Emerging Nanotechnology Trends by the First Lady of Emerging Technologies

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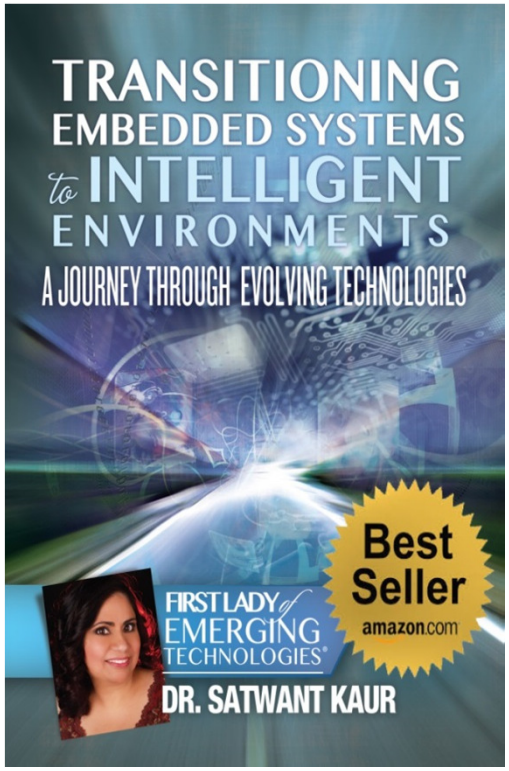

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Speaker's Bio

- **Current Position:**
  - **Chief Technologist (CT) - Innovation (HLS), Hewlett Packard Company**
  - **HP Distinguished Technologist**
- **Previous Positions:**
  - **Platform strategist, Intel Architecture Group, Intel.**
  - **CTO, Emerging Technologies Group, TIBCO Software.**
  - **Director of Development, Symantec.**
  - **Faculty, EE, Idaho State University**
- **Author:**
  - **Author, "Transitioning Embedded Systems to Intelligent Environments"**
- **Inventor of:**
  - **Intel's Reduced Interoperability Technologies**
  - **CA Technologies' Event Correlation Engine**
  - **Dozens of cutting edge inventions at HP.**
- **Education:**
  - **B.Tech. in EE, IIT, Delhi.**
  - **M.S. in CS, Oakland University**
  - **Ph.D. in Mobile Internet Protocols, Oakland University**

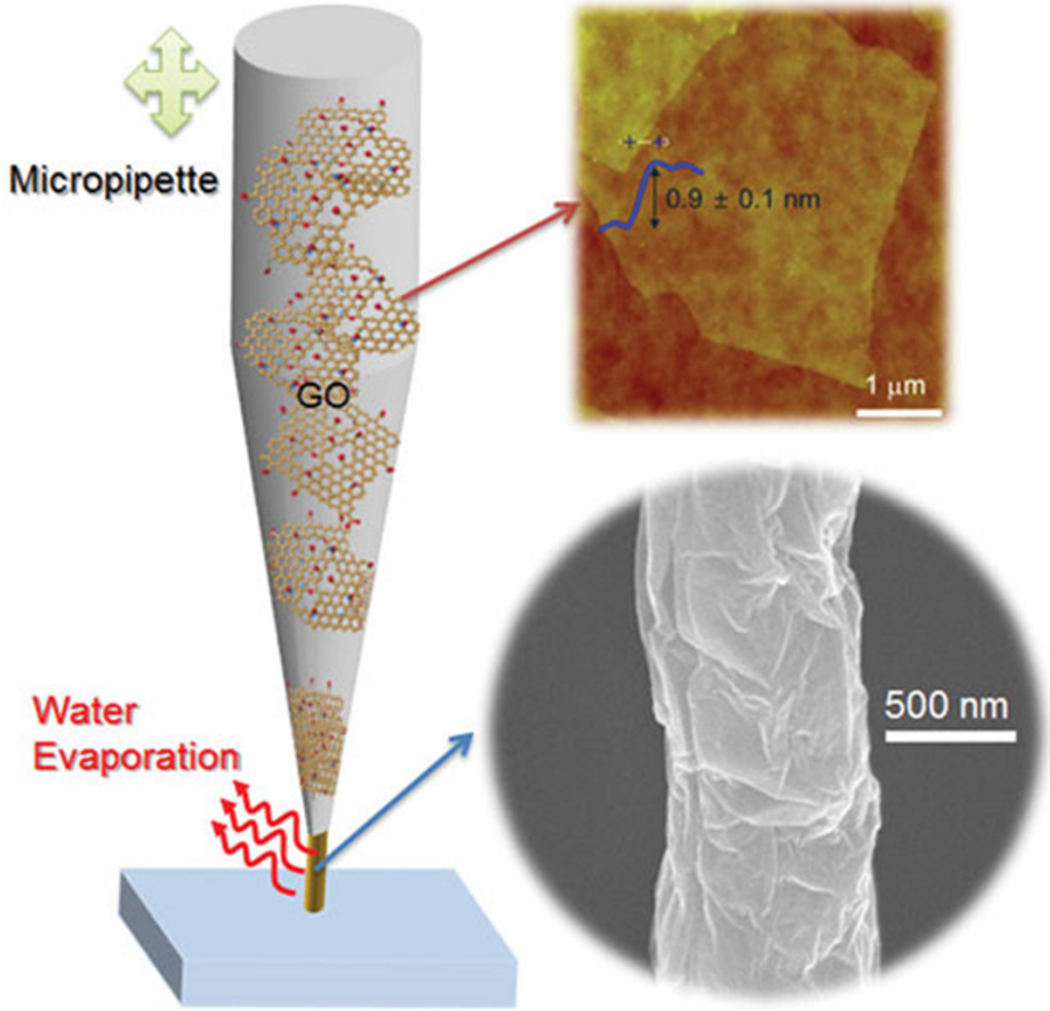
Emerging Nano Technologies:

1. Nano Materials that Detect Explosives
2. 3D Printed Graphene Nano Wires
3. Reducing Infection in Surgical Implants
4. Stem Cell Therapy Without Donor Cells
5. Nano Heart Muscle on Spider Web Silk
6. Treatment of Amputee's Pain with Nano Sensors
7. 3D Scanning and 3D Printing of Nano Electronics
8. Making Nano Circuits with Human DNA

Nano Materials that Detect Explosives

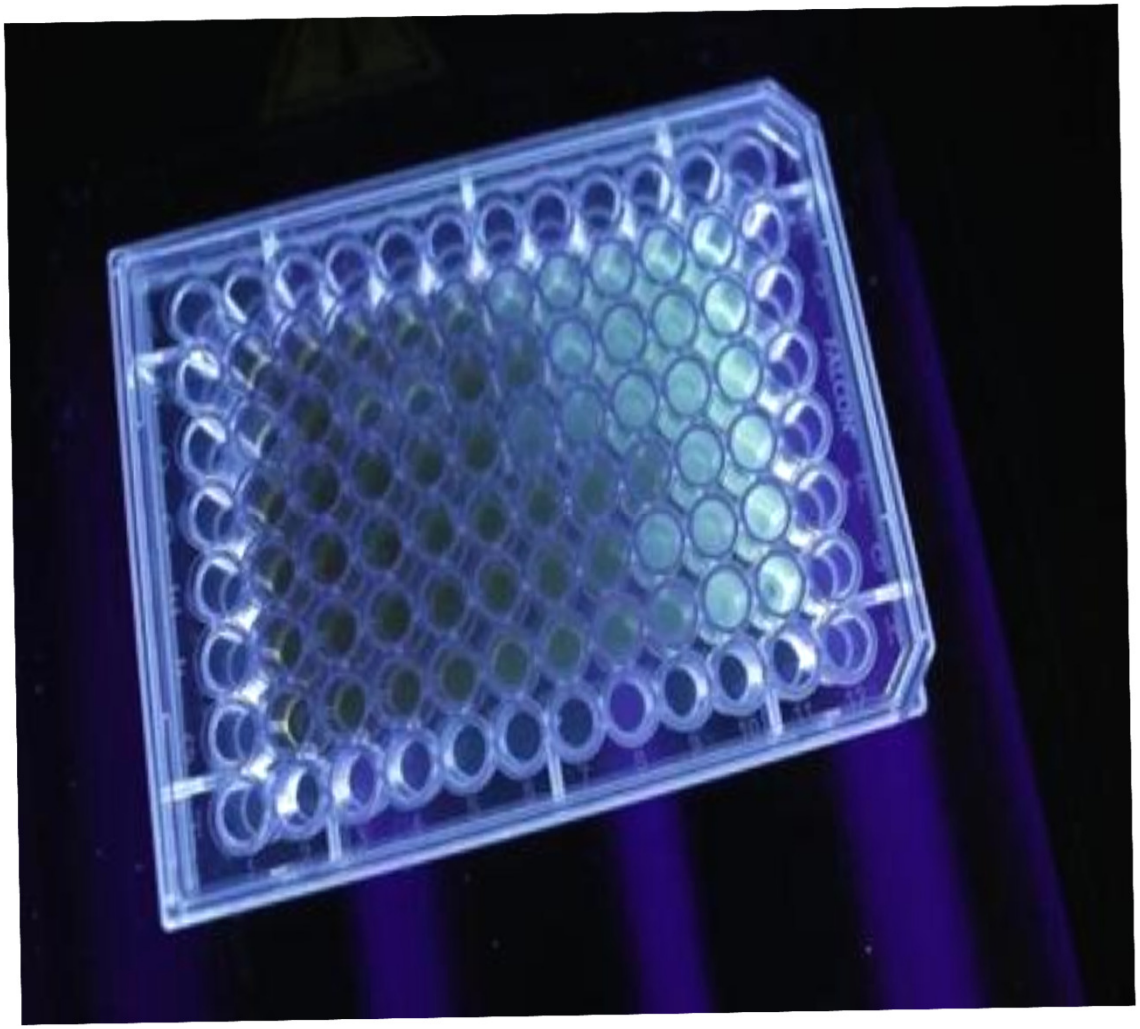
- Handheld explosives detector made with Carbon Nanotubes
- A layer of microscopic deposit of nano electrodes that detects explosives
- The deposit contains bundles of carbon nanotubes that have been broken down with a polymer
- Explosives are detected when voltage between the electrodes results in a change of current through the nanotube
- By University of Utah

3D Printed Graphene Nano Wires



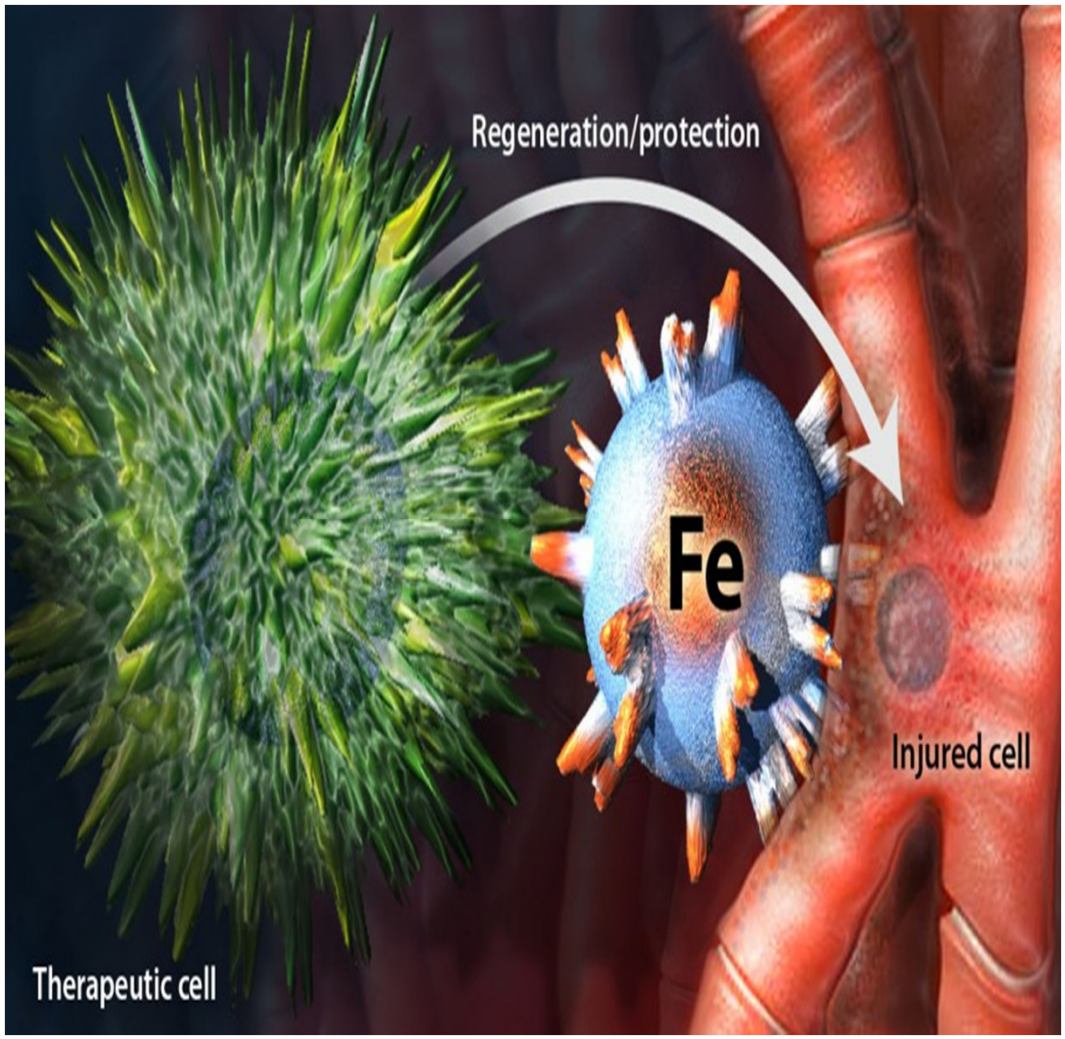
- Graphene is a honeycomb of one atom thick carbon.
- So to make graphene based IC's, we need precise patterning of graphene sheets at nano scale
- This is done by 3D printing uses stretched liquid ink through nozzle aperture
- Used to fabricate graphene nanowires
- By Korea Electrotechnology Research Institute (KERI)

Reducing Infection in Surgical Implants



- Currently, implants are screwed in place during surgery and can get infected
- Nano sized materials in implant reduces infection by mimics the nano size of natural bone and muscles
- Bacterial cells bounce off the tiny spikes on the surfaces of nanomaterials.
- 96 well plate shown here have different concentrations of nanoparticle for treatment of bacteria. Stronger glow show stronger bacteria.
- By Northeastern University

Stem Cell Therapy Without Donor Cells



- Stem cell therapy works by bringing healing cells to the cells needing repair
- Magnetic nano cells act as matchmaker between them.
- MagBICE (magnetic bi-functional cell engager) has Fe platform with two antibodies.
- First locates patient's own stem cells after a heart attack
- Second targets injured tissue
- This brings patients own stem cell to the cells needing repair
- By North Carolina State Univ. & Cedars-Sinai Heart Institute

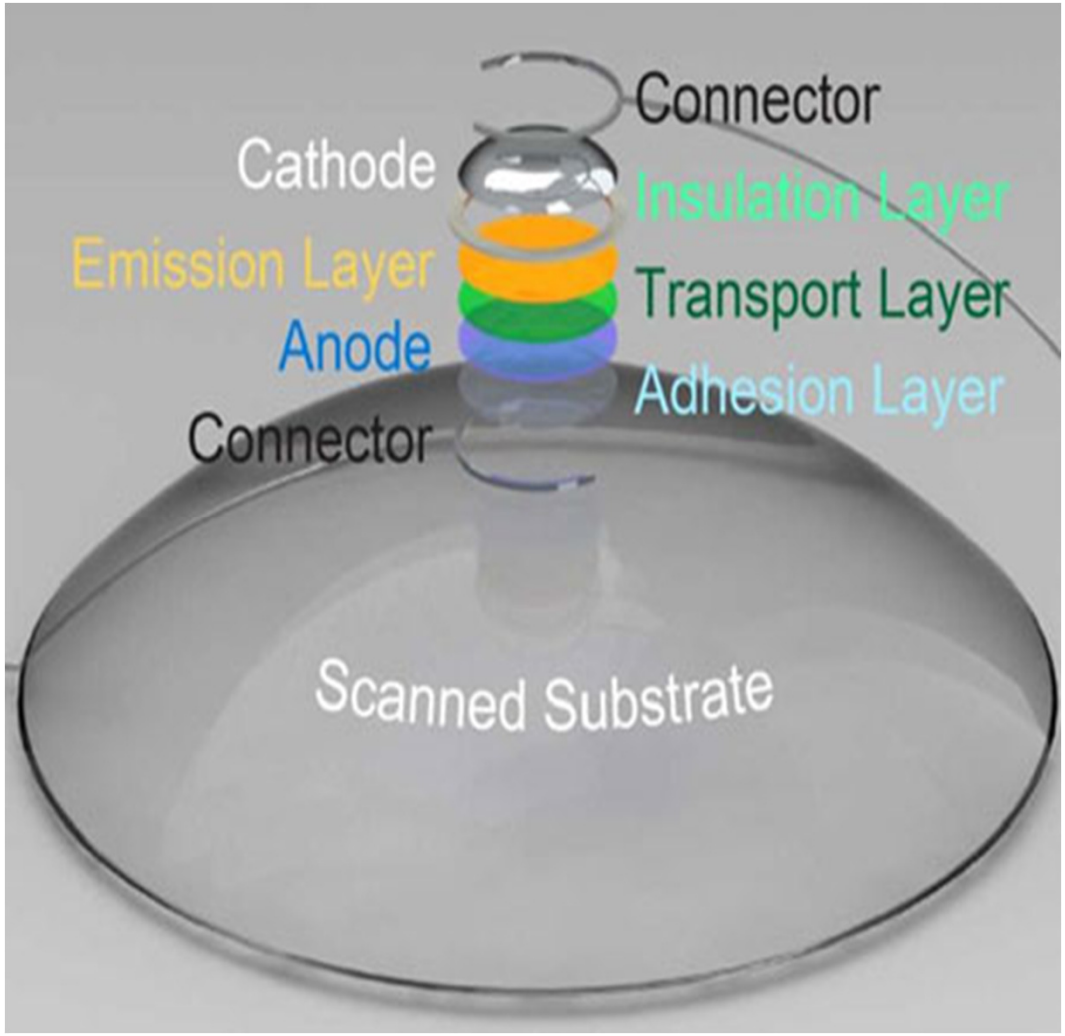
Nano Heart Muscle on Spider Web Silk

- Spider silk is coated with carbon nanotubes to make it contract like a heart muscle
- Coating making it 3 times stronger than untreated spider silk, which weight-for-weight is one of strongest substances. It also makes it conducts electricity.
- When used with heartbeat monitor and a piston it can raise 35 mg; and electrical current can make thread contract like a muscle.
- By National High Magnetic Field Lab, Florida

Treatment of Amputees with Nano Sensors

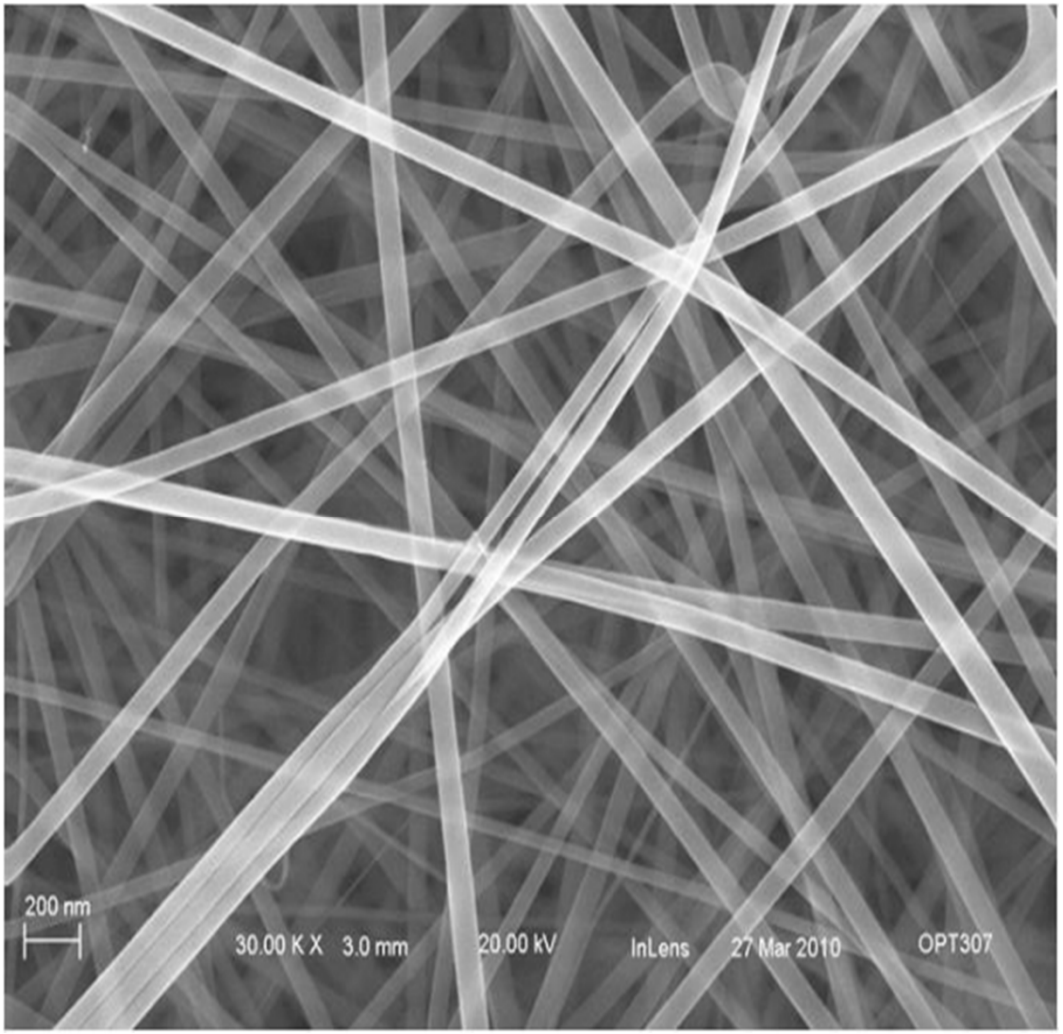
- Amputees due to improvised explosive device (IED) have painful bone growths
- The root cause of pain can be determined by Nanosensors.
- Protein specific gold Nanosensor arrays on microscope coverslips are used to image proteins secretion in real time.
- Brightness of sensors change as the cell secretes proteins
- Unusual secretions can be detected and cured
- By U.S. Naval Research Lab

3D Scanning and Printing of Nano Electronics



- Semiconducting nanoparticles can be used to create active 3D Nanoelectronics
- 5 materials are 3D printed
- 1) emissive semiconducting inorganic nanoparticles
- 2) an elastomeric matrix
- 3) organic polymers: transport
- 4) solid and liquid metal leads
- 5) Transparent substrate layer
- Curved substrate can also be 3D scanned & 3D printed
- Quantum dot LED on curved substrate can be printed
- By Princeton University

Making Nano Circuits with Human DNA



- DNA can carry electricity
- So, Nano Wires can be made from DNA
- Significant current can move through DNA over 100 picoamperes traveling distances exceeding 100 nanometers
- This can enable DNA-based programmable circuits for molecular electronics and nano circuits
- By Hebrew University of Jerusalem

Thank You