

Decode the Secret of ESC Self-renewal

reported by Alfred Sun



Research lead by Dr. Qi-long Ying from University of Southern California has identified three molecules which allow mouse ESCs to self-renew indefinitely without losing their pluripotency in defined culture media.

The work commenced when Dr. Qi-long Ying was doing his post-doc in Professor Austin Smith's lab in UK, while he was looking for a way to substitute LIF, a cytokine that acts through the JAK-STAT3 pathway to keep ESC undifferentiated. Interestingly, it was the Smith lab that originally discovered LIF as an essential factor for ES cells derivation and propagation. After years of work, he eventually came to the recipe of a cocktail of three kinase inhibitors, two MAPK inhibitors, PD184352 and SU5402, and a GSK-3 inhibitor, CHIR99021. Combination of the three molecules renders mouse ES cells to self-renew independent of LIF and other exogenous factors.

Their findings suggest that ES cells have an innate ability for self-replication that does not require external instruction. If this is true, then effectively shielding ES cells from differentiation factors from the culture media with selective kinase inhibitors, as what they have done for mouse ES cells, may work for other species as well. This would bypass the need of identifying specie specific self-renewal factors and allow creation of ES cells of any species to be used for medical and pharmaceutical research. Already, Dr. Ying's group is trying to derive rat ESCs using their kinase inhibitor cocktail.

Dr. Ying received his BS degree in Medicine from The First Military Medical University, China in 1987. He then completed his MS in Neurosurgery in 1992 and his PhD degree in Neurology in 1995 in Shanghai Medical University, China. After conducted a 3 year postdoc in China, he took another postdoc position in Dr. Austin Smith's lab in University of Edinburgh, UK from 1999 to 2006. In 2006, Dr. Ying established his own lab at the Keck School of Medicine at the University of Southern California in Los Angeles to continue the pursuit of his interest in stem cells. During his scientific career Dr. Ying has published several important papers, including a Cell paper in 2003 identifying using BMP, in conjunction with LIF, to sustain ES cell pluripotency in serum free media.



Alfred Sun is currently a 3rd year graduate student in Dr. Gerald Crabtree's lab at Stanford University. He obtained his B.S. in chemistry from Duke University in 2005. In between, he worked for a year in Institute of Molecular and Cell Biology in Singapore. A native of Hangzhou, P.R China, Alfred finished his high school in Singapore, before he came to the US.