INTERFACIAL AND DANGLING WATER AS A "HYDRATION FINGERPRINT" IN NORMAL AND CANCEROUS HUMAN TISSUE

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Combined micro-Raman Imaging, fluorescence imaging, SNOM, AFM imaging and femtosecond spectroscopy are efficient methods for analyzing biological specimens due to their high space, temporal, spectral resolution, sensitivity to subtle chemical, structural, mechanical and topological changes. Abramczyk et al.[1] showed that Raman measurements of the biochemical mapping of human cancer cells and tissues reveal unique Raman fingerprints that help define the stages of cancer progression, cancer phenotype[1,2] and epigenetic modifications [3]. We will show that invasive cancers have characteristic vibrational and mechanical signatures of proteins, lipids, DNA/RNA and interfacial water. Interfacial water can be used as a ''hydration fingerprint'' in normal and cancerous human tissue [4]. Characterizing properties of water at biological interface is a key challenge in understanding the interactions of water in cells and . Although we often assume that the properties of the bulk water can be translated to the crowded biological environment, this approach must be considerably revised when considering the biological interface. To our knowledge, few studies have directly monitored the interactions and accumulation of water in the restricted environments of the human cancer tissue upon realistic crowding conditions. The present study focuses on a molecular picture of water molecules at the biological interface, or specifically, water molecules adjacent to the hydrophobic and hydrophilic surfaces of normal and cancerous tissues [4]. We recorded and analyzed Raman images, femtosecond dynamics and the IR and Raman spectra of the νs(OH) stretching modes of water at the biological interfaces of the normal and cancerous human breast, brain and neck tissues and compared them with corresponding properties of bulk water. The results revealed dramatic changes in the water content in the normal and cancerous tissues and are potentially relevant to both the fundamental problems of interfacial water modeling and the molecular diagnostics of cancer as a 'hydration fingerprint'. Herein, we will discuss the origin of the vibrational substructures observed for the νs(OH) stretching modes of water [4,5], showing that the interfacial water interacting via H-bond with other water molecules and biomolecules at the biological surface and free OH vibration of the dangling water are sensitive indicators of the pathology and can help to discriminate normal (noncancerous) and cancerous tissue and cancer types [4].

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