

Report Keystone symposium

Immunity to Veterinary Pathogens: Informing Vaccine Development



view, friendly people and sunny weather eased the pain.

This Keystone symposium was held in Keystone (Colorado, United States), which is the home of the Keystone Resort Ski area. Keystone is located in the Rocky Mountains, 2830 meters above sea level. Unfortunately, I was struck by altitude sickness, which caused nausea, headache and dizziness. Increased water intake was the only remedy to help me to acclimatize. Although suffering from altitude sickness, the mountain

The conference centre was easy to reach because of the well-organised shuttle buses driving from the hotel to the conference centre every 10-20 minutes. The first day of the conference, we received a warm welcome with drinks and the possibility to network with many junior and senior scientists.

I noticed that most of the attendees were specialised in veterinary medicine and thus work with larger laboratory animals than rodents. Therefore, in this veterinary conference, I have learned more about other species than mice, humans and pigs, the species I work with. However, including more human immunologists in this conference would give the opportunity to better compare between humans and other species, which could lead to new insights and an increased knowledge about the (global) immune system across the species barrier.

Because of its veterinary focus, many talks included pig's research, which was very interesting to me and my research. The most interesting talks for

my research were those based on the mucosal immune responses and vaccine design. By attending these sessions, I learned more about the progress made in unravelling the complex system of mucosal immunology and how this knowledge can be used in vaccine design studies.

Talks from Professor Artur Summerfield and Professor Armin Saalmüller were in particular very instructive, because of their focus on porcine immune cells. Prof Summerfield attempts to classify dendritic cells (DCs) of pigs and identify specific factors influencing pDC responses. Prof Saalmüller described the immune response of CD4⁺CD8⁺ T cells after influenza virus infection. These responses were measured in PBMCs, lung lymph nodes and bronchial lymph nodes. The immune response against influenza virus is first visible in porcine lungs, where multifunctional T cells are activated. Multifunctional T cells perform several functions at the same time, like cytokine production and degranulation. These cells have a central role in the establishment of protective immune responses and therefore, multifunctional T cells may serve as a correlate of protection in immunization studies. Identification of these specific T cells, which are associated with protection against pathogens, can be used in vaccinology studies. Other T cell analysis can be useful as well: evolution of T cell responses, recognition of epitope variants, evaluation of vaccine-induced T-cell responses and the comparison of T cell compartments.

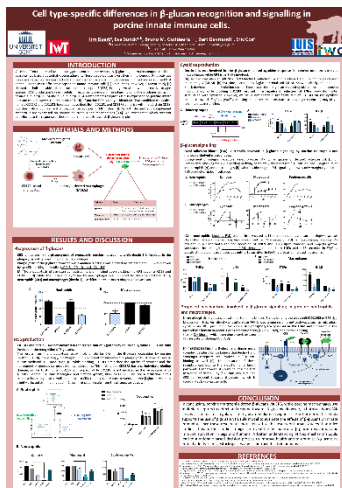
Besides correlation of protection, vaccine formulation and different immunization studies were discussed as well. The presentation of Professor Linda Saif about the beneficial effects of probiotics on mucosal vaccination stands out. Neonatal gnotobiotic pigs were orally administered with two



dominant bacterial species; *Lactobacillus rhamnosus* strain GG and *Bifidobacterium animalis lactis* Bb12. The co-localisation of these probiotics was used as adjuvants in the attenuated human rotavirus (HRV) vaccine. Following HRV challenge, probiotic-colonized vaccinated pigs had significantly lower faecal scores and reduced HRV shedding titres compared to uncolonized vaccinated pigs. These probiotics have beneficial effects on the host by interacting with the intestinal epithelial cells and the intestinal immune cells.

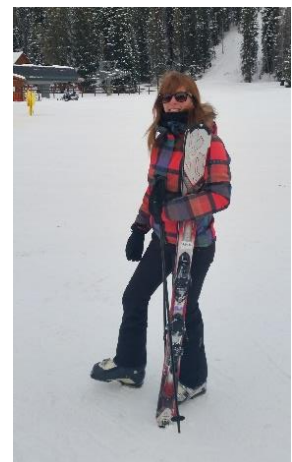
Talks about vaccine formulation were focussed on searching the best method to identify pathogen antigens for vaccine design. Personally, I was more interested in the chemical formulation of subunit vaccines than the different methods to search for the best antigen. I expected to learn more about the new technologies to design subunit vaccines. Nevertheless, one poster had drawn my attention. It detailed the development of a subunit marker vaccine based on yeast cells (verovaccines). Therefore, the pathogenic antigen VP2 was genetically cloned in the DNA of the food grade yeast *Kluyveromyces lactis*, followed by lyophilization of the yeast cells. This whole yeast material consists of individual viral proteins inside these particles with the advantage of the adjuvant character of *K. lactis*. Since my research recently focused on the development of yeast cell wall β -glucans as an oral vaccine delivery system, information about this newly yeast-based vaccine is very interesting for my research.

The second day of the conference, I had the opportunity to present my scientific poster, which reports on the role of the β -glucan receptors dectin-1 and complement receptor 3 (CR3) in the response of innate immune cells towards β -glucans in pigs. My poster elicited many sincere interests of (very friendly) junior and senior scientists, who gave interesting tips for further research.



Since I received the IUIS/VIC award, I was invited to attend the 'Meeting the Scientist Workshop Luncheon' on the third day. In this workshop, I had the opportunity to discuss with senior scientists and to listen to their career development. After presenting my research to the other bursaries, we could discuss with each other and ask the senior scientists for their advice for further career options.

During breakfast, coffee break and dinner, there was plenty of network opportunities. At breakfast and dinner, seating arrangement was opportune to communicate with other junior and senior scientists. Furthermore, two afternoon excursions were organised. Personally, skiing was the most attractive activity to do in Keystone, so I took the opportunity to ski in the Rocky Mountains. Discount prices for renting skiing material and buying skiing passes was distributed. The skiing trip was incredible and the view from the top of the mountain was priceless.



In general, the organisation of the conference was excellent, the attendees were friendly, and the sessions were very instructive. Many network opportunities were created and the incredible location was used to build up connections. Despite the altitude sickness, I would recommend this conference to other junior scientists.