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General Genetics Course

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Preamble

Mendelian genetics, pioneered by Gregor Mendel, aims to elucidate the principles governing trait determination and inheritance through the analysis of offspring resulting from controlled crosses between individuals of different genotypes.

Following the discovery of deoxyribonucleic acid (DNA) as the carrier of genetic information, molecular genetics has continued to investigate the intricate mechanisms underlying the determination, expression, and transmission of traits.

A comprehensive understanding of trait determination and transmission also requires studying individuals under natural conditions, where each is genetically unique and capable of reproducing with any conspecific. This aspect of genetics, which examines the interactions between individuals and their environment, is encompassed within the field of population genetics.

This course, designed for second-year students in the Natural and Life Sciences Common Core, provides a foundational overview of genetics. The curriculum encompasses topics ranging from the structure of DNA and its variations to protein synthesis, culminating in formal genetics with an emphasis on diploid organisms. Although the chapters are not exhaustive, they have been curated to include all the essential components of a basic genetics curriculum.

The course structure has been reorganized into two main sections: the first section covers molecular genetics, while the second section is devoted to fundamental genetics.

TABLE OF CONTENTS

<u>1</u>	<u>GENETIC MATERIAL</u>	<u>1</u>
1.1	NUCLEIC ACIDS	1
1.2	TYPES OF NUCLEIC ACIDS	1
1.3	STRUCTURE OF NUCLEIC ACIDS	3
1.3.1	SUGAR	3
1.3.2	NITROGENOUS BASES	4
1.3.3	PHOSPHORIC ACID:	5
1.4	CONNECTION TO THE BASE	5
1.5	PHOSPHORIC ACID-SUGAR BOND	6
1.6	ASSOCIATION OF NUCLEOTIDES IN A NUCLEIC ACID	7
1.7	NOMENCLATURE	7
1.8	DNA CHARACTERISTICS	8
1.8.1	COMPLEMENTARITY OF BASES AND DOUBLE HELIX STRUCTURE	8
1.8.2	CHARGAFF'S LAWS	9
1.8.3	ANTIPARALLEL CONFIGURATION	10
1.8.4	CATEGORIES OF DNA BASED ON COILING STATE	11
1.8.5	DNA OVERWINDING	11
<u>2</u>	<u>GENE STRUCTURE AND FUNCTION</u>	<u>13</u>
2.1	DEFINITION	13
2.2	NOMENCLATURE OF THE GENE LOCATION (LOCUS)	13
2.3	GENE ORGANIZATION	14
2.4	EUKARYOTIC AND PROKARYOTIC RNA CLASSES	16

2.5	DIFFERENCES AND SIMILARITIES BETWEEN THE PROKARYOTIC AND EUKARYOTIC GENOME	17
2.5.1	IN PROKARYOTES	17
2.5.2	IN EUKARYOTES	17
2.6	STRUCTURE OF GENES	18
2.6.1	STRUCTURE OF A GENE ENCODING A EUKARYOTIC PROTEIN	18
2.6.2	STRUCTURE OF A GENE OPERON ENCODING PROKARYOTIC PROTEINS	19
3	DNA REPLICATION	22
3.1	INTRODUCTION	22
3.2	MODELS OF DNA REPLICATION	22
3.3	MESELSON AND STAHL'S EXPERIMENT	23
3.4	FUNDAMENTAL LAWS OF DNA REPLICATION	26
3.4.1	SEMI-CONSERVATIVE DNA REPLICATION	26
3.4.2	ORIGINS OF REPLICATION	26
3.4.3	DNA POLYMERASES	28
3.4.4	BIDIRECTIONAL REPLICATION	28
3.4.5	UNIDIRECTIONAL CURING	29
3.4.6	SEMI-DISCONTINUOUS REPLICATION	29
3.4.7	ELEMENTS NEEDED FOR REPLICATION	29
3.5	REPLICATION IN PROKARYOTES	30
3.5.1	DNA POLYMERASES IN PROKARYOTES	30
3.5.2	PROTEINS NEEDED FOR REPLICATION	30
3.5.3	MECHANISM OF PROKARYOTIC REPLICATION	32
3.6	REPLICATION IN EUKARYOTES	33
3.6.1	DNA POLYMERASES IN EUKARYOTES	33
3.6.2	TELOMERES	36

3.6.3	MECHANISM OF EUKARYOTIC REPLICATION	36
-------	-------------------------------------	----

4	TRANSCRIPTION OF DNA	38
----------	-----------------------------	-----------

4.1	INTRODUCTION	38
------------	---------------------	-----------

4.2	TRANSCRIPTION TEMPLATE (THE TRANSCRIBED STRAND)	38
------------	--	-----------

4.3	TRANSCRIPTION SYSTEM	38
------------	-----------------------------	-----------

4.4	TRANSCRIPTION SUBSTRATES	39
------------	---------------------------------	-----------

4.5	TRANSCRIPTION UNIT	39
------------	---------------------------	-----------

4.5.1	PROMOTER	40
-------	----------	----

4.5.2	RNA-CODING REGION	40
-------	-------------------	----

4.5.3	TERMINATOR	40
-------	------------	----

4.6	PROKARYOTIC TRANSCRIPTION	41
------------	----------------------------------	-----------

4.6.1	INITIATION	41
-------	------------	----

4.6.2	ELONGATION	42
-------	------------	----

4.6.3	TERMINATION	43
-------	-------------	----

4.7	EUKARYOTIC TRANSCRIPTION	44
------------	---------------------------------	-----------

4.7.1	EUKARYOTIC RNA POLYMERASES	44
-------	----------------------------	----

4.7.2	STRUCTURE OF THE PROMOTER	44
-------	---------------------------	----

4.7.3	PHASES OF TRANSCRIPTION	45
-------	-------------------------	----

4.7.4	POST-TRANSCRIPTIONAL MODIFICATIONS OF PRE-MRNA	46
-------	--	----

5	TRANSLATION	48
----------	--------------------	-----------

5.1	INTRODUCTION	48
------------	---------------------	-----------

5.2	GENETIC CODE	48
------------	---------------------	-----------

5.3	TRANSLATION	50
------------	--------------------	-----------

5.3.1	STRUCTURE OF RIBOSOMES	50
-------	------------------------	----

5.3.2	STRUCTURE OF TRANSFER RNA (tRNA)	52
5.3.3	BINDING OF AMINO ACIDS TO tRNAs	53
5.3.4	TRANSLATION STEPS	54
5.3.5	POST-TRANSLATIONAL MODIFICATIONS OF PROTEINS	57

6 GENE MUTATIONS **58**

6.1	DEFINITION	58
6.2	ORIGIN OF MUTATIONS	58
6.3	TYPES OF MUTATIONS	58
6.3.1	GENE MUTATION	59
6.4	CONSEQUENCES OF GENE MUTATIONS	61

7 REGULATION OF GENE EXPRESSION **64**

7.1	INTRODUCTION	64
7.2	DEFINITION OF THE OPERON	64
7.3	REGULATION OF GENE EXPRESSION IN PROKARYOTES	65
7.4	REGULATION OF THE TRYPTOPHAN OPERON	69
7.4.1	REGULATION BY REPRESSION	69
7.4.2	ATTENUATION REGULATION	70
7.5	REGULATION OF GENE EXPRESSION IN EUKARYOTES	71

8 NOTIONS OF EXTRA-CHROMOSOMAL GENETICS **74**

8.1	INTRODUCTION	74
8.2	MITOCHONDRIA	74
8.2.1	MITOCHONDRIAL GENOME	74

8.2.2	MITOCHONDRIAL GENES	75
8.2.3	PROTEIN SYNTHESIS IN MITOCHONDRIA	76
8.3	CHLOROPLASTS	77
8.3.1	CHLOROPLAST GENOME	77
8.3.2	CHLOROPLAST GENES	77

1 CELL DIVISION **80**

1.1	DEFINITION	80
1.2	INTERPHASE	81
1.3	MITOSIS	81
1.3.1	PHASES OF MITOSIS	81
1.3.2	FATE OF GENETIC MATERIAL DURING THE CELL CYCLE	85
1.3.3	VARIATION IN DNA AMOUNT DURING THE CELL CYCLE	86
1.4	MEIOSIS	86
1.4.1	MEIOSIS I: REDUCTIONAL DIVISION	87
1.4.2	MEIOSIS II: EQUATIONAL DIVISION	88
1.4.3	GENETIC MIXING DURING MEIOSIS	89

2 CHROMOSOMES **90**

2.1	DEFINITION	90
2.2	STRUCTURE	90
2.3	CHROMATIN AND CHROMOSOMES	92
2.4	THE NUMBER OF CHROMOSOMES	93
2.5	TYPES OF CHROMOSOMES ACCORDING TO THE LOCATION OF THE CENTROMERE	93
2.6	HOMOLOGOUS CHROMOSOMES	95

2.6.1	CROSSING-OVER (ENJAMBMENT)	95
2.6.2	TYPES OF HOMOLOGOUS CHROMOSOMES	95

3 CHROMOSOMAL ABNORMALITIES **98**

3.1	INTRODUCTION	98
3.2	NUMBER ANOMALIES	98
3.2.1	ANEUPLOIDY	99
3.2.2	EUPLOIDY	99
3.3	MECHANISMS OF NUMBER ANOMALIES	100
3.3.1	MECHANISM OF ANEUPLOIDY ONSET	100
3.3.2	MITOTIC NON-DISJUNCTION	101
3.3.3	MECHANISMS LEADING TO POLYPLOIDY	101
3.4	STRUCTURAL ABNORMALITIES	102
3.4.1	ABNORMALITIES IN A SINGLE CHROMOSOME	102
3.4.2	ABNORMALITIES AFFECTING TWO CHROMOSOMES	105
3.5	OTHER ABNORMALITIES	107
3.5.1	FRAGILE SITES	107
3.5.2	MARKER CHROMOSOMES	107

4 MENDELIAN GENETICS **108**

4.1	INTRODUCTION	108
4.2	JOHANN GREGOR MENDEL	108
4.3	GREGOR MENDEL'S EXPERIMENTAL APPROACH	109
4.4	TRAIT AND GENE	110
4.5	MENDEL'S THREE LAWS	111

<u>5</u>	<u>MONOHYBRIDISM</u>	<u>114</u>
5.1	DEFINITION	114
5.2	MENDEL'S EXPERIMENT	114
5.3	MENDEL'S FIRST LAW	114
5.4	MENDEL'S SECOND LAW	115
5.5	TEST-CROSS	115
<u>6</u>	<u>DIHYBRIDISM</u>	<u>118</u>
6.1	DEFINITION	118
6.2	MENDEL'S THIRD LAW	119
6.3	TEST-CROSS IN DIHYBRIDISM	119
<u>7</u>	<u>MENDEL'S SPECIAL CASES</u>	<u>122</u>
7.1	INCOMPLETE DOMINANCE (ABSENCE OF COMPLETE DOMINANCE)	122
7.2	CODOMINANCE	123
7.3	MULTIPLE ALLELISM	124
7.4	LETHALITY: LETHAL ALLELE	124
<u>8</u>	<u>POLYHYBRIDISM</u>	<u>128</u>
8.1	DEFINITION	128
8.2	TRIHYBRIDISM	128
8.3	BRANCH METHOD APPLICATION	129
8.4	TRIHYBRID TEST CROSS	130
<u>9</u>	<u>SEX-LINKED GENES</u>	<u>133</u>

9.1	SEX DETERMINATION	133
9.2	MORGAN'S EXPERIMENT	133
9.3	SEX-RELATED INHERITANCE IN HUMANS	134
9.3.1	Y-LINKED INHERITANCE	134
9.3.2	X-LINKED INHERITANCE	135
9.3.3	X-LINKED DOMINANT INHERITANCE	135
9.4	X-LINKED RECESSIVE INHERITANCE	136
9.5	SEX-INFLUENCED TRAITS	137
<u>10</u>	<u>GENE LINKING</u>	<u>139</u>
10.1	DEFINITION	139
10.2	EXPERIMENT	139
<u>11</u>	<u>THREE-POINT TEST</u>	<u>143</u>
11.1	DEFINITION	143
11.2	EXPERIMENT	143
<u>12</u>	<u>EPISTASIS (INTER-CHROMOSOMAL INTERACTION)</u>	<u>147</u>
12.1	DEFINITION	147
12.2	DOMINANT EPISTASIS	148
12.3	RECESSIVE EPISTASIS	148
12.4	CUMULATIVE EFFECT OF GENES	148
12.5	PLEIOTROPY	149
<u>13</u>	<u>BACTERIAL AND VIRAL GENETICS</u>	<u>151</u>

13.1	INTRODUCTION	151
13.2	TRANSFORMATION	151
13.3	STAGES OF TRANSFORMATION	152
13.4	CONJUGATION	153
13.5	TRANSDUCTION	155

<u>14</u>	<u>NOTIONS OF POPULATION GENETICS</u>	<u>159</u>
------------------	--	-------------------

14.1	DEFINITION	159
14.2	GENETIC VARIABILITY IN NATURAL POPULATIONS	159
14.2.1	DETERMINISM OF VARIATIONS	160
14.2.2	EXTENT AND METHODS OF STUDYING VARIABILITY	161
14.2.3	MEASURING GENETIC DIVERSITY	162
14.3	HARDY-WEINBERG EQUILIBRIUM	162
14.4	HARDY-WEINBERG DEVIATIONS AND EVOLUTIONARY IMPLICATIONS	163

Molecular Genetics

1 Genetic Material

1.1 Nucleic Acids

A nucleic acid is a polymer composed of monomeric units called nucleotides, which are linked together by phosphodiester bonds. These nucleic acids are of fundamental importance in all living organisms, as they serve as the carriers of genetic information.

1.2 Types of Nucleic Acids

There are two primary types of nucleic acids: deoxyribonucleic acid (DNA) and ribonucleic acid (RNA):

- **DNA (Deoxyribonucleic Acid):** DNA is a long molecule with a helical structure composed of two strands. These strands are linear and consist of repeating units of nucleotides, which are connected by phosphodiester bonds.
- **RNA (Ribonucleic Acid):** RNA, similar to DNA, is a polymer of nucleotides linked by phosphodiester bonds. However, RNA is typically single-stranded and plays a key role in the expression of genetic information.

Both DNA and RNA are essential for the synthesis of proteins and the functioning of cells, contributing to the development, function, and reproduction of living organisms. While DNA primarily stores genetic information, RNA is involved in gene expression. Table 1 below compares RNA and DNA based on their structure and composition: