

Preface

The present book can be considered as having been “motivated by an IHES Workshop” which was a unique event aimed at creating a venue for communication between biologists and mathematicians. The *Interdisciplinary Workshop on Pattern Formation in Morphogenesis* took place in 2010 at the IHES (Institut des Hautes Études Scientifiques) in Bures-sur-Yvette, France. Organized by Vincenzo Capasso, Misha Gromov, Annick Harel-Bellan, and Nadya Morozova, it was supported by the IHES programme for mathematical biology research.

Morphogenesis—the process of pattern formation during the development of living organisms—is a broad field, including areas ranging from physics to chemical and biological systems. At the same time, morphogenesis represents both a rich source of interesting mathematical challenges and perhaps the most intriguing process in living organisms remaining to be explored. The goal of the IHES Workshop was to generate an interdisciplinary interaction space for discussing the problems of Pattern Formation in Morphogenesis. To that end, leading biologists working on various aspects of Developmental Biology, i.e., embryology, genetics, molecular biology, and cell biology, were invited to discuss their own work as well as to describe the prospects of their specific fields along with the basic knowledge necessary to understand them. The specific idea of the Workshop was to create a frame of productive discussions, in the course of which invited mathematicians would apply the knowledge gained from the biologists for the generalization and mathematical formalization of morphogenetic processes.

This volume collects a set of mathematical contributions presented as a follow-up to discussions arising both during and after the workshop regarding key issues and perspectives on scientific themes related to pattern formation in morphogenesis. The biological presentations at the workshop, the necessary source of the biological input for this activity, were also reworked for inclusion in an independent part. Thus, the book contains three diverse parts: “Biological Background,” which consists of adaptations of the biological presentations; “Mathematical Models,” motivated by both biological presentations and discussions; and “Ideas, Hypotheses

and Suggestions,” for possible mathematical formalization (or, in other words: “Biology”, “Mathematical Biology,” and “Theoretical Biology” parts).

We hope that this volume will help to launch a new set of fruitful discussions in the field of mathematical formalization of Pattern Formation in Morphogenesis.

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Pattern Formation in Morphogenesis

Problems and Mathematical Issues

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