3P-175 電子線回折法を用いた経皮吸収促進剤のヒト皮膚角層脂質充填構造に対する影響の解析

Electron diffraction study on the effect of transdermal absorption promoters on the lipid packing in human skin stratum corneum

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The major barrier against the transcutaneous administration of drugs is thought to lie in the intercellular lipid lamellae in the skin stratum corneum (SC), the outermost layer of the skin. Recent X-ray and electron diffraction studies have suggested that crystalline packing of the lipids plays an essential role for the barrier function. In this study, we evaluated the effect of transdermal absorption promoters such as isopropyl myristate and mineral oil on the lipid packing structures by electron diffraction measurements of a layer of the grid-stripped corneocyte from the human forearm SC. Appearance frequency F_r of the clear reflection around 0.41 nm was reduced after the drug administration for one hour, suggesting that the transdermal absorption promoters disrupted the highly ordered structures in the intercellular lipid lamellae; the domains in the crystalline phases may be transformed into the fluid phase and/or broken into smaller ones. In order to evaluate the penetrability of each drug, we examined the dependence of F_r on the number of tape- and grid-stripping. The value of F_r increased as the depth from the surface increased, and reached the similar level to that before the drug administration at the 5-6th layers. The degree and penetrability of the disruption of the ordered lipid packing depended on the sort of the drug and seemed to correlate to its strength as an absorption promoter.

3P-176 ホスファチジルコリン/ステロールから成る単一巨大リポソームの相転移挙動

Phase transition behavior of a single giant unilamellar vesicle composed of phosphatidylcholine and cholesterol analogue

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Cholesterol is widely distributed in biomembranes and has been one of the major targets for lipid researchers. However, the structural basis for the ability to modify the physicochemical properties of lipid membranes remains unclear. Cholesterol and cholesterol analogues such as ergosterol and stigmasterol show a larger difference in the effect on the lipid membrane properties than expected from their structural similarity. In this study we examined the phase behavior of representative phosphatidylcholine(PC)/cholesterol-analogue bilayers using the micropipette aspiration technique developed by the Evans' group, which can give information on mechanical properties of the vesicle. A single giant unilamellar vesicle with a diameter of 20-30 μm was selected under a phase contrast microscope and trapped at the edge of a micropipette with a small suction pressure. The thermotropic phase transition behavior of PC/sterol mixed bilayers in heating was analyzed by measuring the projection length inside the micropipette and the radius of the outer spherical segment of the vesicle at appropriate temperature intervals. The surface area calculated from the measured parameters showed clear increase at the main transition temperature. The concentration dependence of the phase behavior was analyzed for each sterol. We will discuss the relationship between the structural difference of sterols and their effects on the phase behavior of the mixed bilayers.

3P-177 浮遊密度法による脂質/コレステロール類似体混合バイレイヤーにおける分子間相互作用の解析

Study on molecular interaction in lipid/cholesterol-analogue mixed bilayers by the neutral floatation method

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A relatively rigid microdomain called 'raft' have drawn attention of lipid researchers as its functional importance. Besides sphingolipids, cholesterol (CHOL) is the indispensable component of the raft domain and may work as a modifier of its physicochemical properties. In order to understand the role of cholesterol in the raft, we have examined the interaction between raft lipids and cholesterol analogues. In this study we investigate the interaction of various sterols with dipalmitoylphosphatidylcholine (DPPC) by the neutral floatation method, comparing with that with sphingomyelin (SM). These two lipids having the same head group must show different interaction properties with sterol analogues due to their different interfacial structures. The specific volumes of the mixed bilayers were estimated from the density of the water/heavy water solution which attained their sedimentation equilibrium. As expected, the sterols reduced the specific volume of the mixed bilayers at 45°C (the fluid phase) and raised it at 25°C (the gel phase). However, the degree of the change depended on the combination of the lipids (SM/DPPC) and the sterols, e.g., the reduction of the specific volume in DPPC/CHOL at 45°C was more prominent than that in SM/CHOL while the tendency was opposite in lipids/ergosterol and lipids/stigmasterol systems. We will discuss the effect of the structure of

cholesterol analogues on their interaction with the lipids (DPPC/SM) with different interfacial structure and propensity for forming hydrogen bonds.

3P-178 水素化アモルファスシリコン薄膜上のジミリスチルフォスファチジルコリン・バクテリオロドプシン複合薄膜の IRRAS 解析

IRRAS Analysis on Composite Film of Dimyristoyl-Phosphatidylcholine and Bacteriorhodopsin on hydrogenated amorphous silicon film

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We have been investigated in the problem how to design an artificial bio-mimetic molecular photonic film structure and functional one and recently, have been presented a new way of controlling the light absorption maximum of organic pigment molecules without using proteins, but with a semiconductor. A composite film of dimyristoyl-phosphatidylcholine (DMPC) and bacteriorhodopsin (BR) was fabricated by multilayer molecular thin film method using fatty acid and lipid on a quartz substrate or a hydrogenated amorphous silicon thin film. Firstly, multilayer molecular thin film method using fatty acid and lipid was applied on lipid film above fatty acid film on quartz substrate and became an effective way to accumulate lipid film or lipid and membrane protein composite film above fatty acid, by characterization of Infrared reflection absorption spectrum (IRRAS) and ultraviolet-visible absorption spectrums and direct force microscopy of the lipid film above fatty acid film on quartz substrate. Secondly, comparison of IRRAS of 0, 2, 4, 6, 8, 10 layer of composite film of DMPC and BR fabricated by forming above a layer of fatty acid molecules that is formed on a quartz substrate or a hydrogenated amorphous silicon (a-Si:H) one resulted that 4 layer composite LB film of BR and DMPC exhibited a selective IRRAS at 670cm⁻¹, at 1400-1580cm⁻¹ and at 1600-1800cm⁻¹ depend on the fatty acid species. And we furthermore, report on the surface structural phenomena of the artificial films.

3P-179 水素化アモルファスシリコン薄膜上の単純クーマリン・生体膜構成分子複合薄膜

Composite film of simple coumarin and membrane constituent molecule on hydrogenated amorphous silicon film

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Coumarin has large attentions for the diversion to the material for organic dye laser or photoluminescence and many applications because of its fluorescent quantum property. And recently, application for effective materials for dye sensitized solar cell have been investigated. 4-hydroxycoumarin is often used for creating organic synthesized molecules. Amino acid is critically and essentially and widely useful material for life science and so on. So, fluorescent material, coumarin, and amino acid could be interacted in a controllable designed way, they would have useful properties. To investigate for possibility of applying two typical simple coumarins, 7-hydroxy-4-methyl-coumarin and 4-hydroxy-coumarin, in the field of biosensor, were fabricated into fatty acid film or bio-mimetic multilayer protein and phosphatidylcholine composite film on hydrogenated silicon film and so on. Photo absorption property of 7-hydroxy-4-methyl-coumarin is largely changeable depend on pH condition. Photo absorption property of 4-hydroxy-coumarin is changeable depend on metallic ion environment. In this presentation, we report structural observations, spectroscopic measurement and mass change measurement against chemicals of these composite films in atmospheric environment.

3P-180 脂質・界面活性剤混合系を用いた固体基板表面への脂質二分子膜固定化手法の開発

Detergent assisted formation of substrate supported phospholipid membranes

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see 3TA3-07

3P-181 自己組織化における転写の時空間制御

Spatio-temporal regulation of transcriptional pulses during self-organization in Dictyostelium

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