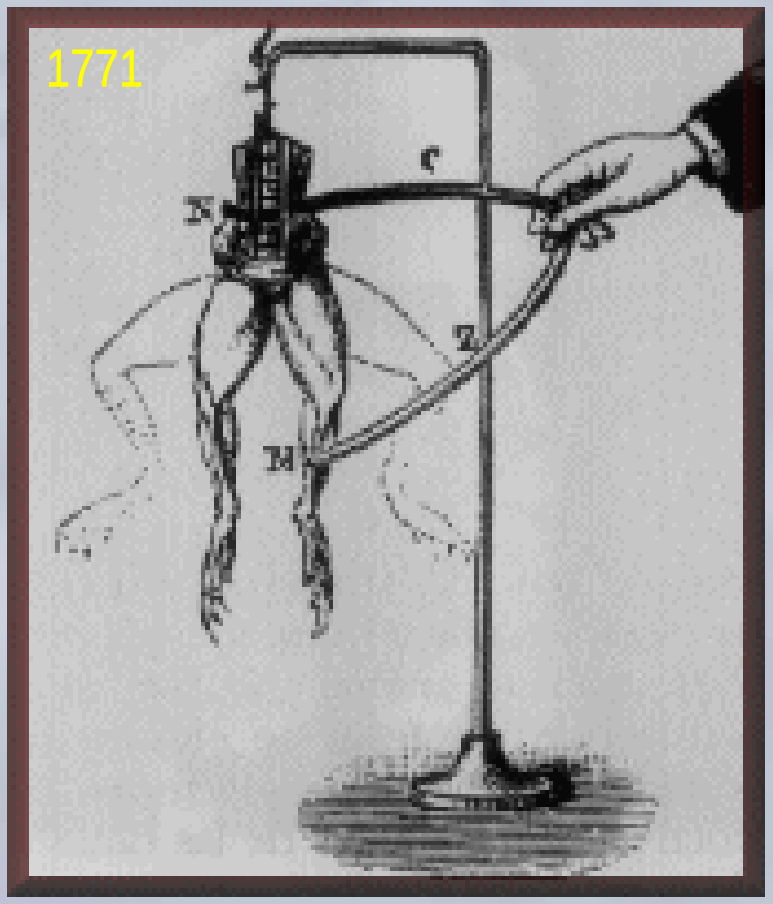
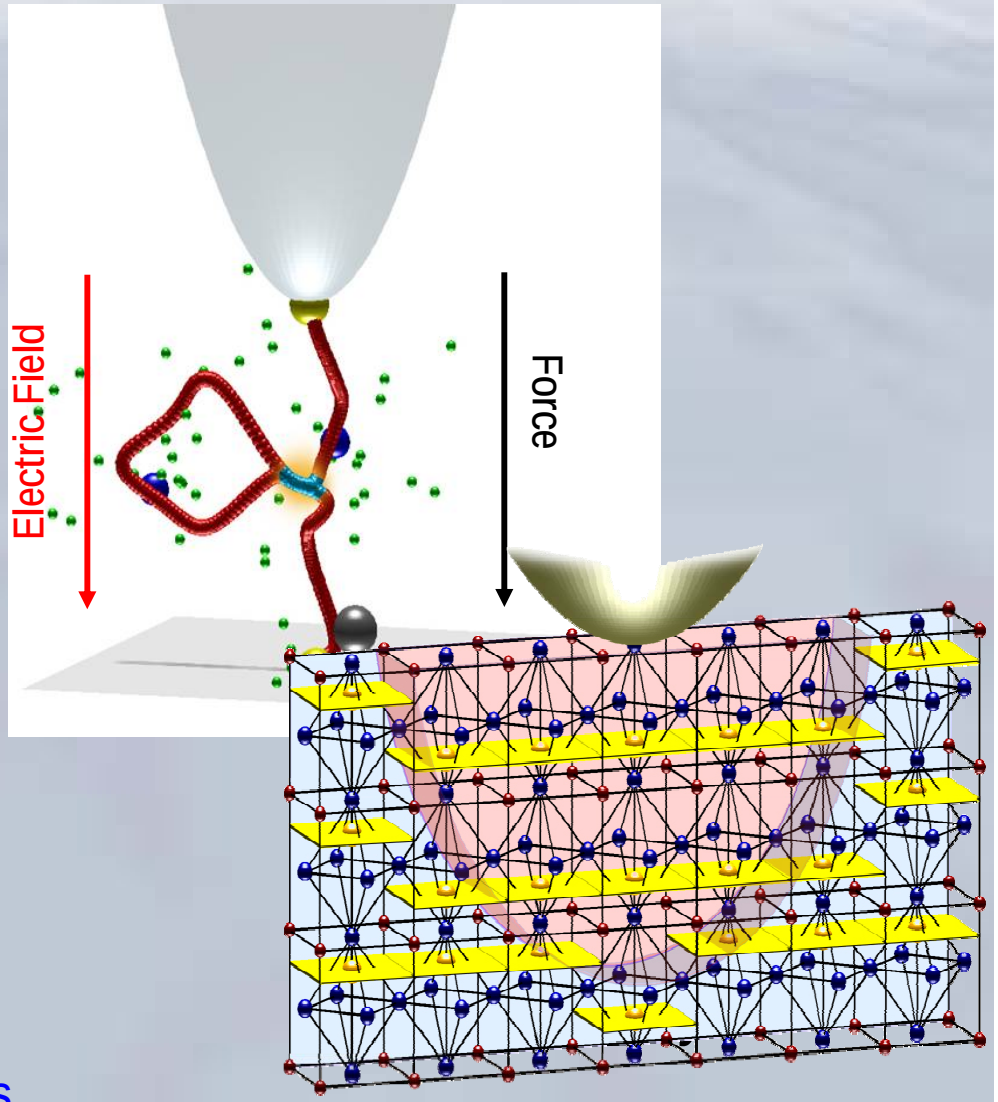
Electromechanics and the Origins of Physics



18th Century

In the beginning, there was electromechanics…

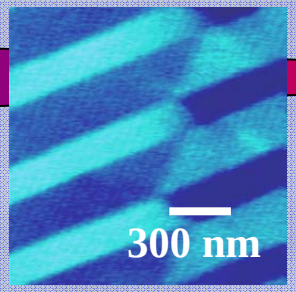


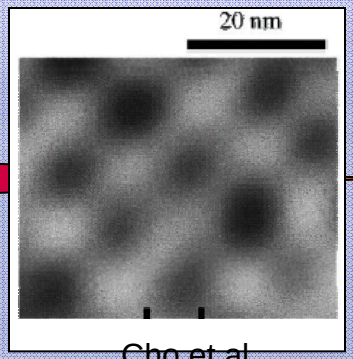
And now is the time to revisit it

Electromechanics: The Next Frontier

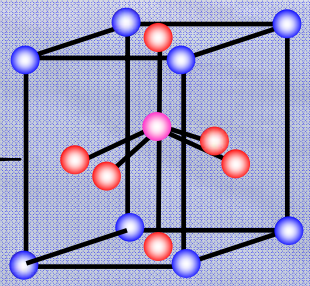
Quartz Crystal

Grains and Domains





Cho et al., APL 2005



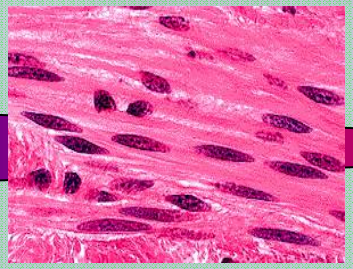
Unit cell

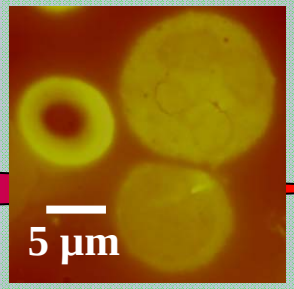
1 m | 0.1 m | 10 mm | 1 mm | 0.1 mm | 10 µm | 1 µm | 0.1 µm | 10 nm | 1 nm | 1 Å

We need to understand structure and electromechanical behavior on the micron, nanometer, and ultimately molecular levels!

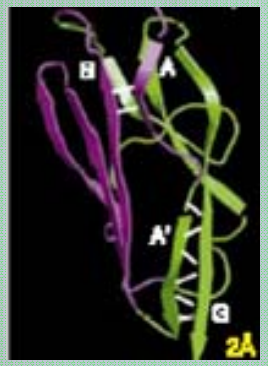
Mouse

Tissues

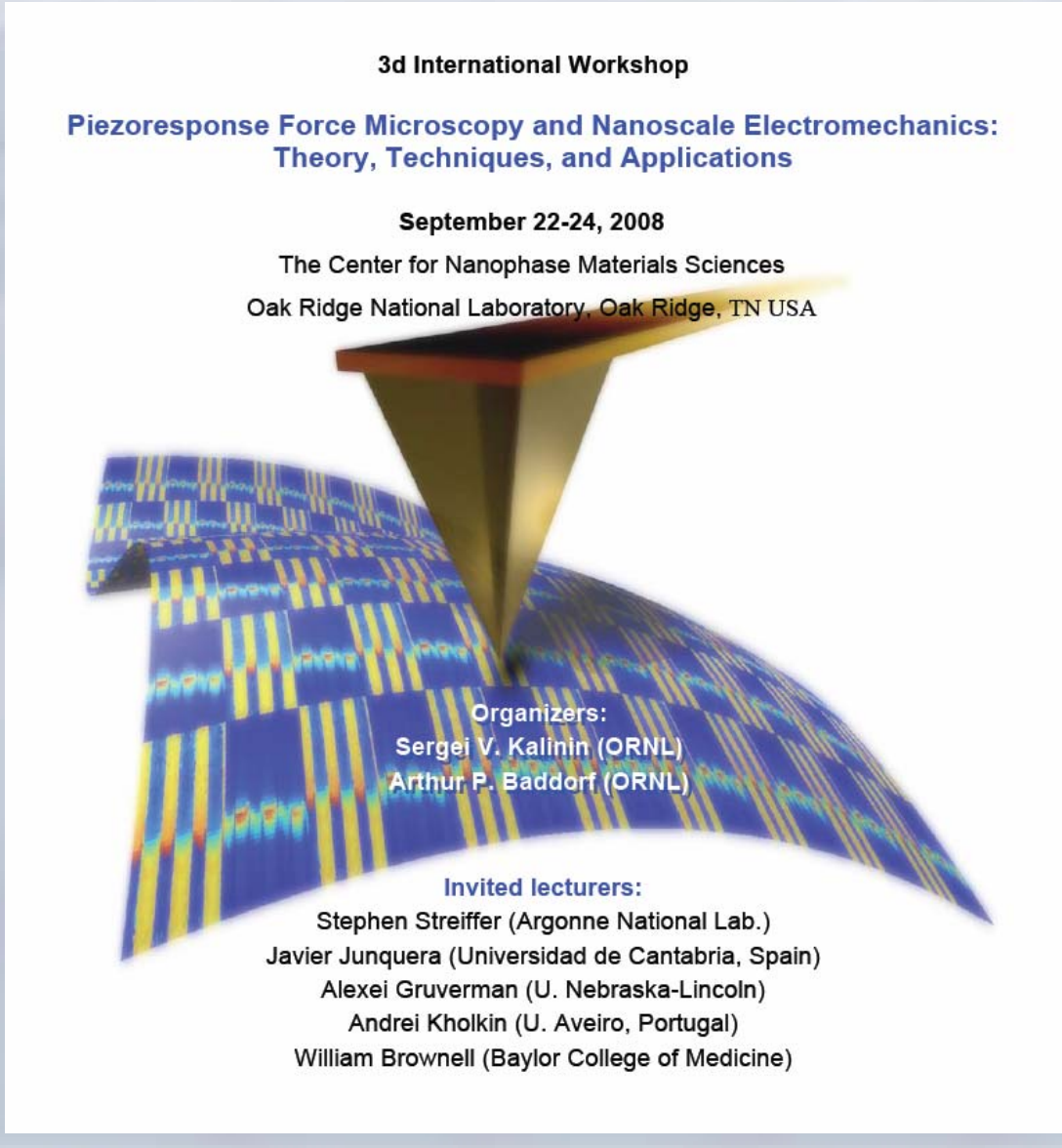




Cell



Molecule



Organizers:

Sergei V. Kalinin (ORNL)
Arthur Baddorf (ORNL)

Experimental Labs:

Katya Seal (ORNL)
Stephen Jesse (ORNL)
Keith Jones (Asylum Research)
G. Thornton (Veeco)
G. Lengell (Nanonis)
M. Nikiforov (ORNL)

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The fact that "small is different" is well established for a wide variety of phenomena including electrical, optical, magnetic and mechanical properties of materials. Untapped but potentially very important area of nanoscience involves the interplay of electricity and mechanics at the nanoscale.

Rationale:

- How important are electromechanical phenomena on the nanoscale?

Fundamental science:

- Are there new behaviors in low dimensional systems?
- Is electromechanics expected to tell us something new about standard systems?

Applications:

- Can we manipulate and control electromechanical energy conversion on the nanoscale?
- What do we need to do to harness it to real world applications?

Electromechanical imaging, spectroscopy, and manipulation