



# Genetics & Molecular Biology

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*Robert Schleif*

# Genetics and Molecular Biology

R O B E R T   S C H L E I F

Brandeis University



A D D I S O N - W E S L E Y   P U B L I S H I N G   C O M P A N Y

Reading, Massachusetts • Menlo Park, California • Don Mills, Ontario • Wokingham, England  
Amsterdam • Sydney • Singapore • Tokyo • Mexico City • Bogotá • Santiago • San Juan

**Library of Congress Cataloging in Publication Data**

Schleif, Robert F.

Genetics and molecular biology.

Bibliography: p.

Includes index.

1. Molecular genetics. I. Title.

QH430.S35 1985 574.87'3282 85-3903

ISBN 0-201-07418-4

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ABCDEFGHIJ-HA-898765

**T**his book evolved from a course in molecular biology that I have taught for the past twelve years to our graduate students and to some undergraduate students. My main theme is that a relatively small number of principles involving cell biology, physical chemistry, genetics, and biochemistry permit the understanding of a large fraction of molecular biology.

This material is intended to encourage thinking and an appreciation for beautiful experiments. Thus the book is selective in the material it presents. Rather than list each fact that is known, I have tried to find a useful subset of the facts. This is necessary, of course, for by now molecular biology is such an ocean of information that no course should touch an appreciable fraction of what is known.

Although the text together with many of the problems forms a self-contained unit, instructors in advanced courses may want to supplement the material contained here with lectures on recent developments and assigned readings of research papers as appropriate to their own course.

Much of the material in this book discusses results found on prokaryotes. This is possible since many of the important principles of molecular biology are most clearly revealed and explored in prokaryotic systems. However, the extension of such results to eukaryotes is discussed, and eukaryotic systems of special interest are presented.

Few undergraduates will have had the ideal preparation for using this book, courses in cell biology, physical chemistry, and biochemistry. To maximize its utility, however, the book is written as though the reader has had partial acquaintance with all three subjects. Consequently, many readers will find familiar material, new material, and a few topics for which reference to other texts will be helpful.

Many of the discussions include numbers and dimensions so that students may begin to develop a reliable intuition as well as a quantitative understanding of biological systems at the molecular level. Also, many experiments are outlined to permit the students to acquire a good idea of the ways in which the facts were learned. This approach appears to facilitate understanding. Although each of the

many findings in molecular biology is rather simple, these are remote from direct experience, and hence a large collection of such facts becomes hard to assimilate. Consequently, describing how the knowledge was discovered assists in its learning, because results become less remote, and slight doubts about their reliability are erased.

Many challenging problems are provided at the end of each chapter. Solving two or three of the typical ones per lecture is a reasonable load. A few deal directly with the textual material, but most amplify the textual material or introduce new ideas for which insufficient room existed in the text. Some require access to the literature. The student is urged to work a few of the problems from each chapter and to read all the rest. The particularly difficult ones are marked with a star.

Extensive references to material covered in the text, as well as related material on both prokaryotes and eukaryotes, are provided at the end of each chapter. The Recommended Readings are papers a more advanced student could profitably read in conjunction with the text. The Related Reviews, Books, and Articles list a few of the papers a student can turn to for background information. The papers listed under Deeper Reading permit the advanced student or research worker to find important papers on many topics related to the chapter. The references cover a substantial fraction of the important literature. Naturally, important papers published before those listed will be referred to in these papers. However, important papers published after those listed can also easily be found with the Science Citation Index. This annual reference lists papers and books published in a given year according to the references made in the paper or book. Thus by using this source to find all references to an important earlier work, one can work forward in time from a key paper.

Many people have contributed to this book. I particularly thank Pieter Wensink for penetrating discussions over the years; Donald Green, Thomas Gray, Edward Simon, Robert Vinopal, Philip Perlman, and Mary Ann Jarema for comments and suggestions on the text; James Funston for guidance through the project; and the staff of Addison-Wesley for their excellent production of this book. I would also like to thank Clifford Brunk and Richard L. Bernstein for their opinions on the final manuscript and to my many students for helping me to refine the presentation.

*Waltham, Massachusetts*

*R.S.*

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# A NOTE TO THE READER

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**S**ince molecular genetics is such a broad subject, many important points have been mentioned only in the problems. Therefore reading all the problems, even if you do not intend to solve them, will help you learn more about what is known. Similarly, some of the references discuss points not dealt with at length in the text, and reading their titles in the lists at the ends of the chapters will add to your knowledge of what is known as well as start you in the direction of more information on a topic.

Many of the problems are of the “*Ah-ha!*” type, so that considerable time may be spent in fully understanding a question or an approach to the answer, and when the insight comes, it often comes in a flash. The problems that are known to be harder are marked with a star, as are sections containing harder material that is not essential to understanding the rest of the book.

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# C O N T E N T S

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## ■ P A R T   O N E ■

---

### Cell Structure and Cell Constituents

#### CHAPTER   1   ■   An Overview of Cell Structure and Function   3

- Cells Operate with an Immense Amount of Information   3
- Rudiments of Prokaryotic Cell Structure   4
- Rudiments of Eukaryotic Cell Structure   7
- DNA Is Tightly Packed Within Cells   9
- Putting Molecules In or Out of Cells   10
- Diffusion Is Very Rapid within the Small Volume of the Cell   14
- Freely Growing Populations Increase Exponentially   15
- Composition Changes Slowly in Exponentially Growing Cells   16
- Age Distribution in Populations of Growing Cells   17
- Problems   18
- Recommended Readings   20
- Related Reviews, Books, and Articles   20
- Deeper Reading   20

#### CHAPTER   2   ■   Nucleic Acid Structure   21

- The Regular Backbone of DNA   22
- Helical Forms of DNA   24
- Base-Paired Strands Can Dissociate   26
- Polynucleotide Strands Can Specifically Reassociate   27
- Specific Reassociation Is a Valuable Tool   28
- Dependence of Reassociation Rates on Salt and Temperature   29
- Counting DNA Copies by Reassociation Kinetics   29
- Topology Introduces Additional Considerations   31

Generating DNA With Superhelical Turns	32
Measuring Superhelical Turns	34
Binding of Proteins and DNA Unwinding	36
Determining Lk, Tw and Wr in Hypothetical Structures	37
Enzymes Can Add or Subtract Superhelical Turns	38
Do Superhelical Turns Have Biological Significance?	39
A Unified Mechanism for DNA Topoisomerases	40
Problems	41
Recommended Readings	43
Related Reviews, Books, and Articles	43
Deeper Reading	43

## CHAPTER 3 ■ DNA Synthesis 47

A. ENZYMOLOGY	48
Proofreading, Okazaki Fragments, and DNA Ligase	48
Multiple Types of DNA Polymerases Are Found in Cells	51
Activities Associated With a DNA Replication Fork	53
$\phi$ X174 Replication: A Specific Case	54
Components of Cellular DNA Replication	58
Error and Damage Correction	59
B. PHYSIOLOGICAL ASPECTS	61
DNA Replication Areas in Bacterial Chromosomes	61
DNA Is Synthesized Outward in Both Directions From Origins	63
<i>Escherichia Coli</i> DNA Elongates at About 500 Bases/Sec	65
Constancy of the <i>E. Coli</i> DNA Elongation Rate	67
Keeping DNA Synthesis in Step with Cell Division	69
Making Synchronized Cells	72
How Fast Can DNA Be Replicated?	74
Problems	75
Recommended Readings	77
Related Reviews, Books, and Articles	78
Deeper Reading	78

## CHAPTER 4 ■ RNA Polymerase and RNA Synthesis 83

Measuring the Activity of RNA Polymerase	84
<i>Escherichia Coli</i> Contains a Single Type of RNA Polymerase	86
Eukaryotic Cells Contain Three Types of RNA Polymerase	87
RNA Polymerases Contain Multiple Subunits	88
Little of the Cellular Polymerase is Free in the Cytoplasm	91
Specificity by the Sigma Subunit: Heat Shock and Sporulation	92
<i>E. Coli</i> RNA Polymerase Elongates at 60 Nucleotides/Sec	93
The Initiation Process Probably Consists of Many Steps	95
Measurement of Binding and Initiation Rates	96
Relating Abortive Initiations to Polymerase Rate Constants	98
Salt Strongly Affects RNA Polymerase Binding	100



Promoters Are Similar but Not Identical	102
RNA Polymerase Melts about 14 Base Pairs After Binding	103
Transcription Termination Occurs at Specific Sites	105
Some Terminators Require Assistance from Rho Protein	106
Processing Prokaryotic RNAs after Synthesis	107
Processing of Eukaryotic RNAs	107
RNA Splicing	109
Problems	111
Recommended Readings	114
Related Reviews, Books, and Articles	114
Deeper Reading	115

## CHAPTER 5 ■ Protein Structure 119

The Amino Acids	120
The Peptide Bond	124
Electrostatic Forces that Determine Protein Structure	125
Hydrogen Bonds and the Chelate Effect	129
Hydrophobic Forces	130
Structures Within Proteins	131
Structure of the Alpha Helix, Beta Sheet, and Beta Turn	132
Thermodynamic Considerations to Protein Structure	134
Prediction of Protein Structure	136
Structure of a DNA-Binding Protein	137
Problems	140
Recommended Readings	141
Related Reviews, Books, and Articles	141
Deeper Reading	141

## CHAPTER 6 ■ Protein Synthesis 143

A. CHEMICAL ASPECTS	144
Activation of Amino Acids during Protein Synthesis	144
Decoding the Message	147
Ribosomal RNA Base Pairs with Bacterial Message	150
Experimental Support for the Shine-Dalgarno Hypothesis	151
Eukaryotic Translation Begins with the First AUG	154
Tricking the Translation Machinery into Initiating	154
Protein Elongation	156
Peptide Bond Formation	157
Translocation	158
A Paradox	159
Termination, Nonsense, and Suppression	160
B. PHYSIOLOGICAL ASPECTS	162
Messenger RNA Is Unstable	162
Protein Elongation Rates	162
The Need For Directing Proteins to Cellular Sites	166

The Signal Peptide Model for Protein Excretion	166
Testing the Signal Peptide Model	167
Alternatives to the Signal Hypothesis	170
Expectations for Ribosome Regulation	171
Ribosome Levels Are Proportional to Cell Growth Rates	172
Regulation of Ribosome Synthesis	174
The Stringent-Relaxed Problem of rRNA Regulation	175
Maintaining Balanced Synthesis of Ribosomal Components	177
Problems	179
Recommended Readings	182
Related Reviews, Books, and Articles	182
Deeper Reading	183

## ■ P A R T   T W O ■

---

### Genetics and Genetic Engineering

#### CHAPTER    7   ■   Formal Genetics   189

Mutations	190
Point Mutations, Deletions, Insertions, and Damage	191
Classical Genetics of Chromosomes	193
Complementation, <i>cis</i> , <i>trans</i> , Dominant, and Recessive	196
Genetic Recombination	198
Mapping by Recombination Frequencies	199
Mapping by Deletions	202
Heteroduplexes Likely Form during Genetic Recombination	203
Branch Migration and Isomerization	204
Elements of Recombination in <i>E. coli</i> , <i>RecA</i> , <i>RecBC</i> , and <i>Chi</i>	207
Problems	209
Recommended Readings	211
Related Reviews, Books, and Articles	211
Deeper Reading	212

#### CHAPTER    8   ■   Genetic Systems   215

Growing Cells for Genetic Experiments	216
Testing Purified Cultures, Scoring	217
Isolating Auxotrophs, Use of Mutagens, and Replica Plating	217
Genetic Selections	218
Mapping with Generalized Transducing Phage	221
Principles of Bacterial Sex	222
Elements of Yeast Genetics	224
Elements of <i>Drosophila</i> Genetics	226

Isolating Mutations in Muscle or Nerve in <i>Drosophila</i>	226
Fate Mapping and Study of Tissue-Specific Gene Expression	228
Problems	230
Recommended Readings	232
Related Reviews, Books, and Articles	232
Deeper Reading	232

## **CHAPTER 9 ■ Probabilities and the Luria-Delbrück Fluctuation Test 235**

The Binomial Probability Distribution	236
Derivation of the Poisson Distribution	237
The Gaussian Distribution	238
Measures of Probability Distributions	239
Elements of the Luria-Delbrück Fluctuation Test	240
Mutation Frequencies from Fluctuation Analysis	241
Problems	244
Recommended Readings	246
Related Reviews, Books, and Articles	246
Deeper Reading	246

## **CHAPTER 10 ■ Genetic Engineering and Recombinant DNA 247**

The Isolation of DNA	248
The Biology of Restriction Enzymes	250
Cutting DNA with Restriction Enzymes	254
Isolation of DNA Fragments	255
Joining DNA Fragments	256
Vectors Provide for Selection and a Cellular Free Ride	259
Plasmid Vectors	259
A Phage Vector for Bacteria	261
Vectors for Higher Cells	263
Putting DNA Back into Cells	265
Chemical DNA Sequencing	266
Enzymatic DNA Sequencing	269
Problems	273
Recommended Readings	276
Related Reviews, Books, and Articles	276
Deeper Reading	277

## **CHAPTER 11 ■ Advanced Genetic Engineering 281**

Cloning from RNA or DNA	283
Plaque and Colony Hybridization for Clone Identification	285
R-Loop Enrichment of DNA Complementary to Purified RNA	285
Walking Along a Chromosome to Clone a Gene	286

Arrest of Translation Assay for DNA of a Gene	287
Tools of Analysis I: Southern Transfers, DNA	289
Tools of Analysis II: Northern and Western Transfers, RNA and Protein	290
Tools of Analysis III: Footprinting and S1 Mapping, DNA	293
Altering Cloned DNA by <i>in vitro</i> Mutagenesis	296
Mutagenesis with Chemically Synthesized DNA	300
Detecting Genetic Diseases	302
Doctoring the <i>E. coli araC</i> Gene for Hyperproduction	304
Problems	307
Recommended Readings	309
Related Reviews, Books, and Articles	309
Deeper Reading	310

## ■ P A R T   T H R E E ■

### How Genes Are Regulated

---

#### CHAPTER   12   ■   Repression and the *lac* Operon   315

Background of the <i>lac</i> Operon	316
The Role of Inducer Analogs in the Study of the <i>lac</i> Operon	318
<i>lac</i> Repressor Is a Protein	320
An Assay for <i>lac</i> Repressor	321
Wild-Type <i>lac</i> Repressor Could Not Be Detected	322
Detection and Purification of <i>lac</i> Repressor	324
Repressor Binds to DNA: The Operator Is DNA	326
The Isolation and Structure of Operator	328
Repressor Slides Along DNA to Find the Operator	330
Repressor Binds DNA <i>in vitro</i> as Tightly as <i>in vivo</i>	331
Repressor's N-Terminus Binds DNA: Genetic Demonstration	332
Isolation and Characterization of 1 <sup>-d</sup> Repressor Mutants	333
Repressor's N-Terminus Binds DNA: Physical Demonstration	334
A Mechanism for Induction	336
RNA Polymerase Binding to the <i>lac</i> Promoter	337
Problems	338
Recommended Readings	341
Related Reviews, Books, and Articles	342
Deeper Reading	342

#### CHAPTER   13   ■   Induction and the *ara* Operon   347

The Sugar Arabinose and Arabinose Metabolism	348
Genetics of the Arabinose System	350

<i>araC</i> Protein Regulates Positively: Detection and Isolation	352
<i>araC</i> Protein Represses as Well as Induces	354
The Promoter for Synthesis of <i>araC</i> Protein Is Also Regulated	357
Binding Sites of the <i>ara</i> Regulatory Proteins	357
DNA Loops Are Involved in Repression of <i>araBAD</i>	360
Electrophoresis to Assay Low Affinity DNA-Binding Proteins	361
Why Positive Regulators Are a Good Idea	364
Problems	366
Recommended Readings	368
Related Reviews, Books, and Articles	368
Deeper Reading	369

## CHAPTER 14 ■ Attenuation and the *trp* Operon 373

The Aromatic Amino Acid Aynthetic Pathway and Its Regulation	374
Rapid Induction Capabilities of the <i>trp</i> Operon: Repression	376
The Serendipitous Discovery of <i>trp</i> Enzyme Hypersynthesis	378
Early Explorations of the Hypersynthesis	380
<i>trp</i> Leader RNA Has the Potential to Form Multiple Hybrids	383
Coupling Translation to Attenuation	384
RNA Secondary Structure and the Attenuation Mechanism	386
Other Attenuated Operons	388
Problems	388
Recommended Readings	390
Related Reviews, Books, and Articles	390
Deeper Reading	390

## CHAPTER 15 ■ Developmentally Regulated Genes in Yeast and *Drosophila* 395

Mating Type Conversion in Yeast	396
Cloning the Mating Type Loci in Yeast	397
Transfer of Mating Type Gene Copies to an Expression Site	398
Structure of the Mating Type Loci	399
The Expression and Recombination of Paradoxes	400
DNA Cleavage at the <i>MAT</i> Locus	401
Regulated Expression of DOPA Decarboxylase in <i>Drosophila</i>	403
Cloning the DOPA Decarboxylase Gene	404
Tissue-Specific Responses: Putting the Cloned Gene Back	405
Tissue-Specific Enhancers for <i>Drosophila</i> Yolk Proteins	406
Problems	408
Recommended Readings	408
Related Reviews, Books, and Articles	409
Deeper Reading	409

## CHAPTER 16 ■ Lambda Phage Genes and Regulatory Circuitry 411

### A. THE STRUCTURE AND BIOLOGY OF LAMBDA 412

The Physical Structure of Lambda 412

The Genetic Structure of Lambda 413

Lysogeny, Immunity, Integration, and Excision 416

Lambda's Relatives and Lambda Hybrids 417

### B. CHRONOLOGY OF A LYTIC INFECTIVE CYCLE 418

Lambda Adsorbs to Cells Via a Maltose Transport Protein 418

Termination Restricts Early Transcription to Genes *N* and *cro* 419

*N* Protein Prevents Termination of Early Gene Transcription 420

*cro* Protein Blocks *C<sub>I</sub>* Repressor Synthesis and Wins the Race 421

Proteins *O* and *P* Initiate DNA Synthesis 422

Proteins *kil*,  $\lambda$ ,  $\beta$ , and *exo* 423

*Q* Protein Blocks Termination to Synthesize Late Proteins 424

Packaging and Lysis 425

### C. THE LYSOGENIC INFECTIVE CYCLE AND INDUCTION OF LYSOGENS 426

Chronology of Becoming a Lysogen 426

*cro* and Repressor Repress and Induce the Same Sites 427

Cooperativity in Repressor Binding and Its Measurement 430

The Need for and Realization of Hair-Trigger Induction 431

Induction from the Lysogenic State 434

Entropy, A Basis for Lambda Repressor Inactivation 436

Problems 437

Recommended Readings 439

Related Reviews, Books, and Articles 439

Deeper Reading 440

## ■ PART FOUR ■

### Mobile DNA

## CHAPTER 17 ■ Lambda Phage Integration and Excision 449

Integrated Lambda Maps Like a Chromosomal Gene 450

Chromosomal Deletions Also Delete Lambda Genes 451

DNA Heteroduplexes Prove that Lambda Integrates 452

Gene Order Premutation and the Campbell Model 453

Isolation and Integration-Defective Mutants 455

Isolation of Excision-Deficient Mutants 456

*Int* and *xis* Are Single Genes and Are Phage-Specific 458

Incorrect Excision Produces *gal* and *bio* Transducing Phage 459

Transducing Phage Carrying Genes Other than *gal* and *bio* 461

Use of Transducing Phage to Study Integration and Excision 462

The Double <i>att</i> Phage, <i>att</i> <sup>2</sup>	464
Regulating Integration and Excision: <i>xis</i> Is Unstable	466
Retro-Inhibition of <i>int</i> Translation	467
<i>In vitro</i> Assay of Integration and Excision	469
Host Proteins Are Involved in Integration and Excision	471
Isolation and Properties of <i>att</i> Mutants	472
Structure of the <i>att</i> Region	473
<i>Int</i> and <i>xis</i> Binding in the <i>att</i> Region	475
Problems	476
Recommended Readings	478
Related Reviews, Books, and Articles	478
Deeper Reading	478

## CHAPTER 18 ■ Transposable Genetic Elements 483

The Discovery of IS Elements in Bacteria	484
The Structure and Properties of IS Elements	486
Discovery of Tn Elements	488
The Structure and Properties of Tn Elements	491
Role of the Repeated Sequence Generated by Transposition	492
<i>Genetic and Physical Mapping of Tn3</i>	494
<i>In vitro</i> Transposition	497
Regulating Flagellin Synthesis by Inverting a DNA Segment	498
Mu Phage Is a Giant Transposable Element	500
Mu Phage Possesses a Segment that Inverts	502
Transposable Elements in Higher Cells	504
Transposons as Genetic Engineering Vectors in Higher Cells	506
Transposition via DNA Intermediates	509
Problems	511
Recommended Readings	513
Related Reviews, Books, and Articles	513
Deeper Reading	513

## CHAPTER 19 ■ Generating Genetic Diversity: Antibodies 517

The Basic Immune Response	517
Telling the Difference Between Foreign and Self	519
The Number of Different Antibodies Produced	521
Myelomas and Monoclonal Antibodies	521
The Structure of Antibodies	524
Cells Have Many Copies of V Genes and Only a Few C Genes	526
The J Regions	528
The D Regions in H Chains	531
Induced Mutations Add to Antibody Diversity	533
Class Switching of Heavy Chains	533
Enhancers and Expression of Immunoglobulin Genes	534

Problems	535
Recommended Readings	536
Related Reviews, Books, and Articles	536
Deeper Reading	537

## ■ P A R T F I V E ■

---

### Special Topics

#### CHAPTER 20 ■ Biological Assembly, Ribosomes, and Lambda Phage 541

A. RIBOSOME ASSEMBLY	542
RNase and Ribosomes	542
The Global Structure of Ribosomes	543
Assembly of Ribosomes	545
Experiments With <i>in vitro</i> Ribosome Assembly	548
Determining Details of Local Ribosomal Structure	550
B. LAMBDA PHAGE ASSEMBLY	552
General Aspects	552
The Geometry of Capsids	553
The Structure of the Lambda Particle	556
The Head Assembly Sequence	556
Packaging the DNA and Formation of the <i>cos</i> Ends	558
Formation of the Tail	560
<i>In vitro</i> Packaging	560
Problems	561
Recommended Readings	563
Related Reviews, Books, and Articles	564
Deeper Reading	564

#### CHAPTER 21 ■ Chemotaxis 569

Assaying Chemotaxis	570
Fundamental Properties of Chemotaxis	572
Genetics of Motility and Chemotaxis	575
How Cells Swim	576
The Mechanism of Chemotaxis	578
The Energy for Chemotaxis	581
Adaptation and Protein Methylation	582
Problems	585
Recommended Readings	587
Related Reviews, Books, and Articles	588
Deeper Reading	588



**CHAPTER 22 ■ Oncogenesis, Molecular Aspects 591**

- Bacterially Induced Tumors in Plants 592
- Transformation by Damaging the Chromosome 593
- Identifying a Nucleotide Change Causing Cancer 595
- Retroviruses and Cancer 598
- Cellular Genes Have Retroviral Counterparts 601
- Identification of the *src* and *sis* Gene Proteins 603
- DNA Viruses and Cancer 604
- Directions for Future Research in Molecular Biology 605
- Problems 606
- Recommended Readings 607
- Related Reviews, Books, and Articles 607
- Deeper Reading 607

**INDEX ■ 611**