Preface

In 1974 Springer published a book entitled *Pollen* by Stanley and Linskens. Years later, when I started researching, this was the first textbook on pollen and pollen tube growth I used. There I got acquainted with the ultrastructural aspects of pollen tubes, how they relate to cellular tip growth and to the progression in stigma and style until fertilization was achieved. The emphasis was then on structure and the most prominent questions at the time also reflected the available methodologies. It was therefore not surprising that studies on pollen tubes focused mainly on elucidating the role of the male gametophyte in double fertilization. Basic information gained on the different steps of fertilization is indeed a contribution to the promotion of genetic engineering in plants and crop improvement.

While this remains true, the outstanding technological advance registered in the past 30 years allowed us to change from a morphological/structural approach to a dynamic/functional approach. It is now evident that pollen tubes are excellent examples for plant cell research, particularly suitable for investigations on cell tip growth and polarization, signal transduction, channel and ion flux activity, gene expression, cytoskeleton and wall structure, membrane dynamics and even cell–cell communication.

The enormous amount of data about pollen tube growth presently available (about its physiology, biochemistry, cell biology, molecular genetics, etc.) clearly demonstrates the interest of the scientific community in this particular cell type and reflects its qualities as a biological model that go much beyond the carrier of the sperm cells essential for reproduction. The diversity of techniques and methodologies now used to study pollen and pollen tube growth is reflected in this book, which is written by biochemists, cell biologists, molecular biologists and geneticists, with obvious different perspectives but that, on the whole, see the cell as a complex network composed of structural and regulatory elements with an assembly and function modulated by internal and external stimuli.

The first chapter of the book introduces the general architecture of the pollen tube and how signalling pathways impinge on this structure. It follows with a chapter about the transcriptomic view of pollen development and how this methodology may help us pinpoint both structural and regulatory components of the pollen tube machinery. Among these are certainly ions, membrane

transporters, GTPases, phosphoinositides and signalling lipids. Together, these form an intricate signalling network modulating crucial processes (e.g. secretion and cytoskeleton dynamics) and are reviewed in the next four chapters. These are followed by chapters on the basic structural components of the pollen tube, but emphasize the dynamics and functional aspects of microfilaments, microtubules and the cell wall. The following two chapters review the interaction of the pollen tube with the female tissue and how this affects the male gametophyte at a molecular and cellular level. The mechanisms of self-incompatibility and guidance to the micropyle are key aspects of plant cell–cell communication that may elucidate us on the evolution of land plants. The last two chapters are conceptually complementary. First, an analysis and discussion of the potential of screening pollen tube mutations taking advantage of bioinformatic and genomic tools in order to identify key components of the pollen tube growth machinery. And naturally, the current model to perform such tests is *Arabidopsis thaliana*. However, in a few more years' time, with ongoing sequencing projects of several economically important species (among others), our choices will be significantly broader. The last chapter focuses precisely on the advantage of studying several species and the benefits we can expect from such diversity analysis.

As a final note, I would like to thank the authors for their work in producing such excellent chapters and the publisher for producing such a book. I also thank all those who contributed over the years to the extensive data now available. It was for me a real pleasure and honour to edit this fine book that, I hope, will serve as a valuable tool for scientists working in sexual reproduction and plants in general.

Lisbon, January 2006 R. Malhó