NCI Alliance for Nanotechnology in Cancer: Research Advances and Development of Clinical Applications

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Nanotechnology has the potential to be the key enabler for the transition of molecular-based science into the clinic, facilitating major advances in the early detection, diagnosis, and treatment of cancer.
Detection, Treatment, Prevention: Nanotech from Bench to Bedside

- Target Identification and Validation
  - High sensitivity Gene/protein detection
  - High Content Cellular Assays

- Lead Development
- Animal Studies
- Clinical Trials
  - Real-time therapeutic monitoring

- Early Detection
  - Contrast and Optical Imaging Agents

- Diagnosis
  - Multifunctional Targeted Nanoparticles

- Treatment
  - Ultrasensitive Biomarker Detection
  - Real-time Therapeutic Monitoring

- Patient Care

NCI Alliance for Nanotechnology in Cancer
NCI Strategic Approach to Nanotech

- **Early investments**
  - Novel technologies through the Unconventional Innovations Program since 1998

- **Counsel from the community**
  - Input from the scientific, cancer research and advocacy communities

- **Planning a comprehensive effort**
  - Cancer Nanotechnology Plan to drive systems-level change and catalyze product development

- **Launch of the Alliance**
  - NCI Alliance for Nanotechnology in Cancer in 2004

- **Milestone-driven execution**
  - Defined programs; collaborators; milestones; reporting processes
Goals:

- Research tools to identify new biological targets
- Agents to monitor predictive molecular changes and prevent precancerous cells from becoming malignant
- Imaging agents and diagnostics to detect cancer in earliest, most easily treatable, pre-symptomatic stage
- Multifunctional targeted devices to deliver multiple therapeutic agents directly to cancer cells
- Systems to provide real-time assessments of therapeutic and surgical efficacy
- Novel methods to manage symptoms that reduce quality of life
NCI Nanotech Alliance Programs

- Centers of Cancer Nanotechnology Excellence
- Nanotechnology Platforms for Cancer Research
- Multidisciplinary Research Teams
  - Training
  - Interagency Collaborations
- Nanotechnology Characterization Laboratory
NCI Nanotech Alliance Program Awards

Centers of Cancer Nanotechnology Excellence (8)

1. Nanotechnology Platform for Targeting Solid Tumors, The Sidney Kimmel Cancer Center, San Diego, Calif.
2. Center of Nanotechnology for Treatment, Understanding, and Monitoring of Cancer, University of California, San Diego, Calif.
4. The Siteman Center of Cancer Nanotechnology Excellence at Washington University, St. Louis, Mo.
5. Hybrid Nanoparticles in Imaging and Therapy of Prostate Cancer, University of Missouri, Columbia, Mo.
6. DNA-linked Dendrimer Nanoparticle Systems for Cancer Diagnosis and Treatment, University of Michigan, Ann Arbor, Mich.
7. Near-Infrared Fluorescence Nanoparticles for Targeted Optical Imaging, University of Texas M. D. Anderson Cancer Center, Houston, Texas
8. Emory-Georgia Tech Nanotechnology Center for Personalized and Predictive Oncology, Atlanta, Ga.

Cancer Nanotechnology Platform Partnerships (12)

1. Novel Cancer Nanotechnology Platforms for Photodynamic Therapy and Imaging, Roswell Park Cancer Institute, Buffalo, N.Y.
2. Multifunctional Nanoparticles in Diagnosis and Therapy of Pancreatic Cancer, State University of New York, Buffalo, N.Y.
4. Novel Cancer Nanotechnology Platforms for Photodynamic Therapy and Imaging, Roswell Park Cancer Institute, Buffalo, N.Y.
5. Multifunctional Nanoparticles in Diagnosis and Therapy of Pancreatic Cancer, State University of New York, Buffalo, N.Y.
6. Hybrid Nanoparticles in Imaging and Therapy of Prostate Cancer, University of Missouri, Columbia, Mo.
7. DNA-linked Dendrimer Nanoparticle Systems for Cancer Diagnosis and Treatment, University of Michigan, Ann Arbor, Mich.
8. Near-Infrared Fluorescence Nanoparticles for Targeted Optical Imaging, University of Texas M. D. Anderson Cancer Center, Houston, Texas
9. Emory-Georgia Tech Nanotechnology Center for Personalized and Predictive Oncology, Atlanta, Ga.
11. Center of Nanotechnology for Treatment, Understanding, and Monitoring of Cancer, University of California, San Diego, Calif.
NCI-NSF Nanobiotechnology Collaboration: Training the Next Generation

IGERT Training Grants (4)

Building Leadership for the Nanotechnology Workforce of Tomorrow, University of Washington, Seattle, WA – Marjorie Olmstead, PI

Nanomedical Science and Technology, Northeastern University, Boston, MA – Srinivas Sridhar, PI

NanoPharmaceutical Engineering and Science, Rutgers University, New Brunswick, NJ – Fernando Muzzio, PI

Integrative Nanoscience and Microsystems, University of New Mexico, Albuquerque, NM – Diana Huffaker, PI
Interagency Collaborations

- Standards/Precision Measurement Capabilities
- Training
- Dissemination of Results
- Shared Data and Platforms
- Public Interface
- Interpret Data on Environment, Health and Safety
Nanotechnology Characterization Laboratory (NCL)

- **NCL Role:**
  - Interface with CCNEs, individual investigators, NIST and FDA to develop standards and characterization data for nanoscale materials
  - Perform preclinical toxicology, pharmacology, and efficacy testing of nanoscale devices
  - Formulate and validate protocols for physical, *in vitro*, and ADME/tox characterization of nanoparticles
Novel Attributes of the NCI Nanotech Alliance

Steady interaction among Alliance participants and the community through:

- Governance Committee
- Continual evaluation of project programs through performance milestones
- Teleconferences
- Technology Transfer, Intellectual Property, and Communications Working Groups
- Website with “Knowledge Environment” and secure Intranet for Alliance members
- Advocacy involvement on an ongoing basis
NCI Nanotech Alliance: The Challenge and Deliverables

- Produce tangible solutions which are clinically applicable, in a short period of time
- Medical community expects significant advances:
  - Where solutions are currently non-existent
  - Where replacement technologies are superior to existing methods
- Identify “early successes”
- Program as viable addition to existing NCI funding portfolio:
  - Well interconnected
  - Truly produces a paradigm change