課題番号　:F-20-KT-0187
利用形態　:機器利用
利用課題名（日本語）　:近位尿細管のオンチップ再構成による臓器機能と腎毒性の評価
Program Title(English)　:Realization of a proximal tubule on a chip to access the organ function and nephrotoxicity in vitro.
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キーワード／Keyword　:リソグラフィ・露光・描画装置、オンチップ，尿細管，バイオ&ライフサイエンス

1. 概要（Summary）

The human renal proximal tubule is comprised of an endothelial/epithelial tissue bilayer and is responsible for reabsorbing water, glucose and proteins such as albumin from the glomerulus ultrafiltrate, and excreting xenobiotics. Here we aim to mimic the organ physiology and function in vitro. To this end we designed a device comprised of two identical PDMS slabs that sandwich a porous PET membrane. RRPTECs (epithelial cells) and HUVECs (endothelial cells) are seeded on the opposite sides of the membrane. Formation of a bilyaer that could last for 10 days was demostrated. The bilayer was subjected to a number of filtration assays such as glucose, albumin, and rhodamine123 as a substrate for the efflux pump, P-gp.

2. 実験（Experimental）

【利用した主な装置】 両面マスクアライナー

【実験方法】

PDMS slabs with S-shaped channels were cast-molded on a Si wafer carrying the embossed channel pattern. The pattern was formed using standard SU-8 photolithography and had a height of ~350 μm. To align the photomask on the Si substrate we used this PEM-800 mask aligner. After curing PDMS at 65°C, the slabs were cut and peeled off from the Si mold. The bottom slab with the channel side faced down was gently put on a glass slide, initially spin-coated with a thin layer of PDMS (uncured), and then removed immediately. This thin PDMS layer served as an adhesion layer once the membrane was sandwiched in between the layers. The slabs were brought together under a microscope to ensure proper alignment and joined securely by curing the thin adhesion layer at room temperature overnight. Curing at room temperature rather that at a high temperature prevents the membrane from bending as the fluidity of the adhesion layer is decreased.

3. 結果と考察（Results and Discussion）

Fig. 1a and 1b show photograph of the device cross-section and a 3D view of the suspended membrane, respectively. Apparently, the membrane stays flat after curing the PDMS adhesion layer at room temperature (RT) rather than at 65 C°.

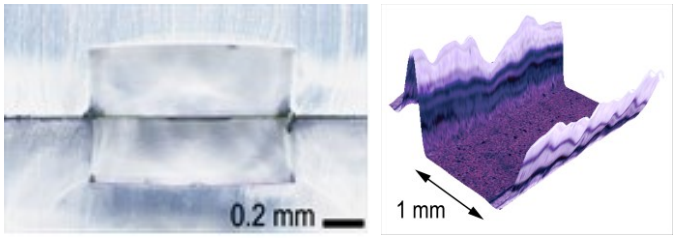

Fig. 1. Photographs of the device. (a) A cross-sectional cut and (b) a 3D view of the suspended membrane showing the membrane remains flat after curing the adhesion layer at RT.

RPTECs and HUVECs cultured on the opposite sides of the membrane formed a confluent bilayer that was viable for at least 10 days.

4. その他・特記事項（Others）　なし

5. 論文・学会発表（Publication/Presentation）

(1) R. Banan Sadeghian et al., MicroTAS 2020, Online, 2020/10/4-9.

(2) R. Banan Sadeghian et al, 36th Sensor Symposium, ACT City, Hamamatsu, 19/11/19-21.

6. 関連特許(Patent)

なし。