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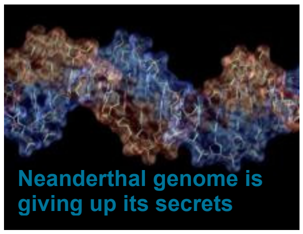

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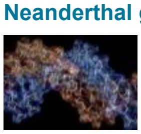

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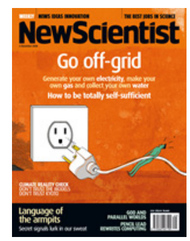

06 December 2008

Micro-origami lets scientists get a grip

17:02 09 December 2008 by **Jon Evans**

Picking up dropped sewing needles can be tricky enough, so imagine the problems of manipulating objects on the microscale.

To try and make such tasks easier, US scientists have now developed a mechanical gripper the size of an amoeba, and used it to pick up and drop microscopic beads, wires and tubes.

The microgripper is shaped like a star, with six arms equally spaced around a hexagonal centre. Constructed from gold-plated nickel, it is around 700 micrometres wide when fully open, shrinking to 200 micrometres with the arms folded.

Each of arms is attached by a three-layered joint comprised of a very thin layer of chromium, just 50 nanometres thick; a thicker layer of copper (250 nm); and a much thicker layer of polymer resin (3500 nm).

The secret to the device's gripping action is that the copper layer is under tension – naturally bent but restrained in a flattened form by the polymer layer.

Look, no wires

In its idle state, the microgripper is open. To close it, David Gracias and his colleagues at Johns Hopkins University, Baltimore, simply expose it to acetic acid – the key ingredient in vinegar.

The restraining polymer resin is dissolved by the acid, freeing the copper springs to bend, and causing the device to close.

To then relax the hold, Gracias exposes the microgripper to hydrogen peroxide, a common bleaching agent, which dissolves the copper layer. This leaves behind just the thin chromium layer, which folds the arms flat once more.

Using a magnet to move the metallic microgrippers around, Gracias has shown how they can securely hold a range of glass beads, wires and tubes – roughly 200 micrometres in size – and release them on command at desired locations.

Moving small objects around with such fine precision should prove very handy for "lab-on-a-chip" devices and micro-manufacturing, says Gracias.

And because the microgripper is controlled by chemical rather than electronic signals, many of them could be opened and closed at the same time without needing to connect them to a power supply.

Disposable drawback

James Burdess of Newcastle University's Institute for Nanoscale Science and Technology agrees. "This is an interesting idea and there is a need to develop devices which can grip a microstructure for placement elsewhere," he told **New Scientist**.

Burgess says his own research has required a microneedle to be grabbed and placed onto another device – it proved no easy task.

But the technique does have limitations, he points out. One is that, unlike many other micromachines, each microgripper can be used only once; the other is

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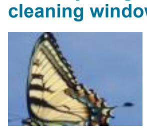
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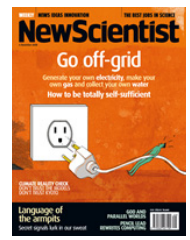

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that the chemicals used to open and close the grippers are not biologically friendly.

Gracias says that he has already overcome the latter problem, having recently developed microgrippers that can open and close under biological conditions, so they could potentially be used to examine living tissue.

Journal reference: *Journal of the American Chemical Society* (DOI: 10.1021/ja806961)

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