Laser interferometry of living cell dynamics in oncological transformation and microgravity environment

Ignatyev P S[1] and Naimark O B[2,@]

[1] Joint Stock Company "Production Association "Ural Optical and Mechanical Plant named after E. S. Yalamov", Vostochnaya 33b, Ekaterinburg 620100, Russia

[2] Institute of Continuous Media Mechanics of the Ural Branch of the Russian Academy of Sciences, Academician Korolev Street 1, Perm 614013, Russia

[@] naimark@icmm.ru

Collective behavior of defects (open states) are studied using original experimental data on in vivo cell dynamics as fluctuations of "phase thicknesses" obtained by laser (interference) microscopy. Collective open state modes have the nature of self-similar solutions corresponding to evolution equations and can be considered as triggering mechanisms for gene expression, transcription and cell division Conclusion is substantiated that monofractal dynamics, caused by development of collective "blow-up modes" in an ensemble of open states, corresponds to spontaneous cell division. Analysis of these data made it possible to establish multifractal dynamics characteristic of "normal" cells ductility and monofractal dynamics for cancer cell reflecting cell fragility. The analysis of external field on the cell dynamics allowed the interpretation of the phenotype changes in the microgravity conditions. Analysis of laser microscopy data in vivo cell dynamics are compared with results of a multifractal analysis of temperature fluctuations field by infrared scanning of "normal tissue" and tissue with oncological pathologies.

This research was supported by the Russian Government contract No. AAAA-A19-119013090021-5.