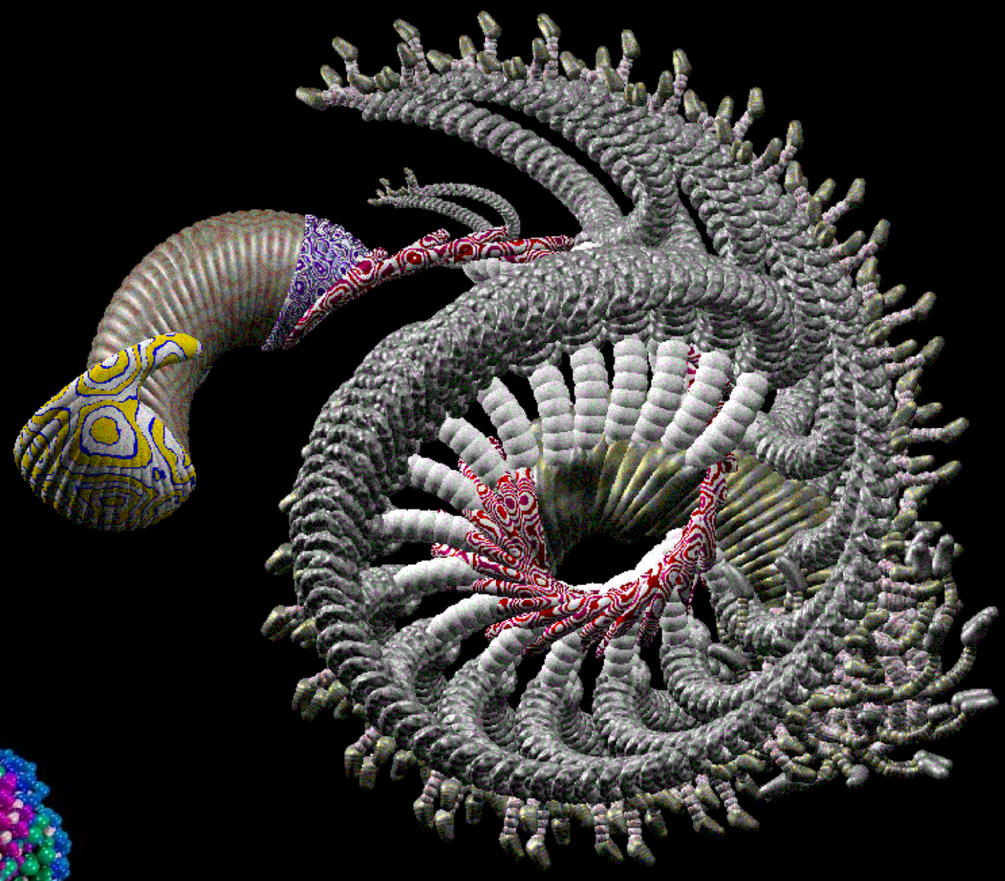
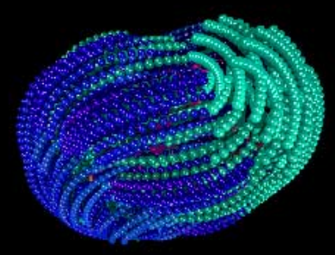
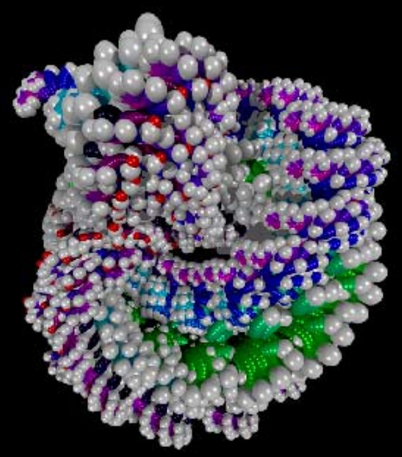
# EVOLUTION IN ACTION

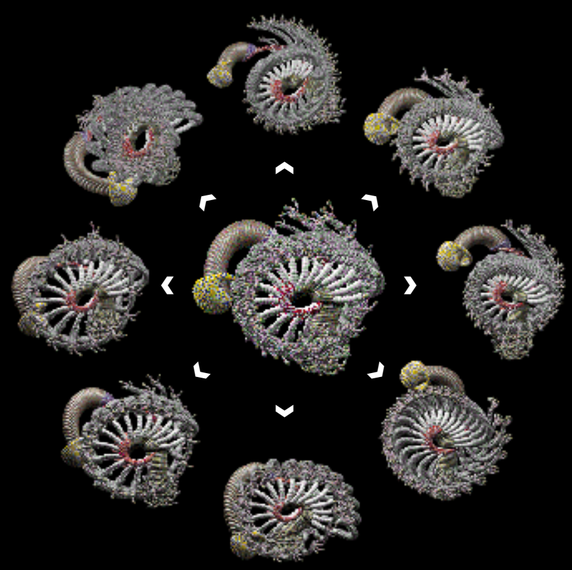
In evolution by natural selection, organisms with a beneficial trait have a better chance of surviving and producing offspring, so the trait is passed on to later generations – a process immortalised in the phrase "survival of the fittest". William Latham of Goldsmiths, University of London, has designed software to mutate the traits – akin to genetic code – of three-dimensional forms (see right). He is now working with scientists to adapt these ideas to try and solve one of the biggest problems in biology: predicting the shapes of synthetic proteins (see below), which could help scientists design new drugs.







Each of the above images shows a new way of describing a protein which combines Latham's art with the latest science. Rather than provide a direct image of the structure of each protein itself, Latham's Mutator Research Group, working with colleagues at Imperial College London, can summarise 40 separate parameters used to describe a protein. Computer-generated footage can then show how these representations – and thus the proteins themselves – vary over time, with 50 million years of evolution covered in every second of footage.
**See www.mrg-gold.com**



NewScientist

## How to breed art

William Latham, a former computer games developer, is internationally known for his "mutation art", which relies on the ideas of Charles Darwin. Latham creates 3D shapes, chooses the ones he likes best, then from them "breeds" variant offspring forms (often weird and wonderful), repeating the process across many generations. The result is survival of the most pleasing to the eye; natural selection is replaced by aesthetic selection. Here the main image is one of the eight progeny of the central image shown below. The striking red mutant is the offspring of a different breeding programme.

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see **www.darwin.rcuk.ac.uk** for details. For the latest news on evolution see **www.newscientist.com**

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# EVOLUTION TODAY

Charles Darwin's revolutionary brainwave reconciled the past and present of all life on Earth, revealing it to be competitive, mutable and shaped by its surroundings. He would be amazed by how his ideas are being applied today, from creating art and designing nuclear reactors to fighting disease.

## HOW IT WORKS

In his landmark work, *On the Origin of Species*, published in 1859, Charles Darwin revealed a unity behind the diversity of life. He proposed that modern species are descended from common ancestors, and that the process of natural selection is the major mechanism of change. That powerful idea has been bolstered by evidence of how evolution works in terms of DNA and genes. Remarkable work is now under way to exploit his ideas across many different fields.

### Breeding designs

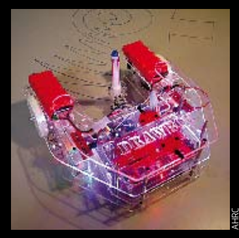
Using "genetic algorithms" – software that imitates natural selection – can accelerate the design of nuclear reactors, a task that can inolve thousands of choices. The program weeds out poor designs and populates the next generation only with the progeny of better designs. This can evolve solutions that would ordinarily have been missed, and much faster too.

### Growing art

Evolutionary ideas are being used to train robots, for instance to create a series of artworks in a project that includes the universities of Sussex and Lancaster. ❯

### Winning formula

By applying evolutionary principles to the art of motor racing, Peter Bentley of University College London has shown in simulations that tailoring a car's set-up to the track conditions it faces can knock crucial tenths of a second off lap times. ❯



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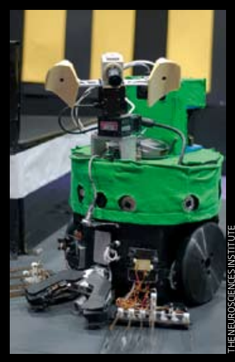
### Modelling brains ❯

The Neurosciences Institute in La Jolla, California, has developed a series of Darwin robots with computer-simulated brains in which the connections between "neurons" evolve in response to experience. They can learn to recognise patterns and navigate new environments.



THE NEUROSCIENCES INSTITUTE

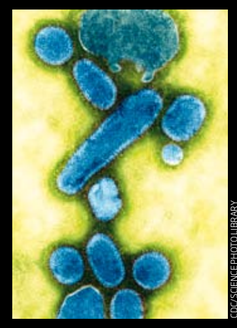
### Artificial Life ❯

Two decades ago at the University of Delaware, Thomas Ray created the first successful attempt at evolution inside a computer, in which "organisms" – scraps of computer code – competed for space (memory) and energy (processor power) within a cordoned-off "nature reserve" inside the machine. Researchers hope that with more computer power they could evolve more complex creatures: the richer the computer's environment, the richer the cyberlife that could go forth and multiply. However, artificial life has proved harder to breed than originally thought.

MARK CYONS

### Killer insights ❯

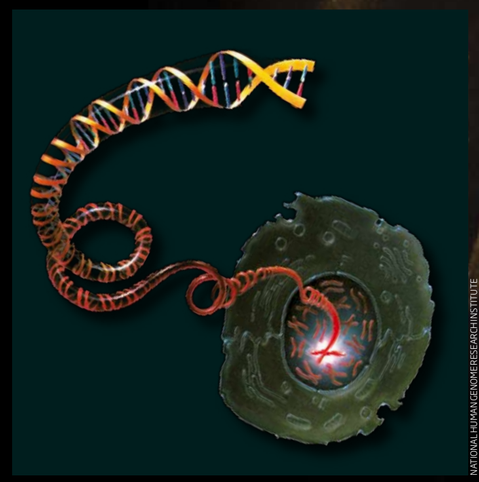
Information on how the genetic code of the influenza virus has evolved has emerged from victims of the 1918 pandemic who ended up preserved in permafrost. Scientists now know that the virus that killed 50 million people in the wake of the first world war started out as a bird virus. This insight may help us predict and cope with the next pandemic.



CDC/SCIENCE PHOTO LIBRARY

### Superbug secrets

Humans are locked in an escalating "arms race" with infectious bacteria, as scientists try to develop new antibiotics faster than bacteria can evolve into superbugs that can tolerate existing drugs. By reproducing in the lab the natural evolution of the bacterial enzymes that confer resistance, scientists can help drug companies to create new antibiotics.



NATIONAL HUMAN GENOME RESEARCH INSTITUTE

### Honing proteins

Directed evolution has been used to change the activity of an enzyme – to make it more effective or better able to catalyse a reaction, for example – or to make antibodies that bind more strongly to bacteria. Molecular biologists deliberately mutate genes, produce the proteins the genes encode, measure the proteins' performance, and then select the best for subsequent bouts of mutation and testing. Repeating this millions of times often yields impressive results.



JULIA MARGARET CAMERON'S STAPLETON COLLECTION/CORBIS

Charles Darwin (1809 – 1882) joined a voyage around the world on the Beagle when he was just 22 years old. During this five-year adventure he keenly observed hundreds of different types of plants, animals, fossils and rocks. Darwin spent the rest of his life carefully interpreting what he had seen, both on the Beagle and in studies of worms, barnacles, sundews and much more in Britain. He was only persuaded to publish his ideas when Alfred Russel Wallace came forward, having independently come up with a similar account of how evolution occurs.

### ❮ Breeding better bugs

Evolution has been exploited to make viruses evolve in a way that benefits us. Gene therapy often relies on a type of adenovirus, a common cold virus, to introduce genes into people to treat disease. However, as many as 90 per cent of people already have the virus so their immune systems are primed with antibodies to quickly neutralise it. At the University of California, Berkeley, a team has accelerated evolution to modify the virus so that it can slip past the body's immune defences, making it a more viable vehicle for gene therapy.

CORBIS

### Watching evolution

Experiments with fruit flies, stick insects and lots more besides reveal evolution in action. For example, bacteria have been observed developing a rare and complex new trait.

### ❮ Darwin in space

Evolution has been used to arrange a flotilla of satellites in orbit around the Earth by a team at Purdue University. Such low-altitude satellite constellations are expected to improve mobile computing by enhancing wireless communications.

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