Preface

How a single cell, the fertilized egg, gives rise to a new individual is one of the most challenging problems in Biology. In a remarkable effort, it has been possible to trace the fate of every cell during development of the determinate embryo of the nematode, which is a relatively simple animal. However, this strategy presents an overwhelming task for vertebrate development and instead attention has typically been focused on crucial stages of development or the generation of specific structures. In the apparently indeterminate embryos of higher vertebrates it may not be necessary or even realistic to give the same detailed attention to the development of every constituent body part, because the same generative processes will be involved repeatedly and will be mediated by cells that have a rather limited repertoire of behaviour. The desire to understand the development of vertebrates generally and the human embryo, in particular, is not simply an intellectual preoccupation – there is also the practical clinical goal of finding out how congenital defects arise.

Until recently, the head, i.e. the craniofacial system, has not been favoured for studying development. Open any textbook on Developmental Biology and craniofacial development is barely mentioned. Of course, anatomically the head is very complex and contains many cells types arranged in precise locations. The anatomical complexity of the 'finished product' is undoubtedly one of the factors that has previously discouraged developmental biologists from tackling craniofacial systems. Furthermore, imposed on the standard facial pattern, there are more subtle qualitative features that are also determined genetically and make each face recognizably different and are, to greater or lesser extents, heritable. Definition of the control mechanisms operating at both these levels is a problem posing a unique intellectual challenge.

In September 1987, the British Society for Developmental Biology held, for the first time, a meeting that focused on these challenges of vertebrate craniofacial development. This book is a collection of the papers presented and reports of some of the discussion that took place. The meeting was designed to be comprehensive, considering the evolution of vertebrate heads; how the face is constructed and the behaviour of neural crest cells; the generation of head-specific structures including sense organs; and finally craniofacial defects. This programme therefore represented a wide range of interests and yet nevertheless, the emphasis was very much on basic mechanisms particularly at the cell and molecular level.

This is an exciting time to be studying embryonic development. With the new techniques in molecular biology, it is now possible to begin to tackle major questions, for example, how gene expression is translated into cell behaviour and specification of position or identity. The solutions will be pieced together from studies on a wide range of different animals from insects to mice and development of organs as diverse as kidneys and limbs. In this context, the study of the craniofacial system has great potential to illuminate many mysteries including the mechanisms of segmentation, cell migration and differentiation, and nervous system connections. The craniofacial system may also be suitable for identification of genes involved in morphogenetic processes by investigation of families with inherited conditions that affect craniofacial development. Therefore, the future appears to hold out great promise for unravelling both fundamental and special problems of face development and approaching a greater understanding of the basis of congenital defects.

P. Thorogood
C. Tickle
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