

**BIOCHEMISTRY OF
MUSCLE AND NERVE;
TEN LECTURES**

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Biochemistry of muscle and nerve; ten lectures by W. D. Halliburton

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LECTURES ON PHYSIOLOGY, PUBLISHED UNDER THE
AUTHORITY OF THE UNIVERSITY OF LONDON

SECOND SERIES

BIOCHEMISTRY OF MUSCLE & NERVE

TEN LECTURES DELIVERED BY
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PREFACE

IN the early part of 1903 I delivered a course of eight lectures on the chemical aspect of muscle and nerve physiology at the Physiological Laboratory of the University of London. A little later I received an invitation from the University and Bellevue Hospital College, New York, to deliver there a course of lectures on some subject of chemico-physiological interest. Dr C. A. Herter had for some years been in the habit of giving a course of lectures on Chemical Pathology at this medical school, and when he received the appointment of Professor of Pharmacology at the Columbia University, New York, he desired to perpetuate the course at his old college. This he did by a generous gift, which enables the Bellevue authorities to annually invite some one who has particularly worked at chemical physiology or pathology to deliver such a course of lectures. It is hardly necessary for me to say that I felt highly honoured at the request, that I should be the first Herter Lecturer; and as my lectures at the University of London had not been published, I determined to take the same subject, and the lectures, twelve in number, were given in New York during January of the present year. The little book which I now present is the outcome of these two courses of lectures. For convenience I have divided the subject into ten lectures, the actual order and arrangement being necessarily somewhat different from those which were actually delivered. In New York the longer course enabled me to amplify some of the subjects which I had to pass over rapidly in the lectures given in London. The arrangements of the two laboratories being different, I had also to vary somewhat the

experiments which I selected to illustrate the lectures; but it has obviously become necessary, in writing them out, to amalgamate the two courses so as to make them read as one.

At the University of London, Dr Waller, and in New York, Professor Graham Lusk, placed the resources of their laboratories at my disposal, and it is my pleasant duty to thank them for the assistance they so ungrudgingly gave me.

My thanks are also due to Dr Alcock and to Professor T. G. Brodie, who helped me with my experiments in London; and to Professor Mandel, Dr Arthur Mandel, and Dr Wolf, who performed similar kindly offices in New York.

The publication of this book gives me an opportunity of presenting in a systematised way the numerous researches on muscle and nerve which have been carried out in my laboratory during the past few years, and here again I have to acknowledge with gratitude the help and co-operation of colleagues, friends, and pupils who have worked with me.

I append to this preface a list of the published papers which have been the result of this work, and which have formed the basis on which these lectures have been built.

W. D. HALLIBURTON.

KING'S COLLEGE, LONDON,
1904.

PRINCIPAL PAPERS

THE following list gives the names and places of publication of the principal papers referred to in the following lectures, which have been carried out, either by myself, or in conjunction with colleagues, or under my superintendence. The first six were published during the time I was Assistant Professor of Physiology at University College, London; the remainder were published since I have held the Chair of Physiology at King's College, London:—

1. "An arrangement for determining the Temperature of Heat Coagulation of Proteids," by W. D. Halliburton, *Jour. of Phys.*, vol. iv., 1883.
2. "The Proteids of Serum," by W. D. Halliburton, *Ibid.*, vol. v., 1884.
3. "On Muscle Plasma," by W. D. Halliburton, *Ibid.*, vol. viii.; Preliminary Communication in *Proc. Roy. Soc.*, vol. xlvii., 1887.
4. "Cerebro-spinal Fluid," by W. D. Halliburton, Report of Spina Bifida Committee, *Clin. Soc. Trans.*, vol. xviii., 1885.
5. "Cerebro-spinal Fluid," by W. D. Halliburton, *Jour. of Phys.*, vol. x., 1889.
6. Report on Pathological Effusions, by W. D. Halliburton, *Brit. Med. Jour.*, 1890.
7. "Mucin in Myxœdema," by W. D. Halliburton, *Jour. of Path.*, May 1892.
8. "The Chemical Physiology of the Animal Cell," by W. D. Halliburton, Goulstonian Lectures delivered before the Royal College of Physicians, London, *Brit. Med. Jour.*, 11th, 18th, and 25th March 1893.
9. "The Fibres of Retiform Tissue," by R. A. Young, B.Sc., *Jour. of Phys.*, vol. xiii., 1892.
10. "On Fractional Heat Coagulation," by R. T. Hewlett, M.D., *Ibid.*, vol. xiii., 1892.
11. "The Proteids of Nervous Tissue," by W. D. Halliburton, *Ibid.*, vol. xv., 1893.

12. "Note on the Chemistry of Muscle," by Arthur Whitfield, M.D., *Jour. of Phys.*, vol. xvi., 1894.
13. "Chemistry of Connective Tissue," by R. A. Young, M.D., *Ibid.*, vol. xvi., 1894.
14. "Nucleo-albumins and Intravascular Coagulation," by W. D. Halliburton and T. Gregor Brodie, M.D., *Ibid.*, vol. xvii., 1894.
15. "Nucleo-proteids," supplementary paper, by W. D. Halliburton, *Ibid.*, vol. xviii., 1895.
16. "Creatinine in Blood," by P. C. Colls, *Ibid.*, vol. xx., 1896.
17. "Hydrolysis of Glycogen," by M. Christine Tebb, *Ibid.*, vol. xxii., 1897.
18. The Articles entitled "The Chemical Constituents of the Body and Food," and "The Chemistry of the Tissues and Organs," in Schäfer's *Text-Book of Physiology*, by W. D. Halliburton, vol. i., 1898.
19. "An Intestinal Plethysmograph," by A. Edmunds, B.Sc., *Jour. of Phys.*, vol. xxii., 1898.
20. "Preliminary accounts of the Physiological Action of Choline and Neurine," by T. W. Mott, M.D., F.R.S., and W. D. Halliburton, *Proc. Phys. Soc.*, February 1897, February 1898, and February 1899.
21. "The Physiological Action of Choline and Neurine," by the same authors. Abstract in *Proc. Roy. Soc.*, vol. lxx., 1899; full paper in *Phil. Trans. of the Roy. Soc.*, series B, vol. cxcii., 1899.
22. "Note on the Blood in a case of Beri-beri," by the same authors, *Brit. Med. Jour.*, 28th July 1899.
23. "Observations on the Cerebro-spinal Fluid in the Human Subject," by St Clair Thomson, M.D., L. Hill, M.B., and W. D. Halliburton, *Proc. Roy. Soc.*, vol. lxxiv., 1899.
24. The Croonian Lectures on the Chemical Side of Nervous Activity, delivered before the Royal College of Physicians, June 1901, by W. D. Halliburton. Abstracts of the four lectures were published in the *Brit. Med. Jour.*, 15th and 22nd June 1901. The full lectures were published as a separate book by Bale, Sons, & Daniellson, London, 1901.
 Dr Mott's Croonian Lectures on the Degeneration of the Neurone, delivered in 1900 (same publishers), also contained much of our joint work.
25. "The Chemistry of Nerve Degeneration," by F. W. Mott, and W. D. Halliburton. Abstract published in the *Proc. Roy. Soc.*, vol. lxxviii., 1901; full paper in the *Phil. Trans. of the Roy. Soc.*, series B, vol. cxciv., 1901.
26. "Regeneration of Nerves," by the same authors, Preliminary Communication, *Annual Reports of the British Association*, Belfast, 1902.
27. "Regeneration of Nerves," by F. W. Mott, Arthur Edmunds, and W. D. Halliburton, Second Preliminary Communication, *Proc. Phys. Soc.*, March 1904.

28. "The Proteids which may occur in Urine," by W. D. Halliburton, *Trans. Path. Soc.*, London, vol. li., 1900.
29. "The Physiological Effects of Extracts of Nervous Tissues," by W. D. Halliburton, *Jour. of Phys.*, vol. xxvi., 1901.
30. "The Veratrine-like action of Glycerin," by H. Willoughby Lyle, M.D., *Proc. Phys. Soc.*, January 1901.
31. "The Action of Ether and Chloroform in the Neurons of Rabbits and Dogs," by Hamilton Wright, M.D., *Jour. of Phys.*, vol. xxvi., 1901.
32. "The Action of Ether and Chloroform on the Cerebral and Spinal Neurons of Dogs," supplementary paper, by Hamilton Wright, *Ibid.*, vol. xxvi., 1901.
33. "Specific Gravity of the Brain," by R. H. C. Gompertz, B.Sc., *Ibid.*, xxvii., 1902.
34. "Reticulin and Collagen," by M. Christine Tebb, *Ibid.*, vol. xxvii., 1902.
35. "Fatigue in Non-medullated Nerves," by T. Gregor Brodie, and W. D. Halliburton, *Ibid.*, vol. xxviii., 1902.
36. "The Coagulation Temperature of Cell-globulin and its Relation to Hyperpyrexia," by F. W. Mott and W. D. Halliburton, *Mott's Archives of Neurology*, vol. ii., 1903.
37. "The Choline Test for Active Degeneration of the Nervous System," by F. W. Mott, *Ibid.*, vol. ii., 1903.
38. "Heat Contraction in Nerve," Preliminary Communication; by T. G. Brodie and W. D. Halliburton, *Proc. Phys. Soc.*, July 1903.
39. "The Precipitation of Proteids by Alcohol and other Reagents," by M. Christine Tebb, *Jour. of Phys.*, vol. xxx., 1904.
40. "Heat Contraction in Nerve," by T. G. Brodie and W. D. Halliburton, in course of publication in the *Jour. of Phys.*