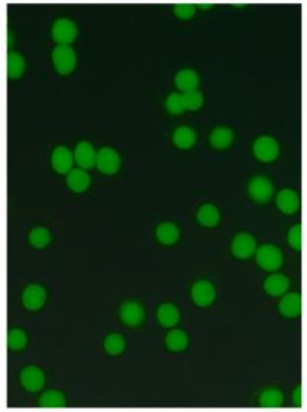

GLOBAL HEALTH AND TROPICAL MEDICINE

GHTM

Omics studies on *Rhipicephalus bursa- Babesia ovis*: development of tick-borne diseases alternative control methods

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encontro CIÊNCIA '22

FCT
Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR

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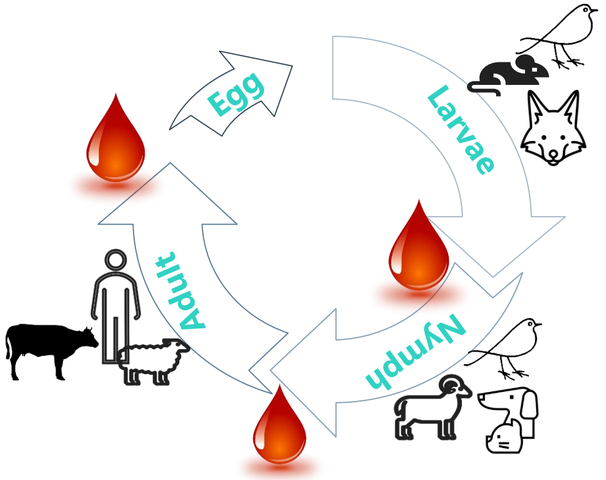
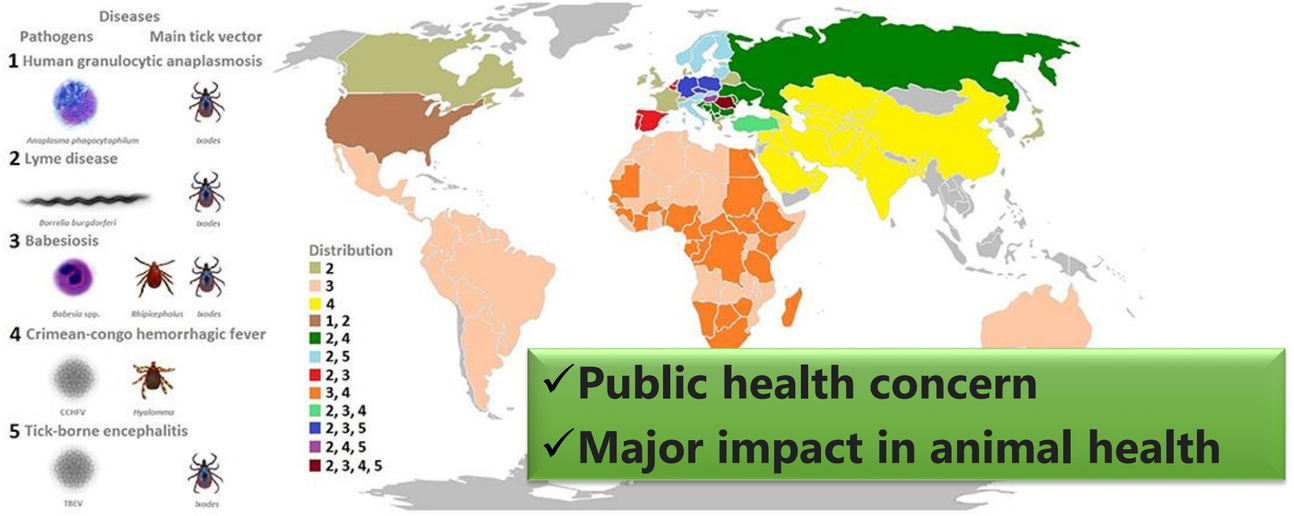
GHTM global health & tropical medicine

Ticks

- Main vector of disease in animals and second in humans
- About 900 species identified & distributed worldwide
- At least 10% are competent vectors of pathogens
- Different blood meals to complete life cycle



Tick-borne diseases



✓**Public health concern**

✓**Major impact in animal health**

Prevention and control

Pathogen

- Chemotherapy
- Vaccination

Vector

- Ecological approaches
- Biological control
- Genetic control
- **Acaricides**

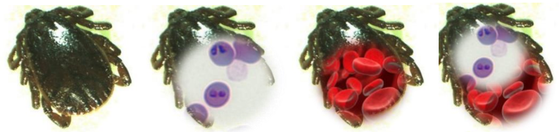
Safer & Sustainable Methods Needed

Anti-TTBD vaccines

de la Fuente J, Antunes S, et al. (2017) Tick-Pathogen Interactions and Vector Competence: Identification of Molecular Drivers for Tick-Borne Diseases. Front Cell Infect Microbiol. 7:114 doi: 10.3389/fcimb.2017.00114.

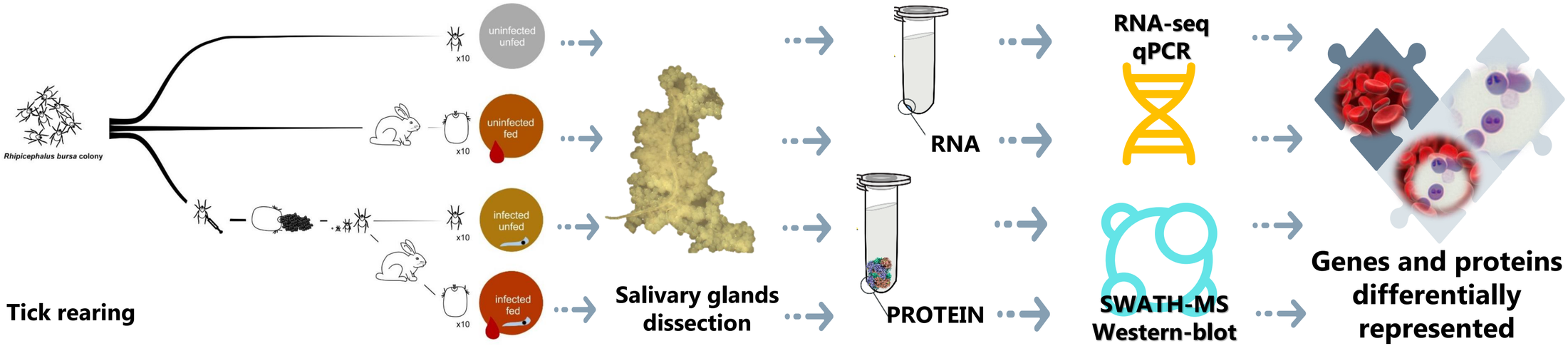
Anti-TTBD Vaccines

Strategies for tick protective antigens discovery



Model : *Rhipicephalus bursa- Babesia ovis*

Comparative transcriptomics and proteomics



Potential candidates

- Fold change
- Putative function
- Response to both feeding and infection

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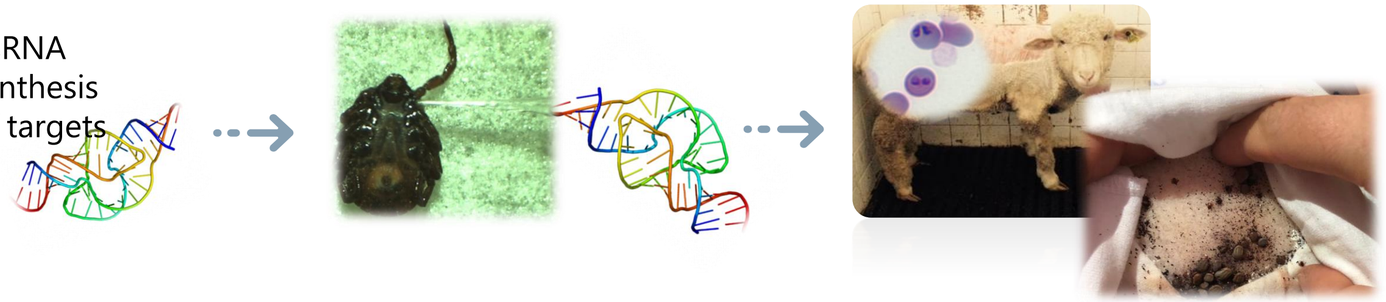
Potential protective antigens

Model : *Rhipicephalus bursa- Babesia ovis*

Selection by gene functional analysis *via* RNA interference

dsRNA synthesis of targets



qPCR for gene silencing and infection
+
Evaluation of biological parameters

A

Group	Gene silencing (% Ave ± S.D.)	*B. ovis* infection levels (Ave ± S.D.)	Infection rate (Ave ± S.D.) (N)
itellogenin-3	92 ± 2*	$4.67e^{-04} \pm 3.05e^{-04}$	314 ± 255.17(4)[a]
achesin	51 ± 9*	$4.48e^{-07} \pm 1.20e^{-07}$	0.30 ± 0.09(8)*
glycine-rich	ND	–	–
secreted cement	65± 11**	$2.97e^{-06} \pm 2.68e^{-06}$	1.99 ± 2.18
Control	–	$1.49e^{-06} \pm 1.09e^{-06}$	–

Ad. Lar.

Vitellogenin

Gene Knockdown:
70% decrease on tick population and infection rate

Secreted cement

Gene Knockdown:
46% of failure in attachment

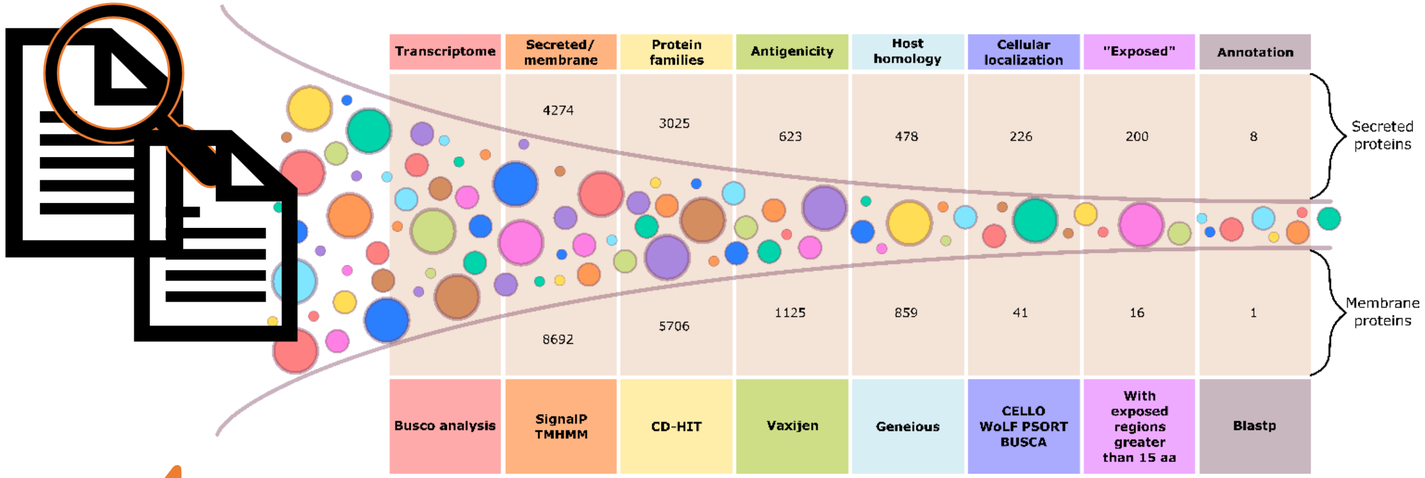
Influence on *Babesia* infection in adult SGs and ovaries

- **Antunes, S.,** Couto, J., …. Domingos, A., 2018. Frontiers in Cellular and Infection Microbiology. DOI: 10.3389/fcimb.2018.00116.
- Couto J,…., **Antunes S**, de la Fuente J., 2020. Vaccines. DOI: 10.3390/vaccines8010091

Potential protective antigens

Model : *Rhipicephalus bursa- Babesia ovis*

Selection by reverse vaccinology using the *R. bursa* sialomes



Identify antigens capable of inducing a **protective, robust, and long-lasting immune response** with no allergenic or toxic effects in vivo.

➢**exposed regions** screened for overlapping coincident epitope groups (**CEGs**), structure, exposure, and the presence of **B and T cell epitopes**.

MARVEL, EVASIN and **RICIN** like proteins.
(peptide-based therapeutics)

❑Pilot vaccination trials with the **Seven candidate protective antigens** identified

Couto ,J., Seixas, G., Stutzer, C., Olivier, N.A., Maritz-Olivier, C., Antunes, S., Domingos, A., 2021. Biomedicines. DOI:10.3390/biomedicines9040363