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## Innate defense- 2<sup>nd</sup> line of the defense

Phagocytes	Natural killer cells	Fever	Antimicrobial proteins
<ul style="list-style-type: none"> <li>□ Macrophages/Monocytes they can be fixed or can float anywhere in the body</li> <li>□ a) Neutrophils - are granular leukocytes which respond first to the microbs</li> <li>b) Eosinophils</li> <li>□ <b>How it fights:</b></li> <li>□ Engulfs the pathogens and debris</li> <li>□ 1) Chemotaxis. The phagocyte is attracted to the site of the infection by chemotactic substances originating from damaged or infected cells.</li> <li>□ 2) Adherence - Phagocyte adheres to the microbe</li> <li>□ 3) Ingestion- phagocyte extends the membrane to engulf and enclose microbe in a phagosome.</li> <li>□ 4) Digestion - newly formed phagolysosome breaks down microbe with lysozyme, digestive enzymes, and oxidants</li> <li>□ 5) Exocytosis Some microbes fight back with multiplying or remaining dormant</li> </ul>	<ul style="list-style-type: none"> <li>• Monitor tissue for abnormal or unusual shape</li> <li><b>How it fights:</b> <ul style="list-style-type: none"> <li>• Rotates the endoplasmic reticulum/Golgi towards target</li> <li>2) Releases protein perforin which puts holes in the plasma membrane of target cells</li> <li>3) Causes cell lysis</li> <li>4) Can release chemicals which can infiltrate the microbe and cause its death</li> </ul> </li> <li>• Found in : blood, spleen lymph nodes, and red bone cells.</li> </ul>	<ul style="list-style-type: none"> <li>• Chemicals from bacteria (pyrogens-pathogens, antigens, antibody complex) signal hypothalamus to raise body temperature</li> <li><b>How it fights:</b> <ul style="list-style-type: none"> <li>1) Increases metabolism, which speeds up healing</li> <li>2) Tells liver to take up iron and zinc ( inhibits growth of bacteria as they feed on those minerals)</li> </ul> </li> <li>• Fever causes viral-infection cells to produce interferons, reducing the signs of infection</li> </ul>	<ul style="list-style-type: none"> <li>• Interferons Small proteins released from virally infected cell to alert neighbouring cells that a virus is present</li> <li><b>How it fights:</b> Virus warning system</li> <li>• Complement proteins (20 plasma proteins that circulate in the blood, when activated they kill microorganisms) Proteins that put holes in phagocytes           <ul style="list-style-type: none"> <li>1) Enhance inflammation</li> <li>2) It can also flag a pathogen for the phagocytes to fight it</li> </ul> </li> <li><b>How it fights:</b> c3 protein will sit down in a bacteria and bring in other proteins to make a hole. It is alerted by           <ul style="list-style-type: none"> <li>1) Antibodies</li> <li>2) or find the pathogens on its own (cell lysis)</li> </ul> </li> </ul>

# Pharmacology

Drugs are chemicals primarily excreted in bile or urine in the form of a bile pigments or urea.

## Drug metabolism

For the drug to be absorbed better in the gut, it has to be in the lipophilic state. Lipophilic drugs filtered at the glomerulus or excreted via bile will be mostly reabsorbed and therefore will stay in the body for prolonged periods. The metabolic processes in the body, make the drugs more hydrophilic in order not to be re-absorbed during the excretory process. Drugs can be metabolized in most cells of the body, but the principal site of drug metabolism is the liver. Microsomes contain important enzymes for metabolism.

- Oxidation- enzymes modify the drug chemically by process such as oxidation (adding oxygen atoms to the molecule)
- Reduction - adding hydrogen atoms to the molecule
- Hydrolysis - adding water molecules
- Removal or addition of an active group
- Cytochrome (CYP 460) plays a key role in the metabolism of drugs.

## Metabolism Phase I

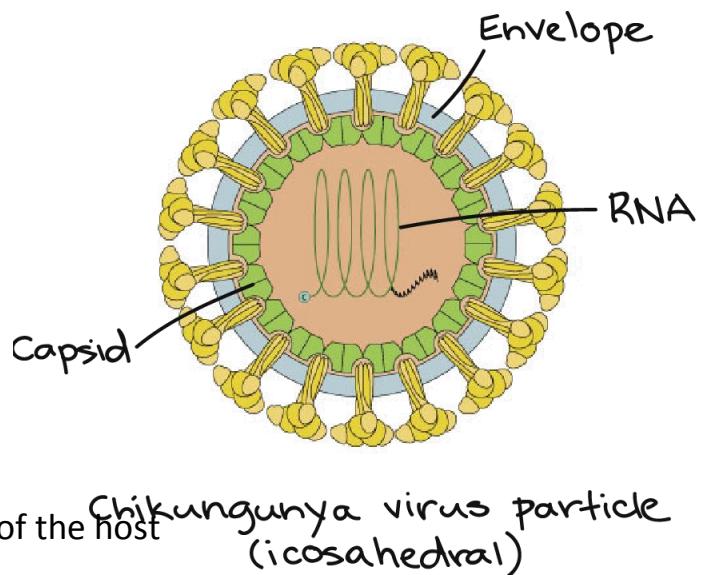
- Drug or a phase I metabolite is conjugated with a polar molecule to render the product soluble for excretion.
- Lack of conjugation of the antibiotic chloramphenicol in babies, leads to circulatory collapse and death ( grey baby syndrome)
- Some antibiotics may influence the conjugation of the drugs, (eg. hormones) leading to lower level of the hormone in the system.

## Metabolism Phase II

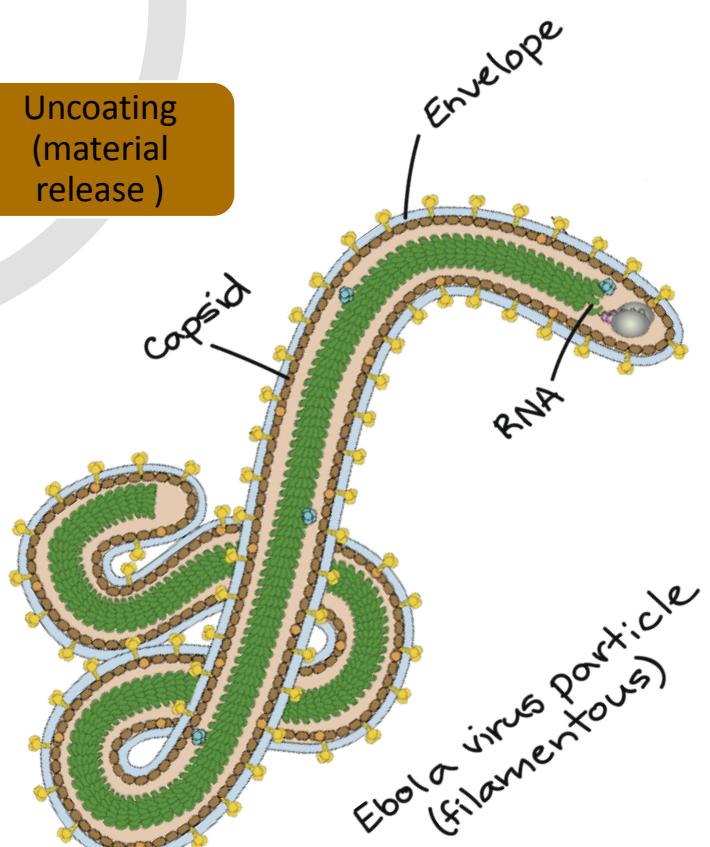
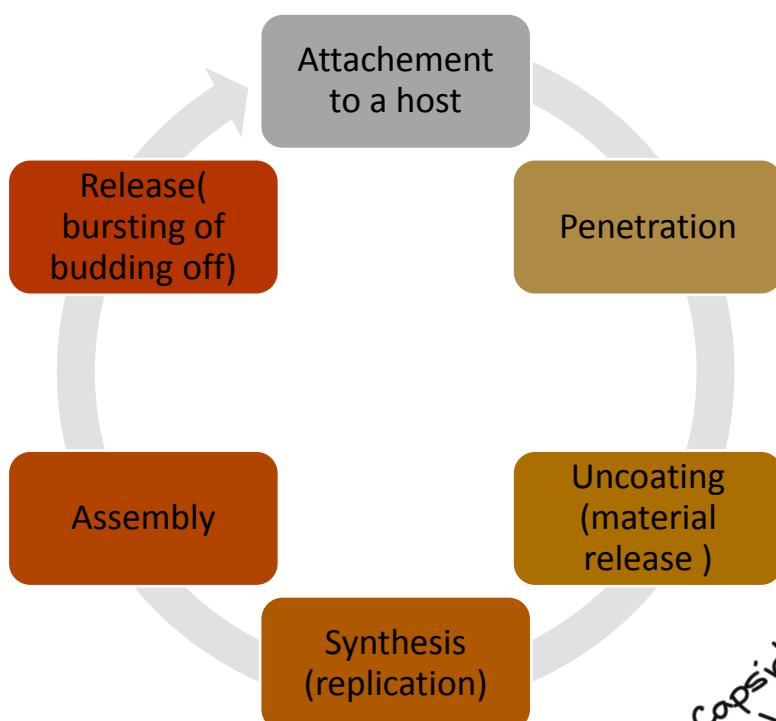
# Viruses

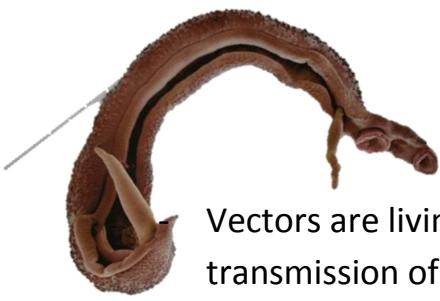
## Structure:

- Smaller than bacteria
- No nucleus
- Nuclear material- capsid
- Some have nuclear envelope
- No ribosomes or organelles
- Shape and structure may vary
- Can't reproduce or live outside of the host



## Viruses replicate through:





### Transmission by vectors



- Vectors are living agents, usually insects which are responsible for the transmission of an infectious agent.
- Mechanical transmission : Passive transport of the microorganism on the outside of the insects body
- Direct: From the source and directly to portal of entry (e.g. contaminated fly sits on a wound)
- Indirect: Insect carrying a pathogen from the source and deposits it on food which is then eaten by a susceptible person.

### Biological transmission:

- Occurs when an insect bites an infected host, and ingests some blood or body fluids containing the pathogen (e.g. malaria). Pathogen then multiplies inside the vector. When the insect bites another host, the pathogen may be present in regurgitated blood or in faeces that is deposited into the site of the bite.

Activity V: Second line of the defence. Find the components of the second line of the defence. Discuss with a friend the role. Challenge each other on how much you have retained!

Cell-based response: Interleukins released by macrophages during an infection signal the hypothalamus. The blood vessels constrict, shivering occurs, metabolism and enzyme activity are increased.

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Protein-based responses: Blood proteins with 3 main responses to an invading antigen. (1) Sticking to invading bacteria (2) stimulate the production of cells (3) destroy the membrane of invading microorganisms.

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Cell-based response: Recognises the distress signals from infected cells. Fights the invading pathogens with a perforin.

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Cell-based response: Eosinophils, neutrophils, monocytes. By the process of chemotaxis finds the pathogenic organisms and engulfs them in the process called "phagocytosis"

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Protein-based responses: A subtype of a cytokine: Triggers production of anti-viral proteins in neighbouring cells, effective over short distances and acts rapidly

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Which one of these is not one of the processes and factors of pharmacokinetics

- a) Metabolism
- b) Ingestion
- c) Absorption
- d) Excretion

Removal of the drug from the body most commonly occurs via?

- a) Kidneys or the GIT
- b) Saliva and GIT
- c) Tears and sweat
- d) Kidneys and saliva

The property of a drug which describes its therapeutic effect caused at the receptor

- a) Affinity
- b) Specificity
- c) Efficacy .
- d) Potency

The property of a drug which describes the strength of the drug required to cause an effect?

- a) Affinity
- b) Specificity
- c) Efficacy
- d) Potency

The property of a drug which describes its selectivity to receptor type?

- a) Affinity
- b) Specificity
- c) Efficacy
- d) Potency

The property of a drug which describes its extent of binding

- a) Affinity
- b) Specificity
- c) Efficacy
- d) Potency