WHAT IS ANGIOGENESIS

The formation of new blood vessels out of pre-existing capillaries.

INVOLVES : Sprouting

Splitting

Remodeling of the existing vessels

Intususeption

WHY IT IS IMPORTANT?

- Supply of oxygen and nutrients
- Removal of waste products

7

WHY ANGIOGENESIS IS SO IMPORTANT

- Common denominator in most common diseases.
- New capillary blood vessel growth in the body.
- Natural process for healing and reproduction.
- Precise growth factors and inhibitors are needed to promote the angiogenesis process.
- Too little or too much can be fatal to the body.

HOW ANGIOGENESIS IS RELATED TO REPRODUCTION:

Fetal Development: Angiogenesis helps in the formation of the placenta

Ovarian Function: blood vessels that support the growth and maturation of ovarian follicles

Uterine Function: it helps prepare the endometrium for embryo implantation.
During the menstrual cycle, the endometrial tissue undergoes cyclical changes.

Fertility Treatments: In ART, angiogenesis can be influenced by medications and procedures. Additionally, during the process of embryo transfer, angiogenesis can influence the successful implantation of the embryo into the uterine lining.

Pathological Conditions: Dysregulated angiogenesis can contribute to reproductive disorders.

Blood vessel formation

a) vasculogenesis:

de novo blood vessel generation from vascular progenitor cells

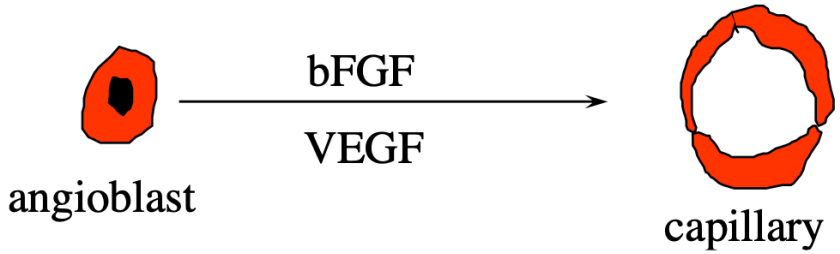
b) angiogenesis:

formation of new blood vessels via extension or remodeling from existing capillaries

DEFINITIONS

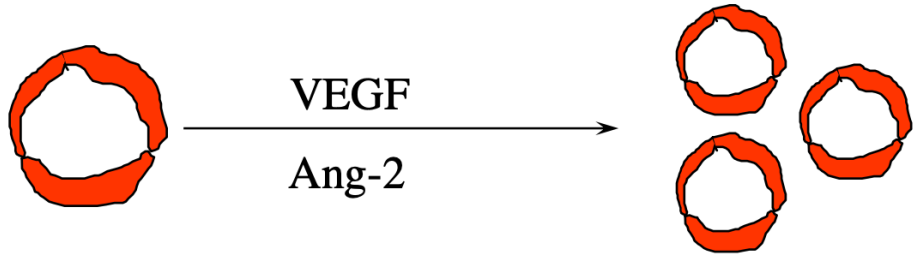
Vasculogenesis	*Formation of new vessels from EC precursors (angioblasts)*
Angiogenesis	*Formation of new vessels from pre-existing BV*
Arteriogenesis	*Subsequent stabilisation and maturation*

Three ways of formation of blood vessels



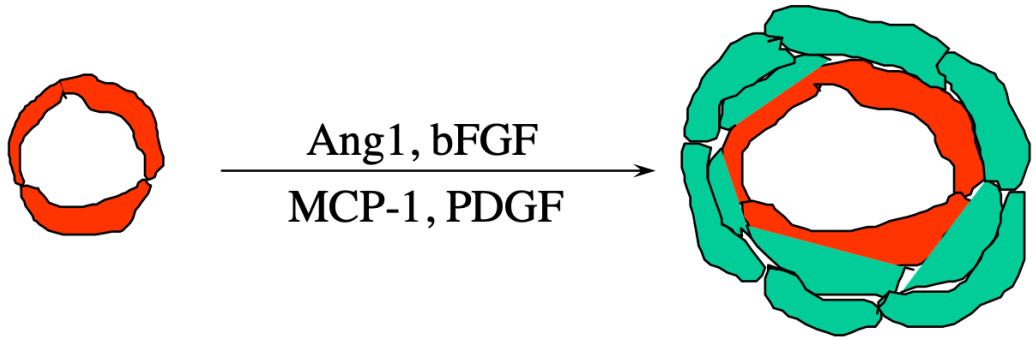
Vasculogenesis

capillaries are formed from vascular progenitor cells



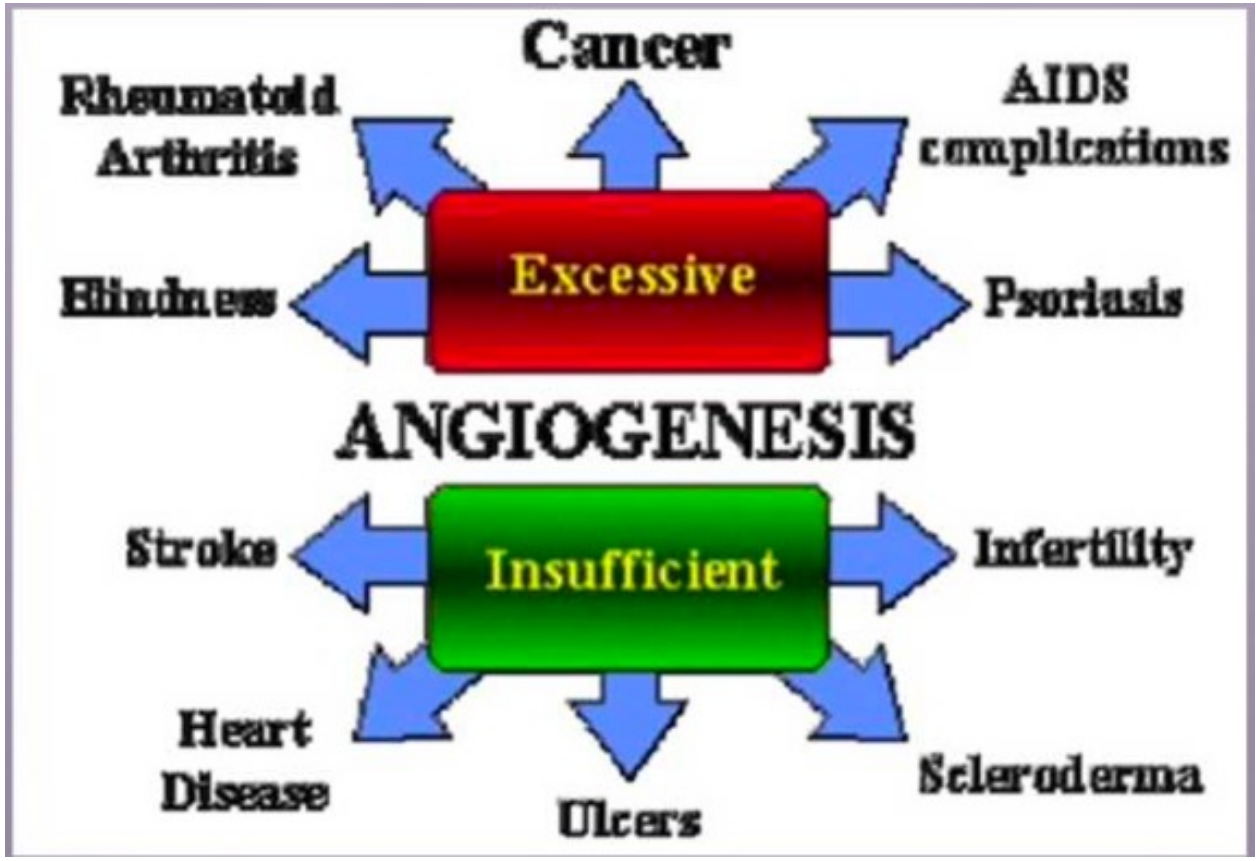
Angiogenesis

formation of new blood vessels from pre-existing vessels



Arteriogenesis

formation of mature blood vessels


Cancer
Rheumatoid Arthritis
AIDS complications
Excessive
Blindness
Psoriasis
ANGIOGENESIS
Stroke
Insufficient
Infertility
Heart Disease
Ulcers
Scleroderma

INSUFFICIENT ANGIOGENESIS AND INFERTILITY

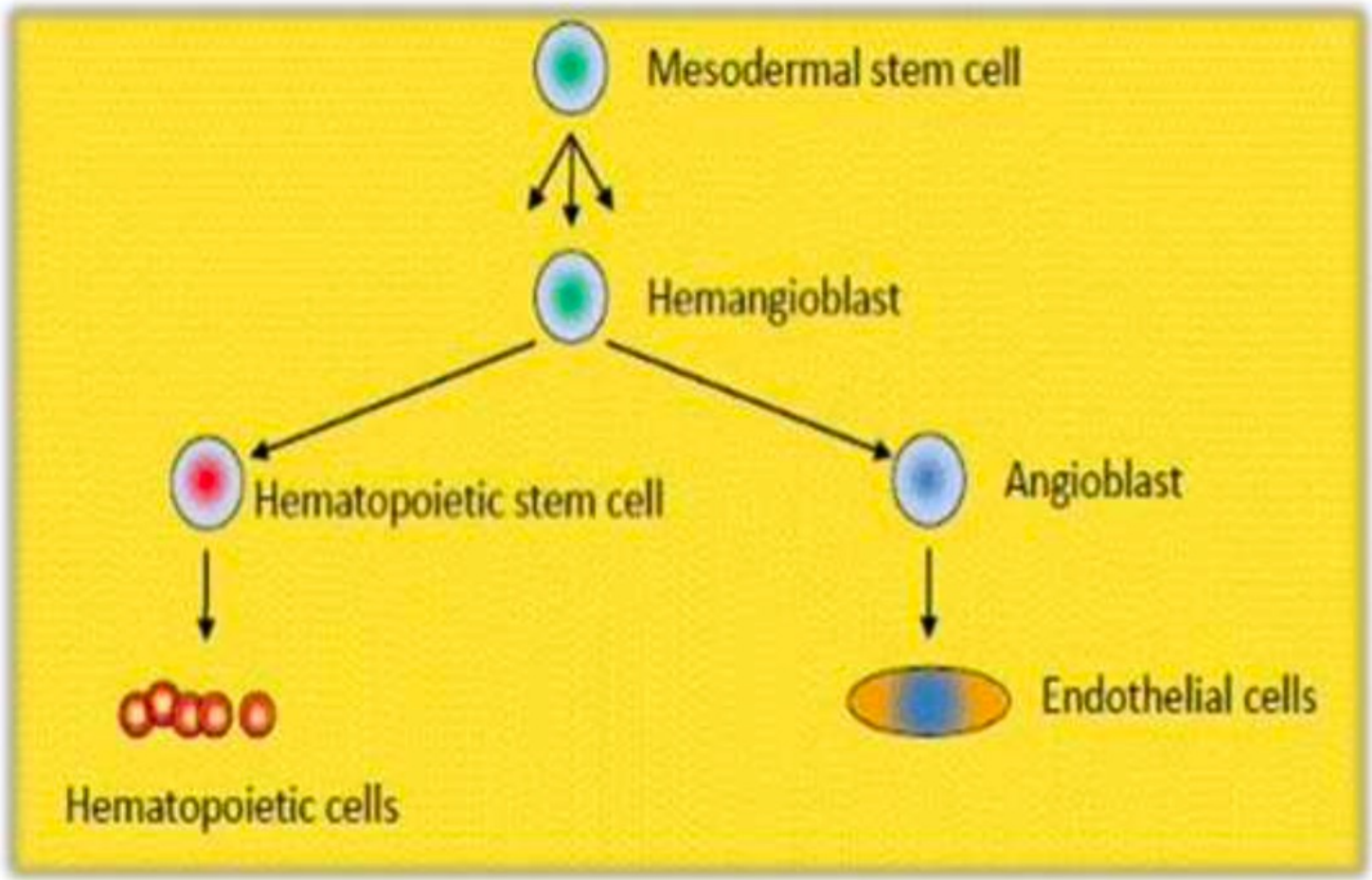
Ovarian Function: Insufficient angiogenesis in the ovaries can lead to impaired blood supply to the ovarian follicles.

Uterine Health: Insufficient angiogenesis in the uterine endometrium can negatively affect implantation and the establishment of a pregnancy.

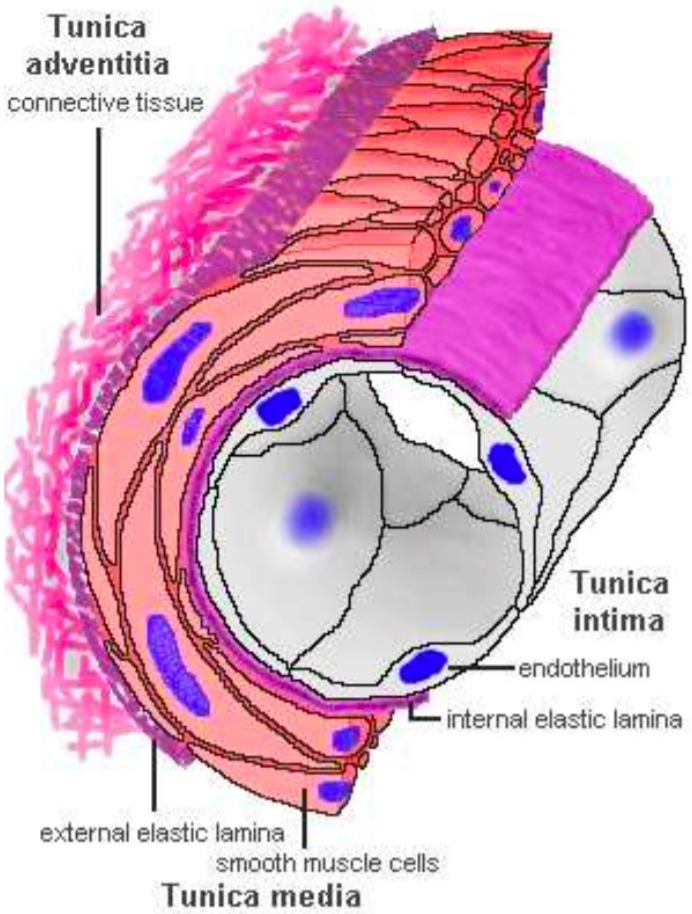
Cervical Mucus: Insufficient angiogenesis in the cervix can lead to alterations in cervical mucus production, potentially hindering sperm mobility and their ability to reach and fertilize an egg.

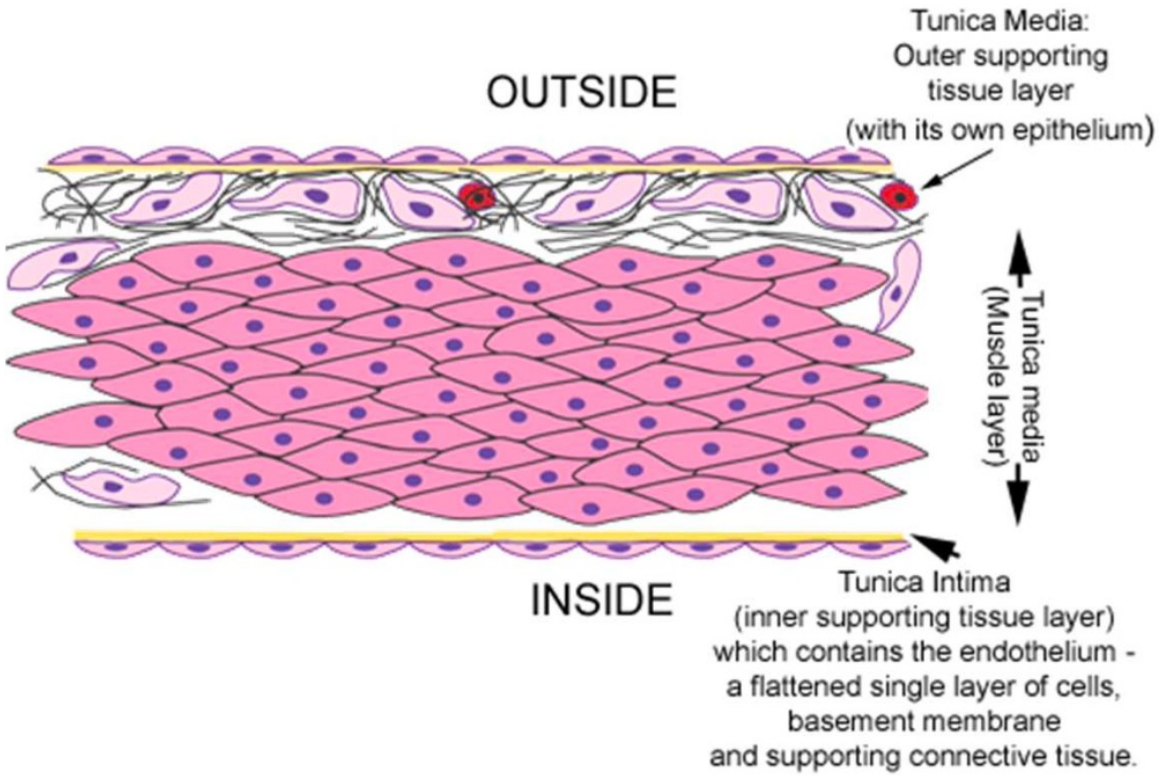
Tubal Function: Insufficient angiogenesis in the fallopian tubes may impair their function, making difficult for fertilization.

Endometriosis: Endometriosis is a condition where tissue similar to the uterine lining grows outside the uterus. This condition can lead to the formation of adhesions and scarring, potentially affecting angiogenesis and causing blockages in the fallopian tubes. It can also impair fertility by altering the pelvic environment.

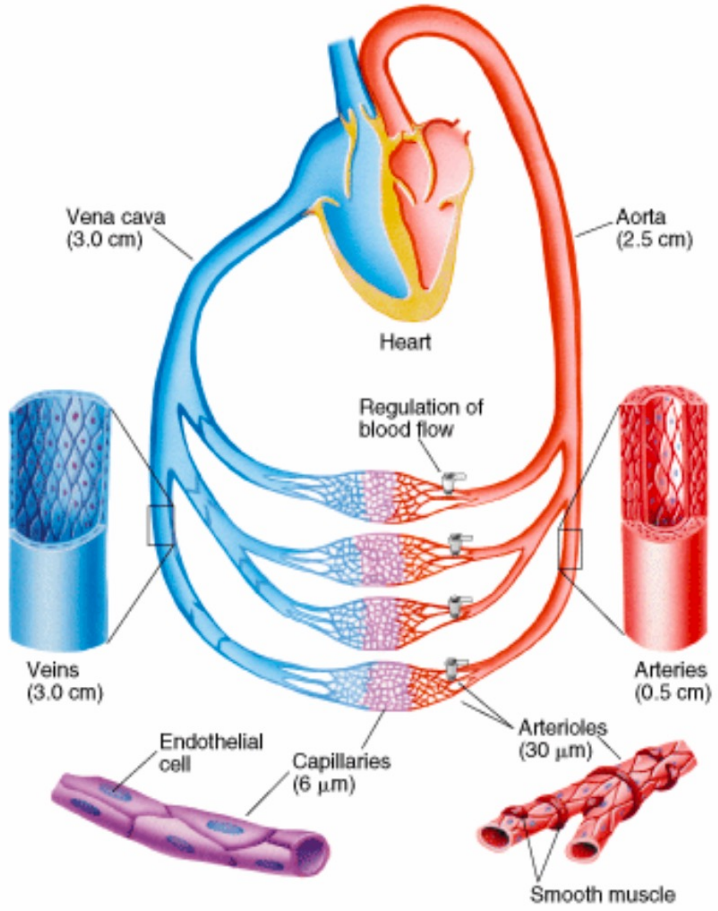

Mesodermal stem cell
Hemangioblast
Hematopoietic stem cell
Angioblast
Endothelial cells
Hematopoietic cells

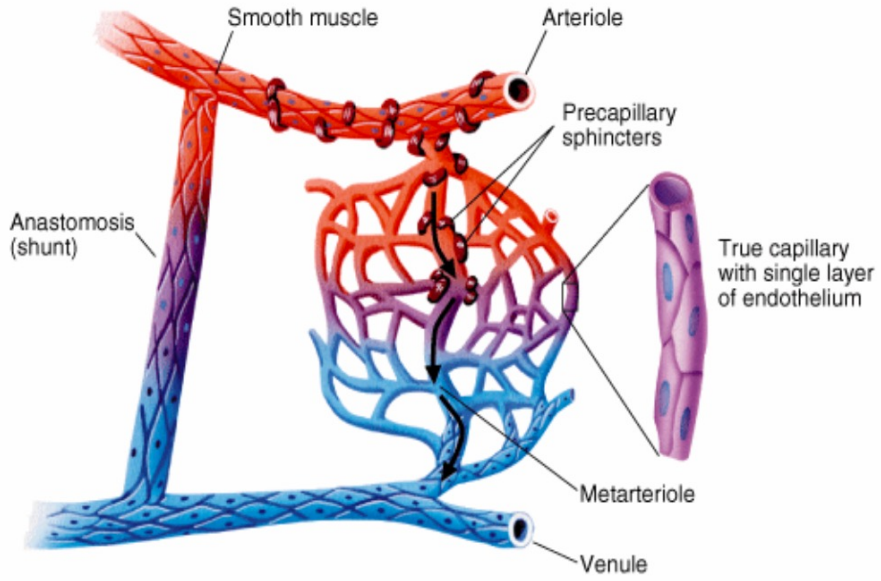
BLOOD VESSELS

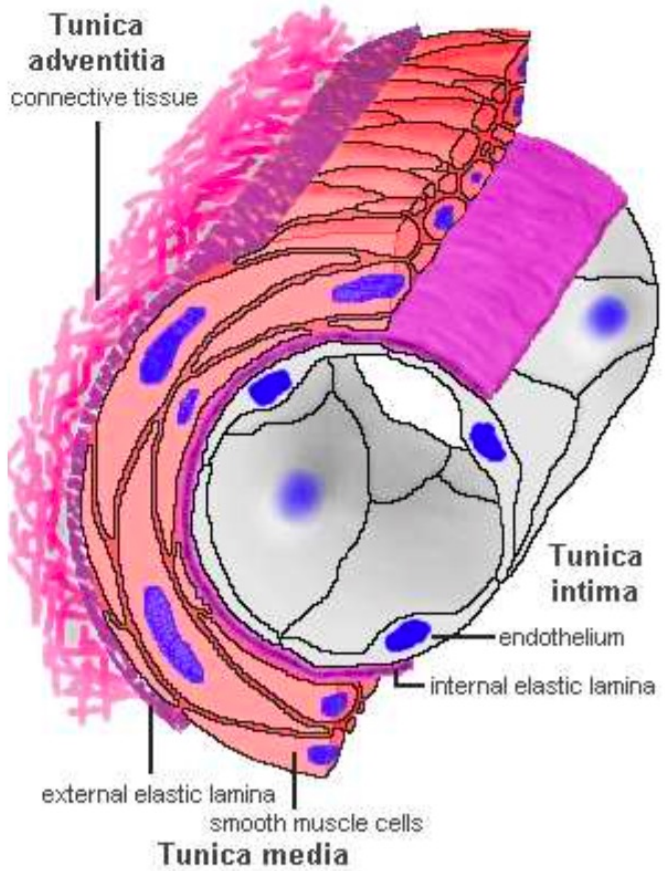


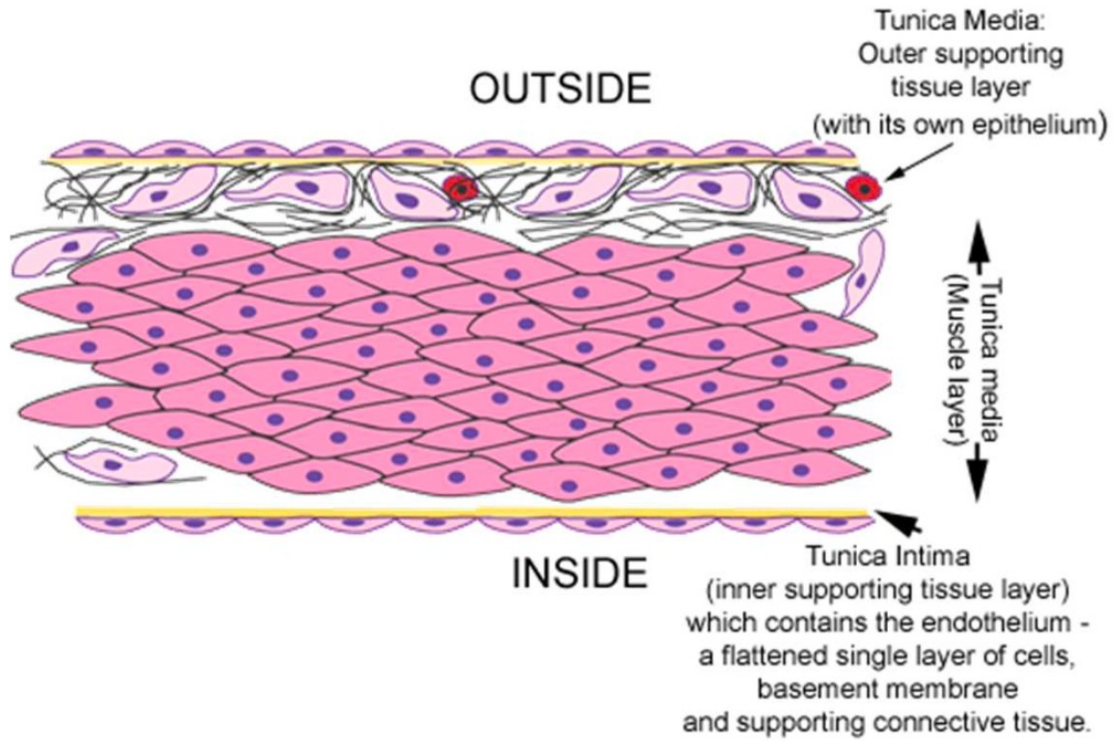


Circulatory system and blood vessels

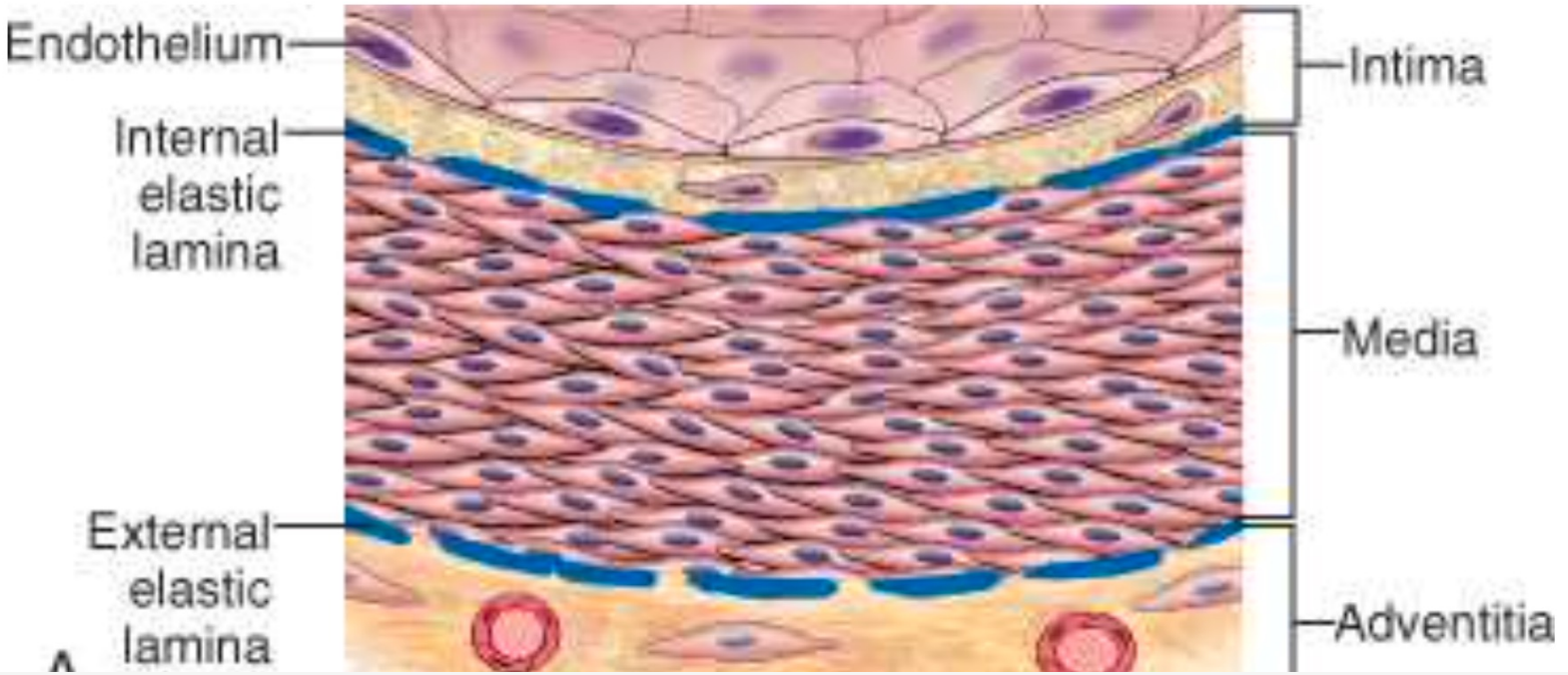





Tunica adventitia
connective tissue
Tunica intima
endothelium
internal elastic lamina
external elastic lamina
smooth muscle cells
Tunica media


OUTSIDE
Tunica Media:
Outer supporting
tissue layer
(with its own epithelium)
Tunica media
(Muscle layer)
INSIDE
Tunica Intima
(inner supporting tissue layer)
which contains the endothelium -
a flattened single layer of cells,
basement membrane
and supporting connective tissue.

The vascular wall



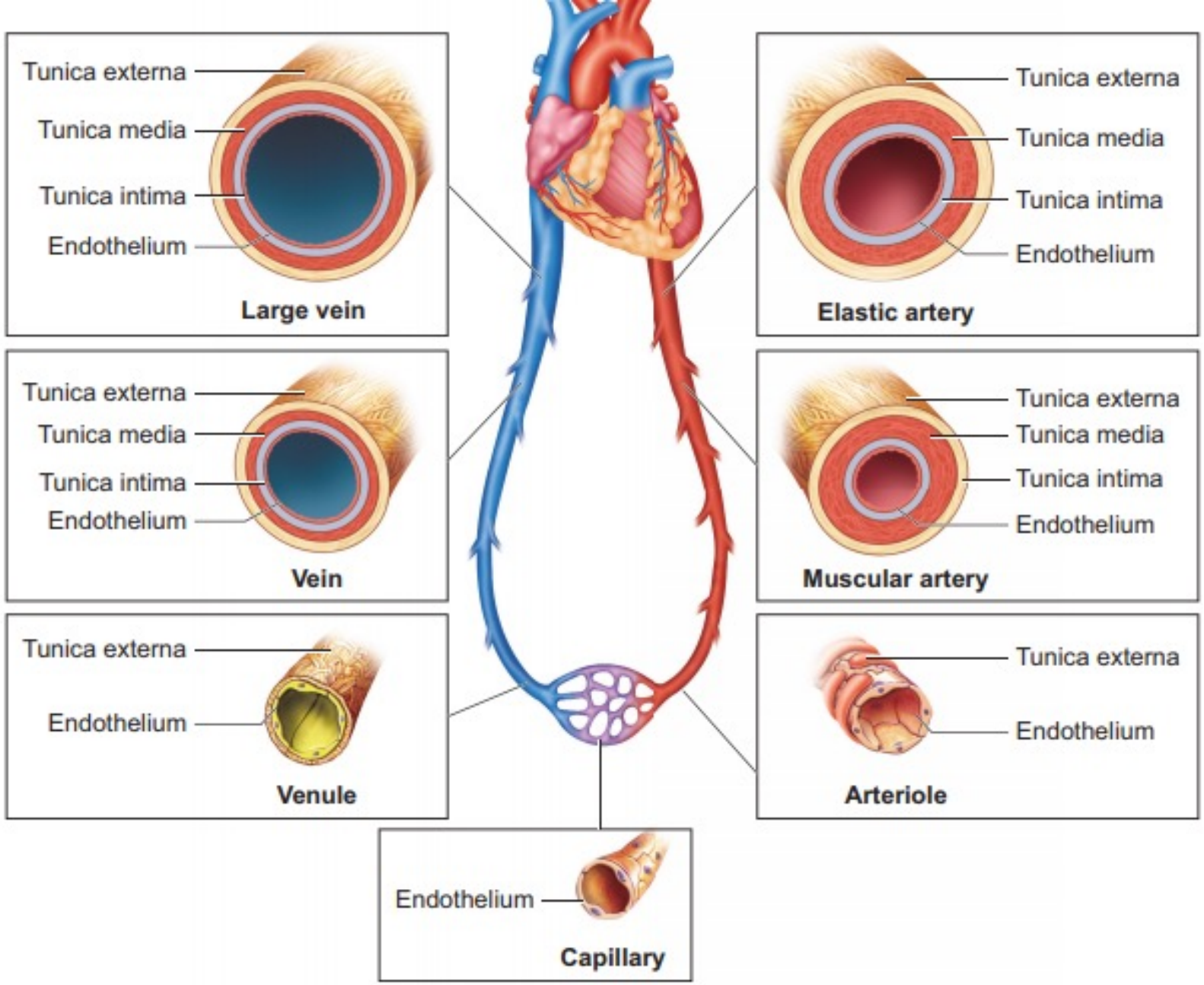
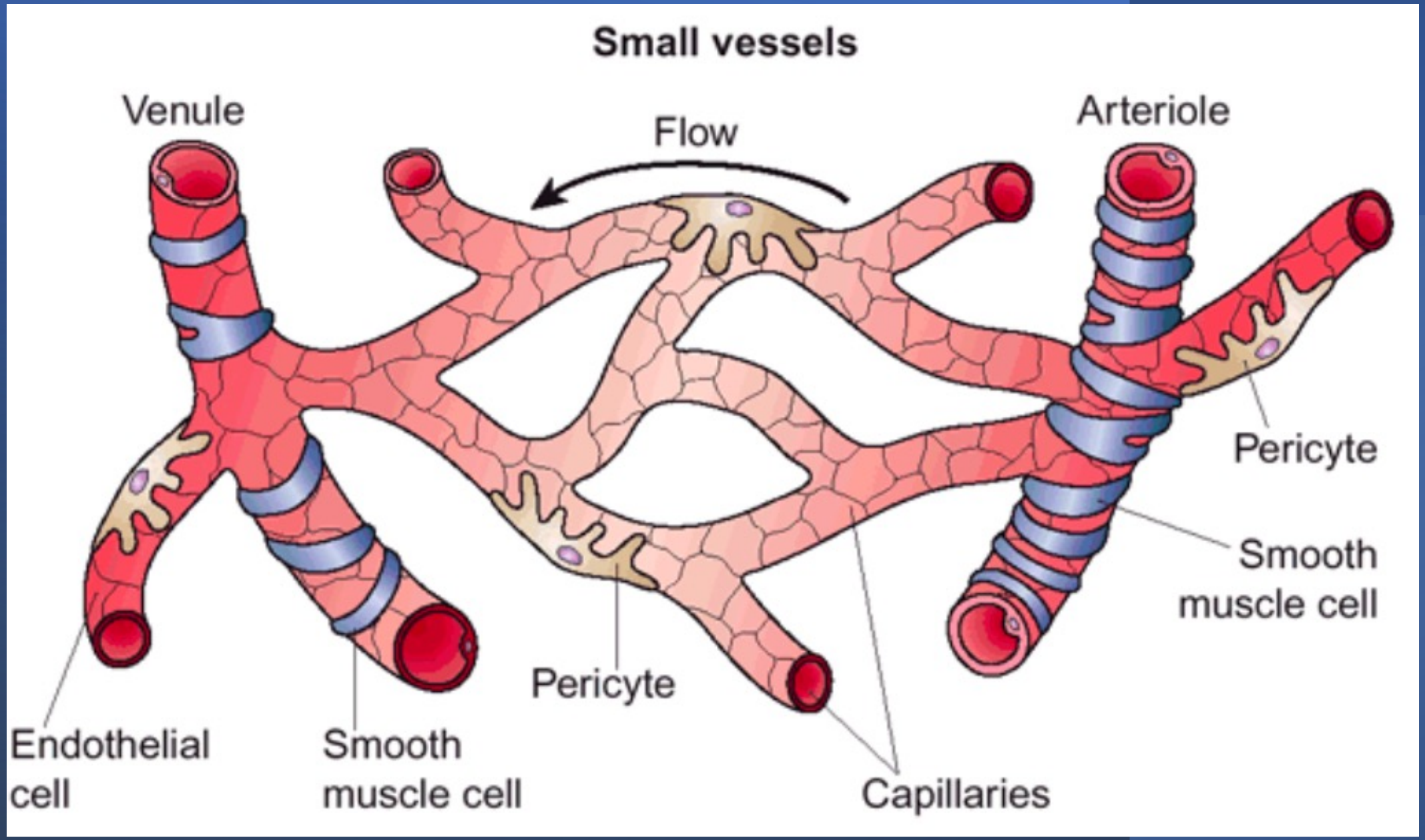


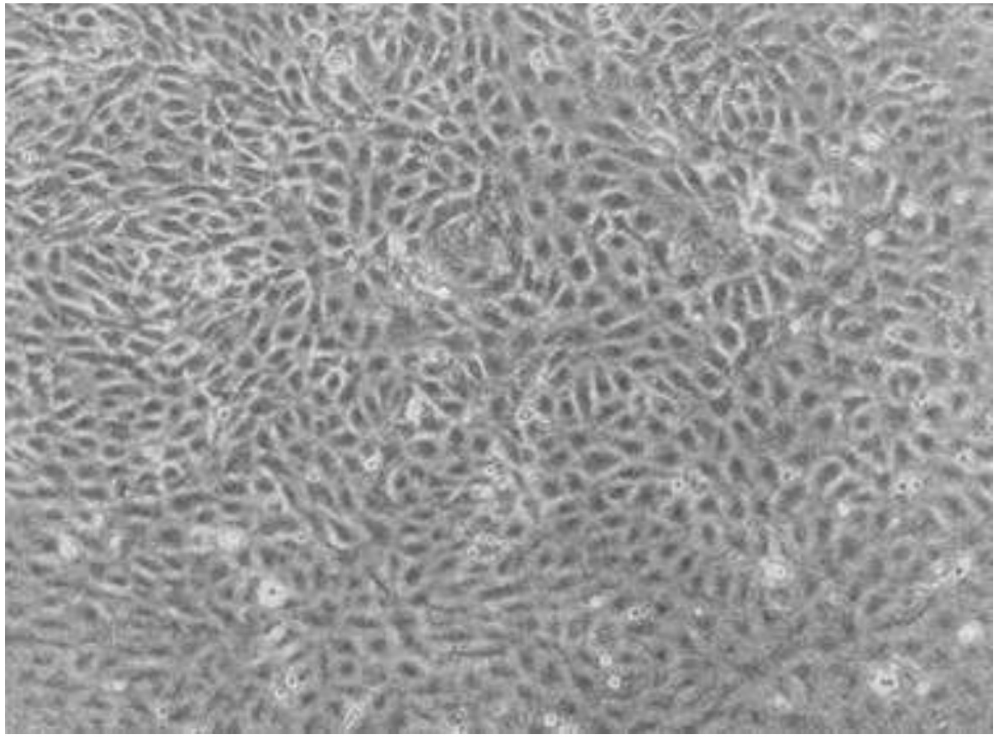
Figure 7.6 Structure of Blood vessels

CAPILLARIES



Endothelial cells

The crucial player in blood vessel formation

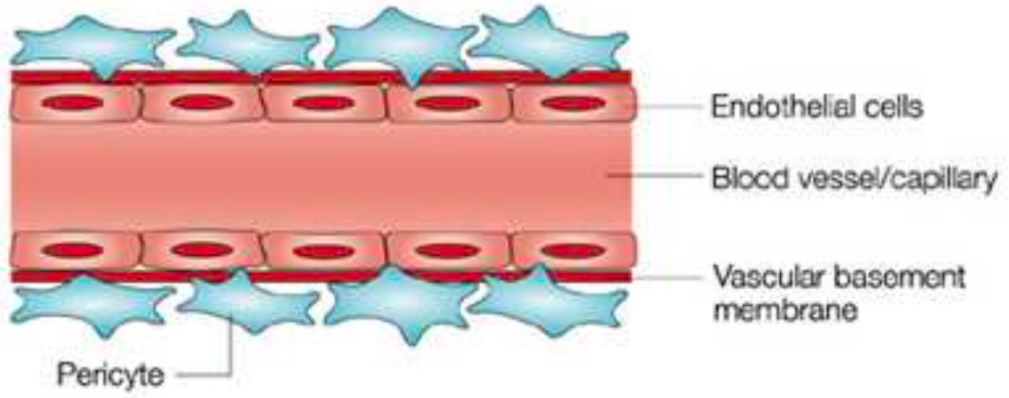


Endothelial cells in culture – cobblestone appearance

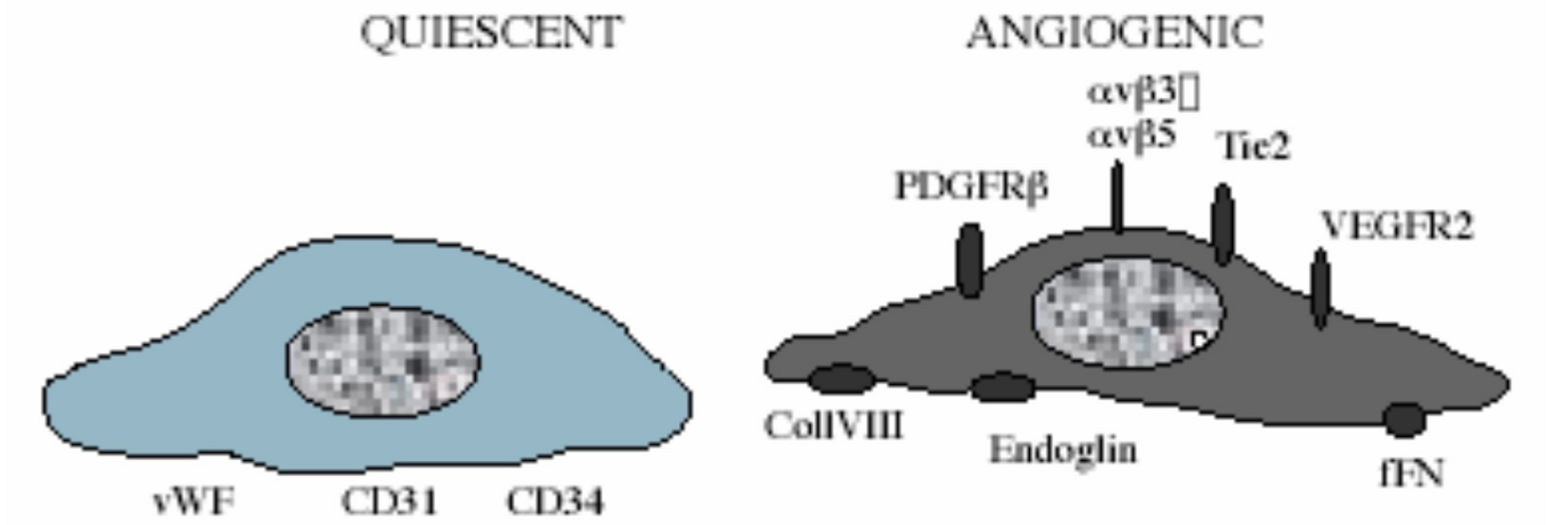
Endothelial cells

- one of the most quiescent and genetically stable cells of the body – turnover time is usually hundred of days

- proliferation is inhibited due to the contact with the capillary basement membrane



ENDOTHELIAL PHENOTYPES



Endoglin is an auxiliary receptor for the transforming growth factor-beta family of cytokines and is required for angiogenesis and heart development.

vWF - Von Willebrand factor

Major growth factors and receptors involved in blood vessels formation

VEGF – vascular endothelial growth factors
VEGF-A – *crucial mediator of angiogenesis*

VEGF-R – receptors for vascular endothelial growth factors

Angiopoietins (Ang-1, 2)
Tie- 2 – receptor for Ang-1, -2

FGFs – fibroblast growth factors

PDGF – platelet-derived growth factor