COMPUTERIZED MULTIVARIATE IMAGING POLARIMETRY SYSTEM FOR IN-VITRO DIAGNOSTICS OF BIOLOGICAL TISSUES

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Today methods of laser imaging polarimetry of biological tissues claim to be new highly informative methods of early in vitro diagnostics of inflammatory and oncological processes of human tissues.

A classical microscopic image provides information about the morphological structure of the cut of biological tissues (BT). However, there are parameters in the optical measurement that formed image, which are not available for immediative visual observation. The proposed system of laser polarimetry BT can identify a number of additional parameters with a set of new methods and establish the actual interconnections between changes in the morphological structure of the sample BT and a set of certain objective characteristics of such an image on the basis of computer analysis.

The source of polarization radiation in the proposed system is a semiconductor laser at a wavelength of 635 nm. The measuring automated channel of the system, based on traditional polarization filters, micro-objectiver and CCD cameras, allows to measure two-dimensional distributions of orientation and phase parameters of structural anisotropy of optical thin specimens of BT on the basis of direct and indirect methods. Further computerized analysis of the received distributions in the system is carried out on the basis of statistical, correlation and fractal analysis methods implemented in MATLAB. Obtained statistical, correlation and spectral moments of the two-dimensional parameters of the anisotropy of the sections of the BT serve as informative parameters of the diagnosis of the physiological state implemented by the expert system.

A comparative analysis of the results of the diagnosis of "healthy" and "hepatitis" states in 86 samples of rat liver transplants with verified diagnoses by 6 proposed methods of measurement and computerized analysis allowed to obtain, using this system, the value of the diagnostic validity value from 82.6% to 95%. At the same time, the lowest levels of errors of the first and second kind, accounting for 4.6%, were obtained.

Their further reduction is associated with the implementation of the measuring channel on optical and electrically controlled light modulators, with intelligent technology of management systems and the search for effective information technology decision support.