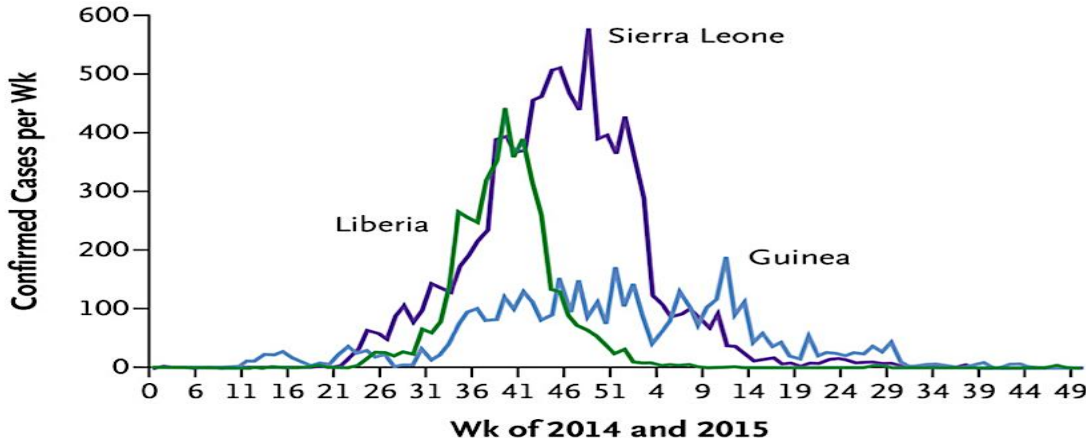


Modelling the humoral immune response to Ebola vaccine

Irene Balelli, Inserm

22 & 23 October 2018 • IMI Scientific Symposium • Brussels, Belgium

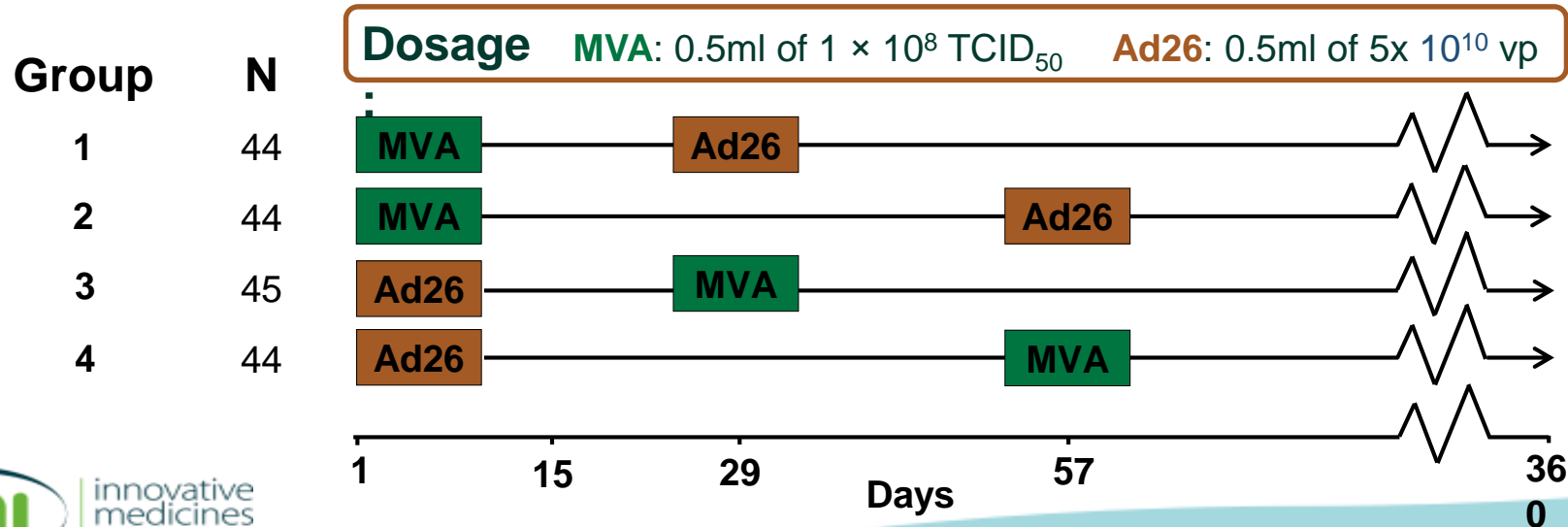
Ebola vaccine projects



2014-2016 Ebola outbreak:
28,616 cases of EVD and 11,310 deaths
(Guinea, Liberia, Sierra Leone)



EBOVAC1: Phase 1 trials in UK, Kenya, Tanzania/Uganda
Prime-boost regimen, 4 vaccination groups, 177 subjects, 1 year follow-up



Modelling the humoral response to vaccine



OPEN ACCESS Freely available online

PLOS COMPUTATIONAL BIOLOGY

Living on Three Time Scales: The Dynamics of Plasma Cell and Antibody Populations Illustrated for Hepatitis A Virus

Mathieu Andraud^{1*}, Olivier Lejeune^{1,2}, Jammbe Z
Hens^{1,3}

frontiers in
CELLULAR AND INFECTION MICROBIOLOGY

ORIGINAL RESEARCH ARTICLE
published: 09 January 2015
doi: 10.3389/fcimb.2014.00177



Mathematical modeling provides kinetic details of the human immune response to vaccination

Dustin Le¹, Joseph D. Miller² and Vitaly V. Ganusov^{1,3*}

Questions:

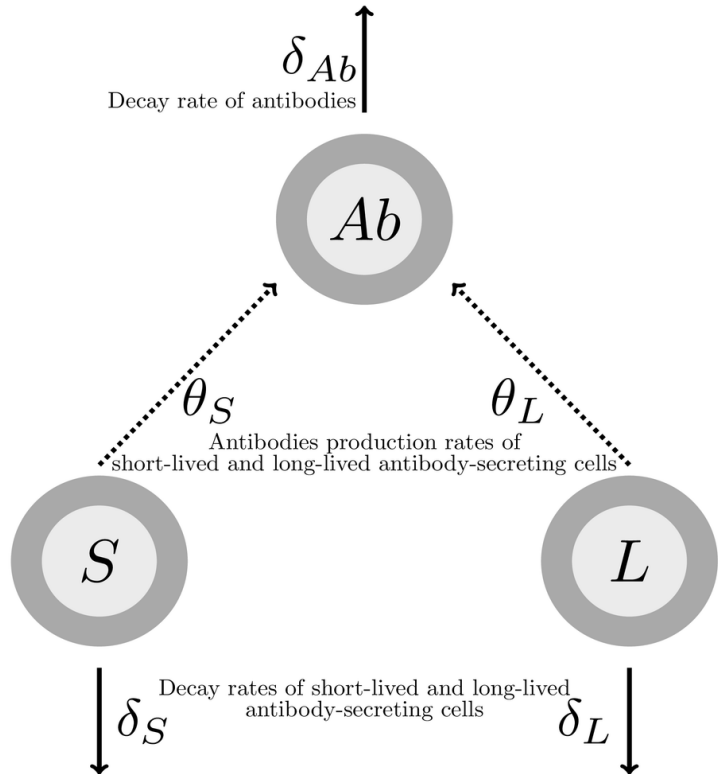
1

- How long the antibody response lasts?
- Which factors affect the variability of the response?

2

- How and how fast immunity builds up?
- How does vaccinated patients react to further exposures?

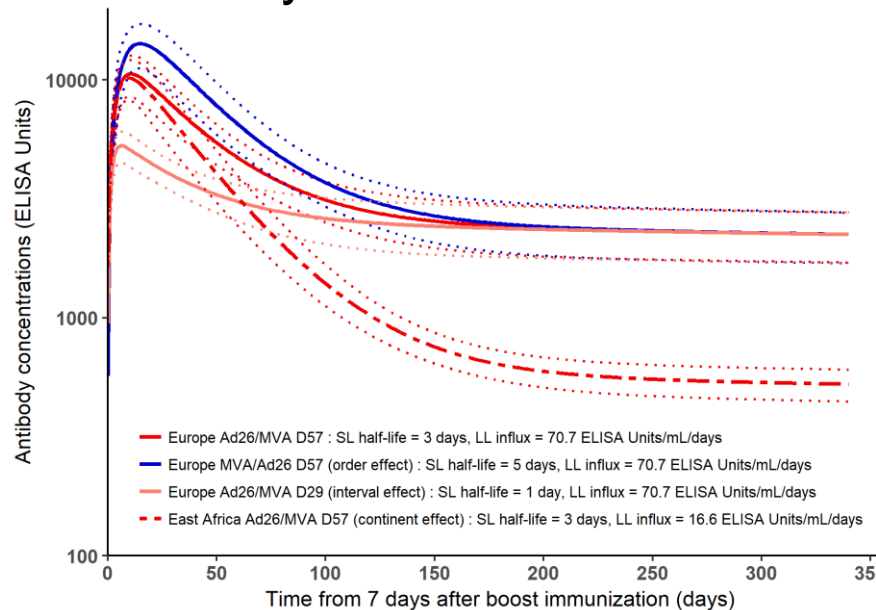
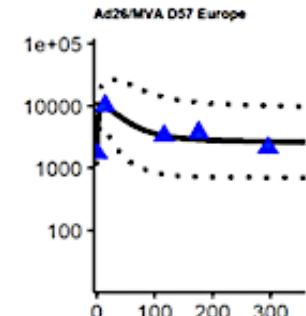
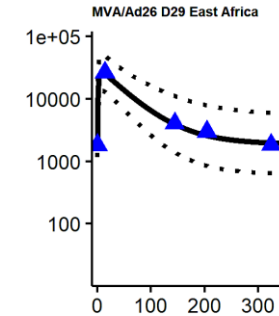
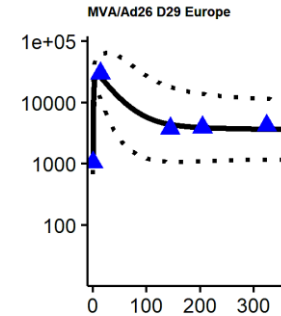
Durability of Antibody response after boost immunization



Half-life

Estimations:

- $Ab=24$ days
- $S=1-5$ days
- $L \geq 5$ years



Variability factors:

- Vaccine regimen: S cells
- Geographic setting: L cells

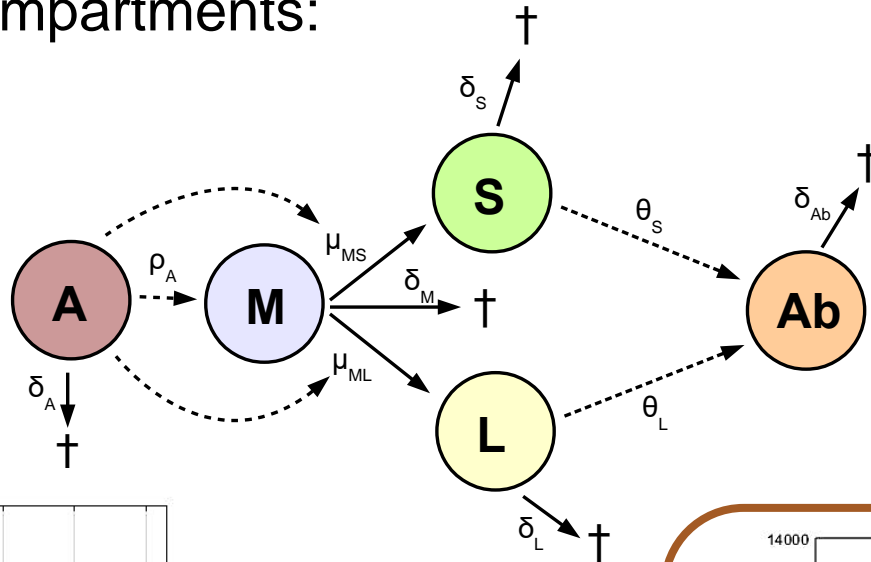
Mechanistic model:
2 populations of Antibody Secreting Cells; Antibodies

Establishment, maintenance and reactivation: the role of memory

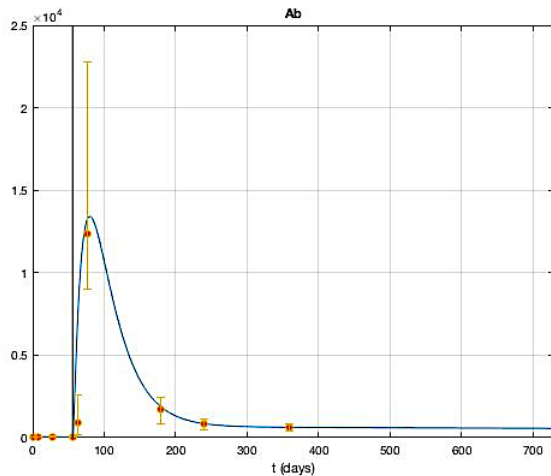
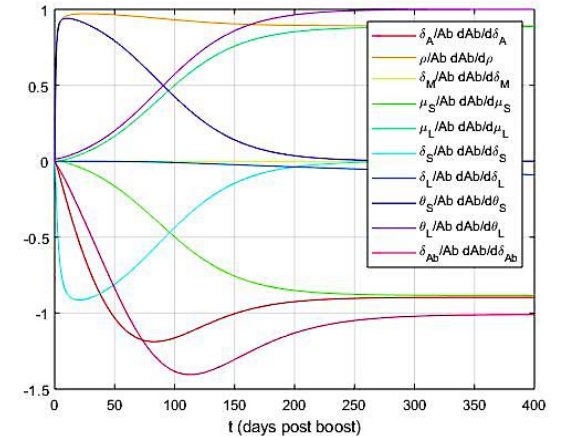


2 additional compartments:

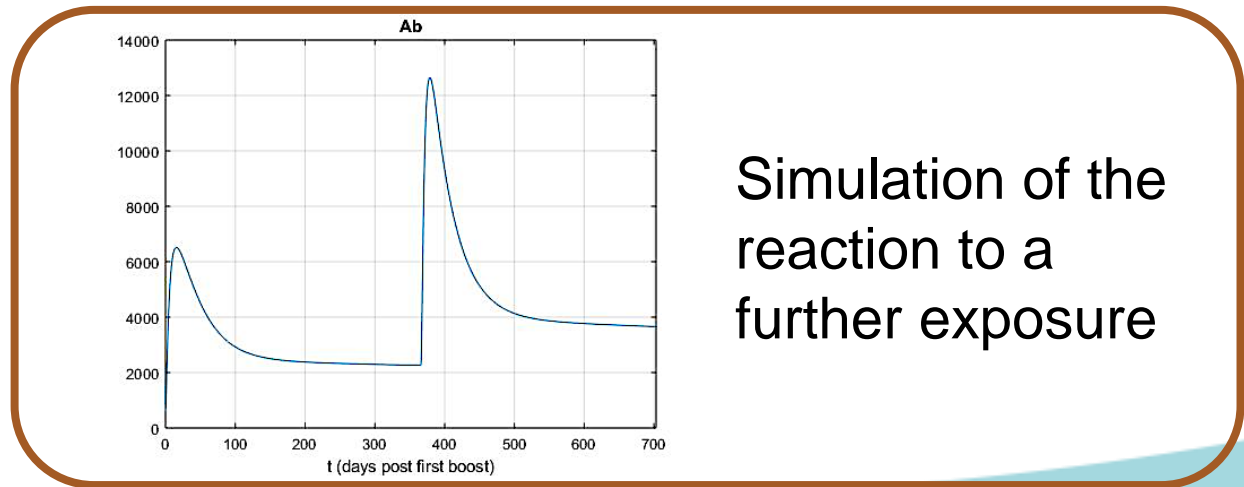
- A =antigen
- M =memory



Identifiability and sensitivity analysis



Model calibration



Simulation of the reaction to a further exposure