SS03-3 Signal Transduction and Transcription Regulation based on Molecular Structure

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In general, inorganic or low molecular organic reactions are simply attenuated dependently on solvent conditions such as temperature, pH, or redox states. In contrast, reactions involving biological macromolecules exemplified by proteins and nucleic acids in multi-cellular organisms are complex and their activities are precisely regulated through allosteric multi-molecular interactions or chemical modifications like phosphorylations, where regulations of their activities mean those of intermolecular interactions physically and spatially in adaptor molecules like G proteins or transcription factors and those of optimized environments in an active center for catalytic reactions chemically in enzymes like kinases. We study molecular mechanism of regulation of activity for transcription factors. Transcription factors regulate gene expressions of target genes to control cell proliferation and differentiation for ontogenesis and maintenance of a living body. Mutations of transcription factors are closely related to diseases such as cancer or anomaly. There are over a thousand different kinds of transcription factors in higher eukaryotes and they bind to DNA regions, referred to as enhancers, in a combinatorial fashion specific to a target gene to regulate transcription, where activities of these transcription factors are further regulated via signaling cascades in cells. However, mechanisms of these events in a molecular structural aspect are largely unknown. Here, we will discuss molecular mechanisms of formation and regulation of some transcription factor assemblies on enhancers, referred to as enhanceosomes, under cell signaling cascades, from viewpoints of a molecular structure and structural fluctuations.