Molecular Foundation of Cancer: A Chemical Biology Approach

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To produce a full understanding of the molecular basis of diseases, we will need to have novel molecular probes to recognize disease targets of interest. Currently, molecular medicine lacks effective probes for understanding and treating human diseases. Of the many potential molecular probes, a new class of designer nucleic acids (called aptamers) holds great potential. Aptamers can be selected for single proteins and even small molecules. Recently, we have applied a novel cell-based aptamer selection strategy (Cell-SELEX) to generate multiple aptamers for the specific recognition of biological cells without prior knowledge of the biomarkers for the specific type of cells. Cell-SELEX uses whole intact cells as target for aptamer selection in order to produce molecular probes binding specifically to the target cells. The selection process is simple, fast, and reproducible. The selected aptamers have dissociation constants in the nanomolar to picomolar range. So far, we have selected molecular probes for many different cancers and used these aptamers in making molecular tools for cancer studies. These tools have been used for the ultrasensitive detection of tumors, the molecular profiling of individual cancer patients, the targeted drug delivery, and, most importantly, the cancer biomarker discovery. We will report our most recent progress in this exciting research area especially in molecular elucidation of the cancer biomarkers.

Dr. Weihong Tan received a Ph.D. in Physical Chemistry from the University of Michigan, Ann Arbor in 1993. He was then named a Distinguished Postdoctoral Researcher by the US-DOE and worked at Ames Laboratory. In 1996, he joined the University of Florida as an Assistant Professor of Chemistry, and was promoted to Associate Professor (2001). Full Professor (2003) and Distinguished Professor (2012) ranks. He was named a University of Florida Research Foundation Professor (2004 and 2012), and V. T and Louis Jackson Endowed Professor (2008 till now). Tan's group has developed research programs in bioanalysis, chemical biology, bionanotechnology, and biomedical engineering. Currently, the Tan group is working on synthesizing a variety of DNA probes for biomedical studies and for DNA nanomotors, in developing new nanomaterials and bionanotechnology for bioanalysis, molecular imaging and drug delivery, and in elucidating molecular foundation of diseases such as cancer using a chemical biology approach. His work has been recognized by many awards, including the Pittcon Achievement Award in 2004. Tan has published extensively in the field of chemical biology, bioanalysis and bionanotechnology with more than 320 papers, with an H-index of 64 and more than 13,500 citations.