BioMEMS – Integrative bio-engineering

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Culturing hepatocytes under oxygen gradient

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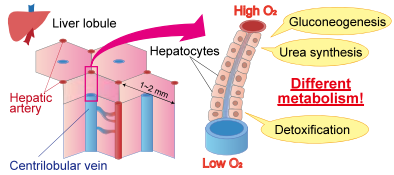
Keywords: **HepG2, liver on-a-chip, oxygen gradient**

Context

Developing a liver on-a-chip reproducing multi-functionality of *in vivo* liver

Goals of the study:

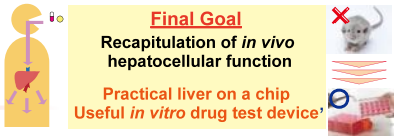
- **Development of a liver-on-a-chip forming and visualizing oxygen gradient by cellular respiration**
- **Regulation of oxygen gradient by changing flowrate of culture medium**



O₂ gradient makes **multi-function system** of liver [Monga 2011]

Purpose

Hepatocyte culture device + **O₂ gradient making & control**



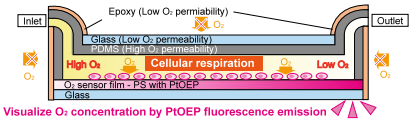
Final Goal

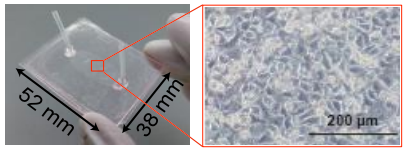
Recapitulation of *in vivo* hepatocellular function

Practical liver on a chip
Useful *in vitro* drug test device

Materials and Methods

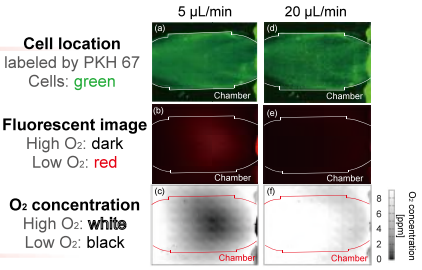
- **Microfluidic PDMS bioreactor covered with glass and epoxy**
- **Fluorescence oxygen sensor made of PS containing Platinum octaethylporphyrin (PtOEP)**
- **Perfusion culture**
- **Converting fluorescence intensity to oxygen concentration**





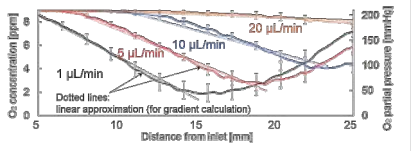
Results

- **Higher flow rate made larger gradient**
- **1/2 to 2/3 as large gradients as *in vivo* was made**



Perspectives

- **Developing the local cell collection method for PCR**
- **Comparing hepatic metabolisms in different part of the device (different oxygen concentration)**
- **Using rat primary hepatocytes or iPS-derived hepatocytes instead of HepG2**



Flowrate [μL/min]	O₂ gradation [mmHg/mm]
1	-17
5	-13
10	-8
20	-1

**In vivo*: -24~-70mmHg/mm

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