

## CELLULAR REPROGRAMMING OF SOMATIC CELLS TO STEM CELLS: AN INNOVATIVE APPROACH IN PHARMACEUTICAL BIOTECHNOLOGY

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*The advancement of cell reprogramming technologies has revolutionized the landscape of regenerative medicine and drug research. This review scrutinizes the process of reprogramming somatic cells into stem cells, particularly focusing on induced pluripotent stem cells (iPSCs), and elucidates their evolution over time. Initially, the review delineates the disparities between normal cells and stem cells. Subsequently, it delves into the historical trajectory of embryonic stem cells (ESCs) and iPSCs. The pivotal role of somatic cell reprogramming in pharmaceutical biotechnology is explored, highlighting its applications in disease modeling, drug discovery, regenerative medicine, and personalized therapies. The review provides insight into the fundamental principles of reprogramming techniques, encompassing iPSC generation, transcription factors, epigenetic modifications, and non-integrative reprogramming methods. Special emphasis is placed on genome-editing techniques such as CRISPR-Cas9, TALENs, ZFNs, and base editing, given their paramount importance in cellular reprogramming endeavours. Finally, the review deliberates on the diverse modalities through which cellular reprogramming can rejuvenate dead cells into stem cells, underscoring the transformative potential of this technology across various domains of biomedicine. By elucidating the multifaceted effects and opportunities of somatic cell reprogramming, this review aims to serve as a valuable resource for scholars and practitioners in the realms of cellular and molecular biology.*

**Key words:** Induced Pluripotent Stem Cell (iPSCs), Cellular reprogramming, Stem Cell, Somatic Cell, Regenerative medicine.

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## КЛІТИННЕ ПЕРЕПРОГРАМУВАННЯ СОМАТИЧНИХ КЛІТИН У СТОВБУРОВІ КЛІТИНИ: ІННОВАЦІЙНИЙ ПІДХІД У ФАРМАЦЕВТИЧНІЙ БІОТЕХНОЛОГІЇ

Розвиток технологій перепрограмування клітин революціонував ландшафт регенеративної медицини та досліджень лікарських засобів. У цьому огляді детально розглядається процес перепрограмування соматичних клітин у стовбурові, зокрема індуковані плюрипотентні стовбурові клітини (iPSC), та простежується їхня еволюція з плином часу. Спочатку огляд окреслює відмінності між звичайними та стовбуровими клітинами. Згодом він заглиблюється в історичну траєкторію ембріональних стовбурових клітин (ECK) та iPSC. Досліджується ключова роль перепрограмування соматичних клітин у фармацевтичній біотехнології, висвітлюється її застосування в моделюванні захворювань, розробці ліків, регенеративній медицині та персоналізованій терапії. Огляд дає уявлення про фундаментальні принципи методів перепрограмування, зокрема, генерацію iPSC, фактори транскрипції, епігенетичні модифікації та неінтегративні методи перепрограмування. Особливу увагу приділено методам редагування геному, таким як CRISPR-Cas9, TALEN, ZFN та редагування основ, з огляду на їхню першочергову важливість для клітинного перепрограмування. Зрештою в огляді розглядаються різноманітні способи, за допомогою яких клітинне перепрограмування може омолодити мертві клітини на стовбурові, що підкреслює трансформаційний потенціал цієї технології в різних галузях біомедицини. Висвітлюючи багатогранні ефекти й можливості перепрограмування соматичних клітин, цей огляд має на меті слугувати цінним ресурсом для науковців і практиків у галузі клітинної та молекулярної біології.

**Ключові слова:** індуковані плюрипотентні стовбурові клітини (iPSC), клітинне перепрограмування, стовбурові клітини, соматичні клітини, регенеративна медицина.

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