

DEVELOPMENTAL AND CELL BIOLOGY SERIES

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PATTERN FORMATION IN PLANT TISSUES

Development and cell biology series

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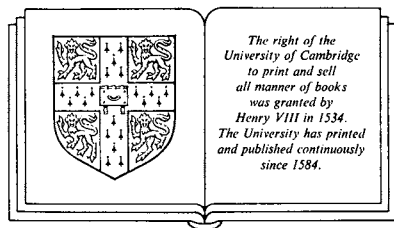
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For Laura

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Preface

The central topic and justification of this book is a conceptual problem: how could orderly or patterned biological form be based on chemical and physical processes. Form is known to be the product of development – but development can lead to tumors rather than organized tissues. Form is also known to depend on the genetic constitution of the organism. Yet this is only a restatement of the problem, since any given gene specifies the structure of a molecule, not the organization of tissues.

The use of new molecular methods is sure to yield a wealth of information. The search for this information requires a conceptual framework of how tissue patterns are formed. Yet many accepted views are implied rather than clearly stated. Furthermore, they consist of unquestioned dogma which is partially contradicted by available facts. An alternative set of concepts is sought here on the basis of a broad, comparative view of available facts, mostly the products of simple techniques. Such a framework should also be important for studies of developmental physiology at non-molecular levels. Finally, though it is the genes that mutate and it is mature structures that are screened by selection, the intervening controls of orderly development must impose constraints on the possibilities exposed to selection – and thus on the course of the evolution of biological form.

Though the central question is theoretical, it is assumed here that at the present state of knowledge theory devoid of observations and experiments is not likely to be useful. Only facts can constrain the almost unlimited theoretical possibilities. A factual approach requires the discussion of defined developmental events and experimental systems. Yet the conceptual problem is the central purpose here, so facts are mentioned only where they are deemed to contribute to theoretical discussion and references to earlier work are meant to be useful rather than historical or laudatory. This book is therefore primarily a series of related research essays, each chapter dealing with a defined problem and meant to be as self-contained as possible. These chapters are followed by a discussion which is meant to develop an alternative or at least supplementary approach to the problem of the specification of form.

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The discussions are limited to plants. This is a relatively advantageous group for the consideration of the development of biological form. Plants share most aspects of cell biology with other organisms and past experience has shown that principles discovered in plants can be of general biological importance. The book is therefore an attempt to continue and update the work on internal controls of plant development of many early authors, especially Vöchting (1892), Jost (1907), Bünning (1953), Sinnott (1960), Steward (1968), Wardlaw (1968) and Steeves & Sussex (1972). It differs from the more recent volume edited by Barlow & Carr (1984) in dealing with many different topics from one point of view.

The conclusions and the organization of the material presented here were products of collaborations and discussions with many people. Some of these have also taken the trouble of commenting on early versions of some chapters. Special thanks are due to P. W. Barlow, D. Cohen, J. Croxdale, A. Fahn, M. Gersani, P. B. Green, M. Kagan, B. Leshem, F. Meins, Jr., G. J. Mitchison, A. Novoplansky, L. W. Sachs, A. R. Sheldrake, and E. Werker. Thanks are also due to Y. Gamborg for help with the photographs.