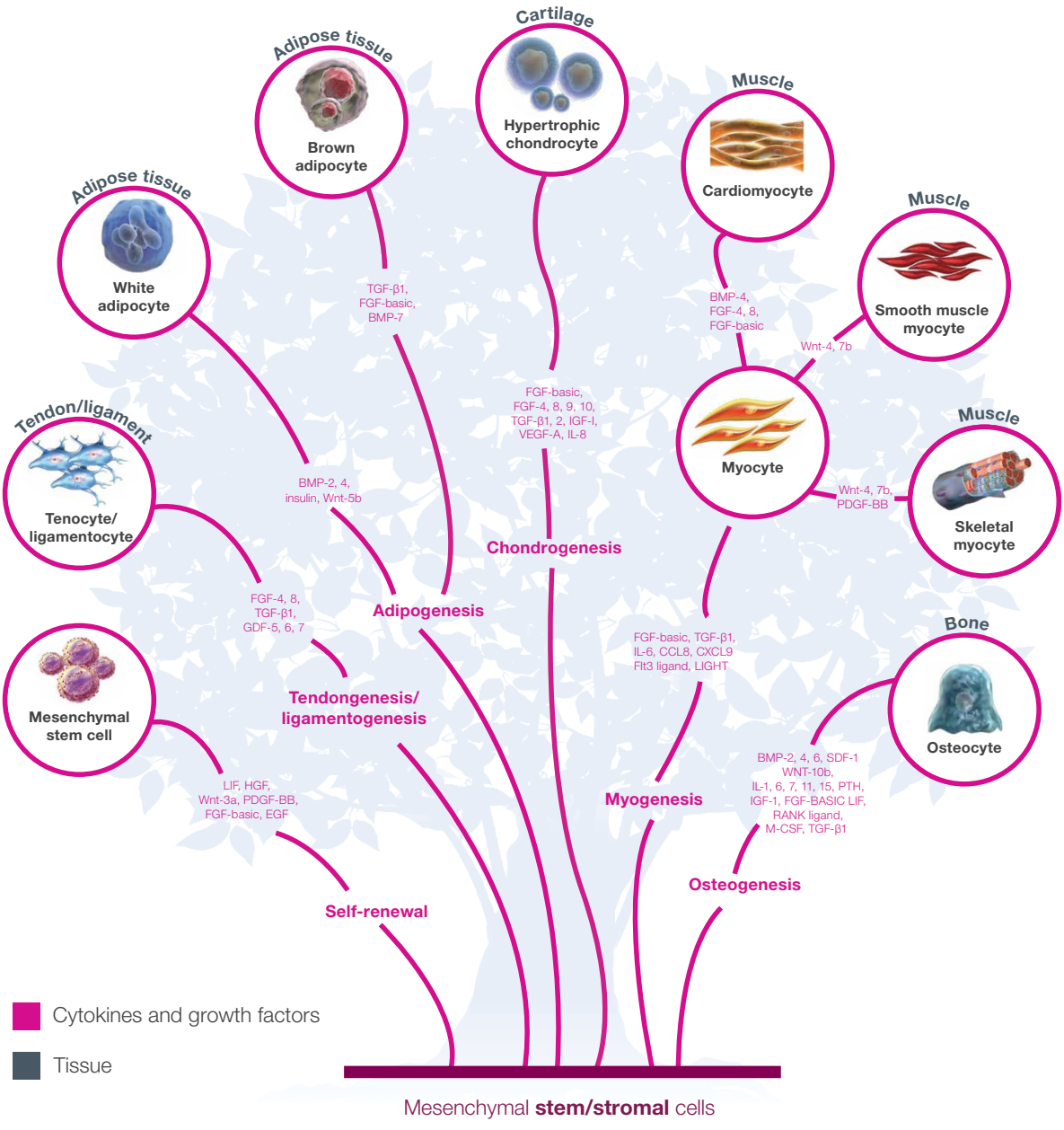
PEPROTECH®
Part of Thermo Fisher Scientific

PeproTech products are now part of the gibco by Thermo Fisher Scientific Recombinant Protein Portfolio

Mesenchymal stem/stromal cells

Mesenchymal stem cells (MSCs), also known as mesenchymal stromal cells, are currently defined as self-renewing, multipotent cells that can differentiate *in vitro* into adipocytes, chondrocytes, and osteocytes [1]. They must express the surface markers CD105, CD73, and CD90, while at the same time lack the expression of CD45, CD34, CD14, CD11b, CD79α, CD19, or HLA-DR [2-5].

MSCs can be isolated from a variety of sources, including amniotic fluid, placenta, umbilical cord blood, dental pulp, and synovial fluid [3,5]; however, bone marrow– and adipose tissue–derived MSCs have been the most extensively studied. Wharton's Jelly, which is found in the umbilical cord, is also a source of MSCs. In light of some special features these cells possess, they hold great promise for regenerative purposes [2,4,5].



Although they share some common features, MSCs retain wide variabilities in terms of differentiation and regenerative capabilities, depending on the tissue of origin. Studies have suggested that MSCs are not of a uniform lineage, but are instead tissue-specific stem/progenitor cells [2,4].

Originally, MSCs were hypothesized to migrate to inflamed tissues where they become engrafted and differentiated to eventually regenerate damaged cells. However, numerous studies demonstrated that the duration and number of cells engrafted do not sufficiently explain the significant regenerative effects observed, suggesting the involvement of other mechanisms [3].

The present notion is that MSCs, in addition to replacing damaged cells at sites of injury, also act to repair damaged tissues by rescuing dying cells through cell fusion, secreting cytokines and growth factors, transferring mitochondria through tunneling nanotubes, and transferring mRNA and miRNA via extracellular vesicles, such as exosomes or microvesicles [1,5]. In different settings, certain mechanisms tend to be more relevant than others.

MSCs possess several characteristics that make them an attractive tool for cell and regenerative therapy, including the ability to differentiate into various cell types; an enhanced proliferation rate; the ability to escape immune recognition and to modulate immune functions; the ability to secrete a wide array of soluble factors; and the capacity to migrate to injured sites. In addition, they do not raise the ethical and safety concerns generally associated with embryonic stem cells and induced pluripotent stem cells [1-5].

Currently, there are over 800 MSC-based clinical trials underway that focus on evaluating the therapeutic potential of MSCs in a variety of diseases, including graft-versus-host disease (GvHD), and bone, cartilage, cardiovascular, lung, liver, neurological, hematological and inflammatory diseases. These ongoing clinical trials, along with future research, support the promise of MSC therapy [4,5]. However, before MSC therapy can become an accepted therapeutic procedure, issues such as donor heterogeneity, *ex vivo* expansion, immunogenicity and cryopreservation, as well as determining the precise mechanisms of action, need to be addressed [3,4].

References

1. Spees JL, Lee RH, and Gregory CA (2016) Mechanisms of mesenchymal stem/stromal cell function. *Stem Cell Res Ther.* 7(1):125.
2. Rohban R and Pieber TR (2017) Mesenchymal stem and progenitor cells in regeneration: tissue specificity and regenerative potential. *Stem Cells Intl.* 2017:5173732.
3. Squillaro T, Peluso G, and Galderisi U (2016) Clinical trials with mesenchymal stem cells: an update. *Cell Transplant.* 25(5):829–848.
4. Brown C, McKee C, Bakshi S, et al. (2019) Mesenchymal stem cells: Cell therapy and regeneration potential. *J Tissue Eng Regen Med.* 13(9):1738–1755.
5. Margiana R, Markov A, Zekiy AO, et al. (2022) Clinical application of mesenchymal stem cell in regenerative medicine: a narrative review. *Stem Cell Res Ther.* 13(1):366.

5 Cedarbrook Drive
Cranbury, NJ 08512

Phone: (800) 436-9910
Fax: (609) 497-0321

peprotech.info@thermofisher.com
thermofisher.com/peprotech

Learn more at **thermofisher.com/peprotech**