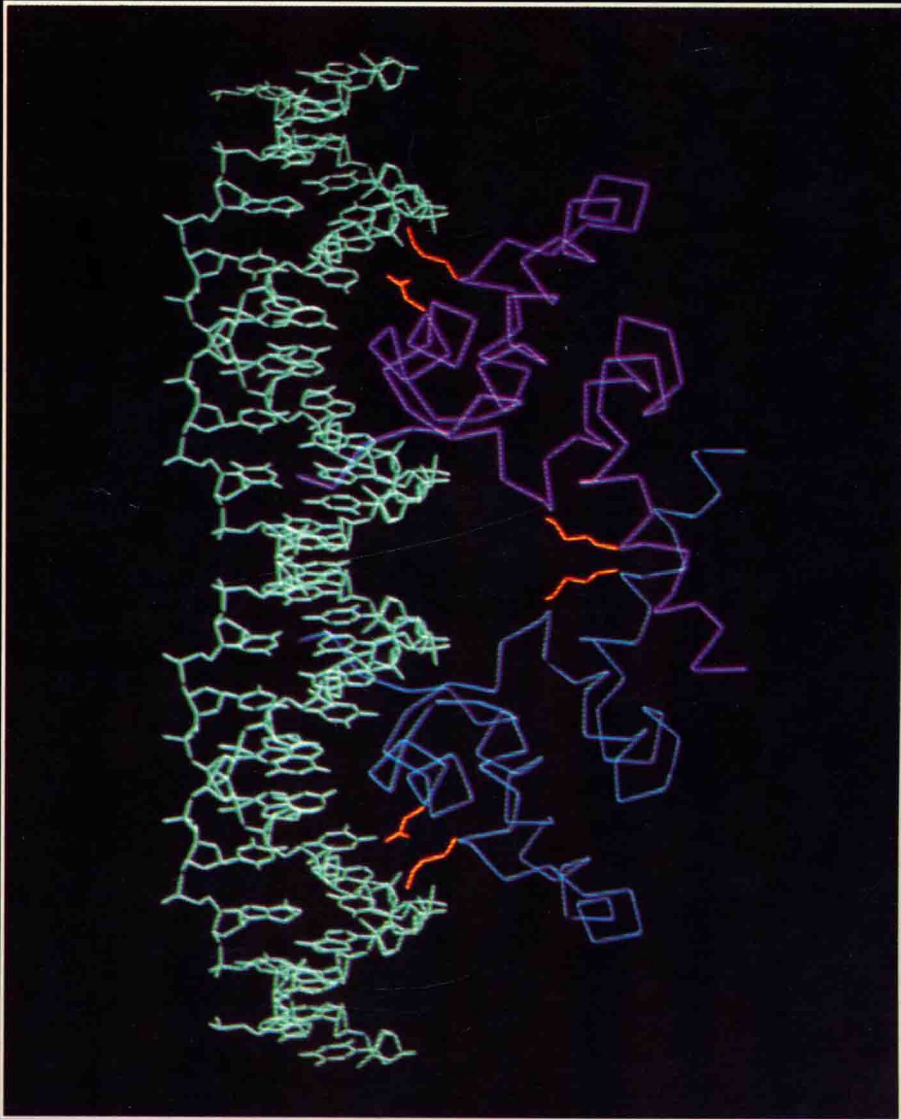


The Biochemistry of the Nucleic Acids

TENTH EDITION

Roger L.P. Adams, John T. Knowler and David P. Leader



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Preface

When the first edition of this book was published in 1950, it set out to present an elementary outline of the state of knowledge of nucleic acid biochemistry at that time and it was the first monograph on the subject to appear since Levene's book on Nucleic Acids in 1931. The fact that a tenth edition is required after thirty five years and that virtually nothing of the original book has been retained is some measure of the speed with which knowledge has advanced in this field.

As a result of this vast increase in information it becomes increasingly difficult to fulfil the aims of providing an introduction to nucleic acid biochemistry and satisfying the requirements of advanced undergraduates and postgraduates in biochemistry, genetics and molecular biology. We have attempted to achieve these aims by concentrating on those basic aspects not normally covered in the general biochemistry textbooks and by providing copious references so that details of methodology can readily be retrieved by those requiring further information.

The first seven editions emerged from the pen of J. N. Davidson who died in September 1972 shortly after completing the seventh edition. The subsequent editions have been produced by various colleagues who have tried to retain something of the character and structure of the earlier editions while at the same time introducing new ideas and concepts and eliminating some of the more out-dated material.

With each new edition very extensive revisions, not only in the content of individual chapters but also in general organization and layout, have been required. With a large amount of additional material to present, the book has grown in size, but every effort has been made to keep the increase within bounds by excluding non-essential detail. In a field in which new developments are occurring so rapidly it is inevitable that new knowledge will accumulate more quickly than it can be embodied in a new edition but we have endeavoured to incorporate into this edition material published up to the date of completion of the manuscript in December 1985.

It is a pleasure to express our thanks to those who have allowed us to reproduce figures and diagrams, especially those who have provided original photographs.

We are particularly grateful to the secretarial staff in the Biochemistry Department at the University of Glasgow for the cheerful and tireless efforts they have put in, typing and retyping the manuscript; and to the artists of the Medical Illustrations Unit.

R.L.P.A.

J.T.K.

D.P.L.

December 1985

Abbreviations and nomenclature

The abbreviations employed in this book are those approved by the Commission on Biochemical Nomenclature (CBN) of the International Union of Pure and Applied Chemistry (IUPAC) and the International Union of Biochemistry (IUB).

Nucleosides

A	adenosine
G	guanosine
C	cytidine
U	uridine
ψ	5-ribosyluracil (pseudouridine)
I	inosine
X	xanthine
rT	ribosylthymine (ribothymidine)
N	unspecified nucleoside
R	unspecified purine nucleoside
Y	unspecified pyrimidine nucleoside
dA	2'-deoxyribosyladenine
dG	2'-deoxyribosylguanine
dC	2'-deoxyribosylcytosine
dT or T	2'-deoxyribosylthymine (thymidine)

Minor nucleosides (when in sequence)

m^1A	1-methyladenosine
m_2^6A	N^6 -dimethyladenosine
iA	N^6 -isopentenyladenosine
m^5C	5-methylcytidine
ac^4C	N^4 -acetylcytidine
m^1G	1-methylguanosine
m^2G	N^2 -methylguanosine
m_2^2G	N^2 -dimethylguanosine
m^1I	1-methylinosine
Cm	2'- <i>O</i> -methylcytidine
Gm	2'- <i>O</i> -methylguanosine
Um	2'- <i>O</i> -methyluridine
D	5,6-dihydrouridine

mcm ⁵ U	5-(methoxycarbonylmethyl)uridine
mcm ⁵ s ² U	5-(methoxycarbonylmethyl)-2-thiouridine
mm ⁵ s ² U	5-(methylaminomethyl)-2-thiouridine
mo ⁵ U	5-methoxyuridine
cmo ⁵ U	5-(carboxymethoxyuridine)
Q	Queosine
yW	Wybutosine

Nucleotides

AMP	adenosine 5'-monophosphate
GMP	guanosine 5'-monophosphate
CMP	cytidine 5'-monophosphate
UMP	uridine 5'-monophosphate
dAMP	2'-deoxyribosyladenine 5'-monophosphate
dGMP	2'-deoxyribosylguanine 5'-monophosphate
dCMP	2'-deoxyribosylcytosine 5'-monophosphate
dTMP	2'-deoxyribosylthymine 5'-monophosphate
2'-AMP, 3'-AMP, 5'-AMP etc	2'-, 3'- and 5'-phosphates of adenosine etc.
ADP etc.	5'-(pyro) diphosphates of adenosine etc.
ATP etc.	5'-(pyro) triphosphates of adenosine etc.
ddTTP etc.	2', 3'-dideoxyribosylthymine 5'-triphosphate
araCTP	1-β-D-arabinofuranosylcytosine 5'-triphosphate

Polynucleotides

DNA	deoxyribonucleic acid
cDNA	complementary DNA
mtDNA	mitochondrial DNA
RNA	ribonucleic acid
mRNA	messenger RNA
rRNA	ribosomal RNA
tRNA	transfer RNA
nRNA	nuclear RNA
hnRNA	heterogeneous nuclear RNA
snRNA	small nuclear RNA
Alanine tRNA or tRNA ^{Ala}	
etc.	transfer RNA that normally accepts alanine
Alanyl-tRNA ^{Ala} or	
Ala-tRNA ^{Ala} or Ala-tRNA	transfer RNA that normally accepts alanine with alanine residue covalently linked
poly(N), or (N) _n or (rN) _n	polymer of ribonucleotide N
poly(dN) or (dN) _n	polymer of deoxyribonucleotide N
poly(N-N'), or r(N-N') _n or (rN-rN') _n	copolymer of -N-N'-N-N'-in regular, alternating, <i>known</i> sequence

poly(A) . poly(B) or (A) _n . (B) _n	two chains, generally or completely associated
poly(A), poly(B) or (A) _n , (B) _n	two chains, association unspecified or unknown
poly(A) + poly(B) or (A) _n + (B) _n	two chains, generally or completely unassociated

Miscellaneous

RNase, DNase	ribonuclease, deoxyribonuclease
P _i , PP _i	inorganic orthophosphate and pyrophosphate
nt	nucleotide
bp	base pair
mt	mitochondrial

Amino acids

Ala or A	alanine
Arg or R	arginine
Asn or N	asparagine
Asp or D	aspartic acid
Cys or C	cysteine
Gln or Q	glutamine
Glu or E	glutamic acid
Gly or G	glycine
His or H	histidine
Ile or I	isoleucine
Leu or L	leucine
Lys or K	lysine
Met or M	methionine
fMet	formylmethionine
Phe or F	phenylalanine
Pro or P	proline
Ser or S	serine
Thr or T	threonine
Trp or W	tryptophan
Tyr or Y	tyrosine
Val or V	valine

In naming enzymes, the recommendations of the Nomenclature Committee of the International Union of Biochemistry (1984) are followed as far as possible. The numbers recommended by the Commission are inserted in the text after the name of each enzyme.

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