One of the major research areas in tissue engineering is to control the material’s chemistry for the promotion of highly specific binding interactions between materials and cells, generally involving enrichment of the material surface to promote cell adhesion with extracellular matrix (ECM) components or their functional domains. Among these functional biosignal molecules, RGD (arginine-glycine-aspartic acid)-containing peptides are by far the most effective and most often employed peptide sequences promoting the adhesion of cells on material surfaces. The ECM signalings through integrins are transduced via the cytoskeletal elements by the interaction of the cytoplasmic domain of the integrins with the cytoskeleton. This signal transduction induces cell shape changes leading to spreading and growth. It has been well established that the RGD sequence of fibronectin could bind with integrin and signalling is regulated through this cell-binding domain. In recent years, the tetrapeptide arginine-glycine-aspartic acid-serine (RGDS) has been receiving much attention as one of the most effective cell adhesive moieties.

The second type of biosignal molecules are growth factors. They are protein fractions inducing a change in cellular functions by transducing proliferation or differentiation signals and play a comprehensive role in the modulation of tissue growth and development. Mitogenic activity is one of the earliest mechanisms of growth factor action in which the rate of cell turnover is increased. It is proposed that mitosis is stimulated by growth factors through secondary intracellular messengers that can upregulate DNA synthesis resulting in mitosis. The growth factor molecules interact with the cognate receptor on the cell surface to form a complex, and the complex aggregates on the cell surface before being internalized into the cell. The internalized complex is then decomposed in the lysosomes. As a result of this rapid internalization process the continuous effect of growth factor on cell metabolism is decreased. It has been realized that the events on the cell surface were enough to transduce the signal to the cellular nucleus. In conclusion, the biomaterials with immobilized adhesion and/or growth factors had the potential to enhance the cellular affinity.