

Johns Hopkins Engineering

Methods in Neurobiology

Organotypic Slices Cultures



JOHNS HOPKINS
WHITING SCHOOL
of ENGINEERING

Acute tissue slices

- Acute cultures
- Organotypic cultures

List of organs for ex vivo tissue slice

Liver

Pancreas

Heart

Brain

Tumors

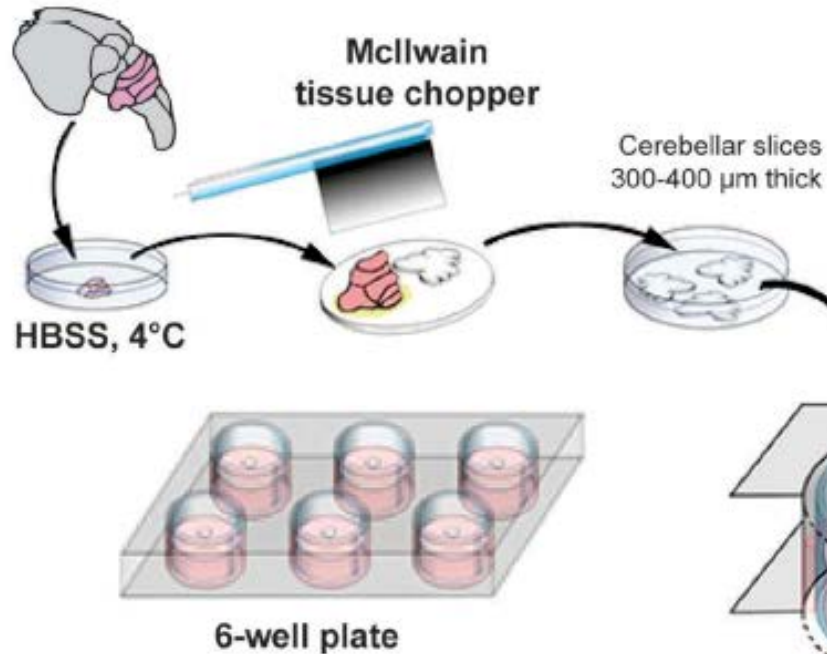
Intestine

Lung

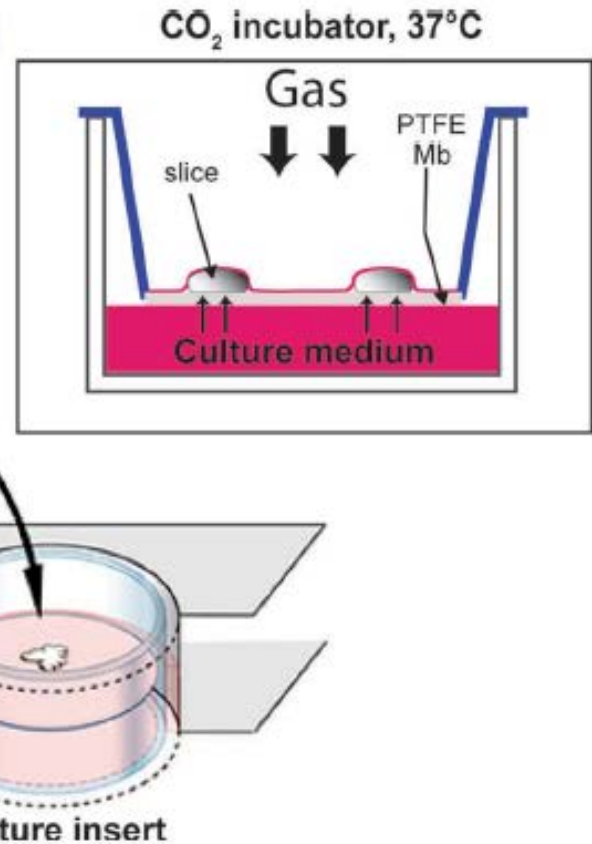
...

Organotypic brain slices

(a)



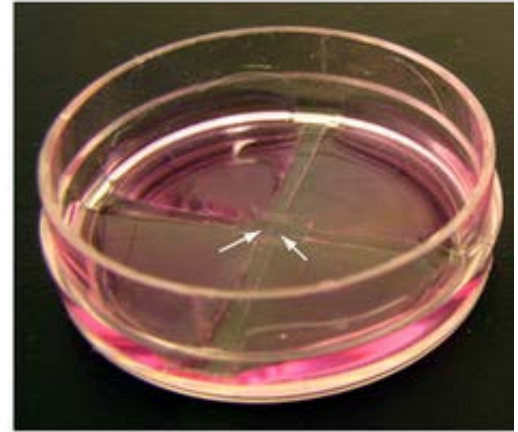
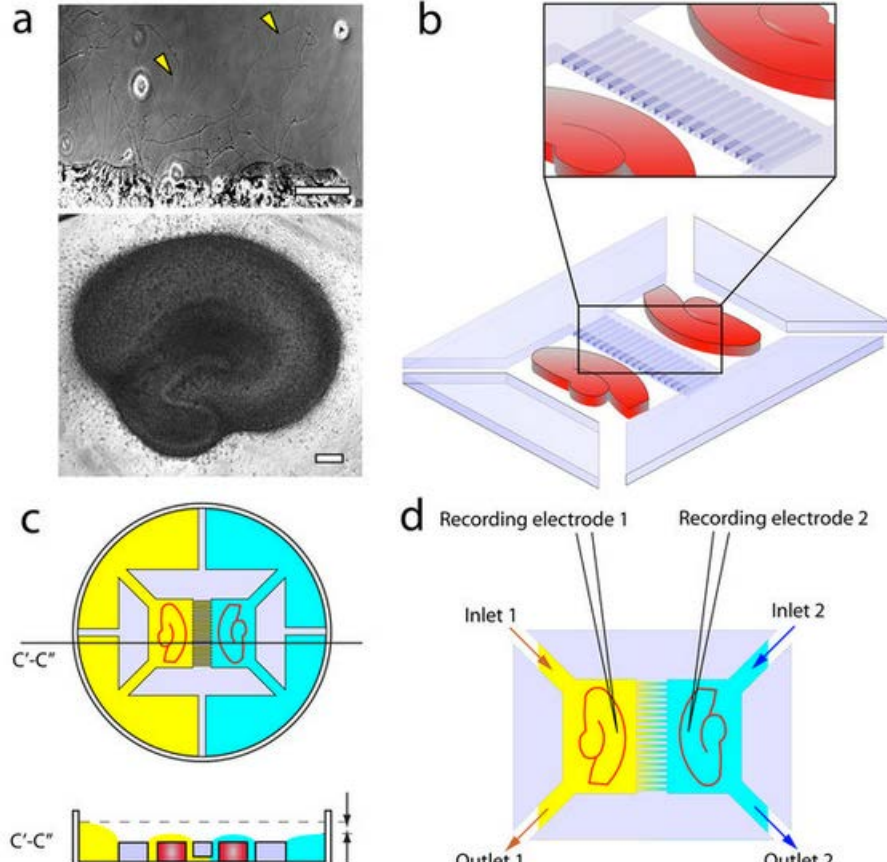
(b)



Tissue slices cultures vs cell cultures

Tissue slices culture	Dissociated cell cultures
Maintain the cytoarchitecture, i.e. the structure and organization of the organ	Cell cultures are dissociated, isolated cells. Derived from tissues but in certain cases do not retain original properties
Greater access to and visibility of deep structures, not clearly visible in the whole organ	No layers
Observe structural and morphological changes such as in the case of brain slices neuronal (cellular) migration, axon outgrowth or synapse formation.	Structural or morphological changes are limited
Slices come often from established animal models	Extremely versatile in terms of generation of models for gene expression
Limited number of slices per organ	Constantly regenerate through subculture

Hippocampal slices in microfluidic chambers



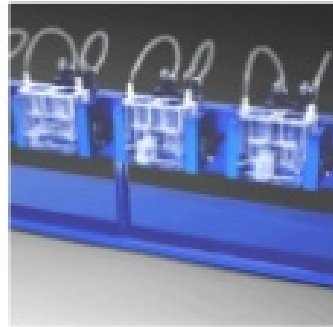
Gut slice cultures

A range of gastrointestinal functions can be explored in human tissues



Tissue baths

- **Motility.** Smooth muscle contractility (e.g. stomach, intestines or gallbladder)
- Nerve-muscle interaction



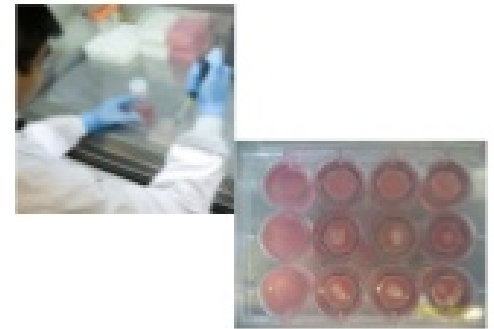
Ussing chambers

- Epithelial **secretion**, ion channel function/diarrhoea
- Epithelial barrier integrity



Perfusion myographs

- Vascular regulation
- **Vascular leakage/** permeability



Ex vivo cultures/
Precision-cut
slices

- GI injury potential
- **Inflammatory processes** (e.g. cytokines)

References

Slide	Reference
3	Doussau, F., Dupont, J-L., Neel, D., Schneider, A., Poulain, B., Bossu., J.L. 2017 Organotypic cultures of cerebellar slices as a model to investigate demyelinating disorders. Expert Opinion on Drug Discovery. 12:10, 1011-1022
5	Berdichevsky Y., Staley K., Yarmush, M. 2010 Building and manipulating neural pathways with microfluidics. Lab on a Chip. 10(8), pp. 999-1004. https://pubs.rsc.org/en/content/articlelanding/2010/LC/b922365g#!divAbstract
6	Linkedin SlideShare (n.d.) Assessing gastrointestinal toxicity using human tissues. Biopta. https://www.slideshare.net/davidbunton/assessing-gastrointestinal-toxicity-using-human-tissues-biopta



JOHNS HOPKINS

WHITING SCHOOL
of ENGINEERING