

Staphylococcus aureus

Naturally selecting innovations

Natural selection generally works against us in our fight against disease, but researchers are now using it to turn the tables on 'superbugs'. Similarly, selection-based approaches are being used to create new chemicals for agriculture, medicine and industry.

Antibiotics and 'Superbugs'

Antibiotics are commonly used to control bacterial infections.

Widespread use of an antibiotic selects for (naturally occurring) variants of bacteria that carry genes for resistance to the antibiotic. Eventually, the antibiotic may become ineffective in controlling infections caused by that type of bacteria as resistance genes spread through the bacterial population.

Scientists have studied the genes of many different strains of *Staphylococcus aureus* (a strain of which is MRSA) and identified several genes that help the bug to infect humans. Because these genes are essential for infectivity they may be good targets for disruption by new types of antibiotics. Any gene variants that might make the bacterium antibiotic resistant might also disrupt its ability to infect humans.

Evolving new molecules

Our understanding of natural selection is being used to evolve molecules that have new or improved properties. Scientists start with an existing molecule and create many different chemical variants, they then select for variant molecules that have improved properties.

Directed evolution of proteins that inhibit plant enzymes is being used to increase their ability to fight nematode infections, which cause devastating crop diseases.

Scientists have used directed evolution to increase the efficiency of enzymes as catalysts for making sialic acid. The variant enzymes produce new types of sialic acid molecules - including some that are used as antiviral drugs.



Nematode

Naturally selecting improvements

Natural selection doesn't just work in nature. Understanding evolution allows us develop better crops and livestock - it can even help us make robots...



Taming the wild

The earliest farmers collected seeds from the wild plants that they liked to eat. Year on year, they sowed seed from the plants in their fields that produced higher or more reliable yields, better tasting food or were easier to process.

As farmers selected for (and against) particular qualities, crop plants quickly became very different from their wild ancestors. About 100 years ago, plant and animal breeding became much more efficient when breeders were able to combine the understanding from Darwin's theory of natural selection with Mendel's theories of genetic inheritance.

Evolving better robots

Computer software that evolves, based on whether small variations in the software 'survive' or not, is commonly used to solve very complex problems.

Can we build robots that evolve?

Robots already exist where the control system is designed to evolve, for example as the robot works out how to move around in a particular space. Remarkably, researchers have described robots evolving ways of communicating with each other to complete a joint task. Researchers are exploring the evolution of robot bodies by allowing body designs to evolve in computer simulations, before the robot is constructed.

