

# Table of Contents

Chapter 1. Graphs in the Analysis of Gene Structure .....	1
§1. Gene systems and their maps .....	1
1. Levels of the genetic language .....	1
2. Mutations, recombination, complementation .....	12
3. Genetic methods of investigation .....	16
§2. The mathematical theory of linear maps: interval graphs .....	20
1. Maps and interval orders .....	20
2. The description of interval graphs .....	25
3. Graphs of non-covering intervals .....	34
§3. The mathematical theory of linear maps: interval hypergraphs .....	35
1. Maps and interval hypergraphs .....	35
2. Minimal hypergraphs and complons .....	40
3. The construction of fictitious complons .....	44
4. Non-linear hypergraphs and interval graphs .....	48
§4. Linear mapping algorithms .....	51
1. The Fulkerson-Gross algorithm .....	51
2. The uniqueness theorem .....	59
3. Admissible orderings of linear matrices .....	61
§5. Examples of structural analysis of genetic systems ...	66
1. The use of deletions and polar mutations .....	66
2. The complementation maps of multiple mutational defects .....	75
3. Complex traits and the loci which control them ....	81
Chapter 2. Graphs in the Analysis of Gene Semantics .....	92
§1. Interallelic complementation and the functioning of protein multimers .....	92
1. Interallelic complementation .....	92
2. The fundamental principles of organization of protein multimers .....	93
3. The molecular mechanisms of interallelic complementation .....	97

§2. The approximation of graphs .....	101
1. Approximation problems in a space of relations ....	101
2. The optimal partition problem .....	105
3. Detecting macrostructure .....	114
§3. Analyzing the spatio-functional organization of specific genetic systems .....	118
1. Complex protein organization .....	118
2. The investigation of genome spatial structure .....	126
Chapter 3. Graphs in the Analysis of Gene Evolution .....	133
§1. Trees and phylogenetic trees .....	133
1. The notion of a phylogenetic tree .....	133
2. The metric generated by a tree .....	136
3. The construction of dendrograms .....	143
4. Reconstructing the probable structure of ancestral successions .....	149
5. Calculating the internal structure of sequences during tree construction .....	154
§2. The evolution of families of synonymous proteins .....	158
1. The dendrogram of the globins and its analysis ....	158
2. Analyzing the evolution of globin sequences from their internal structure .....	165
Epilogue: Cryptographic Problems in Genetics .....	176
Appendix: Some Notions About Graphs .....	180
References .....	188
Index of Genetics Terms .....	194
Index of Mathematical Terms .....	196