Pertussis Vaccination Research

P. Londoño-Hayes (Sanofi Pasteur) , P. Denoel (GlaxoSmithKline) and Fil Randazzo (BMGF)

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Need for public-private collaboration

- Since its introduction in the 1940's, vaccination against *B. pertussis* has demonstrated to be effective in preventing infection and disease.

- Despite the availability of a panel of effective vaccines (aP and wP),
  - Pertussis is still one of the leading causes of vaccine-preventable deaths among children in low income countries
  - The epidemiology of the disease is changing in some industrialized countries, with the incidence increasing among populations not previously considered at risk

- The joint effort of **vaccine manufacturers**, **academic researchers, government health bodies and regulatory authorities** is needed to improve our scientific understanding of the immunity to pertussis in humans and the role of vaccination in facing these challenges, so we can ultimately respond by either
  - modifying current vaccine formulations,
  - refining immunisation schedules and/or
  - accelerating the development of novel vaccines

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Objectives of the full project (1/3)

<u>Overall objective</u>

To pursue the **identification and validation of biomarkers** of protective immunity to pertussis and the **establishment of models of pertussis infection** that will expedite the development and testing of novel or improved vaccine formulations, as well as enable the refinement of current vaccination schedules

Objectives of the project : In detail (2/3)

1. Increase our scientific understanding of the pathogenesis of *B. pertussis* and the underlying molecular mechanisms of vaccine-mediated protection so as to identify **biomarkers of protective immunity**

2. To strengthen our technological capabilities/means for testing novel vaccine candidates and immunisation regimes in **animal and human models of pertussis disease** and immunisation

3. To interact closely with Regulatory Authorities and Public Health Institutions to ensure that the results obtained can be **translated into relevant regulatory guidance** as well as public health and **clinical practice.**

Objectives of the project : In detail (3/3)

4. Investigate **differences between whole cell and acellular pertussis vaccines,** in particular with regards to
   a. their ability to generate protection against infection, disease, carriage and transmission,
   b. **the role of maternal antibody** in modulating immune responses to pertussis vaccination **i**n infants
   c. their ability to establish **long term immunological memory**
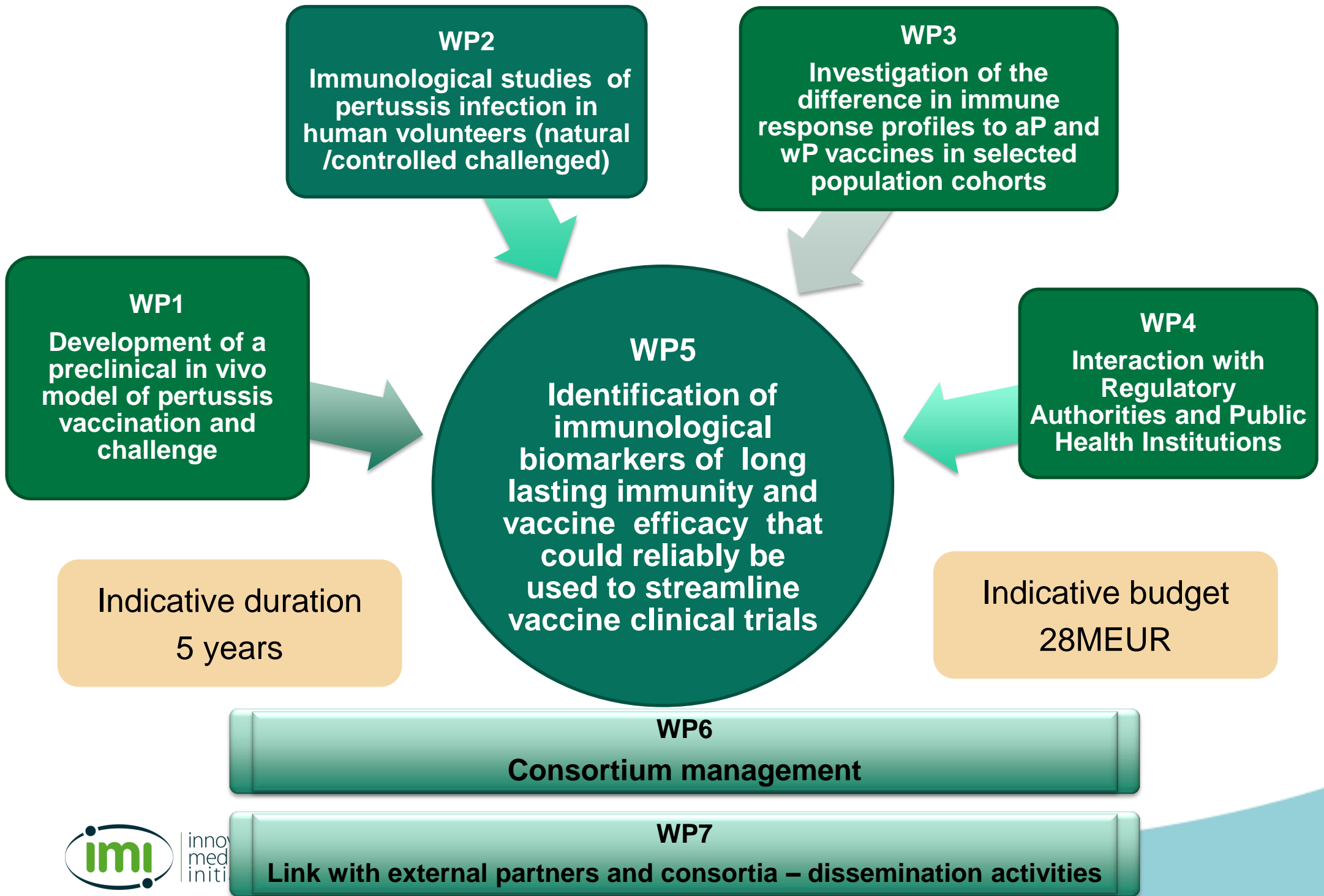
Pre-competitive nature of the project

Ambition to:

- Create a consortium of public-private stake holders prepared to pool together expertise and resources to increase our understanding of the immunity generated by pertussis vaccination in humans

- Combine efforts to expedite the development of a practical toolbox needed to facilitate and boost vaccine development efforts in Europe (biomarkers and disease models)

- Provide a unique platform for dialogue with Regulatory authorities and Public Health Institutions to ensure the acceptance and validation of the newly discovered biomarkers and disease models

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Expected impact on the R&D process

- Boost pertussis vaccine **research**

  - Joint effort to translate into increased possibility of success, higher speed and shared financial burden

- Provide **tools** needed by all stake holders invested in vaccine development

  - Tools (biomarkers, models, bioassays, etc) will be available to all partners to expedite their propietory vaccine development efforts

- Expedite **development** of novel and/or improved vaccines or immunisation regimes

  - Pointers to tackling changing epidemiology of pertussis via vaccination
  - Pointers to refining immunisation regimes in low-income countries (*i.e.* via maternal vaccination)

Suggested Architecture of the Project

Expected contributions of the applicants

- Managerial
  - The capability to commit, focus and adapt as required to work in a collaborative manner towards achieving the goals of the project
  - Management practices that maximize resource utilization and deliver results within agreed budgets and timeframes
- Non-clinical research :
  - Expertise in *in vitro*, preclinical and clinical *B. pertussis* research or pertussis vaccination
  - Expertise in the development of bioassays or immunoassays suitable to assess pertussis infection and functional and memory immune responses to pertussis vaccination.
  - Expertise and infrastructure needed to set up preclinical disease models in non-human primates

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Expected contributions of the applicants (2)

- Clinical research
  - Expertise in the identification of human biomarkers of infectious disease progression, immunological memory and/or vaccine efficacy
  - Expertise and infrastructure to perform prospective clinical studies with licensed pertussis vaccines; access to relevant vaccination cohorts
  - Institutional expertise /infrastructure to develop and perform control bacterial/respiratory pathogen challenge studies in human volunteers

- Expertise in molecular epidemiology and use on *in silico* tools to investigate pathogen biodiversity and epidemiology of infectious disease
  - Banks of clinical isolates of B. pertussis or well-documented biological samples with infected or vaccinated individuals

Expected (in kind) contributions of EFPIA members

- Licensed pertussis vaccine for prospective clinical studies

- Know-how of clinical development of vaccines

- Expertise in *in vitro*, preclinical and clinical *B. pertussis* research, pertussis vaccination and pertussis epidemiology

- Expertise in the identification of human biomarkers of infectious disease progression, immunological memory and/or vaccine efficacy

- Expertise in molecular epidemiology and use on *in silico* tools to investigate pathogen biodiversity

- Expertise and access to epidemiological data on pertussis disease and effectiveness of pertussis vaccination

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What's in it for you?

- The availability of relevant preclinical models of pertussis in Europe will increase the ability of **academic researchers and biotechnology SME's** to screen vaccine candidates and ultimately feed the global pipeline of novel pertussis vaccines

- The identification and validation of biomarker of vaccine protection, as well as the availability of controlled-humans challenge modes will expedite vaccine clinical development for **all stake holders**

- **Public health and regulatory authorities** will have the opportunity to use the information and toolbox obtained to improve pertussis vaccination programs

- By ultimately understanding and explaining the resurgence in pertussis observed in industrialized countries, the program could prevent further erosion of the **public's confidence in vaccination**.

- All those **invested in tackling pertussis disease** will increase their understanding, enlarge their toolbox and – eventually- arsenal of vaccines with which to reduce the burden of this wholly preventable-disease around the world

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Key deliverables of the full project

1. Immunological **biomarkers** of protection and immunological memory that could reliably be used to streamline vaccine clinical trials

2. The laboratory network and technological expertise in Europe to perform immunisation and *B. pertussis* challenge studies in **predictive pre-clinical models of the disease**.

3. A molecular understanding of the progression of *B. pertussis* colonisation, infection and disease in the presence or absence of pre-existing immunity,

    - via **studies in human cohorts** naturally exposed to pertussis and/or

    - via control challenge studies in human adult volunteers (a **human controlled-challenge model** that would need to be developed)

Key deliverables of the full project

4. An understanding of the **difference in immune response profiles** generated by natural pertussis infection and aP and wP vaccines in **selected population cohorts** (school age children, adolescents, younger adults, older adults)

5. An understanding of the **role of maternal antibody** in modulating immune responses to pertussis vaccination in infants, so that recommendations could be made for adoption of maternal immunisation programs in low-income countries

6. A close **interaction,** collaboration and consultation with **Regulatory Authorities and Public Health Institutions** to ensure the results of the project can be translated into Regulatory Guidance and public health and clinical practice.

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Perspective from IMI Associated Partner : Bill and Melinda Gates Foundation

- The goal of the Gates Foundation is for improved Pertussis vaccines to be in the field saving lives as quickly as possible.

- Our main interest in this IMI program is for accelerated and efficient discovery and validation clinically useful pertussis biomarkers of protection to enable this greater goal.

Thanks for your attention

Questions?

Contact the IMI Programme Office
infodesk@imi.europa.eu • www.imi.europa.eu

www.imi.europa.eu
@IMI_JU