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## The Newton NM1 a portable microscope with great potential for mycologists

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Two years ago Don McNeil told me of a new portable microscope which was in development by the Millennium Health Microscope Foundation. The microscope was going to be called the Newton and was being designed for use in the study of tropical diseases in countries where full-sized microscopes were too expensive or required mains electricity which was not always available in the field.

I expressed an interest and started to monitor their website. The months and years went by and still it said "In development...". Finally, this year the microscope was released after extensive and very successful field trials and Don soon acquired units for both of us. What follows is my experience and thoughts after using the microscope for some weeks.

### History

The Newton design team were inspired by, and based many of their ideas on, the old and sadly no longer manufactured McArthur portable microscope, which many mycologists may be familiar with. That microscope, although of an extremely high standard was too expensive for widespread use in countries such as Africa, India etc and production had in any case ceased after its designer Dr John McArthur died in 1996.

The Newton team's aim was to produce a comparable microscope of high quality, ease of use, that could be powered by standard batteries and would be in a price range government institutions could afford.

Following investment and funding by a number of agencies the research and development plus field trials were firmly underway. For a more complete history of the design and development see the Millennium website [www.millennium-microscope.org](http://www.millennium-microscope.org).

### Design

The biggest challenge with any portable microscope is of course to reduce the size of the instrument and this is achieved in this case by bouncing the light path backwards and forwards

using a series of highly reflective mirrors. Newton Microscopes (formerly Cambridge Optronics), the commercial division of the developers, have an excellent visual of this on their website [www.newtonmicroscopes.com](http://www.newtonmicroscopes.com).

By this method the entire microscope was squeezed into a unit a mere 154mm long, 122mm wide and 66mm high (Fig. 1.) and weighing just 480 gm in its basic form! The body is made of what feels like strong, polycarbonate plastic and the whole unit has a very high quality, precision feel about it. Three objective lenses may be fitted from a choice of x10, x40, x60 and x100, the latter being an oil-immersion lens. The lenses are switched in operation by turning a wheel on the underside of the unit. Different eyepieces from x10 to x16 are available including the option of a 100 division measuring reticle.



Fig. 1. The Newton microscope with optional mechanical stage fitted.

### Results

The basic model comes with slide retaining clips but an optional mechanical stage is available and highly recommended for ease of use, especially at the higher magnifications.

Light is provided by a tiny LED light on a movable arm (arrowed in the figure above) and this is fadeable by turning a wheel. In practice the lowest power was sufficient for most uses.

Power is provided by 3 AAA batteries or by plugging it into a computer or other USB power source using the cable provided. The LED is very efficient and stated figures suggest a battery life of 300 hours at full power - remarkable if true!

The whole kit comes in a very nice case with a shock-absorbing foam interior and this allows the user to cut out extra slots to add additional items such as chemicals, slides, droppers etc.

Other available options include an adaptor to attach a mobile phone to act both as a screen and as a camera. You can also fit a USB powered video camera which replaces the eyepiece and can show live images on a laptop computer. Fig. 2 shows some *Cortinarius* spores taken via my iPhone - pretty impressive.

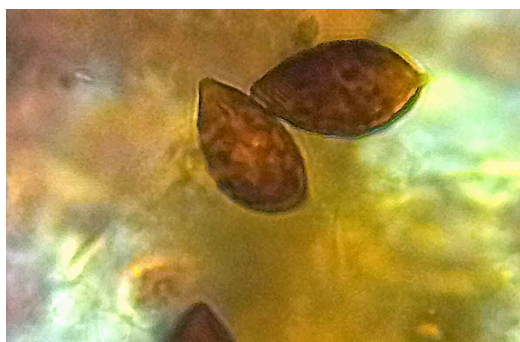


Fig. 2. Spores of *Cortinarius rufo-olivaceus* photographed at x1000 using an iPhone attached to the eyepiece. Each spore is about 10–12  $\mu\text{m}$  in length.

The microscope is easily used handheld or can be mounted on a small tripod for longer use. The focussing wheel is rather small and difficult to control under high power and an additional, larger clip-on wheel is available and should definitely be purchased.

As the microscope uses an inverted system with the objectives below the slide the slide and cover slip must be inserted upside down also. This is tricky but gets easier with practice. When using the x100 oil-immersion lens I find it easier to put the oil on the lens and then raise it up to touch the cover slip having first positioned the mechanical stage into the correct position.

I find the microscope easy to use and gives very high quality images for such small lenses. The click stops for the three objectives could be made more obvious and secure - it is sometimes difficult to be sure the lens is positioned correctly and this is something the manufacturer should address.

The light source is very bright indeed and often it is best raised slightly to reduce the light or you can tape a piece of tissue over it to reduce the power even more.

The price of the basic NM1-400 unit is about £400, and for the NM1-1000 with the mechanical stage and high power lenses around £600. For prices of the optional extras see the websites of either Newton Microscopes or GX Optical ([www.gxoptical.com](http://www.gxoptical.com)).

For a powerful, well-made microscope at a great price, to easily carry to forays etc or even use in the field you need look no further than this amazing unit. I wish the company every success with this remarkable product.