Porcine respiratory cell and tissue coinfections and superinfections with porcine reproductive and respiratory syndrome and swine influenza viruses

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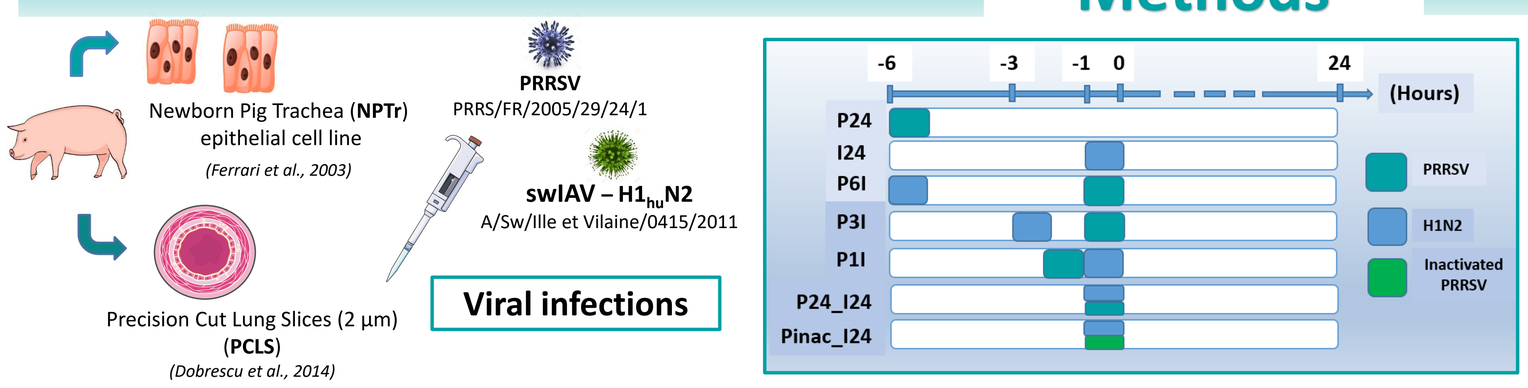
Introduction

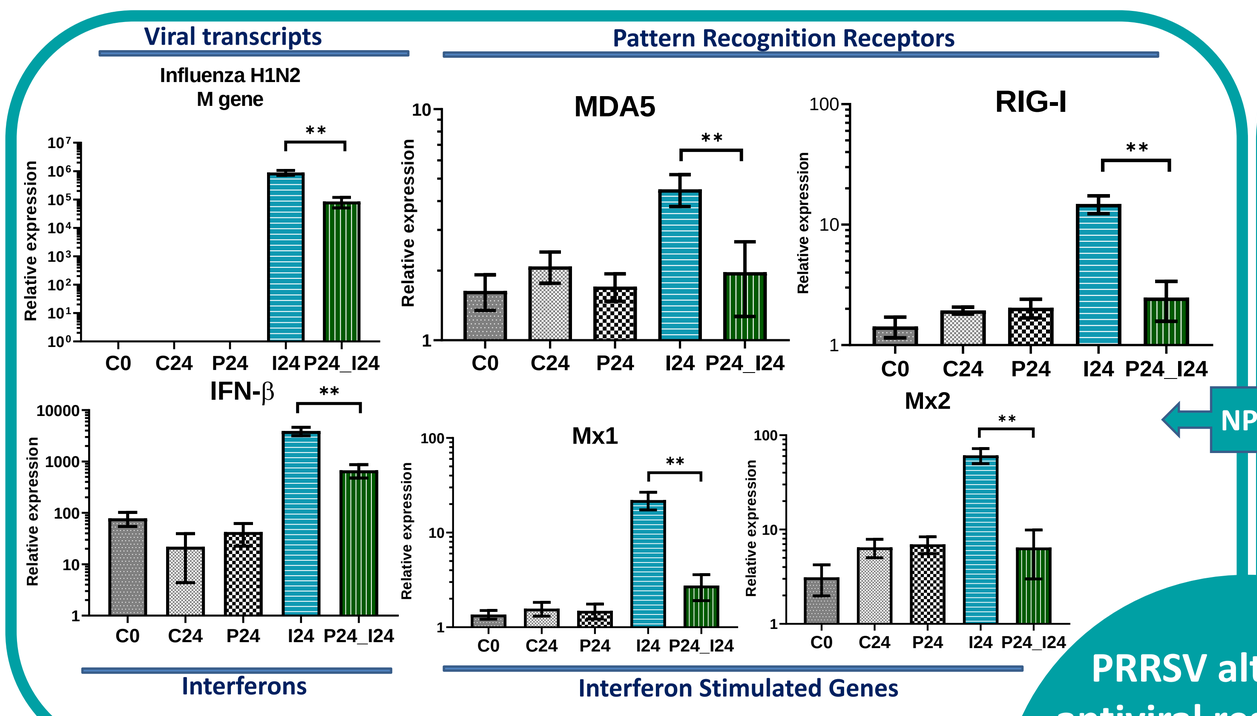
Porcine reproductive and respiratory syndrome virus (PRRSV) and swine influenza type A virus (swIAV) are major contributors to the porcine respiratory disease complex that is still threatening porcine farming around the world. Understanding the interactions between these two viruses and the effect of their coinfections on the porcine immune response will lead to better preventive and therapeutic measures. *In vitro* evaluation of these interactions is still very limited since the two viruses do not share the same host cells. SwIAV infects mainly epithelial cells, while PRRSV infects only cells expressing CD163 such as alveolar macrophages. In this study we tried to evaluate the effect of PRRSV infection on the replication of swIAV, the host antiviral response and the possible induction of trained immunity in trachea epithelial cells and precision cut lung slices, using activated and inactivated PRRSV and comparing different intervals between the infections.

Methods

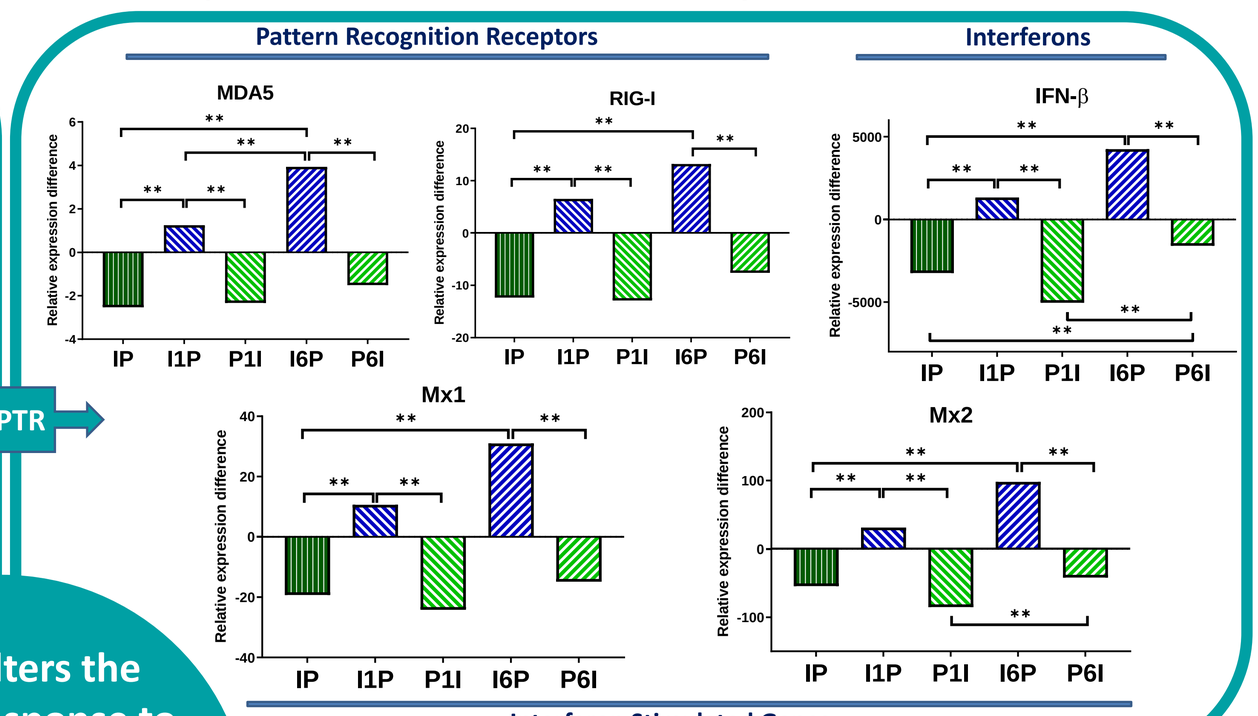


Results

Impact of PRRSV on response to Influenza virus

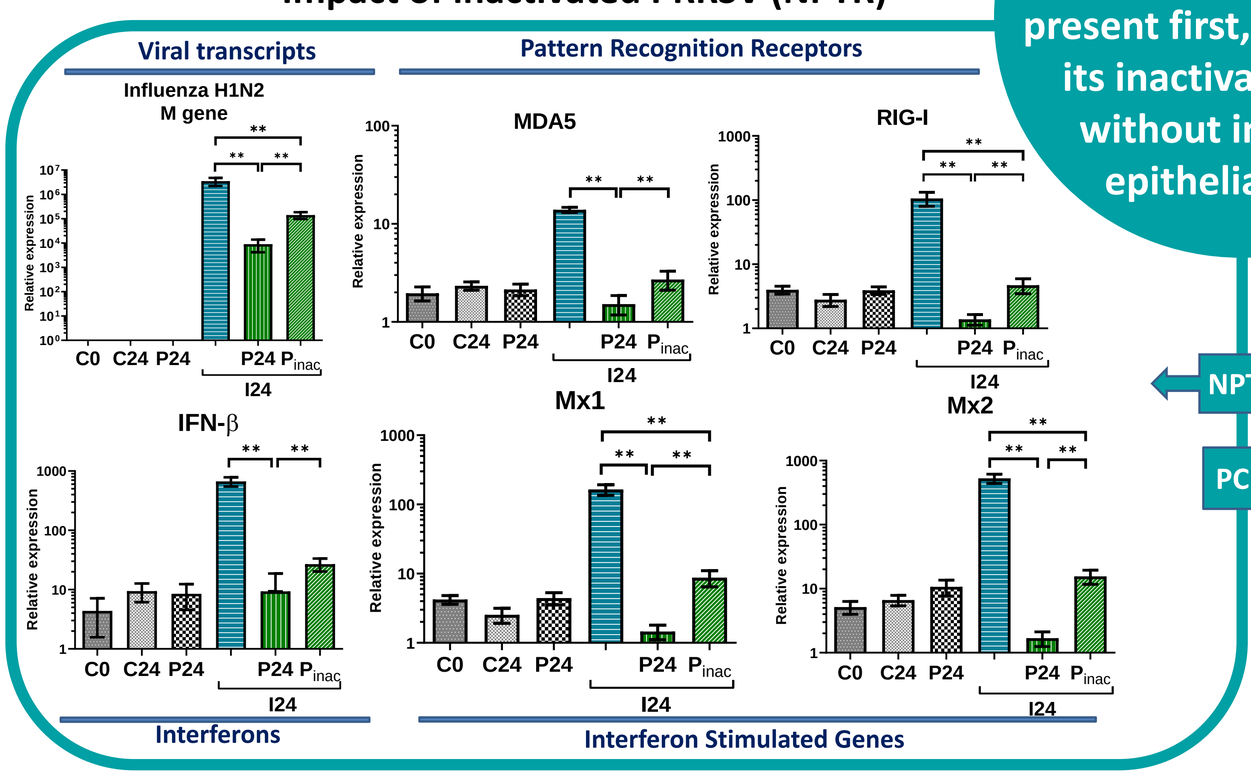


Impact of infection order and delays between infections

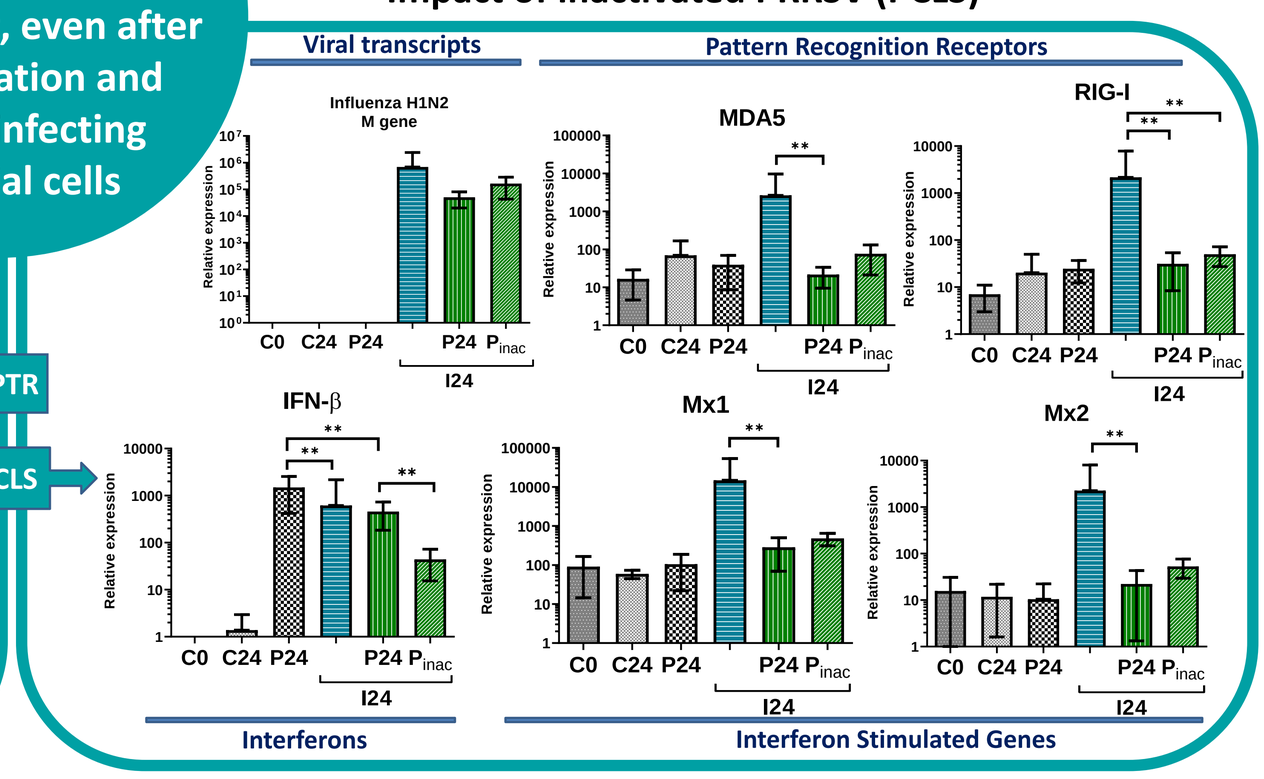


PRRSV alters the antiviral response to swIAV infection only if present first, even after its inactivation and without infecting epithelial cells

Impact of inactivated PRRSV (NPTR)



Impact of inactivated PRRSV (PCLS)



C0: Contol 0h, C24: Control 24h, P24: PRRSV 24h, I24: Influenza 24h, P24_I24: PRRSV_Influenza, Pinac: Inactivated PRRSV 24h, IP: PRRSV_Influenza, I1P: Iinfluenza_1h_PRRSV, P1I: PRRSV_1h_Influenza, I6P: Influenza_6h_PRRSV, P6I: PRRSV_6h_Influenza.
MOI: 3, n = 6, Mean values, Standrad deviations, ** : P < 0,01 *: P < 0,05. Data were sorted by **rank**, then **One-Way ANOVA** was used. Means of the ranks among the groups were compared using **Tukey's test**.

Conclusion

PRRSV has no tropism to epithelial cells, however, our results showed that the virus was able to interfere with swIAV infection by affecting swIAV replication and altering the response of the hosting cell. Inactivation of the virus reduced its inhibiting effect without obliterating it completely, which means that the presence of the virus is sufficient to alter the capacity of the cells to replicate swIAV. PRRSV impact tends to decrease when the delay between the viruses increases and is completely reversed when the PRRSV is inoculated after swIAV. The inhibition effect of the active virus was also confirmed on PCLS combining different cell types, especially alveolar macrophages, the target of PRRSV, and epithelial cells, the target of swIAV. PRRSV again clearly affects the expression of ISGs however, its effect on swIAV replication is less clear. The mechanisms of this viral interference are still unclear and will be investigated later to ultimately apply better preventive and therapeutic approaches.

References

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