

A fast and economical process  
to develop vaccines for the  
purposes of illness prevention  
and treatment

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# Powerful protection by vaccination

Diphtheria



Measles



Mumps



Pertussis



Smallpox



Tetanus



Paralytic Poliomyelitis



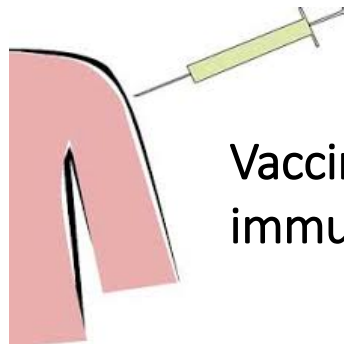
Rubella



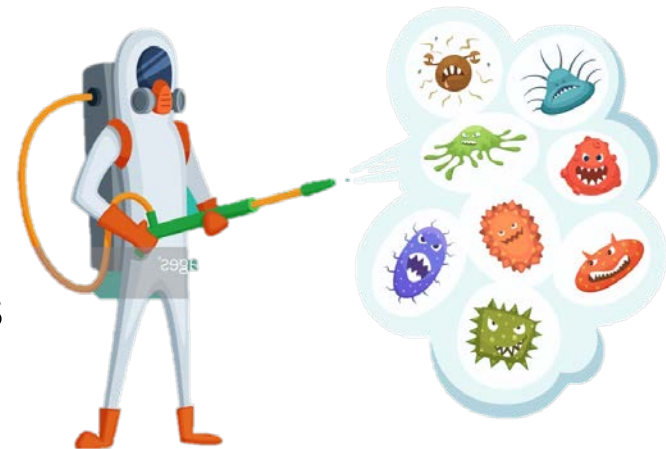
## How do vaccines work?



Contains inactivated/attenuated pathogen or pathogen subunits



Vaccine induced immune responses



# How can vaccines be improved

Designed for one disease



Designed for multiple diseases

i.e. Infanrix® Hexa protects against Diphtheria, Tetanus, Pertussis, Hepatitis B, Poliovirus and *haemophilus influenzae* type B

- “Immunization burden”
- Complex manufacture and adjuvant required → high cost



Demand for single component multi-pathogen vaccine

What can be improved:

- Single construct → Lower cost
- One shot → Less jabs

# Vaccinia virus in vaccine development

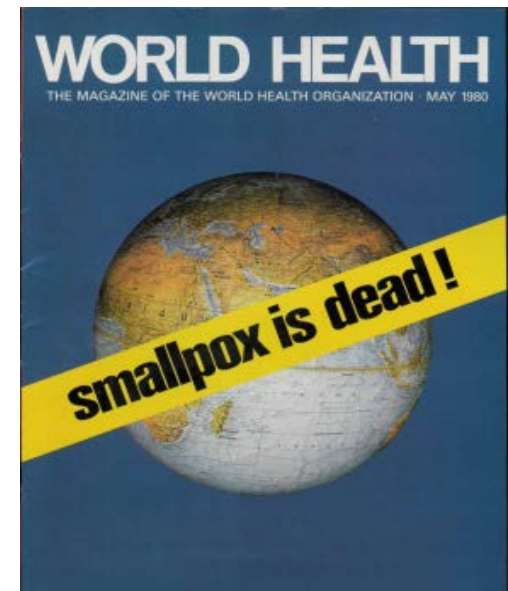
→ Smallpox eradicated using vaccinia virus (VACV)

→ Advantages of VACV as a vaccine platform

- Long-lived antibody and cellular immunity
- Large capacity for insertion (25kb)
- Low risk of genome integration into the host
- Stable in freeze-dried form

→ Current licensed VACV vaccine

- Multiplication-competent
- Severe side effects



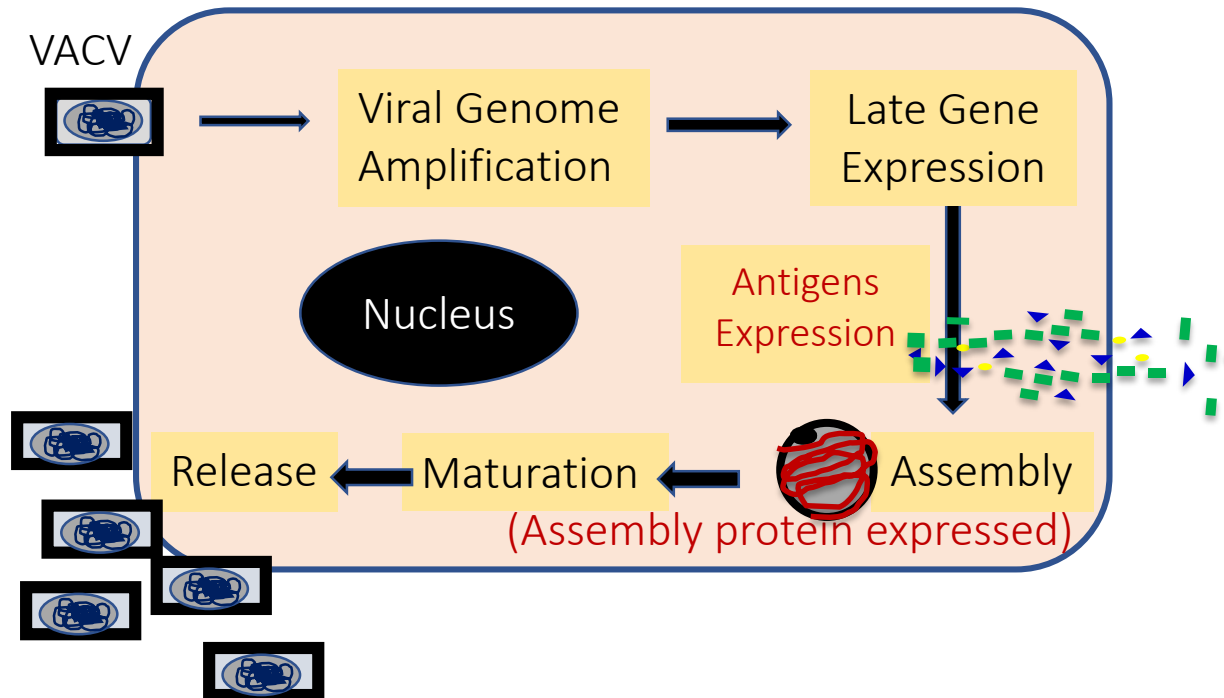
# Latest VACV-based viral vectors

Generation	3 <sup>rd</sup>	4 <sup>th</sup>
Representative	MVA	NYVAC
Attenuation	Host range restriction	
Technique	Passage in alternative host	Genetic engineering
Limitations	Primary cells required → Manufacture hurdle	Translational block → Reduced antigen expression
	Multiple doses required	



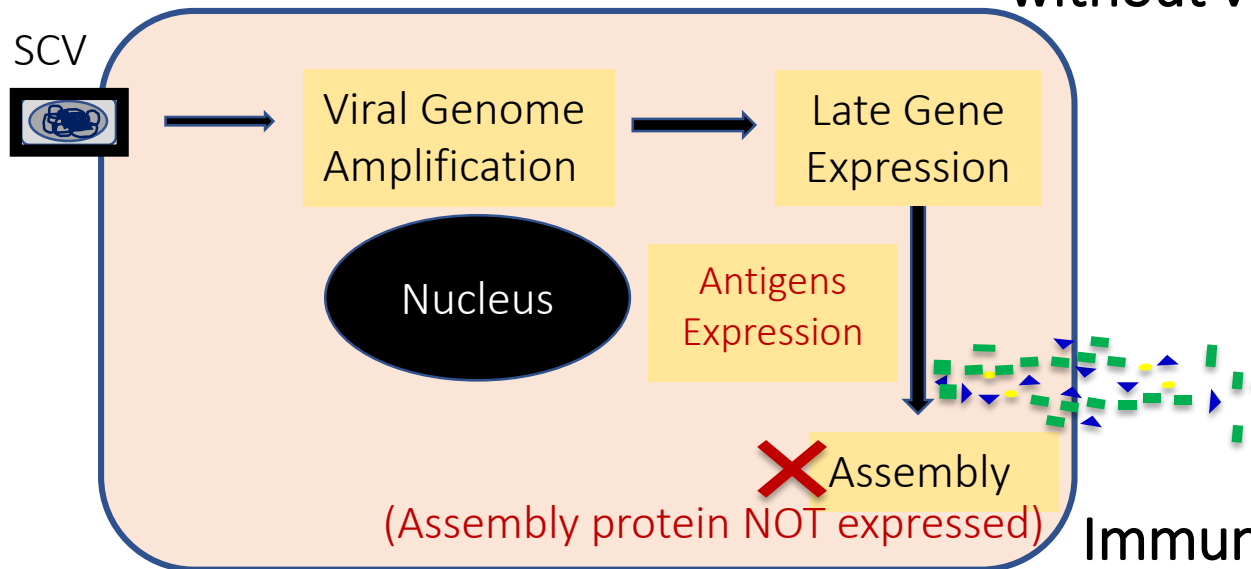
Multiplication-defective VACV: Sementis Copenhagen Vector (SCV)

# Traditional VACV multiplies in cell



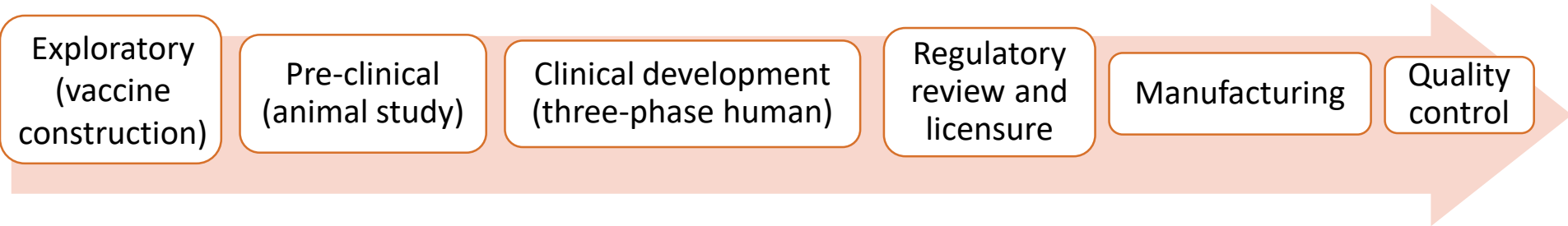
# Sementis Copenhagen Vector (SCV): A new VACV-based platform

Expression of inserted antigens  
without virus amplification



Immune responses induced  
against the inserted antigens

# Fast and economical process for SCV vaccine manufacture



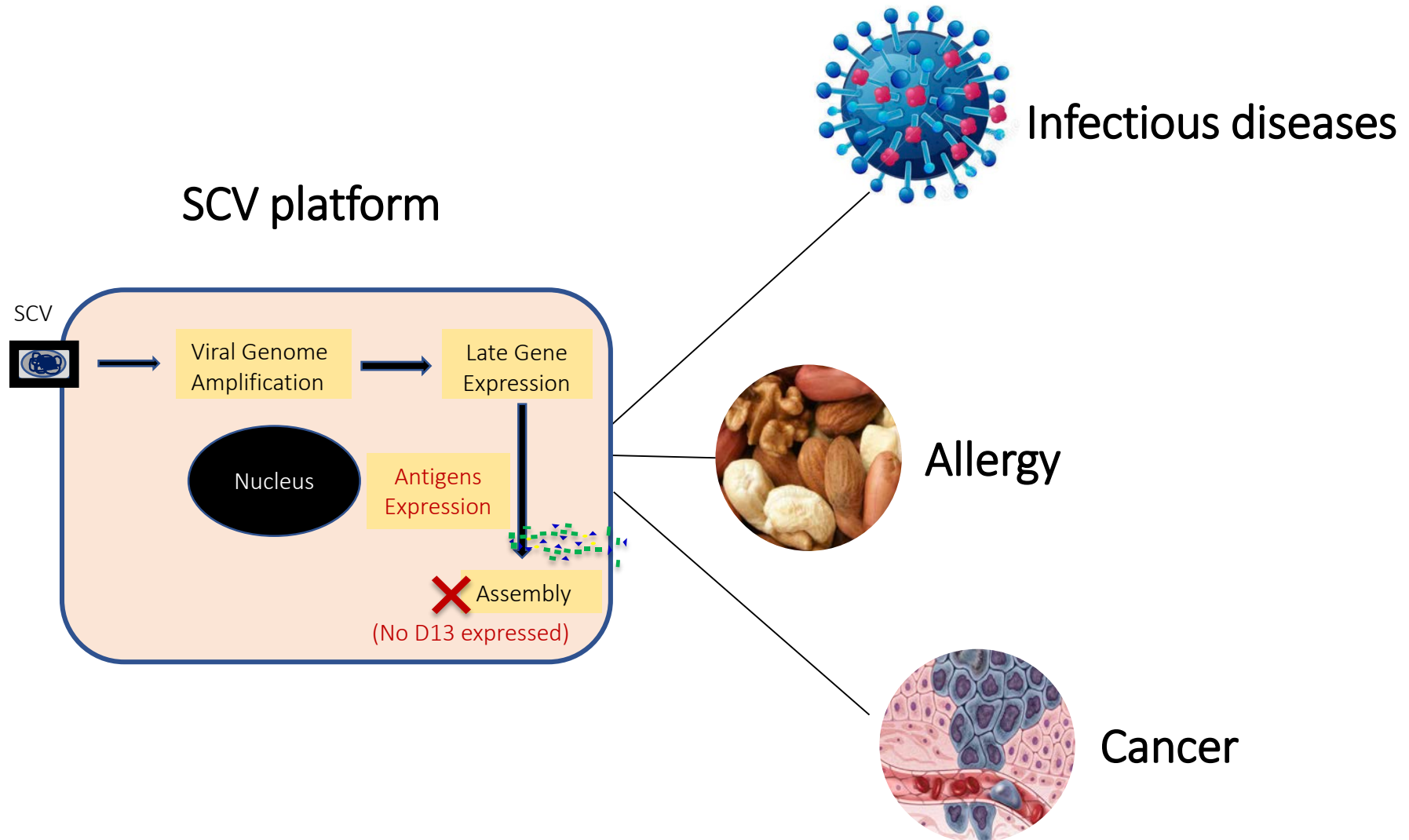
A CHO-based manufacture:

- Fast growth → Fast vaccine production
- Well characterized in biopharmaceutical industries  
→ Well known worldwide by medical control agency  
(TGA in Australia, FDA in USA, EMEA in Europe)

Streamline vaccine development for rapid responses to  
further infections (global pandemics, bioterror attacks)



# SCV potential in prophylactic and therapeutic applications

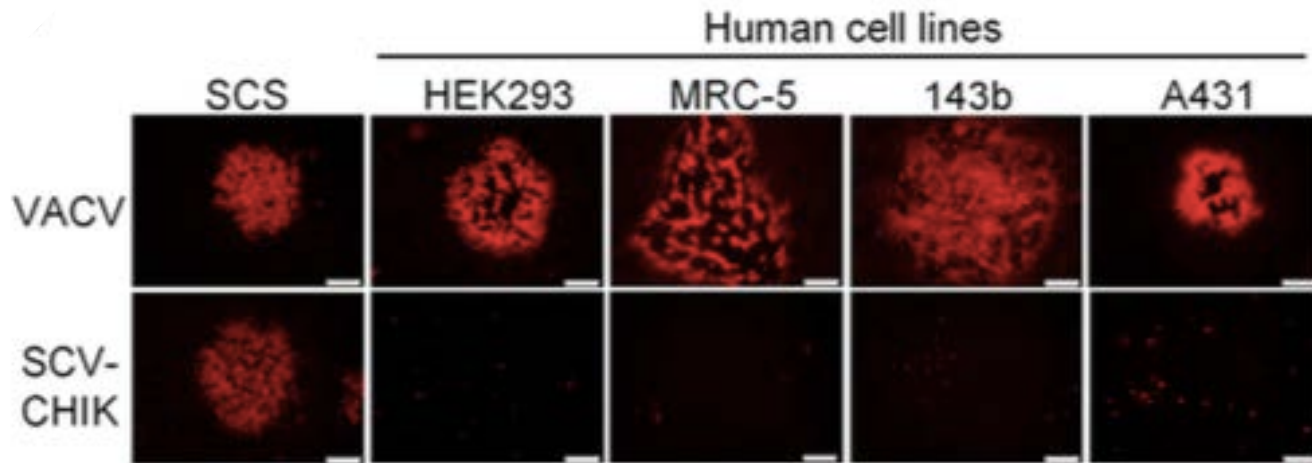


# SCV vaccines: Pre-clinical proof

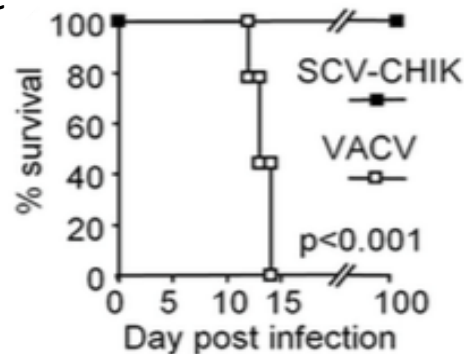
## Single vaccine against chikungunya virus (CHIKV) infection (SCV-CHIK)

- Safety in immunocompromised mice
- Protection against CHIKV challenge

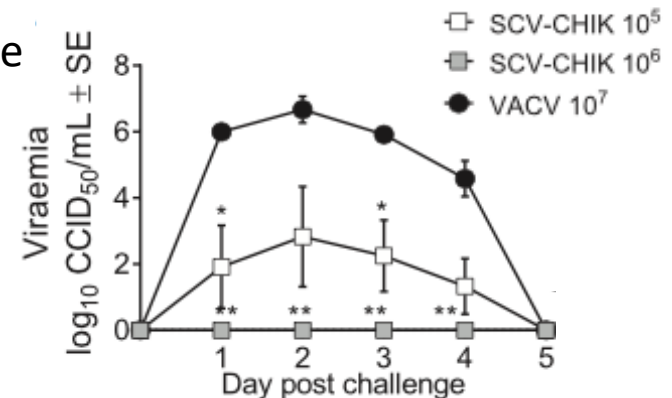
Molecular Therapy



SCID mice



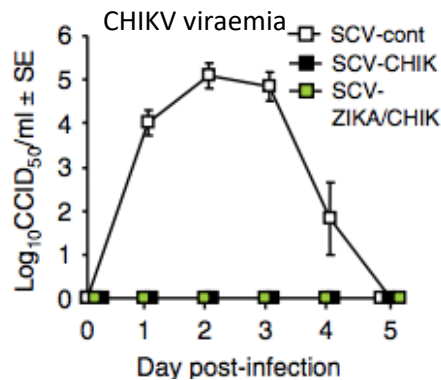
C57BL/6 mice



# SCV vaccines: Pre-clinical proof

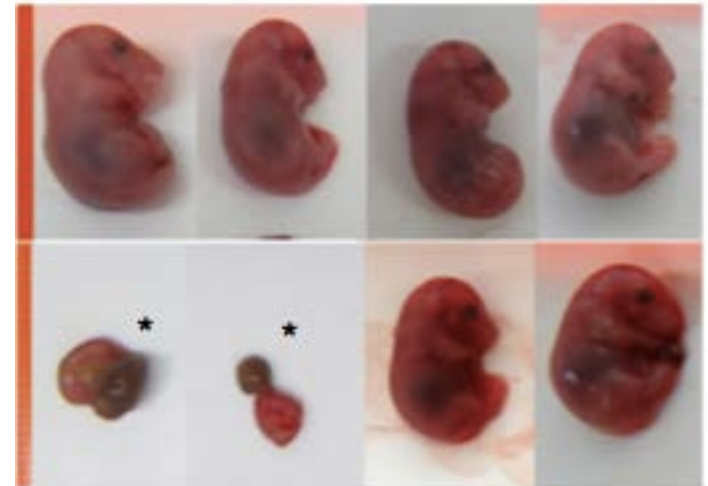
## Dual protection against chikungunya and Zika (SCV-ZIKA/CHIK)

- First time to express large antigens from two unrelated viruses
- Protection against both chikungunya and Zika
- Protection against Zika during pregnancy

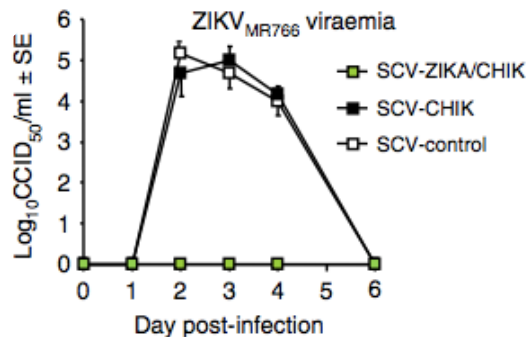


Deformation in fetuses cause by Zika infection

SCV-ZIKA/CHIK  
Vaccinated



Negative control



- First-in-human trial commences in 2019

# Vaccine development for Hepatitis A+B

## Hepatitis B (Engerix-B, H-B-Vax II)

- 3-dose regime
- Booster vaccination
- Non-responders (1 in 20)

## Hepatitis A (Havrix, Avaxim)

- 3-dose regime
- Booster vaccination

## Hepatitis A and B (Twinrix)

Mixture of Engerix-B and Havrix

Can be improved by SCV

- Single construct → Simplified manufacture → Lower cost
- Highly immunogenic → 1-dose vaccination

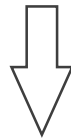
# SCV vaccine for Hepatitis A+B

Potent vaccine responses include both humoral and cellular responses



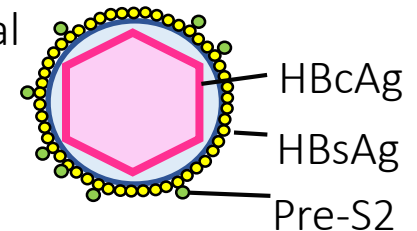
Insert hepatitis virus structural proteins into SCV

Expression of authentic hepatitis antigens

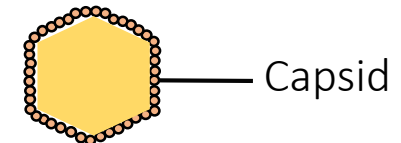


SCV vaccine presumably provide effective and durable protection against hepatitis A and B

Inserted HBV structural proteins



Inserted HAV structural proteins



# Acknowledgement

## Experimental Therapeutics Laboratory



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## Collaborators



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