FEBS Letters 581 (2007) 2749

Preface

Vienna special issue: Molecular machines

After 42 years, the annual FEBS Congress has returned to Austria. FEBS2007 is hosted by the FEBS constituent society, the Austrian Society for Biochemistry and Molecular Biology, ÖGBM. Hence, it is a privilege and pleasure to produce this FEBS Letters Special Issue in conjunction with the 32nd FEBS Congress. FEBS2007 provides a magnificent scientific programme, presenting front-line achievements in the fields of biochemistry, molecular and cellular biology. Modern biology seems to follow new avenues, thereby removing traditional boundaries between scientific fields and disciplines. Hence, we decided to dedicate FEBS2007 to "*Molecular Machines and their Dynamics in Fundamental Cellular Functions*" to promote the interdisciplinary exchange in molecular life sciences.

But what are *Molecular Machines*? There has been considerable discussion about the nature of a molecular machine. Based on machines of our everyday's life – such as engines of cars – we find some characteristics that may hold true even for molecular machines: They are usually composed of individual modular elements, appear to be rather complex and use fuel to perform cycling functions. In essence, machines are simply more than the sum of the modules. Yet, the concept of molecular machines shows us another layer of complexity: they can be either stable or transient macromolecular assemblies and undergo conformational changes during assembly or while functioning. For instance, the mitochondrial F1-ATPase can be considered as a prototype machine. The same is true for the proteasome, the DNA replication machinery, the ribosome or bacterial injectisomes just to name a few. Hence, it is evidently clear that most if not all cellular processes require the function of such machines, yet we still have a limited understanding about their mechanism, assembly or interplay with other cellular components or their dynamic changes as they occur during functional cycles. Importantly, deciphering the function of machines is a prerequiste to dissect the biological processes in the context of living cells or systems as a whole, thus providing a route to a better understanding of their roles in both health and disease.

Many *Molecular Machines* are complex in nature, and highly dynamic regarding the interaction of individual components with each other as well as with other machines. Therefore, unraveling their function(s) will require interdisciplinary strategies, and in particular quantitative approaches to studying machines and their functions. Therefore, it is clear that integrative structural biology, live-cell imaging, proteomics, genomics, metabolomics, electron microscopy, magnetic resonance, genetics, classical biochemistry and molecular and cell biology as well as engineering will be necessary to fully understand all parts or a given machine as a whole. No single discipline alone will be able to unveil how such a machine is embedded in or required for cellular functions, and how machines interact with each other (i.e. the proteasome and the protein protein translocation machinery) to allow for faultless and coordinated biological processes. The interdisciplinary scientific approaches will eventually lead to a new kind of biologist, as biochemists and molecular biologists will have to cross boundaries to other fields, also exploiting theoretical approaches and team up with mathematicians. This is the roadmap for the future in biology, where quantitative biological data on cellular processes or molecular machines will be used to generate testable mathematical models of how entire living cells or parts thereof work. Some scientists call this *systems biology*, maybe one of the hottest buzz-words in today's life science, but perhaps a quantum leap for the approach of the next generation biologists aimed at understanding and predicting living systems.

The need for new interdisciplinary approaches in life science prompted us to dedicate FEBS2007 to Molecular Machines. This is also reflected to a large extent in this *FEBS* Special Issue accompanying the FEBS2007 Congress. The FEBS2007 programme is carried by a formidable collection of invited speakers from all over the world – including two nobel laureates, who will open and close the 32nd FEBS meeting in Vienna with their keynote lecture. We succeeded to commit the best of the best for the symposia, and we are proud to say that we have a large fraction of young scientists attending FEBS2007 as invited speakers.

This FEBS Letters Special Issue and the FEBS Congress programme attempts to cover most aspects of life at a molecular level – nuclear events, chromosome segregation, DNA replication, protein translation, cell division control, signaling, membrane proteins, regulated protein turnover, cell-to-cell transport, trafficking, host–pathogen interaction, etc. just to name a few. A specific session on quantitative biology will highlight the new directions in biology, such as predictive modeling, systems biology, or dynamics of complexes. Afternoon workshops will give ample time for discussion in the respective field: 'integrative structural biology', 'bioinformatics', 'lipids', 'chemogenomics', 'cystoskeleton' and 'quantitative proteomics'. It is virtually impossible to cover all aspects in this issue that you are currently holding in your hands; instead this FEBS Letters Special Issue can therefore be only a small window to an exciting world of biology.

Welcome to FEBS2007 in Vienna.

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0014-5793/$32.00
doi:10.1016/j.febslet.2007.05.061