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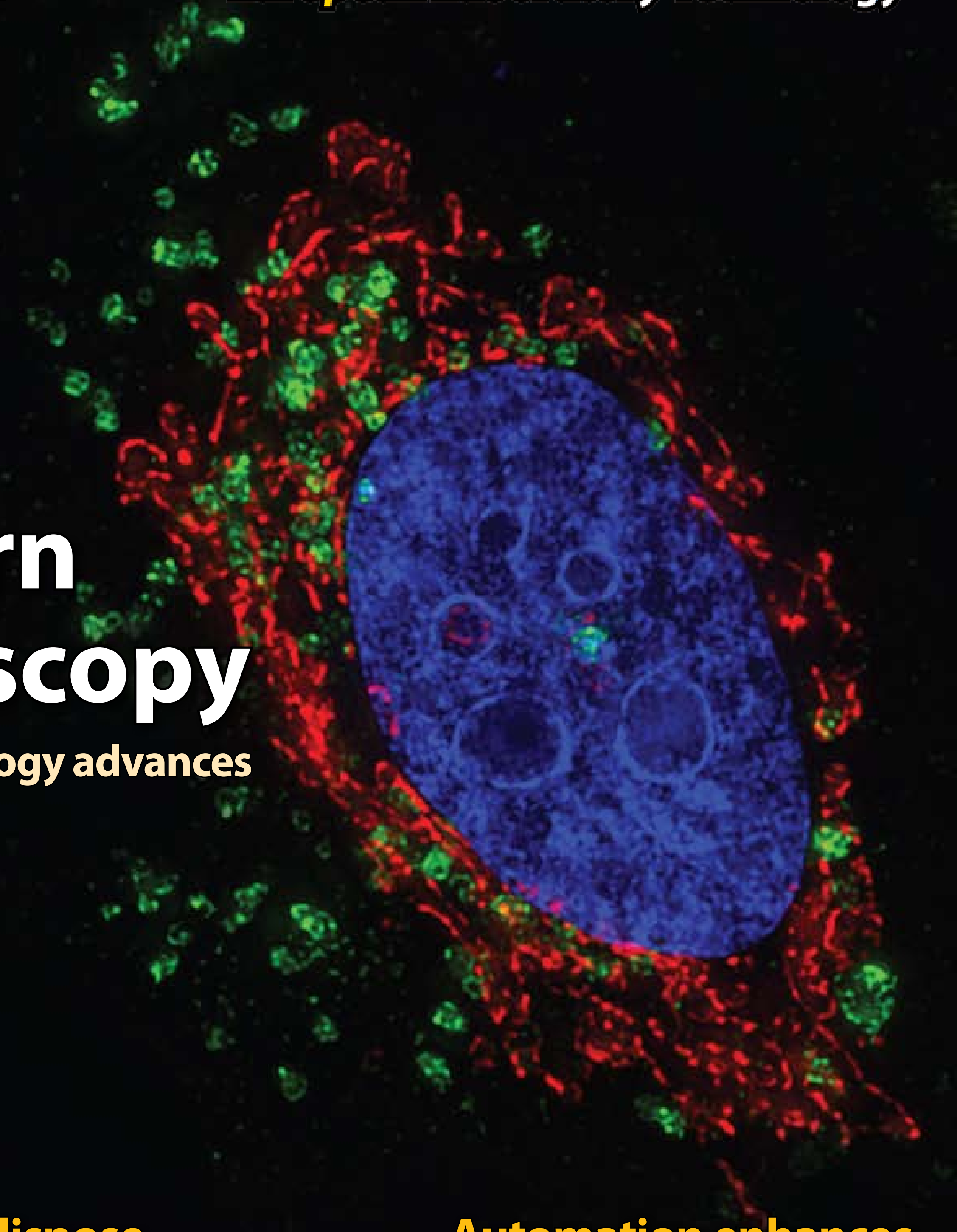

# Modern microscopy

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# Microscope illumination is changing

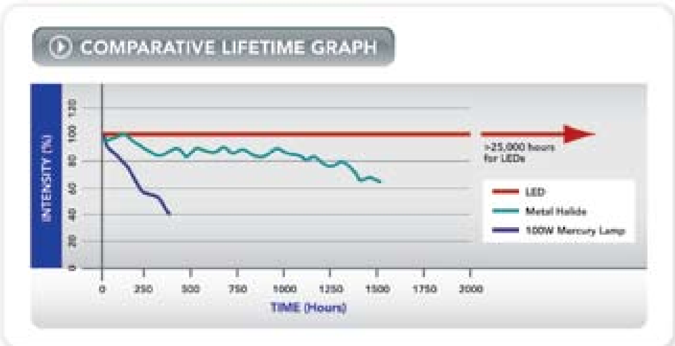
Since their introduction, LEDs have gained acceptance as spectrum coverage has expanded and intensities have reached the levels required for successful sample illumination. Jim Beacher reports.

Microscope illumination is undergoing significant change. Historically, halogen and xenon lamps have been used for transmitted-light applications and the more powerful high-pressure gas discharge lamps (known as 'UV-Burners', 'Mercury' or 'HBO' lamps) have been used for fluorescence applications.

Metal-halide lamps have also been popular due to their longer bulb life. However, all these lamp types have suffered from operating deficiencies such as limited bulb life, declining performance during operating lifetime, and instability. In addition, a warm-up and cool-down period has been required which makes conventional light sources inconvenient to use. High-pressure lamps can also explode; resulting in a dangerous release of mercury vapour.

With LEDs, there are significant advantages: instant on/off, very long lifetime and controllability are the primary benefits. They do not contain hazardous materials which makes their use safe, and disposal simple. Cost of ownership is a fraction of conventional light-sources and the environmental footprint is significantly reduced.

Fig. 1. Comparison of stability and lifetime of different light sources.




Until recently, LED illumination required the user to select a set of specific LED wavelengths which were matched to the passband of the filter set installed in a microscope. To address a wide range of applications, or multiple users of a microscope, many LED systems were modular. Users could exchange LED modules from a range of wavelengths to match with the illumination requirements of particular samples. Although effective, this added a complexity to specifying the LED system configuration at time of purchase.

The breakthrough in recent years has been the ability to combine multiple LED wavelengths to create a broad-spectrum 'white' LED light-source. These units can offer illumination for most applications without the need to exchange modules or purchase additional LED wavelengths. Depending on the complexity of the work being done, different LED systems are available building from as few as three LED wavelength regions to 16 in the most sophisticated. An important additional feature of LEDs is that the level of control is much greater than that available from conventional lamps. Shuttering is not required on the microscope and switching in microseconds is possible. This makes live-cell and ratiometric experiments more effective. Individual control of LED wavelengths means that image contrast can be superior and filter sets for fluorescence can be simplified. Broad-spectrum light-sources which switch all wavelengths on/off together cannot offer this.


Fig. 2. With instant on/off capability and 0-100 per cent intensity adjustment, LED illumination offers convenience and control. No warm-up or cool-down time saves on energy costs.


Fig. 3 Typical LED unit – CoolLED's pE-300-White broad spectrum fluorescent LED illumination.

Growing legislation, and demand for more environmentally-friendly products, mean that LEDs are an attractive option. With lifetimes guaranteed in excess of 25,000 (operating) hours without the need to replace a bulb, cost savings are exceptional. As LEDs are up to five times more efficient, power consumption is lower. It has been calculated that an LED illumination system will use around 10 per cent of the power consumed by a conventional lamp in typical everyday operating conditions. Handling and storage are simpler without any special disposal requirements.

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