【Grant-in-Aid for Scientific Research (S)】

Integrated Disciplines (Complex Systems)

Title of Project： Development of nanogel hybrid materials for medical application

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Research Project Number：16H06313　Researcher Number：90201285
Research Area：Complex Systems
Keyword：Nano-biomaterials

【Purpose and Background of the Research】

Developments of novel biomaterials related to delivery and sustained releases of biologics (such as antibodies, cytokines, nucleic acids, and extracellular vesicles) have become essential in the progress of advanced medical care. The objective of this study is to design novel hybrid gel materials based on nanogels as the building blocks (tectons) for effective utilization of biologics in drug delivery system and tissue engineering. Functional nanogels are constructed by hybrids with biopolymers or metallic/inorganic materials, or extracellular vesicles. A hierarchical gel-biomaterials wherein the structure is controlled from the nano to the macro level were obtained by hybrid nanogel tectonics. The nanogel technology provides a novel method for developing biomaterials whereby spatial and temporal responses can be controlled.

【Research Methods】

The topics of our projects are as folows.
1) Development of functional nanogels and nanogel tectonic materials: design of new glycomaterials as nanogel tectons 2) Construction of nanogel hybrid materials for DDS and tissue engineering: hybrid of nanogel tectonic materials (porous, microspherical, fibrous gel) with proteins, nucleic acids, inorganic / metal nanoparticles, extracellelar vesicles. 3) Nanogel-tectonic materilas for cancer immunotherapy: development of a new nanogel carrier for effective antigen and adjuvant delivery and a nanogel/exosome hybrid that can control the cancer microenvironment.

【Expected Research Achievements and Scientific Significance】

The project proposes a new strategy for designing novel hierarchical hybrid biomaterials as building blocks for functional nanogels (new research field called “Hybrid Nanogel Engineering”). We have successfully developed self-assembled nanogels that prevent irreversible protein aggregation, and can permit sustained release as native form via a chaperone-like mechanism. We believe that our study will be a breakthrough, particularly in the field of protein delivery.

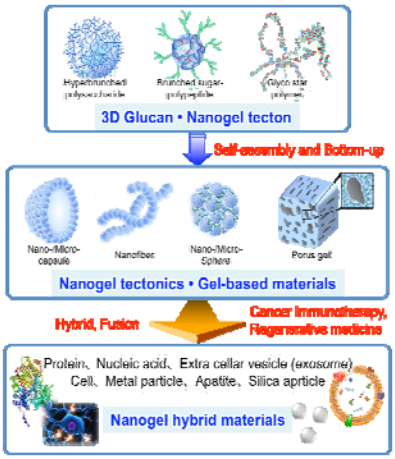

Figure 1　Invention and medical application of nanogel hybrid materials

【Publications Relevant to the Project】

・Tahara Y, Mukai S, Sawada S, Sasaki Y, Akiyoshi K, Nanocarrier-integrated microspheres: Nanogel tectonic engineering for advanced drug delivery systems, Advanced Materials, 27, 5080-5088(2015)
・Hashimoto Y, Mukai S, Sawada S, Sasaki Y,Akiyoshi K, Nanogel tectonic porous gel loading biologics, nanocarriers and sells for advanced scaffold, Biomaterials, 37, 107-115(2015)

【Term of Project】 FY2016-2020

【Budget Allocation】 133,100 Thousand Yen

【Homepage Address and Other Contact Information】

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