NANO HIGHLIGHT
Direct Linkages of Single Biomolecules into Nanocircuits

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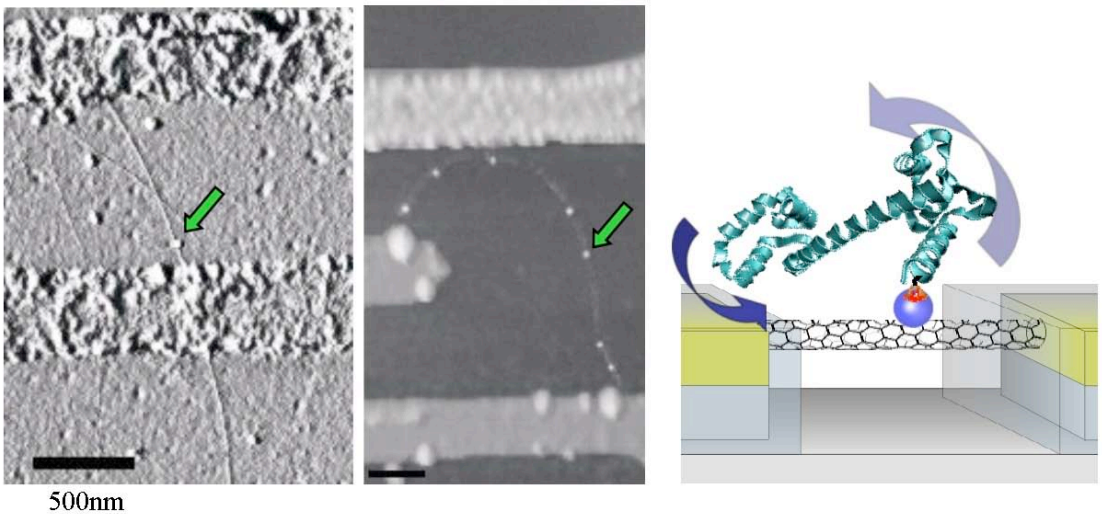
A promising application of electronic circuitry at the nanoscale is the sensing and detection of molecular species in the surrounding environment. Prototype chemical gas sensors and biosensors have been demonstrated with outstanding sensitivities and detection times. In fact, single-molecule sensors appear feasible.

Single-molecule readout could allow the direct, real-time monitoring of complex molecular functions like protein folding or antigen capture. While promising, the reliable and reproducible demonstration of single-molecule sensors remains limited by circuit fabrication techniques. To take advantage of the scientific promise of molecular readout, new routes need to be developed for building functional nanocircuits reliably, simply, and with reasonable yield.

One architecture we investigate is based on carbon nanotube circuits. A carbon nanotube forms an exquisitely small electronic circuit which is, for the most part, chemically inert. However, at discrete defect sites one has the opportunity to covalently link a receptor molecule such as an antibody or peptide substrate. In the ideal case, the resulting circuit incorporates only a single active site which controls the electronic behavior of the circuit. The figure below shows example circuits which have been fabricated, as well as a schematic representation of the structure. The wires in these circuits consist of single-walled nanotubes with 1 nm diameters, and the visible attachments are 10 nm nickel dots [2].



References
[1] For further information about this project link to **www.physics.uci.edu/~collinsp/** or email **<collinsp@uci.edu>**
[2] Y. Fan, B. Goldsmith, P. G. Collins, "Identifying and counting point defects in carbon nanotubes," *Nature Materials* **4** (2005).