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.
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 involve thousands of choices. The program weans out poor designs and populates the next generation only with the property of better designs. This can evolve solutions that would ordinarily have been missed, and much faster too.

Winning formula

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

Breeding better bugs

Evolution has been exploited to make virus evolve in a way that benefits us. Some therapy often relies on a type of adenovirus, a common cold virus, to introduce genes into people to treat diseases. However, as many as 80% of people already have the virus in their immune systems and antibodies to quickly neutralise it. At the University of California, Berkeley, a health care game that evolves to modify the virus’s performance, and then select the best for subsequent bouts of mutation and testing, repeatedly generates new versions of the virus that can in involve thousands of choices.

Growing art

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

Superbug secrets

Humans are locked in an escalating arms race with resistant bacteria, as scientists try to develop new antibiotics. Rather 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.

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 - to make antibodies that bind more tightly to bacteria. Molecular biologists deliberately mutate proteins’ performance, and then select the best for subsequent bouts of mutation and testing. Repeating this millions of times often yields impressive results.

Watching evolution

Experiments with fruit flies, stick insects and robots 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 beaconing around the Earth by a team at Purdue University. Such low-altitude satellite constellations are expected to improve mobile computing by enhancing wireless communications.

Events, exhibitions and schools resources across the UK during 2009

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