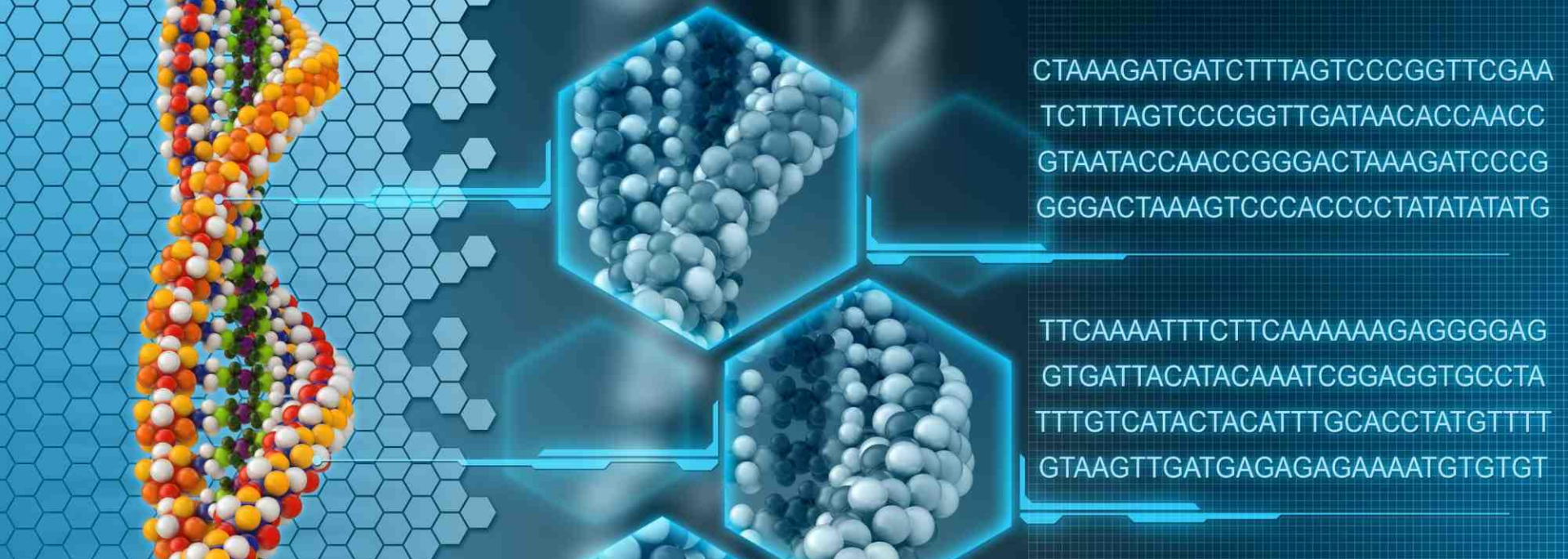


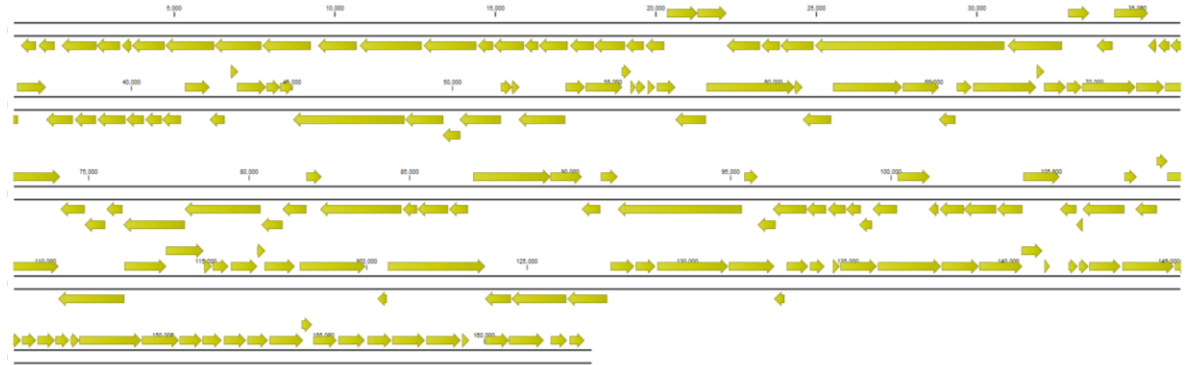


Viruses Discovered in Florida Farmed Deer

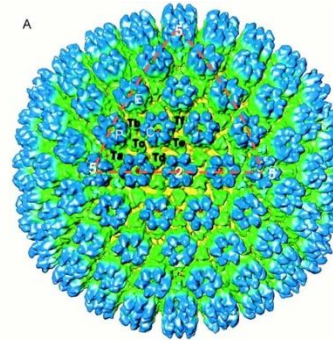
Thomas B. Waltzek, Jessica Jacob, Katherine A. Sayler, Julia Loeb, John Lednicky,
Samantha M. Wisely, Kuttichantran Subramaniam

Talk Outline

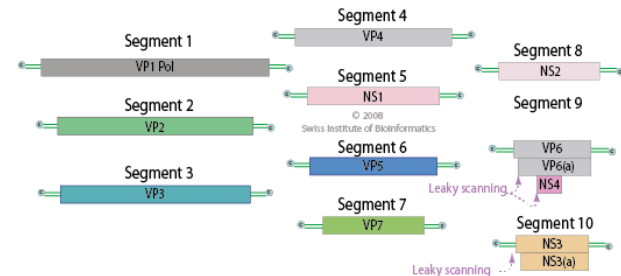
- Cervid Poxviruses



- Cervid Herpesviruses



- Cervid Reoviruses



Poxvirus Disease Characteristics

Typical Gross & Microscopic Lesions

- * Epitheliotropic, inducing proliferative lesions
 - Hyperplasia, neoplasia
 - Macule, papule, vesicle, pustule, crust

Host Specificity & Pathogenesis

- * Viruses of veterinary & medical importance
- * Serious disease in immunocompromised
- * Some genera with broad host range - zoonoses (ortho & parapoxviruses)



Chordopoxviruses of Domestic Animals

	Genus	Virus Infections	Animals Found Naturally Infected	Host Range in Laboratory Animals	Geographical Range, Natural Infection
	<i>Orthopoxvirus</i>	Cowpox virus	Numerous: man, cattle, cats, zoological species	Broad	Europe
	<i>Parapoxvirus</i>	Pseudocowpox virus	Cattle, human	Narrow	Worldwide
		Bovine papular stomatitis virus	Cattle, human	Narrow	Worldwide
		Orf virus (contagious ecthyma)	Sheep, goat human	Narrow	Worldwide
	<i>Capripoxvirus</i>	Sheeppox virus	Sheep, goat	Narrow	Africa, Asia
		Goatpox virus	Goat, sheep	Narrow	Africa, Asia
		Lumpyskin disease virus	Cattle, buffalo	Narrow	Africa
	<i>Suipoxvirus</i>	Swinepox virus	Swine	Narrow	Worldwide
	<i>Leporipoxvirus</i>	Myxoma virus (Oryctolagus and Sylvilagus)	Rabbit	Narrow	Americas, Australia, Europe
	<i>Avipoxvirus</i>	Fowlpox virus	Chickens, turkeys, other birds	Narrow	Worldwide

Orf

Contagious Ecthyma, Contagious Pustular Dermatitis, Sore Mouth

Distribution

- Occurs in sheep/goat-rearing regions worldwide & **DEER!**

Clinical Findings

- Most common 3-6 month old lambs, although adults may be severely affected
- Lesions develop as papules, then pustules, then thick tenacious scabs,
- Oral mucocutaneous junctions, usually the commissures, then spreading to muzzle and nostrils



Orf-like Virus in Deer: Human Disease

The NEW ENGLAND JOURNAL of MEDICINE

BRIEF REPORT

Novel Deer-Associated Parapoxvirus Infection in Deer Hunters

Amira A. Roess, Ph.D., Anjela Galan, M.D., Edward Kitces, M.D., Ph.D.,
Yu Li, Ph.D., Hui Zhao, M.D., Christopher D. Paddock, M.D.,
Patricia Adem, M.D., Cynthia S. Goldsmith, M.S., Debra Miller, M.D.,
Mary G. Reynolds, Ph.D., Sherif R. Zaki, M.D., Ph.D.,
and Inger K. Damon, M.D., Ph.D.

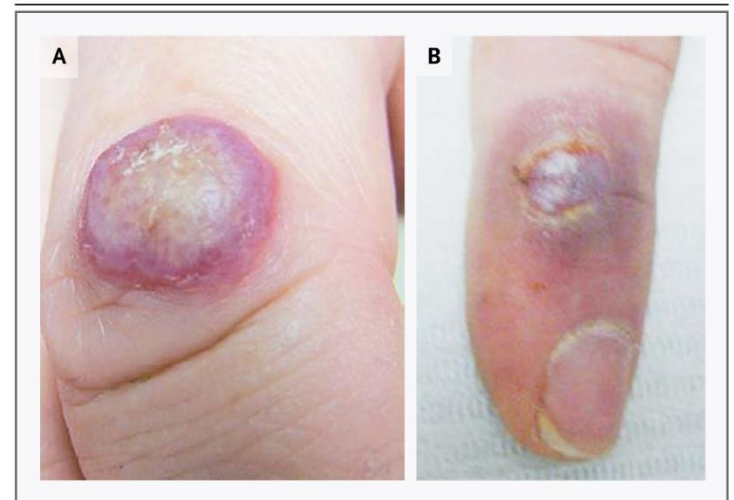


Figure 1. Deer-Associated Parapoxvirus Papulonodular Lesions.

The photograph of the right index finger of Patient 1 (Panel A) was taken approximately 5 weeks after exposure; the photograph of the left index finger of Patient 2 (Panel B) was taken approximately 9 weeks after exposure.

Genus *Cervidpoxvirus*

JOURNAL OF VIROLOGY, Jan. 2005, p. 966–977
0022-538X/05/\$08.00+0 doi:10.1128/JVI.79.2.966–977.2005
Copyright © 2005, American Society for Microbiology. All Rights Reserved.

Vol. 79, No. 2

Genome of Deerpox Virus

C. L. Afonso,^{1*} G. Delhon,^{1,2} E. R. Tulman,¹ Z. Lu,¹ A. Zsak,¹ V. M. Becerra,³ L. Zsak,¹
G. F. Kutish,¹ and D. L. Rock¹

Plum Island Animal Disease Center, Agricultural Research Service, United States Department of Agriculture, Greenport, New York¹; Area of Virology, School of Veterinary Sciences, University of Buenos Aires, Buenos Aires, Argentina²; Center for Veterinary Biologicals, Veterinary Services, Animal and Plant Health Inspection Service, United States Department of Agriculture, Ames, Iowa³

Received 23 July 2004/Accepted 30 August 2004

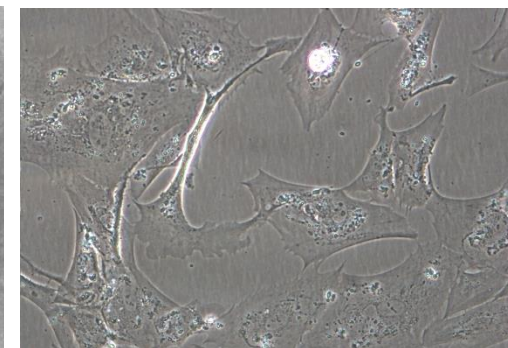
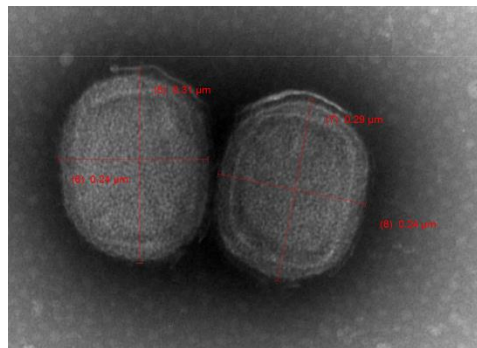
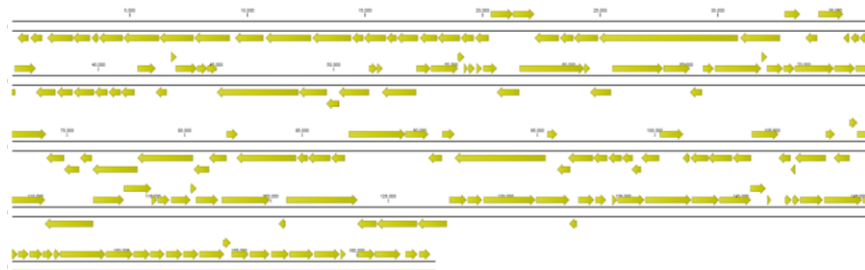
Deerpox virus (DPV), an uncharacterized and unclassified member of the *Poxviridae*, has been isolated from North American free-ranging mule deer (*Odocoileus hemionus*) exhibiting mucocutaneous disease. Here we report the genomic sequence and comparative analysis of two pathogenic DPV isolates, W-848-83 (W83) and W-1170-84 (W84). The W83 and W84 genomes are 166 and 170 kbp, containing 169 and 170 putative genes, respectively. Nucleotide identity between DPVs is 95% over the central 157 kbp. W83 and W84 share similar gene orders and code for similar replicative, structural, virulence, and host range functions. DPV open reading frames (ORFs) with putative virulence and host range functions include those similar to cytokine receptors (R), including gamma interferon receptor (IFN- γ R), interleukin 1 receptor (IL-1R), and type 8 CC-chemokine receptors; cytokine binding proteins (BP), including IL-18BP, IFN- α / β BP, and tumor necrosis factor binding protein (TNFBP); serpins; and homologues of vaccinia virus (VACV) E3L, K3L, and A52R proteins. DPVs also encode distinct forms of major histocompatibility complex class I, C-type lectin-like protein, and transforming growth factor β 1 (TGF- β 1), a protein not previously described in a mammalian chordopoxvirus. Notably, DPV encodes homologues of cellular endothelin 2 and IL-1R antagonist, novel poxviral genes also likely involved in the manipulation of host responses. W83 and W84 differ from each other by the presence or absence of five ORFs. Specifically, homologues of a CD30 TNFR family protein, swinepox virus SPV019, and VACV E11L core protein are absent in W83, and homologues of TGF- β 1 and lumpy skin disease virus LSDV023 are absent in W84. Phylogenetic analysis indicates that DPVs are genetically distinct from viruses of other characterized poxviral genera and that they likely comprise a new genus within the subfamily *Chordopoxvirinae*.

2016 Florida White-tailed Deer Poxvirus

First poxvirus to be identified in Florida white-tailed deer

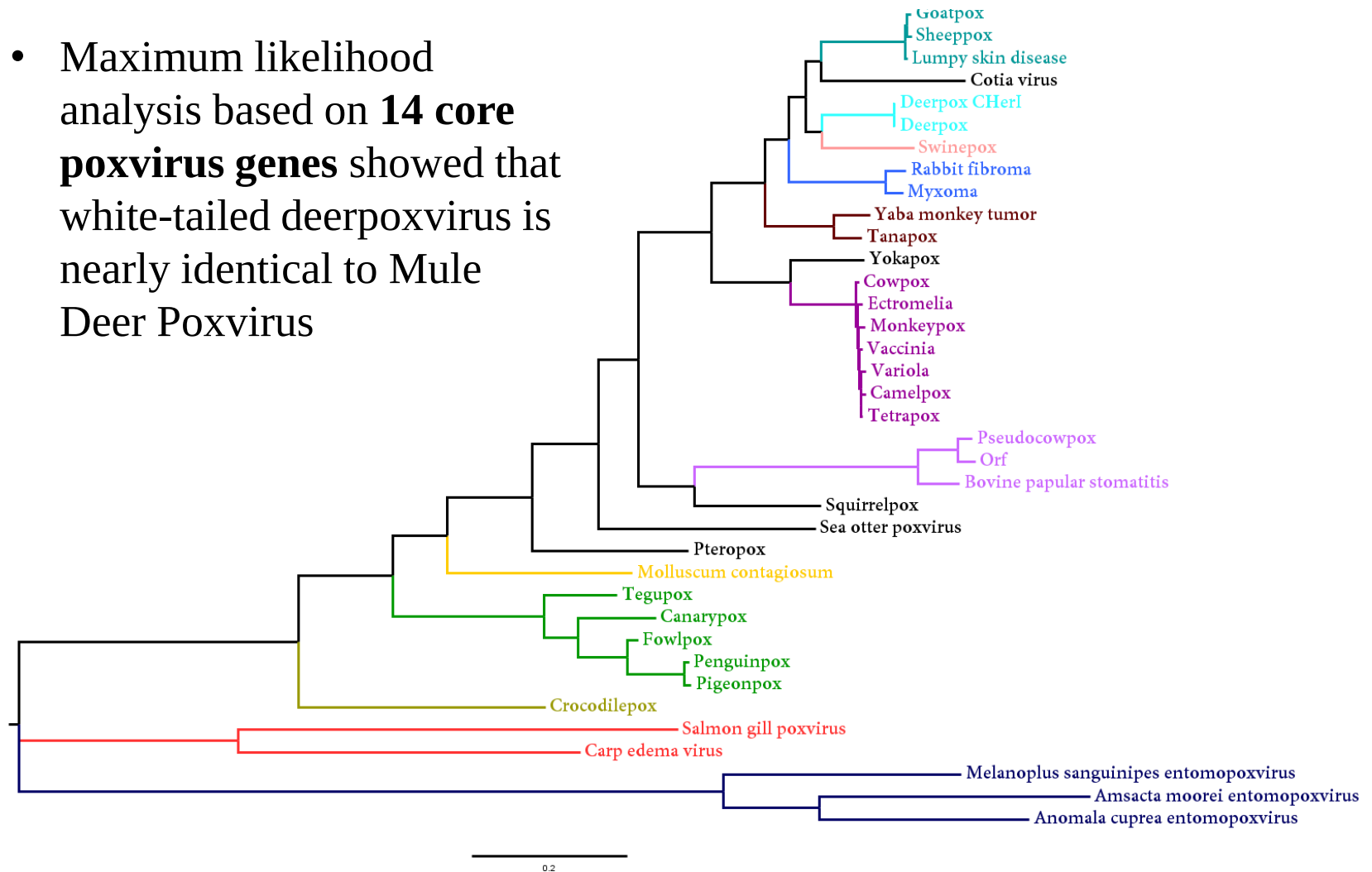
Genomic features:

- 163,340 bp
- %GC - 27.1%
- ITR – 3,458 bp
- 168 proteins



Florida White-tailed Deer Poxvirus

- Maximum likelihood analysis based on **14 core poxvirus genes** showed that white-tailed deer poxvirus is nearly identical to Mule Deer Poxvirus



Herpesvirus Disease Characteristics

Host Specific

- Typically self-limiting infections
- Serious disease in immunocompromised
- Rare Zoonosis/Anthroponosis

After initial infection, they persist in the host

- Latency— herpes is for life!

Newly Recognized Herpesvirus Causing Malignant Catarrhal Fever in White-Tailed Deer (*Odocoileus virginianus*)

HONG LI,¹ NEIL DYER,² JANICE KELLER,¹ AND TIMOTHY B. CRAWFORD^{3*}

Malignant Catarrhal Fever

Virus

Alcelaphine Herpesvirus 1

Ovine Herpesvirus 2

Disease

Bovine Malignant Catarrhal Fever

Bovine Malignant Catarrhal Fever

- Two closely related viruses cause Bovine Malignant Catarrhal Fever
- Wildebeest and Sheep asymptomatic but shed virus to susceptible species
- Associated virus (OvHV-2) passed to cattle, bison, deer (USA)
- Wildebeest associated virus (AlcHV-1) passed to cattle and other susceptible ungulates (Africa) or in managed (zoo) populations



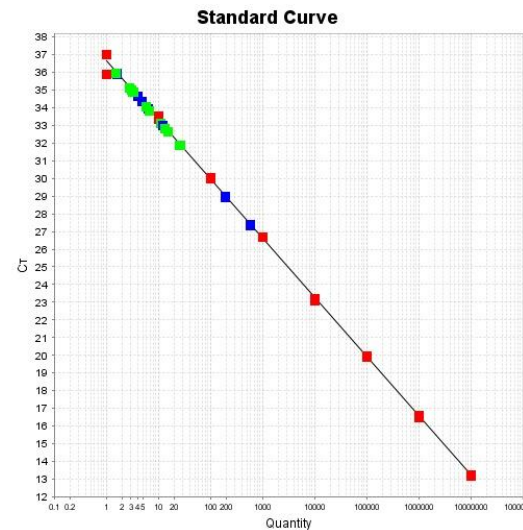
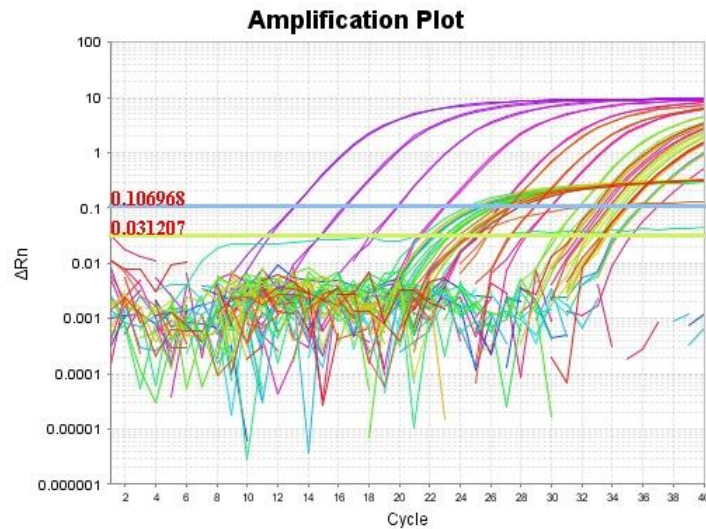
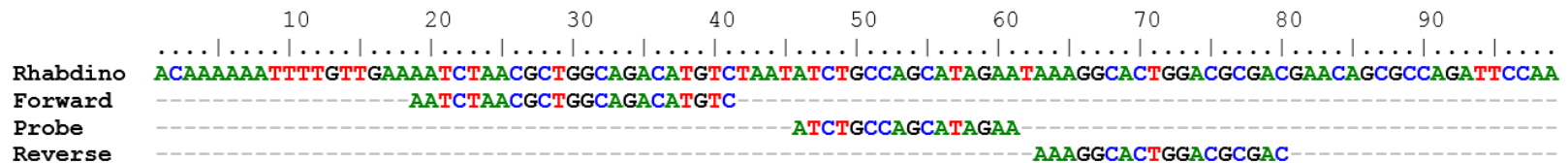
What is this disease and how do sheep and wildebeest feature?



Select Genes Ltd., Irene 1675, Republic of South Africa.

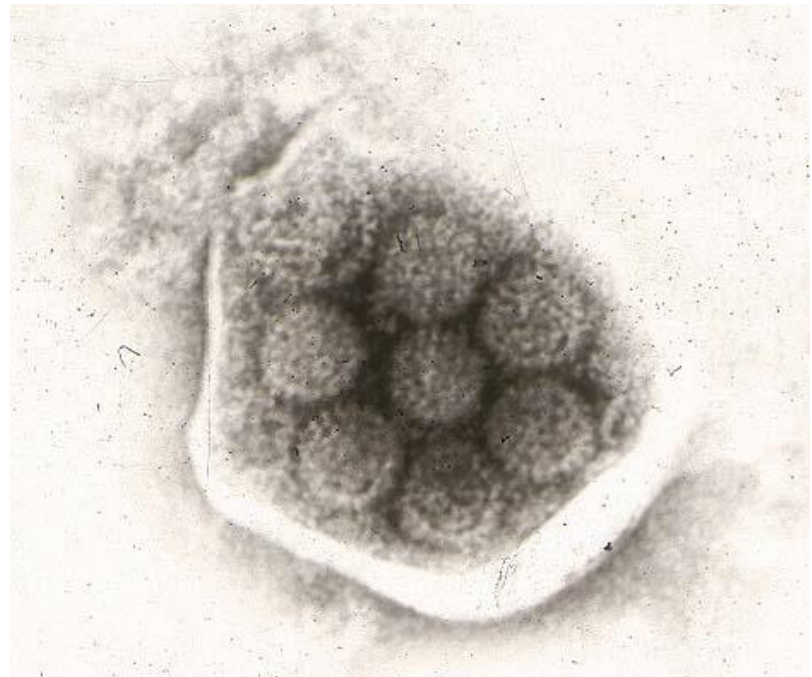
Discovery of Florida White-tailed Deer Herpesvirus

- Herpesvirus detected in 11/49 deer blood samples from 2015-16 = 22%
- Specific qPCR assay designed and validated
- **ASSOCIATION WITH DISEASE NOT YET ESTABLISHED!!!**



Reovirus Characteristics

- RNA viruses
- Double stranded
- 10 segments
- Non-enveloped
- Cytoplasmic replication
- Ring shaped capsomers of core particles



Reoviruses of White-tailed Deer

- Epizootic hemorrhagic disease virus (EHDV)
- Bluetongue virus (BT)
- Closely related orbiviruses that cause hemorrhagic disease



EHD and BT

Transmission & Distribution

Transmission

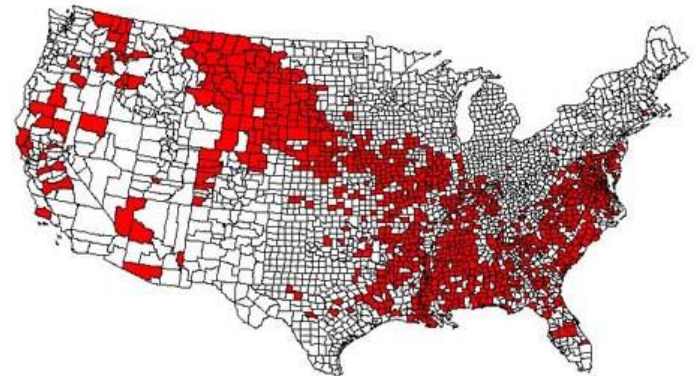
- *Culicoides sonorensis* is the confirmed vector for bluetongue and EHD
- *Culicoides insignis* confirmed vector of bluetongue



Distribution

- BTV and EHDV widely distributed in temperate and tropical climates worldwide

Hemorrhagic Disease Activity 1992-2001



EHD and BT

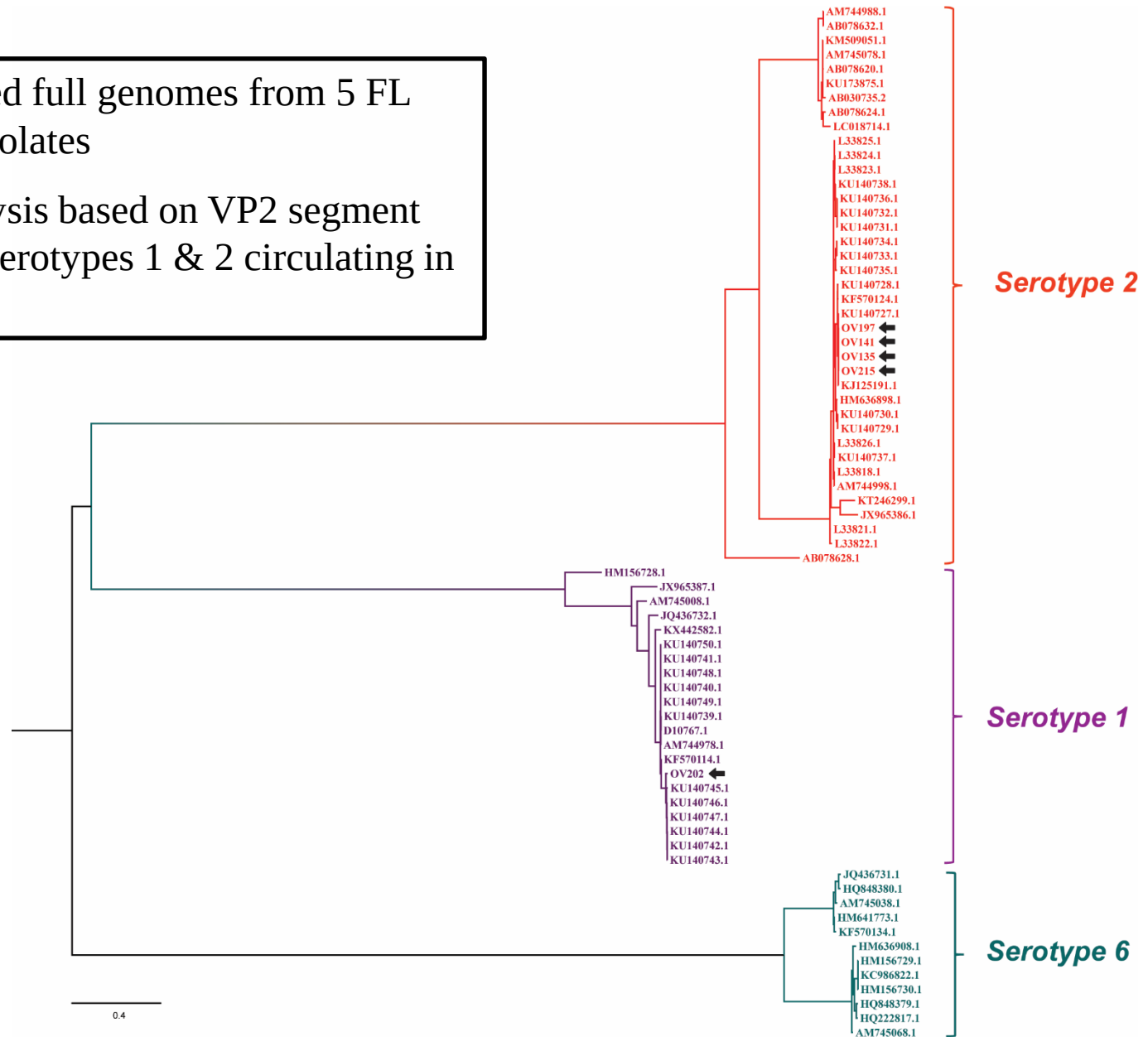
Clinical Signs – Hemorrhagic Disease



- Signs range from sudden death to chronic disease
- Pyrexia, depression
- Reddening of periocular skin and nostrils – hyperemia
- Swelling of head and neck – vascular damage
- Neurological signs – ataxia, blindness, loss of fear
- Sick and dead animals often found near water

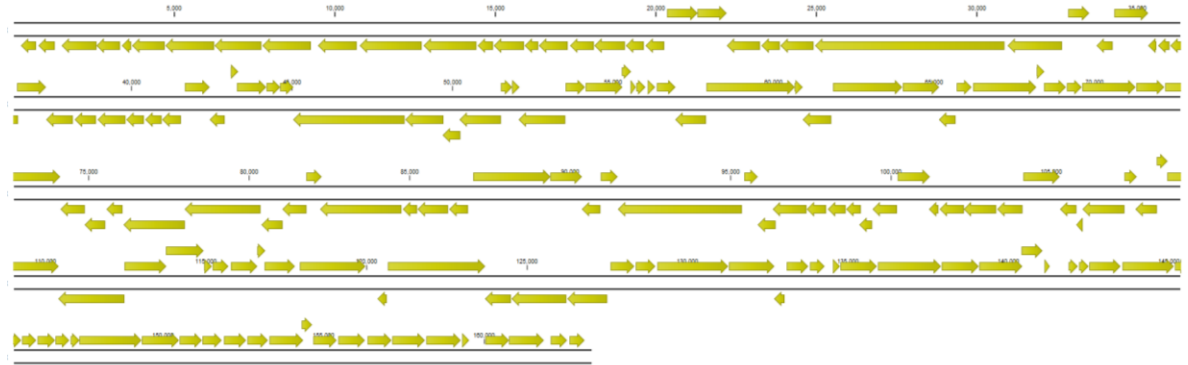
Florida EHDV Serotypes 2015-16

- Recovered full genomes from 5 FL EHDV isolates
- ML analysis based on VP2 segment showed serotypes 1 & 2 circulating in 2015-16

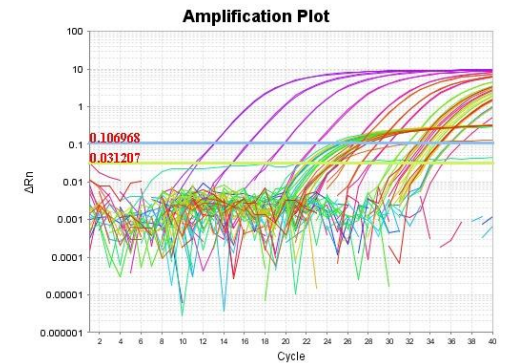
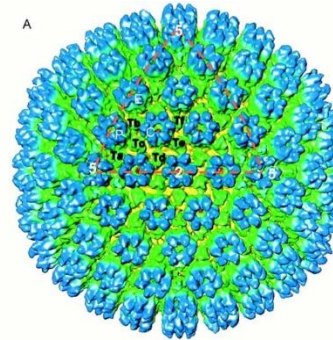


Conclusions

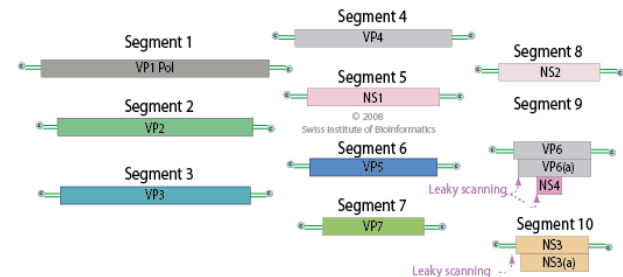
- Cervid Poxviruses



- Cervid Herpesviruses



- Cervid Reoviruses



Thanks for your Attention! Questions?

UF | IFAS Research
UNIVERSITY of FLORIDA



UF | UNIVERSITY of
FLORIDA
College of
Veterinary Medicine

