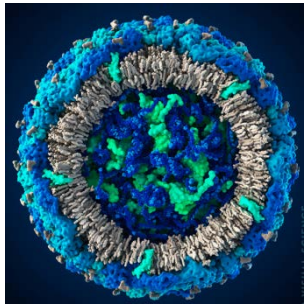
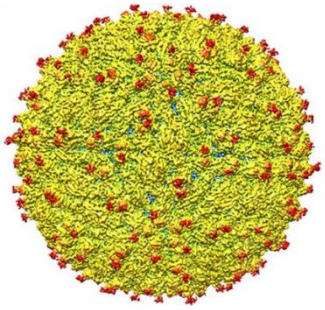
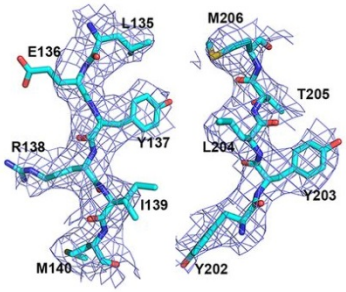
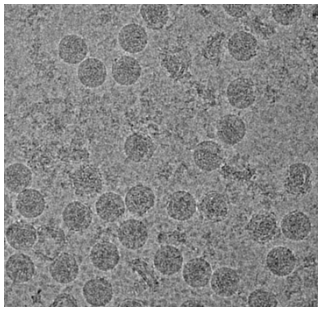







Zika Virus: Epidemiological Background

MARCIA CASTRO

mcastro@hsph.harvard.edu

HARVARD T.H. CHAN
SCHOOL OF PUBLIC HEALTH
Department of Global Health and Population

Brief history

1947 – Virus isolated (Rhesus monkey)
1948 – Virus isolated from *Ae. africanus*

Brief history

1947 – Virus isolated (Rhesus monkey)
1948 – Virus isolated from *Ae. africanus*

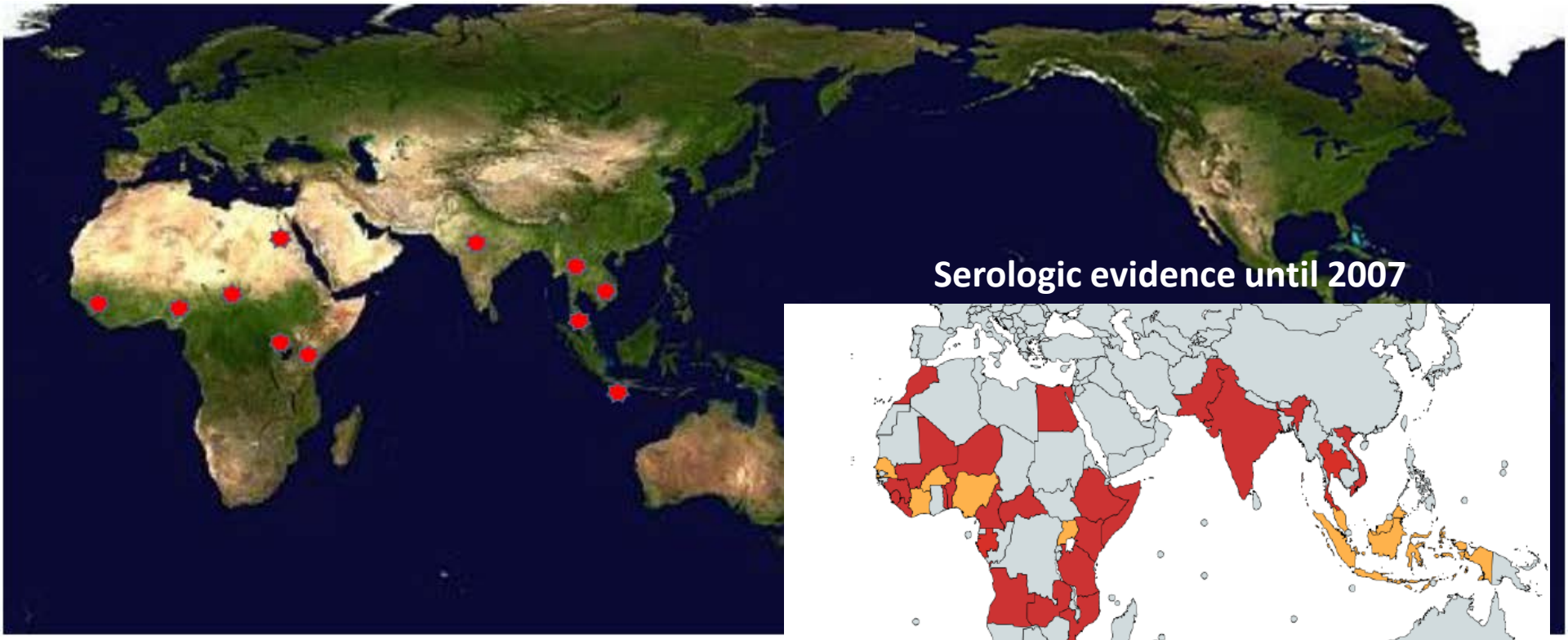
1954 – 1st human case, Nigeria

Brief history

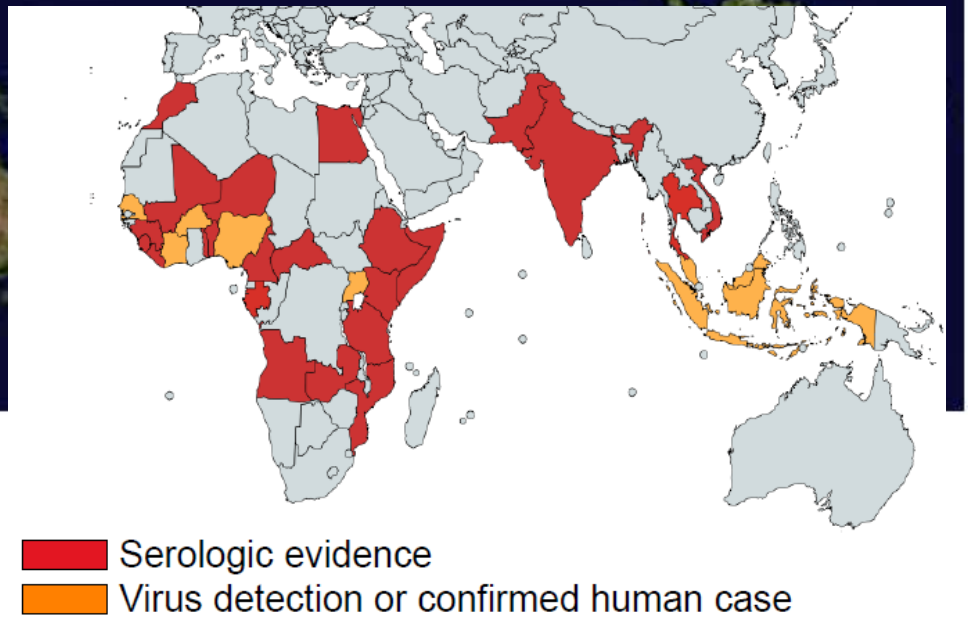
1947 – Virus isolated (Rhesus monkey)
1948 – Virus isolated from *Ae. africanus*

1954 – 1st human case, Nigeria

Next 50 yrs – spread to other areas in Africa/Asia



Serologic evidence until 2007

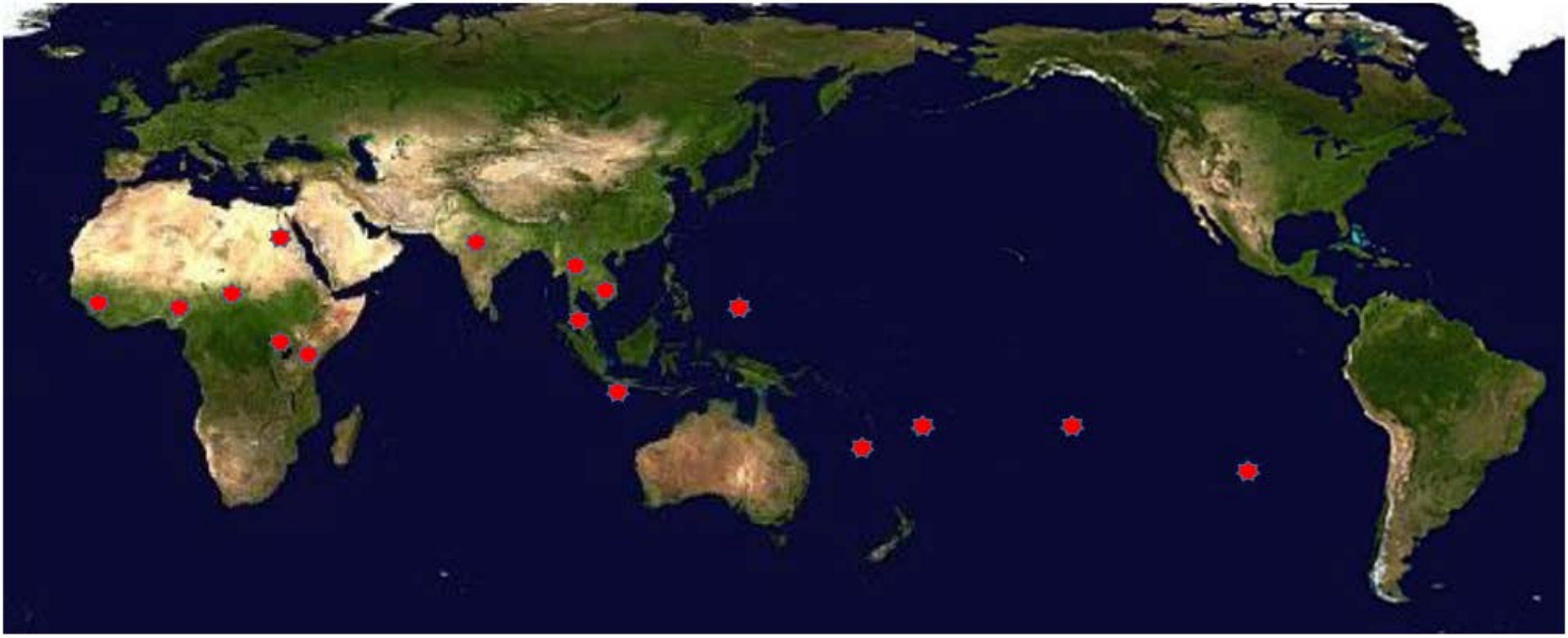


Brief history

1947 – Virus isolated (Rhesus monkey)
1948 – Virus isolated from *Ae. africanus*

1954 – 1st human case, Nigeria

Next 50 yrs – spread to other areas in Africa/Asia



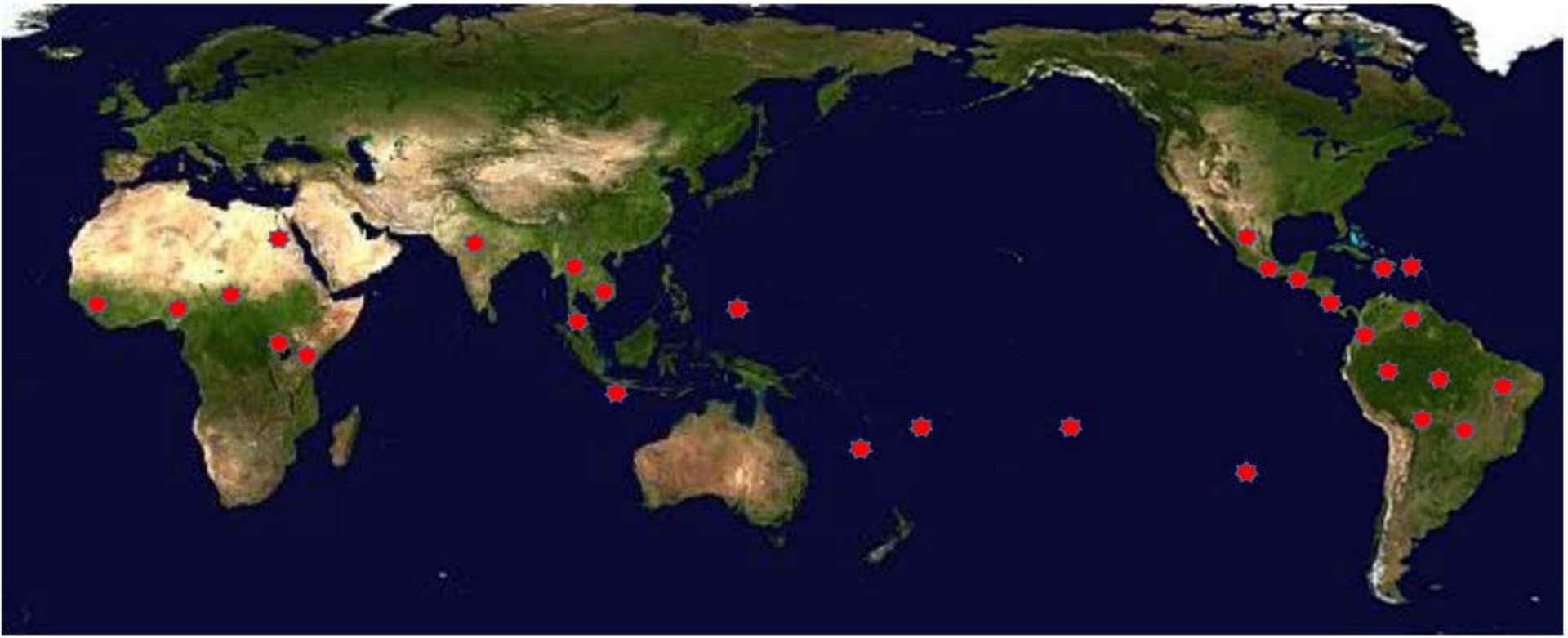
2007-14 – Reach Pacific Islands

Brief history

1947 – Virus isolated (Rhesus monkey)
1948 – Virus isolated from *Ae. africanus*

1954 – 1st human case, Nigeria

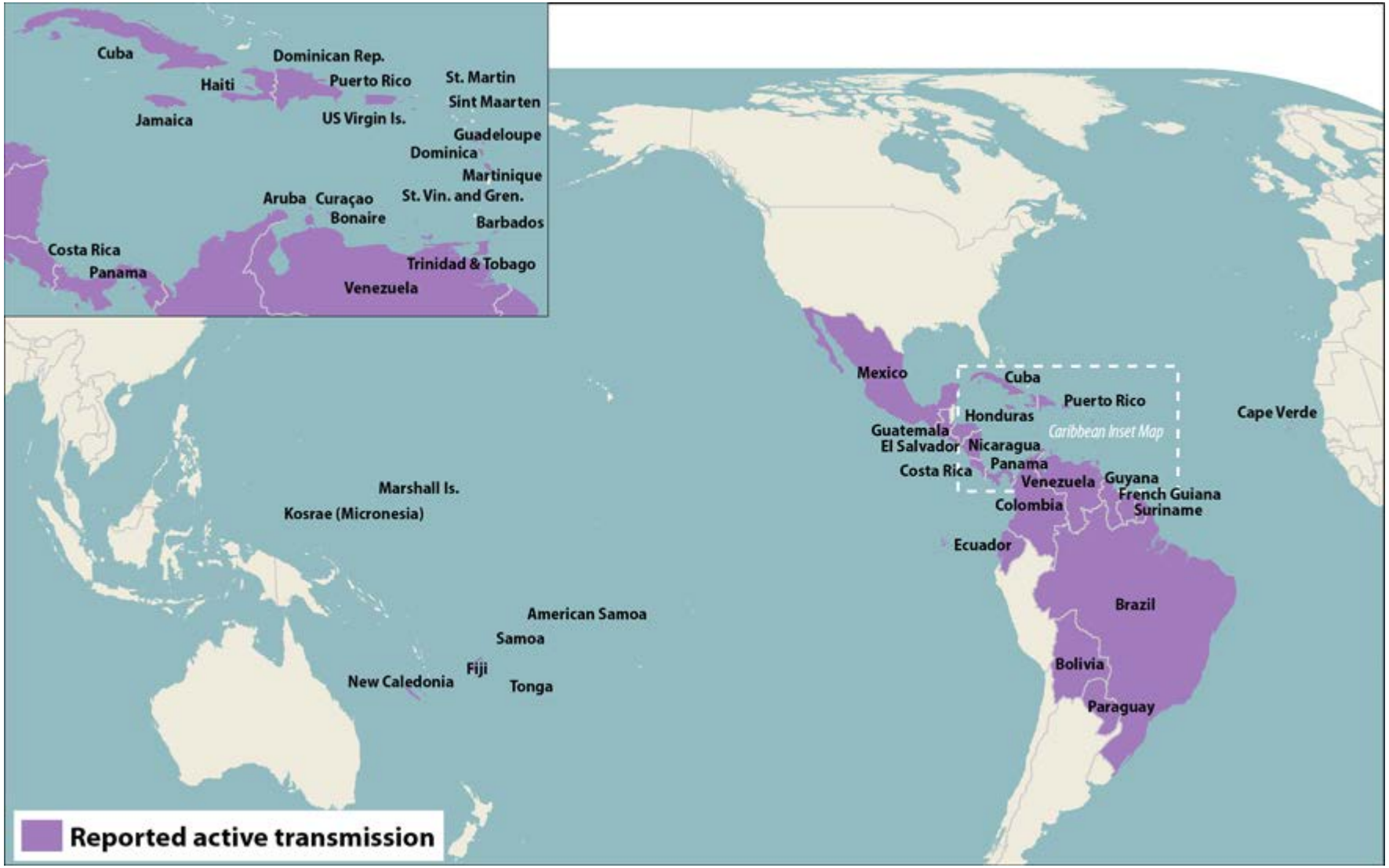
Next 50 yrs – spread to other areas in Africa/Asia



2007-14 – Reach Pacific Islands

2015 – 1st cases in the Americas (arrival of the virus could have been in 2013)

Active Zika Virus Transmission



http://www.cdc.gov/zika/geo/active-countries.html

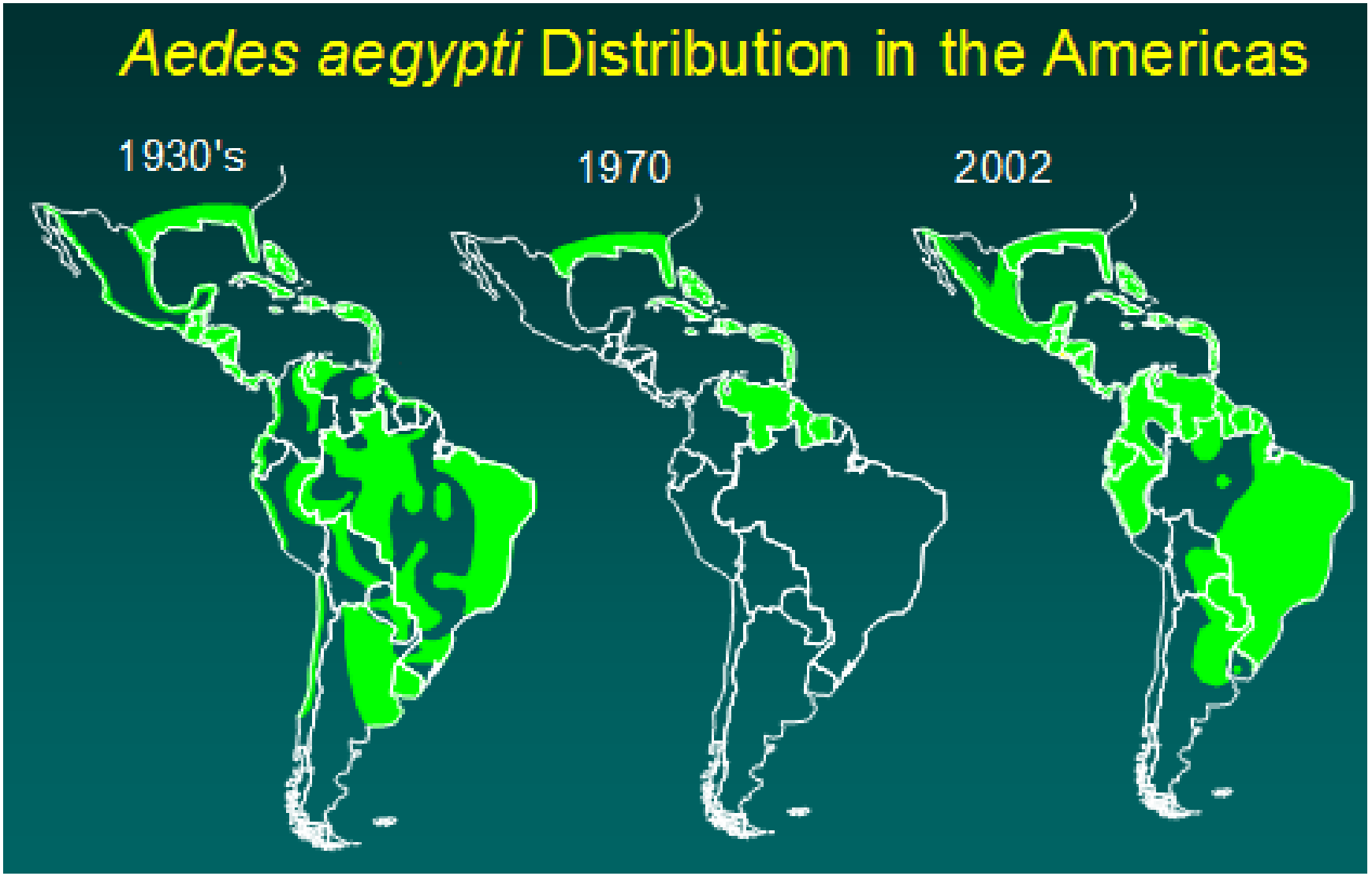
Zika virus

- Flavivirus
  - Dengue, West Nile, Japanese encephalitis, Yellow fever
- Primarily transmitted through the bite of an infected *Aedes* mosquito
  - Other modes: sexual transmission (importance?)
- Most common symptoms (usually mild): fever, rash, joint pain, conjunctivitis
- ~ 1 in 5 people infected with Zika virus present symptoms

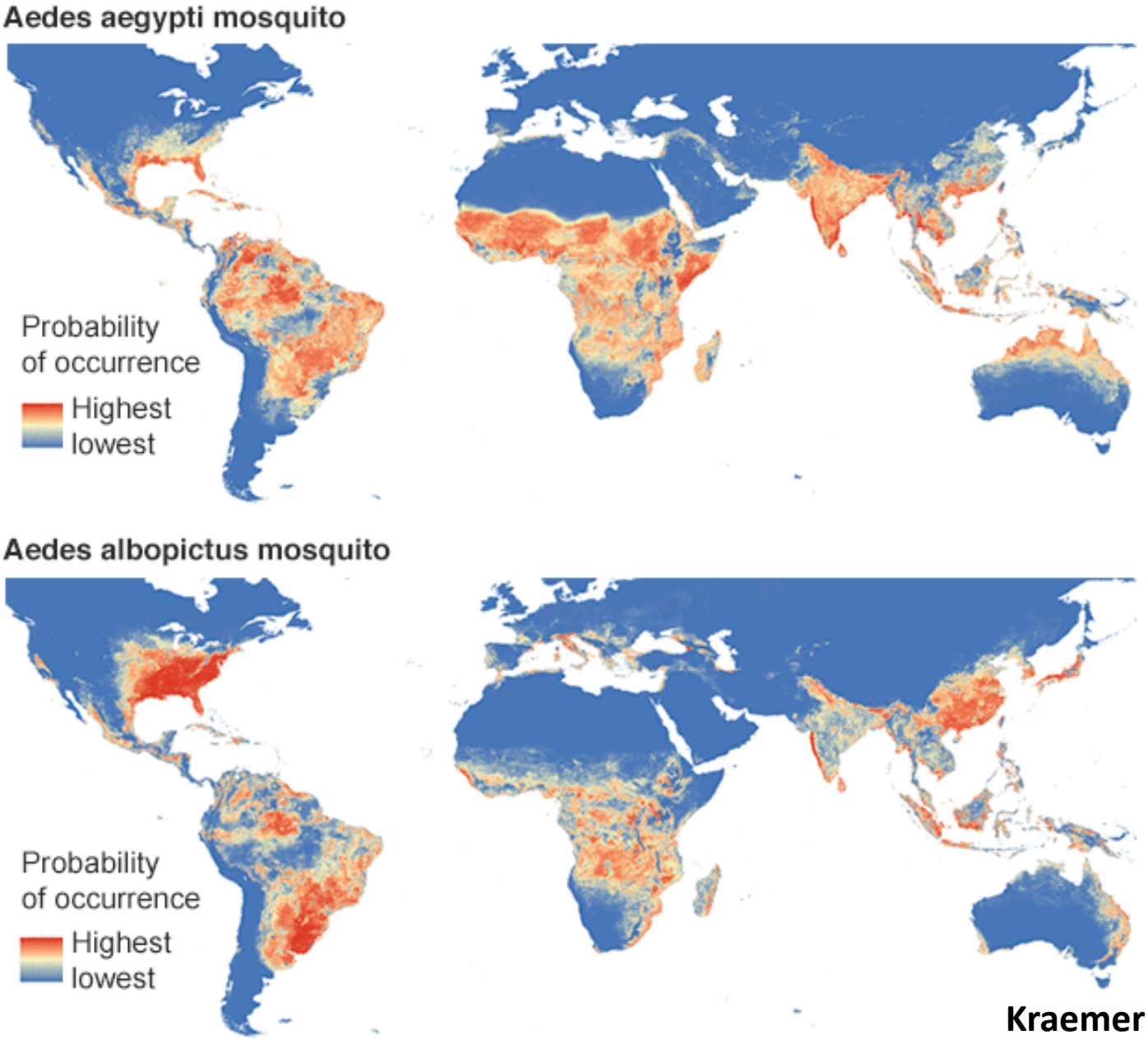
Zika virus

- Treatment: there is no medicine to treat ZIKV
- Prevention:
  - There is no vaccine to prevent ZIKV
  - Reduce exposure to vector (repellent)
  - Vector control
    - Extremely unlikely to be successful without the provision of sanitation, regular access to piped water, and regular waste collection

A note on vector control



Global Distribution of *Aedes* Mosquitoes



Kraemer et al, 2015

Zika virus & complications

- Guillain-Barré syndrome (GBS)
  - Uncommon sickness of the nervous system
  - Evidence of a link between Zika virus infection and GBS in Brazil and French Polynesia

Guillain-Barré Syndrome outbreak associated with Zika virus infection in French Polynesia: a case-control study

Van-Mai Cao-Lormeau, Alexandre Blake*, Sandrine Mons, Stéphane Lastère, Claudine Roche, Jessica Vanhomwegen, Timothée Dub, Laure Baudouin, Anita Teissier, Philippe Larre, Anne-Laure Vial, Christophe Decam, Valérie Choumet, Susan K Halstead, Hugh J Willison, Lucile Musset, Jean-Claude Manuguerra, Philippe Despres, Emmanuel Fournier, Henri-Pierre Mallet, Didier Musso, Arnaud Fontanet*, Jean Neil*, Frédéric Ghawché**

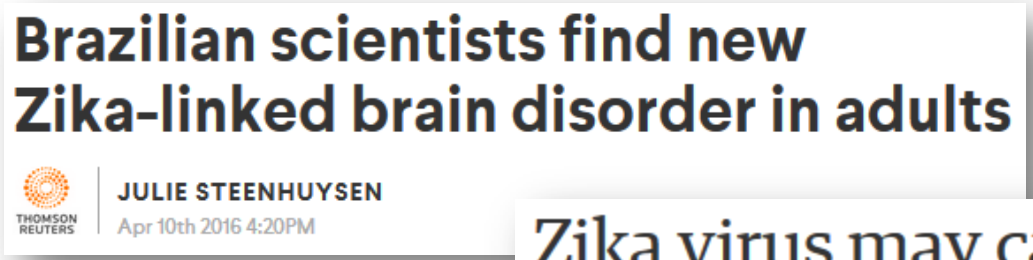
Guillain-Barré syndrome associated with the Zika virus outbreak in Brazil

Síndrome de Guillain-Barré associada ao surto de infecção por vírus Zika no Brasil

Lucas Masiêro Araujo[1], Maria Lucia Brito Ferreira[2], Osvaldo JM Nascimento[1]

Zika virus & complications

- Acute Disseminated Encephalomyelitis (ADEM)
  - Autoimmune syndrome that attacks the brain and spinal cord
    - Results presented April 10th at the annual conference for the American Academy of Neurology in Vancouver



Zika virus & complications

Feb 1, 2016 – WHO declared clusters of birth defects suspected of being linked to Zika virus in the Americas as a Public Health Emergency of International Concern

- Microcephaly
  - Many cases have been reported:
    - Presence of the virus in the placenta, in the amniotic fluid, in the blood of newborns, and in the brain and several organs of microcephalic fetus
    - Asymptomatic Zika virus infections during pregnancy were also associated with fetal malformations
    - Zika virus can cross the placental barrier at any time during the gestational period

Zika virus & complications

Preprint

NOT PEER-REVIEWED

"PeerJ Preprints" is a venue for early communication or feedback before peer review. Data may be preliminary.
Learn more about preprints or browse peer-reviewed articles instead.

Zika virus impairs growth in human neurospheres and brain organoids

Cell Biology | Developmental Biology | Neuroscience

Patricia P Garcez [1,2], Erick C Loiola * [2], Rodrigo F Madeiro da
Pablo Trindade [2], Rodrigo Delvecchio [3], Juliana M Nascimento
Almicar Tanuri [3], Stevens K Rehen [1,2]

March 13, 2016

REPORT

Zika virus impairs growth in human neurospheres and brain organoids

Patricia P. Garcez[1,2,*], Erick Correia Loiola[2,†], Rodrigo Madeiro da Costa[2,†], Luiza M. Higa[3,†], Pablo Trindade[2,†], Rodrigo Delvecchio[3], Juliana Minardi Nascimento[2,4], Rodrigo Brindeiro[3], Amilcar Tanuri[3], Stevens K. Rehen[2,1,*]

+ Author Affiliations

*Corresponding author. Email: ppgarcez@icb.ufrj.br (P.P.G.); srehen@lance-ufrj.org (S.K.R.)

† These authors contributed equally to this work.

Science 10 Apr 2016:

DOI: 10.1126/science.aaf6116

Peer Reviewed
see details

Cell Stem Cell

Brief Report

Zika Virus Infects Human Cortical Neural Progenitors and Attenuates Their Growth

Hengli Tang,[1,11,*] Christy Hammack,[1,11] Sarah C. Ogden,[1,11] Zhexing Wen,[2,3,11] Xuyu Qian,[2,4,11] Yujing Li,[9] Bing Yao,[9] Jaehoon Shin,[2,5] Feiran Zhang,[9] Emily M. Lee,[1] Kimberly M. Christian,[2,3] Ruth A. Didier,[10] Peng Jin,[9] Hongjun Song,[2,3,5,6,7,*] and Guo-li Ming[2,3,5,6,7,8,*]

Zika Virus Infection of the Central Nervous System of Mice

By

T. M. Bell, E. J. Field, and H. K. Narang

Medical Research Council, Demyelinating Diseases Unit, Newcastle General Hospital, Newcastle upon Tyne, England

With 8 Figures

Received February 10, 1971

Pressing questions (a sample)

- If a pregnant woman is infected with Zika virus and the baby is not born with microcephaly, will the child present with developmental problems later in childhood? Does the answer vary if the infection was asymptomatic?
- What is the risk of having a baby with microcephaly, after a Zika virus infection, considering when during the gestational period the infection took place? Does the risk vary if the infection was asymptomatic?
- Are there individual- or contextual-level factors that modify these risks? Does a previous infection with another pathogen (e.g., dengue), or a co-infection, increase the severity of Zika virus?

Zika and Health Systems

- Screening criteria
- Medical attention to children with microcephaly
- Reproductive health and rights
- Understanding and communicating the risk of microcephaly
- Vector control