Anexa II / la contractul de finanţare
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Scientific Report
Workshop on Biodynamics,
17-18 September 2008, Bucharest, Romania

A workshop entitled "Biodynamics and related domains" was organized on 17th and 18th of September 2008. The two day event was part of the "Romanian Scientific Diaspora" conference, and took place at the International Centre of Biodynamics from Bucharest.

The workshop had the following objectives:

- to offer an overview of the most interesting research areas from biodynamics
- to establish (or reinforce) links with those Romanians from diaspora who pursue successful research in biodynamics
- to mobilize scientists from Romania with expertise that doubles/ completes/ could make use of the expertise accumulated by the Romanian diaspora
- to create the appropriate framework for both exchanging ideas and launching new partnerships between Romanian scientist from inside and outside Romania.

The present summary would like to show that the workshop has achieved the above objectives.

The contributions of all speakers at the Workshop on Biodynamics

As will also be indicated below, the speakers presented results from a great variety of research subjects. However, observing a biological system (or a system of biological inspiration) in evolution represented the common theme of all talks. The biological systems taken into study were characterized by a very different complexity, from molecules to whole cells, and from whole animals to Earth (see the presentation given by Prof. Florin Munteanu). The presentations were on the following issues:

1. Prof. Andrei Ruckenstein (Boston University, USA): Mr. Ruckenstein have presented details on a model of the motion of RNA polymerase, the multi-subunit molecular motor that carries out the transcription process, as it proceeds along DNA. Transcription is the process by which the genetic information encoded in DNA is transferred into RNA. Understanding the structural and mechanistic aspects of each step of transcription is thus very important.

2. Prof. Zoltán Néda ("Babes-Bolyai" University, Cluj-Napoca, Romania): The presentation concerned oscillator systems of biological inspiration. Oscillators (elements capable of emitting pulses and detecting the pulse emitted by others) characterized by different oscillating periods have been considered. A model of nontrivial synchronization, and the first attempts to experimentally confirm the predicted nontrivial synchronization (as a co-product of the considered output optimization) have been presented.

3.) Prof. Paul Dan Cristea (Politehnica University, Bucharest, Romania): DNA sequence analysis based on standard symbolic sequence fails to reveal regularities in the distribution of nucleotides and pairs of nucleotides. Therefore, Nucleotide genomic

signal (NuGS) was introduced. NuGS not just identify such regularities in the distribution but also proved useful for early diagnosis and detection of pathogen drug resistance.

4.) Prof. Mihail Popescu (Ian Wark Research Institute, University of South Australia): The presentation has detailed confinement effects on the phoretic motion of self-propellers. With the introduction of the lab-on-a-chip concept, developing miniaturized objects able to perform autonomous and controlled motion has become very important. The motion of self-propellers in three spatial dimensions and two dimensions (adsorbed films or membranes) has been considered.

5.) Prof. Corneliu Balan (Politehnica University, Bucharest, Romania): As a continuation of the above presentation, and with great importance for the very same field (i. e. lab-on-a-chip), Mr. Corneliu Balan has presented some experimental studies and modeling on the vertical structures of complex fluids (such as polymeric solutions) in micro-channels. The effect of surface tension and viscosity ratio on the development and structure of the vortex at the interface between two immiscible fluids was investigated.

6.) Prof. Tiberiu Cheche (University of Bucharest, Physics Faculty): An analytical approach for strain and piezoelectric potential in conical self-assembled quantum dots has been presented. The obtained results were compared with numerical results obtained with an atomistic model based on the valence force field method. Good agreement was found.

7.) Prof. Mircea Rusu (University of Bucharest, Physics Faculty): Mr. Mircea Rusu presented details on pattern formation in complex systems outside of equilibrium. As an example, a film of dimyristoylphosphatidylethanolamine (made by the Langmuir-Blodgett technique) was used to study the conditions and topology of coexistence of the liquid-expanded and liquid-condensed phases.

8.) Prof. Edmond Cretu (University of British Columbia, Vancouver, Canada): Mr. Cretu presented few examples of adaptive microsystems used in medicine. The first example consisted of the nonlinear coupling of a mechanical microstructure and an electric circuit for obtaining a real time spectrum analyzer (an architecture that can be useful for hearing prosthesis). The second presented example was an accelerometer sensitive and small enough to be used in minimally invasive surgeries.

9.) Prof. Vasile V. Morariu (National Institute of R&D for Isotopic and Molecular Technology, Cluj-Napoca, Romania): The presentation concerned the autoregressive description of natural phenomena from molecular biology, cell biophysics, cognitive psychology, and astrophysics.

10.) Prof. Florin Munteanu ("Sabba S. Stefanescu" Institute of Geodynamics"): Plane Earth is a complex system that is difficult to define and characterize properly and completely. Natural structures and Artificial (man-made) elements are continuously interacting with each other. The symbiosis and dynamics of the elements is only partially controllable and predictable. In order to be, at least partially, understood new, interdisciplinary approaches are needed. The talk given by Mr. Munteanu has detailed few ideas, concepts, models and methodologies in order to reveal which are the best directions of study to be followed when studying this Artificial – Narual hybrid in order to extend the lovelock's Gaia hypothesis and to define useful recommendations for sustainable development.

11.) Prof. Eugen Gheorghiu (International Centre of Biodynamics, Bucharest): The presentation made by Mr. Gheorghiu was focused on novel methods for evaluating the effects of different physical or (bio)chemical stimuli on different biosystems. The concepts and the first results have been presented on 1.) an acoustic system for monitoring fish behavior (behavior which is expected to be influenced by the quality of the water environment), 2.) monitoring the cellular cycle by impedance spectroscopy, and 3.) the use of adherently growing cells and impedance for analytical purposes.

12.) Prof. Silvana Andreescu (Clarkson University, Postdam, New York, USA): The presentation has shown few environmental and clinical applications of advanced nanomaterials. It is noteworthy the use of nanoparticles for: 1.) oxygen reservoirs in the construction of oxidase-based biosensors, and 2.) obtaining microcapsules with biocatalytica material for bioremediation.

13.) Prof. Vlad Brumfeld (Weizmann Insitute, Israel): The talk tried to answer the question Photosynthetic Antennae Quo Vadis? The opinion that the photosynthetic membrane is characterized by such a great density that the lateral movement of the elements involved in photosynthesis is not possible was presented. As an alternative to the migration of the photosynthetic complexes in the membrane, the disruption and subsequent reorganization of the thylakoid membrane was proposed.

14.) Prof. Teodor Paunescu (Harvard Medical School, USA): The role of the V-ATPase B subunit in renal proton secretion was detailed. This proton pump plays an essential role in numerous membrane trafficking processes by the acidification of intracellular organelles.

15.) Prof. Dumitru Popescu (Politehnica University Bucharest): The theory of the pulsatory liposome was described. A lipid vesicle (with its membrane impermeable for the solute it is filled with) is introduced into a hypotonic aqueous solution. Because of the mechanical tension induced by osmotic flow, the vesicle swells up to a critical size and then transient lipidic pores are formed. It was observed that the vesicle dynamics is a periodic process. The phenomenon was described by differential equations.

16.) Prof. Simion Astilean ("Babes-Bolyai" University, Cluj-Napoca, Romania): The presentation was focused on plasmonic nanosensors for biological and medical investigations. Details on the fabrication of plasmonic nanostructured surfaces (e.g. Au covered nanoparticle arrays) and their use for spectroscopic detection (by Surface Enhanced Raman Spectroscopy, Surface Enhanced IR Absorption, and Localized Surface Plasmon Resonance) of some compounds (e.g. p-aminothiophenol) were presented.

17.) Prof. Grigore Damian ("Babes-Bolyai" University, Cluj-Napoca, Romania): Free radicals are characterized by an increased reactivity (and thus a short lifetime) and play an important role in biological systems (e.g. they are involved in the aging process). The presentation given by Mr. Damian detailed the use of electron spin resonance spectroscopy for the detection of these free radicals.

18.) Prof. Ralf Neurohr (Politehnica University, Bucharest): Details on known issues and perspectives of delayed luminescence (DL) of dry seeds were presented. The observation that there is a correlation between the intensity of DL and the germination

capacity of the seeds is the catalyst for ongoing research efforts. DL was presented as a highly sensitive and non-invasive tool both for fundamental research on the biology of dry living systems and for seed testing methods.

19.) Dr. Irina Carpusca (CEA, Institut d'Imagerie Biomedicale, Service Hospitalier Frederic Joliot, Orsay, France): Dr. Carpusca presented the European Molecular Imaging Laboratories (EMIL). EMIL is a network of excellence created under the 6th Framework Programme of the European Union, was launched in July 2004, is financed for a period of 5 years, and is coordinating the efforts of 58 research groups active in molecular imaging of cancer.

Event organization details

The workshop was organized by a local organizing committee from the International Centre of Biodynamics. Members of the Centre have successfully dealt with all technical details of the workshop (starting with the registration, and continuing with setting up the hardware needed for the presentations, and organizing the lunch and coffee breaks).

From a scientific point of view, the first day of the workshop focused on theoretical aspects of biodynamics while the second day also dealt with experimental aspects. The workshop days were divided into two sessions (morning and afternoon). Each presentation was followed by discussions meant to clarify all details of the talk. Each session ended with a round table where, along with scientific details, the possibility for new collaborations was also discussed.

The workshop has also contained a tour of the International Centre of Biodynamics for those interested.

Final Programme of the Workshop on Biodynamics

First day					
Morning Session			Afternoon session		
9.30-10.00	Opening				
10.00-10.30	Andrei Ruckenstein	Towards an understanding of single gene transcription: molecular motors without Maxwell demons	14.00-14.30	Corneliu Balan	On the vortical structures of complex fluids in micro-channels
10.30-11.00	Zoltan Neda	Nontrivial synchronization of multimode stochastic oscillators	14.30-15.00	Tiberiu Cheche	Analytical approach for strain and piezoelectric potential in conical self-assembled quantum dots
11.00-11.30	Paul Dan Cristea	Nucleotide Genomic Signals: A Molecular Investigation Tool for Early Diagnosis and Detection of Pathogen Drug Resistance	15.00-15.30	Mircea Rusu	Aspects of pattern formation outside of equilibrium
11.30-12.00	Mihail Popescu	Confinement Effects on Diffusiophoretic Self-Propellers	15.30-16.00	Edmond Cretu	Adaptive microsystems in medicine - from hearing aids to minimally invasive surgery

12.00-12.30	Round Table		16.00-16.30	Vasile V.Morariu	Autoregressive description of natural phenomena
12.30-14.00	Lunch		16.30-17.00	Florin Munteanu	Astro-bio-geodynamics –a transdisciplinary approach to the Lovelock's Gaia hypothesis
			17.00-17.30	Round table	
Second day					
Morning session			Afternoon Session		
9.30-10.00	Eugen Gheorghiu	Biodynamics: ways and means to appraise the interaction between selected environmental stimuli and biosystems of various hierarchies	14.00-14.30	Dumitru Popescu	Theory of the pulsatory liposome
10.00-10.30	Silvana Andreescu	Environmental and Clinical Applications of Advanced Nanomaterials	14.30-15.00	Simion Astilean	Plasmonics-based novel nano-probes and nano-tools for biological and medical investigation
10.30-11.00	Vlad Brumfeld	Photosynthetic antennas - QUO VADIS?	15.00-15.30	Grigore Damian	Applications of electron spin resonance spectroscopy in medicine and biophysics
11.00-11.30	Teodor Paunescu	Role of the V-ATPase B subunit isoforms in renal proton secretion	15.30-16.00	Ralf Neurohr	Delayed Luminescence of Dry Seeds – Known Issues and Perspectives
11.30-12.30	Round Table		16.00-16.30	Irina Carpusca	EMIL (European Molecular Imaging Laboratories) Network of Excellence: experience of a collaborative European Project
12.30-14.00	Lunch		16.30-17.30	Round Table	

Final list of key-speakers – scientific tile, name and surname, country of origin, institution represented, address, telephone, fax, e-mail, short presentation of their professional expertise

1. Prof. Dr. Andrei Ruckenstein

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Mr. Ruckenstein, former director of BioMaPS Insitute of Quantitative Biology, professor of physics at Rutgers University, is currently associate provost and vice president for research at Boston University. His research interest is ranging from theoretical physics (see high temperature superconductivity) to biology (see the study of the mechanism of transcription).

2. Prof. Dr. Paul Dan Cristea

Politehnica University Bucharest
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Mr. Cristea's research interests cover: processing digital signals and images, neural networks, discrete dynamic systems, the theory of circuits and signals, computerized medical equipments, industrial measuring equipments, etc.

3. Prof. Dr. Mihail Popescu

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The research interest of Mr. Popescu include: i.) fluid flow in geometrically and chemically patterned microchannels, ii.) diffusion and attachment of microparticles to interfaces, iii.) models for catalytically activated reactions on microparticles: kinetic and thermodynamic aspects of the adsorbate, iv.) motion of small particles in self-generated asymmetric gradients fields, and v.) fluid transport processes through porous media and in microfluidic elements.

4. Prof. Dr. Corneliu Balan

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Mr. Balan is head of the ReoRom rheology laboratory, and is member of the Bioengineering and Biotechnology Department. Among his research interests one finds: mechanics of continuum media, mechanics of non-Newtonian fluids, rheology, rheometry, constitutive relations, and viscoelastic fluids.

5. Prof. Dr. Tiberiu Cheche

University of Bucharest
Physics Faculty
Research Center for Applied Sciences, Taipei Taiwan
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Among the research interest of Mr. Cheche one finds: i.) Optical and relaxation phenomena in semiconductor quantum heterostructures, ii.) Charge and spin currents in semiconductors, and iii.) Charge transfer reactions in biological systems.

6. Prof. Dr. Mircea Rusu

University of Bucharest
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Research areas of interest for Prof. Rusu are: i.) atomic and molecular physics (magnetic resonance and relaxation, surface physics, quantum modeling of structures and of molecular dynamics and properties), ii.) astrophysics (Sun physics and Sun-Earth interactions, nuclear astrophysics, cosmic radiations, gravity and the structure of space, etc.)

7. Prof. Dr. Vasile V. Morariu

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Dr. Vasile Morariu is heading the Biophysics and Biomolecular Physics group from the institute. Among his research interests we find: i.) Short-range and long-range memory properties of natural structures (DNA and protein organization, flickering of red blood cells), ii.) Non-equilibrium processes, chaos and fractals in biosystems, iii.) Physico-chemical and biophysical processes in electromagnetic fields, iv.) Life in zero magnetic field, v.) Space weather and its terrestrial impact on biological processes, and vi.) Psychophysics.

8. Prof. Dr. Edmond Cretu

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His research interests include: microelectromechanical systems, sensors and actuators, adaptive MEMS/NEMS, modern methodologies of nonlinear signal processing, and Analysis of complex systems.

9. Prof.Dr. Florin Munteanu

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The research interests of Mr. Munteanu include: i.) The science of complexity (self-organization and pattern formation, chaotic systems, criticality, network dynamics, intelligent agents, fractals, etc.), ii.) Bio-economics, iii.) Prospective research within the framework of the Knowledge-based Society, iv.) Novel educational methods, technologies and attitudes (e-learning, content design and management, management of learning processes), and v.) Advanced signal analysis methods for applications in engineering, economy/ finances, and medicine.

10. Prof. Dr. Eugen Gheorghiu

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Mr. Gheorghiu is the director of the International Centre of Biodynamics. His research is currently focused in developing methods and instruments for the non-invasive monitoring and control of biological systems.

11. Prof. Dr. Silvana Andreescu

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The recent research interest of Dr. Silvana Andreescu covers: i.) microincapsulation techniques (e.g. the use of natural biopolymers and hybrid material nanoparticles for developing microcapsules for drug delivery), and ii.) the investigation of novel bio- and nano-particles aiming for an increased selectivity, sensibility and stability of biosensors.

12. Prof. Dr. Astilean Simion

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Prof. Astilean is leading a group with research interests including: i.) the fabrication of nanoparticles and nanostructured surfaces, and ii.) the use of those nanoparticles and nanostructured surfaces for enhancing the sensitivity of Raman spectroscopy, IR absorption, fluorescence, luminescence, etc.

13. Prof. Dr. Vlad Brumfeld

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The research interest of Mr. Brumfeld covers i.) state transitions in the photosynthetic apparatus of superior plants, and ii.) the thermodynamics of protein-protein interactions.

14. Prof. Dr. Teodor Paunescu

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After a post doctoral stage at University of Illinois (1999-2001), Mr. Paunescu has performed research at Harvard Medical School and Massachusetts General Hospital (2001-2005). Starting with 2005 he is Instructor in Medicine at Harvard Medical School, and starting with 2006 he is also Assistant in Biology at Massachusetts General Hospital. His research activity is currently focused on studying the vacuolar proton-pumping ATPase.

15. Prof. Dr. Dumitru Popescu

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The activity of Mr. Dumitru Popescu covers: i.) applications of the advanced control and new information technologies in biology, medicine, transportation, chemistry, urbanism, life quality, linguistics, sociology, and finances, ii.) interdisciplinary research with the participation of the members of the Faculty, in collaboration with other faculties of Politehnica University Bucharest, and/or other research and education units from inside and outside Romania, and iii.) elaboration of programmes for doctoral and master education.

16. Prof. Dr. Néda Zoltán

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Mr. Néda is interested in statistical and computational physics and especially in: Synchronization phenomenon, Statisical physics of fragmentation processes, Stochastic Resonance, Random networks, and Clusterization in sociological systems.

17. Prof. Dr. Grigore Damian

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Mr. Damian is interested in electron spin resonance (ESR) spectroscopy and Fourier transform infrared spectroscopy used in: i.) investigating the effect of pharmaceutical stress (sterilization, oxidation, photolysis) on drugs and foodstuff (formation of free radicals, identification and determination of their structure), ii.) investigating the effects of different biochemical conditions and lyophilization on the conformational changes of proteins, and iii.) investigation of biological processes with different spin markers and traps.

18. Prof. Dr. Ralf Neurohr

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Next to his interest in delayed luminescence, Dr. Ralf Neurohr is also an independent consultant doing research projects for industrial partners in different European countries. Since 1997 Dr. Neurohr is a permanent Senior Consultant of the SGS Institute Fresenius group (Taunusstein, Germany).

19. Dr.Irina Carpusca

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Dr. Irina Carpusca is currently coordinator of EMIL (European Molecular Imaging laboratories) network of excellence. EMIL gathers a number of 59 research groups from universities, research centers, and industry. Its main objective is to efficiently coordinate the molecular imaging efforts in the study of cancer.

Final list of participants – scientific title, name and surname, country of origin, affiliation, address, telephone, fax, e-mail.

	Participants				
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3.	Carpusca Irina	Doctor	France	CEA, Institut d'Imagerie Biomedicale	CEA, Institut d'Imagerie Biomédicale, Service Hospitalier Frédéric Joliot, Orsay, France CEA - I²BM - SHFJ - U803 4 place du Général Leclerc 91401 ORSAY CEDEX FRANCE Tel. : 0033 (0)1 69 86 77 65 irina.carpusca@cea.fr
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III	**Others**			
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Statistic information regarding participants

Total number of speakers and participants from Romania: 23

Total number of speakers from Romanian Diaspora: 7

Number of presentations: 19

Countries represented by the participants: Romania, USA, France, Israel, Canada, Australia

Geographic distribution of the participants:

No.	Country of home institution	No. of participants	%
1.	USA	3	10%
2.	ISRAEL	1	3.33%
3.	FRANCE	1	3.33%
4.	CANADA	1	3.33%
5.	AUSTRALIA	1	3.33%
6.	ROMANIA	23	76.66%
Total		30	100%

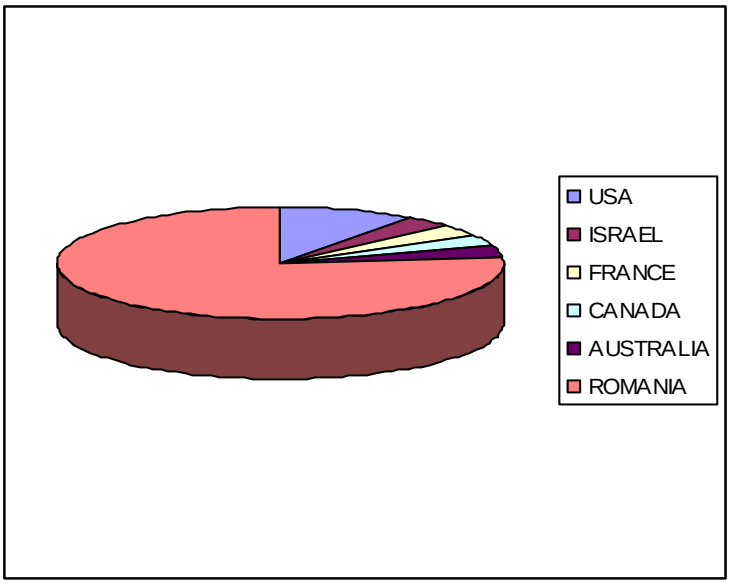

Figure 1.

Distribution of participants as function of their home-institution country

Communication language: English, Romanian

Age of participants:

No.	Age Range	No. of participants	%
1.	25-35 years	9	30%
2.	35-45 years	5	16.66%
3.	45-55 years	13	43.33%
4.	Above 55 years	3	10%
5.	Total no. of participants	30	100%

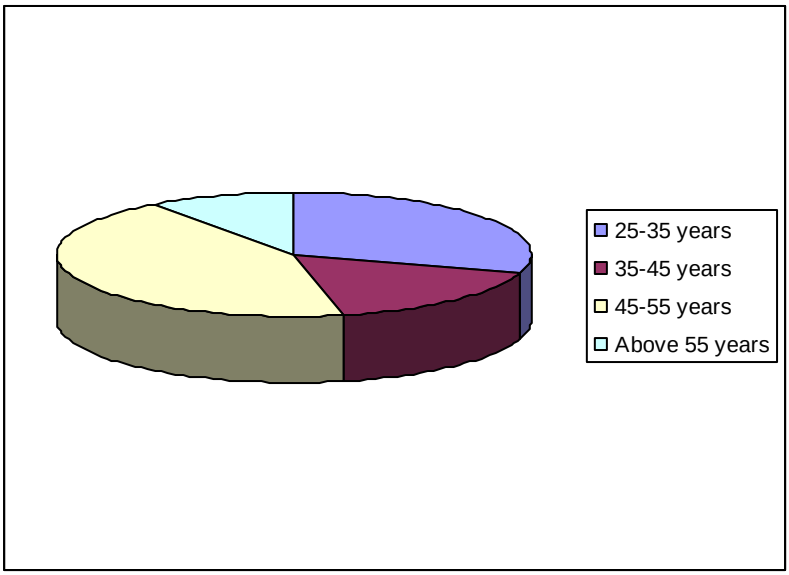

Figure 2 .

Particpants distribution as function of age categories

Organizer:

Prof. Dr. Eugen Gheorghiu