



# HUMAN MICROBIOLOGY

**THE CRASH COURSE**

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**Microbiology** is the study of tiny living things called “microorganisms” that are too small for us to see without using instruments like a microscope.



There are four main subcategories of study in microbiology that pertain to human disease including but are not limited to:

**BACTERIOLOGY**

**VIROLOGY**

**PARASITOLOGY**

**MYCOLOGY**

# BACTERIOLOGY

The study of bacteria as a subcategory of microbiology that seeks to identify, classify and characterize species of bacteria

## FACTS

- Bacteria (including archaea) outnumber all other life on the planet at 5 million trillion trillion and counting.
- They are also the oldest life form; being on the planet for almost 3.5 billion years.
- Your body has 10 times more bacteria cells than its own cells!

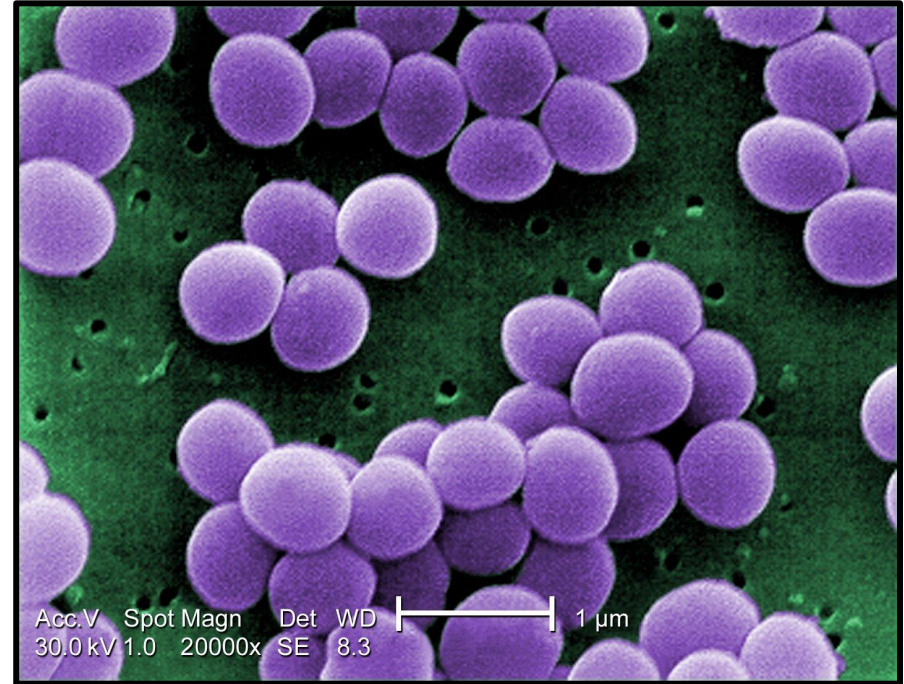


Fig 2. *Staphylococcus aureus* under scanning electron microscope

# Take a close look at your hands. Have you ever wondered how clean they actually are?



Fig 1. Hand print from an 8 year old male on a large TSA plate after being outside

It is estimated that per square centimeter, there are about 1,500 bacteria on your hands; not including the increased amount under your fingernails and between each finger.



Don't freak out just yet! This is just proof that your skin, which is your body's largest organ, is doing its job in protecting you!

# TETANUS

## THE RUSTY NAIL LEGEND

As a kid, it was well known around the neighborhood to watch out for rusty nails on the ground, in fear of stepping on them. For if you did, you may need a tetanus shot. But what does this actually mean?

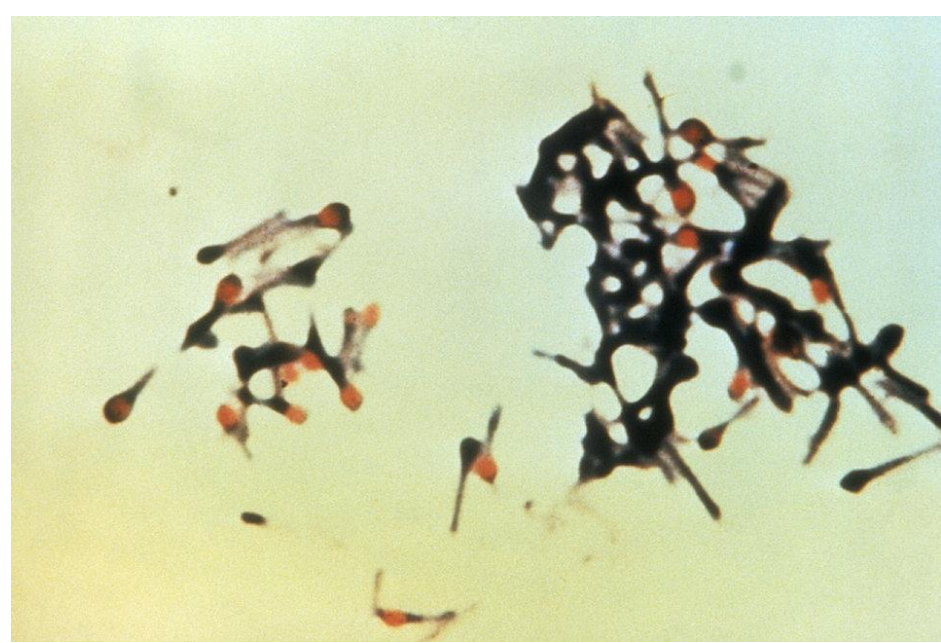


Fig 3. *Clostridium tetani* under microscope

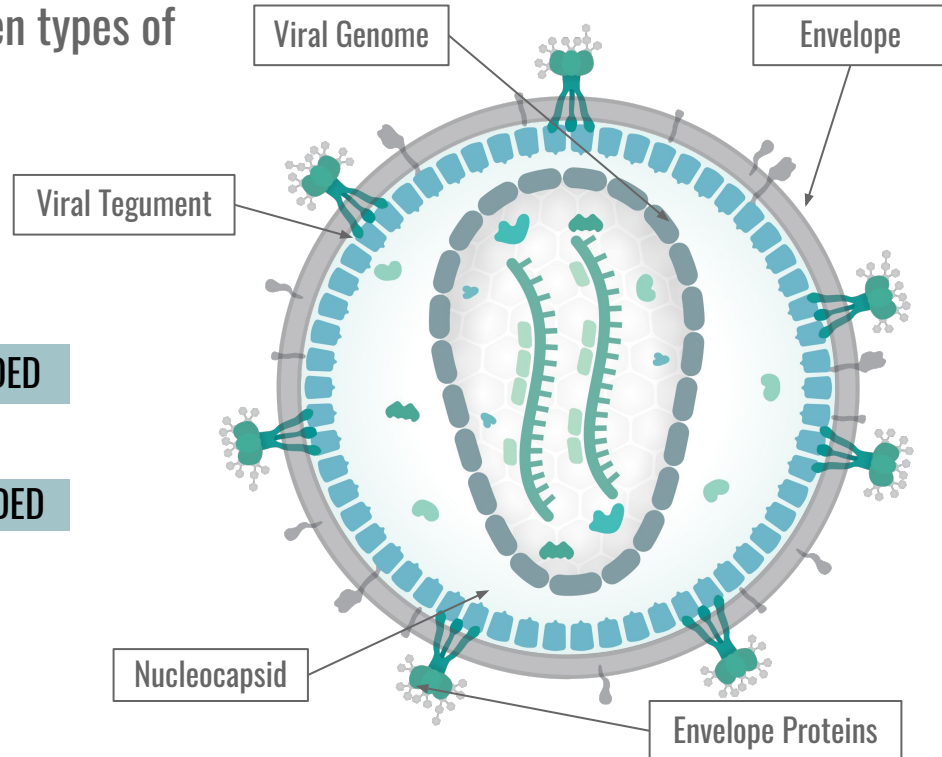
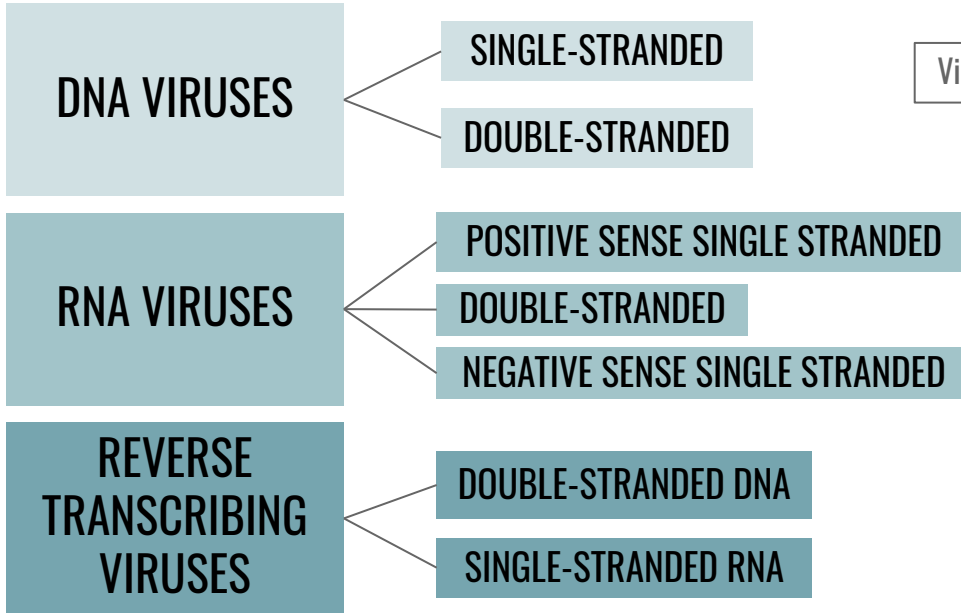
*Clostridium tetani* is the causative agent of Tetanus, a bacterial infection that causes lockjaw and intense muscle spasms across the body. Tetanus can cause death if not treated or vaccinated.

# VIROLOGY

The study of viruses and their structure, classification, identification and possible therapies for diseases they can cause.



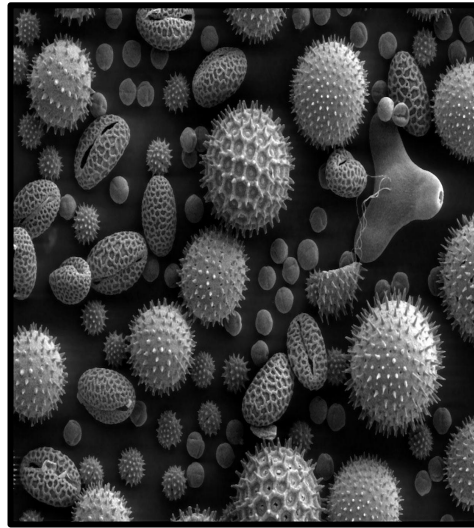
A classification system is used to distinguish between types of viruses that have been discovered.



# RHINOVIRUS

## ALIAS OF THE COMMON COLD

- “Rhinovirus (Picornaviridae)” is the given name of the virus that plagues most of us every fall.
- It is most often referred to as the back to school cold, since most kids go back to being in close quarters with each other.
- Transmission requires the exchange of respiratory droplets.
- This virus causes upper respiratory tract infections.



Washing your hands frequently while avoiding areas of high risk such as door knobs will reduce the risk of contraction.

There are  
**100**  
different  
serotypes of  
Rhinovirus!

Upper respiratory tract

Nasal cavity

Pharynx

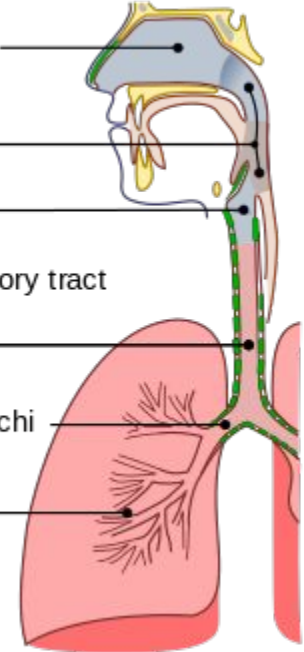
Larynx

Lower respiratory tract

Trachea

Primary bronchi

Lungs



# PARASITOLOGY

The study of parasites and the ways in which they feed off their hosts

- A parasite can be described as a pathogen that injures the host while also surviving off of them at the same time.
- Infections by parasite in humans are numbered in the billions and they can range from being relatively harmless to deadly.
- A prevalent stereotype amongst parasites is that they are only found in tropical climates and countries, which is false. There are a fair amount of parasites that plague temperate climates as well as travelers visiting subtropical climates.
- During parasitic organism development, most go through many stages of differentiation that change the structure and possibly the disease they cause to change.

There are **3** main groups of animals:

## PARASITIC PROTOZOA

UNICELLULAR

## ARTHROPODS

MULTICELLULAR

## PARASITIC HELMINTHS (WORMS)

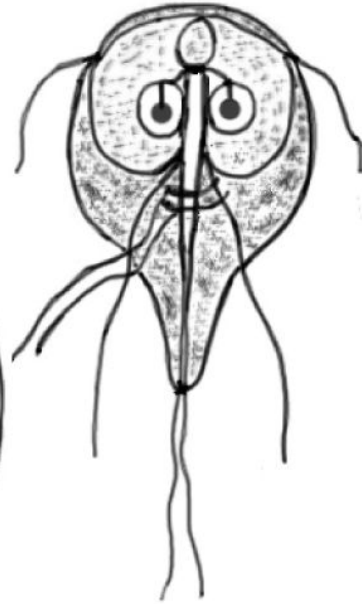
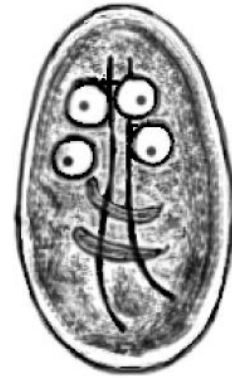
MULTICELLULAR



# GIARDIA

## OUTDOORSMANS BEST FRIEND

- Giardia Lamblia is a protozoan parasite that resides in unsafe water waiting to be ingested by unsuspecting hikers or campers.
- Giardia is the cause of “Giardiasis” which leads to foul smelling, fatty diarrhea.
- Transmission is through the fecal-oral route.
- There are two forms of the parasite, one is the cyst that is infectious and passes through stool, and the other is the trophozoite which can be found in the stool during diagnosis.



Pictured on left:  
Cyst vs. Trophozoite

Cyst

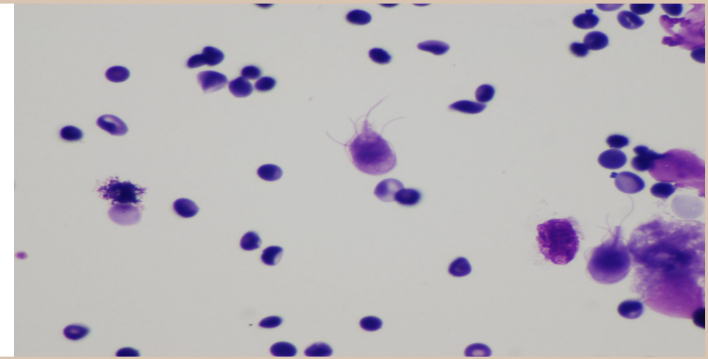
- Round/oval shape
- 4 nuclei

Trophozoite

- Pear or tear shape
- 2 nuclei on top of sucking disk
- 8 flagella
- Falling leaf motility

Pictured on right:

Giardia cysts and trophozoites visible under microscopic observation



# MYCOLOGY

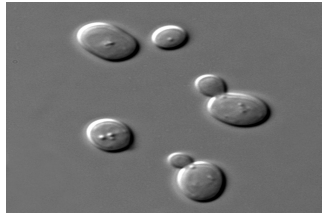
The study of fungi, including mushrooms and yeasts, and their relationship with humans and other living beings.

- **Fungi** are plant-like organisms that do not have chlorophyll.
- There are over 100,000 species of fungi.
- Without fungus, our trash would be everywhere! Fungus eats the trash and turns it into soil.
- Ringworm, which is also called Tinea, is not actually a worm at all. It is a fungus that infects the skin of humans leaving a visible ring on the skin.
- The cell wall of fungi is mainly composed of glucans and chitin.

There are **2** classic forms of fungi:

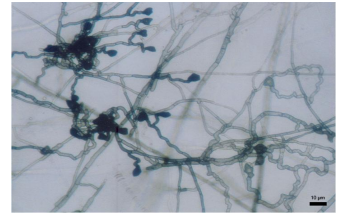
## YEAST

ROUNDED FORMS THAT REPRODUCE TO CREATE MORE ROUNDED FORMS BY FISSION OR BUDDING



## MOLD

SPORES GERMINATE TO PRODUCE FILAMENTOUS BRANCHES CALLED 'HYPHAE'



# CANDIDA ALBICANS

## THE OPPORTUNISTIC FUNGUS

- This fungus is native to the human body, but can get out of hand when it is allowed to grow without control, this is called “Candidiasis”.
- A notable trait that differentiates this fungus from others is that it is a mold form in the heat and a yeast form in the cold.
- It is an “opportunistic” fungus that overgrows when good bacteria are killed off by antibiotics or even when you use an inhaler for asthma due to the steroids in the inhalant.
- Risk factors include patients with diabetes mellitus and patients who use birth control or are on antibiotics.

**CANDIDA COLONY** with ‘filamentous’ cells growing on top and yeast-like opaque cells on bottom.



**ORAL THRUSH** is the condition of Candida overgrowth in the mouth.

Candidiasis of the esophagus, throat and mouth are uncommon in most adults, but very common in the immunocompromised and patients with HIV/AIDS, with about a third of that population having candidiasis of the mouth.

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