A text-book of human physiology, theoretic and practical

Dearborn George Van
Title: A text-book of human physiology, theoretic and practical

Author: Dearborn George Van

This is an exact replica of a book. The book reprint was manually improved by a team of professionals, as opposed to automatic/OCR processes used by some companies. However, the book may still have imperfections such as missing pages, poor pictures, errant marks, etc. that were a part of the original text. We appreciate your understanding of the imperfections which can not be improved, and hope you will enjoy reading this book.
Diagram of Cell-metabolism.

The substances mentioned on the outer edges of the two cells are some of the materials of cell-anabolism, while those whose names are seen between the cells are katabolic products on their outward way into the circulation. The red lines show the locations of osmotic membranes.
A TEXT-BOOK
OF
HUMAN PHYSIOLOGY
THEORETIC AND PRACTICAL

BY
GEORGE W. DEARBORN, A.M. (Harv.), Ph.D., M.D. (Col.)
PROFESSOR OF PHYSIOLOGY IN THE MEDICAL AND DENTAL SCHOOLS OF TUFTS
COLLEGE, BOSTON; PROFESSOR OF THE RELATIONS OF BODY AND MIND IN
THE SARGENT SCHOOL FOR PHYSICAL EDUCATION, CAMBRIDGE, ETC.

ILLUSTRATED WITH 300 ENGRAVINGS AND 9 PLATES

LEA & FEBIGER
PHILADELPHIA AND NEW YORK
1908
Entered according to the Act of Congress, in the year 1908, by

LEA & FEBIGER,

in the Office of the Librarian of Congress. All rights reserved.
Preface.

This book was written primarily for medical and dental practitioners and students. It emphasizes, however, the mechanism of sense-organs, nerves, and muscles as the basis of the individual's efficiency; and it is the first text-book of medical physiology to recognize the more and more insistent demands of the mental process. For both of these reasons it is also especially adapted to the needs of students and teachers of physical education and of psychology.

The great indebtedness of the author to some of his colleagues and students in the preparation of the text and the illustrations is hereby gratefully acknowledged.

G. V. N. D.
CONTENTS.

CHAPTER I.

PROTOPLASM AND THE CELL.

Protoplasmic Structure .............................................. 17
  The General Properties and Nature of Protoplasm .............. 17
  Hypotheses as to the Origin of Life ............................ 18
  Protoplasm is not a Definite Chemical Substance .............. 20
  Cells ...................................................................... 21
  The Structure of Protoplasm ..................................... 23
  Suppositions as to the Molecular Structure of Protoplasm ... 24
  The Chemical Composition of Protoplasm ....................... 25
  Elements .................................................................. 26
  Compounds .................................................................. 26

Protoplasmic Function .................................................. 34
  Respiration .............................................................. 34
  Nutrition ................................................................. 35
  Digestion .................................................................... 36
  Assimilation .............................................................. 36
  Excretion .................................................................... 37
  Irritability .................................................................. 37
  Movement ..................................................................... 37
  Secretion ..................................................................... 41
  The Production of Energy .......................................... 42
  Conductivity .............................................................. 42
  Taxes ......................................................................... 43
  Consciousness ............................................................ 43
  Reproduction and Growth ......................................... 44
  Amitosis ..................................................................... 44
  Mitosis ....................................................................... 45
  Heredity and Adaptation ........................................... 47
  An Example of Relatively Simple Protoplasm: Amoeba ... 47

CHAPTER II.

THE NERVOUS SYSTEM.

The General Functions of the Nervous System ................... 53
Features of the Neural Structure .................................... 56
The Chemical Composition of Nerve-Tissue ....................... 61
The Blood-Supply of the Nervous System ......................... 62
Functional Parts of the Nervous System ............................ 63
  The Hemispheres ....................................................... 63
  The Cerebral Cortex .................................................. 68
  The Motor Areas of the Human Cerebrum ....................... 70
CONTENTS

Functional Parts of the Nervous System (continued):
The Sensory Areas ........................................... 71
The Association-areas ....................................... 73
The Optic Thalami ......................................... 74
The Corpora Striata ......................................... 74
The Corpora Quadrigemina ................................. 74
The Pons .................................................... 75
The Medulla Oblongata ................................... 76
The Cerebellum ............................................. 78
The Spinal Cord ............................................ 79
Conduction .................................................. 80
Distribution and Collection ............................... 82
Reflexion .................................................... 83
Coordination ................................................. 86
Certain Sets of Nerves ...................................... 87
The Cranial Nerves ....................................... 88
The Spinal Nerves ......................................... 89
The Sympathetic Nerves .................................. 93
Other Autonomic Nerves .................................. 97
The Nervous Impulse ...................................... 97

CHAPTER III.
Respiration.

The Chemistry of Respiration Proper .................. 100
The Respiratory Mechanism ................................ 103
The Lungs ................................................... 105
The Capillaries ............................................ 106
The Thorax .................................................. 108
The Nerves .................................................. 111
The Process and the Mechanism of Internal Respiration . 113
The Sequence and the Causes of the Respiratory Events ............................................... 116
The Course and the Kineties of the Oxygen Inward ......................................................... 116
The Course and the Kineties of the Carbon Dioxide Outward ........................................ 118
The Respiratory Rhythm ................................... 120
The Breath-rate ............................................ 122
Special Functions Connected with Respiration .............. 124
The Respiratory Sounds .................................... 125
Some Respiratory Quantities ............................... 128
The Respiration of the Fetus ............................... 128
Respiration through the Skin .............................. 129
Respiration through the Wall of the Alimentary Canal ................................................. 130
The Quantity and Quality of the Air Required for Respiration ....................................... 131

CHAPTER IV.
Foods.

The General Nature of a Food ........................... 133
The Animal Organism's Proximate Principles ............ 133
Nutrient Proximate Principles ............................ 135
General Requirements in a Food .......................... 136
**CONTENTS**

The General Nature of Diet ........................................ 137
A Source Both of Energy and of Tissue .................. 137
The Right Quantity is Important .......................... 140
The Energy-values of Foods ..................................... 140
The Right Proportion of the Diet's Components is Important 145
Variety in the Diet is Necessary ............................. 145
Cookery ...................................................................... 149
Quantitative Adaptation to its Service is Essential ...... 151
Qualitative Adaptation in Certain Physiological Conditions is Valuable 153
Infancy ................................................................... 154
Pregnancy and Lactation ........................................... 158
Senility ..................................................................... 158
Idiosyncrasy .............................................................. 158
Disease .................................................................. 159
Coffee, Tea, Cocoa, Alcohol, and Tobacco .............. 159

**CHAPTER V.**

**DIGESTION.**

The Human Digestive Mechanism .............................. 170
Mastication ................................................................ 176
Deglutition .................................................................. 179
The Stomach .............................................................. 180
The Movements of the Stomach ............................... 182
The Gastric Juice ....................................................... 186
Digestion in the Stomach ......................................... 188
The Stomach's Functions ........................................... 194
The Small Intestine .................................................... 197
The Movements of the Small Intestine .................... 199
Pancreatic Juice ......................................................... 204
Intestinal Juice .......................................................... 207
Bile ....................................................................... 208
The Large Intestine .................................................... 209
The Movements of the Large Intestine .................... 210
Digestion in the Large Intestine ............................... 212

**CHAPTER VI.**

**NUTRITION.**

Absorption .................................................................. 216
Metabolism .................................................................. 218
Organic Growth and Repair ...................................... 219
Secretion .................................................................... 220
Osmosis ...................................................................... 221
"Vitalism" .................................................................... 223
The Phenomena of Secretion .................................... 223
The Internal Secretions ............................................. 225
Animal Heat ............................................................... 228
Human Temperature .................................................... 230
CONTENTS

Metabolism (continued):
  Thermotaxis ................................................. 232
  The Means of Regulating Heat-production ................. 235
  The Regulation of Thermolysis ........................... 235
  The Thermotactic Nerves ................................ 238
Other Forms of Energy-expense ............................ 239
Excretion ................................................... 239
The Urine .................................................... 240
  The Composition of the Urine ............................ 242
  The Excretion of Urine .................................. 245
  The Discharge of Urine .................................. 248
The Expired Air ............................................. 251
The Sweat ................................................... 252
The Feces .................................................... 252

CHAPTER VII.

THE BLOOD AND THE LYMPH.

The Chemical Composition of the Blood and Lymph ........... 254
The Chemical Components of the Plasma and Lymph .......... 255
The Chemical Components of the Erythrocytes ............... 256
The Chemical Components of the Leukocytes ................. 257
The Chemical Components of the Thrombocytes ............... 258
Whole Blood .................................................. 259
Coagulation .................................................... 260
The Physical Constitution of the Blood and Lymph ........... 262
The Erythrocytes ............................................. 263
The Leukocytes .............................................. 266
The Thrombocytes .......................................... 269
Lymph .......................................................... 270
The Formation of Lymph ..................................... 271
The Physical Constitution of Lymph .......................... 273
The Quantity of the Lymph .................................. 274
The Functions of the Lymph .................................. 274

CHAPTER VIII.

THE CIRCULATION.

The Causes of the Circulation ................................ 278
  The Contraction of the Heart ............................. 278
  The Recoil of the Arterial Walls .......................... 279
Thoracic Suction ............................................ 280
Compression by the Body-muscles ............................ 281
The Suction of the Relaxing Auricles ....................... 282
The Speed of the Blood-current ............................ 282
The Circulation-time ...................................... 283
The Pulse-wave .............................................. 284
Blood-pressure .............................................. 284
The Pulse-rate of the Heart ................................ 286
The Cardiac Sequence ...................................... 288