Infrared Spectroscopy of Biological Samples: Cells and Microbial Fossils

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Preliminary experiments have been aimed at establishing and optimising sampling techniques and instrument parameters. The objectives of the current study were to collect biochemical maps of cells, tissues, microbial fossils and fossilised bones. These maps providing information about the distribution of the various biochemical components within the samples.

Cardiac Myocytes: The effect and hypoxia (growth is a reduced oxygen atmosphere) and subsequent exposure to air on HC92 rat cardiac myocytes has been used to stimulate the ischemia reperfusion injury following a heart attack. Changes in biochemical distributions were investigated SR-FTIR spectroscopy to examine the potential of various anti-oxidants and potential drugs to prevent or reduce such changes.

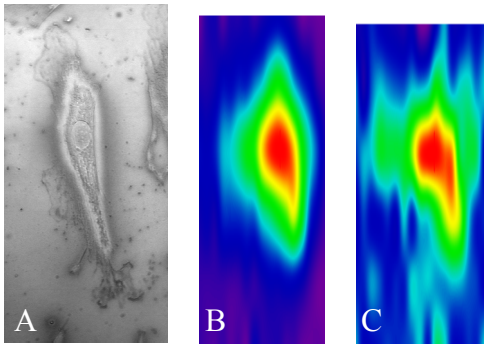

Figure 1. A) White light image of cardiac myocyte B) Infrared functional group map based on area underneath the Amide I band (1771–1587 cm^{-1}) illustrating protein distribution C) Infrared functional group map based on area underneath the CH region (3000–2842 cm^{-1}) illustrating lipid distribution.

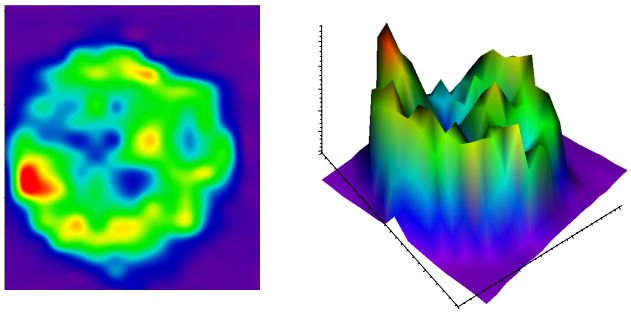

Figure 2. FTIR 2D and 3D Images of *S. favosa* constructed by measuring the area under the ν(C=C) region from 1704 to 1585 cm^{-1}.

Microbial fossils: For the first time, SR-FTIR spectra were acquired from micro-eukaryote fossils. These results indicate that the microfossil is composed of a resistant biopolymer similar to algaenan. In addition, SR-FTIR mapping allowed the delineation of morphological features associated with different functional group chemistry. Not only does this technique provide a means for the determination of biological affinity, but furthermore, morphological features can be correlated with changes in chemistry.

Adipocytes: 3T3-L1 adipocytes are a line of fat cells derived from mice. Adipocytes are derived from fibroblastic precursors, and differentiation is induced by hormone treatment. Shortly after treatment lipid droplets appear inside the cells, rapidly increasing in size to the point where adipocytes are comprised mostly of large fat droplets. The amount, composition and spatial distribution of lipids contained within a fat droplet are yet to be fully studied. The information gained from infrared microspectroscopy may serve as a method of assessing the efficacy of fat-lowering compounds.

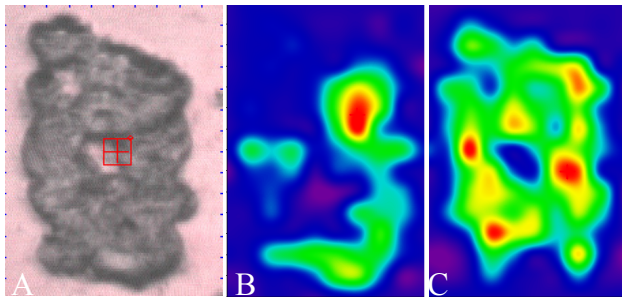

Figure 3. A) White light image of adipocyte B) Infrared functional group map based on area underneath the ν(C=O) ester band (1783–1713 cm^{-1}) illustrating lipid distribution C) Infrared functional group map based on area underneath the Amide I band (1711–1601 cm^{-1}) illustrating protein distribution