Hardware Complex for Rapid-Flow Modification of Cells and Embryos with Use of Methods of Femtosecond Laser Nanosurgery and CARS-microspectroscopy.

Konstantin A. Vereschagin[1], E. Shashkov[1], A. Aybush[2], F. Gostev[2], A. Astaf'ev[2] , A. Shakhov[2], A. Titov[2], A. Zalessky[2], V. Nadtochenko[2]
[1]*A.M. Prokhorov General Physics Institute of RAS*
[2] *N.N. Semenov Institute of Chemical Physics of RAS*

Development of cellular biotechnologies and gaining new knowledge on cytobiology and embryos in an essential measure relies on progress in biophotonics methods for visualization of biostructures and manipulation with nanodimensional objects in microvolumes. Precision spatio-temporal regulation of biological functions of a cell can be based on nonlinear optics processes and application of femtosecond lasers used both for visualization, and for a micromanipulation in a cell [1].
In the present work we report about development of a hardware complex, based on the custom-built microscope equipped with laser's beams scanner, for the needs of laser nanosurgery of cells and embryos. Installation includes both tools for visualization, fixing and position control, as well as means of power influence on an object.
For chemically-selective 3-D cell imaging and determination of a chemical composition of organelles in structure of a cell/embryo, femtosecond CARS-microscopy based on chirped CARS technique [2] with scanning of collinear interacting light beams is used. Through the use of chirped laser pulses, the spectral resolution is determined by the temporal overlap of the 100 fs pulse with a temporally chirped pulse stretched to several picoseconds. The spectral resolution can be adjusted via the change of chirp, while spectral range of visualization has being changed by delay of Stokes pulse.

1. P.Ronchi, S.Terjung, R. Pepperkok. Biol. Chem., Vol. 393, pp. 235–248, 2012.
2. K.P. Knutsen, J.C. Johnson, A.E. Miller, P.B. Petersen, R.J. Saykally. Chem. Phys. Let., 387, (2004), 436–441.

This space will be reserved for notes and will take up the lowest part of the page.