

# Putting the Nano in Medicine

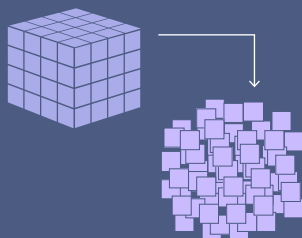
Nanomedicine uses unique properties to prevent, diagnose, and treat medical conditions. Materials <500 nm are used as contrast agents for imaging, diagnostic devices, drug delivery vehicles, nanosensors, tissue engineering, prosthetics, and other applications.

## Drug Delivery

Tiny amounts of drug formulations are encapsulated in nanoparticles—resulting in fewer side effects, faster results, and less medicine needed.

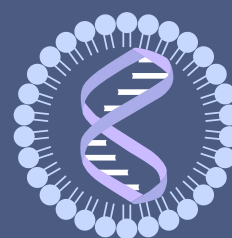
### Nanoformulations

Nanoformulations have a greater surface-area-to-volume ratio compared with “bulk” formulations, yielding a higher percentage of bioavailable medicine per dose.



### COVID-19 Vaccines

Fragile mRNA fragments are encapsulated into lipid nanoparticles that stabilize, protect, and deliver mRNA to your cells quickly.



## Diagnostics

Properties of nanosized metals and semiconductors can be used to develop affordable, easy-to-deploy diagnostic devices.

### Varying Functionality

- Nanoparticles of conducting and semiconducting materials usually have different physical and chemical properties than their bulk counterparts with wide-ranging functionality.
- Minor changes in nanoparticle size and environment dramatically impact properties such as conductivity, color, and reactivity, which can enhance detection capability and performance of sensors and medical devices.



### Home Pregnancy Tests

In most home pregnancy tests, modified gold nanoparticles bind to a pregnancy hormone, causing the characteristic red line to appear. Gold nanoparticles are red due to localized surface plasmon resonance.



## Prosthetics

Incorporating the right nanoparticles into standard materials results in unique nanocomposites or prosthetics.

### Nano's Big Advantages

- High strength-to-weight ratio enhances performance and allows the prosthetics to produce more power with every action.
- Biocompatible nanomaterials help facilitate natural regeneration of bone and skin.
- Antimicrobial properties decrease the probability of infection.



### Bone and Dentures

3D printed nanocomposites of hydroxyapatite, bioceramics, and biopolymers improve design customization and flexibility, reduce costs, and increase biocompatibility.

