

Editorial

Special Issue: The Nucleolus

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The nucleolus is a distinct subnuclear structure that assembles around tandemly repeated rDNA gene clusters. Discovered over 200 years ago and best known for its role in ribosome biogenesis, the nucleolus has recently been shown to have a myriad of additional roles, acting as a central hub in regulating multiple nuclear and cellular processes necessary for maintaining cellular homeostasis. Some of these include nuclear organization, regulation of global gene expression, energy metabolism, and stress signaling. Additionally, deficiencies in many of these processes have been linked to human disease such as neurodegeneration and cancer and natural processes such as aging.

Here, we take a tour through recent discoveries associated with some of the established and some of the newer functions associated with the nucleolus. We begin within the nucleolus with the question of how rDNA copy number is maintained. rRNA is central to ribosome function and rRNA is the most transcribed RNA in the cell. Due to its repetitive nature it is highly unstable and requires active maintenance. Nelson *et al.* discuss the latest developments in understanding how rDNA copy number is maintained. Next, we delve into the process of rRNA transcription by RNA polymerase I. In particular, Scull and Schneider examine the cotranscriptional processing of rRNA; changes in which lead to cellular signaling alterations and stress. Van Sluis and McStay discuss how nucleoli sense and repair breaks in the rDNA locus and discuss how nucleoli can sense and signal repair of non-nucleolar double-strand breaks. The organization of both the nucleolus and the nucleus influence cellular processes and human development and disease. Cerqueira and Lemos discuss how nucleolar elements are organized and how the nucleolus helps to shape the architecture of the nucleus. Along the same lines, Kresoja-Rakic and Santoro discuss how nucleolar architecture and chromatin composition of rRNA genes change during critical phases of gametogenesis and early mammalian development. Ribosomopathies are diseases that are caused by defects in the production of ribosomes. Farley-Barnes *et al.* use new findings in the field to explain how tissue specificity arises from defects in such a general process. Links have been made between the nucleolus and various stress responses. Here, Chen and Stark describe how components of the nuclear factor (NF)- κ B pathway are sequestered within the nucleoli and how nucleolar stress through the NF- κ B pathway regulates cell growth and apoptosis.

These articles touch on exciting findings associated with nucleolar structure and function. However they represent only a subset of functions associated with the nucleolus and we apologize for not being able to cover every aspect of this exciting cellular structure, but we hope you enjoy our selection of articles.

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