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# UPDATE FROM THE NORTH AMERICAN ELEPHANT ENOTHELIOTROPIC HERPESVIRUS (EEHV) ADVISORY GROUP AND SUMMARY OF THE 2019 EEHV WORKSHOP

Lauren L. Howard, DVM, Dipl. ACZM  
Associate Director, Veterinary Services  
San Diego Zoo Safari Park  
EEHV Advisory Group Steering Committee



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# North American EEHV Advisory Group

- Disseminating knowledge
- Providing technical assistance
- Facilitating Research

[www.eehvinfo.org](http://www.eehvinfo.org)







3<sup>rd</sup> EEHV Advisory Group Meeting August 2018





- **Steering Committee**
- **Scientific Program Committee**
  - Chair: Mike McClure
- **Outreach Committee**
  - Chair: Jill Alread
- **Research Committee**
  - Chair: Priya Bapodra
- **Veterinary and Management Resources Committee**
  - Chair: Noha Abou Madi





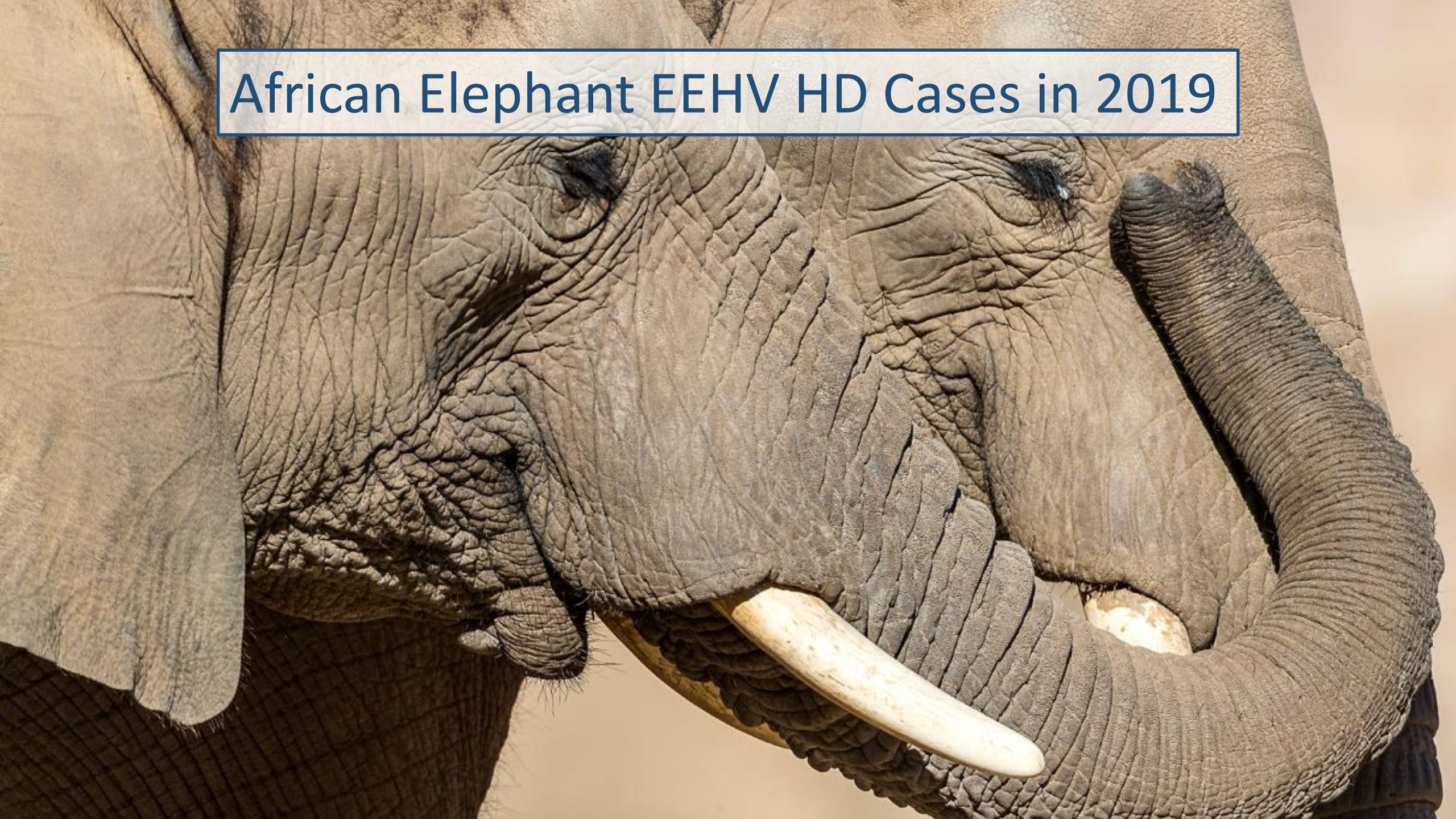
# North American EEHV Workshop



March 2019, Houston Texas



# African Elephant EEHV HD Cases in 2019






## African Elephant EEHV HD Cases in 2019

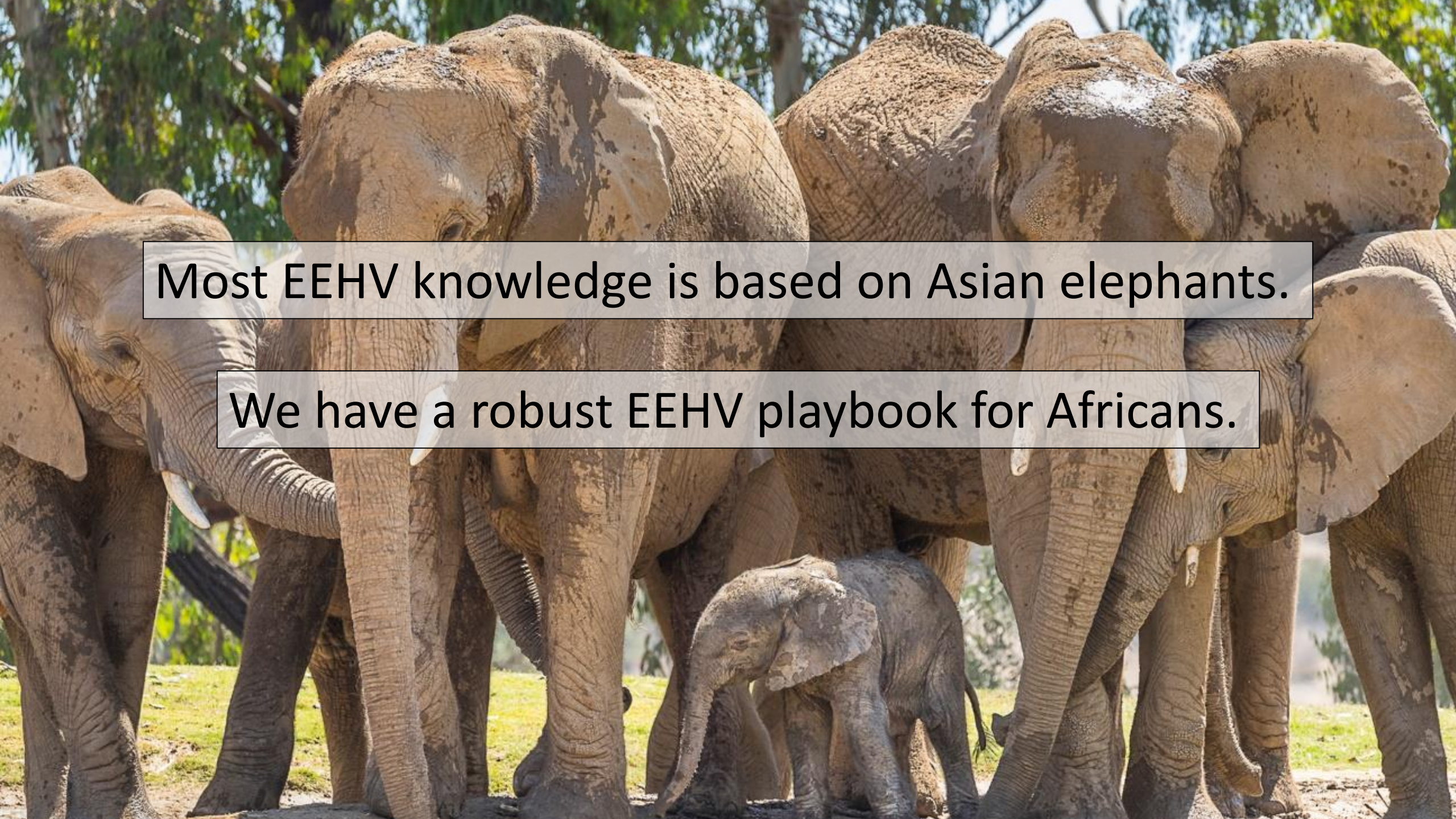
Age/M/F	Virus	Outcome
11 yo F	EEHV3	Died with clostridial enteritis
6 yo F	EEHV3	Died
7 yo F	EEHV3	Died
11 yo F	EEHV3	Survived with treatment
13 yo M	EEHV 3	Survived with treatment
12 yo F	EEHV3	Survived with treatment
36 yo F	EEHV3	Mild signs, survived with treatment



A photograph of a herd of Asian elephants in a savanna environment. Several large adult elephants are visible, with a small calf in the foreground. The elephants' skin is covered in mud. A semi-transparent text box is overlaid on the image.

Most EEHV knowledge is based on Asian elephants.

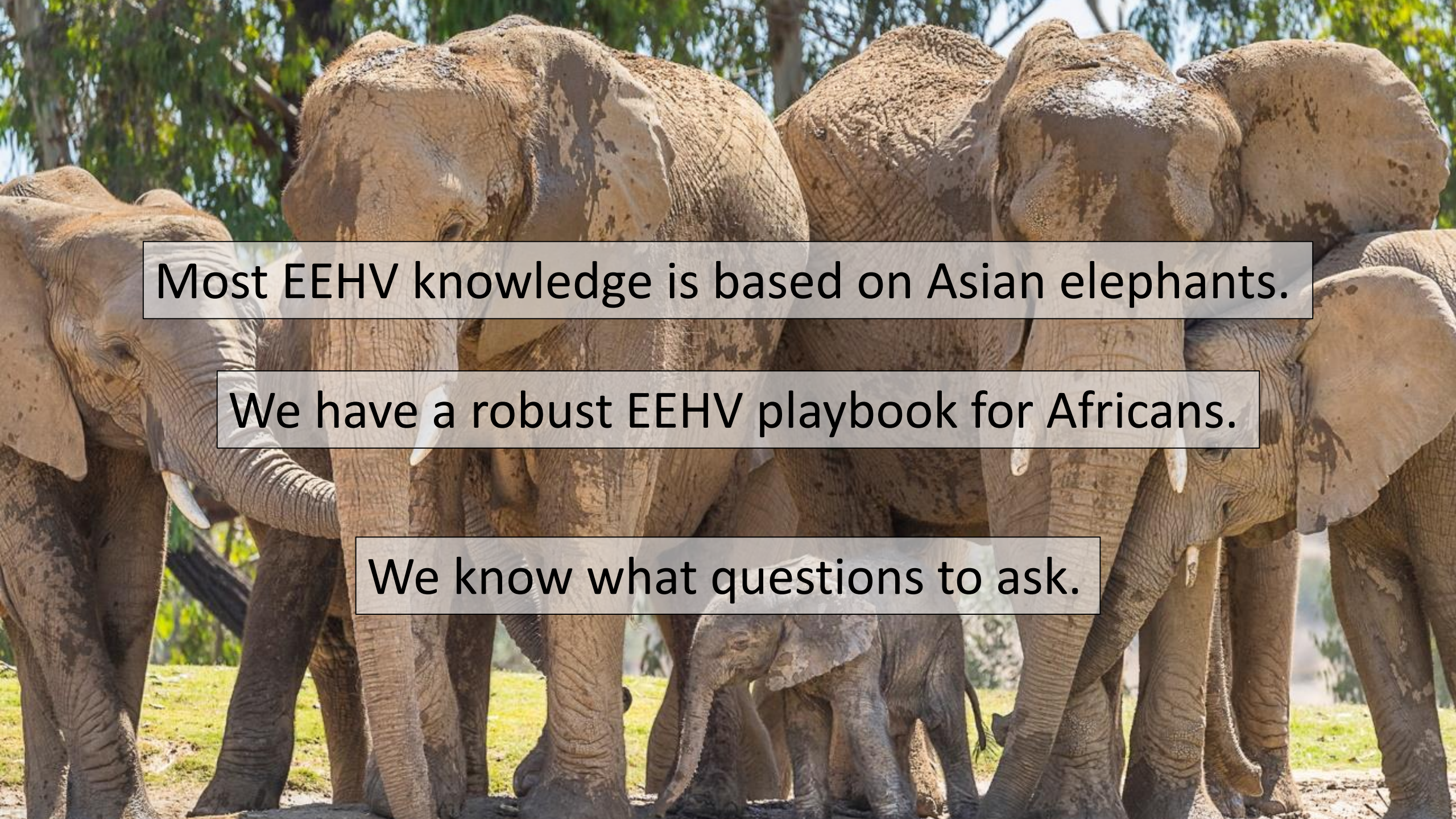


A photograph of a herd of African elephants in a savanna environment. In the foreground, a small elephant calf is walking towards the left. Behind it, several adult elephants are standing, their heads and trunks visible. The elephants have thick, wrinkled skin and large ears. The background shows green grass and trees under a bright sky.

Most EEHV knowledge is based on Asian elephants.

We have a robust EEHV playbook for Africans.



A photograph of a herd of African elephants in a savanna environment. Several large elephants are in the foreground, with a smaller calf visible in the lower center. The elephants have thick, wrinkled skin and large ears. The background shows green trees and a clear sky.

Most EEHV knowledge is based on Asian elephants.

We have a robust EEHV playbook for Africans.

We know what questions to ask.





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*Closing the Gap:  
SDZG 2020 EEHV  
Research Initiative  
in African elephants.*



# North American Elephants and EEHV

	Asian Elephants	African Elephants
Elephants born or imported since 1980, with known follow-up	129	258
Elephants still alive	87	158
Elephants that have died	42	100
EEHV HD deaths	27	5
% of elephant deaths that are from EEHV	$27/42 = 64\%$	$5/100 = 5\%$



# North American Elephants and EEHV

	Asian Elephants	African Elephants
Elephants born or imported since 1980, with known follow-up	129	258
EEHV HD Survivors	15	6
EEHV HD Deaths	27	5
Fatality Rate of EEHV HD Cases	64%	45%
% of all elephants in population that have been impacted by EEHV	$42/129 = 32\%$	$11/258 = 4\%$



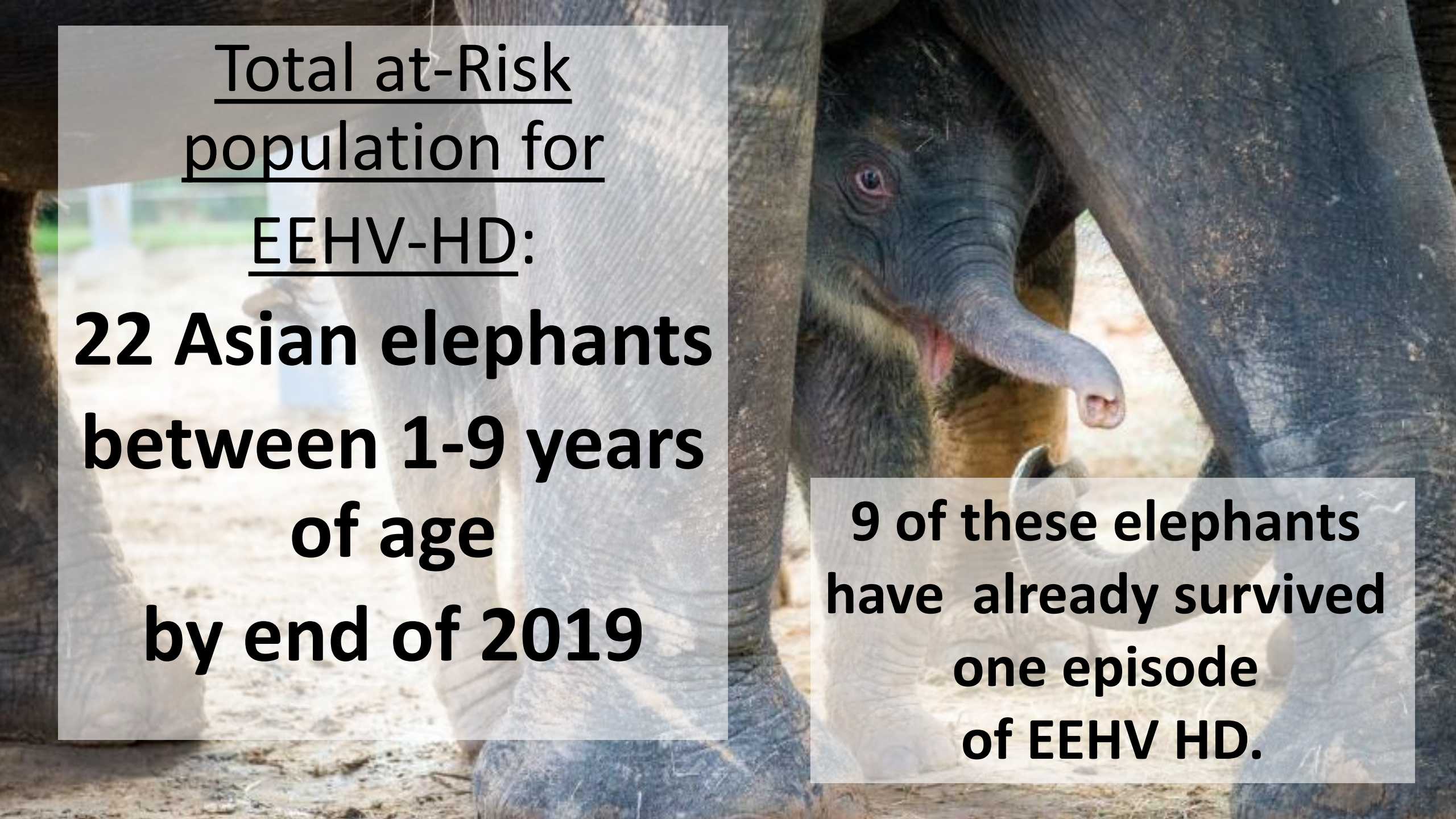
Total at-Risk  
population for

EEHV-HD:

**22 Asian elephants  
between 1-9 years  
of age  
by end of 2019**







Total at-Risk  
population for  
EEHV-HD:

**22 Asian elephants  
between 1-9 years  
of age  
by end of 2019**

**9 of these elephants  
have already survived  
one episode  
of EEHV HD.**



A photograph of a young elephant calf with a pink eye, standing between two larger elephants. The calf is looking towards the camera. The text is overlaid on a semi-transparent white box in the lower right portion of the image.

## 142 EEHV HD Cases confirmed in Asia

Thailand: 81 cases (25 survivors)

Nepal: 12 cases (5 survivors)

India: 32 cases (18 wild elephants)



# EEHV Research Updates



## **“Detection of EEHV 1A DNA using in situ hybridization”**

Dr. Jaime Landolfi, U. Illinois Zoological Pathology Program

- utilize a novel in situ hybridization technique (RNAscope®) to detect and localize EEHV1A in Asian elephant tissues with EEHV-HD lesions.



# **A systematic investigation of the clinical manifestation of EEHV in the captive Asian elephant population of North America**



Victoria Hall DVM, MS,  
Dipl ACVPM  
Smithsonian National  
Zoological Park  
Sharon L. Deem DVM,  
PhD, Dipl ACZM  
Saint Louis Zoo  
Lauren Howard DVM,  
Dipl. ACZM San Diego  
Zoo Safari Park  
Ramiro Isaza DVM, MS,  
MPH, Dipl ACZM  
University of Florida,  
College of Veterinary  
Medicine  
Erin Latimer, MS  
Smithsonian National  
Zoological Park



A photograph of two elephants, an adult and a calf, standing near a body of water in an outdoor enclosure. The adult elephant is on the right, and the calf is on the left. They are both looking down towards the water. The background shows a fence and some greenery.

# Elephant platelets, blood types & transfusions

- Asian elephant blood types done
- African elephant blood types 2020
- Another lyophilized Asian elephant platelet batch ready soon
- Looking for elephants to validate plateletpheresis (30-45 min)
- Dr. Jennifer Kishbaugh  
[jkishbaugh@bodevet.com](mailto:jkishbaugh@bodevet.com)



# Changes in Cardiac Troponin I in Asian Elephants (*Elephas maximus*) infected with EEHV

## Purpose:

- Establish serum cTnI levels in non-viremic Asian elephants
- Can cTnI be a marker for early detection of EEHV HD?

**PI: Kailey Anderson, DVM**  
**Resident, Smithsonian NZP**

[andersonka@si.edu](mailto:andersonka@si.edu)



## How do we identify and select target viral antigens for the vaccine? Ask the elephants.



Journal of  
Virology



JVI

MARCH 2018, VOLUME 92, NUMBER 3

### Articles of Significant Interest Selected from This Issue by the Editors

#### Asian Elephant T Cell Responses to Elephant Endotheliotropic Herpesvirus

Endangered Asian elephants are facing many threats, including lethal hemorrhagic disease from elephant endotheliotropic herpesvirus (EEHV). While most adult elephants are latently infected with EEHV, lethal hemorrhagic disease occurs predominantly in juveniles. Using newly developed, elephant-specific reagents and assays, Fuery et al. (e01951-17) screened nine EEHV proteins predicted to induce cellular immune responses. Three EEHV proteins induced significant T cell responses, suggesting that these proteins may be useful candidates for a vaccine to protect juvenile elephants from EEHV.



Duncan, a Juvenile Asian elephant at the Houston Zoo, is one of several elephants helping investigators understand immune responses to EEHV. (Courtesy of Stephanie Adams, Houston Zoo, Houston, Texas; reprinted with permission.)

**gB is a population prevalent T cell target recognized in chronically infected elephants**

### SEROLOGICAL DETECTION OF EEHV INFECTION

***Angela Fuery, Ph.D, <sup>\*1</sup> Jie Tan, BS, <sup>1</sup> Rongsheng Peng, BS, <sup>1</sup> Gary S. Hayward, Ph.D, <sup>2</sup> and Paul D. Ling, Ph.D <sup>1</sup>***

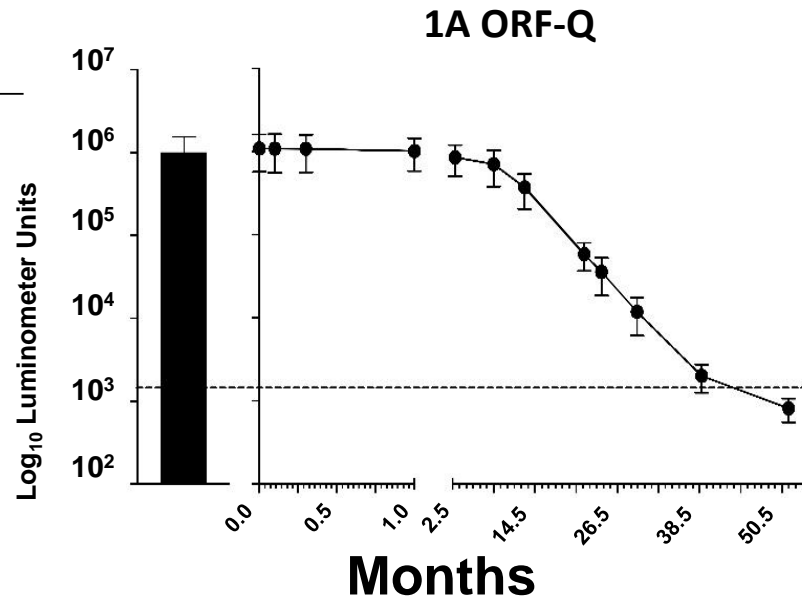
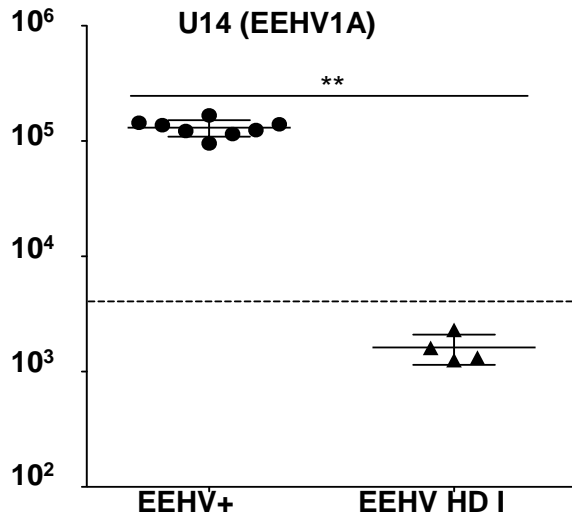
**Significant anti-gB antibodies are present in chronically infected elephants**



# EEHV1-specific Serology Assay



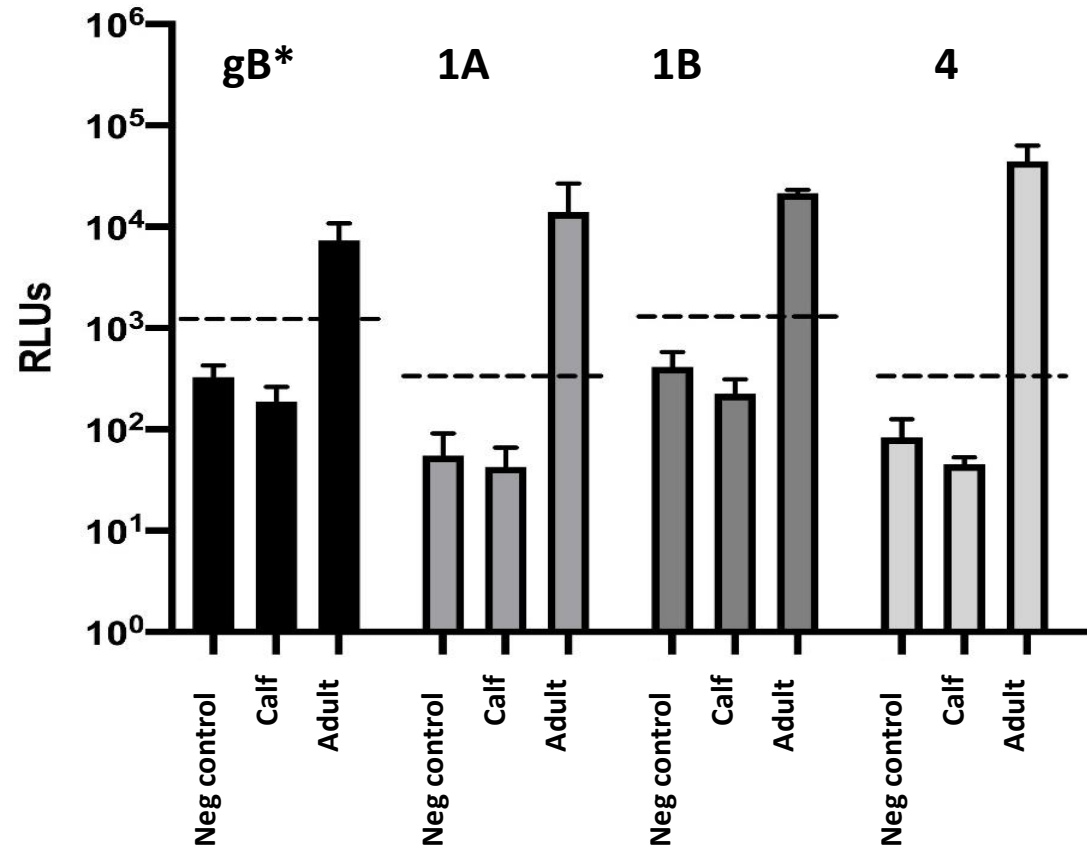
We can determine EEHV1  
infection history  
in any Asian elephant!!





## Serology profile for 1A, 1B, and 4 using LIPS

Contact Dr. Paul  
Ling to run  
immunity profiles  
on your at-risk  
Asian elephants  
(for a fee).  
[pling@bcm.edu](mailto:pling@bcm.edu)



\*General marker for EEHV  
Dotted line: cut-off, 5SD mean



## Towards an EEHV1 Vaccine



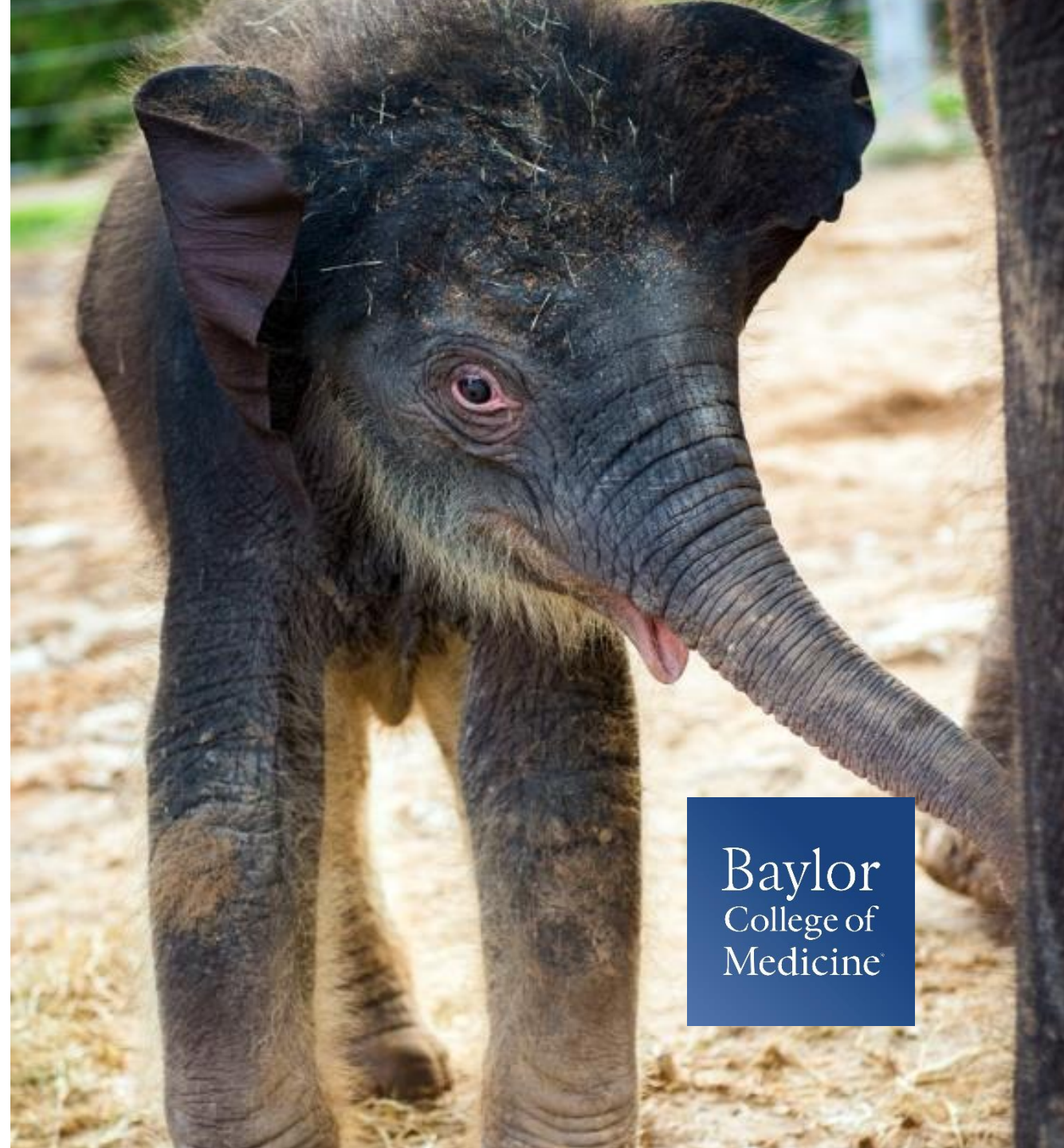
Paul D. Ling, Ph.D, Angela Fuery, Ph.D, Lauren Howard, DVM, Dipl. ACZM, and Charles Richardson, Ph.D



# Vaccine Development Plans

Investigating 2 Vaccine approaches:

- Live MVA recombinant expressing gB
- Adjuvanted recombinant gB Protein vaccine



Baylor  
College of  
Medicine®



- First: Mouse studies
- Next: older elephants
- Then: at-risk calves
- **Elephants well trained for injections and blood sampling will be prioritized**
- Export to Europe and Asia?

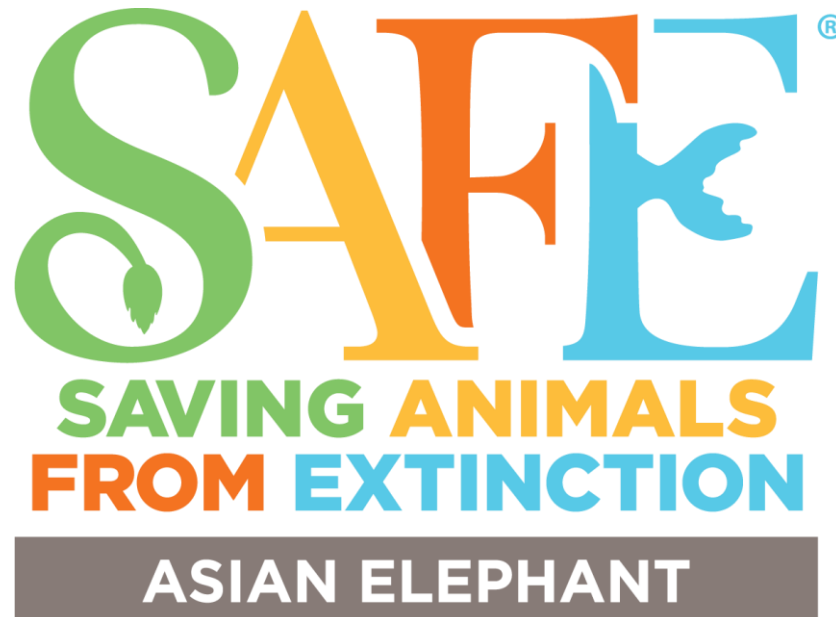
### POTENTIAL TIMELINE:

- 2019-2020: Mouse studies
- Late 2021: establish vaccine protocol
- 2022: trial older elephants first



# EEHV Support in Range Countries

- **Supporting science of the treatment and management of EEHV in Asian elephant range states:** SAFE will engage elephant care professionals to encourage/support fundraisers amongst AZA institutions directed towards supporting the needs of range states in the treatment and management of EEHV.





# EEHV Support in Range Countries

- Collaboration with the International Elephant Foundation and the EEHV Advisory Group
- **Generating funds** to combat EEHV in range countries (Sumatra, Myanmar, Nepal, Vietnam) that are in need of:
  - **Drugs and medications**
  - **Lab enhancements for tracking and treating**
  - **Local capacity building**





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**First EEHV  
in Africa  
Workshop  
Thursday  
Oct. 24,  
2019  
S. Africa**

INTERNATIONAL  
ELEPHANT  
FOUNDATION.ORG



**16th International Elephant Conservation  
& Research Symposium**

**October 21-25, 2019**

*Presented by: International Elephant Foundation*

*Hosted by: Adventures with Elephants*



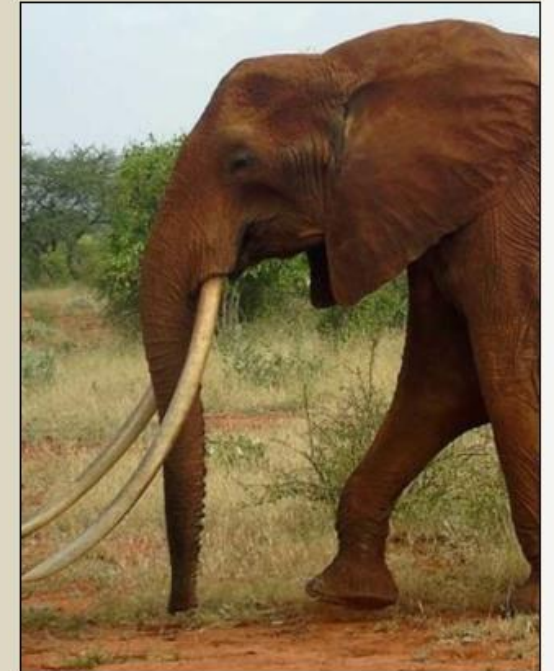
**16TH INTERNATIONAL  
ELEPHANT CONSERVATION  
& RESEARCH SYMPOSIUM**

Come join us at the Zebula Golf Estate and Spa, Limpopo, South Africa to share your experiences and best practices, make friends, and develop new professional associations.

The pressures on wild populations of elephants are increasing at an alarming rate. Wildlife habitat continues to shrink while human-elephant conflict increases. Conservationists and Researchers around the world strive to protect the remaining animals and habitat.

We invite elephant conservationists and researchers from around the world to present conservation projects and research outcomes, new technologies in field conservation and conflict mitigation, studies in disease, reproduction and behavior, and other issues that impact the long-term survival of African and Asian elephants.

**Registration will be limited to 150.**





# 4<sup>th</sup> Asian EEHV Working Group Meeting

Nov. 28-30,  
2020

Assam, India

Dr. Sonja Luz

[Sonja.luz@wrs.com.sg](mailto:Sonja.luz@wrs.com.sg)

REGISTRATION FORM

Name : .....

Organization : .....

Position : .....

First time attending Asian EEHV WG Meeting: Yes ☐ No ☐

Need help with arranging accommodation:

University guest house ☐ Hotel ☐

Dietary restrictions:

Flight Details :

Arrival Time :  Departure Time :

Need for official invitation letter (for VISA): YES ☐ NO ☐

Name	Fathers Name	Address	Nationality	Date of Birth	Place of Birth	Passport Validity
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## FOURTH ASIA WORKING GROUP MEETING AND INTERNATIONAL SEMINAR ON ELEPHANT ENDOTHELIOTROPIC HERPES VIRUS (EEHV)

28-30TH NOVEMBER, 2019

FACULTY OF VETERINARY SCIENCE, ASSAM AGRICULTURAL  
UNIVERSITY, KHANAPARA, GUWAHATI, ASSAM, INDIA

One of the last bastions of Asian elephant is the North-eastern region of India with about 8-9 thousand individuals, one third of the country's elephant population and one tenth of the world's total Asian elephant population. However, various problems have been causing large scale death and damages of this population out of which HEC related deaths, electrocutions, train hits are notable which are outcome of habitat destructions and fragmentations. While these issues are largely discussed and being addressed, yet another killer disease affecting the species is emerging in this region in particular and the entire world in general, Elephant Endotheliotropic Herpes Virus (EEHV) infections affecting young calves from 2-8 years of age. This issue is a global one and therefore, an "EEHV Asia Working Group" has been formed, which sat twice in Singapore zoo and once in Hua-Hin Veterinary University in Thailand. Considering the importance of India for survival of Asian elephants, the 3rd Working group meeting held at Hua-Hin decided India as the venue for the next meeting and entrusted us to organize the same.

The Working Group meeting basically takes stock of the disease and progresses made by scientists of different countries in its diagnosis and management, sharing of knowledge and experiences. Another purpose of this meeting is to enlighten India's elephant vets of the latest developments regarding EEHV, in respect to its clinical signs, diagnostic tools and up-to-date treatment protocol.

The three day event will begin with lectures on up to date knowledge and latest findings of EEHV by world's best experts, followed by country updates and presentations on progresses in research on various aspects of the disease. On 3rd day, the participants will be taken to a wildlife park for demonstration of medical procedures in relation to treatment of EEHV.



February 16 – 18, 2020

@ Myanmar Elephant  
Hospital (MTE)

Dr. Christine Molter

[cmolter@houstonzoo.org](mailto:cmolter@houstonzoo.org)

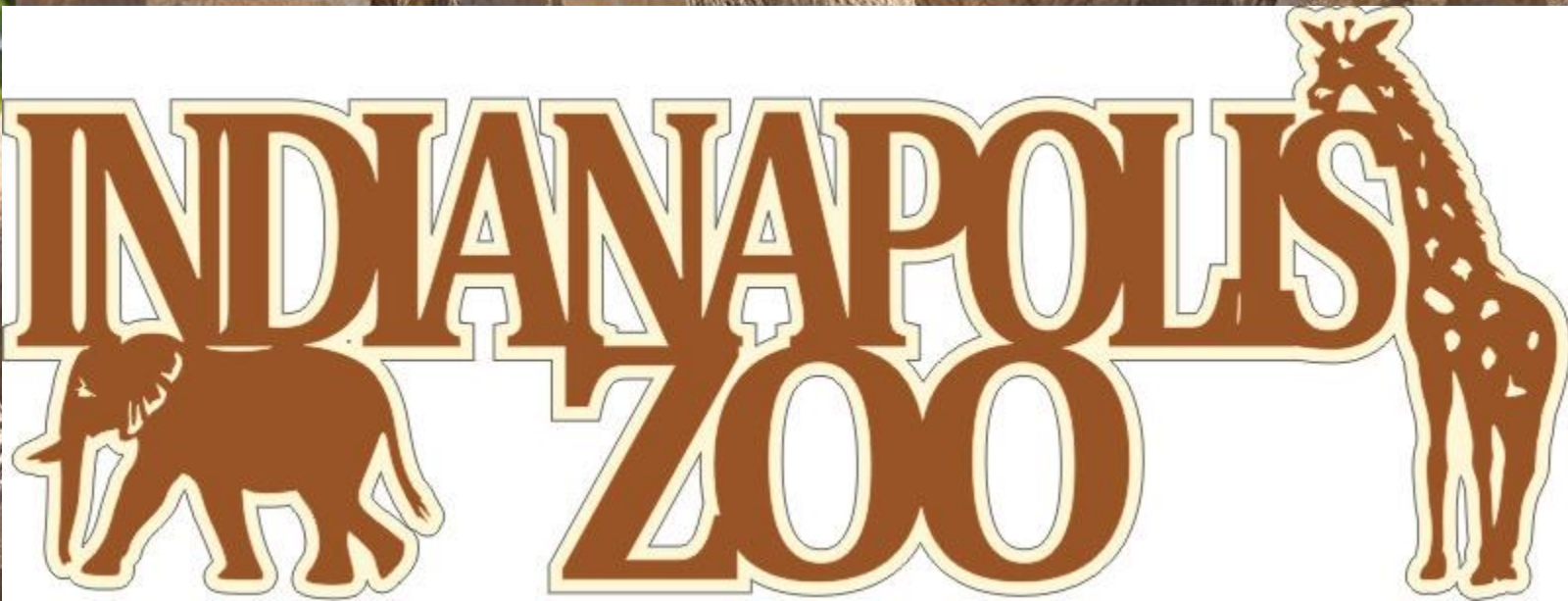


Myanmar Elephant  
Health Workshop



**Houston  
Zoo**





African elephant-focused  
EEHV Meeting  
February 24-26, 2020



# European EEHV Research Meeting

- May 18 – May 19, 2020
- Hosted by Rotterdam Zoo,  
The Netherlands
- Immediately preceding  
EAZWV Annual Conference  
at Emmen



Contact Dr. Willem Schaftenaar: [w.schaftenaar@diergaardeblijdorp.nl](mailto:w.schaftenaar@diergaardeblijdorp.nl)





Chiang Mai,  
Thailand  
2021  
**Global EEHV  
Workshop &  
North  
American  
EEHV Advisory  
Group Meeting**



A photograph of a herd of elephants in a savanna landscape. In the foreground, a large elephant with prominent tusks is walking towards the left. Behind it, a smaller elephant is also walking. In the background, two more elephants are standing near a large, rocky structure that resembles a cave entrance. The landscape is grassy with some trees and hills in the distance. A blue oval in the top left corner contains the text "SAN DIEGO ZOO GLOBAL". A white box in the bottom right corner contains the text "Zoos are the solution to EEHV.".

**SAN DIEGO ZOO  
GLOBAL**

**Zoos are  
the solution to EEHV.**



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[lhoward@sandiegozoo.org](mailto:lhoward@sandiegozoo.org)

