
World Biotech Tour
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Glow-in-the-dark cats

Genes that make jellyfish fluoresce can be transferred into other animals, making pets that glow.

This is possible already in other animals, but isn't just for fun. Scientists studying a gene for resisting AIDS also inserted a gene for fluorescence into cats. This allowed them to easily mark cells that had taken up the gene, helping their understanding of the transfer of this disease.

http://blogs.scientificamerican.com/observations/2011/09/12/jellyfish-genes-make-glow-in-the-dark-cats/

Anti-rot tomatoes

Genetically modified tomatoes can slow down over-ripening, doubling shelf life and reducing food waste.

Genetic engineering of tomatoes can increase the levels of anthocyanins, natural antioxidants in the fruit. More anthocyanins make tomatoes less susceptible to pathogens and slows down the late stage of the ripening process. This has a direct effect for supermarkets, farming, food waste, and transport.

http://www.ncbi.nlm.nih.gov/pubmed/23707429

Personalized medicine

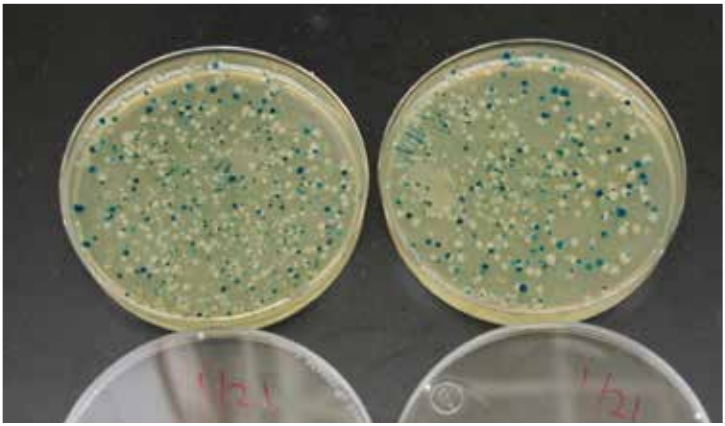
TAIYO FUJII CC BY 2.0

Biotechnology could make medicine more effective and efficient for each person.

Medicines don't work equally well on all patients. There's a period of trial and error to see which drugs patients respond to best. Using the patients' genetic information, pharmacologists can better match the correct drug, dose and timing for the most effective and efficient treatments during all stages of care, including prevention, diagnosis, treatment, and follow-up. While millions of genetic variations exist, and identifying them could take many years, scientists are also trying to reduce the cost of running these large genetic tests.

http://www.europabio.org/how-are-personalized-medicines-and-biotechnology-related

Insulin-producing bacteria



PLAXCOLAB CC BY-SA 2.0

Genetically modified bacteria and yeast save the lives of diabetics worldwide by making insulin cheaply and efficiently.

Some diabetics require insulin to keep their blood sugar levels stable. Insulin is a complex protein that is difficult to make chemically in the lab. In the 1980s, biotechnologists inserted a gene into bacteria and yeast in order to produce it in the lab, increasing availability and decreasing cost.

http://www.dnalc.org/view/15928-How-insulin-is-made-using-bacteria.html

Oil spill bacteria

DEEPWATER HORIZON RESPONSE CC BY-ND 2.0

Modifying bacteria that consume oil could protect sensitive environments.

Oil spills cause huge ecological damage globally, often in sensitive environments. Bacteria that eat hydrocarbons (the chemical compound in oil) are found naturally, but they aren't efficient at metabolizing the oil quickly and they don't multiply fast enough to help the clear up. Modifying these bacteria through biotechnology could have a significant impact on the environments currently affected after an oil spill if we can ensure the bacteria get what they need to thrive.

http://www.technologyreview.com/news/406177/better-bugs-for-oil-spills/

Test tube burgers

ERNESTO ANDRADE CC BY-ND 2.0

Producing artificial meat in the lab means we can eat meat, without the high costs.

Meat is expensive, not only in monetary terms, but also environmentally. Raising cattle takes more land, water and nutrients per calorie than raising other animals or growing crops. This farming is costly. Dutch scientists propose a device that can create cultured beef muscle cells in a container—enough to feed whole villages of people, but so far this is much more expensive than raising animals. Biotechnology may provide solutions, reducing the cost of meat based proteins for everyone.

http://news.discovery.com/tech/biotechnology/biotech-factories-to-farm-fake-meat-140520.htm
http://www.pnas.org/content/111/33/11996

Seaweed solar

HENRY BURROWS CC BY-SA 2.0

Floating natural solar panels could produce large amounts of solar energy providing a new, renewable electricity source.

Plants produce energy from sunlight. Chinese scientists have used extracts from Sea Tangle, a Japanese kelp, to produce an "all-natural solar cell". This could revolutionize electricity production in coastal areas, but may have an effect on the amount of light reaching the marine environment.

http://pubs.rsc.org/en/Content/ArticleLanding/2014/EE/c3ee42767f#!divAbstract

Malaria wipe-out

Biotechnology could wipe out the malaria disease.

Malaria is a mosquito-borne infectious disease that kills hundreds of thousands of people every year. Insecticide resistant mosquitoes and malaria that is resistant to current drugs mean that the battle to conquer malaria has still not been won. Biotechnologists in the UK have pioneered a fresh approach by modifying mosquitoes to only produce male offspring, causing populations to crash. In the lab, four out of five populations of mosquitoes were wiped out in only six generations. Without the carrier mosquito, malaria will be defeated.

http://www.nature.com/ncomms/2014/140610/ncomms4977/full/ncomms4977.html

Regenerating limbs

ENRICO STROCCHI CC BY-SA 2.0

Scientists learn to re-grow limbs by studying salamanders.

Salamanders can re-grow legs if they are damaged or lost. Learning how, biotechnologists could help amputees re-grow new limbs. Humans have the ability to re-grow muscles, nerves and such, but salamanders take it to the next level, re-growing entire limbs or organs. American scientists are sequencing the salamander genome looking for relevant genes for regeneration. Many of the relevant genes appear to have human equivalents that might be deactivated in us. One day regenerating limbs may be more than just science fiction.

http://www.technologyreview.com/news/410616/a-blueprint-to-regenerate-limbs/page/2/

Resistant crops

Modifying crops to be resistant to salt or drought will produce more reliable yields.

Some plants are naturally more drought or salt tolerant than other plants. By transplanting genes for this tolerance into crop plants, we can increase crop yields and feed more people from the same land area. This becomes increasingly important in areas such as California that are seeing more extreme conditions due to climate change. However, there are concerns of spreading genetically modified organism (GMO) seeds in the environment, such as the possible risk of large scale sensitivity to a new disease or predator.

Journal of Crop Improvement (2009) 23 (1) 19-54 http://r4d.dfid.gov.uk/Output/182951/

Genetically modified salmon

SHARON MOLLERUS CC BY 2.0

Genetically modifying salmon can make the fish grow faster and larger.

By altering genetic materials of animals, scientists have proposed — and in some cases actually created — animals that would be bred to be free of diseases, be cleaner in their environments or grow more efficiently. AquaAdvantage® salmon, which has an added gene from the Pacific Chinook salmon, enables the salmon to produce more growth hormone, allowing it to grow faster. Many people protest and say there is not enough data to show that eating the modified salmon does not cause side effects such as allergic reactions or that accidental escape will not harm other fish.

http://www.npr.org/templates/story/story.php?storyId=129939819
http://aquabounty.com/

Algae carbon capture

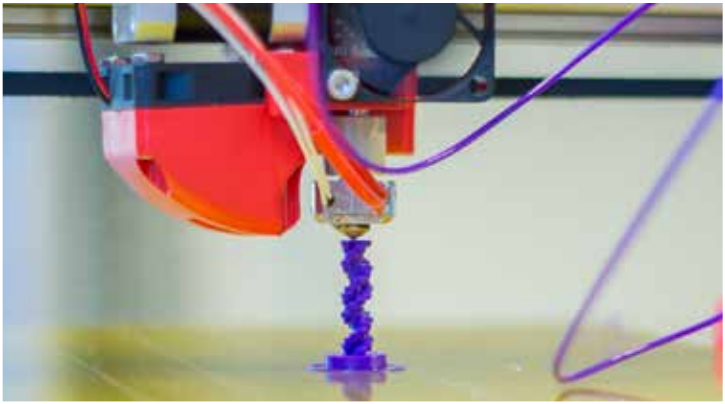
STEVE JURVETSON CC BY 2.0

Microalgae, or microscopic algae, can be used to capture carbon emissions and converted into an alternative fuel.

Microalgae are among the most productive biological systems for generating biomass and capturing carbon. Not only can microalgae capture carbon dioxide (CO2) its biomass can be converted to biodiesel, a renewable fuel that emits less CO_2. With algae, all the biomass can be harvested at any time of the year, rather than seasonally. The major constraints facing biofuel production from algae come from the amount of land and water needed for producing and harvesting the biomass as well as extracting the oils.

http://bioscience.oxfordjournals.org/content/60/9/722.full

3D printed organs



JONATHAN JUURSEMA CC BY-SA 3.0 WIKIMEDIA COMMONS

Bio-printing promises to change the way the medical community deals with organ failure.

The demand for donor organs far exceeds the supply. Scientists have been able to 3D print several types of human tissue, most notably liver tissue which is currently being used in drug toxicity testing. The goal is to eventually print entire 3D organs, which could one day be created by a patient's own stem cells, and transplanted to save their life. However, human organs are complex; every cell within a human organ, such as the liver, kidney or heart are networked with thin capillaries that connect the organ to an essential blood supply. It will be a long while before entire 3D printed organs will be viable for transplant, but scientists are making great progress.

Nature Biotechnology 32, 773–785 (2014) http://www.nature.com/nbt/journal/v32/n8/full/nbt.2958.html

Cloned dogs

ANDREW E. LARSEN CC BY-ND 2.0

Puppies are being cloned in Korea.

There are different ways to clone cells and animals. At Sooam Biotech Research Foundation in South Korea, scientists use a method that involves removing a donor egg's nucleus containing its DNA and then injecting the cell of the animal to be cloned into the empty egg where it then grows into a clone of that animal, such as a dog. It is expensive and time-intensive, but besides cloning pets, scientists hope to use cloning technology to produce drugs, cure diabetes and Alzheimer's disease, provide transplantable organs, and save endangered species.

Nature 505, 468–471 (23 January 2014)

Designer babies

Advanced reproductive technologies allow parents and doctors to screen embryos for genetic disorders and select healthy embryos.

In the future, it may be possible to create designer babies who are free from disease and super athletic or smart. Currently, parents can choose to screen embryos created via in vitro fertilization (IVF) for sex or diseases. Soon it may be possible to screen the entire genome of a fetus, or to select a child based on its odds of long-term diseases. While this technology is still a ways away, the idea of a "designer baby" evokes ethical issues about gender equality and safety, to name a few.

http://www.bionetonline.org/

Foldscope

FOLDSCOPE TEAM WWW.FOLDSCOPE.COM

Foldscope, a 50-cent microscope, has the potential to be distributed widely to detect dangerous blood-borne diseases.

Developed at Stanford University, the Foldscope, an origami-based paper microscope, can be assembled in minutes and can survive harsh field conditions while providing a diversity of imaging capabilities. The ultra low-cost microscope can help health workers who do diagnostics out in the field, especially in remote locations, to detect dangerous blood-borne diseases like malaria, African sleeping sickness, schistosomiasis, and Chagas.

Cybulski JS, Clements J, Prakash M (2014) Foldscope: Origami-Based Paper Microscope. PLoS ONE 9(6): e98781.

Biological detergent

Enzymes are used to enhance detergents so that clothes can be washed at lower temperatures.

Enzymes are proteins produced by all living organisms that act as catalysts to speed up chemical reactions. Certain enzymes have allowed detergents to work better at removing stains, in smaller volumes and at lower wash temperatures. All these benefits can reduce energy consumption, costs, and the amount of phosphates, an environmental hazard, used for washing clothes. However, some claim that detergents with enzymes can irritate sensitive skin if traces of detergent are left on laundered clothing.

https://www.persil.co.uk/laundry-tips/difference-bio-non-bio-detergent/

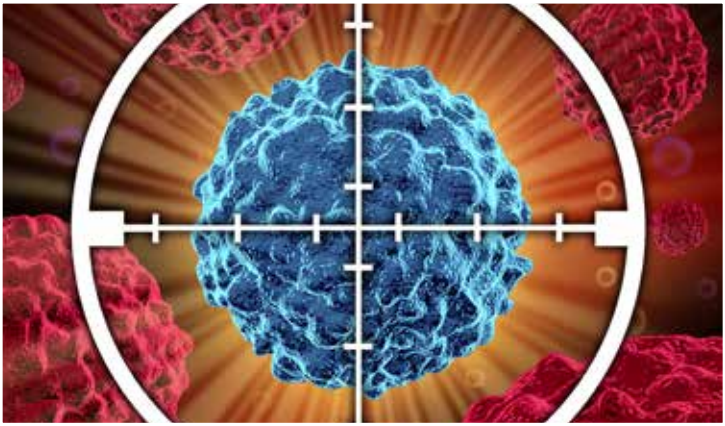
"Greener" concrete

Adding biotechnology additives to concrete can reduce the amount of cement used in construction, which results in reduced material costs and a more environmentally friendly structure.

Concrete is the world's most-used construction material, and a leading contributor of industry-generated greenhouse-gas emissions, such as carbon dioxide (CO_2). Scientists are researching ways to reduce concrete and cement's affect on the environment. One such way is adding biotechnology additives called superplasticizers that reduce the amount of water content needed for concrete mixtures or make the concrete flow better.

http://www.kambiotechnology.com

Nanobiotechnology



Nanobiotechnology uses nanotechnology to help doctors fight diseases inside cells.

Nanobiotechnology is the study of biological systems at the nanoscale, 1 billionth of a meter, much smaller than the size of a cell. Scientists have designed nanospheres that target and deliver drugs to cancer cells, reducing the amount of side effects a patient experiences. The particles are coated with sensors that target diseased cells, are small enough to enter the cell, and then release treatment inside the cell. Advance nanotechnology methods to treat cancer are largely still in the development phase, with only a few currently undergoing clinical trials.

http://nano.cancer.gov/

DNA fingerprinting food & wine

EMILIANO DE LAURENTIIS CC BY 2.0

DNA fingerprinting can identify tainted meats and determine the origins of wine grapes

DNA fingerprinting is a test that identifies and evaluates the genetic information, called DNA, in cells. It has been widely used in forensics and criminal cases but now can be found throughout biotechnology research, including the food and wine industry. The test can thwart false labelling on meat products and determine the origins of wine grapes. DNA fingerprinting can also help scientists understand diseases better and improve how doctors diagnose and monitor patients during treatment.

http://news.sciencemag.org/1997/04/dna-fingerprinting-traces-roots-fine-wine
https://www.fsai.ie/faqs/horse_pork_dna_meat_products.html