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Aptamer panning against gold

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APTAMER PANNING AGAINST GOLD

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Oligonucleotide aptamers are single-stranded sequences that exhibit high affinity and specificity for a particular non-nucleotide target including, but not limited to small molecules, proteins, and even whole cells. Aptamers are conventionally isolated and identified using a multi-round screening approach called "Systematic Evolution of Ligands by Exponential Enrichment" (SELEX) in which a pool of approximately 10^9 random candidate sequences is continuously enriched with amplified copies of “winning” sequences or adsorbates from prior selection rounds. While SELEX has revolutionized the discovery of numerous DNA and RNA-based aptamers for a variety of targets and dominated the field for two decades as a screening approach, we have developed a *non*-SELEX screening approach we call CISL (Competition-Induced Selection of Ligands) to identify single-stranded DNA aptamers for gold substrates. One of the key differences in our competition-based screening approach is the elimination of intermittent, time-intensive elution and amplification steps of random sequences that (1) can introduce undesired PCR side products (e.g. partially elongated duplexes) into the candidate pool and (2) bias the candidate pool towards early winners that may simply outnumber higher affinity aptamer candidates introduced at later selection rounds. Following aptamer selection against our gold-based target (e.g. planar crystalline gold, gold nanospheres, gold nanorods) we then evaluate sequences to identify base consensus as well as shared structural elements such as hairpins, internal loops, and multi-branched loops to reveal any shared patterns in the identified primary and predicted secondary structures of the ~20 identified aptamer sequences for a given gold target. Lastly, we have ranked our aptamer sequences for one of our gold targets in terms of their frequency as a bound species using a high throughput sequencing method known as “deep sequencing” or next generation sequencing (NGS). As aptamers continue to be pursued as potential analogs and even substitutes for antibodies and other ligands in the broader materials community, we continue to adapt our unconventional screening approach to hopefully enable faster and easier aptamer identification for a rich range of material targets.