Dr David Maitland has won second prize in our Olympus Image of the Year competition 2017 for his striking and interesting phase contrast image of sponge anatomy. We spoke to David to find out more about the image and how he created it.

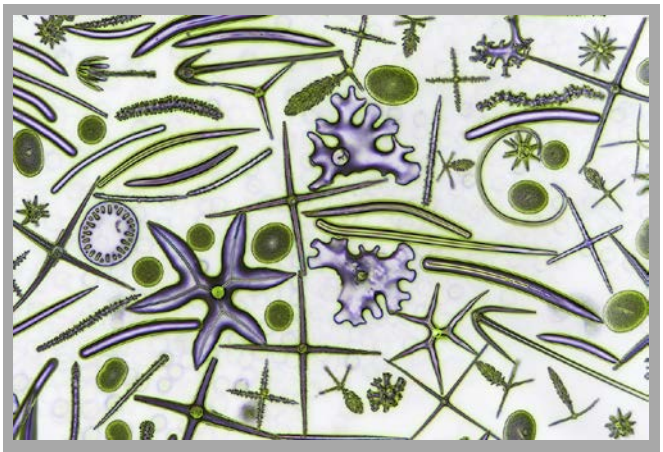
Tell us about yourself and your interests

I am a zoologist and I've had a career teaching and researching at various universities. My interest is in invertebrate zoology, particularly form and function – I'm always fascinated by the structure and function of things. About 10 years ago I decided I wanted to perfect my photographic art, so I left academia to pursue a full-time professional photography career. When I was working in science I was taking photographs in order to illustrate lecture material and research papers. When I began my professional photography career, I was looking for a new avenue, new subjects for photography, and I taught myself microscopy.

I was introduced to microscopy as an undergraduate of course, but this tended to be uninspiring from a creative point of view – endless lugworm cross sections stained red turned me off! However, when I started using a microscope as an imaging tool, it opened up a new world for me. The image I took for this award is a good example of where my interests now lie – looking for the miraculous sub-structures in life and explaining why they are the way they are.

Can you tell us about the image?

The image shows the hard, circular-based structures in sponges called spicules. Sponges have soft bodies and they gain mechanical structure by embedding a scaffolding of these spicules, which also have a defence function as quite a few animals eat sponges. These are mainly spicules from the glass sponge but there are also some from other species. I like this image as it shows great diversity, everything you see in the picture is a spicule – they come in a variety of shapes, which tend to be characteristic of the species of sponge. As you can see from this image, the diversity is spectacular. The



Glass spicules come in all shapes and sizes and give sponges shape and protection against predators. Phase contrast imaging using a home-made blue phase ring highlights the three-dimensional structure of the spicules and a simple colour inversion provides the striking contrast that further accentuates these weird and wonderful shapes.

spicules are made of a form of silica, known as hydrated silica, which is in turn a form of glass chemically close to the precious stone opal.

How did you find this slide?

The sample is from a fossil deposit in St Peter's, Hungary and the slide is a Victorian museum slide. These slides were made at the end of the 19th century for educational purposes and museum collections. They're beautifully done, I think the cleaning process was particularly challenging. You can find them in antique shops, junk shops and the like, but they are getting more and more popular, and harder to come by.

How did you create the image?

The first thing that I look at when I take an image is the composition and the design within it. I'm trying to create an image that's going to draw the viewer's eye to it because they think: "Wow, that's a pretty picture!" That's the first task – to get someone interested in the image for the image's sake, regardless of the content. Then of course the reason I want to do that is that the objects in the picture have a compelling and interesting story behind them – I hope somebody will pause long enough to ask the question: "What is that?" That's what I want to achieve.

I use my own microscopes to take the images. I have many of them because I need a separate microscope for each different microscopy technique. In normal photography, you have different lenses, for example you might have a wide-angle lens or a close-up lens. In microscopy, you also have different lenses to change the magnification, but you control the image through the lighting, which is controlled by the condenser. For this image I've used a technique called phase contrast but I've played around with it so it's not standard phase contrast.

Which microscope did you use and what modifications did you make?

I've taken this with an Olympus BX51 upright microscope and an Olympus 4X Super-Apochromat objective. I've inserted a home-made phase ring inside the Olympus condenser. The phase contrast technique allows you to get a three-dimensional look to structures. You can see that very nicely in the three large spicules in the centre of the image. Normally, phase contrast rings are transparent but the phase ring is a grey colour. I've made my own phase ring – it's basically a blue phase ring. I've also adjusted the way the condenser is aligned so that I improve the three-dimensional quality – it's slightly oblique lighting.

It's a completely straight photograph – no photoshop involved, other than just flipping the image – to make it negative rather than positive. In the image I took originally the colours are inverted, but I think it looks better with a light background – it would have been dark originally. In order to make the spicules stand out the way that they do, I simply inverted it.

Why did you choose this picture as an entry for the award?

That's the hardest thing – choosing an image! I wanted to pick one with interesting microscopy and photographic techniques, and an interesting background story to the subject matter. It's the perfect image in that respect as there's something interesting on many levels.

What do you find most fascinating about microscopy and where does that fascination stem from?

That fascination comes from my childhood – I don't know how I got fascinated by everything nature, but I did. I collected natural bric-a-brac. I grew up in St Andrews by the sea in Scotland and I used to go beach combing and collecting skulls and all sorts of things. Basically, I'm still doing exactly the same as I've always done, but now I put something under a microscope.

For me the challenge with the microscope is part of the fascination – it's very difficult to get good photographs that are interesting to the wider public using a microscope because as you increase the magnification the technical problems increase logarithmically. You're also limited by the structure of the microscope and so to try and use the microscope to break away from the standard is difficult. That's a challenge and also fascinating. I'm still learning.

Why do you think microscopy is a good tool for art?

I'm a scientist at heart and I'm trying to make compelling pictures for my art. In my career, and ever since I was a kid, I always wanted to look at things with a magnifying glass. I specialise in microphotography, and using a microscope is an extension of that. I love the fact that familiar objects, when magnified under a microscope, become very unfamiliar yet they reveal the science behind them – the structure of things.

The sponge is a good example: to the naked eye it doesn't really look that interesting, but when you start looking at what makes up its body – and I think this image is the perfect example of what's revealed – you had no idea. The structures are precise, they've got form, whereas as a whole the sponge is almost formless. For those reasons, microscopy is the perfect tool for me to make new designs for pictures, new art.

More information: www.olympus.eu/imageoftheyear