HORIZON 2020

THE FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION

Societal challenge 2 – H2020 call 2014

Sustainable Food Security: tackling losses from terrestrial animals

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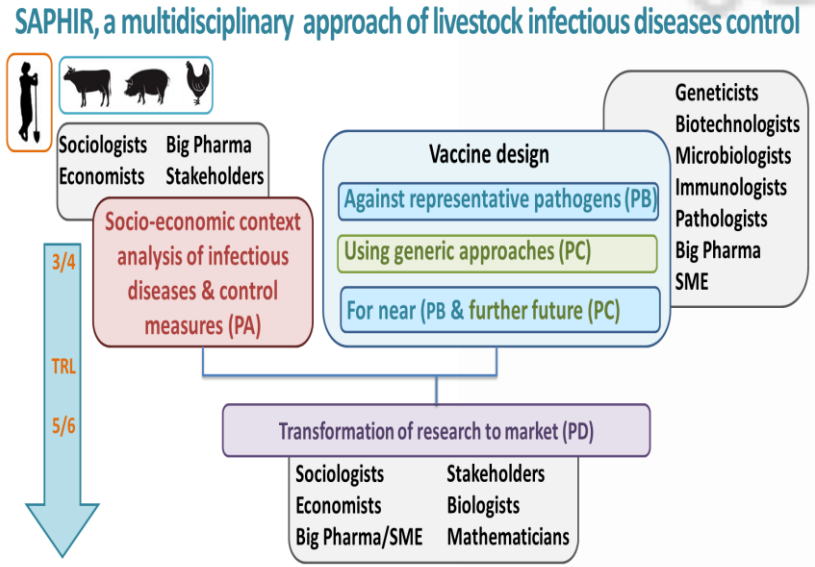
SAPHIR

Strengthening Animal Production and Health through the Immune Response

Objectives: Generate effective, safe, affordable vaccination strategies towards the control of endemic pathogens responsible for economic losses in livestock

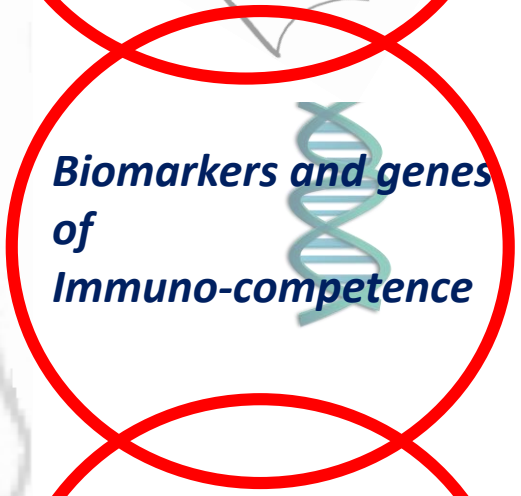
Approaches: Specific and generic vaccine strategies against representative pathogens

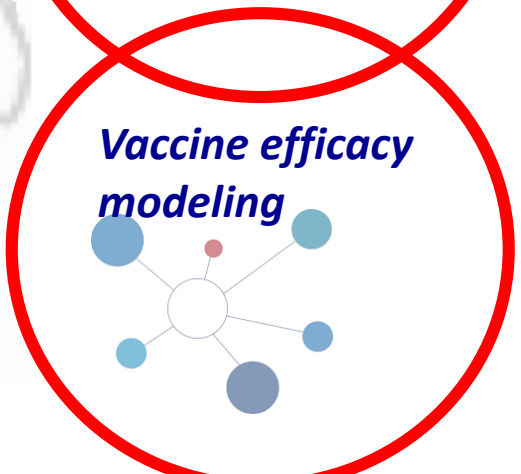


Bovine Respiratory Syncytial Virus (BRSV)
Mycoplasma bovis

Porcine Reproductive and Respiratory Syndrome Virus (PRRSV)
Mycoplasma hyopneumoniae

Eimeria species
Clostridium perfringens





New vaccines in response to unmet needs

The disease problems	*The SAPHIR solutions*
Porcine Reproductive and Respiratory Syndrome Virus (PRRSV): Most damaging infection worldwide. Abortion and serious respiratory problems. 560 M $/year in US. Commercial vaccines not efficient against circulating variants	- New attenuated and adaptable vaccines: GMO and non GMO, safe and efficient. In development to reach the market, Virbac - DNA vaccines (compliant delivery) and replicons with broad protection against variants
Mycoplasma hyopneumoniae: Main pathogen of the respiratory disease complex, decreased performances, antibiotic resistance. Mainly in grow-finishing pigs. 250 – 500 M€/year in EU. Commercial vaccines not efficient against circulating variants	- New adjuvants and bacterin inactivated vaccines against a current strain - Genetically modified *Mycoplasma hyopneumoniae*
Bovine Respiratory Syncytial Virus: BRSV causes respiratory diseases in young cattle. Protective immunity of current vaccines is limited	- Protein vaccine efficient in one shot in calves with maternal Ab - Attenuated vaccine efficient in one shot - clinical biomarkers of severity to taylor antibiotic treatment
Mycoplasma bovis *M. bovis* ause pneumonia, mastitis, arthritis, otitis, conjunctivitis and genital disorders in cattle of all ages. Increase in antibiotics resistance. No commercial vaccine in Europe.	- Conserved antigen candidates for a new vaccine with broad protection
Coccidiosis *Eimeria* causes enteric coccidiosis, mainly in growing chickens. Current vaccines include 7 different strains, precluding their use in broilers.	- Genetically complemented *Eimeria* with heterologous antigens
Clostridium perfringens *Cp* causes necrotic enteritis in the small bowel of chickens, and Eimeria promotes sensitivity.Increase of feed conversion ratio, mortality. Antibiotics. No commercial vaccine.	- Recombinant *Bacilli* expressing Cp protective and conserved antigens

The STEPS FORWARD via SAPHIR

- **Innovative vaccines** for exploitation: tissue culture-adapted PRRSV, DNA vaccines, *M. bovis* candidates, BRSV protein and attenuated vaccines, recombinant Eimeria, bacilli-cp.

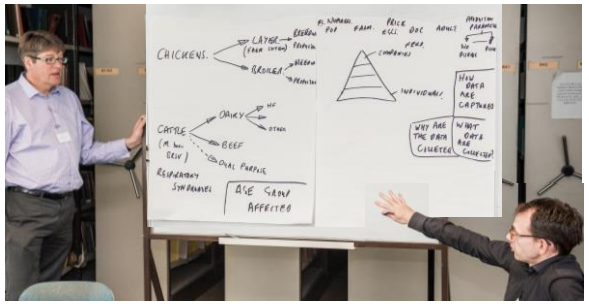
- **Adjuvants**: specific types with species and age categories (neonates), able to induce cross-reactive response against antigenic variants.

- **Genetic marks** of good and bad responders to pig vaccines => impact for breeding schemes

- **Blood biomarkers** of good and bad vaccine responders => impact for breeding schemes

- **Broncho-alveolar lavage biomarkers** of severe respiratory disease evolution => tailored use of antimicrobials

- **Socio-economic drivers** of vaccine use



CONTRIBUTION TO THE STRATEGY

Vaccine strategies against endemic diseases strongly contribute to:

Improve the efficiency of livestock production

reduction of disease-induced costs (death, altered weight gain/reproduction/productions, antimicrobial costs)

Protect animal health and one's health (human + environment)

preventive & sustainable control measures
control of detrimental infectious diseases and of the emergence of new strains
reduction of antimicrobial use
reduction of the risk of zoonotic infections fostered by endemic animal pathogens
optimisation of the use of scarce feed, improve the feed conversion ratios, decrease waste emissions

Improve animal welfare

reduction of death and suffering from endemic infectious diseases

Improve genetic resources

genetic markers and biomarkers of good response to vaccines can improve breeding for higher robustness

MAIN REMAINING GAPS FOR FUTURE RESEARCH

Economic impact of endemic diseases taking into account the pathogenic etiology

Protection of mucosal surfaces by vaccines

Protection of the young animal by vaccines

Identify pertinent correlates of protection induced by vaccine: systems vaccinology

Validation of biomarkers of immunocompetence

SAPHIR Kick-off Meeting

INRA center – Jouy-en-Josas, FR 11-13 May 2015