NBC has teamed with AltSpaceVR to stream the U.S. presidential debate Monday night Sept. 26 live in virtual reality for HTC Vive, Oculus Rift, and Samsung Gear VR devices.

Or as late-night comic Jimmy Fallon put it, “If you’re wearing a VR headset, it will be like the candidates are lying right to your face.”

NANOTECH UPDATE

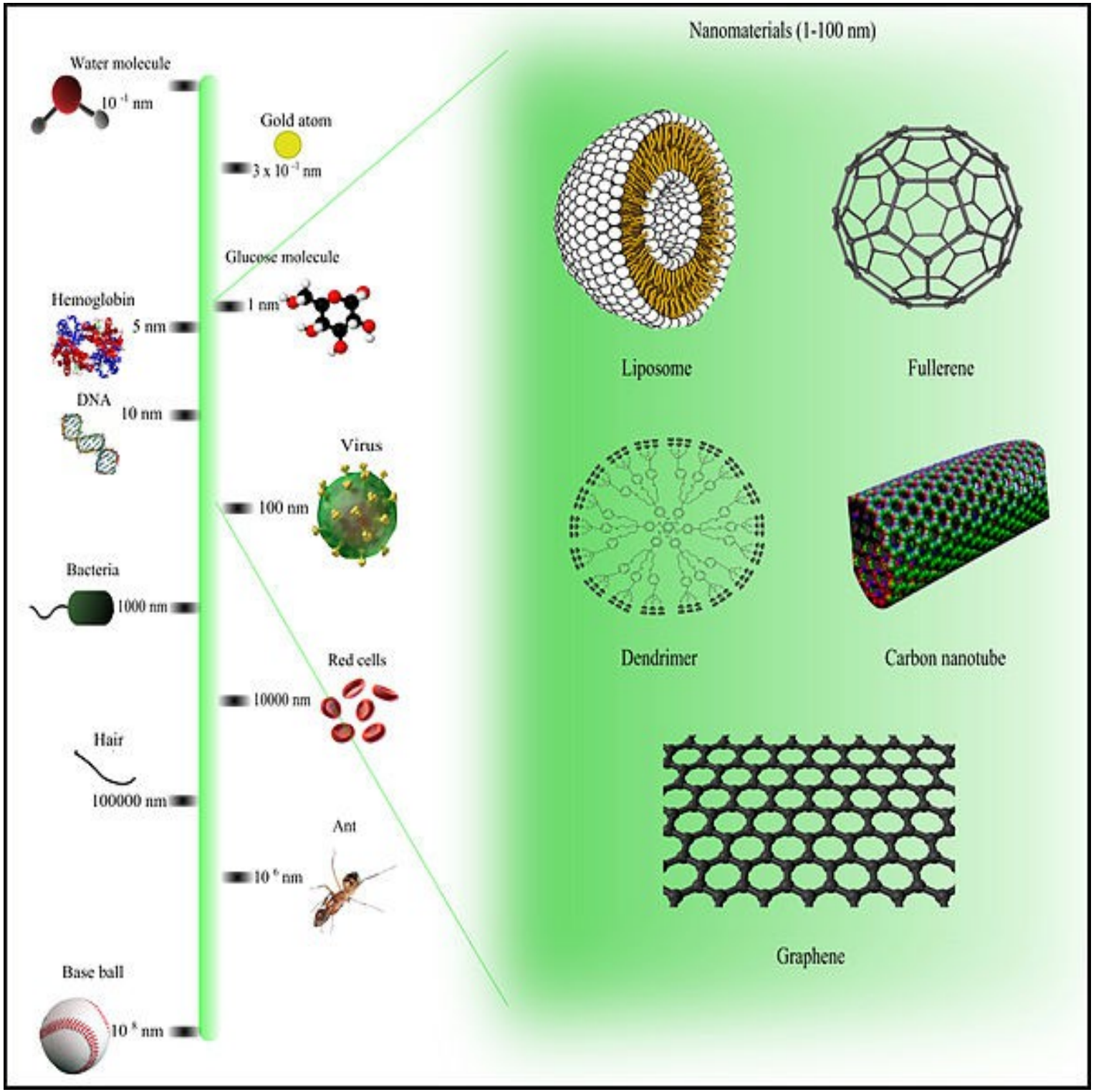
SEPTEMBER 2016

WHAT IS A NANOMETER?

A nanometer (nm) is a unit of measurement equal to one billionth, or 10−9, of a meter.

To put that scale in another context, the comparative size of a nanometer to a meter is the same as that of a marble to the size of the earth.

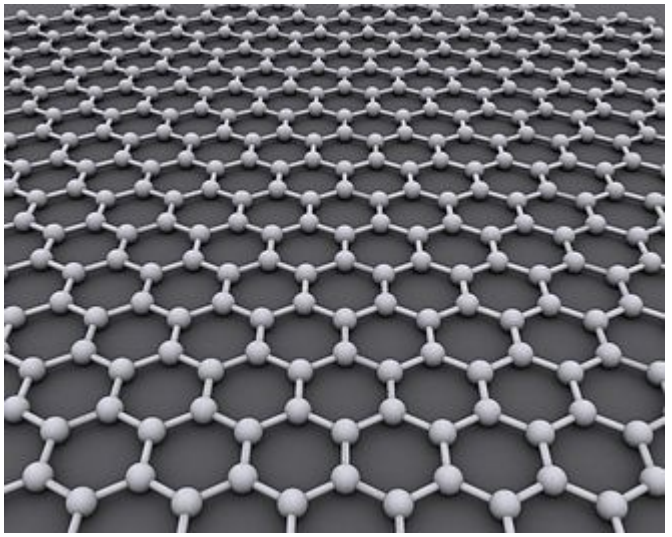
Or another way of putting it: a nanometer is the amount an average man's beard grows in the time it takes him to raise the razor to his face.


Nanomaterials (1-100 nm)
Water molecule
10 -1 nm
Gold atom
3 x 10 -1 nm
Glucose molecule
1 nm
Hemoglobin
5 nm
DNA
10 nm
Virus
100 nm
Bacteria
1000 nm
Red cells
10000 nm
Hair
100000 nm
Ant
10 6 nm
Base ball
10 8 nm
Liposome
Fullerene
Dendrimer
Carbon nanotube
Graphene

Dictionary definition of graphene:

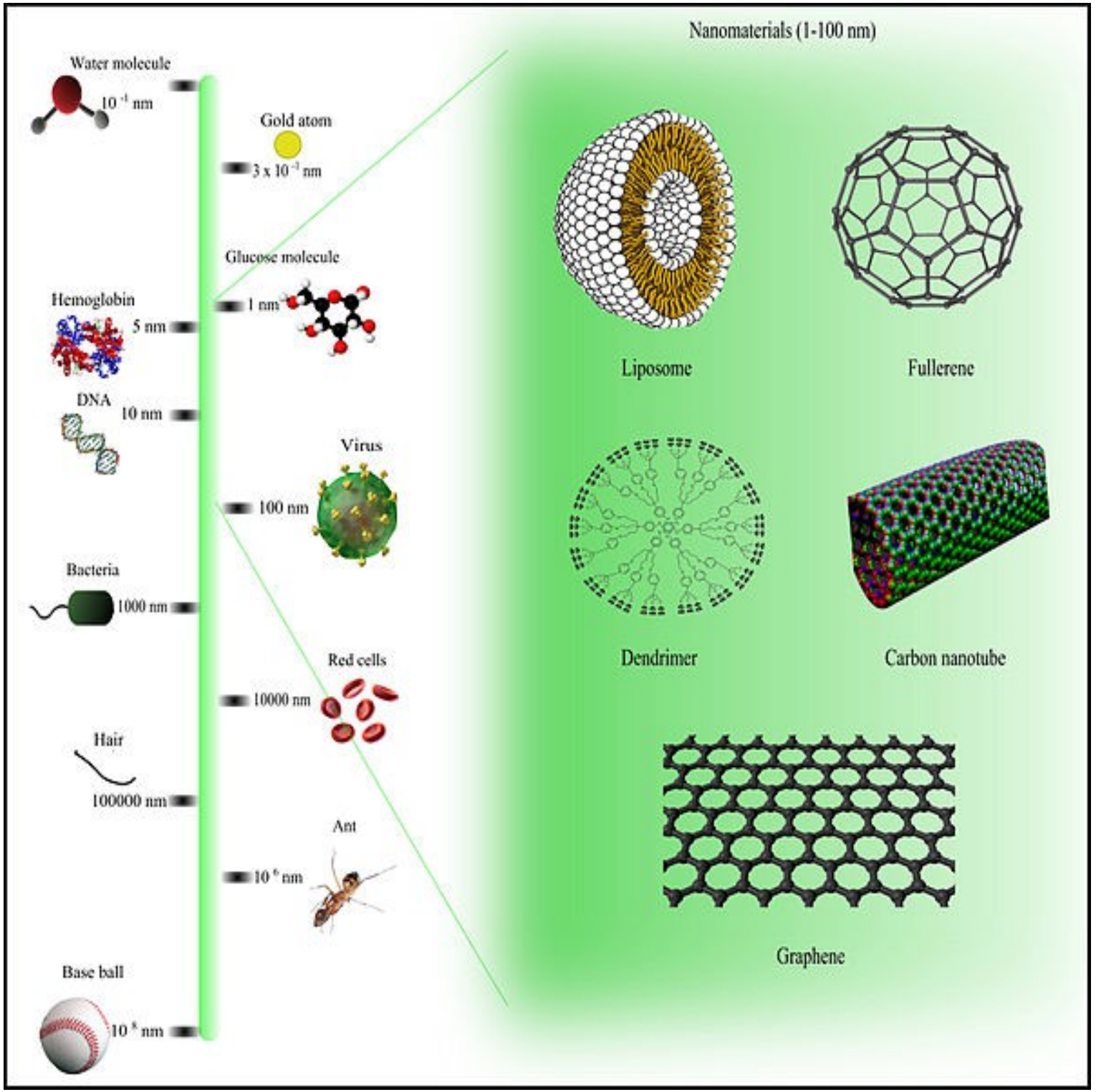
An extremely electrically conductive form of elemental carbon that is composed of a single flat sheet of carbon atoms arranged in a repeating hexagonal lattice. [Often referred to as a two-dimensional or 2D material.]

Example: “Graphene is the net of carbon atoms, reminiscent of chicken wire, that forms graphite and carbon nanotubes.” — D. Castelvecchi, Science News, 11 Aug. 2007



...strongest material in the world. Columbia University mechanical engineering professor James Hone once said it is “so strong it would take an elephant, balanced on a pencil, to break through a sheet of graphene the thickness of Saran Wrap,” according to the university.

Graphene Conductivity: Electrons are the particles that make up electricity. So when graphene allows electrons to move quickly, it is allowing electricity to move quickly. It is known to move electrons 200 times faster than silicon because they travel with such little interruption. It is also an excellent heat conductor. Graphene is conductive independent of temperature and works normally at room temperature.


Nanomaterials (1-100 nm)
Water molecule
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10000 nm
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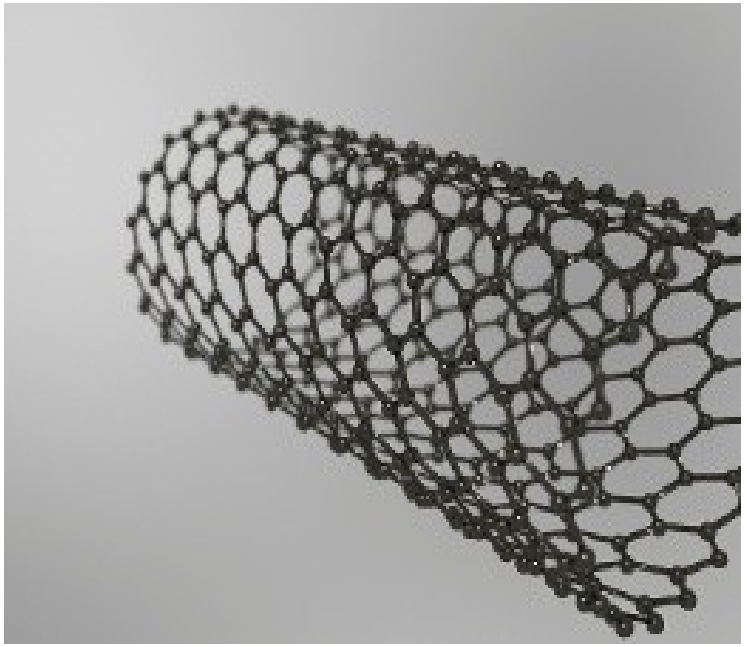
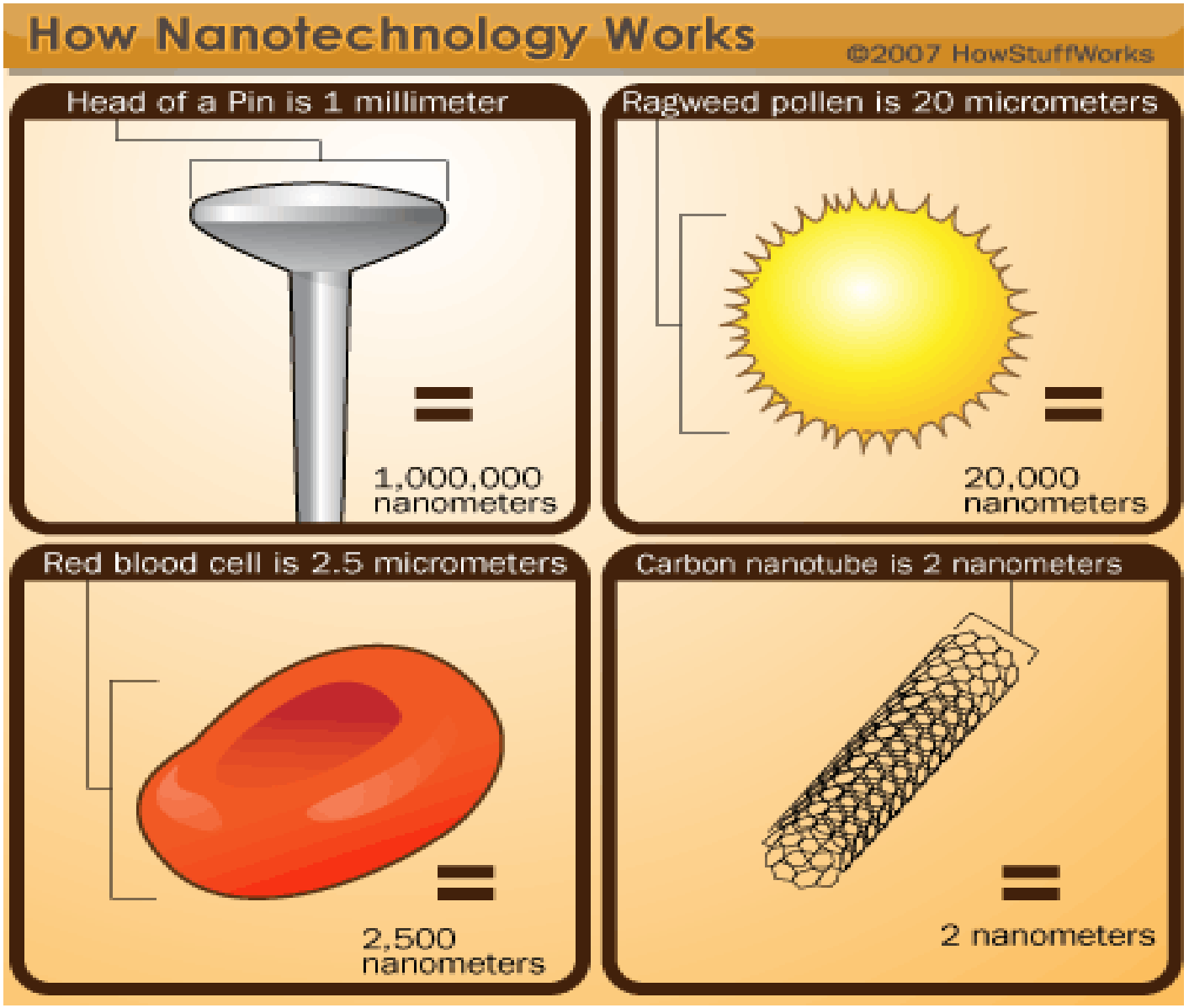
Ant
10 6 nm
Base ball
10 8 nm
Liposome
Fullerene
Dendrimer
Carbon nanotube
Graphene

A carbon nanotube is a nano-size cylinder of carbon atoms. Imagine a sheet of carbon atoms, which would look like a sheet of hexagons. If you roll that sheet into a tube, you'd have a carbon nanotube. Carbon nanotube properties depend on how you roll the sheet. In other words, even though all carbon nanotubes are made of carbon, they can be very different from one another based on how you align the individual atoms.

Carbon nanotubes (CNTs) are best described as a seamless cylindrical hollow fibers, comprised of a single sheet of pure graphite (a hexagonal lattice of carbon, similar to a chain link fence), having a diameter of 0.7 to 50 nanometers with lengths generally in the range of 10’s of microns. Being a hollow tube comprised entirely of carbon, they are also extremely light weight.





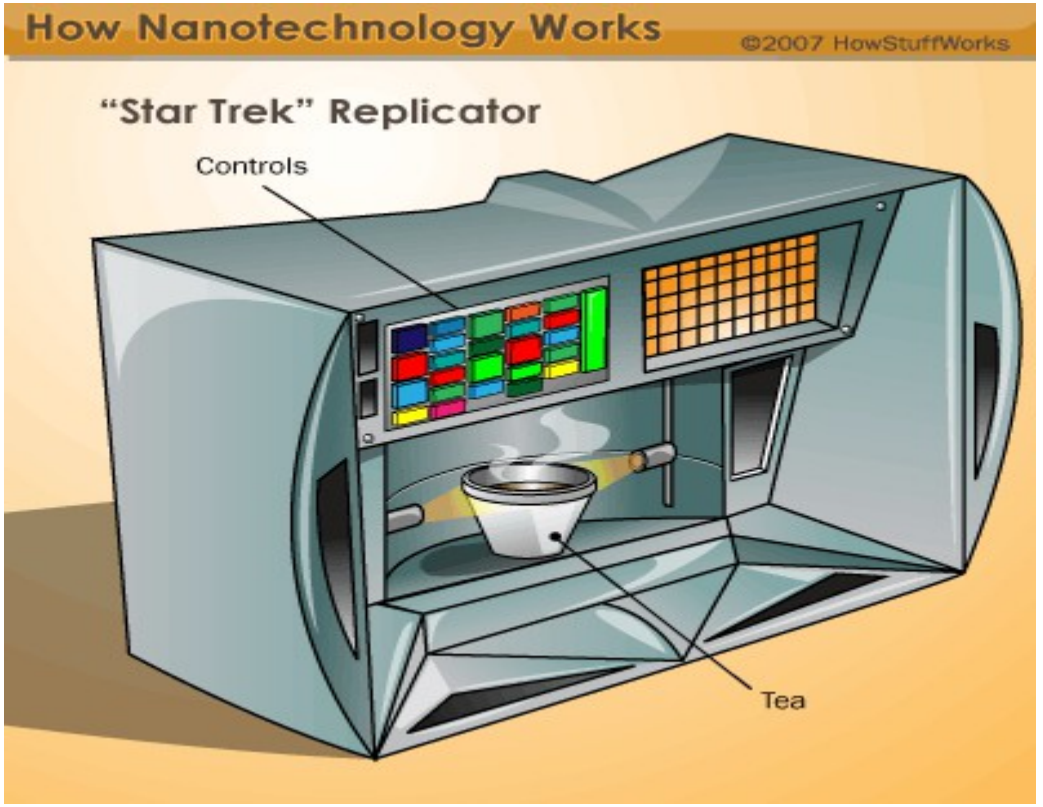
A nanometer (nm) is one-billionth of a meter, smaller than the wavelength of visible light and a hundred-thousandth the width of a human hair.

Nanotechnology defined:

n. The science and technology of building devices, such as electronic circuits, from single atoms and molecules.

American Heritage Dictionary

Nanotechnology is the managing of matter at a very small scale. Specifically, it is controlling matter at the atomic level. Nanotechnology refers to structures or matter that are one hundred nanometers large or smaller. The actual field is quite assorted, and includes both man-made objects and natural objects that are manipulated.



In the world of "Star Trek," machines called replicators can produce practically any physical object, from weapons to a steaming cup of Earl Grey tea. Long considered to be exclusively the product of science fiction, today some people believe replicators are a very real possibility. They call it molecular manufacturing, and if it ever does become a reality, it could drastically change the world.

The goal of molecular manufacturing is to manipulate atoms individually and place them in a pattern to produce a desired structure.

“Nature manipulates individual molecules to build the most complex things in the world—plants, animals, and our own bodies. The goal of nanotechnology is to use systems of molecular machines to build whatever we want with that same level of precision, and do it cleanly—just as nature does”

Christine Peterson, Foresight Institute
(“How nanotech will lead to a better future for us all”,
SingularityHub, August 12 , 2016)

Christine Peterson YouTube video (5 minutes of 18 minute interview):

https://www.youtube.com/watch?v=dXEMFIrm0Rs

The future is incredibly hard to predict, but not for the reasons we normally think. The truth is, not only are new technologies advancing quickly, but how they're converging and influencing one another kicks the pace up another gear. The result? The future is approaching faster than we can imagine. This concept, and the opportunity to leverage accelerating technologies to solve real human challenges, will be the central themes explored over three days this August.

The Singularity University Global Summit, happening August 28-30 in San Francisco, is bringing the brightest minds together for a three-day conference to begin tackling the world's biggest challenges and give participants a look at the future of technology and business. This will be the definitive place to meet innovators and understand what business, technology and government will look like in the next 10 years.

Mind-Controlled Nanobots Used to Release Chemicals in Living Cockroaches

This is wild: a team of Israeli scientists developed a contraption that uses a person's brain waves to remotely control DNA-based nanorobots — while the nanobots were inside a living cockroach. When prompted by a human thought, the clam shell-like robots opened up, revealing a drug-like molecule that tweaked the physiology of the cockroach's cells.

http://singularityhub.com/2016/09/18/mind-controlled-nanobots-used-to-release-chemicals-in-living-cockroaches/

From Living Computers to Nano-Robots: How We're Taking DNA Beyond Genetics

DNA-based nanothermometers

Biological nanorobots

Bio-computers in living animals

Light-harvesting antennas [for artificial photosynthesis]

http://singularityhub.com/2016/06/07/from-living-computers-to-nano-robots-how-were-taking-dna-beyond-genetics/?utm_source=TopNav&utm_medium=link&utm_campaign=content%20access

IBM's New Artificial Neurons a Big Step Toward Powerful Brain-Like Computers

Thanks to a sleek new computer chip developed by IBM, we are one step closer to making computers work like the brain.

The neuromorphic chip is made from a phase-change material commonly found in rewritable optical discs (confused? more on this later). Because of this secret sauce, the chip's components behave strikingly similar to biological neurons: they can scale down to nanometer size and perform complicated computations rapidly with little energy.

http://singularityhub.com/2016/08/14/ibms-new-artificial-neurons-a-big-step-toward-brain-like-computers/?utm_source=TopNav&utm_medium=link&utm_campaign=content%20access

You might be surprised to find out how many products on the market are already benefiting from nanotechnology.

Sunscreen - Many sunscreens contain nanoparticles of zinc oxide or titanium oxide. Older sunscreen formulas use larger particles, which is what gives most sunscreens their whitish color. Smaller particles are less visible, meaning that when you rub the sunscreen into your skin, it doesn't give you a whitish tinge.

Self-cleaning glass - A company called Pilkington offers a product they call Activ Glass, which uses nanoparticles to make the glass photocatalytic and hydrophilic. The photocatalytic effect means that when UV radiation from light hits the glass, nanoparticles become energized and begin to break down and loosen organic molecules on the glass (in other words, dirt). Hydrophilic means that when water makes contact with the glass, it spreads across the glass evenly, which helps wash the glass clean.

Clothing - Scientists are using nanoparticles to enhance your clothing. By coating fabrics with a thin layer of zinc oxide nanoparticles, manufacturers can create clothes that give better protection from UV radiation. Some clothes have nanoparticles in the form of little hairs or whiskers that help repel water and other materials, making the clothing stain-resistant.

Scratch-resistant coatings - Engineers discovered that adding aluminum silicate nanoparticles to scratch-resistant polymer coatings made the coatings more effective, increasing resistance to chipping and scratching. Scratch-resistant coatings are common on everything from cars to eyeglass lenses.

Antimicrobial bandages - Scientist Robert Burrell created a process to manufacture antibacterial bandages using nanoparticles of silver. Silver ions block microbes' cellular respiration. In other words, silver smothers harmful cells, killing them.

New products incorporating nanotechnology are coming out every day. Wrinkle-resistant fabrics, deep-penetrating cosmetics, liquid crystal displays (LCD) and other conveniences using nanotechnology are on the market. Before long, we'll see dozens of other products that take advantage of nanotechnology ranging from Intel microprocessors to bio-nanobatteries, capacitors only a few nanometers thick. While this is exciting, it's only the tip of the iceberg as far as how nanotechnology may impact us in the future.

Nanotechnology may have its biggest impact on the medical industry. Patients will drink fluids containing nanorobots programmed to attack and reconstruct the molecular structure of cancer cells and viruses. There's even speculation that nanorobots could slow or reverse the aging process, and life expectancy could increase significantly. Nanorobots could also be programmed to perform delicate surgeries -- such nanosurgeons could work at a level a thousand times more precise than the sharpest scalpel [source: International Journal of Surgery]. By working on such a small scale, a nanorobot could operate without leaving the scars that conventional surgery does. Additionally, nanorobots could change your physical appearance. They could be programmed to perform cosmetic surgery, rearranging your atoms to change your ears, nose, eye color or any other physical feature you wish to alter.

Watch This Amazing 3D Bioprinter Make Artificial Bones From Scratch

https://www.youtube.com/watch?v=KuO0tdF3ySA

One of the exciting and challenging aspects of the nanoscale is the role that quantum mechanics plays in it. The rules of quantum mechanics are very different from classical physics, -which means that the behavior of substances at the nanoscale can sometimes contradict common sense by behaving erratically. You can't walk up to a wall and immediately teleport to the other side of it, but at the nanoscale an electron can -- it's called electron tunneling. Substances that are insulators, meaning they can't carry an electric charge, in bulk form might become semiconductors when reduced to the nanoscale. Melting points can change due to an increase in surface area. Much of nanoscience requires that you forget what you know and start learning all over again.

WHAT IS MATERIALS SCIENCE?

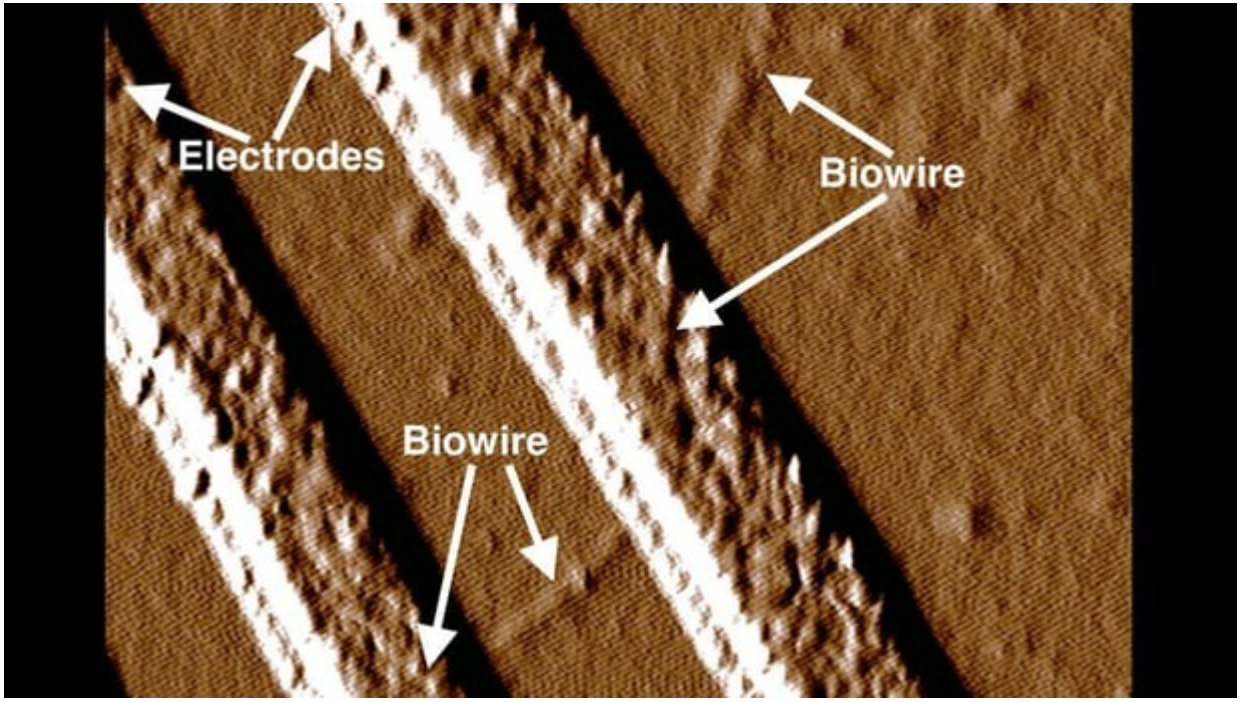
"The interdisciplinary field of materials science, also commonly known as materials science and engineering, involves the discovery and design of new materials, with an emphasis on solids. ...Many of the most pressing scientific problems humans currently face are due to the limitations of the materials that are available and, as a result, breakthroughs in materials science are likely to affect the future of technology significantly."

Wikipedia

From the Stanford University website describing their Materials Science and Engineering department: "Our faculty and students research the infinitesimally small to achieve breakthroughs of global significance, working at the atomic and molecular levels to create the microscopic devices and systems essential for cutting-edge solar energy production, energy storage, information technology and medicine."

Biomedicine

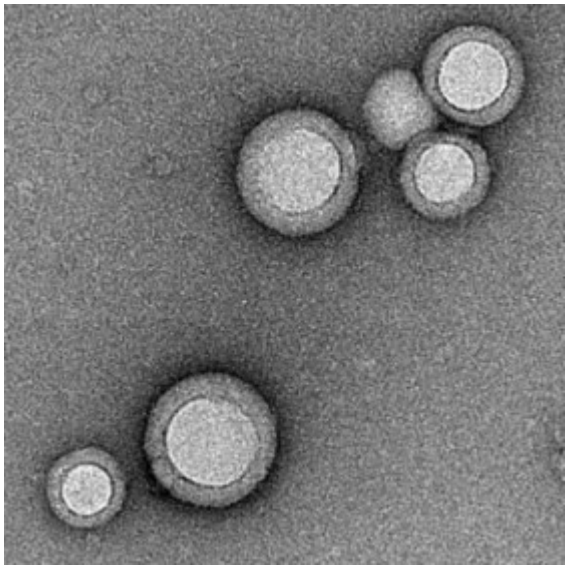
Nano-sized conductive wires built by bacteria



Upon testing, the modified Geobacter hugely surpassed the expectations of the team, with the tryptophan-infused nanowires being some 2,000 times more conductive than the naturally occurring wires. They were also even smaller than their natural counterparts, with a diameter of just 1.5 nanometers (equivalent to 60,000 times thinner than a human hair), and they were more durable.

http://newatlas.com/onr-nanosized-conductive-wires-bacteria/44939/

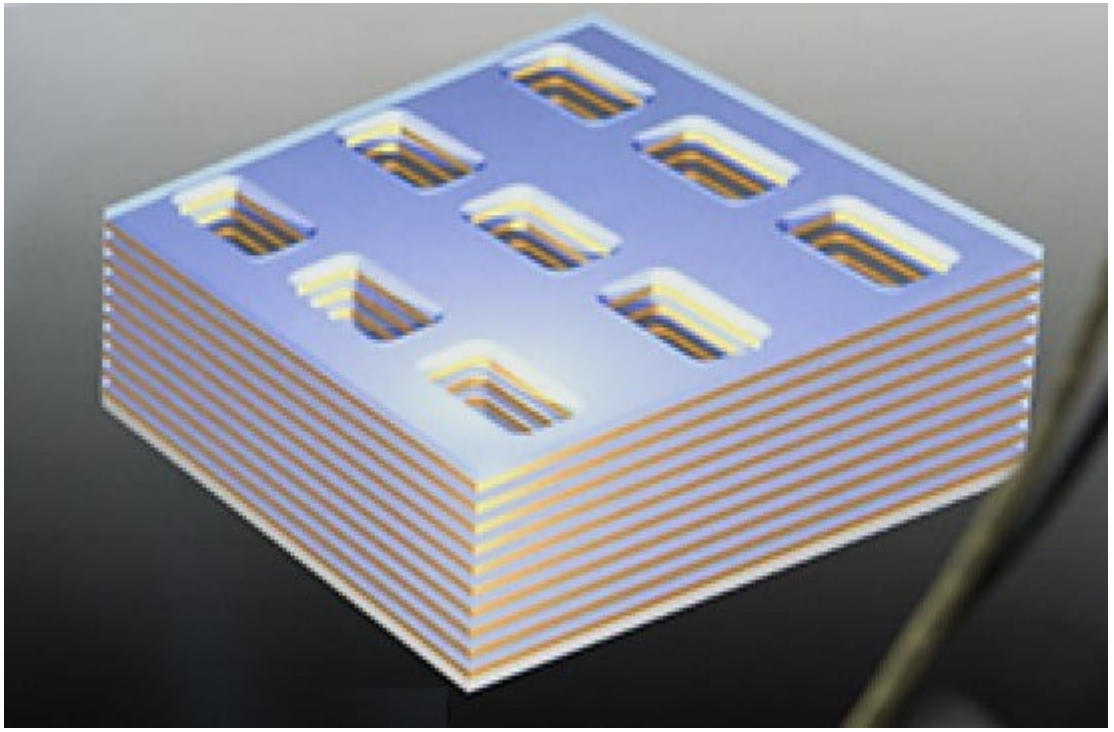
Nanoparticle That Mimics Red Blood Cell Shows Promise as Vaccine for Bacterial Infections



A nanoparticle wrapped in material taken from the membranes of red blood cells could become the basis for vaccines against a range of infectious bacteria, including MRSA.

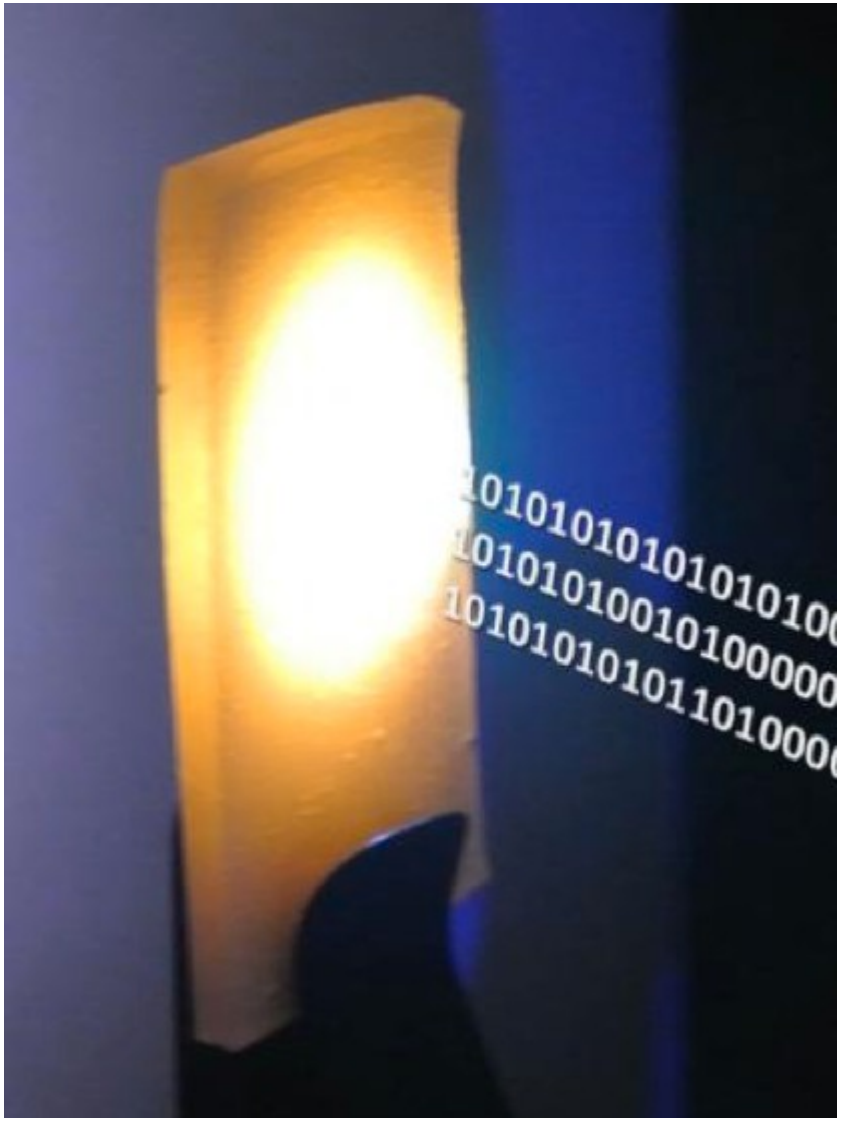
https://www.technologyreview.com/s/522846/nanoparticle-that-mimics-red-blood-cell-

Metamaterial paves way for thermophotovoltaic cells that generate electricity in the dark



"...have produced a prototype device that could be used in super-efficient thermophotovoltaic cells. These cells do not need direct sunlight to generate electricity, but instead absorb infrared radiation to convert to electric current and, unlike conventional photovoltaic cells, can do so even in the dark."

http://newatlas.com/thermophotovoltaic-metamaterial-electricity/42877/?



A nanocrystal-based material converts blue laser emission to white light for combined illumination and high-speed data communication. (credit: KAUST 2016)

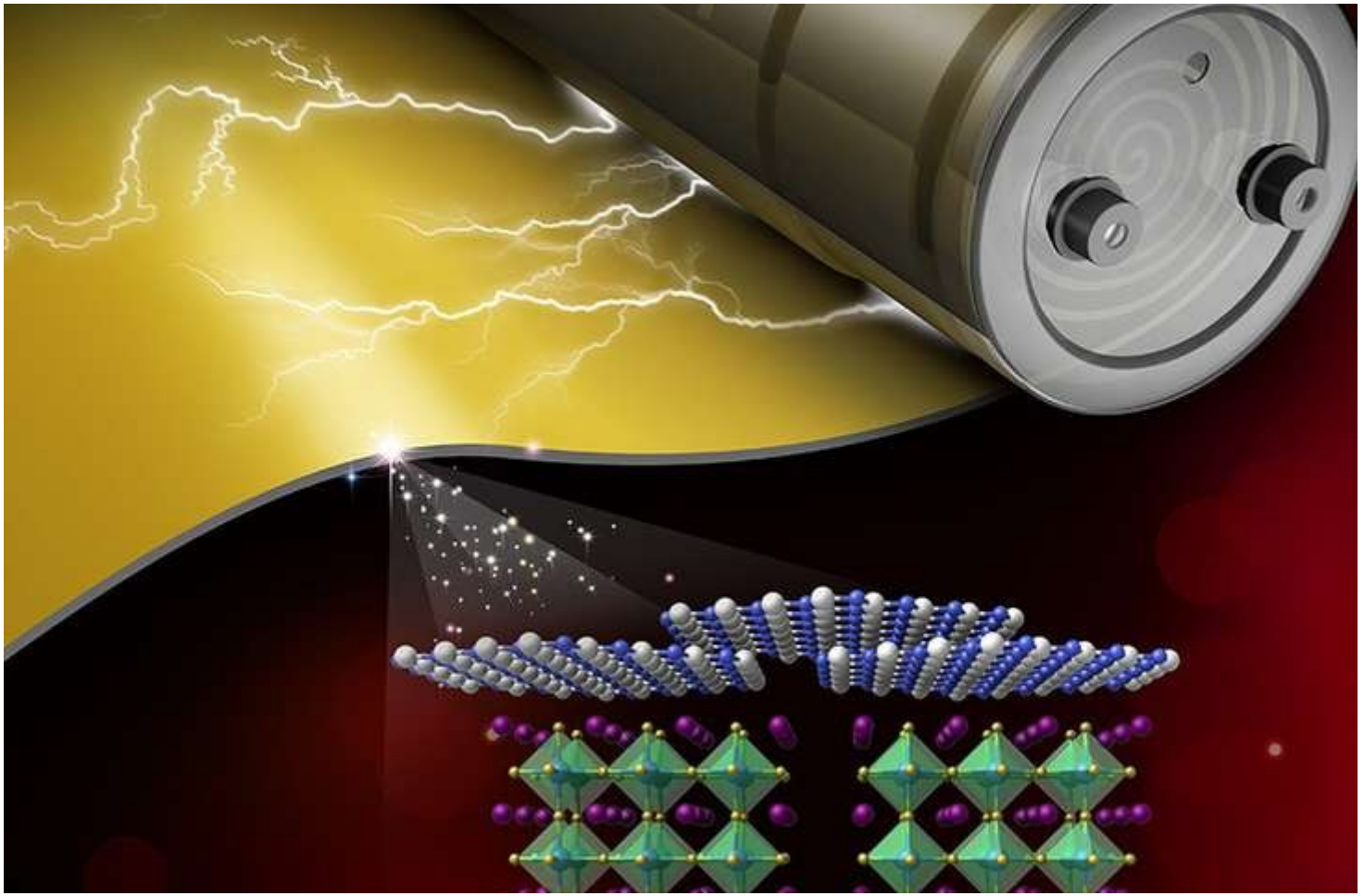
Researchers at King Abdullah University of Science and Technology (KAUST) have developed a system that uses high-speed visible light communications (VLC) to replace slower Wi-Fi and Bluetooth, allowing ceiling lights, for example, to provide an internet connection to laptops.

“VLC has many advantages compared with lower frequency communications approaches (including Wi-Fi and Bluetooth), such as energy efficiency, an unregulated communication spectrum, environmental friendliness, greater security, and no RF interferences,” according to KAUST researchers.

...the researchers created nanocrystals based on cesium lead bromide perovskite combined with a conventional nitride red phosphor, which achieved a data rate of 2 gigabits/sec.

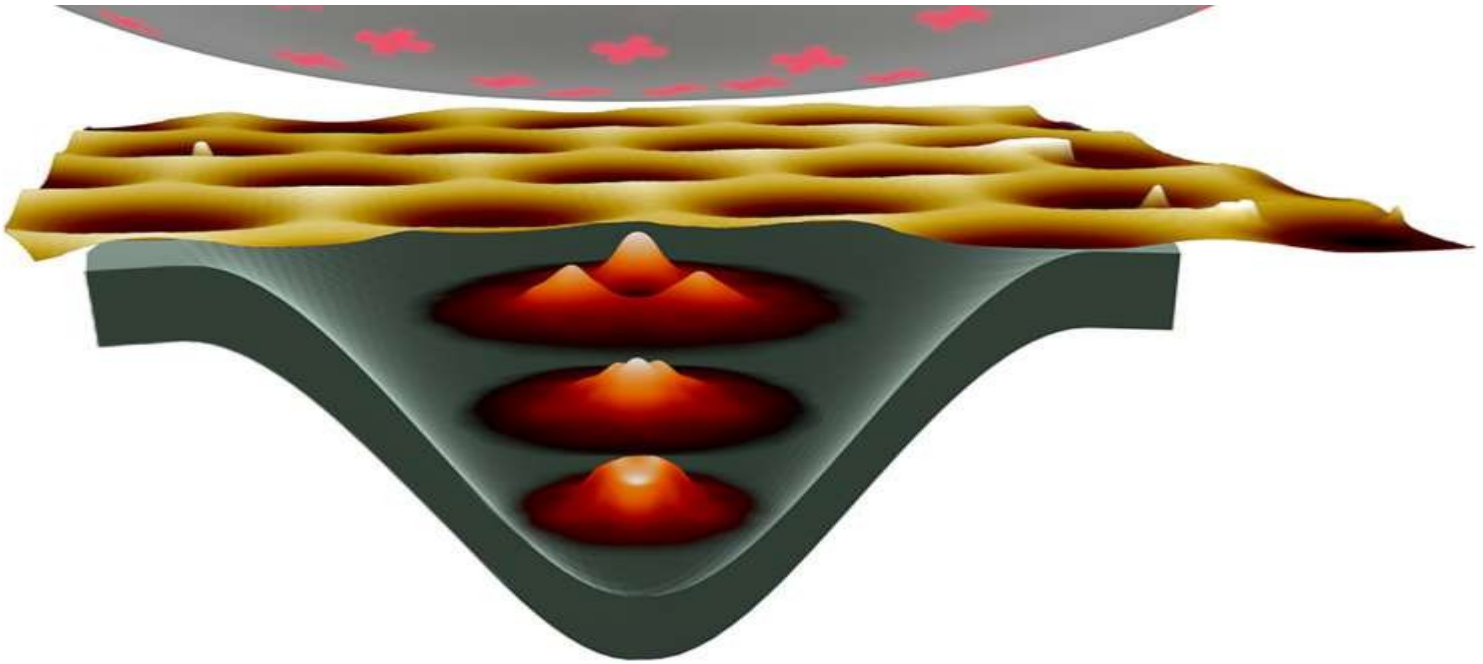
http://www.kurzweilai.net/beyond-wi-fi

'Ideal' energy storage material for electric vehicles developed



Boron nitride nanosheets (blue and white atoms) act as insulators to protect a barium nitrate central layer (green and purple atoms) for high temperature energy storage. Credit: Wang Lab/Penn State

'Artificial atom' created in graphene



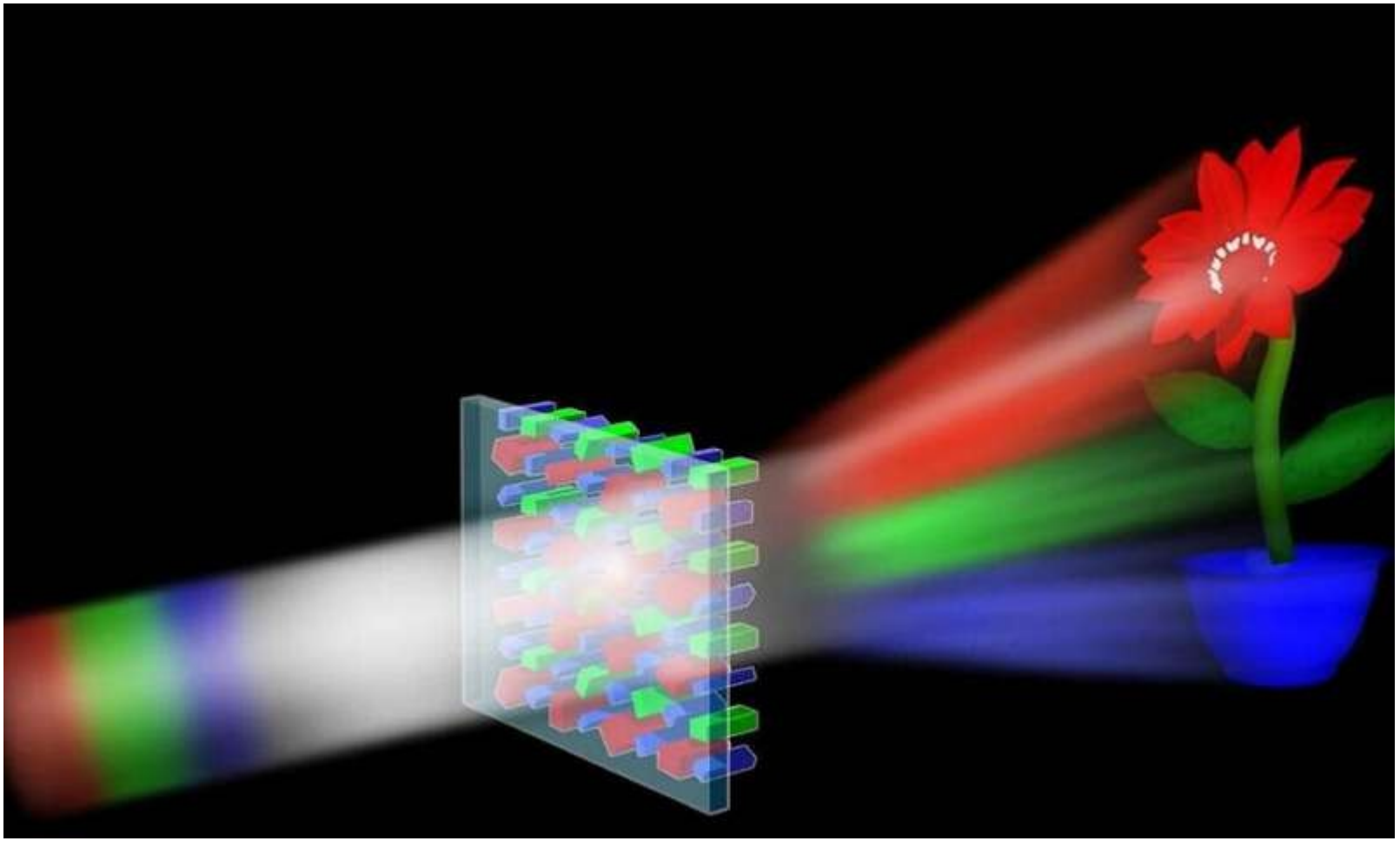
The charged tip of a scanning tunneling microscope and an additional magnetic field lead to localized stable electron states in graphene.

Read more at: http://phys.org/news/2016-08-artificial-atom-graphene.html#jCp

In a tiny quantum prison, electrons behave quite differently as compared to their counterparts in free space. They can only occupy discrete energy levels, much like the electrons in an atom - for this reason, such electron prisons are often called "artificial atoms". Artificial atoms may also feature properties beyond those of conventional ones, with the potential for many applications for example in quantum computing.

Read more at: http://phys.org/news/2016-08-artificial-atom-graphene.html#jCp

High-efficiency color holograms created using a metasurface made of nanoblocks



http://phys.org/news/2016-07-high-efficiency-holograms-metasurface-nanoblocks.html

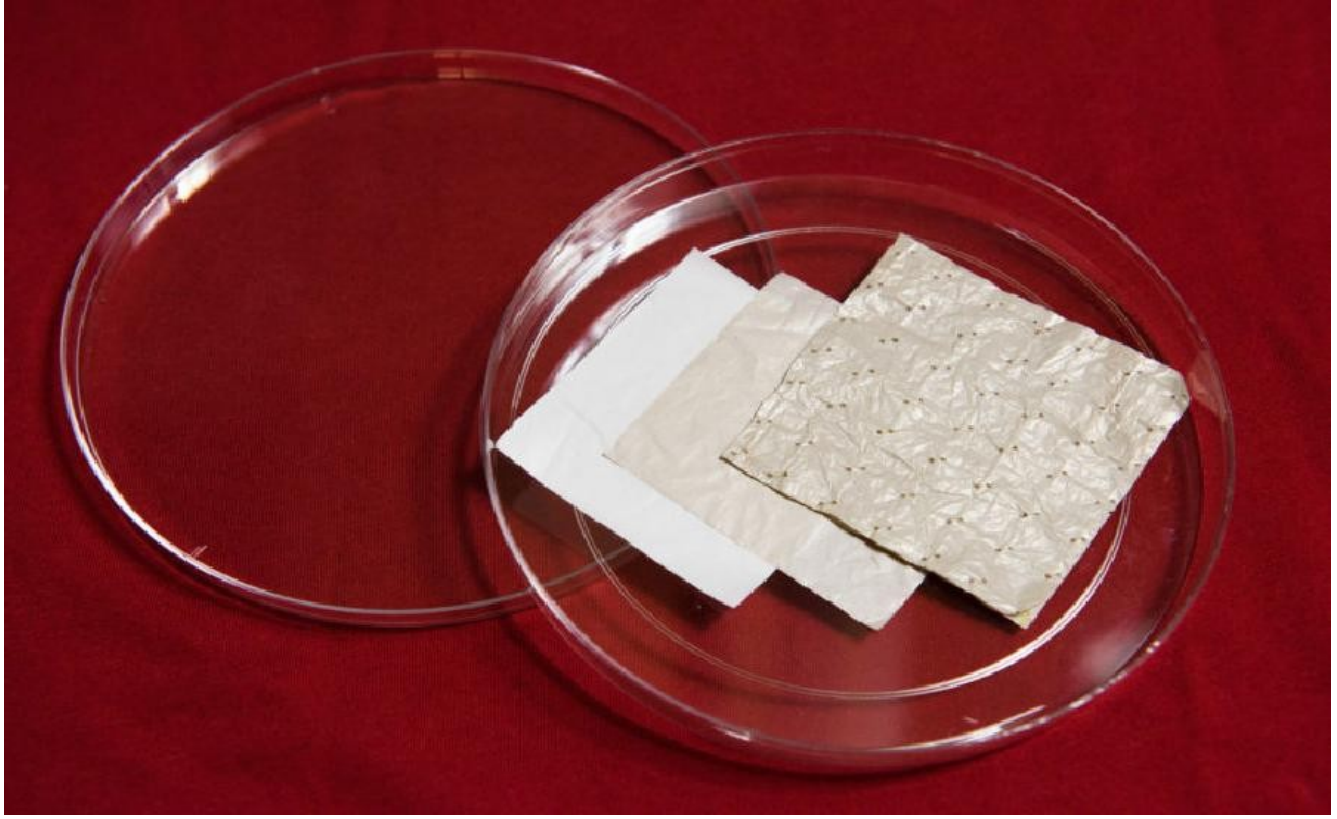
Graphene nanoribbons show promise for healing spinal injuries

The combination of graphene nanoribbons made with a process developed at Rice University and a common polymer could someday be of critical importance to healing damaged spinal cords in people, according to Rice chemist James Tour.

"Neurons grow nicely on graphene because it's a conductive surface and it stimulates neuronal growth," Tour said.

In experiments at Rice and elsewhere, neurons have been observed growing along graphene.

Read more at: http://phys.org/news/2016-09-graphene-nanoribbons-spinal-injuries.html#jCp

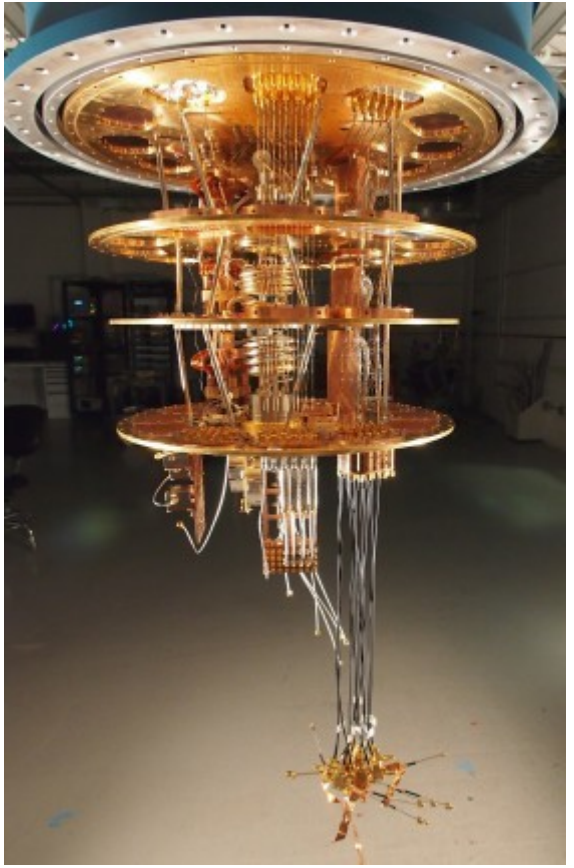


Plastic Clothing Inspired By Kitchen Wrap Releases Body's Infrared Radiation To Cool The Skin

The new cooling clothing material has two ways to make the wearer feel cooler by about 4 degrees Fahrenheit. First, it cools by allowing perspiration to evaporate through the material which is already something that ordinary fabrics can do.

Second, it provides a revolutionary cooling mechanism by allowing body heat, emitted as infrared radiation, to pass through the plastic textile. Ordinary clothes and blankets keep us warm by trapping infrared heat emissions close to the body. With this new technology, heat can be pass through clothes and help keep us cool even during the hottest summer day.

The Stanford University researchers combined nanotechnology, photonics and chemistry to give polyethylene, the clear plastic used as kitchen wrap, additional characteristics that allows thermal radiation, air and water vapor to pass through. Plus, it is opaque to visible light.



Google’s Quantum Dream May Be Just Around the Corner

Google plans to demonstrate a quantum chip that, using an assembly like this, can solve problems beyond what any ordinary computer is capable of.

Researchers at [Google] could unveil a quantum computer that is superior to conventional computers by the end of next year.

Several scientists familiar with Google's progress suggest that a functioning 50-qubit quantum chip, enough to overpower conventional supercomputers at a certain kind of calculation, could be ready by as soon as the end of 2017.

Demonstrating quantum supremacy would mark an inflection point in the history of computing technology. The first machines would be unlikely to be of much practical use, but they would almost certainly trigger a huge amount of investment in developing quantum computers that could blow away today's supercomputers in almost every type of calculation imaginable.

Carbon Nanotube Outperforms Silicon: Will Microprocessors Ditch Silicon Transistors Over Carbon Nanotube Transistors?

Carbon nanotubes have long been considered a promising material for the future of transistors. In theory, these materials should be able to perform five times faster than silicon transistors. The ultra-small dimension of the nanotube also allows it to rapidly change a current sign traveling across it.

….Arnold says the team's achievement has long been a dream of nanotechnology for the last two decades. He says such a big milestone is a crucial advancement in the use of carbon nanotubes for high-speed communications, logic and other electronic technologies.

Furthermore, the carbon nanotube transistors could someday replace silicon transistors and offer bigger gains that the computer industry can rely on. Researchers say the transistors are especially promising for wireless communication technologies that depend on a lot of current that flow across a small area.

Solar Cells and Nanotech-- TED Talk

(time--7:37)

http://www.tedxtoronto.com/talks/redefining-nanotechnology-ted-sargent-professor-canada-re

Quote from

THE POST-AMERICAN WORLD (2.0)

by Fareed Zakaria

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http://singularityhub.com/2016/08/30/peter-diamandis-well-radically-extend-our-lives-with-ne

TED Talk

Andy Yen:
Think your email's private? Think again

http://www.ted.com/talks/andy_yen_think_your_email_s_private_think_again?language=en