

Acoustic Wave Biosensors for Molecular Recognition and Detection of Conformational Change

William D. Hunt, Ph.D.

Professor

School of Electrical and Computer Engineering

Georgia Institute of Technology

Atlanta, Georgia

and

Adjunct Professor

Department of Hematology and Oncology

Emory University School of Medicine

Atlanta, Georgia

Acoustic wave devices coated with a bilayer represent one biosensor approach for the detection of medically relevant biomolecules. In a typical application, the acoustic wave device is connected in an oscillator circuit, and the frequency shift Δf resulting from a biomolecular event is recorded. In this lecture we discuss our recent work in this field, which has included the use of Rayleigh wave surface acoustic wave devices for vapor phase detection as well as ZnO resonators and quartz crystal microbalance devices for liquid phase measurements. For most of the results to be presented the biofilm on the surface of the acoustic wave device consists of a layer of antibodies raised against a specific target molecule or antigen. We present our results for the vapor phase detection of small molecules such as uranine, cocaine, TNT and RDX as well as liquid phase detection of small, proteins, lipids and DNA. The data we present from these various experiments is the signature associated with the biomolecular recognition events; that is, we record and present $\Delta f(t)$. Finally, we present the results of our time-dependent perturbation theory work, which gives a potential method for resolving the acoustic wave biosensor signature into information relating to molecular structure changes during a molecular recognition event.

William D. Hunt earned his B.S. from the University of Alabama in 1976, his Master's degree from the Massachusetts Institute of Technology in 1980, and his Ph.D. degree from the University of Illinois, Urbana-Champaign in 1987. All three degrees are in electrical engineering. He joined the electrical engineering faculty at Georgia Tech following completion of his Ph.D. degree. Special recognitions he has received include the NSF Presidential Young Investigator Award in 1989, the DuPont Young Faculty Award in 1988, the University of Alabama Distinguished Engineering Fellowship in 1994. Dr. Hunt was a Rhodes

Scholar Finalist in 1975. His "dog on a chip" invention which is a chip which can do specific molecular recognition of compounds in the vapor phase garnered world-wide press culminating in Dr. Hunt's appearance in the January 12, 2004 issue of Time Magazine in their inaugural article on Innovators. His area of expertise is in the area of Microelectronic acoustic devices for wireless applications as well as chemical and biological sensors based on this technology. He has published over 70 papers in refereed journals and conference proceedings. He holds 4 US patents and 5 provisional patents.