DEVELOPING NEW DRUGS

NEW MATERIAL IMPROVES DRUG DELIVERY

Researchers from Western University developed a material that could eventually improve the way drugs are administered to patients, by allowing doctors to "see" exactly whether drugs are reaching their targets and working properly. By combining a material already used to deliver medication to specific sites in the body with another that glows in the dark, the team created a composite that can be used to track the path of a drug carrier through the human body. In the short term, the new approach could be used to monitor medication used for cancer and bone diseases, and could eventually have a wide range of other therapeutic applications.

DO: 10.1039/D2PD04721J

NEXT GENERATION OF MEDICATIONS

As antibiotic resistance continues to grow, we need new drugs that the bad bacteria in our bodies don't recognize. Researchers from McGill University discovered how molecular machinery inside microbes builds antibiotics. The molecular machines they studied are called nonribosomal peptide synthetases, or NRPSs. They build some of the most important compounds in current health care and environmental treatments, including antibiotics, anti-cancer agents, and immunosuppressants. Researchers have been working on this problem for decades; this discovery is a major step forward in our ability to create new therapies whose effectiveness will endure in the battle against bacterial infections.

DO:10.1038/s41586-024-08457-4

HOW HIV EVADES THE IMMUNE SYSTEM

About 42 million people have died from AIDS-related illnesses and approximately 40 million people globally are living with HIV, according to the World Health Organization in 2024. Researchers from the University of Toronto investigated key proteins on the HIV virus that are crucial to developing an effective vaccine. Using the CMCF beamline, the research team analyzed the outer proteins on the HIV virus. They discovered that an area of one protein acts as a decoy-- diverting the immune system's response towards a false target. The team hopes that their research will provide a strategy for future vaccine design that will avoid this region, allowing for a better immune response and a more effective vaccine.

DO: 10.1038/s42003-022-03220-w.

NEW HOPE FOR FIGHTING MALARIA

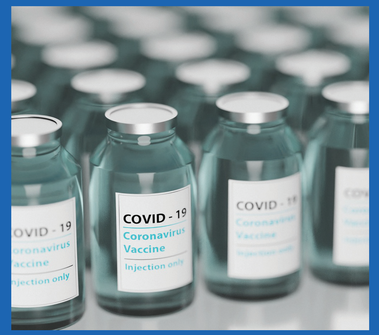
Malaria is a deadly disease spread by mosquitoes. An international team that included researchers from SickKids in Toronto used the CLS to develop a new vaccine that looks promising in lab tests. They studied blood from people who have natural immunity to find the parasite proteins with the biggest role in transmission. By joining the two most potent parts into one vaccine, they were able to achieve a very strong immune response. X-ray imaging showed that human antibodies stick to the relevant proteins and how they do so. If the vaccine candidate continues to perform well in testing, it could soon move to clinical trials.

DO: 10.1038/s41467-024-48765-1

IMPROVING ANTIVIRAL MEDICATION FOR COVID-19

Researchers from the University of Alberta used the CLS to improve Paxlovid so it can be used by people who are immunocompromised or have other chronic conditions. The COVID antiviral uses a second drug as a metabolic booster to keep the active drug in the bloodstream longer. However, this additive can interact with other medications. The U of A team modified a specific area of the molecule in the active drug so it stays in the system – meaning an additional "booster" drug is not necessary. The team is now working to expand what they learned to design drugs to help fight other viruses.

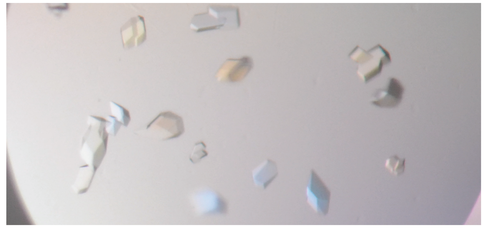
DO: 10.1021/acsinfecdis.3c00559

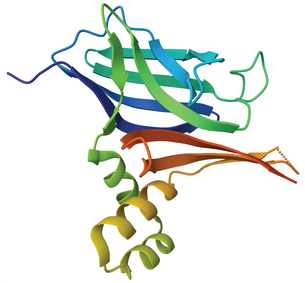


NEW TARGET IN ANTIBIOTIC-RESISTANT BACTERIA

Antimicrobial resistance poses a growing threat to public health. Using our CMCF beamline, researchers from the University of British Columbia and McMaster University generated an atomic level "blueprint" of a protein called TarL that's located within methicillin-resistant Staphylococcus aureus (MRSA). It produces an acid that helps bacteria cells evade our immune system and continue to spread. Membrane proteins like TarL are notoriously tough to characterize. By deepening our understanding of TarL, this research can help inform development of drugs that precisely target and block the mechanisms that allow bacteria to proliferate.

DO: 10.1126/sciadv.adj0860





Left: protein crystal structures imaged at the CLS. Right: the TarL protein blueprint generated by the researc

UNDERMINING THE FOUNDATIONS OF BACTERIAL RESISTANCE

Scientists from the University of Guelph have used the Canadian Light Source (CLS) at the University of Saskatchewan to better understand how several infectious bacteria, including *E. coli.*, build a protective sugar-based barrier that helps cloak their cells. The study provides very early steps toward new treatments for *E. coli* and a whole range of bacteria. The researchers are focused on strains of *E. coli* that cause urinary tract and bloodstream infections, particularly those that are antibiotic resistant. They are working to understand the enzyme that many infectious bacteria use to build the foundations of their protective capsule, which helps shield the bacterium from attack by the human immune system. This foundation could serve as a common point of attack, allowing a single treatment for several key pathogens infecting humans and livestock.

DO: 10.1016/j.jbc.2023.104609