

Somatic cells

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- Fully differentiated specialised cells (somatic cells) obtained from normal tissues have been used for tissue engineering and regenerative therapy with some degree of success. For example, skin has been engineered using cultured epithelial cells grown in vitro and used to treat patients with burn injuries. Chondrocytes have been isolated, expanded in vitro - and implanted into areas of deficient cartilage in a procedure called autologous chondrocyte implantation. Bladder wall has a

Adult stem and stromal Somatic (differentiated) cells cells Controlled delivery Cells Materials Molecules Anti-inflammatory Osteogenic

also been engineered using a combination of smooth muscle cells and uroepithelial cells expanded in vitro and grown on a scaffold before reimplantation. Such tissues can be grown using cells obtained from the intended recipient by tissue biopsy (autologous cells) or using cells obtained from unrelated donors (allogeneic cells). The major advantage of the former source is that, after implantation, they are not rejected by the recipient's immune system; hence there is no requirement for immunosuppression (see Chapter 88). For other indications, the use of fully differentiated specialised cells is not practical in most situations because such cells are not readily available in sufficient numbers and they have only limited proliferative ability in vitro, which means that their numbers cannot be readily expanded to sufficient levels. To overcome these limitations, the major focus in the field of cell therapy has been on the use of stem cells.

Cell type Somatic cells SSCs Ease of availability Limited Good Expansion in vitro Limited Good Potency No Limited Ethical concerns No No Risk of malignancy None Low Autologous Yes Yes Anticipated future use Limited High hESCs, human embryonic stem cells; iPSCs, induced pluripotent stem cells; SSCs, somatic stem cells. ethical issues associated with hESCs. Zygote Totipotent cell Blastocyst ESCs or iPSCs Trophoblast Pluripotent cell Primitive endoderm Epiblast Multipotent cell Nullipotent cell Figure 4.2 Hierarchy of cells according to potency, ranging from stem cells to specialised differentiated cells. ESC, embryonic stem cell; iPSC, induced pluripotent stem cell. (Adapted with permission from Tewary M, Shakiba N, Zandstra PW. Stem cell bioengineering: building from stem cell biology. Nat Rev Genet 2018; 19: 595-614.) hESCs Fetal cells iPSCs Moderate Moderate Good Excellent Good Excellent Excellent Limited Excellent a Yes Yes Yes Moderate Moderate Moderate No No Yes Limited Limited High a Note that iPSCs avoid some of the

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