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RNAs for omics applications

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(1) Specific knock-down of target genes in cells using siRNAs has proven to be a powerful tool for functional genomics and a promising future therapeutics. We are using siRNAs targetin gtranscription factors to perturb specific gene expression programs. Combined with DNA microarray, novel target genes of specific transcription factors can be identified. I will also introduce our effort to extend this approach to a regulome-level, by using a number of siRNAs targeting a family of transcription factors.

Recently, however, several studies have shown that siRNAs can trigger non-specific inflammatory response in immune cells. Here we show that siRNA can also induce inflammatory responses in several established human cell lines in a cell-type specific manner. Different cell lines showed different level of inflammatory response, and the pattern of inflammatory response was siRNA-specific. We also found that different lipofection reagents have different effects in triggering inflammatory responses without any siRNA involved. Our results provide an important guideline in designing and analyzing siRNA-based experiments in cultured cell lines.

(2) Aptamers are short, single-stranded DNAs or RNAs which can fold into specific three-dimensional structures to recognize target molecules such as small chemicals, proteins, or even cells. High affinity aptamers for specific target molecules can be isolated from a library of randomized sequences in vitro by using the SELEX process. In addition to the affinity and specificity which rival those of antibodies, aptamers are stable and non-immunogenic, which makes them promising tools for diagnostic and therapeutic applications. In addition, high-throughput selection of aptamers against extracellular proteins or secreted peptides can provide a novel functional proteomics tool. I will present recent progresses in our laboratory in screening aptamers which can specifically bind to therapeutically important biological targets with high affinity.