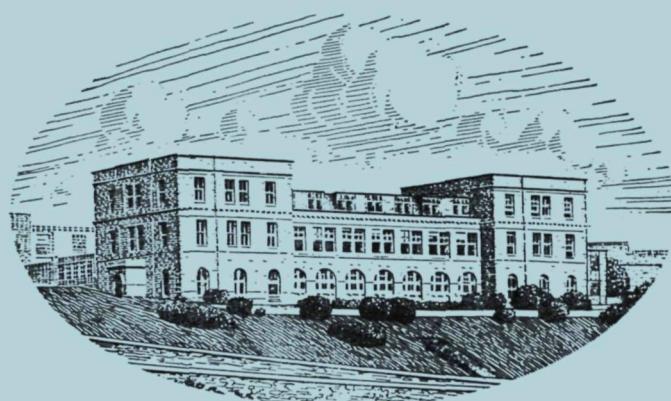


JOURNAL OF THE
MARINE BIOLOGICAL ASSOCIATION
OF THE UNITED KINGDOM



THE PLYMOUTH LABORATORY

VOLUME 44, No. 1

(issued February 1964)

CAMBRIDGE
AT THE UNIVERSITY PRESS
1964

Price Eighty shillings net

(U.S.A. \$14.00)

Annual Subscription for Volume (of three parts); £11 (U.S.A. \$35.00)

MARINE BIOLOGICAL ASSOCIATION OF THE UNITED KINGDOM

PATRON

H.R.H. THE PRINCE PHILIP, DUKE OF EDINBURGH, F.R.S.

OFFICERS AND COUNCIL

President: Prof. C. F. A. PANTIN, Sc.D., D.Sc., Dr Univ., F.R.S.

Vice-Presidents

The Earl of IVEAGH, K.G., C.B., C.M.G.

Sir NICHOLAS E. WATERHOUSE, K.B.E.

Prof. A. V. HILL, C.H., O.B.E., Sc.D., LL.D., F.R.S.

Sir EDWARD J. SALISBURY, Kt., C.B.E., D.Sc.,
LL.D., F.R.S.

Major E. G. CHRISTIE-MILLER

MORLEY H. NEALE, C.B.E.

Prof. Sir JAMES GRAY, Kt., C.B.E., M.C., Sc.D.,
LL.D., F.R.S.

G. M. GRAHAM, C.M.G., O.B.E.

Prof. Sir ALISTER HARDY, Kt., D.Sc., F.R.S.

Prof. C. M. YONGE, C.B.E., D.Sc., F.R.S.

Honorary Members

Dr H. B. BIGELOW

Prof. LOUIS FAGE

E. H. E. HAVELOCK, C.B., C.B.E.

Prof. Sir ALISTER HARDY, Kt., D.Sc., F.R.S.

Dr A. G. HUNTSMAN

Prof. HANS PETTERSSON, For. Mem. R.S.

Dr A. C. REDFIELD

Prof. C. M. YONGE, C.B.E., D.Sc., F.R.S.

COUNCIL

Elected Members

H. A. COLE, D.Sc.

R. I. CURRIE

Prof. J. E. HARRIS, C.B.E., Ph.D., F.R.S.

Prof. A. V. HILL, C.H., O.B.E., Sc.D., LL.D., F.R.S.

Prof. B. KATZ, M.D., D.Sc., F.R.S.

R. D. KEYNES, Ph.D., F.R.S.

C. E. LUCAS, C.M.G., D.Sc.

J. W. G. LUND, D.Sc., Ph.D., F.R.S.

C. H. MORTIMER, Dr.phil., D.Sc., F.R.S.

Prof. Sir JOHN T. RANDALL, Kt., D.Sc., F.R.S.

Prof. J. E. SMITH, Sc.D., F.R.S.

N. TEBBLE

H. G. VEVERS, M.B.E., D.Phil.

Prof. W. F. WHITTARD, D.Sc., F.R.S.

Prof. C. M. YONGE, C.B.E., D.Sc., F.R.S.

Governors

H. GARDNER, C.B.E. (Ministry of Agriculture,
Fisheries and Food)

The Worshipful Company of Fishmongers:

The Prime Warden

Sir EDWARD CHADWYCK-HEALEY, Bt., M.C.

Col. Sir JOHN CAREW POLE, Bt., D.S.O., T.D.

Prof. Sir ALISTER C. HARDY, Kt., D.Sc., F.R.S.
(Oxford University)

S. SMITH, Ph.D. (Cambridge University)

EDWARD HINDLE, Sc.D., F.R.S. (British
Association)

Prof. G. P. WELLS, Sc.D., F.R.S. (Zoological
Society)

Prof. Sir JAMES GRAY, Kt., C.B.E., M.C., Sc.D.,
LL.D., F.R.S. (Royal Society)

Hon. Treasurer: Sir EDWARD CHADWYCK-HEALEY, Bt., M.C., The Mill House,
Hook, Basingstoke, Hants.

Secretary: F. S. RUSSELL, C.B.E., D.S.C., D.F.C., D.Sc., LL.D., F.R.S., The Laboratory,
Citadel Hill, Plymouth, Devon

SCIENTIFIC STAFF

Director: F. S. RUSSELL, C.B.E., D.S.C., D.F.C., D.Sc., LL.D., F.R.S.

D. P. WILSON, D.Sc., F.R.P.S. (*Zoologist*)

L. H. N. COOPER, D.Sc., F.R.I.C., F.G.S. (*Chemist*)

G. M. SPOONER, M.B.E., M.A., F.R.E.S. (*Zoologist*)

MARY W. PARKE, D.Sc., Ph.D., F.L.S. (*Botanist*)

P. G. CORBIN, B.A. (*Zoologist*)

J. A. C. NICOL, D.Sc., M.A., D.Phil. (*Experimental
Zoologist*)

E. J. DENTON, Sc.D., B.A., B.Sc., Ph.D. (*Physiologist*)

N. A. HOLME, M.A. (*Zoologist*)

G. R. FORSTER, B.Sc. (*Zoologist*)

F. A. J. ARMSTRONG, F.R.I.C. (*Chemist*)

E. D. S. CORNER, M.Sc., Ph.D. (*Biochemist*)

A. J. SOUTHWARD, D.Sc., Ph.D. (*Zoologist*)

T. I. SHAW, M.A., Ph.D. (*Physiologist*)

J. V. HOWARTH, B.Sc. (*Physiologist*)

Q. BONE, B.A. (*Zoologist*)

G. T. BOALCH, B.Sc., Ph.D. (*Botanist*)

G. W. BRYAN, B.Sc., Ph.D. (*Zoologist*)

A. G. DAVIES, B.Sc., Ph.D. (*Special Appointment:
Physical Chemist*)