Title:
A review of intraoperative THz neurodiagnosis technologies

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Abstract (250 words):

Recently terahertz (THz) imaging and spectroscopy have found applications in intraoperative label-free diagnosis of human brain neoplasms [1–5]. In our work we overview existing developments in this field as well as original results, including THz spectroscopy of human brain gliomas featuring different grades and analysis of THz dielectric permittivity models of normal and pathological brain tissues. We have used THz pulsed spectroscopy to study dielectric properties of *ex vivo* gelatin-embedded human brain gliomas featuring WHO grades 1–4, as well as perifocal, edematous and intact tissues [6]. We have obtained the significant differences between the THz responses of normal brain tissues and gliomas of all grades, while the response of edematous tissues was similar to that of tumors. The development of THz technology in neurodiagnosis is limited by the absence of physical models describing the THz dielectric permittivity of healthy and pathological brain tissues. Furthermore, we have applied the double-Debye and double-overdamped-oscillator models of complex dielectric permittivity to parametrize the *ex vivo* THz dielectric response of human brain tissues [7]. Thus, recent developments evidence that THz technology has interesting prospects in intraoperative human glioma diagnosis.

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