

Methods of the Optical *in Vivo* Imaging and Its Application

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The optical *in vivo* imaging makes it possible to observe noninvasively the level of the gene expression and the behavior of the protein which were tagged by “the light” in the living small animal. This method is divided into two, and one is using bioluminescence which occurred by the enzymatic reaction (luciferase vs. luciferin) and the other is using fluorescence, for example GFP, Cy5.5. It is general knowledge that the light of the long wavelength (>600 nm) is hardly absorbed in tissue. The firefly luciferase as a reporter gene is one of suitable light source for the *in vivo* imaging because it can produce such lights. Recently, the trafficking of a fluorophore labeled anti-body to tumor cells was observed using the optical *in vivo* imaging. Although a number of machines have been placed on the market in Japan, there are differences of sensitivity and usability in each machine. The biggest advantage is that a special place is not necessary in comparison with PET and/or CT etc., and it is easy-to-use very much. Using the optical *in vivo* imaging, we are able to quantify the number of the tumor cells, the microorganism and the level of expression of genes which are linked to a disease as photon count. And we can expect to decrease the number of animals and increase the quality of data because we can observe the same animal longitudinally under the anesthesia. The ideal trend of the research from the viewpoint of translational research is as follows; the optical *in vivo* imaging will be a first choice and the second is the confirmation using PET and/or CT before the clinical study.