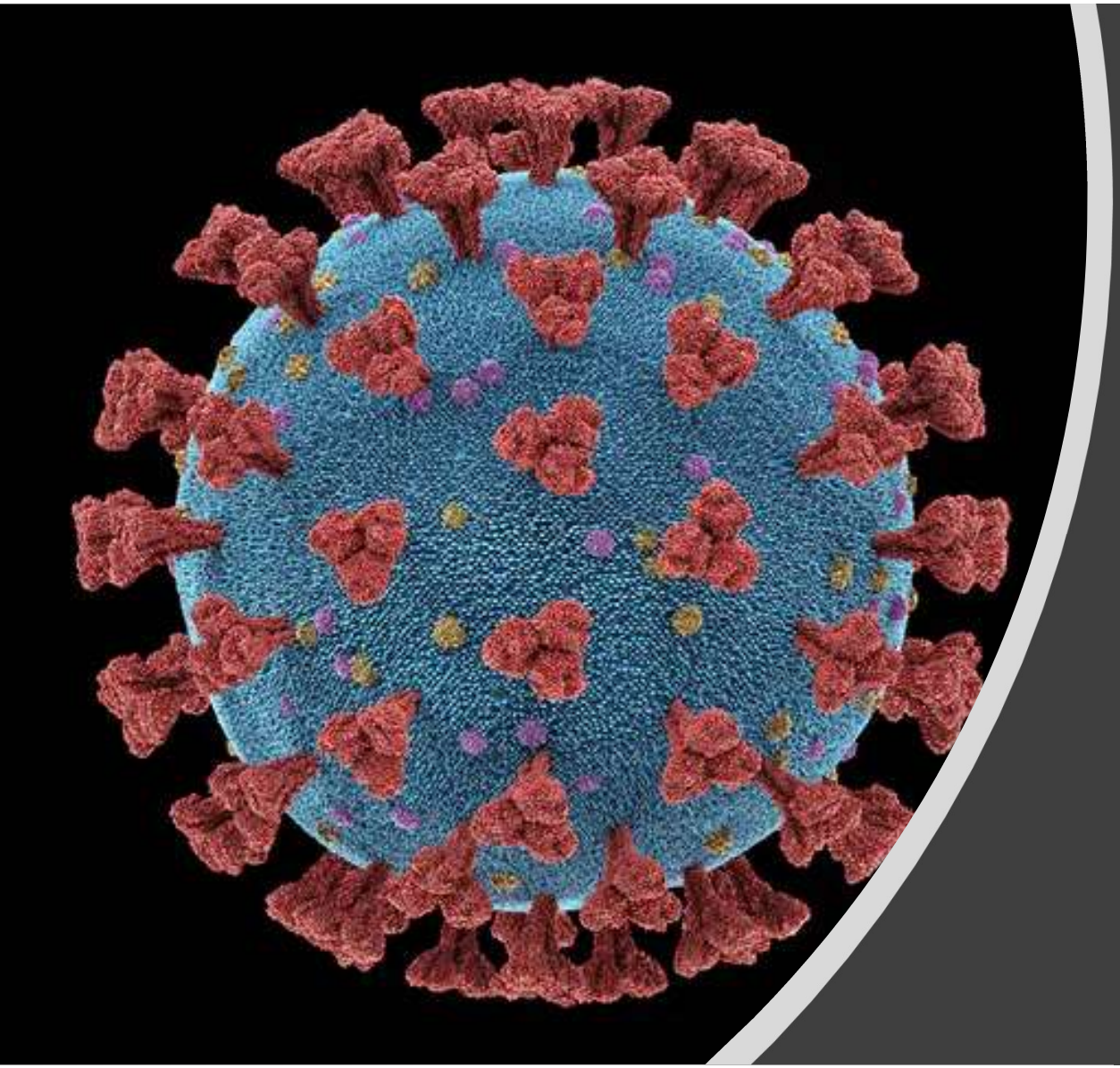
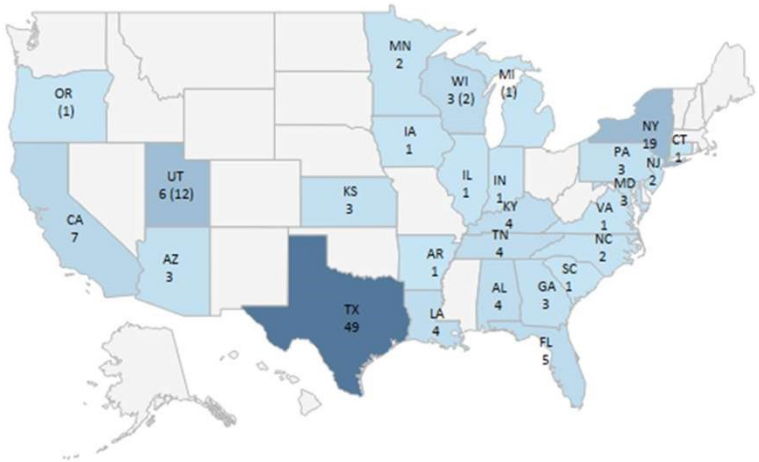


SARS CoV-2 Considerations for Great Apes

Hayley Murphy, DVM

ZOO ATLANTA

Cases of SARS-CoV-2 in Animals in the United States as of 3.23.2021



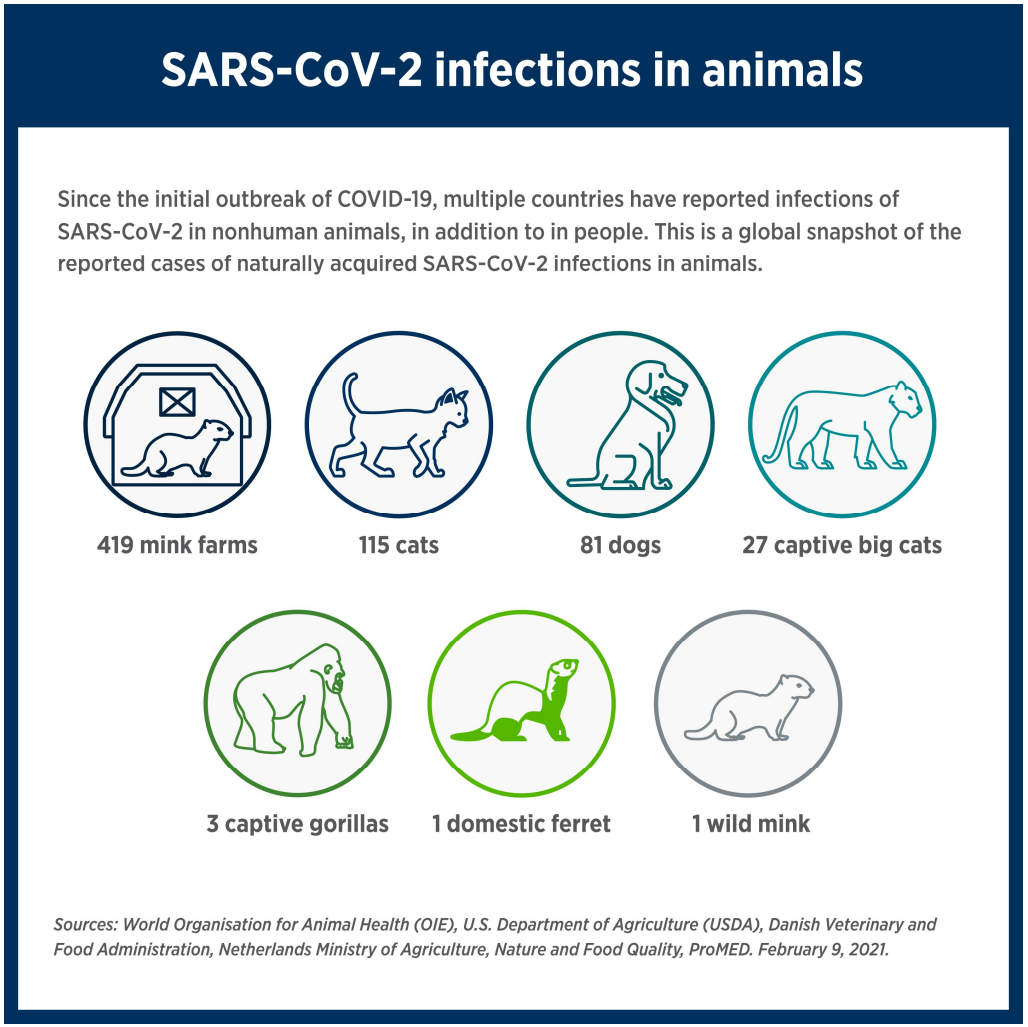
	PCR	Ab	Total
Mink Premises	16		16
Cats	34	33	67
Cougar	1		1
Dogs	20	26	46
Gorillas	3		3
Lion	3		3
Snow Leopard	3		3
Tiger	11		11

OIE Technical Factsheet: Infection with SARS CoV-2 in Animals

https://www.aphis.usda.gov/aphis/dashboards/tableau/sars-dashboard

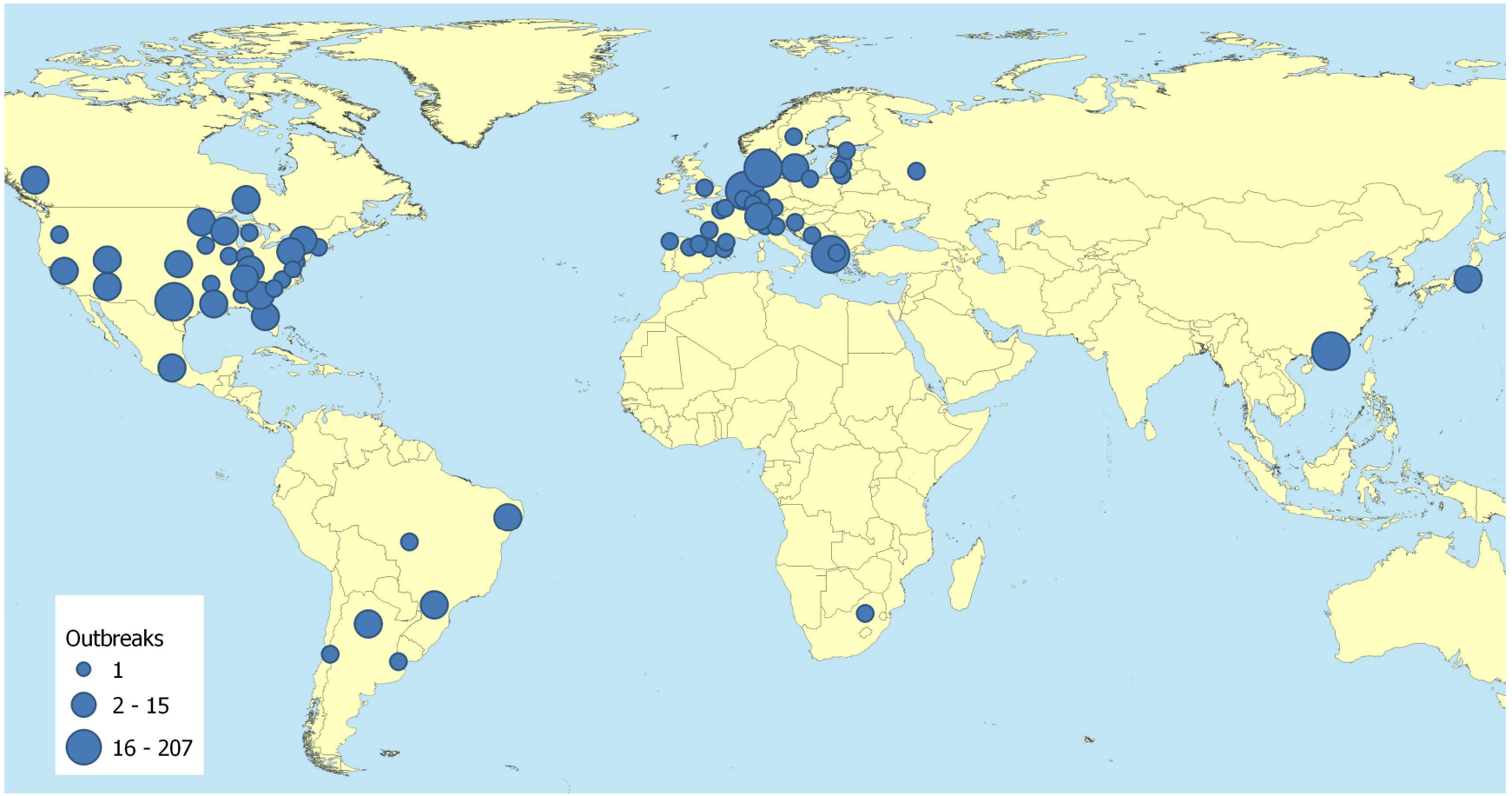
ZOO ATLANTA

Cases of SARS-CoV-2 in Animals Globally 2.9.2021



https://www.avma.org/resources-tools/animal-health-and-welfare/covid-19/sars-cov-2-animals-including-pets

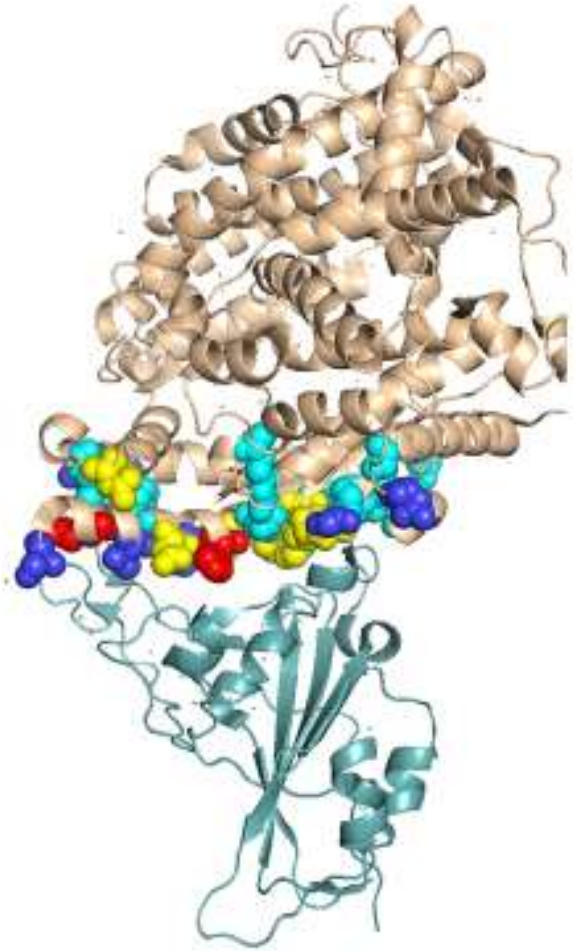
World Distribution of SARS CoV-2 in Animals



https://www.oie.int/en/scientific-expertise/specific-information-and-recommendations/questions-and-answers-on-2019novel-coronavirus/events-in-animals/

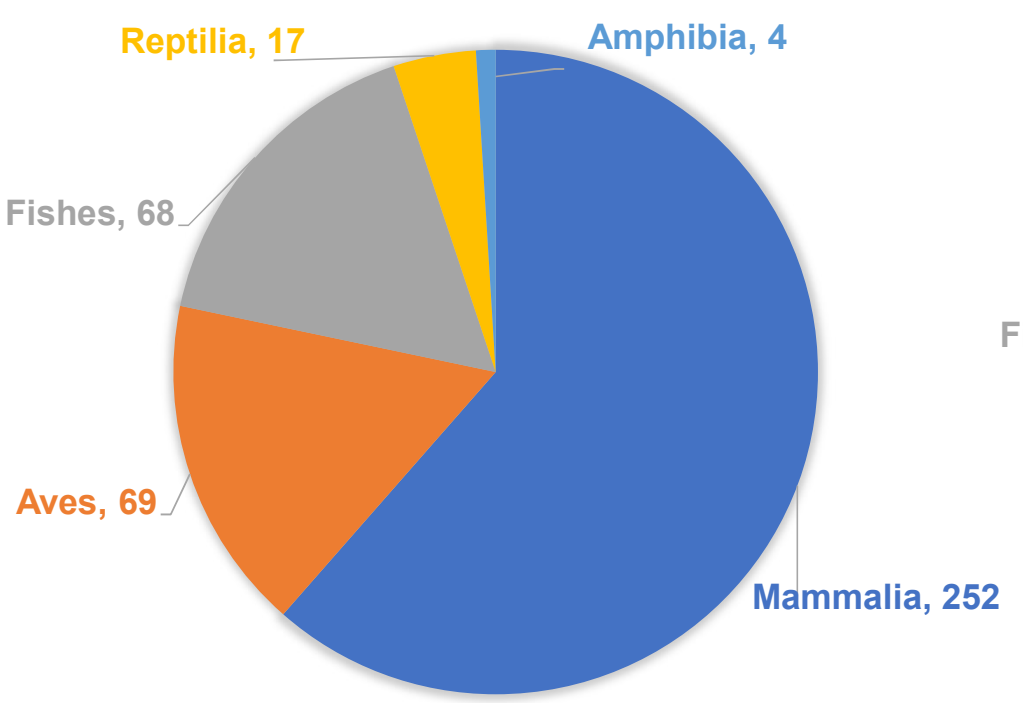
Broad Host Range of SARS-CoV-2 Predicted by Comparative and Structural Analysis of ACE2 in Vertebrates

Joana Damas, Graham M. Hughes, Kathleen C. Keough, Corrie A. Painter, Nicole S. Persky, Marco Corbo, Michael Hiller, Klaus-Peter Koepfli, Andreas R. Pfenning, Huabin Zhao, Diane P. Genereux, Ross Swofford, Katherine S. Pollard, Oliver A. Ryder, Martin T. Nweeia, Kerstin Lindblad-Toh, Emma. C. Teeling, Elinor K. Karlsson, and Harris A. Lewin

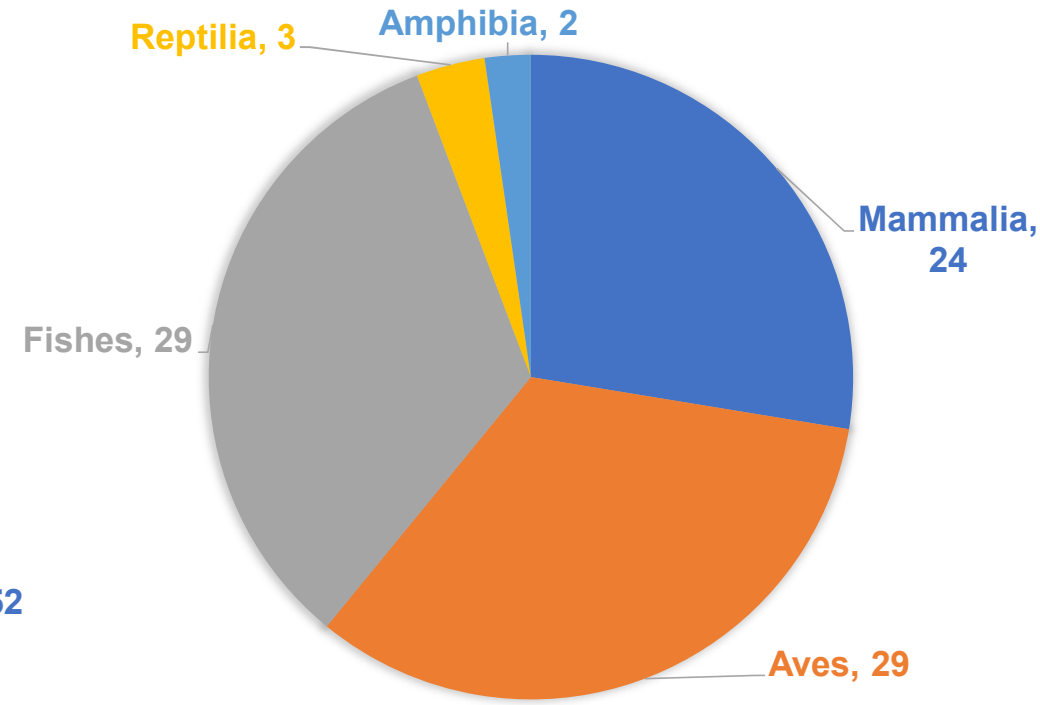


Taxon sampling

Species distribution



Orders distribution



SARS-CoV-2 binding risk

	Very High	High	Medium	Low	Very Low
Mammalia	19	28	57	49	99
Aves	0	0	0	0	69
Amphibia	0	0	0	0	4
Reptilia	0	0	0	0	17
Actinopterygii	0	0	0	0	66
Coelacanthimorpha	0	0	0	0	1
Chondrichthyes	0	0	0	0	1

Experimental Studies Do Not Mirror Natural Conditions

- **Experimentally induced infections do not mirror naturally induced infections.** Just because an animal can be experimentally infected via direct intranasal or intratracheal inoculation with high concentrations of purified tissue-cultured virus does not mean that it will easily be infected with that same virus under natural conditions.
- **Experimental transmission studies are typically done under ideal conditions** that may include use of negative pressure test chambers and unidirectional flow of HEPA-filtered air from the infected to the naïve animal. Such highly controlled conditions do not reflect conditions found outside a laboratory setting. As such, results should not be used as conclusive evidence that an experimentally infected animal can readily transmit COVID-19 under natural conditions.
- **The numbers of animals used in these types of experiments is typically small**, with conclusions drawn based on data points that are in some cases collected from as few as two animals, making it challenging to draw definitive conclusions regarding all animals of a given species from results of only a few—and in some cases a single—study.

www.avma.org

ENVIRONMENT 02/25/2021 06:27 pm ET

COVID-19 Causes Prague Zoo Gorilla To Lose Appetite, Lions To Develop Cough

The animals were mostly likely infected by staff and other animals will be tested as well.

Robert Muller REUTERS

DAVID W CERNY/REUTERS

Richard, a western lowland gorilla, who was tested positive for COVID-19 on February 25, 2021, eats vegetables inside its enclosure at closed Prague Zoo amid the coronavirus disease (COVID-19) outbreak in Prague, Czech Republic, November 10, 2020. Picture taken November 10, 2020.

PRAGUE (Reuters) - A gorilla and two lions have tested positive for COVID-19 at the Prague Zoo, which is closed amid lockdown restrictions in the country.

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TRENDING

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Do Your Vaccine Side E Predict How You'd Rea COVID-19?

Mitch McConnell Gets Fact-Check Over Braze False Filibuster Defens

Biden's Disciplined Ap

SARS CoV-2 and apes

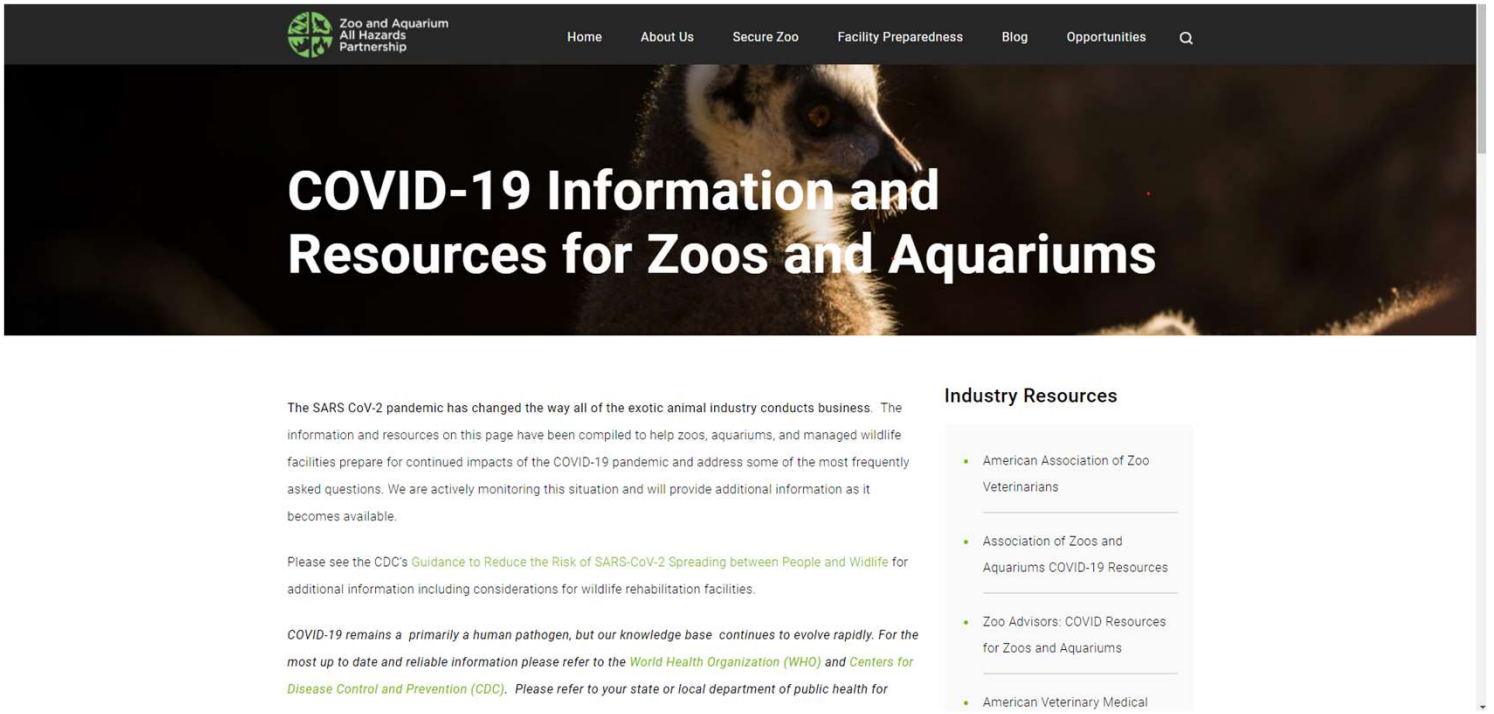
Corona virus disease (COVID-19): considerations for Apes in human care

Prepared March 12, 2020

Revised January 11, 2021

Vaccination Statement Released March 26, 2021

www.zahp.org



Clinical Signs- San Diego Zoo Safari Park

- Most severe signs were in the oldest gorillas (>40yo):
  - Coughing, lethargy/fatigue and reduced appetite
- Moderate signs in adolescent males (9-12yo) :
  - Coughing, reduced vitality, nasal discharge
- Minor signs in adult and juvenile females:
  - Nasal discharge, slightly subdued, infrequent coughing

- First clinical sign in the troop was seven days after the last possible exposure to an infected staff member
- Clinical signs lasted up to 21 days, with 49yo old silverback with longest clinical course
- 49yo silverback and 43yo female were of enough clinical concern to warrant intervention

https://zahp.org/wp-content/uploads/2021/02/Gorilla-SARS-CoV-2-White-Paper-Bulleted-SDZG-Feb-2021.pdf

CLINICAL SIGNS OF SARS-COV-2 INFECTION IN CATS AND DOGS

- Asymptomatic
- Fever
- Coughing
- Difficulty breathing or shortness of breath
- Lethargy
- Sneezing
- Nasal Discharge
- Ocular Discharge
- Vomiting
- Diarrhea

https://observer.com/2020/03/coronavirus-covid19-pet-dog-cat-infection-explainer/

PPE and Best Practices

- Detailed and intentional disinfection protocols in at-risk animal areas, keeper areas, animal food prep / enrichment prep areas
- Controls to reduce staff time indoors with at-risk apes.
- Staff medical screening
- Increased air flow / proper ventilation

- Considerations:
  - Dedicated Uniforms and footwear
  - Footbaths
  - Gloves
  - Masks (fit-tested N95s)
  - Safety goggles / Face shields
  - Tyvek suits
  - The principles of donning and doffing PPE
  - Clean and dirty areas maintained to avoid cross contamination

Treatments at San Diego Zoo Safari Park- Gorillas

Monoclonal Antibodies (mAbs)- 49yo silverback

- mAbs antibodies bind the virus itself (specifically the spike protein)
- In human SARS CoV-2 patients, mAbs are most effective five to ten days from the start of clinical signs, in patients that are ambulatory and not oxygen dependent.
- mAbs were given to as an intravenous infusion over one hour while under anesthesia
    - 1,400mg diluted into 1 liter of 0.9% saline and delivered over 60 minutes
- Acquired through contacts from their county public health department and with the approval of the FDA CVM.
- Locally sourced- not from human supply chain

Other Meds- 49 yo Male and 43 yo Female

- Meloxicam – Non-steroidal anti-inflammatory (NSAID)
- Maropitant (Cerenia) and Ondansetron – Antiemetic
- Famotidine – H2 blocker – Antacid
- Azithromycin – Macrolide antibiotic
- Ceftiofur – Long-acting cephalosporin
- Lactated Ringer Solution – Isotonic Fluids

Post procedure:

- Dexamethasone 6 mg PO once a day X 10 days
- Azithromycin PO once a day X 7 days
- Cardiac Meds (**49yo Male only)**
    - Amiodarone
    - Carvedilol
    - Furosemide

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San Diego Zoo gives experimental COVID-19 vaccine to 9 great apes COMMENTS

By Euronews with AP • Updated: 05/03/2021

A Sumattran orangutan climbs onto a landing to get some food at the Denver Zoo on Nov. 5, 2020.

Nine great apes after been vaccinated against the coronavirus at the San Diego Zoo in California.

Officials have said that four orangutans and five bonobos received COVID-19 injections in January and February.

It came after several gorillas at the zoo became infected with the virus, likely from contact with a zookeeper who tested positive for the virus.

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ANIMALS

Zoo Vaccinates Apes To Protect Both Animals And Humans From COVID-19

March 16, 2021 · 8:51 AM ET

Heard on All Things Considered

EVA TESFAYE

3-Minute Listen PLAYLIST

SARS CoV-2 Vaccination Considerations
Apes

Vaccination for SARS CoV-2 USA

Vaccine	Label	Type	Route	Dosage	Comments
Pfizer-BioNTech	Humans	mRNA	IM	0.3 ml, 2 shots, 21 days apart	Initially storage temperatures were -112 to -76°F. As of Feb 25th 2021 FDA approved standard freezer storage temperature (0°F or below)
Moderna	Humans	mRNA	IM	0.5 ml, 2-dose series separated by 28 days	Store in a freezer between -13°F and 5°F.
Janssen Biotech Inc. (Johnson and Johnson)	Humans	Recombinant – adenovirus vectored	IM	0.5 ml, Single dose	Store refrigerated between 36-46°F
Zoetis	Mink	Adjuvanted	SC	1 ml, 2 doses 21 days apart	Store refrigerated between 36-46°F. Pending FDA approval.
Altimmune, Inc.	Humans, Started Phase 1 clin trial late Feb 2021	Recombinant – adenovirus vectored	Intranasal	Single dose	Systemic and mucosal immunity

Compiled by Dr. Sam Rivera- Zoo Atlanta

Vaccination for SARS CoV-2in Animals

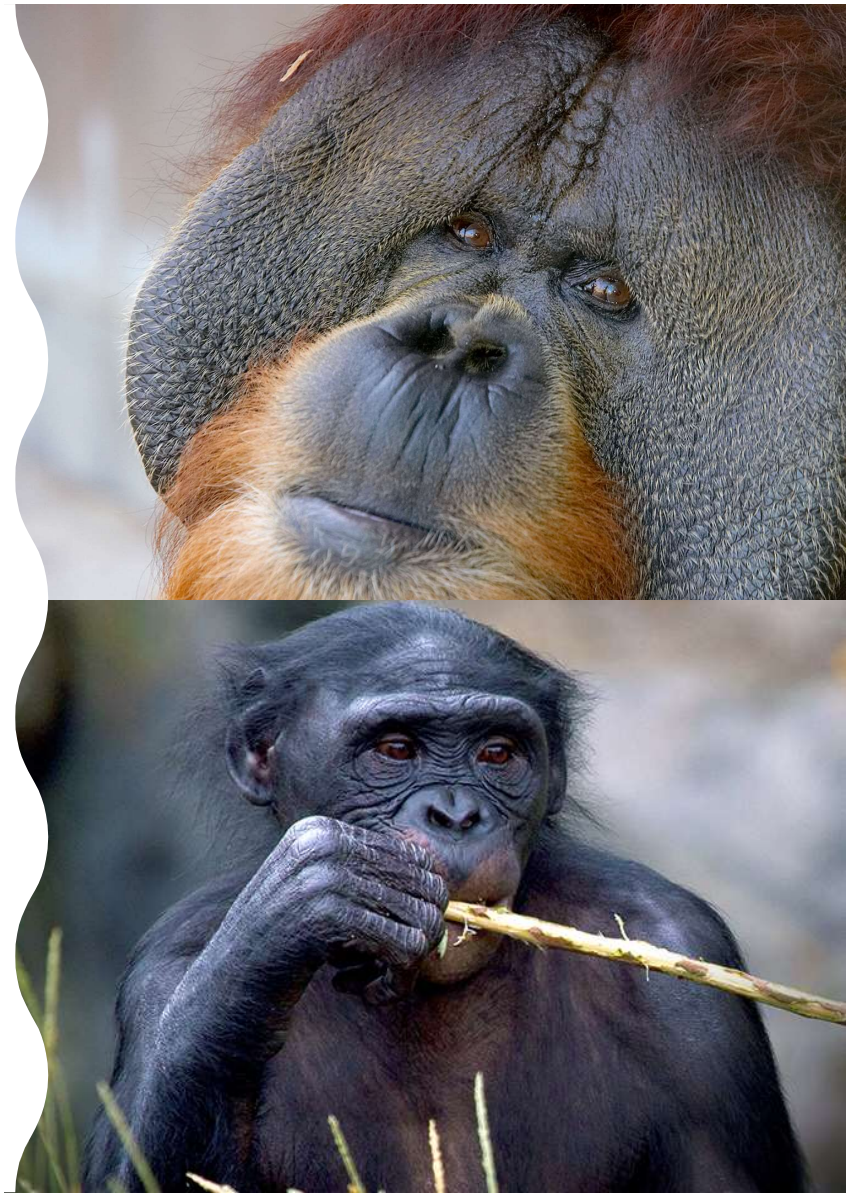
- The FDA has not approved any drugs for the diagnosis, cure, mitigation, treatment or prevention of SARS CoV-2 in animals
- US Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) Center for Veterinary Biologics (CVB) regulates veterinary biologics, including vaccines, diagnostic kits and other products of biological origin
- APHIS CVB has not licensed any products to diagnose, treat or prevent SARS CoV-2 infections in animals

Vaccination for SARS CoV-2 in apes

- **Do a risk analysis of your ape populations for exposure to the SARS CoV-2 virus.**
- **Strongly recommend the proper use of PPE and social distancing between humans and between humans and at-risk species of animals.**
- **Encourage staff members to become vaccinated during the phased roll-out of vaccinations in the United States.**

Vaccination for SARS CoV-2 at San Diego Zoo

- Vaccines were procured for orangutans and bonobos
- On request- Zoetis provided a limited supply of experimental SARS-CoV-2 vaccines used under informed consent.
- They anticipate vaccination of gorilla troop at the Safari Park later this spring, after waiting the recommended 60 to 90 days between SARS-CoV-2 infection and vaccination



ZOETIS VACCINE

- **Cost of the vaccine**
  - Currently producing a large batch of the experimental vaccine (~3-6 million doses) for the Mink Industries
  - Plan to produce a 10-dose per vial presentation for Zoos
  - No cost yet but hopefully will be nominal or donation
- **Cost of the lateral flow assay for antibodies**
  - Currently have the lateral flow assay in R&D organization
  - A final cost per sample has not yet been determined
- **Estimated vaccine availability timeline?**
  - They anticipate that the experimental vaccine doses for Zoos should be available in the June/July timeframe

ZOETIS VACCINE

- In order to receive the experimental vaccine, three forms of documentation is required by the USDA
    - USDA 103.3 permit for use of an experimental vaccine
    - State Veterinarian Authorization
    - Material Transfer Agreement that contains informed consent and non-use in other species including humans
- It is helpful to have an estimated number of doses sooner rather than later so that they know how many doses to produce in the 10-dose per vial presentation

Zoetis Vaccine

Ordering guidelines:

Requests for experimental vaccine doses should be forwarded to:

John M. Hardham, Ph.D. | Research Director, Global Biologics

Director, Zoetis Center for Transboundary and Emerging Diseases

Zoetis | 333 Portage Street, KZO-300-204.3, Kalamazoo, MI 49007

Office: 269-359-9211 | Mobile: 269-492-5253 | john.m.hardham@zoetis.com

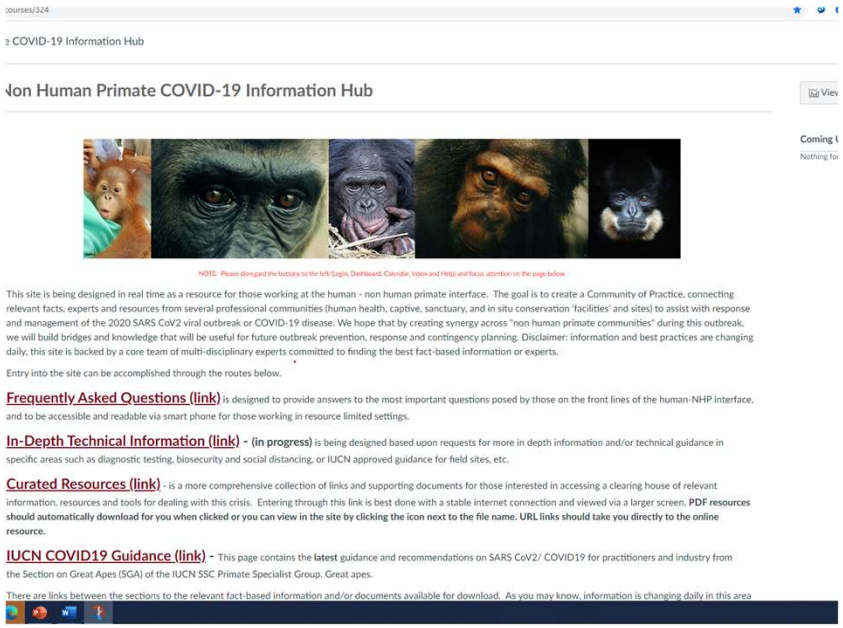
SARS-CoV-2 serology testing (virus neutralization assay)

- Diego G. Diel, DVM, MS, PhD
- Associate Professor
- Director, Virology Laboratory
- Department of Population Medicine and Diagnostic Sciences
- Animal Health Diagnostic Center
- College of Veterinary Medicine
- Cornell University
- 240 Farrier Rd | Ithaca, NY 14853
- Tel. AHDC: 607-253-4359 | Baker: 607-256-5605

- dgdiel@cornell.edu

Resources

- http://www.internationalprimatologicalsociety.org
- www.oie.int (world organization for animal health)
- www.cdc.gov
- www.usda.gov
- www.zahp.org



courses/324

COVID-19 Information Hub

Non Human Primate COVID-19 Information Hub

View

Coming

Nothing fo

NOTE: Please disregard the buttons to the left (Login, Dashboard, Calendar, Inbox and Help) and focus attention on the page below

This site is being designed in real time as a resource for those working at the human - non human primate interface. The goal is to create a Community of Practice, connecting relevant facts, experts and resources from several professional communities (human health, captive, sanctuary, and in situ conservation 'facilities' and sites) to assist with response and management of the 2020 SARS CoV2 viral outbreak or COVID-19 disease. We hope that by creating synergy across "non human primate communities" during this outbreak, we will build bridges and knowledge that will be useful for future outbreak prevention, response and contingency planning. Disclaimer: information and best practices are changing daily, this site is backed by a core team of multi-disciplinary experts committed to finding the best fact-based information or experts.

Entry into the site can be accomplished through the routes below.

Frequently Asked Questions (link) is designed to provide answers to the most important questions posed by those on the front lines of the human-NHP interface, and to be accessible and readable via smart phone for those working in resource limited settings.

In-Depth Technical Information (link) - (in progress) is being designed based upon requests for more in depth information and/or technical guidance in specific areas such as diagnostic testing, biosecurity and social distancing, or IUCN approved guidance for field sites, etc.

Curated Resources (link) - is a more comprehensive collection of links and supporting documents for those interested in accessing a clearing house of relevant information, resources and tools for dealing with this crisis. Entering through this link is best done with a stable internet connection and viewed via a larger screen. **PDF resources should automatically download for you when clicked or you can view in the site by clicking the icon next to the file name. URL links should take you directly to the online resource.**

IUCN COVID19 Guidance (link) - This page contains the **latest** guidance and recommendations on SARS CoV2/ COVID19 for practitioners and industry from the Section on Great Apes (SGA) of the IUCN SSC Primate Specialist Group, Great apes.

There are links between the sections to the relevant fact-based information and/or documents available for download. As you may know, information is changing daily in this area

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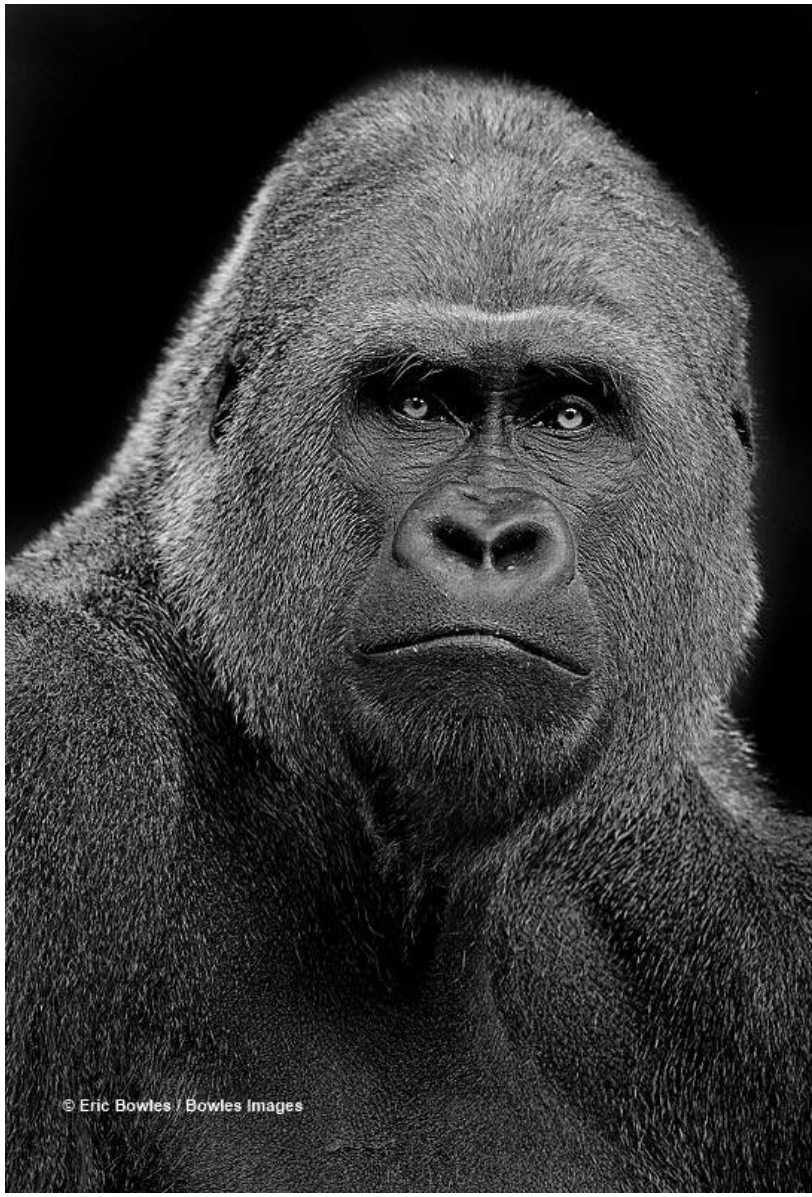

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QUESTIONS