

# Buying a cheap microscope for home use

To buy old 20th century lab microscopes and specimen slides for home use by adults and older teenagers try [eBay](#). Investigate the microscope brand (e.g. Watson, Baker, Leitz, Vickers, Prior, Philip Harris, Bausch & Lomb not Tasco) and s/h condition before buying. Avoid cheap 'student' or toy microscopes. There are also small UK companies specialising in repair, new and reconditioned second hand microscopes, e.g. [J. B. Microscopes](#)<sup>1</sup>.

The microscope on the left below is a 1913 Philip Harris model and although it's useable for viewing specimens it's more a collector's display item. More modern lab microscopes, like the post-war C. Baker of London one shown on the right, are more practical for home use and may include high power 100x objectives.



Although microscopes age well being made of metal/glass, internal dust and mould can kill them off, so look out for ones that look clean, undamaged and are still stored in their box or were kept covered.

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<sup>1</sup> Commercial websites mentioned are just typical examples, I don't endorse any particular company. For eBay items check that all important sellers feedback rating, and if in doubt just ask the eBay seller. The views expressed here are my personal ones, reflecting my role as a UK [STEM Ambassador](#), and are not those of my employer.

Note that the above image of polyester fibres (sewing thread) is all in focus – this is because it was created from a series of semi-blurred photos captured by moving the microscope focus slowly down the 3D object. I used expensive professional PC software to combine these into a single fully focussed image, but you buy cheaper versions: e.g. Brunel microscopes '[Fine Focus](#)' software.

## Microscopes for Children

For youngsters a cheaper 4x to 32x stereo 'dissection' microscope may be a better choice as it can enlarge living insects and pond life - but don't forget the simple magnifying glass. Apparently younger children aren't so good at using microscopes with twin eyepieces (giving a stereo 3D effect), as the eyepieces are set too far apart, so for primary school 'dissecting' microscopes with a single mono eyepiece are also sold (below left). Further details can be found in the section 'Advice for Primary School teachers' (Buying for schools). Youngsters can also have real problems finding the focus point, and will initially need one-to-one adult help getting started.



A traditional compound microscope, above right, is only suitable for viewing flat specimens on glass slides, which with few specimens to view may become boring for younger children. As well as sand, cotton fibre, animal hair, plant and insect specimens also try growing micro-crystals, e.g. a drop of warm saturated NaCl salt or copper sulphate solution on a glass slide.

The above microscopes cannot take photos. You can buy cheap USB2 video cameras to fit into the eyepiece slot and capture images onto a PC via dedicated 'image acquisition' software (supplied with the camera). It's also very easy to use a compact digital camera held against the eye-piece to photograph the view down the microscope and there are digital microscopes available – see the next sections.

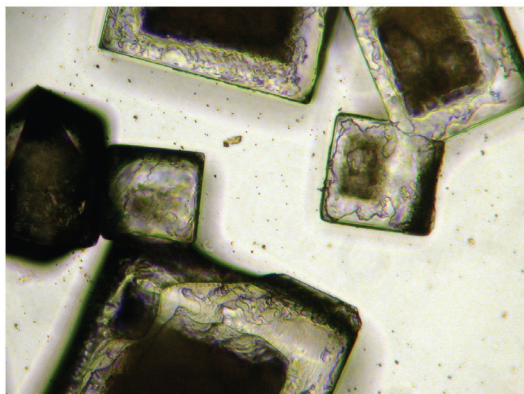
If you want to buy a microscope for you or your children to use at home, search out further advice from on-line sites such as [Microscopy-uk.org.uk](http://Microscopy-uk.org.uk), [Microscope Master.com](http://Microscope Master.com), [Microscopes.org](http://Microscopes.org) and the [Royal Microscopy Society](http://Royal Microscopy Society).

Also search for on-line retailers geared up to supply schools, e.g. [Brunel Microscopes](http://Brunel Microscopes) and [GX Optical](http://GX Optical) in the UK, for both new microscopes and specimens. I've found their help lines very useful for general advice of this sort . Although I've used them for teenage secondary school-kids who want decent microscopes at home, they will be clued up to Primary/Elementary school needs [although they will probably want to sell you a budget microscope not a decent magnifying glass]. Professional microscopists wouldn't tolerate the kit schools use and so often can't offer that much useful advice on particular models suitable for children.

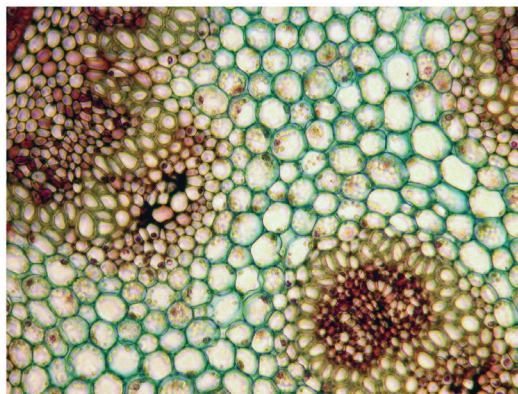


## Using a digital camera to take photos down a microscope

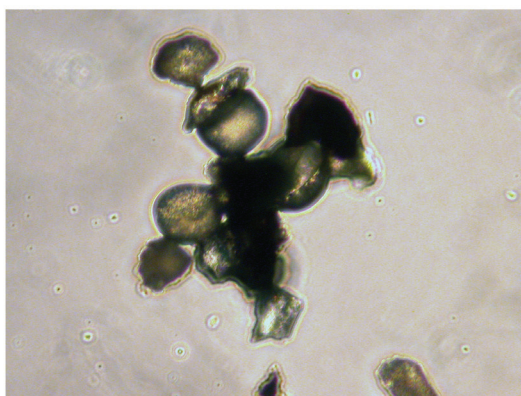
You can simply hold a compact camera close to the eyepiece and take an excellent still photo that way. Just use the camera normally and hold it steady by hand next the eyepiece. It should focus lock with the microscope view shown on the camera's LCD screen – younger kids will need adult help doing this and this technique is more suitable for older preteens [11+], teenagers and adults.



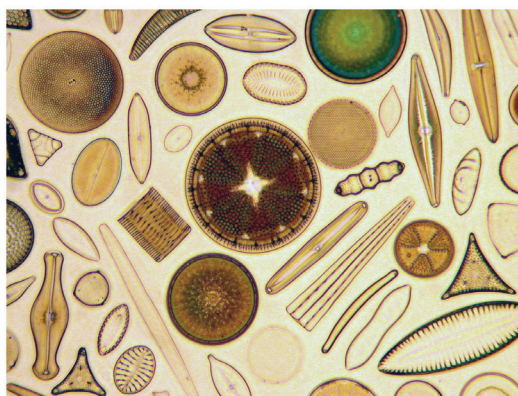
Dried NaCl salt crystals on a slide



Lily of the Valley stem (bought slide)



Icelandic volcanic ash that fell in the UK



Diatoms (bought from Klaus Kemp)

All the above pictures were taken with an old 3.3MP Coolpix 995 camera held by hand against the compound microscope's eyepiece – no cropping applied. The captured image is very dependent on the camera lens, so try a few other compact camera models if the results aren't so good.

For low magnifications, the camera's internal macro zoom will fine, with no microscope needed. A small desk lamp to provide extra light on the sample can help a lot. You might also benefit from using a small camera tripod and then using the camera's shutter delay timer to avoid camera shake.

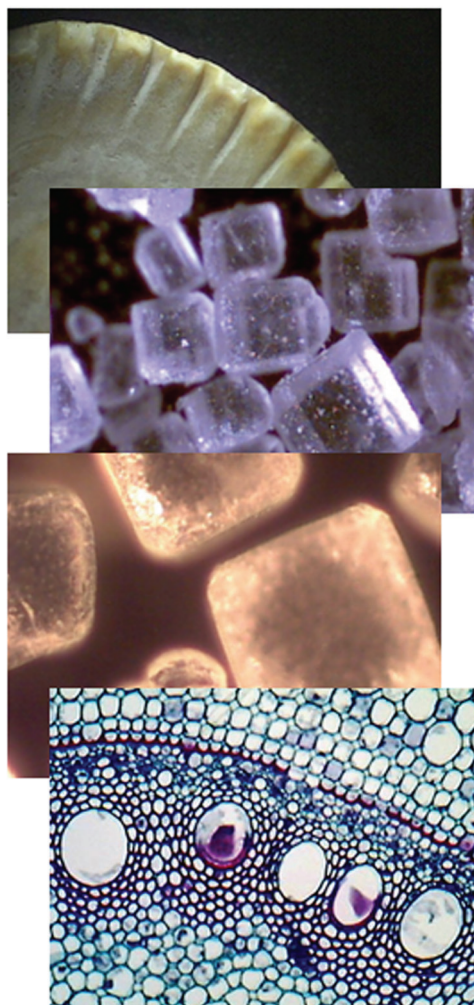
For taking enlargement photos, as well as a digital camera's in-built macro zoom, try out a home flatbed document scanner (not the LiDe type) that can also magnify small static objects quite well. See the section "Alternative ways to magnify a specimen".

## The Digital Blue QX-5 microscope



10x 60x  
and 200x

Digital Blue QX-5



Based on the even lower resolution cheap Intel QX-3 video microscope from 1990, the upgraded Digital Blue QX-5 boasted a resolution of 640x480 pixels, although it could magnify up to a fuzzy 200x. Costing £60 in its day (2005), it's now obsolete but is typical of cheap educational/toy video microscopes that are fun to use – although don't expect detailed photos, as capturing high quality images from specimens down a microscope can cost serious money<sup>2</sup>. Adults tend to be far more critical of the QX-5s low video resolution than 5 to 10 year old kids.

The latest version, the **Digital Blue QX-7**, is slated for release sometime soon (probably 2012). Assuming it is manufactured, it will have 1280x1024 resolution, glass not plastic lenses, and offer better software support for Windows and Mac OSX. As an educational toy, it should be great for pre-teens as it's all easily viewed on the PC screen – and the microscope can even take time-lapse videos.

Other 'cheap' video microscopes include the £250 [MOTIC Digiscope DS300](#) which was apparently superior to the Digital Blue QX-5 in terms of picture quality – probably due to better lenses rather than a better 640x480 pixel VGA video camera.

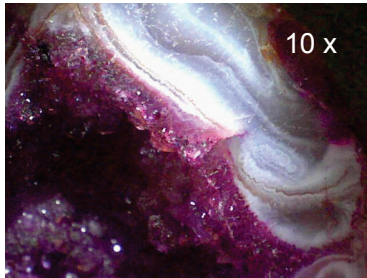
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<sup>2</sup> A typical Microscopy Core research microscope costs around £50,000 including cameras, and more advanced versions, such as laser scanning confocal microscopes are nearer £250,000.



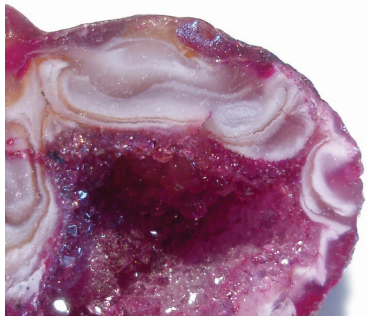
## Alternative ways to magnify a specimen

Don't forget the digital camera's macro enlargement feature. These photos were taken using a school's Digital Blue QX5 microscope and two Olympus consumer digital cameras, a compact u740 and a large E-500 SLR. Both cameras were used with a small £20 tripod and the specimen illuminated via a cheap halogen desk lamp. Younger children can be pretty useless with adult auto-focus cameras and may need a lot of supervision.



Digital Blue QX-5

Olympus u740



Olympus E-500 DSLR with EX-25 Extension tube



The u740 compact camera



The Olympus E-500 digital SLR



### The Canon 9950F flatbed scanner

Likewise a decent home office flatbed scanner has good depth of field and can create good photographic enlargements, e.g. see images below from a Canon 9950F scanning in standard reflection mode (not 35mm film scanning):



Canon 9950F film scanner



Olympus E500 D-SLR



QX-5

Avoid using the thinner LiDe type flatbed scanner models for imaging as they have a limited depth of field and so are poor at scanning small 3D objects - although naturally they are fine for very flat things like paper and 35mm film.



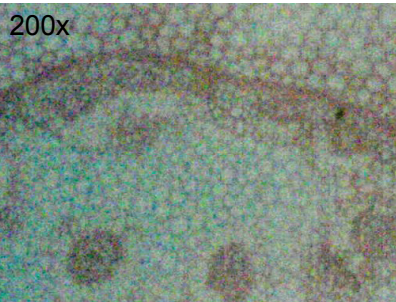
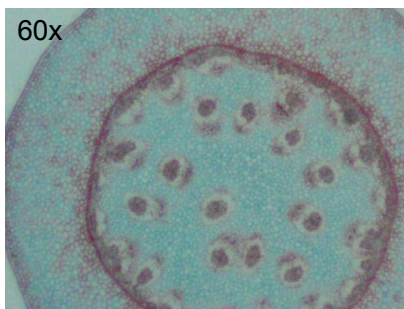


Olympus E-500 D-SLR

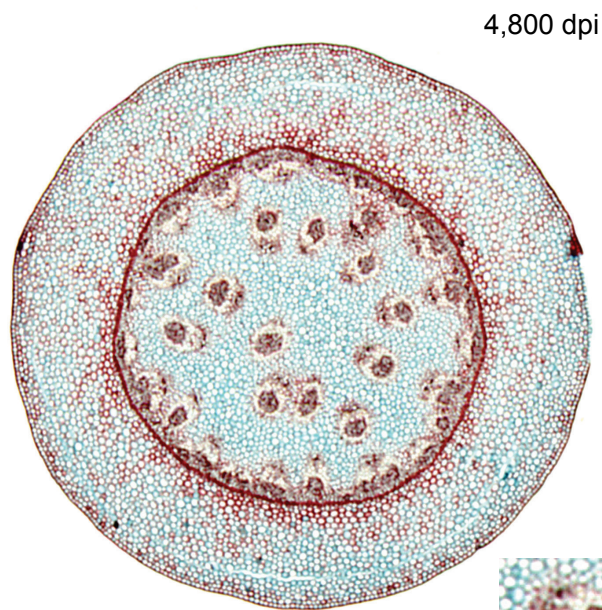
Canon 9950F scanner

Digital Blue QX-5

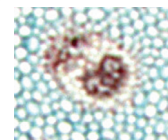
A film scanning flatbed scanner scan also scan tissue sections on glass slides in transmission mode as well as film, and does a far better job than the Digital Blue QX-5 microscope:



Digital Blue QX-5



Canon 9950F flatbed scanner



Place small pieces of card at each end to support the glass slide. This prevents scratching the glass platen of the scanner and also raises the specimen into the fixed focus area of the scan head. Again younger children will need adult supervision to run the scanner software and ensure that the scanner glass platen isn't damaged.

# Microscopy on-line

There's plenty of excellent microscopy related websites on-line aimed at home enthusiasts, children and schools:

HOME	GALLERY	<b>MICSCAPE Mag</b>	MENU	MUSEUM	CONTACT	HELP	PAGE URL	SHOP	SUBSCRIBE
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## Microscopy-UK

Resources for the microscopy enthusiast including free monthly Micscape magazine.  
Established 1995 as a benevolent presence for 'community' before 'profit'!

Updated May 13th - the May Micscape issue is now available online. The downloadable version is also available.

[Join our free International Gallery](#) - let your work be seen.

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Quick links to site resources	Microscopy-UK Resources - May 2007 highlights and news	
<p><a href="#">About Microscopy-UK</a></p> <p><a href="#">About Micscape Magazine</a></p> <p><b>Main Resources:</b></p> <p><a href="#">Micscape Magazine</a></p> <p><a href="#">Micscape Article Library</a></p> <p><a href="#">Introduction to Microscopy</a></p> <p><a href="#">Menu</a></p> <p><a href="#">Micropolitan Museum</a></p> <p><a href="#">Microscopy Primer</a></p> <p><a href="#">Movies</a></p> <p><a href="#">Pond Life ID kit</a></p> <p><a href="#">Projects</a></p> <p><a href="#">Schools</a></p> <p><a href="#">Smallest Page on the Web</a></p> <p><a href="#">Software</a></p> <p><a href="#">3D Images</a></p>	<p style="text-align: center;"><b>Micscape Magazine - this month</b></p> <p>The <b>May 2007</b> Micscape issue is online. Image right by Richard Howey showing the remarkable adaptations of a leaf insect.</p>  <p>The downloadable zipped version of Micscape magazine issues are now available free to all visitors.</p> <p>Next issue June 13th.</p>	<p style="text-align: center;"><b>Sponsor's Online Shop</b></p> <p>Our sponsor's online shop, managed and run by <a href="#">Brunel Microscopes</a> in the UK, provides a range of microscopy equipment, new and used, with an online catalogue.</p> <p><b>Second Hand and Used Microscopes</b></p> <p><a href="http://www.usedmicroscopes.co.uk">www.usedmicroscopes.co.uk</a></p> <p><b>Safety &amp; Training</b></p> <p><a href="http://www.microscopysafety.co.uk">www.microscopysafety.co.uk</a></p> <p><b>Imaging via Microscopy</b></p> <p><a href="http://www.microscopyimaging.co.uk">www.microscopyimaging.co.uk</a></p> <p><b>Training</b></p> <p><a href="http://www.microscopytraining.co.uk">www.microscopytraining.co.uk</a></p> <p>Over twenty years of friendly professional help for enthusiast, educational, and professional microscopy. The UK's leading Microscope help center. No call or inquiry is too big or too small!</p>
	<p style="text-align: center;"><b>Software</b></p> <p><i>Not microscopy, but possibly of interest to students and everyone else who wonders about the beauty of the Universe... and our place in it: a microscopic movie of space?</i></p> <p><a href="#">See the beauty here!</a> by co-founder - Mol Smith</p> <p><b>Website hosting:</b> One of the founders (Mol) is now offering fantastic web site hosting, including Flash web sites, image galleries, and E-shops, designed to be easily self-managed without any techie know-how. Take a test-drive FREE for as long as you like here at ... <a href="http://www.webdesigneroflondon.net">www.webdesigneroflondon.net</a></p>	<p style="text-align: center;"><b>Contributions and Donations</b></p> <p>Mic-UK and Micscape have been here on the web since the days of the</p>


## MOLECULAR EXPRESSIONS™

### Optical Microscopy Primer

#### Anatomy of the Microscope

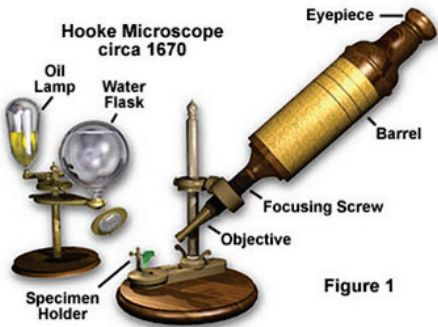
Search our site:  [GO](#)

BASIC CONCEPTS • DIGITAL IMAGING • VIRTUAL MICROSCOPY • PHOTO GALLERY • HOME



### Introduction to Microscopy

Microscopes are instruments designed to produce magnified visual or photographic images of objects too small to be seen with the naked eye. The microscope must accomplish three tasks: produce a magnified image of the specimen, separate the details in the image, and render the details visible to the human eye or camera. This group of instruments includes not only multiple-lens (compound microscopes) designs with objectives and condensers, but also very simple single lens instruments that are often hand-held, such as a loupe or magnifying glass.



**Figure 1**

The microscope illustrated in Figure 1 is a simple compound microscope invented by British microscopist Robert Hooke sometime in the 1660s. This beautifully crafted

Microscopy Primer

Light and Color

Microscope Basics

Special Techniques

Digital Imaging

Confocal Microscopy

Live-Cell Imaging

Photomicrography

Microscopy Museum

Virtual Microscopy

Fluorescence

Web Resources

Browse the MOLECULAR EXPRESSIONS™ On-Line Store

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## Optical Microscope Enthusiast Sites

Microscopy UK - thousands of microscopy related pages for kids & enthusiasts  
[www.microscopy-uk.org.uk](http://www.microscopy-uk.org.uk)

Ask-a-microscopist and list-server postings [with an electron microscopy bias]  
[www.microscopy.com](http://www.microscopy.com)

101Science.com's microscope pages for older school-kids & parents  
[www.101science.com/Microscope.htm](http://www.101science.com/Microscope.htm)

The Science for Fun website for older school-kids & parents  
[www.funsci.com/texts/index\\_en.htm](http://www.funsci.com/texts/index_en.htm)

Schools website of the British Mycological Society  
[www.fungi4schools.org](http://www.fungi4schools.org)

Take the 'Micro-Bus' into the world of microscopes  
[www.microscope-microscope.org](http://www.microscope-microscope.org)

The McCrone atlas of microscopic particles - many images are pay to view  
[www.mccroneatlas.com](http://www.mccroneatlas.com)

Klaus Kemp's diatom & butterfly scale microscopy slides - to purchase  
[www.diatoms.co.uk](http://www.diatoms.co.uk)

The Royal Microscopical Society  
[www.rms.org.uk](http://www.rms.org.uk)

The Quekett Microscopical Society  
[www.quekett.org.uk](http://www.quekett.org.uk)

The Microscopical Society of America [MICRO for schools]  
[www.microscopy.org](http://www.microscopy.org)

Olympus Bioscapes site - Beautiful images from the microscope  
[www.olympusbioscapes.com](http://www.olympusbioscapes.com)

# The Optical Microscope

For details on how the modern microscope works and the history of its development see:

Molecular Expressions Microscopy Primer - a great site

[www.microscopy.fsu.edu/primer/index.html](http://www.microscopy.fsu.edu/primer/index.html)

Modified Nikon and Olympus versions of above - also worth a look

[www.microscopyu.com](http://www.microscopyu.com)

[www.olympusmicro.com](http://www.olympusmicro.com)

Olympus's 'basics of light microscopy' & glossary web pages

[www.microscopy.olympus.eu/about\\_microscopy](http://www.microscopy.olympus.eu/about_microscopy)

[www.microscopy.olympus.eu/Glossary](http://www.microscopy.olympus.eu/Glossary)

Download the Olympus [Microscopy Basics](#) and [Optical Microscopy](#) pdf files only

Zeiss's 'Microscopy from the very Beginning'

[www.zeiss.com](http://www.zeiss.com). Download the [Zeiss Microscopy](#) pdf file

Zeiss's 'The clean microscope', i.e. how to keep your microscope clean

Download [The clean microscope](#) pdf file

Microscopy & Analysis: "The premier [free] journal for all microscopists worldwide"

[Microscopy and Analysis website](#)

Read the latest copy on-line as a pdf: [Microscopy & Analysis](#)



## Buying for schools

### Primary School teachers (ages 8 to 11)

Regarding specific microscopes for the UK, I would suggest visiting the websites of the national suppliers to British schools - they know their microscopes, the school market [low prices], and their user base [the kids]. Professional microscopists just wouldn't tolerate the kit schools use and so often can't offer much useful up-to-date advice on particular budget models. In the UK schools national suppliers would be the likes of:

[www.gxoptical.com](http://www.gxoptical.com) or

[www.brunelmicroscopes.co.uk](http://www.brunelmicroscopes.co.uk) and [www.educationalmicroscopes.co.uk](http://www.educationalmicroscopes.co.uk)

[The DM1 microscope and a selection of magnifying glasses]

I've found their help lines very useful for general advice of this sort – and although I've used them for teenage secondary school-kids who want decent microscopes at home, they will be clued up to Primary/Elementary school needs, although they will probably want to sell you a budget microscope as well as a quality magnifying glass. They also offer free demonstrations or models on approval for assessment at school. Americans should search the US sites for similar school/home suppliers and they should provide excellent support for the 'best' microscope for your children's age and price range.



**The Brunel DM1 (Omano M185 in the US)**

Plus our Royal Microscopy Society has microscope loan kits available for Primary schools to borrow and they subsidise the purchase of microscopes for Primary schools. The RMS recommend the cheap and basic [DM1](#) x20 monocular microscope for looking at whole objects. Although the similar DM5 has the LED light source, it is a binocular microscope which can be a problem for very young Primary school kids, although the DM5 microscope is adapted for a child's use. The DM1 can be fitted with extras like an attachment for a digital camera. In the USA, MICRO also recommends the same scope as the UK DM1 model, the key is to look for "model 185" which seems to remain constant even when the importer's brand name changes.

The DM1 is a UK Brunel branded microscope, although in the US the Omano M185 monocular microscope at [www.microscope.com](http://www.microscope.com) is clearly the same microscope. The Microscopy Society of America has a similar outreach program to the UK's RMS, called Project MICRO, and its web pages [www.microscopy.org](http://www.microscopy.org) includes very similar

advice, a reviewed booklist, and other resources<sup>3</sup>. MSA's regional societies (e.g. New England) may have a few kits available for loan to teachers within their area. Battery LED "booklights" suitable for DM1 sample illumination can be found on Amazon or you can use a small bendy swan neck mains desk lamp, replacing the 20w halogen bulb with a 10w one.

Youngsters [under 10s] often have real problems using optical technology designed for adults, and it's not just binocular eyepieces - give them a digital SLR or compact camera and invariably the photos will be blurred and useless, even with 1 to 1 adult supervision. Looking down a microscope they can have trouble finding the focus, even with a monocular microscope, and will often tell you they see something when they can't [probably in an attempt to get rid of you] - although when their face lights up you know they have found it. Understanding the concept of "focus" isn't intuitive for youngsters. You'll find advice on how to teach it in the booklet "[Introducing Pre-Kindergartners to 'The Private Eye'](#)", published by [Private Eye](#)<sup>3</sup>.



### **The Mitoc DS300 digital microscope**

It's now very dated with only 640x480 pixels resolution and expensive, but the kids like it and it's robust. Hopefully higher resolution models will arrive soon.

Personally for home use I prefer video PC based microscopes that can be more fun for younger kids and these can also give them a thing they love - the photo keepsake to paste into their notebooks. Disadvantages: adults frown on the poor image quality, they will need full adult supervision or demonstration unless ruggedised, and the CMOS chips/software rapidly dates - no problem for home use as your kids get bored with them very quickly once they have tried everything/done everything, but at school you want them to last for the next few batches of kids coming along. The most successful microscope systems for kids under 10 I have seen in UK museum and national science centres are based around expensive ruggedised [Perspex shielded] video camera microscopes with simple focussing.

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<sup>3</sup> With thanks to Caroline Schooley, Project MICRO Coordinator, Microscopy Society of America for the US information here.

There are PC USB2 or CCTV based cameras you can add to microscopes, although they require a PC/TV. Plus there's the £300 DinoLite<sup>4</sup> + Stand (never tried the range or the far cheaper, and no doubt far nastier, £50 generic versions) and the £280 Motic DS300 or DS-2 PC based USB microscopes, all of which will probably be outside your budget (although one for a small group in rotation will be more affordable). However the image quality of the cheaper £100 DinoLite, Motic DS300 or DS-2 is little better than the obsolete £80 640x480 pixel Digital Blue QX-5 USB2 microscope (although an updated Digital Blue QX-7 with 1280x1024 pixels and glass lenses was slated for production in early 2012).

However video microscopes are a bit of a distraction, so for Primary school classes the monocular Brunel DM1 (Omano M185) is probably the best option for price and letting the kids get involved hands on. Try one with your class on approval if you can.

## Secondary School Science (ages 12 to 18)

For secondary school children [ages 12 to 18], the following pages are more suitable:

[www.educationalmicroscopes.co.uk](http://www.educationalmicroscopes.co.uk)

Again, ask for models on approval and seek general advice from your educational suppliers, local education authorities [LEAs] and other secondary science school teachers in your area.

For older kids, compound biological microscopes require more thought in obtaining suitable translucent flat specimens than stereo microscopes and some prepared slides sold for schools can be rather uninspiring. However well looked after, properly mounted, slide specimens can easily last 100+ years, so old school specimen slide collections should be fine. Victorian slides from eBay are more for collectors, and can be relatively expensive [£10 each], although they can also be of very high quality. Sadly youngsters and expensive specimen slides don't mix, with the objective crashing down on the slide being the prime risk – fortunately the basic school microscope is designed with durability in mind so it outlives the glass slides.

Often unstained samples look far better with phase contrast optics, but this is an expensive optical add-on for a schools microscope and 3D structures such as salt or copper sulphate crystals still look quite good with standard non-phase transmission illumination. Phase contrast enhancement isn't required for dye stained samples such as thin tissue sections or cells, where the stain itself provides more than adequate contrast within the specimen [under transmitted light illumination].

Older children [12+] should find the stereo [3D] binocular microscopes easier to use as their eyes are wider apart and they have better mental concentration. Low power [up to 32x magnification] is fine for stereo microscopes. Compound ones for glass slides benefit from more expensive optics and higher magnifications up to 60x objectives [600x magnification] or possibly 100x [1000x magnification] for sixth form.

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<sup>4</sup> I have used a similar video system to the DinoLite, the [Keyence VHX](#) series which was superb. Trouble is the Keyence digital microscope system costs around £30,000 – it comes with it's own PC in a suitcase and does have a '54MP' camera though.



Most on-line advice is aimed at microscopes for primary school aged children [under 12s] and sites such as [science-active.co.uk](http://science-active.co.uk) and [sciencespot.net](http://sciencespot.net) don't have so much for older kids with microscopes. Plus the typical 'student' microscope made for schools [started by the likes of Bausch & Lomb in the US and Signalling Equipment Ltd in the UK during the 1950s] have offered relatively basic imaging quality, concentrating instead on low magnifying power, low price and high durability. However thanks to these basic microscopes every schoolchild in the industrialised world has since been taught to use a laboratory instrument capable of revealing microscopic things like cells and tissues previously unseen by all except a few scientific elite.

For a few ideas visit the 'Optical Microscope Enthusiast Sites' links on previous pages. Fortunately microscopists are a techie bunch like photographers and IT specialists so there is a wealth of useful information on the internet. GCSE and A Level text books and curriculum guides can also provide some ideas for microscope use in classrooms.

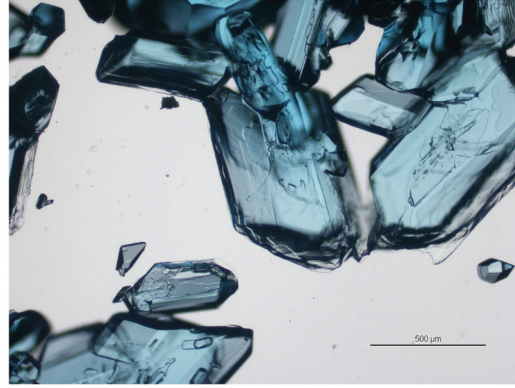
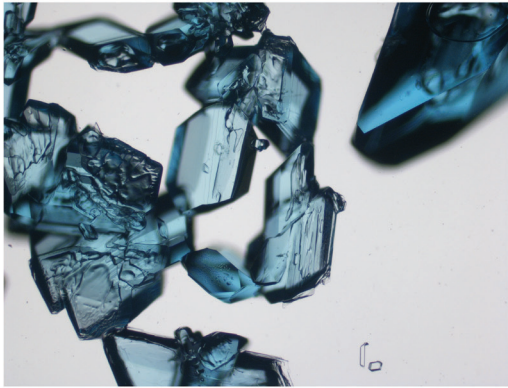


The [EV5610 Digital microscope](#) [£300] – looks cool but the 3.5” TFT screen resolution is only 320x200 pixels. However, it can transfer images to the PC at a more respectable 2MP [1600x1200 pixels]. Never used one, but it does look cool. Try before you buy. It's a compound microscope for glass slides.

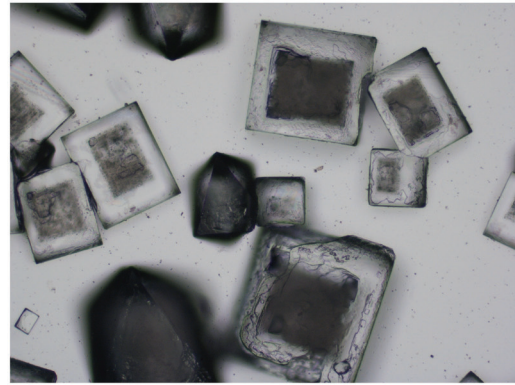
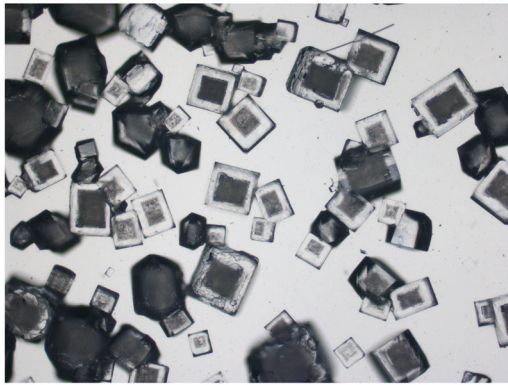
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Dr Keith J. Morris  
Molecular Cytogenetics and Microscopy Core  
The Wellcome Trust Centre for Human Genetics  
The Old Road Campus, Oxford University  
Roosevelt Drive  
Oxford OX3 7BN  
United Kingdom  
Web-pages: <http://www.well.ox.ac.uk/microscopy-core>

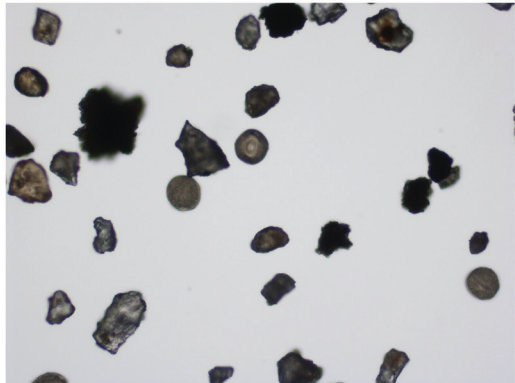
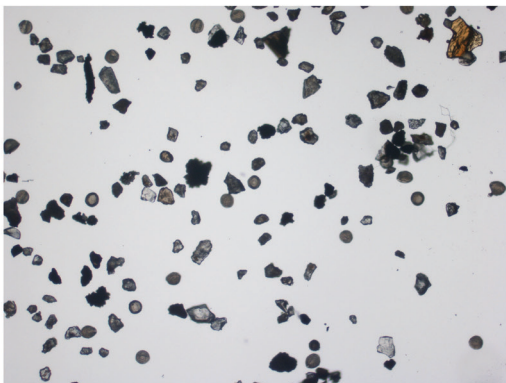
Updated: December 2011



Copper sulphate crystals at 40x and 100x magnification. A warmed saturated solution was applied as drop to a glass slide and allowed to dry. Once the crystals had formed the excess liquid was removed using a 1ml plastic Pasteur pipette.



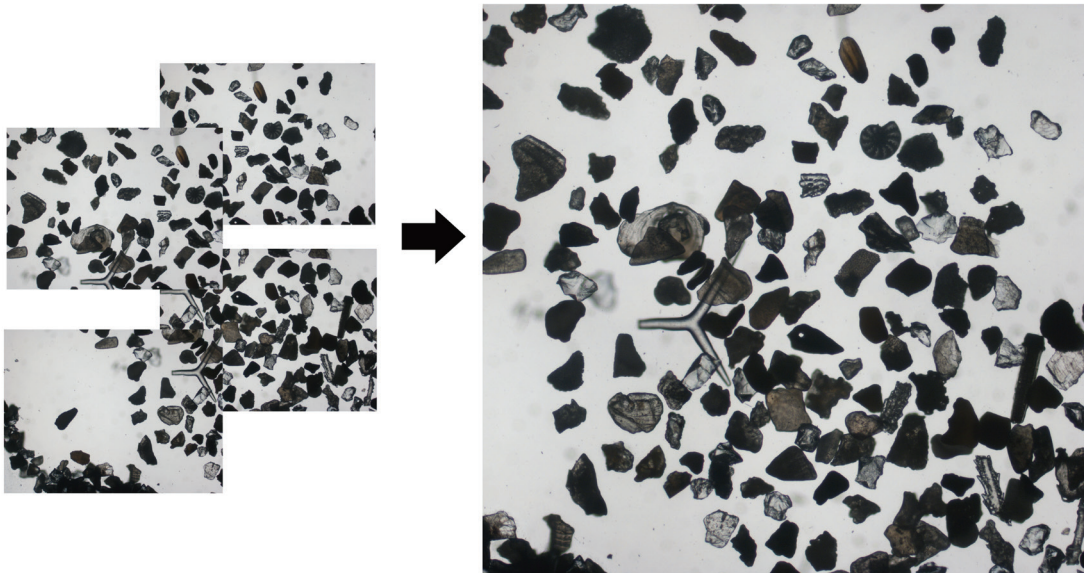
Sodium Chloride [salt] crystals as 40x and 100x magnification



Volcanic ash from an eruption in Iceland. Collected as a dust sample from a bonnet of a car in England. 40x and 100x magnification



Foraminifera - a large group of amoeboid protists which are among the commonest plankton species producing tests (shells) that can be complex in nature with chambers like a snail shell. The scatter glass slide sample [slew] was created from sand bought on eBay



Using Adobe Photoshop Elements 9 Photomerge tool to combine a series of microphotographs into one larger field (File, New, PhotoMerge, Panarama)

Coloured sewing thread. Although not stated this thread is clearly manufactured from man made polyester fibres and not natural cotton.

