PAGEANT (Projects Aiding Gambian Education And Natural Talent) is a UK registered charity which aims to help education in The Gambia, West Africa. It works with local Gambian agents to provide help with such things as provision of furniture and teaching equipment as well as sponsorship of individual children and construction projects for a large number of schools over a wide area. It also helps with education and self-sufficiency projects in village communities.

During the course of the past eleven years a number of microscopes have been either bought by or donated to PAGEANT and taken out to a few schools, colleges and a teaching hospital lab in The Gambia. We wished to increase the number of Gambian schools able to benefit from practical microscopy and to do so in a more structured manner. A series of extremely successful microscopy workshops were run in 2010, the greater part of which was funded by a 2009 RMS VP Award, which enabled us to give microscopes and instruction to teachers from 40 secondary schools. All of these – instruction sessions and microscopes - have been greeted with huge enthusiasm by both teachers and children. The main questions we are now asked are ‘can we do this for more schools?’ and ‘when?’.

During 2007 we ran a series of Practical Science workshops, sponsored by Collyer’s Sixth Form College and Christ’s Hospital School in Horsham, and a commercial firm (Fusionex). We took a specially written teaching manual describing a series of 73 school science experiments and sets of the equipment with which to do them to over 40 Gambian schools.

In 2010 we received a large donation of school Physics equipment and ran Practical Physics workshops in February 2011, this time at Gambia College, which is the teacher training college of the University of The Gambia (UTG). Here we were able to show the value of practical experimentation to the student teachers before they were sent off to their schools. We are using all the experience gained during these previous workshops when planning the current microscopy project.

The microscopy workshops that we ran in 2010 were really successful – however, logistics of Gambian travel make it very difficult to access schools in the up-country areas. Not only are the roads bad, but there is nowhere to stay.

Now we aim to run workshops at which the student teachers at Gambia College can learn how to use microscopes and to look after them properly – and then to go out to their new schools, in ALL parts of the country, and teach their students. This will mean that our instruction and equipment can reach regions of The Gambia that we have so far been unable to access. Gambia College is located in Brikama, a town about 20 miles south of the capital, Banjul, with good tarmac road access. We held discussions with the Head of Science at the college in October 2011 and agreed that we would run 4 days of workshops, each to 20 student teachers, during a period of one week in February 2012.

We have found that Gambian teachers are generally receptive to new ideas and are very motivated. The Gambian Education Department is now encouraging teachers to change from the old purely theory-based science lessons to a more pupil-
centred, practical approach, so our workshops and the equipment we provide are very welcome at all levels.

Many of the members of the UK team running the workshops will be the same as in 2010 and once more, almost all of the cost of the flights and hotel expenses for the trip is being met by the participants themselves, leaving the bulk of the sponsorship money available for buying microscopes.

Each day, the student teachers will be using a range of microscopical equipment bought with the fund and donations (the precise mix depending on the level of support from the suppliers and any further donations we may receive). 20 sets of this equipment will be used by the student teachers during the workshops and some will remain at Gambia College for further use in teacher training. However, we anticipate that about 25 sets (more if funds are sufficient) will be available for the best student teachers to take to their new schools once they are qualified, thus spreading both equipment and expertise through The Gambia.

Many of the schools will not have access to electricity or other facilities that we take for granted, so the microscopes need to be simple, robust and easy to illuminate. From past experience we will be providing simple monocular or binocular ‘stereo’ microscopes, as the Gambian schools have found them to be very useful and an excellent introduction to microscopy. We have also been given 20 Olympus and Philip Harris student multi-objective microscopes by Tyne Metropolitan College, which were shipped out to The Gambia during the summer. We took these down to Gambia College in October, where they are being stored in readiness for the workshops. These microscopes are several years old but are in very good condition and – perfect for Gambian schools – they have a tilted mirror for illumination. As we found during the 2009 workshops, these work really well either on a table close to a window or on a bench outside, with the mirror pointed to the blue sky through a gap between the buildings and the trees.

We will be organising the UK team of microscopists and preparing workshop notes, purchasing all the microscopes and ancillary equipment, holding at least one team meeting in UK to prepare the workshop programme and timetable, finalising the timing with Gambia College and then packing all the equipment and arranging its carriage to The Gambia prior to the workshops.

Printed notes on the operation, applications and care of the microscopes will be supplied to each teacher as well as a certificate of attendance at the workshop.

PAGEANT could not fund such a large scale event as this without financial assistance - the money from the RMS Vice President's Fund means that these Gambian student teachers can get some really useful instruction in light microscopy, some proper equipment to use in the classroom and suggestions for applications and samples.

One headmaster of a school where we held a microscopy workshop in 2010 reported to us in October that his school did startlingly well in the 2011 Grade 9 exams – they achieved a 92% pass rate in Maths and 88% in Science!! When you find that the overall national pass rates are 12% and 11% respectively, you see the measure of the achievement. Mr Jallow was kind enough to say that a lot of the credit should go to PAGEANT for the Science and Microscopy workshops that his teachers have benefited from, which was very nice of him.

So, in our turn we have to say that we owe a big vote of thanks to the RMS for this award – we could not run the workshops without it.

Pippa Howard
PAGEANT
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Life Through a Lens: On The Road

Life Through a Lens – On The Road is a workshop touring schools, aiming to engage school children in:

- The process of scientific discovery;
- Using microscopes;
- Understanding cells and;
- How researchers today are building on the work of scientists that came before them.

Using a mixture of experimentation, drama, microscopes and art, the endeavours of early scientists such as Robert Hooke and Anthony van Leeuwenhoek are recreated and explored with researchers and students from the Wellcome Trust Centre for Cell Biology, and School of Biology, at the University of Edinburgh. We take pupils on a journey of scientific discovery, emphasising that scientific theories must be proven to be accepted.

Life through a Lens was initially conceived as an outreach activity in conjunction with the Wellcome Trust 75th Anniversary celebrations. The project was resident at the Royal Botanic Garden Edinburgh in November 2011, where over 800 members of the public visited and 480 school children attended one of our two-hour workshops.

We saw 16 school classes from 10 schools, but had to turn away 29 schools. We therefore decided to take the project out on a tour of schools. The Vice-President’s Award from the RMS is significantly helping to fund this tour in 2012.

For some of our tour, in particular a proposed visit to the Orkney Islands in September, we hope to combine our project with the RMS Microscope Activity Kit programme. Our arrival will coincide with the arrival of RMS microscopes, helping to get teachers and other staff confident using the microscopes with a class.

What happens in a workshop?
Our workshop has a strong performance theme, using people dressing and acting the roles of historical scientists such as Robert Hooke.

Hands-on activities for pupils include:
- Using a microscope to view everyday things close up, such as fabric, poppy seeds, peacock feathers and a butterfly, in the manner of Robert Hooke.
- Using a microscope to examine a drop of pond water in the manner of Anthony van Leeuwenhoek.
- Preparing a sample to view via a microscope, using raw onion or possibly cheek cells to reveal visible cells and nuclei in the manner of Robert Brown.
- Staining a sample to view via a microscope, of their cheek cells in the manner of Theodore Schwann.
- Dressing-up as a historical scientist.

What will people gain by attending our workshop?
School children, teachers and helpers who visit for a full session should understand:
- The historical nature of science and value of scientific method.
- That simple science experiments and use of the microscope can help us answer fundamental questions.
- That there is a microbial world, invisible to the naked eye that affects everything around us.
- An appreciation of how microscopy has changed our understanding of biology over the centuries – and continues to do so.
- A sense of wonder at how looking at anything closely can reveal layers of unseen, unimagined complexity and give insights into how things work.
- That all living things are built of cells.
Attending adults would be trained in microscope use and made to feel confident adapting this to their own classroom needs.

This presentation is aimed at Scottish school children age 8 – 12 years. It is hoped to deliver two sessions on each day, to approximately 400-500 pupils in total. We will put an emphasis on reaching schools in rural and deprived areas.

The scientists from the University of Edinburgh who volunteer to work on this project will improve their communication skills and hopefully have as much fun as the pupils!

**Feedback comments from pupils who have attended our workshops**

**What did you most enjoy?**
I most enjoyed the free time looking through the microscopes because it was fun looking at my finger and the butterfly wings.
I most enjoyed looking at pond water through a microscope and seeing the tiny animals.
I most enjoyed the microscopes because I got to dress up and look at the tiny creatures.
The single-celled organisms were adorable. Everything is so pretty close up!

**What will you remember from today?**
I will remember to always say 'prove it' and not take someone's word for it.
I will remember that there is a nucleus in the cells.

**What did you learn?**
I learnt that science is fun!
I learnt that I am made up from cells.
I learnt the science has been going on for hundreds of years.
I learnt that Hooke was the one who made up the name 'cells' because when he looked through a microscope the cork looked like prison cells.
I learnt that there are thousands of creatures in a drop of pond water.
I learnt that I might be a scientist when I am older.
I learnt that some theories are a load of rubbish.
I learnt that everything living is made of cells.

**Teachers comments**
Microscopes were great. Acting and dressing up was good/funny. Pond water was brilliant. Staff were good with pupils.
Good mix of facts and hands on, role-playing.
What worked best were the hands-on activities, especially the microscope work.
The pupils enjoyed using the microscopes and joining in with the experiments.

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Supported by wellcome trust
A Virtual Microscope Through Time

Communicating physical sciences to the public can be a challenge particularly where specialist hardware is required for this communication. In this project we aim to make microscopy techniques accessible, meaningful and at the same time capture the imagination. To this end, we are developing a web-based virtual microscope that will allow a range of objects to be defined with optical and electron microscopy complemented with virtual object imaging methods. There is a broad and growing public interest within ancient samples, both artefact and natural hence the underlying theme of this project is the study of a diverse range of objects representing different points in time explored from the perspectives of both science and culture. The project aims to include something of interest to everyone allowing rare and important materials to be accessible not just to specialists but anyone with a desire to learn.

The background to this project started in 1993 when the Open University first developed a virtual microscope to enhance the teaching of optical microscopy to Earth science students. This project was limited to optical microscopy and delivered to registered students via CD. Mineral studies generally require the use of polarised light on a microscope with a rotating stage - a petrological microscope. Significant costs associated with petrological studies are such that the majority of people cannot gain access to appropriate microscopes and collections of suitable materials for study. Addressing this problem was an early motivation for virtual microscope development. Initially developed for OU students, with time the project was developed and broadened to give free access to numerous collections via the internet. The current system was developed and launched as a website and a downloadable application approximately two years ago. It has proved to be very popular; the website attracting over 39,000 hits since December 2010 from a world-wide audience of 105 countries (and including 150 locations in the UK and 41 of the American states). Numerous virtual microscopes exist today driven by both Open University teaching needs and collaborative projects including a Mars themed project based around Martian meteorite studies, a NASA project exploring the Apollo missions through lunar rocks returned to Earth and a Darwin project in collaboration with the Sedgwick Museum, Cambridge, allowing access to rock samples collected by Charles Darwin on the HMS Beagle voyage.

Being awarded the RMS Vice President’s fund will allow the development of a virtual microscope project that expands beyond our current optical microscopy projects to include electron microscopy and rotational object imaging. It will be the first of our virtual microscopes to feature objects in thin section other than rocks. The RMS Virtual Microscope will contain data gathered from important samples, of both natural and artificial origin, spanning a range of 4.5 billion years. With analysis performed as optical microscopy, electron microscopy and energy dispersive X-ray spectroscopy a series of techniques applied as appropriate for each sample. This detailed high quality data will be merged into a website which functions interactively allowing the user to develop an understanding of the materials and structures of the samples but also gives an understanding of the function and application of optical and electron microscopy. A major aim of the project is to allow the general public to develop an understanding of the practice and application of research microscopy to valuable samples of our natural and manufactured heritage, while bringing alive the science of imaging and analysis to the non-specialist audience. It will also highlight these fascinating iconic objects from both scientific and cultural viewpoints giving a broad view of our understanding of their place within our past.
Images and compositional data acquired by electron microscopy along with the optical microscopy, allow the user to explore the sample from the perspective of a scientist. We will be working with multiple museums to highlight relevant objects, in particular the Sedgwick Museum has kindly allowed us access to a selection of rare fossils.

Objects in the study include early solar system materials such as primitive meteorites which contain components that pre-date the solar system in excess of 4.5 billion years old. These include: a meteorite from Mars which contains structures that may be evidence of liquid water flow at 1.3 billion years; evidence of simple early life forms on Earth such as stromatolites from approximately 600 million years; to dinosaurs and flying reptiles at 100-150 million years; early humans at 4 million years mark the boundary into objects made by mankind from flint tools at 10000 years. Objects from the ancient world superpower Egypt are also included - objects from tombs defining early belief in an afterlife then we progress to modern objects represented by technological materials used within space missions.

The Vice President's Fund will allow us to upgrade our camera equipment so we can produce a series of images of samples which we will process and reconstruct as 3D objects at high resolution. The resulting virtual object can then be 'handled' and examined by the virtual microscope user. We will also invest in a reliable professional data storage system to securely store the large numbers of images generated by the project.

Electron microscopy and analysis has been performed primarily upon non-terrestrial materials at the Open University by the project lead Diane Johnson for approximately six years. During this time new applications have been developed and typical sample range also expanded to include fossils and artefacts. The project co-designer Andrew Tindle has extensive experience in electron microprobe analysis in addition to his special interests in mineralogy and the imaging of geological specimens. They have joined their skills and interests to produce this project with the aim of both engaging and informing a broad cross section of society in making specialist microscopy and imaging techniques available freely to any web user. In the future the project could easily be developed beyond our current plans to further expand upon the subthemes within the project.

For more information on the Virtual Microscope Project visit http://microscope.open.ac.uk/andy. We also have a Collections Site at http://www.virtualmicroscope.co.uk.