Disentangling the Diversity of Organoids

PSA 2024, 2024-11-14

Charles H. Pence and Maxence Gaillard

@pence@scholar.social

UCLouvain

ISP Institut supérieur de Philosophie

LIBST Louvain Institute of Biomolecular Science and Technology

Académie royale de Belgique 1772

The Histories of Organoids

Organoids as Models of Development

A first history: Organoids are models of development, in a continuous line of research dating back, at least, to 1950s work on cell aggregation in chicken embryos. What matters is their ability to ("naturally" or "automatically") recapitulate developmental processes.

Organoids as Models of Development

> At the end of 2013, *The Scientist* named organoids as one of its "advances of the year" (Grens, 2013), not because the technology was new, but because it had suddenly become much more pervasive and visible thanks to some high-profile research papers. (Davies 2018, 4)

Organoids as Models of Development

> For decades, almost all work and commentary on organoids was done from the point of view of basic developmental biology: organoids were **tools that could inform embryologists about cellular mechanisms of development.** They had the useful feature that they would allow questions to be asked in a simple system, away from the complexity of the body as a whole. (Davies 2018, 9)

Organoids as Models of Development

> "I didn't really know what they were," says Lancaster... [W]hen she sliced one of the balls open, she could pick out a variety of neurons. Lancaster realized that **the cells had assembled themselves into something unmistakably like an embryonic brain,** and she went straight to her adviser, stem-cell biologist Jürgen Knoblich, with the news. "I've got something amazing," she told him. "You've got to see it." (Willyard 2015, 520)

Organoids as Translational Therapies

A second history: Organoids are a specific form of translational cellular therapies, best understood as part of the genealogy of stem cell research and therapy.

Organoids as Translational Therapies

While the term “organoid” was not used in these pioneering studies, Rheinwald and Green were the first to reconstitute 3D tissue structure from cultured human stem cells. (Clevers 2016, 1586)

Organoids as Technological Platforms

A third history: Organoids are a kind of bioengineering construct, most potentially useful for building engineered therapies or artificial organs.

Organoids as Technological Platforms

> Organoids are in vitro miniaturized and simplified model systems of organs… We examine how microfluidic approaches and lessons learnt from organs-on-a-chip enable the integration of mechano-physiological parameters and increase accessibility of organoids to improve functional readouts. Applying engineering principles to organoids increases reproducibility and provides experimental control, which will, ultimately, be required to enable clinical translation. (Hofer & Lutolf 2021, 402)

A Few Consequences

What is Philosophically Relevant?

If organoids are...

- **models of development:** research ethics; possibilities of replacement of animal models
- **translational therapies:** debates over personalized medicine; the ethical framework already at play in stem cell research
- **technological platforms:** ethics of synthetic biology; development of systems like organs-on-chip

What is Philosophically Relevant?

When and how can these various visions for what organoids are actually converge?

How does this interact with the extant literature on differences between scientific and engineering perspectives on living systems?

What is Philosophically Relevant?

And, perhaps most importantly: philosophical work on organoids needs to be extremely careful to acknowledge the existence of this diversity.

While it might be obvious that the ethical issues for developmental biology research and personalized medicine are different, in other areas of study this might be much less obvious!

Questions?

charles@charlespence.net
https://pencelab.be
@pence@scholar.social

PENCE LAB

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 101006012