

MVX10 ARTICLE

A New Viewpoint on Macrofluorescence Imaging

Choosing a microscope best suited to the work of a laboratory is not always an easy task. With so many accessories and add-ons, such as the plethora of different objectives and illumination sources, one must find a balance between specialised and general applications. The single most important choice to make is the type of microscope. Now, a unique new microscope from Olympus – the MVX10 – offers brightfield and fluorescence observation capability at both the whole organism and cellular level, all on a single instrument. Furthermore, a unique pupil division mechanism mimics the effect of stereo microscopy, whilst image quality can be adjusted independently of specimen medium due to a novel correction collar on the 2x objective.

Classically, the lines dividing the microscope types have been clear. For applications requiring high power magnification, the options are reduced to either upright or inverted, since stereo microscopes are generally used for low power observation in 3D. The choice between upright and inverted though, is traditionally down to the type of specimen being observed. For fixed cells on slides, it is more common to use an upright microscope (such as the Olympus BX and CX series). However, for cells in liquid culture, an inverted microscope (such as the Olympus IX and CKX series) is more suitable since the objective can focus on the cells through the bottom of the culture vessel. With some microscopes though, the distinction is not so clear. A unique new microscope – the Olympus MVX10 – is capable of brightfield and fluorescence observation on whole organisms. This is ideal for work on common research species such as *A. thaliana*, *Xenopus spp.*, *M. musculus*, *D. rerio*, *C. elegans* and *D. melanogaster*, generating far better image and data quality.

The MacroPlus Concept

Until now, stereomicroscopes have been the instruments of choice for fluorescence observation at low magnifications. To obtain the stereoscopic effect, two optical paths are used – one for the left and one for the right eye. However, stereomicroscopy is not well suited to imaging the weak light generated by fluorescence, since the light collected by the objective is split in two. To overcome this issue, the MVX10 MacroView has been designed with a single-zoom optical path with a large diameter, which is optimised to collect light with unprecedented efficiency and resolution at all magnifications. Consequently, this new mono-zoom microscope enables researchers to see fluorescent light from whole organisms right down to the cellular level, all on a single instrument. Furthermore, a unique pupil division mechanism in the MVX10 light path mimics the effect of stereo microscopy. This combines the greatest light efficiency with stereo observation in one system just by moving a slider.

Dedicated to fluorescence

The perfect microscope for fluorescence observation of intact organisms in *in vivo* studies must combine maximum detection sensitivity at the lowest magnifications with a high magnification zoom for the resolution of fine details within organs, tissues and even cells. The Olympus MVX10 MacroView microscope uniquely combines both of these factors with many other unique features to bridge the gap between macro- and micro-observation. Seamless observation from 4x to 125x enables low magnification confirmation of gene expression in whole organisms for example, through to detailed observation of expression in cells at high magnification. Furthermore, due to its specially designed planapochromatic objectives, the MVX10 delivers brightness and resolution beyond the capabilities of conventional fluorescence stereo microscopes. Consequently, the MVX10 completely eliminates the need for switching

between a stereomicroscope and inverted or upright compound microscopes during fluorescence screening procedures.

An objective approach

All components of the light path contribute to the unprecedented fluorescence performance of the MVX10. Using the latest technologies and new materials, the new microscope's objectives produce minimal autofluorescence. Together with very high numerical apertures this results in an extremely good signal-to-noise (S/N) ratio, ensuring excellent contrast for observation of even the faintest fluorescence signals. In addition, the S/N ratio is further enhanced by two novel proprietary features:

- A new ion-coating technique which gives the Olympus HQ-fluorescence filters an exceptional edge steepness and extremely low autofluorescence
- All filter cubes are equipped to absorb any stray light

Light collection efficiency is also maximised due to an aspherical fluorescence collector, which bundles the light for minimum intensity loss.

The MVX10's ability to provide the same working distance and wide field of view as a stereo microscope, but with far higher resolutions, is due to the increased numerical apertures (NA). Specially designed for the MVX10, the 0.63x, 1x and 2x planapochromatic objectives produce the highest image quality at all wavelengths. All three objectives are plan-corrected for best image flatness and show high transmission from UV to NIR with superior chromatic aberration correction. This produces great flexibility for efficient, fast and precise fluorescence observation, screening and imaging - from low to high magnification - over time.

The peerless NA and S/N ratio values of all the optical components have further benefits. For example, specimens can be exposed to fluorescent light for shorter periods, thereby minimising the risk of photobleaching, or even cell damage. This is also true at near-infrared wavelengths where the MVX10 has superior transmission properties to increase the range of useable fluorophores. The 0.63x objective has a maximum field of view of 55 mm making it easy to track dynamic processes over time. Furthermore, with its high NA of 0.15, fluorescence from large objects, such as whole embryos, can be viewed at an ideal brightness at all magnifications.

Using the two-position revolving nosepiece with the 0.63x and 2x objectives, expands the usable zoom range up to 31x. The objectives are all parfocal corrected making refocusing after objective switching very quick and easy. Just a small amount of fine focusing is necessary to return to the optimal focus position, making macro to micro changes seamless. The 2x objective is also equipped with an additional correction collar to adjust the image quality independently of the specimen medium.

Accurate records

The growing need for fluorescence observation of living organisms at low magnification has also increased the need to record fluorescence images at high magnification using high-performance digital cameras. The MVX10 is fully compatible with a wide range of photography units, illuminators and stands to ensure that optimal images are recorded at high magnifications.

The Olympus imaging system solutions ensure the best possible results. Highly sensitive and dynamic cameras enable high quality data acquisition in the shortest possible time period. The intuitive software allows easy control of all functions and experimental parameters including processing and analysis of images. The systems are also capable of supporting prolonged visualisation of samples requiring careful environmental control with the addition of accessories, such as a heated stage.

A microscope for all reasons

With the introduction of naturally occurring fluorescent protein markers, such as Green Fluorescent Protein (GFP), isolated from the bioluminescent jellyfish *Aequoria victoria*, there was a significant breakthrough in live cell studies enabling the long term, non-destructive observation of model organisms. The introduction of the MVX10 MacroView certainly provides a radical new approach to observation of such fluorescent markers and model organisms. Through its proprietary technology that allows easy one-touch switching from standard to stereo observation, as well as its unique zoom capabilities, the MVX10 provides an ideal answer to the microscope choice conundrum, whilst at the same time increasing the efficiency of fluorescence screening observations.

Please contact:

OLYMPUS LIFE AND MATERIAL SCIENCE EUROPA GMBH

Microscopy

Esther Ahrent

Section Manager Marketing Communication

Tel: +49 40 2 37 73 - 5426

Fax: +49 40 2 37 73 - 647

E-mail: microscopy@olympus-europa.com

www.olympus-europa.com