IHI Call Days | Call 12

Decoding Protective Immunity in Global Populations (DECODE)

A moonshot project

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Link to the IHI brokerage platform:

- Proposal sharing tool
- Participant profile

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Challenges and objectives

- DECODE addresses a critical knowledge gap: We don't understand how immune responses to infections and vaccines vary across different ages, populations, and genetic backgrounds worldwide.
  - This matters because:
    - The aging crisis: Over 2.1 billion people will be 60+ by 2050 (mostly in low/middle-income countries), facing declining immunity and poor vaccine responses
    - One-size-fits-all doesn't work: Recent findings show immune aging isn't universal - what we know from Western populations doesn't apply everywhere
    - We can't predict or optimize: Without understanding what drives protective immunity across diverse populations, we can't design equitable vaccines or prepare for emerging infectious diseases
    - The bottom line: We're trying to decode the universal and population-specific features of protective immunity to create more effective, equitable vaccines and health interventions for our rapidly aging, increasingly vulnerable global population.
- DECODE will contribute to a better understanding of the determinants of immune health and will be fundamental in development of future vaccine constructs, taking into consideration the needs of special populations like the elderly and children of any ethnicity.
- Vaccines are a critical public health tool, which will be even more valuable if we understand how differences in age, sex, ethnicity and environmental exposures impact the antigen-specific immune responses.

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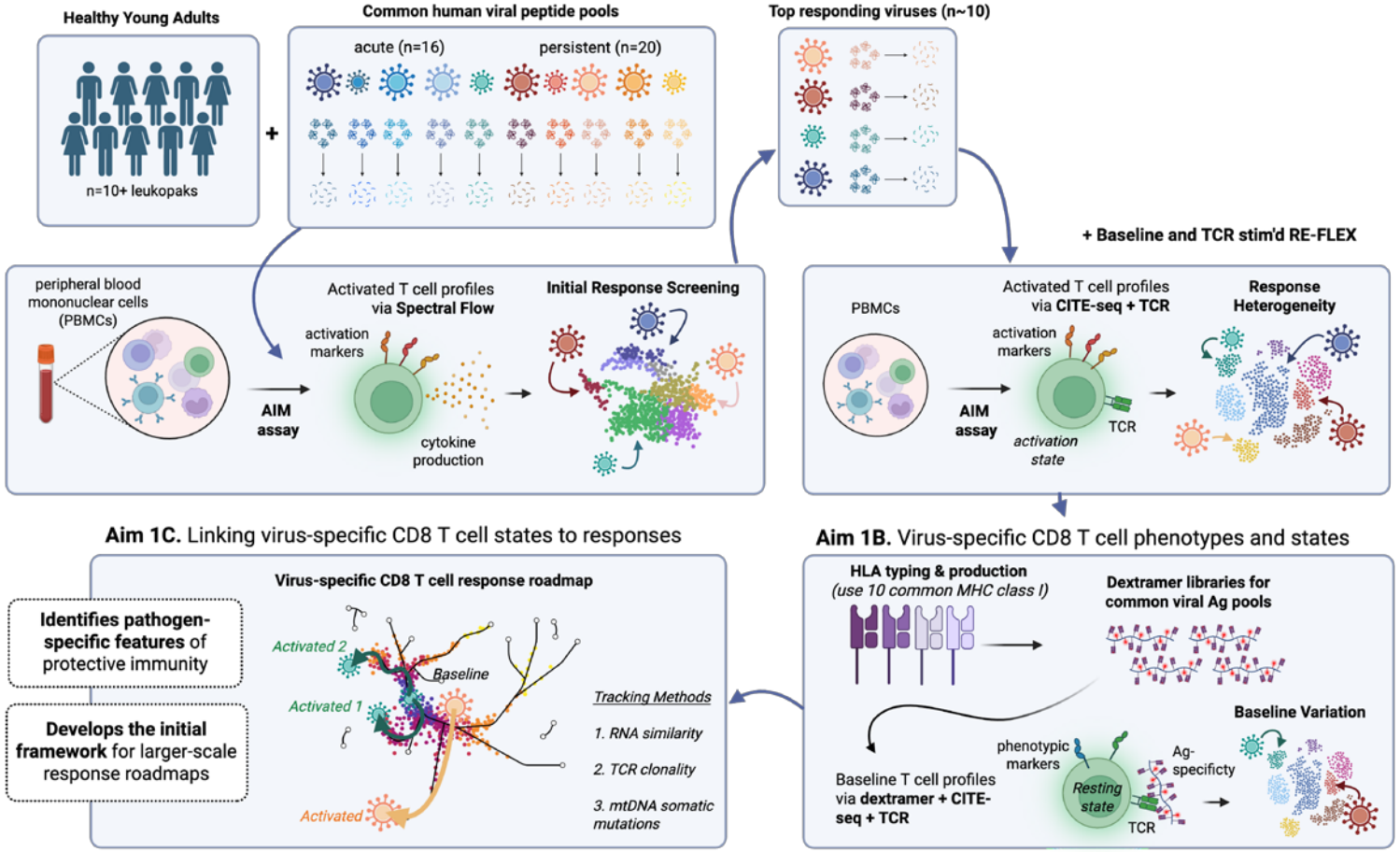
Your approach to solve the problem



DECODE will leverage **cutting-edge, scalable multi-omic technologies** to generate a comprehensive understanding of **protective human immune responses to infection and vaccination** at single cell resolution across >50 different pathogens and adults 20-80yrs of age worldwide.

DECODE will move beyond baselining the immune system into functional immune cell dynamics - **building novel foundational models** to predict an individuals' immune responses to any pathogen or vaccination across the globe.

Is your project suitable for IHI?

- Delivering a comprehensive open science resource like DECODE requires cross-sectorial collaboration to ensure that the human immune response “roadmap” is designed for priority pathogens and relevant for implementation by organizations working on development novel vaccines for global populations.
- DECODE would benefit from further co-shaping by vaccine, pharma and in vitro diagnostic Industry partners with regards to selection of use cases (priority pathogen selection), access to diverse clinical samples from around the world, data and overall design of studies and development of AI/ML foundational models.
- Working closely with EU based development organizations will strengthen the competitiveness of the EU health industry and reinforce the European R&I strategy by implement new knowledge to innovative health solutions.

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Outcomes and Impact

- **DECODE** aims to create ***the world's most comprehensive map of protective immune responses*** across diverse global populations, addressing critical gaps in how age, sex, genetic ancestry, and immune history shape *functional* human immunity.
- By generating this globally-representative immunological data resource and predictive models, this project will enable R&D organizations to pursue precision vaccine design strategies and immune-modulating therapies, improving health equity and disease prevention—especially in aging and underrepresented populations such as elderly and children.
- The project will yield global impact as patients will receive vaccines that will offer better protection for their age, sex and genetic ancestry.

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Expertise and resources

- We have:
  - Track record of generating massive high-quality immune data sets leveraging cutting edge novel multi-omic technologies incl. such as the TEA-seq assay, which allows for simultaneous measurement of transcriptomics, protein epitopes, and chromosome accessibility.
  - Access to bio repositories with samples from people that have been tracked for up to 30 years, allowing for the study of the aging process' impact on the immune system.
- We are looking for:
  - Scientific partners that will help co-shape the strategy and study design, particularly with regards to vaccine development, pathogen selection and translation of results to impact.
  - Access to samples that will further increase diversity.
  - Computational resources (high performance cloud computing), AI/ML (e.g foundational modelling)

Allen Institute can make In-kind (IKOP) contributions as a Contributing Partners)

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Additional information

- Scientific Leads

Peter Skene, PhD is the Senior Director of High Resolution Immunology at the Allen Institute for Immunology. Dr. Skene specializes in multi-omic technologies, epigenetics, and implementing assay development/improvements at scale.

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Claire Gustafson, PhD is an Assistant Investigator and Immune Health Program Lead at the Allen Institute for Immunology. Dr. Gustafson has expertise in immune-aging as well as T cell homeostasis and responses to aging, infection and vaccination.

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