ADVANCED NANOELECTRONIC ARCHITECTURES FOR THz-BASED BIOLOGICAL AGENT DETECTION

D. L. WOOLARD, *U.S. Army Research Office*; J. O. JENSEN, *U.S. Army Edgewood Chemical Biological Center (ECBC), Edgewood, MD.*

The U.S. Army Research Office (ARO) and the U.S. Army Edgewood Chemical Biological Center (ECBC) have strategic interests in advancing the state-of-the-art in nanoelectronic engineering towards new research applications that have relevance to national defense and security. Hence, ARO and ECBC have been long-time supporters of terahertz (THz) frequency sensing science and electronic technology as a potentially new long-wavelength counterpart to the more established hyperspectral technological capability. An important driver of this interest are spectroscopic measurements conducted on biological materials and agents which produced spectral features within the THz frequency regime (i.e., 300 GHz to 1000 GHz) that appear to be representative of the internal structure and characteristics of the biological samples under study - e.g., DNA, RNA and bacterial spores. However, the THz spectroscopic approach is problematic in that the spectral features observed from bulk samples of the biological materials tends to be very weak (i.e., 1-5% local variation in spectral absorption) and of limited number within the band (i.e., <50-100 spectral features). One fundamental approach for avoiding the previously cited limitations is to prescribe novel techniques whereby the THz-frequency absorption signatures could be collected from individual biological molecules at the nanoscale. To this end, ARO and ECBC have launched a multidisciplinary research program under the support of the U.S. Defense Threat Reduction Agency (DTRA) that seeks to develop new devices and architectures that will be effective in extracting THz signatures from target bio-molecules. This presentation will overview the goals of the research team and present details on spectral-based sequencing and imaging of genetic molecules at the nanoscale.