

Content

Preface	7
1 LIGHT AND ELECTRON MICROSCOPY	9
1.1 Light microscopy	9
1.1.1 Immunofluorescence microscopy	12
1.1.2 Polarizing microscopy	13
1.2 Electron microscopy	13
1.2.1 Transmission electron microscope	13
1.2.2 Scanning electron microscope	14
1.3 Instructions for light microscopy	15
2 TYPES OF SLIDES USED BY LIGHT MICROSCOPY AND THEIR PREPARATION.....	18
2.1 Native slides.....	18
2.1.1 Tissue cultures	18
2.2 Smears	19
2.3 Fixed slides – histological samples.....	20
3 TRAFFIC ACROSS MEMBRANES.....	24
3.1 Osmosis and it's importance for integrity of cells	24
3.1.1 Osmotic control in animal cells	24
3.1.2 Osmotic control in plant cells.....	25
3.2 Passive and active transport	25
3.2.1 Passive transport.....	26
3.2.1.1 Simple diffusion.....	26
3.2.1.2 Facilitated diffusion	27
3.2.2 Active transport	27
4 SIZE OF CELLS AND MEASUREMENT OF MICROSCOPIC OBJECTS	30
4.1 Preparation of microscope for measurement	31
5 STATISTICAL METHODS IN BIOLOGY	33
5.1 Tests of significance	36
5.1.1 Student's t-test	37
5.1.2 Chi square χ^2	38
6 THE DIVISION OF THE CELLS	43
6.1 The cell cycle	43
6.2 Mitosis	43
6.3 Meiosis.....	46
6.3.1 First meiotic division (heterotypic)	46
6.3.2 Second meiotic division (homeotypic).....	48
6.4 Human gametogenesis	48
6.4.1 Spermatogenesis.....	49
6.4.2 Oogenesis.....	50
7 MOLECULAR BIOLOGY	52
7.1 Nucleic acids	52
7.2 Structure of DNA and chromatin	54
7.3 Replication of DNA.....	56
7.4 Types of RNA and their function.....	58

7.5	Gene expression	58
7.5.1	Molecular definition of a gene	58
7.5.2	Transcription	58
7.5.3	Translation	60
7.6	Control of gene expression in bacteria (lac operon)	62
8	HUMAN KARYOTYPE	68
9	MUTATIONS	72
9.1	Gene mutations	73
9.2	Chromosomal mutations or chromosomal aberrations	75
9.2.1	Structural aberrations	75
9.2.2	Numerical aberrations	78
10	INHERITANCE OF QUALITATIVE TRAITS/MENDEL'S LAWS	82
10.1	Monohybrid cross with complete dominance and the Law of segregation	83
10.2	Dihybrid cross with complete dominance and the Law of independent assortment	84
10.3	Incomplete dominance	85
10.4	Practical resolutions	86
11	GENETICS OF BLOOD TYPES	91
11.1	Genetics of ABO system	91
11.2	Genetics of MNS system	92
11.3	Genetics of Rh system	92
12	INTERACTIONS OF NON-ALLELIC GENE PAIRS	97
12.1	Complementarity	97
12.2	Epistasis	98
12.3	Secretor and Lewis blood systems	99
13	IMMUNOLOGY AND IMMUNOGENETICS	103
13.1	Organs of immune system	104
13.2	Cells of immune system	104
13.3	Molecules of immune system	105
13.3.1	Immunoglobulins (antibodies)	105
13.3.2	Cytokines	107
13.4	The major histocompatibility complex	107
13.4.1	Inheritance of HLA antigens	108
13.4.2	Medical applications of HLA system	109
13.4.2.1	Transplantation	109
13.4.2.2	Paternity testing	109
14	SEX-LINKED TRAITS	112
14.1	Examples of X-linked traits	114
14.2	X chromosome inactivation	114
15	POPULATION GENETICS	117
15.1	Application of the Hardy-Weinberg equilibrium	118
16	GENEALOGY – STUDY OF PEDIGREE	122
16.1	Autosomal dominant inheritance	122
16.2	Autosomal recessive inheritance	124
16.3	X-linked inheritance	125
16.4	Coefficient of relationship and inbreeding	127

17	DERMATOGLYPHICS.....	131
18	METHODS OF MOLECULAR BIOLOGY.....	134
18.1	DNA isolation with DNAzol	134
18.2	Polymerase chain reaction (PCR).....	135
18.3	Agarose gel electrophoresis.....	137