

Program	Institute
<b>M.Sc. Clinical Embryology</b> <b>M.Sc. Reproductive and Developmental Biology</b>	<b>Kasturba Medical College (KMC), Manipal</b>

### Department Test (DT) 2022 Details

- Test Duration: 120 minutes
- Total Questions: 120 MCQs
  - Zoology (40 Qs), Chemistry & Biochemistry (40 Qs), Basic Biology & Embryology and Cell Biology (40 Qs)
- Marking Scheme: + 4 for every correct answer, -1 for every wrong answer, 0 for every unattempted question
- Schedule: Refer [www.manipal.edu/dt](http://www.manipal.edu/dt) for updates

### ZOOLOGY

**Contribution of scientists to society:** Introduction to biological concepts, Biographies and contributions of scientists: Charaka, Sushruta, Charles Darwin, John Gregor Mendel, Louis Pasteur, A.I. Oparin, J.B.S. Haldane, J. C. Bose, Hermann Joseph Mueller, J.D. Watson, Francis Harry Compton Crick, Har Gobind Khorana, Francois Jacob and Jacques Monod, Marshall W Nirenberg and Frederick Sanger, Barbara McClintock, Venkatraman Ramakrishnan and others

**Trends in animal body evolution** (germ layers, symmetry, body cavity, etc.), **Principles of animal classification, nomenclature and concept of species, General characteristics and classifications:** **Protozoa:** Type study: *Paramecium* (structure and reproduction), **Porifera:** Type study: *Leucosolenia*, types of spicules and cells, water canal systems, **Cnidaria:** Type study: *Obelia* (structure and life cycle), structure of nematocyst, **Platyhelminthes:** Type study: *Fasciola hepatica* (structure and life cycle), **Nematoda:** Type study: *Ascaris* (structure and life cycle), **Annelida:** Type study: *Nereis* (morphology), metamerism, **Arthropoda:** Type study: *Panews* (morphology), life cycles of silk worm, **Mollusca:** Type study: *Lamellidens* (shell structure and internal anatomy), **Echinodermata:** Type study: Star fish (morphology), water vascular system, **Fishes:** Type study: *Scoliodon* (morphology), scale types, accessory respiratory organs in fishes, migration in fishes, **Amphibia:** Type study: *Rana tigrina* (morphology), digestive system, urogenital systems and respiratory system, Parental care in Amphibia, **Reptilia:** Amniotic egg, identification of poisonous and non-poisonous snakes, poison apparatus and mechanism of biting, Jacobson's and pit organs, snake venom and its importance, **Aves:** Type study: Ostrich (morphology), flight adaptations, flightless birds, **Mammalia:** Type study: Rat (morphology), dentition in mammals, adaptive radiations in mammals

### BIOCHEMISTRY

**Biomolecules, Carbohydrates:** Definition. Classification - monosaccharides (ribose, deoxyribose, glucose, fructose and galactose), oligosaccharides (maltose, sucrose and lactose) and polysaccharides (starch, glycogen, cellulose, pectin, chitin and agar agar). Biological significance, **Proteins:** Definition. Classification - simple proteins (albumins, globulins, histones, actin, myosin and keratin), conjugate proteins - Chromoproteins (haemoglobin), glycoproteins (mucin of saliva), phosphoproteins (casein of milk) and lipoproteins (lipovitelline of egg yolk). Biological significance of amino acid and proteins, **Lipids:** Definition. Classification - Simple lipids - oils (vegetable oil and oil of animal origin), fats (butter) and waxes (beeswax), Compound lipids - phospholipids (lecithin and cephalin) and sphingolipids (cerebrosides), Related compounds - steroids (estrogen, progesterone and testosterone), sterols (cholesterol) and prostaglandins. Biological significance, **Nucleic acid:** Occurrence, basic chemical composition (nucleoside and nucleotide), type (DNA and RNA) and functions, **Enzymes:** Definition, properties, classification based on functions. Mode of action - induced fit theory of Koshland, Metabolism of carbohydrates and lipids

### BASIC BIOLOGY & EMBRYOLOGY

**Introduction to Biology:** Definition of Biology and its main branches - Botany and Zoology. Scope of Biology. Branches of Biology. Classical branches - morphology, cytology, histology, anatomy, physiology, developmental biology, biosystematics, genetics, ecology, organic evolution and palaeontology. Interdisciplinary branches - biophysics, biochemistry and biostatistics. Applied branches and career prospects - agriculture, entomology, silviculture, pathology, apiculture, microbiology and bioinformatics. Role of biology in dispelling myths and disbeliefs, **Origin of Life and Organic Evolution:** Origin of life: Introduction. Concept of abiogenesis and biogenesis (experimental evidences not required). A.I.Oparin's Theory of chemical evolution of life (Views of Haldane and Sidney Fox to be mentioned). Stanley Miller's experiment in support of chemical evolution. Divergent and convergent evolution. Evolution of man. Organic evolution: Introduction. Darwin's Theory (DDT resistance in mosquitoes and industrial melanism in Peppered moth, to illustrate natural selection to be quoted as examples). Brief account of Mutation Theory. Neo Darwinism - Introduction, Darwinian concept vs Neo Darwinian concept (gene pool and gene frequency), Hardy - Weinberg Law and sources of variations as evolutionary force - sexual reproduction, genetic drift, gene flow,

mutation and isolation (reproductive and geographic), **Cell Biology:** Cell structure: Structure and functions of cell components - cell wall, plasma membrane (fluid mosaic model), endoplasmic reticulum, plastids (brief), mitochondria (brief), Golgi complex, Ribosomes, Lysosomes, Centrosome, vacuole and nucleus - nuclear envelope (nuclear pores and nuclear lamina) nucleoplasm, nucleolus and chromatin. A brief account of ergastic substances (mention about reserve food, secretory and excretory substances with examples). Differences between plant cell and animal cell. Cytoskeleton, cilia, flagella, centriole, **Chromosomes:** Discovery, shape, size and number of chromosomes, Autosomes and allosomes; Karyotype and idiogram. Chemical composition and function. General structure - Concept of centromere (primary constriction), secondary constriction, satellite, kinetochore, telomere. Types of chromosomes based on the position of centromere. Ultrastructural organization of the eukaryotic chromosome - nucleosome model. Numerical aspects of chromosomes: A brief note on aneuploidy (monosomy and trisomy) and euploidy (haploidy, diploidy and polyploidy), **Cell Reproduction:** Cell division and types. Concept of cell cycle. Mitotic division and significance. Meiotic division and its significance. Cancer - meaning of cancer, benign and malignant tumours, characters of cancer cells, types of cancer (Carcinoma, Sarcoma, Lymphoma and Leukemia), causes of cancer (physical, chemical and biological carcinogens with examples). Concept of cell senescence and apoptosis. **Gene:** The gene, the genetic code and its characteristics, genetic control of protein synthesis (transcription and translation) and Lac operon. Concept of gene (prokaryotic and eukaryotic). **Genetics:** Mendelian genetics: Mendel and his work. Definitions of the following terms: Allele, Phenotype, Genotype, Homozygous and Heterozygous. Principles of inheritance, dominance, law of segregation (purity of gametes) and law of independent assortment. Monohybrid cross, Dihybrid cross and Test cross, **Deviations from Mendelian laws:** Incomplete dominance: Example - Flower colour in *Mirabilis jalapa*. Pleiotropy, Polygenic inheritance, chromosomal theory of inheritance, Sex determination, Linkage and crossing over, Pedigree, **Multiple allelism:** Example - ABO blood groups and their inheritance in man: Blood typing; Rh factor with a note on erythroblastosis foetalis. Sex linked inheritance in man: Example - Inheritance of colour-blindness, hypertrichosis in man, Phenylketonuria, **Genetic disorders in man:** Chromosomal disorders - Down's syndrome, Klinefelter's syndrome, Turner's syndrome and Cri-du-Chat syndrome. Gene disorders - Sickle cell anaemia, haemophilia, Thalassemia.

**Embryology: Male reproductive system:** Anatomy of male reproductive system, structure and function of testes, histology of testes, accessory male sex glands and their function, spermatogenesis, regulation of spermatogenesis, structure of spermatozoa. **Female reproductive system:** Anatomy of female reproductive system, structure and function of ovary, histology of ovary, menstrual cycle, folliculogenesis and oogenesis, regulation of oogenesis, structure of mature oocyte, **Hormones:** Classification of hormones, mechanism of action of hormones, regulation of hormone action, endocrine disorders in reproduction, **Fertilization:** Sperm oocyte interaction and fertilization, early embryo development, implantation, structure and function of placenta

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### CELL BIOLOGY

**Cell Structure:** Prokaryotic cell and Eukaryotic cell, **Model Organisms:** *E. coli*, Yeast, Flies, Fish, Worms and Mice. **Membrane Enclosed Organelles:** Nucleus, Endoplasmic Reticulum, Golgi Apparatus, Lysosomes, Endosomes, Mitochondria, Peroxisomes. **Cytoskeleton:** Intermediate Filaments, Microtubules, Actin Filaments. **Cell-Division Cycle:** Eukaryotic Cell Cycle, Mitosis, Cytokinesis, Meiosis, Fertilization. **Tissue Architecture:** Extracellular Matrix, Epithelial Sheets, Cell Junctions, Cell-Cell Adhesion, Cell-Matrix Adhesion, **Architecture of cells in Brain, Heart & Liver & Skin.** **Immunology:** Cells of Immune System, Humoral Immunity, Cell Mediated Immunity. **Tissue Maintenance and Self Renewal:** Renewal of tissues, Resident Stem Cells in Different Tissues, Hematopoietic Stem Cell, Therapeutic cloning, Reproductive Cloning. **Induced Pluripotent cells** Principles and Methodology. **Cancer:** Properties of cancer cells: Proliferation, Invasion and Metastasis; Gene Mutations, Oncogenes and Tumor Suppressor Genes.

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♣ Best of Luck ♣

Updated: 9 AM, 30 March, 2022