

PURPOSE AND SIGNIFICANCE

The Summer School 2024 **BIO: PHYSICS, STATISTICS, AND INFORMATICS** is a form of education that offers courses, both academic and non-academic, during the summer period. The main goal is to show students that knowledge of fundamental sciences is not just knowledge of "dry" theoretical facts based on various formulas and calculations.



The organizers are "burning" with the desire to interactively and interestingly convey to the future participants their point of view, that the knowledge of fundamental sciences is the satisfaction of personal curiosity, self-awareness, and the need for knowledge of the environment, that everyone of their daily activities is directly or indirectly based on the knowledge of fundamental sciences. Summer school participants can look forward to lectures on various exciting topics (from Albert Einstein and his attempt to create a "theory of everything" to how to lie with the help of statistics), practice in scientific laboratories (a unique opportunity not only to inspect the equipment but also to participate in experiments), getting to know the world of science (micro and the macro world and jazzy statistics), as well as a fun quiz in which teams of scientists and students will compete against each other and an educational excursion.

ORGANISERS/COORDINATOR

Department of Physics, Mathematics and Biophysics
Faculty of Medicine
Lithuanian University of Health Sciences

PARTNERS:

MAIN INFO FOR STUDENTS

Erasmus+ for higher education aims to modernise and improve higher education across Europe and the rest of the world.

Registration:

Accommodation:

Hotels and apartments that we recommend to book:

- "Zaliakalnio terasos apartamentai" address: savanorių pr. 276 393, 50201 Kaunas, Lithuania.

- "Kaunas City" address: laisvės al. 90, LT-44251 Kaunas, Lithuania.

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All these hotels, condo hotels and more you can find in the <https://www.booking.com/>

CONTACTS

If you have any question due the academic matters of BIP, please contact dr. Diana Meilutyte-Lukauskiene (diana.meilutyte-lukauskiene@lei.lt) or doc. dr. Renata Paukstaitiene (renata.paukstaitiene@lsmu.lt).



LITHUANIAN UNIVERSITY
OF HEALTH SCIENCES

Summer School 2024

BIO: PHYSICS, STATISTICS, AND INFORMATICS

3ECTS



Have fun with scientists in 2024!

25 August – 1 September

Lectures-Discussions in an interesting and light-hearted manner with related experiments and open laboratories:

1. Data Science (dr. Vita Speckauskiene)

*Data + Science = Data Science * Informatics = More Data + Information + Outcomes = Evidence Based Outcomes. But it's not all about calculations. Get in touch with Data Science and see more.*

2. Electricity in the Human Body (doc. dr. Arturas Grigaliunas)

Biologic systems frequently have electric activity associated with them. This activity can be a constant electric field, a constant flux of electrically charged particles (electric current), or a time-varying electric field or current associated with some time-dependent biologic phenomenon. Bioelectric phenomena are associated with the distribution of ions or charged molecules in a biologic structure and the changes in this distribution resulting from specific processes.

3. Biosignals (prof. Algimantas Krisciukaitis)

Data compression from inside: „...it is easier for a camel to go through the eye of a needle... (Gospel of Matthew, 19:23-30)“. As much powerful computers we have, as much fast Internet we have, ... - as more computation power or Internet speed we wish. Data compression methods are developed in parallel to the data processing ones and we use them daily, even without knowing about that. However, most powerful of them, unfortunately are not „harmless“.

4. Seeing the Invisible (prof. Algimantas Krisciukaitis)/Jonas Schurr (online)

Every image registered in our daily life is data. The useful information we get by processing it, which means we detect objects, we segment them, and finally we measure them. Multimodal images are processed using mathematical morphology or even multivariate analysis methods. The capabilities and expectations of such advanced image processing methods will be illustrated on biomedical images of cell cultures, living tissues, and the whole human body (CT, MRI).

“Don't get lost in Biomedical Images” (dr. Robertas Petrolis)

Image analysis is a broad term that covers a lot of processes but the main goal it is to extract meaningful information from the digital image.

5. Biomolecules by Chemical and Physical Methods (doc. dr. V. Andrulevičiūtė)

Biochemistry describes structures, mechanisms, and chemical processes of the main biomolecules: proteins, lipids, carbohydrates, and nucleotides. The methods used to investigate biomolecules are based on their chemical and physical properties. Monosaccharides and disaccharides, due to their structure, can polarize light, so their amount can be determined either by polarimetry, or by enzymatic spectroscopic methods that are widely used in clinical biochemistry.

6. Biological Effects of Ionizing Radiation:

a) Although invisible, it is dangerous. Background of ionizing radiation (prof. Arvidas Galdikas)

The ionizing radiation's ability to ionize atoms and molecules, including biologically important macromolecules, is the main factor of biological effects on the exposed organism. Sources of ionizing radiation. The most known types and effects of ionizing radiation. The final effects of ionizing radiation depend mainly on the radiation dose, the dose rate, the way of exposure, the spatial distribution, and the type of radiation.

b) Radioactivity Around Us (dr. Jurgita Laurikaitienė)

Natural sources of ionizing radiation. Radon gas. Radioactive substances in food. How much radioactive materials do we eat every day? (+interactive activity with an app for calculating the radioactivity of eaten food). Medical exposure. (Im)morta cells ionizing radiation in therapy. Dosimetry, types of dosimeters (+demonstration of several different types of dosimeters).

7. Catch a Wave and Touch the Sound (prof. Arvidas Galdikas)

a) Oscillations and Mechanical Waves

Oscillations and waves. Can you catch a wave? An overview of the forced oscillations and understanding of resonance. Physics of sound waves. Can you touch the sound? Standing waves. Can sound hurt you?

b) Fluid Mechanics

Why is fluid dynamics important for understanding how the body works? Blood flow in blood vessels. Blood pressure measurement. Fluid flow in a pipe and blood flow in the human body. Are they different processes?

8. Get in touch with Big Data (dr. Ingrida Grabauskite/doc. dr. Mindaugas Kavaliauskas (KTU))

Could You imagine that around 2.5 quintillion bytes of data are generated each day?! It is called Big Data. All those quintillion bytes of data need to be stored, analysed, and kept secure. Let's get acquainted with it all!

9. What's next?! (doc. dr. Renata Paukstaitiene)

Interpretation and presentation of the research results is the last but very important stage of the research. The results cannot present themselves. Therefore, their interpretation is very important. Each researcher can interpret the results differently, so let's talk and practice how to do it properly.

SUMMER SCHOOL PROGRAM

	Sunday 25 August	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday 1st September	
8:00	Student arrival	Student registration and welcome coffee	Biosignals	Seeing the Invisible (contact/online)	History and science in one day (full-day excursion)	Catch a Wave and Touch the Sound	What's Next?!	Student departure	
10:00		Welcome lecture	The ABC of ECG	Don't Get Lost in Biomedical Images		Frequency of Oscillations. Dynamic Viscosity			
11:00		Students' introductions					11:00-11:30 Coffee break		11:00-11:30 Coffee break
13:00		Data Science	Fun Programming	Biological Effects of Ionizing Radiation		Jazz up Statistics	Get Touch with Big Data		
14:00		Lunch				Lunch			
16:00		Electricity in the Human Body	Jazz up Statistics	Biomolecules by chemical and physical methods		World of Health science	Scientists on the Go		
18:00		Measuring Tissue Impedance	Student free time			Student free time			
			15:45-16:00 Coffee break						
		Micro and Macro world							
		Trickster Quiz							

Open Laboratories: Come, See, and Touch

This is a unique opportunity not only to view the equipment but also to participate in experiments!

- “Measuring Tissue Impedance” (prof. Armantas Baginskas).** *Tissues of living organisms have different conductances to electric current. The total resistance to the flow of electric current is called an impedance. The value of tissue impedance depends on blood supply and could be informative in the sense of medical diagnostics.*
- “The ABC of ECG” (doc. dr. Arturas Grigaliunas, dr. Robertas Petrolis).** *During the practical approach, you will have an opportunity to put your hands-on physiological signal acquisition and biomedical signal processing methods. The focus of hands-on exercises is not only fun and interesting but also ensures the deepening of the knowledge on how to solve frequently occurring biomedical signal registration and analysing problems.*
- “Protection against Ionizing Radiation” (dr. Reda Cerapaite-Trusinskiene).** *The absorbed dose of ionizing radiation depends on several important factors such as time of exposition, distance from source, and shielding. During lab work students will be introduced to the most popular detectors of ionizing radiation and will experimentally investigate the influence of distance, angle and shielding on the absorbed dose.*
- “Frequency of Oscillations” (dr. Diana Meilutyte-Lukauskieni).** *Possibility to understand the oscillations and waves as a physical phenomenon and to determine the wavelength and frequency of sound waves. Come, ask, and try to catch!*
- “Dynamic Viscosity in Different Liquids” (dr. Diana Meilutyte-Lukauskieni).** *Get to know the viscosity of liquids and the methods of determining the dynamic viscosity coefficient. Determine the coefficient of dynamic viscosity of different “unexpected” liquids.*

Micro and Macro world OR “Test your sense of scale!” (dr. Robertas Petrolis, dr. Reda Cerapaite-Trusinskiene) <i>Scale is a very tricky parameter to judge in science especially when it comes to images. Monitored objects' images without proper description or context can be misleading. Is this something that I can hold in my hand, find under a microscope, or does it reach across the galaxy? The object can only be observed or analysed. But it's much more fun to measure it! Are you wondering how wide a dust mite's thigh is, or how long a mosquito larva's tail is? You can find it on the Internet, but it is much more interesting to measure it with a microscope.</i>	Jazz up statistics (Jurate Tomkeviciute, dr. Ingrida Grabauskite) <i>Try to “talk” with quantitative and qualitative data and get evidence-based outcomes.</i>
Fun programming (doc. dr. Vita) <i>If (you == understand.this) {come.do.have.fun} else {read.again} return (you == are.coming) See you soon! (^v^) A little basics of programming is just as catchy as you can see \(\^_-\)/</i>	Word of Health Science (doc. dr. Sigita Kerziene) <i>Animals and humans. How far from each other are we? Is it a question of bioscience or maybe artificial intelligence? We welcome you to a museum of science of “bio” in all as.</i>
Trickster Quiz (dr. Diana Meilutyte-Lukauskieni, dr. Ingrida Grabauskite) <i>Prove that you are smarter than a scientist!</i>	Scientists on the Go (Jurate Tomkeviciute) <i>Reflection: share your experience and discover the best!</i>

History and Science in One Day (full day excursion)

Feel the history and spirit of The Pažaislis Monastery and church of the Holy Mary Arrival, understand the meaning and power of Kuonis PSP and fairy tale of Trakai Island Castle!!!

