Nano-notes

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January 2019

Blowing up superbugs: IBM reveals nanotech gel that can 'explode' cells

- Firm says breakthrough could replace antibiotics
- 'hydrogel' could be used for creams, coating for medical instrumen

Nano-based, spray-on, bomb-proof

Plus ... Are those brass knuckles in your chest or are you just ... um

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Science News ... from universities, journals, and other researc

DNA Motor 'Walks' Along Nanotube, Transports Tiny Particle

Alert over the march of the 'grey goo' in nanotechnology Frankenfoods

{2}A breed of Frankenfood is being introduced into human diet and cosmetics with potentially disastrous consequences, experts said last night.

Academics, consumer groups and Government officials are warning that the arrival of

http://www.telegraph.co.uk/news/picturegalleries/earth/10744432/Animal-photos-of-the-week.html?frame=2868115


Why do lotus leaves never get wet?
http://www.easywildflowers.com/quality/ner.lute.htm

How does the gecko stay on the ceiling above your head?

http://www.cites.org/eng/gallery/species/reptile/madagascar_day_gecko

A Changing World

- Nanotechnology is going to rapidly change the world that we know
- Atomically precise manufacturing
- Make what you want at a lower cost
- No waste
- Large scale
- A world where solar cells cost no more than paper
- Nanotechnology will be the driving force behind the next industrial revolution

K. Eric Drexler

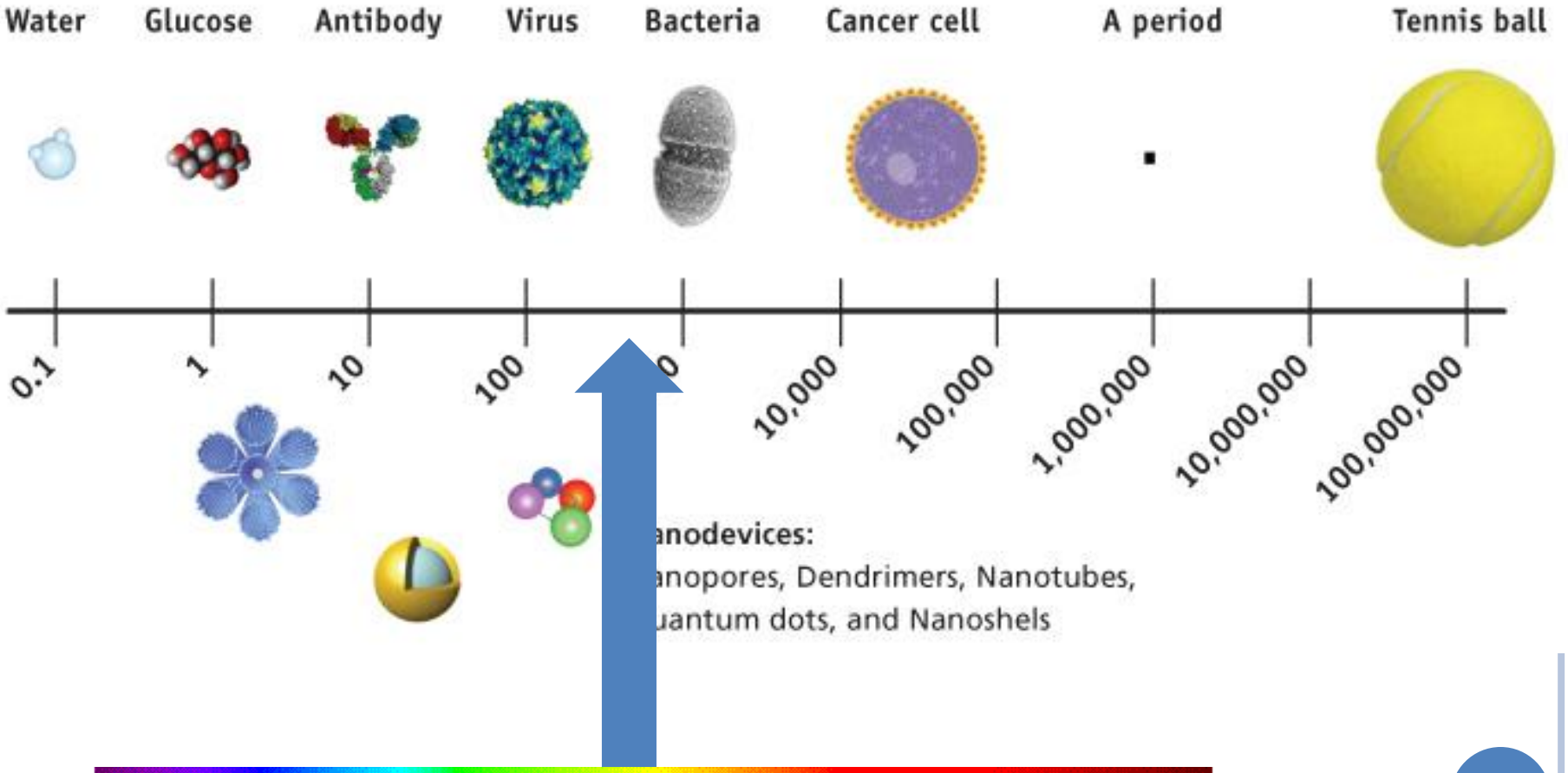
What is nanotechnology?

- Definitions
  - "nanotechnology is the understanding and control of matter at dimensions between 1 and 10 nanometres where unique phenomena enable novel applications"
    - US National Nanotech Institute
  - "nanoscience is the study of phenomena and manipulation of materials at atomic, molecular and macromolecular scales where properties differ significantly from those at larger scale"
    - The Royal Society (UK)

Appreciating scales

- Exercise in comparing sizes of objects in the world
- What would you say about the nano-part of the scale?

Appreciating scales



Why is nanotechnology so *sexy*?

- The properties of materials change dramatically at this scale because of the size of the materials involved.
- New materials hold promise in all walks of life
  - New textiles
  - Medical treatments and diagnosis
  - Improved energy efficiency
  - A greener world – against pollution

AN *ENABLING* TECHNOLOGY

- The techniques and approaches of nanotechnology as a field are considered "enablers"
- They can be the tools and methods that can be applied across many different sectors of the economy
  - Aerospace
  - Construction
  - Textiles
  - Transportation
  - Healthcare
  - Energy
  - Chemical
  - Computing……

When did it all start?

- 1959 Richard Feynman
- "There's plenty of room at the bottom"
- Envisaged technologies that would enable the exploration and exploitation of the world at the atomic scale

but Mother Nature got there first!

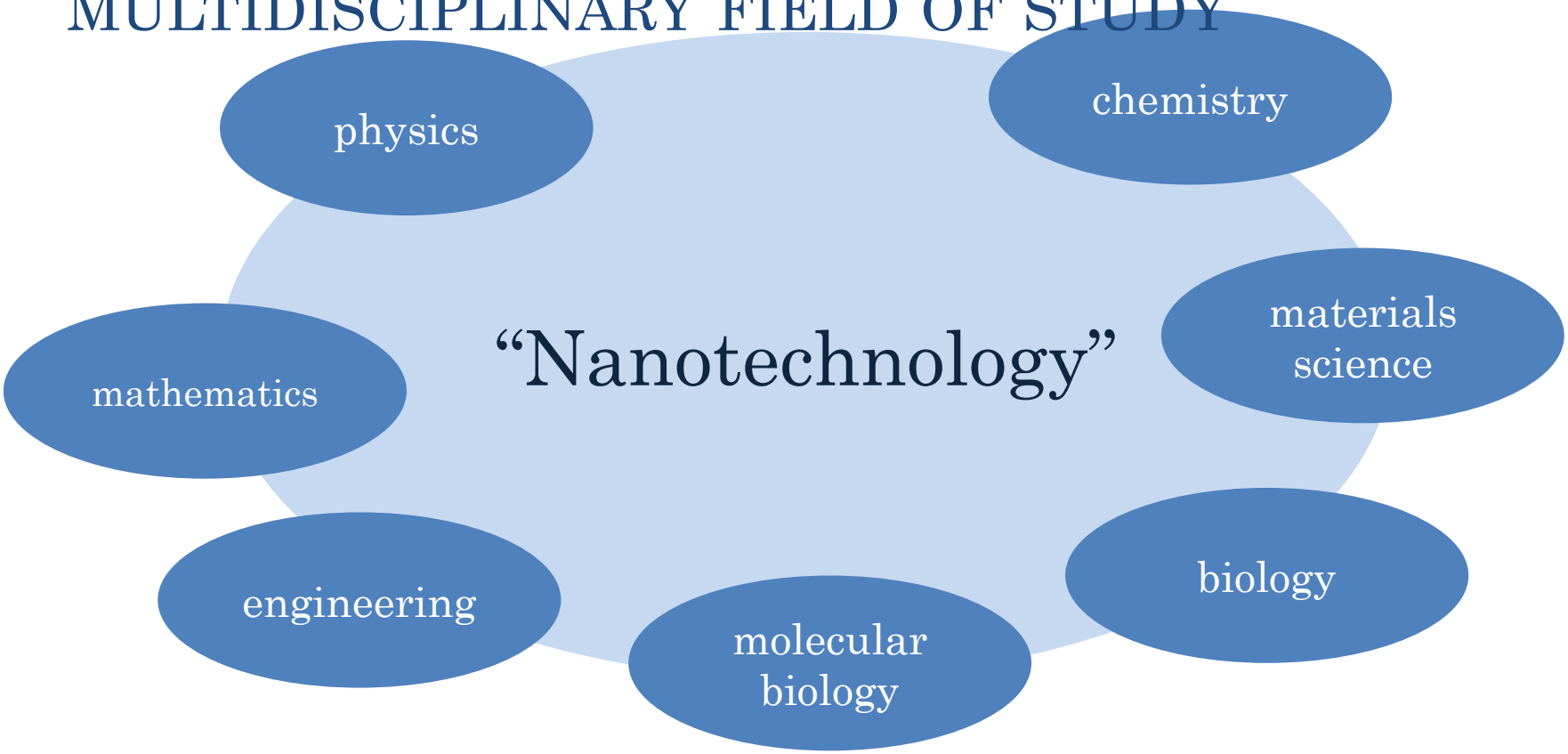
Swimming in molasses

- The world of bacteria is full of machinery that works on the nano-level
- *E.coli* has *molecule-sized motors* which turn *corkscrew-shaped flagellae* that allow it to propel itself through water
- But the forces involved are very different at this scale
- *It is like swimming through molasses*

The Big Ideas behind nanotechnology

- Size and scale
- Small is (very) different
- Structure of matter
- Forces at nanoscale
- Applications
- Ethical questions

Nanotechnology is a multidisciplinary field of study



- Contributions from these different perspectives to build understanding and create solutions for problems or better ways of doing something

Where is nano?

- Just because we can't see it, doesn't mean that it doesn't have an effect.
- Nano is all around us but because it is small, we need special methods to study and understand it.
- It is only now with the advent of the digital computer and techniques that allow us to see things on the atomic scale that we can begin to make sense of this nano-world

Summary

- In these sessions we are going to explore together different aspects of nanotechnology
  - How the physical and chemical properties of materials change at the nanoscale
  - Nanomaterials, self-assembly and the metal that never forgets
  - How we do we know?
  - Carbon – balls, tubes and sheets
  - New medicines: encapsulation and biosensors
  - Awareness: how will nanotech affect our lives?