Growth Factor

Growth factors (GFs) are essential substances found in humans that enhance the cellular growth, proliferation, and cellular differentiation.

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Growth Factors

Wilma Friedman, Wilma Friedman, in Basic Neurochemistry (Eighth Edition), 2012

Introduction: What is a Growth Factor?

Growth factors are proteins that

Principles of Tissue Engineering

F. Akter, in Tissue Engineering Made Easy, 2016

2.5 Growth Factors

Growth factors are soluble signaling molecules that control cellular

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regulate many aspects of cellular function, including survival, proliferation, migration and differentiation. In non-neuronal cells growth factors stimulate proliferation, but mature neurons are postmitotic and cannot re-enter the cell cycle. Consequently, when considered in the context of the nervous system, growth factors are frequently referred to as neurotrophic factors. These factors are critical for proper development of the nervous system from the earliest embryonic stages. Growth factors determine the fate of cells as they differentiate from being progenitors along either neuronal or glial lineages. In addition, during embryonic development, growth factors are crucial for regulating neuronal survival, determining cell fate and establishing proper connectivity. Many growth factors have now been identified that function in the brain, even factors that were originally identified in other systems, and there is an ever-expanding landscape of growth factor interactions with cellular populations in the nervous system, both during development and in the adult. The nervous system is composed of an extremely

responses through specific binding of transmembrane receptors on target cells. Growth factors applied to a cell–scaffold construct can help promote tissue regeneration in comparison to non-use of growth factors (Ikada, 2006). Growth factors that have been used in TE include bone morphogenetic proteins, basic fibroblast growth factor (bFGF or FGF-2), vascular epithelial growth factor (VEGF), and transforming growth factor-β (TGF-β) (Lee et al., 2011).

What is the rationale for growth factor immobilization?

Growth factor immobilization prevents the loss of bioactivity due to diffusion seen in conventional delivery of growth factors in the soluble form. Immobilization also allows a more controlled release of the growth factor.

How are growth factors immobilized?

The growth factor can be immobilized to the scaffold by either noncovalent or covalent binding (Table 2.5, Vasita and Katti, 2006).

Table 2.5. Immobilization of Growth Factor to Scaffold (Vasita and Katti, 2006)

heterogeneous population of cells. In addition to the broad categories of neurons, astrocytes and oligodendrocytes, there are multiple types of neurons with a diversity of structure, function, localization, phenotype and projections, each with specific needs for trophic support. Understanding the complexity of these relationships is a major challenge (see Chaps. 1, 6, 28).

In this chapter the neurotrophin (NGF) family of factors, which were the first growth factors to be identified for actions in the nervous system, will be emphasized. Several other families of growth factors that have important functions in the peripheral and central nervous systems, including the GDNF family, the neuregulins, and the neurotrophic cytokines will be discussed. Finally, other factors that were initially discovered in non

Noncovalent growth factor immobilization	Encapsulation	Physical entrapment of the growth factor in the carrier matrix. Carrier systems used to deliver growth factors by their physical entrapment include polymeric microspheres, liposomes, hydrogels, and foams.
	Adsorption of the growth factor on the matrix surface	Physical adsorption of growth factors on the carrier material prevents their denaturation. Growth factors that can naturally bind to the extracellular matrix are desirable.
	Ion complexation	Formation of polyionic complexes with each other. A positively charged growth factor can be complexed with negatively charged polymer chains in the carrier matrix. The complexed growth factor will be released from the growth factor–carrier complex if a significant

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