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# Applications of Antisense Peptide Nucleic Acid in Biomedicine and Biosciences

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## Opinion

Peptide Nucleic Acids (PNAs) are synthetic mimics of DNA/RNA [1] containing N-2-aminoethylglycine repeating units in place of sugar-phosphate backbone of DNA or RNA. Due to the absence of electrostatic repulsions, PNA/DNA duplexes are thermally more stable as compared to DNA/DNA double helix. The sequence selective nature and mismatch intolerance of PNA probes make them useful in biomedical and biosciences applications [2]. PNAs can be used as antisense agents that block the translation process and inhibit the synthesis of targeted protein. These antisense oligonucleotides are used to treat genetic mutations or different infections.

## Anticancer Agents

For instance, antisense PNA (APNA) was found to inhibit the over expression of microRNA-155 which is responsible for causing various diseases especially tumors. An encapsulated APNA conjugate was found to obstruct microRNA-155 over expression that resulted in finding of potential anticancer therapeutics [3]. In another report, radiolabeled conjugate of PNA-peptide inhibited the over expression of B-cell leukemia-2, a proto-oncogene in non-Hodgkin's lymphoma via antisense activity [4]. Another citation also concluded the inhibition of CerbB-2 proto-oncogene over expression through 125I labeled APNA in human ovarian cancer cell lines SKOV3 [5]. Furthermore, it was also reported that DNA transcript promoter of lung cancer SPC-A1 was blocked by APNA after changing its physiological characteristics [6]. In addition, APNAs also provide a new methodology which can suppress nonsense terminations that are found to cause cancer and a large number of hereditary genetic disorders [7].

## Antiviral Agents

APNA can also be potentially used as antiviral agents and it was evaluated by Lee et al. [8] with PRF-1 signal as target. In viruses, PRF-1 signal causes synthesis of RNA replicase polyproteins for genome replication. Recently, APNA with low cellular toxicity was reported to target replication process of Hepatitis B virus. This virus was found to be responsible for causing chronic hepatitis, cirrhosis and carcinoma [9].

## Antibacterial Agents and Antibiotics

Nowadays, increasing multidrug resistance in bacteria poses major threat for human health. It is one of the serious problem which is an alarm for the need of new antibacterial drugs as these pathogenic bacteria exhibit resistance for traditional antibiotics due to their excessive use.

APNAs as antibacterial agents were found to treat infections due to resistant reversal in bacteria. APNA was found to be a therapeutic platform that targets varied genes in Pseudomonas aeruginosa that acquired resistance to most of the antibiotics [10]. Acinetobacter baumannii causes common and severe community¬ and hospital ¬acquired infections. In another report, Wang et al. [11] reported APNAs to show strong inhibitory effects in multiresistant drug for Acinetobacter baumannii with minimum bactericidal and inhibitory concentration of 10 and 5 μM, respectively.

APNAs were also found to effective antibacterial agent and its potential was studied by Sadeghizadeh et al. [12]. The studies revealed that PNA conjugate might prove as an outstanding candidate for immunological and DNA vaccine. These APNAs were also found to target essential genes diseased with Klebsiella pneumoniae (10^4 CFU) with negligible toxicity to the human cells [13].

## Conclusion

PNAs, created in 1991 are the natural nucleic acid analogues which are found to possess potential applications in biomedicine and biosciences due to their stability and high binding affinity. Due to their great impact as antisense agents, PNAs are gaining interest in the field of research and development as anticancer, antiviral and antibacterial agents.

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