

Biomolecules as Anti-Cancer Therapeutics: Alternative to Chemotherapy

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Chemotherapeutics have been used as potential anticancer agent for last 75 years but they suffer from some of the major drawbacks of toxicity, non-specificity and adverse side effects on various organs and tissues. "Biologics" represent a consortium of biomolecules including nucleic acid, protein and peptide and have emerged as potential anticancer agent for cancer therapy [1]. They mimic various cellular pathways to modulate a specific function in such way that can act as molecular switch both inside and outside the cell. A brief introduction to such biologics is mentioned below.

Nucleic acid

Nucleic acid includes DNA, RNA, and small interfering RNAs (siRNAs). DNA based therapeutics include transgenic plasmids for gene therapy, as antisense oligonucleotides, ribozymes, DNazymes and siRNAs. Some of the commonly studied nucleic acids are TNF- α , Bcl12-siRNA, MRP1-siRNA, VEGF-siRNA etc. as anticancer therapeutics [2,3]. These therapeutics have more specificity and lesser toxicity over small low molecular weight pharmaceuticals [4].

Proteins

Proteins includes antibodies [5,6], granulocyte counting stimulating factor (GCSF) [7,8], interferon [9,10] megakaryocyte growth and development (MGD) factor [11,12]. The specific receptors that are over expressed by cancer cells can be targeted by antigen binding fragment (Fab) of antibody. The antibody can target specific cellular pathway leading to cell arrest or activation of apoptosis.

Peptides

Peptides have lesser toxicity, high specificity and can easily be designed to interact specifically with biological targets like endogenous hormones, growth factors, neurotransmitters, signaling molecules, immunologic and defense agents [13]. A few examples of such anticancer peptides are BH₃/BCL₂ targeting peptides [14], luteinizing hormone-releasing hormone gene receptors (LHRHR) peptides [15] and RGD peptides [16,17]. Some of the common advantages and disadvantages of biologics are mentioned in table 1.

Advantages	Disadvantages
Negligible toxicity	Short half life
Biocompatibility	Lesser systemic circulation
Easy tunability	Degradation by enzymes
Specificity	Immunogenicity

Table 1: Advantages and disadvantages of biologics.

Biologics are potential anticancer agents and can replace the existing chemos. Nanotechnological approach for delivery of biologics can surpass most of the drawbacks. Recently, nanocarrier prepared from biodegradable polymers for delivery of the biologics have been reported thus opening new horizon for the biologics [18,19].

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