UNIVERSITÀ DEGLI STUDI DI PADOVA

SHANGHAI SUMMER SCHOOL
VENICEASIAGO2016

DATE: 28th August 2016
TIME: 10:30 - 12:00
LOCATION: Osservatorio Astronomico di Asiago, via dell'Osservatorio, 8; Asiago, Vicenza

Engineering stem cell potential

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ABSTRACT

Stem cells were discovered in many tissues, especially those that require continual replacement of cells throughout life. These observations led to the concept of a tissue architecture in which a small population of stem cells, which persist through the life of the organism, can give rise to a population of cells that amplify progenitors capable of a limited period of cell division but committed to the eventual differentiation into terminal functional cells of the tissue. Such tissue stem cells have a limited repertoire of differentiation, being capable of only generating cells appropriate to their respective tissues.

In 1998 human embryonic stem cells became available. That achievement of James Thomson greatly promoted the idea of regenerative medicine, since such cells could, in principle, provide an unlimited resource for generating all somatic human cells, which could, in turn, be used to replace tissues and organs lost to accident or disease.

Further developments included the discovery that cells akin to ES cells, induced Pluripotent Stem [iPS] cells, could be generated from fully differentiated somatic cells by forcing the expression of only three or four key genes. Not only did this discovery help obviate the ethical concerns about the experimental use of human embryos, and further open up opportunities for 'personalised' regenerative medicine, but also greatly stimulated the possibility of disease modelling in vitro, with such cells carrying disease associated genomes being used to explore the development of particular cellular pathologies and to test potential therapeutic drug candidates.

The exploitation of pluripotent stem cells, whether for regenerative medicine, disease modelling or drug screening requires a detailed understanding of the biology of these fascinating cells and the molecular mechanisms that guide their fate. The pluripotent stem cells show an unexpected level of self-organization with defined spatio-temporal patterns, also resembling tissue development or pathogenesis. Factors affecting quality control, including the genetic stability of these cells, which may impact on safety and efficacy of eventual products, must also be considered. Addressing these issues will be facilitated by the development of new technologies such as gene editing, or micro-engineering to manipulate the microenvironment of the cells for investigating, dissecting, reconstructing the complex biological molecular mechanisms underneath their behaviour.

FURTHER READINGS

Will be provided by the Professor during the lecture.