How nanotechnology is revolutionizing medicine

In a 1959 lecture at Caltech famously dubbed “There’s Plenty of Room at the Bottom,” American physicist and Nobel laureate–to-be Richard Feynman discussed the idea of manipulating structures at the atomic level.

Although the applications he discussed were theoretical at the time, his insights prophesied the discovery of many new properties at the nanometer scale that are not observed in materials at larger scales, paving the way for the ever-expanding field of nanomedicine. These days, the use of nanosize materials, comparable in dimension to some proteins, DNA, RNA, and oligosaccharides, is making waves in diverse biomedical fields, including biosensing, imaging, drug delivery, and even surgery.

Nanomaterials typically have high surface area–to-volume ratios, generating a relatively large substrate for chemical attachment. Scientists have been able to create new surface characteristics for nanomaterials and have manipulated coating molecules to fine-tune the particles’ behaviors. Most nanomaterials can also penetrate living cells, providing the basis for nanocarrier delivery of biosensors or therapeutics. When systemically administered, nanomaterials are small enough that they don’t clog blood vessels, but are larger than many small-molecule drugs, facilitating prolonged retention time in the circulatory system. With the ability to engineer synthetic DNA, scientists can now design and assemble nanostructures that take advantage of Watson-Crick base pairing to improve target detection and drug delivery.

Both the academic community and the pharmaceutical industry are making increasing investments of time and money in nanotherapeutics. Nearly 50 biomedical products incorporating nanoparticles are already on the market, and many more are moving through the pipeline, with dozens in Phase 2 or Phase 3 clinical trials. Drugmakers are well on their way to realizing the prediction of Christopher Guiffre, chief business officer at the Cambridge, Massachusetts–based nanotherapeutics company Cerulean Pharma, who last November forecast, “Five years from now every pharma will have a nano program.”

Read the full, original story: Nanomedicine