The walls of all blood vessels, except capillaries, consist of three layers named tunica intima, tunica media, and tunica adventitia (tunica externa). The latter contain fibroblasts, collagen, and nerves. Blood vessels are formed early on during embryogenesis from the mesoderm in a process known as vasculogenesis. Pericytes surround the endothelium as part of the basement membrane.
Pericytes

- Pericytes have stem cell-like properties and are seemingly able to differentiate into adipocytes, chondrocytes, osteoblasts and granulocytes, leading them to be identified as mesenchymal stem cells (MSCs).
- They increase ECs proliferation/survival and migration.
- They release a large variety of GFs and cytokines.
- They may accelerate wound healing.
- There are several markers, none unique, and vary with location and time.


Marker Expression

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<th>Pericytes</th>
<th>MSCs</th>
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Expressed Markers & Overlap

- SMCs: smooth muscle cells
- Pericytes: adventitial cells
- MSCs: mesenchymal stem cells
- ECs: endothelial cells

Strategies for Vascularization

a) Uniform vascularization.

b) Combination of the material with cells able to support angiogenesis.

c) Design of the scaffold structure reproducing vascular like-structures that will act as a guide for the angiogenic process.

d) Incorporation of angiogenic factors during the manufacture of the graft.

e) The result should be a vascularized graft in which new-formed vessels are mature and functionally competent.

Perivascular Cells for Damaged Tissues

a) Bone reconstruction was achieved by incorporating PCs in 3D scaffolds.

b) Heart patches obtained by stacking multilayers of PCs combined grown on matrix substrate were devised for myocardial infarction.

c) Topical application of dermal patches containing PCs improved skin wound healing.
Role of Perivascular Cells in TE Grafts

1. The seeding of vascular grafts with perivascular cells increases their contractility and mechanical properties, regulating permeability.
2. The release of growth factors by the perivascular cells regulates endothelialization and endothelial cell function.
3. Additionally, perivascular cells contribute to the reconstitution of the perivascular niche, favoring the long-term graft success.


Summary

- Pericytes have stem cell-like properties and are mesenchymal stem cells.
- They promote vessel growth and stability.
- May in the future be useful for vascular graft repopulation, and skeletal and cardiac muscle grafts.
- May be an alternative to bone marrow mesenchymal stem cells (BMSCs) for bone regeneration.