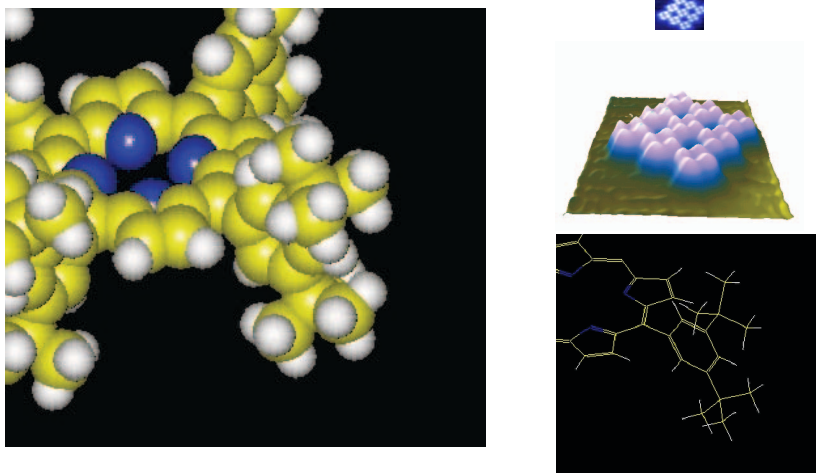
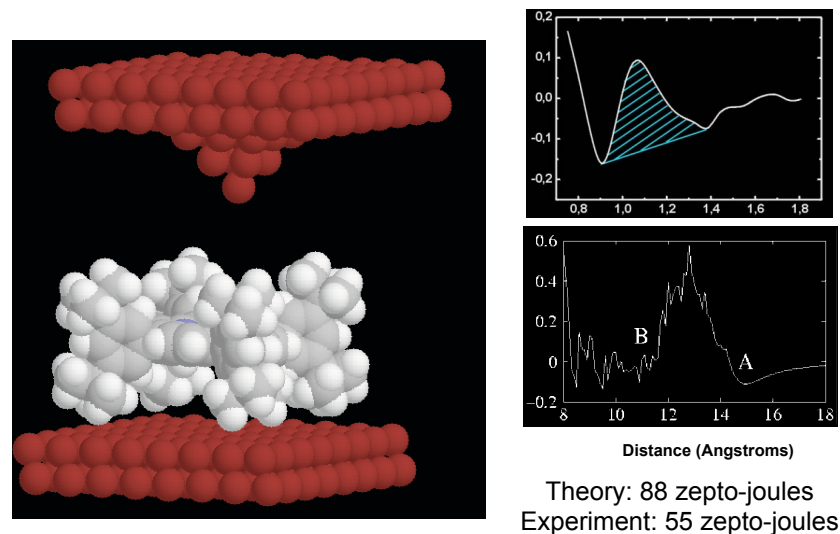


Measuring the force to rotate a single C-C bond
In di-*t*-butyl phenyl porphyrin



Single molecular bond rotation by nc-AFM

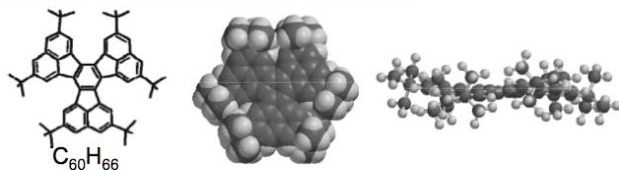


Ch. Loppacher, M. Guggisberg, O. Pfeiffer, E. Meyer, M. Bammerlin, R. Lüthi, R. Schlittler, J.K. Gimzewski, H. Tang, C. Joachim, Phys. Rev. Lett. 90, 066107 (2003)

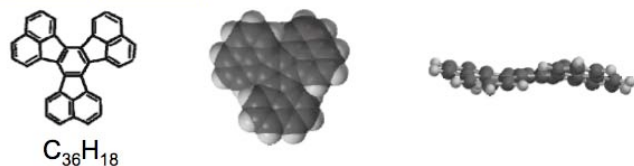
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Molecules Studied by PicoLab

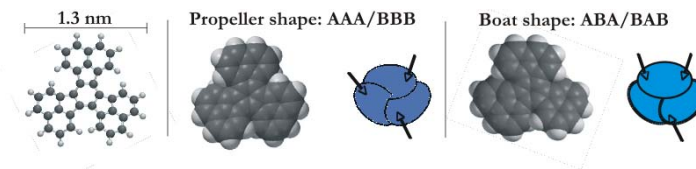
Hexa-(*tert*-butyl)decacyclene, HtBDC



Decacyclene, DC



Decacyclene: Image Contrast and Dimerization



Observations of image contrast and dimerization of decacyclene by low temperature scanning tunneling microscopy

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James K. Gimzewski
California NanoSystems Institute and Department of Chemistry and Biochemistry, University of California,

Image Contrast

Cu(111) - tip dependent

Type 2 tip

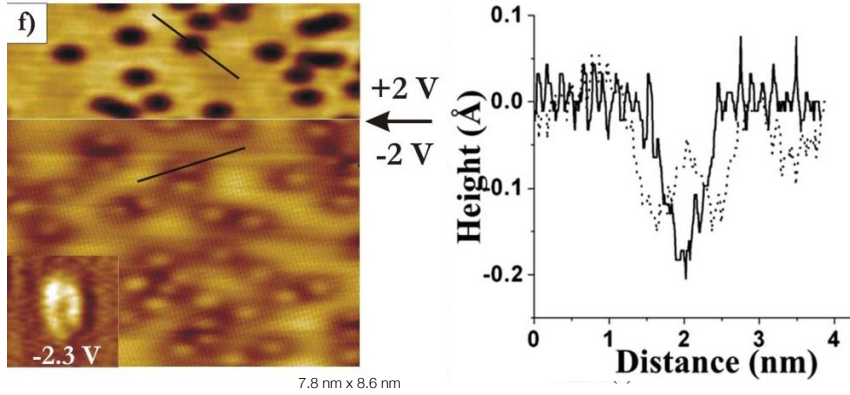
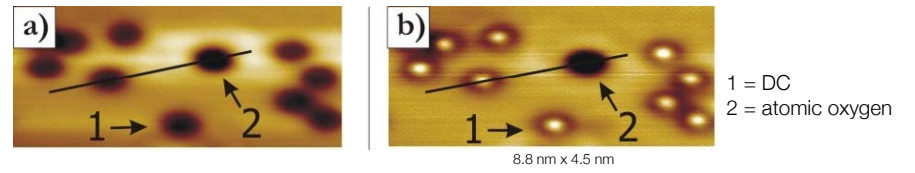
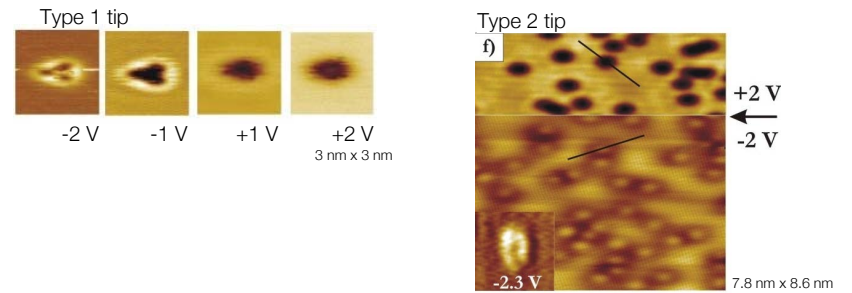


Image Contrast - Summary

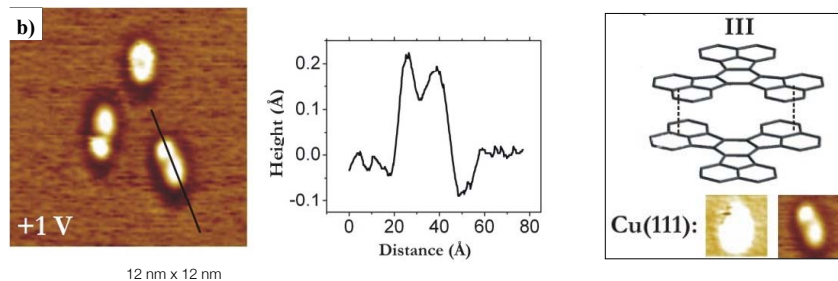
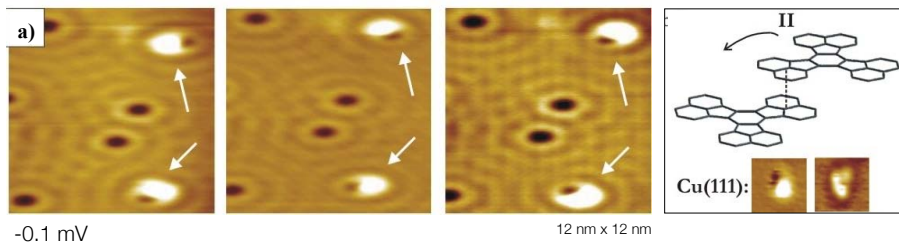
Cu(100) - bias dependent



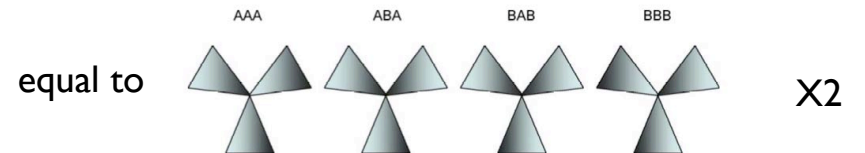
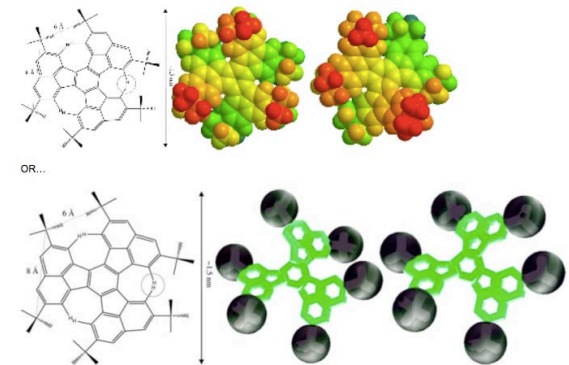
Cu(111) - tip dependent



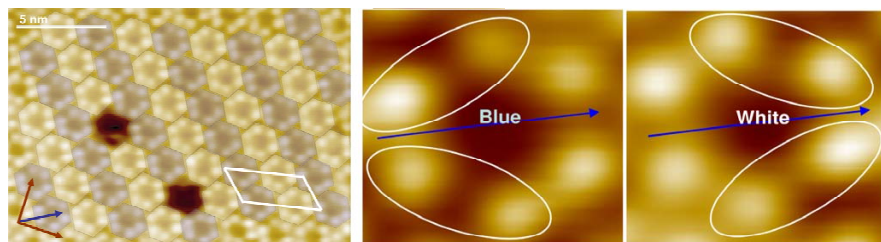
Dimers on Cu (111)



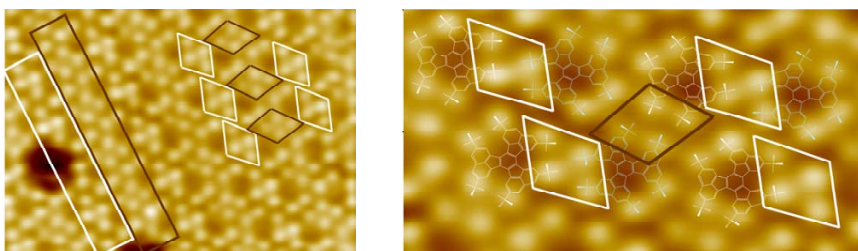
Conformation of t-butyl groups indicates propeller twist



Lattice structure and molecular distortion

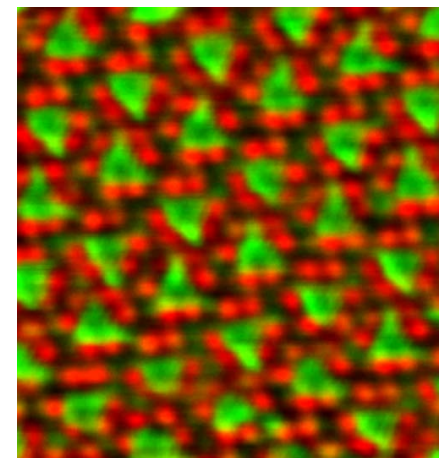
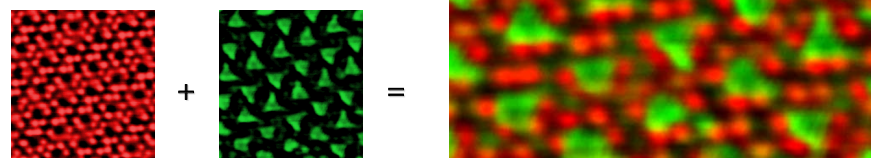


Molecules immobilized by supramolecular interactions

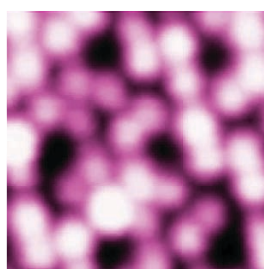
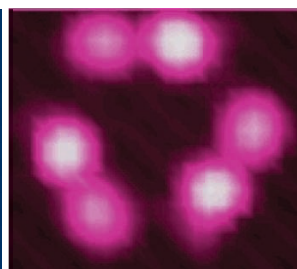
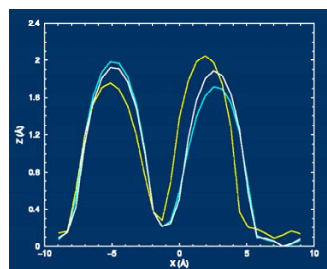
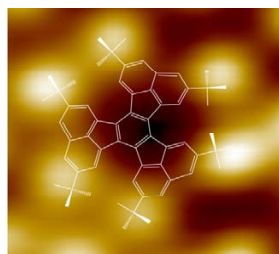
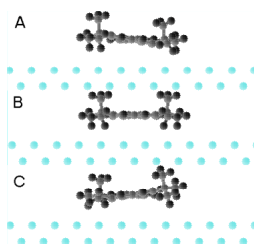
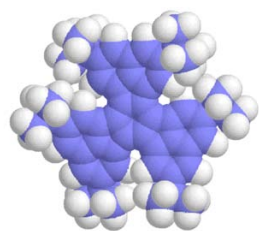


Full Monolayer of Propeller Molecules imaging with two chemically different tips

- **RED** image recorded with a metallic tip
- **GREEN** image recorded with a 'molecular' tip
- Different tips image different molecular sub-components

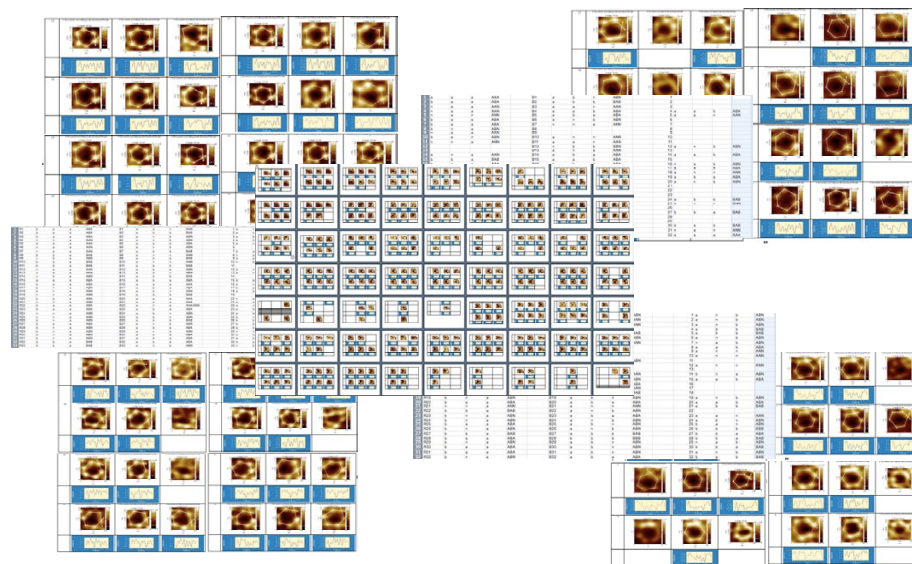


Theory & Experiment of single bond-rotation

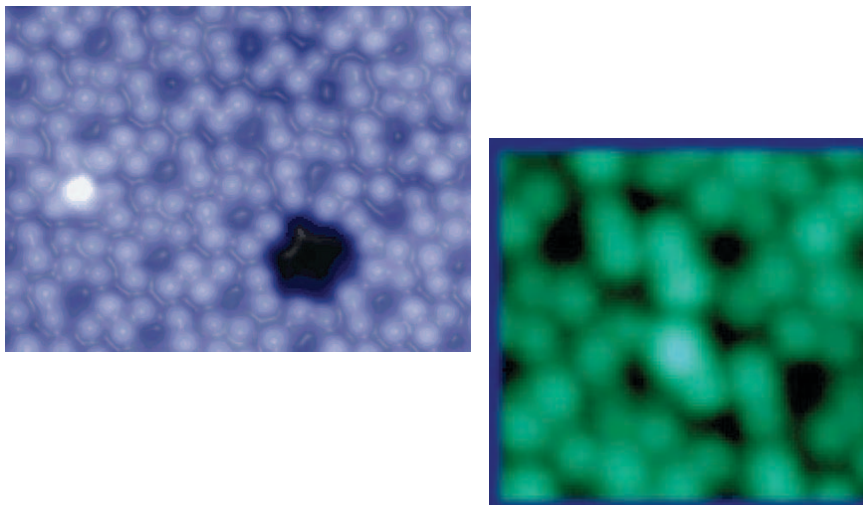


STM ESQC MM2 SIMULATIONS

Cross-Sectional Conformation Analyses

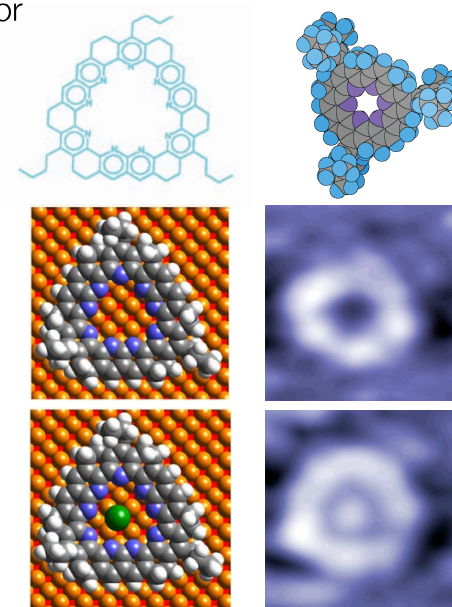


Collective Systems: switching induced stress
Morphing of 2 images



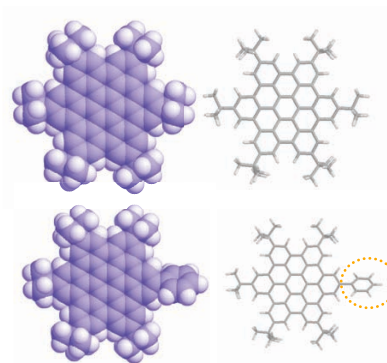
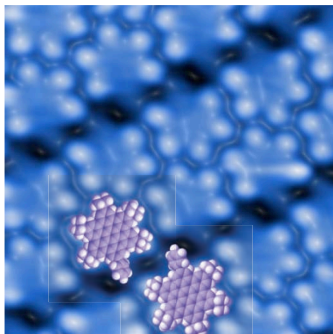
TORANDS: The Stator

- ◆ Torands are receptors for small molecules
- ◆ Central cavity is hollow
- ◆ Copper atoms can be trapped central cavity

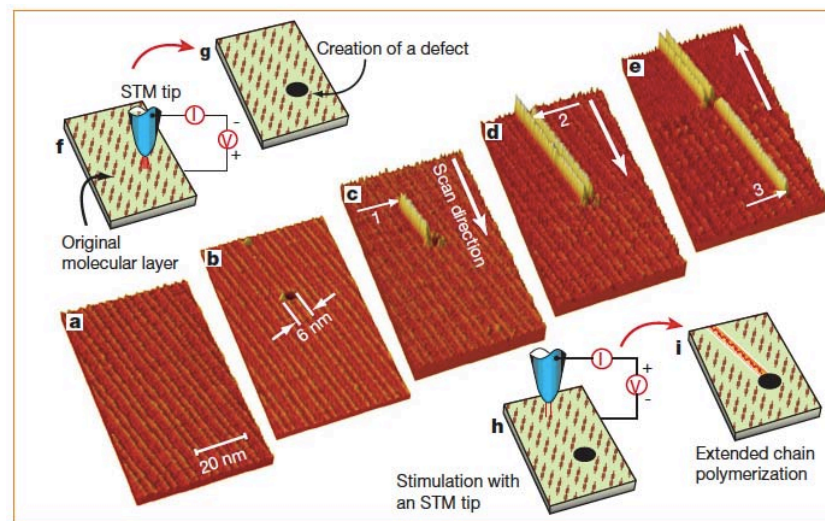


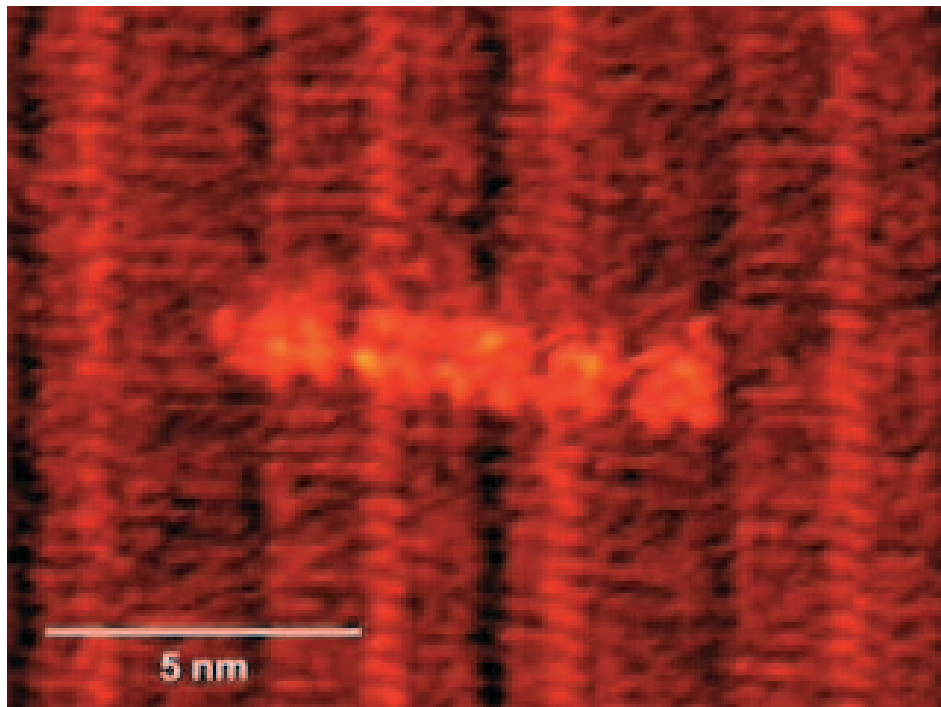
New Molecular System: The Pancakes

- ◆ Disc-Type Polycyclic Aromatic Hydrocarbons (hexa-peri-hexabenzocoronene (HBC))
- ◆ 1958 Halleux et al
- ◆ Super-benzene
- ◆ Modification of substituents permits fine tuning of orbital energies
- ◆ Experiment originally designed for selective docking of Phenyl on monoatomic Cu(100) step



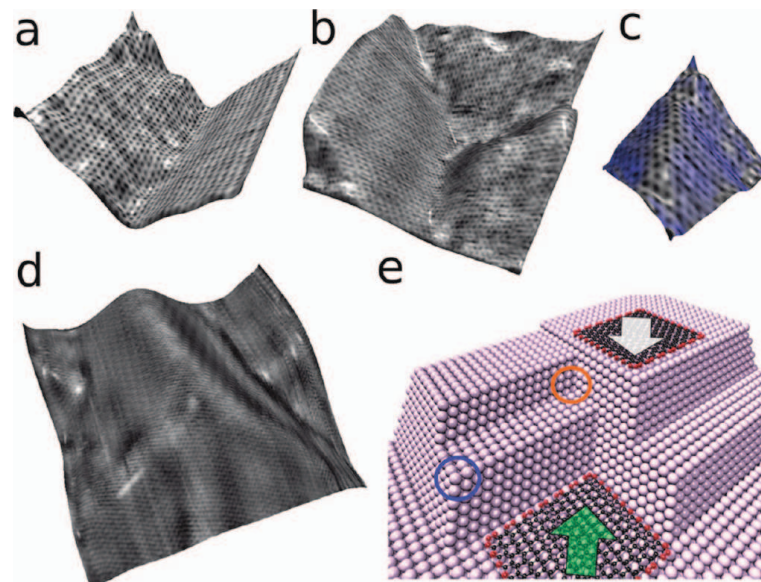
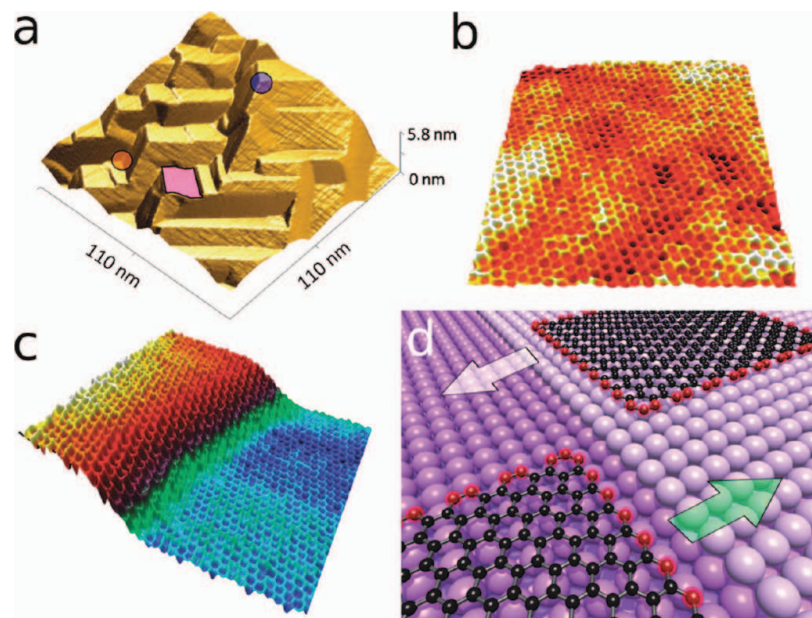
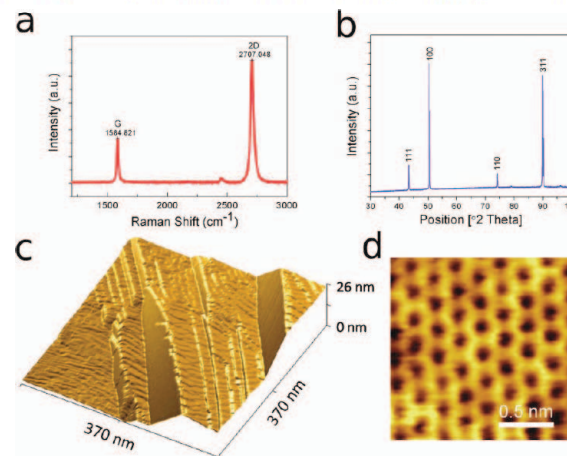
A. Gourdon, H. Tang, C. Joachim, M. Pederson, R. Schlittler and J. Gimzewski





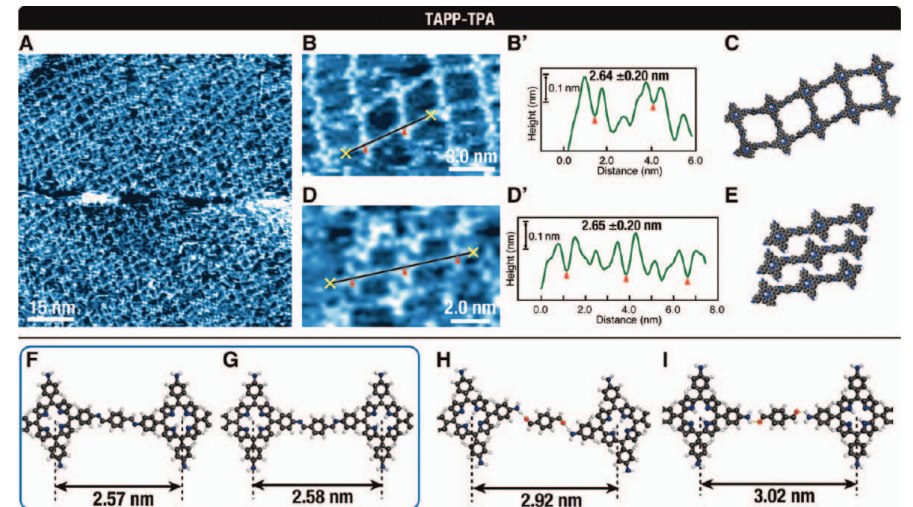
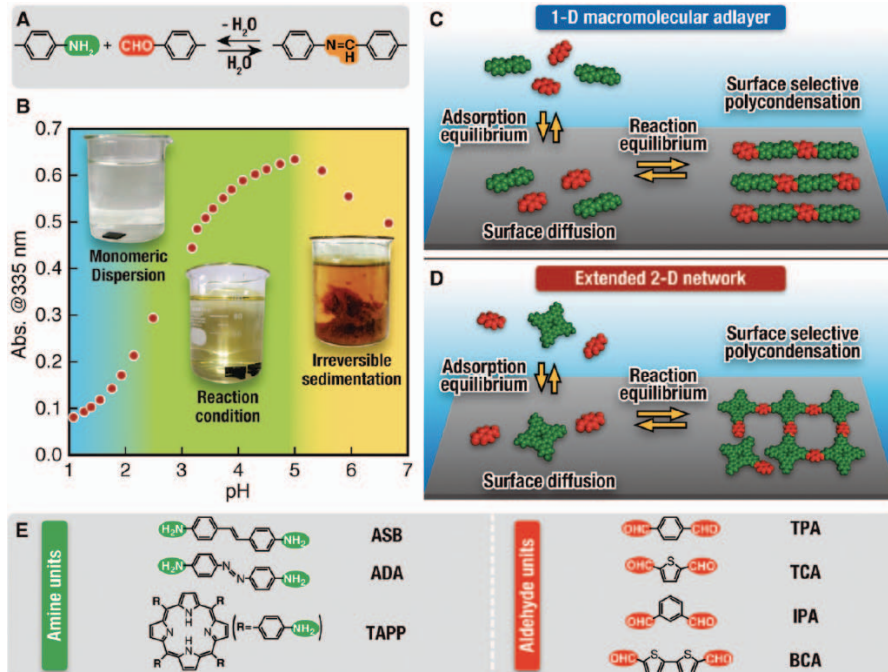
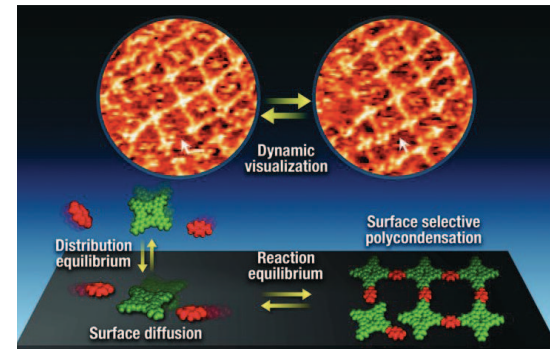
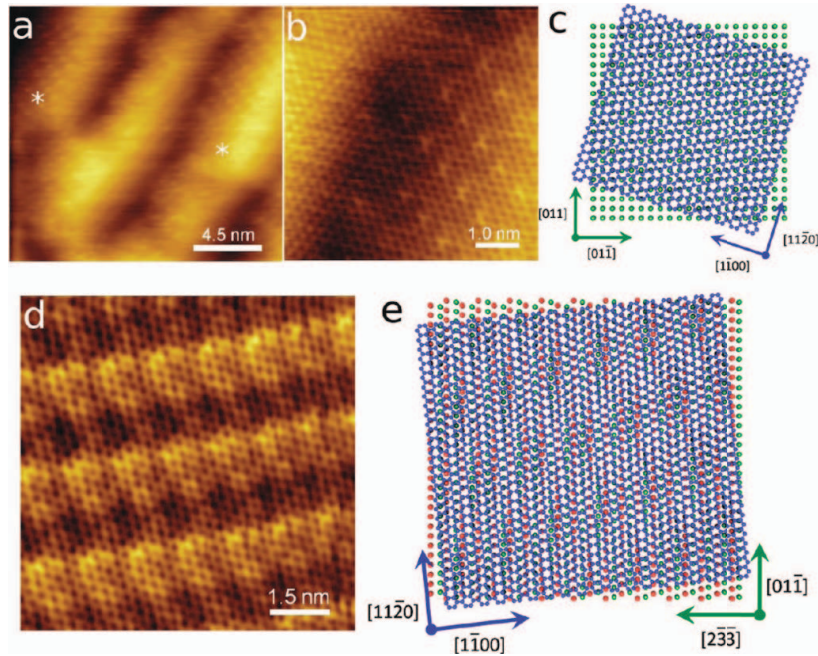
Continuity of Graphene on Polycrystalline Copper

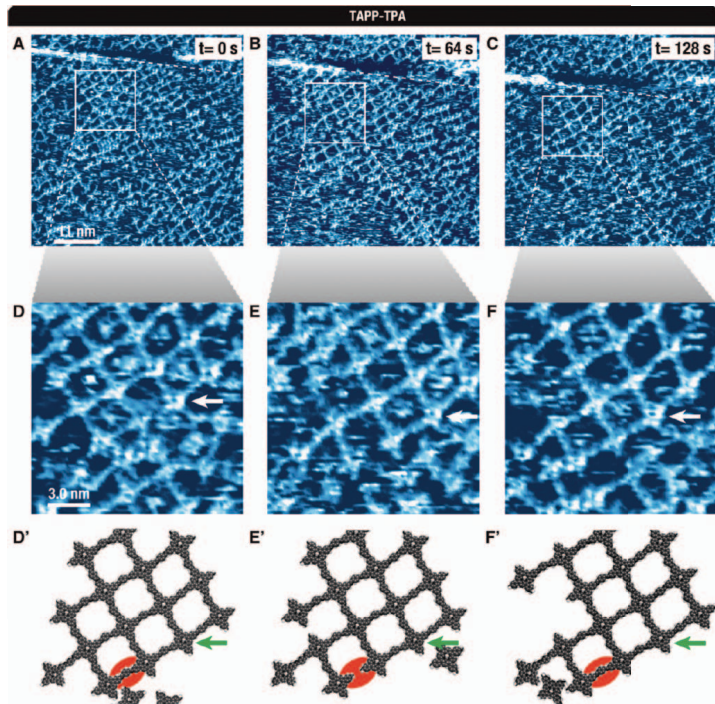
Haider I. Rasool,^{*,†,‡,§} Emil B. Song,^{*,§,||,¶} Matthew J. Allen,[†] Jonathan K. Wassei,[†] Richard B. Kaner,^{†,⊥} Kang L. Wang,[§] Bruce H. Weiller,^{||} and James K. Gimzewski^{†,¶}



Thermodynamically Controlled Self-Assembly of Covalent Nanoarchitectures in Aqueous Solution

Ryota Tanoue,[†] Rintaro Higuchi,[†] Nobuo Enoki,[†] Yuya Miyasato,[†] Shinobu Uemura,[†] Nobuo Kimizuka,^{*,5} Adam Z. Stieg,^{1,5} James K. Gimzewski,^{1,5,*} and Masashi Kunitake^{1,2,*}



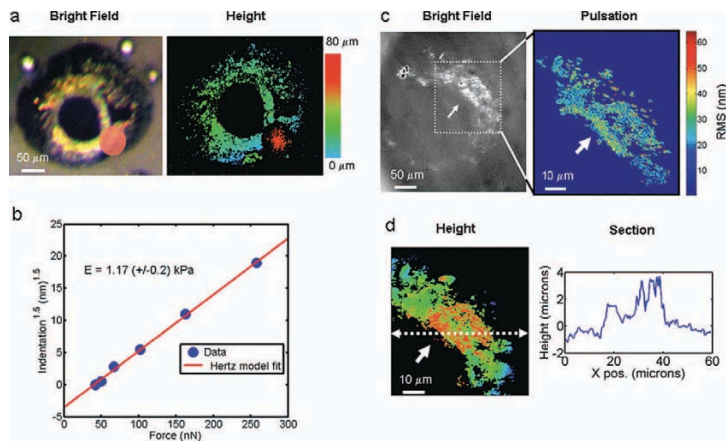
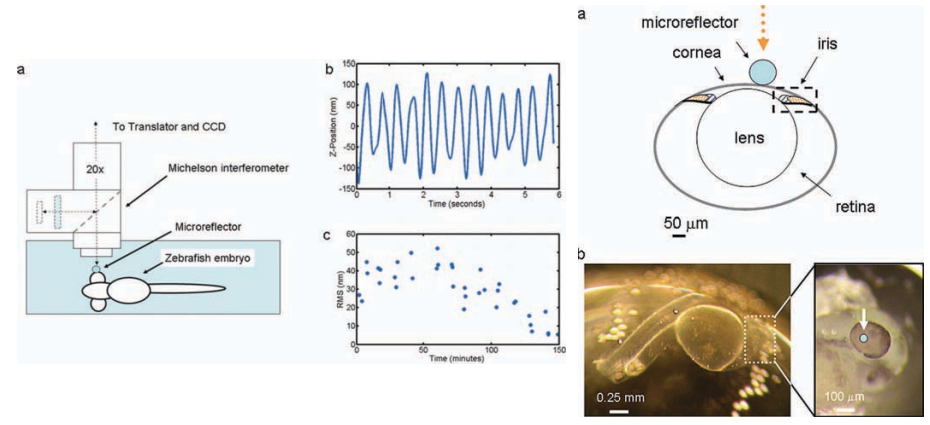


Mechanical Interferometry of Nanoscale Motion and Local Mechanical Properties of Living Zebrafish Embryos

Jason Road,^{1,*} Siddarth Ramakrishnan,² Joanna Schmit,³ and James K. Gimzewski^{1,2,*}

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ARTICLE

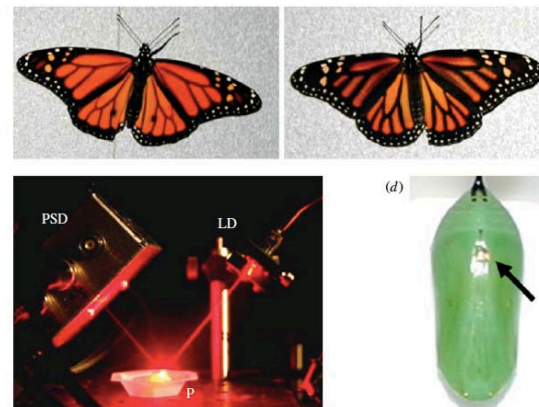


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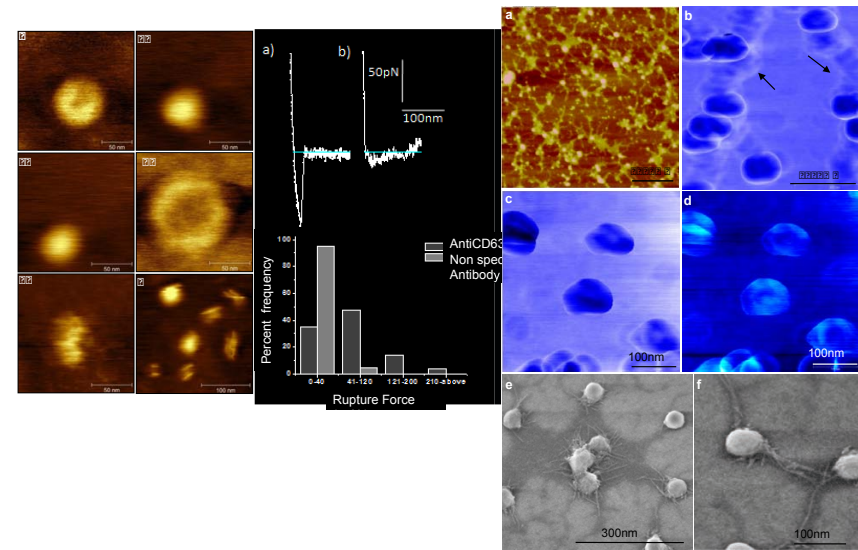
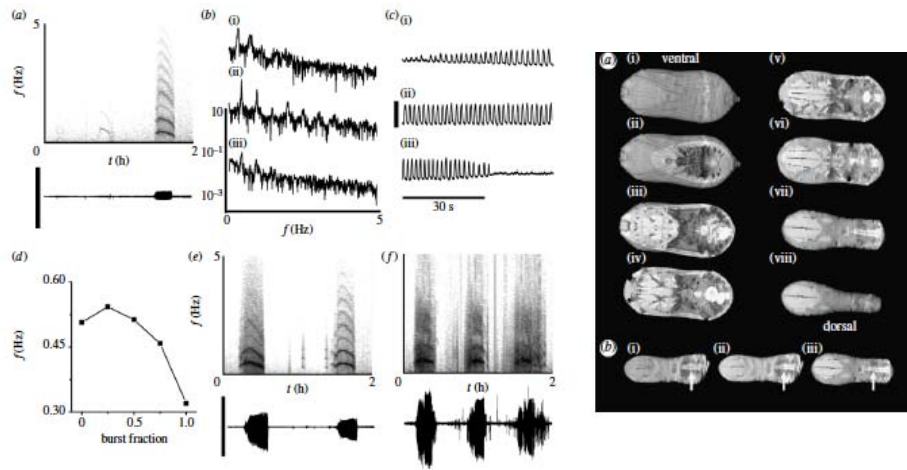
J. R. Soc. Interface
doi:10.1098/rsif.2008.0224

Dynamic mechanical oscillations during metamorphosis of the monarch butterfly

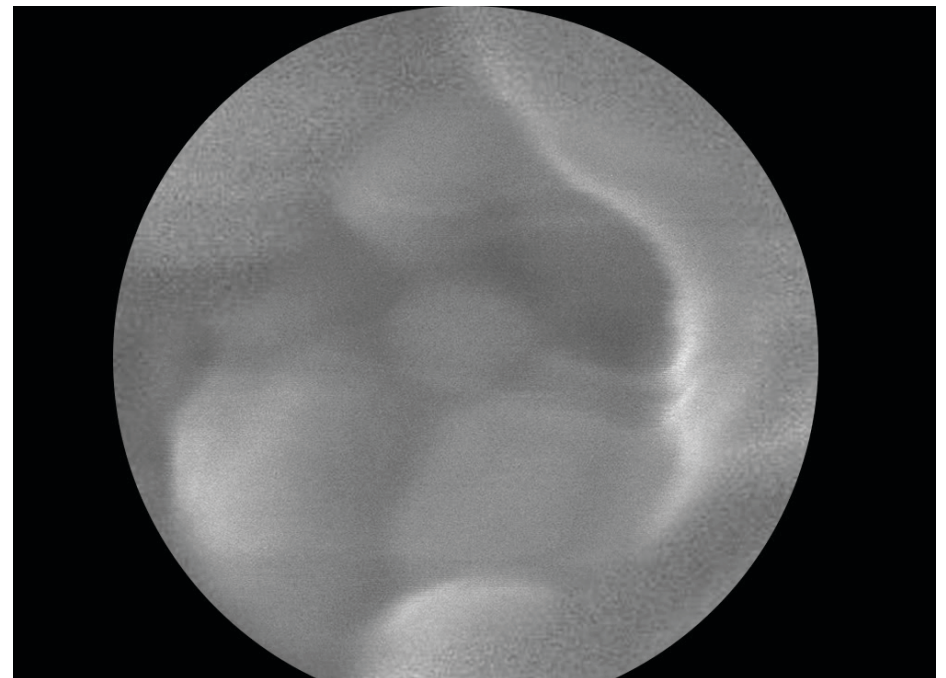
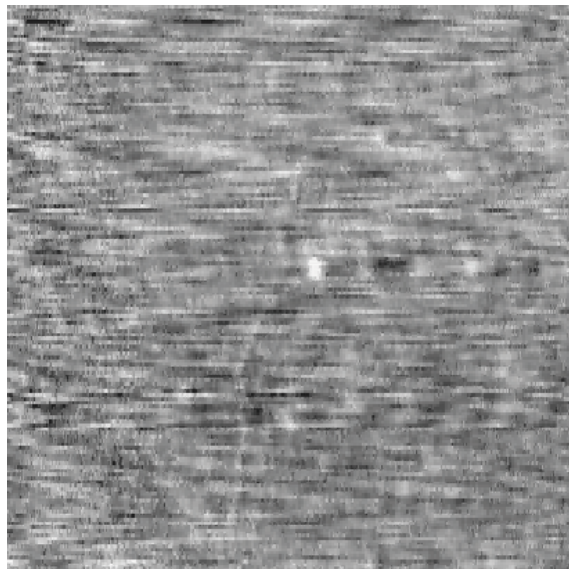
Andrew E. Pelling^{1,2,3,†}, Paul R. Wilkinson^{1,2}, Richard Stringer⁴
and James K. Gimzewski^{1,2,*}

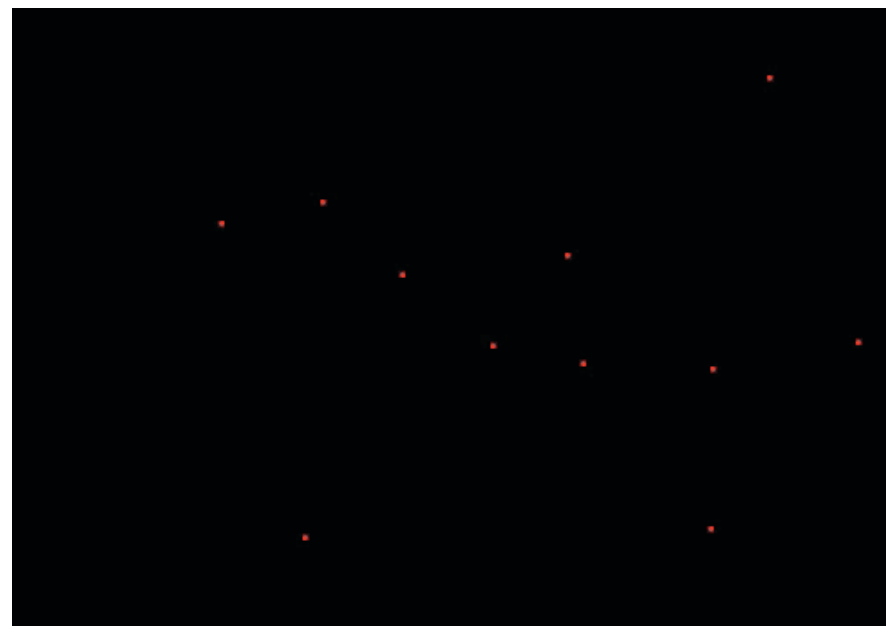
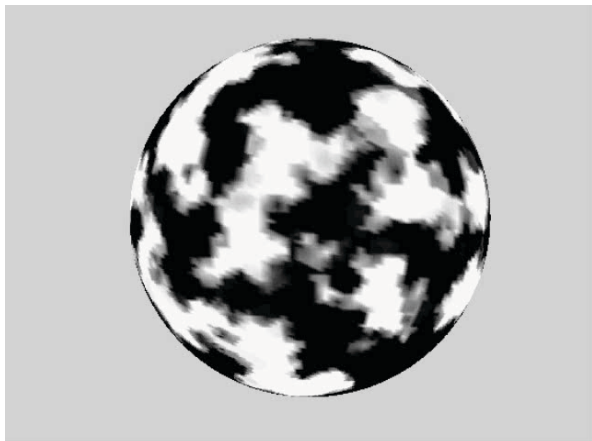


Ultrastructure of individual saliva exosomes observed under Tapping mode, AM-AFM and FESEM



Fast DNA imaging





Thank you

Gimzewski Lab (past and present members):

Dr. James K. Gimzewski
Dr. Adam Stieg
Dr. Sarah Cross
Dr. Andrew Pelling
Dr. Masashi Kunitake
Dr. Jason Reed
Dr. Maria Jose Esplandiú
Dr. Shane Dultz
Dr. Cathy Skibo
Dr. Keith O'Doherty
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