Journal of Biomedical Optics

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Recent advances in nanotechnology have led to improvements in numerous fields, including biomedical research and health care systems. Successful application of nanotechnology in the areas of biosensing, imaging, and spectroscopy is expected to revolutionize medical research and diagnostics, ultimately leading to unprecedented improvement in healthcare. This special section presents 10 papers covering a wide range of research topics on optical biosensing, nanomaterial-based biological imaging and phototherapy, and nanofabrication technologies.

Two papers are related to biosensing applications based on surface plasmon resonance. Y. Hong et al. report on a nanobiosensors for recognition of the proteolytic activity of membrane type 1 matrix metalloproteinase as a cancer biomarker. Y.-S. Sohn and Y. K. Lee report on characterization of a waveguide-coupled sensor, and its utility in detection of immunoglobulin gamma G by activated protein A.

Three of the papers in this special section are related to optical technologies to study neurodegenerative disorders. C.-B. Kim et al. report on a magnetically assembled antibody-conjugated nanoparticles immunoassay system that utilizes saliva as a biomarker medium for correlation of beta-amyloid peptides with Alzheimer's disease pathological aspects. S. Ha et al. use human adipose-derived stem cells labeled with multimodal (fluorescent and magnetic) nanoparticles in a mouse model of Alzheimer's disease to track the stem cells and study their biology as related to neurodegenerative diseases. E. S. Oh et al. quantify the distribution of cellular iron in an *in vitro* model of Parkinson's disease based on intrinsic iron hyperspectral fluorescence imaging.

Aptamer-based recognition is the subject of two papers. J. Choi et al. investigate the utility of aptamer-conjugated gold nanorods for photothermal destruction of cancerous tissues that overexpress the epidermal growth factor receptor. M. Chang et al. report on use of quantum dot–labeled aptamers to investigate the spatiotemporal dynamics of insulin receptors.

S. Bouccara et al. report on the use of ligand-coated quantum dots for homogenous cytoplasmic distribution of nanoprobes and time-gated cell tracking. G. P. Neupane et al. report on a method based on spin coating of dye-stained DNA molecules to stretch the DNA to their full length on a glass substrate, and the utility of this method for spectroscopic analysis of DNA. D.-S. Lee et al. report a fabrication method based on natural thermal reflow to control or reduce the size of nanopores, and the potential of this technology as it relates for mass production of nanobio sensors.

We hope that this collection of papers will be of interest to the biophotonics community in general, and researchers in the area of nanobio sensing. We thank the investigators for their outstanding contributions.