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Permeability of membranes is more susceptible to hyperthermia in cancer cells as compared to normal cells lines

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Hyperthermia is promising modality for cancer treatment that requires more detailed knowledge on molecular and cellular processes for rational development of treatment protocols. It is important to establish thresholds for thermal damage of various structures in human tissues that vary among tissue species as well as among normal and diseased tissues. Comparison of thermal susceptibility of biomolecules has revealed that among all cellular components, plasma membrane (PM) is the most sensitive to heating. The response of other cellular membranes was not yet more thoroughly studied in this respect.

The aim of this study was to compare the effect of 30 min hyperthermia (42°C) on permeability of PM and inner mitochondrial membrane (IMM) in Chinese hamster ovary (CHO), rabbit myoblasts, murine liver cancer (MH22A), human pancreatic carcinoma (PANC1) and human primary pancreatic adenocarcinoma (BXPC3) cells. The effect of hyperthermia on PM and IMM permeability was evaluated by fluorimetry and fluorescence microscopy analysis after staining cells with propidium iodide and JC-1 dye. The results showed that increase of temperature from 37 to 42°C increased permeability of PM and IMM (by 13% and 27%, respectively) in cancer cells stronger than in normal cells. The results of our study demonstrate for the first time that inner IMM is cellular component that is even more sensitive to hyperthermic treatment than cellular PM. Another important observation was that both PM and IMM in cancerous cells was more sensitive to the damaging effect of hyperthermia in comparison to the same membranes in normal cells.