Preface

Gastrulation is the developmental process, involving extensive cell reorganizations, which results in the formation of the mesoderm and gut endoderm of the embryo. The prefix gastr- in fact means 'stomach', which is perhaps both a reference to the shape of the gastrula stage of miolecithal eggs (e.g. sea urchin, *Amphioxus*) and to the fact that the endoderm, which lines the digestive tube, arises during gastrulation. Its importance was eulogised by Lewis Wolpert's famous statement that '*it is not birth, marriage or death but gastrulation that is truly the most important time in your life*'. Not only does the embryo become trilaminar, but it is also during gastrulation that the basic body plan is laid down, the three axes of the embryo become established and many cells receive the signals that lead them to acquire developmental fates and positional information.

We have attempted to collate a volume that reflects the current emphasis of research into gastrulation. Thus, four main themes recur: (a) investigations of the patterns of movement of embryonic cells, (b) analysis of cell fate and developmental potential, (c) the role of induction in cell fate allocation, and (d) the acquisition of more refined regional pattern ('regionalization') beyond differentiation into the major classes of cell types. But we have also tried to put gastrulation into a broader context, both in terms of its evolution and of the history of its study.

The last 5-10 years have seen an explosion in the number of publications concerned with gastrulation and the early development of the mesoderm. From this, one might be tempted to assume that we now understand much more about gastrulation than we did 20 years ago. But a deeper analysis might reveal that our understanding has not increased greatly; perhaps the only thing that we now understand about gastrulation is that the process is far more complex and sophisticated than our predecessors thought. To the existing descriptions of cell movements, made mainly from histological observations at the turn of the century and from vital dye mapping in the 1930s and 1940s, we are now adding more descriptions of morphogenetic movements, and constantly re-discovering the accuracy of the earlier observations. We are also adding descriptions of the patterns of gene expression, particularly of genes suspected of playing a role in gastrulation. Yet unravelling the functional significance of these patterns continues to present us with a major challenge. In Drosophila, of course, such genes have for the most part been discovered through their mutant phenotypes, so that the characterisation of their expression patterns has gone hand in hand with the analysis of their functions. This mutational approach has provided us with some fascinating insights into the cellular basis of the morphogenetic movements that underlie the gastrulation process. Many now hope that a similar approach can be applied to at least one vertebrate, the zebrafish, with similarly fruitful results. Even in Drosophila, however, it is clear that the genetics cannot yield all the answers, and in this and all the other systems that we study we have to face the prospect of characterising large numbers of spatially restricted genes of unknown function. Our goal then will be to make the link between gene expression and morphogenesis, a familiar problem but none the less exciting for that!

For a reader who wants to become familiar with gastrulation, we hope that this Supplement will represent an introduction to this fascinating process and encouragement to make a contribution to the field. We hope to help dispel the view that a knowledge of the genes expressed during gastrulation will suffice to understand the process itself, just as much as we wish to discourage the equally extreme view that genes are irrelevant to this largely epigenetic process.

To a reader already familiar with the embryology of gastrulation, the volume may seem to concentrate unduly on mesoderm, at the expense of endoderm. This is a reflection of the direction of current research, and the paucity of good endodermal markers may be partly responsible. We feel that the importance of the endoderm both during and shortly after gastrulation has been neglected. Perhaps we should not be surprised if the *Development* Supplement volume for the year 2002, containing papers presented at the SDB meeting in, say, Berkeley, were entitled 'The Endoderm'.

> *"What has been achieved is but the first step; we still stand in the presence of riddles, but not without hope of solving them. And riddles with the hope of solution? What more can a scientist deserve?"*. (Hans Spemann, 1927)

C.D.S./P.W.I., Oxford, Summer of 1992

Editors' note:

When we planned this meeting, we were anxious to introduce young students of gastrulation to some of the colourful history of the subject. Johannes Holtfreter would have been an ideal choice, but his health precluded him from being able to accept. We were very pleased when Salome Gluecksohn-Waelsch, who was also a graduate student in Hans Spemann's laboratory when some of the 'organizer' experiments were being conducted, did accept our invitation to give a plenary after-dinner talk. She was to reminisce on the atmosphere in Spemann's lab and on her other colleagues during her distinguished career. A few weeks before the meeting, she was forced to decline because of pressure of grant applications and teaching. Our disappointment at her decision diminished only when she very kindly agreed to our inclusion of the text of this unpublished lecture in this volume. The lecture was given at a Conference on 'Embryonic origins and control of neoplasia' in Dubrovnik, October 13-16, 1986.