

*Ministering to the Community in a Time of Crisis*



# Overview of a Virus

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- These PowerPoint Presentations are written and provided to prepare the Body of Christ for disasters such as the current pandemic
- These trainings are meant to enable people to safely care for themselves and minister to their neighbors
- By being properly equipped we are then able to bring the gospel of our Lord, Jesus Christ into the situation
- For more information, please visit [outrunningthehorses.com](http://outrunningthehorses.com)

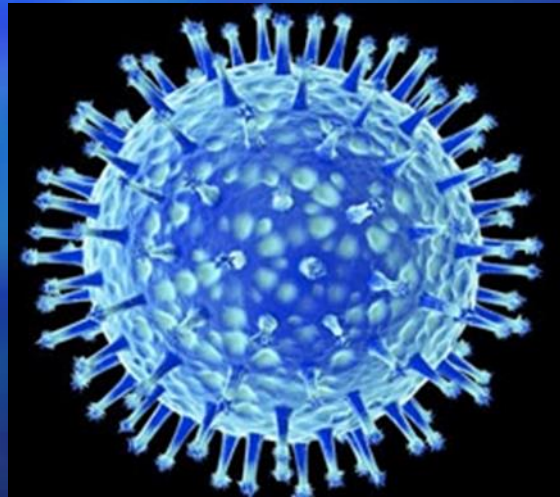
“For I was hungry,  
and you gave Me something to eat,  
I was thirsty,  
and you gave me something to drink;  
I was a stranger,  
and you invited Me in;  
naked, and you clothed Me;  
I was sick, and you visited Me...  
Truly I say to you,  
to the extent that you did it  
to one of these brothers of Mine,  
even the least of them,  
you did it to Me.”

Matthew 25:35-40

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“Viruses are not plants,  
animals, or bacteria,  
but they are  
the quintessential parasites  
of the living kingdoms”

Michael W. Davidson and The Florida State University



## Overview of a Virus

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- By understanding the structure and the means by which viruses replicate; we can better recognize and discern the pathophysiology (process of the disease) of viral infections.

# Overview of a Virus

## Objectives

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- The following topics will be discussed
  - Overview of a virus
  - Virus species
  - Virus structure
    - Virus vs. human cell
  - Virus size

# Overview of a Virus

## Objectives Continued

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- Pathophysiology of viral diseases
  - Life Cycle of a Virus
    - Entrance
    - Receptors (Adsorption)
    - Replication
    - Release
  - Cell injury and clinical illness
    - Recovery
    - Shedding

# Overview of a Virus

## Objectives Continued

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- Pathophysiology of viral diseases
  - The significance of cell receptors and their relation to various viruses
  - The lifecycle and its' consequence to clinical illness



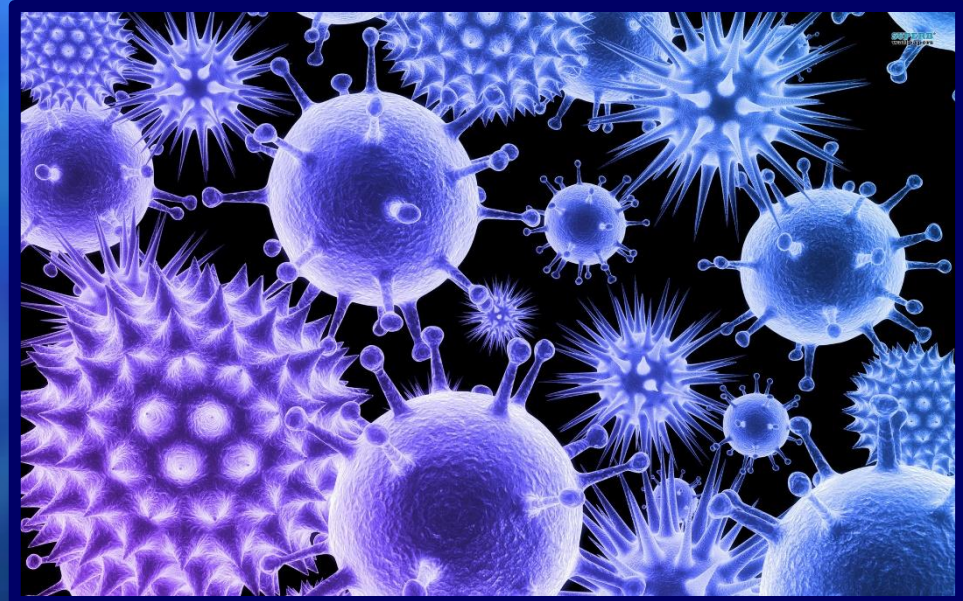
## Overview of a Virus

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- Overview of a virus
  - Have had an enormous impact on humans and other organisms
  - Very little known about them until recently
  - Unique group of infectious agents
  - Quintessential parasite

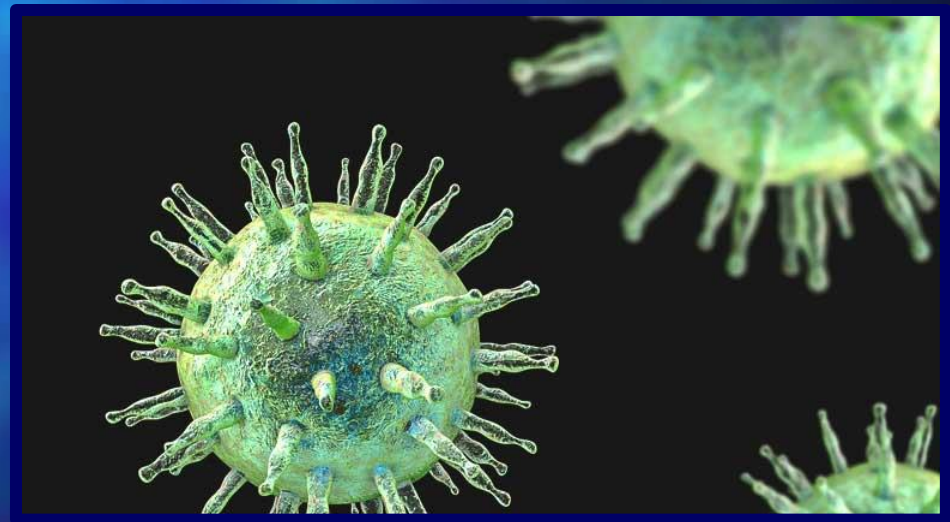
## Overview of a Virus

- The most abundant biological entities on planet Earth
  - All organisms of life are subject to viral infection
  - Among most symmetric and beautiful of biological objects



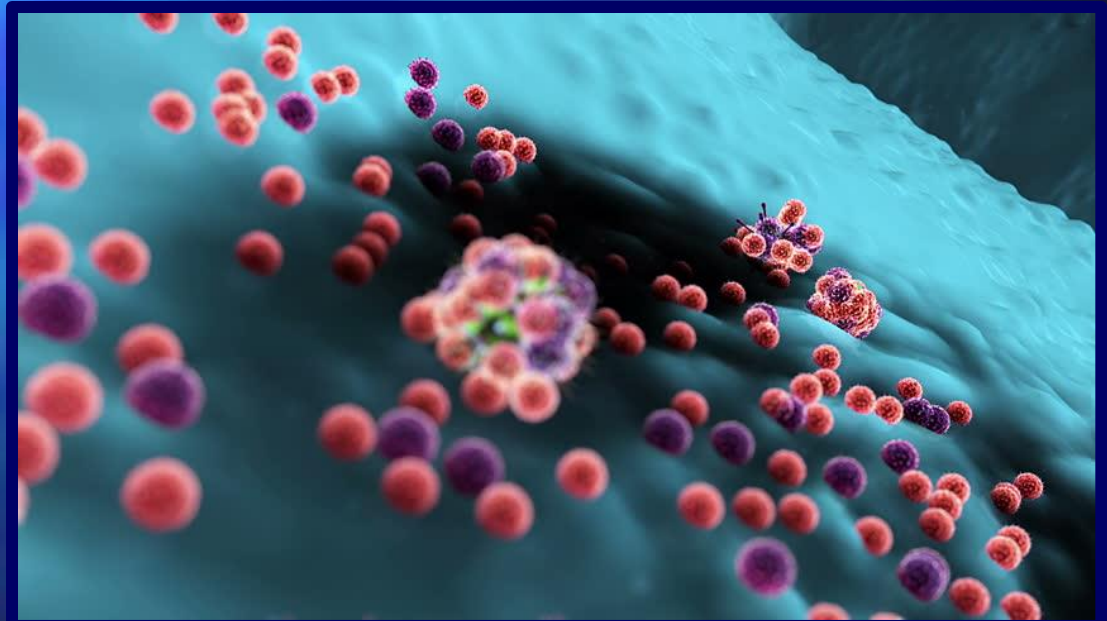
## Overview of a Virus

- Viruses not considered to be living organisms (but can kill us)
  - Do not have capability to metabolize energy for:
    - Respiration
    - Growth
    - Reproduction



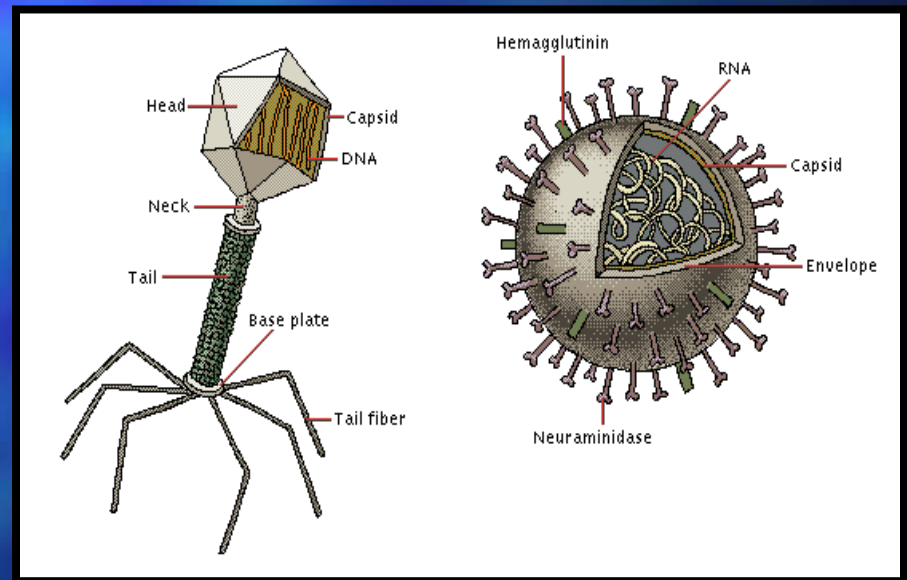
## Overview of a Virus

- Consist of one or more molecules of DNA or RNA enclosed in a capsule
- Smallest infectious organism
  - 100 times smaller than a bacteria cell
  - Millions can fit inside one human cell



# Overview of a Virus Species

- Eighteen classifications grouped by similar characteristics
  - Nucleic acid
  - Capsid symmetry
  - Presence or absence of an envelope
  - Hosts they infect
  - Diseases caused



# Overview of a Virus Species

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- Cause of at least 27 human diseases including:
  - Chickenpox
  - Influenza
  - Herpes
  - HIV/AIDS
  - Mumps, measles, rubella
  - Polio
  - Rabies
  - Hepatitis A
  - Hepatitis B
  - SARS
  - Colds

# Overview of a Virus Structure

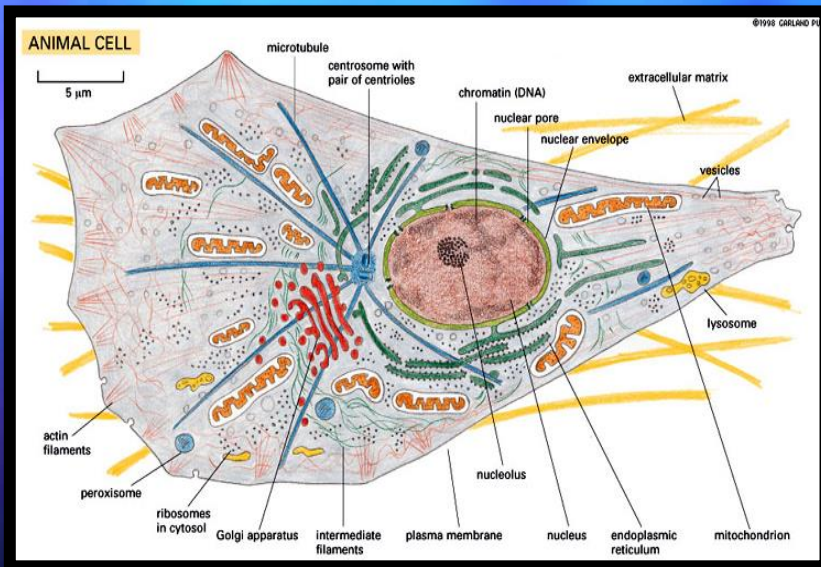
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- Different from living organisms:
  - Do not have cell membranes – have protein shells
  - Do not have organelles
  - Do not eat or burn energy
  - Do not move around on their own
  - Must invade living cells to reproduce

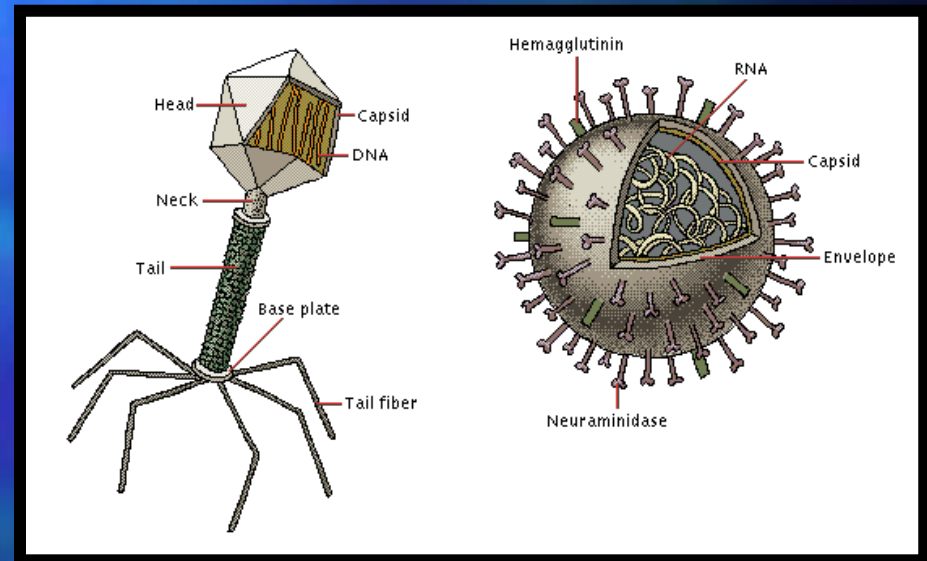
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# Overview of a Virus Structure

## Animal Cell



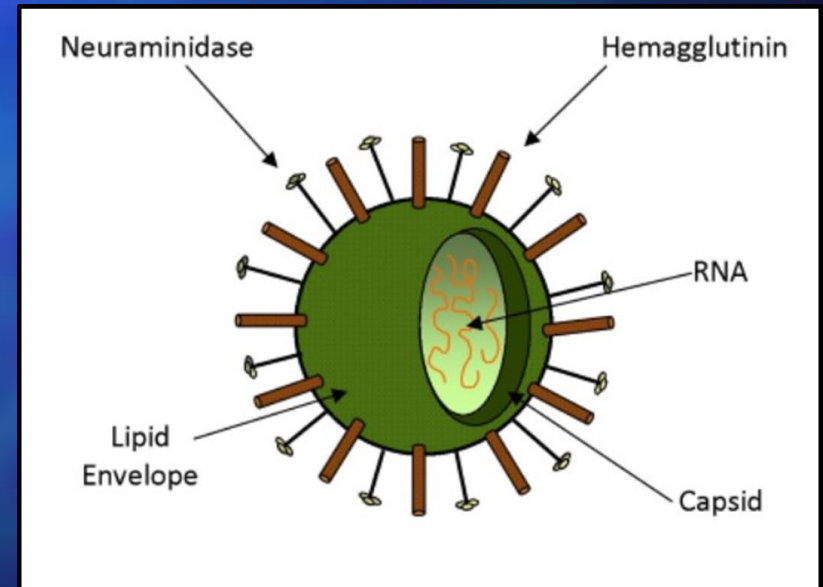
## Virus





# Overview of a Virus Structure

- A virion (virus particle) has three main parts:
  - Protein Coat (capsid) – Covering and protection of nucleic acid
  - Lipid membrane (envelope) – covers the capsid
  - Nucleic acid –core containing DNA or RNA



# Overview of a Virus Size

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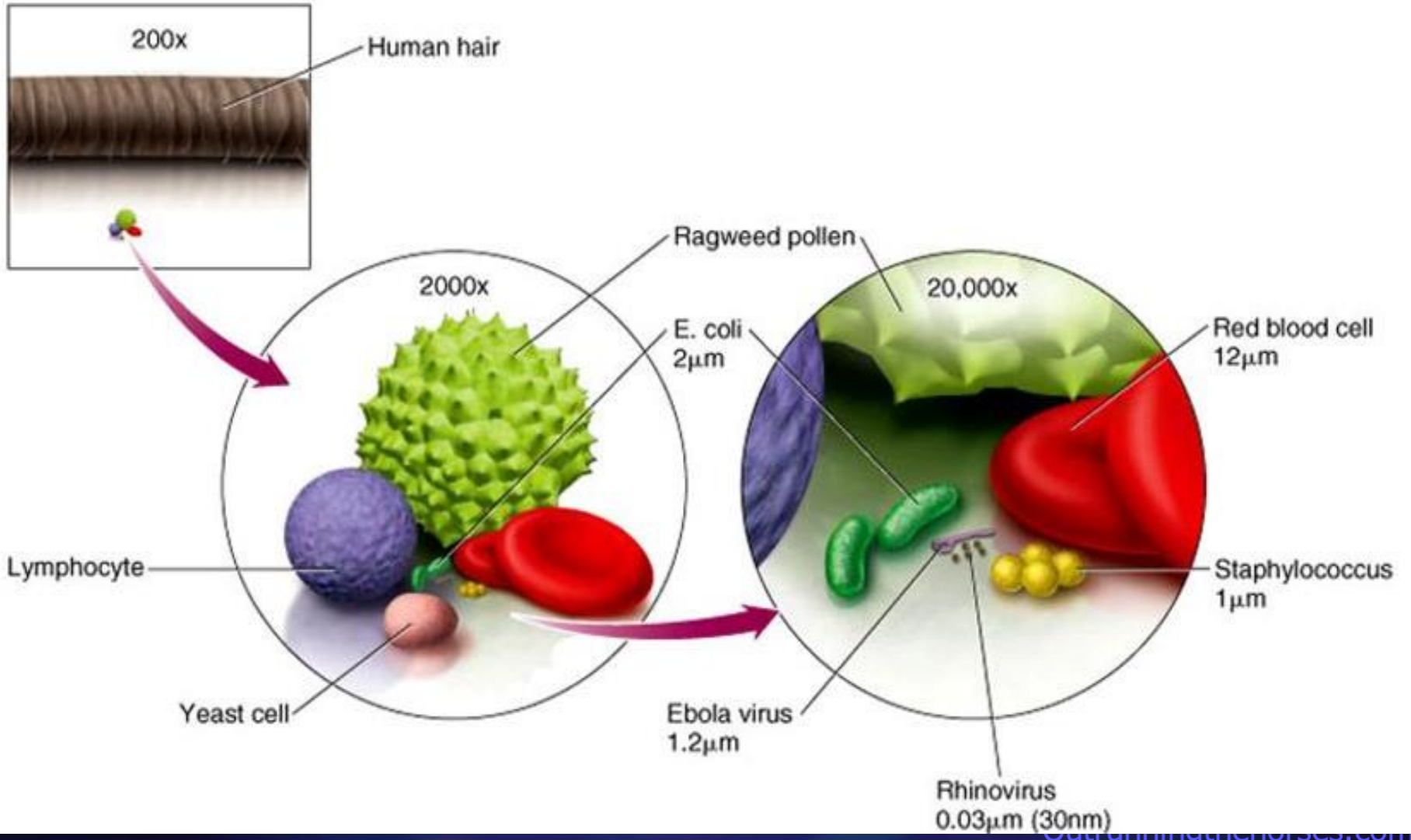
- Seen through an electron microscope
  - 100 times smaller than a single bacteria cell
  - Bacteria cell 10 times smaller than a human cell
  - Human cell is 10 times smaller than diameter of a single human hair

# Overview of a Virus Size

- If a cell were the size of a baseball stadium
  - Bacteria the size of the pitchers mound
  - Virus the size of the baseball



# Relative Sizes of Cells and Viruses



# Pathophysiology of Viral Diseases

## Life Cycle of a Virus

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- Virus' only purpose is to replicate itself
  - Only able to reproduce inside a living host cell
  - Lack needed components to reproduce on their own

# Pathophysiology of Viral Diseases

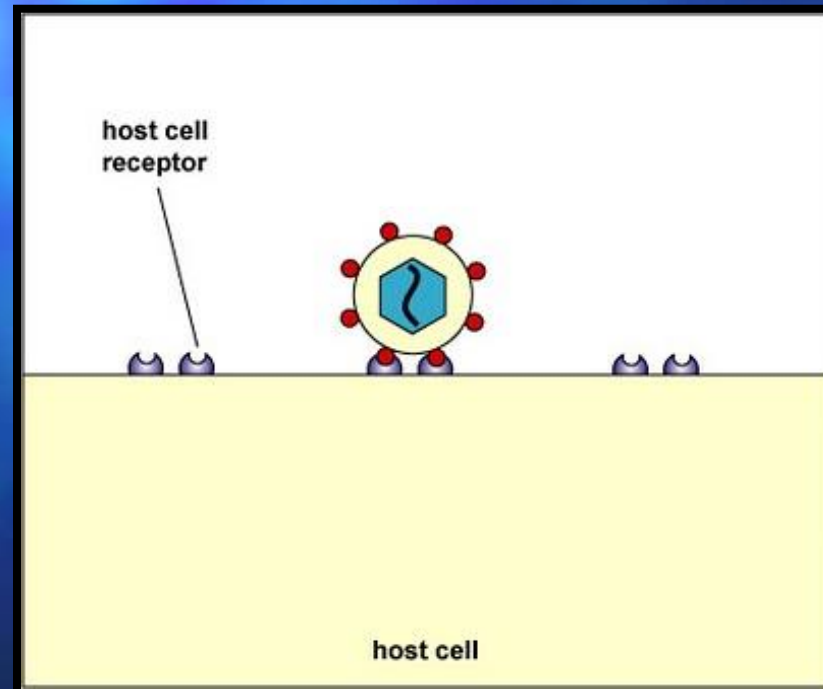
## Life Cycle - Entrance and Receptors

- Step One of Infectious Process – Entrance and attachment into susceptible host
  - May be accomplished through body surfaces
    - Skin
    - Gastrointestinal System
    - Urogenital System
    - Conjunctiva of the Eye
  - May be accomplished through other means
    - Needle stick
    - Blood transfusions
    - Organ transplants
    - Insect Vectors

# Pathophysiology of Viral Diseases

## Life Cycle - Entrance and Receptors

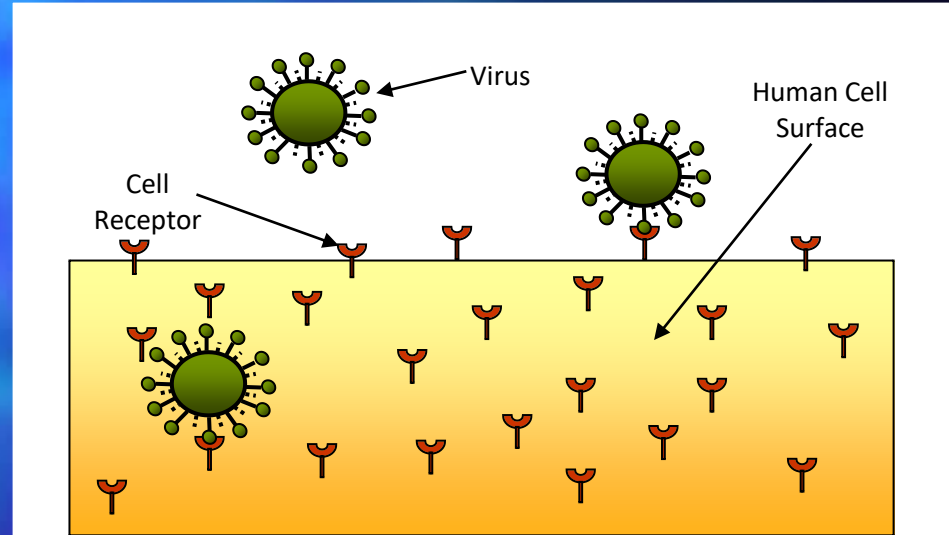
- Step Two – Adsorption (Attaching to Receptors)  
Each virus has its own specific receptor



# Pathophysiology of Viral Diseases

## Life Cycle - Entrance and Receptors

- Entrance into cells
  - Receptor can be by:
    - Cell
    - Tissue
    - Organ



- Specificity called "tropism"
  - Reflects the presence of specific cell surface receptors



# Pathophysiology of Viral Diseases

## Life Cycle - Entrance and Receptors

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- Receptor molecules on specific a host cell determine preference of a specific virus:
  - Corona/Flu viruses target respiratory receptors
  - Enteroviruses target gastrointestinal tract
  - HIV targets T-cells
  - Polio viruses target central nervous system

# Pathophysiology of Viral Diseases

## Life Cycle - Entrance and Receptors

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- Some viruses replicate at point of entry
  - Respiratory
  - Gastrointestinal
- Some viruses spread to distant sites then replicate
  - Enterovirus
  - Ebola

# Pathophysiology of Viral Diseases

## Life Cycle - Entrance and Receptors

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- Receptor molecules on specific a host cell determine preference of a specific virus:
  - Corona/Flu viruses – Respiratory receptors
  - Enteroviruses – Gastrointestinal tract
  - HIV – T-cells
  - Polio viruses – Central nervous system
  - Ebola – Lymph tissue

# Pathophysiology of Viral Diseases

## Life Cycle of a Virus - Replication

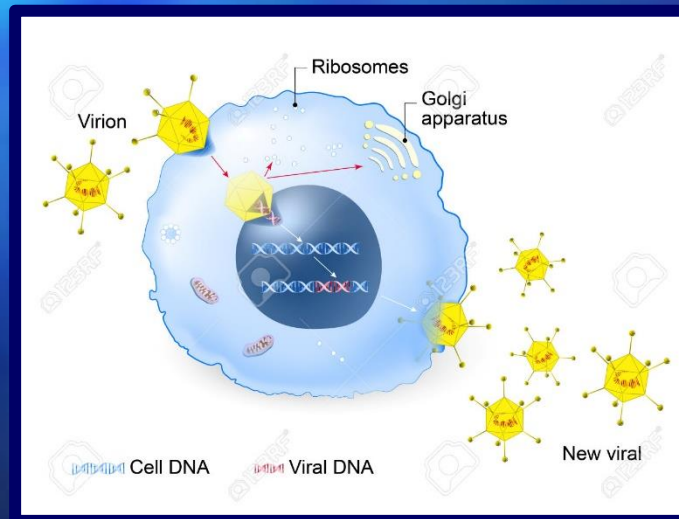
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- Step Three – Replication
- Virus' only purpose is to replicate itself
  - Only able to reproduce inside a living host cell
  - Lack needed components to reproduce on their own

# Pathophysiology of Viral Diseases

## Life Cycle of a Virus - Replication

- Virus injects its DNA or RNA into host cell
  - RNA takes over the machinery of the cell
    - Also known as Assembly
      - Makes it a little virus factory

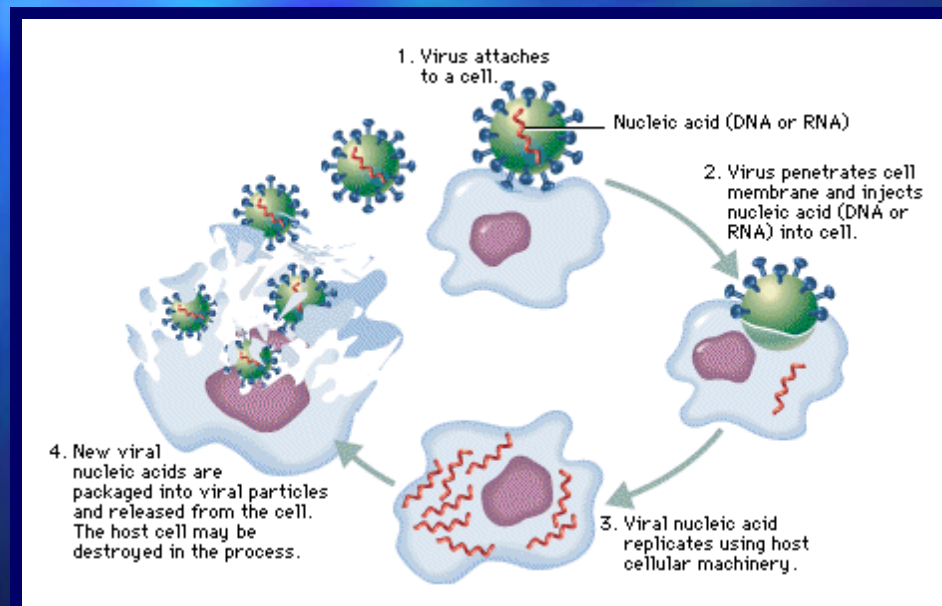


# Pathophysiology of Viral Diseases

## Life Cycle of a Virus - Release

### ■ Step Four – Release

- The host cell ruptures and dies
- New viruses released to find new host cells



# Pathophysiology of Viral Diseases

## Cell Injury and Clinical Illness

- Clinical illness due to destruction of cells in target tissues produce the following:
  - Fever
  - Headache
  - Body aches
  - Fatigue
  - Stuffy nose
  - Sneezing
  - Malaise
  - Sore throat
  - Chest congestion
  - Nausea/Vomiting
  - Diarrhea
  - Paralysis

# Pathophysiology of Viral Diseases

## Cell Injury and Clinical Illness

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- Destruction of target cells and tissues
  - Intestinal Epithelium
    - Rapidly regenerates after viral attack
    - Able to withstand extensive damage
  - Nervous System Tissue
    - Not able to regenerate
    - Never resume normal functioning



# Pathophysiology of Viral Diseases

## Recovery

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- Recovery – Immune System
  - Makes antibodies every time there is an exposure to a new antigen
  - Antibodies bind to H or N of virus
    - “Gets in the way for new virus to complete life cycle”
  - Host’s immune system eventually destroys invading virus

# Pathophysiology of Viral Diseases

## Recovery

- Immune System
  - “Red Queen” Dynamics
    - After the Red Queen in Lewis Carroll’s, *The Looking Glass*

“It takes all the running you can do, to keep in the same place.”



# Pathophysiology of Viral Diseases

## Recovery

- Recovery – Immune System
  - Will either kill or slow down the virus
    - Can make the difference between:
      - Fever and cough vs. pneumonia and death



# Pathophysiology of Viral Diseases

## Shedding

- Shedding the Virus
- Virus leaves host by way it entered
  - Sneezes
  - Coughs
  - Feces
  - Blood
  - Other body fluids



## Conclusion

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- By understanding the life-cycle of a virus, cell injury, and the effects these have on the human body, we can better comprehend the pathophysiology of viral diseases

# Overview of a Virus



# Questions?

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