



Ukrainian Healthcare Transformation Priorities: Focus on Classical Universities Medical Education and Science Role

Kharkiv V.N. Karazin National University Team
14th March, Kiev, Ukraine

Kharkiv V.N. Karazin' National University Team List

- Bakirov V.S. Rector, PhD, Dr. Soc. Sc., Prof.
 - Zalubovsky I.I. Vs. Rector, PhD, Dr. Phys. Sc., Prof.
 - Azarenkov N.A. Vs. Rector, PhD, Dr. Phys. Sc., Prof.
 - Katrich V.A., PhD, Dr. Phys. Sc., Prof.
 - Mustetsov N.P., PhD, Dr. Phys. Sc., Prof.
 - Barannik E.A ., PhD, Dr. Phys. Sc., Prof.
 - Gritsyna V.T., PhD, Dr. Phys. Sc., Prof.
 - Gorbenko G.P., PhD, Dr. Phys. Sc., Prof.
 - Bogkov A.I ., PhD, Dr. Biol. Sc., Prof.
 - Savchenko V.N., PhD, Dr. Med. Sc., Prof.
 - Martynenko AV., PhD, Dr. Phys. Sc., Prof.
 - Iabluchanskiy M.I. (Yabluchanskiy M/I.) , PhD, Dr. Med. Sc., Prof. -
speaker
-

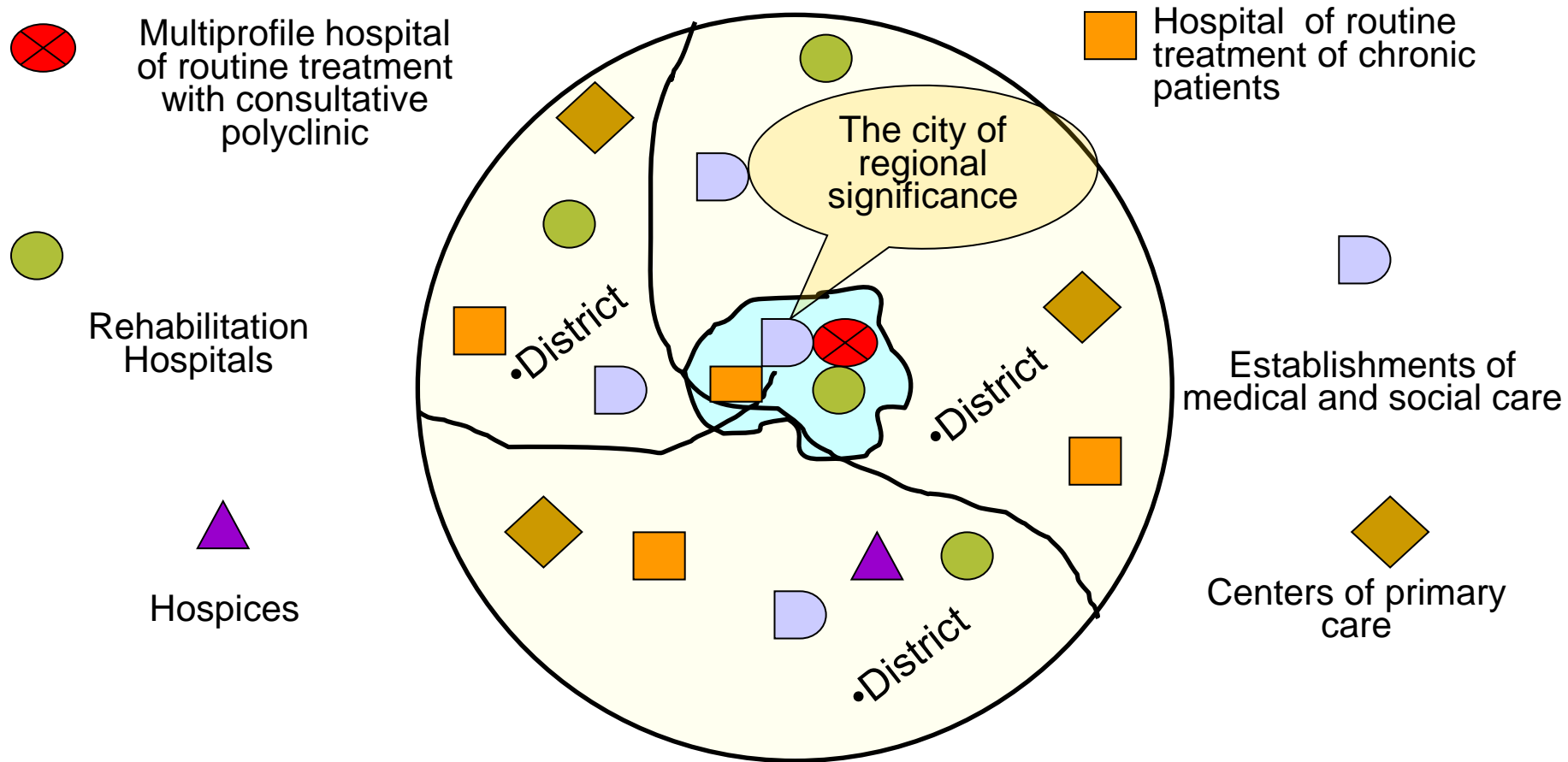
Ukraine in Transformation

- Ukraine is still at the beginning of the reforms
 - Previous years of the independence were mostly declarative and at the system level almost nothing has been done
 - It is hoped that the declarations of the new government will be turned into decisions
 - The time of the unavoidable reforms has come
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Ukrainian Healthcare in Transformation

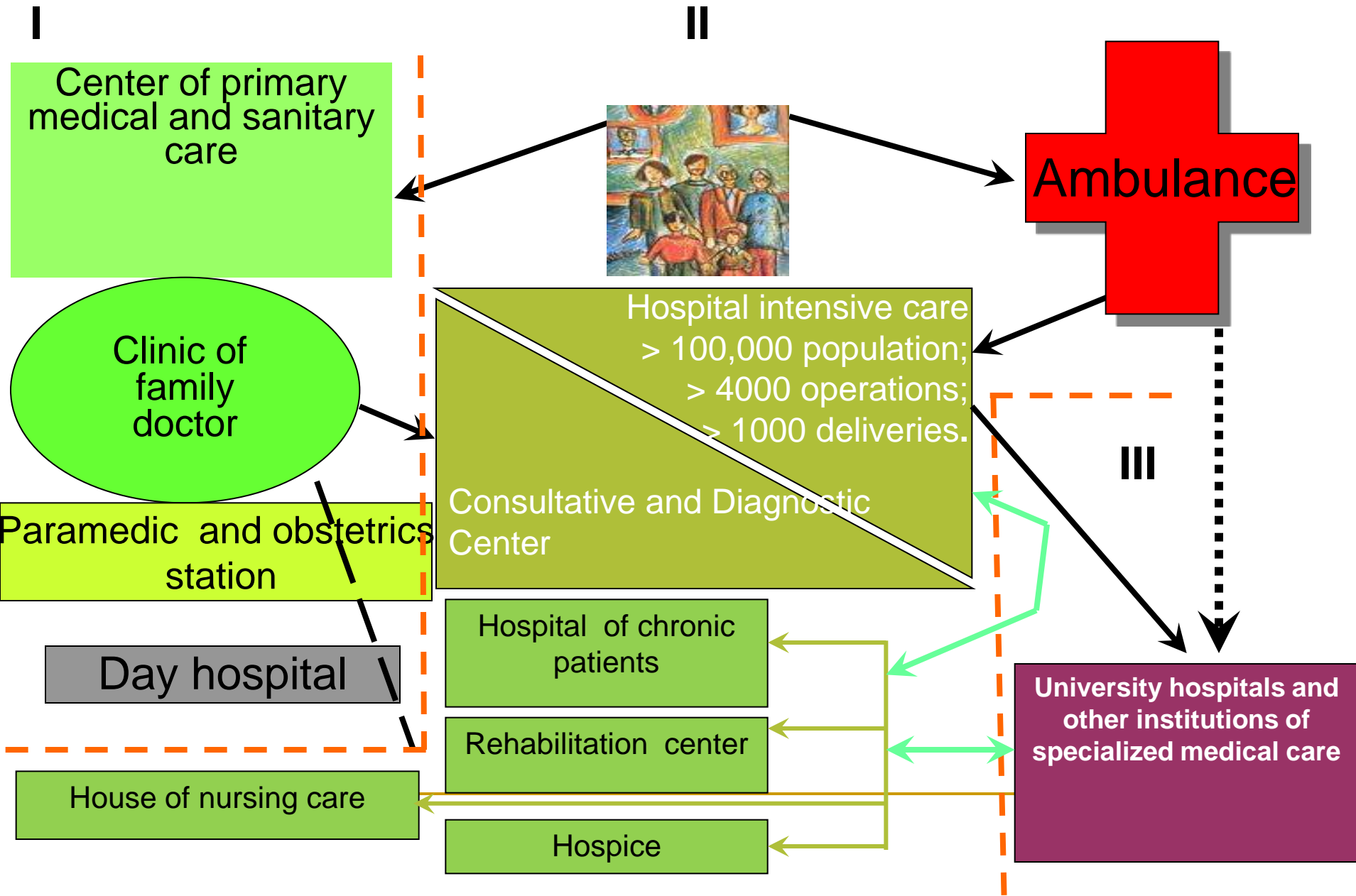
- Healthcare occupies the central place in reforms of Ukraine
 - The reform was started at the same time at a pilot and national scale, which does not provide for a temporary break
 - The strategic goal of the reform is to provide the best possible medical care to population while optimizing the use of economic resources
 - The reform covers all levels of the system with the radical changes in resource and finance management, organization and implementation the medical care with a timely and full legislative support
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Reorganization of specialized medical care in the form of hospital districts



Hospital district – is a territorial association which provides specialized medical and sanitary care by complex of health care institutions

Reorganization of medical care system



Expected results of Healthcare Reform

- Increase of quality, availability and continuity of care to ensure the medical and sanitary care
- Decrease of requirements in in-patient, specialized outpatient and emergency care
- Improving health (quality and lifetime) of the population
- Changing the attitude and increasing the responsibility for the health of every individual, employer and government institutions

Unsolvable problem in healthcare reform and the way of solution

- Unsolvable problem is the continuing conflict of interest
 - Medical education under the control of the Ministry of Health (exceptions prove the rule)
 - Medical science under the control of the Ministry of Health or the Academy of Medical Sciences (public organization, financed by the state)
- Way to solve - the transfer of functions to profile ministry will improve the quality and contribution of medical Education and Science in healthcare reform

Focus on Medical Education and Science Role

- Educational ensure of the reforms by staff training in the areas of healthcare management and medical care
 - Scientific support of the reforms with forecasting and recommendations for optimization
 - Development and introduction of new tools and technologies of management of the healthcare sector and implementation of medical care
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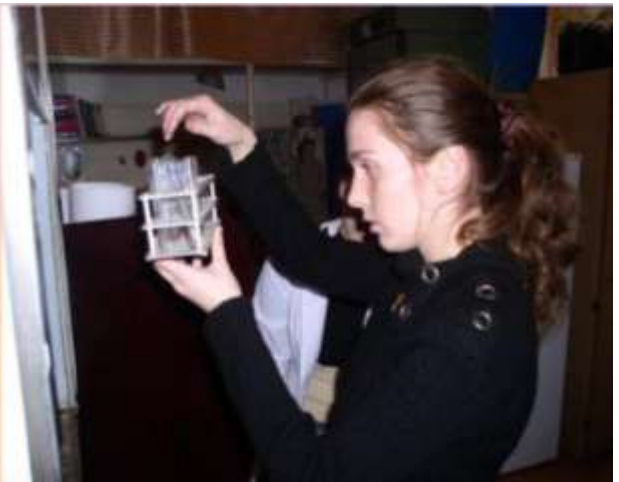
Focus on Classical Universities Medical Education and Science Benefits

- External control (Ministry of Health)
 - Mobility of educational programs and teaching
 - A multidisciplinary approach in solving of scientific problems
 - Relationship between science and production
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The Reason to Focus on Kharkiv V.N. Karazin National University Health' Scientific Research Examples

- The best of the classic universities in the country
 - All kinds of classic university education, including medical
 - Mobility of learning and teaching
 - Developed intrauniversity and interuniversity cooperation
 - Wide contacts with foreign partners
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Students as the main driving force of scientific discoveries



Our Future

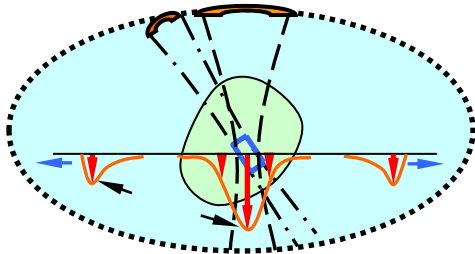
The Collaborators and Research Projects Part List

- STCU Project # 865 “Elaboration of new physical method of ultrasound visualization and medical diagnostics”
- STCU Project # 865(c) “Elaboration of new physical method of ultrasound visualization and medical diagnostics (continued)”
- STCU Partner Project # P-150 “Doppler ultrasound detection system”
- STCU Project # 4534 “New approaches to sensing and modulation of amyloid fibril assembly”
- STCU Project #4744 “Methods of nanoparticle production using extremophiles”
- Daugavpils University, Helsinki University, Finland, Institute of Bioorganic Chemistry, Russia, Sofia University, Bulgaria, University of North Texas, Michigan University, Artannlabs, NJ, USA,
- E. Andronikashvili Institute of Physics, Georgia

Pioneering Developments in Ultrasound Diagnostics

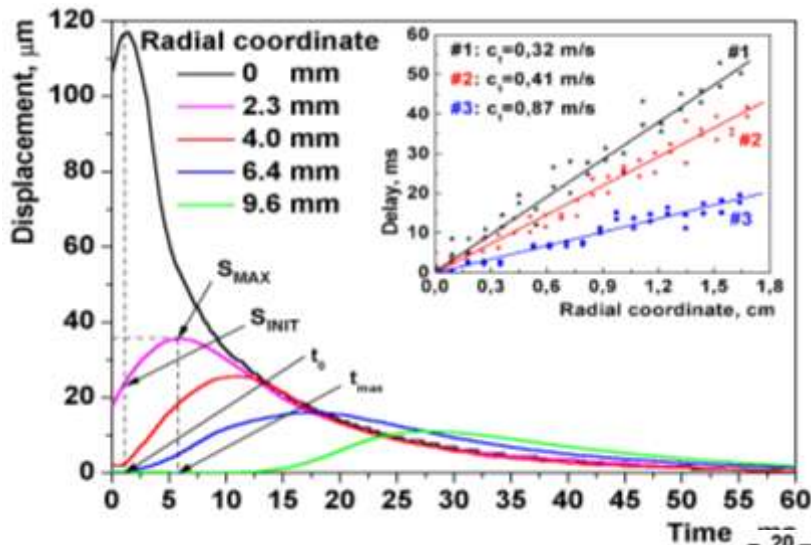


- Phased tracking technology of micron and submicron measurements of tissue displacements
- Doppler Elastography using shear waves excited by acoustic radiation force (Shear Wave Elasticity Imaging - SWEI)
- Ultrasound Doppler monitoring of ultrasound hyperthermia and destruction of soft tissues
- Ultrasound Doppler myography based on the spectral analysis of isometric muscle contractions

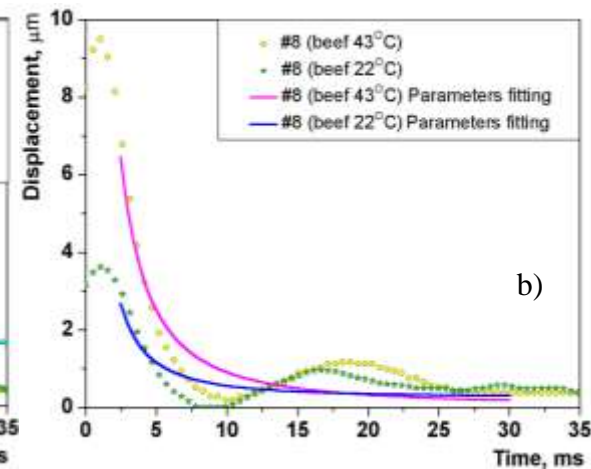
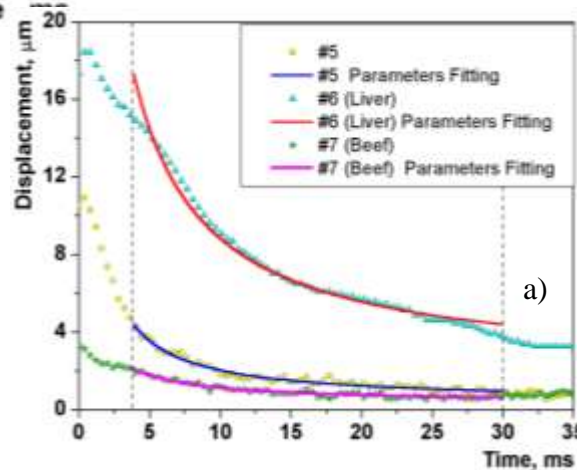


Doppler Elastography Using Shear Waves Excited by Acoustic Radiation Force

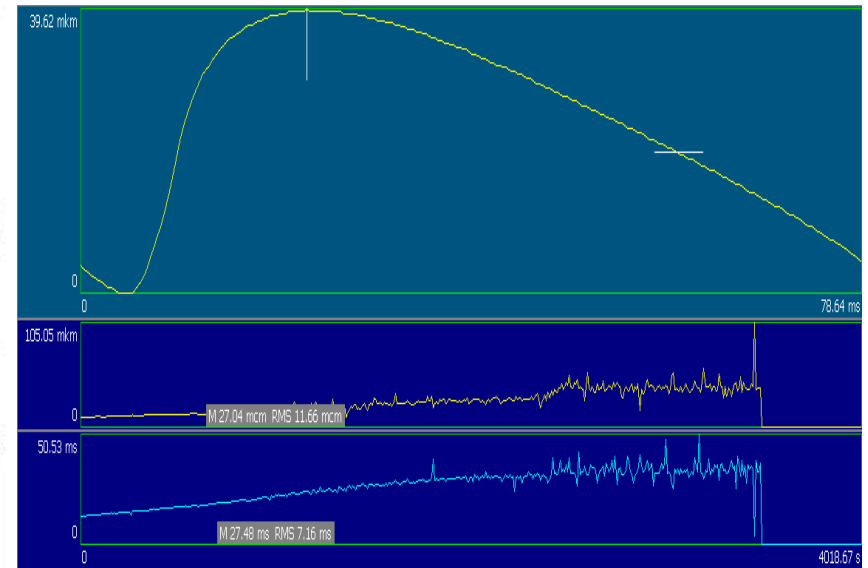
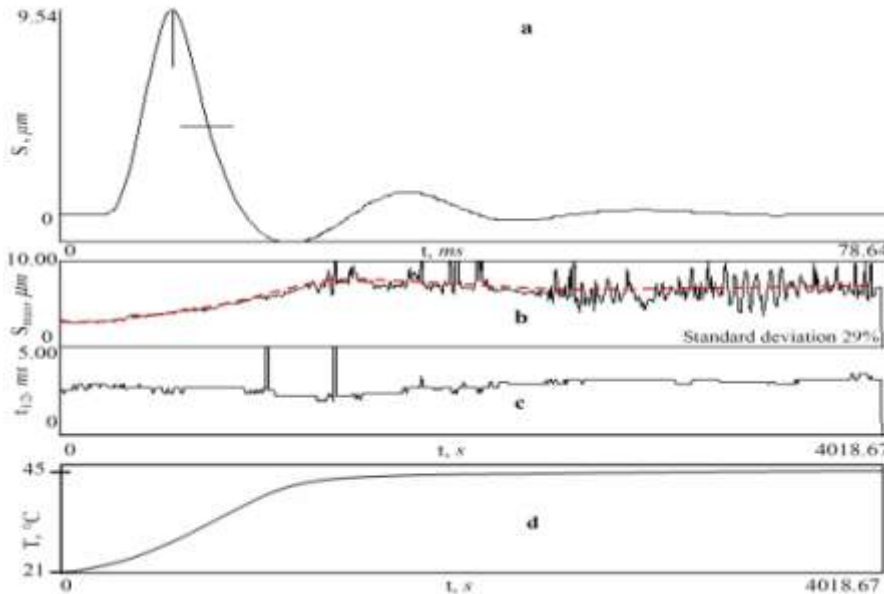
Evaluation of shear wave velocity and shear modulus in tissue phantoms by SWEI method



Displacement
through the time in
tissues *in vitro*

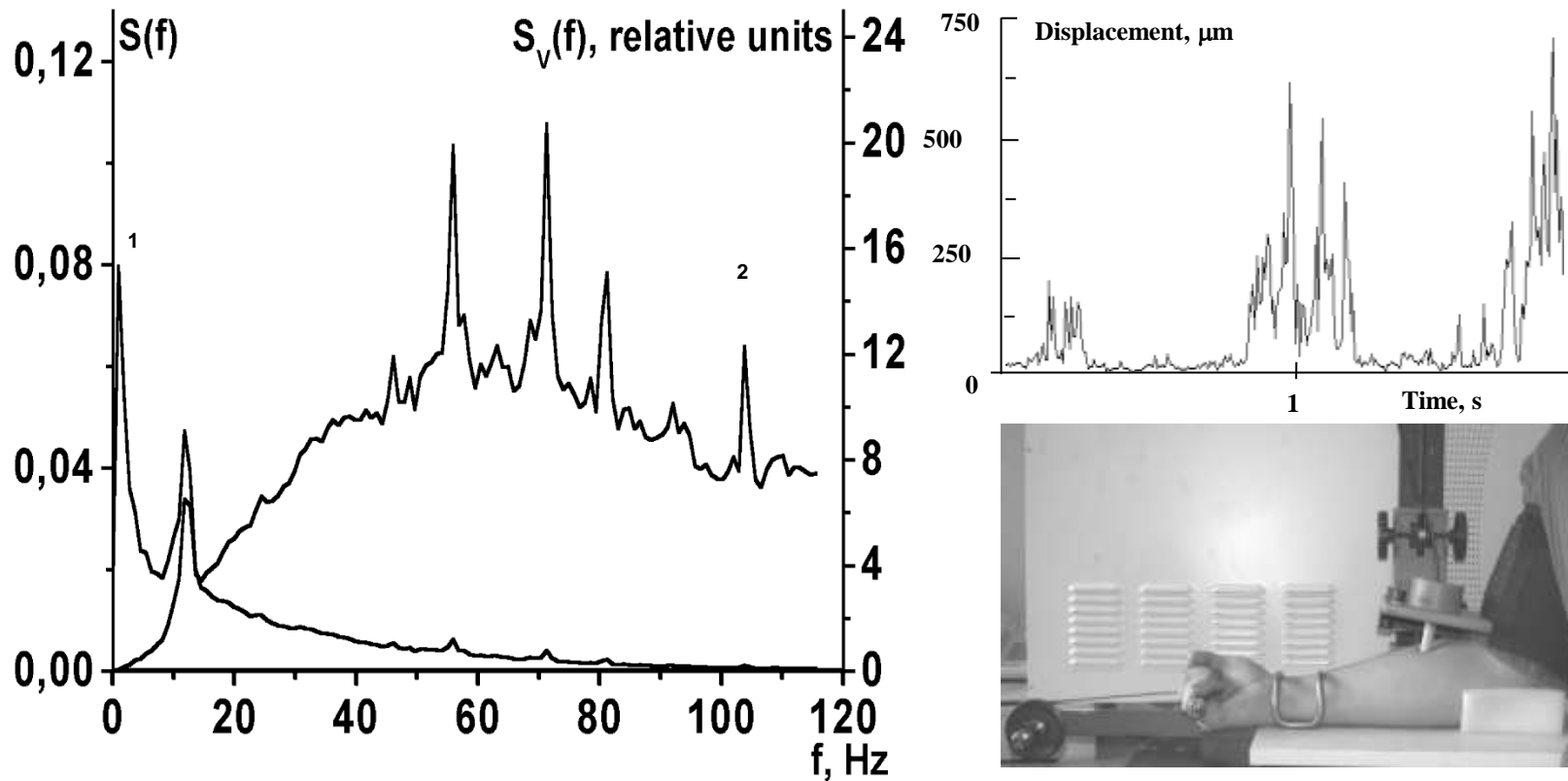


Doppler Monitoring of Ultrasound Hyperthermia and Thermal Destruction of Soft Tissues



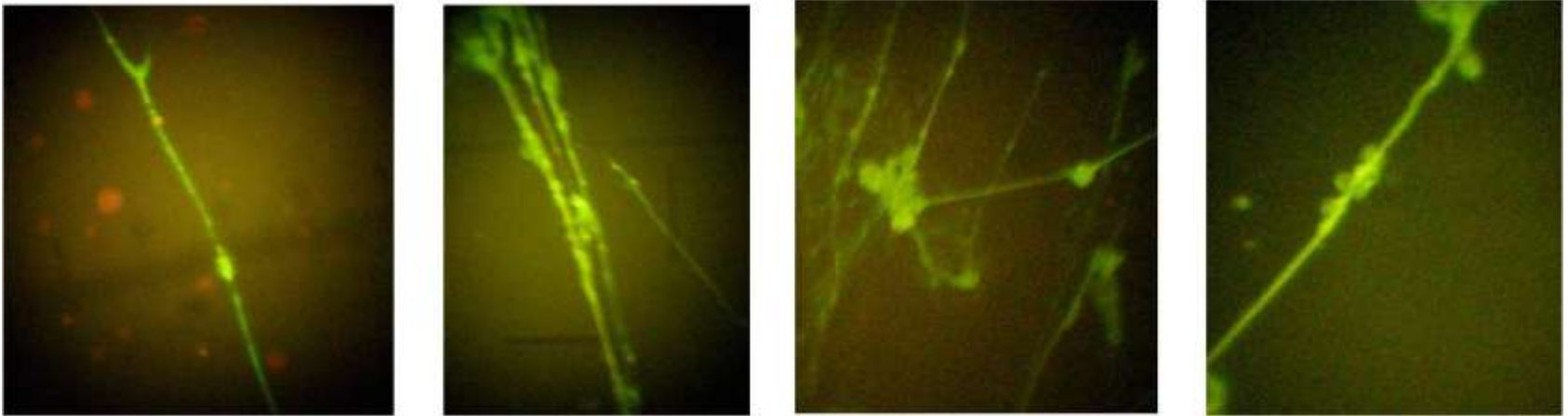
The strain relaxation at different temperatures during the Doppler monitoring of tissue ultrasound hyperthermia

Doppler Spectral Monitoring of Isometric Muscle Contractions



Spectra of tissue displacements and velocities under isometric muscle contractions

Novel Fluorescent Markers of protein conformational and aggregation changes



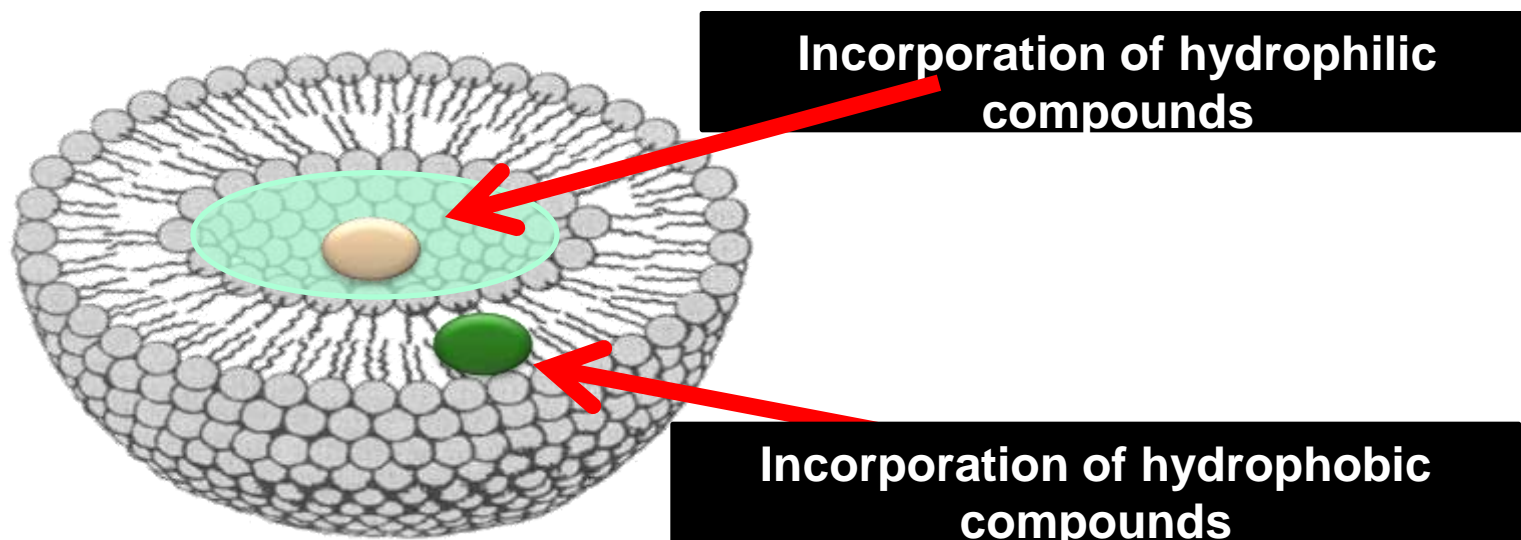
Fluorescent markers on the benzantron dyes base for the abnormal amyloid proteine aggregates detection

The fluorescence-based optical sensors for glucose detection



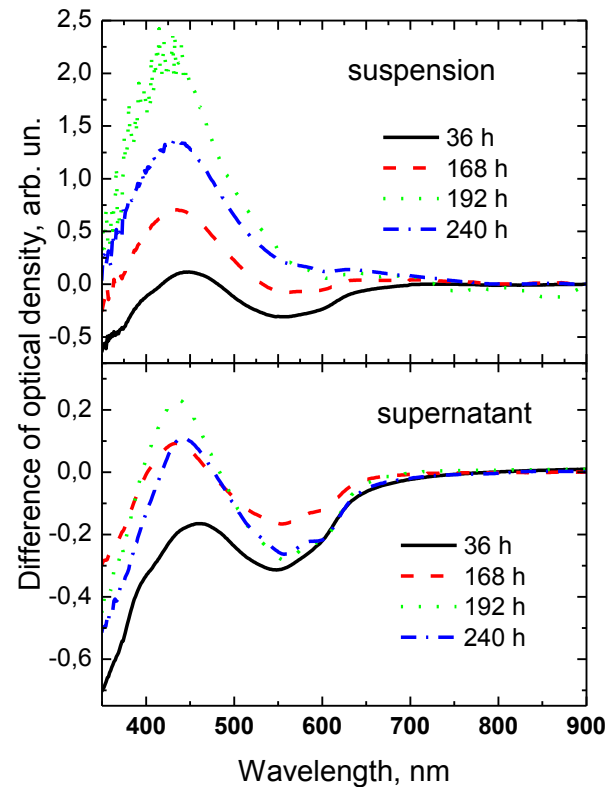
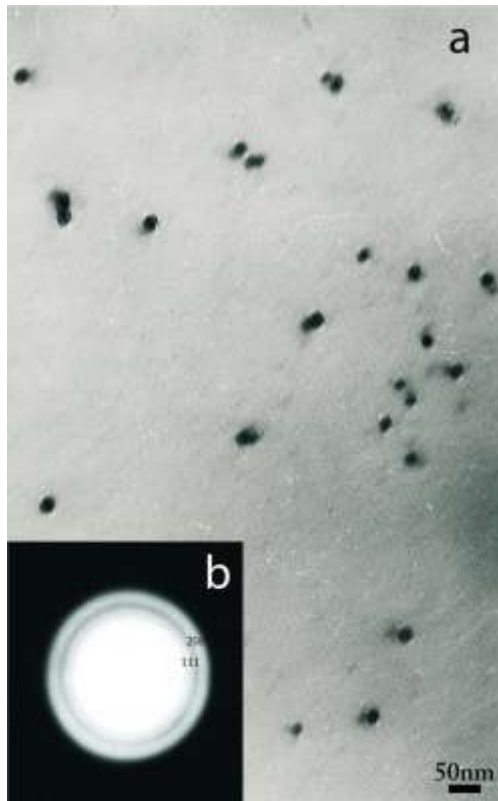
The fluorescence-based optical sensors for glucose detection as modern detectors

The novel type of anticancer drugs



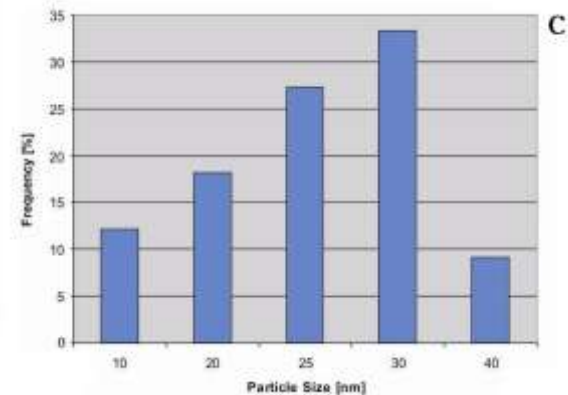
Based on the study of drug partitioning into lipid/protein phase and encapsulation of drug in liposomes developed liposomal form coordination complexes of europium as novel type of anticancer drugs

Development of technology of nanoparticle production for medical applications



Optical absorption spectra of silver nanoparticles

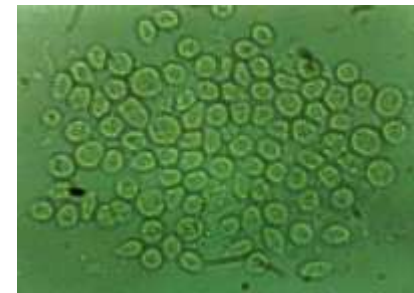
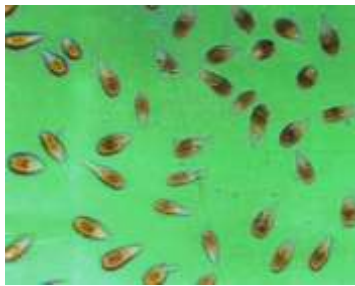
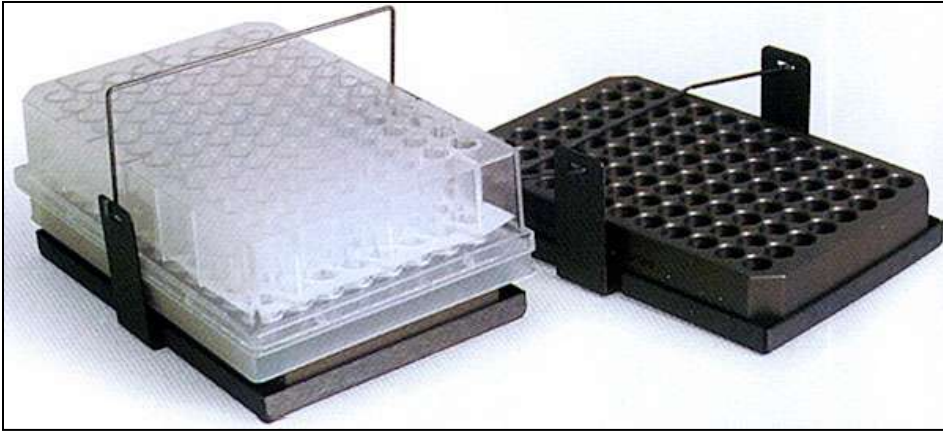
Size distribution of produced silver nanoparticles



Silver nanoparticles produced using
Streptomyces spp.211A

Biosensors for Pathological Processes

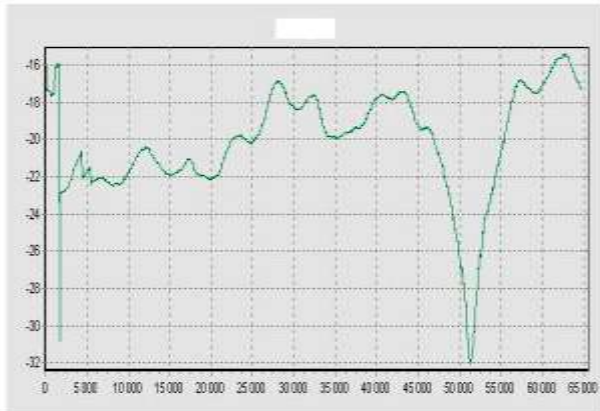
Diagnostics



Cellular *Dunaliella viridis* test system

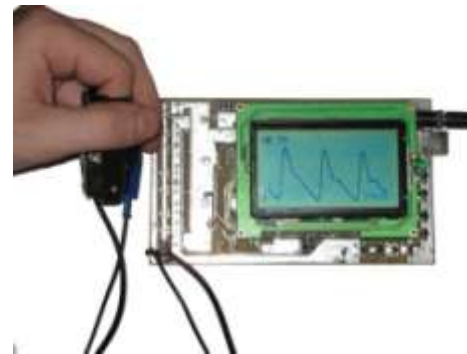
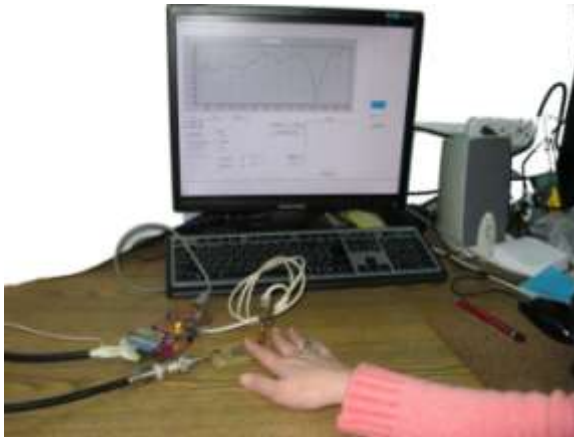
Electromagnetic system for biochemical processes testing

Radio frequency band



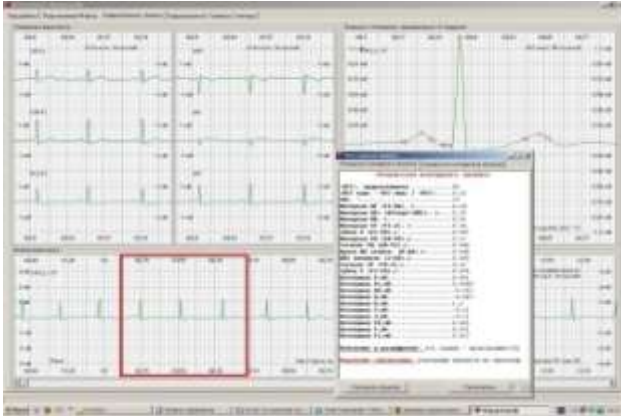
- Diabetology
- Clinical biochemistry
- For general and private medical practice
- Homemonitoring
- Noninvasive

Optical band



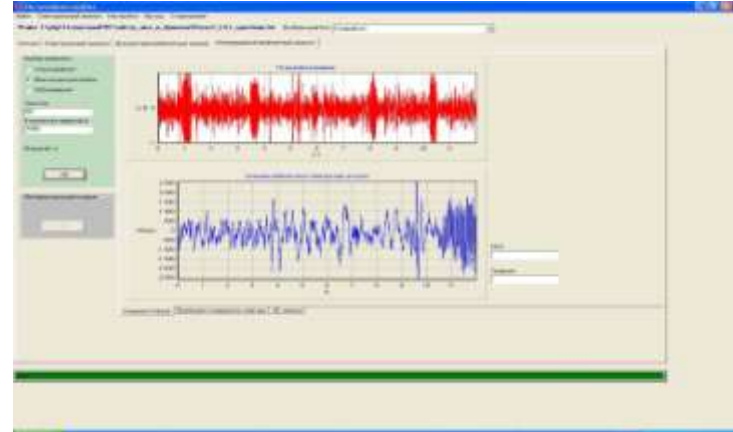
Different physiological signals telemetric systems testing

System of ECG research



ECG processing

Acoustic system for lung research



Wavelet image of pulmofofonogramm



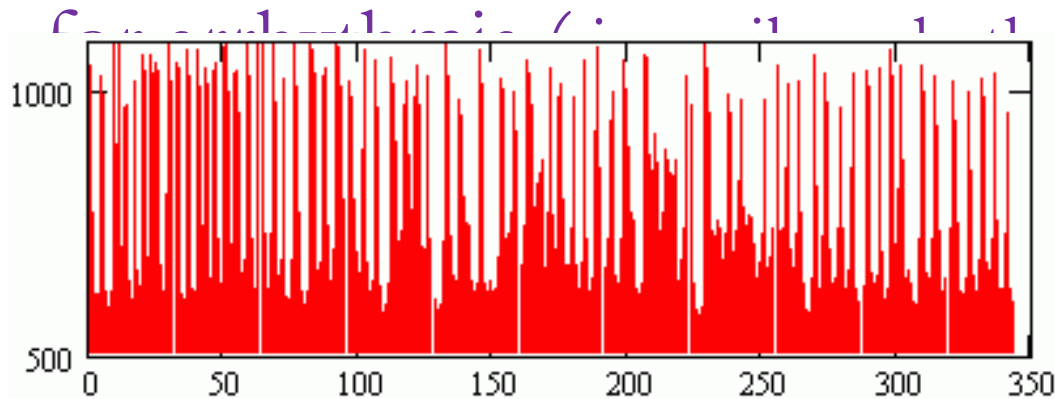
Heart Rate Variability in Neurohumoral Regulation and Biofeedback for Health Control and Support



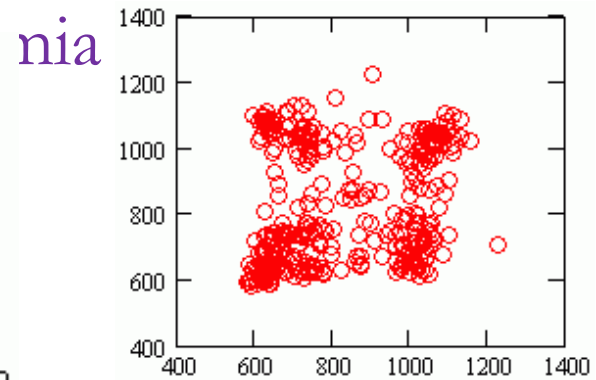
- Theory
- Methods
- Equipments
- Applications in healthy life and clinical practices
- Team approach (EU partners: Catholic University, Leaven, Belgium Aberdeen University, Scotland, GB Graz University, Austria; UA partner: Kharkiv National Aerospace University)

One of Models of Personal Health Assistant

Nonlinear Independent Components HRV Spectrum Analysis



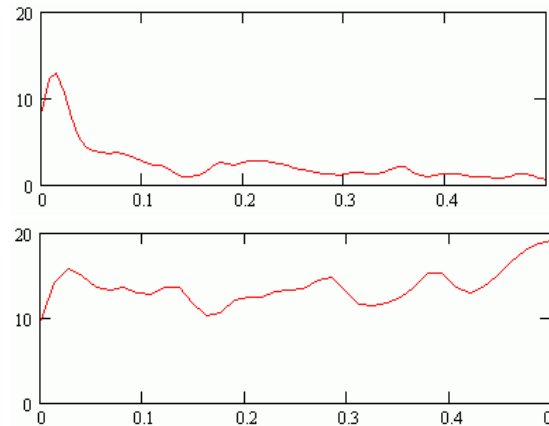
HRV record



Poincare plot simulation

Error of decomposition

- 2 sources – $\varepsilon=2.9\%$;
- 3 sources – $\varepsilon=1.7\%$;
- 4 sources – $\varepsilon=1.0\%$;
- 5 sources – $\varepsilon=18.2\%$.



Harmonic part:

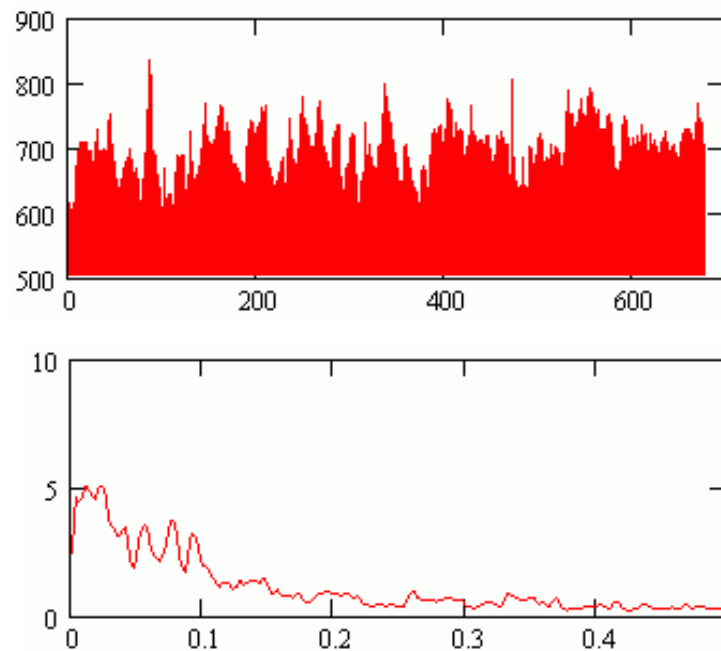
$$TP_{\text{harm}} = 2420 \text{ ms}^2$$

Stochastic part:

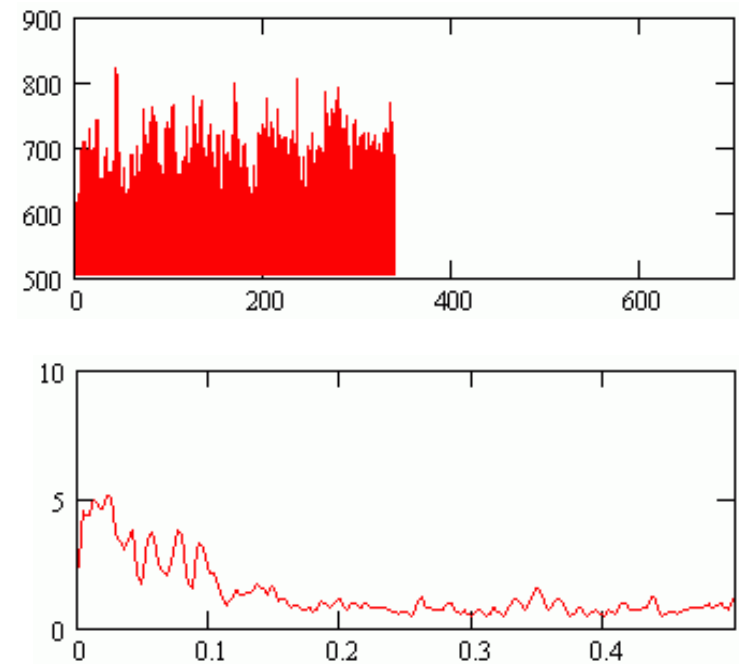
$$TP_{\text{stoch}} = 6110 \text{ ms}^2$$

HRV Spectrum Analysis with Regular Missing Data

Initial HRV record and spectrum

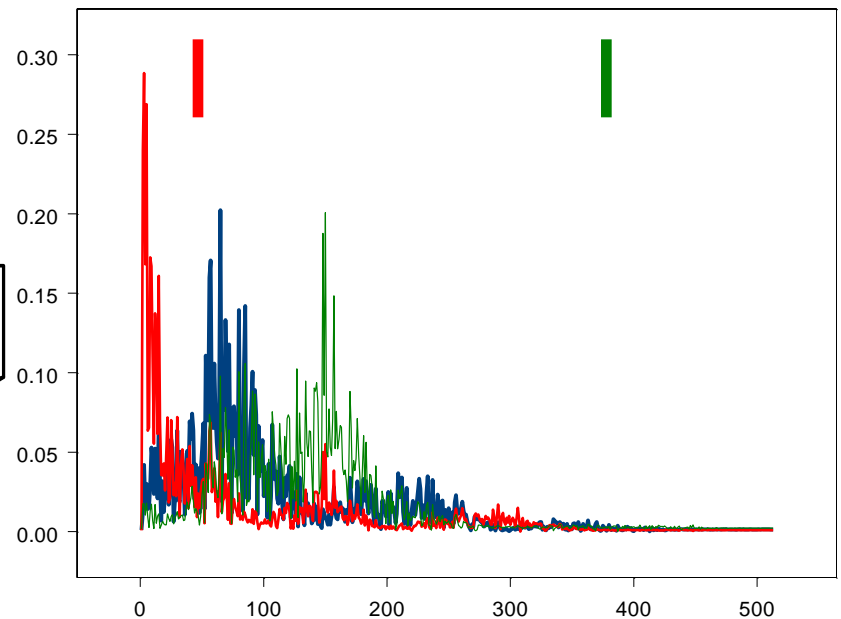
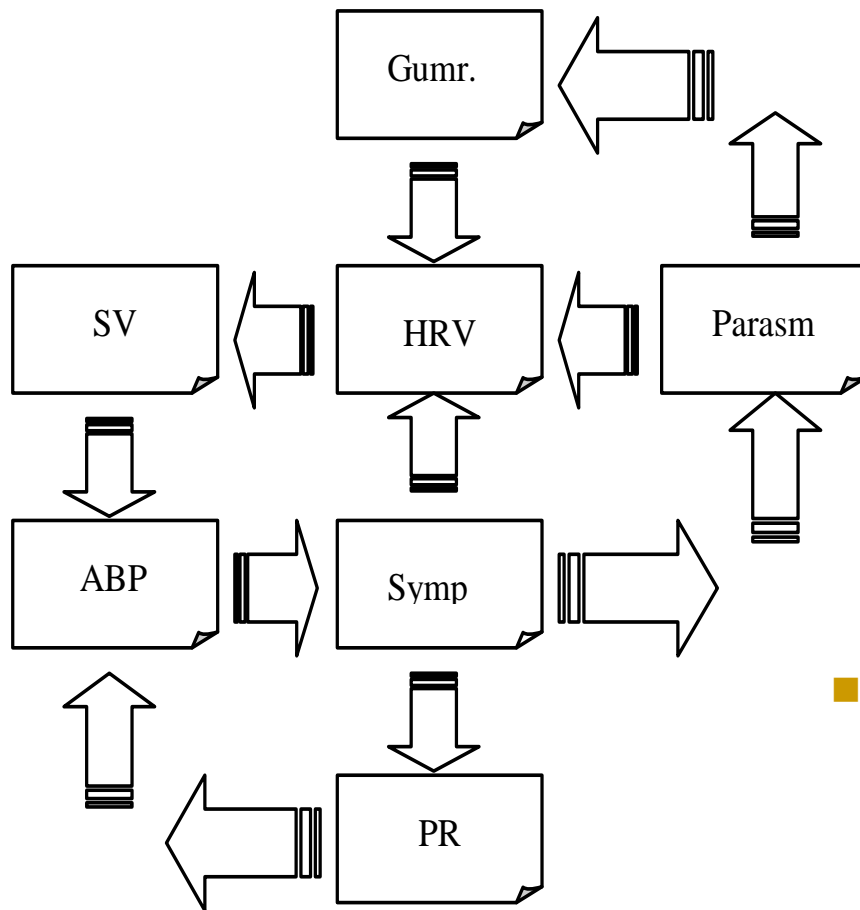


HRV record and spectrum after missing every 2nd observation



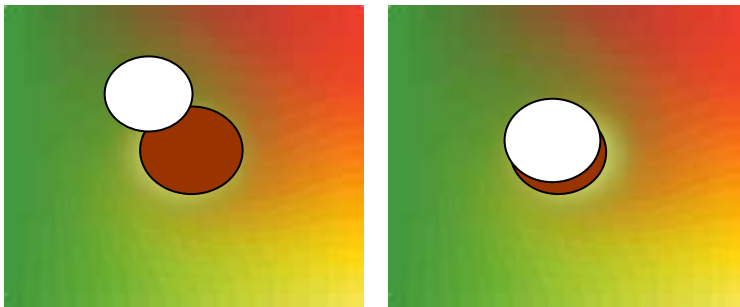
Difference in TP calculations only 5%!
Difference in calculations M – 0.03%; σ – 0.16%

Heart Rate Variability (HRV) Based Mathematical Model in Neurohumoral Regulation and Biofeedback



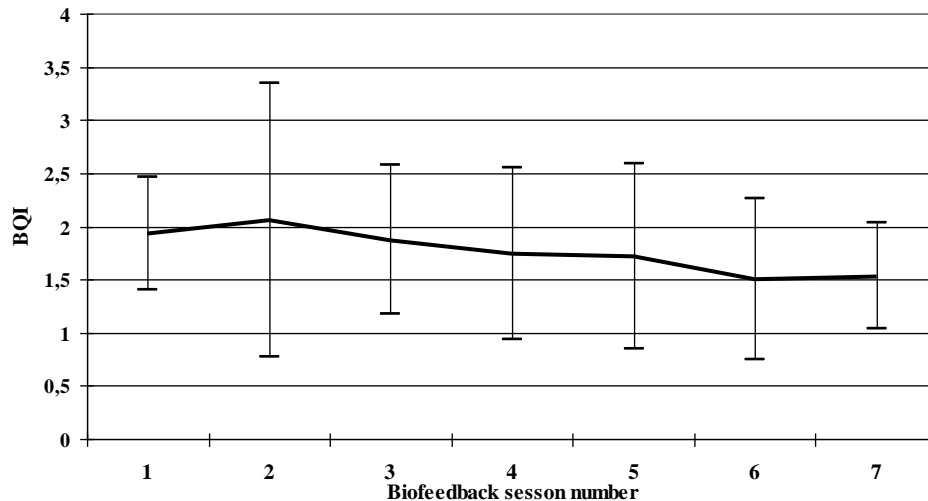
- Extraction from HRV signal precise separate information of neurohumoral branches condition and changes

Heart Rate Variability in Biofeedback Self Correction



- Easy and useful for real-time self correction
- A male that was 22 years old was identified as volunteer Z.
- The fig.1 – for relaxed position (small disturbances in patient's regulation system)
- The fig.2 – volunteer watched for biofeedback monitor and walking in place at different paces for the best result (shows the positive self regulatory reaction)

Biofeedback measures for Heart Rate Variability in Biofeedback Self Correction



- Biofeedback training of 14 healthy volunteers aged from 18 to 26 years/
- The changes of mean BQI values in 7 biofeedback sessions. With increasing session number the values of BQI decrease, that indicates the training effect of regulation system in the repeated biofeedback sessions and its positive impact on the regulatory systems.

- Optimality (O) as a measure of system remoteness for the entire biofeedback test
- Sensitivity (S) as a measure of susceptibility of the system to paced breathing
- Effectiveness (E) is estimated by the degree of HRV indices approaching to physiologically optimal condition in the biofeedback algorithm execution time
- Biofeedback Quality Index (BQI) as an integral index, covering all parameters (O, S, E) of biofeedback quality.

Funding agencies should keep in mind that more organization and control do not necessarily mean better science

Jeff's view on science and scientists

Gottfried Schatz

Thank You Very Much
for Your Kind Attention!
