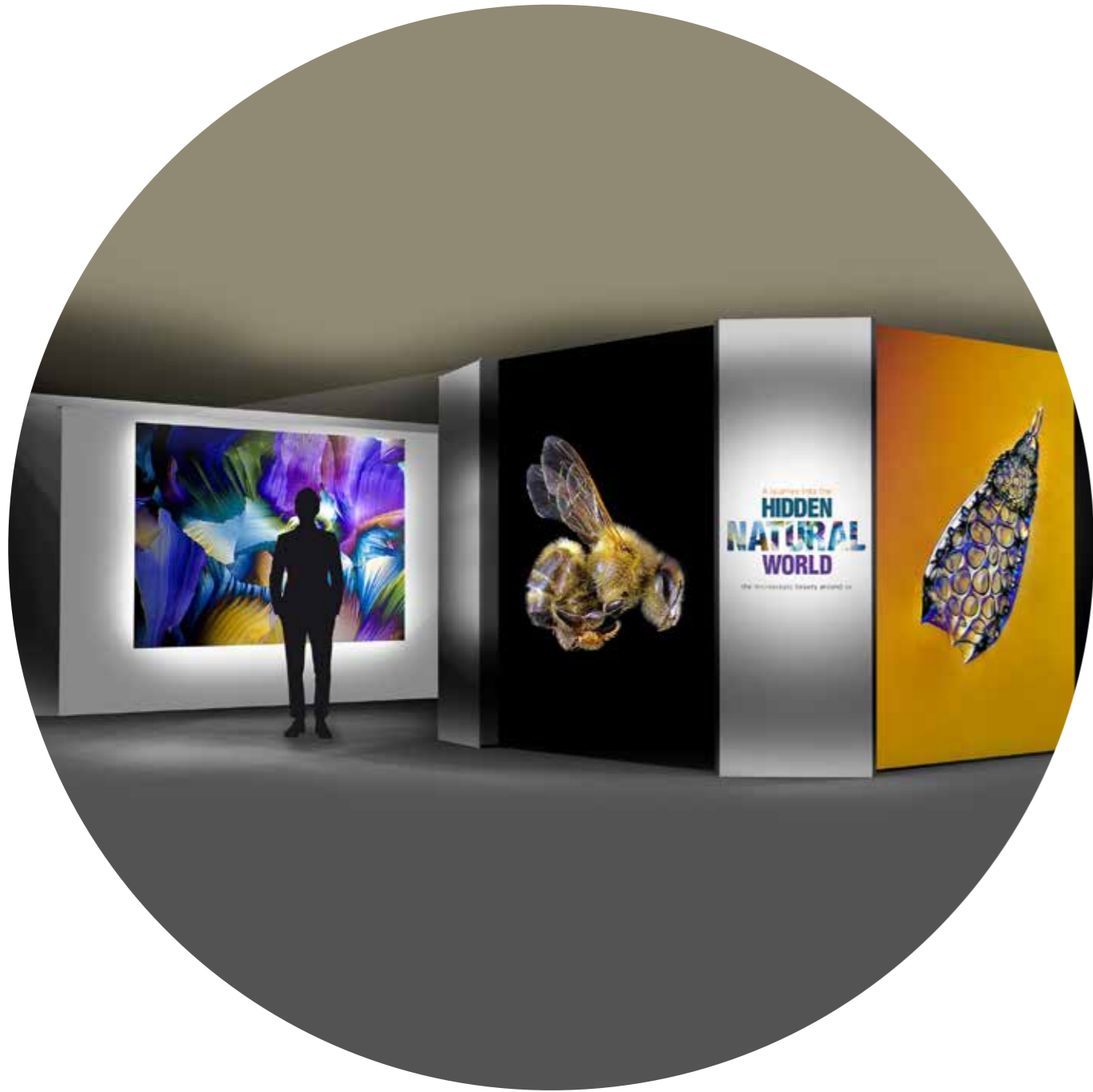
A microscopic view of biological cells, possibly bacteria or fungi, showing a variety of vibrant colors including bright green, yellow, orange, and purple. The cells are elongated and have a textured, almost crystalline appearance. A white circular line is overlaid on the image, framing the central text.

A JOURNEY INTO THE
**HIDDEN
NATURAL
WORLD**

THE MICROSCOPIC BEAUTY AROUND US

DIGITAL
GUIDE



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PHOTOMICROGRAPHY

BY MICHAEL
CRUTCHLEY

○ BIOGRAPHY ○

MICHAEL CRUTCHLEY

Michael's career began with the British Ceramic Research Association. In the 1960s he helped create specialist ceramics for use in radar equipment and micro-electronics. He worked on the development of high strength beryllium oxide ceramics for military electronics as well as components for high power carbon dioxide lasers. As part of his work Michael investigated the structure of ceramics with scanning electron microscopes.

In 2005 Michael retired and devoted his spare time to photography. A few years later a former friend and colleague, Professor Ron Stevens, retired from academic life and passed on his research microscope to Michael. This opened up new opportunities including photomicrography. Living near the sea, Michael developed an interest in collecting and photographing marine life – an interest which continues to this day.

Michael subsequently joined the Postal Microscopical Society and cultivated many valuable contacts amongst its members. He developed expertise in a wide range of microscopy techniques and slowly built up an impressive collection of instruments to support his interest. His engineering skills enabled him to upgrade and enhance their performance taking advantage of the latest LED technology and modern digital cameras.

Michael's portfolio of photomicrography images include aerial, terrestrial and aquatic subjects. He has photographed land plants and insects as well as life from both marine and freshwater environments. Fungi are a particular interest, especially the smaller species which require very particular care and attention to get the best results.



Michael Crutchley

○ BIOGRAPHY ○

MICHAEL CRUTCHLEY

1
Young Sea Anemone
Juvenile *Bunodactis verrucosa* anemone. 1-2mm across. Rheinberg illumination technique with blue filter.
©Michael Crutchley

2
Slime Mould Fungi
Slime mould fungi on rabbit droppings. Specimens 0.1-1mm in height. Zeiss Tessovar lens, Nikon camera.
©Michael Crutchley

3
Blackthorn flower
10mm diameter. Zeiss Tessovar lens, Nikon camera. Images digitally stacked using Helicon Focus software.
©Michael Crutchley

4
Small Elephant Hawk Moth
Head view detail of a *Deilephila porcellus* or Small Elephant Hawk Moth. Zeiss Tessovar lens, Nikon camera.
©Michael Crutchley



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IMAGES OF INTERNATIONAL STANDING

Since 2010 Michael's work has received international recognition.

Nikon's Small World is widely regarded as a leading forum for showcasing photographic images taken using light microscopes.

Since 1975 the organisation has run an annual Photomicrography Competition which is open to both amateurs and professionals who practice photography through a microscope. Entries are judged by an independent panel of recognised experts in the fields of photography and microscopy. The competition is open to an international audience with submissions coming from around the world.

The **Olympus Bioscapes** Competition was launched in 2003. Over the subsequent years till it closed in 2014 it became recognized as the foremost showcase for outstanding photographic images taken through light

microscopes. Researchers and enthusiasts from around 70 countries submitted photographs and movies for judging. The competition has been superseded by the **Olympus Global Image of the Year** Competition which continues to celebrate the very best of scientific microscopy images from around the world.

For some time Michael Crutchley has been submitting his photomicrography images to **Olympus Bioscapes** and **Nikon's Small World** Competitions. They have been judged annually against thousands of entries from around the world. His work has received both Honourable Mention (HM) and Image of Distinction (IOD) recognition.

In a satirical vein, Michael's work has even found its way into the popular BBC TV programme *Have I Got News For You* in their Guest Publication slot.



Pilobolus fungi
Otherwise known as a 'dung cannon' or 'hat thrower'.
Single specimen height 1-2mm.
Zeiss Tessovar lens. 10 image stack.
Nikon Small World 2014 Image of Distinction.
© Michael Crutchley

IMAGES OF INTERNATIONAL STANDING

1 Beadlet Anemone

Live specimen from local coastal rock pool. Zeiss Tessovar lens with flash lighting. Image width 4mm.
Nikon Small World 2019 Image of Distinction.
© Michael Crutchley

2 Autolytus Worm growing Clone

Junction between adult *Autolytus* polychaete worm and new growing clone. Zeiss Tessovar lens with flash lighting.
Nikon Small World 2015 Honourable Mention.
© Michael Crutchley

3 Starfish Breathing Gills

Breathing gills on the top surface of Cushion Starfish *Asterina gibbosa*. Image 1mm wide. Zeiss Tessovar lens with electronic flash lighting.
Nikon Small World 2014 Image of Distinction.
© Michael Crutchley

4 Limpet's Tongue

Detail of a limpet's radula or rasping tongue. Specimen prepared from collected shell. Width of sample 0.5mm. Zeiss Tessovar lens.
Nikon Small World 2015 Image of Distinction.
© Michael Crutchley

5 Juvenile flatfish feeding

Pigmented chromatophores in skin of flatfish. Sample width 2mm.
Image from Members Exhibition in Royal Photographic Society.
© Michael Crutchley



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○ WHAT IS ○ PHOTOMICROGRAPHY?

In its simplest terms this is the technique of combining photography with higher magnifications provided by specialist microscopes. Working at high magnifications throws up numerous challenges.

One major drawback is the lack of depth of focus. This means that in any single photograph only a small part of an object remains in focus. The rest is blurry and out of focus. A modern and powerful solution to this is the use of specialist digital processing software that allows 'image-stacking'. In this a series of photographs of an object are taken, each with a different depth of focus so that a different part of the object is in focus each time. Then the powerful processing software combines or 'stacks' the images on top of each and produces a final single image that is in focus throughout. Michael uses this technique to great effect.

Over the years Michael has amassed an array of microscopes that he uses for different projects. These include a Leitz Ortholux II, Nikon Inverted Diaphot, Reichert Polyvar, Zeiss Ultraphot and Zeiss Photomicroscope.



Leitz Ortholux II
Microscope with digital
camera.

The microscope is fitted with a UV and white LED lighting rig. A good fluorescence microscope. Coupled with the digital camera lens it can provide up to x1000 magnification.

© Michael Crutchley

With his Nikon digital camera he also favours using a high quality Zeiss Tessovar macro/micro lens which was made in the 1960s. It is now rare, expensive and hard to find. However Michael feels that this particular lens has not been surpassed in quality since it was first made.

In order to improve the results of his photomicrography Michael has called on his engineering background and made numerous technical refinements and improvements to the systems he uses. He has replaced the standard mercury lights with LED lighting rigs which are controllable and produce no heat to damage the specimen. He has also incorporated Ultra Violet lighting for fluorescence photography. Michael has engineered manual stepper-motors which allow a series of incrementally focused images to be taken. These can later be digitally 'stacked' to produce the final picture. He has adapted some of his microscopes to take both still photos and video. Microscopes previously rigged for 35mm film or even glass-plate cameras are now adapted to accept modern digital cameras.

○ WHAT IS ○ PHOTOMICROGRAPHY?

Zeiss Photomicroscope.

Originally fitted with an in-built 35mm film camera, Michael has up-graded this to use a digital camera. Fitted with Differential Interference Contrast, Phase Contrast and other filter systems. The microscope also has epi and dark-field illumination as well as ultra-violet lighting.

© Michael Crutchley



Polyvar microscope by Reichert.

This very large microscope has high quality optics and is excellent for observing and imaging. It can magnify up to x 1000.

© Michael Crutchley



Zeiss Ultraphot microscope.

Originally fitted with a 5x4 plate camera, Michael has upgraded it with a modern digital camera. Fitted with Differential Interference Contrast, Phase Contrast and other filter systems. The microscope also has epi and dark-field illumination as well as ultra-violet lighting.

© Michael Crutchley

