Emerging Trends, Disruptive Technologies and Innovations in Veterinary Diagnostic Science

Combining Diagnostic Laboratory with Structured Data and Artificial Intelligence to enable better medicine – *Jon Lustgarten*

Many diagnostic laboratory systems do not allow or enable the work to be easily shared or extended from within clinical practice. What we will attempt to do is walk through different steps and ideas on how to bring the information that is produced everyday together, putting a structure to it, adding artificial intelligence, and hopefully, produce new and meaningful results across various aspects. We will use examples of routine diagnostics, histopathology, cytology, zoonotic disease (and surveillance), and quality assurance/validation as conduits for demonstrating the above concepts. We will also introduce vocabularies such as LOINC and advanced modeling and learning techniques such a probabilistic and deep learning. By the end of the talk, our goal is to have at least one identifiable step for every attendee to apply to their laboratory.

Diagnostic Pathology in the Age of Genomics - *Barbara Davis*

To envision the future of veterinary diagnostics, we need only to look at the roadmap set forth by the key role that molecular diagnostics play in transforming human medicine. With respect to cancer, the great advances in genomics have propelled the development of rapid, sensitive and more accurate diagnostics that enable clinicians to make better treatment decisions based on the molecular profiles of the particular cancer. Indeed, the first lesson learned was the understanding that even though cancers look the same under the microscope, they can have very different molecular or genomic profiles and consequently very different responses to therapy. As we translate these genomic approaches to the everyday practice of veterinary diagnostics, a number of challenges need met. These include the need to perform molecular analysis from formalin-fixed paraffin-embedded tissues, cell aspirates or blood while maintaining accuracy, specificity and sensitivity; the need to have these tests at reasonably affordable costs to a pet-owner; and the ability to perform in a high-volume, high through-put laboratory environment. The exciting news is that we are indeed meeting these challenges, which will be discussed in detail from the basics of genomic approaches to the development of relevant diagnostics and towards the future of veterinary diagnostic pathology in the age of genomics.

Diagnostic bacteriology service delivery in the era of antimicrobial resistance crisis: Re-defining the veterinary approach. – *Musangu Ngeleka*

Antimicrobial resistance (AMR) is a global public and animal health crisis recognized by the World Health Organization (WHO). Commitment to fight AMR received the highest level of political endorsement at the United Nations General Assembly. The resulting WHO Global Action Plan and Pan-Canadian AMR Framework challenge animal health scientists and diagnosticians to provide support for enhanced antimicrobial stewardship in veterinary medicine. National stewardship initiatives include changes to Canadian regulations effective December 1, 2018 that will require prescriptions for the sale

of all medically important antimicrobials for use in animals.

There are three key objectives in improving the veterinary diagnostic bacteriology service delivery to help inform prudent antimicrobial usage in animal healthcare and animal agriculture:

- Streamlining and revising classical bacteriology methods to expedite turnaround time and diagnostic information handling;
- Exploring novel technology for benchtop and point-of-care applications to provide accurate and rapid diagnostic test results to veterinarians;
- Strengthening professional communication and continuing education.

Harnessing antimicrobial resistance data from diagnostic laboratory LIMS to the benefit of animal and human health. – *Susan Sanchez*

The WHO and the CDC have recognized antimicrobial resistance (AMR) as "one of the greatest threats to human health in the 21st century". Not only resistance is increasing, but the antibiotic pipeline is also dry. The future is bleak to the point of some report estimating that the number of human deaths in 2020 due to AMR will be 10M with a cost of $88 Trillion. AMR is a quintessential One Health problem with human, animal and environmental use/accumulation being part of the problem. Therefore, the solution must be addressed at these three levels and soon. The need to implement appropriate antimicrobial stewardship guidelines and implementations measures is paramount. Nevertheless, the antibiotic prescribers are human and therefore subject to multiple pressures, including the need for a happy patient/client that will come back. In human medicine has been understood for some time that the integration of Laboratory Information Management Systems (LIMS), Electronic Medical Records (EMR) have considerable potential in helping prescribers with information regarding the prevalence of AMR locally and nationally. Regrettably, most in human medicine and none in veterinary medicine today can assimilate Antimicrobial Resistance Programs (ARP) without third-party vendors and considerable investments in IT. These third-party vendors can sustain clinical decision support systems (CDSSs) that, when integrated within the EMR, have been shown to improve the function of ASPs significantly. CDSSs can alert a clinician about a drug-drug interaction, or they may serve a more involved role as a clinical tool to aid in the management of community-acquired infections providing a recommendation regarding the appropriateness of inpatient or outpatient therapy. This presentation will discuss how several current third-party vendors have achieved integration in human hospitals and how such technology can be integrated to veterinary medicine systems allowing diagnostic laboratories, veterinary hospitals, and corporate veterinary medicine groups, thus bringing veterinary medicine in the fight against AMR.

Real-time integration of MALDI-TOF and BIOMIC data into an electronic bacteriology workflow – *Dan Andrews*

Shifting from paper to electronic bacti worksheets provides opportunities for reducing transcription errors, eliminating redundant steps, maintaining turnaround time at peek capacities and enhancing the tracking and reporting of bench level lab processes. The ability to query activities on the bacti bench can provide unexpected process insights ranging from training issues, consumable costs through to time savings and scheduling optimizations. Creating a new

digital process that still felt like the manual bacti workflow was critical to our success. We used value-stream mapping that was performed with our business analyst, IT and the entire bacti team. Sample barcoding as well as isolate barcoding helped eliminate redundant marking pen writing. Well coded samples and isolates were integrated into our bench process from planting through to susceptibility plates and MALDI-TOF plate definitions. Creating the digital worksheets allowed for MALDI-TOF and BIOMIC data capture to be integrated into our process.