

Development unchained: how cellular reprogramming is redefining our view of cell fate and identity.

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Public Summary:

Higher eukaryotic development has traditionally been considered a unidirectional and irreversible process. Beginning in 2006, with Yamanaka and colleagues' report on the first successful generation of induced pluripotent stem cells (iPSCs), the field of stem cell biology has experienced perhaps unprecedented rates of growth and discovery. This review is a summary of recent progress in the field of reprogramming. Advances in small molecule-aided reprogramming and transdifferentiation, currently two of the most intensely studied areas of stem cell biology, are emphasized. The field has collectively covered much ground in the past five years, dramatically increasing reprogramming efficiency and successfully eliminating the need for permanent genetic modification, perhaps the biggest obstacle to eventual clinical use of this strategy. Simultaneously, various transdifferentiation strategies are rapidly expanding the scope of cellular plasticity interconverting unrelated cell types with relative technical ease. While significant challenges remain--such as accomplishing small molecule-only "chemical reprogramming" or ensuring the functional and epigenetic equivalency of reprogrammed or transdifferentiated cells--there is no shortage of enthusiasm in the field.

Scientific Abstract:

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