bears little resemblance to the traditional microscope. The user just has to add a monitor and a computer mouse.

"The Coolscope is basically a bright-field imaging system," says Robert Forster, general manager for Nikon Instruments UK. "It's primarily aimed at the clinical market for consultant pathologists to share images in multidisciplinary meetings with surgeons and radiologists. The Coolscope enables them to look at a patient's specimen on a microscope glass slide. It also enables them to view that slide remotely and to control the functions from anywhere in the world, providing you get the correct access through the hospital networks."

Digital technology is changing lab microscopes in many different ways. The DM DigitalMicroscope range produced by Leica Microsystems of Wetzlar, Germany, is not based on a digital camera as the name might imply, although Leica's DC range of cameras can be added as extras. Here, 'digital' refers to an integrated user-interface and control system.

"What scientists want is to concentrate on their work," says Michael Ganser, project leader for the Leica DM4000 B and DM5000 B microscopes for biological applications. "Ten or fifteen years ago, scientists loved their microscopes and knew exactly how to work them, but this has changed and microscopes are becoming more and more of a tool. What we tried to do is make it really easy to operate the microscope."

The DM series includes what Leica calls "intelligent automation" — push-button controls to rapidly configure the microscope for complex procedures. Automatic aperture and light adjustment, and colour-intensity control allow the microscope to keep itself at the optimum settings. The DM4000 B and DM5000 B are mainly aimed at biomedical applications and pathology, and can be integrated with control systems for fluorescence, cytogenetics or other common techniques.

Live cell imaging

With the completion of the human genome sequence, the emphasis in biomedical research is now firmly back on functional biology and attempts to characterize and understand the proteome. To do this, researchers want to look inside live cells to study the expression and function of genes and proteins within particular pathways.

Using fluorescence to image living cells has become a major application for microscope producers and users. As well as its stand-alone microscopes, Leica Microsystems also produces the AS MDW, a dedicated workstation for the rapid imaging of molecular interactions in live cells. "All the hardware components, such as camera and piezo-focus, are designed in a way to optimize the speed of acquiring images," says Werner Kampe, marketing manager for Leica's compound-microscopy business unit. "That's important not just for scientists; it's also important not to damage the living cells under the microscope. The longer they're under the light, the shorter their lifetime is." Sophisticated software means that cell interactions can be recorded in three dimensions, and merged into a time-lapse movie of changes over several days — something that Leica refers to as four-dimensional imaging.

Easy viewing: Nikon's Coolscope.

A rival system from PerkinElmer of Wellesley, Massachusetts, boasts six-dimensional imaging of live-cell interactions. As well as three dimensions of space and one of time, the UltraView RS can image cellular interactions at two additional wavelengths. "To be able to do that for a live cell and get meaningful data you need to be sampling every few seconds," says Terry McCann, cellular sciences business manager at PerkinElmer. "UltraView RS takes advantage of the speed of the system so that we can generate these multidimensional images on biologically relevant timeframes."

EASING THE STRAIN

Many microscope users know all too well that prolonged use can be a real pain. Many systems demand that the user maintains a rigid body posture which can become increasingly uncomfortable, and concentrating on the magnified image for long periods can lead to eye fatigue and nausea. It can all add up to a serious reduction in accuracy and efficiency in the short term, and a long-term risk of debilitating repetitive strain injury (RSI).

Many manufacturers now design their microscopes to be ergonomically efficient, making operation as simple and intuitive as possible while minimizing the risk of strain or fatigue. Leica Microsystems of Wetzlar in Germany, for example, worked with the Fraunhofer Institute of Stuttgart, Germany, to design its DM series of microscopes. The main control panels are positioned for direct and intuitive access, and height, viewing angle and eyepiece length can be adjusted to suit the user.

Isis eyepiece from Vision Engineering gives a wider view.

The narrow field of view from most microscope eyepieces is a major cause of eye strain and bad posture. Users who wear spectacles often have to remove them, increasing the risk of eye strain; and many users also suffer the distraction of floating fragments of tissue debris in the eye.

Vision Engineering of Woking, UK, a company specializing in microscope ergonomics, claims to have solved these problems with an eyepiece called the Isis expanded-pupil system. Fitted in place of the traditional eyepiece, the Isis is based on a small disc containing more than 2 million microlenses. This disc rotates at about 5,000 r.p.m., so that the millions of individual optical paths are merged to form a single high-clarity image, with an exit field around ten times as wide as from a conventional eyepiece.

"The key thing is the image, and where the image leaves the microscope and meets the operator," says international marketing manager Geoff Collins. "Our technology allows the image to have a much wider exit pupil, which means you can see it from much further away, from a greater range of angles. That allows you to move your head around, wear spectacles, and be further away from the eyepiece." Isis is available on Vision's own range of laboratory microscopes, and as an accessory to replace the conventional eyepieces on a wide range of commercial microscopes. **T.C.**