

THE HARTWELL FOUNDATION

2006 Individual Biomedical Research Award

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New Technologies and Methods for Developing Optimized Quick-Response DNA Vaccines for Infectious Diseases

Dr. Tian proposes to develop a fast and cost-effective method to make fully optimized, quick-response vaccines against potentially fast-mutating infectious agents (pathogens). His approach takes advantage of innovative high-throughput combinatorial gene (DNA) synthesis technology developed in his lab, which enables rapid synthesis of large pools of specific genes in a cost-effective manner. In contrast to current vaccines, which require utilizing the complete pathogen, the premise in DNA vaccination is that only a single gene *derived* from a pathogen is required to produce an immunological response. This is because when the gene finds its way into a cell it will get copied and multiplied, which leads directly to synthesis of the gene product, resulting in a strong immunological response known as cell-mediated immunity. An inherent limitation in the DNA approach is a requirement to select the optimal sequence of nucleic acids required to express the desired gene product. By comparison, however, few vaccines induce the preferred cell-mediated immunity that protects against the disease; most generate only antibodies, which are fine only for blood-borne pathogens. Dr. Tian proposes to develop a fast and cost-effective method to make fully optimized, quick-response vaccines, which induce the preferred cell-mediated immunity that protects against infectious disease. His innovation is high-throughput combinatorial gene synthesis technology developed in his lab, which has the potential for rapid synthesis of large pools of specific genes against potentially fast-mutating infectious pathogens. If successful, Dr. Tian will significantly advance vaccine development. The increased efficacy, reduced cost, and speed of delivery of such pharmaceuticals (weeks versus months) offer extraordinary potential for making a significant positive impact on improving children's health care.