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 **PREPARED BY**

 **WILSON FAVOUR UWEM**

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**CHAPTER 1.1**

**INTRODUCTION: (PHARMACOLOGY,BRANCHES AND ROUTES OF ADMINSTRATION)**

Pharmacology is the study of relationship between drugs and its reaction in the human body.

**Branches of pharmacology**

* Pharmacodynamics
* Pharmacokinetics
* Pharmacogenomics

PHARMACODYNAMICS

It’s the study of biochemical and physiologic effects of drugs.

PHARMACOKINETICS

It’s the study of the extent of drug absorption,distribution,metabolism, and excretion. These process determine the fate of a drug in the body.

PHARMACOGENOMICS

It’s the study of the role of the genome in drug response.It analyzes how the genetic makeup of an individual affects response to drugs.

**ROUTES OF DRUG ADMINSTRATION**

The routes of administration is determined by the properties of the drug and by the therapeutic.Major routes of drug administration include: Enteral, parental and topical.

ENTERAL

ORAL: This route provides many advantage. They are easily self administered , and toxicities and overdose of orally administered drugs may be overcome by antidotes e.g activated charcoal.It involves a wide range of preparations which may include enteric coated and extended-release preparations.

SUBLINGUAL: Placement under the tongue allows a drug to diffuse into a capillary network and enter the systemic circulation directly.It also has a lot of advantages except that this method is not for all drugs which might not be suitable for the gastrointestinal tract(GIT).

PARENTAL

This route introduces drugs directly into the systemic circulation.

Example: Intravenous

 Intramuscular

 Subcutaneous

 Intraventricular

OTHER ROUTES INCLUDE: Oral inhalation

 Transdermal

 Rectal etc.

**CHAPTER 2**

**ANTIBIOTICS**
 An antibiotic is a type of antimicrobial substance active against bacteria and is the most important type of antibacterial agent for fighting bacterial infections.

**CLASSIFICATION OF ANTIBIOTICS**

**Penicillins**: The **side effects of penicillin**are bodily responses to [penicillin](https://en.wikipedia.org/wiki/Penicillin) and closely related [antibiotics](https://en.wikipedia.org/wiki/Antibiotic) that do not relate directly to its effect on bacteria. A side effect is an effect that is not intended with normal dosaging.[[1]](https://en.wikipedia.org/wiki/Side_effects_of_penicillin#cite_note-WHO2017-1) Some of these reactions are visible and some occur in the body's organs or blood. [Penicillins](https://en.wikipedia.org/wiki/Penicillin) are a widely used group of medications that are effective for the treatment of a wide variety of [bacterial infections](https://en.wikipedia.org/wiki/Bacterial_infection) in human adults and children as well as other species. Some [side effects](https://en.wikipedia.org/wiki/Side_effects) are predictable, of which some are common but not serious, some are uncommon and serious and others are rare.[[2]](https://en.wikipedia.org/wiki/Side_effects_of_penicillin#cite_note-FOOTNOTEValerand3%E2%80%934-2) The route of administration of penicillin can have an effect on the development of side effects. An example of this is irritation and inflammation that develops at a peripheral infusion site when penicillin is administered intravenously. In addition, penicillin is available in different forms. There are different penicillin medications ([penicillin G benzathine](https://en.wikipedia.org/wiki/Penicillin_G_benzathine), [penicillin G potassium](https://en.wikipedia.org/wiki/Penicillin_G_potassium), [Penicillin G sodium](https://en.wikipedia.org/wiki/Penicillin_G_sodium), [penicillin G procaine](https://en.wikipedia.org/wiki/Penicillin_G_procaine), and [penicillin V](https://en.wikipedia.org/wiki/Penicillin_V))[[3]](https://en.wikipedia.org/wiki/Side_effects_of_penicillin#cite_note-FOOTNOTEKarch115-3) as well as a number of [β-lactam antibiotics](https://en.wikipedia.org/wiki/%CE%92-lactam_antibiotic) derived from penicillin (e.g. [amoxicillin](https://en.wikipedia.org/wiki/Amoxicillin)).

Side effects may only last for a short time and then go away. Side effects can be relieved in some cases with non pharmacological treatment.[[4]](https://en.wikipedia.org/wiki/Side_effects_of_penicillin#cite_note-mayo-4) Some side effects require treatment to correct potentially serious and sometimes fatal reactions to penicillin. Penicillin has not been found to cause birth defects

 example; phenoxymethylpenicillin, amoxicillin, flucloxacillin

**Cephalosporins**: Cephalosporins are indicated for the [prophylaxis](https://en.wikipedia.org/wiki/Prophylaxis) and treatment of infections caused by [bacteria](https://en.wikipedia.org/wiki/Bacteria) susceptible to this particular form of antibiotic. First-generation cephalosporins are active predominantly against [Gram-positive](https://en.wikipedia.org/wiki/Gram-positive) bacteria, such as [*Staphylococcus*](https://en.wikipedia.org/wiki/Staphylococcus) and [*Streptococcus*](https://en.wikipedia.org/wiki/Streptococcus).[[6]](https://en.wikipedia.org/wiki/Cephalosporin#cite_note-:0-6) They are therefore used mostly for skin and soft tissue infections and the prevention of hospital-acquired surgical infections.[[7]](https://en.wikipedia.org/wiki/Cephalosporin#cite_note-:31424895-7) Successive generations of cephalosporins have increased activity against [Gram-negative](https://en.wikipedia.org/wiki/Gram-negative) bacteria, albeit often with reduced activity against Gram-positive organisms.

The antibiotic may be used for patients who are allergic to penicillin due to the different [β-lactam antibiotic](https://en.wikipedia.org/wiki/%CE%92-lactam_antibiotic) structure. The drug is able to be excreted in the urine.[[6]](https://en.wikipedia.org/wiki/Cephalosporin#cite_note-:0-6)

## Side effects

Common [adverse drug reactions](https://en.wikipedia.org/wiki/Adverse_drug_reaction)  associated with the cephalosporin therapy include: diarrhea, nausea, rash, electrolyte disturbances, and pain and inflammation at injection site. Infrequent ADRs include vomiting, headache, dizziness, oral and vaginal [candidiasis](https://en.wikipedia.org/wiki/Candidiasis), [pseudomembranous colitis](https://en.wikipedia.org/wiki/Pseudomembranous_colitis), [superinfection](https://en.wikipedia.org/wiki/Superinfection), [eosinophilia](https://en.wikipedia.org/wiki/Eosinophilia), [nephrotoxicity](https://en.wikipedia.org/wiki/Nephrotoxicity), [neutropenia](https://en.wikipedia.org/wiki/Neutropenia), [thrombocytopenia](https://en.wikipedia.org/wiki/Thrombocytopenia), and [fever](https://en.wikipedia.org/wiki/Fever).

## Mechanism of action

Cephalosporins are [bactericidal](https://en.wikipedia.org/wiki/Bactericidal) and have the same mode of action as other β-lactam antibiotics (such as penicillins), but are less susceptible to [β-lactamases](https://en.wikipedia.org/wiki/%CE%92-lactamase). Cephalosporins disrupt the synthesis of the [peptidoglycan](https://en.wikipedia.org/wiki/Peptidoglycan) layer forming the bacterial [cell wall](https://en.wikipedia.org/wiki/Cell_wall). The peptidoglycan layer is important for cell wall structural integrity. The final transpeptidation step in the synthesis of the peptidoglycan is facilitated by [penicillin-binding proteins](https://en.wikipedia.org/wiki/Penicillin-binding_protein) (PBPs). PBPs bind to the D-Ala-D-Ala at the end of muropepti to crosslink the peptidoglycan. Beta-lactam antibiotics mimic the D-Ala-D-Ala site, thereby irreversibly inhibiting PBP crosslinking of peptidoglycan.

example; cefalor,cefadroxil, and cefalexin.

**Tetracyclines:** Tetracycline inhibits protein synthesis by blocking the attachment of charged [aminoacyl-tRNA](https://en.wikipedia.org/wiki/Aminoacyl-tRNA) to the [A site](https://en.wikipedia.org/wiki/Prokaryotic_translation) on the [ribosome](https://en.wikipedia.org/wiki/Ribosome). Tetracycline binds to the 30S and 50S subunit of microbial ribosomes.[[1]](https://en.wikipedia.org/wiki/Tetracycline#cite_note-AHFS2016-1) Thus, it prevents introduction of new amino acids to the nascent peptide chain.[[17]](https://en.wikipedia.org/wiki/Tetracycline#cite_note-17) The action is usually inhibitory and reversible upon withdrawal of the drug. [Mammalian](https://en.wikipedia.org/wiki/Mammal) cells are less vulnerable to the effect of tetracyclines, despite the fact that tetracycline binds to the small ribosomal subunit of both [prokaryotes](https://en.wikipedia.org/wiki/Prokaryotes) and [eukaryotes](https://en.wikipedia.org/wiki/Eukaryotes) . This is because bacteria actively pump tetracycline into their [cytoplasm](https://en.wikipedia.org/wiki/Cytoplasm), even against a concentration gradient, whereas mammalian cells do not. This accounts for the relatively small off-site effect of tetracycline on human cells. Common side effects include vomiting, [diarrhea](https://en.wikipedia.org/wiki/Diarrhea), rash, and loss of appetite. Other side effects include poor [tooth](https://en.wikipedia.org/wiki/Tooth) development if used by children less than eight years of age, [kidney problems](https://en.wikipedia.org/wiki/Kidney_problems), and [sunburning](https://en.wikipedia.org/wiki/Sunburn) easily. Use during [pregnancy](https://en.wikipedia.org/wiki/Pregnancy) may harm the baby. Tetracycline is in the [tetracyclines](https://en.wikipedia.org/wiki/Tetracyclines) family of medications.[]](https://en.wikipedia.org/wiki/Tetracycline#cite_note-AHFS2016-1) It works by blocking the ability of [bacteria](https://en.wikipedia.org/wiki/Bacteria) to make [proteins](https://en.wikipedia.org/wiki/Protein).[[](https://en.wikipedia.org/wiki/Tetracycline#cite_note-AHFS2016-1)

example; tetracycline,doxycycline, and lymecycline.

**Aminoglycosides**: Aminoglycosides display concentration-dependent bactericidal activity against "most gram-negative aerobic and facultative anaerobic bacilli" but not against gram-negative anaerobes and most gram-positive bacteria. They require only short contact time, and are most effective against susceptible bacterial populations that are rapidly multiplying.[[8]](https://en.wikipedia.org/wiki/Aminoglycoside#cite_note-DVM_Boothe,_DVM_2012-8) These activities are attributed to a primary mode of action as [protein synthesis inhibitors](https://en.wikipedia.org/wiki/Protein_synthesis_inhibitor), though additional mechanisms are implicated for some specific agents, and/or thorough mechanistic descriptions are as yet unavailable.

The inhibition of protein synthesis is mediated through aminoglycosides' energy-dependent, sometimes irreversible binding, to the [cytosolic](https://en.wikipedia.org/wiki/Cytosol), membrane-associated bacterial [ribosome](https://en.wikipedia.org/wiki/Ribosome) (image at right). (Aminoglycosides first cross bacterial cell walls—[lipopolysaccharide](https://en.wikipedia.org/wiki/Lipopolysaccharide) in gram-negative bacteria—and cell membranes, where they are [actively transported](https://en.wikipedia.org/wiki/Active_transport).

Aminoglycosides can exacerbate weakness in patients with [myasthenia gravis](https://en.wikipedia.org/wiki/Myasthenia_gravis), and use is therefore avoided in these patients.

Aminoglycosides are contraindicated in patients with mitochondrial diseases as they may result in impaired mtDNA translation, which can lead to irreversible hearing loss, tinnitus, cardiac toxicity, and renal toxicity.

examples; gentamicin and tobramycin

**Macrolides** : The **macrolides** are a class of [natural products](https://en.wikipedia.org/wiki/Natural_product) that consist of a large [macrocyclic](https://en.wikipedia.org/wiki/Macrocycle) [lactone](https://en.wikipedia.org/wiki/Lactone) ring to which one or more [deoxy sugars](https://en.wikipedia.org/wiki/Deoxy_sugar), usually [cladinose](https://en.wikipedia.org/wiki/Cladinose) and [desosamine](https://en.wikipedia.org/wiki/Desosamine), may be attached.

### Antibacterial

Macrolides are [protein synthesis inhibitors](https://en.wikipedia.org/wiki/Protein_synthesis_inhibitor). The [mechanism of action](https://en.wikipedia.org/wiki/Mechanism_of_action) of macrolides is [inhibition](https://en.wikipedia.org/wiki/Enzyme_inhibitor) of bacterial [protein biosynthesis](https://en.wikipedia.org/wiki/Protein_biosynthesis), and they are thought to do this by preventing [peptidyltransferase](https://en.wikipedia.org/wiki/Peptidyltransferase) from adding the growing peptide attached to [tRNA](https://en.wikipedia.org/wiki/Transfer_RNA) to the next amino aci as well as inhibiting [ribosomal translation](https://en.wikipedia.org/wiki/Prokaryotic_translation) Another potential mechanism is premature dissociation of the [peptidyl-tRNA](https://en.wikipedia.org/wiki/Peptidyl-tRNA) from the ribosome.

#### Diffuse panbronchiolitis

The macrolide antibiotics erythromycin, clarithromycin, and roxithromycin have proven to be an effective long-term treatment for the [idiopathic](https://en.wikipedia.org/wiki/Idiopathic), Asian-prevalent lung disease [diffuse panbronchiolitis](https://en.wikipedia.org/wiki/Diffuse_panbronchiolitis) (DPB). The successful results of macrolides in DPB stems from controlling symptoms through [immunomodulation](https://en.wikipedia.org/wiki/Immunotherapy) (adjusting the immune response), with the added benefit of [low-dose](https://en.wikipedia.org/wiki/Dosing) requirements

Macrolides, mainly erythromycin and clarithromycin, also have a class effect of [QT prolongation](https://en.wikipedia.org/wiki/QT_prolongation), which can lead to [torsades de pointes](https://en.wikipedia.org/wiki/Torsades_de_pointes). Macrolides exhibit [enterohepatic recycling](https://en.wikipedia.org/wiki/Enterohepatic_recycling); that is, the drug is absorbed in the gut and sent to the liver, only to be excreted into the [duodenum](https://en.wikipedia.org/wiki/Duodenum) in bile from the liver.

 examples; erythromycin,azithromycin and clarithomycin.

**Sulfonamides** : **Sulfonamide** is a [functional group](https://en.wikipedia.org/wiki/Functional_group) (a part of a [molecule](https://en.wikipedia.org/wiki/Molecule)) that is the basis of several groups of [drugs](https://en.wikipedia.org/wiki/Medication), which are called **sulphonamides**, **sulfa drugs** or **sulpha drugs**.

In bacteria, antibacterial sulfonamides act as [competitive inhibitors](https://en.wikipedia.org/wiki/Competitive_inhibitor) of the enzyme [dihydropteroate synthase (DHPS)](https://en.wikipedia.org/wiki/Dihydropteroate_synthase), an enzyme involved in [folate synthesis](https://en.wikipedia.org/wiki/Folate_synthesis). Sulfonamides are therefore bacteriostatic and inhibit growth and multiplication of bacteria, but do not kill them. Humans, in contrast to bacteria, acquire [folate](https://en.wikipedia.org/wiki/Folate) (vitamin B9) through the diet.

Sulfonamides have the potential to cause a variety of untoward reactions, including urinary tract disorders, haemopoietic disorders, [porphyria](https://en.wikipedia.org/wiki/Porphyria) and hypersensitivity reactions. When used in large doses, they may cause a strong allergic reaction. The most serious of these are classified as [severe cutaneous adverse reactions](https://en.wikipedia.org/wiki/Severe_cutaneous_adverse_reactions)

 examples; cotrimoxazole.

**CHAPTER 3**

**PRATICAL ASPECT[MAKING OF SIMPLE CYRUP**

**\**DEFINITION OF SIMPLE CYRUP: Simple cyrup is a mixture used for mixing medication for a particular age of group at their suitable doses.

**PROCESS OF MAKING SIMPLE CYRUP**

MATERIALS

850g of sugar

100mg of water

Tripod stand

Measuring scale

Distilled water( its water that has been boiled into vapour and condensed back into liquid. It is also called a purified water.)

Face mask

Hand gloves

Lab coat

Nurse cap

Hot plate

Measuring cylinder

Spoon

Colouring

First of all make sure all equipment are rinsed,such as the bowl,pot,measuring cylinder,spoon,etc.

After this measure 850g of sugar with the scale and put into the pot and mixed with distilled water then put on the electric cooker to boil gradually while this is happening its expected to stir the mixture once in every 5minutes to avoid the sugar to settle at the bottom of the pot.The mixed sugar and distilled water should be mixed until it becomes translucent.

Then it should be placed on a tripod stand to cool, then 5drops of colouring is put into the mixture to give it an attractive look