Establishment of the multi-tracer technology as a tool for analytical method of multi-elemental simultaneous metabolisms and developments of new analytical technologies

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Multi-tracer Technology

Radioactive multi-tracer technology has been developed at RIKEN Accelerator Research Facility about 20 years before. It enables efficient and simultaneous tracing of a number of elements under identical experimental conditions. Since 1991, the multi-tracer technology has been applied for an investigation of a behavior of various elements in chemistry, biochemistry, pharmaceutical sciences, medical sciences, nutritional sciences, agricultural sciences, and environmental sciences. In 2004, a new multi-tracer production system, which consists of a gas-jet-coupled multi-target system for short lived radioactive tracers and a gas- and water-cooled target system for intense beam irradiations, has been installed on a beam line of the K540 MeV RIKEN Ring Cyclotron. In this paper, we presented its principle and features with several examples of recent studies.

R & D of Gamma-Ray Emission Imaging GREI

Multiple molecular imaging, which allows simultaneous visualization of the molecular dynamics in various biological processes, is required to achieve more advanced and precise diagnosis. To realize the multiple molecular imaging, we have demonstrated the feasibility of semiconductor Compton cameras for multiple molecular imaging in nuclear medicine. The Compton camera used in this work comprises two double-sided orthogonal-strip germanium detectors, which we call “GREI”. Their excellent energy resolution enabled discrimination of the nuclides and accurate determination of the scattering angle for γ rays in wide energy range. In parallel with the system development, it is also required that exploration of imaging probes which have suitable characteristics for the GREI. The throughput speed and sensitivity of the present prototype is not so powerful that approximately 10 hours of data acquisition is needed for a reasonable image reconstruction. To satisfy such requirement, we investigated an experimental model using tumor-bearing mice and antibody probes. In this paper, we presented several examples of recent studies.