



Detection of Viruses Using Artificial RNA Structures

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MITRE Sponsored Research

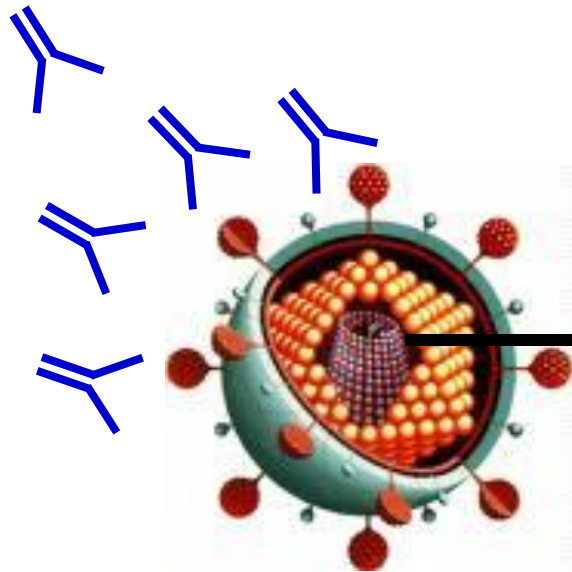
Problem



- **There is a pressing need in the Intelligence Community and in Public Health systems to be able to detect emerging viruses and viruses that may have been altered to evade standard detection methods.**

Background

Viruses are identified using
specific antibodies...



...or by detection of the virus
genes using PCR and derivatives



These methods fail detection of unknown or genetically
engineered viruses designed to avoid detection

Objective



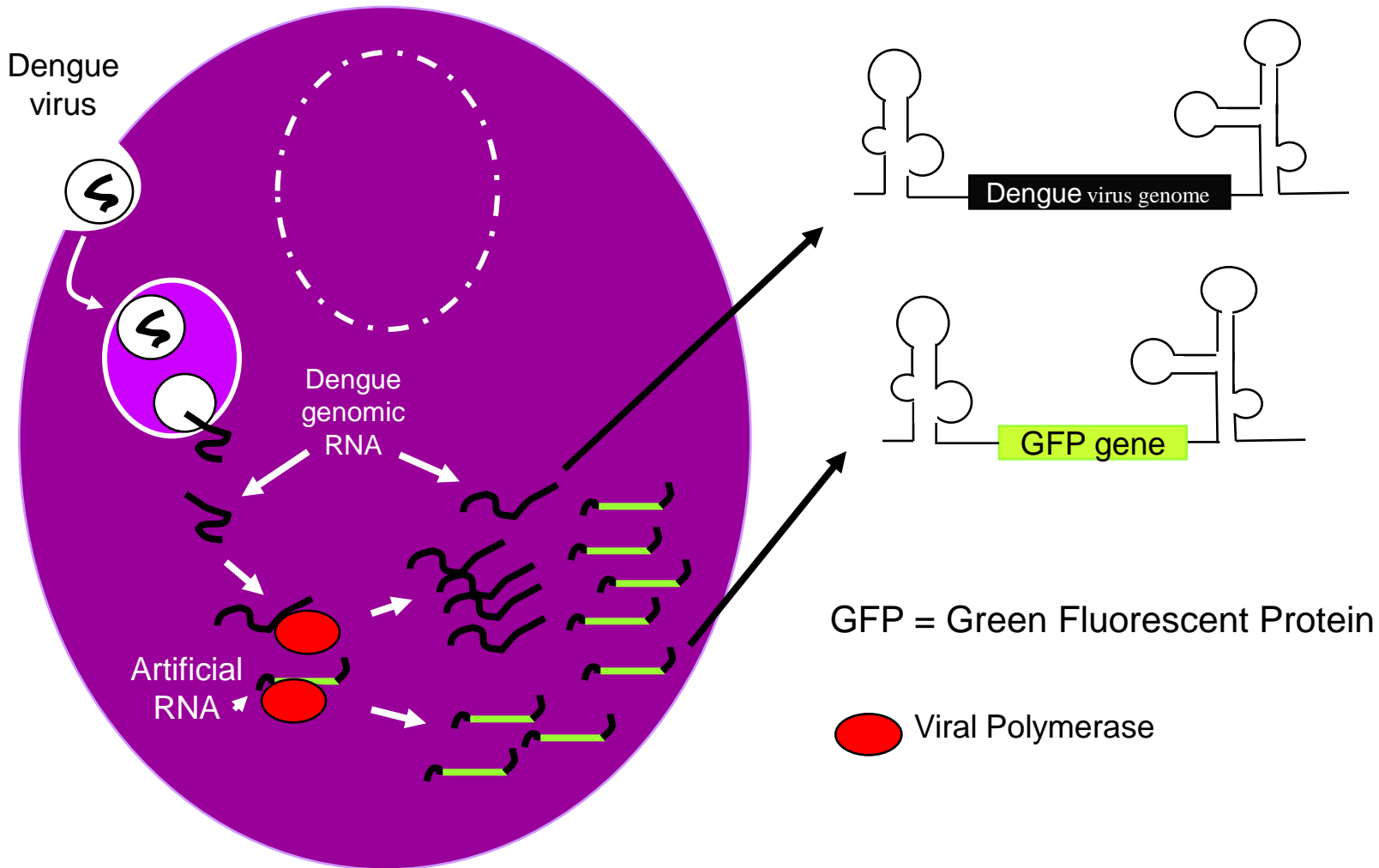
- **To develop technology geared to detect small quantities of unknown viruses collected from the environment**
- **The technology will be first tested using dengue viruses**
 - **Dengue is highly relevant to Global Health and Biodefense**
- **The technology will then be generalized from dengue to related viruses (Japanese encephalitis, Yellow fever, Tick-borne encephalitis) and later to many other viruses of interest**

Activities



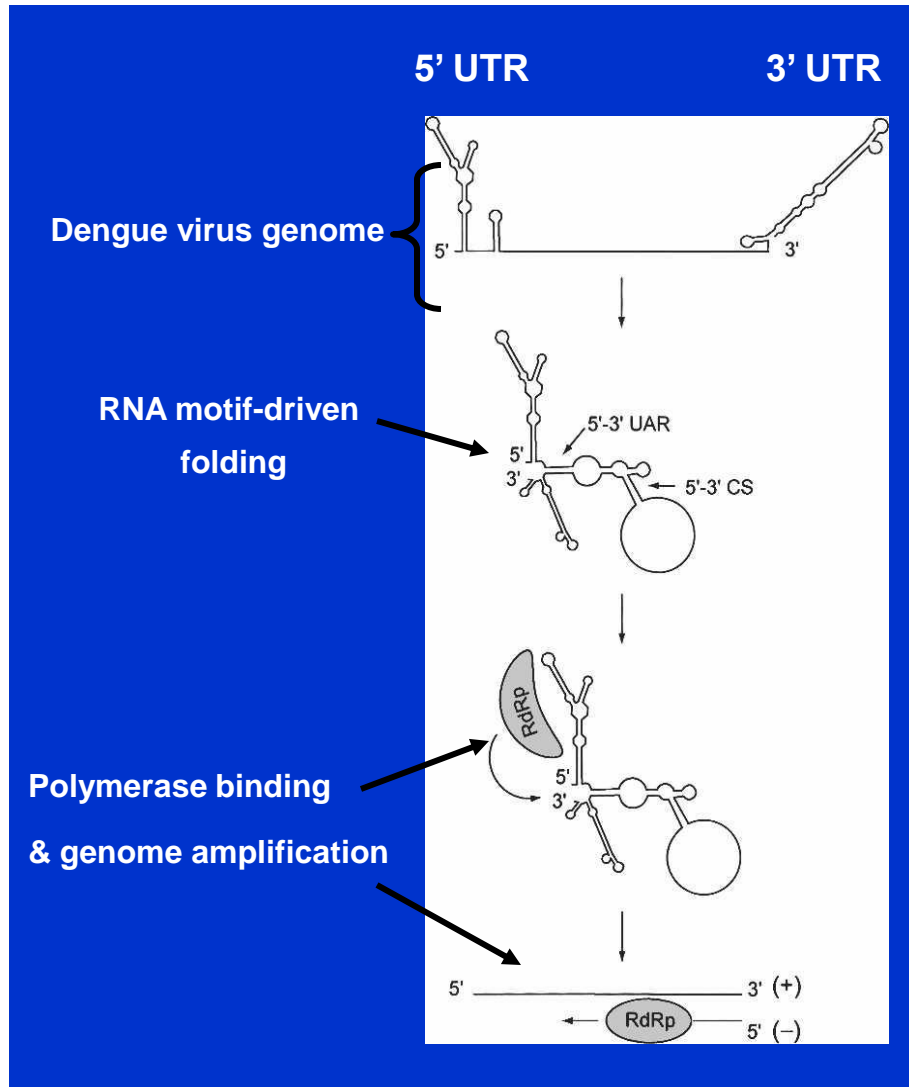
- **Create artificial RNA sequences recognizable by a virus replication system to result in amplification of fluorescent signals**
- **Generate artificial RNA modifications to increase virus detection range (broad spectrum)**
- **Test range of detection capability using live viruses**

Highlight



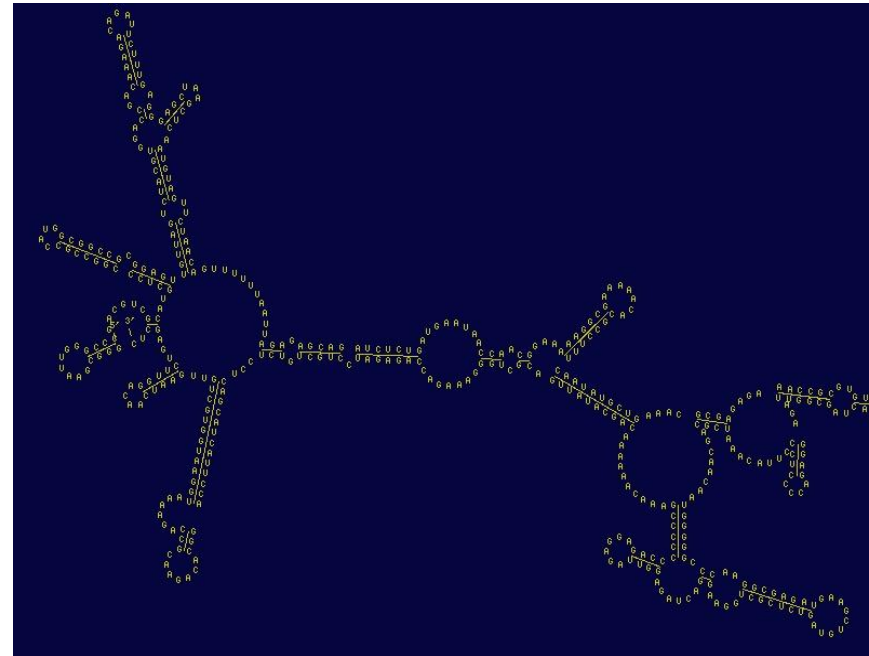
Artificial RNA constructs are designed to be amplified by the virus replication system

Demonstration



Filomatori, et. al., *Genes & Development*, 2006

Artificial RNA construct folding*



*KnetFold — Mfold — MPGAfold — StructureLab
Computational RNA Structure Group, NCI, NIH

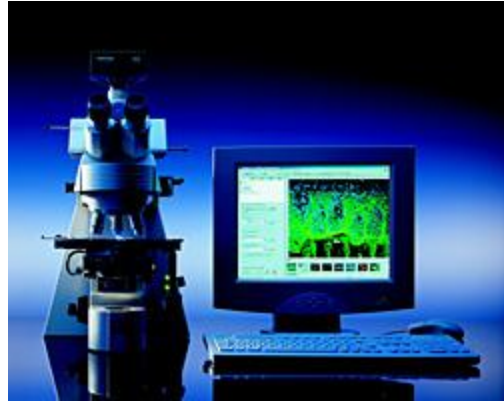
Impacts



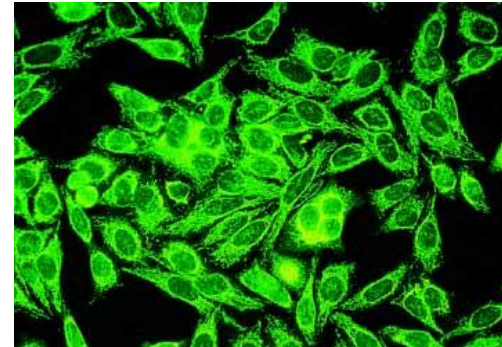
- **A new technology for broad-range detection of unknown and genetically manipulated viruses**
- **Amplifies viral genome for further testing (e.g., PCR based technologies)**
- **Biodefense interest: genetically engineered and unnamed natural viruses**
- **Public Health interest: emerging viruses detection**

Future Plans

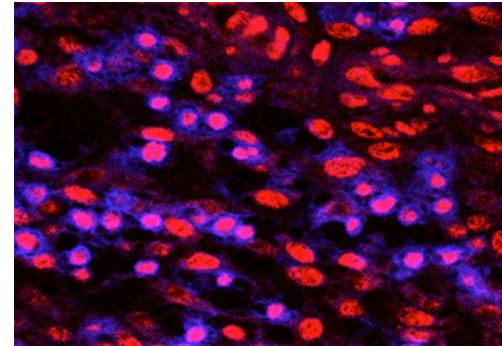
Expand detection scope beyond
dengue viruses



Flaviviruses



Other RNA viruses



Test sensitivity and
speed of detection

Couple the technology to existing fluorescence detection systems