Filovirus rVSV Vaccines

- Michael A. Egan, Ph.D.
- Director of Immunology
Presentation Outline:

1.) Background on the Vesiculovax™ Vaccine Platform

2.) Ability of a Single Dose Tri-valent Vesiculovax™ panFilo Vaccine to protect against EBOV, SUDV and MARV challenge

3.) Phase I Safety and Immunogenicity of the mono-valent Vesiculovax™ EBOV Vaccine

4.) Identification of a Correlate of Protection Against Aerosol MARV challenge in NHPs

5.) Future Plans
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5.) Future Plans
VesiculoVax™: A Family of Vaccine Vectors

RNA genome:
- Nonsegmented, single-stranded, negative-sense

Components of the virus:
- Nucleocapsid
- Phosphoprotein
- Matrix protein
- G protein
- Large protein (RNA Pol)

G protein:
- Mediates cell attachment
- Target of neutralizing antibodies

Envelope RNA genome

1. Nucleocapsid
2. Phosphoprotein
3. Matrix protein
4. G protein
5. Large protein (RNA Pol)
The Vesiculovirus mRNA Transcriptional Gradient

mRNA transcription (+) genome synthesis

Intergenic Stop/Start

N P M G L
Using the Vesiculovirus mRNA Transcriptional Gradient to Attenuate the Vector and Overexpress a Gene of Interest

mRNA transcription (+) genome synthesis

N gene shuffle

Truncation of G protein cytoplasmic tail (CT1)
VesiculoVax™ Vectored Vaccines

Single Stranded/Non-segmented/Negative-sense RNA Viruses

* Small simple genome, large capacity for inserting multiple foreign genes
* Modulation of antigen expression controlled by gene position
* Synergistic attenuating mutations:
  * [N gene shuffle (N4) & G protein CT truncation (CT1)]
* Family of non-cross-reactive (both B and T cell) vectors
  * Four reduced to practice and three under development

**Immunogenicity**

* Replication competent vectors
* Targets antigen-presenting cells
* Attenuating mutations increase immunogenicity

**Manufacturing**

* Propagates efficiently in PBS certified Vero production cell line
* GMP Manufacturing and purification processes in place

**Vector Immunity**

* Little pre-existing immunity in the human population
* Clinical demonstration of effective homologous boosting
**VesiculoVax™ Vectored Vaccines**

### rVSV N4CT1 Clinical Status

- **HVTN-090**
  - FIM dose escalation, N=60, $10^4$ – $10^8$ PFU
  - 100% seroconversion, 63% ELISpot response rate, **homologous boosting induces anamnestic response**
  - Safe and well tolerated, no vaccine-related SAE

- **HVTN-087**
  - pDNA prime / rVSV boost, N=100, $10^8$ PFU
  - 92% CD4 ICS response rate, 58% CD8 ICS response rate, highest ICS response rate in any HVTN trial
  - Safe and well tolerated, no vaccine-related SAE

- **TheraVax**
  - pDNA prime / rVSV boost, N=30, $10^7$ PFU
  - Study is on-going
  - Safe and well tolerated, no vaccine-related SAE

- **HVTN-112**
  - pDNA prime / rVSV boost, N=15, $10^7$ PFU
  - Study is on-going

- **EBOV-001**
  - FIM dose escalation, N=39, $10^4$ – $10^6$ PFU
  - Study is on-going
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rVSV Vectored Tri-Valent Filovirus Vaccine Candidate

rVSVN4CT1-panFiloGP
## Single Dose NHP Immunogenicity/Efficacy Trial of Tri-Valent rVSVN4CT1-panFilovirus Vaccine

<table>
<thead>
<tr>
<th>Iteration</th>
<th>Group</th>
<th>Vaccine</th>
<th>Dose (PFU)</th>
<th>Animals</th>
<th>Vacc. Day</th>
<th>1,000 PFU IM Virus Challenge Day 28</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Tri-val N4CT1 panFilovirus(a1)</td>
<td>$3 \times 10^7$</td>
<td>3</td>
<td>2</td>
<td>0</td>
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<tr>
<td></td>
<td>2</td>
<td>N4CT1-HIVgag(s1)</td>
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<td>2</td>
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<td>0</td>
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<tr>
<td></td>
<td>6</td>
<td>N4CT1-HIVgag(s1)</td>
<td>$3 \times 10^7$</td>
<td>1</td>
<td>1</td>
<td>0</td>
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</table>
Efficacy of a Single Dose Tri-Valent rVSVN4CT1-panFilovirus Vaccine in NHPs

Low Passage 7U EBOV Challenge
1,000 PFU IM

Low Passage SUDV Challenge
1,000 PFU IM

Low Passage MARV Challenge
1,000 PFU IM

Day post challenge

% Survival

rVSVN4CT1-panFiloGP (N=5)
rVSVN4CT1-HIVgag (N=2)

rVSVN4CT1-panFiloGP (N=5)
rVSVN4CT1-HIVgag (N=2)

rVSVN4CT1-panFiloGP (N=5)
rVSVN4CT1-HIVgag (N=2)
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5.) Future Plans
A Phase 1 Clinical Trial to Evaluate the Safety and Immunogenicity of a Monovalent Ebola Zaire Vaccine (rVSVN4CT1-EBOVGP1) Delivered by Intramuscular Injection in Healthy Adult Subjects

IND No.: BB-IND-16670

Phase: 1
Protocol Number: rVSV-EBOV-01
## Protocol Number: rVSV-EBOV-01

### Phase 1 Dose Escalation and Vaccination Schedule in Months (Days)

<table>
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<tr>
<th>Study Arm</th>
<th>N</th>
<th>Dose</th>
<th>Month 0 (Day 0)</th>
<th>Month 1 (Day 28)</th>
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<tr>
<td><strong>Group 1</strong></td>
<td>10</td>
<td>2.5 x 10⁴ PFU</td>
<td>rVSVN4CT1-EBOVGP1</td>
<td>rVSVN4CT1-EBOVGP1</td>
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<tr>
<td></td>
<td>3</td>
<td>—</td>
<td>control (saline)</td>
<td>control (saline)</td>
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<tr>
<td><strong>Group 2</strong></td>
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<td>2.5 x 10⁵ PFU</td>
<td>rVSVN4CT1-EBOVGP1</td>
<td>rVSVN4CT1-EBOVGP1</td>
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<tr>
<td></td>
<td>3</td>
<td>—</td>
<td>control (saline)</td>
<td>control (saline)</td>
</tr>
<tr>
<td><strong>Group 3</strong></td>
<td>10</td>
<td>2.0 x 10⁶ PFU</td>
<td>rVSVN4CT1-EBOVGP1</td>
<td>rVSVN4CT1-EBOVGP1</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>—</td>
<td>control (saline)</td>
<td>control (saline)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>39</td>
<td>—</td>
<td>control (saline)</td>
<td>control (saline)</td>
</tr>
</tbody>
</table>

Notes: All immunizations will be administered IM in the deltoid; for Groups 1 and 2 each dose will be delivered bilaterally as 2 x 0.5 mL inoculations, and for Group 3 as 2 x 1.0 mL inoculations; CoA = Certificate of Analysis; PFU = plaques forming units.
Protocol Number: rVSV-EBOV-01: Adverse Events

Injection site pain/tenderness

- Vax1 Cohort 1: Grade 1 = 0, Grade 2 = 2
- Vax2 Cohort 1: Grade 1 = 4, Grade 2 = 0
- Vax1 Cohort 2: Grade 1 = 5, Grade 2 = 2
- Vax2 Cohort 2: Grade 1 = 4, Grade 2 = 6
- Vax1 Cohort 3: Grade 1 = 6, Grade 2 = 7
- Vax2 Cohort 3: Grade 1 = 0, Grade 2 = 0

13 subjects/16 related AEs

Nausea

- Vax1 Cohort 1: Grade 1 = 0, Grade 2 = 0
- Vax2 Cohort 1: Grade 1 = 0, Grade 2 = 0
- Vax1 Cohort 2: Grade 1 = 0, Grade 2 = 0
- Vax2 Cohort 2: Grade 1 = 0, Grade 2 = 0
- Vax1 Cohort 3: Grade 1 = 3, Grade 2 = 5
- Vax2 Cohort 3: Grade 1 = 0, Grade 2 = 0

3 subjects/7 related, 1 unlikely related AEs

Diarrhea

- Vax1 Cohort 1: Grade 1 = 0, Grade 2 = 0
- Vax2 Cohort 1: Grade 1 = 0, Grade 2 = 0
- Vax1 Cohort 2: Grade 1 = 0, Grade 2 = 2
- Vax2 Cohort 2: Grade 1 = 0, Grade 2 = 2
- Vax1 Cohort 3: Grade 1 = 0, Grade 2 = 2
- Vax2 Cohort 3: Grade 1 = 0, Grade 2 = 0

3 subjects/3 related, 1 unlikely related AEs

Fever

- Vax1 Cohort 1: Grade 1 = 0, Grade 2 = 0
- Vax2 Cohort 1: Grade 1 = 0, Grade 2 = 0
- Vax1 Cohort 2: Grade 1 = 0, Grade 2 = 0
- Vax2 Cohort 2: Grade 1 = 0, Grade 2 = 0
- Vax1 Cohort 3: Grade 1 = 0, Grade 2 = 4
- Vax2 Cohort 3: Grade 1 = 0, Grade 2 = 0

4 subjects/4 related AEs

From blinded data (Active and Placebo), excluding AEs considered unrelated.
Protocol Number: rVSV-EBOV-01: Adverse Events

**Arthralgia**

- **Cohort 1**: 11 AEs
- **Cohort 2**: 1 AE
- **Cohort 3**: 2 AEs

- **Grade 1**: 5 AEs
- **Grade 2**: 6 AEs

2 subjects/2 related AEs

**Muscle pain/Myalgia**

- **Cohort 1**: 7 AEs
- **Cohort 2**: 3 AEs
- **Cohort 3**: 0 AEs

- **Grade 1**: 2 AEs
- **Grade 2**: 6 AEs

3 subjects/3 related AEs

**Bruise/Erythema**

- **Cohort 1**: 1 AE
- **Cohort 2**: 2 AEs
- **Cohort 3**: 2 AEs

- **Grade 1**: 2 AEs
- **Grade 2**: 1 AE

2 subjects/3 related AEs

**Increased WBC**

- **Cohort 1**: 3 AEs
- **Cohort 2**: 2 AEs
- **Cohort 3**: 2 AEs

- **Grade 1**: 1 AE
- **Grade 2**: 2 AEs

2 subjects/3 unlikely related AEs
**Protocol Number:** rVSV-EBOV-01

### Detection of Disseminated Vaccine Virus (Blinded)

<table>
<thead>
<tr>
<th>Sample Day</th>
<th>Blood</th>
<th>Urine</th>
<th>Saliva</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (Prime)</td>
<td>RT-qPCR (LOQ=1.36x10³ copies/mL)</td>
<td>Culture Confirmed (LOD=100 PFU/0.1 mL)</td>
<td>RT-qPCR (LOQ=8.30x10² copies/mL)</td>
</tr>
<tr>
<td>1</td>
<td>0/39</td>
<td>NA</td>
<td>0/39</td>
</tr>
<tr>
<td>3</td>
<td>0/39</td>
<td>NA</td>
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<td>7</td>
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<td>0/39</td>
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<tr>
<td>14</td>
<td>0/39</td>
<td>NA</td>
<td>0/39</td>
</tr>
<tr>
<td>28 (Boost)</td>
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<td>0/39</td>
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<td>29</td>
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<tr>
<td>56</td>
<td>0/38</td>
<td>NA</td>
<td>0/38</td>
</tr>
</tbody>
</table>

**Notes:**
- RT-qPCR values refer to LOD=100 PFU/0.1 mL.
- Culture confirmed values refer to LOD=100 PFU/0.1 mL.
- Sample Day 1 is marked with a red box and noted as "1³/39 Neg."
Protocol Number: rVSV-EBOV-01

EBOV GP-specific ELISpot analysis conducted by Profectus BioSciences

Cryo-preserved PBMCs were collected at the following time points for ELISpot analysis:

- Visit 2: Day of 1st vaccination
- Visit 5: 1 week post 1st vaccination
- Visit 6: 2 weeks post 1st vaccination
- Visit 7: Day of 2nd vaccination
- Visit 10: 1 week post 2nd vaccination
- Visit 11: 2 weeks post 2nd vaccination
- Visit 12: 4 weeks post 2nd vaccination
- Visit 13: 22 weeks post 2nd vaccination
**Protocol Number:** rVSV-EBOV-01  

**BLINDED** EBOV GP-specific cell mediated immune (CMI) responses over time by IFN-gamma ELISpot assay

<table>
<thead>
<tr>
<th>Groups</th>
<th>ELISpot Response (SFC/10⁶ PBMCs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grp 1:</td>
<td>2.5x10⁴ PFU</td>
</tr>
<tr>
<td>Grp 2:</td>
<td>2.5x10⁵ PFU</td>
</tr>
<tr>
<td>Grp 3:</td>
<td>2.0x10⁶ PFU</td>
</tr>
</tbody>
</table>

**Human ELISpot assay positivity criteria:**
- ≥ Assay LOB (80 SFC/10⁶ PBMCs for EBOV GP)
- ≥ 2x baseline visit 2 response
Protocol Number: rVSV-EBOV-01

EBOV GP-specific ELISA analysis conducted by Battelle

Serum was collected at the following time points for ELISA analysis:

- **Visit 2:** Day of 1<sup>st</sup> vaccination
- **Visit 5:** 1 week post 1<sup>st</sup> vaccination
- **Visit 6:** 2 weeks post 1<sup>st</sup> vaccination
- **Visit 7:** Day of 2<sup>nd</sup> vaccination
- **Visit 10:** 1 week post 2<sup>nd</sup> vaccination
- **Visit 11:** 2 weeks post 2<sup>nd</sup> vaccination
- **Visit 12:** 4 weeks post 2<sup>nd</sup> vaccination
- **Visit 13:** 22 weeks post 2<sup>nd</sup> vaccination
**Protocol Number:** rVSV-EBOV-01

**EBOV GP-specific ELISA responses**

**Cohort #1:** 2.5x10^4 PFU dose level

Study 3671-100062783  
Friday, November 11, 2016

**QA Reviewed ELISA Data**

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Visit 2</th>
<th>Visit 5</th>
<th>Visit 6</th>
<th>Visit 7</th>
<th>Visit 8</th>
<th>Visit 9</th>
<th>Visit 10</th>
<th>Visit 11</th>
<th>Visit 12</th>
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<td>100.77</td>
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<td>647.01</td>
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<td>1785.12</td>
<td>1936.73</td>
<td>647.01</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

**AVG** | 0.00 | 0.00 | 4.22 | 130.84 | 909.78 | 1232.96 | 912.34 | 424.29 |

**SE**  | 0.00 | 0.00 | 4.22 | 52.95  | 222.12 | 291.59  | 248.51 | 193.61 |

**Responder Freq** 10 of 13 (77%)
**Protocol Number: rVSV-EBOV-01**

**EBOV GP-specific ELISA responses**

**Cohort #2: 2.5x10^5 PFU dose level**

---

**QA Reviewed ELISA Data**

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Visit 2</th>
<th>Visit 5</th>
<th>Visit 6</th>
<th>Visit 7</th>
<th>Visit 10</th>
<th>Visit 11</th>
<th>Visit 12</th>
<th>Visit 13</th>
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<tr>
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**AVG**  
5.50  
6.92  
27.67  
282.20  
2334.21  
2995.31  
1529.54  
467.50

**SE**  
5.50  
6.92  
18.84  
98.54  
878.44  
1061.68  
414.03  
181.81

**Responder Freq**  
10 of 13 (77%)
**Protocol Number:** rVSV-EBOV-01

**EBOV GP-specific ELISA responses**

**Cohort #3:** 2.0x10⁶ PFU dose level

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Visit 2</th>
<th>Visit 5</th>
<th>Visit 6</th>
<th>Visit 7</th>
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<td>11170.07</td>
<td>10175.08</td>
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</table>

| AVG | 0.00 | 0.00 | 214.78 | 537.63 | 10044.08| 7784.63 | 6238.27 | 712.59 |
| SE  | 0.00 | 0.00 | 93.43  | 159.03 | 3161.09 | 2536.74 | 2073.85 | 198.16 |

**Responder Freq** 10 of 13 (77%)
Protocol Number: rVSV-EBOV-01

**BLINDED** Mean EBOV GP-specific ELISA responses over time

<table>
<thead>
<tr>
<th>Group</th>
<th>PFU</th>
<th>Responder Freq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grp 1</td>
<td>$2.5 \times 10^4$</td>
<td>10 of 13 (77%)</td>
</tr>
<tr>
<td>Grp 2</td>
<td>$2.5 \times 10^5$</td>
<td>9 of 12 (75%)</td>
</tr>
<tr>
<td>Grp 3</td>
<td>$2.0 \times 10^6$</td>
<td>10 of 13 (77%)</td>
</tr>
</tbody>
</table>
rVSV-EBOV-01 Summary

- **Safe and well-tolerated at all tested doses**
  - No vaccine-related AEs greater than grade 2
  - 13/39 reported mild to moderate injection site tenderness
  - No other AEs reported in more than 5/39 subjects
  - Vaccine shedding:
    - 1 blood sample PCR positive, culture negative
    - PCR and culture of urine and saliva, universally negative

- **Immunogenic at all tested doses and blinded data consistent with:**
  - CMI responses by IFNγ ELISpot
    - Response rates of 60-80% post dose 1 and 80-90% post dose 2
  - Antibody responses by ELISA
    - Response rates of 70-100% post dose 1 and 100% post dose 2
Presentation Outline:

1.) Background on the VesiculoVax™ Vaccine Platform

2.) Ability of a Single Dose Tri-valent VesiculoVax™ panFilo Vaccine to protect against EBOV, SUDV and MARV challenge

3.) Phase I Safety and Immunogenicity of the mono-valent VesiculoVax™ EBOV Vaccine

4.) Identification of a Correlate of Protection Against Aerosol MARV challenge in NHPs

5.) Future Plans
### Identification of a Correlate of Protection Against Aerosol MARV challenge in NHPs

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of NHPs</th>
<th>Dosing Material</th>
<th>Vaccine Dosage (PFU)</th>
<th>Vaccination (Day/Route)</th>
<th>Challenge 1,000 PFU MARV (Day/Route)</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>7.5 x 10^6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
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<td>3</td>
<td>5</td>
<td>7.5 x 10^4</td>
<td>0 / IM</td>
<td></td>
<td>42 / Aerosol</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>7.5 x 10^3</td>
<td></td>
<td></td>
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<td>5</td>
<td>4</td>
<td>7.5 x 10^2</td>
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<tr>
<td>6</td>
<td>2</td>
<td>N4CT1-HIVgag(s1)</td>
<td>7.5 x 10^6</td>
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</table>

N=26

**Goal:** to achieve a wide range of:
- MARV GP-specific immune responses
- Post MARV challenge protection
Anti-EBOV GP ELISA titers

ELISA units/mL

Days post immunization

-20 -10 0 10 20 30 40

7.5 x 10^6
7.5 x 10^5
7.5 x 10^4
7.5 x 10^3
7.5 x 10^2
Control
Con
Anti-SUDV GP ELISA titers

ELISA units/mL

Days post immunization

-20 -10 0 10 20 30 40

7.5 x 10^6
7.5 x 10^5
7.5 x 10^4
7.5 x 10^3
7.5 x 10^2
Control

10^5
10^6
10^4
10^3
Con
Anti-MARV GP ELISA titers

ELISA units/mL

Days post immunization

-20 -10 0 10 20 30 40

7.5 \times 10^6
7.5 \times 10^5
7.5 \times 10^4
7.5 \times 10^3
7.5 \times 10^2
Control

10^6
10^5
10^3
Con
## FiloGP-specific Neutralizing Ab Responses* (PRNT50) at Day 35

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<th>Animal ID</th>
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<td>1</td>
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<td><strong>77.6</strong></td>
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<td>C62625</td>
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<td>7.5 x 10^5</td>
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<td>6</td>
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</table>

* Research assay
D35 (5wks post immunization) anti-Filo GP IFNγ ELISpot response

![Graph showing ELISpot response to different GP strains](image)

**Responder Freq**

- Zaire GP: 3/5 (60%)
- Sudan GP: 4/5 (80%)
- Marburg GP: 3/5 (60%)
- 1/5 (20%)
- 2/4 (50%)
- 0/2 (0%)
Post Challenge Survival (1,000 PFU AE MARV)
Determining a Correlate of Protection against 1,000 PFU AE MARV Challenge
Relationship between D35 anti-MARV ELISpot response and post challenge outcome

D35 Anti-MARV ELISpot Response (SFC/10^6 PBMCs)

‡ not challenged
Relationship between D35 anti-MARV Neut Ab titer and post challenge outcome

D35 Anti-MARV Neut Ab titers

‡ not challenged
Relationship between D35 anti-MARV ELISA titer and post challenge outcome
Univariate Logistic Regression Models Fitted to Immune Response Data

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<thead>
<tr>
<th>Assay</th>
<th>Virus</th>
<th>Study Day</th>
<th>Slope Estimate</th>
<th>P-Value</th>
<th>False Discovery Rate Benjamini-Hochberg P-Value</th>
<th>Area Under Curve</th>
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<td>1.1052</td>
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<td>0.6060</td>
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Only MARV GP-specific ELISA responses at study days 28 and 35 (p-values = 0.0078 and 0.0061, respectively) were shown to be significantly associated with survival.
Using an Immune Correlate to Gauge **Potential** Protective Efficacy of a Vaccine in Ph I/II Clinical samples

- Extrapolate an “threshold” MARV GP-specific ELISA response associated with 80%, 90% or 95% probability of survival

- Experimental vaccines capable of eliciting and / or maintaining an immune response above a pre-defined “protective” level might be expected to be efficacious and would warrant additional development
Presentation Outline:

1.) Background on the VesiculoVax™ Vaccine Platform

2.) Ability of a Single Dose Tri-valent VesiculoVax™ panFilo Vaccine to protect against EBOV, SUDV and MARV challenge

3.) Phase I Safety and Immunogenicity of the mono-valent VesiculoVax™ EBOV Vaccine

4.) Identification of a Correlate of Protection Against Aerosol MARV challenge in NHPs

5.) Future Plans
# rVSV-MARV-01: Marburg Vaccine Phase I Study

## Phase 1 Dose Escalation and Vaccination Schedule in Months (Days)

<table>
<thead>
<tr>
<th>Study Arm</th>
<th>N</th>
<th>Total Dose</th>
<th>Month 0 (Day 0)</th>
<th>Month 1 (Day 28)</th>
<th>Month 1 (Day 56)</th>
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<tbody>
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<td>10</td>
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<td>rVSVN4CT1-MARVGP1</td>
<td>—</td>
<td>rVSVN4CT1-MARVGP1</td>
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<tr>
<td></td>
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<td>—</td>
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<td>—</td>
<td>control (saline)</td>
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<td>rVSVN4CT1-MARVGP1</td>
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<tr>
<td></td>
<td>3</td>
<td>—</td>
<td>control (saline)</td>
<td>—</td>
<td>control (saline)</td>
</tr>
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<tr>
<td></td>
<td>3</td>
<td>—</td>
<td>control (saline)</td>
<td>—</td>
<td>control (saline)</td>
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<td>rVSVN4CT1-MARVGP1</td>
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<td></td>
<td>3</td>
<td>—</td>
<td>control (saline)</td>
<td>control (saline)</td>
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<tr>
<td><strong>Total</strong></td>
<td>52</td>
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<td>control (saline)</td>
<td>control (saline)</td>
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</tbody>
</table>

PFU = plaques forming units.
Work in-progress:

- **Development of a VesiculoVax™ Vaccine with >2 yr shelf life at room temperature**
  - rVSV-EBOV and rVSV-MARV lyophilized with ~75% retention of potency
  - rVSV-SUDV lyophilization development in progress

- **Development of a Quadra-valent VesiculoVax™ panFilo/Lassa Vaccine**
  - rVSVN4CT1-EBOV/SUDV/MARV/LASV has entered animal testing
Acknowledgements

John Eldridge, CSO

- David Clarke
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- Tracy Chen
- Marc Tremblay
- Alan Gordon
- Jeff Meshulam
- Loema Titanji
- Greg Goffreda
- Susan Sciotto-Brown
- Edens Lamarre

Battelle

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- Callie Bounds
- Lucy Ward
- Chris Badorrek
- Clint Florence
- T Rudge
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