Functional Materials (Applied Functional Molecules)

1. Staffs and Students (April, 2010)

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2. Purpose of Education

In order to develop technology which may contribute to the advance in the medical science, lectures on functional molecules from basic to advanced knowledge on molecular design for specific purpose, mainly concentrated on medical application would be executed. Theories on functional molecules and overviews on medical system would be lectured in Graduate School of Medical and Dental Sciences. Students would have chances to learn about Genomics and Bio-intelligent system in Graduate School of Biomedical Science.

3. Research Subjects

1) Decellularization of native tissue for regenerative medicine

In order to obtain a novel scaffold which can be applied for regenerative tissue, ultra-high pressurization method was developed for the complete elimination of the cells and inactivation of the viruses.

2) Inducing molecular aggregation using ultra-high pressurization

The basic and applied science on molecular aggregation triggered by hydrogen bonding at over 6,000 atm is studied. This technique is being applied for hybridization of DNA with polymer for drug delivery system.

3) Bio-interface

To investigate how the materials interact with biological cues such as phospholipids, proteins, or cells, precisely controlled surface via atomic transfer radical polymerization was prepared. The basic research on physical and biological properties of this surface is being investigated.

4) Control of cell functions by physical stimuli.

Using physical stimuli such as nano-vibration or pressure, the technology for the control of cell functions such as the proliferation and differentiation is being developed.

5) Search for novel drugs based on medicinal plants

There are countless natural medicines portions which are not revealed so far. By screening novel drugs originated from Brazil, China, or Japan area for the cancer or dementia treatments the novel bioactive compounds are isolated and being investigated.

6) Development of high functional adhesive

For the development of stable adhesive for precious metal and resin, high functional monomer possessing adhesivity to the precious metal is being developed.

4. Clinical Services

The development of functional molecules can provide novel materials for the clinical application such as blood vessel, cornea, skin, or bone. Unlike the conventional materials which have been used in clinics so far, it would be possible to promote or suppress specific biological response using functionalized materials. Furthermore, the screening essential drug compound for certain purpose, it would help the patients to be treated with higher efficiency and less pain.

5. Publications

Original Article

1. Kwangwoo Nam, Tsuyoshi Kimura, Seiichi Funamoto, Akio Kishida, Preparation of a collagen/polymer hybrid gel designed for tissue membranes. Part I: Controlling the polymer collagen cross-linking process using an ethanol/water co-solvent, Acta Biomaterialia, 6(2) , 403-408, 2010.
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4. Yoshihide Hashimoto, Seiichi Funamoto, Shuji Sasaki, Takako Honda, Shinya Hattori, Kwangwoo Nam, Tsuyoshi Kimura, Manabu Mochizuki, Toshiya Fujisato, Hisatoshi Kobayashi, Akio Kishida, Preparation and characterization of decellularized cornea using high-hydrostatic pressurization for corneal tissue engineering, Biomaterials, 31(14), 3941-3948, 2010.
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11. Akio Kishida, Seiichi Funamoto, Jun Negishi, Yoshihide Hashimoto, Kwangwoo Nam, Tsuyoshi Kimura, Toshiya Fujisato, Hisatoshi Kobayashi, Tissue Engineering with Natural Tissue Matrices, Advances in Science and Technology, 76, 125-132, 2010.
12. Kwangwoo Nam, Rie Fukaya, Yoshihide Hashimoto, Yukiko Ito, Tsuyoshi Kimura, Akio Kishida, Human Mesenchymal Stem Cell Behavior on Concentrated Polymer Burudhes Presenting Different Surface Stiffness, Chemistry Letters, 39(11), 1164, 2010.
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