Cancer Research

What Is Angiogenesis?

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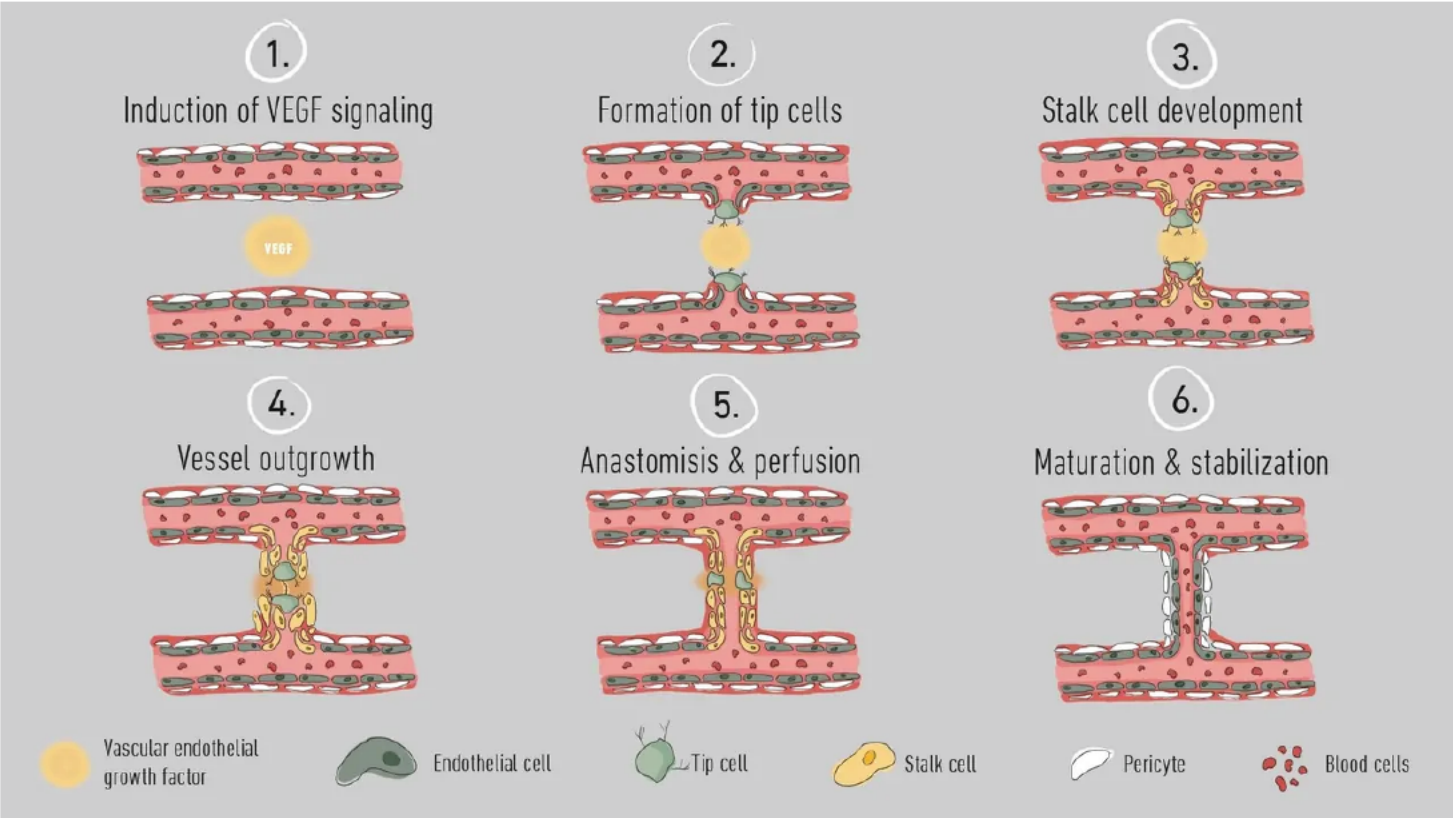

Read time: 8 minutes

Angiogenesis is the formation of new blood vessels, an essential process that facilitates tissue growth and wound healing in living things. However, diseases like cancer can take advantage of angiogenesis and use it to grow and spread. In this article, we will describe the different types of angiogenesis, how it goes out of control in cancer and how we can use drugs to inhibit angiogenesis and reduce tumor growth.

Angiogenesis definition

Angiogenesis is defined as the process by which new blood vessels are formed from existing ones. The term angiogenesis comes from the words “angio” meaning blood vessels and “genesis” meaning creation.

Angiogenesis begins during embryo development, when the growth of new blood vessels is essential for the development of new cells and tissues. The new veins, arteries and capillaries are needed to supply cells with oxygenated blood and nutrients and take away deoxygenated blood and waste products. In adult organisms, the endothelial cells that line the inside of blood vessels (the lumen) are largely dormant. However, specific signals can reactivate these cells and induce angiogenesis when

Angiogenesis was first described in 1794, with the observation that pronounced metabolic activity is dependent on the extent of the vascular system.[1] More recent research investigating how angiogenesis works in cancer began in 1971 with the hypothesis that the growth of cancerous tumors is dependent on angiogenesis.[2]

Regulation of angiogenesis

Angiogenesis is a tightly regulated process. Strict control is necessary to make sure that new vasculature is only formed when and where it is needed, and organisms have several "off" and "on" switches to facilitate this.

If these signals controlling angiogenesis are unbalanced, this can result in the abnormal formation of blood vessels, which can play a role in the pathogenesis of many diseases. Increased angiogenesis can lead to diseases such as cancer, arthritis, retinopathy and atherosclerosis.[3] On the other hand, impaired angiogenesis can lead to heart and limb ischemia and delayed wound healing.[4]

Therefore, it is important to maintain this balance between pro-angiogenic and anti-angiogenic signals, which is known as the "angiogenic switch". This steady equilibrium is maintained through the activity of cellular signaling pathways, particularly through the activation of growth factor receptors.

Pro-angiogenic factors include[5]:

- **VEGFR** – vascular endothelial growth factor receptor
- **EGFR** – endothelial growth factor receptor
- **PDGFR** – platelet-derived growth factor receptor
- **TIE2** – angiopoietin-1 receptor

Anti-angiogenic factors and endogenous angiogenesis inhibitors include[6]:

- Angiostatin
- Endostatin
- Thrombospondin

Types of angiogenesis

Angiogenesis is split into two main types: sprouting angiogenesis and intussusceptive angiogenesis. These occur both in adult organisms and *in utero*, taking place in nearly all organs and tissues.

Sprouting angiogenesis

First discovered almost 200 years ago, sprouting angiogenesis is the more well understood of the two types. During sprouting angiogenesis, new blood vessels sprout from pre-existing ones following a gradient of growth factor signals produced by endothelial cells.[1,7] It is initiated and driven by the secretion of pro-angiogenic growth factors such as VEGF.

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