

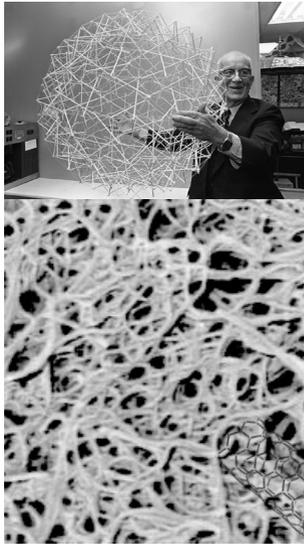
Catalogue

Diploma 18
[Architecture of Particles]

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Giurgiu



Ibrahim Al-Mouaser



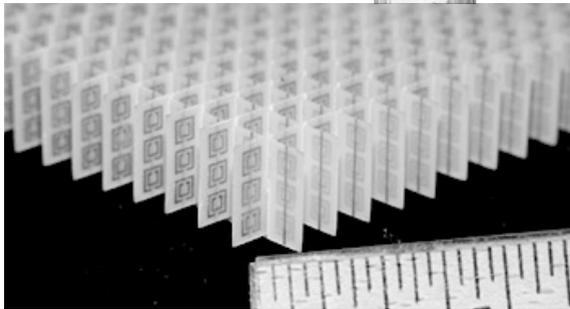
Buckypaper

Buckypaper is of highest interest to scientists due to its incredible strength and light weight (250 times stronger than steel, 10 times lighter). Buckypaper is made from carbon nanotubes with amazingly strong fibers 1/50,000th the diameter of a human hair.



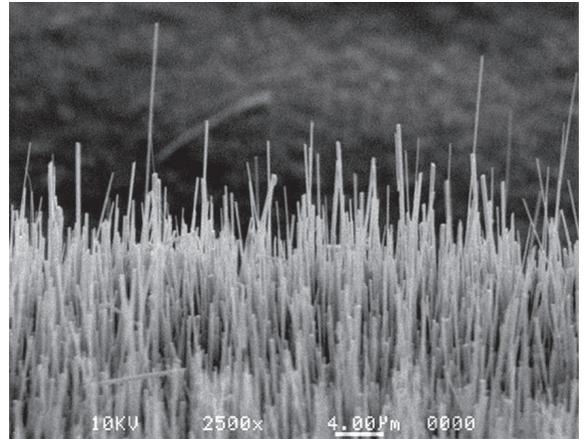
Metamaterials

Metamaterials are new forms of artificial matter with properties that do not depend on what material constitutes them, rather how the constituents are put together. Light waves diffract through the gaps within the molecular structure.



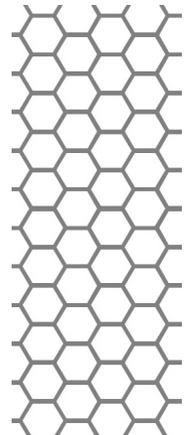
Light Absorbing Nanowires

No, this solar power innovation isn't in need of a good shave. It's actually a product of nanotechnology, using light-absorbing nanowires on carbon-nanotube fabric. These nanowires can absorb more energy from the sun than silicon can, which may allow for more efficient energy harvesting (as well as giving us a fun new term, "hairy solar.")



Graphene

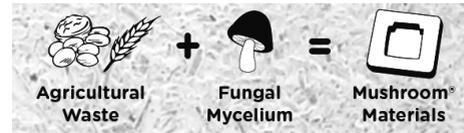
Graphene is pure carbon in the form of a very thin, nearly transparent sheet, one atom thick. It is remarkably strong for its very low weight (100 times stronger than steel) and it conducts heat and electricity with great efficiency. While scientists had theorized about graphene for decades, it was first produced in the lab in 2003. Because it is virtually two-dimensional, it interacts oddly with light and with other materials.





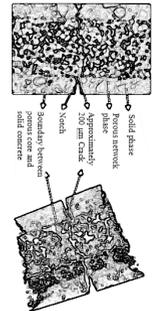
Mushroom Materials

Ecovative is a material science company developing a new class of home-compostable bioplastics based on mycelium, a living organism which is the vegetative growth stage of fungi. Mushroom Materials are high-performance, environmentally responsible alternatives to traditional plastic foam packaging, insulation, and other synthetic materials.



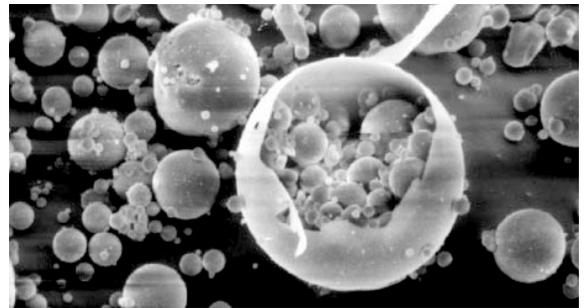
Self-Healing Concrete

Scientists are developing special bacteria contained within protective microcapsules that can be added to the original mix of concrete. As the concrete cracks, so do the capsules releasing bacteria that can convert water to limestone in a simple biological process closing the gap.



Biodigital Micro-Algae

Urban Algae Canopy Module by ecoLogicStudio + Carlo Ratti Associati: The Urban Algae Canopy by ecoLogicStudio [M. Poletto, C. Pasquero] has been presented at the 'feeding the planet' exhibition in Milan with the 1:1 scale prototype of the world's 1st bio-digital canopy integrating micro-algal cultures and real time digital cultivation protocols on a unique architectural system.

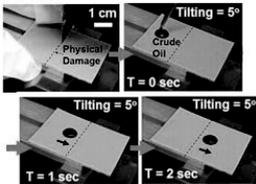


Synthetic Leather

Humans, the naked/nude apes, have been covering their fragile bodies/skins to protect themselves from the external environment. This humble act for survival has developed into a complex social ritual which transformed the concept of a "Garment" into an evocative object that cannot be taken on its face value.

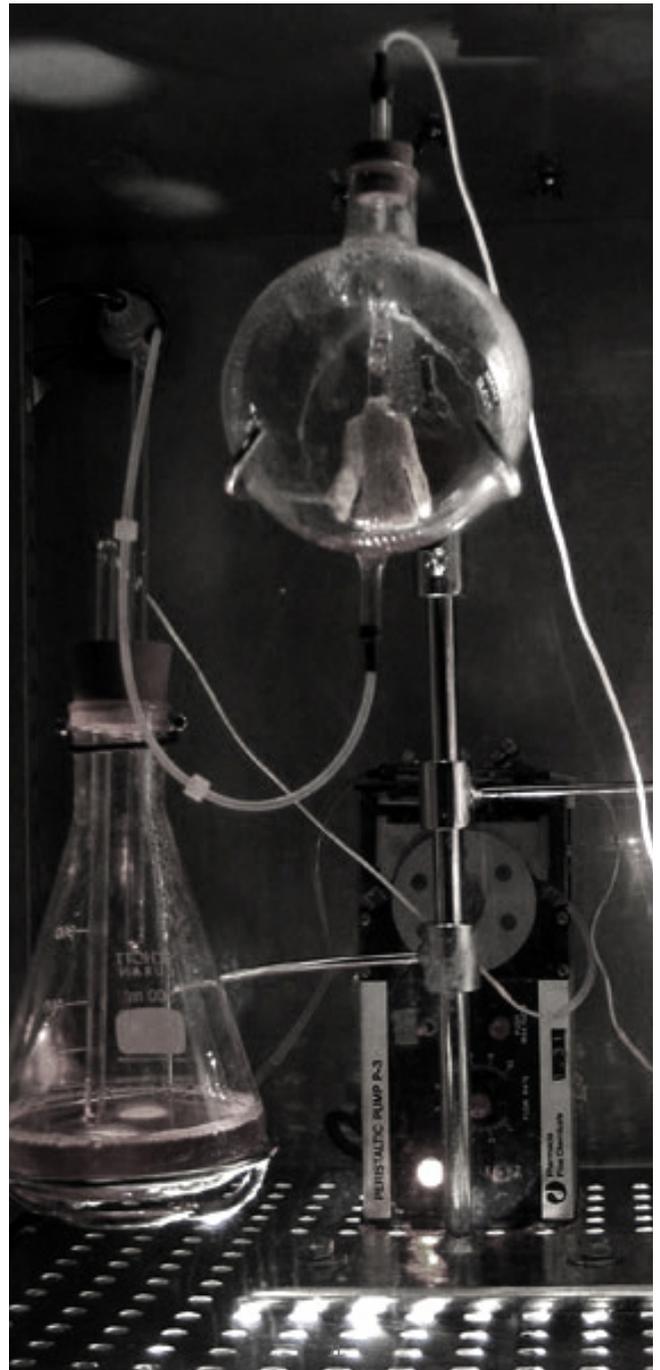
By growing Victimless Leather, the Tissue Culture & Art (TC&A) Project is further problematising the concept of garment by making it Semi-Living.

The Victimless Leather is grown out of immortalised cell lines which cultured and form a living layer of tissue supported by a biodegradable polymer matrix in a form of miniature stitch-less coat like shape. The Victimless Leather project concerns with growing living tissue into a leather like material.



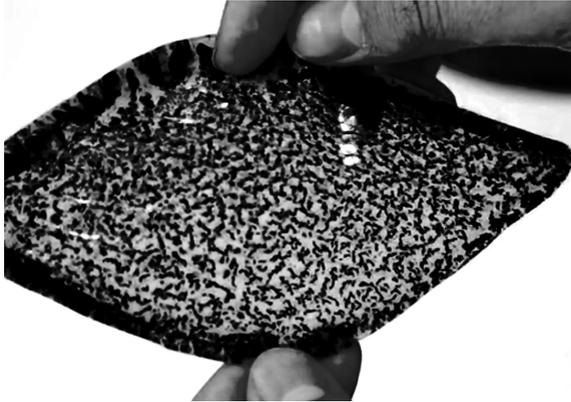
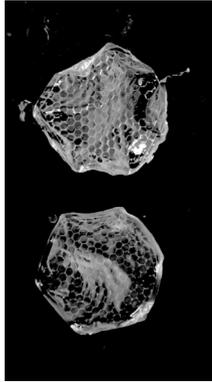
SLIPS

SLIPS -Slippery liquid infused porous surfaces- technology, inspired by the Nepenthes pitcher plant, provides unique capabilities that are unmatched by any other liquid-repellent surface technologies. SLIPS surfaces function under extreme high pressure conditions, instantly self-heal imperfections, provide optical transparency, and are ultra-repellent to pure and complex fluids such as blood, crude oil, and brine.



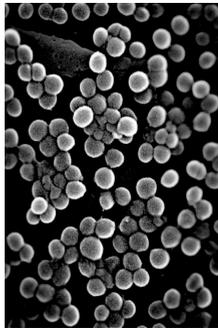
Artificial Photosynthesis

At the Royal College of Art, Julian Melchiorri has developed a photosynthetic material that lives and breathes as a leaf does. The man-made leaf absorbs carbon dioxide and water and releases oxygen. The leaf works by suspending chloroplasts (the part of the plant where photosynthesis happens) in a material made from silk protein.



Battling Superbugs

In the new Nature Biotechnology study, graduate students Robert Citorik and Mark Mimee worked with Lu to target specific genes that allow bacteria to survive antibiotic treatment. The CRISPR genome-editing system presented the perfect strategy to go after those genes.



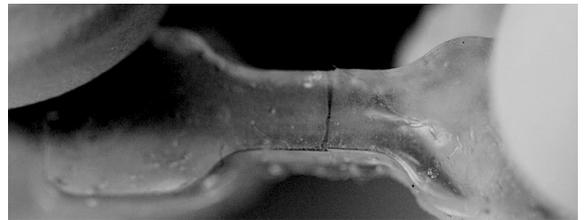
Bionic Plants

Plants have many valuable functions: They provide food and fuel, release the oxygen that we breathe, and add beauty to our surroundings. Now, a team of MIT researchers wants to make plants even more useful by augmenting them with nanomaterials that could enhance their energy production and give them completely new functions, such as monitoring environmental pollutants.



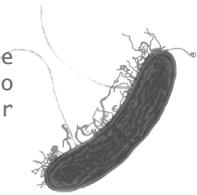
Self repairing Polymers

Stretchy, self-healing paints and other coatings recently took a step closer to common use, thanks to research being conducted at the University of Illinois. Scientists there have used “off-the-shelf” components to create a polymer that melds back together after being cut in half, without the addition of catalysts or other chemicals. The material is being called “dynamic polyurea”

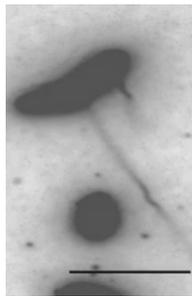


Bacterial Nanowires

For the past 10 years, scientists have been fascinated by a type of “electric bacteria” that shoots out long tendrils like electric wires, using them to power themselves and transfer electricity to a variety of solid surfaces.



Today, a team led by scientists at USC has turned the study of these bacterial nanowires on its head, discovering that the key features in question are not pili, as previously believed, but rather are extensions of the bacteria’s outer membrane equipped with proteins that transfer electrons, called “cytochromes.”



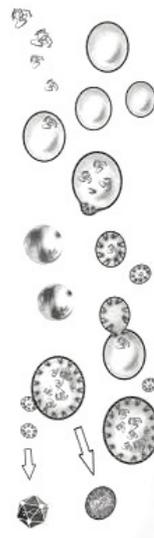
Microbes to Morphine

Researchers from Stanford University have created a version of baker’s yeast (*Saccharomyces cerevisiae*) that contains genetic material of the opium poppy (*Papaver somniferum*), bringing the morphine microbial factory one step closer to reality. These results published in the journal *Nature Chemical Biology* represent a significant scientific success, but eliminating the need to grow poppies may still be years away.



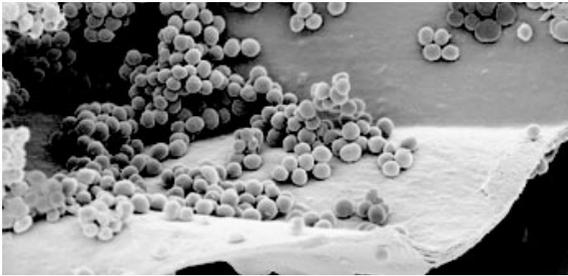
Synthetic Protoceells

Protoceells offers a comprehensive resource on current attempts to create simple forms of life from scratch in the laboratory. These minimal versions of cells, known as protoceells, are entities with lifelike properties created from nonliving materials. Rachael Armstrong speculated a project in Venice where protoceells digested water from the canals into limestone, reinforcing the foundations of the sinking city.



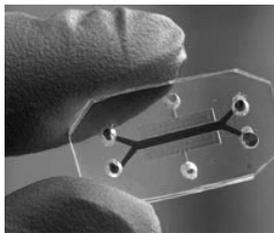
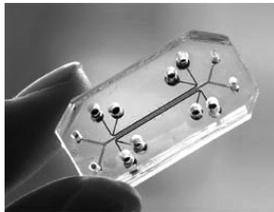
Biofilms

A biofilm is any group of microorganisms in which cells stick to each other on a surface. These adherent cells are frequently embedded within a self-produced matrix of extracellular polymeric substance (EPS). Biofilm extracellular polymeric substance, which is also referred to as slime (although not everything described as slime is a biofilm), is a polymeric conglomeration generally composed of extracellular DNA, proteins, and polysaccharides. Biofilms may form on living or non-living surfaces and can be prevalent in natural, industrial and hospital settings..



Organs on Chips

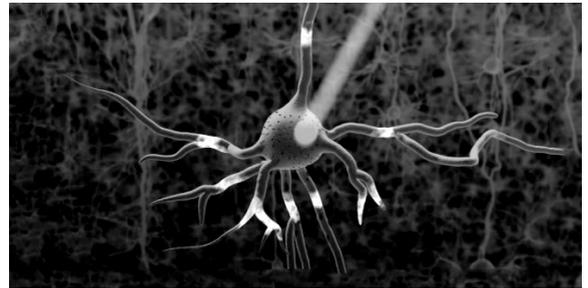
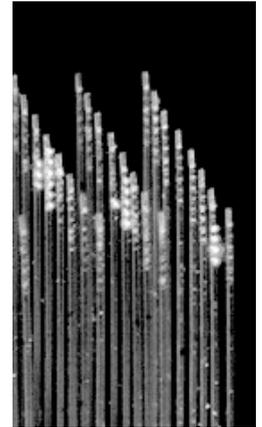
Institute researchers and a multidisciplinary team of collaborators are engineering microchips that recapitulate the microarchitecture and functions of living organs, such as the lung, heart, and intestine. These microchips, called organs-on-chips, could one day form an accurate alternative to traditional animal testing.



Opticogenetics

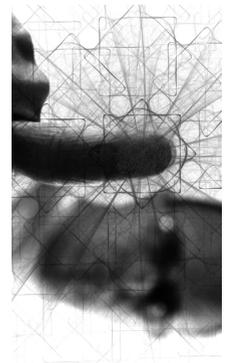
Opticogenetics uses light to control neurons which have been genetically sensitised to light.

A research team at Stanford University has sketched out how patients afflicted by chronic pain might one day find relief: simply by pressing a bright flashlight to their skin.



Subdermal Digital Implants

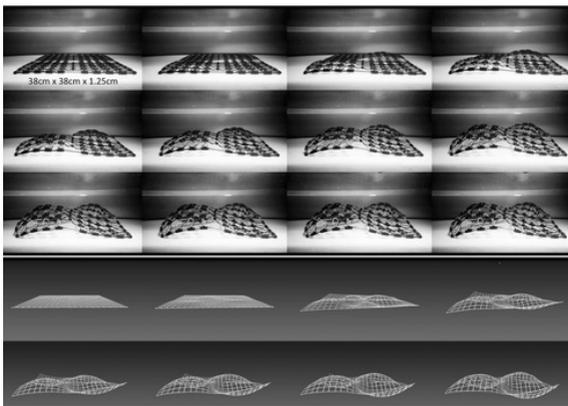
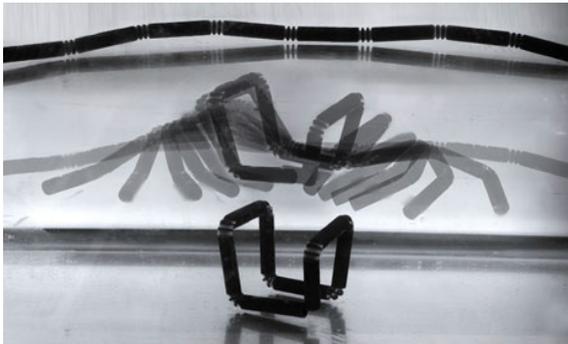
"Project Underskin". The project takes the concept of tattoos and underskin implants up a level as it proposes to quite literally implant a "smart digital tattoo" under the skin of your hand. This multifaceted tattoo would be powered by your body's electro-chemical energy and interact with things that you touch.



4D Printing

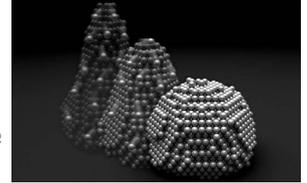
A surprising phenomenon has been found in metal nanoparticles: They appear, from the outside, to be liquid droplets, wobbling and readily changing shape, while their interiors retain a perfectly stable crystal configuration.

Using a new technique known as 4D printing, researchers can print out dynamic 3D structures capable of changing their shapes over time. Such 4D-printed items could one day be used in everything from medical implants to home appliances.

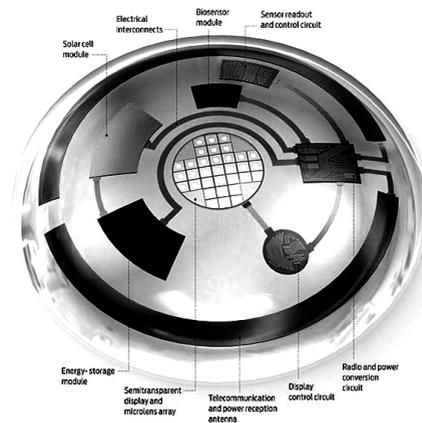


Solid/Liquid Nanoparticles

A surprising phenomenon has been found in metal nanoparticles: They appear, from the outside, to be liquid droplets, wobbling and readily changing shape, while their interiors retain a perfectly stable crystal configuration.

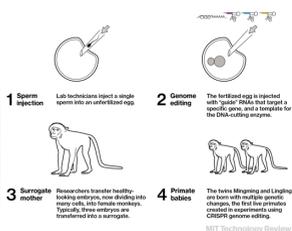


Nano Contact Lenses



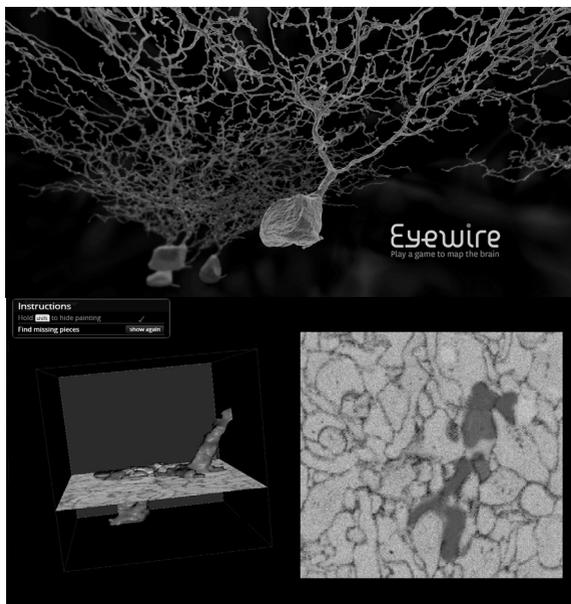
Another area of Nano Technology research looks to marry together “Augmented Reality” with the contact lens. Augmented Reality devices (already available on many Smart Phones) overlay graphical displays over real-time video footage of the world around. For instance, a user might use his or her mobile phone camera to look around an unfamiliar city. The picture they see on the phone screen will be overlaid with helpful directions and annotations that change according to the direction of the camera.

Genome Editing



Last November, the female monkey twins, Mingming and Lingling were born. They had been conceived via in vitro fertilization. Then scientists used a new method of DNA engineering known as CRISPR to modify the fertilized eggs by editing three different genes, and they were implanted into a surrogate macaque mother. They were created with specific mutations.

Eyewire



Eyewire is a game to map the brain from Seung Lab at MIT. Anyone can play and you need no scientific background. Over 130,000 people from 145 countries already do. Together they are mapping the 3D structure of neurons that exist behind the retina advancing our quest to understand ourselves.

Players are challenged to map branches of a neuron from one side of a cube to the other, the cube represents a series of 2D brain scans. Players scroll through the cube (measuring about 4.5 microns per side) and reconstruct neurons in volumetric segments with the help of an algorithm.



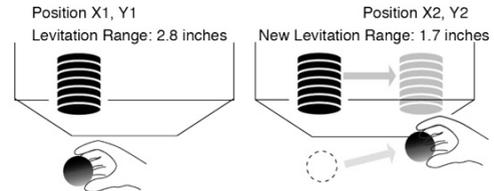
The Physical Web

The Physical Web is an approach to unleash the core superpower of the web: interaction on demand. People should be able to walk up to any smart device - a vending machine, a poster, a toy, a bus stop, a rental car - and not have to download an app first. Everything should be just a tap away.



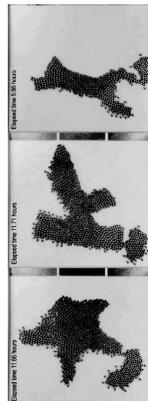
ZeroN

ZeroN is a new physical/digital interaction element that can be levitated and moved freely by computer in a three dimensional space. Both the computer and people can move the ZeroN simultaneously. In doing so, people and computers can physically interact with one another in 3D space. Users are invited to place or move the ZeroN just as they can place any other objects on surfaces. Once levitated, ZeroN's behavior can be digitally programmed. For example, users can place the sun above physical objects to cast digital shadows, or place a planet that will start revolving based on simulated physical conditions.



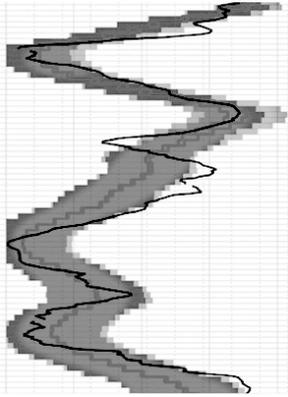
Swarm Robotics

Swarm robotics is a new approach to the coordination of multirobot systems which consist of large numbers of mostly simple physical robots. It is supposed that a desired collective behavior emerges from the interactions between the robots and interactions of robots with the environment. This approach emerged on the field of artificial swarm intelligence, as well as the biological studies of insects, ants and other fields in nature, where swarm behaviour occurs.



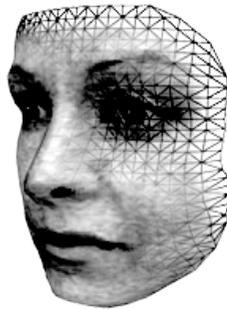
Big Data Smart Grids

Using sensors, big data and artificial intelligence within a renewable energy power grid will create an unprecedented level of accuracy with energy monitoring and forecasting. In turn this will reduce the need for backup power plants and energy for storage, radically reducing wasted energy.



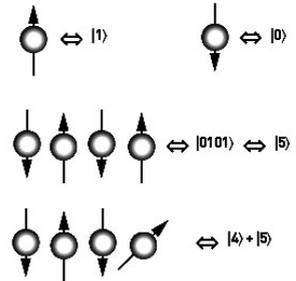
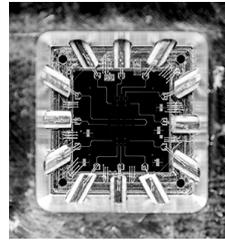
Facial Recognition

A number of algorithms are being developed that use a range of sensors that detect specific movements and expressions of people's faces, allowing companies to read consumers' reactions providing an effective marketing or market research tool.



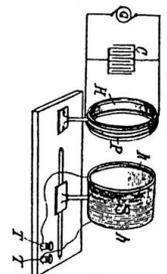
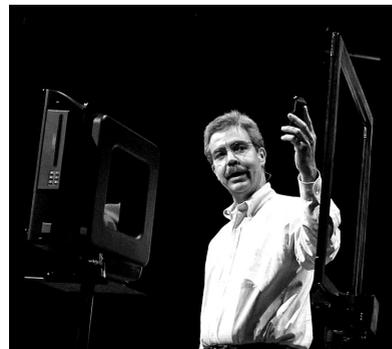
Quantum Computers

A quantum computer is a computation system that makes direct use of quantum-mechanical phenomena, such as superposition and entanglement, to perform operations on data. Quantum computers are different from digital computers based on transistors. Whereas digital computers require data to be encoded into binary digits (bits), each of which is always in one of two definite states (0 or 1), quantum computation uses qubits (quantum bits), which can be in superpositions of states.



WiTricity

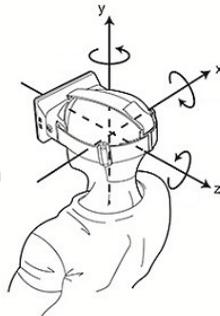
Prof. Marin Soljagic of MIT Technology and his research team powered a 60W light bulb safely and efficiently at a distance of 2m. The concept is based on strong coupling between electromagnetic resonant objects to transfer energy wirelessly between them.



Oculus Rift

The Rift is an upcoming virtual reality head-mounted display, being developed by Oculus VR. During its period as an independent company, Oculus VR raised US\$2.4 million for the development of the Rift. [3]

The consumer version of the product is expected to become available sometime in 2015. Early versions of the product are being purchased by many virtual reality enthusiasts for general usage.



World Wide Telescope

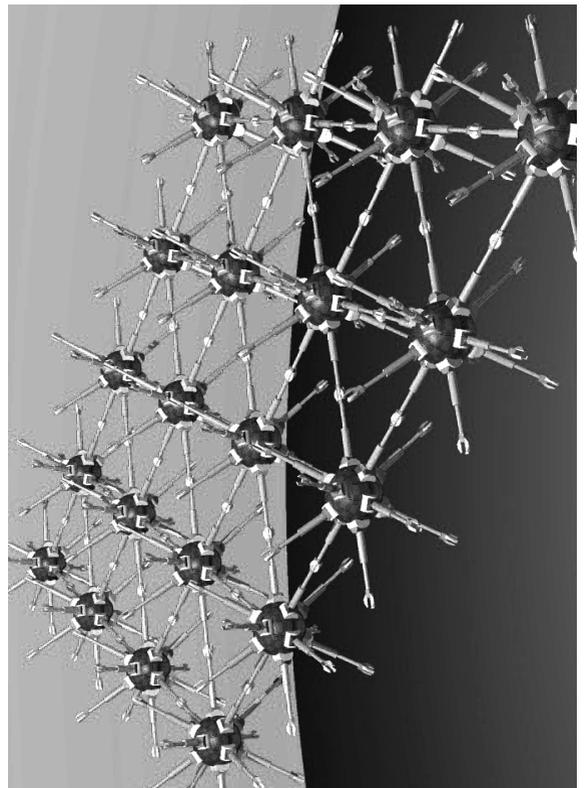
WorldWide Telescope, developed by Microsoft allows you to explore real images obtained with some of the world's most advanced telescopes. These are the same images that professional astronomers use in their research. Guided tours have been created to present particular topics by using WWT to show specific views of the sky and astronomical objects. It is an interactive display of the highest resolution image taken from the combined power of a large number of telescopes scattered world wide



Utility Fog

Utility fog (coined by Dr. John Storrs Hall in 1993) is a hypothetical collection of tiny robots that can replicate a physical structure. As such, it is a form of self-reconfiguring modular robotics.

While the foglets would be micro-scale, construction of the foglets would require full molecular nanotechnology. Hall suggests that each bot may be in the shape of a dodecahedron with 12 arms extending outwards. Each arm would have four degrees of freedom. The foglets' bodies would be made of aluminum oxide rather than combustible diamond to avoid creating a fuel air explosive



Telepresence

Telepresence refers to a set of technologies which allow a person to feel as if they were present, to give the appearance of being present, or to have an effect, via telerobotics, at a place other than their true location.

Telepresence requires that the users' senses be provided with such stimuli as to give the feeling of being in that other location. Additionally, users may be given the ability to affect the remote location. In this case, the user's position, movements, actions, voice, etc. may be sensed, transmitted and duplicated in the remote location to bring about this effect. Therefore information may be traveling in both directions between the user and the remote location.



Biologically Enhanced Senses

We are at a point where the artificial is merging with the natural. People are already looking at ways to enhance their biological limitations by adding artificial materials upgrading their senses. One of many examples, is subdermal magnets, where subjects can now feel the presence of magnetic and electric fields as well as metals.



Cryonics

Cryonics is the low temperature preservation of animals who cannot be sustained by contemporary medicine. Some scientific literature supports the feasibility of cryonics. An Open Letter supporting the idea of cryonics has been signed by 63 scientists, including Aubrey de Grey and Marvin Minsky. So far this has worked for bacterial cells and even human tissue, but it will still be some time until a whole human is successfully retrieved.

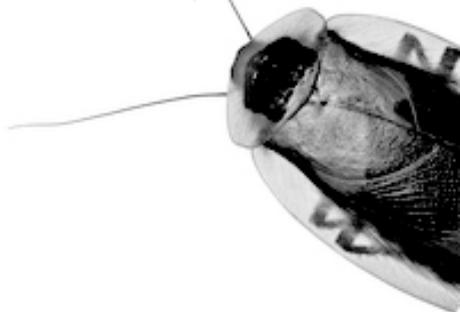


"I want to be cryogenically preserved when I die from brain cancer but can't afford it," she wrote, [...] I am literally begging for financial help." Kim Suozzi, a 23-year old neuroscience student who was in the midst of battling terminal brain cancer.



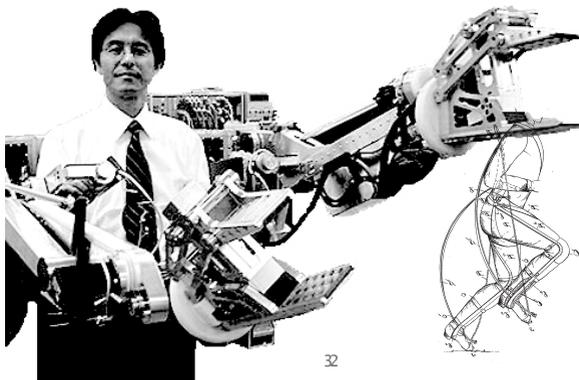
DNA Robots in Cockroaches

Molecular 'robots' can perform complex logic tasks inside a living organism. Ido Bachelet of Bar-Ilan University in Ramat Gan, Israel, and his colleagues used folded strands of DNA to create a suite of nanorobots that open, close and coordinate with each other in response to various interactions with certain proteins. When the robots were injected into a living cockroach (*Blaberus discoidalis*; pictured), different robot combinations created seven kinds of logic gate that each delivers a different outcome – such as releasing various antibody payloads



Strength Enhancing Suit

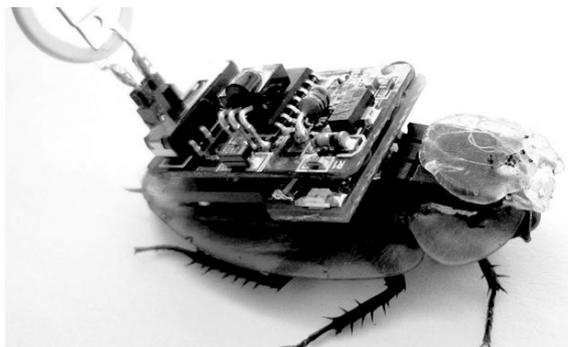
Robotic suits that can be intuitively controlled by body movements. Soon enough though researchers are looking at brain electrodes that can transfer brain signals to the exoskeleton.



Cyborg Insects

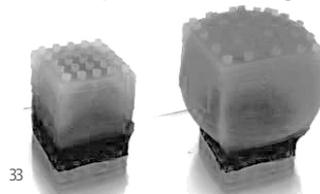
In 2006 the US Defense Advanced Research Projects Agency (Darpa) asked America's scientists to submit "innovative proposals to develop technology to create insect-cyborgs".

So called "micro air vehicles" – ultra-small flying robots are capable of performing surveillance in dangerous territory. Building these machines is not easy. The dynamics of flight change at very small sizes, and the vehicles need to be lightweight enough to fly, yet strong enough to carry cameras and other equipment.

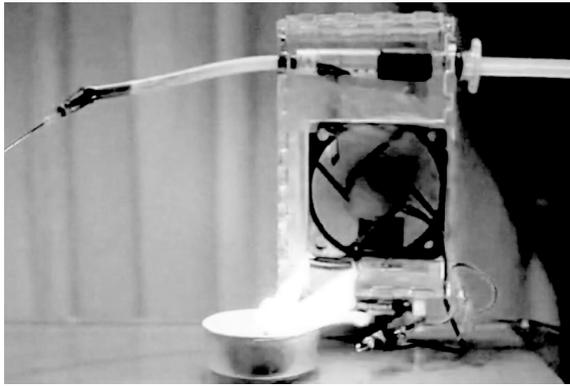


Squidgy Bricks

Pliable bricks that stick together like Lego could be the ultimate play set for advanced robotics. At Harvard University a range of soft robots, from limbo-dancing squid to bendy tentacles have been developed, based on flexible plastics and powered by air. All of these had to be made with specialised moulds, and the team realised that they could be more creative if they used building blocks.



Recycled 3D Printing

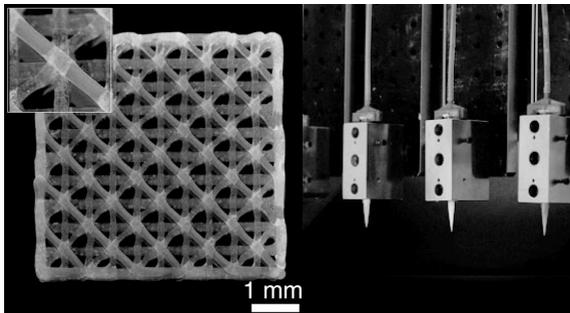


A Printer contraption that runs on soot from pollution. Black printing ink is one of the most consumed products in the industry.

Most of this printing ink is produced in factories with complex chemical procedures. Companies like HP/Canon make 70 percent of their profits by selling these cartridges at 400% margin.

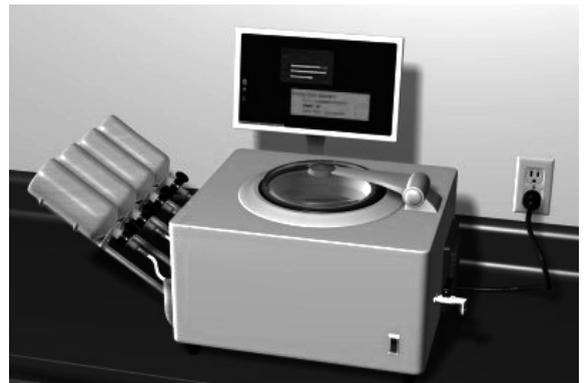
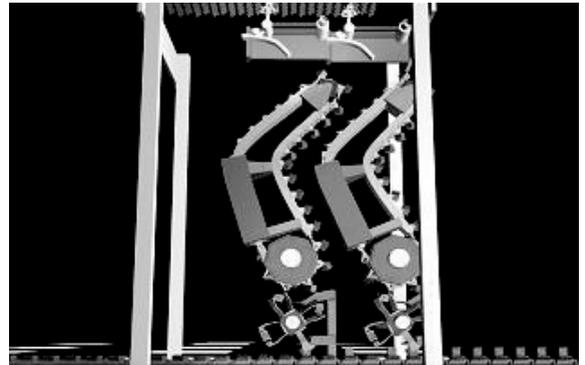
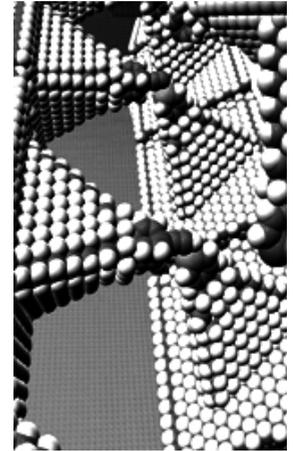
Microscale 3D Printing

The scale of 3D printing has become so small that tissue could now be printed, with complex networks of blood vessels within using different nozzles and “inks”.



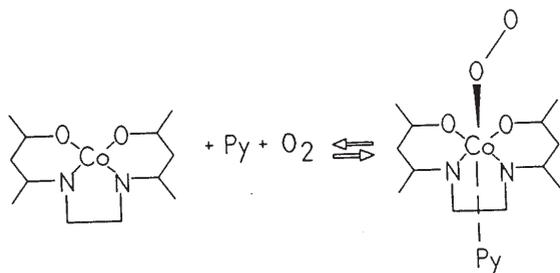
The Nanofactory

The nanofactory is a proposed compact molecular manufacturing system, possibly small enough to sit on a desktop, that could build a diverse selection of large-scale atomically precise diamond products. The nanofactory is potentially a high quality, extremely low cost, and very flexible manufacturing system.



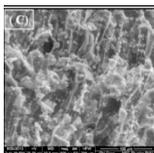
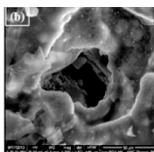
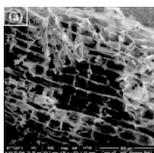
O₂ Absorbtion

Scientists from the University of Southern Denmark have developed a new form of crystalline cobalt salt that acts like a super-effective oxygen sponge. Once it sucks up oxygen, it will hold on to it indefinitely until it's gently heated or exposed to low oxygen pressure, at which point it will quietly release its oxygen hoard back out into the atmosphere. About 10 litres of it would be needed to suck all of the oxygen out of an average-sized room.



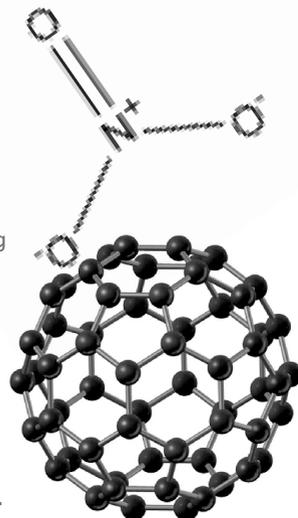
Coconuts Storing H₂

In recent years, researchers have turned their attention to carbon rather than metal hydrides. The bond between hydrogen and carbon is known to be quick and reversible. What's more, it is relatively straightforward to create strong, porous carbon with a high surface area. One way of doing this is to carbonise biological material, such as fruit or coconut shell. This means heating the material to few hundred degrees centigrade in a nitrogen atmosphere which ensures that the carbon retains its porous biological structure.



Buckybombs

Trying to fight off a virus army? Nanoscale explosives made from spherical carbon molecules could be the answer. Buckyballs, made from 60 carbon atoms arranged like a football, are usually stable. But researchers at University of Southern Denmark suspected that adding common explosive ingredients like nitrates could turn them into tiny buckybombs.



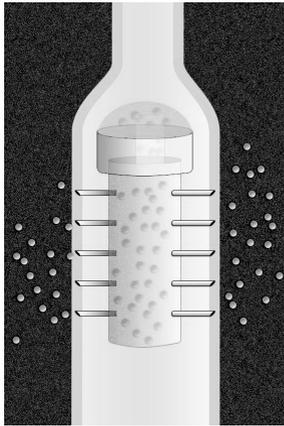
So they simulated a buckyball with 12 nitrate molecules added to the surface. When the buckybomb explodes, it should reach nearly 4000 °C in a billionth of a second.

Magnetorheological Fluid

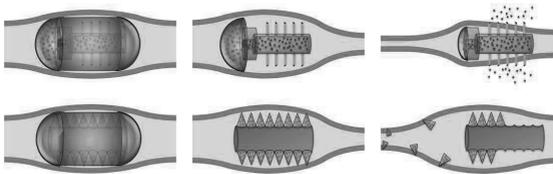


A magnetorheological fluid is one that can change its viscosity based on the presence of a magnetic field.

Internal Injection

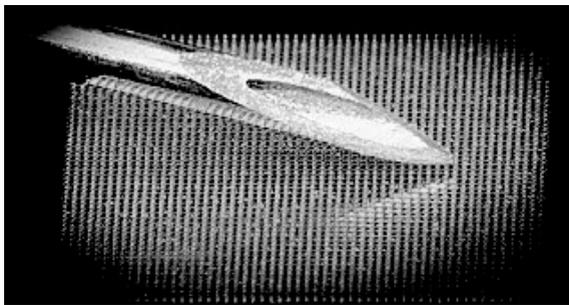


People who dread the sharp stab of an injection at the doctor's office may be in luck. A team of researchers from MIT and Massachusetts General Hospital have developed a capsule coated in needles for patients to swallow, enabling the delivery of drugs directly into the stomach lining.



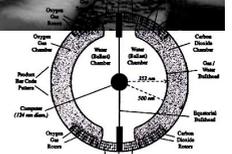
Nanovaccine Patch

The Nanopatch, invented at The University of Queensland's Australian Institute for Bioengineering and Nanotechnology (AIBN) by Professor Mark Kendall, seeks to replace traditional needle and syringe methods with a small patch that delivers vaccines painlessly.



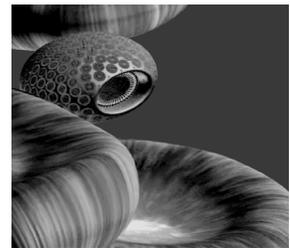
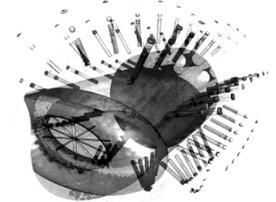
Respirocytes

A respirocyte is a theoretical engineering design for an artificial red blood cell about a micron in diameter - a machine that cannot be constructed with current technology. Respirocytes are micron-scale spherical robotic red blood cells comprised of nanometer-scale components, containing an internal pressure of 1000 atmospheres of compressed oxygen and carbon dioxide.



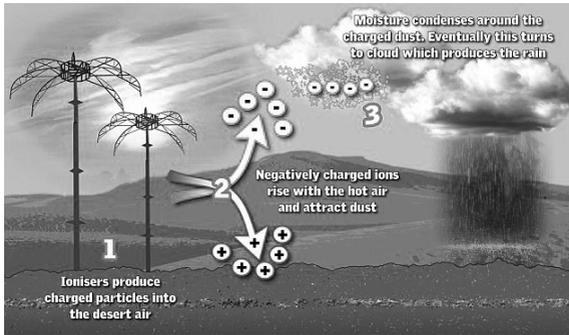
Microbivores

A nanorobotic device that could safely provide quick and complete eradication of bloodborne pathogens using relatively low doses of devices would be a welcome addition to the physician's therapeutic armamentarium. Such a machine is the microbivore, an artificial mechanical phagocyte designed by Robert A. Freitas Jr.



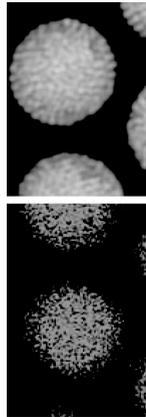
Weather Control

The Metro System scientists used ionisers to produce negatively charged particles called electrons in Abu Dhabi's Al Ain region. They have a natural tendency to attach to tiny specks of dust which are ever-present in the atmosphere in the desert-regions. These are then carried up from the emitters by convection - upward currents of air generated by the heat release from sunlight as it hits the ground. Once the dust particles reach the right height for cloud formation, the charges will attract water molecules floating in the air which then start to condense around them.



Controlling Nanoparticles

The new technology could make it possible to track the position of the nanoparticles as they move within the body or inside a cell. At the same time, the nanoparticles could be manipulated precisely by applying a magnetic field to pull them along. And finally, the particles could have a coating of a bioreactive substance that could seek out and bind with particular molecules within the body, such as markers for tumor cells or other disease agents.



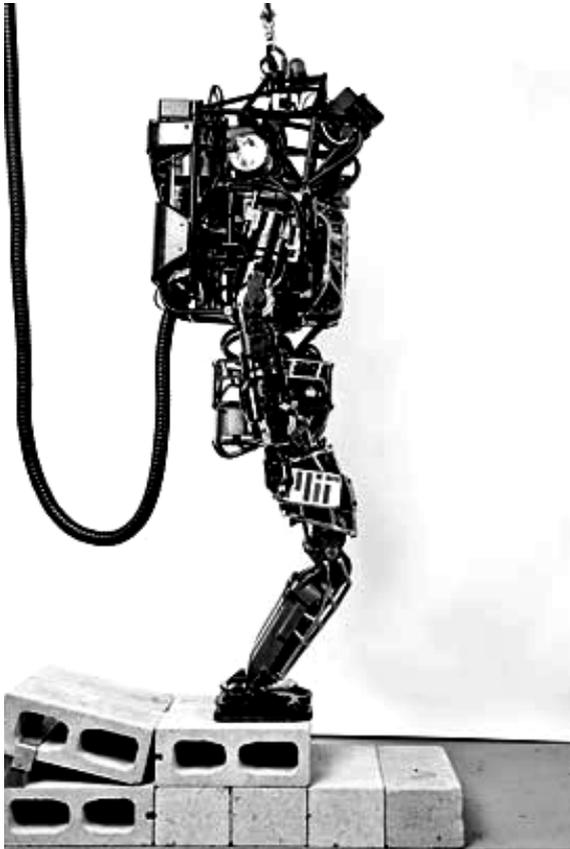
Man Made Vortex

An atmospheric vortex engine (AVE) uses a controlled vortex to capture mechanical energy produced when heat is carried upward by convection in the atmosphere. A tornado-like vortex is produced by admitting warm or humid air tangentially into a circular arena. Tangential entries cause the warm moist air to spin as it rises forming an anchored convective vortex. The work of convection is captured with turbines located at ground level around the periphery of the arena. The heat source can be solar energy, warm water or waste heat.



Agile Robots

Meet Atlas, a humanoid robot created by Boston Dynamics, a company that Google acquired in December 2013. It can walk across rough terrain and even run on flat ground. Although previous robots such as Honda's ASIMO and Sony's diminutive QRIO are able to walk, they cannot quickly adjust their balance; as a result, they are often awkward, and limited in practical value. Atlas, which has an exceptional sense of balance and can stabilize itself with ease, demonstrates the abilities that robots will need to move around human environments safely and easily.

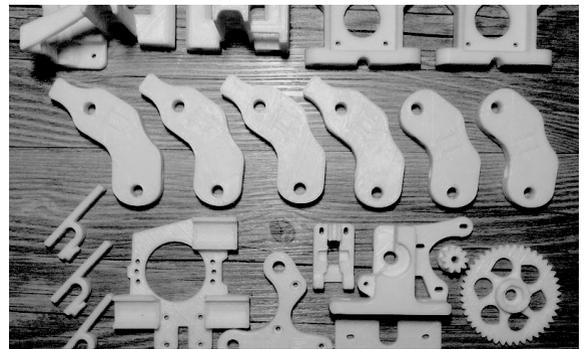
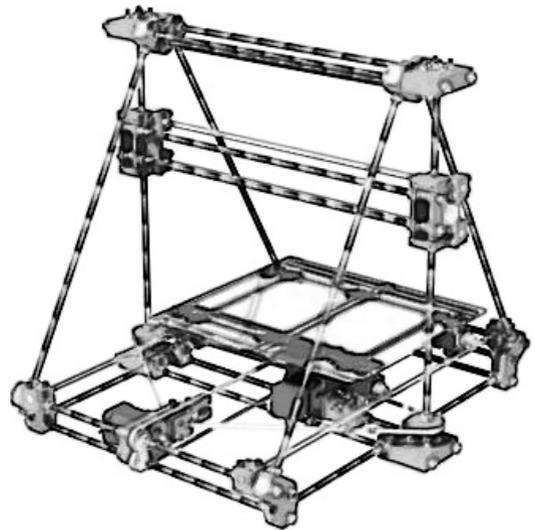


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RepRap Printer

RepRap takes the form of a free desktop 3D printer capable of printing plastic objects. Since many parts of RepRap are made from plastic and RepRap prints those parts, RepRap self-replicates by making a kit of itself - a kit that anyone can assemble given time and materials.

RepRap is about making self-replicating machines, and making them freely available for the benefit of everyone.



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