Evolution of the Protein Synthesis Machinery and Its Regulation

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Editors

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Preface

Proteins are one of the elementary molecules of the biosphere. They catalyze the majority of life-sustaining reactions and play structural, transport, and regulatory roles in all living organisms. Protein synthesis or "translation" is the process of decoding the genetic information of a messenger RNA by the ribosome along with translation factors to synthesize a protein. Translation regulation allows organisms to (1) rapidly respond to a variety of stresses, sudden environmental changes, and nutritional deficiencies, (2) produce proteins in tissues and developmental processes where transcription is strongly limited, and (3) elicit asymmetric localization of proteins when and where required. Thus, translation is a fundamental process for gene expression in all forms of life and should have evolved ever since the beginning of life.

The knowledge of basic processes and regulatory mechanisms of translation was established in the last five decades by the brilliant work of many scientists in different countries, mostly studying the bacteria *Escherichia coli*, human, mouse, rabbit, the budding yeast *Saccharomyces cerevisiae*, and the fruit fly *Drosophila melanogaster* as model organisms. In recent years, the advent of the powerful "omics" era (i.e., genomics, transcriptomics, and proteomics) has created a novel perspective in the study of biological processes at the genome-wide and thousands-of-species scales from many phyla never studied before. These studies have led to crucial findings on the origin and evolution of the process of translation.

Here, we have gathered experts in different aspects of translation to review the state of the art of their respective fields in the attempt to answer the question of how the protein synthesis machinery and its regulation might have originated and evolved. We wish to thank the authors for their excellent contributions. We also thank our editor team at Springer, especially Janet Slobodien and Eric Hardy, for producing this book.

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