Foreign Animal Disease Research Unit Update 2016
To FED Committee USAHA 2016

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Research Leader

Agricultural Research Service, Plum Island Animal Disease Center
Current FADRU Staff

- 6 administrative staff
- 9 Senior scientists
- 12 support scientists
- 1 ARS postdocs
- 12 PIADC-ORISE Research Fellows
- 6 University Collaborators

TOTAL ARS AND COOPERATOR PERSONNEL AT PIADC 46
APPROVED NEW CRIS PROJECTS 2012-2017

• Intervention Strategies to Support the Global Control and Eradication of FMD

• Countermeasures to Control and Eradicate Foreign Animal Diseases of Swine: CSF/ASF

• Ecology of Vesicular Stomatitis Virus
Deliverables

- New generation marker CSF vaccine - **FlagT4G**
- Characterization of persistently infected tissues in cattle
- Data on **inactivation of FAD** agents pork packing plants
- Discovery of **IFN-lambda+ Ad5FMD** effective against FMDV (cattle and swine)
- Novel vaccine platform **FMD-LL3B3D**
- Challenge models for FMDV and ASF
- In 2016: **32 scientific publications**, two patents
- **International activities**: Vietnam, Uganda, Cameroon, India, Kenya, Pakistan, Spain…
Foot and Mouth Disease

- FMD is considered number one threat to American Agriculture and related industries (livestock, crops, farm supply, etc)
- FAO/OIE announced eradication from Americas by 2023 – global strategy key to eradication
- FMD is main barrier to international trade of animal products
- FMD is one of the main threats to global food security

“Countries infected with FMD are more prone to food insecurity as a result of the impact of FMD at household level and through reduced access to local, national and international markets and of animal draught power for agriculture”

OIE/FAO, 2009
Pathogenesis Virus – Host Interactions

• Determined that at the site of persistent infection in the bovine pharyngeal tissue, there is an impaired immune response and decreased mechanisms for viral clearance.

• Discovered host proteins that bind to two viral proteins playing a critical role in infection including a novel receptor for FMDV (JMJD6).
Improving Foot-and-Mouth Disease Virus (FMDV) vaccines with novel adjuvant approaches.

- ARS researchers at the Plum Island Animal Disease Center, Orient, NY in collaboration with scientists at the Lawrence Livermore National Laboratory in Livermore CA, engineered a novel FMDV with structural modifications to the capsid (6xHis) that allows the vaccine to bind to metal ions.
Collaborative Studies

- Demonstrated that the two main variants of FMDV from Korea - 2010 had ability to infect both cattle and pigs and cause propagation of disease. The viruses were transmissible from pigs to cattle as well as from cattle to pigs.
Classical Swine Fever

- Endemic in Asia, Central and South America, and Eastern Europe
- Outbreaks reported in past decade in Mexico, Cuba and Dominican Republic
- Re-introduction is always a possibility
FlagT4 FTG virus: A Next Generation Classical Swine Fever DIVA Vaccine

WH 174
WH 303
Anti-Flag

FlagT4 TGFv
BICv
African Swine Fever
Gene deleted recombinant ASFV strain Georgia vaccine candidates

Infection
ASFV Georgia

Transfection

Macrophages/Vero

Recombination

Selection

Virus Stock

Test for attenuation

Full length sequence

Purity assessment

P72 GUS

Virus Stock
New candidates for African Swine Fever Virus (ASFV) vaccine.

Removal of specific virus genes by genetic recombination allowed the development of two different attenuated virus strains that are able to induce protection in swine against ASF infection with the highly virulent Georgia isolate. This is the first time that an experimental vaccine is reported to protect against this virulent field isolate.
Ecology of VSV in North America
Working Hypothesis

Endemic cycle

Epidemic transmission
Lineage 1.1 → 2012 US outbreak
Lineage 1.2
NJ00VCB4
NJ00VCB2
NJ00VCB1

NJ0911CPB9
NJ0911CPB2
NJ0911CPB4
NJ1105TBB

2004-06 US outbreak
NJ0507CPB
NJ1205TBB
NJ1010CPB2
NJ1010CPB
NJ1011CPB
NJ0508TBB
NJ0908VCB
NJ0708CPB
NJ1205OAB

1995-97 US outbreak
NJ0905CPB
NJ1105CPB
NJ1207CPB
NJ1005TBB

1985 US outbreak
NJ1207CPB2
NJ1107TBB
NJ1107CPB
NJ1006TBB

1983 US outbreak
NJ1105CPB2
NJ0905TBB
Southeastern US

0.005 substitutions/site

Expanded in Figure 3
2015-2016 US (CO, NM, AZ, SD, NE, WY, UT)

NJ13CHB
NJ1014COB5
NJ1014COB6
Colorado 21793 2014
NJ0814COB
NJ0914COB1
NJ0914COB2
NJ0612NME1, 3, 4, 7
NJ1014COB3
NJ1014COB4
NJ1014COB7
NJ1114COB
NJ1114NEB
NJ0512NME/Genbank
Texas 16313 2014
Texas NJ18826 2014
NJ1114COE
NJ0612NME5
NJ1208JAB4
NJ0107GRB1
NJ1006GRB
NJ0309SIB

Lineage 1.1

0 nucleotide differences between the 2012 New Mexico isolates and the 2014 CO/NE/TX isolates at the node root

2012 isolates in red
2014 isolates in green

endemic Mexico (Chiapas, Veracruz, Tabasco)
ML, P hyp

2015-2016 US (CO, NM, AZ, SD, NE, WY, UT)

2013 isolate from northern Mexico state of Chihuahua
APHIS- ARS-Palantir Collaborative research on VSV Ecology

VSV confirmed during 2004-2016

VS Occurs in a large area in S/N Western US (>1M Km2)

Reoccurrence in same states on different years/ outbreak cycle

What factors determine the occurrence of VSV?

Max Ent analysis – 5 reference premises for each case

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Strategic partnerships

- **Government**: DHS, USDA/APHIS, DOD, DOS, DOE

- **Stake holders**: National Pork Board (> $2 M in last 4 years)


- **Industry**: Zoetis, Merial, Codagenix
GLOBAL PARTNERSHIPS

“To establish and sustain global research partnerships to generate scientific knowledge and discover the tools to successfully prevent and control FADs”

Countries with current research collaborations

- India  Australia
- Spain  Pakistan
- Vietnam  South Africa
- UK  Argentina
- Kenya  Cameroon
- Russia  R. Georgia
- S.Korea  Japan
- Mexico  Uganda
- Israel  Denmark
Thank you!