Program Component Areas (PCAs)
in the National Nanotechnology Initiative

Background:

The 21st Century Nanotechnology Research and Development Act (P.L. 108-153, Dec. 3, 2003) called for the Federal nanotechnology program to establish program component areas (PCAs), defined as "major subject area[s] … under which [are] grouped related individual projects and activities carried out under the Program," and to break out funding each year by agency for these nanotechnology PCAs. The PCAs were first defined in the 2004 NNI Strategic Plan, and subsequent annual NNI Supplements to the President's Budget have reported funding on this basis. In developing the 2013 NNI Strategic Plan, the participating agencies created a revised listing of PCAs. The new PCAs better represent current categories of NNI-related activities and will help simplify agency reporting while making agency reports more informative. The intent behind these revisions is not to change the overall spectrum of activities and resources associated with the NNI, but rather to characterize those activities in a way that better reflects the current structure and emphases of the Federal effort, including the topical areas that are highlighted as Nanotechnology Signature Initiatives. The revised and prior PCAs are listed here for reference, and full definitions of the revised PCAs (which will be used in the collection of funding data for annual reporting) follow.

Revised PCAs

1) Nanotechnology Signature Initiatives (NSIs)*
    a) Nanotechnology for Solar Energy Collection and Conversion
    b) Sustainable Nanomanufacturing
    c) Nanoelectronics for 2020 and Beyond
    d) Nanotechnology Knowledge Infrastructure
    e) Nanotechnology for Sensors and Sensors for Nanotechnology
2) Foundational Research
3) Nanotechnology-Enabled Applications, Devices, and Systems
4) Research Infrastructure and Instrumentation
5) Environment, Health, and Safety

Prior PCAs:

1) Fundamental Nanoscale Phenomena and Processes
2) Nanomaterials
3) Nanoscale Devices and Systems
4) Instrumentation Research, Metrology, and Standards for Nanotechnology
5) Nanomanufacturing
6) Major Research Facilities and Instrumentation Acquisition
7) Environment, Health, and Safety
8) Education and Societal Dimensions

** NSI titles are abbreviated*

Definitions of Revised Program Component Areas:

1) Nanotechnology Signature Initiatives (NSIs):

Nanotechnology Signature Initiatives serve to spotlight topical areas that exhibit particular promise, existing effort, and significant opportunity, and that bridge across multiple Federal agencies. They are intended to be dynamic, with topical areas rotating and evolving over time. This category includes both foundational research and nanotechnology-enabled applications, devices, and systems within each NSI, as appropriate. Instrumentation that is specifically developed in support of a confined topical area covered by one of the NSIs is included here, but otherwise the development or acquisition of more broadly applicable instrumentation (as well as resources devoted to facilities) falls under the separate PCA on Research Infrastructure and Instrumentation. Most research on Environment, Health, and Safety falls within the separate Program Component Area described below, but activities directly pertinent to specific NSIs are reported in this section instead.

a) Nanotechnology for Solar Energy Collection and Conversion: Contributing to Energy Solutions for the Future

Enhancing understanding of energy conversion and storage phenomena at the nanoscale, improving nanoscale characterization of electronic properties relevant to solar energy, and utilization of the unique physical phenomena that occur on the nanoscale to help overcome current performance barriers and substantially improve the collection and conversion of solar energy.

b) Sustainable Nanomanufacturing: Creating the Industries of the Future

Establishing manufacturing technologies for economical and sustainable integration of nanoscale building blocks into complex, large-scale systems by supporting product, tool, and process design informed by and adhering to the overall constraints of safety, sustainability, and scalability. This signature initiative specifically focuses at this time on high-performance structural carbon-based nanomaterials, optical metamaterials, and cellulosic nanomaterials.

c) Nanoelectronics for 2020 and Beyond

Discovery and use of novel nanoscale fabrication processes and innovative concepts to produce revolutionary materials, devices, systems, and architectures to advance the field of nanoelectronics.

d) Nanotechnology Knowledge Infrastructure (NKI): Enabling National Leadership in Sustainable Design

Activities surrounding the fundamental, interconnected elements of collaborative modeling, a cyber-toolbox, and data infrastructure for nanotechnology, leveraging and extending existing and emerging resources, programs, and technologies to create an infrastructure to accelerate the vetting of new knowledge and to enable effective data utilization.

e) Nanotechnology for Sensors and Sensors for Nanotechnology: Improving and Protecting Health, Safety, and the Environment

Use of nanotechnology and nanoscale materials to build more sensitive, specific, and adaptable sensors in order to overcome the technical barriers associated with conventional sensors, and development of new sensors to detect engineered nanomaterials across their life cycles in order to assess their potential impacts.

2) **Foundational Research:**

Discovery and development of fundamental knowledge pertaining to new phenomena in the physical, biological, and engineering sciences that occur at the nanoscale. Elucidation of scientific and engineering principles related to nanoscale structures, processes, and mechanisms. Research aimed at discovery and synthesis of novel nanoscale and nanostructured materials and at a comprehensive understanding of the properties of nanomaterials ranging across length scales, and including interface interactions. Research directed at identifying and quantifying the broad implications of nanotechnology for society, including social, economic, ethical, and legal implications.

3) **Nanotechnology-Enabled Applications, Devices, and Systems:**

Research and development that applies the principles of nanoscale science and engineering to create novel devices and systems, or to improve existing ones. Includes the incorporation of nanoscale or nanostructured materials and the processes required to achieve improved performance or new functionality, including metrology, scale up, manufacturing technology, and nanoscale reference materials and standards. To meet this definition, the enabling science and technology must be at the nanoscale, but the applications, systems, and devices themselves are not restricted to that size.

4) **Research Infrastructure and Instrumentation:**

Establishment and operation of user facilities and networks, acquisition of major instrumentation, workforce development, and other activities that develop, support, or enhance the Nation's physical or human infrastructure for nanoscale science, engineering, and technology. Includes R&D pertaining to the tools needed to advance nanotechnology research and commercialization, including next-generation instrumentation for characterization, measurement, synthesis, and design of materials, structures, devices, and systems. While student support to perform research is captured in other categories, dedicated educational and workforce efforts ranging from curriculum development to advanced training are included here as resources supporting the human infrastructure of the NNI.

5) **Environment, Health, and Safety:**

Research and development primarily directed at understanding the environmental, health, and safety impacts of nanotechnology development and corresponding risk assessment, risk management, and methods for risk mitigation.