A Race to Arms: The Pace of Advancement in Medical Research

Lecture Series Outline

Daniel Burnside

- Tuesdays, 10 a.m. to 12:00 p.m., May 18 – June 22.

Description: The COVID-19 pandemic demonstrated how incredibly quickly, and effectively modern medicine can innovate when called upon. However, there are other areas of medical research that seem to have reached stalemates, or roadblocks, unable to overcome certain hurdles or develop revolutionary new technologies. This series will focus on the varying pace of advancement in medical research and discuss how different fields have experienced dramatically different patterns of progression. Local, and Canadian research will be highlighted.

Week 1: Fundamentals of Medical Research

- A general introduction and overview of the medical research landscape – with a focus on Canada.
- Clinical trials – Traditional drug development vs. expedited testing. When has need immediate need potentially trumped sufficient safety review?
- What is required to get Health Canada approval? How does this compare to other countries?
- Lessons learned from drug approvals – e.g. Thalidomide, Accutane
- Is there sufficient incentive for drug development in Canada? Providing protection for drug developers while keeping costs to patients low.

Week 2: Tools made for Speed

- An overview of major advances in medical research.
- Designing new drugs with computers – Science fiction or science fact?
- DNA sequencing, examples of where this technology has allowed rapid advancement.
- High throughput screening – how to test thousands of drugs very quickly.
- Repurposing drugs – When a drug is deemed safe for preventing hair loss, can it quickly be approved to treat hypertension? Several examples of repurposing new drugs will be discussed.

Week 3: Alzheimer's

**Note – this topic was covered in a previous series in 2018 but the field has rapidly evolved since.

- What do we know so far and why is the prevalence of this disease increasing?
- Recent clinical trials – huge investments, lots of hope, mixed results.
- Has research hit a wall? Is prevention the best option?
- Is a silver bullet solution possible?
- Future promise – Is prevention the key or can modern medicine make a breakthrough.

Week 4: Inflammatory Bowel Diseases – Chohn's and Colitis

- What are these diseases and why are they quickly becoming more prevalent in people of all ages?
- Microbiome
- Some major advances in combination therapies, pre/probiotics and dietary changes?
- Local research focus.

Week 5: Antibiotics and Drug Resistant Bacterial Infections

- Has the development of new antibiotics stalled?
- The rising threat of antibiotic resistant bacteria.
- Without antibiotics, can many modern medical treatments continue?
- A look at the wide range of methods to find new antibiotics.

Week 6: COVID-19

- Drug discovery in warp speed
- The role of computer models in developing new drugs.
- Speed and variety of vaccine development
- Future variants

Biography: Daniel Burnside is trained as a molecular microbiologist and has been involved in research and innovation in a variety of different fields over his career. After receiving a B.Sc. with a concentration in Health Science, he later received a PhD from Carleton University. Work during his thesis involved the development and validation computational tools for engineering completely novel synthetic proteins and drugs, the identification of novel DNA repair proteins, and understanding biological pathways in various scenarios such as during HIV and Zika Virus infection. Daniel also worked for a Biotechnology company that evolved out of the research completed during his PhD. Later, he did postdoctoral work at the University of Ottawa Faculty of Medicine investigating the use of patient-derived intestinal organoids for studying Inflammatory Bowel Disease before beginning work in the intellectual property field. He currently works as a patent professional at an intellectual property firm, focusing on securing patent protection primarily in the fields of health, chemical inventions, biotechnology, and bioengineering.

Daniel's goal is to make science accessible and understandable to anyone. He has taught a variety of undergraduate courses at Carleton University including Microbiology of Health and Human Physiology. His seminars are not only informative, but also entertaining, engaging, and directly applicable to everyday life. He uses simplified explanations, metaphors, and modern examples to impart knowledge that can be translated directly from the classroom to the community. No previous scientific knowledge is needed to enjoy his lecture series.