Thesis Progression

PROTEOMIC PROFILING OF IMMUNE RESPONSE TO DENGUE VACCINE

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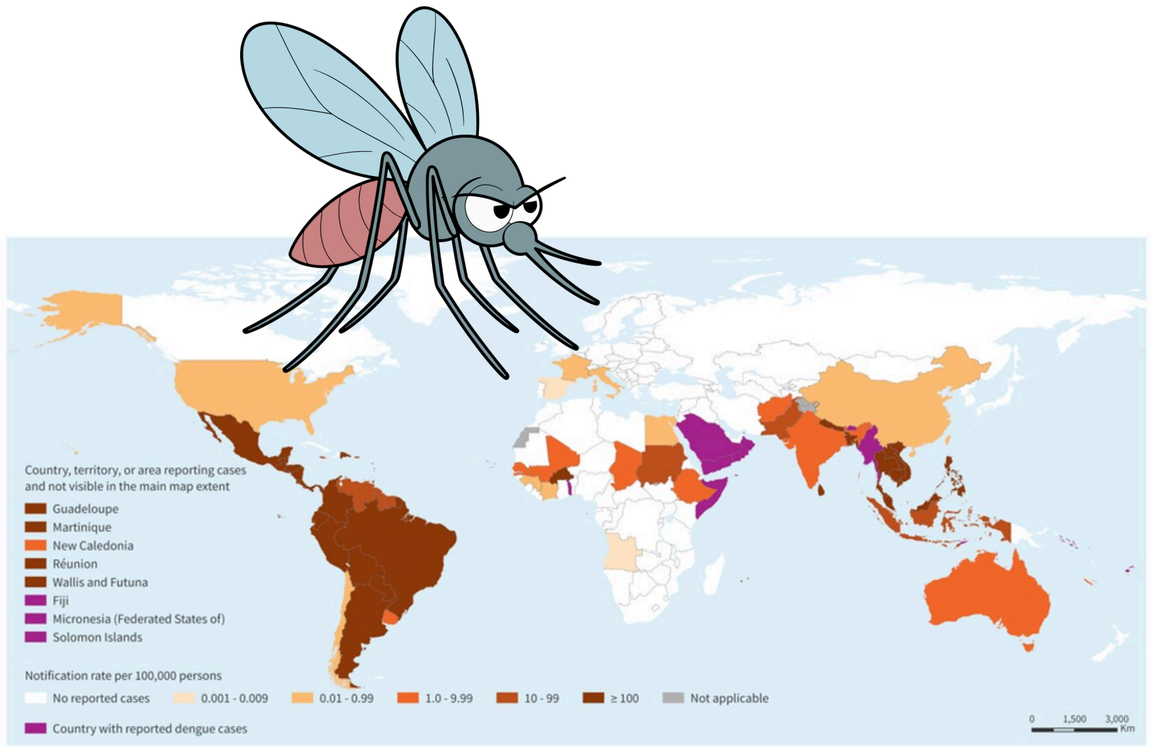
INTRODUCTION

DENGUE FEVER

- Dengue is a major mosquito-borne viral disease worldwide
- Major public health problem in tropical & subtropical regions

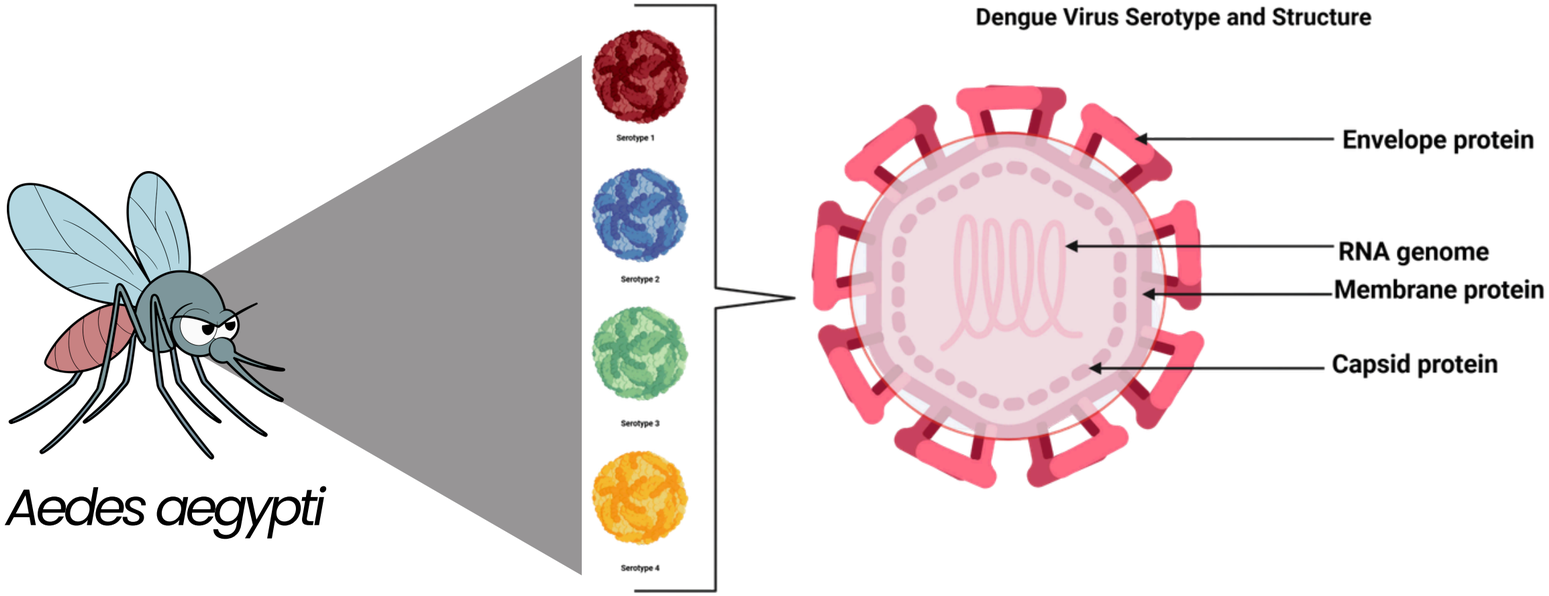


- Clinical spectrum ranges from
  - Mild dengue fever
  - Severe dengue

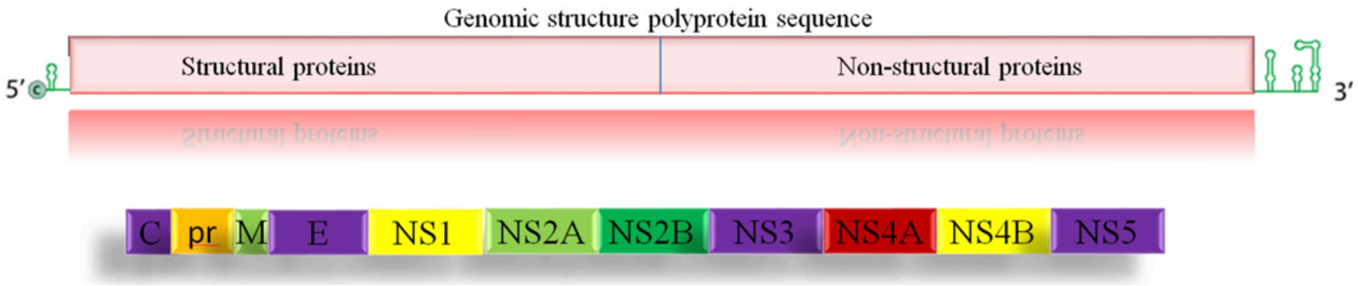
- No specific antiviral treatment
- Supportive care is main management
- Early diagnosis reduces mortality
- Vaccine development ongoing

Pourzangiabadi et al., 2024

DENGUE VIRUS



- Family: Flaviviridae
- Genus: *Flavivirus*
- +ssRNA genome
- 4 serotypes: DENV-1 to DENV-4

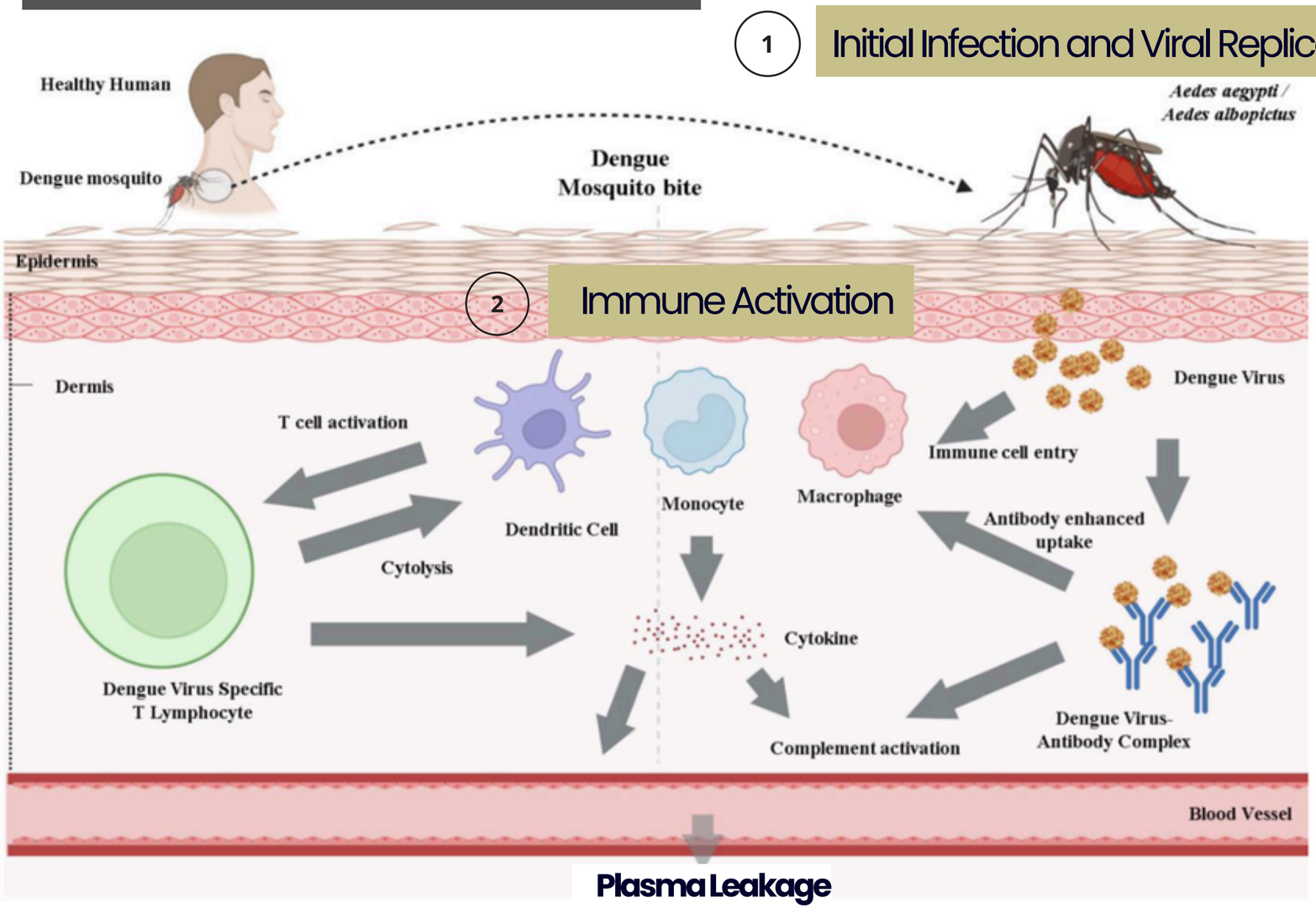


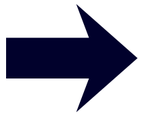
Genome encodes:

- 3 structural proteins (C, prM/M, E)
- 7 non-structural proteins (NS1–NS5)

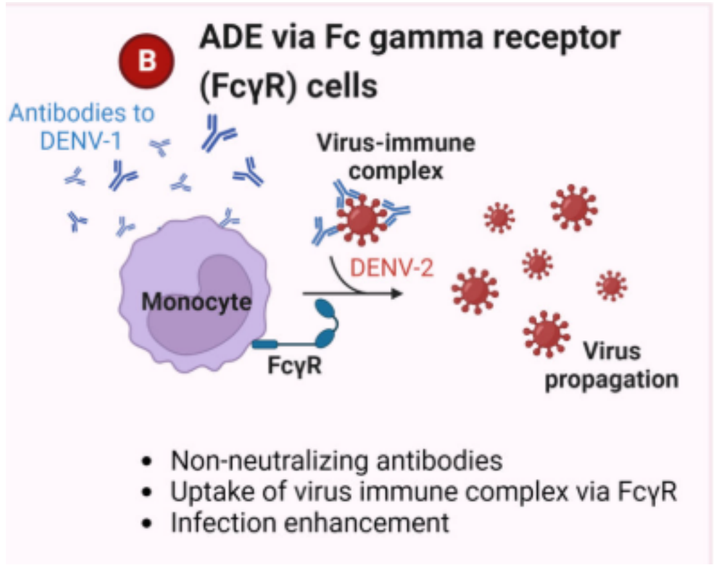
Pourzangiabadi et al., 2024

DENGUE PATHOGENESIS





Antibody-Dependent Enhancement (ADE)



Incomplete vaccine

No specific antiviral treatment

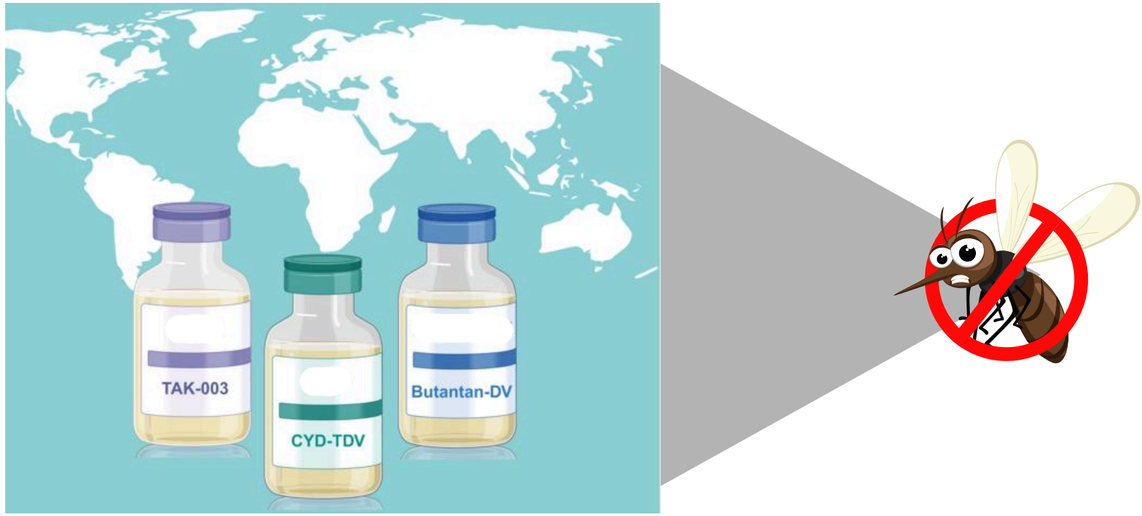
Four serotypes cause repeated infections

DENGUE VACCINE

Vaccine prevent dengue fever, development began in 1920s

Live-Attenuated Vaccines

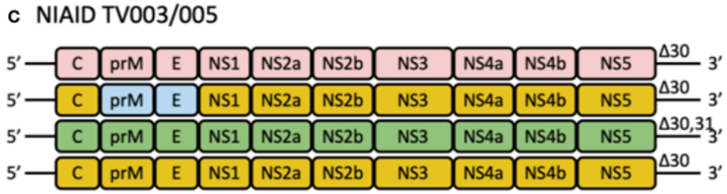
- Dengvaxia (CYD-TDV) by Sanofi Pasteur
  - First licensed dengue vaccine
  - Using the yellow fever 17D backbone



https://www.eurekalert.org/news-releases/1082220

- **Qdenga (TAK-003)** by Takeda
  - Secondary licensed dengue vaccine
  - Using the DENV-2 backbone with chimeric DENV-1, 3 and 4

- Butantan (TV003/TV005) by NIH
  - Not yet licensed
  - Using full-length virus with genetic deletions



(Hou et al., 2022)

Objective

Compare protein expression profiles between pre- and post- vaccination.

Specific objectives

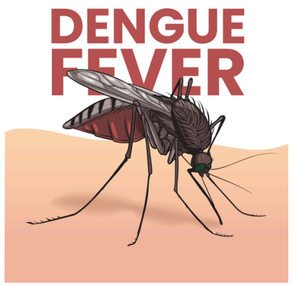
1. To identify differentially expressed proteins (DEPs) between pre- and post-vaccination.
2. To identify enriched biological pathways and molecular functions associated with vaccine-induced immune responses.
3. To characterize the immune networks associated with vaccine-induced protein expression changes using protein-protein interaction (PPI) analysis.

Hypothesis

Dengue vaccinee have differences proteomic profiling and immune response compared with pre-vaccination.

Conceptual framework

Problem



Dengue fever is a major public health concern

No universally effective vaccine

Mechanism of immune response to vaccine is still unclear

Process

Collect blood samples from vaccinee

Sample classification using ELISA

Perform Olink proteomic analysis

Olink Proteomics

Outputs

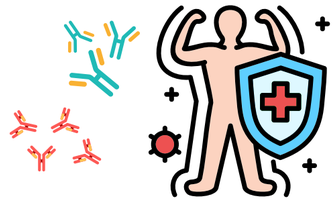
- Antibody level IgM and IgG
- List of proteins
- List of enriched biological pathways
- PPI network diagram and hub proteins

Outcomes

Sample classification

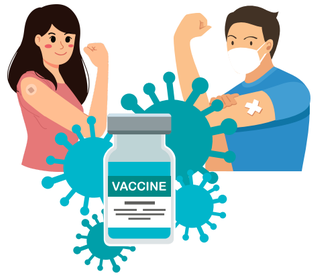
Understand immune-related pathways activated by the vaccine

Understand immune response to vaccine



Impacts

Improved the efficacy of vaccine

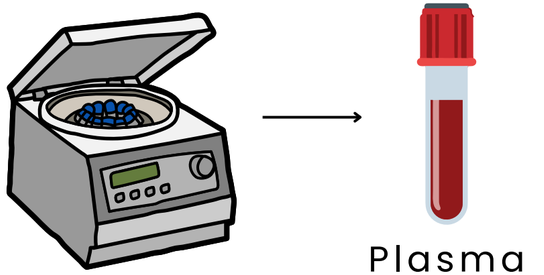


Improved public health value and disease management

Study design

PART 1 : Sample collection and Preparation

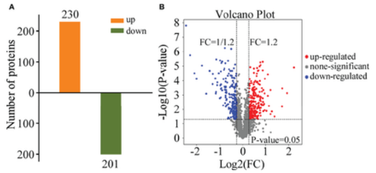
Blood collection



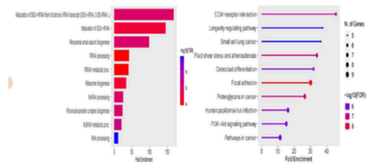
Sample processing

PART 2 : Proteomic analysis

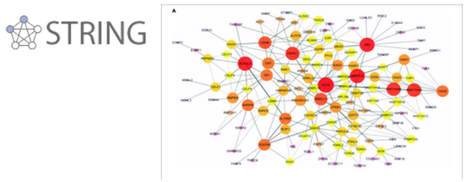
Differential expression proteins (DEPs) analysis



Pathway enrichment analysis



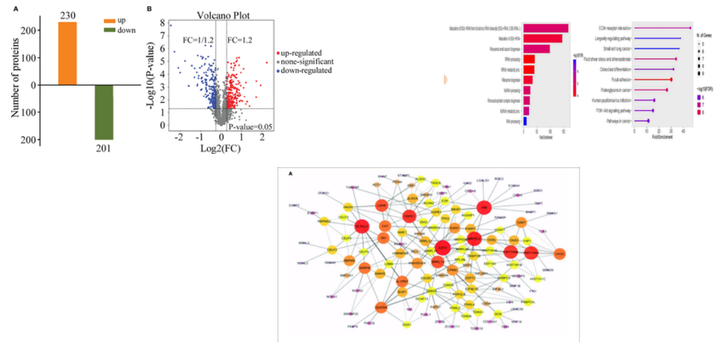
Protein-protein interactions (PPI)



PART 3 : Data interpretation

Classification	IgM	IgG
Response to vaccine	+	+
Non-response to vaccine	−	+
	+	−

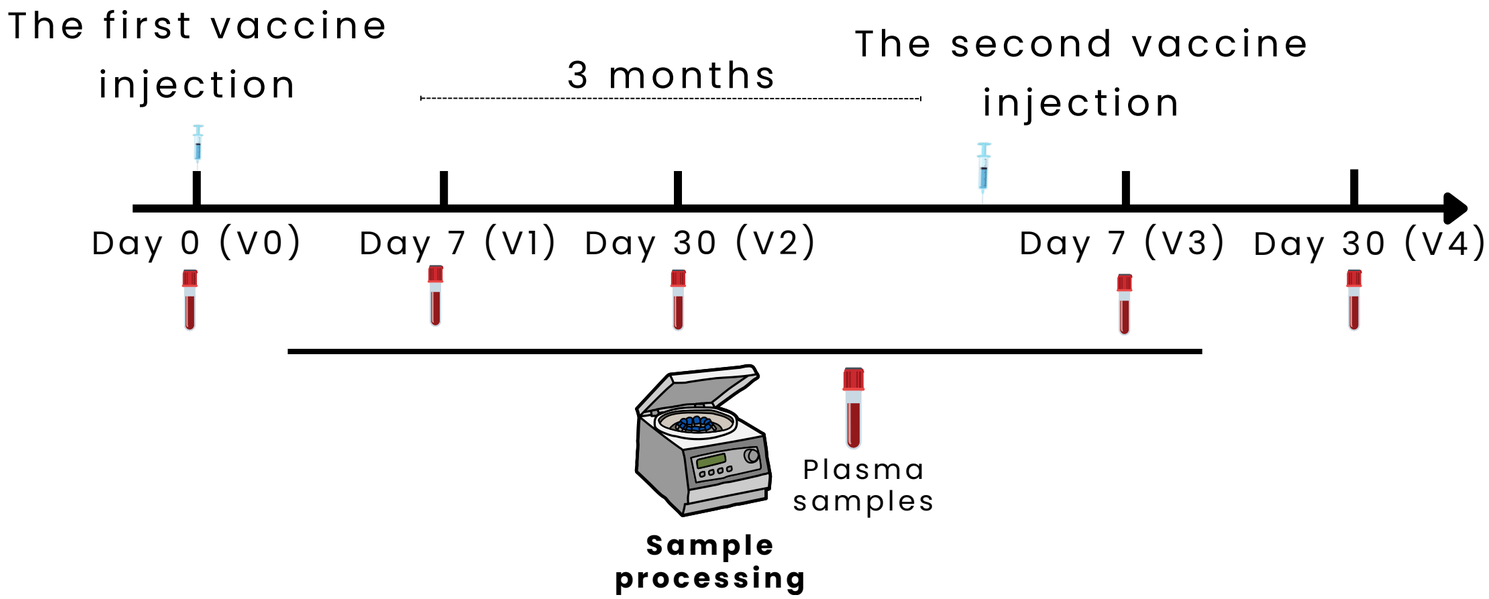
Sample classification



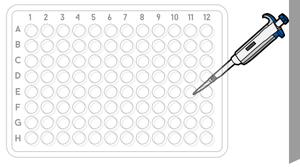
Proteomic results

PART 1 : Sample collection and Preparation

Objective: To collect plasma samples at 5 time points before and after two vaccine injections and measure IgM and IgG antibody titer using ELISA.



ELISA test for Anti-DV1-4



Sample classification

Classification	IgM	IgG
Response to vaccine	+	+
Non-response to vaccine	−	+
	+	−

PART 1 : Sample collection and Preparation

Objective: To collect plasma samples at 5 time points before and after two vaccine injections and measure IgM and IgG antibody titer using ELISA.

Sample classification

Classification	IgM	IgG
Response to vaccine	+	+
Non-response to vaccine	−	+
	+	−

Select plasma samples

Proteomics analysis

Olink Proteomics

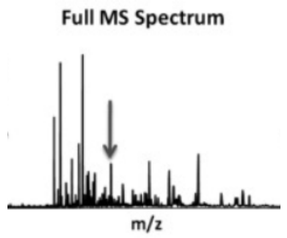
Olink target 48 panel

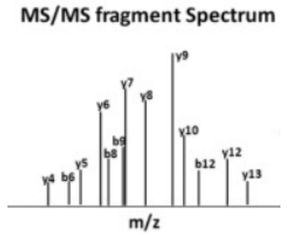
- Olink Target 48 Cytokine
- Olink Target 48 Immune Surveillance

PART 2 : Differential expression proteins (DEPs)

Objective: To identify differentially expressed proteins (DEPs) between pre- and post-vaccination.

Data Retrieval



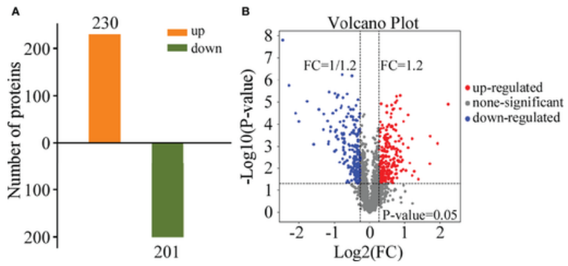


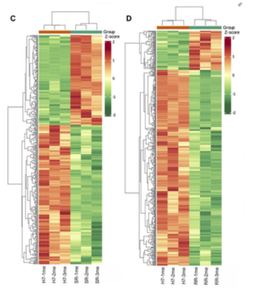
Raw data from LC-MS/MS

Data Processing

- Quality control
- Normalization

Differentially Expressed Proteins (DEPs)

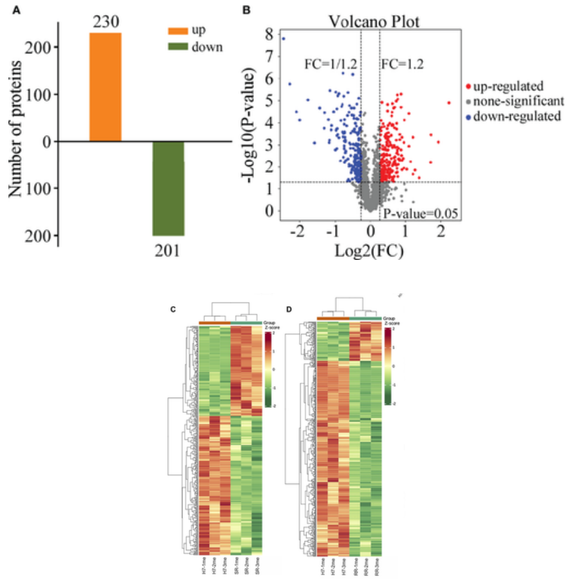




PART 2 : Pathway enrichment analysis

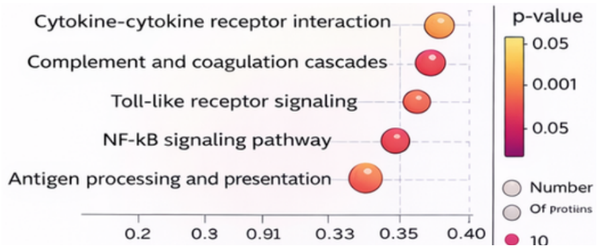
Objective: To identify enriched biological pathways and molecular functions associated with vaccine-induced immune responses.

Differentially Expressed Proteins (DEPs)



Pathway Enrichment Analysis

Pathway Enrichment Analysis (KEGG / GO)



Key Pathways Involved In Immune Response

Significant Immune Pathways

Example

Cytokine signaling

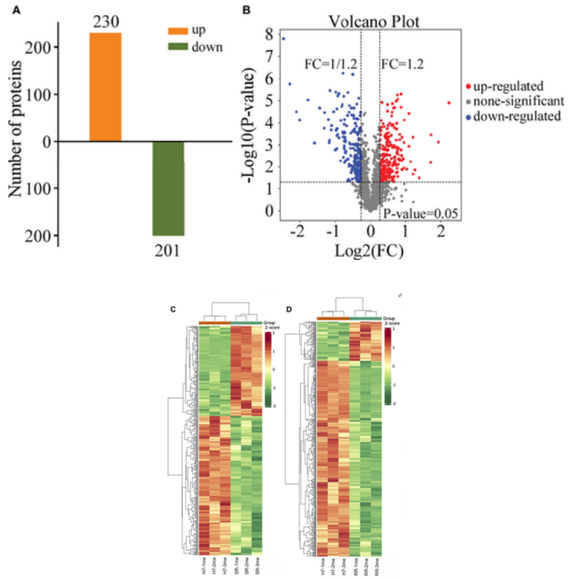
Complement activation

Toll-like receptor signaling

PART 2 : Protein-Protein interactions (PPI Network)

Objective: To characterize the immune networks associated with vaccine-induced protein expression changes.

Differentially Expressed Proteins (DEPs)



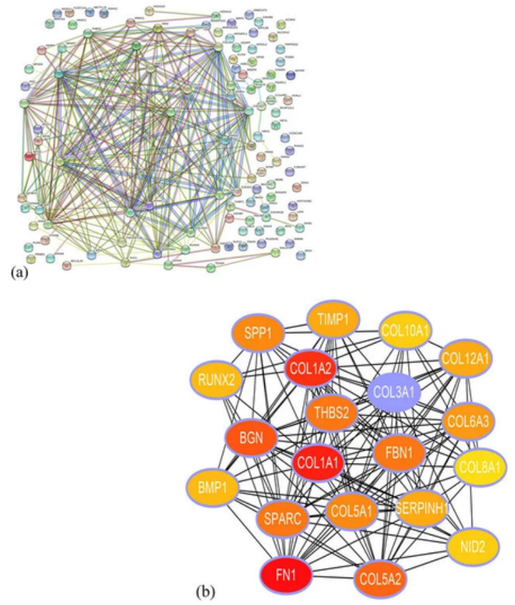
PPI Network Analysis

STRING

STRING Database

PPI Analysis

PPI Network Visualization



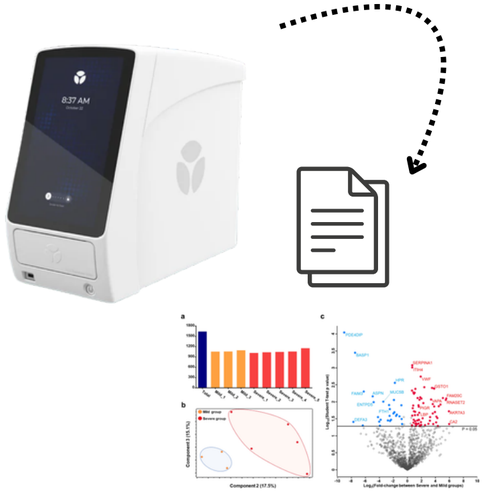
PART 3 : Data interpretation

Objective: To analyze proteomic profiles between sample groups and interpret results compare with previous literature.

ELISA Test

+

Olink Proteomics



Proteomic Results

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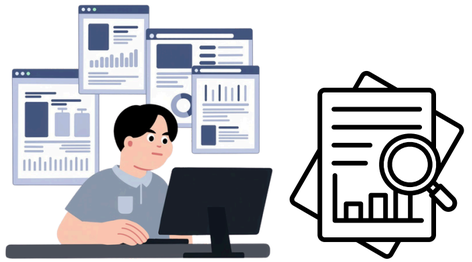

Literature comparison

Thesis plan

Activities	2025		2026				2027	
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
1.Coursework								
2.Literature review and Planning								
3.Proposal writing								
4.Proposal examination								
Part I ELISA test								
5.Measure IgM and IgG antibody titer								
Part II Proteomic analysis								
6.Differentially expression proteins (DEPs)								
7.Pathway enrichment								
8.PPI analysis								
Part III Data interpretation								
10.Proceeding								
11.Thesis defense examination								

Done **On process** **Future work**

ACKNOWLEDGMENT

ADVISOR

ASSOC. PROF. SUPRANEE PHANTHANAWIBOON

SP LAB MEMBERS

THANK YOU

For Your Attention