Scientists identify genes implicated in the high regenerative capacity of embryos and ESCs

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Researchers at Insilico Medicine, AgeX Therapeutics and the Biogerontology Research Foundation have published a landmark study titled "Use of deep neural network ensembles to identify embryonic-fetal transition markers: repression of COX7A1 in embryonic and cancer cells" in the journal *Oncotarget*.

In the study, researchers used deep learning techniques to analyze gene expression data in embryonic stem cell (ESC) lines at varying stages of development in order to characterize the gene expression profile of cells right at the boundary of the embryonic-fetal transition, when embryos become fetuses and experience a remarkable reduction in their regenerative capacity. In essence, the study's objective was to hone in on those genes responsible for the remarkable regenerative capacities of embryos and ESCs.

Mimicking the gene expression profile of cells prior to the embryonic fetal transition in adult tissues and organs is the concept underlying one of the central and most ambitious therapeutic modalities being pursued by AgeX Therapeutics, namely induced Tissue Regeneration (iTR). Therapeutic elaboration of the insights derived from this study could pave the way for in-situ tissue regeneration, and its application to ageing and age-related disease.

"induced Tissue Regeneration (iTR) is one of the most promising

therapeutic modalities for enabling in-situ tissue regeneration proposed to date, and one that is likely to bring substantial healthspan-extending effects if implemented. This landmark study paves the way toward that bright future. Interestingly, in its identification of COX7A1 as one of the genes implicated in the remarkable regenerative potential of embryos and ESCs, the study also extends the purview of these findings to novel potential cancer therapies as well" said Franco Cortese, Deputy Director of the Biogerontology Research Foundation.

The authors also developed effective methods of deriving biologically-relevant information from these profiles, identifying the most interesting genes characterizing the regenerative capacity of ESCs, and performed additional experimental validation to support the findings of the study's deep learning analysis. Interestingly, one of the genes implicated in the embryonic-fetal transition that the study identified, COX7A1, is dysregulated in a diverse array of cancer types, including breast, lung, kidney, bone and muscle. As such, the results of this study could be used create novel cancer therapies as well.

"AI is quickly becoming the main driver of progress in so many fields of science, technology and human endeavor that it is easy for one to lose count. From healthcare to finance to governance, AI is galvanizing rapid paradigm shifts all around us. Insilico Medicine is rapidly establishing themselves as the leader of AI for longevity, and the combination of their deep-learning expertise with the assets for expert experimental validation and interpretation possessed by AgeX Therapeutics is a partnership that has yielded significant synergistic results in using AI to yield novel insights into the biology of aging and charting the path toward next generation healthspan-extending therapies" said Dmitry Kaminskiy, Managing Trustee of the Biogerontology Research Foundation.

More information: Michael D. West et al. Use of deep neural network

ensembles to identify embryonic-fetal transition markers: repression of *COX7A1* in embryonic and cancer cells, *Oncotarget* (2017). DOI: 10.18632/oncotarget.23748