Morphology and Anatomy Of Bacteria Lec. 3 M.Sc. Shahalaa Ali MAIN TOPICS 🗈 At the end of the Lecture, the students will be able to understand: 1- Classification of bacteria depending on their morphology and Gram staining property. 2- Anatomy of Bacterial Cell. 3- Various Bacterial cell appendages and their functions. Classification of bacteria depending on their morphology and Gram staining property. I Most clinically relevant bacterial species range in size from 0.25 to 1 um in width and to 3 um in length, I Thus requiring microscopy for visualization. I Just as bacterial species and genera vary in their metabolic processes, their cells also vary in size, morphology and cell - to -cell arrangements and chemical composition and structure of the cell wall. I Bacterial cell wall differences provide the basis for the Gram stain, a fundamental staining technique used in bacterial identification schemes. I This staining procedure separates almost all medically relevant bacteria into two general types: 1- gram -positive bacteria (deep blue or purple) 2- gram - negative bacteria (pink to red) Shape of Bacteria .Cocci – arranged in group (clusters), pair or chains. .Bacilli – arranged in chain, pair, and some bacilli are curved, comma shaped, or cuneiform shaped. Anatomy of Bacteria cell 9 Structure of Bacterial Cell A- Cell Envelope 1- Cell Wall 2- Cell membrane (plasma membrane, Cytoplasmic membrane ) B- Cytoplasm 1- Nucleoid 2- Ribosomes 3- Granules / Inclusion bodies 4-Mesosomes 5- Spores 6- Plasmids C- Appendages 1- Pilli 2- Flagella 3- Capsule Cell Wall I Is a tough & rigid structure surrounding the bacterium like a shell . The Weighs about 20-25 % of the dry weight of the cell . Functions : Accounts for shape of cell. Provides protection to the cell against osmotic damage . I Confers rigidity upon bacteria . I Takes part in cell division . I Possesses target site for antibiotics, lysozymes and bacteriophages I Carries bacterial antigens that are important in virulence and immunity. S. No. Character 1 Thickness 2 Periplasmic space 3 Lipids 4 Teichoic acid 5 Peptidoglycan Gram Positive Thicker Absent Absent or small Present 16-80nm Gram Negative Thinner Present Present Absent 2nm Gram Positive Cell Wall 9 Peptidoglycan : thicker (16-80nm) than gram negative bacteria (2nm). Teichoic acid: 1- Contains in a significant amount which is absent in gram negative . 2- Constitute major surface Ags . 3- Two types (wall teichoic acid and lipoteichoic acid ) . Gram Negative Cell Wall I Gram negative cell wall components -Lipoprotein layer -Outer membrane complex structure with following -LPS (Lipopolysaccharide) : 1- constitutes endotoxin of GNB 2-Determine major surface Ag 3- Toxicity (pyrogenicity, lethal effect, tissue necrosis) -Periplasmic space -Peptidoglycan . Lipoprotein Layer: - Connects the peptidoglycan to outer membrane - . Outer membrane : - Contains certain proteins called as OMP (outer membrane protein) . - Target sites for phages, antibiotics and bacteriocins. - . Lipopolysaccharides (LPS): - Consist of lipid A attached to a polysaccharide. - Constitutes the endotoxin of GNB. - . Periplasmic space : - Space between inner and outer membrane. - Contains various binding proteins for specific substrates. Peptidoglycan : Rigid part of cell wall peptidoglycan mucopeptide(murein) composed of N-acetyl muramic acid and N-acetyl glucosaminde alternating in chains, cross linked by peptide subunits. Bacterial with Defective Cell Wall 🗹 Synthesis of cell wall interfered or inhibited by many factors : Antibiotics Bacteriophage Lysozyme Cell membrane : Cytoplasmic Membrane . Is 5–10nm thick elastic semipermeable layer lies beneath for separating it from cell cytoplasm . . Acts as an osmotic barrier . . Acts as a semipermeable membrane controlling the inflow and outflow of metabolites to and from the protoplasm. Contains enzymes

necessary for cell wall synthesis (cytochrome oxidase, enzymes of tricarboxylic acid). Cytoplasm I ls a colloidal system containing variety of organic and inorganic solutes in a viscous watery solution. Lacks: 1- Mitochondria 2- Endoplasmic reticulum I Contains: 1- 70% water of bacterial mass. 2-Ribosomes . 3- Mesosomes 4- Vacuoles. 5- Inclusions Ribosomes I Centre for protein synthesis. I Are composed of 1– Ribosomal RNA (rRNA) 2–Ribosomal proteins. Intracytoplasmic inclusions 1– Source of stored energy 2- Are grow under conditions of nutritional deficiency and disappear when deficient nutrients are supplied. 3- Volutin or metachromatic granules are +nt in C. dipyheria. INucleoid Bacteria don't have true nucleus and there is no nuclear membrane or nucleolus. I Nucleiod is present irregularly shaped region containing DNA. 
Bacterial DNA is haploid replicates by simple binary fission and maintains bacterial genetic characteristics. I Some bacteria may possess extra- nuclear genetic material in the cytoplasm consisting of DNA named as Plasmids or episomes . Capsule and Slime layer 1 Is amorphous viscid bacterial secretion of bacteria surrounds outer layer 1 when diffuses into surrounding medium and remains as a loose under marcated secretion as "Slime layer" when it is organized into a defined structure known as "Capsule". E FUNCTIONS: 1- Antiphagocytic in nature. 2-Antigenic. 3- Virulence. Flagella : Cytoplasmic appendages protruding through cell wall. Composed of a protein (flagellin) (5-20um in length and 0.01-0.02um in diameter). I Organ of locomotion. I All motile bacteria contains either one or more flagella . Part and composition : . Three parts: 1- Flament 2-Hook 3- Basal body Arrangements / types 1 - Monotrichous. 2- Amphitrichous. 3- Lophotrichous. 4-Peritrichous. Fimbriae Hair like appendage projecting from cell surface -Also called as "Pili". -Composed of protein called pilin. -Unrelated to motility. - Functions: 1-Adhesion .2- Transfer of genetic material. Endospores I Are highly resistant resting stage formed in unfavorate environmental conditions . - Depletion of nutrients. - . Sporulation is not a method of reproduction as bacteria is not divide during sporulation . - .each vegetative cells one spore one vegetative bacterium. Morphology of Spore 1- Core 2- Forespore 3- Spore membrane 4- Spore cortex 5- Spore coat 6- Exosporium