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# Joint Symposium

## J-1

Plant-made Vaccines and Therapeutics for COVID-19. HENRY DANIELL. Department of Basic and Translational Sciences, School of Dental Medicine, University of Pennsylvania, Philadelphia, PA 19104-6030. Email: hdaniell@upenn.edu

Amidst the emergence of new SARS-CoV-2 variants like omicron with higher rates of transmissibility, a large majority of global population still remain unvaccinated. Among 7.51 billion administered doses, 52.1% are in developed countries but only 4.5% in low-income countries. Only 2% of the African continent is vaccinated even though it has >17% of the global population. SARS-CoV-2 injectable vaccine using virus like particles from tobacco made by Medicago was recently approved by Health Canada. While injectable vaccines save lives, limitations include inadequate mucosal immunity at the surface of virus entry, thereby not preventing virus transmission. A recent study on community transmission and viral load kinetics of the SARS-CoV-2 delta variant in vaccinated and unvaccinated individuals in the U.K revealed that fully vaccinated individuals with breakthrough infections had peak viral loads similar to unvaccinated individuals and efficiently transmitted SARS-CoV-2 in household settings. Therefore, plant-made oral booster vaccines, free of cold chain could play a critical role in addressing challenges of current vaccines. Populations where vaccines are not yet available, cost-effective measures to minimize virus transmission are needed. The oral cavity is an important portal of entry for SARS-CoV-2 virus because oral epithelial cells are enriched in viral entry receptors. Salivary glands are a primary site of replication of this virus and oral transmission is 3-5 orders of magnitude higher than nasal transmission, with speaking four words releasing more virus particles than one hour of mask-less breathing, suggesting that decrease in oral/throat viral load could have substantial effect on virus transmission. Recently, plant-made CTB-ACE2 chewing gum was shown to efficiently trap SARS-CoV-2, thereby debulking virus from saliva of COVID-19 patients and minimizing symptom development by clearing the throat area, where virus infection is initiated. Contribution of plant science to address challenges of recent pandemic will be discussed.

## J-2

Biotechnology for the Next Generation of Veterinary Antiviral Vaccines. H. VU. University of Nebraska-Lincoln, Nebraska Center for Virology and Department of Animal Science, 4240 Fair St, MOLR 111, Lincoln, NE 68583. Email: hiepvu@unl.edu

Viruses are obligate intracellular parasites which must enter permissive cells to replicate. Viral diseases are the leading cause of livestock production loss. Vaccination is the most cost-effective method to mitigate the impact of viral diseases in livestock. Two major mediators of vaccine-induced protection include neutralizing antibody and cytotoxicity T cells. Virus-neutralizing antibodies bind to viral surface proteins and block virus entry into permissible cells. On the other hand, cytotoxicity T cells kill virus-infected cells, thereby eliminating the virus. An effective vaccine should elicit both neutralizing antibody and cytotoxicity T cell responses. Conventionally, antiviral vaccines are formulated using inactivated viruses or attenuated viruses. The conventional approaches are not suitable for the development of vaccines against viruses that cannot be cultivated due to the lack of a suitable cell culture system. Advances in biotechnology have made it possible to develop novel safe and effective vaccines without the need of virus cultivation. There is a class of viral proteins that are responsible for viral attachment and penetration to the cells. These viral proteins are considered protective antigens and are ideal targets for vaccine development since immune responses against these proteins are sufficient to prevent infection. Multiple approaches can be used to induce an immune response to the protective antigens. For instance, genes encoding the protective antigens can be inserted into a protein expression vector to produce large quantities of recombinant proteins to be used as protein-based subunit vaccines. Alternatively, these genes can be inserted into viral vectors which will be administered to animals as viral vector-based vaccines. These protective antigen genes can also be administered to the animals in forms of DNA or mRNA. Biotechnology has been playing a major role in the development of new generations of veterinary antiviral vaccines with improved levels of safety and effectiveness.