IMCB Invited Speaker

Speaker : **Dr. Maria Elena Torres Padilla**
Team Leader, Epigenetics and Cell fate in early mammalian development, Institute of Genetics and Molecular and Cellular Biology (IGBMC), Strasbourg, France

Date : 4th June 2012 (Monday)

Time : 4pm - 5pm

Venue : Level 4, Creation Theatrette, Matrix., Biopolis

Host : Dr. Ernesto Guccione

Seminar :

Epigenetics mechanisms in early mammalian development

In mammals, oocyte fertilisation by the sperm initiates development. This is followed by epigenetic reprogramming of both parental genomes, which involves de novo establishment of chromatin domains. Embryonic chromatin is believed to be more 'plastic' in the totipotent blastomeres of the early embryo, which is thought to be directly linked to their potency. But how this plasticity is regulated and what are the chromatin signatures that distinguish it from differentiated cells has not been addressed.

Heterochromatic-mediated silencing of repetitive elements is essential for genome stability, with differentiated cells exhibiting virtually complete repression of these regions. Here, we have used repetitive elements, including retrotransposons, as model loci to address how and when global heterochromatin rearrangements and acquisition of heterochromatic marks occur during development. By performing high throughput RNA-sequencing using a protocol adapted to low cell number throughout early embryogenesis, we find that the expression of repetitive elements is abundant, highly dynamic and developmental stage-specific. Importantly, we find that fertilisation is accompanied by a robust transcriptional activation of retrotransposons. We have further established a chromatin immunoprecipitation protocol to analyse the chromatin signatures of these repetitive regions in the embryo. We find that retrotransposons have an 'atypical' chromatin configuration at the beginning of development, which is resolved into a more ES-type at the 8-cell stage, coincident with the time when differentiation events start taking place in the embryo.

Our results suggest that activation of retrotransposons is an important part of the reprogramming process and shed light into the mechanisms directing the formation of heterochromatin domains during embryogenesis.

About the Speaker :

Maria-Elena did her undergraduate studies at the Faculty of Sciences of the UNAM, Mexico and obtained her Ph.D at the Institut Pasteur in Paris in 2002. She was a postdoctoral fellow at The Gurdon Institute, University of Cambridge, UK between 2002 and 2006. She then worked as scientist with Laszlo Tora until 2008. She leads the team "Epigenetics and cell fate in early mammalian development' at the IGBMC in Strasbourg, France since december 2008.

Research in Maria-Elena Torres-Padilla's laboratory focusses on understanding how early mouse development is regulated by chromatin-mediated changes in gene regulation, that is, by epigenetic information. In particular, we are interested in understanding how the transitions in cell potency and cell fate are regulated by chromatin-mediated processes. We use the mouse embryo as a model because this is one of the few systems where it is possible to explore the foundations of totipotency and differentiation. Indeed, the zygote, which is the product of fertilisation of an oocyte by sperm, has an inherent capacity to form all cell types in an organism. Chromatin-mediated changes in gene regulation have to ensure the plasticity required for undertaking such essential task during development. Our projects will help us to understand how chromatin structure is progressively modified to restrict cell fate determination with the consequent loss of totipotency. Our work will also allow new insights in biology of the pluripotent stem cells, in particular on their origin and development. From a more broader perspective, deciphering the basic mechanisms underlying the earliest steps of mammalian development is essential to understand early aspects of embryonic development human reproduction and stem cell biology.

Institute of Molecular and Cell Biology
A*STAR

If you have questions about IMCB seminars, please contact seminars@imcb.a-star.edu.sg .