The evolution machine

It could transform genetic engineering – and perhaps humanity too. **Jo Marchant** reports

IT IS a strange combination of clumsiness and beauty. Sitting on a cheap-looking worktop is a motley ensemble of flasks, trays and tubes squeezed onto a home-made frame. Arrays of empty pipette tips wait expectantly. Bunches of black and grey wires adorn its corners. On the top, robotic arms slide purposefully back and forth along metal tracks, dropping liquids from one compartment to another in an intricately choreographed dance. Inside, bacteria are shunted through slim plastic tubes, and alternately coddled, chilled and electrocuted. The whole assembly is about a metre and a half across, and controlled by an ordinary computer.

Say hello to the evolution machine. It can achieve in days what takes genetic engineers years. So far it is just a prototype, but if its proponents are to be believed, future versions could revolutionise biology, allowing us to evolve new organisms or rewrite whole genomes with ease. It might even transform humanity itself.

"They want to change the very language in which the instructions of life are written"

These days everything from your food and clothes to the medicines you take may well come from genetically modified plants or bacteria. The first generation of engineered organisms has been a huge hit with farmers and manufacturers – if not consumers. And this is just the start. So far organisms have only been changed in relatively crude and simple ways, often involving just one or two genes. To achieve their grander ambitions, such as creating algae capable of churning out fuel for cars, genetic engineers are now trying to make far more sweeping changes.

Yet changing even a handful of genes takes huge amounts of time and money. For instance, a yeast engineered to churn out the antimalarial drug artemisinin has been hailed as one of the great success stories of synthetic biology. However, it took 150 person-years and cost $25 million to add or tweak around a dozen genes – and commercial production has yet to begin.

The task is so difficult and time-consuming because biological systems are so complex. Even simple traits usually involve networks of many different genes, which can behave in unpredictable ways. Changes often do not have the desired effect, and tweaking one gene after another to get things working can be a very slow and painstaking process.

Many biologists think the answer is to try to eliminate the guesswork. They are creating ›

PIERLUIGI LONGO