OptArc Test Slide Sets 1a,b,c

User Guide

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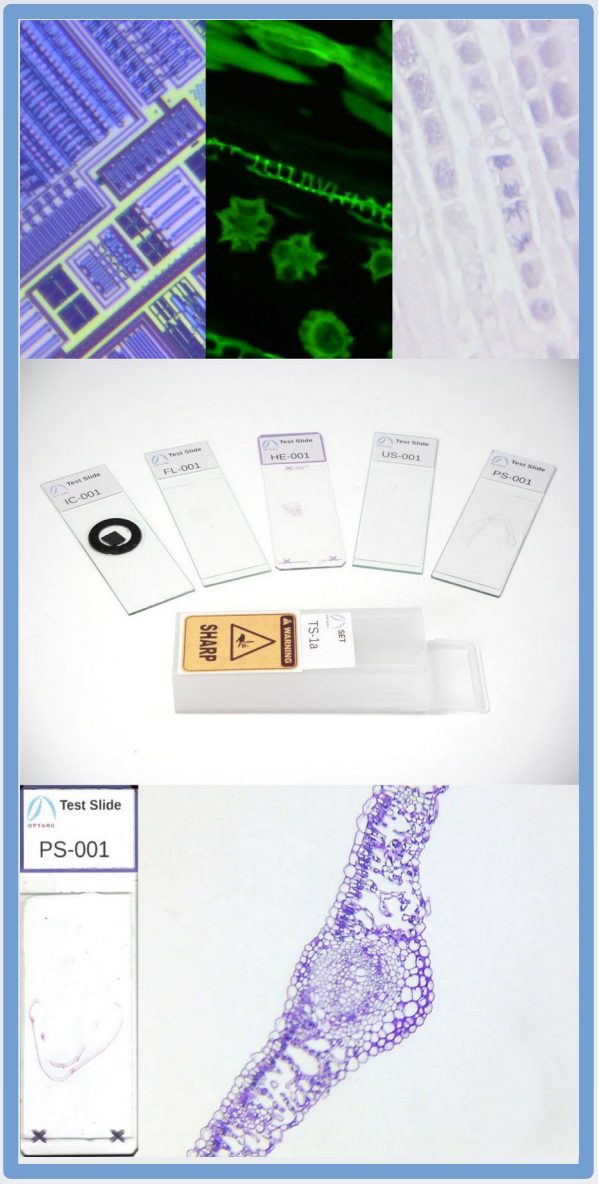


Manual prepared by **OptArc** – Designers and manufacturers of custom optical and optoelectronic systems using 3D printing rapid prototyping and based in the UK.
See **optarc.co.uk** for details.

Safety Information

Identification of risk

Throughout this manual please take heed of **warnings given in bold text and highlighted yellow** to avoid possible damage to equipment and/or harm to people.

Risk to vulnerable groups

OptArc lab supplies and equipment are not toys. They contain small parts which may come loose, glass components that may splinter or break or otherwise present a choking or sharp object hazard or chemical hazard (e.g. chemicals used in stains or silicon wafers). **Please do not let babies or young children play with or gain access to any aspect of this product. Older children should only access this product with close appropriate adult supervision. Likewise keep this product away from pets**.

Risk of damage by sharp objects

These slides are made of glass and covered by thin slips of glass. These may splinter and fragment, especially at the corners, during normal use. Take appropriate safety precautions while handling and clean the work surface after use to remove any small fragments of glass.

Dispose of broken slides or fragments of glass in accordance with local safe disposal of sharps policies and / or local authority guidelines.

Infection control

These biological specimens are made of plant tissues that have been through histological processing so they are considered to be of negligible infection risk to human beings. They are not a biohazard. Infection may occur if broken glass from the slides causes a break in the skin but this risk is the same as that caused by any glass cuts from any source and are due to local pathogens that may be found on the skin surface or glass surface in your local environment and not due to any particular infection risk by the specimen.

Personal protective equipment

Take standard infection control measures and wear gloves when handling to minimise the risk of skin penetrating injury.

The wearing of eye protection is also advised to minimise the risk of eye damage due to fragmentation of glass from the slides during normal handling.

Contents

Download link for PDF version of this Manual

You can download the latest version of this User's Manual as a PDF file from the Support section of the OptArc website via this link:

https://www.optarc.co.uk/support/

Legal Information

Copyright

Trade Marks

Limitations of Use

These slide sets are released to be used for research and educational purposes only.

Disclaimer

Only competent people trained in the use of microscopy and the handling of laboratory glassware and laboratory reagents should use this product.

Dr Paul J. Tadrous, TadPath and OptArc cannot accept any liability for any loss or damages that may occur from the misuse or mis-handling of this product.

Discrepancy in Appearance of Parts

The glass slides used to mount these specimens may come from a variety of brands of glass slide manufacturer. They may differ from pack to pack and even between slides within an individual pack.

The integrated circuit specimens are are cut from silicon wafers that are chosen at random and may be of various size and shape from pack to pack. The type of integrated circuit displayed is chosen at random and may differ from pack to pack.

The biological specimens are cut from wax blocks of histologically processed plant tissue and so will vary from pack to pack and from slide to slide accordingly.

The illustrations used in this guide are indicative of the typical appearance of each specimen but will not exactly correspond to the actual specimen you receive for this reason.

Introduction

The OptArc pre-prepared slide sets have been carefully designed to allow you to test the various illumination and resolution functions of a light microscope operating in various illumination modes.

They also have educational value in demonstrating aspects of integrated circuit construction and biological processes at the microscopic level.

It is hoped that these slide sets will be useful to teachers and researchers in biology, medicine, electronic engineering and applied optics as well as those who need to test microscopes for any reason.

The sets each comprise five slides. The first three slides are identical in each set – a silicon chip with a printed integrated circuit die, a slide demonstrating mitosis and nuclear chromatin in plant root tips and a sample of plant tissue stained with a fluorescent dye.

The sets differ from each other in the exact type of plant tissue used for the last two specimens – stained and unstained examples of plant histology.

The sets are provided in a handy 'slide mailer' plastic case for ease of transport and storage. We suggest you keep the slides in this case when not in use to protect them from dust and physical damage.

The slides are made of glass so may be damaged if dropped or if leant on and may result in small fragments of glass being chipped off the edges when in normal use due to scraping them against the slide holder system of many microscopes. Please take heed of the safety information and disposal guidance provided in this manual for the safe handling of these specimens.

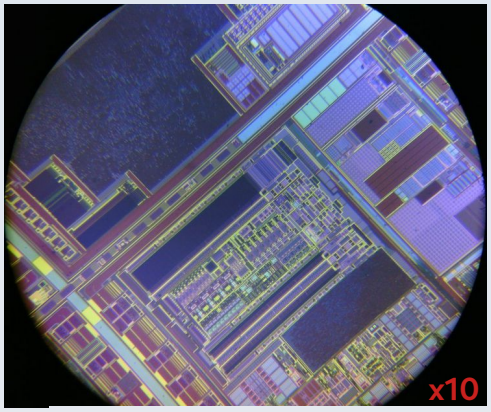
All specimens are permanent preparations mounted with a xylene-free and toluene-free mounting medium (ExPert™ brand supplied by CellPath™ Ltd) and covered with a thin glass coverslip. This protects both the specimen and the user as well as allowing the use of oil immersion microscopy.

All photomicrographs in this manual are taken using a PUMA microscope with the OptArc 5 megapixel Wide Field USB2 camera. Images have been scaled down and compressed for use in this manual. See the OptArc or PUMA Microscope gallery pages on the web for full size high quality images.

Specimens common to all sets

Magnifications shown in figures are those of the objective lens. Total magnification will be that multiplied by the ocular (which is always x10 in these examples). Photomicrographs are typical of the specimen but variation between batches mean that the exact structures shown here may not be present in your own particular set (although something very similar will be).

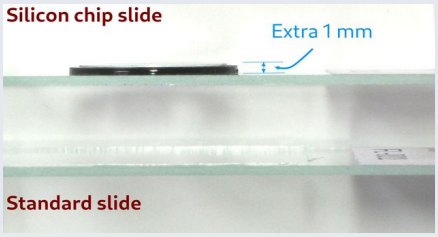
IC-001 – Silicon chip



This is a fragment of an integrated circuit (IC) silicon wafer. The specimen illustrates microelectronics fabrication with various circuit components. The exact model of IC is not documented and may vary from batch to batch.

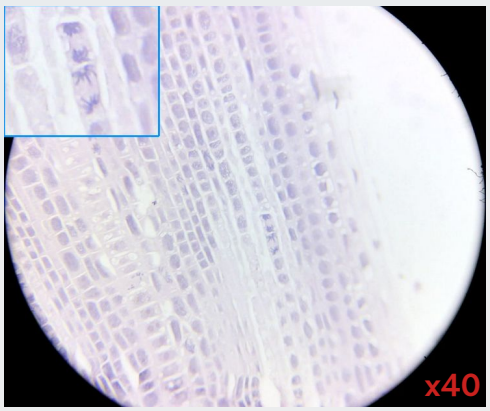
The specimens is designed to allow the following experiments and demonstrations:

- Epi-illumination microscopy including epi-polarisation
- Resolution testing including the option of oil immersion
- Demonstration of microelectronics structures.



It may prove useful in education and research in electronics engineering, microscopy and applied optics. **Note: This specimen is 1 mm thicker than all the others (see figure above) so ensure the objective is raised by ~1 mm using the focus mechanism before inserting the specimen on the stage to avoid damage to the slide and objective.**

HE-001 – H&E-stained *Allium* root tips



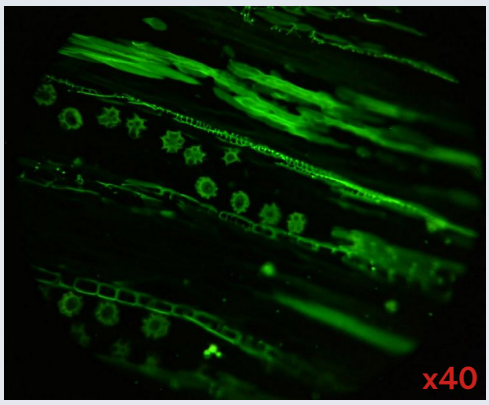
This is a histological thin section (cut at a nominal 2 to 3 micrometers thick on a microtome) of a collection of several root tips from *Allium* species (e.g. garlic). The specimen is stained with haematoxylin and eosin. The eosin staining is very pale in plant specimens. This specimen is designed to allow the following experiments and demonstrations:

- Examination of nuclear chromatin (note the eosinophilic large nucleoli indicative of active gene transcription)
- Examination of the various stages of mitosis

- Demonstration of chromosomes (note that because this is a thin histological section you will not see complete chromosome karyotypes as would be the case in squash preparations).
- Demonstration of plant cell histology.
- Examination with high magnification transillumination methods including Köhler illumination, the use of an Abbe condenser and oil immersion microscopy.

It may prove useful in biology education, microscopy and applied optics.

FL-001 – Fluorescein-stained *Sonchus* flower bud



The is a histological section of a flower bud including pollen grains and multicellular structures. It is stained with fluorescein disodium solution by means of a selective chemical uptake of the dye by various tissue structures (this is ***not*** antibody immunostaining). The sections used are cut thicker than those in the other specimens. They are cut at a nominal thickness of 5 microns. These thick sections allow for more experimentation with fluorescence methods such as deconvolution. Note that the mounting medium used, although permanent, never fully sets hard so you may see floating fluorescent debris fragments over the sample during viewing, particularly if the specimen is subjected to pressure on the coverslip from stage clips.

The specimen is designed to allow the following experiments and demonstrations:

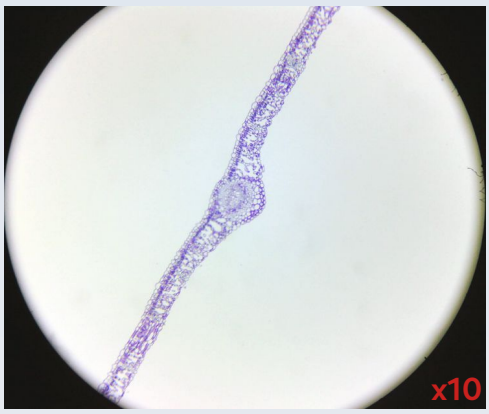
- Fluorescence microscopy at fluorescein excitation and absorption wavelengths.
- Epifluorescence microscopy
- Resolution testing including with the option of oil immersion microscopy
- Focus stacking image capture
- Focus stack image processing such as extended focal imaging and deconvolution.
- Optical contrast methods such as phase contrast and dark ground microscopy (dark field microscopy).

It may prove useful in biology education, image analysis teaching and research, applied optics and microscopy.

Set TS-1a

All histological specimens are fixed in a formalin-containing solution prior to being histologically processed to paraffin wax blocks. These are then cut on a microtome and the sections mounted onto glass slides and de-waxed in xylene and toluene free solvent prior to further treatment. They are finally dehydrated and mounted using a permanent mounting medium (ExPert™ supplied by CellPath™ Ltd).

PS-001 – PAS-stained Oak leaf

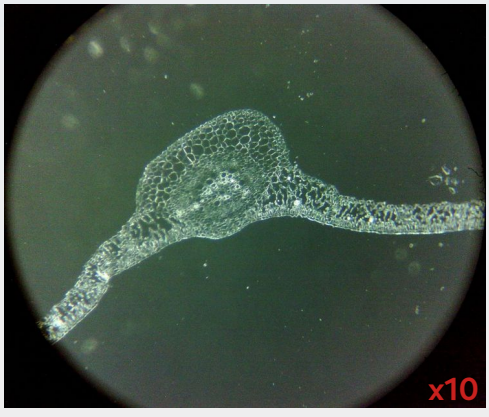


This is a histological thin section (cut at a nominal 2 to 3 micrometers thick on a microtome) of Oak tree leaf on edge and stained with the periodic acid Schiff reaction which demonstrates carbohydrates as reddish magenta. The nuclei are lightly counterstained with haematoxylin. The specimen is designed to allow the following experiments and demonstrations:

- Examination with low and high magnification transillumination methods including Köhler illumination, the use of an Abbe condenser and oil immersion microscopy.
- Polarisation microscopy for birefringence (the cell wall structures are birefringent)
- Demonstration of plant leaf histology structures including vascular structures.
- Correlation of morphology with the appearance of the unstained section described below.

It may prove useful in biology education, image analysis teaching and research, applied optics and microscopy.

US-001 – Unstained Oak leaf



This is a histological thin section (cut at a nominal 2 to 3 micrometers thick on a microtome) of Oak tree leaf on edge which is mounted, unstained, on a slide. The section is de-waxed but not stained with any dye and it is cut from the same block as the PAS stained section described above so the structures will correlate with what is seen there

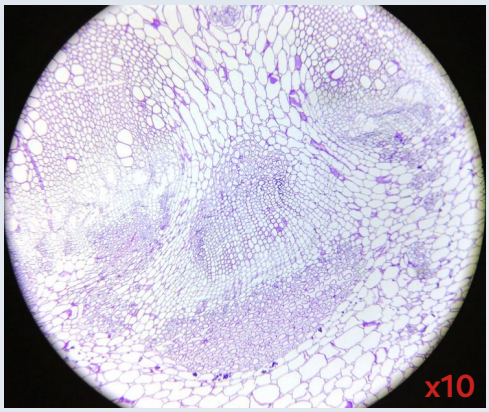
(but not exactly because this is a separate tissue section). The specimen is designed to allow the following experiments and demonstrations:

- The use of phase contrast microscopy (including Schlieren phase contrast)
- The use of dark ground microscopy (dark field microscopy). The illustration above shows an example field using dark ground microscopy.
- Contrast generated by the above methods may be correlated with the appearances in the PAS stained tissue section described above.

It may prove useful in biology education, image analysis teaching and research, applied optics and microscopy.

Set TS-1b

PS-002 – PAS-stained *Sonchus* stems



This is a histological thin section (cut at a nominal 2 to 3 micrometers thick on a microtome) of *Sonchus* species stem orientated both *en face* and on edge and stained with the periodic acid Schiff reaction which demonstrates carbohydrates as reddish magenta. The nuclei are lightly counterstained with haematoxylin. The specimen is designed to allow the following experiments and demonstrations:

- Examination with low and high magnification transillumination methods including Köhler illumination, the use of an Abbe condenser and oil immersion microscopy.
- Polarisation microscopy for birefringence (the cell wall structures are birefringent)
- Demonstration of plant stem histology structures including vascular structures.
- Correlation of morphology with the appearance of the unstained section described below.

It may prove useful in biology education, image analysis teaching and research, applied optics and microscopy.

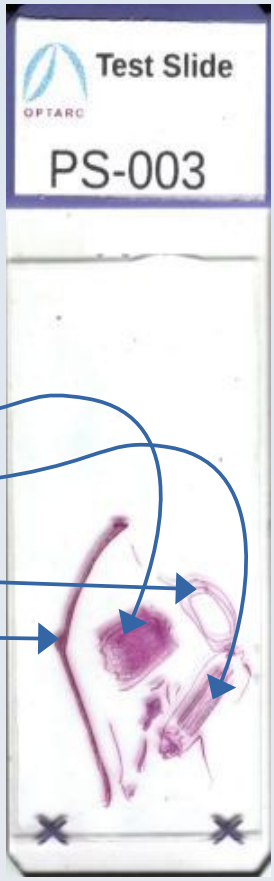
US-002 – Unstained *Sonchus* stems

This is a histological thin section (cut at a nominal 2 to 3 micrometers thick on a microtome) of *Sonchus* species stem orientated both *en face* and on edge which is mounted, unstained, on a slide. The section is de-waxed but not stained with any dye and it is cut from the same block as the PAS stained section described above so the structures will correlate with what is seen there (but not exactly because this is a separate tissue section). The specimen is designed to allow the following experiments and demonstrations:

- The use of phase contrast microscopy (including Schlieren phase contrast)
- The use of dark ground microscopy (dark field microscopy)
- Contrast generated by the above methods may be correlated with the appearances in the PAS stained tissue section described above.

It may prove useful in biology education, image analysis teaching and research, applied optics and microscopy.

Set TS-1c



PS-003 – PAS-stained Multi-selection

This is a histological thin section (cut at a nominal 2 to 3 micrometers thick on a microtome) of a compound block containing the following specimens all on one slide:

1. *Sonchus* species flower bud
2. *Campanula* species flower bud
3. Oak leaf on edge
4. Holly leaf on edge

These are stained with the periodic acid Schiff reaction which demonstrates carbohydrates as reddish magenta. The nuclei are lightly counterstained with haematoxylin. The specimen is designed to allow the following experiments and demonstrations:

- Examination with low and magnification transillumination methods including Köhler illumination, the use of an Abbe condenser and oil immersion microscopy.
- Polarisation microscopy for birefringence (the cell wall structures are birefringent)
- Demonstration of various aspects of plant histology structures including vascular structures, pollen, flower structures and two different types of leaf structure.
- Correlation of morphology with the appearance of the unstained section described below.

It may prove useful in biology education, image analysis teaching and research, applied optics and microscopy.

US-003 – Unstained Multi-selection

This is a histological thin section (cut at a nominal 2 to 3 micrometers thick on a microtome) of a compound block containing the following specimens all on one slide:

1. *Sonchus* species flower bud
2. *Campanula* species flower bud
3. Oak leaf on edge
4. Holly leaf on edge

These are mounted, unstained, on a slide. The section is de-waxed but not stained with any dye and it is cut from the same block as the PAS stained section described above so the structures will correlate with what is seen there (but not exactly because this is a separate tissue section). The specimen is designed to allow the following experiments and demonstrations:

- The use of phase contrast microscopy (including Schlieren phase contrast)
- The use of dark ground microscopy (dark field microscopy)
- Contrast generated by the above methods may be correlated with the appearances in the PAS stained tissue section described above.

It may prove useful in biology education, image analysis teaching and research, applied optics and microscopy.

Maintenance

The slides should be kept in their original plastic 'slide mailer' case when not in use to keep them clean and free of dust and to protect them from accidental damage.

If dust or finger prints get on the surface of the slide or coverslip these may be cleaned away with a standard tissue or soft cloth.

Stubborn marks may be removed by prior application of breath condensation on the surface to be cleaned before wiping. If that is not sufficient then a few drops of isopropyl alcohol may be used instead.

Over time the mounting medium may dry out from the edges of the coverslip resulting in growing dry patches underneath the slide. This can be remedied in the short term by dipping the slide in isopropyl alcohol or low odour white spirits then wiping the outer facing surfaces of the slide dry. The alcohol or white spirit will form a temporary mounting medium in the dry areas. However this will not last long because those solvents will evaporate.

A longer term solution will be to remove the old coverslip and re-mount the specimen. This is only recommended for the biological tissue samples. This should only be done by trained laboratory personnel (trained in histological methods) to avoid damaging the specimen and harm to the operator. Suitable laboratory gloves (resistant to the solvents used) must be worn at all times and there must be adequate ventilation. The procedure should only be undertaken in a histology laboratory environment. A suitable solvent to remove the old coverslip would be low odour white spirits. The slide should be fully immersed in this solvent at a controlled temperature of 45 degrees Celsius for at least 24 to 48 hours with occasional gentle agitation. The slide should be suspended vertically in this medium e.g. in a slide holder. The old coverslip should then slide off under gravity without manual assistance when the slide is lifted up vertically from the solvent container in which is was soaking. The section can then be remounted. We recommend the use of the same mountant that was originally used (ExPert™ xylene-free and toluene-free mountant).

The silicon chip sample is not suitable for re-mounting using the above method and re-mounting is not recommended for that sample. If it becomes unusable is should be disposed of (see the 'Disposal and Recycling' chapter in this guide).

Disposal and Recycling

Semiconductor specimen (silicon chip die)

The silicon chip specimen should be treated as an electronic component.

Electronic components used in various upgrade modules should be disposed of in special electrical goods recycle facilities.

Electronic components should NOT be disposed of in the general household waste or general household recycle bins.

If the silicon chip sample is exposed from its protective environment (e.g. if the slide breaks) then **do not handle it with bare hands – wear gloves to avoid skin contact with the potentially toxic doping agents used in silicon chip manufacture.**

Glass slides and coverslips

Dispose of broken slides or fragments of glass in accordance with local safe disposal of sharps policies and / or local authority guidelines. There is no clinical infection risk – the samples do not need to be treated as clinical waste.

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