

Introduction to Nanotechnology



What is Nanotechnology

- the study of the controlling of matter on an atomic and molecular scale. Generally nanotechnology deals with structures sized between 1 to 100 nanometer in at least one dimension, and involves developing or modifying materials or devices within that size.

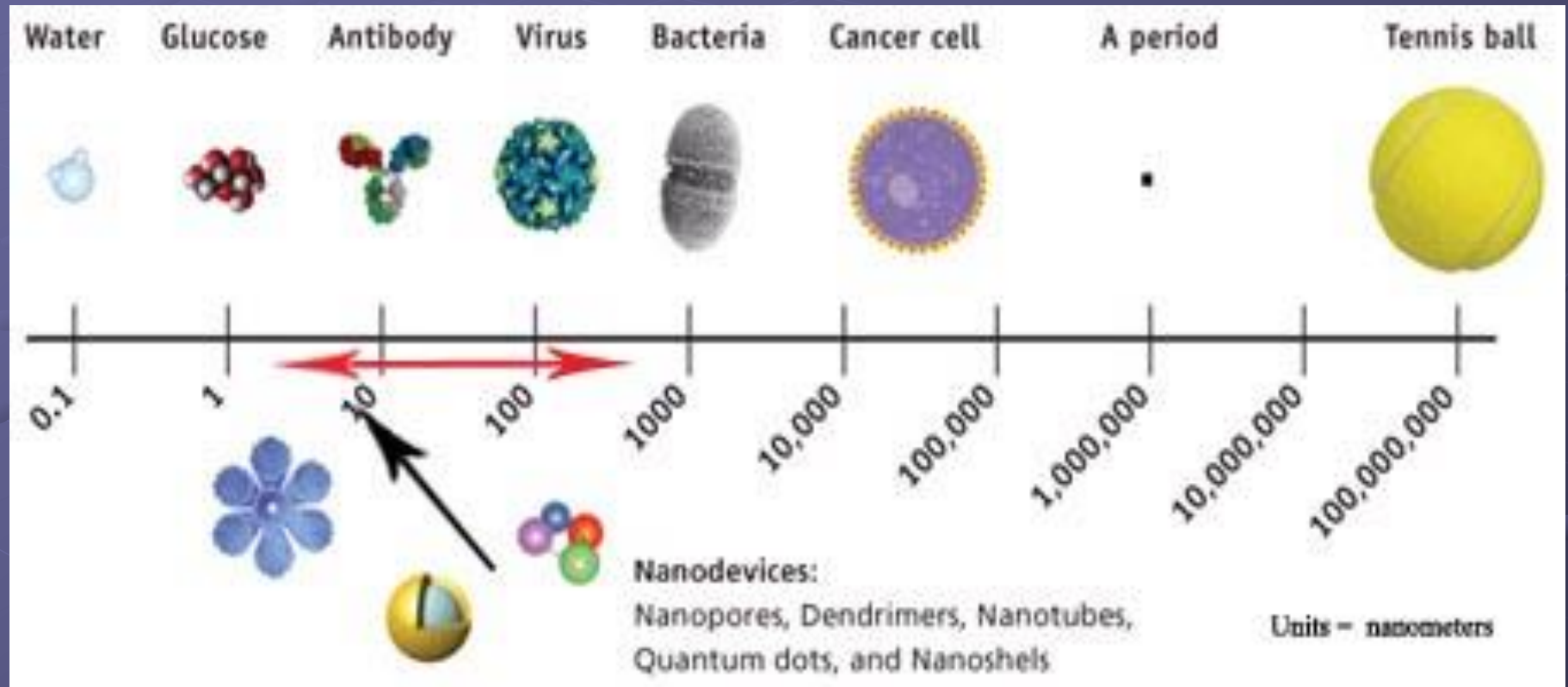
Nanotechnology

● is already making today's products:

- Lighter
- Stronger
- Faster
- Smaller
- More Durable

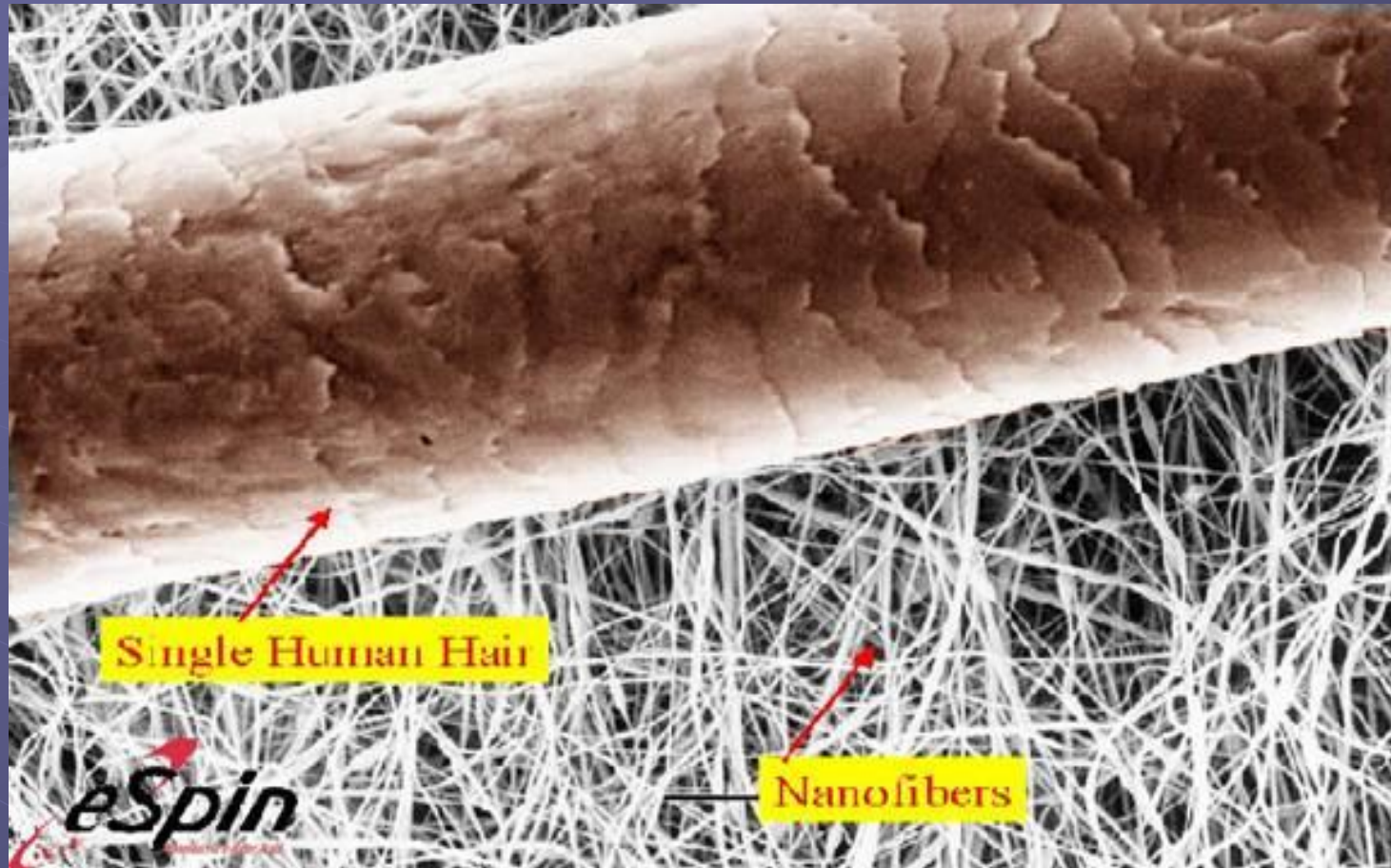


How small is Nano - small?



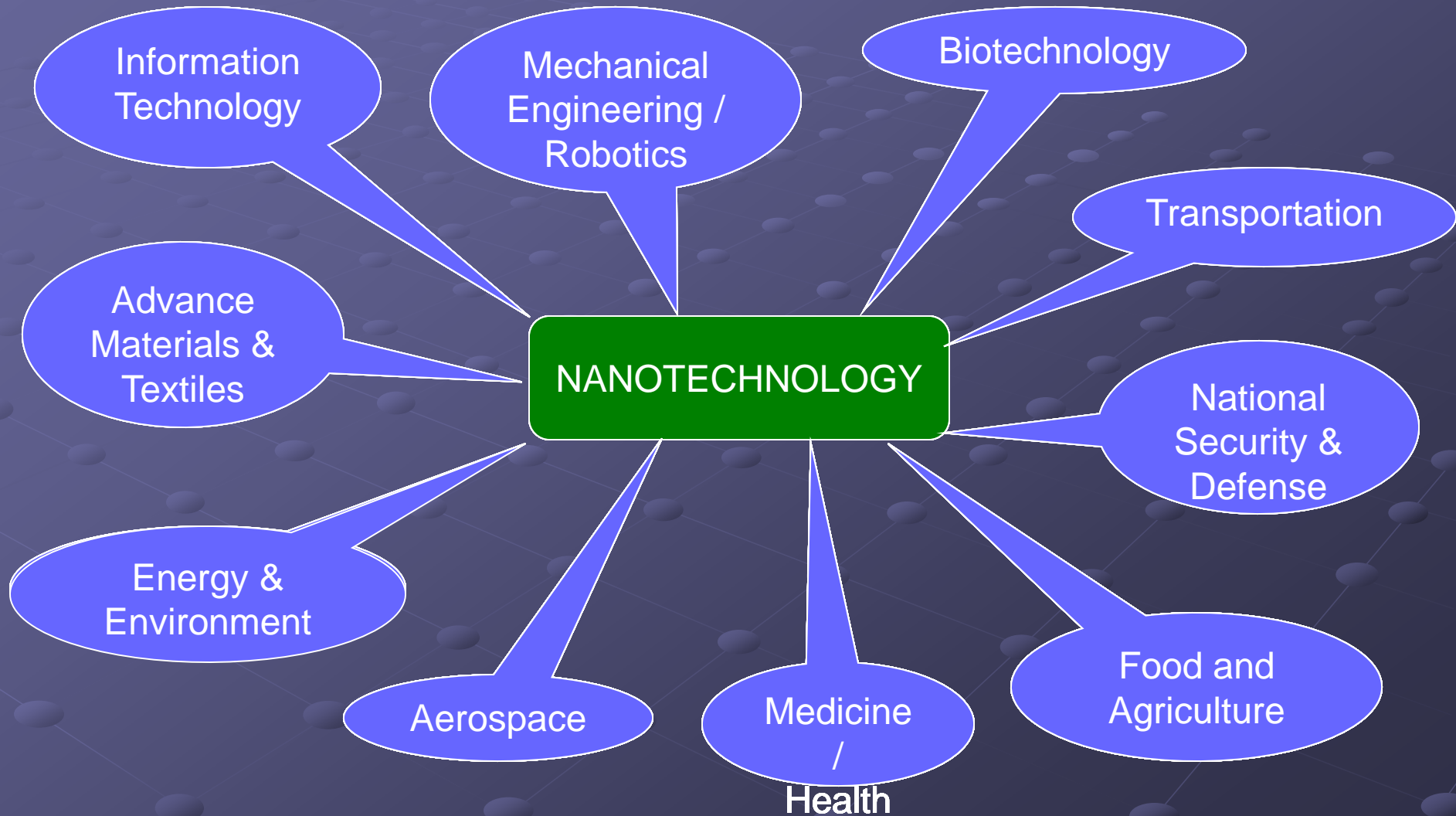
Units in nanometers (μm)

Compared to Human Hair



A Human Hair is about 100,000 μm wide

Nanotechnology spans many Areas



Key Terms

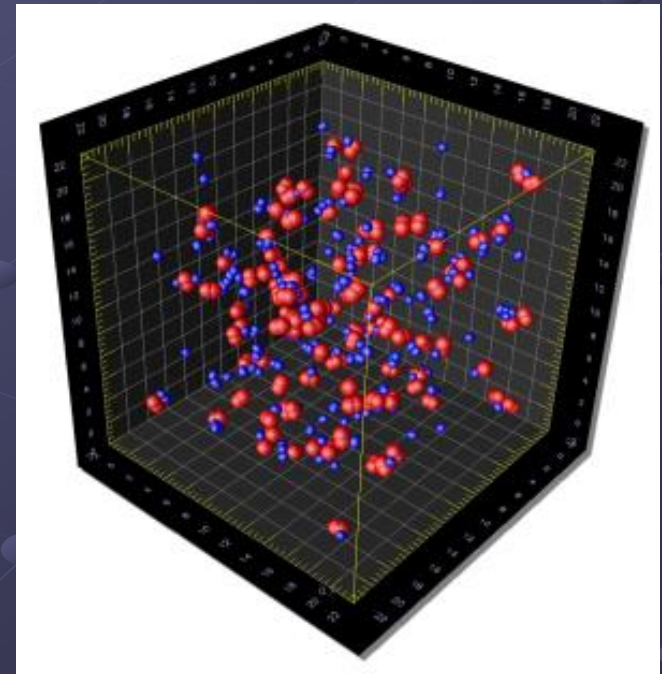
- Nonotechnology
- Nanometer
- Nanotube
- Atom
- Atomic Level
- System
- Atomic Structure
- Fluence (Laser)
- Defects
- Dislocation
- Molecule
- Molecular Dynamics
- Computational Materials Science
- Newton's Laws of Motion

Material Sciences

- Atomic – level Simulations:
Molecular Dynamics
- Computational Research
- Dislocation Dynamics

Emphasis of Research

- Atomic – level Simulations:
Molecular Dynamics
- Computational Research
- Dislocation Dynamics

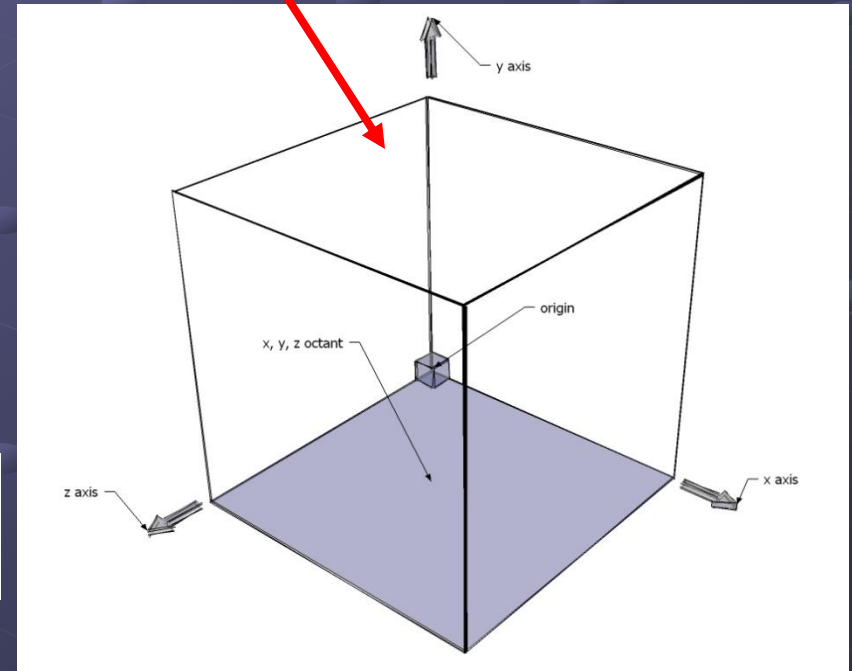
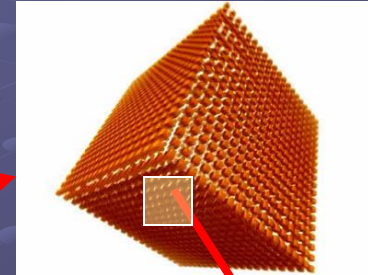
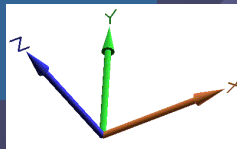


Getting a Base Line on Material Molecular Behavior

Molecule

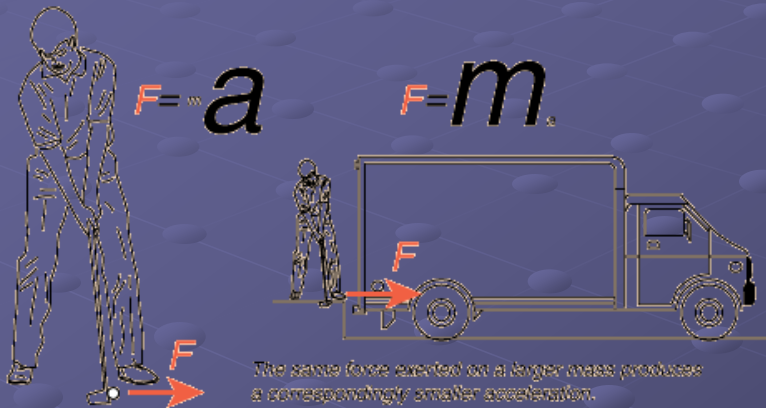
Section of Material

Relationship
To other
Molecules

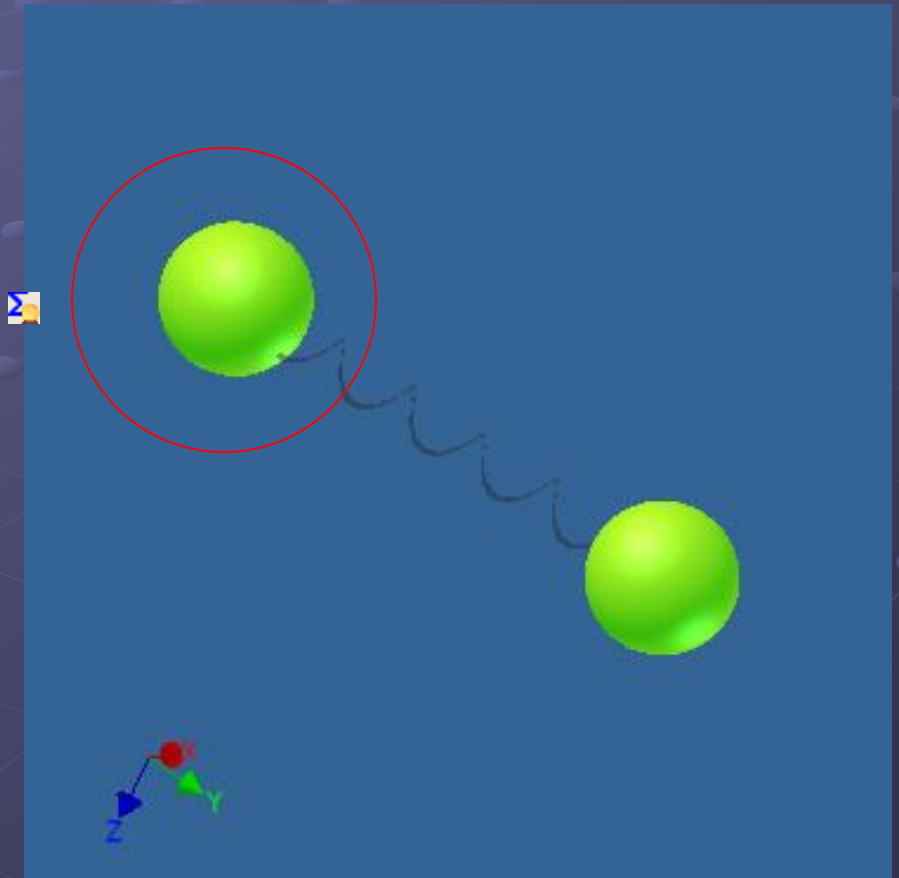


Determine Starting Point (Initial Conditions)

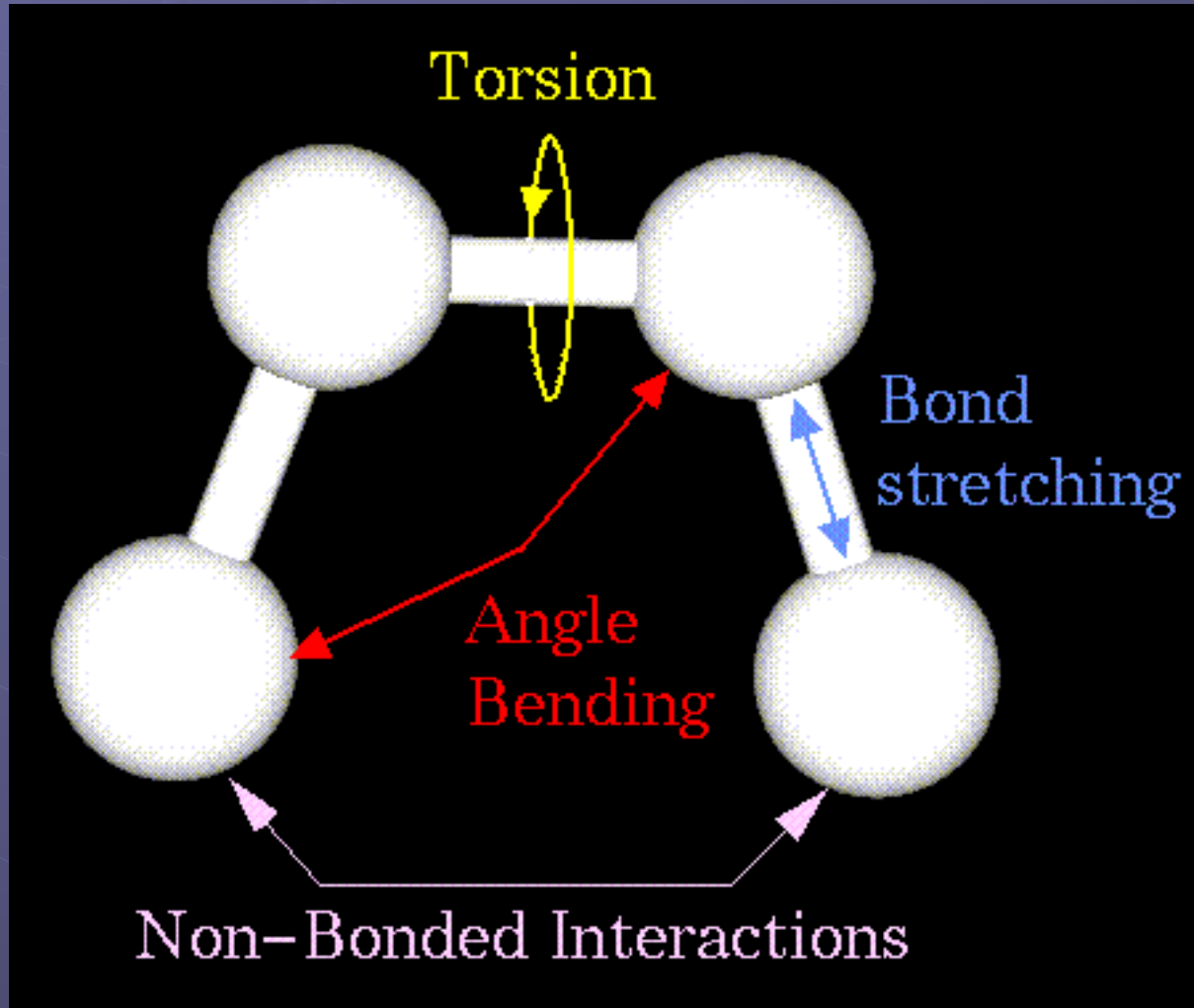
Using Newton's Second Law of
Classic Motion



$$m_i \vec{a} = \vec{F}_i$$



How Molecule Move...



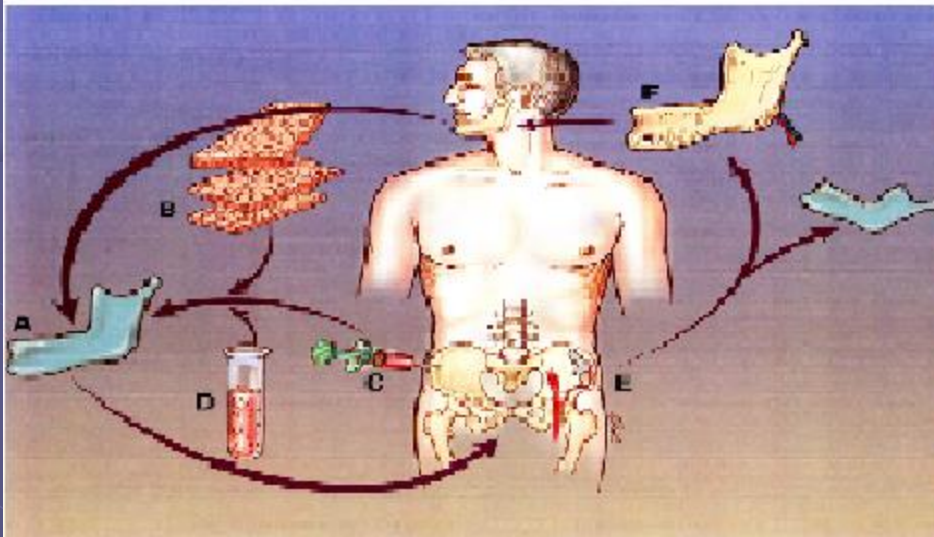
Applications of Nanotechnology

MEDICINE

Diagnostics

Drug Delivery

Tissue Engineering



Current Applications

- burn and wound dressings, water filtration devices, paints, cosmetics, coatings, lubricants, textiles, memory/storage devices
- medical diagnostics, displays, sensors, drug delivery, composite materials, solid state lighting, bio-materials, nano arrays, more powerful computers, protective armor, chem-bio suits, and chem-bio sensors

Future Applications

- 2011-15 -- nanobiomaterials, microprocessors, new catalysts, portable energy cells, solar cells, tissue/organ regeneration, smart implants
- 2016 and beyond – molecular circuitry, quantum computing, new materials, fast chemical analyses