Source: [KBhBIO101Viruses]

1 | Virus Infections and Lifecycle

1.1 | Viral Life Cycle, an Overview

1. **Attachment** => protein contact between virus and host
2. **Viral entry** => entering the cell
3. **Uncoating** => shedding the protein layer
4. **Biosynthesis** => make baby viruses
    1. Genome Replication: transcribe DNA/RNA
    2. Genome Expression: read DNA/RNA to make proteins
5. **Genome integration** => retrovirus only — put the viral gene into the genetic sequence of the actual cell
6. **Assembly** => put it all together
7. **Viral Exit** => mature virons leave

1.2 | Viral attachment

To be able to enter a cell, viruses have to do something to stick to it. B/c otherwise they would just be stuck in the bloodstream and be very sad.

See [KBhBIO101ViralAttachment]

1.3 | Viral Entry

In this step, the sticky virus on the surface of the cell gets into the cell. There are three different types of mechanisms by which this is achieved.

See [KBhBIO101ViralEntry]

1.3.1 | Direct Injection/insertion

- Insert genome through the bi-layer
- Leave the rest behind

1.3.2 | Endocytosis

- Trick the host cell into introducing the virus as food
- Endocytosis!
- Bam

1.3.3 | Fusion

- Virus fuse with cell membrane
- Shed the protein coat once in
- Shazam!

1.4 | Uncoating

After the virus enters the cell, the lipid/protein shell on the outside must be shred to be able to release the additional DNA inside.

To achieve this, the virus triggers *early endosome* in the cell, which…

- Causes pH dependent protein denaturation
- Causing the capsid to fall apart
- Triggering *late endosome* => releasing genome

1.5 | Viral Replication

Now, with the viruses's DNA out on full display inside the cell, how do we make another virus? There are two key questions that must be asked to answer this:

- **How are viral mRNAs produced from the viral genome?** => virus will hijack the ribosomes in the host cells. So, it is more important to ask how the mRNAs are produced to tell ribosomes what to do
- **What serves as the template for viral genome replication** => replication will need a polymeraese; but the source and mechanism is dependent on viral genome structure/composition

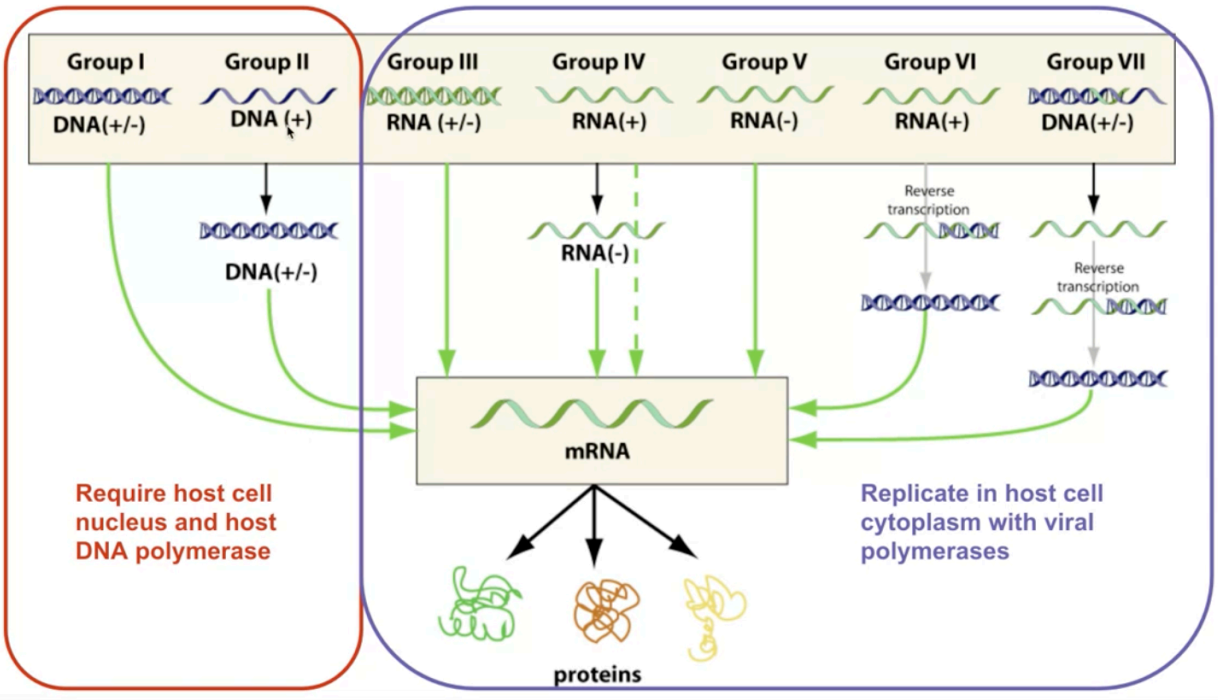

Figure 1: Screen Shot 2020-10-12 at 11.04.53 PM.png

For DNA Viruses…

How are viral mRNAs produced from the viral genome?

- Viral DNA enters, through RNA polymerase II in the host cell, mRNA is produced
- mRNAs then read by ribosomes, and there we go

What serves as the templates for viral genome replication?

- Viral DNA serves as template for host cell DNA polymerase
- Viral genome copied repeatedly
- Virus, then, **will be replicated within the nucleus** due to it needing the host polymerase to copy DNA

Except! Poxvirade viruses carry their own polymerase, so they replicate in the cytoplasm by simply entering and releasing the polymerease.

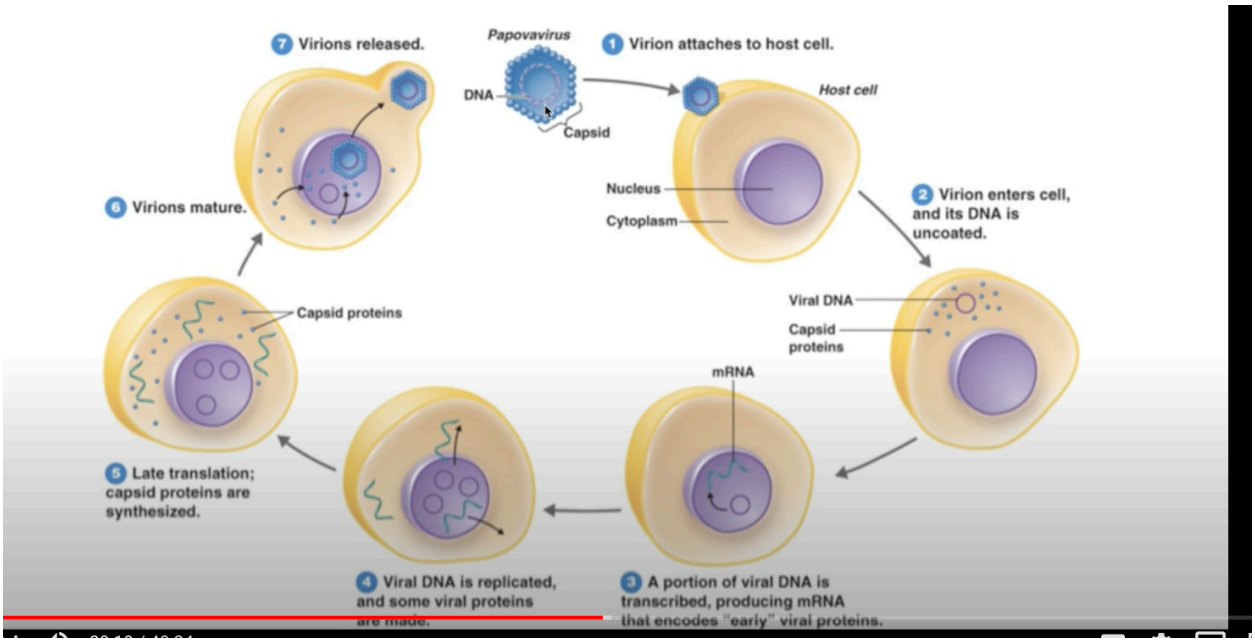

Figure 2: Screen Shot 2020-10-12 at 11.09.46 PM.png

RNA Viruses

How are viral mRNAs produced from the viral genome?

Depends on what [KBhBIO101SenseAndAntisense] the viral RNA is, there are different processes

- If the virus is carrying +SS RNA, they do not need to produce anything because that is directly translatable by the host ribosomes
- If the virus is carrying -SS RNA (which is useless by itself as it is the template RNA, making it harder to detect), they would trigger the process of RNA replication either using their own RNA-dependent RNA polymerase or using that of the host cells
- If the virus is carrying both, it will infect with both +-stranded and –stranded RNA, but the latter requires conversion

What serves as the templates for viral genome replication?

- with dsRNA; takes +ssRNA and makes -ssRMA; combining the two to produce dsRNA
- with +ssRNA, takes +ssRNA and makes temporary -ssRNA which makes more +ssRNA
- with -ssRNA, takes -ssRNA, and makes temporary +ssRNA, which makes -ssRNA

Instead of waiting for the RNA-dependent-RNA polymerase of the cell, viruses sometimes decide to just bring-your-own-polymerase to catalyze this process.

1.6 | **Packaging**

"Viral self-assembly" — make the protein, and, without ATP, just seal the newly-formed virus DNA in.

1.7 | **Viral Exit**

Lysis

Replicate so much that the membrane burst.

Budding

Trigger…

- Trigger extocytosis
- Meanwhile, send virus's own spikes to the membrane
- On exit by extocytosis, steal a part of the newly-spikey membrane with it to serve as new casing