인체 세포생리학-조직의 전기전도-심장역학 기전을 포함하는 3차원 가상심장의 개발

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Development of a 3D virtual heart including the mechanism of human cardiac cell physiology-electric conduction of cardiac tissue-heart mechanics

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Key Words: Human cardiac cell model(인체심근세포 모델), Tissue model(조직모델), 3D virtual heart(3차원 가상심장), Finite element method(유한요소법)

Abstract : A 3D virtual heart model is proposed to simulate an integrative analysis of heart physiology. This consists of the models of electrophysiology of human cells, electric wave propagation of tissue, heart solid mechanics, and 3D coronary blood hemodynamics. The 3D geometry of human heart is discretized to a finite element mesh for the simulation of electric wave propagation and mechanics of heart. In cellular level, excitations by action potential are simulated using the existing human models. Then the contraction mechanics of a whole cell is incorporated to the excitation model. The excitation propagation from SA node to ventricular cells are transiently computed in the 3D cardiac tissue using a mono-domain method of electric wave propagation in cardiac tissue. The increase of calcium concentration in cardiac cells induces cellular forces which eventually converted to heart contraction.

박테리아 주화성 정량화를 위한 미세 유동 시스템

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Development of a Microfluidic Assay for Quatification of Bacterial Chemotaxis

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Key Words: Chemotaxis (주화성), Bacteria (박테리아), Hydrodynamic focusing (유체역학적 집속효과)

Abstract : Bacterial chemotaxis may have a significant impact on the study of structure and function of bacteria. Quantification of chemotactic motion is necessary to identify chemoeffectors and to determine the bacterial transport parameters used in prediction models of chemotaxis. Although many studies have accumulated the knowledge about chemotaxis for many years, the motion of a single bacterium has not been studied yet. In this study we propose a device microfabricated by soft lithography and consisting of microfluidic channels, which can generate a gradient of chemoeffectors in the main channel so that a single bacterium is injected into this channel by hydrodynamic focusing. This microfluidic assay offers superior performance to measure a single cell or a group of cells and to quantify their motion, and it also builds a delicate gradient of chemoeffectors to raise accuracy of measuring the bacterial motion.