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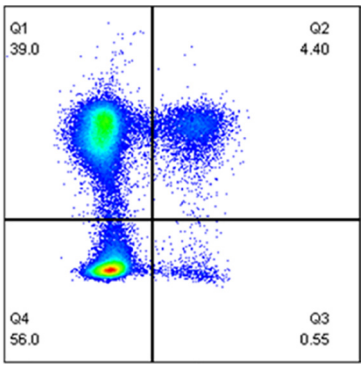
GÖTTINGEN MINIPIGS

The Porcine Immune System and the Toolbox Available to Study it

The pig has a long-standing role in vaccine development and as model for human infectious diseases,[1-3] and the immune system in the pig is well characterized. In the last decade, the knowledge about the porcine immune system – and the tools to study it – have increased tremendously. Much is known about the porcine immune system, which in many aspects is quite like that in humans.[4-8] Detailed gene family analyses have revealed a large overall pig-human homology of pattern recognition receptors, and human-like responses to IFN-γ and LPS were found by transcriptome analyses using next generation sequencing.[7] To that, it might be mentioned that LPS not only has a low potency in rodents but also in Cynomolgus Macaques.[9] A detailed comparison of the human and the porcine immune system is available in recent reviews.[3,5-8,10,11]

A large toolbox is available to study the porcine immune system, and a large number of CROs and universities have specific expertise in this area. The genome is known in the Göttingen Minipig,[12] and a very large manually curated gene database is available for a vast number of porcine immune targets,[13] allowing for instance multiplex qPCR. Up-to-date tools are available for studying the humoral immune response, including tools to study the different porcine T-cell subsets and their production of relevant cytokines, such as IFN-γ, TNF-α and IL-17.[14,15] In addition, flow cytometry tools have improved immensely in recent years, a fact which has led to an increased understanding of porcine immune cells and their function, and antibodies now allow detailed studies of all cell subsets and cytokines.[15-18] A review of the available knowledge of porcine cluster of differentiation markers, including a listing of expression pattern and available antibodies was published recently.[11] In addition, recent developments have been made within next-generation MHC(SLA) typing,[19] and methods for recombinant antibody expression and tetramers for antigen-specific T-cell responses in swine have been developed.[20] Thus, it is now possible to determine which immune cells are involved in the response to a specific pathogen, which immune modulators these cells produce, and into which memory cells they develop. Finally, it should be mentioned that efficient and precise techniques for genetic engineering of pigs are now available.[21]



Treg cells identified by flow cytometry using CD4 and FOXP3 antibodies. Picture by Nana Overgaard and Gregers Jungersen, Technical University of Denmark

"We have used minipigs and production pigs in many different immune related contexts and find the results translate very well to what we and others see in humans. This makes the pig a very interesting model to advance preclinical studies and hopefully secure a higher rate of success for new products to go into clinical studies".

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