IMPROVING HUMAN HEALTH

IMPROVED TREATMENT FOR KIDNEY FAILURE

Over two million people worldwide depend on dialysis or a kidney transplant, according to the National Kidney Foundation. Using the CLS, researchers developed a better membrane for dialysis machines that could lead to safer treatment and improved quality of life for patients with kidney failure. Some of the commercial membranes currently in use contain heparin, a medicine that reduces blood clots; however, the membranes also have an intense negative charge on their surface that causes serious side effects. The new membrane not only reduces blood clotting but also has a neutral surface that is biocompatible and should lead to improved outcomes for patients.

DOI: 10.3390/membranes13080718

REDUCING FAILURE IN HIP IMPLANTS

Researchers from the University of British Columbia used the CLS to identify the cause of hip implant failure. A small number of patients will suffer from an implant failure that causes various symptoms and will require an implant replacement. As an implant breaks down in the body, it can shed tiny metal particles and ions and cause adverse reactions in local tissue. The team's research focused on understanding the chemical nature of these damaging particles and precisely how they are produced. Their study has opened the door for research into how cells react to the particles and cause these reactions.

DOI: 10.1016/j.mtla.2022.101433

BATTLING ANTIBIOTIC-RESISTANT PATHOGENS ON SURFACES

Using the CLS, researchers from the University of Windsor developed a unique material engineered to limit disease spread and replace cumbersome cleaning protocols on high-touch surfaces like door knobs and hand rails. The material is a compound of ionic (salt-based) fluids and copper nanoparticles that can coat surfaces and provide germ-free protection that lasts far longer than conventional bleach-based cleaning. It takes advantage of copper's natural germicidal properties. Now the team is formulating a new combination of materials that will be easy to apply to surfaces and durable. The group's results are published in the journal *RSC Sustainability* under the creative title "Lethal Weapon IL (Ionic Liquid)."

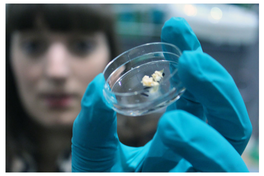
DOI: 10.1039/D3SU00285B

KEEPING AGING BRAINS LIGHTNING FAST

Researchers from the University of Northern British Columbia pinpointed the causes of brain aging and how we can prevent or reverse the damage of time. Myelin degradation is one of the contributing factors to lapses in memory and cognition. The fatty substance covers the neurons in the brain and spinal cord, helping to insulate the connections between cells and allowing lightning-fast information flow through the nervous system. As we age, the brain becomes less flexible and rewiring pathways becomes more difficult, leading to changes in learning and memory. The team used the Mid-IR beamline to learn more about how changes in the brain impact myelin formation and degeneration, and found that there are distinct changes in the fat composition in myelin with age.

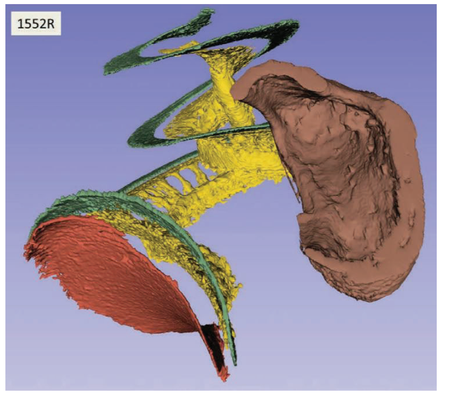
DOI: 10.1007/s11064-021-03491-y

THE DIFFERENCES IN HEART DISEASES



Researchers from McGill University uncovered new information about heart disease using the CMCF beamline. The scientists analyzed the build up of minerals in damaged heart valves but, to their surprise, found there is a difference in the mineral composition between male and female samples.
They also found that the growth of mineral deposits is slower in women and that different types of mineral are deposited on the surface of the valves in the hearts of females. Because current diagnostics are skewed toward the identification of heart disease primarily in men, the team's findings could inform development of diagnostics and therapeutics that target women.

DOI:10.1016/j.actbio.2020.02.039



MAPPING THE INNER EAR

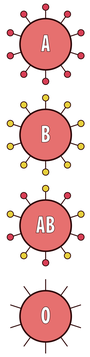
Using the BMIT beamline, an international team of researchers created three dimensional images of the cochlea, a spiral-shaped structure in the inner ear. This cochlear mapping enabled the researchers to understand anatomical variations and could lead to better design and placement of cochlear implants. The team was able to see how electrodes fit inside the structure and how they stimulate the auditory nerve. They were able to assess how deeply electrodes can be placed within the ear and create optimal stimulation strategies for the nerve, helping to create better implants for patients.

DOI: 10.1097/01.ED.0000000000000735.

CREATING A UNIVERSAL BLOOD TYPE

In 2015, researchers at the University of British Columbia identified a series of enzymes that could convert Type A blood into Type O blood, the universal donor type. The team used the CMCF beamline at the CLS to better understand how the enzymes cause this change. The team demonstrated that the enzymes they discovered are very efficient at making this conversion both on the surface of red blood cells and on the surface of donated human organs such as lungs or kidneys. Avivo – the company launched to bring this technology to the marketplace – is now finetuning both applications. If successful, this exciting advance would be a huge step forward in addressing shortages in blood and organ supply in Canada and around the world.

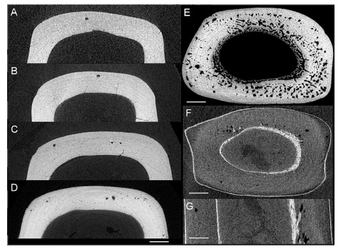
DOI:10.1038/s41564-019-0469-7



NEW TECHNIQUE TO IMPROVE OSTEOPOROSIS TREATMENT

A research team from the University of Saskatchewan developed a new imaging method that detects changes in bone tissue far quicker than bone densitometry scans. While the study was done using a rabbit model, the results could lead to improved drug treatment in humans with osteoporosis. Using the BMIT beamline the scientists were able to see the incredibly tiny pores inside cortical bone, the dense outer surface of bone that accounts for the majority of bone mass. These pores change over time, as bone tissue is continuously removed and replaced.

DOI: 10.1002/jbmr.4700



Bone scans done by the researchers using our BMIT beamline.