



Biology Data Book

Second Edition

VOLUME I



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COMPILED AND EDITED BY

Philip L. Altman and Dorothy S. Dittmer /

502335

Federation of American Societies for Experimental Biology

BETHESDA, MARYLAND



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FOREWORD

The *Biology Data Book* in its current revision is being brought up-to-date and greatly expanded, the expansion resulting in part from the use of material taken from the specialized handbooks previously published in this Series. The data are being organized for publication in three volumes, the first appearing in the summer of 1972, the second in the spring of 1973, and the third early in 1974. Each volume will be independently indexed and can be purchased separately by those wishing to have data limited to particular fields of interest. Volume I will cover genetics, cytology, reproduction, development and growth. It will include tables giving the properties of biological substances and information about some of the many widely used materials and methods. It will also have tables on diet, culture media and chemical indicators. In the appendixes there will be found keys to the scientific and corresponding common names of animals and plants. There will be tables giving the taxonomic classification of all living things, and an estimation of the number of species in phyla and classes of the plant and animal kingdoms. Past history of living things will be illustrated by a table on geologic distribution. In addition to chemical, physiological and mathematical constants, there is also a bibliography on sources of organisms and equipment. This storehouse of basic biological information should be useful in any laboratory dealing with living material.

Volume II of the *Biology Data Book* will include information on biological regulators and toxins; on the biological effects of the environment; parasitism of plants on plants, animals on animals, and each on the other. There will also be a new section on sensory and neuro-biology.

Volume III will contain sections on nutrition, digestion and excretion; metabolism; respiration and circulation; and blood and other body fluids. Those familiar with the Data Book Series will recognize that the last three sections have appeared as complete specialized handbooks: *Blood and Other Body Fluids*, 1961—2nd printing, 1966; 3rd printing, 1971; *Metabolism*, 1968; and *Respiration and Circu-*

lation, 1971. Other specialized handbooks published by FASEB were *Environmental Biology*, 1966 and *Growth, Including Reproduction and Morphological Development*, 1962.

The FASEB Publications Committee listed on the following page has the responsibility for general guidance of the data book program and the selection of fields to be covered. A special Biology Data Book Advisory Committee also listed on the following page was chosen to determine what should be included and what should be excluded from the three volumes described briefly above. On the basis of their extensive experience in research and teaching, Advisory Committee members have also made suggestions as to authorities in particular fields who should be asked to contribute their services in the preparation of a table or a part of a table. Tables or portions sent in by more than one contributor are integrated by the handbook staff and then sent to two or more reviewers for critical evaluation. With the aid of Committee members, the staff has obtained remarkable cooperation in securing data for these volumes. The tables are organized to conform to established standards and are subject to critical evaluation and another review. Because of the intricate nature of the compilation, it has been found more efficient to have composition, editing, indexing and the preparation of camera-ready copy done entirely within the Office of Biological Handbooks.

The Federation of American Societies for Experimental Biology realizes that Volume I of the *Biology Data Book* is based on contributions made by 245 research scientists who have given generously of their time and advice. Listed on the following pages are the names and institutional affiliations of the contributors and reviewers. Financial support for the production of Volume I was provided in part by the National Library of Medicine under grant No. 5 RO1 LM00334 and by the U.S. Atomic Energy Commission under contract No. AT(30-1)-4179. The Federation acknowledges with appreciation both the intellectual and monetary contributions that have been made.

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INTRODUCTION

The first edition of the *Biology Data Book*, published in 1964, was a 630-page compendium of "broad scope and limited coverage designed to serve as a basic reference in the field of biology." The scope of the second edition of the *Biology Data Book* is broader, and the coverage is not so limited. This newer edition should therefore be even more useful, than was the original publication, in providing information in subject areas outside the user's own field of competence.

Since it was impractical, as well as impossible, to include data for all species, contributors were instructed to restrict coverage to man and the more important laboratory, domestic, commercial, and field organisms. Despite this restriction, data for many more species—than the 400 covered in the 1964 volume—can now be found in the second edition.

As a result of the broadened scope and coverage, and the inclusion of data for additional species, the revised *Biology Data Book* will appear as three volumes totaling more than 1600 pages. Publication dates and a brief description of the contents of Volumes II and III are given in the Foreword to this volume.

Contents and Review

Volume I of the *Biology Data Book* is arranged in five sections, with the data organized in the form of 71 tables (quantitative and descriptive) and charts plus nine appendixes. Contents of this volume were verified by 245 outstanding authorities in the fields of biology and medicine. The review process to which the data were subjected was designed to eliminate, insofar as possible, material of questionable validity and errors of transcription.

Headnote

An explanatory headnote, serving as an introduction to the subject matter, may precede a table. More frequently, tables are prefaced by a short headnote containing such important information as units of measurement, abbreviations, definitions, and estimate of the range of variation. To interpret the data, it is essential to read the related headnote.

Exceptions

Occasionally, differences in values for the same specifications, certain inconsistencies in nomenclature, and some overlapping of coverage may occur among tables. These result, not from oversight or failure to choose between alternatives, but from a deliberate intent to respect the judgment and preferences of the individual contributors.

Conventions and Terminology

The main conventions used throughout this volume were adapted from the third edition of the *CBE Style Manual*, published in 1972 for the Council of Biology Editors by the American Institute of Biological Sciences. Terminology was checked against *Webster's Third New International Dictionary*, published in 1961 by G. & C. Merriam Company.

Contributors and References

Appended to the tables are the names of the contributors, and a list of the literature citations arranged in alphabetical sequence. The reference abbreviations conform to those in *ACCESS: Key to the Source Literature of the Chemical Sciences*, published by the American Chemical Society in 1969.

Animal and Plant Classification

Animal and plant taxa are arranged according to the classification outlines designated Appendix III and Appendix IV at the back of this volume. These outlines were compiled from information provided by specialists at the Smithsonian Institution's National Museum of Natural History, the U.S. Department of Agriculture, and the American Type Culture Collection. The classifications reflect some of the recent agreements reached by the International Commissions on Nomenclature in the biological sciences.

Scientific Names

In the tables, a synonym following the scientific name of an organism indicates that the synonym, although cited in the reference, is no longer the preferred name. No other attempt was made to provide taxonomic synonymy. All scientific names were either verified in standard taxonomic checklists and classification lists, or submitted for authentication to the appropriate experts at the institutions listed above.

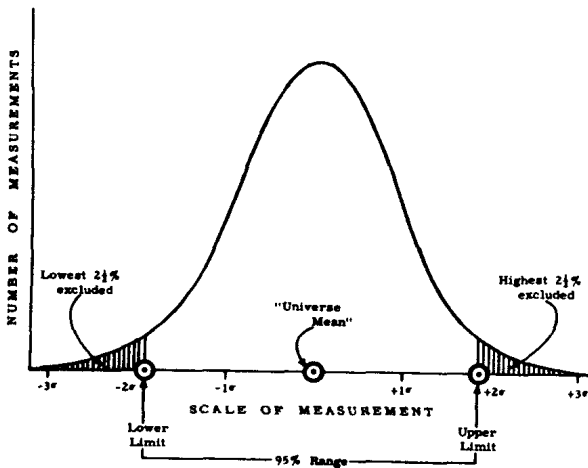
To aid the user in identifying an organism, the index includes the taxonomic orders for animals, and the families for plants. Two appendixes provide cross-reference to scientific and equivalent common names occurring in this volume.

Range of Variation

Values are generally presented as either the mean, plus and minus the standard deviation, or the mean and the lower and upper limit of the range of individual values about the mean. The several methods used to estimate the range—depending on the information available—are designated by

continued

the letters "a, b, c, or d" to identify the type of range in descending order of accuracy.



"a"—When the group of values is relatively large, a 95% range is derived by curve fitting. A recognized type of normal frequency curve is fitted to a group of measured values,

and the extreme 2.5% of the area under the curve at each end is excluded (see illustration).

"b"—When the group of values is too small for curve fitting, as is usually the case, a 95% range is estimated by a simple statistical calculation. Assuming a normal symmetrical distribution, the standard deviation is multiplied by a factor of 2, then subtracted from and added to the mean to give the lower and upper range limits.

"c"—A less dependable, but commonly applied, procedure takes as range limits the lowest value and the highest value of the reported sample group of measurements. It underestimates the 95% range for small samples and overestimates for larger sample sizes, but where there is marked asymmetry in the position of the mean within the sample range, this method may be used in preference to the preceding one.

"d"—Another estimate of the lower and upper limits of the range of variation is based on the judgment of an individual experienced in measuring the quantity in question. The trustworthiness of such limits should not be underestimated.

ABBREVIATIONS AND SYMBOLS

Only those abbreviations and symbols not generally defined in the headnote, body, or footnotes of a table are included in this list.

Measurements

yr	= year
mo	= month
wk	= week
da	= day
hr	= hour
min	= minute
s	= second

m	= meter
cm	= centimeter
mm	= millimeter
μ	= micron
nm	= nanometer
ft	= foot

wt	= weight
g	= gram
kg	= kilogram
mg	= milligram
μ g	= microgram
pg	= picogram
lb	= pound

vol	= volume
ml	= milliliter
μ l	= microliter
%	= parts per hundred
‰	= parts per thousand
ppm	= parts per million

atm	= atmosphere
RH	= relative humidity
temp	= temperature
°C	= degrees Celsius
°F	= degrees Fahrenheit
J	= joule

avg	= average
max	= maximum or maximal
no.	= number
$\pm$	= plus or minus
<	= less than
>	= more than
$\nless$	= not less than
$\nmore$	= not more than
$\sim$	= equivalent to or similar to
$\approx$	= approximately equal to

$\sim$	= approximately
ca.	= circa (approximately)

Biological and Chemical Specifications

σ	= male
φ	= female
sp.	= species (singular)
spp.	= species (plural)
var.	= variety (taxonomic)
CNS	= central nervous system
DNA	= deoxyribonucleic acid
RNA	= ribonucleic acid
IU	= international unit
ICU	= international chick unit
U.S.P.	= United States Pharmacopeia
pH	= hydrogen ion concentration (negative log)

DL or <i>dl</i>	= racemic mixture
D	= dextro (configuration)
L	= levo (configuration)
<i>d</i>	= dextro (rotation)
<i>l</i>	= levo (rotation)
<i>i</i> or <i>meso</i>	= optically inactive
<i>m</i>	= meta
<i>o</i>	= ortho
<i>p</i>	= para
<i>M</i>	= molar
<i>n</i>	= normal
<i>N</i>	= normal, or nitro
<i>O</i>	= oxy
<i>S</i>	= sulf or sulfo
ad lib.	= ad libitum (as desired)

Miscellaneous

Fn	= footnote
e.g.	= exempli gratia (for example)
i.e.	= id est (that is)
Jan	= January
Feb	= February
Mar	= March
Apr	= April
Aug	= August
Sept	= September
Oct	= October
Nov	= November
Dec	= December

ABBREVIATIONS AND SYMBOLS

Only those abbreviations and symbols not generally defined in the headnote, body, or footnotes of a table are included in this list.

Measurements			
yr = year	mA = milliampere	<i>o</i> = <i>ortho</i>	
mo = month	F = farad	<i>p</i> = <i>para</i>	
wk = week	μ F = microfarad	<i>n</i> or <i>N</i> = normal	
da = day	pF = picofarad	<i>N</i> = normal; <i>nitro</i>	
hr = hour	Hz = hertz	<i>M</i> or <i>M</i> = molar	
min = minute; minimum	MHz = megahertz	<i>mM</i> = millimolar	
s = second	M Ω = megohm	μ M = micromolar	
ms = millisecond	k Ω = kilohm	<i>O</i> = <i>oxy</i>	
ps = picosecond	Ω -cm = ohm centimeter	<i>S</i> = <i>sulf</i> ; <i>sulfo</i>	
ht = height	mV = millivolt	ad lib. = <i>ad libitum</i> (as desired)	
m = meter	μ V = microvolt	NAD ⁺ = nicotinamide adenine dinucleotide, oxidized form	
km = kilometer	no. = number	PABA = <i>p</i> -aminobenzoic acid	
cm = centimeter	max = maximum	Ala = alanine; alanyl	
mm = millimeter	approx. = approximate; approximately	Arg = arginine; arginyl	
μ = micron	$\sim$ = approximately	Asn = asparagine; asparaginyl	
nm = nanometer	$\approx$ = approximately equal to	Asp = aspartic acid; aspartyl	
Å = Angstrom	$\cong$ = congruent to	Cys = cysteine; cysteinyl	
mi = mile	$\pm$ = plus or minus	CyS = cystine; cystinyl	
yd = yard	$<$ = less than	Gln = glutamine; glutaminyl	
ft = foot	$>$ = more than	Gly = glycine; glycinyl	
in. = inch	$\nless$ = not less than	His = histidine; histidyl	
wt = weight	$\nless$ = not more than	Ile = isoleucine; isoleucyl	
g = gram	$^{\circ}$ = degree (angular)	Leu = leucine; leucyl	
kg = kilogram	' = arc minute	Lys = lysine; lysyl	
mg = milligram		Met = methionine; methionyl	
μ g = microgram	Biological and Chemical Specifications	Phe = phenylalanine; phenylalanyl	
ng = nanogram	δ = male	Pro = proline; prolyl	
pg = picogram	φ = female	Ser = serine; seryl	
lb = pound	$\delta\varphi$ = male and female	Thr = threonine; threonyl	
vol = volume	sp. = species (singular)	Trp = tryptophan; tryptophyl	
dl = deciliter	spp. = species (plural)	Tyr = tyrosine; tyrosyl	
ml = milliliter	subg. = subgroup	Val = valine; valyl	
μ l = microliter	var. = variety		
% = parts per hundred	f. sp. = forma specialis	Miscellaneous	
ppm = parts per million	RBC = red blood cells	Fn = footnote	
pphm = parts per hundred million	WBC = white blood cells	A.M. = <i>ante meridiem</i> (before noon)	
RH = relative humidity	CNS = central nervous system	P.M. = <i>post meridiem</i> (after noon)	
temp = temperature	ECG = electrocardiogram	$^{\circ}$ N = degrees north (latitude)	
$^{\circ}$ C = degrees Celsius	VCG = vectorcardiogram	$^{\circ}$ S = degrees south (latitude)	
$^{\circ}$ F = degrees Fahrenheit	DNA = deoxyribonucleic acid	vs. = versus	
$^{\circ}$ K = degrees Kelvin	RNA = ribonucleic acid	e.g. = <i>exempli gratia</i> (for example)	
cal = calorie	IU = international unit	i.e. = <i>id est</i> (that is)	
kcal = kilocalorie	LD = lethal dose	etc. = <i>et cetera</i> (and so forth)	
atm = atmosphere	log = logarithm	Jan = January	
mm Hg = millimeters of mercury	pH = hydrogen ion concentration (negative log)	Feb = February	
μ bar = microbar	pI = isoelectric point	Mar = March	
ft-lb = footpound	U.S.P. = United States Pharmacopeia	Aug = August	
cpm = cycles per minute	DL or <i>dl</i> = racemic mixture	Sept = September	
rpm = revolutions per minute	D = dextro (configuration)	Nov = November	
dB = decibel	L = levo (configuration)	Dec = December	
cd = candela	<i>d</i> = dextro (rotation)		
rem = roentgen equivalent man	<i>-f</i> = furanose ring form		
	<i>m</i> = <i>meta</i>		

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