

The
Home University Library

**THE LIFE
OF THE CELL**

**THE
HOME UNIVERSITY LIBRARY
OF MODERN KNOWLEDGE**

**EDITORS OF THE
HOME UNIVERSITY LIBRARY
OF MODERN KNOWLEDGE**

Rt. Hon. H. A. L. FISHER, M.A., F.B.A.

PROF. GILBERT MURRAY, LITT.D., LL.D., F.B.A.

PROF. J. ARTHUR THOMSON, M.A., LL.D.

PROF. WILLIAM T. BREWSTER, M.A.

(Columbia University, U.S.A.)

THE LIFE OF THE CELL

By

DAVID LANDSBOROUGH THOMSON,
M.A., B.Sc., Ph.D.

LECTURER IN BIOCHEMISTRY, MCGILL UNIVERSITY, MONTREAL

ILLUSTRATED



THORNTON BUTTERWORTH, LIMITED
15 BEDFORD STREET, LONDON, W.C.2.

First Published . . . 1928

MADE AND PRINTED IN GREAT BRITAIN
All Rights Reserved

PREFACE

It is the aim of this little book to consider in its different aspects the conception of the cell as the unit of life. Its endeavour is to tell the story of the cell in the light of recent advances, which have been many ; and furthermore to show how the new understanding of the cell throws light on each of the biological sub-sciences in turn : histology, biochemistry, biophysics, physiology, embryology, and genetics.

Limitation of space and the desire for the fullest possible integration of the material have frequently compelled the author to treat debatable hypotheses as if they were unchallenged, and to do rival theories the injustice of omitting them altogether ; for these and other faults he must simply make his apology, with the hope that the marshalling of the results of a large body of modern researches on the cell may in some measure justify itself by being useful.

D. L. T.

*Gonville and Caius College,
Cambridge.*

*Volumes of kindred interest already published in
the Library are:*

Animal Life. By Prof. F. W. GAMBLE.

Bacteriology. By Prof. C. H. BROWNING.

Biology. By Profs. PATRICK GEDDES and J. ARTHUR THOMSON.

Evolution. By Profs. J. ARTHUR THOMSON and PATRICK GEDDES.

Evolution of Plants. By Dr. D. H. SCOTT.

Heredity. By Prof. E. W. MACBRIDE.

Introduction to Science. By Prof. J. ARTHUR THOMSON.

Microscopy. By R. M. NEILL.

Origin and Nature of Life. By Prof. BENJAMIN MOORE.

Plant Life. By Prof. J. B. FARMER.

Principles of Physiology. By Prof. J. G. MCKENDRICK.

Sex. By Profs. PATRICK GEDDES and J. ARTHUR THOMSON.

CONTENTS

CHAP.	PAGE
I. THE VISIBLE STRUCTURE OF THE CELL	9
II. THE CHEMICAL STRUCTURE OF THE CELL	30
III. THE CHEMICAL DYNAMICS OF THE CELL	75
IV. THE PHYSICAL DYNAMICS OF THE CELL	135
V. THE LIFE-HISTORY OF THE GERM-CELLS	181
BIBLIOGRAPHICAL NOTE	249
INDEX	250

ILLUSTRATIONS

FIG.		PAGE
1.	CELLS OF DIFFERENT KINDS	12
2.	CELL DIVISION	26
3.	STRUCTURE OF A COLLOIDAL GEL	150
4.	ELECTRIC CURRENTS IN LIVING CELLS	172
5.	FERTILIZATION OF AN ANIMAL OVUM	197
6.	THE SIXTEEN-CELL STAGE IN DEVELOPMENT	206
7.	FERTILIZATION IN A FLOWERING PLANT	217

BIBLIOGRAPHICAL NOTE

General Cytology, edited by E. V. Cowdry (Chicago, 1924), is the only recent work which covers the wide field of the present little book ; it is a large volume, written in symposial form by thirteen distinguished American scientists ; it contains, however, little that corresponds to the discussion of the chemistry of the cell given here in Chapters II and III. Chapters I and V of this volume deal with "pure" cytology, and in this field there are many books, the best perhaps E. B. Wilson's *The Cell in Development and Heredity* (New York, 3rd ed., 1925) ; good, also, are the books by Agar, Doncaster, and Sharp—the last-named distinguished by its emphasis on the plant kingdom. The discussion of surfaces and colloids in Chapter II is taken largely from Freundlich's monumental *Colloid and Capillary Chemistry* (London, 1926), and of many smaller works on the subject the same author's *Elements of Colloidal Chemistry* (London, 1925) is one of the best ; but as a whole Chapters II and IV are modelled on a splendid book by Höber, *Physikalische Chemie der Zelle und der Gewebe* (Leipzig, 6th ed., 1926), unfortunately not translated into English. Chapter III is pure biochemistry, and reference should be made to the text-books of that subject ; Robertson's *Principles of Biochemistry* is planned with special reference to the cell. Bayliss's *Principles of General Physiology* (London, 4th ed., 1924), a book of very wide scope, may be turned to for an expansion of the three centre chapters of this brief survey of the field.

INDEX

- Acids, 40, 45, 152
Action current, 174
Activation, 83, 103, 104, 105,
 106, 110
Adsorption, 59, 150, 151
Amino-acids, 53, 54, 55, 87,
 88, 92, 93, 94, 148
Ammonia, 41, 94, 132, 152
Amœba, 10, 95, 96, 138
Antagonism of ions, 72, 153,
 154, 155, 156
Aster, 23, 198
Autoxidation, 100, 101, 102
Axial gradient, 202

Bacteria, 21, 130, 131, 132,
 133, 134, 222
Baly, 127
Bases, 40, 45, 152
Bateson and Punnett, 236,
 238
Bayliss, 170, 249
Bee, 210
Belar, 219
Bernstein, 175
Blastula, 207
Boveri, 208, 227
Brownian movement, 33
Buchner, 89
Bütschli, 218

Carbohydrates, 46, 47, 48, 49,
 92, 112 *seq.*, 126
Carnivorous plants, 128
Catalase, 105, 112
Catalysis, 81 *seq.*, 100, 101
Cell-division, equational, 22
 seq., 198
— reductional, 187, 188, 189,
 250
- 193, 212, 213, 214, 220,
 221, 222, 227, 228, 234,
 245
Centriole, 19, 23, 27, 191, 197
Chambers, 22, 137
Child, 202
Chlorophyll, 17, 123 *seq.*
Chromatin, 20, 24, 56, 183
— diminution, 208
Chromidia, 21
Chromosomes, 24, 25, 26, 27,
 183 *seq.*, 227, 228, 229,
 231 *seq.*, 237 *seq.*
Colloidal state, 62 *seq.*
Conjugation, 219, 220, 221,
 222, 223
Conklin, 199
Crossing-over, 243, 244, 245,
 246, 247
Cyanide, 102, 103, 104, 109,
 110, 111
Cysteine, 54, 107
Cytochrome, 109, 110, 111
Cytoplasm, 13

Dakin, 111
Dedifferentiation, 204
Delage, 212
Development, 198 *seq.*, 216
Differentiation, 198 *seq.*, 219
Digestion, 91, 92, 93, 96, 160
Donnan equilibrium, 69, 170
Drosophila, 236, 238, 239

Electrical stimulation, 163,
 166, 167, 168, 169, 177
Electric fishes, 176
Electrolytic dissociation, 38,
 39, 40, 41, 167

- Elementary composition, 30, 31
 Endomixis, 219, 222, 223
 Enzymes, 88 *seq.*, 105, 106, 107, 112, 229
 Equilibrium, 34, 79
 Excretion, 94, 144, 159
 Fats, 49, 50, 51, 52, 92
 Fermentation, 113, 114
 Fern, 212, 213
 Fertilization, in animals, 194, 195, 196, 197, 198
 — in ferns, 213
 — in flowering plants, 215, 216, 217
 Fletcher, 115
 Flowering plants, 213, 214, 215, 216, 217
 Formaldehyde, 97, 98, 126, 127
 Gamble, 128
 Gel, 71, 149, 150, 151
 Gene, 228, 243
 Glucose, 47, 112, 113, 114, 115
 Glutathione, 107, 108, 109
 Glycogen, 49, 94, 107, 108, 109, 115 *seq.*
 Goldschmidt, 230
 Golgi apparatus, 18
 Hæmoglobin, 11, 56, 123
 Harden, 114
 Heredity, 224 *seq.*
 Hertwig, 211
 Heterotypic cell - division, 187, 188, 189
 Hexose-phosphate, 114, 116
 Hill, 115
 Höber, 159, 249
 Hopkins, 107, 115
 Hormones, 203
 Hydrogen ion concentration, 41
- Hydrogen peroxide, 101, 105, 106, 109, 111, 112
 Hydrolysis, 93
 Inhibition, 165
 Injury current, 173
 Iron, 31, 46, 56, 103, 104, 109, 110, 111, 123, 131
 Irritability, 162 *seq.*
 Karyokinesis, 23, 24, 25, 26, 27
 Keeble, 128
 Kidney cells, 159, 160, 204
 Kinetic theory, 32, 33
 Lactic acid, 113, 115 *seq.*
 Lavoisier, 75
 Leцитin, 51, 148
 Lillie, 168, 176
 Linkage, 236 *seq.*
 Lipoids, 51, 148, 151, 158
 Loeb, 156, 209
 Magnesium, 31, 124
 Maturation, 193
 Meiosis, 187, 188, 189
 Mendel, 224, 225, 227, 228, 230, 232, 236, 238
 Merogony, 212
 Metabolism, 95, 196
 Meyer, 147
 Meyerhof, 115
 Microdissection, 14, 137
 Mitochondria, 17, 28
 Mitosis, 23, 24, 25, 26, 27
 Morgan, 236, 243, 245, 246, 247
 Muscarine, 169
 Muscle, 11, 115 *seq.*, 164, 166, 175
 Narcotics, 102, 103, 147, 148, 151, 165
 Nernst, 167
 Nerve, 11, 177, 178, 179, 180
 Nitrogen, 31, 45, 52, 94, 123, 127, 132, 133, 134

INDEX

- Nucleolus, 20
 Nucleoprotein, 56
 Nucleus, 19 *seq.*
 Organizer, 203
 Osmotic pressure, 36, 37, 38,
 39, 138 *seq.*, 160, 174
 Osterhout, 156, 162
 Ostwald, 155
 Overton, 147, 148, 152, 158
 Ovum, 192 *seq.*
 Oxidation, 75, 76, 77, 78, 86,
 87, 88, 95, 97 *seq.*, 131,
 132, 179
 Parasitic plants, 128
 Parthenogenesis, 209, 210,
 211, 212
 Permeability, 136, 144 *seq.*,
 165, 170, 171, 196
 Peroxidase, 106, 109, 112
 Phagocytes, 10, 97, 159
 Phosphoric acid, 52, 56, 114,
 116, 119
 Plasmolysis, 139, 145, 152
 Plastids, 16, 124
 Polar bodies, 193
 Polarization, 167
 Pollen, 12, 213, 214, 215
 Proteins, 52, 53, 54, 55, 56,
 66 *seq.*, 92, 94, 117, 154
 Protozoa, 10, 16, 96, 129, 142,
 218, 219, 221
 Punnett, 236, 238
 Purine, 56, 106
 Red blood corpuscle, 11, 138
 Reduction, 97 *seq.*, 123 *seq.*
 Reversible reactions, 79, 90
 Schleiden, 9
 Schwann, 9, 27
 Seed, 215, 216
 Semi-permeable membrane,
 35, 138, 144
 Sensitive plant, 165
 Sex-chromosomes, 234, 235,
 239
 Sex-linked characters, 239,
 240, 241, 242
 Solutions, 33 *seq.*
 Spemann, 203
 Spermatozoa, 183 *seq.*, 194,
 213
 Staining, 14, 20, 158, 159
 Starch, 15, 17, 48, 125, 126
 Stoll, 126
 Strasburger, 216
 Sugars, 46, 47, 48, 112, 113,
 114, 115
 Sulphur, 30, 54, 108, 131
 Surface tension, 58
 Synapse, 179, 180
 Synapsis, 188, 193, 245, 246
 Symbiosis, 128, 129
 Tchahotine, 143
 Tissue culture, 14, 204
 Tumours, 118
 Tyrosinase, 106, 229
 Ultra-microscope, 63
 Ultra-violet light, 127, 143
 Urea, 37, 94
 Uric acid, 56, 106
 Vacuoles, 16, 96, 142
 Vapour pressure, 34
 Virchow, 9, 28
 Vital staining, 17, 158, 159
 Warburg, 87, 102, 103, 104,
 105, 127, 162, 196
 Wenrich, 185
 Wieland, 104, 105, 107
 Willstätter, 89, 124, 126
 Wilson, 199, 249
 Xanthine-oxidase, 106, 107
 Yeast, 89, 113, 114, 115, 129
 Young, 114

THE HOME UNIVERSITY LIBRARY OF MODERN KNOWLEDGE

Art

39. ARCHITECTURE (Illustrated) Prof. W. R. LETHABY
63. PAINTERS AND PAINTING (Illustrated) Sir FREDERICK WEDMORE
75. ANCIENT ART AND RITUAL (Illustrated) JANE HARRISON, LL.D., D.Litt.
93. THE RENAISSANCE EDITH SICHEL
112. MUSIC Sir HENRY HADOW, C.B.E.
123. DRAMA ASHLEY DUKES

Economics & Business

5. THE STOCK EXCHANGE F. W. HIRST
16. THE SCIENCE OF WEALTH J. A. HOBSON, M.A.
24. THE EVOLUTION OF INDUSTRY Prof. D. H. MACGREGOR
26. AGRICULTURE Prof. W. SOMERVILLE
59. POLITICAL ECONOMY Prof. Sir S. J. CHAPMAN, K.C.B.
69. THE NEWSPAPER G. BINNEY DIBBLEE
80. CO-PARTNERSHIP AND PROFIT-SHARING ANEURIN WILLIAMS, M.A.
85. UNEMPLOYMENT Prof. A. C. PIGOU
109. COMMERCIAL GEOGRAPHY Dr. MARION NEWBIGIN, F.R.G.S.
117. ADVERTISING Sir CHARLES HIGHAM
124. BANKING WALTER LEAF, D.Litt.
137. RAILWAYS W. V. WOOD, M.INST.T. and Sir Josiah STAMP,
G.B.E. D.Sc., F.B.A.

Geography

7. MODERN GEOGRAPHY Dr. MARION NEWBIGIN, F.R.G.S.
8. POLAR EXPLORATION Dr. W. S. BRUCE
12. THE OPENING UP OF AFRICA (Maps) Sir HARRY JOHNSTON, G.C.M.G.
36. CLIMATE AND WEATHER Prof. H. N. DICKSON
53. THE MAKING OF THE EARTH (Illustrated) Prof. J. W. GREGORY, F.R.S.
88. THE GROWTH OF EUROPE (Illustrated) Prof. GRENVILLE A. J. COLE
91. THE ALPS (Illustrated) ARNOLD LUNN
92. CENTRAL AND SOUTH AMERICA Prof. W. R. SHEPHERD
101. BELGIUM (Maps) R. C. K. ENSOR
105. POLAND (Maps) Prof. W. ALISON PHILLIPS
107. SERBIA L. F. WARING, B.A.
113. WALES W. WATKIN DAVIES, F.R.Hist.S.
114. EGYPT (Illustrated) Sir E. A. WALLIS BUDGE, M.A.
118. THE BYZANTINE EMPIRE NORMAN H. BAYNES

History

3. THE FRENCH REVOLUTION (Maps) HILAIRE BELLOC, M.A.
4. HISTORY OF WAR AND PEACE G. H. PERRIS
13. MEDIÆVAL EUROPE H. W. C. DAVIS
14. THE PAPACY AND MODERN TIMES Rev. Dr. W. BARRY
23. HISTORY OF OUR TIME, 1885-1913 G. P. GOOCH, M.A.
25. THE CIVILIZATION OF CHINA Prof. H. A. GILES, LL.D.
29. DAWN OF HISTORY Prof. J. L. MYRES
33. THE HISTORY OF ENGLAND: A Study in Political Evolution Prof. A. F. POLLARD
34. CANADA A. G. BRADLEY
37. PEOPLES AND PROBLEMS OF INDIA Sir T. W. HOLDerness
42. ROME W. WARDE FOWLER, M.A.
48. THE AMERICAN CIVIL WAR (Maps) Prof. F. L. PAXSON
51. WARFARE IN ENGLAND (Maps) HILAIRE BELLOC, M.A.
55. MASTER MARINERS J. R. SPEARS
61. NAPOLEON (Maps) Rt. Hon. H. A. L. FISHER, M.A., LL.D.
66. THE NAVY AND SEA POWER DAVID HANNAY
71. GERMANY OF TO-DAY CHARLES TOWER
82. PRE-HISTORIC BRITAIN Dr. ROBERT MUNRO
97. THE ANCIENT EAST D. G. HOGARTH, F.B.A.
98. WARS BETWEEN ENGLAND AND AMERICA Prof. T. C. SMITH
100. HISTORY OF SCOTLAND Prof. R. S. RAIT
101. BELGIUM (Maps) R. C. K. ENSOR
105. POLAND (Maps) Prof. W. ALISON PHILLIPS
107. SERBIA L. F. WARING, B.A.
108. OUR FORERUNNERS M. C. BURKITT, M.A., F.S.A.
113. WALES W. WATKIN DAVIES, F.R.Hist.S.
114. EGYPT (Illustrated) Sir E. A. WALLIS BUDGE, M.A.
118. THE BYZANTINE EMPIRE NORMAN H. BAYNES
125. ENGLAND UNDER THE TUDORS AND STUARTS KEITH FEILING, M.A.
129. HISTORY OF ENGLAND, 1688-1815 E. M. WRONG, M.A.
134. THE CIVILIZATION OF JAPAN J. INGRAM BRYAN, M.A., M.Litt.
135. A HISTORY OF ENGLAND 1815-1918 J. R. M. BUTLER, M.A.
136. THE BRITISH EMPIRE BASIL WILLIAMS, M.A., O.B.E.

Literature

2. SHAKESPEARE JOHN MASEFIELD
25. THE CIVILIZATION OF CHINA Prof. H. A. GILES, LL.D.
27. ENGLISH LITERATURE: MODERN GEORGE MAIR, M.A.
35. LANDMARKS IN FRENCH LITERATURE LYTTON STRACHEY
43. ENGLISH LITERATURE: MEDIÆVAL Prof. W. P. Ker
45. THE ENGLISH LANGUAGE L. PEARSALL SMITH
52. GREAT WRITERS OF AMERICA Profs. W. P. TRENT and J. ERSKINE
64. DR. JOHNSON AND HIS CIRCLE JOHN BAILEY, M.A.
65. THE LITERATURE OF GERMANY Prof. J. G. ROBERTSON, M.A.

70. THE VICTORIAN AGE IN LITERATURE	G. K. CHESTERTON
73. THE WRITING OF ENGLISH	Prof. W. T. BREWSTER
76. EURIPIDES AND HIS AGE	Prof. GILBERT MURRAY, LL.D.
77. SHELLEY, GODWIN, AND THEIR CIRCLE	H. N. BRAILSFORD, M.A.
87. CHAUCER AND HIS TIMES	GRACE HADOW
89. WILLIAM MORRIS	A. CLUTTON BROCK
95. ELIZABETHAN LITERATURE	J. M. ROBERTSON, M.P.
99. AN OUTLINE OF RUSSIAN LITERATURE	Hon. MAURICE BARING
103. MILTON	JOHN BAILEY, M.A.
111. PATRIOTISM IN LITERATURE	JOHN DRINKWATER, M.A.

Political and Social Science

1. PARLIAMENT	Sir C. P. ILBERT
6. IRISH NATIONALITY	Mrs. J. R. GREEN
10. SOCIALIST MOVEMENT	RT. HON. J. RAMSAY MACDONALD, M.P.
11. CONSERVATISM	Lord HUGH CECIL, M.P.
21. LIBERALISM	Prof. L. T. HOBHOUSE
30. ELEMENTS OF ENGLISH LAW	Prof. W. M. GELDART
38. THE SCHOOL	Prof. J. J. FINDLAY
81. PROBLEMS OF VILLAGE LIFE	E. N. BENNETT, M.A.
83. COMMON-SENSE IN LAW	Prof. Sir P. VINogradoff, D.C.L.
96. POLITICAL THOUGHT IN ENGLAND: From Bacon to Halifax	G. P. GOOCH, M.A.
104. POLITICAL THOUGHT IN ENGLAND From Herbert Spencer to the Present Day	ERNEST BARKER, M.A.
106. POLITICAL THOUGHT IN ENGLAND: The Utilitarians from Bentham to J. S. Mill	W. L. DAVIDSON, M.A.
111. POLITICAL THOUGHT IN ENGLAND: From Locke to Bentham	Prof. HAROLD J. LASKI
131. COMMUNISM	Prof. HAROLD J. LASKI

Religion and Philosophy

15. MOHAMMEDANISM	Prof. MARGOLIOUTH
40. PROBLEMS OF PHILOSOPHY	Hon. BERTRAND RUSSELL
47. BUDDHISM	Mrs. RHYS DAVIDS
50. NONCONFORMITY	Principal W. B. SELBIE
54. ETHICS	G. E. MOORE, M.A.
56. MAKING OF THE NEW TESTAMENT	Prof. B. W. BACON, LL.D.
60. MISSIONS	MRS. CREIGHTON
68. COMPARATIVE RELIGION	Prof. J. ESTLIN CARPENTER, LL.D.
74. A HISTORY OF FREEDOM OF THOUGHT	Prof. J. B. BURY, LL.D.
84. LITERATURE OF THE OLD TESTAMENT	Prof. GEORGE MOORE, D.D.

90. THE CHURCH OF ENGLAND Canon E. W. WATSON
94. RELIGIOUS DEVELOPMENT BETWEEN THE
OLD AND NEW TESTAMENTS
102. HISTORY OF PHILOSOPHY CLEMENT C. J. WEBB, M.A.
Canons R. H. CHARLES, D.Litt.

Science

- | | |
|---|---|
| 9. EVOLUTION OF PLANTS | Dr. D. H. SCOTT |
| 17. HEALTH AND DISEASE | Dr. W. L. MACKENZIE |
| 18. INTRODUCTION TO MATHEMATICS | |
| 19. THE ANIMAL WORLD (Illustrated) | A. N. WHITEHEAD, D.Sc. |
| 20. EVOLUTION | Prof. F. W. GAMBLE |
| 22. CRIME AND INSANITY | Profs. J. ARTHUR THOMSON and P. GEDDES |
| 28. PSYCHICAL RESEARCH | Dr. C. A. MERCIER |
| 31. ASTRONOMY | Sir W. F. BARRETT, F.R.S. |
| 32. INTRODUCTION TO SCIENCE | A. R. HINKS, M.A. |
| 41. ANTHROPOLOGY | Prof. J. ARTHUR THOMSON, M.A. |
| | R. R. MARETT |
| 44. PRINCIPLES OF PHYSIOLOGY | Prof. J. G. MCKENDRICK |
| Revised (1928) by Prof. J. A. MACWILLIAM, M.D., F.R.S. | |
| 46. MATTER AND ENERGY | F. SODDY |
| 49. PSYCHOLOGY: The Study of Behaviour | |
| | W. McDougall, F.R.S. |
| 57. THE HUMAN BODY | Prof. Sir ARTHUR KEITH |
| 58. ELECTRICITY | Prof. GISBERT KAPP |
| 62. THE ORIGIN AND NATURE OF LIFE | |
| | Prof. BENJAMIN MOORE |
| 67. CHEMISTRY | Prof. RAPHAEL MELDOLA, D.Sc. |
| Revised (1928) by Prof. ALEXANDER FINDLAY, D.Sc., Ph.D. | |
| 72. PLANT LIFE (Illustrated) | Prof. J. B. FARMER, D.Sc. |
| 78. THE OCEAN: A General Account of the | |
| Science of the Sea | Sir JOHN MURRAY, K.C.B. |
| 79. NERVES | Prof. D. FRASER HARRIS, M.D. |
| 86. SEX | Profs. GEDDES and J. ARTHUR THOMSON |
| 110. AN INTRODUCTION TO THE STUDY OF HEREDITY. | |
| (Illustrated) | E. W. MACBRIDE, M.A., D.Sc. |
| 115. BIOLOGY | Profs. P. GEDDES and J. ARTHUR THOMSON |
| 116. BACTERIOLOGY (Illustrated) | Prof. CARL H. BROWNING |
| 119. MICROSCOPY (Illustrated) | ROBERT M. NEILL |
| 120. EUGENICS | Prof. CARR SAUNDERS |
| 122. GAS AND GASES (Illustrated) | Prof. R. M. CAVEN |
| 126. TREES | Dr. MACGREGOR SKENE |
| 127. MOTORS AND MOTORING (Illustrated) | E. T. BROWN |
| 128. SUNSHINE AND HEALTH | |
| | R. CAMPBELL MACFIE, M.A., M.B.C.M., LL.D. |
| 130. BIRDS | A. LANDSBOROUGH THOMSON, O.B.E., D.Sc. |
| 132. THE EVOLUTION OF A GARDEN | E. H. M. COX |
| 133. INSECTS | F. BALFOUR-BROWNE, M.A., F.R.S.E. |
| 138. THE LIFE OF THE CELL. | |
| | DAVID LANDSBOROUGH THOMSON, M.A., B.Sc., Ph.D. |

Complete List up to Dec., 1928. New titles will be added yearly.