

## HABILITATION THESIS REVIEWER'S REPORT

### Masaryk University

**Applicant**

MGR. EVA BUDINSKA, PH.D.

**Habilitation thesis**

Integrative Bioinformatics and Computational Modelling in Colorectal Cancer: Unveiling Tumor Heterogeneity through Multi-Omics Data

**Reviewer**

Dr. Panagiotis Alexiou, Ph.D.

**Reviewer's home unit, institution**

Faculty of Health Sciences, University of Malta

This Habilitation Thesis provides a comprehensive overview of research on colorectal cancer (CRC) heterogeneity, by synthesizing the author's research developments through 20 selected high impact publications. The candidate demonstrates a strong interdisciplinary approach, successfully bridging computational approaches with experimental and clinical validation of findings.

There are a few key research themes and contributions that stand out:

Dr. Budinska has developed novel computational approaches for biomarker identification, including feature selection methods, transcriptomic classifiers, and integrative multi-omics analyses. These are tools with practical application in biomedical settings, leading to better refinement of CRC molecular classification, patient stratification, and treatment selection.

A significant portion of the work involves image-based analysis of histopathological samples/slides. By linking tumor morphological heterogeneity with molecular profiles, this research offers new insights into tumor aggressiveness and patient risk stratification.

There is a thread of research that explores the complex role of the gut microbiome in CRC heterogeneity and its interactions with the tumor microenvironment. This aspect of the research is highly interesting as it can potentially lead to less invasive therapeutical avenues for patients.

Of interest is also the application of molecular classifiers to genetically engineered mouse models and patient-derived xenographs, which shows that such preclinical models can be used to study CRC in patients, by validating such models.

Overall, the candidate has played a leading role in both method development and biological interpretation. The provided publications underscore the substantial contribution that Dr. Budinska has had in several scientific research directions within the study of CRC. Ultimately this body of work highlights the critical role of integrative computational methods in advancing clinical and basic cancer research. I believe that the quality of the presented work is of high standard and shows a wide but coherent approach to a very complex and impactful issue in human disease.

## **Reviewer's questions for the habilitation thesis defence**

1. In your experience with CRC, what remain as the most significant computational or biological challenges in ensuring preclinical models accurately capture the complex heterogeneity of human cancers?
2. Given that the microbiome is highly dynamic compared to a tumour's genomic profile, how do you envision the future of computational models successfully integrating these very different types of temporal and spatial data?

## **Conclusion**

The habilitation thesis entitled Integrative Bioinformatics and Computational Modelling in Colorectal Cancer: Unveiling Tumor Heterogeneity through Multi-Omics Data by Eva Budinska **fulfils** requirements expected of a habilitation thesis in the field of Environmental Health Sciences.

Date:  
06 March 2026

Signature: