Abstracts

Microwave Transmission through Normal and Tumor Cells

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The role of standing waves in the microwave measuring systems used in the study of normal and tumor cells is discussed. A pronounced cyclic variation in measured power as a function of frequency through biological materials has been reported in curves published for two frequency ranges 66-76 GHz and 76-86 GHz. The materials studied included a variety of normal and tumor cells and compounds such as guanine and guanylic acid. A condition for cyclic and multiple resonances in a waveguide system is satisfied when at least two impedance discontinuities giving rise to reflections are present. When we have only two discontinuities, the distance between them may be calculated from the operating frequency and the separation between frequencies for maximum power transmission through a branch of the measuring system. In the resulting standing-wave pattern, the effect of introducing the organic or biological sample with losses over a wide frequency range into the measuring system is to reduce the magnitude of the maxima in the standing-wave pattern and to increase the magnitude of the minima. To distinguish between losses due to the sample and the frequency selectivity of the microwave measuring system, one sound procedure is to adjust the system for unity standing-wave ratio (SWR). After this is done, if one still observes a frequency-dependent absorption which arises on introducing the sample or by use of a comparison method employing two samples, the results will no longer be ambiguous. The ambiguity in results reported in the literature will be resolved when effective methods are used to control the frequency selectivity of the equipment.

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