NANO HIGHLIGHT
A Nanoscale Bio-electronic Switch

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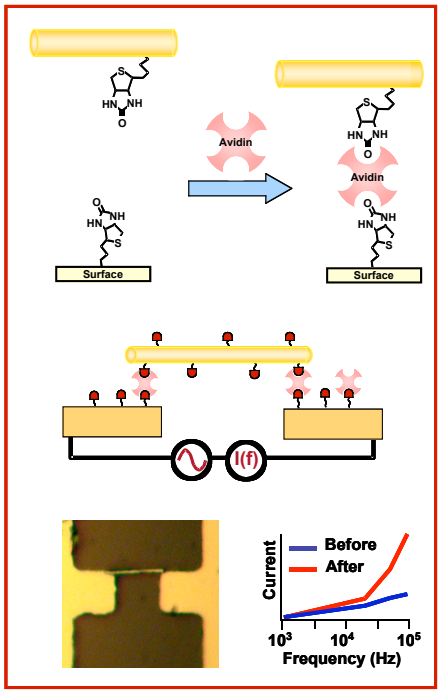
While there are many approaches to nanoscale sensing, one promising approach is to use biomolecular interactions to induce nanotubes or nanowires to link across a set of electrical contacts, forming a bio-electronic switch.



Biomolecular interactions can be very selective and very strong. The binding of the protein avidin to the small vitamin avidin is one good example. The protein avidin has four binding sites, each of which is able to bind tightly to a biotin molecule. The avidin molecule can therefore act as a kind of "biomolecular glue" , holding several biotin molecules together. If these biotin molecules are already linked to other objects, then it is possible to use the avidin-biotin biomolecular interactions to control the assembly of the larger objects.

Metal nanowires and metal surfaces can be chemically modified with biotin molecules. The resulting biotin-modified nanowires and the biotin-modified gold surface have little affinity for one another unless avidin is present. However, if avidin *is* present, then it acts as biomolecular glue to strongly bind the nanowires to the surface.

We have used this idea to fabricate a new type of bioelectronic switch, by having the highly selective biotin-avidin binding induce nanowires to bind across two insulated electrical contact pads, as shown above. The biotin-avidin biological interaction causes the nanowires to form a bridge across the pads. Even though the molecules are not conductive, the presence of the nanowire dramatically changes the capacitance between the contact pads, producing a very clear electrical signature.

The method described here represents a bio-electronic switch in which the presence of avidin produces a large change in electrical current. This idea should be applicable to other biological molecules of interest, including proteins, antibodies, and DNA. Because the number of molecules needed to link the nanowires to the surface is very small and the change in electrical conductivity due to nanowire bridging is very large, this type of biosensor should have extremely high sensitivity, requiring only a small number of molecules to achieve detection

References:

[1] For further information about this project link to http://hamers.chem.wisc.edu/ or email **rjhamers@facstaff.wisc.edu**