Sewing DNA thread with lasers, hooks and microbobbins

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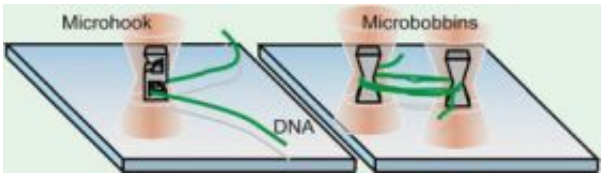

(PhysOrg.com) -- Japanese scientists have made a micro-sized sewing machine to sew long threads of DNA into shape. The work published in the Royal Society of Chemistry journal *Lab on a Chip* demonstrates a unique way to manipulate delicate DNA chains without breaking them.

Scientists can diagnose genetic disorders such as Down's syndrome by using gene markers, or "probes", which bind to only highly similar chains of DNA. Once bound, the probe's location can be easily detected by fluorescence, and this gives information about the gene problem.

Detecting these probes is often a slow and difficult process, however, as the chains become tightly coiled. The new method presented by Kyohei Terao from Kyoto University, and colleagues from The University of Tokyo, uses micron-sized hooks controlled by lasers to catch and straighten a DNA strand with excellent precision and care.

"When a DNA molecule is manipulated and straightened by microhooks and bobbins, the gene location can be determined easily with high-spatial resolution," says Terao.

The team used optical tweezers – tightly focused laser beams – to control the Z-shaped micro hook and pick up a single DNA "thread". The hook is barbed like an arrow, so the thread can't escape. When caught on the hook, the DNA can be accurately moved around by refocusing the lasers to new positions.

But just like thread in a sewing machine, a long DNA chain can be unwieldy – so the researchers built micro "bobbins" to wind the chain around. The lasers move one bobbin around another, winding the DNA thread onto a manageable spindle.

It is "an excellent idea to fabricate unique microtools that enables us to manipulate a single giant DNA molecule", says Yoshinobu Baba, who researches biologically useful microdevices at Nagoya University, Japan. The technology will also be useful for a number of other applications including DNA sequencing and molecular electronics, he adds.

Original article: Kyohei Terao, *Lab Chip*, 2008, DOI: 10.1039/b803753a

Source: Royal Society of Chemistry