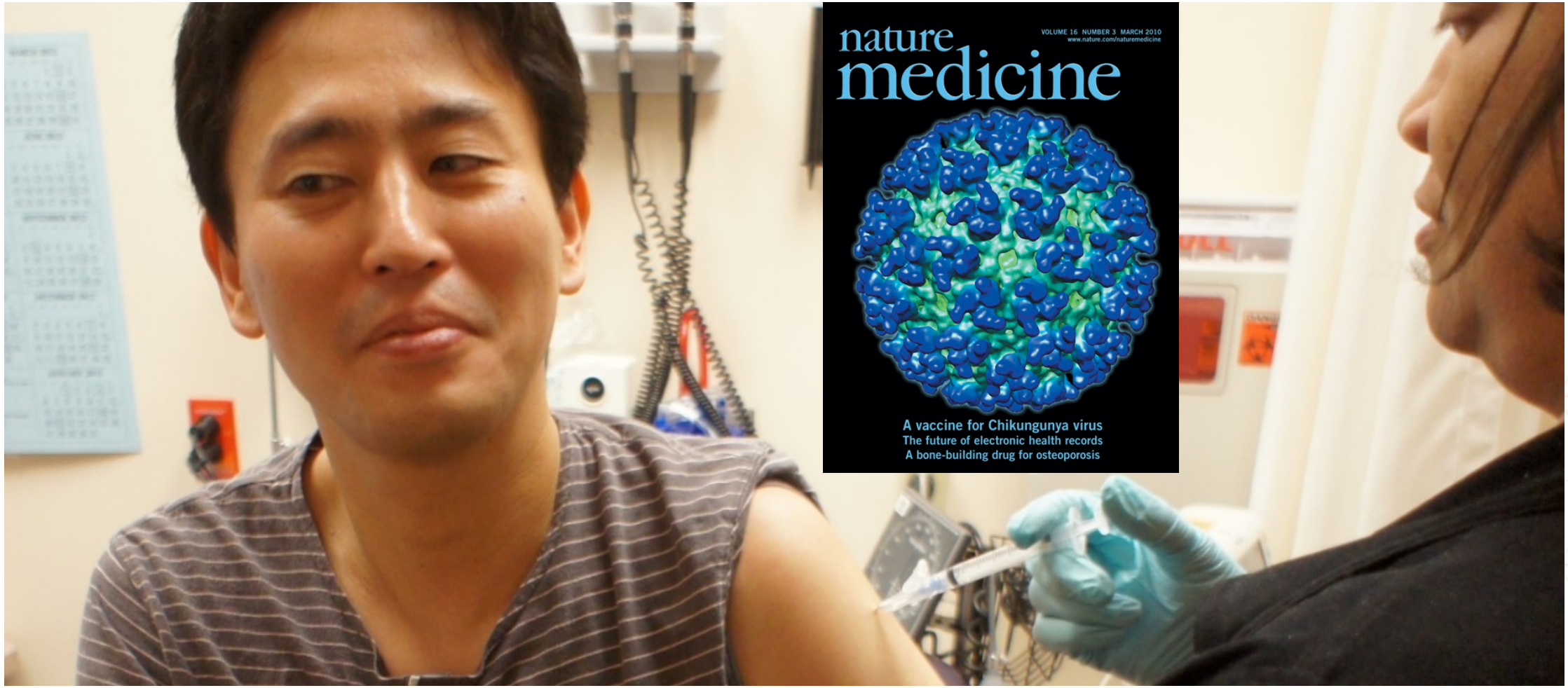
VLP Therapeutics

Gaithersburg, MD, USA

To combat 21st century global public health problems, we develop next generation vaccines against

Infectious diseases and Cancer

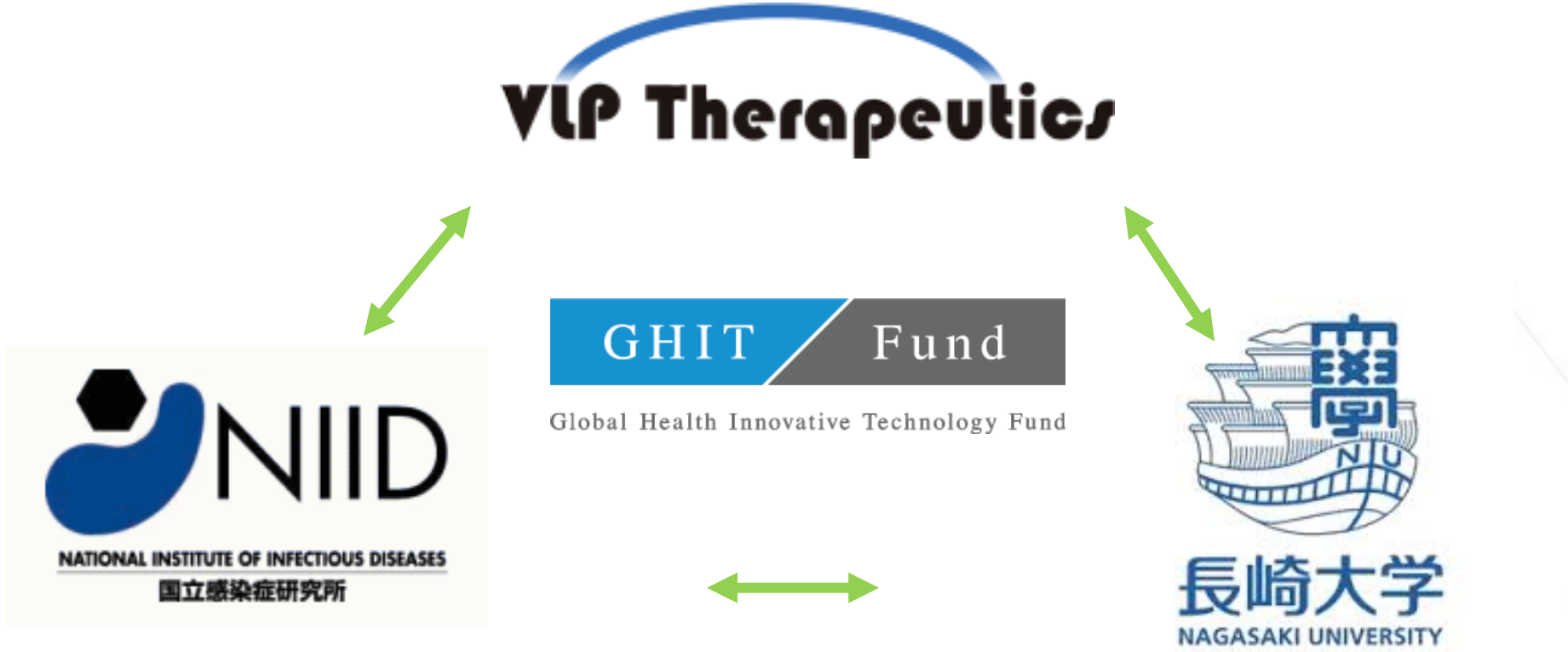
Introduction



GHIT– A global partnership focused on translational development

2016 GHIT Grant

Development of novel dengue virus-like particle (VLP) vaccines against all four serotypes



Director Tetsuro Matano
Japan

Professor Kouichi Morita
Japan

Leading Dengue Vaccine Candidates

Preclinical

- Virus Like Particles
- Virus-vectored
- NS1 Protein
- DNA
- Recombinant Fusion

Phase 1

Merck
V180
Subunit

NMRC
TVDV
DNA

WRAIR
TDENV-LAV
TDEN-PIV
Prime-boost

Phase 2

NIAID
TV003/
TV005
Live attenuated

GSK/ WRAIR/ Fiocruz
TDENV-PIV
inactivated

Phase 3

Takeda
TDV
Live attenuated

Butantan
TV003
Live attenuated

Approved

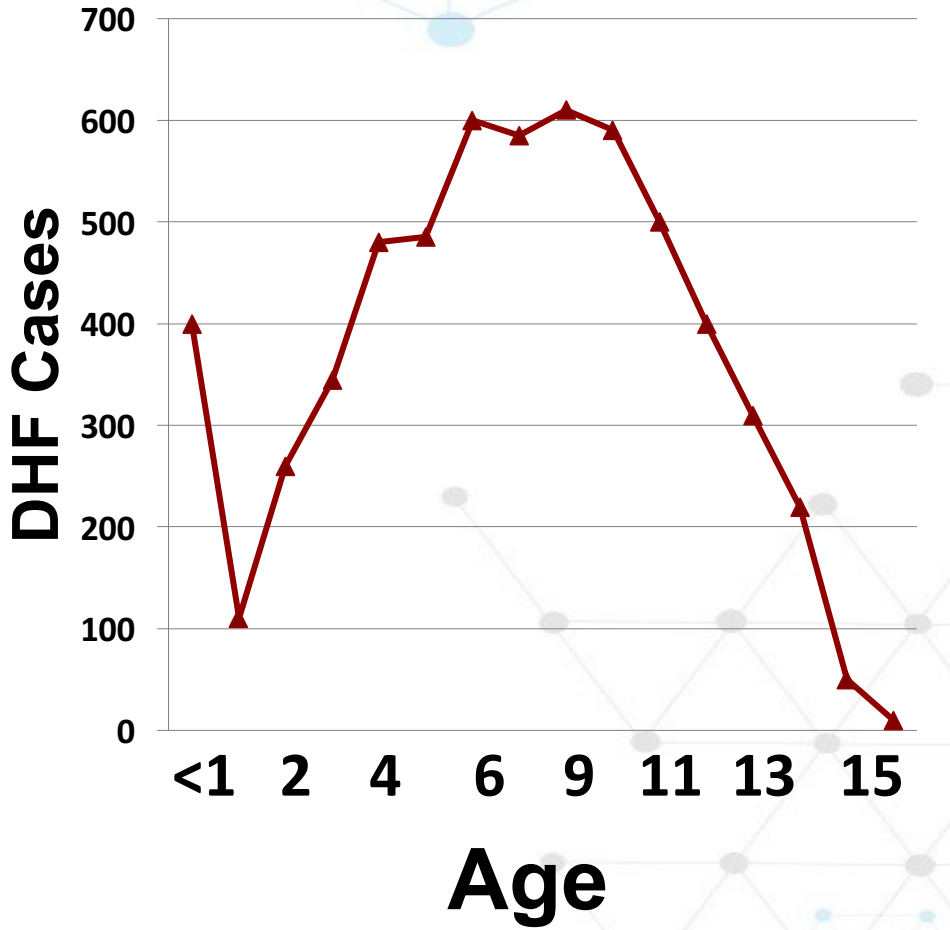
Sanofi
Dengvaxia
Live attenuated

~~Seronegative~~

Advantages of VLP Vaccines for Dengue

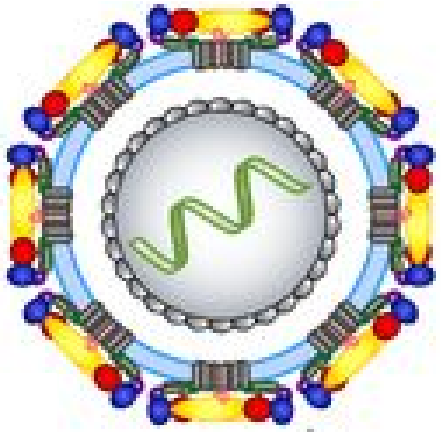
- Approved vaccine has only indicated for 9-45 year-old populations

- VLP vaccine is appropriate for: **Infants, children and adults**

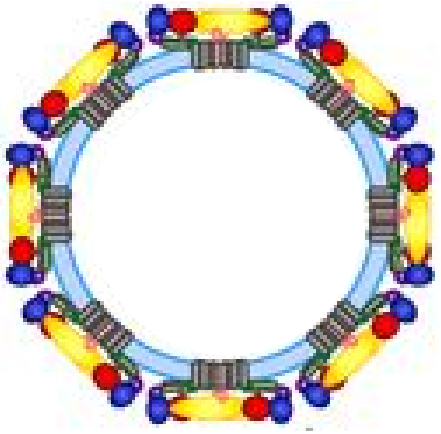


VLP Therapeutics Dengue Vaccine

Native Dengue Virus

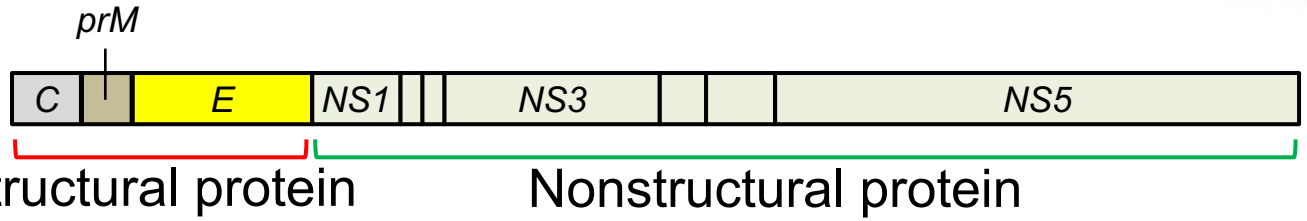


Dengue VLP



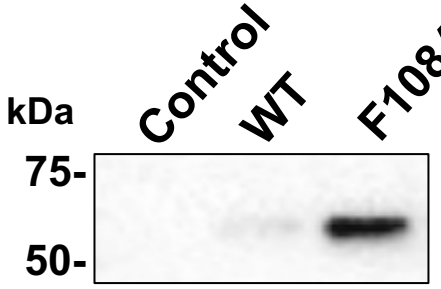
VLP Therapeutics Dengue VLP Vaccine Concept

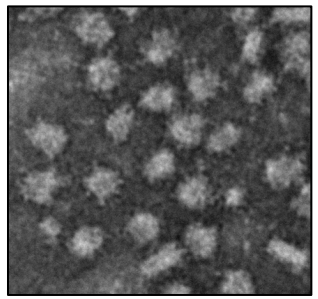
Native Dengue



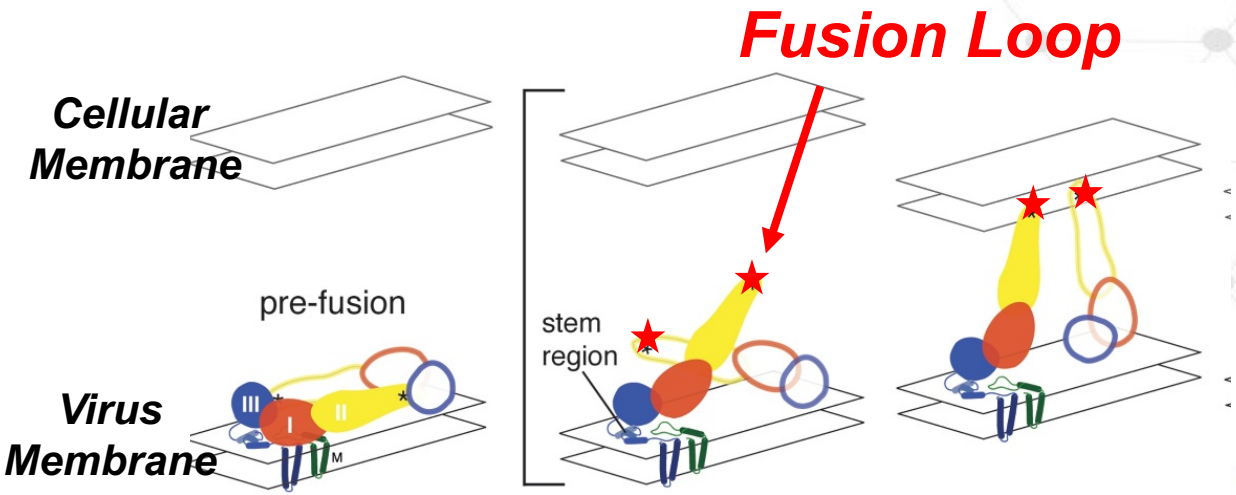
Dengue VLP

F108A



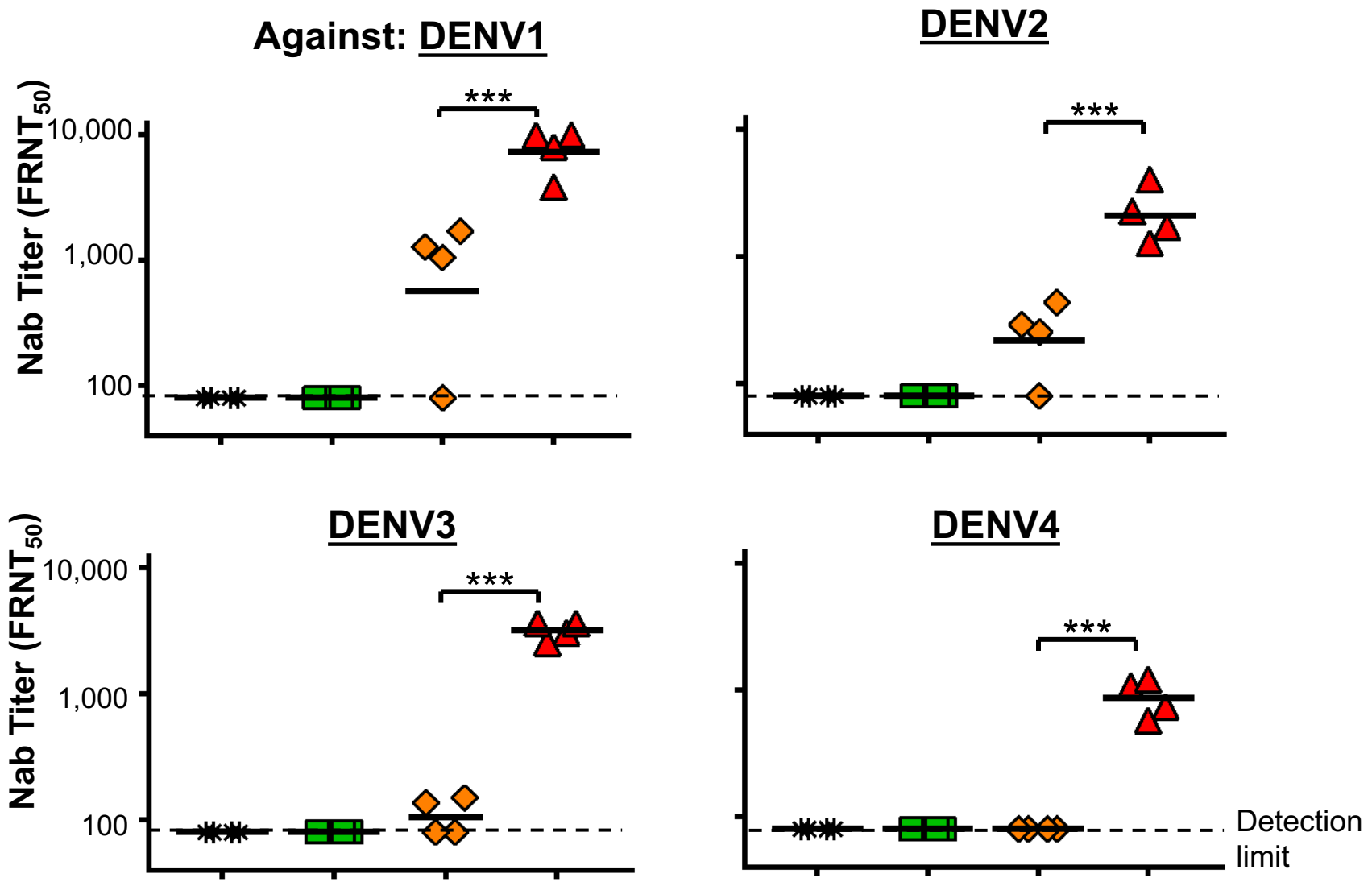


Critical E Conformational Change During Viral Fusion



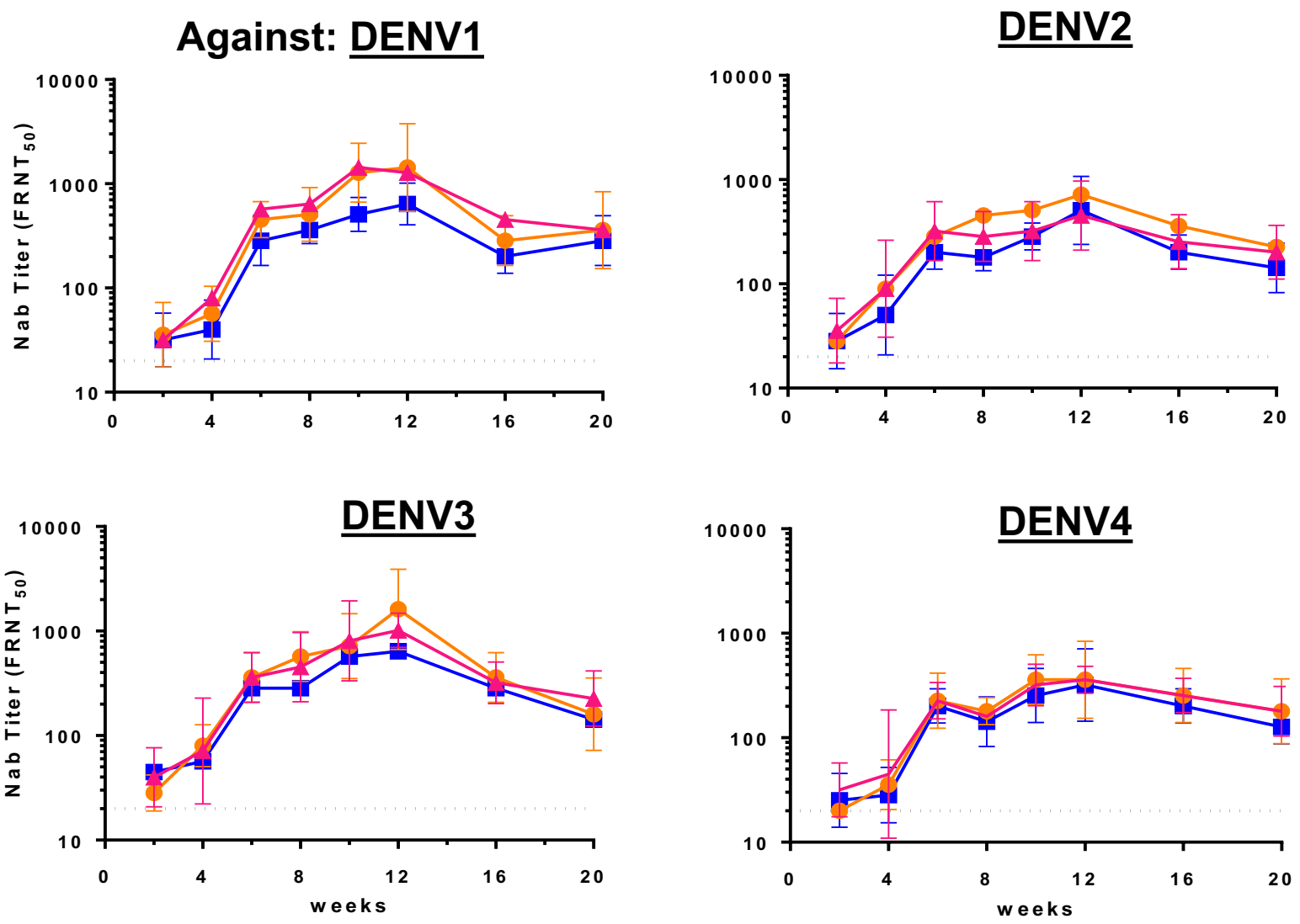
Results of GHIT – VLP Therapeutics Collaboration

Immunogenicity of VLP tetravalent Vaccine and DNA Vaccine in mice



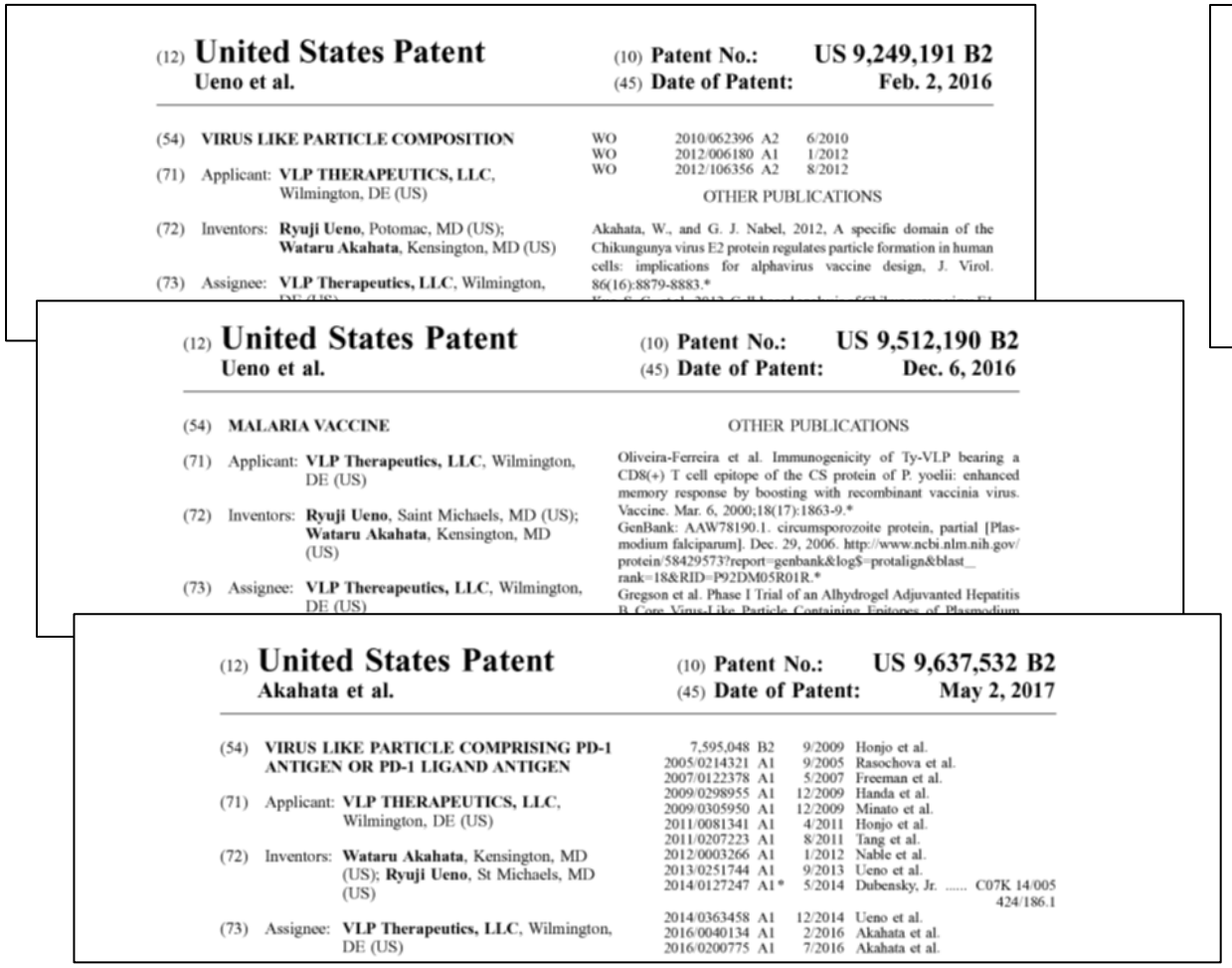
Results of GHIT – VLP Therapeutics Collaboration

Immunogenicity of VLP tetravalent Vaccine in nonhuman primates (N=6)



About VLP Therapeutics - Intellectual Property

Three Issued Patents



(12) **United States Patent**
Ueno et al.

(10) **Patent No.: US 9,249,191 B2**
(45) **Date of Patent: Feb. 2, 2016**

(54) **VIRUS LIKE PARTICLE COMPOSITION**

(71) Applicant: **VLP THERAPEUTICS, LLC**, Wilmington, DE (US)

(72) Inventors: **Ryuji Ueno**, Potomac, MD (US); **Wataru Akahata**, Kensington, MD (US)

(73) Assignee: **VLP Therapeutics, LLC**, Wilmington,

WO 2010/062396 A2 6/2010
WO 2012/006180 A1 1/2012
WO 2012/106356 A2 8/2012

OTHER PUBLICATIONS

Akahata, W., and G. J. Nabel, 2012, A specific domain of the Chikungunya virus E2 protein regulates particle formation in human cells: implications for alphavirus vaccine design, J. Virol. 86(16):8879-8883.*

(12) **United States Patent**
Ueno et al.

(10) **Patent No.: US 9,512,190 B2**
(45) **Date of Patent: Dec. 6, 2016**

(54) **MALARIA VACCINE**

(71) Applicant: **VLP Therapeutics, LLC**, Wilmington, DE (US)

(72) Inventors: **Ryuji Ueno**, Saint Michaels, MD (US); **Wataru Akahata**, Kensington, MD (US)

(73) Assignee: **VLP Thereapeutics, LLC**, Wilmington, DE (US)

OTHER PUBLICATIONS

Oliveira-Ferreira et al. Immunogenicity of Ty-VLP bearing a CD8(+) T cell epitope of the CS protein of P. yoelii: enhanced memory response by boosting with recombinant vaccinia virus. Vaccine. Mar. 6, 2000;18(17):1863-9.*
GenBank: AAW78190.1. circumsporozoite protein, partial [Plasmodium falciparum]. Dec. 29, 2006. http://www.ncbi.nlm.nih.gov/protein/58429573?report=genbank&log$=protalign&blast_rank=18&RID=P92DM05R01R.*
Gregson et al. Phase I Trial of an Alhydrogel Adjuvanted Hepatitis B Core Virus-Like Particle Containing Epitopes of Plasmodium

(12) **United States Patent**
Akahata et al.

(10) **Patent No.: US 9,637,532 B2**
(45) **Date of Patent: May 2, 2017**

(54) **VIRUS LIKE PARTICLE COMPRISING PD-1 ANTIGEN OR PD-1 LIGAND ANTIGEN**

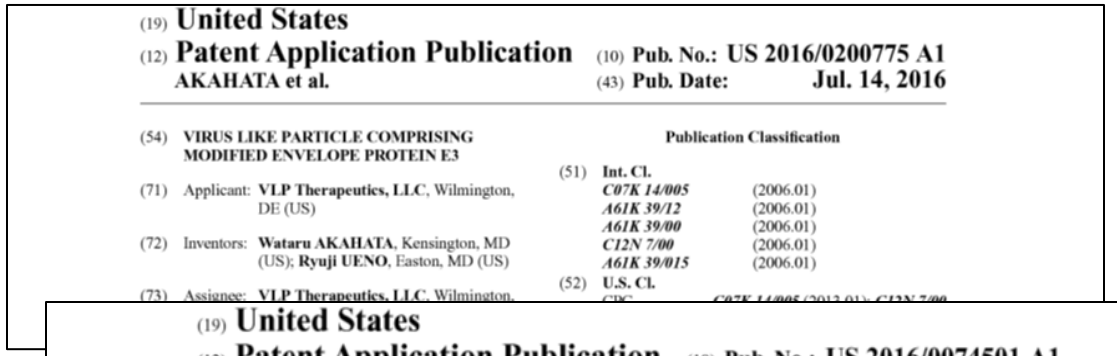
(71) Applicant: **VLP THERAPEUTICS, LLC**, Wilmington, DE (US)

(72) Inventors: **Wataru Akahata**, Kensington, MD (US); **Ryuji Ueno**, St Michaels, MD (US)

(73) Assignee: **VLP Therapeutics, LLC**, Wilmington, DE (US)

7,595,048 B2 9/2009 Honjo et al.
2005/0214321 A1 9/2005 Rasochova et al.
2007/0122378 A1 5/2007 Freeman et al.
2009/0298955 A1 12/2009 Handa et al.
2009/0305950 A1 12/2009 Minato et al.
2011/0081341 A1 4/2011 Honjo et al.
2011/0207223 A1 8/2011 Tang et al.
2012/0003266 A1 1/2012 Nable et al.
2013/0251744 A1 9/2013 Ueno et al.
2014/0127247 A1* 5/2014 Dubensky, Jr. C07K 14/005 424/186.1
2014/0363458 A1 12/2014 Ueno et al.
2016/0040134 A1 2/2016 Akahata et al.
2016/0200775 A1 7/2016 Akahata et al.

Three Published Patent Applications



(19) **United States**
(12) **Patent Application Publication**
AKAHATA et al.

(10) **Pub. No.: US 2016/0200775 A1**
(43) **Pub. Date: Jul. 14, 2016**

(54) **VIRUS LIKE PARTICLE COMPRISING MODIFIED ENVELOPE PROTEIN E3**

(71) Applicant: **VLP Therapeutics, LLC**, Wilmington, DE (US)

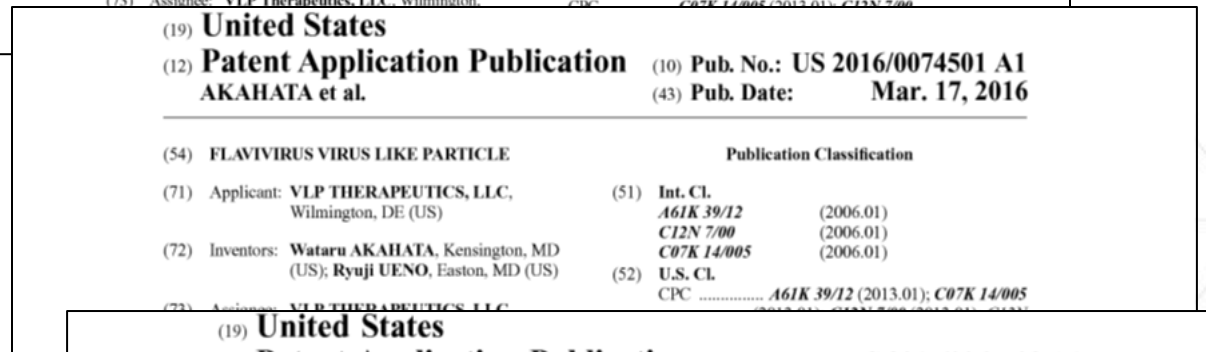
(72) Inventors: **Wataru AKAHATA**, Kensington, MD (US); **Ryuji UENO**, Easton, MD (US)

(73) Assignee: **VLP Therapeutics, LLC**, Wilmington,

Publication Classification

(51) **Int. Cl.**
C07K 14/005 (2006.01)
A61K 39/12 (2006.01)
A61K 39/00 (2006.01)
C12N 7/00 (2006.01)
A61K 39/015 (2006.01)

(52) **U.S. Cl.**
CPC .....



(19) **United States**
(12) **Patent Application Publication**
AKAHATA et al.

(10) **Pub. No.: US 2016/0074501 A1**
(43) **Pub. Date: Mar. 17, 2016**

(54) **FLAVIVIRUS VIRUS LIKE PARTICLE**

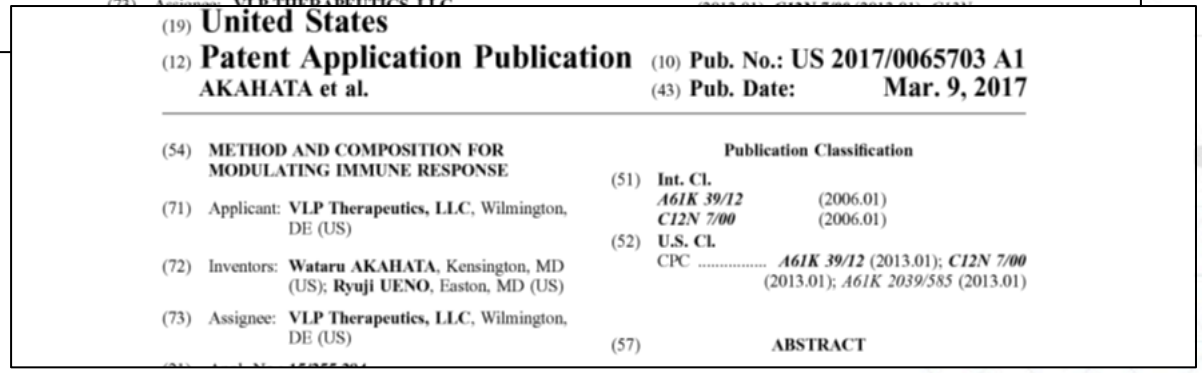
(71) Applicant: **VLP THERAPEUTICS, LLC**, Wilmington, DE (US)

(72) Inventors: **Wataru AKAHATA**, Kensington, MD (US); **Ryuji UENO**, Easton, MD (US)

Publication Classification

(51) **Int. Cl.**
A61K 39/12 (2006.01)
C12N 7/00 (2006.01)
C07K 14/005 (2006.01)

(52) **U.S. Cl.**
CPC ***A61K 39/12*** (2013.01); ***C07K 14/005***



(19) **United States**
(12) **Patent Application Publication**
AKAHATA et al.

(10) **Pub. No.: US 2017/0065703 A1**
(43) **Pub. Date: Mar. 9, 2017**

(54) **METHOD AND COMPOSITION FOR MODULATING IMMUNE RESPONSE**

(71) Applicant: **VLP Therapeutics, LLC**, Wilmington, DE (US)

(72) Inventors: **Wataru AKAHATA**, Kensington, MD (US); **Ryuji UENO**, Easton, MD (US)

(73) Assignee: **VLP Therapeutics, LLC**, Wilmington, DE (US)

Publication Classification

(51) **Int. Cl.**
A61K 39/12 (2006.01)
C12N 7/00 (2006.01)

(52) **U.S. Cl.**
CPC ***A61K 39/12*** (2013.01); ***C12N 7/00*** (2013.01); ***A61K 2039/585*** (2013.01)

(57) **ABSTRACT**

About VLP Therapeutics – Publications

“Structural Studies of Chikungunya virus maturation”

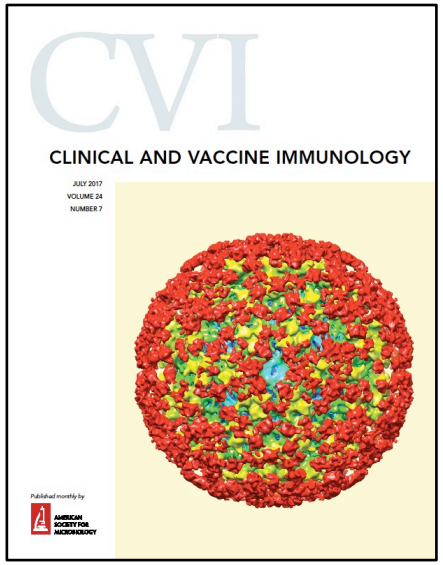
Proceedings of National Academy of Sciences of the United States of America, December 2017

“Envelope-modified tetravalent dengue virus-like particle vaccine: implication for flavivirus vaccine design”

Journal of Virology, December 2017, Volume 91, Issue 23

“Development of a Novel Virus-Like Particle Vaccine Platform That Mimics the Immature Form of Alphavirus”

Clinical and Vaccine Immunology, July 2017, Volume 24, Issue 7

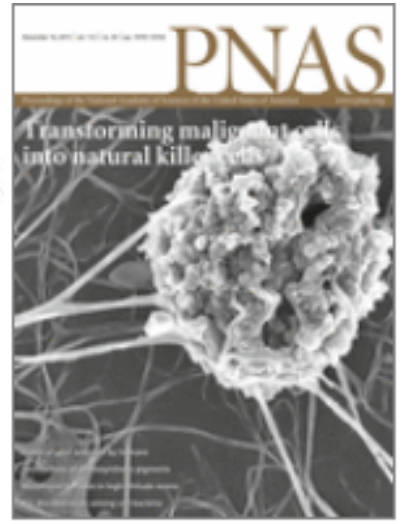


“Structural Studies of Chikungunya virus-Like Particles Complexed with Human Antibodies: Neutralization and Cell-to-Cell Transmission”

Journal of Virology, February 2016

“Cryo-EM structures elucidate neutralizing mechanisms of anti-chikungunya human monoclonal antibodies with therapeutic activity”

Proceedings of National Academy of Sciences of the United States of America, November 2015



About VLP Therapeutics - Non-dilutive Funding

Dengue

GHIT Fund

Global Health Innovative Technology Fund

$960K Grant

2016

Malaria

$2.4M Grant

2016

$230K Grant

2016

Life Science Grant 2015

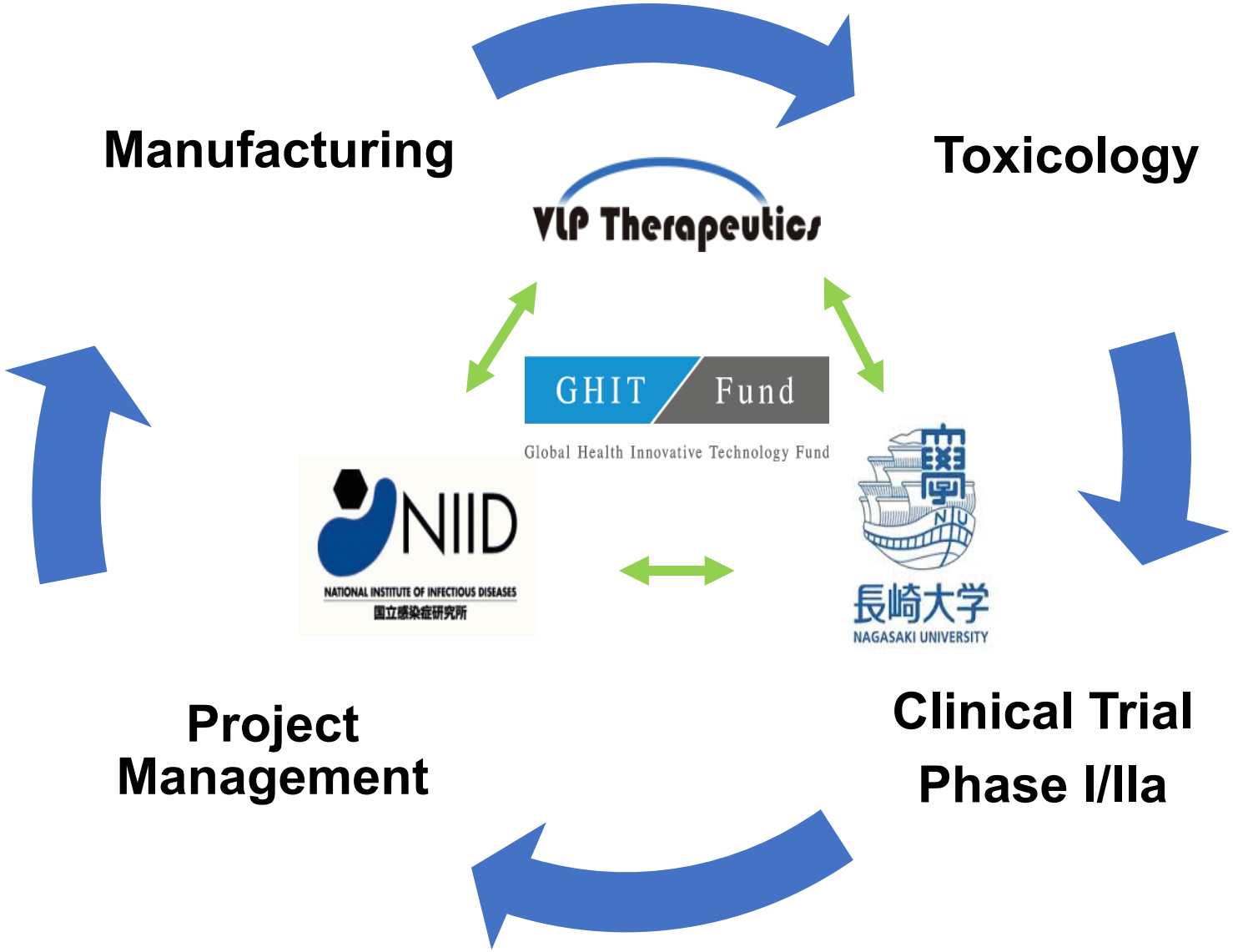
Oncology

NATIONAL CANCER INSTITUTE

$300K SBIR Grant

2017

Future GHIT Collaboration Manufacturing and Clinical



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THANK YOU