【Grant - in - Aid for Scientific Research on Innovative Areas(Research in a proposed research area)】
Biological Sciences

Title of Project: Chromatin potential for gene regulation

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Research Project Number : 18H05526 Researcher Number : 30241392

【Purpose of the Research Project】

In multicellular organisms, diverse cell phenotypes arise from identical genetic information in DNA. The diversity in phenotypes is achieved by differential gene expression in different cell types. Therefore, understanding the mechanism of gene regulation is one of the most important subjects in biology.

Genetic information in eukaryotes is packed into the nucleus through the formation of chromatin. Recent studies have revealed that chromatin structure plays an important role in gene regulation. However, the big question of "how chromatin regulates gene expression in living cells" remains unclear. Recent imaging techniques to track particular chromatin structures in living cells have allowed us to link chromatin structure with transcription potency. In this research program, we aim to reveal the factors that determine the "chromatin potential" for gene activation (Fig. 1).

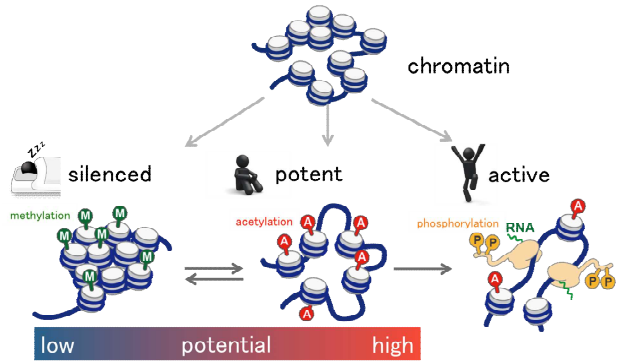

Fig. 1: The concept of "chromatin potential".

【Content of the Research Project】

Genes are regulated at various levels of chromatin, including post-translational histone modifications, histone variant exchange, chromatin condensation, higher-order nuclear compartmentalization, interactions with nuclear domains, and physical forces (Fig. 2). By gathering top researchers with different expertise, this research group will help reveal the nature of chromatin potential through interdisciplinary approaches, including quantitative measurements of chromatin dynamics, acquisition of omics data, reconstitution of functional chromatin *in vitro* and *in vivo*, and theoretical modeling. By integrating the data obtained from different approaches, we will be able to address which factors contribute and to what extent each helps establish transcriptionally competent or incompetent chromatin states. This research group will focus on biological phenomena associated with dynamic changes in chromatin and gene expression, such as development and differentiation in model organisms.

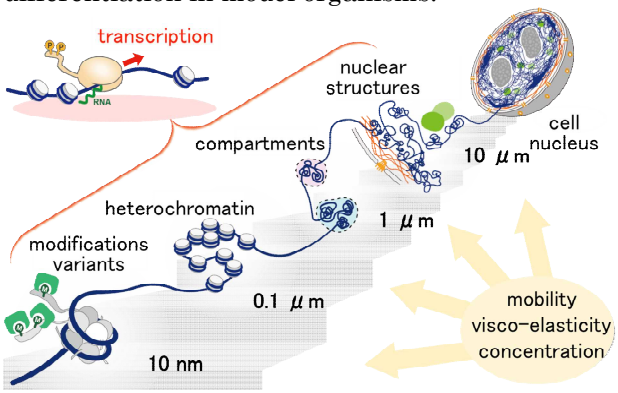

Fig. 2: Various levels that determine chromatin potential.

【Expected Research Achievements and Scientific Significance】

By revealing the factors that control chromatin potential, we expect to predict and control the probability of gene expression through the measurement and manipulation of chromatin states. This study will open up new routes to designing cell properties and fate by artificially controlling gene expression, which in turn will contribute to broad fields of applied biology.

【Key Words】

Chromatin: A complex in the eukaryotic nucleus, consisting of DNA, protein, and RNA. The major components of chromatin are DNA and histone protein.

【Term of Project】 FY2018-2022

【Budget Allocation】 1,181,500 Thousand Yen

【Homepage Address and Other Contact Information】

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