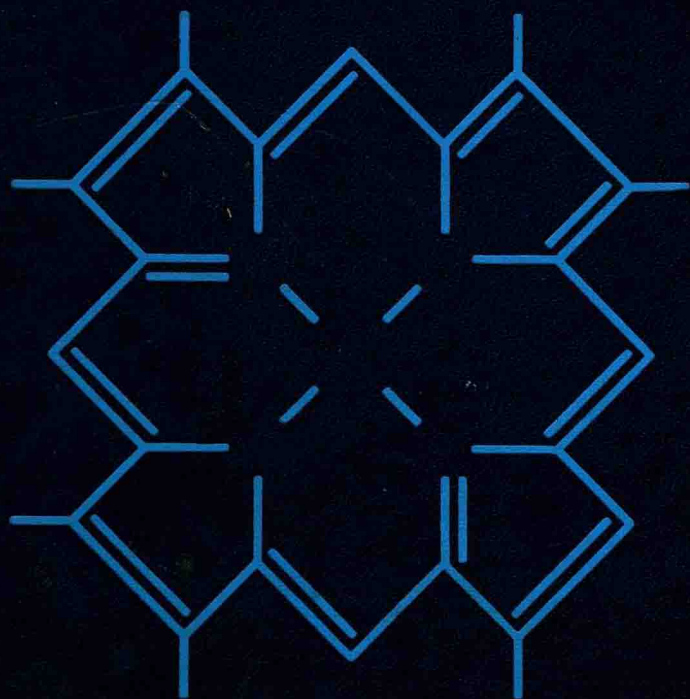


Enzymes in Anesthesiology

Edited by Francis F. Foldes



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ENZYMES IN ANESTHESIOLOGY

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With contributions by

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ENZYMES IN ANESTHESIOLOGY

Foreword

It is a pleasure to have the privilege of writing the foreword for a book edited by Dr. Francis F. Foldes. Dr. Foldes has collected in one convenient place a discussion and description of enzyme systems of use to the anesthesiologist and to those other individuals, such as undergraduate and graduate students in related basic sciences, who will profit by and can make use of this body of information.

The practicing anesthesiologist and those who work in related fields have become increasingly aware of the need to understand enzyme activities which influence the uptake, distribution, and excretion of those substances that are used in the anesthetic management of surgical patients. A variety of such activities is obvious when one considers that such diverse substances as analgesic drugs, tranquilizers, hypnotics, anesthetic agents, and muscle relaxants are strongly affected by these systems and have an influence over the basic understanding of how these drugs operate and act in the body, as well as providing a safety measure so necessary to the proper conduct of clinical anesthesia.

The editor and his colleagues have rendered us a great service in collecting information that deals with the basic activity of enzymes including their structure, their kinetics, and to the degree that knowledge permits, mechanism of actions.

Included in this small and good book, in addition to basic enzymology of practical use to the individuals mentioned, are the discussions of enzyme systems dealing with nerve transmitters, with enzymes that markedly affect in both directions the activity of nonvolatile substances, and a group of enzymes that have not been ordinarily thought to be directly applicable to clinical anesthesiology, but on simple reflection are of great importance.

I feel particularly pleased to note that I have had the opportunity of association in a direct sense with all but two of the co-authors of this splendid book.

It promises to be a collection that will be of considerable conceptual value and, probably even more important, of practical use as a reference for anesthesiologists, medical, and graduate students in the basics of the sciences as well. I hope the spirit and intention of the editor and the co-authors will find the receptivity their work deserves among these groups.

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Preface

Enzymes are essential components of biochemical reactions and are indispensable for the smooth functioning of the physiologic processes based on these reactions. The field of enzymology is one of the most rapidly expanding sciences. Day by day the wealth of information available on enzyme properties and functions increases by leaps and bounds. The possibilities for interactions between enzymes and anesthetic agents are almost limitless. To consider even a small fraction of all the relevant possibilities would be impossible.

Perhaps the most difficult task that confronted us was the selection of the enzyme systems to be discussed from the list of over 4000 entries in the *Enzyme Nomenclature* (Florkin and Stotz 1973). Our choice was guided by three principles: The first was to select enzyme systems of theoretical and practical importance for anesthesiologists. Our second goal was to furnish enough, up-to-date, information on general enzymology to facilitate the understanding of the kinetics of the selected enzyme systems. Our third objective was to demonstrate an avenue of approach to the investigation of other enzyme systems not discussed in this monograph. To achieve our second and third objectives we have devoted a considerable part of the monograph to basic enzymology. This section is comprehensive enough to stand on its own as an introductory text in general enzymology.

Although the enzymes discussed were selected with primary consideration for the interests of anesthesiologists, this monograph contains much information in the discussion of the specific enzyme systems to appeal to a much larger readership. It should be useful for undergraduate and graduate students in biology, biochemistry, physiology, pharmacology, and for medical students. This volume could also serve as a starting point for those wishing to

embark on research on any of the enzyme systems discussed. This applies especially to geneticists and pharmacogeneticists interested in abnormal cholinesterases and malignant hyperthermia.

Monographs are seldom read from cover to cover, but more often than not are used as reference sources. With this in mind it was attempted to make each chapter self sufficient. To facilitate this, we have compiled a glossary that will help the reader to comprehend any chapter, with frequent references to other chapters, or to other sources of information.

Francis F. Foldes

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Glossary

AADC:	Aromatic L-amino acid decarboxylase
AcCoA:	Acetylcoenzyme-A
ACh:	Acetylcholine
AChE:	Acetylcholinesterase
ACP:	Acyl carrier protein
ACTH:	Adrenocorticotropic hormone
ADH:	Antidiuretic hormone
ADP:	Adenosine diphosphate
AK:	Adenylate-kinase; myokinase; EC 2.7.4.3.
AMP:	Adenosine monophosphate
5'-AMP:	5'-Adenosine monophosphate
ATP:	Adenosine triphosphate
ATPase:	Adenosine-triphosphatase; ATP-phosphohydrolase; EC 3.6.1.4.
BuChE:	Butyrylcholinesterase
cAMP:	Cyclic adenosine 3', 5'-monophosphate
CD:	Circular dichroism
CDP:	Cytidine diphosphate
ChAc:	Choline acetylase
ChE:	Cholinesterase
CM Sephadex:	Carboxymethyl Sephadex
CMP:	Cytidine monophosphate
CNS:	Central nervous system
CoA:	Coenzyme A
COMT:	Catechol- <i>O</i> -methyltransferase
CoQ:	Coenzyme Q
CP:	Creatine phosphate

CPK:	Creatine-phosphokinase; ATP: creatine phosphotransferase; EC 2.7.3.2.
CTP:	Cytidine triphosphate
D β H:	Dopamine- β -hydroxylase
dcMP:	2'Deoxycytidine monophosphate
dcTP:	2'Deoxycytidine triphosphate
DEAE Sephadex:	Diethylaminoethyl Sephadex
DFP:	Diisopropyl fluorophosphate
dG:	2'Deoxyguanosine
dGTP:	2'Deoxyguanosine triphosphate
DNA:	Deoxyribonucleic acid
DOCA:	Deoxycorticosterone
DOPA:	3,4-Dihydroxyphenylalanine
DOPAC:	3,4-Hydroxyphenylacetic acid
DTT:	Dithiothreitol, Cleland reagent
EC:	International Union of Biochemistry enzyme numbering system
EDTA:	Ethylene diamine tetraacetic acid
EPR:	Electron paramagnetic resonance
ETP:	Electron transport particles, submitochondrial particles
F:	Folic acid
FH ₂ :	Dihydrofolic acid
FH ₄ :	Tetrahydrofolic acid
FMN:	Flavin mononucleotide
FP ₁ :	Ferroflavoprotein, NADH dehydrogenase
G6-P:	Glucose6-phosphate
G-6-PDH:	Glucose-6-phosphate dehydrogenase; D-glucose6-phosphate: NADP oxidoreductase; EC 1.1.1.49.
GDP:	Guanosine diphosphate
GMP:	Guanosine monophosphate
GTP:	Guanosine triphosphate
5-HIAA:	5-Hydroxyindoleacetic acid
HK:	Hexokinase; ATP: D-hexose-6-phosphotransferase; EC 2.7.1.1.
5-HT:	5-Hydroxytryptamine, serotonin
HVA:	Homovanillic acid
ICSH:	Interstitial cell-stimulating hormone
IMP:	Inosine monophosphate
K _m :	Dissociation constant of an enzyme-substrate complex (index of affinity)
LDH:	Lactate dehydrogenase; L-lactate: NAD-oxidoreductase; EC 1.1.1.27.
LH:	Luteinizing hormone
LSD:	Lysergic acid diethylamide
M:	Mole
MAC:	Minimum alveolar concentration of anesthetic to prevent gross movement in response to surgical stimulation in 50 percent of patients

MAO:	Monoamine oxidases
MAOI:	Monoamine oxidase inhibitors
MH:	Malignant hyperthermia
mU:	One milliunit equals 1 nmole of substrate converted in 1 min at 25°C
NAD:	Nicotine adenine dinucleotide
NADH:	Nicotine adenine dinucleotide, reduced form
NADH ₂ :	Reduced nicotineamide-adenine dinucleotide
NADP:	Nicotine adenine dinucleotide phosphate
NADPH:	Nicotine adenine dinucleotide phosphate, reduced form
NADPH ₂ :	Reduced nicotineamide-adenine dinucleotide phosphate
NBT:	Nitrobluetetrazolium
n.m.:	Neuromuscular
NREM:	Nonrapid eye movement sleep
ORD:	Optical rotatory dispersion
2-PAM:	Pyridine-2-aldoxime methiodide
4-PAM:	Pyridine-4-aldoxime methiodide
PCP:	Parachlorophenylalanine
PEP:	Phosphoenolpyruvate
PHS:	Phenazine methosulfate
Pi:	Inorganic phosphate
PK:	Pyruvate kinase; ATP: pyruvate phosphotransferase; EC 2.7.1.40.
PNMT:	Phenylethanolamine- <i>N</i> -methyltransferase
REM:	Rapid eye movement sleep
RNA:	Ribonucleic acid
S:	Svedberg unit (sec)
SGOT:	Serum glutamic-oxaloacetic transaminase; aspartate aminotransferase; L-aspartate: 2-oxaloglutarate aminotransferase; EC 2.6.1.1.
TH:	Tyrosine hydroxylase
TRIS:	2-Amino-2-hydroxymethyl-1,3-propanediol (trometamol)
tRNA:	Transfer ribonucleic acid
TSH:	Thyroid-stimulatory hormone
UDP:	Uridine diphosphate
UMP:	Uridine monophosphate
UTP:	Uridine triphosphate
V_{\max} :	Maximum velocity of the enzyme-catalyzed reaction
V_{O_2} :	Oxygen consumption
VMA:	3-methoxy-4-hydroxy mandelic acid

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