



**Canadian Centre for Electron Microscopy** provides world-class electron microscopy capabilities and expertise. We are the go-to provider of electron microscopy services and consultation to Canadian industry and researchers working in a broad range of fields. Located at McMaster University, CCEM features state-of-the-art instrumentation and experienced, dedicated staff who are happy to work with you to find solutions to your research and development questions.

# Life Sciences

**The resolution achieved** with electron microscopy makes it an invaluable tool for biological and biochemical investigation, clinical diagnosis and medical research. Through characterization at the micron and nanoscale, we can study the function, structure, and life-cycle of different pathogens, diseases, and genetic mutations, thus aiding researchers to develop methods to prolong and improve human-life.

## We can provide

- Chemical specimen processing and resin embedding of biological samples
- Room temperature and frozen sectioning of samples
- Structural and compositional data and elemental maps of biological cells/tissue, polymers, viruses, and small molecules
- Immuno-labelling techniques

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“ I am a relatively new user but to be honest the experience [at CCEM] was incredible. We obtained fast service, knowledgeable and helpful staff, and the characterization was incredible. We are restructuring our research to better utilize this great resource. ”

Anonymous user from 2020 Annual User Survey

## Investigation of abnormal eye structure development due to genetic mutation

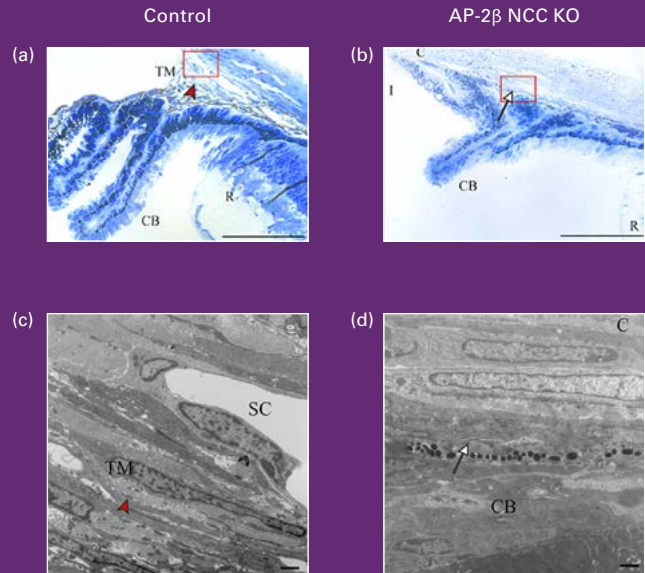
Genetic research on mice provides practical information on genetic risk factors for the same diseases in humans. TEM can be employed to study the specific ultrastructural changes to eye development caused by genetic modifications. Targeted loss of transcription factor AP-2 $\beta$  in embryonic periocular mesenchyme cells results in defects in the iridocorneal angle tissue of the eye. These defects can lead to rare ocular diseases and early onset glaucoma.

Transmission electron microscopy (TEM) can be used to compare the trabecular meshwork cells of control mice to AP-2 $\beta$  neural crest cell knockout (NCC-KO) mutant mice. The top panels (A, B) are toluidine blue stained sections of the mice from the postnatal day (P), P14, at the iridocorneal angle. Higher magnification images (C, D) come from the approximate regions of interest shown by the red boxes in images A and B. The mutant mice displayed abnormalities in the iridocorneal angle (labeled by arrows in A and B), and notable condensing of angle tissue and ciliary body tissues which are no longer clearly defined. Trabecular beams surrounded by trabecular meshwork cells are visible in C (red arrow) and Schlemm's canal endothelial cell is clearly evident (black arrow). These features are not distinguishable in D and the boundary between corneal stroma and angle tissue is unpronounced (white arrow).

TM – trabecular meshwork, CB – ciliary body, I – iris, R – retina, C – cornea, SC – Schlemm's canal

Top panel scale bars = 100  $\mu$ m. Bottom panel scale bars = 1  $\mu$ m.

REFERENCE Akula M, Taiyab A, Deschamps P, Yee S, Ball AK, Williams T, West-Mays JA. AP-2 $\beta$  is required for formation of the murine trabecular meshwork and Schlemm's canal. *Exp Eye Res.* 2020 Jun;195:108042. doi: 10.1016/j.exer.2020.108042. Epub 2020 Apr 27. PMID: 32353428.



## Evaluating the effectiveness of new compounds for use as antibiotics

The discovery of new antibiotics is essential to combat drug resistant bacterial strains. A comprehensive phylogenetic study of glycopeptide compounds that are created by soil bacteria led to the finding of two antibiotics, corbomycin and complestatin. These antibiotics kill bacteria in a novel way by blocking the function of the bacterial cell wall to remodel and divide. The antibiotics have been shown to be effective against MRSA infection in mice. Electron microscopy can be employed to show morphological effects of the antibiotics on targeted bacteria.



Effects of corbomycin and complestatin on the morphology of *Bacillus subtilis* as shown by TEM. Exposure to both antibiotics results in a twisted phenotype. The red triangles mark sites of abnormal division septa formation, thickened cell walls and granular formation.

Scale bars = 200 nm.

REFERENCE Culp, E.J., Waglechner, N., Wang, W. et al. Evolution-guided discovery of antibiotics that inhibit peptidoglycan remodelling. *Nature* 578, 582–587 (2020). <https://doi.org/10.1038/s41586-020-1990-9>