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► To cite this version:

Fany Blanc, Jordi Estellé, Gaëtan Lemonnier, Jean Jacques Leplat, Edwige Bouguyon, et al.. Searching for markers of immunocompetence in blood: application to vaccination against Influenza A virus in pigs. International Veterinary Immunology Symposium (IVIS), Aug 2019, Seattle, United States. , 2019. hal-02285632

HAL Id: hal-02285632

<https://hal.science/hal-02285632v1>

Submitted on 2 Jun 2020

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Searching for markers of immunocompetence in blood: application to vaccination against Influenza A virus in pigs

Blanc Fany¹, Estellé Jordi¹, Lemonnier Gaëtan¹, Leplat Jean-Jacques¹, Bouguyon Edwige², Billon Yvon³, Bouchez Olivier⁴, Pinard-van der Laan Marie-Hélène¹ and Rogel-Gaillard Claire¹

1 GABI, INRA, AgroParisTech, Université Paris-Saclay, 78350 Jouy-en-Josas, France

2 VIM, INRA, Université Paris-Saclay, 78350 Jouy-en-Josas, France

3 GenESI, INRA, 17700 Surgères, France

4 GeT-PlaGe, INRA, 31326 Castanet-Tolosan, France

Understanding why some animals respond better to vaccination than others is important to define biomarkers of immunocompetence and improve the sustainability of animal production. Our study focused on the response of pigs to Influenza A virus (IAV) vaccination to search for blood biomarkers from a prior-vaccination transcriptome that could differentiate animals with contrasted vaccine responses. Large White pigs without maternal IAV-specific IgG transmission (26 families, 98 animals) were vaccinated at weaning (around 28 days of age) with a booster 21 days post-vaccine (dpv). The humoral response was evaluated by measuring seric IAV-specific IgGs by ELISA and antibodies directed against HA antigens by hemagglutination inhibition assays (HAI) at three time-points corresponding to early response (21 dpv), maximum response intensity (28 or 35 dpv) or long-term persistence (118 dpv). At each time-point, high and low responders were selected and differential analyses of genes expressed in blood collected before vaccination (0 dpv) were conducted from RNA-Seq data. Ingenuity Pathway Analysis was performed to identify the biological functions enriched from the sets of differentially-expressed genes (DEGs). At the early response time-point, 91 DEGs were found between high and low responders for specific IgG levels (FDR < 0.01) with decreased functions related to blood cell migration, maturation and viability in low responders. At the persistence time-point, 269 DEGs mainly related to cell cycle were detected for the HAI titres (FDR<0.05). Interestingly, a common network of genes related to humoral response involving immunoglobulins and IL-12 complex was obtained at both time-points. In conclusion, we show that gene expression levels in blood before vaccination correlate with vaccine response. Genes related to blood cell migration, maturation and viability seem to have an impact on the early response to IAV vaccination and other genes more related to cell cycle seem linked to the persistence of the response.