

Matéria

the results of arranging cells in different ways in an animal's body.

The cells themselves are stored in suspension, in glass reservoirs, and each reservoir is connected to a computer-controlled spray gun. The hydrogels (several sorts are needed) are stored separately. One, known as osteogel, is particularly important, as this solidifies to provide the animal's initial skeleton. Once the new creature is up and running (both literally and metaphorically), the various hydrogels are gradually replaced by natural secretions. In the case of osteogel, that secretion is bone.

The biggest difficulty Dr Fril has encountered is with nerve cells. Unlike most other types of cell, which are small, the protuberances from a nerve cell, known as axons and dendrites, may stretch from the animal's spinal cord to the tips of its toes. To deal with this problem, the pet printer leaves a hole in each layer of cells at every point through which a nerve cell is supposed to pass. The holes are then filled with nerve-growth factor before the next layer is printed, so that when the main body of the nerve cell is sprayed into place it rapidly grows axonal and dendritic protuberances to the right destinations.

Knowing how to print nerve cells, is, in fact, the key to the whole thing. Size apart, a healthy heart, kidney or liver is pretty much the same in a retriever or a Rottweiler. Coat colour, an important consideration for many owners, is easily dealt with by picking the right pattern of melanocyte cells in the skin. But an animal's temperament is a very different matter.

Controlling temperament means laying down the right mixture of nerve cells in the brain, since different types of cell have different effects on personality. Having worked out how to do this, GeneDupe is able to offer pets that have had their behavioural characteristics fine-tuned. If you want a docile Rottweiler, or even an aggressive retriever, you can have one made to your exact specifications. Dr Fril, though, thinks that the most popular modification will be his tweaking of canine scent-marking behaviour so that local lampposts are no longer the preferred sites of relief and communication. Instead, GeneDupe's pooches are pre-wired to recognise the company's proprietary Doggie-Loos, which have a distinctive odour that is perceptible to canids, but not humans.

There are still a few technical difficulties to overcome, of course, but Dr Fril plans to start taking orders soon. And he is already looking forward to the firm's next product, custom-printed boyfriends and girlfriends for those who cannot find the right partner by conventional means—a surprisingly large proportion of the population. If all goes well, these will be available by St Valentine's day. If not, customers will probably have to wait until April 1st of next year.

Bespoke pets

Just press “print”

SAN MELITO

It will soon be possible to design and build household animals to order

ONE of the most interesting technological trends of the past few years has been the rise of additive manufacturing. This technique, which uses three-dimensional printing to make objects ranging from violins to pilotless aircraft, allows the construction of individual objects at the whim of the designer. Now, a small Californian company, the Gene Duplication Corporation, based in San Melito, proposes to push the technology to its limits. On Sunday it will announce plans to use 3D printing to make bespoke pets.

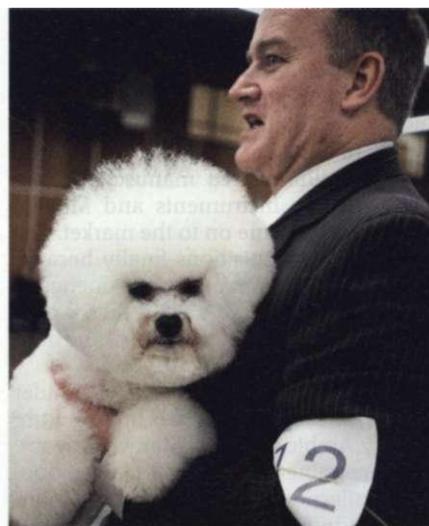
GeneDupe, as the firm is known colloquially, has previously focused on the genetic engineering of animals. However Paolo Fril, the company's boss, is keen to expand into manufacturing them from scratch. PrintaPet does just that.

The idea of printing organs such as kidneys for transplant has been around for several years. It works by growing separate cultures of individual cell types, and then spraying them out, layer by layer, in combination with a binding agent called a hydrogel, to build up the correct shape.

Printing an organ this way is fairly easy. A kidney, for instance, has only eight cell types. An entire mammalian body, though, has 220 cell types. Laying these down in the correct order is a much more complex problem. To solve it, GeneDupe's researchers used nanotomography, a precise form of CT scanning that has a resolution of 500 nanometres (billionths of a metre), to analyse the position and nature of

every single cell in a variety of animals, particularly breeds of dog. This knowledge not only permits existing breeds to be re-created, but allows entirely new combinations of form, colour and behaviour to be invented, at the customer's command.

GeneDupe's Universal Pet Printer is loaded with each of the 220 cell types (grown from stem cells in the company's histology laboratory), and is programmed with a three-dimensional map of the creature it is to create. That is devised by the firm's scientists, based on what the nanotomographic analysis has told them about



I could have sworn I ordered this in blue