Centennial History of the Carnegie Institution of Washington
Volume V The Department of Embryology

Founded in 1914, the Department of Embryology of the Carnegie Institution of Washington has made an unparalleled contribution to the biological understanding of embryos and their development. Originally much of the research was carried out through experimental embryology, but by the second half of the twentieth century, tissue and cell cultures were providing histological information about development, and biochemistry and molecular genetics have now taken center stage. This final volume in a series of five histories of the Carnegie Institution of Washington provides a history of embryology and reproductive biology spanning a hundred years. It provides important insights into the evolution of both scientific ideas and the public perception of embryo research, concluding with a reflection on current debates.

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CENTENNIAL HISTORY OF THE
CARNEGIE INSTITUTION OF WASHINGTON

Volume V

THE DEPARTMENT OF EMBRYOLOGY

edited by

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CAMBRIDGE
UNIVERSITY PRESS

PUBLISHED BY THE PRESS SYNDICATE OF THE UNIVERSITY OF CAMBRIDGE
The Pitt Building, Trumpington Street, Cambridge, United Kingdom

CAMBRIDGE UNIVERSITY PRESS
The Edinburgh Building, Cambridge, CB2 2RU, UK
40 West 20th Street, New York, NY 10011–4211, USA
477 Williamstown Road, Port Melbourne, VIC 3207, Australia
Ruiz de Alarcón 13, 28014 Madrid, Spain
Dock House, The Waterfront, Cape Town 8001, South Africa

http://www.cambridge.org

First published 2004

Printed in the United Kingdom at the University Press, Cambridge

Typeface Adobe Garamond 10.75/12.5 pt. *System* LaTeX 2ε [TB]

A catalogue record for this book is available from the British Library

ISBN 0 521 83082 6 hardback

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FOREWORD

In 1902 Andrew Carnegie, a steel magnate turned philanthropist, had a brilliant idea. Carnegie was prescient in recognizing the important role that science could play in the advancement of humankind. He also believed that the best science came by providing "exceptional" individuals with the resources they need in an environment that is free of needless constraints. He created the Carnegie Institution as a means to realize these understandings, directing the Institution to undertake "projects of broad scope that may lead to the discovery and utilization of new forces for the benefit of man." Carnegie was confident that this unusual formula would succeed. And he was right.

For over a century, the Carnegie Institution has sponsored creative and often high-risk science. Some of the luminaries who were supported by the Institution over the years are well known. For example, Edwin Hubble, who made the astonishing discoveries that the universe is larger than just our galaxy and that it is expanding, was a Carnegie astronomer. Barbara McClintock, who discovered the existence of transposable genes, and Alfred Hershey, who proved that DNA holds the genetic code, both won Nobel Prizes for their work as Carnegie scientists. But many other innovative Carnegie researchers who are perhaps not so well known outside their fields of work have made significant advances.

Thus, as part of its centennial celebration, the Institution enlisted the help of many individuals who have contributed to the Institution's history to chronicle the achievements of the Institution's five major departments. (Our newest department, the Department of Global Ecology, was started in 2002 and its contributions will largely lie ahead.) The result is five illustrated volumes, which describe the people and events, and the challenges and controversies, behind some of the Institution's significant accomplishments. The result is a rich and fascinating history not only of the Institution, but also of the progress of science through a remarkable period of scientific discovery.

Andrew Carnegie could not have imagined what his Institution would accomplish in the century after its founding. But I believe that he would be very proud. His idea has been validated by the scientific excellence of the

exceptional men and women who have carried out his mission. Their work has placed the Institution in a unique position in the world of science, which is just what Andrew Carnegie set out to do.

RICHARD A. MESERVE
President, Carnegie Institution of Washington

PREFACE

Any life a century long deserves notice, especially when that life has been full of innovation, inspiration, and incubation of new ideas and contributions and especially when at 100, the individual is as full of life and promise as ever before. The Carnegie Institution of Washington (CIW) has had such a life and is full of such promise. As CIW President in 2001, Maxine Singer was in the position to develop ways to reflect on the past, celebrate the present, and look forward to the future. She decided to follow the traditions of the CIW itself, namely relying on research and investing in individuals with a clear set of goals and mission. One result was the lovely public volume celebrating the CIW personality, by James Trefil and Margaret Hindle Hazen (*Good Seeing. A Century of Science at the Carnegie Institution of Washington. 1902–2002* (Washington, DC: Joseph Henry Press, 2002)).

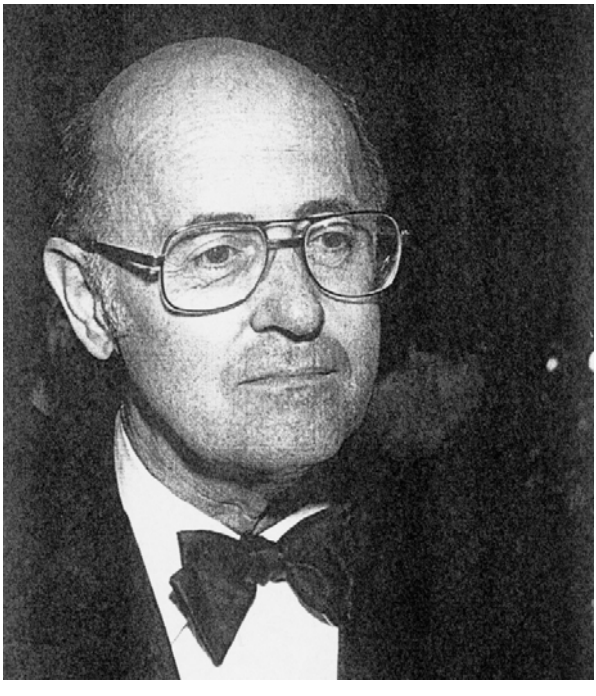
Another result is these volumes, a product of Maxine Singer's interest in capturing what is exciting about the science. To this end, she focused on existing CIW Departments and lined up single authors to write all but one of them. This one required a more complex approach, and she decided to pursue a multi-authored volume instead. She put together a team that includes leading historians of biology and the past two Directors of the Department. The group came together twice, once for a planning meeting and once after circulating drafts in order to provide comments on each of the other chapters and to work toward greater integration and communication among the chapters. That process has worked well, and the result is a rich set of original chapters looking at the CIW Department of Embryology. In addition, the editors added Jane Maienschein's introductory essay and Garland Allen's explanation of the role of the CIW Department of Genetics and its relations to the Department of Embryology, since the two were closely connected in the short-lived Division of Animal Biology. Marie Glitz has coordinated the project and has held the authors' hands through all the annoying details that make a set of chapters a whole instead of a stapled-together bunch of individual manuscripts.

This project, like any complex process, would not be possible without a team. Along with Maxine Singer, Margee Hazen got us started and provided energetic moral support through the first stages of the project. When she left the CIW, Tina McDowell adopted the project and has eased it through the

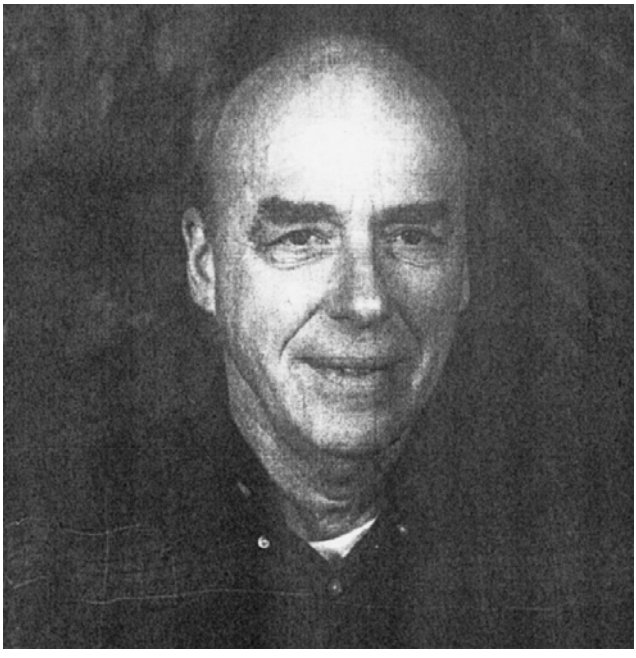
Franklin Paine Mall (first Director, 1914–18)

George L. Streeter (second Director, 1918–41)

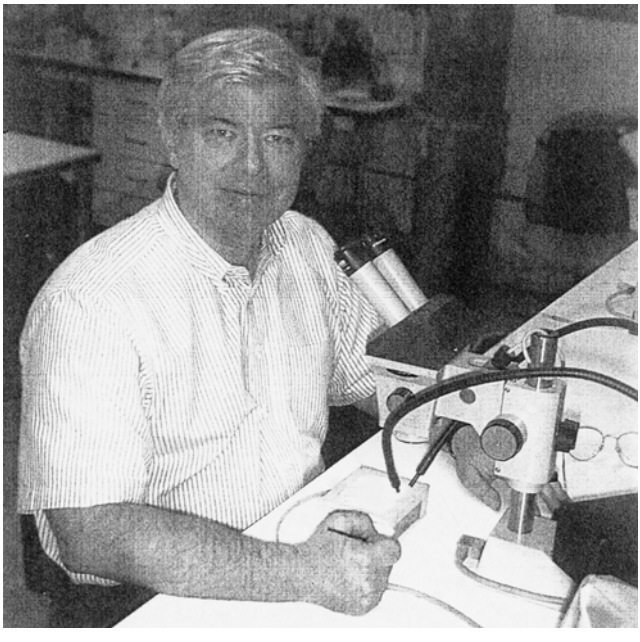
George Corner (third Director, 1941–55)



James Ebert (fourth Director, 1956–76)



Donald Brown (fifth Director, 1976–94)



Allan C. Spradling (sixth Director, 1994–)

production process. All the CIW staff have been wonderfully supportive and helpful, for which we are grateful.

Illustrations throughout the book, unless otherwise indicated, come from the CIW Archival Collection. This collection consists of file cabinets full of photographs that complement the major archival collection of documents. The CIW Archives should serve well the interests of many historians for the next centennial project, though scientists are developing the habit of not saving documents that remain ephemeral and electronic, and the records may be better for the first hundred than for the next hundred years.

As Donald Brown noted in his final annual Department report (*Year Book* 93 (1993–4), p. 29), "A visiting committee report once said that our department functions with no trace of administration. I think that was a compliment." We all know that the Department Directors are indispensable to the CIW success, which is based on the central premise that investing in outstanding individuals will work. The Department of Embryology has succeeded in large part because of its excellent leadership by scientists who understand the possibilities of investing in exciting research, and they deserve our notice and applause. These include: Franklin Paine Mall (1914–18); George L. Streeter (1918–41); George Corner (1941–55); James Ebert (1956–76); Donald Brown (1976–94); and Allan C. Spradling (1994–).