

# The 62nd Frontier Brain Science Seminar

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## Fluorescent indicators for probing neuronal activity and biochemical signaling *in vivo*.

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**場所:** 日医工オーデトリウム (医薬イノベーションセンター1F)

### Abstract

To understand how neurons communicate with each other to generate cognition, emotions, and memory, it is necessary to monitor neuronal activity and activity-dependent biochemical signaling in the brain. We focus on designing and developing fluorescent protein-based biosensors that visualize these signals with a high signal-to-noise ratio *in vivo*. Here, I will introduce our recent progress in engineering genetically encoded indicators. First, we generated an improved red calcium indicator, RCaMP3, with a larger dynamic range and higher fluorescence than jRGECO1a, the most prevalent existing sensor. Second, by utilizing machine learning-based screening, we also developed a new microbial rhodopsin-based voltage indicator, vGR, available for *in vivo* imaging with high brightness. Lastly, we designed an ultrasensitive green cAMP (cyclic adenosine monophosphate) indicator, cAMPinG1, surpassing its predecessors in both dynamic range and cAMP affinity. These biosensors enable the detailed investigation of neuronal activity and biochemical signaling in defined populations *in vivo*, facilitating the dissection of functional relationships within neural networks.

### References

Yokoyama T, Manita S, Uwamori H, Tajiri M, Imayoshi I, Yagishita S, Murayama M, Kitamura K, Sakamoto M. A multicolor suite for deciphering population coding in calcium and cAMP *in vivo*. bioRxiv 2023, doi:10.1101/2023.01.06.522686.

Zhang XM, Yokoyama T, Sakamoto M.

Imaging Voltage with Microbial Rhodopsins. *Frontiers in Molecular Biosciences* 2021; 8, 738829. doi: 10.3389/fmolb.2021.738829.

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