

The background of the slide is a close-up, artistic photograph of a microscope. The lens and various mechanical parts are visible, with a soft, out-of-focus bokeh effect of warm, golden light spots scattered across the scene. The overall color palette is dark with highlights of gold and blue.

VMC 321: Systematic Veterinary Virology

Orthopoxvirus

Presented by

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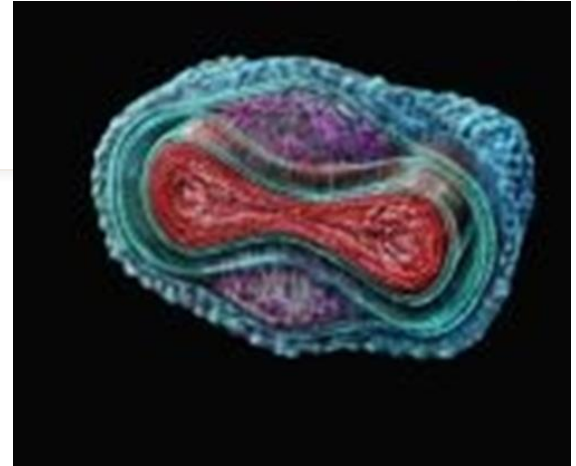
BIHAR ANIMAL SCIENCES UNIVERSITY , PATNA

Genus Orthopoxvirus

- buffalopox virus {buffalo, cattle, human}
- camelpox virus {camel} (CMLV)
- cowpox virus {rodents, felines, bovines, human}
- Horse poxvirus {horses}
- ectromelia virus {mousepox, reservoir unknown}
- monkeypox virus {rodents, primates, human}
- rabbitpox virus {colonized rabbit only}
- raccoonpoxvirus {North America}
- skunkpox virus {North American striped skunk}
- taterapox virus {African gerbil}
- vaccinia virus {no natural reservoir}
- Uasin Gishu disease {Central African horses}
- variola virus {human; eradicated from nature}
- volepox virus {California pinon mouse and voles}

CHARACTERISTICS SHARED BY SPECIES OF ORTHOPOXVIRUS :

- Largest and most complex viruses
- Can be visualized under light microscope
- Linear genome of a single double-stranded DNA
- Replicate in the cytoplasm of the host cell
- Have own mRNA and DNA synthetic machinery (including DNA-dependent RNA polymerase)

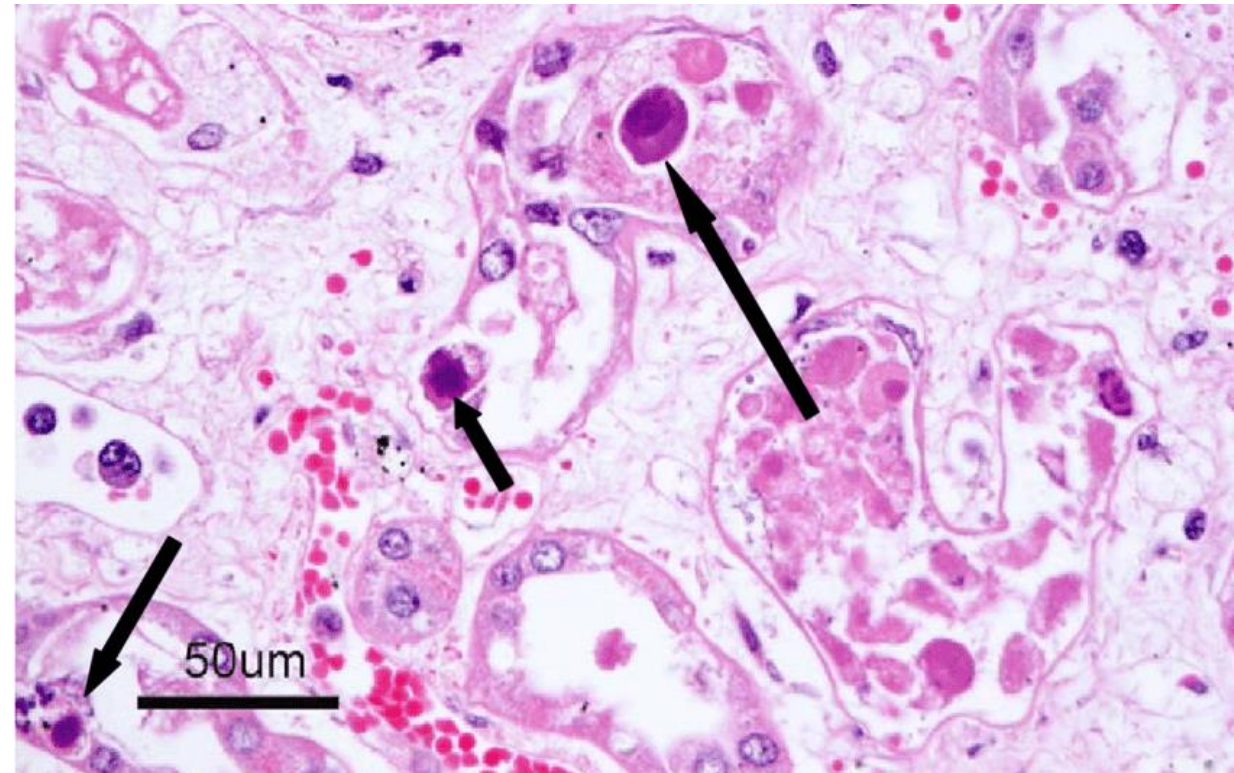


Inclusion bodies

- cells infected with orthopoxviruses
- numerous mature virions (MVs) become embedded within large, cytoplasmic A-type inclusions
- protect infectivity after cell lysis.
- A-type inclusions - composed of an abundant viral protein called ATIp - truncated in orthopoxviruses

Viral factories

- Viral factories (VFs) are cytoplasmic juxtannuclear bodies (also called B-type inclusions)
- Function:
 - organize poxvirus
 - DNA replication
 - intermediate
 - late transcription
 - protein synthesis
 - assembly of mature virions (MVs).



Inclusion bodies

- Two types of Orthopoxvirus inclusion bodies
 - Type-A inclusion bodies
 - Guarnieri bodies.
- Type-A inclusion bodies are found only in certain poxviruses like cowpox
- The Guarnieri bodies are found in all poxvirus infections
- The diagnosis of an orthopoxvirus infection can also be made rapidly by electron microscopic examination of pustular fluid or scabs.
- Guarnieri bodies are named after Giuseppe Guarnieri (1856-1918), an Italian physician.

Poxvirus infected cells



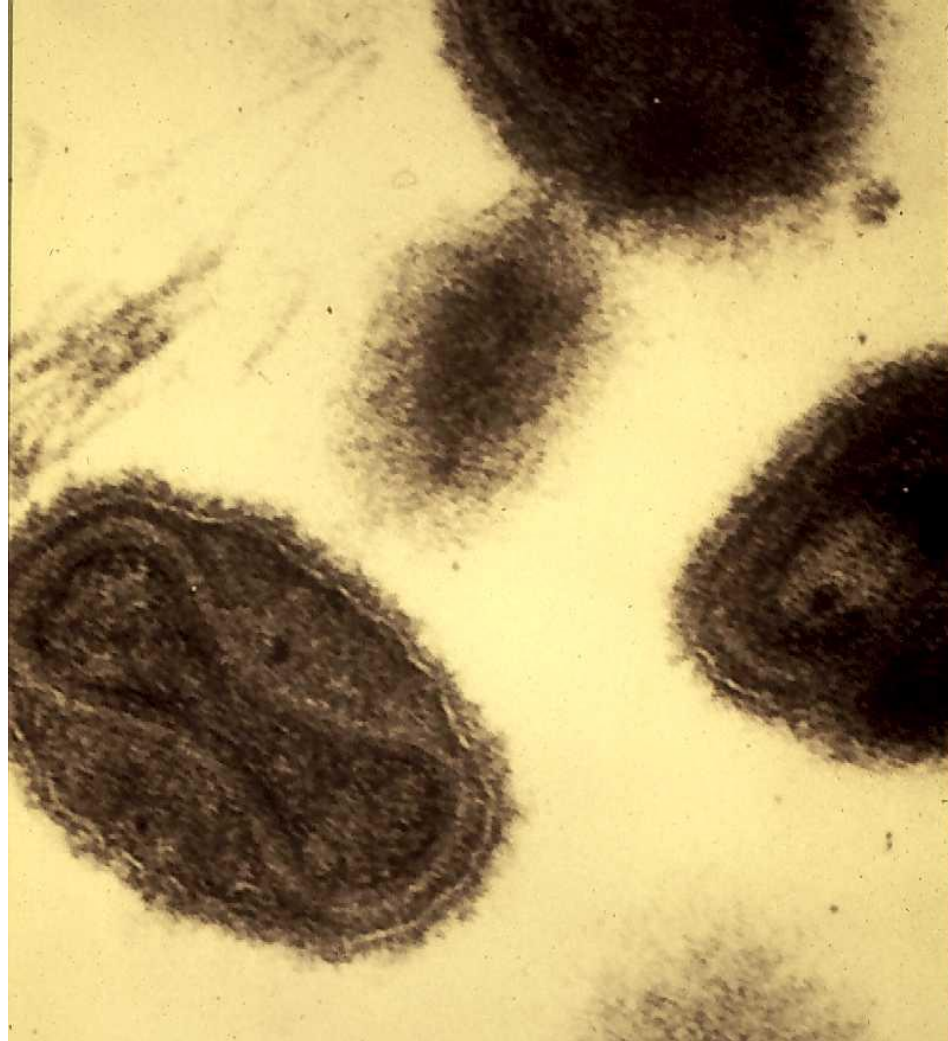
Cowpox in primary monkey kidney cells, cytoplasmic inclusions with halo (Guaneiri body)

(Versteeg J., A Color Atlas of Virology, 1985)

- Inclusion bodies: type B and type A
- Virions have a brick-like shape
- Present in 2 forms, both are infectious:
 - i. EEV (extracellular enveloped virus)
 - ii. IMV (intracellular mature virus)
- Serological cross-reactivity
- Produce a hemagglutinin antigen (HA)

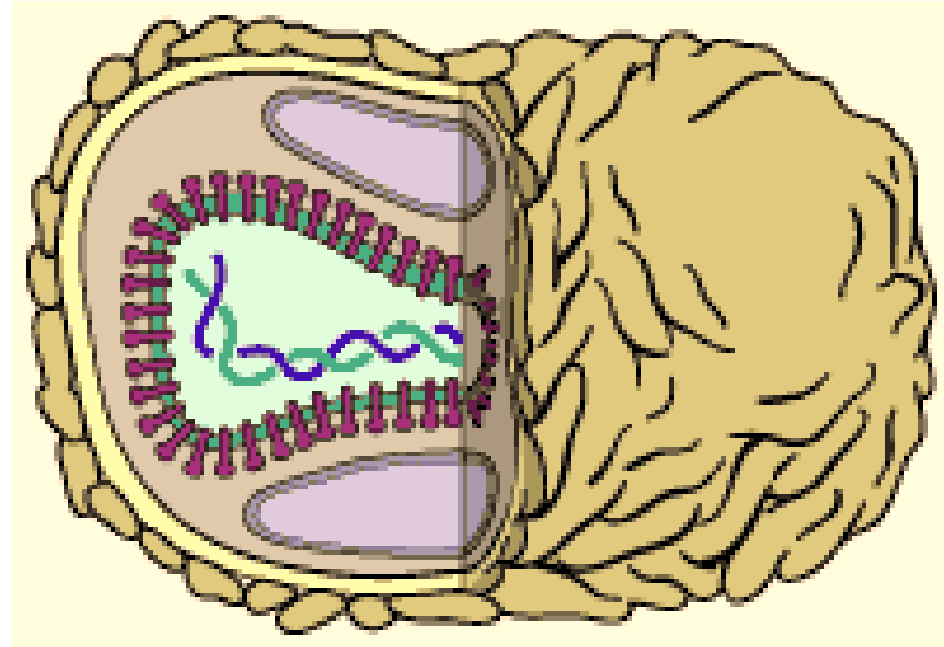
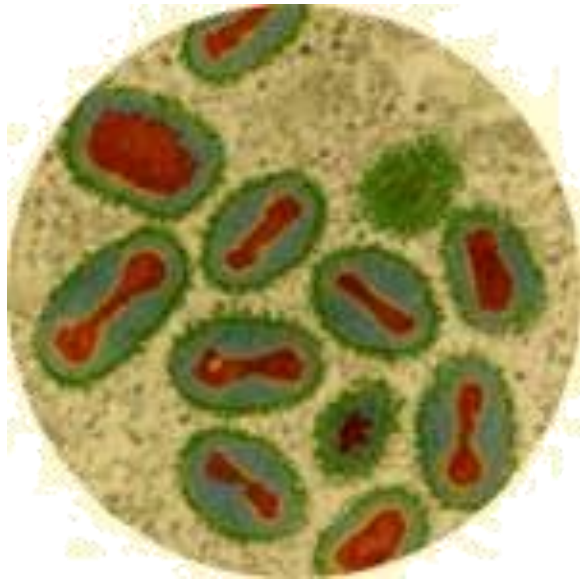
Virus Structure

- very large, brick-shaped viruses
- 300 x 200 nm
- size of chlamydia
- visible under light microscope
- complex internal structure



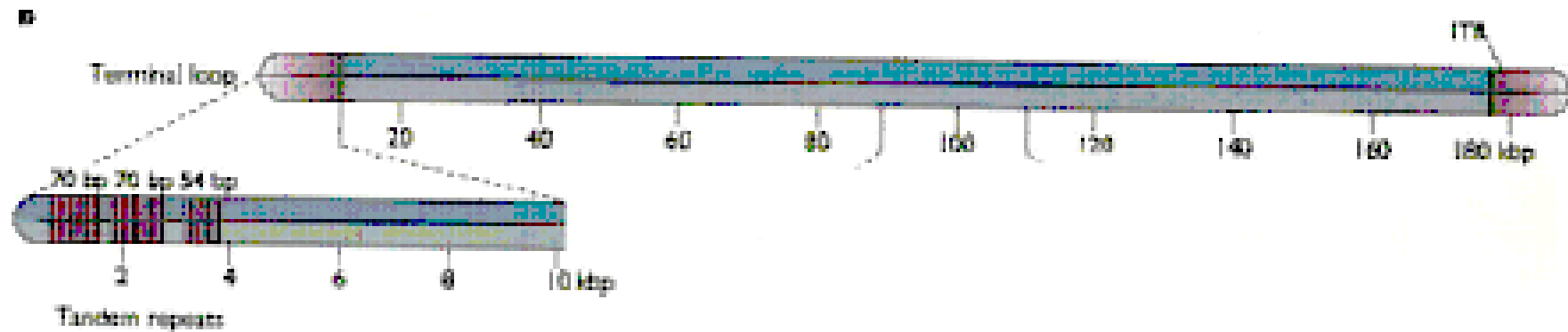
Virus Structure

- **"core"**
- biconcave = dumb bell shaped
- tightly compressed nucleoprotein



Virus Structure

- Core
 - linear double-stranded DNA genome
 - terminal hairpin loop advantage?
 - several tandem (i.e. direct) repeat sequences
 - ends of the genome form direct repeats
 - inverted terminal repeats (ITRs).



Virus Structure

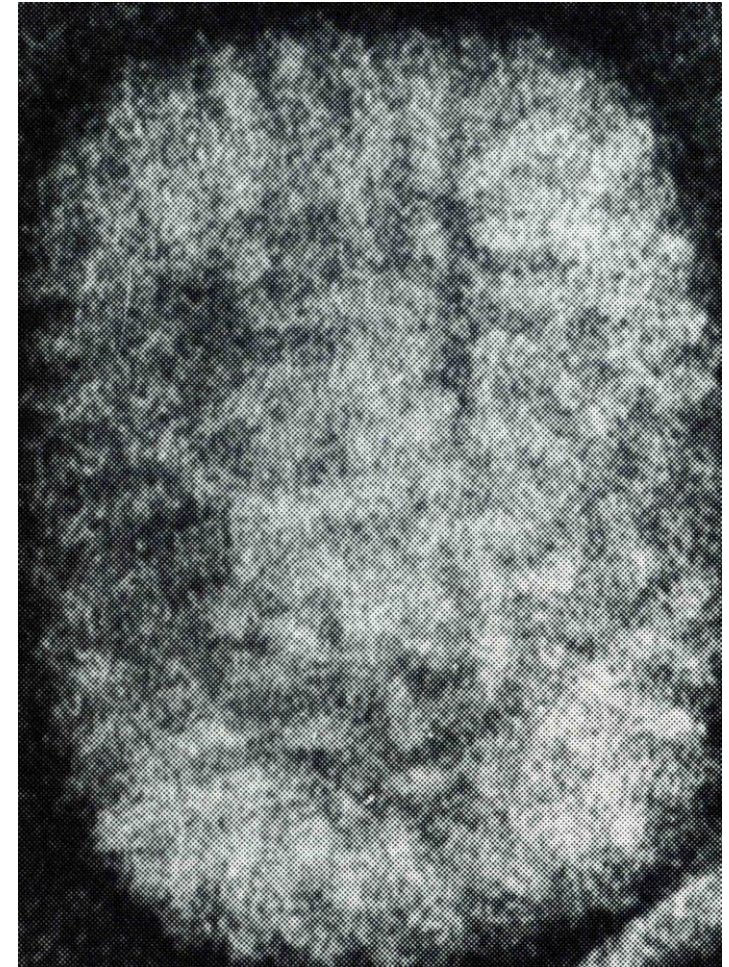
- Core DNA
 - most essential genes located in the central part of the genome
 - non-essential genes are located at the ends.
 - general
 - 130-300kbp
 - Vaccinia
 - 190,000 nucleotide base pairs
 - completely sequenced

Virus Structure

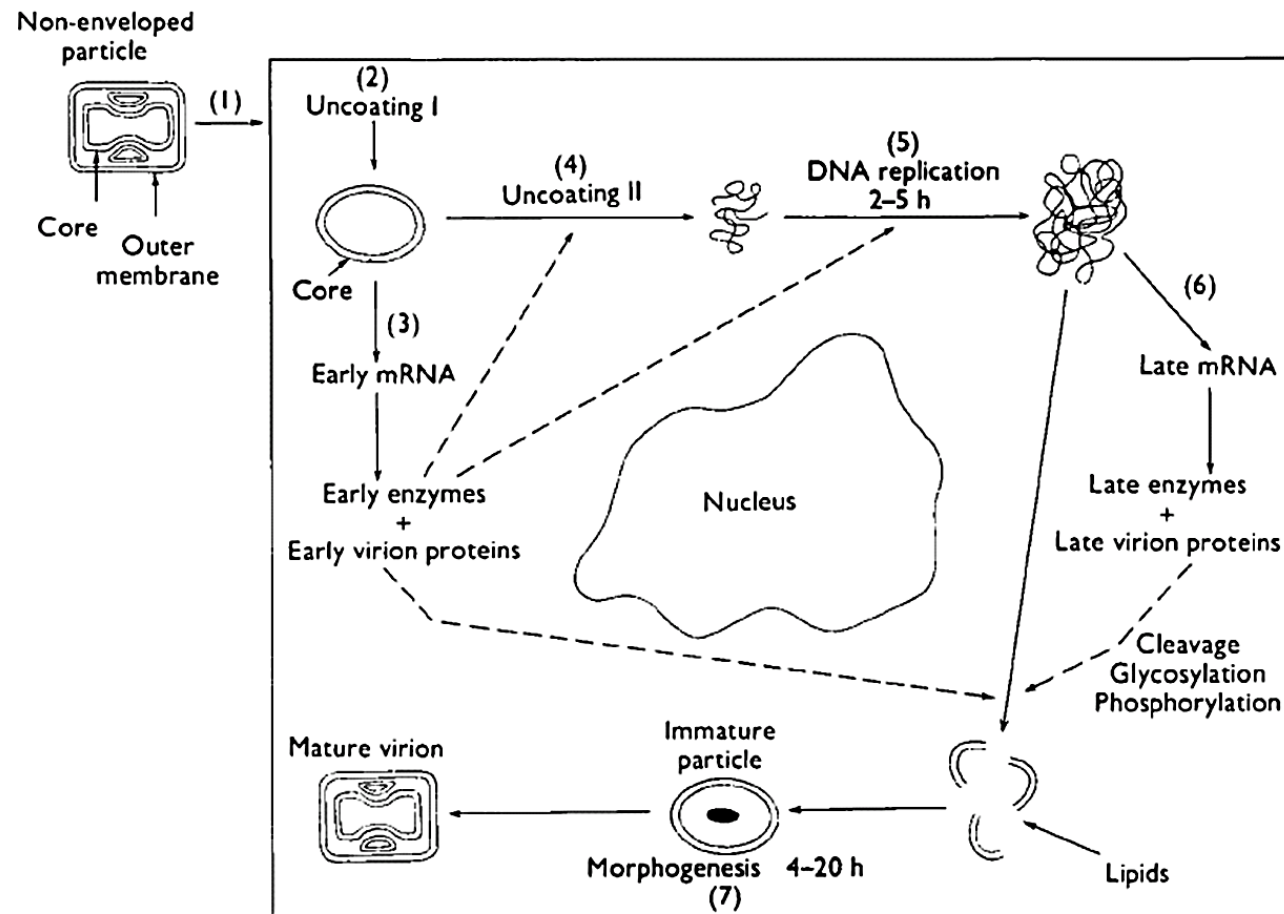
- CORE
 - Enzymes
 - Host RNA polymerase is in the cell nucleus
 - Pox replicates in cytoplasm
 - poxviruses use a virally-coded DNA-dependent RNA polymerase
 - needed immediately upon infection,
 - in virions
- flanked by 2 "lateral bodies"
 - function unknown

- **surface of virus covered with filamentous protein**
- " ball of knitting wool".
 - surface tubules
- **envelope**
 - intracellular particles only have an inner membrane
 - IMV - intracellular mature virions
 - not host membrane
 - extracellular forms contain 2 membranes
 - EEV - extracellular enveloped virions
 - second derived from Golgi or ER

Virus Structure




VIRAL REPLICATION - CELL CYCLE



Diseases caused by Orthomyxovirus

Virus	Infections in	Spectrum of hosts	Natural host
Variola (VARV)	human	narrow	human
Vaccinia (VACV)	human, buffalo, cattle, elephant, pig, rabbit, etc.	broad	unknown
VACV-like Brazilian isolates (BRZ-VACV)	human, cattle, rodent	broad	rodent
Buffalopox (BPXV-VACV)	buffalo, cattle, human	broad	
Rabbitpox (RPV-VACV)	rabbits in breeding establishments	broad	
Monkeypox (MPXV)	human, ape, monkey, rodent, prairie dog, etc.	broad	rodent, sciuridae
Cowpox (CPXV)	human, cat, cattle, elephant, rodent, rhinoceros, etc.	broad	rodent
Camelpox* (CMLV)	camel	narrow	unknown
Ectromelia (ECTV)	mouse, laboratory mouse	narrow	vole?
Raccoonpox	raccoon	broad?	unknown
Volepox	vole, pinon mouse	narrow	vole
Uasin-Gisha pox	horse	medium (?)	unknown
Taterapox	tatera kempi (gerbil)	narrow	gerbil?

Genus	Species	Clinical sign	Host
Parapox virus	orfvirus	Orf; ecthyma contagiosum	sheep, goat, wild ruminant
	pseudo cowpox virus	Melker's nodule	cattle
	parapox in cattle (stomatitis papulosa virus of the cattle)	local infections	cattle
	seal parapox virus (SPPV)	local infections	seal
	reindeer parapox virus	local infections	reindeer
Molluscipoxvirus	molluscum contagiosum virus	non-malignant tumours	human
Yatapoxvirus	yaba monkey tumour virus	yaba monkey tumour	monkey
	tanapoxvirus	tanapox	monkey (rodent)

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- Vaccinia (smallpox vaccine)
 - variola (smallpox)
 - Monkeypox
 - cowpox

are the four orthopoxvirus species known to cause human disease.