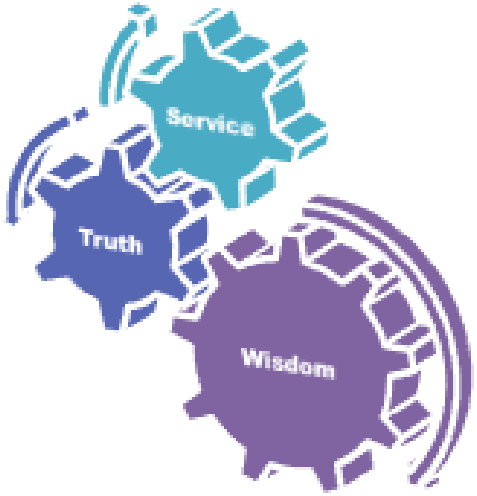
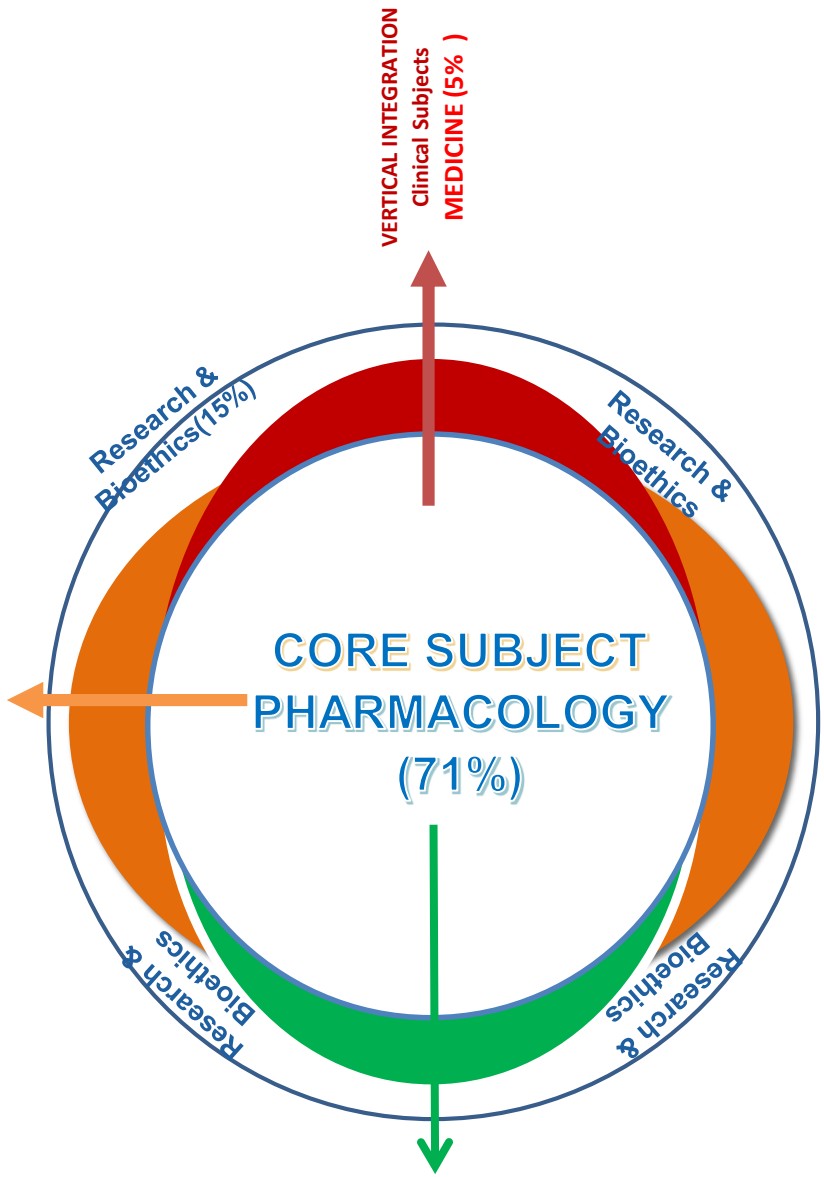

بسم الله الرحمن الرحيم

MOTTO AND VISION



- To impart evidence based research oriented medical education
- To provide best possible patient care
- To inculcate the values of mutual respect and ethical practice of medicine

Prof. Umar's Clinically Oriented Integration Model
For Basic Sciences Interactive Lectures



3rd Year Pharmacology LGIS (22 slides)
Core Subject –pharmacology – 16 slides (71%)
Spiral Integration physiology – 1 slides (5%)
horizontal Integration – pathology 1 slides (5 %)
Vertical Integration – medicine/surgery 1 slide (5%)
Research & Bioethics , AI - 3 slides (–14 %)

PENICILLINS

Dr Uzma Umar

SOURCE:

- **Bertram G. Katzung Basic & Clinical Pharmacology 15th Edition**
- **Google for images & research article**

spiral

CHEMISTRY

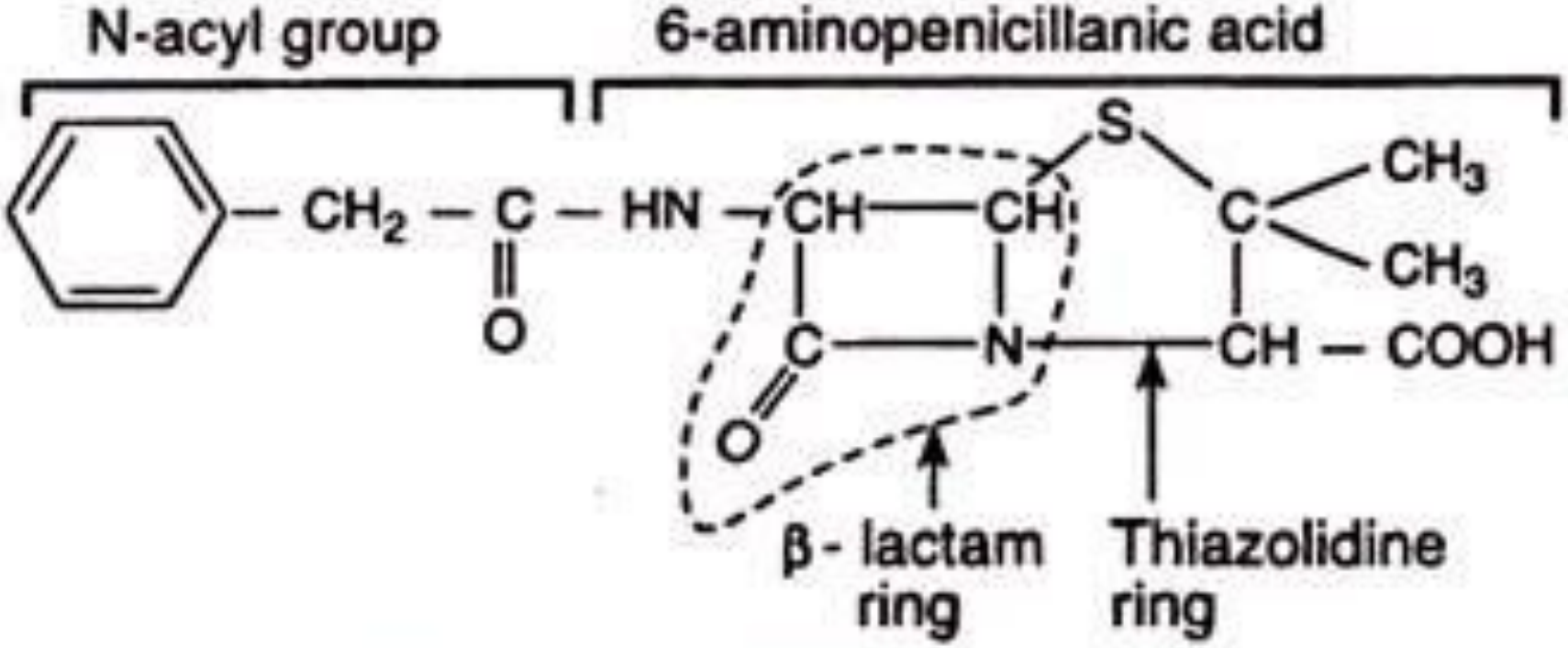


FIG. 45.6. Basic structure of penicillins.

horizontal

Spectrum Of Activity (Penicillin G)

- **Gram +ive cocci**

  Streptococci, staphylococci, pneumococci

- **Gram -ive cocci**

  gonococci, meningococci

- **Gram +ive bacilli**

  Bacilllus anthracis, corynebacterium diptheria , clostridium

- **Spirochetes**

  Treponema pallidum

core

CLASSIFICATION

I) NATURAL PENICILLINS AND RELATED COMPOUNDS

- Benzyl penicillin (penicillin G)
- Phenoxymethyl penicillin (penicillin V)
- Benzathine penicillin
- Procaine penicillin

II) SEMISYNTHETIC (Antistaphylococcal)

(against beta lactamase producing staphylococci)

- Methicillin
- Oxacillin
- Cloxacillin
- naficillin
- Dicloxacillin

III) EXTENDED SPECTRUM

i. **AMINOPENICILLIN (against E.Coli & H.Influenza)**

   Amoxicillin(alone or with clavulinic aci)

   Ampicillin (alone or with sulbactum)

ii. **CARBOXY PENICILLIN (against Pseudomonas, enterobacter ,proteus etc)**

   Carbenicillin

   ticarcillin

iii. **UREIDO PENICILLIN (against Pseudomonas, Klebsiella &other gram negative)**

   Azlocillin

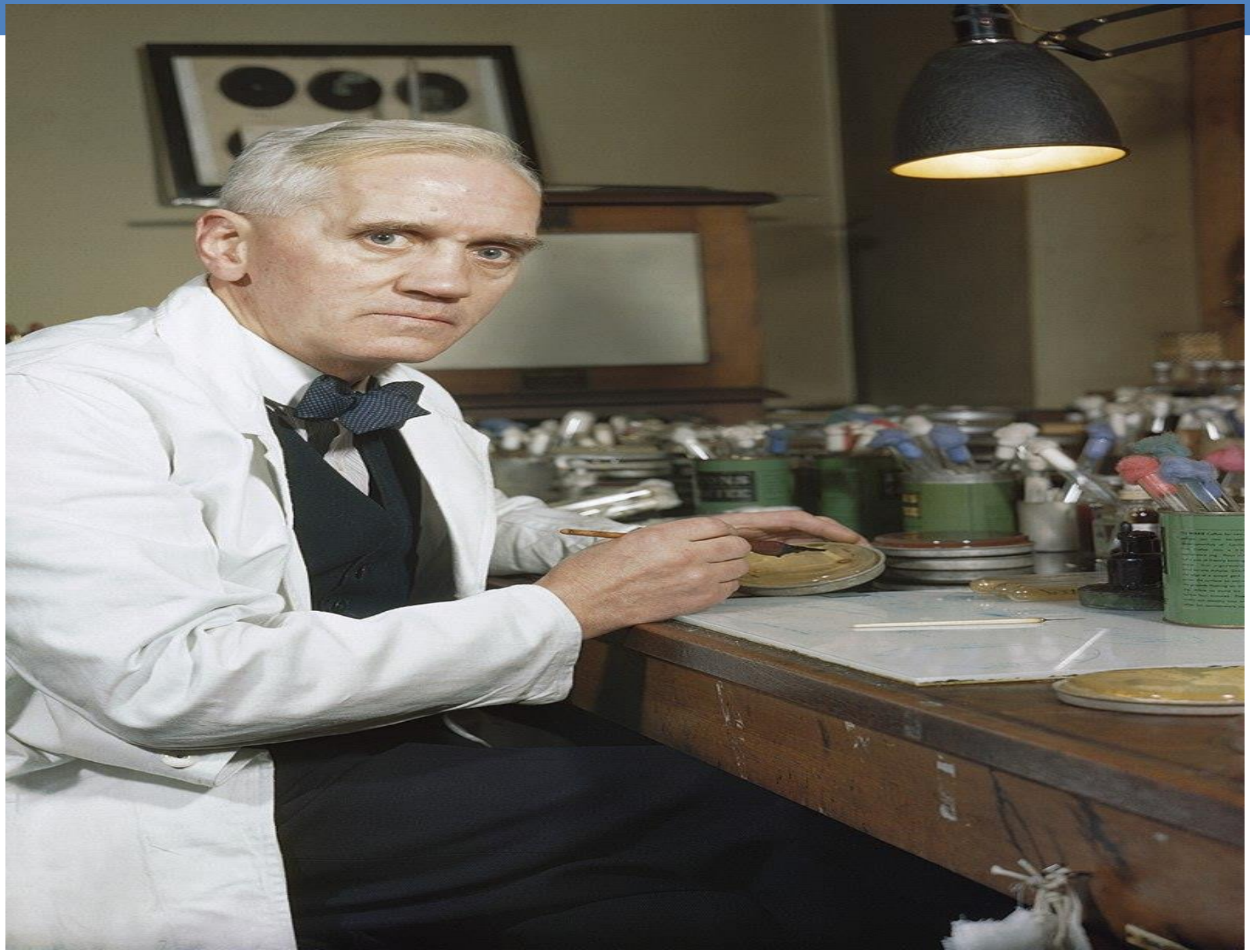
   Mezlocillin

   Piperacillin (alone or with tazobactum)

MECHANISM OF ACTION

- Bactericidal
- Cell wall synthesis inhibitor
- Cell burst

MECHANISM OF RESISTANCE



core

PENICILLIN G

core

PHARMACOKINETICS

- **Route Of Administration:**
  - Parentral
  - I/V prefferred over I/M
- **Plasma Protein Binding:**
  - less
- **Distribution:**
  - Widely distributed
- **T1/2:**
  - 30 min
  - 10 hrs in renal failure
- **Excretion:**
  - Readily excreted by kidneys

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CLINICAL USES

streptococcal infections

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CLINICAL USES

Staphylococcal infections

Pneumococcal pneumonia

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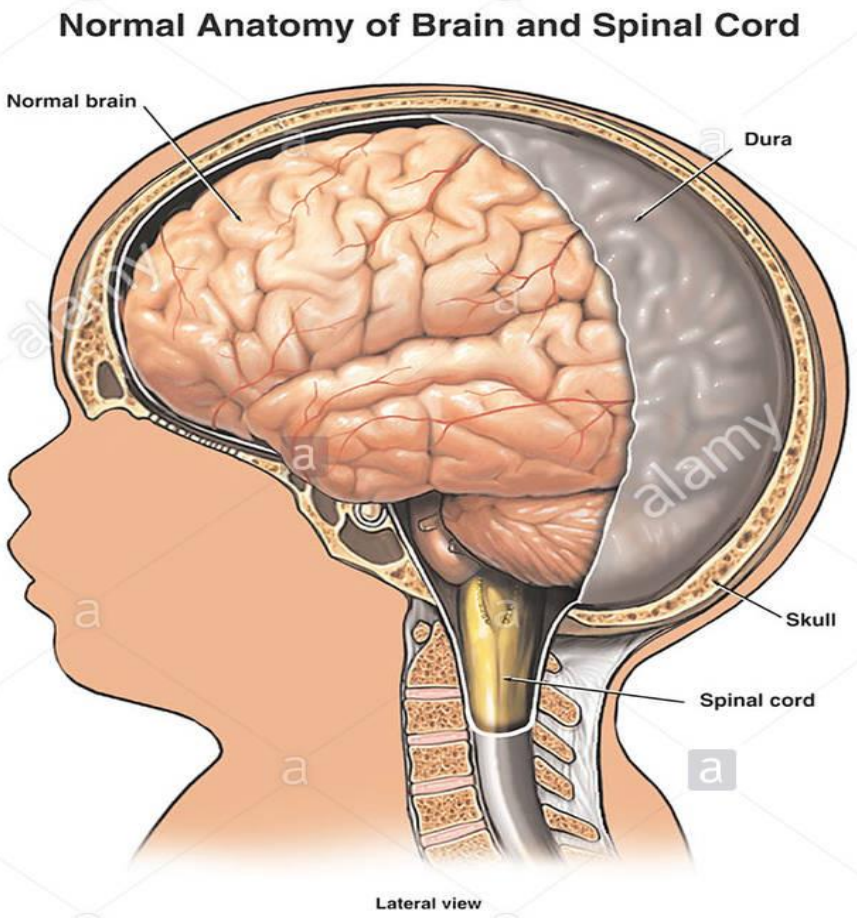
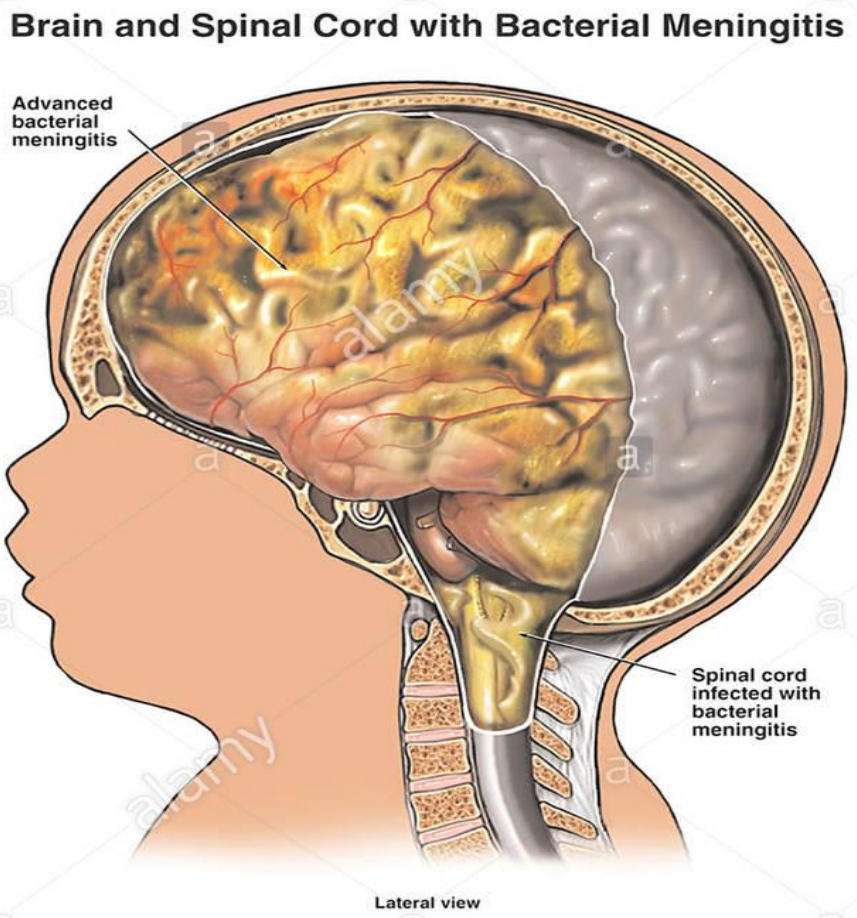
CLINICAL USES

Meningococcal and pneumococcal meningitis





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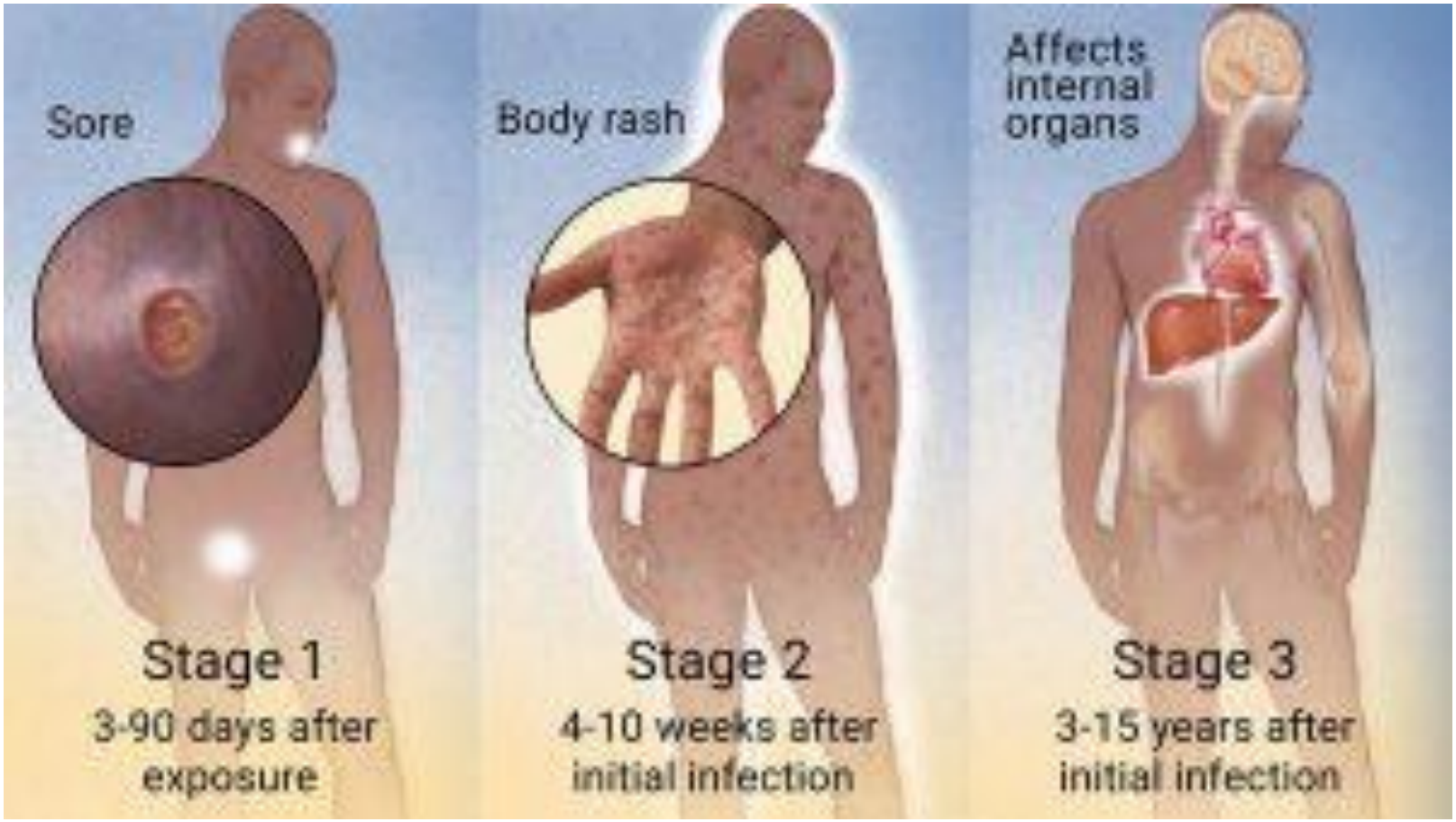
Syphilis



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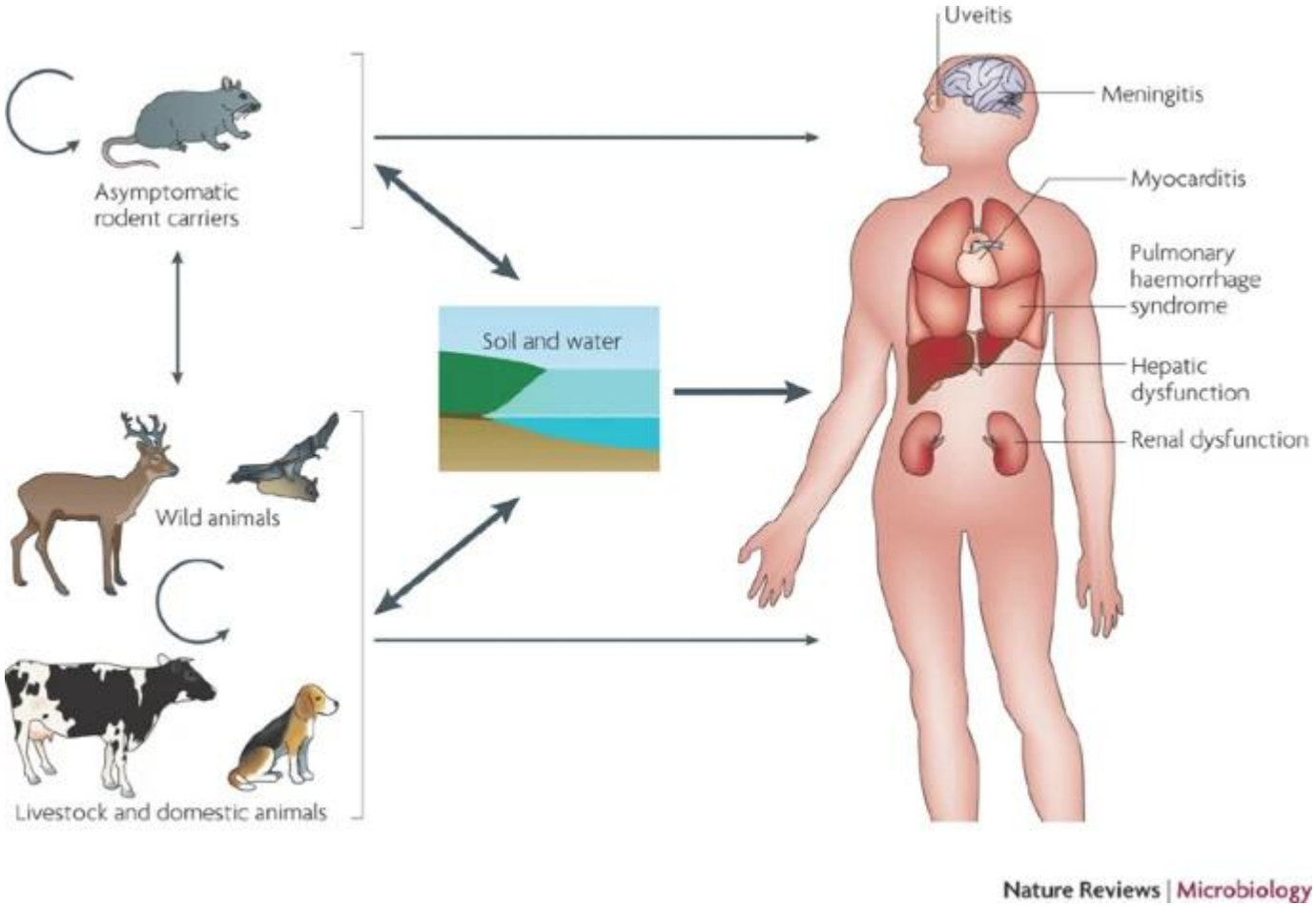
leptospirosis



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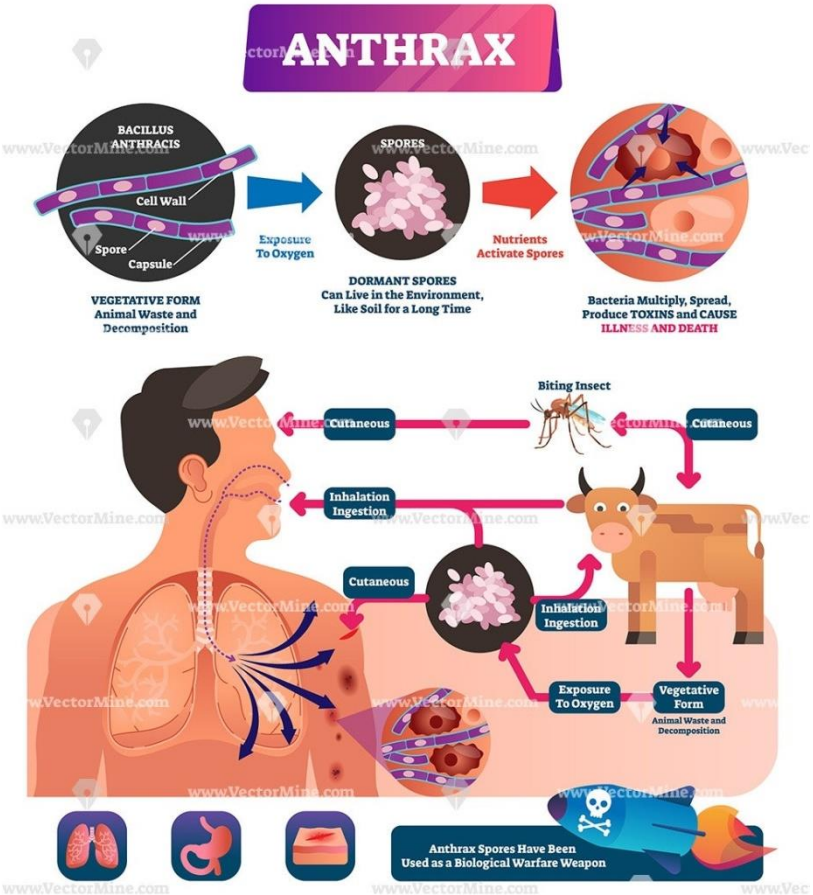
ANTHRAX
BACILLUS ANTHRACIS
Cell Wall
Spore
Capsule
VEGETATIVE FORM
Animal Waste and Decomposition
Exposure To Oxygen
SPORES
DORMANT SPORES
Can Live in the Environment, Like Soil for a Long Time
Nutrients Activate Spores
Bacteria Multiply, Spread, Produce TOXINS and CAUSE ILLNESS AND DEATH
Biting Insect
Cutaneous
Cutaneous
Inhalation Ingestion
Cutaneous
Inhalation Ingestion
Exposure To Oxygen
Vegetative Form
Animal Waste and Decomposition
Anthrax Spores Have Been Used as a Biological Warfare Weapon

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Other Penicillin

core

Pharmacokinetics

- **Route of administration**
  - **Natural penicillins**
    - Penicillin V ----- oral
    - Benzathine and procaine penicillin -----I/M
  - **Antistaphylococcal /semisynthetic penicillin**
    - Naficillin,oxacillin------I/V
    - Cloxacillin ,dicloxacillin------P/O
  - **Extended spectrum**
    - Aminopenicillin------P/O
    - Ticarcillin , piperacillin-----I/V
- **Plasma protein binding**
  - Highly protein bound------naficillin
  - Low protein binding-------amoxicillin , penicillin G
- **Distribution**
  - Widely distributed
- **Excretion**
  - Naficillin-----biliary excretion
  - Ampicillin and other extended spectrum-----excreted slowly by kidneys as compared to penicillin G

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CLINICAL USES

Other natural penicillins

- Penicillin V------only minor actions as it has poor bioavailability
- Benzathine penicillin
  - single I/M injection of 1.2 million units ------beta hemolytic streptococcal pharyngitis

    (Once every 3-4 wk prevents reinfection)
  - I/M inj of 2.4 million units -------Once a week for 1-3 wks -------syphilis

Antistaphylococcal penicillins

- beta lactamase producing staphylococci
- Mild to moderate localized staphylococcal infection - ---oxacillin , cloxacillin, dicloxacillin---p/o route
- Serious staphylococcal infection----oxacillin, naficillin---parentral route

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CLINICAL USES

Extended spectrum penicillins

- **Aminopenicillins:**
  - Sinusitis , otitis and lower respiratory tract infections (oral use)
  - Shigellosis---ampicillin
  - i/v use ----serious infections caused by anaerobes ,enterococci ,listeria ,beta lactamase –ive gram negative cocci and bacilli e.g E.Coli
- **Carboxypenicillin:**
  - UTI
- **Ureidopenicillin**
  - Pseudomonal infections----in combination with aminoglycosides or fluorouinolones

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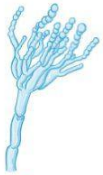
ADVERSE REACTIONS

- Allergic reactions
  - Anaphylactic shock
  - Serum sickness reactions
  - Skin rashes
  - Interstitial nephritis (autoimmune reaction to penicillin protein complex)
  - Eosinophilia, hemolytic anaemia, vasculitis
- Seizures---in pts with renal failure---in high doses
- GI upset--- nausea , vomitting , diarrhea ---oral penicillin
- Pseudomembranous colitis----ampicillin
- Secondary infections eg vaginal candidiasis
- Neutropenia---naficillin
- Hepatitis---oxacillin
- Interstitial nephritis----methicillin

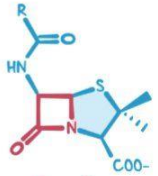
Vertical

PENICILLINS

BETA-LACTAM ANTIBIOTICS

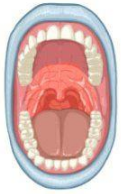


Penicillium mold

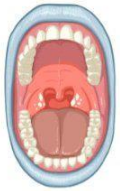


beta-lactam ring

USED to TREAT:

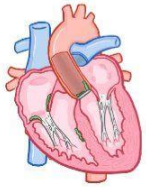


PHARYNGITIS



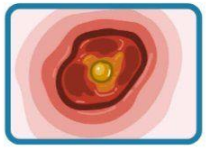
TONSILLITIS

SCARLET FEVER



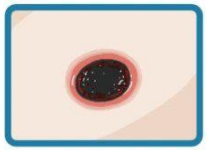
ENDOCARDITIS

PNEUMOCOCCAL INFECTIONS



STAPHYLOCOCCAL INFECTIONS

DIPHTHERIA



ANTHRAX

SYPHILIS

Further reading

Research and bioethics

- *Darby EM, Trampari E, Siasat P, Gaya MS, Alav I, Webber MA, Blair JM. Molecular mechanisms of antibiotic resistance revisited. Nature Reviews Microbiology. 2023 May;21(5):280-95.*
- Ethically speaking, the overuse of antibiotics is one of the major factors driving the current increase in antimicrobial resistance (AMR), with such overuse threatening not only the health of individuals, but also the financial wellbeing of national healthcare systems.

Further reading

Artificial Intelligence

- AI can analyze genomic data to detect resistance markers early on, enabling early interventions.
- In addition, AI-powered decision support systems can optimize antibiotic use by recommending the most effective treatments based on patient data and local resistance patterns

Further reading

Family medicine

- Doctors should play their role by educating patients about antimicrobial resistance, and improving prescription practices to save antibiotics for the future generations
- Prescribing antibiotics to patients represents an ethical dilemma for physicians since the current health needs of the patients have to be balanced with concerns for long term containment of antimicrobial resistance in the community. Overuse of antibiotics is a major pathway for development of antimicrobial resistance.