

## 2003 MAFMA Final Report

Project Title            **Microfluidic CD-ELISA for Fast Detection of Food-borne Pathogens and Toxins**

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### 1. Objective Summary

The objective was to develop a novel CD-based microfluidic sensor device for enzyme-linked immunosorbent assay (CD-ELISA) for rapid detection of food-borne pathogens and toxins. A prototype CD-ELISA was designed, fabricated and tested for its use in high-throughput screening of food and water samples

### 2. Objective Accomplishments

We have completed our project objectives: 1) to design and fabricate prototype CD-ELISA microfluidic platform, 2) to evaluate the prototype CD-ELISA for detection of food-borne pathogens and toxins. We demonstrated the feasibility and advantages of this novel ELISA platform for fast detection of *E. coli* and *Salmonella*. This CD-ELISA can reduce the assay time from over 8 hours to less than 1 h and the reagent consumption by over 90%, and still maintain comparable or even better detection limits as compared with current 96-well and 384-well ELISA.

We are currently working with BIC and BioLOC, a spin-off of Bioprocessing Innovative Company (BIC), on the commercial development of this microfluidic CD-ELISA. BIC has a ~\$1 million research grant contract with the Ohio Department of Development for commercial development of CD-ELISA. We are a partner of this project as a subcontractor. BIC has also received a NSF STTR Phase I grant (\$100,000) on the development of this CD-ELISA technology. Phase II grant with \$500,000 will be through BioLOC with a subcontract to OSU. We have a pending US patent application for the CD-ELISA, which has been licensed to BioLOC for commercial development.

### 3. Unexpected findings, if any

None

### 4. Practical impacts of research efforts.

This novel CD-ELISA should have wide applications in clinical diagnosis of disease-associated antigens (antibodies) and detection of pathogens, toxins, pesticides, allergens, and other hazardous contaminants present in foods and water. Sales in the US for food testing products used by food processors alone will increase to \$150.6 million (29.4 million tests) in 2003, with about 92% of the sales for tests to detect bacterial pathogens (mainly *Salmonella*, *E. coli*, *Campylobacter*, and *Listeria monocytogenes*) and natural toxins (mainly mycotoxins and seafood

toxins). Immunoassays are the main test methods used. The price for a typical 96-well ELISA kit is \$300 to \$500, or ~\$4 per sample on average. With the microfluidic CD-ELISA, the per-sample price will be lower than \$0.5. Many pesticide and veterinary drug residues (e.g., hormones and antibiotics) of food safety concerns are also detectable by immunoassays. Low cost, quick, and reliable methods such as the proposed CD-ELISA enabling the industry to detect the contamination agents in food and water will be highly in demand.

As discussed in the previous section, we are currently working with BIC and BioLOC on the commercial development of this technology with funding from Ohio Department of Development and National Science Foundation.