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Inverse Wavelet Transform in Virus–Cell Interaction Imaging

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We have shown previously that the diffraction patterns obtained by laser irradiation scattering on virus–cell system demonstrate fractal properties which reflect the fractal structure of the system itself. Diffraction process is equivalent to the formation of the wavelet direct Fourier transform of the said system's components, including sensitive cells (about 10 μm n diameter), cell nuclei (about 1 μm) and virions (about 0.1 μm). The multi-order imaging of the virus–cell system is provided due to the self-affinity of the fractal aggregates involved in imaging process. We propose here to use the inverse wavelet Fourier transform of the pattern formed on the target of the fractal microscope in order to get the real enlarged image of the viruses attacking the sensitive cell as well as the cell's structural transformation caused by the interaction itself. The set of bright and dark spots, which forms the diffraction pattern, could be transferred into set of numbers using the regular quantification procedure. The full information included into the pattern peaks' diameters and color index is transformed using inverse wavelet Fourier technique into set of intersecting bright and dark circles. The full *in vitro* dynamics of the structural changes of the virus–cell system is described by the changes of circles' diameters and their intersection's area. It was shown, also, that the magnification of the proposed fractal microscope could achieve 10,000–100,000×, depending on the used laser power. Proposed fractal microscope could be applied as well *in vivo* experiments until the required magnification will not make us to use projection laser with the output exceeding 20 mW. The reliability and sensitivity of the proposed device is defined by the parallel virus–cell structural information processing by a regular laptop. The fractal microscope based on the inverse wavelet Fourier transform procedure could be applied successfully in pharmaceutical antiviral drug design, laboratory and clinical trials of new antiviral preparations.

doi:10.1016/j.antiviral.2008.01.070

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New Microscopic Description of Herpes Virus–Cell Dynamic System

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We have shown that the fractal approach to the problem of virus–cell interaction gives the unique possibility to process the data through the sequence of the direct and inverse wavelet Fourier transforms. We have studied the Herpes simplex virus US-1 strain interacting with the Hep-2 sensitive cell culture. The object was imaged as bright peaks considered as wavelets formed as a result of a laser diffraction on the structural elements of the virus–cell system. The whole virus–cell interaction information is inserted into computer in a fastest parallel way. The laser intensity peaks, forming the speckle image of the system under consideration, could be transformed into the hierarchical system of the circles (or squares) according to the choice of the researcher, but conserving the same D value, which depends only on the true intermolecular interaction potential. This potential, being characteristic for every stage of virus–cell interaction, is responsible also for the structure of the dynamic virus–cell system. The unique, but the typical form of the fractal cluster corresponding both to the system itself and its image as well, was processed by computer techniques. The hierarchical fractal design of the virus–cell system, proposed here for the first time, gives the universality, needed for the quantitative description of any possible combination of the virus and corresponding sensitive cell. It should be noted, as well, that the fractal microscope use for virus–cell dynamic system imaging have all the properties, required from all other experimental tools of monitoring, including the reliability, reproducibility and preciseness. The device could be used in drug design tests with the scope of time and efforts economy during the compounds libraries screening. The fractal microscope combined with the QSAR drug design technique makes the anti-herpetic drug design more competitive as compared to the regular approaches.

Acknowledgement: The authors are indebted to the partial support of the STCU Grant #3147.

doi:10.1016/j.antiviral.2008.01.071

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Dielectric Spectroscopy as a Tool for Virus–Cell Interaction Rate Description

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We propose to apply the dielectric spectroscopy (DS) of virus–cell interaction in laboratory practice. We have chosen the human immune deficiency virus (HIV) applied to the lymphocytes system as the actual object for investigation at various stages of interaction. The thin layer (10 μm) of the sensitive cells (SC) placed between parallel glass plates with transparent SnO_2–In_2O_3 electrodes. HIV was added in concentration of 10^{12} m^{-3} what means about 1 ppm ratio. The DS curves for real ε' and imaginary ε'' parts of the complex dielectric permeability were registered for the chamber containing either SC only or with addition of HIV particles with the use of BM-560 Q-meter in the frequency range of 50 kHz–35 MHz. We have shown experimentally that the DS curves demonstrated the presence of various number of maxima depending on the