Preface

Recent years have witnessed an extraordinary explosion in our knowledge of the dynamics of nuclear structure. The constantly growing interest in the molecular aspects of RNA trafficking has received a dramatic stimulus from the synergistic boost of two rapidly developing technologies over recent years. On the one hand, the use of nontoxic fluorescent proteins (GFP, green fluorescent protein and its derivatives) has allowed the visualization of moving molecules in living cells due to computerized 3-D cell imaging techniques. These, in combination with FRAP (fluorescence recovery after photobleaching) methods, make it possible to follow the dynamic interactions between individual molecules. On the other hand, the development of proteomics has led to the molecular identification of proteins in motion within the nucleus.

In the face of the wealth of new observations (and reviews thereof) dealing with nuclear structure, it appeared timely to narrow the scope of this book and to restrict it to dynamic aspects, as they involve or are of relevance to RNA. It came with the realization that nuclear structure is much more dynamic than previously anticipated; this is probably the major general message of this volume.

The first three chapters deal with the structural organization of different subnuclear compartments. Nuclear compartments, unlike those in the cytoplasm, are not delimited by surrounding membranes. The chapter by Platani and Lamond surveys the chromatin compartment, the nucleolus and perinucleolar compartment, Cajal bodies and gems, the speckles containing splicing factors, as well as the PML bodies characteristic of promyelocytic leukemia.

The second chapter by Raška concentrates on the structure – function relationship of the nucleolus, in a search for active ribosomal genes. He first reviews the results obtained by a combination of electron microscopy, cytochemistry and immunocytochemistry approaches to refine nucleolar structure. He then goes on with the mapping of its DNA and RNA moieties by in situ hybridization together with its protein components by immunocytochemistry.

The next chapter by Nykamp and Swanson touches on RNA-mediated pathogenesis by presenting an original view of diseases involving trinucleotide expansion. They argue that, in addition to the protein being altered by the presence of unusual glutamic acid repeats, RNA can have an intrinsic toxic effect due to the (CUG)n expansions themselves.

The next four chapters impinge on more dynamic aspects of RNA trafficking. Bertrand and Bordonné concentrate on small nuclear and nucleolar RNPs (snRNPs and snoRNPs) with special emphasis on the latter. They draw attention to similarities in their biogenesis and argue for the possibility of a common origin between snoRNAs and snRNAs.

The other chapters focus on mRNA trafficking toward the nuclear pore. Kiesler and Visa further the monumental work of Daneholt's lab, using as a model system the Balbiani rings of *Chironomus tentans*. They track BR RNP particles from the gene to the nuclear pore, arguing for a free diffusion process with transient interactions with nonchromatin nucleoplasmic structures. They also discuss the functional significance of nuclear retention of mRNA. The paper by Braga, Rino and Carmo-Fonseca reaches the same conclusion about a passive diffusion mechanism for nuclear mRNPs, but also suggests the possibility of additional energy-dependent reactions.

Finally, Fusco, Bertrand and Singer review the latest technologies for live cell imaging of mRNA which were pioneered in Singer's lab and have already proven so useful.

Obviously, this blooming field is still in its infancy and has yet to yield its full harvest of new mechanisms and concepts.

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