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Evolution of DNA aptamers for use as a biological receptor in biosensing platforms

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In 1990, Szostak and Gold labs independently developed techniques to select Ribonucleic Acid (RNA) against specific ligands. The Gold laboratory called the method Systematic Evolution of Ligands by Exponential Enrichment (SELEX). The term aptamer was coined to collectively describe these synthetic polynucleotides that are artificially evolved to bind a target of interest in a lock and key manner. A custom designed synthetic library is subjected to iterative rounds of selection and mutagenesis or enrichment PCR amplification until a resulting dominant aptamer sequence is isolated from the random pool. Both RNA and DNA have been extensively used to target a plethora of molecules from ions, organic, inorganic, peptides and proteins, bacterial and mammalian cells to viruses. Developing single stranded DNA aptamers capable of binding small molecular targets pose some complexities. This talk elaborate on the intricacies of developing highly selective ssDNA aptamers capable of binding small molecules such as estradiol, bisphenol A and a commonly used herbicide glyphosate in a variety of biological and environmental matrices. Once the target binding characteristics are determined, the DNA aptamers unique physical and chemical properties are utilized to develop a variety of sensing platforms such as eastern blotting, dynamic light scattering-resistive pulse sensing, gold nanoparticle-based sensing, impedance spectroscopy, lateral flow, Enzyme Linked Oligonucleotide Assay (ELONA) and microfluidics. Aptamers enabled successful detection of small molecular targets in a range of detection limits reaching femtomolar levels in a variety of biological and environmental matrices tested.

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