Nano-scale characterization and assembly holds the promise of transforming our physical and biological worlds. Currently, the vast potential of nanotechnology is just now beginning to be realized.

**Right Now**

- **Nanoimprint gives lift to Moore’s law**
  - Many of the tools used in nano-scale R&D already enjoy wide use in the semiconductor industry, where nanoimprint lithography is enabling atomic-scale chip features and micro-mechanical arrays.

**The Near Future**

- **Carbon nanotubes and energy efficiency**
  - Polymer-nanotube composites will enable highly efficient pv applications and other low power applications.

- **New fuel cell technologies**
  - New nano-fabrication techniques will soon boost production of heteropolyacid-based membranes that will allow for highly efficient, very compact fuel cells.

- **Nanocrystals illuminate smaller cell features**
  - Nanocrystal quantum dots are now being used to fluorescent proteins, cells and viruses at much higher resolution than previously possible with traditional fluorophores.

- **Carbon nanotubes and energy efficiency**
  - Polymer-nanotube composites will enable highly efficient pv applications and usher in new durable, low power lighting applications.

- **New applications for nanophotonics**
  - Current research in photonic crystals will lead to production of a host of nano-scale optoelectronic components of very high capacity and sensitivity.

**The Coming Decades**

- **Quantum computing**
  - Spintronics and other quantum effects could exponentially increase the computing power and flexibility of future electronic devices while dramatically reducing their power consumption.

- **Implications of nanotechnology**
  - While the benefits of nano-scale characterization and assembly have been widely articulated, the health risks and environmental impacts of nanotechnology are not well understood.

- **Nanotechnology in nature**
  - The iridescent color of a butterfly wing derives from the nano-photonic properties exhibited by its scales.

- **True nano-assembly**
  - Coming advances in computing, chemistry, biology and physics could usher in the “bottom-up” approach first articulated by Richard Feynman in 1959.

- **Plasmonics will revolutionize diagnostics**
  - Plasmon-based nanoscale optics will soon enable quick, very finely detailed spectroscopic identification and characterization of peptides, proteins, and viruses in their native environments.

- **Gold will unlock novel cancer therapies**
  - Binding gold nanoparticles to a specific antibody for cancer cells will allow clinicians to noninvasively detect, diagnose and treat cell tissue cancers.

- **New applications for nanophotonics**
  - Current research in photonic crystals will lead to production of a host of nano-scale optoelectronic components of very high capacity and sensitivity.

**Implications of nanotechnology**

While the benefits of nano-scale characterization and assembly have been widely articulated, the health risks and environmental impacts of nanotechnology are not well understood. Much work needs to be done to properly assess and articulate the risks, benefits, and ethical implications of nanotechnology.