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

Kharkiv V.N. Karazin National University Team
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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.
- Yabluchanskiy 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
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.
Reorganization of specialized medical care in the form of hospital districts

- Multiprofile hospital of routine treatment with consultative polyclinic
- Rehabilitation Hospitals
- Hospices
- Hospital of routine treatment of chronic patients
- Establishments of medical and social care
- Centers of primary care
- The city of regional significance
- Hospital district – is a territorial association which provides specialized medical and sanitary care by complex of health care institutions
Reorganization of medical care system

Center of primary medical and sanitary care

Clinic of family doctor

Paramedic and obstetrics station

Day hospital

House of nursing care

Consultative and Diagnostic Center

Hospital intensive care
- > 100,000 population;
- > 4000 operations;
- > 1000 deliveries.

Hospital of chronic patients

Rehabilitation center

Hospice

University hospitals and other institutions of specialized medical care

Ambulance
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
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
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
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 hypertermia 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 \textit{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

Silver nanoparticles produced using *Streptomyces* spp. 211A

Optical absorption spectra of silver nanoparticles

Size distribution of produced silver nanoparticles
Biosensors for Pathological Processes Diagnostics

Cellular Dunaliella viridis test system
Electromagnetic system for biochemical processes testing

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

**Radio frequency band**

**Optical band**
Different physiological signals telemetric systems testing

System of ECG research

Acoustic system for lung research

ECG processing

Wavelet image of pulmofonogramm
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

Error of decomposition
- 2 sources – ε=2.9%;
- 3 sources – ε=1.7%;
- 4 sources – ε=1.0%;
- 5 sources – ε=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 2\textsuperscript{nd} observation

Difference in TP calculations only 5%!
Difference in calculations M – 0.03%; \(\sigma\) – 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

- 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.

- 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.
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!