

News from World Immune Regulation Meeting-V, 24-27 March 2011, Davos, Switzerland

The topics discussed at the WIRM-V meeting were very broad and interesting, covering a wide field in immunology. Since it is impossible to summarize everything, I will discuss the influence of diet and intestinal flora on immune responses, as this was a recurrent subject throughout the meeting. I will summarize a few presentations (given by E.G. Pamer, C. MacKay, D.R. Littman, Y. Belkaid, R. Maizel, M. Geuking) that were most interesting in relation to my own research, which is about the intestinal immune system and food allergy.

Intestinal flora and diet are very important factors for proper functioning of the immune system. The composition of microbiota in the colon is different between individuals and differs throughout the colon. Compounds present in our diet and specific microbiota and/or their secreted products can affect intestinal epithelial cells, dendritic cell subsets and T cell subsets, thereby shaping immune responses.

Vitamin A, present in our diet, is a very important compound in shaping immune responses, since it can induce either an effector or a regulatory immune response. Intestinal CD103⁺ DCs are good APCs and can metabolize vitamin A into retinoic acid (RA). RA can control T cell priming, homing (by upregulating CCR9 and α 4B7) and induce DC activation (IL-6 and IL-12 production). RA can be sensed by RAR α . This receptor is very important for development of immune responses, since in the absence of this receptor T cell signal transduction pathways are affected, resulting in impaired T cell function. If there is an acute infection, there is an increase of vitamin A metabolism in both spleen and LP. An infection with *T. Gondii* for example results in an increase of neutrophils (which can process vitamin A) in the intestine. The importance of vitamin A to induce an immune response is further illustrated by the fact that vitamin A deficient mice have impaired (Th17) immune responses.

However, RA can also induce regulatory responses. In the lamina propria there is a balance of T_{reg}/Th17 cells. The presence of IL-6, IL-21, IL-23 and small amounts of TGF- β results in the induction of ROR γ t cells, whereas the presence of RA and high levels of TGF- β results in the induction of Foxp3⁺ cells. This shows that nutritional status and the cytokine environment are very important in the regulation of adaptive immune responses.

Next to compounds present in our diet, bacterial products also affect immune responses. Short chain fatty acids (SCFA), e.g. acetate and propionate, are bacterial products which have anti-inflammatory properties. They reduce the migration of neutrophils and improve intestinal defense by epithelium. SCFA act through the newly identified receptor GPR43 (G-protein coupled receptor 43). GPR43 is mainly expressed on innate/inflammatory leukocytes, such as neutrophils, eosinophils and activated macrophages and functions as a chemoattractant receptor. Ligation of GPR43 reduces migration of neutrophils. For example, acetate binding to GPR43 has been shown to protect mice from DSS induced colitis and OVA/alum induced airway inflammation.

In addition, intestinal microbes can affect immune responses by themselves. Segmented filamentous bacteria (SFB) can profoundly shape mucosal CD4⁺ T cell subsets (Th1, Th2 and Th17). For example, SFB induce Th17 cells in the small intestine and thus protect the host from colitis induced by *Citrobacter rodentium*. However, colonisation with SFB can also increase the susceptibility of mice to autoimmune diseases. In addition, intestinal microbiota can activate, expand and generate the *novo* mucosal T_{reg} in a Toll-like receptor dependent manner. Together, this illustrates that an appropriate commensal bacterial-regulated balance between effector and Treg cells is very important

Furthermore, helminths are protective in autoimmunity and allergy, since they downregulate host inflammatory responses. Excretory-secretory products from the natural parasite *H. Polygyrus* have been shown to induce Foxp3⁺ T_{reg} cells via the TGF- β receptor and to block the development of OVA-induced allergy.

All together, this shows that diet and intestinal flora can have a very big effect on the immune system and can be decisive for the induction of either an inflammatory or a regulatory response, thereby affecting the course of a lot of diseases. Therefore, diet and intestinal flora can be new therapeutic targets to cure diseases.