Celebrating three years of the PORTABLE SEM IN SCHOOLS PROGRAMME Supported by HITACHI STEM GLOBAL OUTREACH

By Zoe Kathleen Barr

Through the loan of a portable Scanning Electron Microscope (SEM), this successful outreach programme focuses on bringing research directly to schools. In the first three years close to 14,000 students and teachers have benefitted from the experience of using this high-level technical equipment. An overview of the programme and the success so far is here, accompanied by some of the images produced by students from participating schools. More information about the programme impact, structure, pedagogy, and future can be found in the full impact report available on the RMS website

The programme aims to foster awareness for STEM in schools and the wider community, using state-of-the-art research instruments. By providing an extended loan, designed to be long enough for meaningful depth of use and investigation, we aim to encourage the use of microscopy as a tool for enacting best practice for STEM teaching. The programme so far has reached students throughout the UK, upskilled teachers and technicians, and enhanced the curriculum through research-based activities. The flexibility of the programme, centred around the SEM itself, supports a variety of outreach styles, cross-disciplinary engagement and builds communities connecting researchers with schools.

In partnership with

HITACHI
Inspire the Next

Hitachi Global Partners
Courtesy of HITACHI Global partners, the SEM is loaned and fully insured with support for repair and advice.

NATURAL HISTORY MUSEUM

Natural History Museum (NHM)
Provides a logistical hub to check the SEMs and to support teachers in set-up, training, and technical enquiries. The museum contributes technical expertise of SEM use and maintenance, and in outreach and education.

Institute for Research in Schools (IRIS)

Schools participating in the SEM loan are a part of the IRIS network of schools with IRIS as a logistical base for applications. As experts in developing research programmes within schools, data and research from IRIS facilitates and encourages a pedagogical framework for STEM-learning via research.

Oxford Instruments

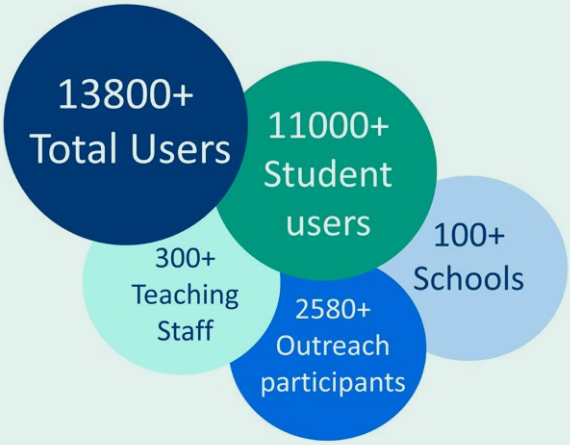
Provision of the Energy Dispersive X-ray Spectrometry (EDX) system, an X-Ray microanaylsis feature. The use of the EDX system extends the curriculum reach thanks to the additional feature specifications.

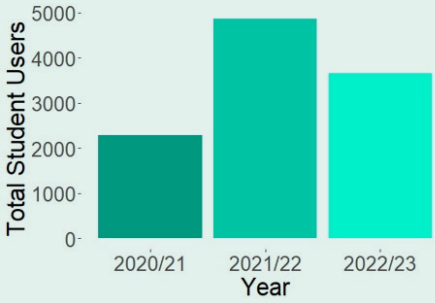
Royal Microscopical Society (RMS)

Support from the RMS includes logistical handling and transport costs. The oversight of the Outreach and Education Committee provides evaluation and encouragement.



Headline numbers:





Hear from our students

"When my class used the scanning electron microscope it was really interesting and I felt like I was actually doing a project like a scientist"

"It was mind blowing to see things you can't see with the naked eye"

"It was amazing!"

"I thoroughly enjoyed seeing the microscope in action. It's amazing to see such detailed imagery!"

"Very interesting to see things not visible normally"

"As a young black female, I rarely get opportunities like this. Using the electron microscope was an amazing experience. I learned so much in a short period and would be ever so grateful if we could continue using it."

"The SEM really made me think, and realise how complex microorganisms are"

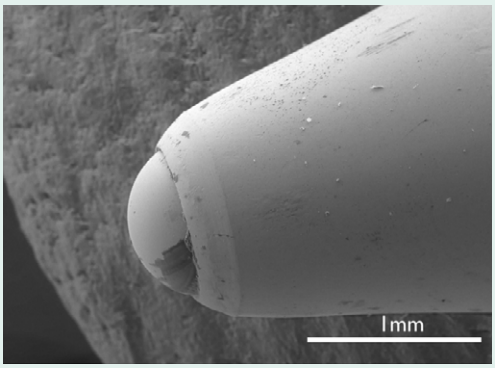
"I liked the SEM as I got to go deeper into my learning and also just trying something new."

"It was amazing! And even better you get to see your own item under the microscope. Fascinating stuff!"

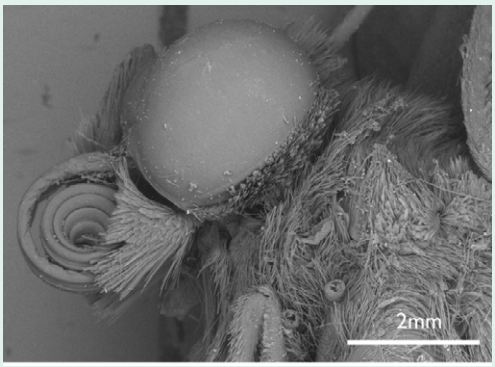
"I enjoyed it. It made me think I was a smart scientist."

"It was incredible to be able to use the microscope myself, an experience I think that many people might never get. I was amazed at what it could do and the levels of magnification that it could achieve."

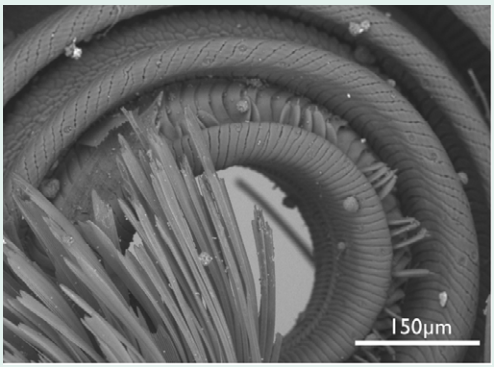
A selection of eye-catching images from student projects:



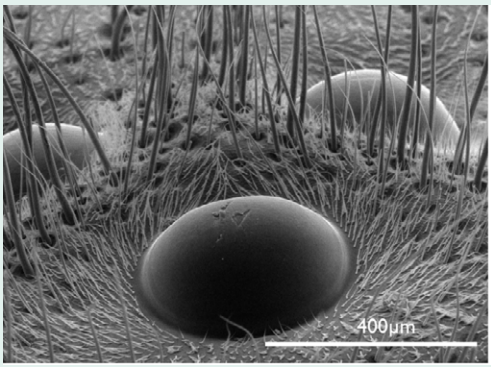
Ballpoint Pen



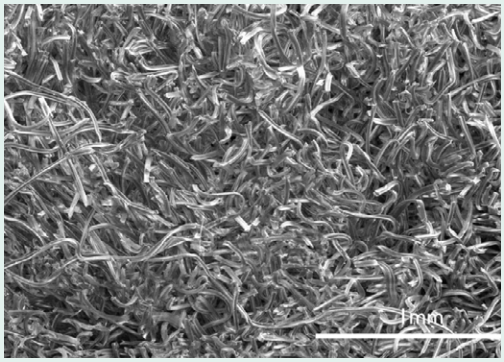
Butterfly



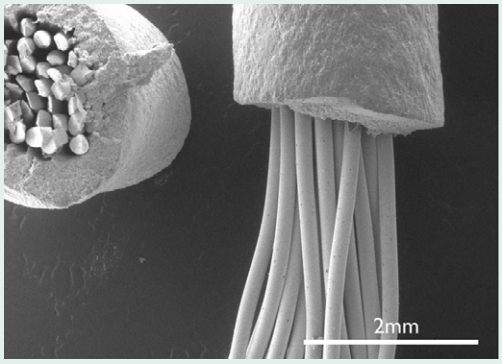
Butterfly Tongue



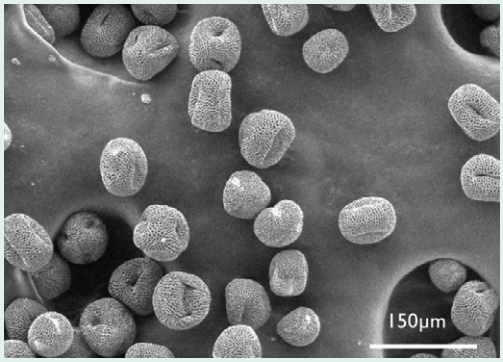
Hornet Ocelli



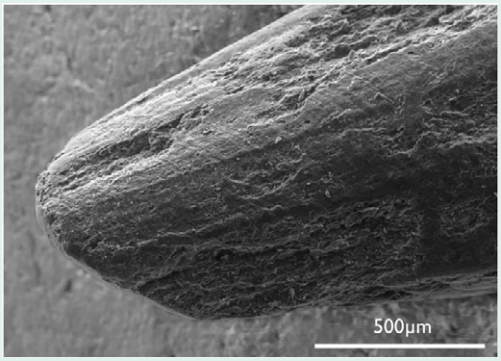
Cigarette Filter



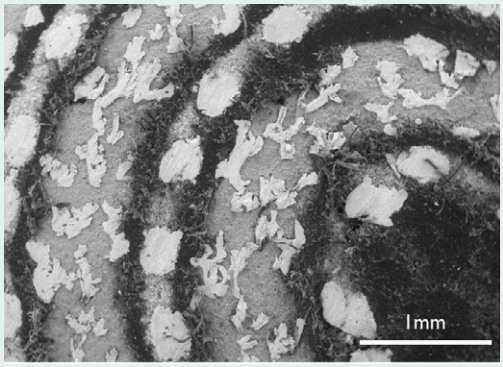
Cable Wire



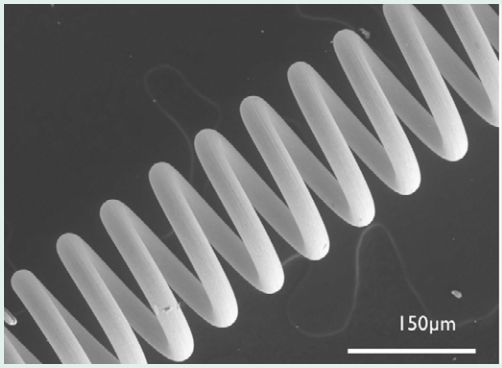
Pollen Grains



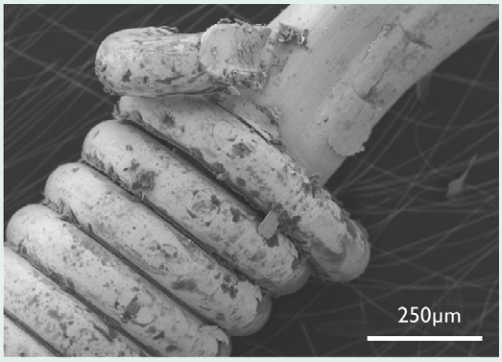
Pencil Tip



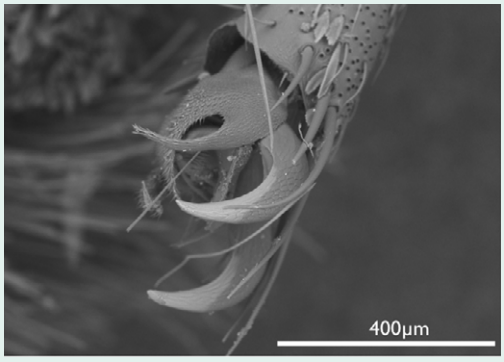
NiMH Battery Cross-Section



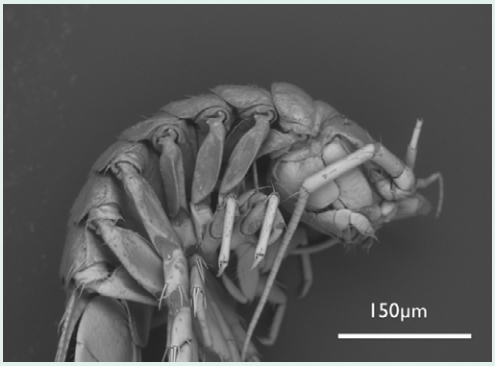
Tungsten Filament



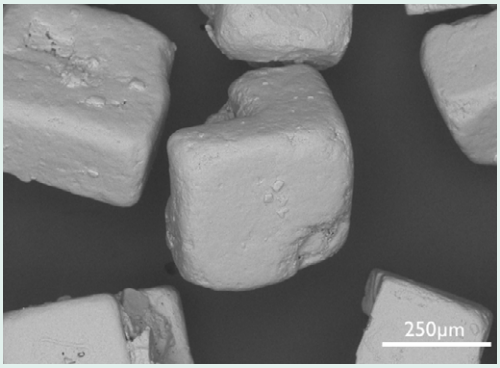
Guitar Strings



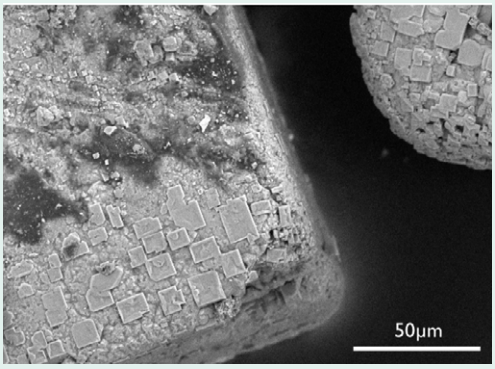
Insect Foot



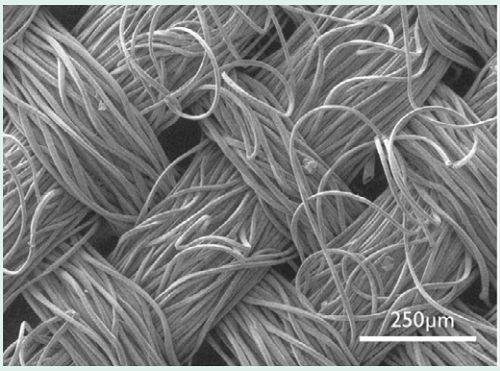
Water Slater



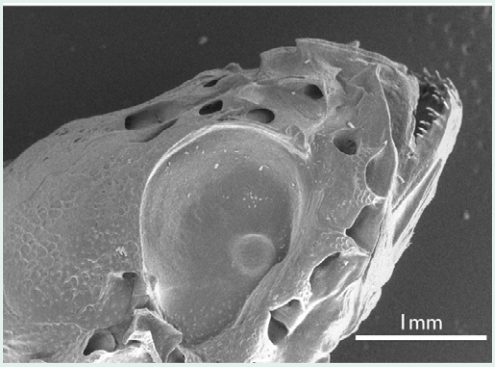
Salt



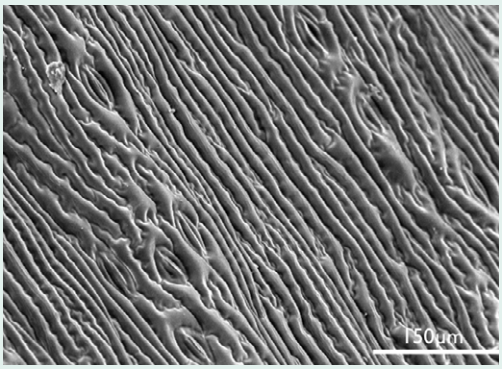
Quartz Crystal



Cotton Mask



Bullhead Fisheye



Stomata

Teacher Comments:

"It has been a great privilege to be able to use the microscope and to share it with other schools, and it has definitely helped inspire our students in their research projects. Science should be all about excitement and discovery, and the results from the Scanning Electron Microscope certainly deliver on both these fronts." Head of Science, Tonbridge School

"It is (also) a new experience for students who are interested and encourages them to pick careers in sciences. We are happy to be able to benefit from the SEM and create projects using it to get more experience with scientific instruments and tech." Lampton Academy

"We have enabled the development of enquiring minds in our students using the SEM. Again, we have given them agency over their work, students are astonished that they are 'allowed' to use this equipment for their work thus developing self-esteem and self-confidence. This was especially the case with some students who would not necessarily comfortable with academic study who have been empowered by this technology to produce excellent work. There are three students in particular for whom I would say that their SEM projects have changed the way they think about themselves and have had a profound effect on life outcomes." Liverpool Lifesciences UTC

"It was such a rewarding experience to see the children's faces light up as they observed life sciences unravel right in front of their eyes. The SEM is truly the ultimate tool to spark curiosity in the future generation of scientists." Science Technician, Tonbridge School

"Collaboration between staff, academic and industry partners and students on SEM projects has further enhanced the idea of the schools as a safe learning space where all are included and work together to secure good outcomes for all." Science teacher, Liverpool Lifesciences UTC

The Scanning Electron Microscope (SEM)

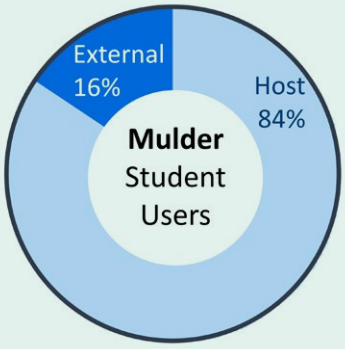
Hitachi TM4000 Plus/Plus II

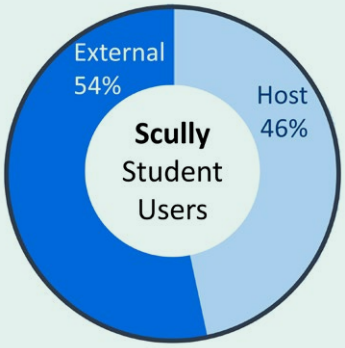
Feature highlights include 'Plug-n-Play' design to connect to power and use microscope within 15-60 minutes and variable pressure for simple sample preparation with no requirements for sample coating.

Nicknames to distinguish between the TM4000 Plus (without EDS) and the TM4000 Plus II (with EDS) are 'Mulder' and 'Scully' respectively.

The remote operation and EDS of 'Scully' facilitates more external student users.

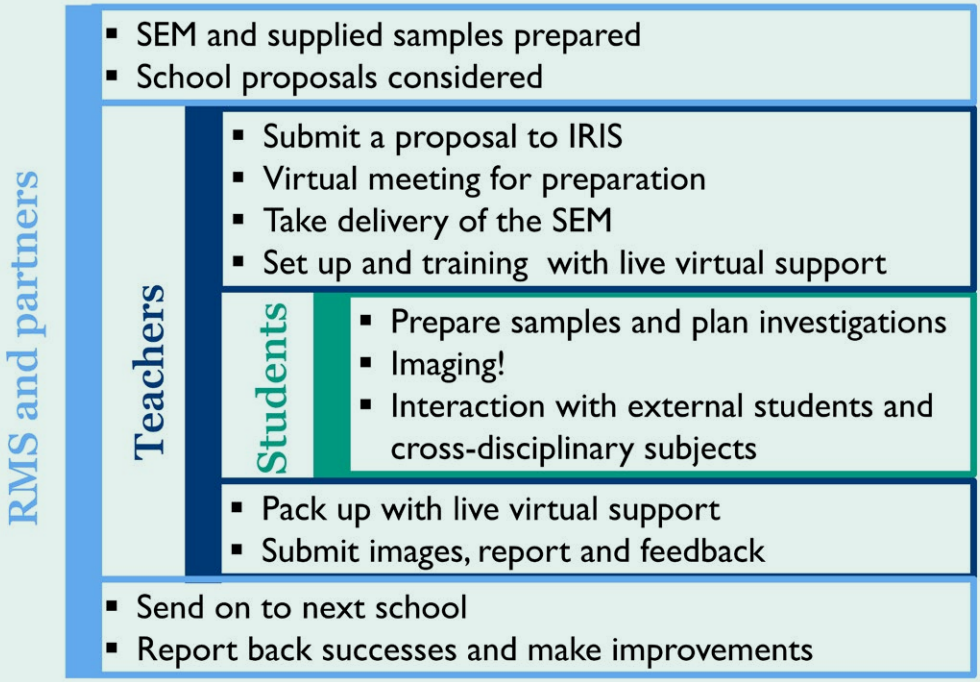




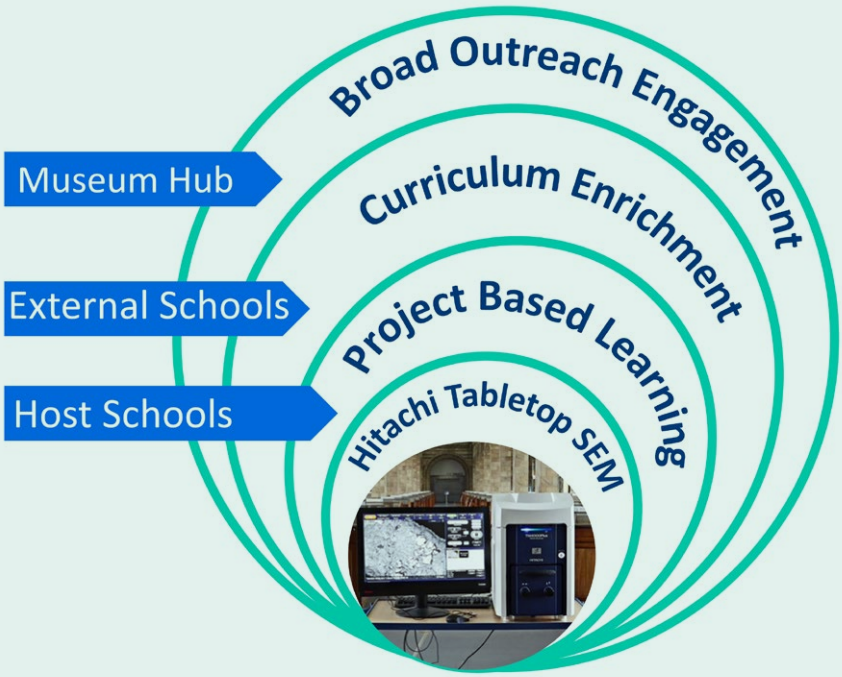


How the loan works

Free loan of potable SEM for half a term



The SEM is at the centre of multiple styles of outreach:



1. Individual Student Research Projects: an opportunity for Project Based Learning
2. Lesson and In-Class Demonstrations: integrating the SEM as curriculum teaching tool
3. Demonstrations and Workshops:



4. Wide-reaching Public Outreach: including museum visits and conference days

A hub and spoke model supports collaboration between our host schools and their local partner schools.

Private host schools fulfil their responsibility to be a community hub.

Educators' perspective

Cross-disciplinary use is taking microscopy into all spaces. (Image below)

"It was amazing, they were using metaphor and similes, the language for them was brilliant, using words like delicate!"

English teacher (Principal of Liverpool Life Sciences) talking about the students using the SEM as stimulus for descriptive languages.

Building a pedagogical framework for STEM learning (Bottom of page).

Impact report

Further detail of the logistics, success, and future plans are included in the full impact report. Available on the RMS website.

