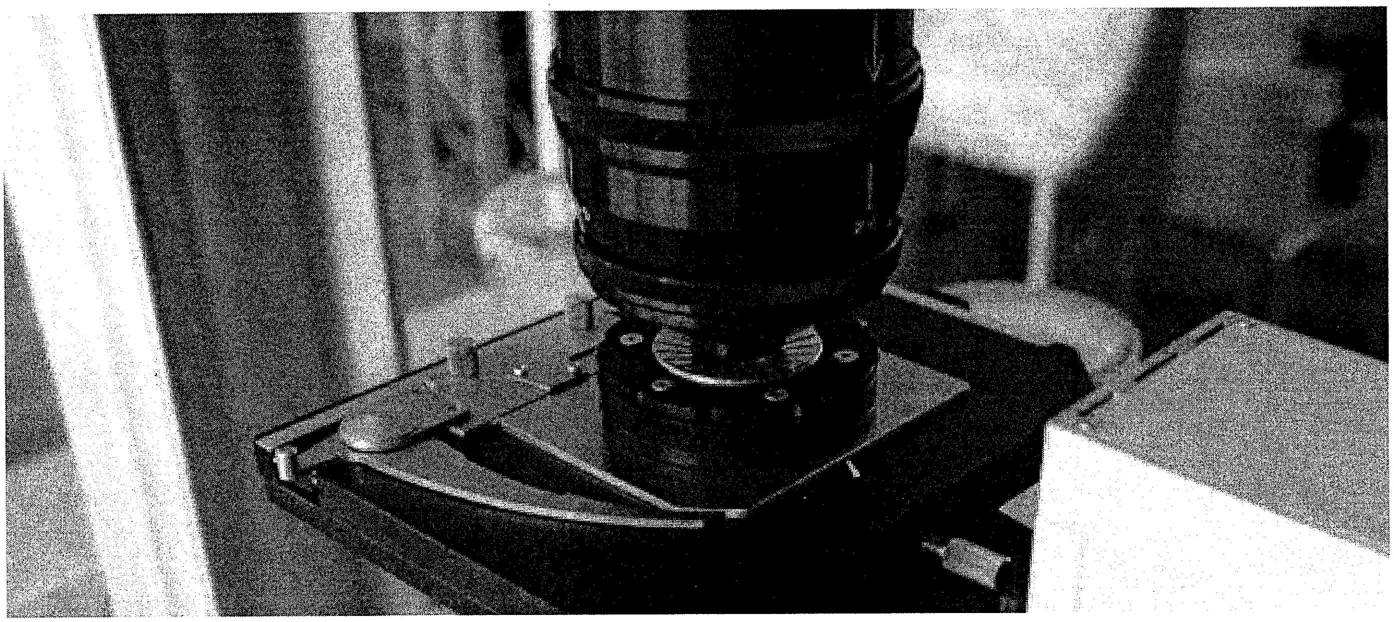
Giant 'Mesolens' observes in incredible detail

By Duncan Geere | 29 June 2010 | Categories: Wired Science



This is the second post in a series of five articles that will examine in detail some of the scientific work that's being exhibite the Royal Society to mark its 350th anniversary. You can see more at the Summer Science exhibition, being held in the Roy Festival Hall.

Once, microscopes were simple. If you wanted to examine something, you'd kill it, chop it into slices, then stick the slice th you're interested in under the microscope. Today, however, microscopes are rather more complex -- and don't require the su to be sliced open before they can be examined. Instead, you just focus the microscope on the exact depth that you're interest in, using what's called a Confocal microscope.

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The way it works is that focus the lens on one tiny spot, using extremely shallow de of field to blur out the layers you don't need. You see clearly the layer that interests and other layers aren't visible. This approach was pioneered in the mid-80s by the Medical Research Council's Laboratory of Molecular Biology (LMB) in Cambridge, is now widely in use across the world.

Using this principle, it's possible to build up a three-dimensional model of an organi You set the microscope to scan different areas of the object at different levels progressively, then combine the images to create a picture that can be zoomed throu

But there's a problem with the existing technology. Achieving the shallow depth of required to blur out the other layers of a subject means compromising on the size of the image itself. The existing confocal microscope produces images that are one fifth of a millimetre across. It's impossible to see the big picture.

So the team at the LMB wanted to build a microscope that's able to discriminate high levels of detail and focus on specific depths, but can also capture an area approximately 6mm in size. It also needs to allow for at least 3mm between the specim and the lens, so it can be handled.

The way the team achieved this is by chucking away one of the principles of microscope design. The lens required to satisfy the conditions ended up very large, meaning that it had to be positioned extremely accurately. Changing focus in a tradition microscope involves moving the lens, but with such precise positioning, that wasn't possible with the giant lens.

So instead, the giant lens microscope moves the specimen nearer and further away from the lens. This means that the optica elements of the microscope can maintain their precise alignment, but that it's still possible to focus on different depths of the specimen. It can also distinguish incredible resolution in large images, showing the entirety of a mouse embryo but being ab zoom in to observe subcellular detail.

The team has named the giant lens "Mesolens", and formed a company with the aim of exploiting the discovery commercial The next steps will be to get it inside a working microscope, rather than just using it as a camera lens as they are at present.

As part of a full confocal system it'll be possible to very rapidly build up 3D models of relatively large objects, but without sacrificing any of the detail that's so crucial in molecular biology.

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