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Protein Electrodynamics and Terahertz Medicine

It is well known that proteins exhibit dynamic behavior with their normal modes specifically vibrating at terahertz frequencies. These motions are essential to protein function and because these macromolecules are charged the existence of such vibrations suggest the possibility of specific interaction with electromagnetic radiation in the terahertz band. Time-domain spectroscopic experiments were performed identifying specific absorption of terahertz radiation ($\sim 0.8\text{THz}$ and 1.3THz) by met-hemoglobin as well as potential interactions between high frequency and low frequency modes (e.g. Stokes shift). This proof-of-concept result suggests that these protein spectroscopic signatures can serve as the basis of a novel form of molecular medical imaging; likewise terahertz-modulated manipulation of such motions may underlie new forms of therapy. Other collaborative studies now underway, including THz imaging of Alzheimer's tissue, THz spectroscopy of diabetes-related hemoglobin, and 2D THz spectroscopy as applied to biomolecules, will also be discussed.

Biographical Sketch

Dr. Ogan Gurel is Chief Innovation Officer at CampusD, a Seoul-based startup incubator, as well as a Visiting Professor at the Samsung Advanced Institute of Health Sciences and Technology (Sungkyunkwan University/Samsung Medical Center) with research interests in protein electrodynamics and terahertz medicine. He is also Director & Innovation Advisor at DRB Holdings, Ltd. as well as Innovation Ambassador at the Korea Business Leaders Alliance (KBLA). Previously, he served as a Director in the CTO office and Open Innovation group at the Samsung Advanced Institute of Technology (SAIT). His wide healthcare expertise covers the clinical, business, executive management, marketing and R&D sides, with direct experience in medical devices, mobile health, healthcare IT, medical imaging, and pharmaceuticals. Prior to surgical training at the Massachusetts General Hospital, he obtained his M.D. *Alpha Omega Alpha* from Columbia University where he worked in structural biology (x-ray crystallographic studies of growth factors with Prof. Wayne Hendrickson), was a visiting researcher at the Institut Laue-Langevin in Grenoble (working with Dr. Giuseppe Zaccai on membrane proteins), and obtained his Bachelor's in Biochemical Sciences *cum laude* from Harvard College, studying the then nascent field of protein dynamics with Prof. Martin Karplus, 2013 Chemistry Nobel Laureate.

