Evaluation of cell viability under the THz irradiation

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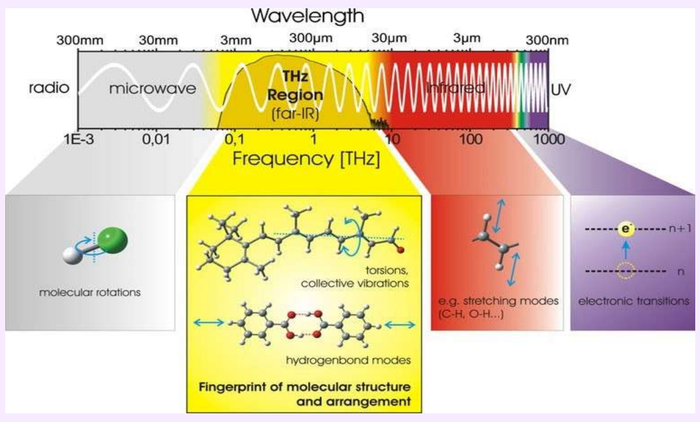
Background: The THz radiation (a wavelength is 10 μm – 1 mm and a frequency 0.1-10 THz) draws nowadays much attention, due to its application in astronomy, security screening, imaging, biomedicine, etc. (Sizov F, SPQEO, 2019). Such approaches gave rise to a question on influence of the THz irradiation on biological objects, especially on cells of a human body.

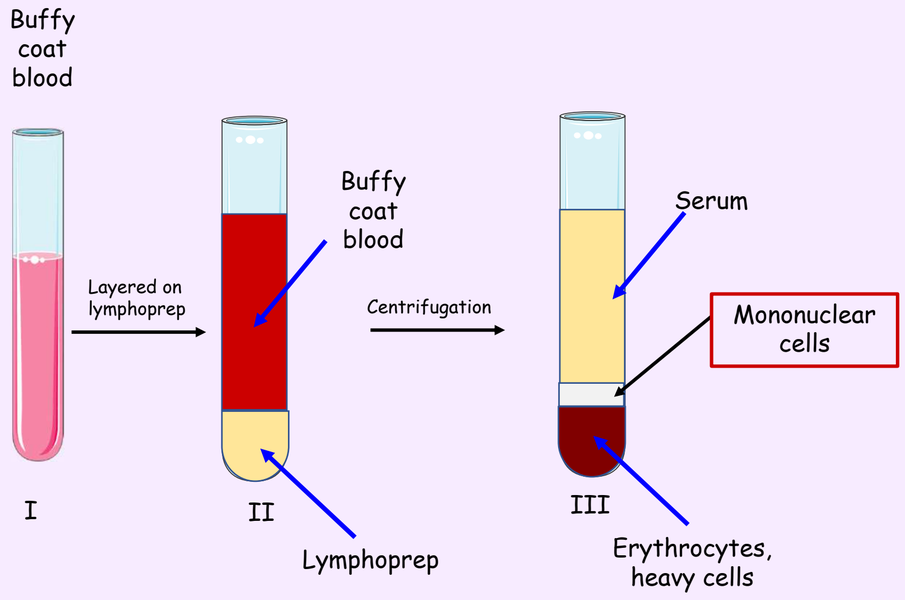
Aim: to perform a comparative study to evaluate the viability of normal and cancerous cells upon irradiation with a steady beam of THz rays.

Materials and methods: An experimental system was built up, consisting of the radiation source with a rectangular acoustic horn antenna, vertical translation stage, a well in a polystyrene plate, and the timer. The human mononuclear cells, isolated from buffy coat blood, and cancerous cells of the B- and T-cell origin (RAMOS and Jurkat, respectively) were studied.

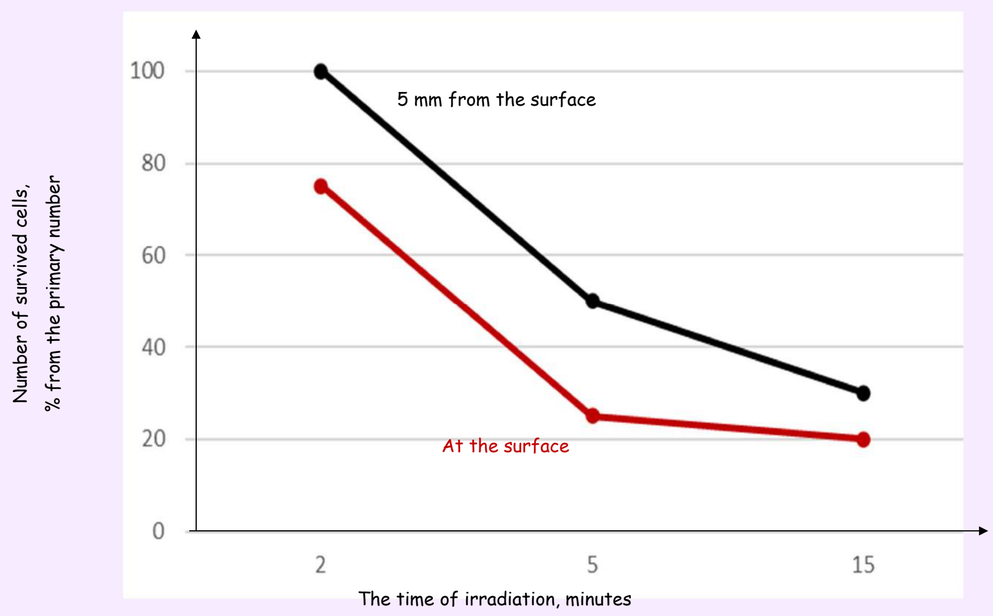


The electromagnetic spectrum. The terahertz pulse frequency range (0.1-5 THz) that is frequently used for THz imaging and spectroscopy is shown in yellow (from Sizov F., 2020, 10.21741/9781644900758

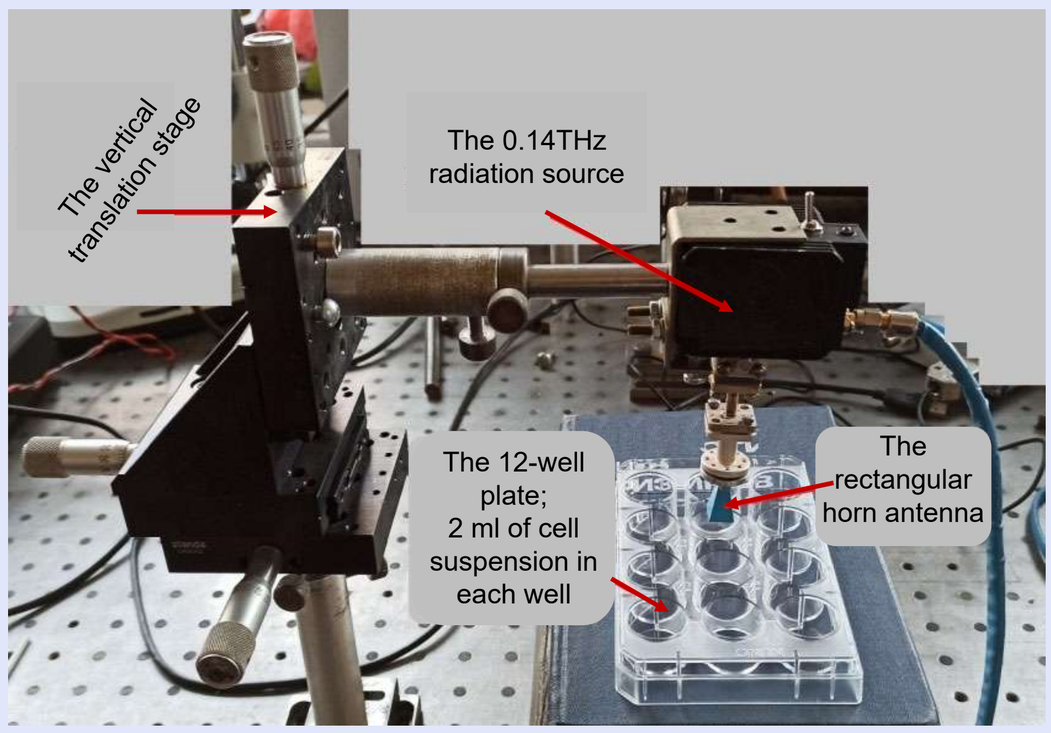
The human mononuclear blood cells were isolated on the Lymphoprep gradient from the buffy-coat blood

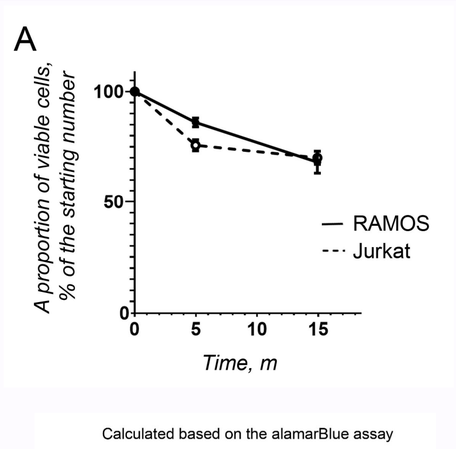


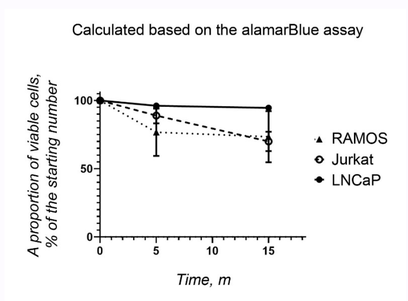
The primary fragile human mononuclear blood cells showed increased death rate upon the 0.14 THz irradiation, compared to non-irradiated cells, kept at the same conditions in the IMDM medium, supplemented with FBS and appropriate antibiotics.



A photo on the experimental system, including the 12-well plastic plate for the suspended cells.







The RAMOS and Jurkat cells showed the moderate effect while irradiated with the THz waves. At 15 m after starting irradiation, both cell lines showed similar value of viability - approximately 75%. In this sense, they behaved similarly to primary mononuclear blood cells.

Conclusions: The THz radiation can result in the death of human mononuclear blood cells. However, mechanism of this phenomenon is largely unknown. No doubt, more work should be done to shed some light on the mechanisms of action of the THz irradiation on the living organisms, to speed up the technologic developments.

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