Nuclear Architecture and Epigenetics of Lineage Choice

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Abstract

Differentiation is an epigenetic process which is installed by changes of transcriptional programs over successive cellular divisions. A number of studies have reported the effects of biochemical modifications of chromatin (DNA and chromatin proteins) on the regulation of transcription. Although, these studies are able to explain how transcription of a given gene is regulated (toward activation or silencing), and how this regulation is memorized by cells through mitotic and meiotic divisions, they are not able to explain the co-regulation of thousands of genes occurring during specific periods of development e.g. in preimplantation embryo or in embryonic stem cells. Our findings acquired by novel microscopic techniques suggest that alterations of nuclear architecture and chromatin organization have deterministic effects on global transcription. Here, I report our latest findings on changes of nuclear architecture and chromatin organization in early embryonic and stem cells. Association of these architectural changes with morphogenetic processes in embryo and states of pluripotency in embryonic stem cells will be emphasized. In addition, the possibility of a deterministic nature for nuclear architecture and organization is discussed. A detailed understanding of regulatory processes for the large-scale and global control of genome function during pluripotency and differentiation is crucial to recognize mechanisms of diseases and cancer states. It seems that, in essence the same principles govern processes of pluripotency and differentiation in embryonic and stem cells, and the de-differentiation process in cancer cells.

Keyword: Epigenetics, Nuclear architecture.

Oral Presentation

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