

Institute of Physics of the National Academy of Sciences of Ukraine  
Taras Shevchenko National University of Kyiv  
Ukrainian Physical Society

# **SPECTROSCOPY OF MOLECULES AND CRYSTALS**

Book of Abstracts  
of XXVI Galyna Puchkovska International School-Seminar

*Dedicated to 90<sup>th</sup> birthday of Professor Galyna Puchkovska*

September 22-25, 2024  
Wojanow, Poland

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Tetiana Gavrilo

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# Galyna Puchkovska International School-Seminar Spectroscopy of Molecules and Crystals

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**Professor Galyna Puchkovska** (June 22, 1934- September 29, 2010) is a famous Ukrainian scientist, physicist, Laureate of the State Prize of Ukraine, Honored Worker of Science and Technology of Ukraine, member of European Academy of Arts, Sciences and Humanities.

In 1973, Galyna Puchkovska initiated the all-Ukrainian School-Seminars "Spectroscopy of Molecules and Crystals" which since 1991 became an international one being among the first of such kind scientific meetings in Ukraine. In 2011, after professor Galyna Puchkovska's pass away, the International School- Seminar "Spectroscopy of Molecules and Crystals" was named in her honor. The ISSSMC conferences headed by professor Puchkovska were held for almost 35 years biennially in different cities of Ukraine, even in the most severe times for our country, and are still traditionally organized nowadays as a recognized world-wide meeting of spectroscopists from different research fields.



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**Spectral markers and morphological features of  
diabetic foot ulcer tissues**

**T. Isokov<sup>1</sup>, L. Yanitskaya<sup>2</sup>, S. Verevka<sup>3</sup>, O. Gnatyuk<sup>1</sup>, T. Voitsitskyi<sup>1</sup>, G. Dovbeshko<sup>1</sup>**

*<sup>1</sup>Department of Physics of Biological Systems, Institute of Physics, NAS. of Ukraine, Kyiv, Ukraine, [matinelli@gmail.com](mailto:matinelli@gmail.com); <sup>2</sup>Bogomolets National Medical University, Kyiv, Ukraine; <sup>3</sup>O.S.Kolomiychenko Institute of Otolaryngology, NAMSU, Kyiv, Ukraine*

Metabolic disorders are an integral part of the development of diabetes mellitus. One of the most severe complications of diabetes is diabetic foot, which is characterised by the formation of necrotic sores. As a result, local accumulation of tissue breakdown products, secondary toxins, complications and progression of the disease. The aim of the study was to experimentally test the hypothesis of the formation and accumulation of  $\beta$ -structured protein aggregates in diabetic foot tissues. The formation of  $\beta$ -structured protein aggregates promotes their non-enzymatic glycosylation, which in turn promotes aggregation. Thus, there is a positive connection between the individual links of the pathological process. Breaking this link is a prerequisite for effective treatment.

The study investigated samples of surgical material of pathological tissues of the diabetic foot with fixation in a 10% formaldehyde solution. The samples were taken in accordance with the provisions of bioethics with the consent of the patients. The structure of the studied histological samples was assessed with Congo red staining by Puchtler-Mayer. To register the infrared absorption spectra, the tissues were washed from formaldehyde and dried on the working surface of the ATR attachment in the cuvette chamber of the Tensor 27 FTIR spectrometer.

The results of the optical image analysis indicate the presence of  $\beta$ -structured protein aggregates, which was confirmed by IR spectroscopy. However, such structures may not be amyloid fibrils, but instead be linked to aggregates of a different type. In addition, unique IR markers of necrotic tissues in the absorption region of stretching vibrations of C=O and C-O molecular groups were registered, and a 2.5-fold increase in the intensity of the CH stretching bands was observed compared to OH. The obtained data raises the question of the necessary methodological approaches to prevent sores progression and require further research to develop effective therapeutic strategies.