Johns Hopkins Engineering

Methods in Neurobiology

Organs on a Chip

JOHNS HOPKINS
WHITING SCHOOL
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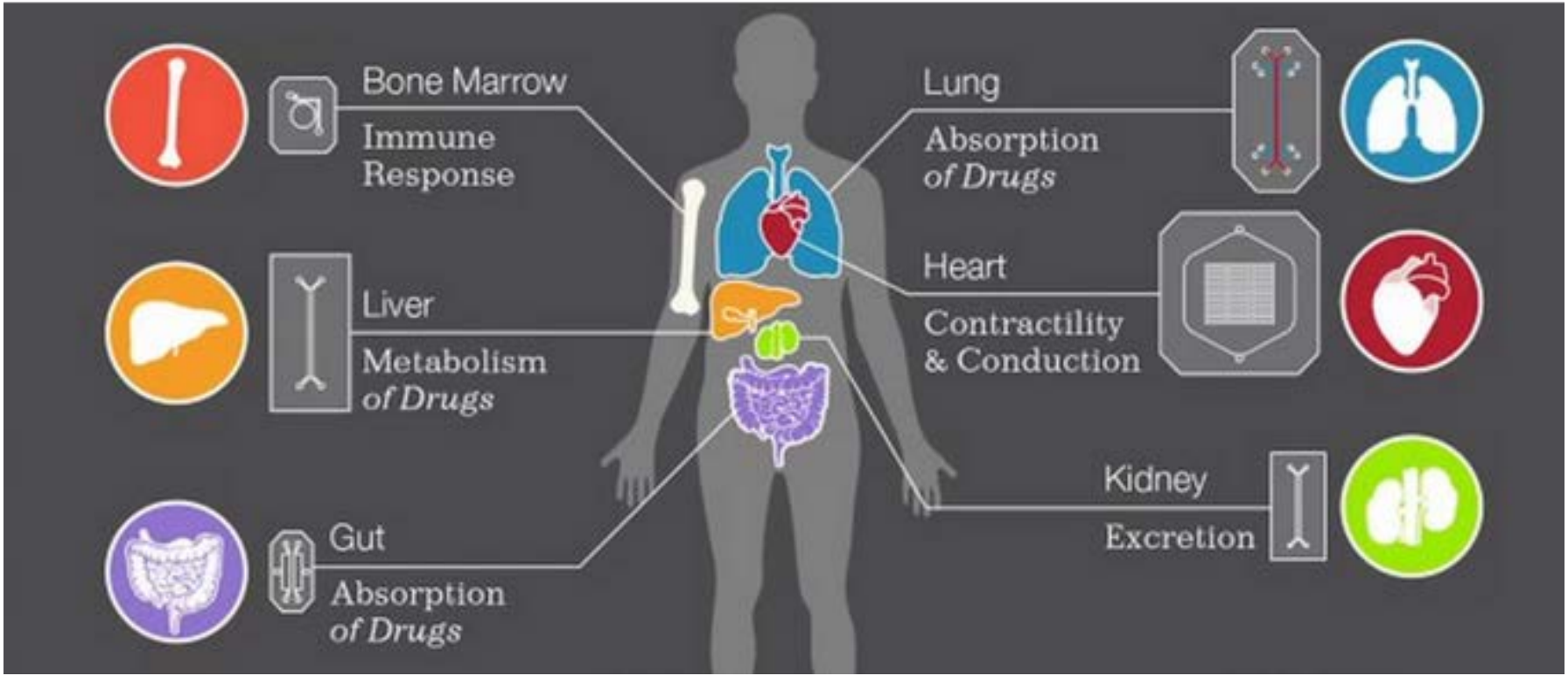
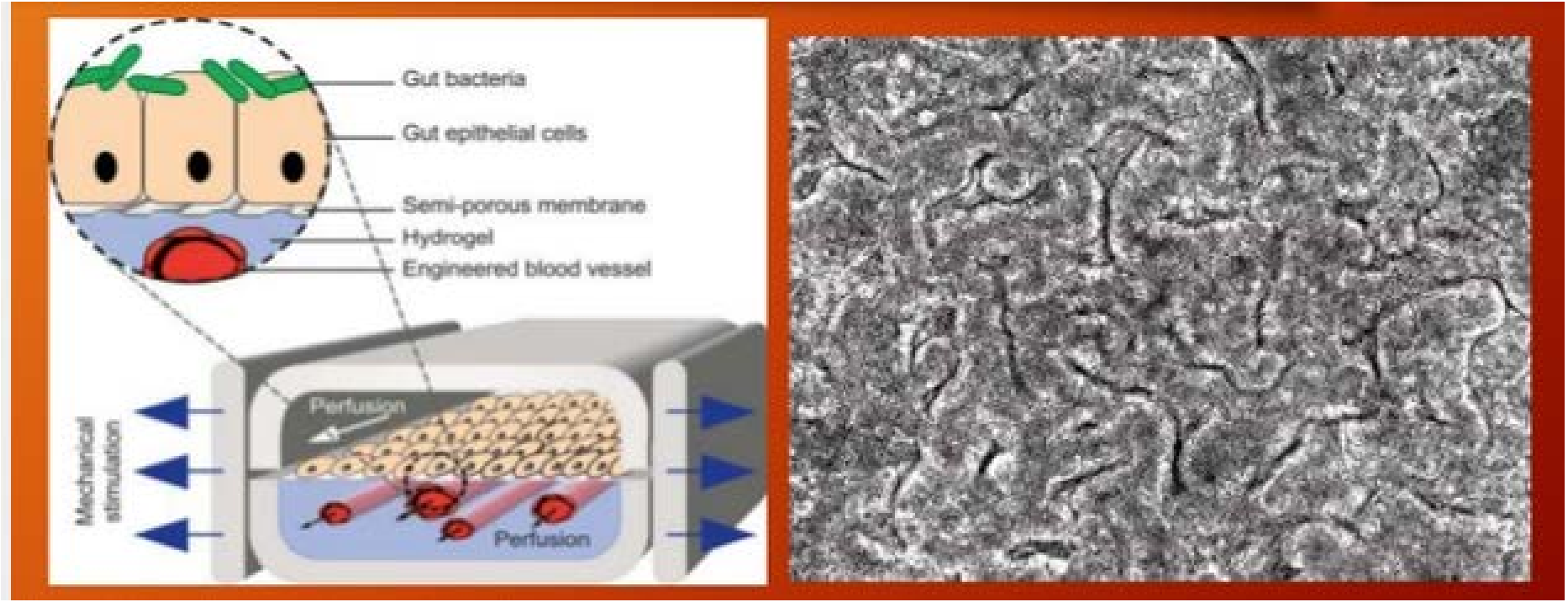
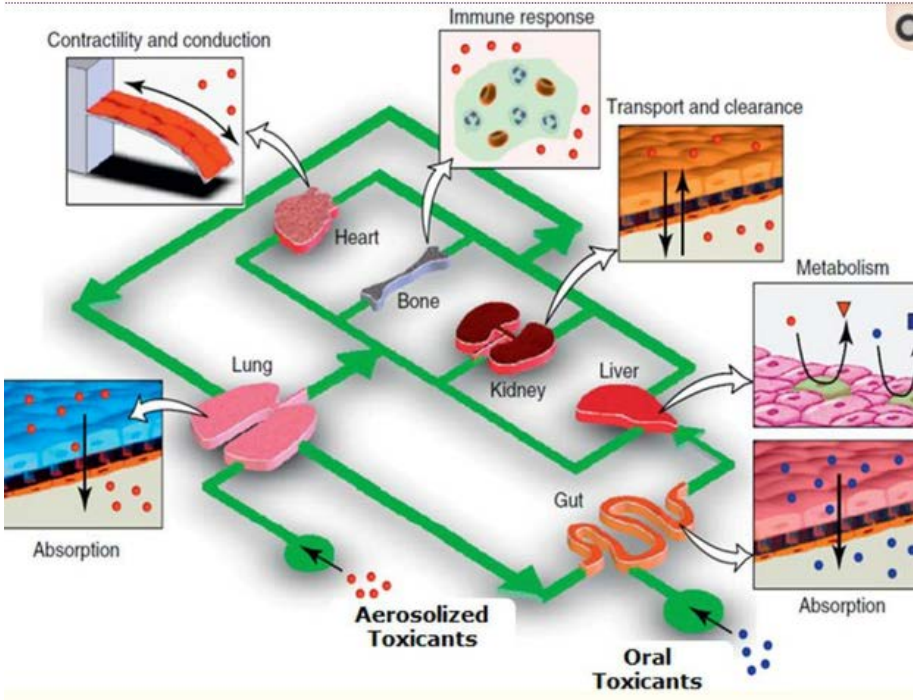
Organs on a chip (OOC)



Gut on a chip


Gut bacteria
Gut epithelial cells
Semi-porous membrane
Hydrogel
Engineered blood vessel
Perfusion
Perfusion
Mechanical stimulation

Multiorgans on a chip (MOC) for precision medicine



MOC as human disease model:

Microphysiological 3D model of amyotrophic lateral sclerosis (ALS) from human iPS-derived muscle cells and optogenetic motor neurons.

OOC, MOC…

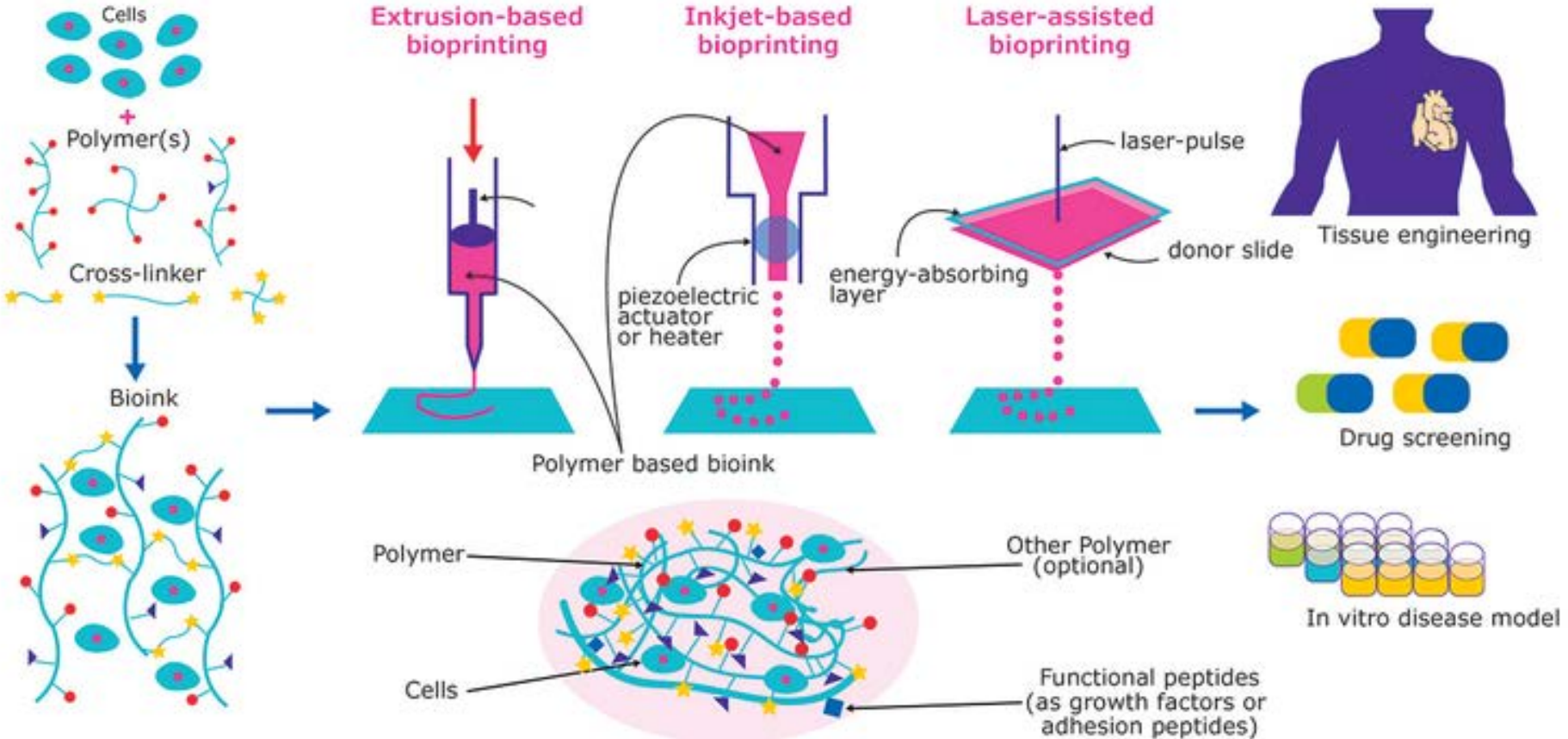
Advantages

- Replace animal models
- Study on interactions of pathogens & organ cells, mechanism of virus infection
- To study effect of drug on target organ and also others
- Study of toxicity of drugs and cosmetics
- To study cancer cells and produce new drugs
- Helps in pharmacological studies

Disadvantages

- Some organ functions—cognition in the brain, mechanical function in bone, ligaments, tendons cannot be readily modeled on chips
- Specialized microengineering capabilities
- microbial contamination
- Chronic disease???

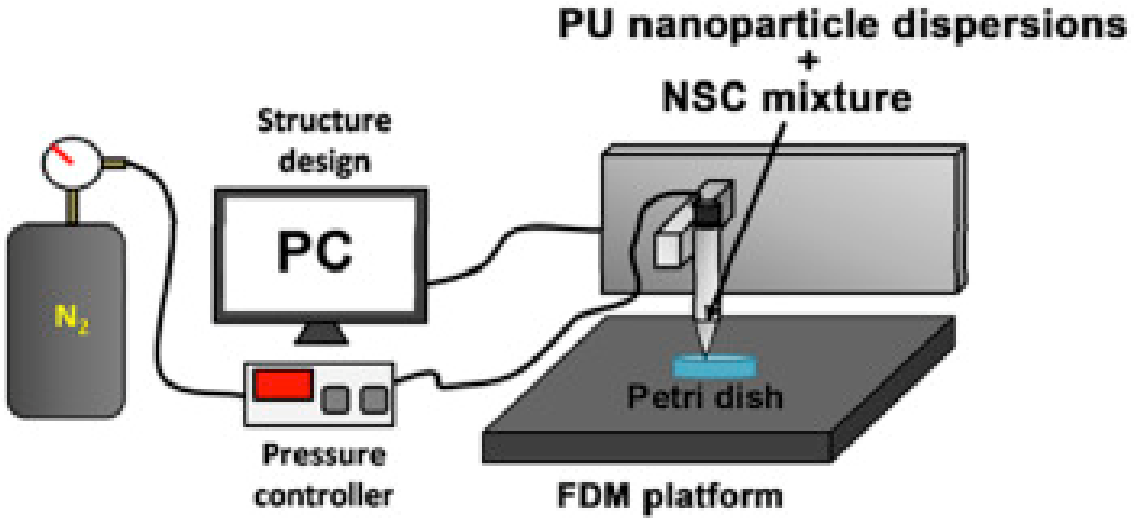
Bioprinting

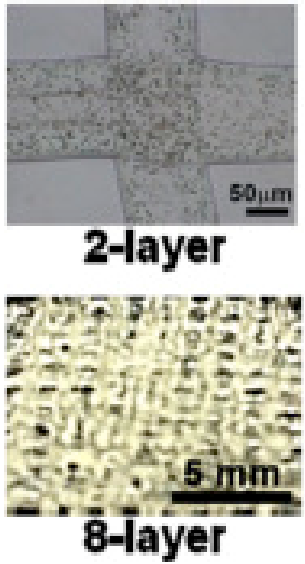


Bioprinting for 3D cultures

3D bioprinting of neural stem cell-laden thermoresponsive biodegradable polyurethane hydrogel and potential in central nervous system repair.

Hsieh et al Biomaterials 2015





References

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7	Hsieh, F-Y, Lin, H., Hsu, S-H. 2015 3D Bioprinting of Neural Stem Cell-Laden Thermoresponsive Biodegradable Polyurethane Hydrogel and Potential in Central Nervous System Repai. Biomaterials. 71:48-57.