

## Biomedical IR spectroscopy: Quo Vadis?

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### Abstract

In the last decades, spectroscopic methods have been intensively used in medical analysis, drug research and even diagnosis. Biomolecular spectroscopy that covers mostly optical/vibrational spectroscopic techniques has been frequently used to image, to detect and to analyze the biological samples. Particularly, Fourier transform infrared (IR) spectroscopy, or briefly IR spectroscopy, provides rapid information about life sciences from biomedical materials including biomolecules, metabolites, sub-cellular structures, cells, tissues and even body fluids.

In the current talk, I will address about our medical analysis and pharmaceutical studies in vitro by using IR spectroscopy combined with multivariate statistical analysis (PCA, HCA, PLS-DA). Our recent applications involve deciphering of cancer biomarkers, discrimination among cancer stem cells, cancer cells and healthy cells, determination of drug-action mechanisms, tracking of therapeutic effects and cellular events (apoptosis etc.). As a result of our studies, we found that the IR technique was capable of detecting fingerprint-like signatures of lipidemic, proteomic, metabolic and genomic alterations in biological samples. IR spectroscopy is a time-saving and non-destructive technique and requires also low setup and running cost. Thus, it can be applied as 'rejuvenated' technique for molecular and chemical characterization of cells/tissues/biosamples in the field of molecular medicine, and thus, it should be further developed for label-free screening of biomarkers from human body fluids (blood, urine etc.) in early clinical diagnosis. At this point, future perspectives along the way to translation of research results into clinical practice are also the subject of this talk.

### Biography

Günnur Güler works in Biomedical Engineering, Izmir University of Economics, Turkey. Her research interests are mainly focused on biomedical spectroscopy, biomedical optics, cellular and molecular biophysics, biomolecular interactions, drug studies, Nano bio, proteins, cell membrane fluidity, enzyme reactions, docking simulations as well as chemo metrics. She got her BSc in Physics from Izmir Institute of Technology in Turkey, and got her Master and PhD degrees from the Institute of Biophysics Frankfurt Goethe University in Germany where she received a grant from German Research Foundation. She worked as a postdoctoral researcher (2015-2017) at Ege University. She also worked as a lecturer (2017-2019) at Izmir Institute of Technology. She scientifically visited to Swiss Institute of Bioinformatics, Université Libre de Bruxelles where she gained further computational and experimental experiences. She also organized a couple of international conferences/workshops in Turkey. She is a member of epiSTEM Turkey Association and Turkish Biophysics Association.

### Publications

1. Effect of Flavopiridol on Cell Cycle, Apoptosis and Biomolecule Structure Changes in Breast Cancer Stem Cells
2. Synthesis and characterization of folic acid-chitosan nanoparticles loaded with thymoquinone to target ovarian cancer cells
3. The effect of extracellular matrix on the differentiation of mouse embryonic stem cells
4. Geleneksel Olarak Yara Tedavisinde Kullanılan Kudret Narı (*Momordica charantia* L.) Zeytinyağı Maseratı Kullanılarak Krem Formunun Geliştirilmesi ve İn Vitro Yara İyi Edici Etkisinin Araştırılması
5. Determination of cellular differences of CD133+/CD44+ prostate cancer stem cells in two-dimensional and three-dimensional media by Fourier transformation infrared spectroscopy
6. Characterization of CD133+/CD44+ human prostate cancer stem cells with ATR-FTIR spectroscopy
7. Flow Cytometry and FTIR Spectroscopy for Detection of Early Apoptosis in Human T Cells
8. Glycogen synthase kinase-3 inhibition in glioblastoma multiforme cells induces apoptosis, cell cycle arrest and changing biomolecular structure
9. Deciphering of biochemical similarities and differences among mouse embryonic stem cells, somatic and cancer cells using ATR-FTIR spectroscopy
10. Surface Characterization Techniques
11. A novel method for sensitive microRNA detection: Electropolymerization based doping
12. Proteolytically-induced changes of secondary structural protein conformation of bovine serum albumin monitored by Fourier transform infrared (FT-IR) and UV-circular dichroism spectroscopy
13. Lipid-Protein Interactions in the Regulated Betaine Symporter BetP Probed by Infrared Spectroscopy

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