Frequently Asked Questions

Q. What is bioluminescence imaging?
A. When we think about bioluminescence, we can think of firefly. A firefly produces light via a chemical reaction involving the pigment luciferin and the enzyme luciferase. Luciferase catalyzes the oxidation of luciferin which results in the lighting of the firefly's tail.

In small animal imaging, an animal such as a mouse is first genetically transfected with luciferase vector. Second the mouse is administered with luciferin. Then the mouse is put in a sealed dark chamber for imaging. The image is then captured by a CCD camera. Bioluminescence imaging enables the visualization of genetic expression and physiological processes at the molecular level in living tissues. Because there is no competing background signal, it can be used to detect much lower levels of light. Small animal imaging using bioluminescent sources has become increasingly more adapted over recent years. The use of bioluminescent sources, such as cells tagged with light-emitting probes, allows detection of gene expression in living cells, which is a well-established technique for non-invasive studies at cellular and molecular levels. In vivo imaging of bioluminescent sources in the living animals (e.g. genetically engineered mice) offers the opportunity to evaluate pathologic progression in a more compressed time frame and with a greater resolution, which is of increasing importance to understand the biologic basis for pathologic disease manifestations.

Q. What can I do with in vivo bioluminescence imaging?
A. With in vivo bioluminescence imaging, you can study tumor growth, gene expression, regenerative medicine, developmental therapeutics, treatment of residual minimal disease, and cancer stem cells and much more. People have found uses of bioluminescence imaging in cardiovascular, oncology, antisense, virology, immunology, etc.

Q. What is fluorescence imaging?
A. When we think about fluorescence, we can think of jellyfish. The jellyfish (Aequorea victoria) produces a naturally fluorescent protein known as green fluorescent protein (GFP). The jellyfish glow comes from the interaction of two proteins: aequorin and GFP. Aequorin emits blue light when it reacts with calcium and this light then excites GFP which in turn emits in the green portion of the spectrum.

Fluorescence results from a process that occurs when certain molecules (generally polyaromatic hydrocarbons or heterocycles) called fluorophores, fluorochromes, or fluorescent dyes absorb light. The absorption of light by a population of these molecules raises their energy level to a brief excited state. As they decay from this excited state, they emit fluorescent light. While GFP is one of the widely used fluorescent proteins, there are yellow and red fluorescent proteins as well.

Q. What can I do with in vivo fluorescence imaging?
A. With in vivo fluorescence imaging, you can track cell movement, cell growth, and even some cell functions. Thus, fluorescence imaging can be used in intact animals for disease detection, screening, diagnosis, drug development, and treatment evaluation and much more.

Q. Can I use quantum dot with in vivo fluorescence imaging?
A. Yes, you can.

Q. Can the images be quantified?
A. Yes. After acquiring a bioluminescence or fluorescence image, one can manually or automatically draw regions of interest over the image to obtain the number of photons emitted from the region per second. The number of photons can then used as a quantitative measurement of the underlying biological process for inter- and intra-subject comparison.