

Itmar Willner (Hebrew University, Jerusalem) Metallic and Conductive-Polymer Nanowires on DNA Templates for Electronic Applications:

e-mail: willnea@vms.huji.ac.il

DNA as a template for the construction of Au-nanowires: DNA functionalized semiconductor nanoparticles, polyaniline-DNA conductive wires, DNAzymes as active components for the generation of polymer and metallic wires. Actin as a template for the generation of wires. Why DNA? E.g. synthetic construction, availability of enzymes for scission/elongation, and polymerization. dsDNA provides sequence-specific intercalators or the association of cations into the phosphate units. Sequence addressable binding of proteins to NA provides means for patterning. dsDNA, intercalate gold nanoparticles, and image via light activation. Hard to get uniform coverage of the DNA. The idea is to use the particles to make wire. Use of cancer cells to identify telomeric DNA. Use the telomeres as a template for wires. Telomerase to grow dNTPs/dUTP-NH₂, intercalate gold particles and can secure μm long nanowires. Or, just telomere to makes ssDNA, intercalate through complimentary double strand assembly with nanoparticle, also provides nice wires. Three-arm branched junction with amine branched DNA, delivers nice "Y" shaped gold intercalated wires. We can also combine three DNA arms at the center. Metallization is relatively easy. Metal semiconductor hybrid devices: attached cadmium sulfide nanoparticles with complementary strands linked to CdS. Evaluated using absorption spectroscopy. Photocurrent increases with number of layers, but DNA has no effect on conductivity. Must decorate DNA with positively charged particles for charge transport. Photocurrent jumps with ruthenium oxide. How do we make contacts? Semiconductor nanoparticle, cadmium sulfide, attached dye labeled dUTP+dNTPs, to examine fluorescence energy transfer, find it improves transfer. Semiconductor with two gold contacts on either end: polyaniline-DNA conductive wire. ds- λ DNA, attached copolymer of aniline such that FAD attached to DNA backbone. Glucose oxidase was attached to the wire to make electron transfer from DNA to gold wire. G-quadruplex with amine intercalated can result in chemiluminescence repeats on the surface. Amplified the system to get gold attached to G-wire templates. Can amplify detection of DNA. Actin as a template for the generation of wires: motor protein, coupled to myosin, and ATP, myosin starts to move. Took actin monomers to polymerize to f-actin, modify with gold NP, decorated filament, depolymerize, repolymerize and enlarge with gold, 2- μm long, 80-nm high nanowires. Attached unlabeled filaments and got a "bar of gold" with unlabeled f-actin at edges. Can go from non-patterned actin to decorated to make monomer gold contacts. Tested gold decorated f-actin for electronic conduction and measured a highly conductive nanowire. In principle a motor with gold to get a nano transporter, to glass slide with myosin, followed spectroscopically, add ATP, see four pictures at 5 second intervals. Can calculate motility rate, 254nm/s. Have motor that moves on a surface.