

Real-Time Open Data Sharing of Zika Virus Research using LabKey



Who We Are

Laboratory of David H O'Connor

University of Wisconsin Madison

Aids Vaccine Research Lab

Areas of research:

Non-human primate genetics: MHC, KIR, FCGR

HIV / SIV

Host / pathogen interactions in Non-human primates

Novel viruses in Non-human primates

.... lately ZIKA



LabKey Usage prior to Zika

Our lab has been using LabKey server for years prior to Zika

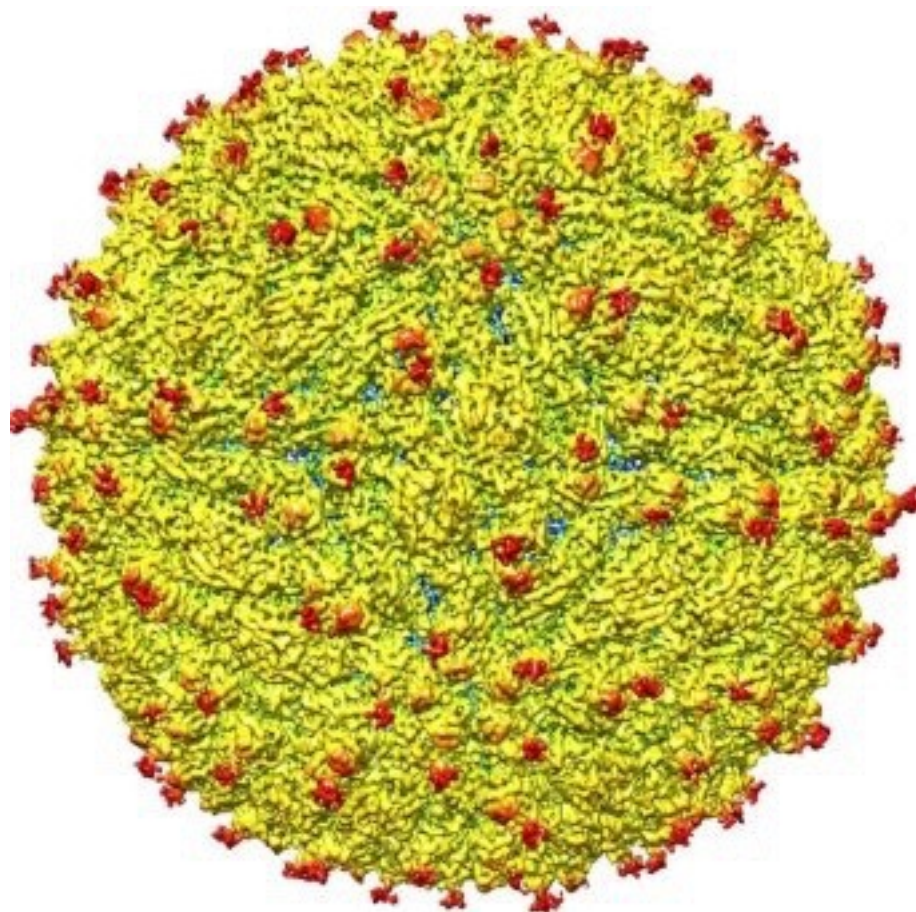
- Electronic laboratory notebook system
- High throughput sequencing data archival
- Purchasing management
- Contract reporting of results
- Freezer / reagent inventory
- Animal records

Prior familiarity with the system helped with getting Zika studies presented in labkey

The laboratory of David O'Connor at the University of Wisconsin-Madison has been involved in Zika virus research during the recent outbreak in the Americas

The laboratory is conducting studies with several goals

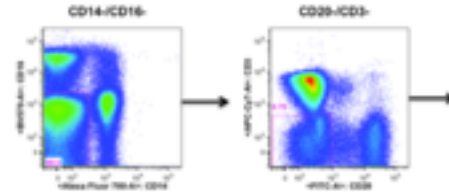
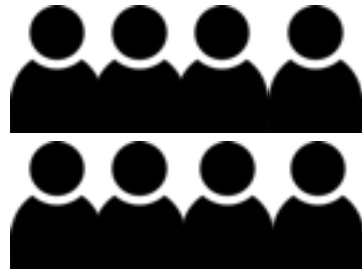
- Establish the natural history of infection
- Create an animal model of disease progression (Rhesus macaques), that can be used to target future vaccine development
- Explore the role of Zika virus infection during pregnancy causing birth defects (E.g. microcephaly)



Team ZEST

(Zika Experimental Science Team)

Immunology and Pathogeneis



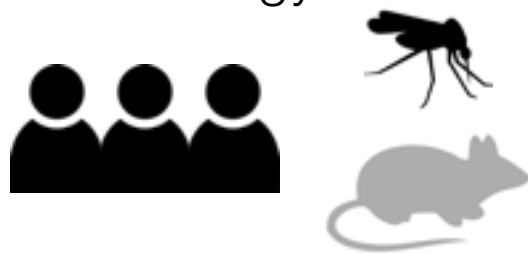
Nonhuman primate core



Admin Core



Vector Biology



LabKey Server



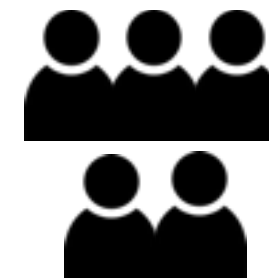
Data Management



Virology



Translational Core



Pregnancy and fetal development



Neurobiology



Multi Disciplinary Team of Scientists

Rapidly assembled a large group of researchers to address the Zika virus outbreak

- Multi-disciplinary team allows for rapid, expert interpretation of data
- Presents challenges aggregating data and interpretations
- Data of numerous types being generated daily



Real-Time Data Sharing

Our lab determined Real-Time data sharing was critical to addressing the public health emergency of the ongoing Zika outbreak

- A diversion from the traditional wait to publish model
- Real-Time release of data important for public health officials to provide guidance to the public
 - Study data released has informed guidance given by the NIH and CDC
- Open sharing of data reduces the number of primates needed for research, prevents duplication of effort

We began by setting up our zika sharing portal on our own labkey server

- LabKey server's study module provided a centralized place to store and display data being collected in real-time



Q Search

dho Projects Administration WNPRC

Admin ▾ Help ▾ pipeline_user@wisc.edu ▾

public

Start Page

ZEST Zika data has moved to zika.labkey.com

This data has moved to another server which houses Zika data for other researchers as well. Please visit the new location for the real-time data: <https://zika.labkey.com/project/OConnor/begin.view>

You will be automatically redirected in a few seconds.

Introduction

Welcome to the Zika experimental science team (ZEST) data portal. Given the urgency of the ongoing Zika virus epidemic, we are making our study results available in real-time. Each study and its available data are shown below. For example, the first study performed by the ZEST team is ZIKV-001. If there are data you would like but are not available, please contact us. We are also happy to answer questions about the data as best as possible, but we apologize in advance if we do not have time to answer each and every question.

Questions or comments can be directed to Dave O'Connor dhoconno@wisc.edu. You can also follow the O'Connor lab (@oconnorlab) or Dave (@dho) on Twitter.

ZIKV-001: Infection of three rhesus macaques with French Polynesian Zika virus


Primary objectives

- Assess the infectivity of a Zika virus isolate from French Polynesia at different doses in rhesus macaques
- Measure concentration of Zika virus RNA in plasma, urine, CSF, saliva, and feces
- Determine whether immunity elicited by Zika virus infection protects from subsequent re-infection with genetically similar. Asian-lineage Zika viruses

Real-Time Data Sharing

We then moved our zika study portal to a labkey hosted server

- Benefit from a professionally managed server
- Allow other groups doing zika research to setup their own study portals in the same place

 **Zika Open-Research Portal**

Q Search

O'ConnorAdminHelplankage22

O'ConnorStart Page

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Questions or comments can be directed to Dave O'Connor dhoconno@wisc.edu. You can also follow the O'Connor lab (@dho_lab) or Dave (@dho) on Twitter.

LabKey (long-time technology partners of the O'Connor Lab) has launched the [Zika Open-Research Portal](#) to help facilitate collaborative research. This portal provides researchers with a platform to share raw data, study commentary and results with the public in real-time. Projects are freely available to investigators.

If you are interested in making your research publicly available through the portal, please [contact LabKey](#) to get started.

Direct Study Links

- [ZIKV-001](#)
- [ZIKV-002](#)
- [ZIKV-003](#)
- [ZIKV-004](#)
- [ZIKV-005](#)
- [ZIKV-006](#)
- [ZIKV-WILD](#)

Messages

NEW

Showing: recent messages

More ZIKV-003 tissues positive for ZIKV vRNA

mmohns2016-07-22 10:09

Further testing of tissues isolated from [ZIKV-003](#) mother and fetus show that the maternal spleen and maternal liver also have trace amounts of vRNA detectable.

Gotten a little bit of attention...



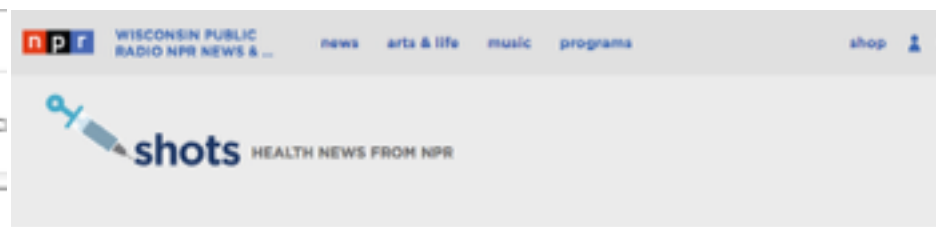
HEALTH

Zika Data From the Lab, and Right to the Web

By DONALD G. McNEIL Jr. JULY 18, 2016



A pregnant rhesus macaque monkey infected with the Zika virus. University researchers released a study that found the Zika virus persisted in the blood of pregnant monkeys for 30 to 70 days but only around seven days in others. Scott Olson/Getty Images



3:47

+ Queue

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Embed

Transcript



ZIKA VIRUS

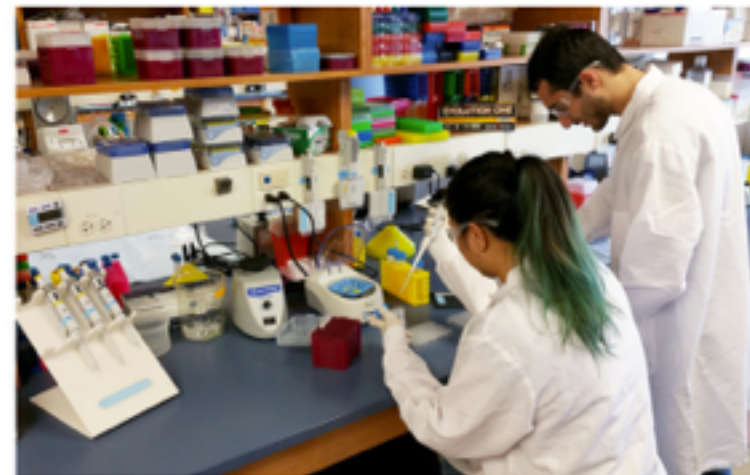
Scientists Report In Real Time On Challenging Zika Research

March 8, 2016 · 5:00 PM ET

Heard on All Things Considered



NELL GREENFIELDBOYCE



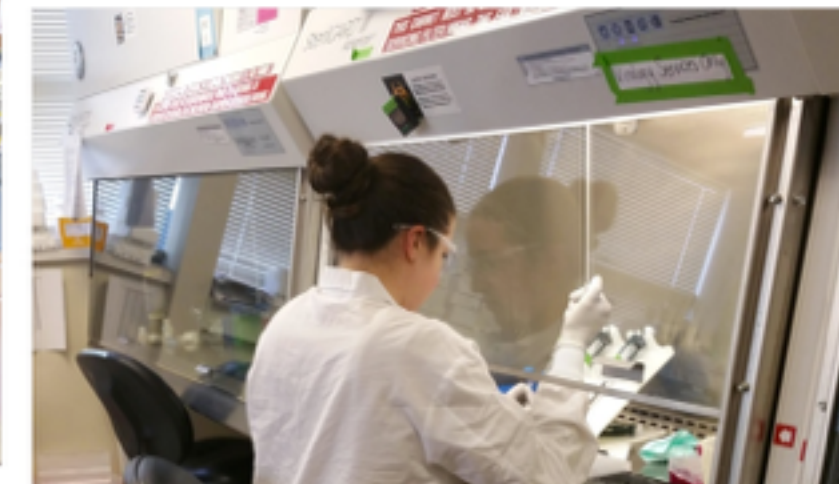
Zika researchers release real-time data on viral infection study in monkeys

Raw data from macaque experiment published daily online.

Declan Butler

23 February 2016

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MEDIA AVAILABILITY

Zika Virus Infection May Be Prolonged in Pregnancy

Monkey Model Offers Clues on How Virus Progresses and Confers Immunity

WHAT: Zika virus infection confers protection against future infection in monkeys, but lingers in the body of pregnant animals for prolonged periods of time, according to research funded by the National Institute of Allergy and Infectious Diseases (NIAID), part of the National Institutes of Health (NIH). The findings appear in the June 28 issue of *Nature Communications*.



Home » Lifestyle » Health » Zika infection may linger longer during pregnancy: Study

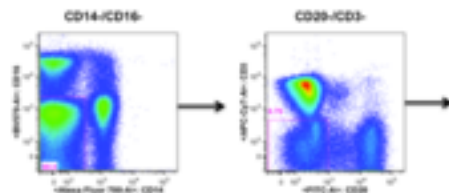
Zika infection may linger longer during pregnancy: Study

The results indicate that natural immunity may be sufficient to protect against future Zika infections in humans, and a vaccine that can mimic this immunity would likely be safe.

How We Use LabKey Server

- Data contributors upload raw data to datasets within a Private Master study
- Sub-studies are published that draw from the main pool of data within the Private Master study

Immunology data



Viral Load Data



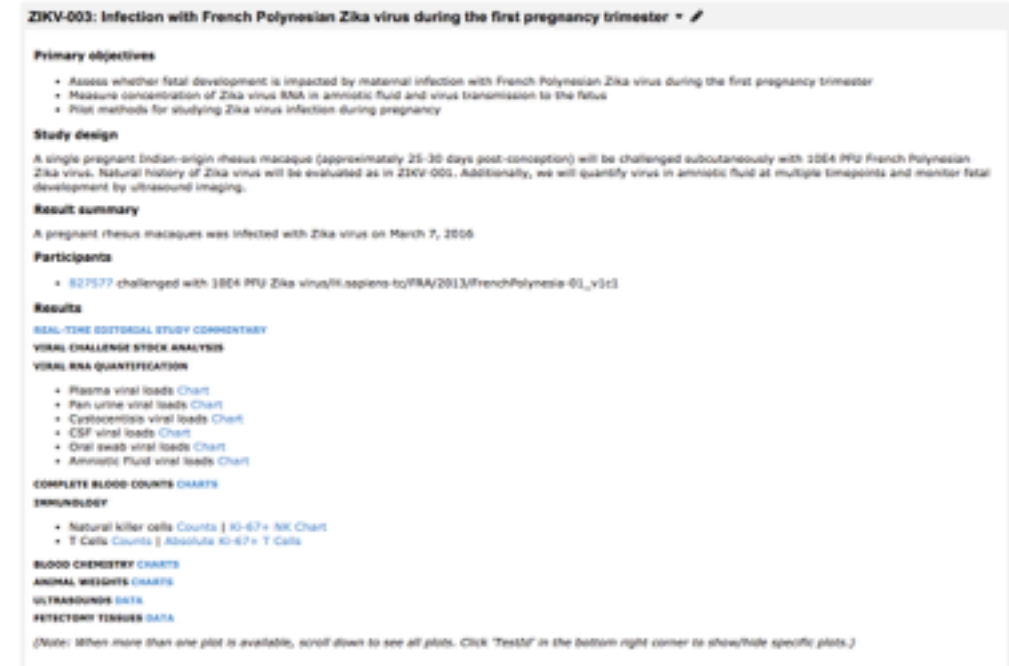
Animal Blood chemistry,
weight, etc.



ZIKV-Master

PRIVATE

Ultrasounds



PUBLIC

ZIKV-001

ZIKV-002

ZIKV-003

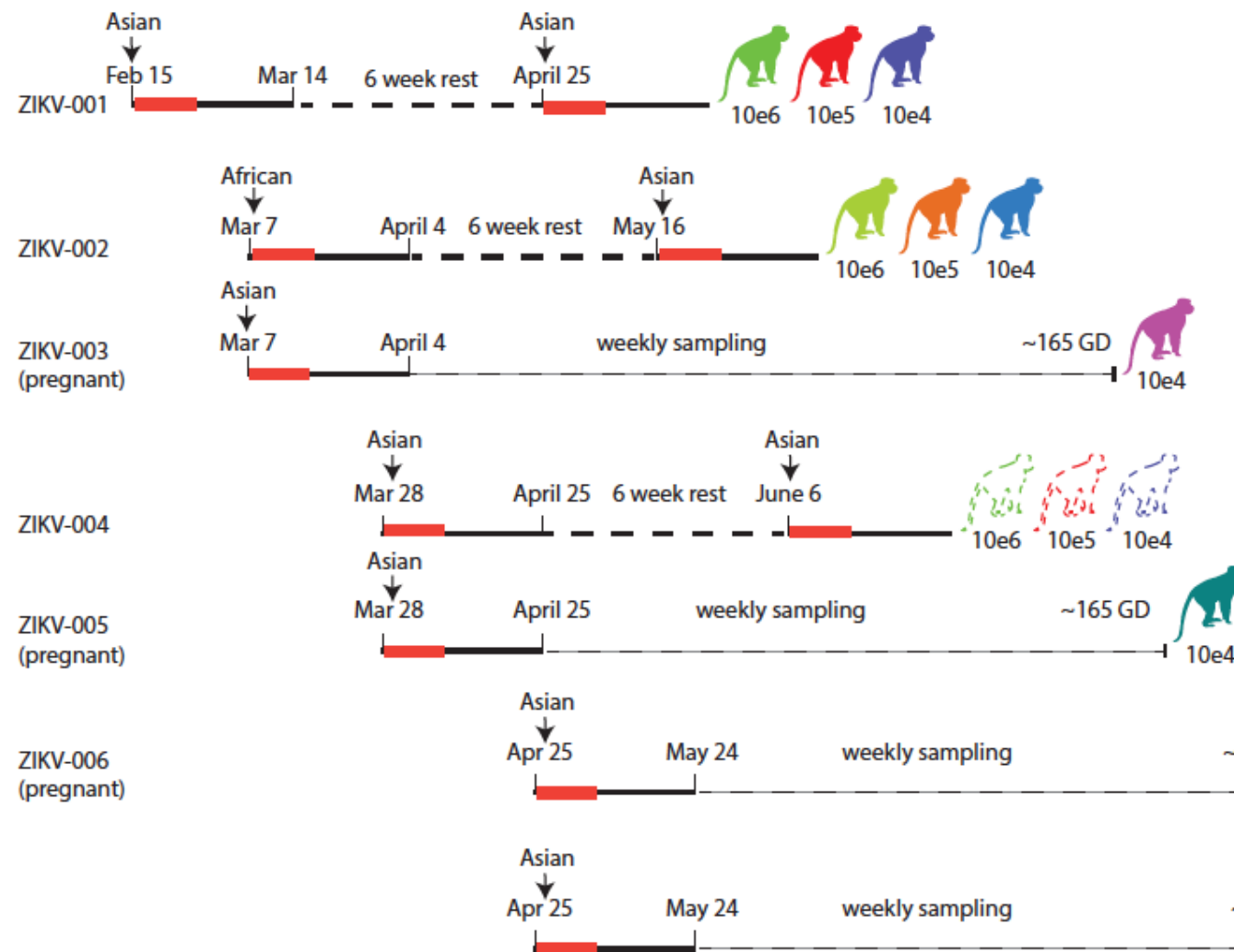
ZIKV-004

ZIKV-005

ZIKV-006

Advantages of the Study Module

- Study module allows for automatic propagation of data from master study to sub studies based on participant ID
- Study module allows for deidentification of animal IDs
- Data contributors only have to be trained how to upload data to one place, and the data becomes available in real-time
- Centralizing the data means passing spreadsheets through email is a thing of the past



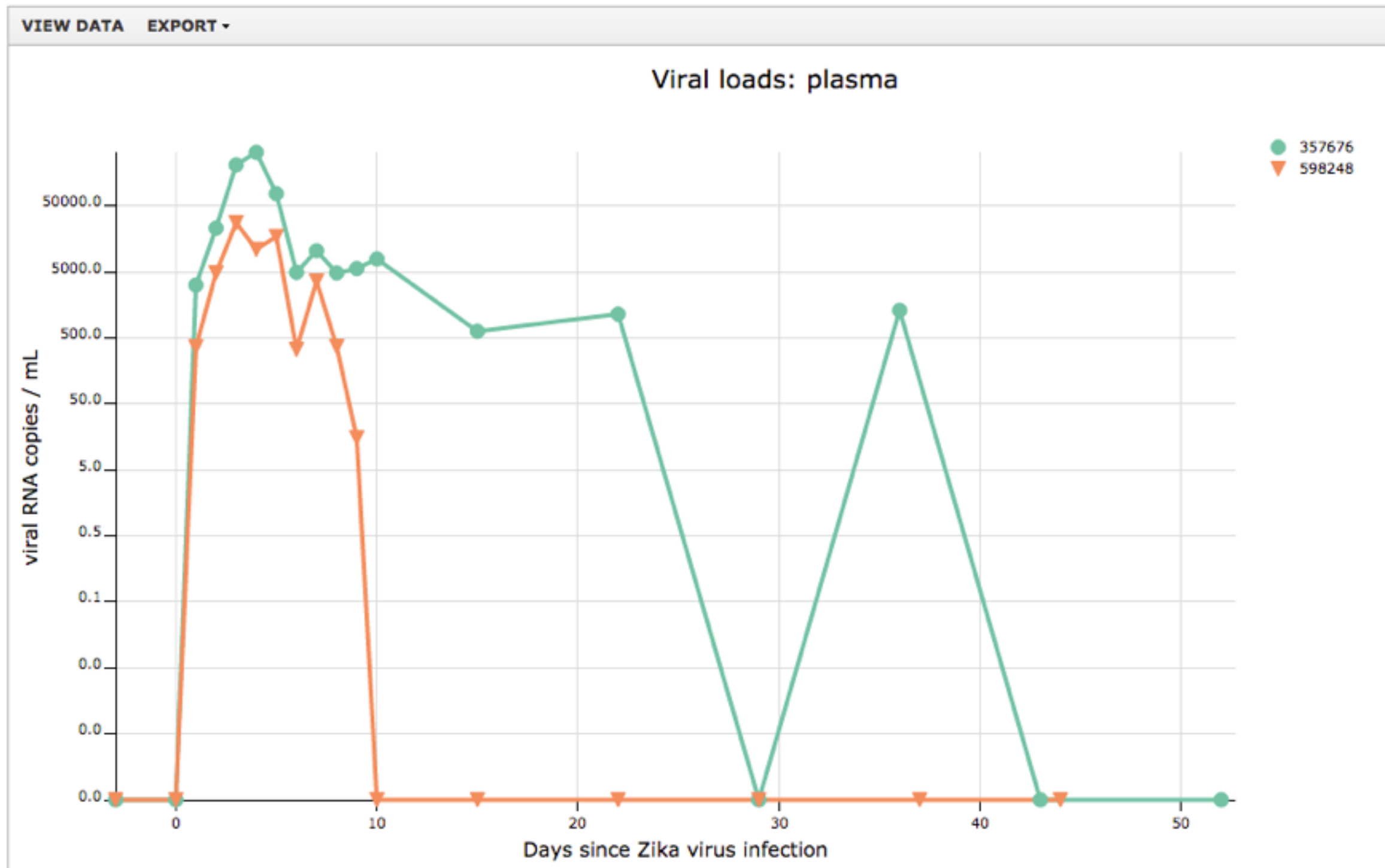
- Complicated studies tracking data over an extended period of time aided by centralization and standardization of data collection

Data types we post to public studies

Viral load time charts

- Viral RNA copies measured in different fluid samples over time

Plasma viral load

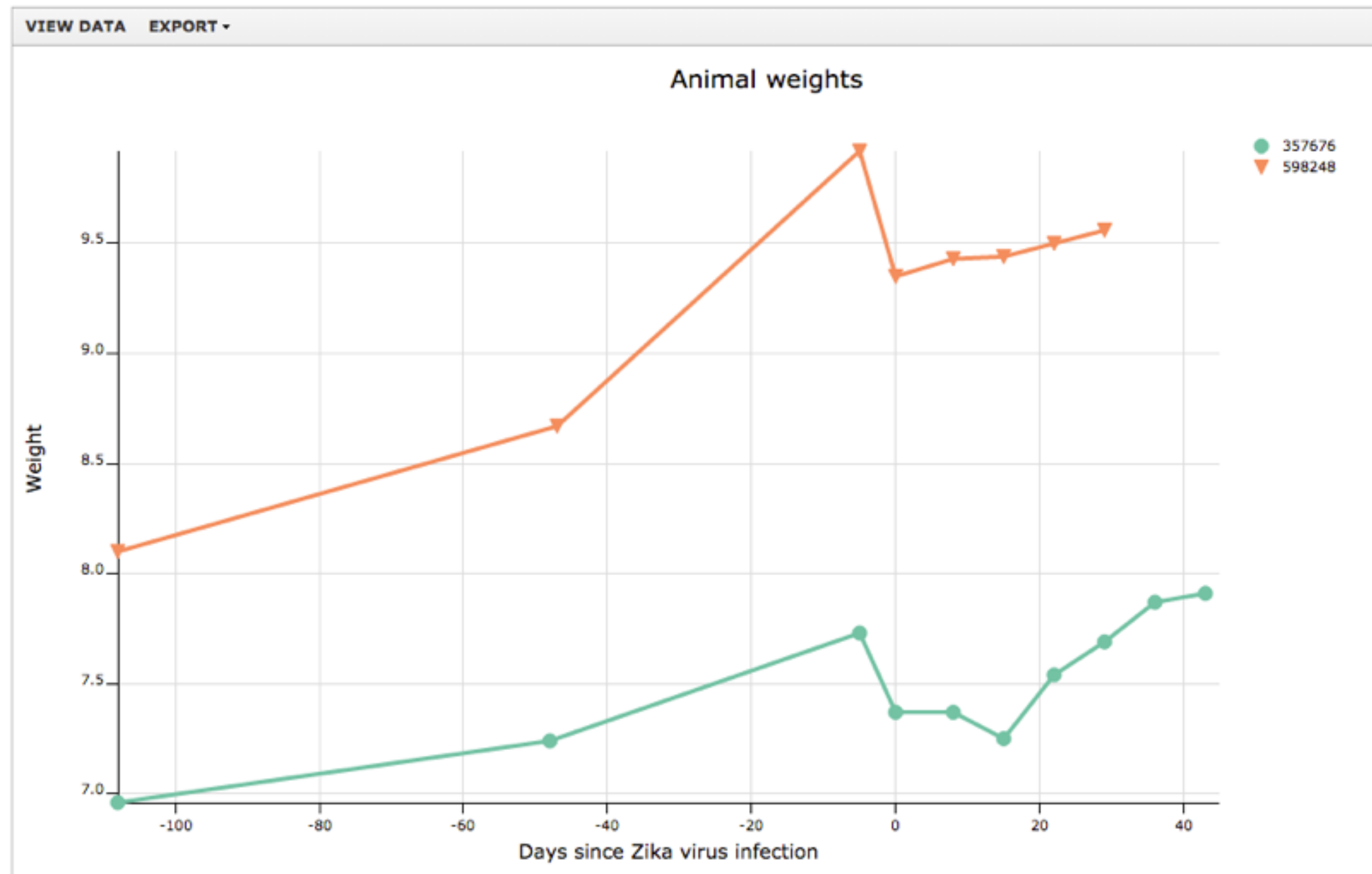


Data types we post to public studies

Participant health data

- E.g. animal weight during study, blood chemistry etc.

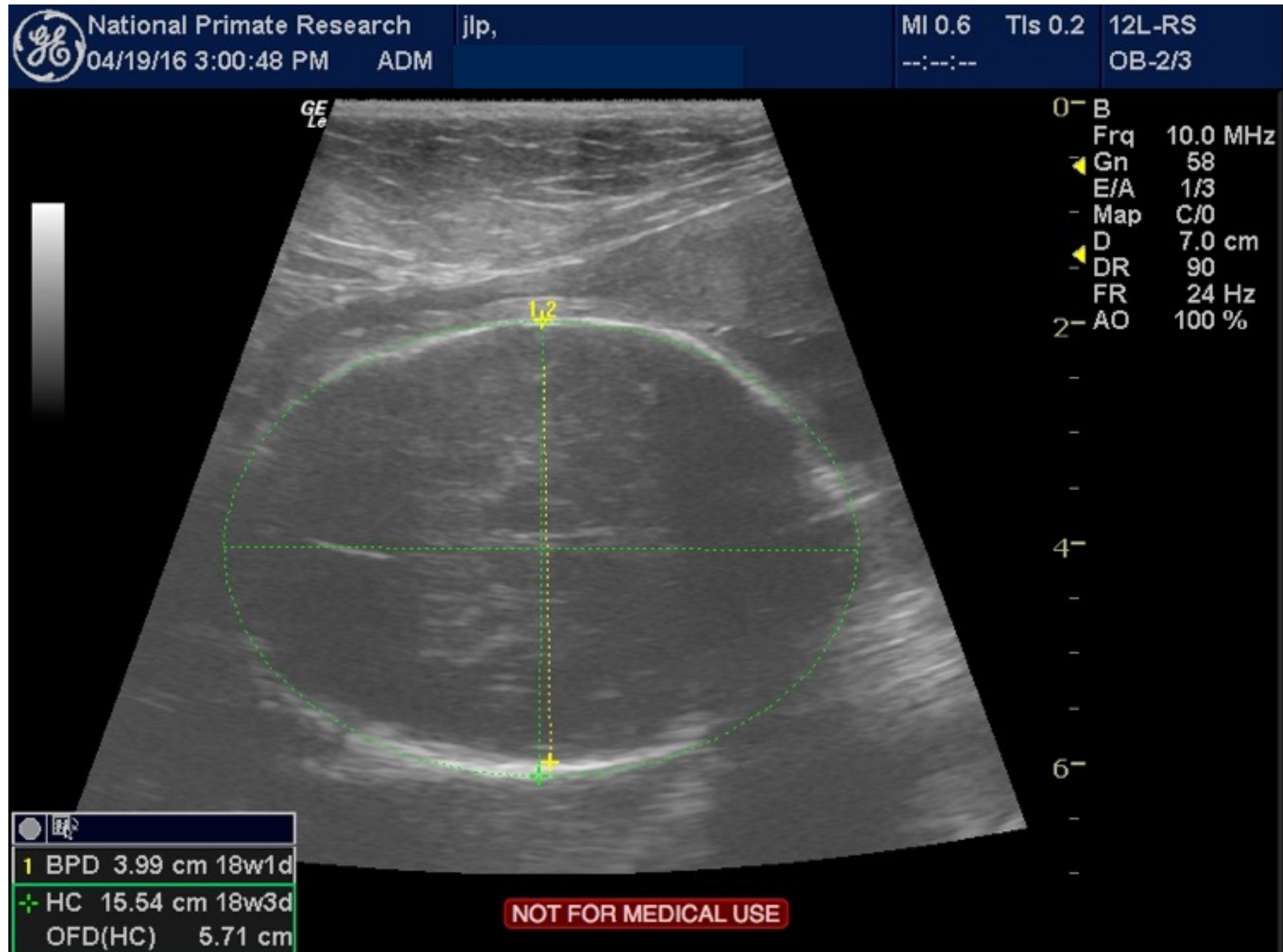
Weight chart



Data types we post to public studies

Ultrasounds

- Ultrasound images with meta data managed by custom views / queries

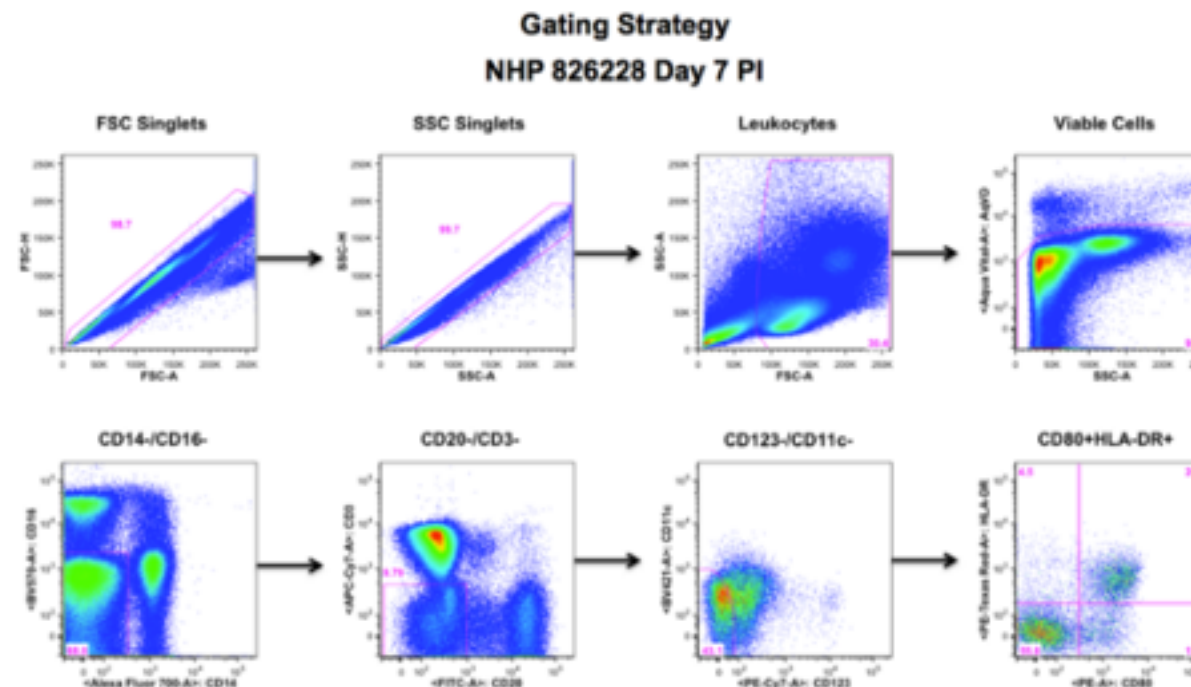
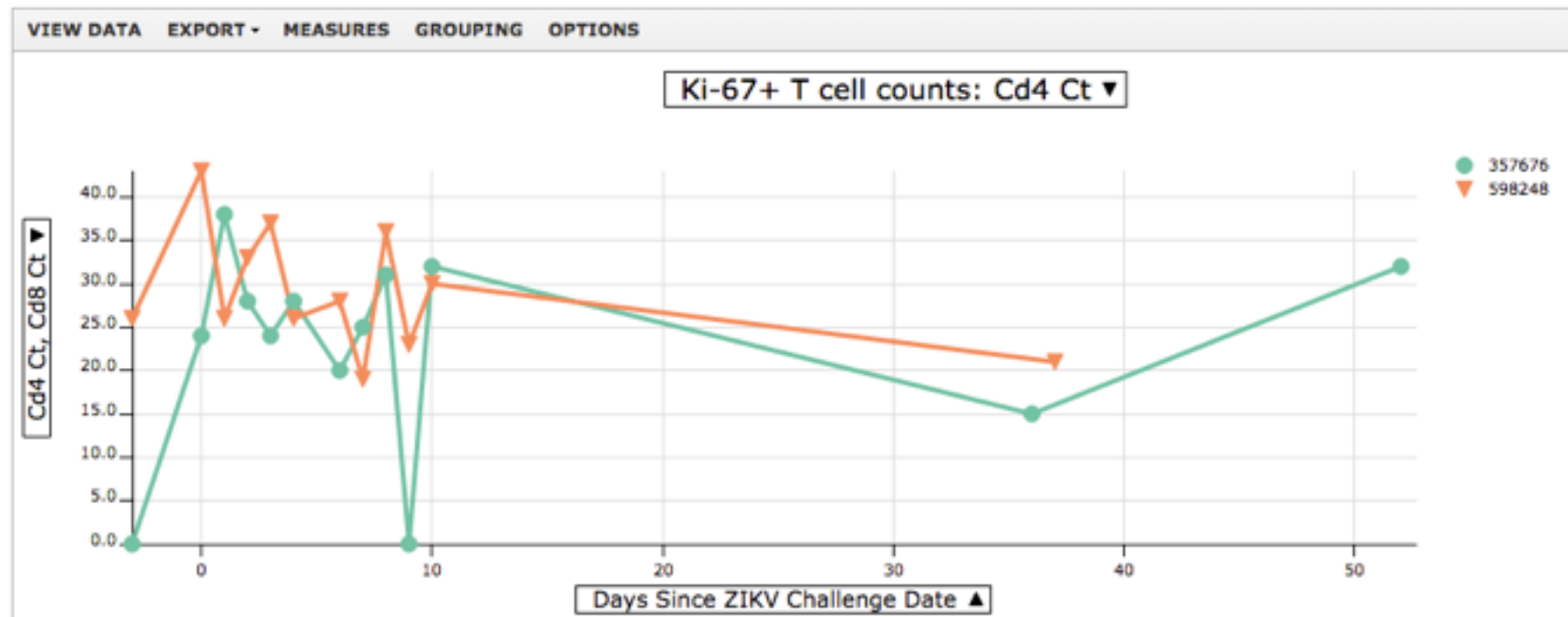


Data types we post to public studies

Immunology Data

- T cell counts measured over time relative to date of infection
- Flow cytometry cell staining imagery

Ki-67+ T Cells Absolute Counts



Data types we post to public studies

Sequencing Data

- Interpretations of viral sequencing data posted alongside raw data

Assessment of challenge stock variants

The most interesting region of variability involves a sequence at position 1430-1441 (relative to Genbank LC002520) where the major sequences have a 4 amino acid in-frame deletion. Reads that do not have the deletion have two non-synonymous nucleotide changes region.



Data types we post to public studies

Messages Webpart

- Interpretations of data communicated as small stories within the messages webpart. Helps communicate context associated with data.

Messages ▾

NEW

Showing: recent messages

More ZIKV-003 tissues positive for ZIKV vRNA

mmohns2016-07-22 10:09

Further testing of tissues isolated from [ZIKV-003](#) mother and fetus show that the maternal spleen and maternal liver also have trace amounts of vRNA detectable.

Maternal liver: 2.15e2 copies/mg

Maternal spleen: 3.23e2 copies/mg

These biopsies were taken at the time of C-section -- 120 days post-infection. The mother had prolonged viremia through day 70, but was then free of virus through the end of her pregnancy. Go [here](#) for the current list of raw data for tissues we have processed so far. We are still waiting on histopathology results from fixated tissues.

[VIEW MESSAGE OR RESPOND](#) ▸

A few additional thoughts on yesterday's detection of viral RNA in fetal tissues

david h oconnor2016-07-08 07:13

Yesterday Mariel posted viral load data from the fetus born to the mother who had the longest sustained viremia. If the duration of maternal viremia correlates with fetal outcome (as we speculate it may), this would be the fetus where we might expect the most significant adverse outcomes.

Indeed, while we are still catching up on getting the data online, we did not detect viral RNA in any of the tissues we examined from fetuses born to mothers infected with Zika virus in the third trimester of pregnancy.

What does this mean in terms of fetal pathology? We do not know -- yet. Pathologists on our team are currently fixing the tissues, a process that takes about two weeks. After th

[VIEW MESSAGE OR RESPOND](#) ▸

Preformatted HTML posting in Wikis

Ability to post blocks of preformatted HTML allows for posting of reproducible analysis methods

- Featured: Heat Map generation from peptide array data using python

```
# make heatmap and save as figure
dataframe_fig = pivoted.iplot(kind='heatmap',
                              layout=layout,
                              colorscale='rdylbu',
                              world_readable=False,
                              asFigure=True)

# set zmin = 0 to not plot negative values
dataframe_fig['data'][0]['zmin'] = 0

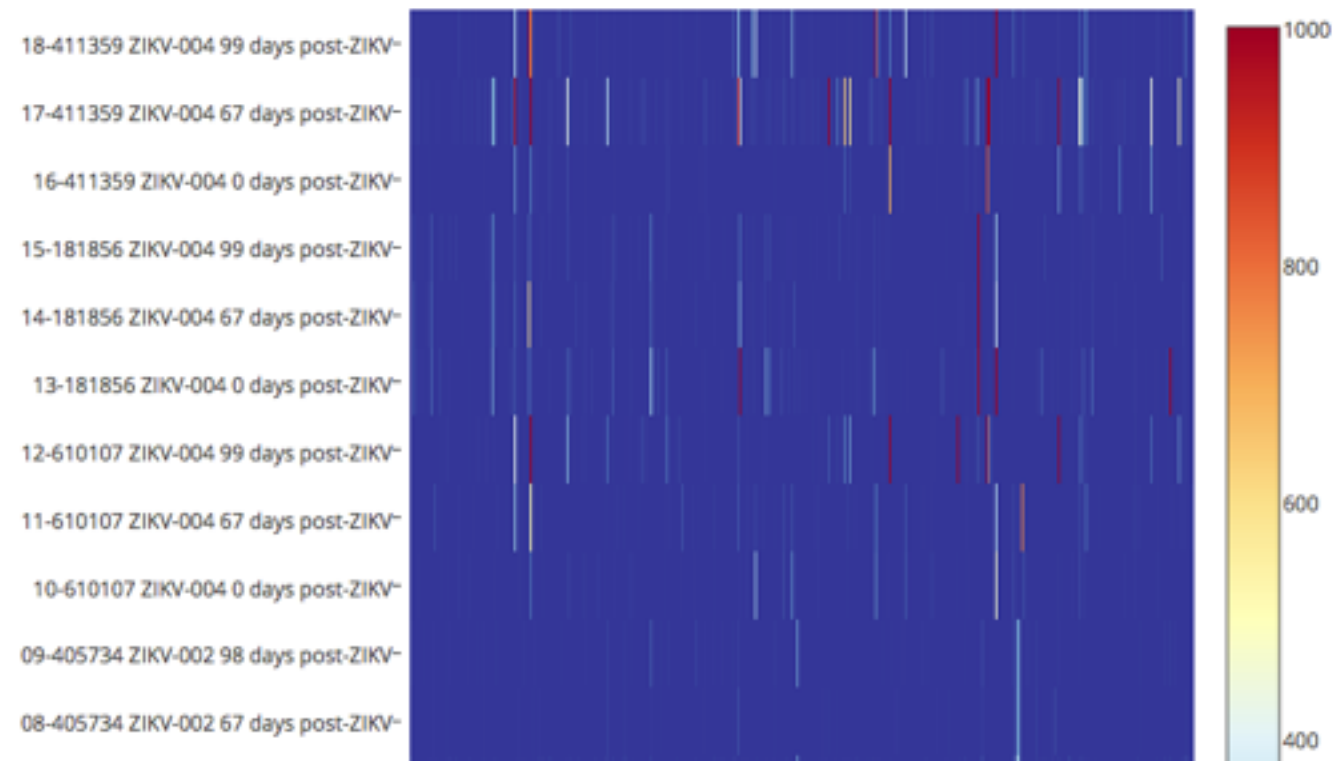
# set zmax to 1000 to amplify modest responses
dataframe_fig['data'][0]['zmax'] = 1000

# set filename
filename = 'cufflinks/17912/ZikaOpen' + '/' + title + 'zmax1000'

py.iplot(dataframe_fig, filename=filename)
```

Out[63]:

A0A140D2T1 - ZIKV African MR766 isolate, passage details: Vero cells 3x passage



Manuscript Writing

Centralizing Data

- Storing raw data and interpretations within the study module provided a central place where a large team was able to retrieve up-to-date information used to quickly draft a manuscript



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NATURE COMMUNICATIONS | ARTICLE OPEN  



A rhesus macaque model of Asian-lineage Zika virus infection


Dawn M. Dudley, Matthew T. Aliota, Emma L. Mohr, Andrea M. Weiler, Gabrielle Lehrer-Brey, Kim L. Weisgrau, Mariel S. Mohns, Meghan E. Breitbach, Mustafa N. Rasheed, Christina M. Newman, Dane D. Gellerup, Louise H. Moncla, Jennifer Post, Nancy Schultz-Darken, Michele L. Schotzko, Jennifer M. Hayes, Josh A. Eudailey, M. Anthony Moody, Sallie R. Permar, Shelby L. O'Connor  *et al.*

[Affiliations](#) | [Contributions](#) | [Corresponding author](#)

Nature Communications **7**, Article number: 12204 | doi:10.1038/ncomms12204
Received 27 May 2016 | Accepted 10 June 2016 | Published 28 June 2016

zika.labkey.com

<https://zika.labkey.com/project/home/begin.view?>

 Zika Open-Research Portal

Search

Home Help

Home

Welcome

Welcome to the Zika Open-Research Portal, powered by [LabKey](#).

In response to the declaration of the Zika virus as a public health emergency, LabKey has launched the Zika Open-Research Portal to help facilitate collaborative research. This portal provides a platform for investigators to make Zika research data, commentary and results publicly available in real-time.

Projects are freely available to researchers. If you are interested in sharing real-time research through the Zika Open-Research Portal, please [contact LabKey](#) to get started.

Community Support

Ask questions of the Server community or share insights in the Zika Open-Research Portal community forum.

[Community Forum](#)

Investigators

Dave O'Connor
O'Connor Lab, University of Wisconsin-Madison

Project Overview: This project includes raw data, study commentary and results of studies conducted with three Indian rhesus macaques.

[View Project >](#)

University of Washington

**Dave O'Connor Lab:**

Dawn Dudley
Mariel Mohns
Mustafa Rasheed
Meghan Breitbach
Connor Buechler
Christina Newman
Michael Graham
Emma Mohr
Adam Ericson

Tom Friedrich Lab:

Andrew Weiler
Gabrielle Lehrer-Brey
Louise Moncla

LabKey Support:

Josh Eckels
Brian Connolly

Shelby O'Connor Lab:

Dane Gellerup

WNPRC:

Jen Post
Nancy Schultz-Darken
Heather Simmons
Buddy Capuano III
Sydney Skopos

Jorge Osorio Lab:

Matthew Aliota

Ted Golos Lab:

Greg Wiepz

Sallie Permar Lab:

Josh Eudaily
Tony Moody



**Wisconsin National
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*Celebrating 50 years of life-saving research
and humane animal care*