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Editorial

Organoids Are Us

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"Organoids Are Us" is an annual one-day symposium organised to highlight the advances in science and medicine that are the direct result of organoid technology. I conceived and named the symposium series "Organoids Are Us" because "organoids are" indeed "us".

Organoids (meaning organ-like) are miniature replicas of tissues grown in a dish. The advent of organoid technology represents a ground-breaking achievement stemming from the realm of Wnt research. Wnt signalling, an age-old mechanism of cell-to-cell communication, has been conserved throughout evolution. It instructs our body's cells on their destinations and actions and dictates their identity. Wnt signalling also holds a crucial role in embryonic development and ensures the proper functioning of tissues in adults. However, when the pathway is inappropriately activated, it gives rise to a wide range of human diseases, including cancer [1].

The first Organoids Are Us symposium held in 2018 followed and built on the first international Wnt meeting held in Australia [2] and had a strong Wnt signalling component. The symposium's focus was on tissue-restricted adult stem cell (ASC)-derived organoids, which were first described by the Clevers group in the Netherlands. The Clevers laboratory discovered an exclusive marker to identify and track ASCs [3] and devised a way to coerce the stem cells to make their tissue of origin in a dish [4]. This advancement triggered an exponential increase in "organoid"-based publications [5]. Organoids offer a convenient platform for exploring the fundamental characteristics of stem cells and the transformative processes that drive their transition into cancer cells. By means of genetic or pharmacological interventions, organoids can be manipulated to uncover the factors that define stemness and unravel the changes that propel normal stem cells towards a cancerous state. Additionally, organoids derived from patient tumours can be established, allowing the effective pre-screening of anti-cancer drugs [6]. The drug response observed in tumour organoids mirrors the treatment outcomes experienced by patients, thereby enabling personalised therapeutic approaches [7]. Organoid technology has been embraced by a diverse range of fields and is specifically fuelled by stem cell and cancer research.

In 2018, organoids were gaining momentum as a promising development in the field of infectious disease modelling. These organoids accurately replicate essential characteristics and functions of intact tissues, such as the presence of specific cell types and tissue architecture. This renders them ground-breaking models for studying infections in an authentic manner. Notably, organoids have the potential to facilitate the investigation of various human viruses that previously lacked appropriate cell culture or animal models for research purposes. Researchers have developed organoids from a vast array of organs, including the gut, stomach, liver, brain, and kidneys, to understand how tissues develop and repair. However, the potential of these organoids as authentic infection models was largely not embraced until the COVID-19 pandemic [5]. COVID-19 has been described as a "rampage through the body" [8], and organoids established from diverse organs were adopted globally in the scramble to develop therapies to combat COVID-19. In 2018, the

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"organoids/infection" component of "Organoids Are Us" was brief, consisting of three short talks. In 2019, it was the topic of one of the keynote presentations. In 2020, the symposium was cancelled due to COVID-19, while in 2021, "organoids/infection" was the main theme of the symposium. "Organoids Are Us 2021" was a virtual meeting due to the ongoing pandemic. A PDF of the meeting program with links to the talks can be viewed from the Special Issue website or at the following link: (https://www.doherty.edu.au/uploads/content_doc/OrU2021_Sessions_Video_Links_V2.pdf, accessed on 29 May 2023).

"Organoids Are Us 2022" saw a return to the fundamentals of organoid technology. Munro and colleagues [9], for this Special Issue, review the application of organoid technology to model the human colon and highlight recent advances, such as apical-out models, that provide access to the apical surface of the organoid epithelium. Nag and Boyd [10] describe advancements made with complex organoid models derived from human induced pluripotent stem cells and the role of the extracellular matrix in renal cell differentiation and modelling kidney disease. The symposium always has a focus on high content and high-throughput imaging as these tools are advancing rapidly, given the adoption of organoids into the realm of drug development and therapeutics. To this end, Ramm and colleagues [11] detail a protocol for sample preparation for high content and high-throughput imaging that does not alter the morphology of the organoids. The selected articles in this Special Issue also include new themes, such as animal tissue organoids, to introduce organoid technology into the veterinary infectious disease field and livestock industry. Quah and colleagues [12] established organoids from bovine trachea and characterised the models using single-cell RNA sequencing. The authors assessed the effect of immune modulation on the susceptibility of epithelial cells to viral infection. Organoids established from animals are a new and exciting advancements from veterinary science.

The articles selected for this Special Issue, "Advances in Organoid Technology—Selected Papers from Organoids Are Us 2022", highlight the advances in and the cross-discipline adoption of organoids. The next phase for organoid technology looks very exciting indeed.

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