CURRENT USG INVESTMENTS IN ZIKA VIRUS MEDICAL COUNTERMEASURES

October, 2016
Diagnostics
HHS Zika Diagnostics
Strategic Goals

- Expand testing capacity in public health/LRN and commercial laboratories.
- Advance the development of more specific and sensitive tests for use in the U.S. and elsewhere.
- Provide reagents (viruses, antigens, clinical samples) and reference panels for test development and validation.
- Develop high throughput assays to detect Zika virus in the blood supply.
- Define and communicate to developers the FDA regulatory pathways for Zika virus assays.
NIAID Zika Diagnostics Research

- **Goal:** Development of rapid, specific, low-cost diagnostic tools

- **Molecular tests**
  - Multiplex PCR-based assays
  - On-chip assay for direct ZIKV RNA detection
  - Paper assays with CRISPR-based technology
  - Virome capture sequencing platform (VirCapSeq)
BARDA Zika Diagnostic Activities

- Market research
- Rapid performance evaluation of early candidates
  - Collaboration with CDC
- Fund development of commercial assays via BAA
  - point-of-care and laboratory based serology assays for Zika virus
  - serologic assays to discriminate Zika, dengue and chikungunya virus infections
- Connect developers to flavivirus researchers
  - Collaboration with NIH
- Assemble specimens for test evaluation
- Identify role of diagnostics for vaccine trials
Current Available Diagnostics for Zika

- **CDC Developed Assays**
  - TrioPlex Molecular Test (Zika, Dengue, Chikungunya)
  - Zika MAC-ELISA (IgM)

- **BARDA-Enabled Commercial Tests**
  - Laboratory Serology Tests
    - InBios International (IgM capture)
    - Diasorin, Inc. (IgM and IgG capture)
  - Point of Care Serology Tests
    - Chembio Diagnostic Systems
    - Orasure Technologies
  - Blood Screening Molecular Tests
    - Roche
    - Hologic

- **Sample Collection and Characterization**

All assays operating under Emergency Use Authorization
# Zika Diagnostic Assays

<table>
<thead>
<tr>
<th>Indication</th>
<th>Diagnostic Technology</th>
<th>Useful Period (Post Onset)</th>
<th>EUA/IND</th>
<th>BARDA Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify persons with active Zika infection (active symptoms)</td>
<td>Molecular (PCR-like) tests</td>
<td>Up to 7 days</td>
<td>CDC and 6 commercial partners</td>
<td>Small Zika PCR positive validation panels (plasma)</td>
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<tr>
<td>Identify persons previously infected with Zika virus, particularly women infected during pregnancy.</td>
<td>Serologic/Antibody (IgM) tests</td>
<td>~3 days to &gt;&gt; 3months</td>
<td>CDC and 1 commercial partner</td>
<td>ARD funding, Serum panels</td>
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<tr>
<td>Ensure safety of the blood supply.</td>
<td>Molecular assays, high-throughput platforms</td>
<td>Active infection in asymptomatic individuals</td>
<td>2 commercial partners (IND)</td>
<td>ARD funding, validation panels</td>
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<tr>
<td>Laboratory</td>
<td>Serology Test name</td>
<td>Company</td>
<td>Status</td>
<td></td>
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<tr>
<td></td>
<td>Zika Detect™ IgM</td>
<td>InBios International, Inc.</td>
<td>EUA issued Aug 17</td>
<td></td>
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<tr>
<td></td>
<td>Capture ELISA</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>LIAISON Zika Virus IgM and IgG assays</td>
<td>Diasorin</td>
<td>Late stage development</td>
<td></td>
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<tr>
<td>POC</td>
<td>DPP® Zika IgM/IgG Assay</td>
<td>ChemBio Diagnostics, Inc.</td>
<td>Late stage development</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OraQuick® Zika Test</td>
<td>OraSure Technologies, Inc.</td>
<td>Mid-stage development</td>
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Opportunities for FL Research Investments: Diagnostics

- Other serological assays (e.g. NS-1 based)
- Other multiplexed assays
- Subtractive or reductive diagnostics for flavivirus pre-exposed populations
  - Differentiate Zika from other flavivirus responses
Vaccines
Vaccine Strategic Needs

- Protect at-risk population of pregnant women / women of child-bearing age
- General population protection and potential herd-immunity
- Travel-medicine or military deployment needs
# Overview of Vaccine Platforms

<table>
<thead>
<tr>
<th>Current Aim</th>
<th>Candidate Vaccine</th>
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<tr>
<td>Evaluation of viable vaccine platforms and deployment to “at risk” population</td>
<td>DNA Vaccine Candidate VRC</td>
</tr>
<tr>
<td></td>
<td>PIV ASPR, BARDA, Emergent</td>
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<tr>
<td></td>
<td>mRNA vaccine candidate VRC, GSK</td>
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<tr>
<td></td>
<td>mRNA ASPR, BARDA, Moderna</td>
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<tr>
<td>Commercialization of Global, Durable Vaccine</td>
<td>Live Attenuated Zika Chimera LID, Butantan</td>
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<tr>
<td></td>
<td>PIV WRAIR, NIAID, BARDA, Sanofi</td>
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<tr>
<td></td>
<td>PIV ASPR, BARDA, Takeda</td>
</tr>
<tr>
<td></td>
<td>PIV ASPR, BARDA, Butantan</td>
</tr>
<tr>
<td>Research Understanding Only</td>
<td>VSV Vectored Vaccine NIAID, Harvard CoE</td>
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<tr>
<td></td>
<td>Chimera CDC</td>
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<td>VLP CDC</td>
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*Note: primary aim is based largely on time of availability of market data, this preliminary alignment does not preclude the ability of a candidate to achieve the other aims*

**Note: A vaccine designated as being for "research understanding only" indicates that a vaccine does not meet the necessary criteria for either set of aims**
Opportunities for FL Research Investments: Vaccines

- Expanded Clinical Trial Network Sites for Vaccine Development
Therapeutics
Therapeutic Strategic Needs

- Treat infected pregnant women to reduce viral impact on developing fetus
- Treat individuals with residual infection for viral clearance from immune-privileged sites
- Treat moderately to severely ill patients
- Potential for non-vaccine afforded passive immunity for specialized needs
NIAID Biomedical Research Response: Therapeutics

- Developed Zika in vitro screening assay
  - 326 compounds with known anti-flavivirus activity tested to date
  - 29 compounds showed moderate to high activity
- Developed a mouse model for further testing
  - BCX4430 (RNA polymerase inhibitor) protected mice infected with Zika virus
  - Screened 8 compounds with 3 showing activity
- Screening approved-drug libraries (collaboration with NCATS and Gates Foundation)
- Identifying promising monoclonal antibodies
Opportunities for FL Research

Investments: Therapeutics

- Therapeutic approaches for viral clearance and treatment post infection
Other Efforts

- Development of novel toxicants and/or repellents with high safety profile
- Pathogen reduction technologies in blood products
Additional Ideas for FL Research Investments

- Novel products and approaches to vector control
- Participate in clinical trial protocol for pathogen reduction in blood products
Current Florida-affiliated R&D Efforts for Zika

- NIAID Grant Supplement to J.G. Morris, University of Florida, study on Zika transmission