## Electron Microscopy Core

More info: <https://research.missouri.edu/electron-microscopy>

The University of Missouri Electron Microscopy Core (EMC) is a resource center for electron microscopy and broader imaging needs, providing investigators with consultation, training, access to instrumentation, and extensive services. The EMC is housed in the Roy Blunt NextGen Precision Health building and encompasses over 6,400 square feet of office space, preparation laboratories, and customized imaging suites. The EMC houses seven advanced EM imaging and spectroscopy platforms as well as all necessary preparatory equipment, and information technology support for both life and material science research. Three full-time EMC staff members are responsible for the day-to-day operation of the facility, including user training and support, custom services, and standard maintenance tasks, as well as instrument scheduling and billing. The EMC combines multiple imaging technologies across multiple length scales in one sustainable user facility. The EMC provides services and expertise in all aspects of transmission and scanning electron microscopy; in addition to imaging, this includes elemental analysis via Energy Dispersive X-ray Spectroscopy (EDS), Electron Energy Loss Spectroscopy (EELS), and Time of Flight Secondary Ion Mass Spectroscopy (TOF-SIMS)), as well as crystallographic characterization via High-Resolution TEM (HR-TEM) indexing, Selected Area Electron Diffraction (SAED), and Electron Backscattered Diffraction (EBSD)). The EMC houses eight advanced electron microscopes capable of high-resolution imaging across a broad length scale from sub 2.0 Å single particle analysis to large-volume 3D modeling of biological and materials science samples. This includes three TEMs, two dedicated SEMs, and three dual-beam FIB-SEMs:

**Transmission Electron Microscopes (TEMS)**

* Jeol JEM-1400: a high performance, high contrast, 120 kV TEM with an acceleration voltage ranging from 40 kV to 120 kV. The Jeol JEM-1400 is suitable for a wide range of biological, polymer, and materials science applications.
* ThermoScientific Titan Krios G4 Cryo-TEM: a dedicated cryo-TEM consisting of a 300 kV ultra-stable imaging platform, capable of single particle analysis (SPA), cryo-electron tomography (ET), and microelectron diffraction (MicroED). Can deliver high-throughput structural determination at sub 2.0 Å resolution, the highest resolution achievable for structural biology using Cryo-TEM.
* ThermoFisher Spectra 300 (S)TEM: a world-class aberration-corrected (S)TEM capable of imaging and spectroscopy at atomic resolution of both soft and hard materials. Tomography enables 3D characterization of specimen structure and composition.

**Scanning Electron Microscopes (SEMS)**

* FEI Quanta 600F Environmental SEM: Ideal for surface sensitive examination of tissues or materials and elemental analysis by EDS. Variable pressure vacuum modes allow for analysis of non-conductive media.
* ThermoScientific Volumescope 2: An integrated microtome enables large volume 3D modeling for life sciences via automated Serial Block Face Imaging (SFBI).
* ThermoScientific Phenom ProX: SEM with EDS that allows for rapid sample screening and routine analysis.

**Dualbeam Microscopes (FIB-SEMS)**

* ThermoScientific Aquilos2 DualBeam: Cryo-FIB: Allows for preparation of thin biological samples in the hydrated and close to native state for Cryo ET on the Krios G4 TEM.
* Facilitates in-situ preparation of cryo preserved cellular and materials science samples destined for high-resolution cryo-tomography on the Krios G4. ￼
* Cryo preservation takes advantage of superior ultrastructural preservation and reduced ion beam sensitivity during milling.
* EasyLift NanoManipulator expediates site specific lamella removal from bulk specimens. Auto Slice and View software can be utilized to acquire 3D datasets.
* The Aquilos2 Cryo-FIB is accompanied by the Leica Microsystems Thunder imager for correlative Cryo-LM and Cryo-FIB for feature of interest identification. Correlate multiple imaging modulates on a single specimen with integrated Maps software.
* ThermoScientific Helios Hydra UX DualBeam: Plasma FIB-SEM: Variable plasma sources facilitate improved FIB milling rates over traditional Ga+ systems. Incorporated TOF-SIMS allows for ppb-level chemical species identification at 50nm spatial resolution
* FEI Scios DualBeam: Housed at the MU Research Reactor to facilitate analysis of radioactive specimens. A FIB SEM combines focused ion beam (FIB) and scanning electron microscopy (SEM) techniques to allow site-specific analysis and precise ablation of materials on the micro scale. FEI Scios™ is an ultra-high-resolution analytical DualBeam™ system that delivers outstanding 2D and 3D performance for a broad range of samples, including magnetic material.

**Additional Equipment (user accessible)**

* E.A. Fishione Model 1070 Nanoclean Plasma Cleaner: Designed for cleaning residual hydrocarbons of TEM holders and SEM specimens but can be used as a general-purpose low-wattage plasma cleaner. Can input up to three gases (Ar, O, plus a third auxiliary gas) at user-defined ratios.
* Pelco Easiglow Glow Discharge: Allows investigators the ability to pursue protein structural analysis via negative staining and cryo-EM. The Easiglow temporarily alters the charge on a carbon film — this charge can be selected by altering the composition of the gas molecules in the chamber of the unit.
* Quorum 150TES Sputter Coater: Sputters a thin coating of material at a user-defined thickness. Pt is used by default for SEM imaging, but many other targets are available (Au, Cr, Ti) in addition to custom user-provided materials. Swappable head allows for carbon evaporation as well.
* Buehler EcoMet 30 Semi-Automatic Grinding/Polishing system: Hands-free polishing enables repeatable and reliable sample quality. The swappable magnetic platen system allows complete polishing of up to four resin-embedded samples in about 30 minutes.
* Buehler IsoMet Low Speed Precision Diamond Saw: Precision sectioning saw designed for cutting several types of materials with minimal deformation.
* Leica S8-APO Stereo Microscope with Flexacam C3 Camera: Stereo microscope that offers up to 80x magnification. Flexacam mount allows for live display on an external monitor and capture of 12MP images/videos.
* Leica DM1000 Compound Microscope with Flexacam C3 Camera: Compound microscope that offers up to 200x magnification in air, and up to 1000x magnification in oil. Flexacam mount allows for live display on an external monitor and capture of 12MP images/videos.