HelmholtzZentrum münchen
German Research Center for Environmental Health

Scientific Highlight October 2015

☒ co-ordinated with the Director of the Institute / Research Unit

Institute of Computational Biology

PSP-Element:
G-503800-001

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Title of the highlight:
Different than previously assumed: The dynamics of pluripotency transcription factors

Keywords:
Embryonic stem cells, computational modelling, protein dynamics, pluripotency.

Central statement of the highlight in one sentence:
We systematically analysed the kinetics of protein expression in mouse embryonic stem cells an discovered that variations in the Nanog expression are not necessarily linked to differences in the expression of other pluripotency factors.

Text of the highlight:
Nanog (a gene named after 'Tír na nÓg', the mythological Celtic land of the ever-young) is a transcription factor that is involved in regulating stem cell self-renewal. Earlier models assigned a central role to Nanog in the regulation of pluripotent, embryonic stem cells.
We conducted an accurate quantification and analysis of Nanog protein expression over several generations, based on mouse embryonic stem cells in which the Nanog protein is marked with a fluorescent protein. We were able to identify two different types of colonies: While one type re-expressed Nanog in a mosaic pattern, the other did not express Nanog over many generations. Surprisingly, both colonies expressed pluripotency markers. On the single cell level, we discovered that variations in the Nanog expression are not necessarily linked to differences in the expression of core pluripotency factors Oct4, Sox2 and Klf4.
The methods we developed for the quantification and analysis of single cells can also be applied to other factors and cells. The data resource that has been

created within this project will be used for further model-based analyses of the regulation of Nanog protein expression."

Publication:
Filipczyk et al. (2015) Network plasticity of pluripotency transcription factors in embryonic stem cells, Nature Cell Biology, DOI: 10.1038/ncb3237

Taking account of the HMGU mission:
The research findings are important for understanding protein dynamics and for regulating cell states, for example during the targeted re-programming of cells, a future tool for therapeutic, personalized intervention.

The internal HMGU co-operation partners with whom the highlight was compiled, if appropriate:
Prof. Timm Schroeder (ex. Stem Cell Dynamics research unit, now Department of Biosystems Science and Engineering at ETH Zurich in Basle).