

Polymeric design of cell culture materials that guide the differentiation of human pluripotent stem cells

ABSTRACT

Human pluripotent stem cells (hPSCs), including embryonic stem cells (hESCs) and induced pluripotent stem cells (hiPSCs), have the potential to differentiate into many cell types that originate from the three germ layers, such as dopamine-secreting cells and insulin-secreting cells for the treatment of Alzheimer's disease and diabetes, respectively. However, it is challenging to guide hPSC differentiation into desired cell lineages due to their varying differentiation ability. A reasonable strategy is to mimic the stem cell microenvironment for the differentiation of hPSCs into specific cell lineages using optimal polymeric biomaterials for hPSC culture. This review summarizes various methods for differentiating hPSCs cultured on polymeric biomaterials and discusses the optimal methods and cell culture polymeric biomaterials for hPSC differentiation into specific cell lineages. The recent trend in protocols avoids embryoid body (EB, aggregated cells) formation because EBs contain different types of cells. The combination of appropriate differentiation protocols and cell culture polymeric biomaterials for the differentiation of hPSCs into specific cell lineages will produce a large quantity of highly pure GMP-grade differentiated cells for use in translational medicine.

Keyword: Biomaterial; Embryonic stem cell; Induced pluripotent stem cell; Differentiation; Hydrogel; Nanofiber