Author's Accepted Manuscript

www.elsevier.com/locate/talanta

A bio-image sensor for simultaneous detection of multi-neurotransmitters

You-Na Lee, Koichi Okumura, Tomoko Horio, Tatsuya Iwata, Kazuhiro Takahashi, Toshiaki Hattori, Kazuaki Sawada

PII: S0039-9140(17)31186-4
DOI: https://doi.org/10.1016/j.talanta.2017.11.058
Reference: TAL18120

To appear in: *Talanta*

Received date: 4 October 2017
Revised date: 22 November 2017
Accepted date: 26 November 2017

Cite this article as: You-Na Lee, Koichi Okumura, Tomoko Horio, Tatsuya Iwata, Kazuhiro Takahashi, Toshiaki Hattori and Kazuaki Sawada, A bio-image sensor for simultaneous detection of multi-neurotransmitters, *Talanta,* https://doi.org/10.1016/j.talanta.2017.11.058

A bio-image sensor for simultaneous detection of multi-neurotransmitters

You-Na Lee*, Koichi Okumura, Tomoko Horio, Tatsuya Iwata, Kazuhiro Takahashi,
Toshiaki Hattori, and Kazuaki Sawada
Electrical & Electronic Information Eng., Toyohashi University of Technology, Hibarigaoka 1-1, Tempaku-cho, Toyohashi, Aichi, Japan 441-8580;

*Author for correspondence: lee@ee.tut.ac.jp

Abstract

We report here a new bio-image sensor for simultaneous detection of spatial and temporal distribution of multi-neurotransmitters. It consists of multiple enzyme-immobilized membranes on a 128 x 128 pixel array with read-out circuit. Apyrase and acetylcholinesterase (AChE), as selective elements, are used to recognize adenosine 5′ -triphosphate (ATP) and acetylcholine (ACh), respectively. To enhance the spatial resolution, hydrogen ion (H^+) diffusion barrier layers are deposited on top of the bio-image sensor and demonstrated their prevention capability. The results are used to design the space among enzyme-immobilized pixels and the null H^+ sensor to minimize the undesired signal overlap by H^+ diffusion. Using this bio-image sensor, we can obtain H^+ diffusion-independent imaging of concentration gradients of ATP and ACh in real-time. The sensing characteristics, such as sensitivity and detection of limit, are determined experimentally. With the proposed bio-image sensor the possibility exists for customizable monitoring of the activities of various neurochemicals by using different kinds of proton-consuming or generating enzymes.

Keywords

Simultaneous detection, Bio-image sensor, Enzyme-immobilized membrane, Multi neurotransmitters, Multiplexing bio-image sensor, H^+ diffusion-barrier layer