Bacteria	Gram	Catalase	Coagulase	Hemolysis	colony		Adherence factors	Enzymes produced	Toxin	sDisease
Staphylococci	+	+	Description:(1 µm in diameter usually arranged in grapelike irregular clusters,It does not form spores and it is non-motile(you can't see any flagella)							
S. aureus			+	+	round, smooth, raised, glistening (shining)	gray to deep golden colonies	(MSCRAMM) * protein A * Elastin-binding protein * collagen binding protein * fibronectin binding protein * clumping factor	*Hyaluronidase (spreading factor) *Staphylokinase (fibrinolysis) *proteases *lipases *β-lactamase	* five cytolytic or membrane-damaging toxins (alpha, beta, delta, gamma, and Panton-Valentine leucocidin PVL)	-
									* exfoliative toxins (A and B)	scalded skin syndrome
									* enterotoxins (A–E, G–P)	violent nausea, vomiting, abdominal cramping and diarrhea
									*toxic shock syndrome toxin-1 (TSST- 1)	Toxic shock syndrome
									-	* localized staphylococcal infection causes: Impetigo, Folliculitis, Furuncles or boils, Carbuncles. * Osteomyelitis, septic shock, pneumonia, infect blood vessels or joints
S. epidermidis			–	–		grayish to whitish colonies				* Wound infection causing erythema and pus * Catheter and shunt infection causing chronic inflammatory response to bacteria. * Prosthetic device infection causing chronic infection of device characterized by localized pain and mechanical failure of the device. * Urinary tract infections causing dysuria and pyuria in young sexually active women (S. saprophyticus, in patients with urinary catheters (other coagulase-negative staphylococci), or following seeding of the urinary tract by bacteremia(S. aureus)
S. lugdunensis										
S.saprophyticus			–							

Bacteria	Gram	Catalase	Hemolysis	Lancefield Grouping	Biochemical sensitivity	Distribution	Toxins and enzymes	Diseases	Notes
Streptococci									
S. pyogenes Description: (Spherical, 1-2 µm, arranged in chains)	+	–	β	A	Bacitracin Sensitive	oropharynx of children and young adults without causing a clinical disease	* Pyrogenic Exotoxins (Spe, also called Erythrogenic Toxin) * Streptolysins S (Non-immunogenic,O2-stable haemolysin) * Streptolysin O (O2-labile haemolysin) * Streptokinase (Fibrinolysin) * Deoxyribonucleases (DNases)	**A. Suppurative infections:** **1.** Pharyngitis > Redness and swelling of tonsils and pharynx, with exudate (pus)+cervical lymphadenopathy **2.** Scarlet Fever > erythematous (red) rash **3.** Pyoderma (Impetigo) > localized skin infection causing pustules **4.** Erysipelas > pain, inflammation, lymph node enlargement, and systemic signs **5.** Cellulitis **6.** Necrotizing fasciitis (streptococcal gangrene) > destruction of muscle & fat **7.** Streptococcal Toxic Shock Syndrome > bacteremia with evidence of fasciitis **B. Nonsuppurative infections:** **1.** Rheumatic Fever > pancarditis, arthralgias to arthritis, & inflammatory changes of blood vessels and subcutaneous tissues. **2.** Acute Glomerulonephritis > acute inflammation of the renal glomeruli, edema, hypertension, hematuria, & proteinuria.	It has Hyaluronic Acid Capsule, M Protein, and C5a peptidase that help avoiding opsonization and phagocytosis
S. agalactiae			β	B	Bacitracin resistant	harmless bacterium colonizing GI & GU tract		* In nonpregnant old adults with debilitating underlying conditions it causes pneumonia, skin and soft-tissue infection, bone and joint infection, and bacteremia. * In pregnant women, GBS severe infections can cause serious illness for the mother and the newborn * In newborns causes either early-onset disease or late-onset disease.	
S.pneumoniae Description: (Oval, 0.5 -1.2 µm, arranged in pairs/ diplococci)			α	None	Optochin sensitive	throat and nasopharynx	* IgA protease. * Pneumolysin (a toxin similar to the streptolysin O) * Amidase	**A.** Invasive: affecting normally sterile sites such as bloodstream (Bacteraemia) and the meninges (Meningitis). **B.** Non-invasive: affecting places other than the major organs or the blood, such as theparanasal sinuses (sinusitis), ears (otitis media).	Encapsulated strains can cause disease in humans, whereas non-encapsulated strains are avirulent

Viridans streptococci			α		Optochin resistant	oropharynx, GI & GU tract		* S. Mitis can cause subacute endocarditis * S. Mutans & S. sobrinus cohabit the mouth, both contribute to oral disease such as dental caries	
Enterococci (E. faecalis and E. faecium) Description: (Arranged in pairs and short chains)			γ, α, β		grow well in 6.5% NaCl	* E. faecalis is found in the large intestine in high concentrations and in the GU tract * E. faecium is found in lower concentrations			They can grow both aerobically and anaerobically in a broad temperature range, in a wide pH range, and in the presence of high (NaCl) and bile salts

Bacteria			Gram	Distribution	Toxins and enzymes	Diseases	Transmision
Enterobacteriaceae							
Escherichia coli							
1	**Diarrhoeagenic E coli**			Intestine		**All DEC cause gastroenteritis**	
	a	**Enterotoxigenic**		S. Intestine	Heat-stable toxins (ST): ↑cGMP & hypersecretion of fluids well as inhibition of fluid absorption Heat-labile toxins (LT): ↑cAMP & ↑ Cl secretion &↓ Na + Cl absorption	traveler's diarrhea>> the symptoms are: Secretory diarrhea (watery, non-bloody diarrhea) and abdominal cramps.	* Consumption of fecally contaminated food or water. ((Person-to-person spread does not occur)) * incubation period: 1- to 2-day and persists for an average of 3 to 5 days.
	b	**Enteropathogenic**		S. Intestine	A protein called translocated intimin receptor (Tir)>> not a toxin but helps adhesion	Important cause of watery diarrhea in infants.	transmitted by fecal-oral exposure to contaminated surfaces or food products
	c	**Enteroaggregative**	–	S. Intestine		1. chronic diarrhea >> the symptoms are watery secretory diarrhea, often with inflammatory cells and accompanied by fever, nausea, vomiting, and abdominal pain, then it might progress to chronic in children or HIV patients. 2. growth retardation in children	
	d	**Shiga toxin – producing**		L. Intestine		* ranges from mild uncomplicated diarrhea to hemorrhagic colitis with severe abdominal pain and bloody diarrhea. * Hemolytic uremic syndrome (HUS)	* consumption of undercooked meat products, water, unpasteurized milk or fruit juices uncooked vegetables, and fruits. * Ingestion of fewer than 100 bacteria can produce disease, and person-to-person spread occurs * incubation period: 3 to 4 days.
2	**Extraintestinal E coli**					* Urinary Tract Infection * Neonatal Meningitis * Septicemia (blood poisoning)	

Salmonella				* Gastroenteritis, nausea, vomiting, and non-bloody diarrhea. * Septicemia. *S. Typhi produces typhoid fever >> the symptoms are gradually increasing fever, with nonspecific complaints of headache, myalgias, malaise, and anorexia. * S. paratyphi produces paratyphoid fever	* The most common sources of human infections are poultry, eggs, dairy products, and foods prepared on contaminated work surfaces, large inoculum (e.g., 10^6 to 10^8 bacteria) is required for symptomatic disease. * The infectious dose for *Salmonella* Typhi infections is low, so person-to-person spread is common, occur when food or water contaminated by infected food handlers is ingested. * Incubation period for enteric fever: 10 to 14 days. *For gastroenteritis, it can persist for 2 to 7 days before spontaneous resolution.
Shigella		colon	S. dysenteriae strains produce an exotoxin, Shiga toxin (the toxin causes disrupting protein synthesis, damage to the intestinal epithelium, damage to the glomerular endothelial cells, resulting in renal failure (HUS))	abdominal cramps, diarrhea, fever, and bloody stools	transmitted person to person by the fecal-oral route. * Incubation period: 1 to 3 days
Klebsiella **(K. pneumoniae and Klebsiella oxytoca are the most common)**		nose, mouth, and GI tract as normal flora		* Lobar pneumonia (involves necrotic destruction of alveolar spaces, formation of cavities, and production of blood-tinged sputum) * Wound and soft-tissue infections and UTIs.	hospital-acquired infections
Proteus **(P. mirabilis, the most common)**			Urease (splits urea into carbon dioxide and ammonia)	renal (kidney) stones (because of ↑ in urine pH, precipitating Mg & Ca in the form of struvite and apatite crystals, respectively)	
Yersinia **(Y. pestis, Y. enterocolitica, and Y. pseudotuberculosis**				Bubonic plague caused by Y. pestis >> high fever and a painful bubo in the groin or axilla & bacteremia	* zoonotic, with humans the accidental hosts * Y. pestis infections: urban plague (reservoirs: rats) and sylvatic plague (reservoirs: squirrels, rabbits, field rats, and domestic cats) * Person-to-person spread occurs by aerosols in case of **pneumonic plague.** * Incubation period of bubonic plague: no more than 7 days

Spore forming bacteria

		Gram	Toxins and enzymes	Diseases	Transmision
1. Bacillus aerobic rods					
a	**B. anthracis** Description: (a large (1 × 3 to 8 µm) organism arranged as single or paired rods or as long, serpentine chains)	+	protective antigen (PA), edema factor (EF), and lethal factor (LF), are nontoxic individually but form important toxins when combined: PA+EF=edema toxin PA+LF=lethal toxin	* formation of a gelatinous edema and congestion which progress to shock and death within 3 days of initial symptoms. * cutaneous anthrax: painless papule progresses to an ulcer surrounded by vesicles and then to a necrotic eschar. * Inhalation anthrax: Hemorrhagic necrosis and edema of the mediastinum, then Sepsis occurs and spread to other organs (GI ulcerations, meningitis) can take place	* inoculation (Skin infections represent more than95% of cases), ingestion, and inhalation. * exposure to contaminated animals or animal products. Exposure can also be part of biological warfare.
b	**B. cereus**			Vomiting disease (emetic form) & diarrheal disease (diarrheal form)	* Emetic form: consumption of contaminated rice (intoxication) > incubation period: short (1-6 hours) * Diarrheal form: consumption of contaminated meat, vegetables, or sauces (true infection) , with longer incubation period. * Ocular infections : after traumatic, penetrating injuries of the eye with a soil-contaminated object
2. Clostridium obligate anaerobic rods					
a	**C. difficile** large (0.5 to 1.9 by 3.0 to 17 µm)		Enterotoxin (toxin A) Cytotoxin (toxin B)	Range from mild diarrhea to severe lifethreatening inflammation of the colon (e.g. Pseudomembranous Colitis > elevated yellow-white plaques that coalesce to form pseudomembranes on the mucosa.).	* Feco-orally and commonly a nosocomial infection. * It's also part of the normal intestinal flora in a small number of healthy people and hospitalized patients.
b	**C. perfringens** a large (0.6 to 2.4 × 1.3 to 19.0 µm), rectangular rods with spores rarely observed either in vivo or after in vitro cultivation		Theta toxin causes complete hemolysis. Alpha toxin causes partial hemolysis	a range of soft-tissue infections including cellulitis, fasciitis or suppurative myositis, and myonecrosis with (gas gangrene caused by α toxin).	* Clostridial food poisoning, an intoxication * Incubation period: short (8 to 12 hours)

c	**C. tetani** a large (0.5 to 2 × 2 to 18 µm), motile rod		* tetanolysin (oxygen-labile hemolysin) * tetanospasmin (plasmid-encoded, heat-labile neurotoxin)	spastic paralysis	
d	**C. botulinum** a heterogeneous collection of large (0.6 to 1.4 × 3.0 to 20.2 µm), fastidious, rods		Seven antigenically distinct botulinum toxins (A to G), human disease is associated with types A, B, E, and F.	flaccid paralysis (death is most commonly attributed to respiratory paralysis)	* foodborne botulism (most are associated with consumption of home-canned foods) * Infant botulism: Associated with consumption of foods (e.g., honey, infant milk powder) contaminated with botulinum spores and ingestion of spore-contaminated soil and dust. * Incubation period: 1 to 3 days

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