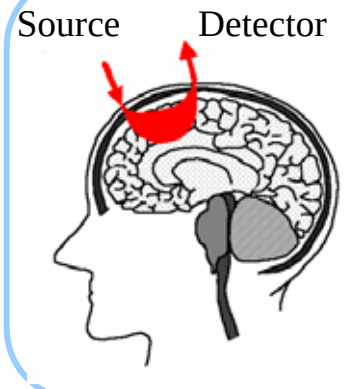
What's Optical Topography?

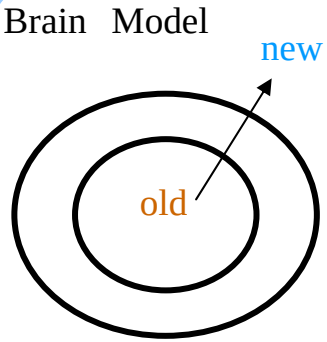
Optical topography is one of the medical apparatuses for investigating brain activity by use of near-infrared light which can penetrate bones to reach brain. Absorption of near infrared light by blood changes with the amount of oxygen in blood. By measuring the change in the absorption spectrum of near infrared, optical topography can provide the image of brain activity.

Light propagation in a head



Since near-infrared light is strongly scattered by living tissues, some of near-infrared light incident on the head surface returns back to the head surface after propagating through the shallow region of the brain. Therefore, the optical signal detected at the head surface carries the information of brain activity.

Higher order brain function



Inner brain manages functions required for survival as the result of evolution. Higher order functions, such as motion, language, thinking, emotion, etc., are managed at the outer or shallow region of brain.

Imaging principle and research subjects of optical topography

Optical topography images the activities of shallow region of the brain managing higher order functions like language, motion, and thinking. For example, when a human tries to speak the speech center (Broca's area) will be stimulated and more blood flows in the area. Therefore, the light propagating through the area is absorbed more strongly when the area is stimulated, and we can know the position and activation degree of the activated area by measuring the change in the detected light at the head surface. However, there exist some unresolved items. The propagation path of the light in the head is unknown, and the anatomical and functional differences from person to person affect the resultant images. The purpose of our research is to provide solutions to these items by experiment and simulation.