

MICROBIOLOGY

Skill Based Elective I (Semester IV)

MICROBIAL NANOTECHNOLOGY

OBJECTIVES

To introduce the students to the novel/emerging subject – nanotechnology as to sensitize them with the growing research and career opportunities in the field.

UNIT I

Definition - history of nanomaterials – Richard Feynman and his contributions – classification and properties of nanomaterials – concept of nanoscale engineering - size and confinement effects.

UNIT II

Nano architecture: strategies - bottom up, top down and functional approaches; Chemical and physical synthesis of nanoparticles - characteristics of nanoparticles; Characterization of nanoscale materials using UV spectroscopy, TEM, AFM/STM, XRD and FTIR.

UNIT III

Bionanomaterials – DNA, protein and lipids based nanostructures- synthesis, characterization and applications; Bionanopores- Microbial synthesis (bacteria, fungi and yeast) of nanoparticles – mechanism of synthesis – Molecular Self assembly in biology.

UNIT IV

DNA/protein-gold nanoparticle conjugates; DNA nanostructures for mechanics and computing; DNA as smart glue- DNA analyzer as biochips; Biologically inspired nanocomposites ; Peptide nanostructures and their applications– electronics, antibacterial agents.

UNIT V

Antimicrobial activity of nanoparticles- mechanism; Nanoanalytics- Quantum dots - Bioconjugates in cell and tissue imaging; Diagnosis of cancer and other diseases using bionano systems; Drug and gene delivery.

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6. Bhushan B. Handbook of Nanotechnology - Springer, Heidelberg. 2006.

Skill Based Elective II (Semester V)

DIAGNOSTIC MICROBIOLOGY

OBJECTIVES

To provide the learners an overview of the clinical microbiology laboratory organization and its activities. To outline various diagnostic approaches covering representative techniques in each category starting from traditional to molecular diagnosis of various diseases caused by bacterial, viral, fungal and protozoan pathogens.

Unit I

Purpose and philosophy of diagnostic microbiology – Organization of clinical microbiology laboratory - responsibility – Laboratory safety: General safety considerations – biohazards and practices specific to microbiology – classification of biological agents on the basis of hazards

Unit II

Collection of bacterial, viral, fungal and protozoan diseases associated clinical specimens (oral cavity, throat, skin, blood, CSF, urine and faeces) for diagnosis and methods of transport and storage – rejection of specimen.

Unit III

Examination of clinical sample by staining - Gram stain, Ziehl - Neelson staining for tuberculosis Giemsa stained thin blood film for malaria - LCB for fungal identification - Preparation and use of culture media - Blood agar, Chocolate agar, Lowenstein-Jensen medium, MacConkey agar, Distinct colony and biochemical properties of various bacterial pathogens. Culture and identification of fungi.

Unit IV

Serological Methods – Agglutination based methods: WIDAL, immunofluorescence – Automated methods: ELISA, Nucleic acid based methods - PCR. Brief note on immunodiffusion and immunoelectrophoresis. Brief note on commercial kits for typhoid, dengue and HIV, swine flu detection.

Unit V

Importance and determination of resistance/sensitivity of bacterial pathogens using disc diffusion method, Determination of minimal inhibitory concentration (MIC) of an antibiotic by serial double dilution method and E test – importance of MIC determination. Antimycotic susceptibility testing –reporting and

expediting results – Computerization - Quality assurance - safe disposal of specimens and biohazards.

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1. Ananthanarayan R and Paniker CKJ. Textbook of Microbiology, 8th edition, Universities Press Private Ltd. 2009.
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Skill Based Elective III (Semester V)

ANTIMICROBIAL AGENTS

OBJECTIVES

To improve awareness and understanding of antimicrobial resistance through effective communication, education and training

Unit I

Definition – disinfection – antiseptics – antibiotics – chemical agents (antibacterial, antifungal, antiviral and antiparasitic) – non pharmaceutical agents (essential oils) –physical agent (Ozone, heat, radiation).

UNIT II

Antibacterial agent - mechanism of action- cell wall synthesis inhibitor (penicillin, arabinoglycan), protein synthesis inhibitor (Tetracycline, Chloramphenicol), nucleic acid synthesis inhibitor (metronidazole, rifampin) , alteration of cell membranes (gramicidin, polymyxin, antimetabolite (sulfanilamide).

Unit III

Antiviral agents - interferon – types- mechanism of action - amantadine, rimantadine, zanamivir, and oseltamivir - viral vaccines.

Unit IV

t – mode of action- amphotericin, nystatin and fluorocytosine. Antiprotozoal agents – mechanism of action – (Metronidazole – chloroquine, Paromomycin sulfate,– quinolines).

Unit- V

Emergence of drug resistance – bacteria, fungi and viruses. Alternative drugs- antimicrobial peptides.

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1. Alan R Hauser. Antibiotics basics for clinicians: choosing the right antibacterial agent. Wolter Kluwer / Lipponcott Williams and Wilkins Publisher, New York. 2007.
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