WHITEPAPER

Biocare Basics:
Angiogenesis: How Tumors Stay Fed

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Biocare Basics: Angiogenesis: How Tumors Stay Fed

Tumors are abnormal masses of tissue that form from unchecked cellular growth and division. While the behavior of these neoplastic cells is unlike that of normal cells, their needs are very much the same. Whether benign or cancerous, all living cells rely on a constant supply of oxygen and nutrients for survival, as well as the removal of waste products, which keeps cells from being poisoned by their own metabolism.[2,3] These functions are performed by the circulatory system, which ferries these products in the blood and lymph through a network of vessels throughout the body. In order to survive, tumors must obtain these things in proportion to their rate of growth by stimulating the growth of new blood vessels, a process known as angiogenesis.

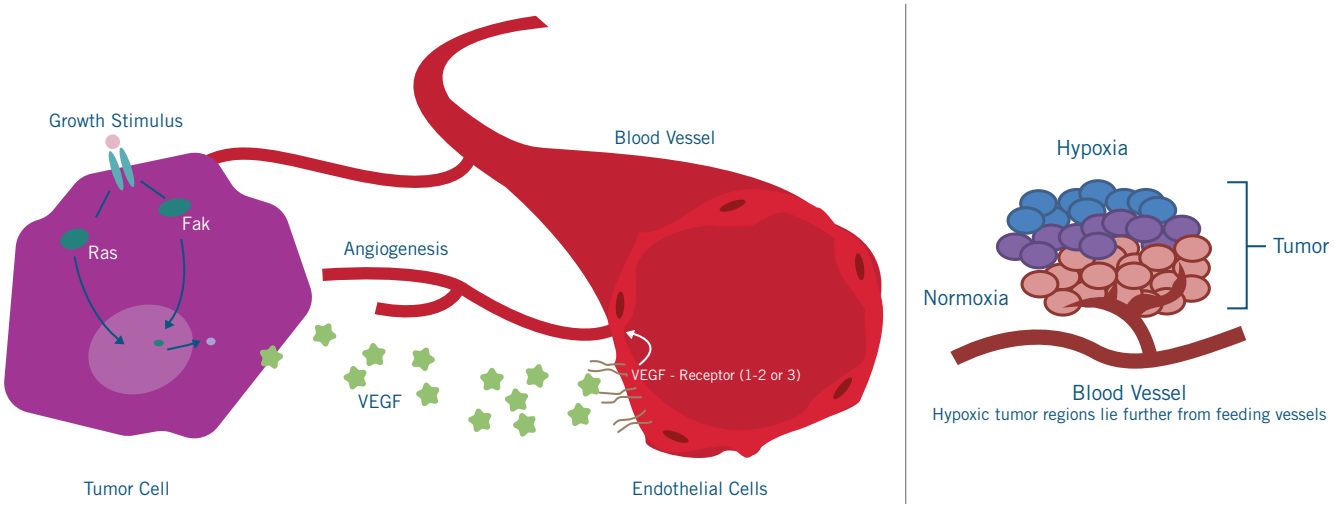
Angiogenesis is regulated by more than a dozen different proteins, which serve as activators and inhibitors meant to induce new vascular growth only where it is needed, such as in states of growth and healing.[2,4] However, tumors have developed ways of manipulating these signals by secreting these proteins in response to oxygen and nutrient deprivation.[1,2] This deprivation occurs when tumor growth outstrips the existing vascular supply, and the resulting hypoxia triggers what has been termed the "angiogenic switch" in tumor protein production.[1]

The angiogenic growth factor VEGF has been the focus of most research into this phenomenon. VEGF expression is induced by hypoxic conditions in the tumor microenvironment via hypoxia-inducible factor-1 alpha (HIF-1 alpha).[2] When VEGF is secreted by the tumor into the surrounding tissue, it binds to receptors on the surface of endothelial cells, transmitting the signal for new blood vessels to "sprout" from the existing network.[2,3] This allows the tumor to be fed and is key for its ability to grow and metastasize.

Since angiogenesis is such an important mediator of tumor progression, levels of angiogenic factors can indicate cancer aggressiveness.[1,2] These factors are known to affect prognosis in adenocarcinomas of the uterine cervix, endometrium, ovary, and stomach.[2] Researchers have also found a significant correlation between VEGF expression and prognosis in colorectal, breast, and lung cancer, as well as head and neck squamous cell carcinoma, Kaposi sarcoma, and malignant mesothelioma.[2]

Angiogenesis inhibitors have also been employed as a method of cancer treatment. These monoclonal treatments and other drugs can bind VEGF and its receptor to block the angiogenic signaling pathway.[3,4] Without new blood supply, the tumor cannot continue to grow.[3] However, angiogenesis inhibition has not been proven to sufficiently clear the cancer, so it is typically combined with other conventional cancer treatments.[3]

Angiogenesis Illustration



Biocare provides immunohistochemical stains for angiogenic markers such as VEGF, HIF-1 alpha, and CD31 as well as markers for cellular hypoxia such as CA-9. To learn more about these offerings and their applications, please visit biocare.net or call our Technical Support line at 1-855-504-9997, Option 3.

1. Liao, D., Johnson, R.S. Hypoxia: A key regulator of angiogenesis in cancer. Cancer Metastasis Rev 26, 281–290 (2007). https://doi.org/10.1007/s10555-007-9066-y
2. Nishida, N., Yano, H., Nishida, T., Kamura, T., & Kojiro, M. (2006). Angiogenesis in cancer. Vascular health and risk management, 2(3), 213–219. https://doi.org/10.2147/vhrm.2006.2.3.213
3. Rajabi, M., & Mousa, S. A. (2017). The Role of Angiogenesis in Cancer Treatment. Biomedicines, 5(2), 34. https://doi.org/10.3390/biomedicines5020034
4. National Institutes of Health (NIH). (2018, April 2). Angiogenesis Inhibitors. National Cancer Institute. Retrieved February 7, 2023, from https://www.cancer.gov/about-cancer/treatment/types/immunotherapy/angiogenesis-inhibitors-fact-sheet