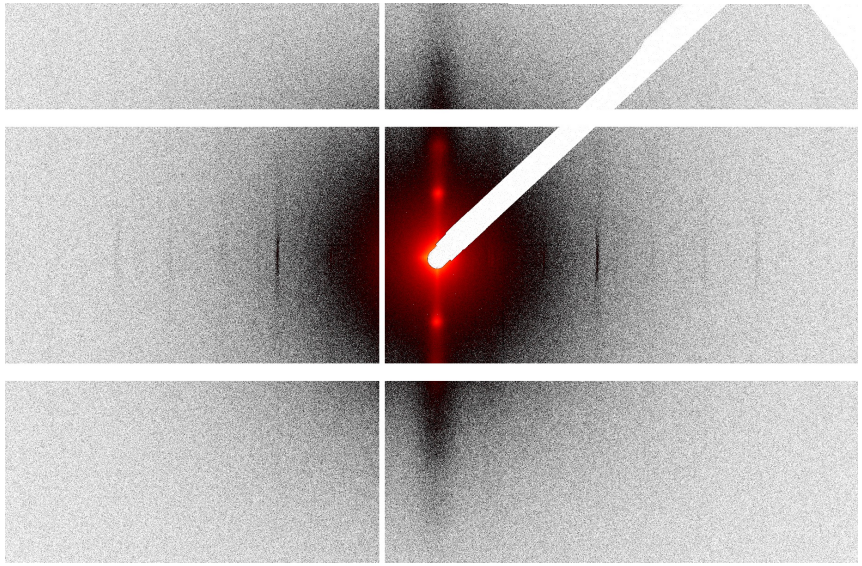
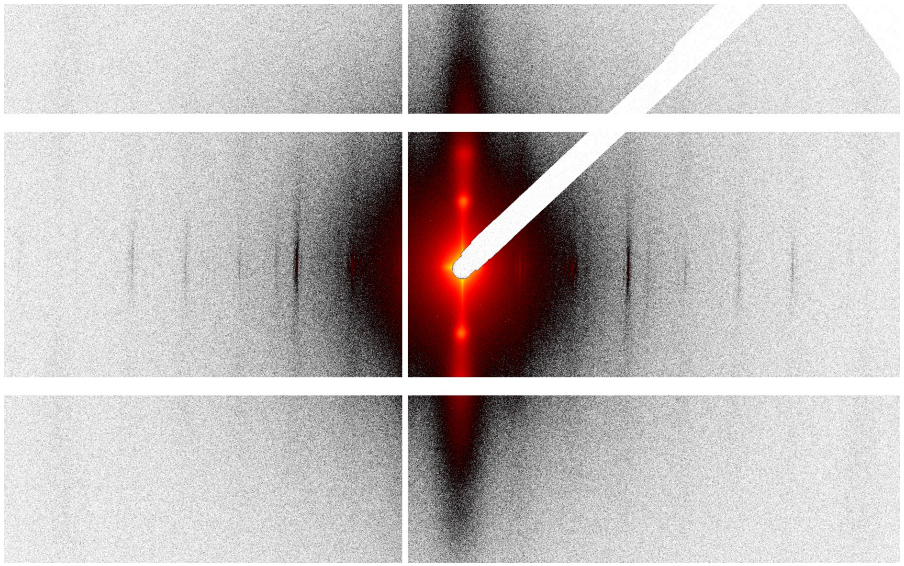


In air shot



100 ms



100 ms

- Diffracted intensities are ~3-4 times stronger in air
- Optimization in progress

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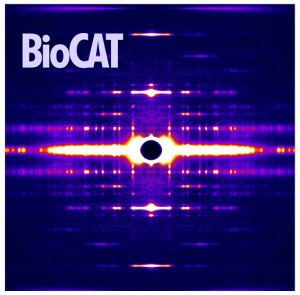

Thank you

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