Virology 101—Slat Level

Andrew S. Bowman, MS, DVM, PhD, DACVPM
What is a virus?

An **infectious**, *obligate intracellular parasite comprising genetic material (DNA or RNA)* surrounded by a *protein coat and/or an envelope derived from a host cell membrane*.
Infectious diseases:

- Bacteria
- Fungi
- Parasites
- Viruses
  - Virus: Latin word meaning poison
  - Viruses are everywhere.
  - Viruses infect all life forms.
Have you ever heard of:

- Porcine reproductive and respiratory syndrome virus
- Influenza A virus
- Porcine epidemic diarrhea virus
- Porcine deltacoronavirus
- Porcine parvovirus
- Porcine circovirus type 2
- Porcine rotaviruses
- Pseudorabies virus
- Classical swine fever virus
- Foot-and-mouth disease virus
Plants, bacteria, fungi, and parasites can be come infected with viruses.
Shorter medical history
- First virus discovered in 1892 (TMV)
- 1898, Foot-and-mouth disease virus (1st animal virus)

2,618 species of viruses
Indian fly fox (Anthony et al. 2013)

- 55 viruses were identified (~30 were novel)

Extrapolate findings

~320,000 unknown mammalian viruses

>1 nonillion

Swine Disease Manual (3rd edition)

- 22 viral pathogens of swine

How many more are out there?
The vast majority of viruses have little or no impact on health or well being.

Some viruses are helpful…
What is a virus?

An infectious, obligate *intracellular* parasite comprising genetic material (DNA or RNA) surrounded by a protein coat and/or an envelope derived from a host cell membrane.

©Principles of Virology, ASM Press
Relative Sizes and Detection Devices

- Human Eye
- Light Microscope
- Electron Microscope
- Apple
- Ant
- Hair
- Cell
- Bacteria
- Virus
- Small Molecule
- DNA
- Atom
- Electron Orbital
How many viral particles can fit on the head of a pin?

500 million rhinoviruses
One sneeze contains enough viral particles to infect thousands of people.
How well do you really clean your equipment?
What is a virus?

An infectious, **obligate intracellular parasite** comprising genetic material (DNA or RNA) surrounded by a protein coat and/or an envelope derived from a host cell membrane.
How are they so small

Animal Cell  Bacterium  Virus
Hijack the host cell
Are viruses alive?
What is a virus?

An infectious, obligate intracellular parasite comprising genetic material (DNA or RNA) surrounded by a protein coat and/or an envelope derived from a host cell membrane.

©Principles of Virology, ASM Press
Viral genomes are either DNA or RNA but not both.
Mutation frequency of 10,000,000 – 1,000,000,000 nucleotides
Mutation frequency of 1,000 – 100,000 nucleotides
REASSORTMENT
Viral Replication

![Diagram of viral replication process](http://askabiologist.asu.edu/)

Image from Arizona Board of Regents / ASU Ask A Biologist (http://askabiologist.asu.edu/)
Viruses replicate by assembly of pre-formed components into many particles

Make the parts, assemble the final product

Not binary fission like cells
What is a virus?

An infectious, obligate intracellular parasite comprising genetic material (DNA or RNA) surrounded by a protein coat and/or an envelope derived from a host cell membrane.
Enveloped vs. non-enveloped
Viral Replication

Host range and tissue tropism

Image from Arizona Board of Regents / ASU Ask A Biologist (http://askabiologist.asu.edu/)
What is a virus?

An infectious, obligate intracellular parasite comprising genetic material (DNA or RNA) surrounded by a protein coat and/or an envelope derived from a host cell membrane.
<table>
<thead>
<tr>
<th>Virus</th>
<th>Nucleic Acid</th>
<th>Enveloped/Non-Enveloped</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRRSV</td>
<td>RNA</td>
<td>Enveloped</td>
</tr>
<tr>
<td>IAV-S</td>
<td>RNA</td>
<td>Enveloped</td>
</tr>
<tr>
<td>SECD (PEDV, PDCoV)</td>
<td>RNA</td>
<td>Enveloped</td>
</tr>
<tr>
<td>PPV</td>
<td>DNA</td>
<td>Non-enveloped</td>
</tr>
<tr>
<td>PCV2</td>
<td>DNA</td>
<td>Non-enveloped</td>
</tr>
<tr>
<td>Rotavirus</td>
<td>RNA</td>
<td>Non-enveloped</td>
</tr>
<tr>
<td>PRV</td>
<td>DNA</td>
<td>Enveloped</td>
</tr>
<tr>
<td>CSFV</td>
<td>RNA</td>
<td>Enveloped</td>
</tr>
<tr>
<td>FMDV</td>
<td>RNA</td>
<td>Non-enveloped</td>
</tr>
</tbody>
</table>
• Obligate intracellular parasites; use host cell's replication processes to duplicate themselves.

• Virus core has RNA or DNA (never both) with protective proteins (nucleocapsid); some virus nucleocapsids are enveloped (host membranes).

• Viruses are “alive” inside cells only.
The Ohio State University

Andrew S. Bowman, MS, DVM, PhD, DACVPM
Assistant Professor

College of Veterinary Medicine
Department of Veterinary Preventive Medicine
A100B Sisson Hall, 1920 Coffey Road
Columbus, OH 43210
614-292-6923 Office
bowman.214@osu.edu
614-292-6616 Lab
go.osu.edu/vetfluresearch