*Adansonian classification :-
-The major groups are distinguished by: cell shape, Gram-stain reaction and spore formation.
-Genera and species are distinguished by: fermentation reaction, pathogenicity and nutritional requirements.

*Microorganisms can be examined microscopically by :-
a- Bacterial motility: Hanging drop method
b- Morphology and staining reactions of bacteria:
-Simple stain: methylene blue stain.
-Gram stain:
- Primary stain (crystal violet)
- Mordant (Grams iodine mixture)
- Decolorization (ethyl alcohol)
- Secondary stain (Saffranin)
-Ziehl-Neelsen stain:
• Staining acid fast bacilli
• Decolorization (H_2SO_4 20% & ethyl alcohol)
• Counter stain (methylene blue)

*Types of culture media :-
a- Liquid media:
- Nutrient broth: meat extract & peptone
- Peptone water for preparation sugar media
- Growth of bacteria detected by turbidity
b- Solid media:
- Colonial appearance
- Hemolytic activity
  → No (gamma) hemolysis: Enterococci
  → Partial (alpha) hemolysis: Streptococcus viridans & pnemococci
  → Complete (beta) hemolysis: Staphylococcus aureus & Streptococcus pyogenes
- Pegment production

*Types of solid media :-
1- Simple media: Nutrient agar
2- Enriched media (high nutritive value): Blood agar & chocolate agar
3- Selective media:
Lowenstein-Jensen medium
MacConkey's agar
Mannitol salt agar
4- Indicator media (lact. or non-lact. ferment):
MacConkey's medium
Eosin Methylene blue agar
5- Anaerobic media:
Deep agar
Robertson's Cooked Meat Medium

*Pigment production:
• Endopigment (restricted to the colonies):
Golden yellow with Staphylococcus aureus
White with Staph. epidermidis
• Exopigment (the color diffuses in the surrounding medium):
Green exopigment with Pseudomonas aeruginosa.

*Some correlation between morphology and disease:-
-Spiral bacteria: Treponemes, Borrelias, Leptospiras tend to cause systemic diseases.
-Pathogenic Filamentous bacteria: Actinomyces, Nocardia, Mycobacteria tend to cause chronic diseases.
-Gram positive bacteria: Staphylococcus, streptococci more likely to cause skin infections.

* Bacteria *
□ With cell wall :-
• Gram +
Staphylococcus, streptococcus, clostridium, Bacillus
• Gram -
Enteric, respiratory
Acid fast
Mycobacterium
• Wall less
Mycoplasma
□ Unusual :-
• Obligate intracellular
Rickettsia, chlamydia

API system (analytical profile index):
-This system is developed for quick identification of clinically relevent bacteria
Only known bacteria can be identified
API 20E :-
contains dehydrated substrates to detect the: enzymatic activity, fermentation of sugars

Automated bacterial identification systems :
eg: Vitek system
-These systems identify the organism and its antibiotic sensitivity by detecting color changes or turbidity
-Results are available within 4-6 hours.

*Effect on lactose of MacConkey's agar :-
- Lactose fermenters : rose pink colonies
eg: E.coli & Klebsiella
- Non Lactose fermenters : pale colonies
eg: salmonella & shigella

*Production of indole :- (from tryptophan) :-
- Indole is detected by Kovac's reagent.
• pink color → (+) test → E.coli
• No color → (-) test → Klebsiella

*Hydrogen sulfide (H_2S) production test :-
- Sulfide Indole Motility (SIM) medium.
- Triple sugar iron agar (TSIA)
→ Aids in the identification & differentiation of members of Enterobacteriaceae (enterics)
→ It's especially helpful in identifying Salmonella, Francisella and Proteus species
(+) → blackening on the medium.
(-) → no blackening on the medium.

*Methyl red reaction (MR) :-
- Fermentation of glucose with production of huge amount of acid (is detected by methyl red indicator)
Red → (+) → E.coli
Yellow or orange → (-) → Klebsiella

*Voges proskauer's reaction (VP) :-
- Production of acetyl methyl carbinol from glucose fermentation ↳ (is detected by KOH)
Pink → (+) → Klebsiella
No pink → (-) → E.coli

*Citrate utilization test :-
→ Allows the species-level identification of the members of the Enterobacteriaceae
- The citrate enzyme hydrolyses the citrate to form oxaloacetic acid & acetic acid.
- Medium used is : Simmons citrate agar
(+) → develops blue color from green
growth of bacterium is occurs
(-) → No color change → no growth occurs

*Oxidase test :-
- Detection by adding few drops of colorless oxidase reagent
→ Colonies turn deep purple in color (+)
→ This test is used to differentiate enterobacteriaceae (-) from Pseudomonas (+)

*Catalase test :-
→ Addition of (H_2O_2) lead to production of gas bubbles (O_2 production)
- Is used to differentiate between Staphylococci (+) and Streptococci (-)

*Coagulase test :-
- Coagulase enzyme converts fibrinogen to fibrin (plasma clot)
- Detected by slide or test tube method
- is used to differentiate staphylococcus aureus from coagulase (-) staphylococci

*Urease test :-
- Urease enzyme hydrolyze urea with production of NH_3 → alkaline pH → change color of indicator from yellow to pink
(+) → pink → proteus vulgaris
(-) → no pink → E.coli