A model of protective immune responses against African swine fever virus infection in immunized pigs

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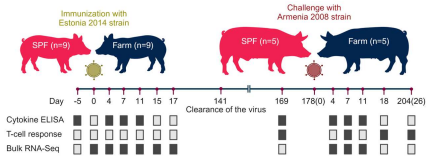
Introduction

Live attenuated vaccines (LAVs) have shown promise in providing protection against ASFV, but their broader application is limited by safety concerns and an incomplete understanding of the immune mechanisms underlying protection. In this study, we used an established model with two groups of pigs differing in baseline immunological status (farm and specific pathogen-free, or SPF) to dissect protective and detrimental immune responses following immunization with the attenuated Estonia 2014 strain and subsequent challenge with the pathogenic Armenia 2008 strain. By applying a systems immunology approach, we correlated immunological data, including serum cytokines, T-cell responses, and blood transcription modules (BTMs), with clinical outcomes of the challenge.

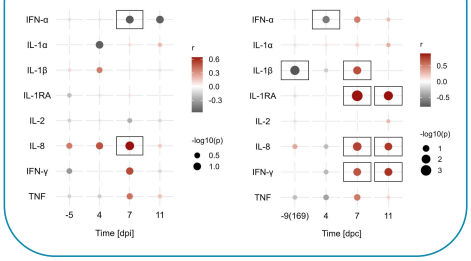
protection — lack of protection

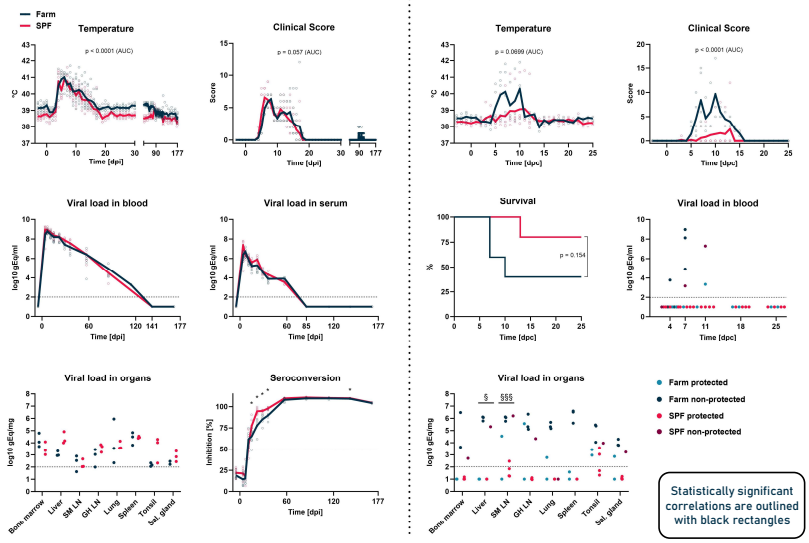
Further data from the animal study



Dark squares indicate collected data

Correlation of cytokine responses with clinical outcomes

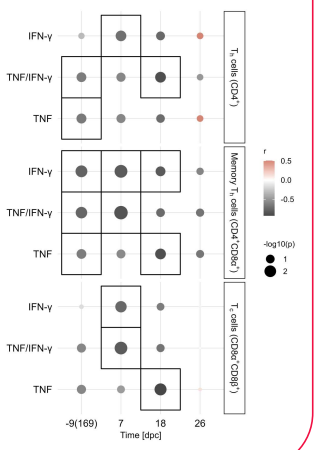




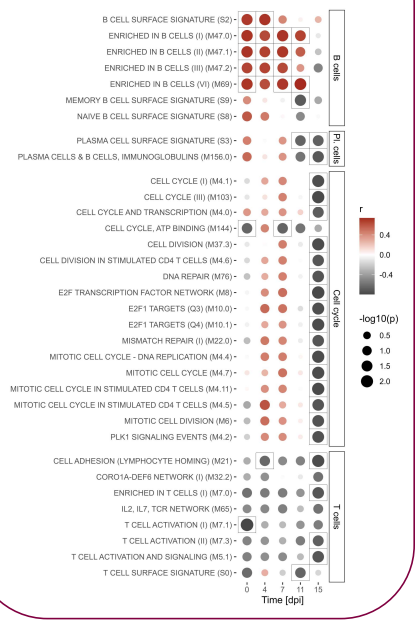
Farm protected
Farm non-protected
SPF protected
SPF non-protected

Statistically significant correlations are outlined with black rectangles

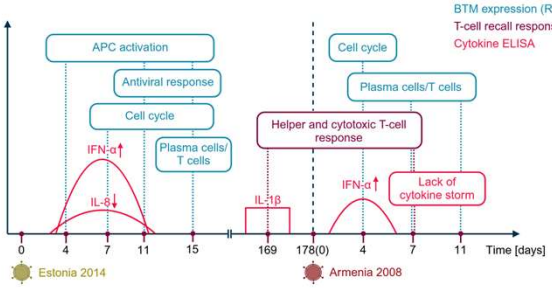
Correlation of T-cell responses with clinical outcomes



Correlation of adaptive BTM expression after immunization with clinical outcomes



Summary of protective immune responses following immunization and challenge



Conclusions

- Key innate correlates of protection included early and sustained IFN-α response, activation of antigen presentation BTMs, and controlled IL-8 levels during immunization.
- Lower baseline immune activation was linked to increased protective immunity.
- Adaptive correlates included cell cycle, plasma cell, and T-cell BTM responses lasting until day 15 post-immunization.
- Consequently, an effective response from ASFV-specific T_h cells, together with sustained levels of IL-1β, predicted protection.
- After the challenge, an early IFN-α response, along with low levels of pro-inflammatory cytokines and a strong induction of memory T_h and T_c cells, correlated with improved clinical outcomes.
- The model provides a framework for assessing efficacy of LAV vaccine candidates against ASFV and should be further validated in a farm pig setting.