

**QUANTUM DOTS BASED TECHNOLOGIES FOR CANCER DIAGNOSIS,
IN VIVO STEM CELL IMAGING FOR CELL THERAPY,
AND GENE DELIVERY SYSTEM**

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The lecture will describe new synthetic method for QDs and their applications to the single molecular real-time imaging of enzymatic reaction, single cancer cell and cancer stem cell imaging, stem cell *in vivo* imaging, imaging of single QD tracking in a single living cell for cancer diagnosis, stem cell therapy, and gene delivery therapy [1-14]. In this research, we developed several types of nano- and micro-fluidic technologies: one for real-time monitoring of interaction and enzymatic reaction between a Qdot-labeled single DNA molecule and an enzyme molecule and another for manipulation of a single cell by balancing laminar flow rate and power of optical force. Using nano- and micro-microfluidic devices coupled with optical force, we can selectively manipulate and separate single cancer cells and single cancer stem cells by the balancing the nano- and micro-fluidic flow and optical force by laser tweezers. After separation of a cancer cell, we can confirm the separated cell as a single cancer cell through detection of specific sugar chain on the cell surface by using lectin conjugated quantum dot. Quantum dot is applied to the imaging of stem cell and we confirmed that quantum dots could be applied for labeling stem cells without fatal toxicity and serious influence on the ability of differentiation. The quantum dot is utilized for *in vivo* tracing after the transplantation of stem cell to disclose mechanism of therapy for acute liver failure. We developed the cellulose-immobilized carbon nanotube as a novel gene transfection nanomaterial for a plant cell. Real time imaging of a single carbon nanotube during cell transfection illustrates that this technique allows us to develop high efficient gene transfection technologies.

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