Predicting 'live' cell fate dynamics in human stem cells by deep learning-enhanced morphological profiling

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Abstract

The Regenerative Medicine of tomorrow will rely on being able to produce a wide variety of "designer" tissues of choice (neurons, heart cells, liver cells, etc) that can be used for Personalised tissue replacement in the clinic. This goal has become achievable in particular thanks induced Pluripotent Stem cells (iPSCs), a technology enabling to manufacture pluripotent stem cells from any individual and use them to derive from them almost any desired target cell or tissue of choice by differentiation in vitro. However, key challenges have to be overcome before iPSC therapeutics becomes a routine reality in the market and in the clinic, notably how to control efficiently and consistently iPSC differentiation into target tissues of choice. In this talk I will describe machine learning-enabled microscopy phenomics technologies we have pioneered in the past few years that make it possible to visualise and predict in a non-destructive manner human cell proliferation and differentiation dynamics 'live', across days, and at single-cell level. Leveraging these technologies in the future will be key to enable robust human tissue design and manufacturing for therapeutic applications.

References

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