

Broad-Based Detection of Viruses by Fluorescence

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MSR in collaboration with NCI



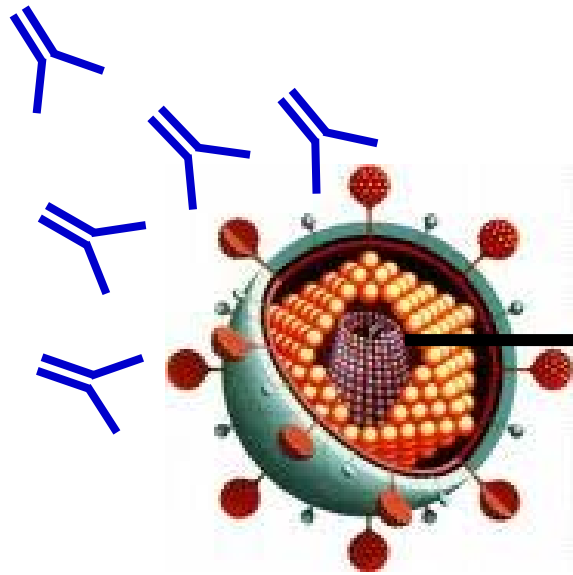
Problem



- **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

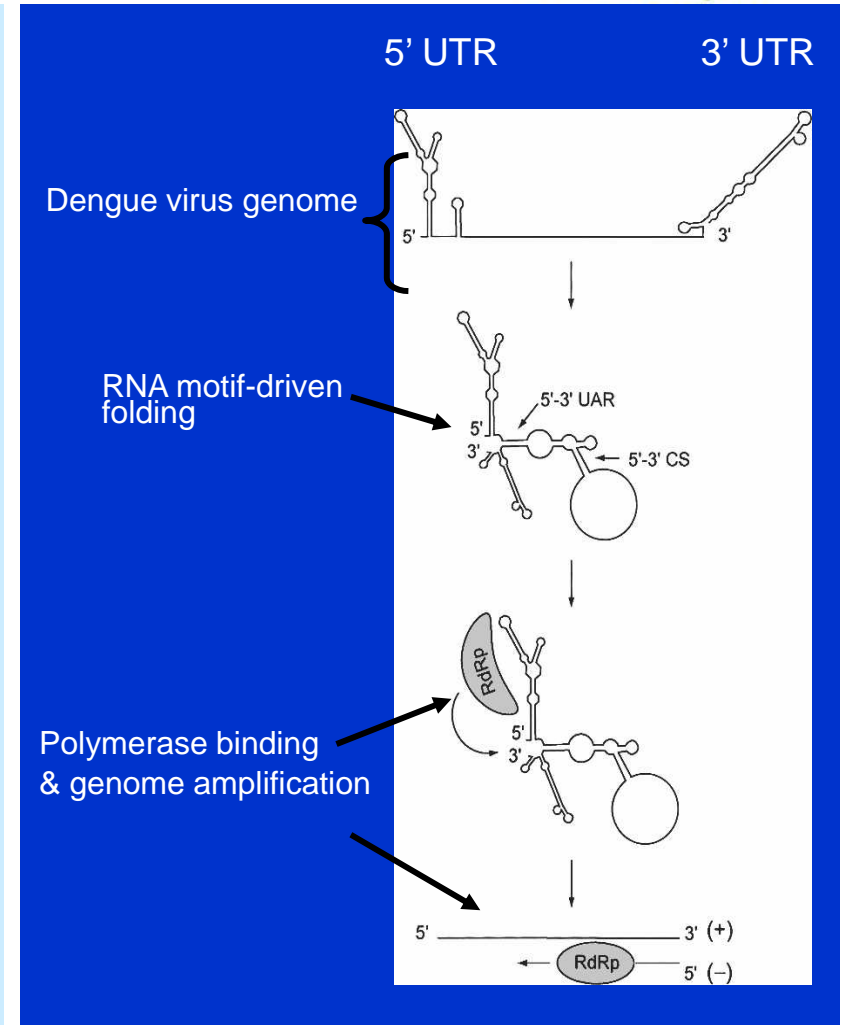
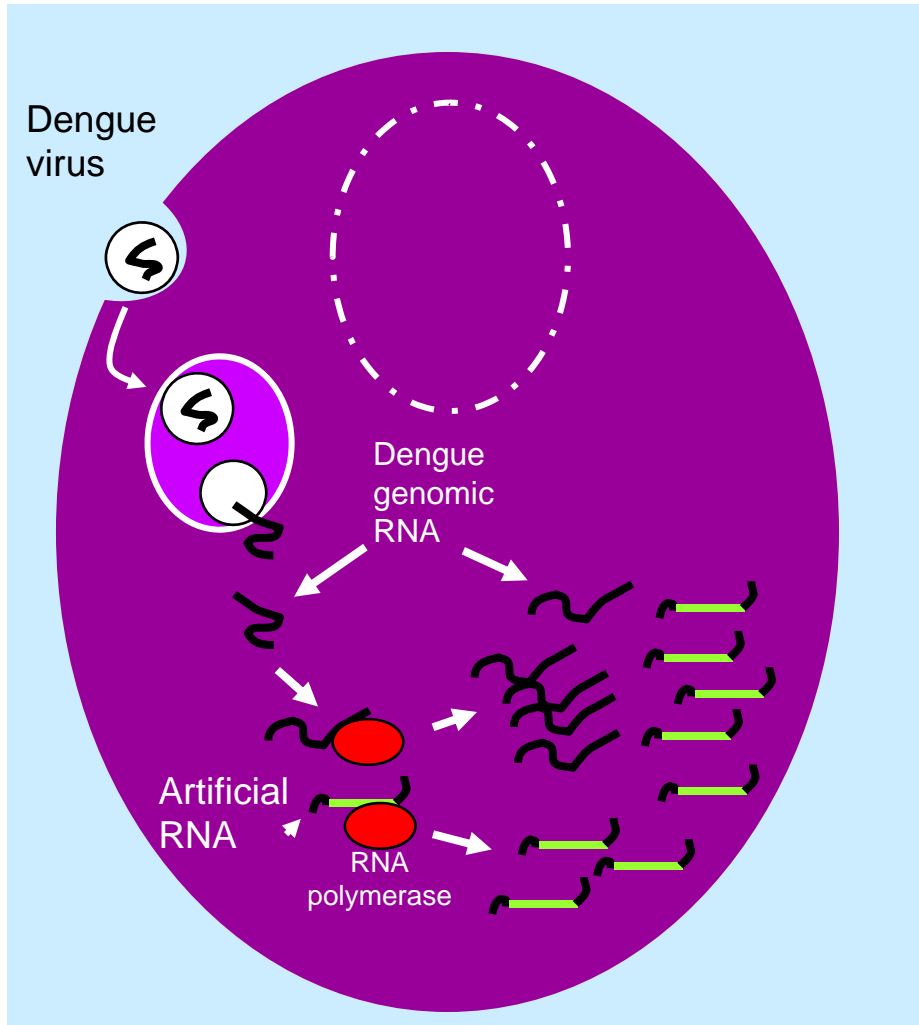


- To develop technology geared to detect small quantities of unknown viruses collected from the environment
- The technology will be first tested using **dengue** viruses
 - Dengue is highly relevant to Global Health and Biodefense
- The technology will then be generalized from dengue to related viruses (**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**
- **Test range of detection capability using live viruses**

Highlight



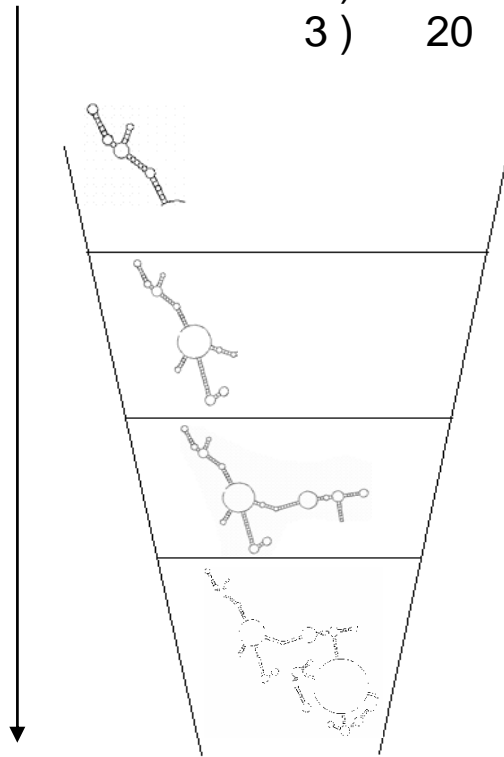
Filomatori, et. al., Genes & Development, 2006

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

Demonstration

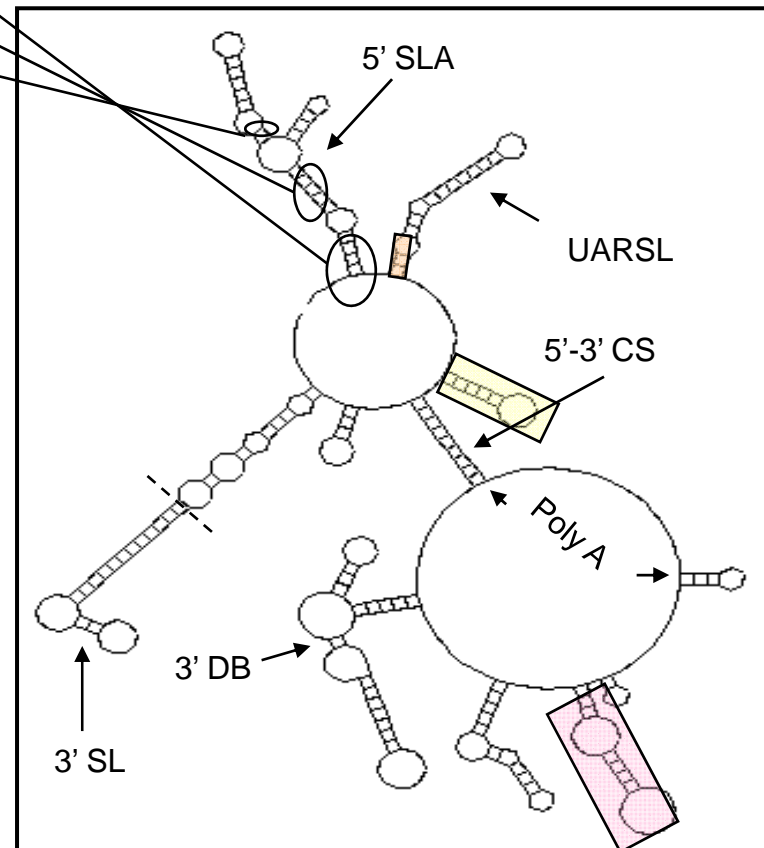
Detecting RNA folding pathways

1)	3	70	7	-9.2
2)	11	61	6	-8.4
3)	20	43	2	-3.3



GGGCGAAUUGGGCCCGACGUCGCAUGCUC...

Dengue-2 RNA Construct



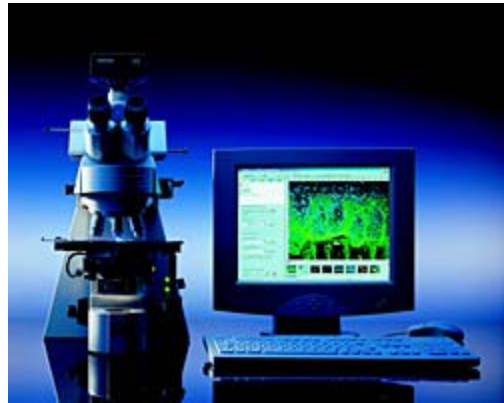
Replica Exchange Genetic Algorithm Development

Impacts

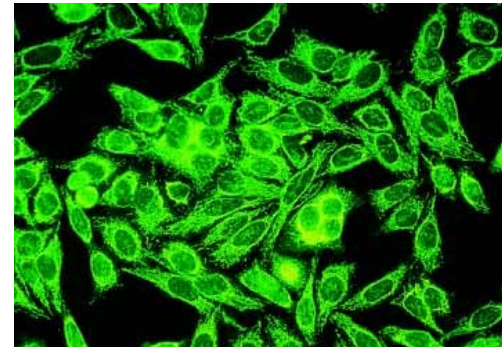
- A technology for the detection of viruses
- Amplifies viral genome for further testing
- **Biodefense interest:** Genetically engineered and unnamed natural viruses detection
- **Public Health interest:** Emerging viruses detection

Future Plans

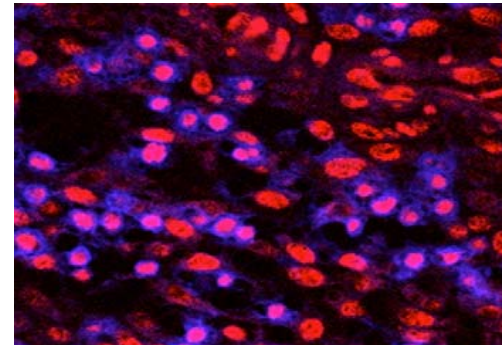
Expand detection scope
beyond dengue viruses



Flaviviruses



Alphaviruses



Test sensitivity and
speed of detection

Couple the technology to other “signal” detection systems