【Abstract of 2011 Grant - in - Aid for Scientific Research on Innovative Areas
(Research in a proposed research area)】
Science and Engineering

Title of Project: Nanomedicine Molecular Science

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【Purpose of the Research Project】

Nanomedicine Molecular Science focuses on molecular reactions in the cells, which constitute the living organism and control its biological activities. The cellular environment, however, differs from the chemical reaction environment. The goal of this project is to develop molecular reaction parameters to quantify and examine such reactions. The studies, therefore, are part of a scientific initiative focusing on cells and have the following main objectives: establishing the theoretical basis of molecular reactions in the cell, and understanding the cellular environment and intracellular chemical reaction mechanisms. The achievement of these objectives will enhance the understanding of and facilitate multidisciplinary discussion about the system that coordinates molecular reactions in individual cells and living organisms.

【Content of the Research Project】

Theme A01 "Molecular Science of Nanomedicine": This initiative aims to examine, establish, and review the principles for measuring parameters describing the intracellular reaction environment. Theme A02 "Molecular Science for Nanomedicine": This initiative aims to directly observe the intracellular reactions and develop and examine the parameters. Theme A03 "Molecular Science with Nanomedicine": This initiative aims to understand pathological conditions by using the parameters describing molecular reactions in the cellular environment and to design molecular structures for nanotherapy. The emphasis will be on molecular reactions for innovative therapeutic approaches or equipment.

We will undertake sponsored research programs and promote interdisciplinary research to promote the synthesis of knowledge and establish molecular nanomedicine. Furthermore, we will provide technological insights to the knowledge base of molecular science and develop novel research strategies for medical technology and industry.

On the basis of the research findings, we aim to develop approaches for treating the root cause of diseases and equipment using molecules regulating cell cycles and reactions.

Sponsored research projects will include topics related to the origin of cellular functions, which will provide knowledge indispensable for molecular nanomedicine; topics required for establishing molecular nanomedicine; topics that may help integrate the research projects and promote constructive interactions among researchers; and topics that encourage original ideas to solve difficulties in the field.

【Expected Research Achievements and Scientific Significance】

This project will provide new insights into intracellular molecular reactions and develop accurate parameters for those reactions. Moreover, they will help develop innovative chemotherapies and efficient computer-assisted drug designs, promote innovative medical-equipment development and reliable production of cells, including iPS cells. They may positively influence research on molecular dynamics in the cellular environment, development of less-invasive diagnostic and therapeutic approaches for improving the quality of life, establishment of novel technology driving medical innovations, growth of medical and pharmaceutical industries, restoration of international competitiveness, and development of potential leaders among scientists.

【Key Words】

Cellular environment: Includes the cell membrane and intracellular substances and provides a molecular reaction field.

Molecular reaction parameters: Constants for molecular reactions, including reaction rate, activation energy, diffusion, binding, and intermolecular interaction.

【Term of Project】 FY2011-2015

【Budget Allocation】 901,400 thousand Yen

【Homepage Address and Other Contact Information】

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