

## Is Mg ion a new second messenger?

Kotaro Oka, Ph.D. Chief Professor, Department of Biosciences and Informatics, Keio University

Mg<sup>2+</sup> is an important cation for maintain cellular functions and, therefore, suggested the relation of Mg<sup>2+</sup> to various diseases such as cancer, obesity, type 2 diabetes and neurological diseases. Furthermore, intracellular Mg<sup>2+</sup> plays roles as a second messenger in the immune system and it has been recognized as a multi-target metabolic regulator. Therefore, regulation of intracellular Mg<sup>2+</sup> is critical for maintenance of cellular functions and tissue integrity. To reveal the regulatory mechanism of intracellular Mg<sup>2+</sup>, we have developed Mg<sup>2+</sup> sensitive fluorescence probes and imaging techniques. These intracellular Mg<sup>2+</sup> imaging works revealed Mg<sup>2+</sup> mobilization in pathological and physiological conditions, and mitochondria are intracellular Mg<sup>2+</sup> stores. Although mitochondrial Mg<sup>2+</sup> concentration ([Mg<sup>2+</sup>]<sub>mito</sub>) is normally at the similar level with cytosolic Mg<sup>2+</sup> concentration ([Mg<sup>2+</sup>]<sub>cyto</sub>), mitochondria redistribute cytosolic and mitochondrial Mg<sup>2+</sup> sufficient to change the cytosolic Mg<sup>2+</sup> level in response to several physiological stimuli. Recent studies using novel Mg<sup>2+</sup> fluorescent probe successfully visualized that Mg<sup>2+</sup> concentration dynamically changes also in the mitochondria. However, it is not clear, in cells, how the changes of [Mg<sup>2+</sup>]<sub>mito</sub> comprehensively affect the cellular energy metabolism in detail. In this presentation, I will demonstrate our recent approaches for visualizing intracellular Mg<sup>2+</sup> concentration with fluorescent imaging techniques, and show the physiological function of Mg<sup>2+</sup> in neuronal cells.

### Selected references from our works

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