MUNI

Annex No. 11 to the MU Directive on Habilitation Procedures and Professor Appointment Procedures

# PUBLIC LECTURE EVALUATION

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| **Masaryk University** | |
| **Faculty** | Faculty of Science |
| **Procedure field** | Analytical Biochemistry |
| **Applicant** | Dr. rer. nat. habil. Hans-Heiner Gorris |
| **Lecture date** | 3.10.2024 |
| **Lecture topic** | Taking analytical biochemistry to the single molecule level by photon-upconverting nanoparticles and femtoliter arrays |
| **Persons present** (number) | 64 |
| **Designated evaluators** (board members) | Ing. František Foret, DSc. (on-site)<br>Prof. Dr. hab. Tomasz Grzyb (on-site)<br>Prof. Mgr. Jan Preisler, Ph.D., (on-site)<br>Prof. RNDR. Zdeněk Glatz, CSc., (on-site) |

The public professorship lecture delivered in English took place as a part of a scientific seminar of the Department of Biochemistry, Faculty of Science, Masaryk University. Scientists from other departments of the Faculty of Science as well as from CEITEC and the Institute of Analytical Chemistry CAS were also invited.

Prof. Glatz opened the lecture by welcoming the participants, introducing the members of the professorship committee (the evaluators of the lecture) and introducing the participants the figure of Associate Professor Hans Heiner Gorris.

At the beginning of his lecture, Hans Gorris briefly introduced the audience with the story of his career, his mentors, students and departments with which he has collaborated. Subsequently, the lecture concentrated on the two research areas that the group, under the leadership of Hans Gorris, is primarily oriented, i.e. the analyses of single enzyme molecules in femtoliter arrays and the application of photon-upconversion nanoparticles (UCNP).

In the initial section of the presentation, Hans Gorris highlighted the distinctions between the determination of enzyme activities in the classical and single molecule formats. Subsequently, he outlined the potential methodologies for conducting single enzyme molecule experiments, encompassing techniques such as capillary electrophoresis and microarrays, which is being employed by his research group. β-galactosidase and β-glucuronidase were used as model enzymes. In addition to the experiments obtained, the conceptual kinetic models utilized in their evaluation were also presented. Moreover, single-molecule enzyme experiments have yielded crucial insights into the catalytic heterogeneity of enzymes, enzyme inhibition, and the potential for molecular evolution of enzymes.

In the second part of the lecture, devoted to UCNP, he first emphasized the necessity of increasing the sensitivity of the respective assays in view of the very low concentrations of possible biomarkers. He then proceeded to examine the distinctions between analog and digital immunoassays. In this context, he introduced the digital ELISA technique and highlighted the differences in the limits of detection (LOD) achieved. He then continued to examine the potential applications of diverse detection techniques and elucidated the underlying principles of UCNP and its various applications. The advantages of UCNP labels in immunoassays for the detection of SARS-CoV-2 and other diagnostically relevant biomarkers, as well as in DNA hybridization assays, were demonstrated with particular emphasis on the fact that upconversion microscopy achieves a significantly higher imaging contrast than standard fluorescence microscopy. Consequently, the lecture covered methods for the surface modification and characterisation of UCNP.

It can be stated that the lecture was well organized, easily understandable, and interesting for the audience. During the subsequent discussion, Hans Gorris answered the questions from the committee members as well as several questions from the people present in the auditorium. The emphasis was focused on the kinetics of single enzyme molecule reactions, the obtained LODs, the application of different particle types, etc. Furthermore, some general questions dealing with publications on the given fields (difficulty of publication in top journals, using terms "Photon-upconversion nanoparticles" versus "Photon-upconverting nanoparticles"), including recent trends in these fields were discussed as well. At that point, the applicant demonstrated an excellent orientation within the subject of his research interest.

**Conclusion**

The lecture delivered by Hans-Heiner Gorris, entitled **Taking Analytical Biochemistry to the Single Molecule Level by Photon-upconverting Nanoparticles and Femtoliter** Arrays, delivered as part of the professor appointment procedure, **demonstrated** sufficient scholarly qualifications and pedagogical capabilities expected of applicants participating in a professor appointment procedure in the field of Analytical Biochemistry.

The lecture took place on-site at 12:00 on 3.10.2024. The above-mentioned members of the board attended the lecture and provided its evaluation. All designated evaluators are familiar with the text of the evaluation and agree with it.

Date: October 14, 2024

[Frantisek Foret]

[name and surname]
prof. Mgr. Jan Preisler, Ph.D.

[name and surname]
Prof. RNDR. Zdeněk Glatz, CSc.