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<AT>The Structure and Function of Cell Membranes Studied by Atomic Force Microscopy

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<ABS-HEAD>Abstract

<ABS-P>The cell membrane, involved in almost all communications of cells and surrounding matrix, is one of the most complicated components of cells. Lack of suitable methods for the detection of cell membranes *in vivo* has sparked debates on the biochemical composition and structure of cell membranes over half a century. The development of single molecule techniques, such as AFM, SMFS, and TREC, provides a versatile platform for imaging and manipulating cell membranes in biological relevant environments. Here, we discuss the latest developments in AFM and the progress made in cell membrane research. In particular, we highlight novel structure models and dynamic processes, including the mechanical properties of the cell membranes.

<KWD>Keywords: Cell Membrane; Atomic Force Microscopy; Structure Models of Cell Membranes; Single Molecule Force Spectroscopy; Molecular Recognition Imaging Microscopy

<H1>1. Introduction

The cell membrane, the outermost layer of a cell, plays vital roles not only in the interactions between cells and the external environment, but also in cellular physiological processes, such as signal communication, inductive stimulation, cell adhesion, material transport, energy conversion, embryo and histogenesis, tumor homeostasis, viral and bacterial infections, etc.[1-3]. These highly complex functions are accomplished by the well-assembled patterns and dynamic changes of specific sugars, proteins, phospholipids and other macromolecules in the cell membranes. The cell membrane mainly consists of 50% lipid, 40% protein, 2%-10% sugars; small amounts of water, inorganic salts, and metal ions are coexisted[4]. Phospholipids, cholesterol and glycolipids constitute a major fraction of the membrane lipid. As the basic scaffold of the membrane, membrane lipid provides an environment for the conformation maintaining and function performing of membrane proteins. Membrane proteins execute the major functions of the cell membranes, which involve in selective ion transport, energy conversion and the signal induction or conduction across the cell membrane. They are also responsible for the transmembrane transport of soluble metabolites (glucose, amino acids, etc.), as well as the regulation of cell morphology through the interactions with extracellular matrix. It is a long history of research on membrane proteins, but the diversity, the complex functions, the difficulties in

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