Electrophysiological analysis of regeneration of nerve tissue and muscle cells

Neuron, Brain / vision, Biometry, Photometry, Integrated device

Representative researcher : Tetsuya Yagi (professor)
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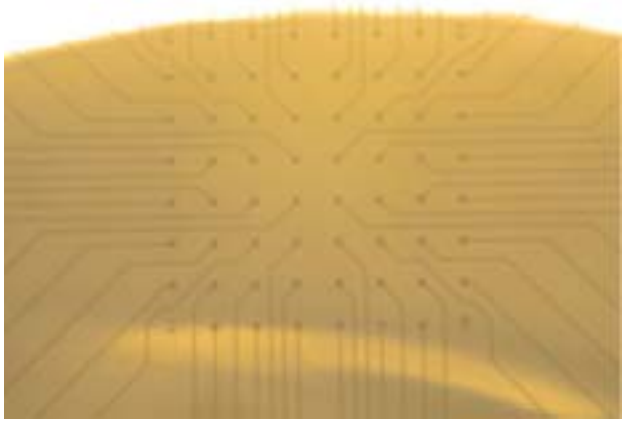
1 Investigation of expression of function of neurons and muscle cells by electrophysiology using a multipoint-electrode plate

Activity of neurons and muscle cells can be monitored by electrical measurement methods. These cells generate electric signals with action called action potential. These action potentials are measured by various methods, and a method using a multipoint-electrode plate, on which multiple electrodes are arranged, is promising.

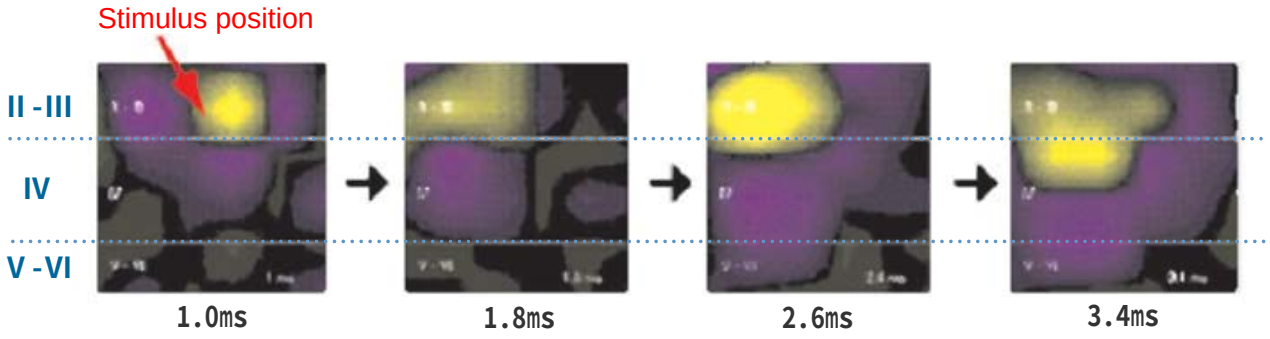
Using the multipoint electrodes, difference in activity between normal and transplanted tissues is monitored, and functional differentiation and regeneration levels of transplanted cells and tissues are analyzed.



left: Cerebral visual area slice on multi point electrode bases

under: The result of current source density analysis of electric potential outside Cell with multi point electrode bases

This analysis shows the spreading circumstances of activated Synapse (yellow part) in the slice



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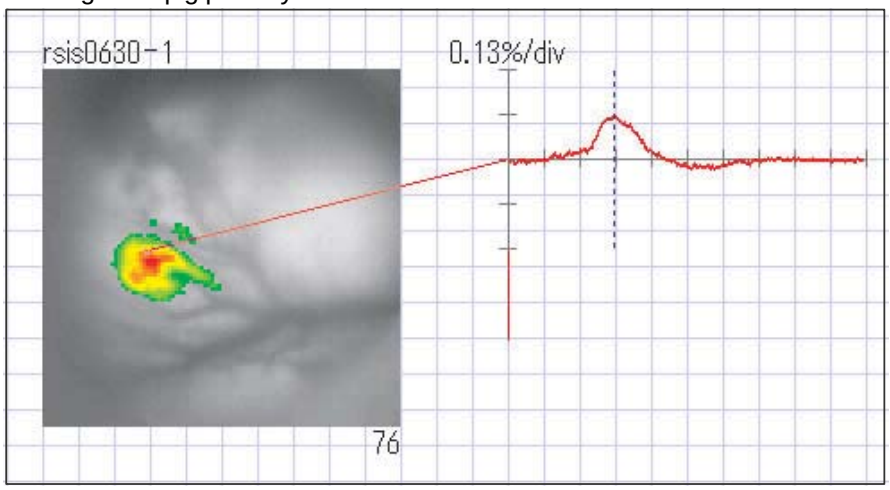
2 Investigation of expression of function of neurons and muscle cells by photometry using potential-sensitive dye

Electrical activity of neurons and muscle cells can also be measured by imaging using a potential-sensitivity dye. The dye is incorporated into the cell membrane, and changes fluorescence due to difference in potential between outside and inside of the cell membrane. Electrical activity of neurons and muscle cells can be analyzed by capturing this change in fluorescence as a motion image using a specific camera. Imaging measurement using a potential-sensitive dye is an effective mean to observe functional differentiation and regeneration levels of transplanted neurons and muscle cells, as well as the multipoint-electrode plate method.

The membrane potential sensitivity pigment was used, response of the guinea pig primary visual area for retina electric stimulus



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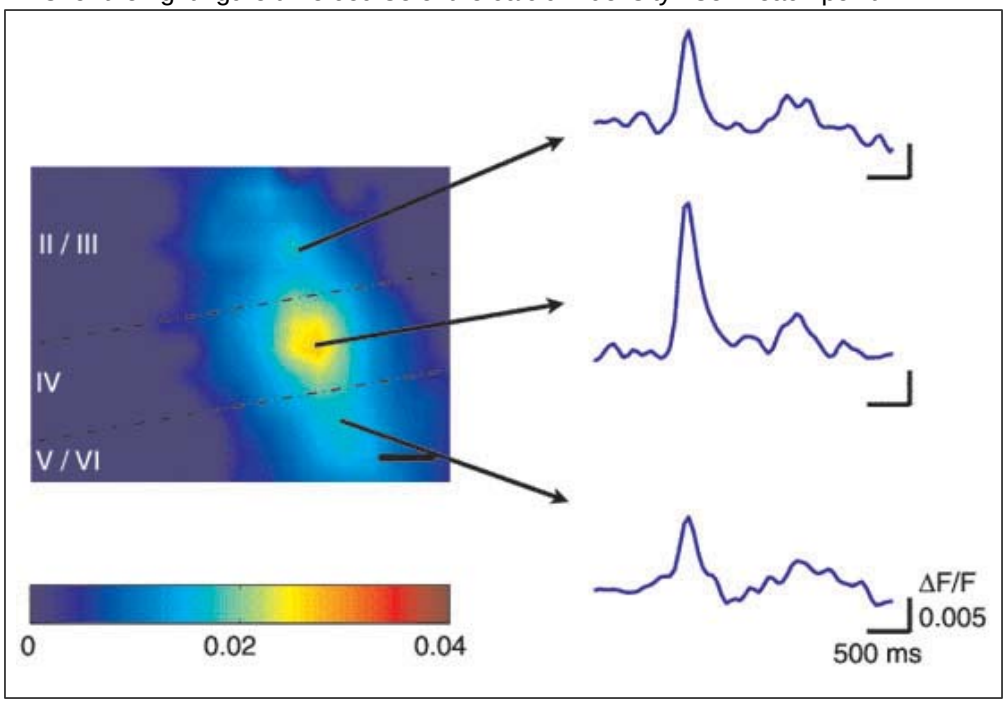
3 Investigation of expression of function of neurons and muscle cells by photometry using calcium-sensitive dye

Calcium ion is very important physiological active substance. Intracellular calcium concentration is closely related to not only electrical activity of neurons and muscle cells but also various physiological changes in cells. Calcium-sensitive dyes change fluorescence by binding with calcium. Electrochemical activity of neurons and muscle cells can be analyzed by capturing changes in fluorescence of calcium-sensitive dye incorporated into cells as a motion image. Using this method, we observe the functional differentiation and regeneration levels of transplanted neurons and muscle cells.

In the cerebral adrenal cortex visual area, the result fluorescence of measuring the response for electric stimulus due to the calcium sensitivity pigment.

-In the left figure about the red place calcium density rises.
-As for the right figure time course of the calcium density rise in each point.



Other study contents of Yagi laboratory

- Study of dynamics of nerve circuit in the cerebral visual area
- Study of transplantation-type artificial visual device for reconstruction of vision
- Study of application for superparallel analog integrated circuit and robot vision