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LIVING CELLS IN MODERN BIOTECHNOLOGY: FROM ADVANCED PRECLINICAL MODELS TO INNOVATIVE THERAPEUTIC PRODUCTS

Andrea Maria MALANCA, Aleksandra ČEBZAN-ZEMAN, Ioan-Bogdan PEȚ, Darius Sebastian RUS, Mihai Adrian COSTEA, Mirela AHMADI*

Univ. of Life Sciences „King Mihai I” from Timisoara, Fac. of Bioengineering of Animals Resources, Dept. Biotechnology, C. Aradului 119, Timisoara-300645, Romania;

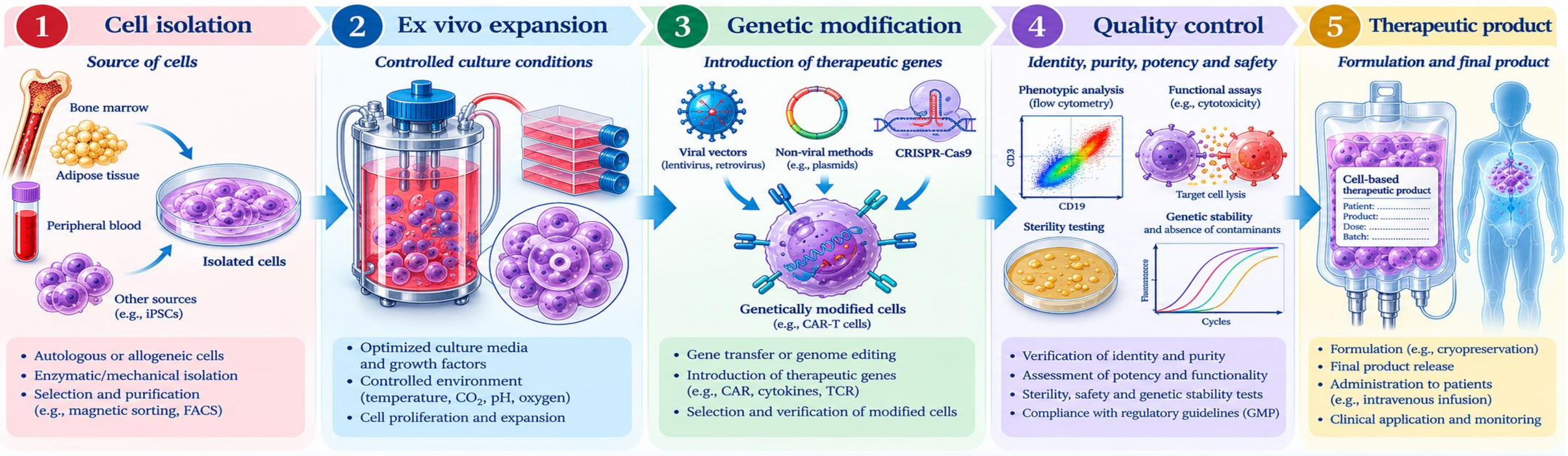
Abstract: Cell-based therapies use living cells to develop innovative therapeutic products. This review examines stem cell-derived therapies, CAR-T cells, manufacturing processes, and quality control, while considering advanced cellular models as alternatives that may reduce animal use in preclinical research.

• Introduction

Cell-based therapies involve the isolation, expansion, and modification of living cells for therapeutic applications. Advances in stem cell biology and genetic engineering have enabled new treatment strategies, particularly in oncology, while introducing specific manufacturing and safety requirements.

• Results and discussions(continue)

- Cell-based therapies have shown clinical benefits, particularly in hematological malignancies, where CAR-T cells can induce durable responses. Stem cell therapies are established in hematopoietic transplantation, while regenerative applications remain under investigation.



• Results and discussions

- **Therapeutic applications:** CAR-T immunotherapy, hematopoietic stem cell transplantation, and investigational regenerative therapies.
- **Biotechnological advances:** Controlled cell expansion, genetic modification, and standardized quality control.
- **Alternative testing:** Organoids and organ-on-a-chip models support human-relevant preclinical evaluation
- **Current limitations:** Manufacturing costs, product variability, safety risks, and regulatory requirements.
- Advances in cell isolation, expansion, and genetic engineering have improved therapeutic development, although cell viability, safety, and manufacturing consistency remain challenging.
- Organoids and organ-on-a-chip systems support preclinical drug evaluation and may reduce animal testing, but cannot fully replicate human physiology.

• Conclussions

Cell-based therapies offer new treatment opportunities through advances in cellular biotechnology. Despite manufacturing and safety challenges, their development, supported by advanced preclinical models, may improve personalized therapeutic approaches.