Editorial

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Editorial Note on Biomedical Imaging System

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Editorial

Biomedical imaging concentrates on the capture of images for both therapeutic and diagnostic purposes. Snapshots of physiological and *in vivo* physiology processes can be garnered through advanced sensors and computer technology. Biomedical imaging technologies utilize either x-rays (CT scans), sound (ultrasound), magnetism (MRI), radioactive pharmaceuticals (nuclear medicine: SPECT, PET) or light (endoscopy, OCT) to assess the current condition of an organ or tissue and can monitor a patient over time over time for diagnostic and treatment evaluation.

The science and engineering behind the sensors, instrumentation and software which are used to obtain biomedical imaging has been evolving continuously since the x-ray was first invented in 1895. Modern x-rays using solid-state electronics require just milliseconds of exposure time, drastically reducing the x-ray dose originally needed for recording to film cassettes. The image quality has also improved with the enhanced resolution and contrast detail providing more reliable and accurate diagnoses.

The limitations of what x-rays could reveal were partially addressed through the introduction of contrast medium to help visualize blood vessels and organs. First introduced as early as 1906, contrast agents, too, have evolved over the years. Today, digital x-rays enable images to more easily be shared and compared.

Biomedical imaging has developed from early, simple uses of X-rays for diagnosis of fractures and detection of foreign bodies into a compendium of powerful techniques, not only for patient care but also for the study of biological structure and function and for addressing fundamental questions in biomedicine.

A variety of new microscopies has also flourished, making use of novel phenomena such as non-linear photon interactions and the sensing of atomic forces at surfaces. Imaging can provide uniquely valuable information about tissue composition, function, morphology as well as quantitative descriptions of many fundamental biological processes. In recent years, biomedical imaging science has matured into a distinct and coherent set of ideas and concepts, and it has attained a position of central importance in much medical research.

Biomedical imaging is a useful tool for measuring the bio distribution, targeting, and elimination of nanostructures in real time. This is especially needed at the whole organism level. To provide sufficient imaging contrast, biomedical nano devices can be designed with reporting functions or moieties that provide signal in conventional medical imaging modalities. These include gamma scintigraphy, Magnetic Resonance Imaging (MRI), Computed Tomography (CT), Ultrasound Imaging and Positron Emission Tomography (PET). Of these, the functional imaging modalities are particularly useful given that nanomedicine targets processes at the cellular and molecular level.

Biomedical imaging is a powerful tool which is used for visualizing the internal organs of the body and its diseases. Today's imaging tools provide unprecedented views of biological processes. Biomedical imaging allows *in vivo* imaging of biological processes, including changes in molecular and cellular signaling, receptor kinetics and interactions and the movement of molecules through membranes. Being mostly noninvasive, biomedical imaging offers precise tracking of metabolites that can be used as biomarkers for disease identification, progress, and treatment response.

