
The task of sensing and regulation of physiological levels of metabolites in cells has been traditionally ascribed to proteins. However, it is becoming increasingly clear now that these activities can also be carried out by RNA. Riboswitches are among the latest additions to the growing field of RNA-based gene expression control systems found in both prokaryotic and eukaryotic cells. Riboswitches are structures residing in the noncoding regions of mRNAs that are capable of specific binding to small metabolic molecules without assistance of proteins. The formation of a complex between the evolutionarily conserved metabolite sensing (aptamer) domain of the riboswitch and the metabolite brings about allosteric reorganization of the mRNA structure, leading to alternations in genetic expression. Riboswitches modulate gene expression at various levels, such as transcription, splicing, translation, and mRNA degradation. They are known to regulate several metabolic pathways, including the biosynthesis of several vitamins and metabolism of methionine, lysine and purines.

The reviewed volume consists of 25 chapters contributed by active scientists and experts in the field of RNA research. The methods assembled in this book may be useful in various aspects of work on riboswitches and other regulatory RNAs. The described techniques, such as fluorescence spectroscopy, in vitro reconstituted transcription elongation/termination system, or nucleotide analogue interference mapping (NAIM)/suppression (NAIS), allow one to study the mechanism of the riboswitch-ligand interactions. The wide range of protocols of modern biophysical techniques, from X-ray and NMR to FRET and isothermal titration calorimetry, may be helpful in studying riboswitch structures and their folding. Two chapters are focused on various aspects of identification and characterization of riboswitches and other regulatory RNAs in living cells, and one is devoted to computerized searches of riboswitches in an intergenic region, genome or larger sequence database of interest. The reader will also find an informative review on regulatory systems in bacteria in which the signal is a specific RNA that binds to the target mRNA.

Each chapter consists of the following parts: Summary, Introduction, Materials, Methods and Notes. Summary gives rationale for the research approach. Introduction supplies information about riboswitches in the context of the methods included in a given chapter, and explains the principles of described techniques. It also refers to pertinent and up-to-date literature. The Materials part is divided into sections in which the equipment, bacterial strains, reagents (often accompanied by the method of their preparation), etc., necessary for each step of the experiment, are listed. The detailed laboratory protocols in Methods allow easy reproduction of the described experiments. The Notes section contains advice on avoiding traps into which a less experienced researcher may easily fall.

The reviewed book can be strongly recommended to RNA researchers with different levels of expertise, as well as to those who learn or teach in this field.

Joanna Cieśla
Institute of Experimental Biology, Polish Academy of Sciences, Pasteur 3, 02-093 Warszawa, Poland


We have received a new volume of the Humana Press Methods in Molecular Biology Series entitled “Nucleic Acids and Peptide Aptamers”. The Editor, Professor Günter Mayer from the University of Bonn has invited 67 authors, leading authorities in the field, to contribute papers about aptamers.

Nucleic acids or peptides which efficiently bind to target molecules can be used to provide information on the structure and function of these targets as well as to provide tools that could serve not only scientific but possibly also therapeutic purposes. The use of methods whose basic concept is simi-
lar to the Darwinian idea of evolution allows generation of efficiently binding ligands, called aptamers. These methods are based on in vitro selection of ligands from an initial library of molecules, followed by amplification of selected ones. Then the resulting pool of molecules undergoes modification to increase their diversity for a next round of selection.

The book “Nucleic Acids and Peptide Aptamers” is a collection of detailed protocols describing various aspects related to generating aptamers, characterizing them, and applying for particular purposes. The book contains 22 chapters and is divided into two major parts. In Part I, fifteen chapters deal with nucleic acid aptamers, and Part II is focused on peptide aptamers. Each chapter is organized in a similar way and contains a short introduction explaining the particular field’s standpoint and defining the purpose of the work, followed by a list of necessary materials and equipment, and then a detailed description of the procedures used. Chapters conclude with “Notes” calling attention to possible experimental difficulties and suggesting troubleshooting tricks to overcome them. The list of references is a useful and timely source of further reading on the subject.

Part I. Chapter 1 (by Piasecki et al.) describes procedures used to generate a starting pool of nucleic acids for the subsequent selection. Following chapters describe details of aptamers preparation, as exemplified for ssDNA (Chapter 2, by Mayer and Höver) and allosteric ribozymes (Chapter 4, by Pignaneau), and present details of a method of their isolation, e.g. capillary electrophoresis - SELEX (Chapter 3, by Mosing and Bowser). The methods used to characterize the structure and properties of selected aptamers include structural probing (Chapter 8, by Wakeman and Winkler) and analysis using physicochemical methods such as X-ray (Chapter 9, by Edwards et al.), fluorescence correlation spectroscopy (Chapter 7, by Werner and Hahn) and in vivo imaging (Chapter 15, by Tavitian et al.). Chapter 10 (by Barciszewski et al.) describes the chemical synthesis and applications of locked nucleic acids (LNA) to stabilize the structure of tailored RNA aptamers. Important contributions show aptamer’s applications to target specific molecules of therapeutic importance, such as retroviral stem-loop RNA structures (Chapter 6, by Watrin et al.), HIV-1 reverse transcriptase (Chapter 11, by Yamazaki and Famulok) or living cells (Chapter 5, Cerchia et al.) or to affect gene expression (Chapter 12, by Suess and Weigand). Novel applications of aptamers in the area of bio-sensing (Chapter 13, by Gronewold) and analysis based on aptamer-assembled gold nanoparticles (Chapter 14, Lu et al.) conclude Part I.

Part II of the book, dealing with peptide aptamers, starts with a chapter describing generation of peptide libraries, phage display - based selection methods, and purification strategies (Chapter 16, by Gaida et al.). Other chapters describe methods of peptide selection using mRNA display (Chapter 17, by Takahashi and Roberts) or yeast two-hybrid system (Chapter 18, by Miller), as well as high-throughput protocols that facilitate the selection and analysis of peptide aptamers targeting proteins functions (Chapter 19, by Lopez-Ochoa). A novel protein scaffold that is used to generate aptamers is described in the chapter on Microbodies13 (Chapter 20, by Schmoldt et al.). These are derived from so called cystine-knot microproteins, which exist in various species, and have extremely stable structures. They can be used as scaffolds to display peptide aptamers targeting specific proteins of interest. Therapeutic applications of peptide aptamers include their use in drug discovery and as drug carriers, which are described in Chapters 21 (by Bardou et al.) and 22 (by Rennert et al.), respectively.

“Nucleic Acids and Peptide Aptamers”, edited by Günter Mayer, can be certainly recommended as an excellent handbook addressed to researchers and students in the molecular biology field.

Ryszard W. Adamiak,
Mikołaj Olejniczak
Laboratory of Structural Chemistry of Nucleic Acids, Institute of Bioorganic Chemistry,
Polish Academy of Sciences, Noskowskiego
12/14, 61-704 Poznań, Poland