Sherman Fairchild Foundation awards Macalester $487K for scientific equipment

St. Paul, Minn. – The Sherman Fairchild Foundation has awarded Macalester College a four-year, $487K grant for scientific equipment to enhance the college's imaging resources. The equipment will be used in courses and research opportunities across multiple departments.

The award was made as part of the Sherman Fairchild Foundation Scientific Equipment Program Phase XIII. The equipment consists of: an atomic force microscope, confocal microscope, and micro x-ray fluorescence system for use with the college's current scanning electron microscope. In addition, Macalester will obtain a critical point dryer and items that will enhance the fluorescence stereomicroscope.

Student exposure to the new instruments, through both coursework and independent research, will improve their understanding of the concepts and methods of their field.

President Brian Rosenberg said the new equipment will also help students better prepare for their careers beyond Macalester.

"If their careers take them to graduate school in fields that use these imaging technologies, then their hands-on knowledge of these instruments will strengthen their applications," Rosenberg said. "Research and course development will also benefit as additional faculty gain familiarity with the equipment."

The breadth of departments interested in the use of these instruments presents opportunities for interdisciplinary student research. Tonnis ter Veldhuis, associate professor and chair of Physics and Astronomy, and Mark Davis, DeWitt Wallace Professor and chair of Biology, led proposal development with input from other faculty in Biology, Chemistry, Geology, Physics & Astronomy, and Psychology.

"Hands-on experimenting with the state-of-the-art new imaging instruments will help Macalester students develop a deep understanding of fundamental physical phenomena at very small scales and appreciate the universal applicability of imaging methodologies throughout the natural sciences," said ter Veldhuis.

In addition to helping students, the instruments will also upgrade faculty research, adding analytical capabilities and allowing new questions to be investigated.

A description of the equipment follows:

Atomic Force Microscope (AFM):
The Atomic force microscope or AFM senses the force between a sample surface and a tip to build nanometer-resolution images of a wide range of conducting and insulating surfaces and probe a variety of material properties such as topography, magnetization, surface bonding and conductivity. The AFM can probe surfaces under ambient conditions and surfaces covered by water, advantageous for studying biological samples such as self-assembled microstructures of DNA oligomers. As a result, AFMs now find use across physics, chemistry, biology and geology.

Confocal Microscope:
Confocal microscopy advances the study of fluorescent material, producing images of greater resolution, without the out-of-focus blur inherent in conventional fluorescence microscopy. Whereas conventional fluorescence microscopy illuminates a wide field of the specimen and captures light from all focal planes,

confocal microscopy uses lasers to excite a fluorophore at the proper wavelength, illuminating a single point of the specimen at a time.

Micro X-Ray Fluorescence (XRF) System:
X-Ray Fluorescence (XRF) is a well-developed and widely used technique for the elemental analysis of trace elements in a wide range of materials in art, archeology, biology, chemistry, environmental science, forensics, geology, and physics. Typical laboratory or benchtop XRF instruments have low spatial resolution and are used to analyze relatively large bulk samples. In order to study chemical variations at small spatial scales (e.g., millimeter-scale compositional zones in minerals or fossils), samples are typically analyzed by energy or wavelength dispersive spectrometry (EDS or WDS) using a scanning electron microscope or SEM. However, while the SEM permits observations at small spatial scales, the high backgrounds produced by electron beams make the analysis of trace elements difficult. By combining a new IXRF Micro XRF system with scanning electron microscope, a high-energy x-ray source can be used to excite trace elements in samples. The secondary x-rays produced by elements are then analyzed using traditional EDS techniques.

Critical Point Dryer (CPD):
A key piece of equipment for ensuring versatility of SEM use by biologists is a critical point dryer. The CPD provides an efficient method for preparing delicate samples for SEM, expanding the types of samples available for SEM imaging.

Fluorescence Stereomicroscope Enhancements:
Macalester's current Leica MZFLIII fluorescence stereomicroscope allows examination of a range of biological specimens at low magnifications (10x-120x). It is also very useful for manipulating specimens while under magnification. The addition of a digital camera, imaging software, and a dedicated computer would expand its imaging functionality to allow viewing, preview, acquisition, post processing, image overlay, and movie/time lapse capture. Additional filters would expand the color range of fluorescent molecules available for detection.

Macalester College, founded in 1874, is a national liberal arts college with a full-time enrollment of 2,011 students. Macalester is nationally recognized for its long-standing commitment to academic excellence, internationalism, multiculturalism, and civic engagement. Learn more at macalester.edu (http://www.macalester.edu/)

April 29 2014

- About Macalester (http://www.macalester.edu/about/)
- Academics (http://www.macalester.edu/academics/)
- Admissions & Financial Aid (http://www.macalester.edu/admissions/)
- Life at Mac (http://www.macalester.edu/lifeatmac/)
- Support Mac (http://www.macalester.edu/supportmac/)