# 第 14 回 NMMS セミナー

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場　所：　京都大学再生医科学研究所　東館　５階ルーフテラス

# Translational Nanomedicine for Advanced Disease Management


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【主催】新学術領域研究「ナノメディシン分子科学」


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**Abstract**

The physiological function and pathological transition of human arise from a bottom up process and interaction of biological molecules in the nanometer scale. Micro and Nano scale engineering enabled opportunity for precision disease prevention, diagnostics and therapeutics through direct modulation of biomolecular interactions. In this talk, I will briefly introduce disease prevention through intelligent capsules that sense and respond to pathological microenvironment to fine-tune mode of action and to optimize efficacy while minimize side effects. Nano scale imaging play important roles to resolve macromolecular structure and their dynamics in the pathogenic processes, which allowed rationale based design of vaccination and therapeutics. Microelectronics and microfluidics could facilitate automatic molecular profiling from cellular to molecular levels. Distinct nano-formulations that integrate diagnostic and therapeutic functions will be discussed. A surfactant-free nanoformulation SFINX enabled simultaneous encapsulation of hydrophobic and hydrophilic drugs and versatile subsequent design to adopt various clinical needs. I will demonstrate how such platform augmented potency of existing and new anti-cancer compounds. Such formulation significantly sensitized lung cancer cells for Taxol and significantly increased solubility and therapeutic efficacy of new anti-tubulin compound J-30 and more. Nano engineering also integrate the diagnostic imaging with therapeutics thus realized personalized medicine. Such idea is demonstrated by Theranox-FP, a CT/MRI dual modality molecular imaging contrast agent that harbored radiation sensitivity detection and potentiation property for cancer therapy. The other example is the Theranox-HTC, a single octahedron crystal core particle containing alpha-Fe and magnetite that provides outstanding magnetic property for MRI imaging contrast and radiofrequency-induced hyperthermo-chemotherapy- synchronized hyperthermia and precision chemotherapy. The Fe@Au is a core-shell nanoparticles that present distinctive selection for cancer cell toxicity while spare normal cells. Fe@Au could either be applied alone or play a synergistic effect with chemotherapeutic compounds such as methotrexate. The mechanism of such selective toxicity was based on mitochondria response in cancer cells and subsequent induction of cell death. Finally, the ATLANS (artificial targeting light activated nano scissor) series enabled electromagnetic wave controlled double strand DNA scission at desired sequence base in both test tube and target cells. The vector featured high efficient cellular uptake, nuclear targeting and temporal/spatial control of gene scission for silencing or replacement by visible light. The long recognition sequence improves its specificity. The platform exhibits high potential in the development of biotechnology, diagnostics and therapeutics. We anticipate successful translational development of these platforms toward clinical niche through the partnership programs.