

## COST Action: CliniMARK meetings in Greece, fall 2019

The CliniMARK COST action (CA16113) was established in 2017, to increase awareness of good biomarker practice. The action will endeavor to not only establish best practice guidelines for research in this field, but also disseminate said guidelines to the broader research community. As biomarker research gains more ground, the necessity of good practice for discovery, validation and implementation of biomarkers becomes evident.

The potential of biomarkers has been widely recognized for decades, and interest in the field has steadily increased. The implementation of biomarkers in the clinical setting improves the diagnosis and prognosis of diseases and paves the way for the development of new therapeutic approaches.

Thousands of studies are published claiming the discovery of biomarkers suitable for improving disease management. The stark reality, though, indicates that very few potential biomarkers are approved for clinical use. The application of omics approaches in biomarker discovery has contributed significantly to increasing the number of publications reporting initial findings that are not validated. This dire situation has been brought on by the difficulties in analytical validation of robust biomarker assays, flawed study designs, and the inability to exploit the full potential of high-throughput omics approaches. Thus, there is a waste of research resources, as these studies do not produce any tangible benefits to society. Moreover, many clinical needs are currently not addressed by the available biomarkers in diseases of high prevalence and of high financial and social cost such as cancer, cardiovascular disease, chronic kidney disease, and chronic obstructive pulmonary disease. These failures are partly due to a lack of education resources dedicated to omics studies in biomarker research. By establishing good practice guidelines for biomarker research and educating future research leaders on these practices, the CliniMARK action aims at increasing the number of biomarkers making it through the “valley of death” separating discovery from clinical application.

As part of these efforts two meetings recently took place in Greece: 1) the CliniMARK Athens meeting 21-22/09/19; 2) the CliniMARK training school in Spetses on approaches for biomarker discovery and validation 23-27/09/19.

The CliniMARK Athens meeting presented unique opportunities for international collaborations on the dissemination of biomarker practice. During the meeting, participants agreed on a specific plan for writing several publications. Amongst them was a review on analytical techniques for protein biomarker validation focusing on multiplex detection of soluble biomarkers with clinical applications, which should be submitted by the end of 2019. Further, a white paper concerning the

necessary alignments between academic biomarker research and the requirements of regulatory organizations, clinical laboratories, and the industry was proposed. Submission of the paper is expected in the spring of 2020. Ideas for other publications, e.g. concerning the role of extracellular matrix remodeling in chronic obstructive pulmonary disease, were discussed. The meeting minutes and above-mentioned publications are available on the COST CliniMARK website (<https://clinimark.eu/>).

Directly following the Athens meeting the CliniMARK school on approaches for biomarker discovery and validation took place in Spetses. A unique feature of the training school was the focus on problems associated with omics biomarker studies and training a new generation of scientists to be able to fix the flawed biomarker discovery and implementation paradigm. The learning outcomes for the students were to obtain a global view of omics approaches and the biomarker life cycle from discovery to clinical implementation, as well as to acquire skills relevant for biomarker data analysis. Lastly, particular emphasis was placed on the development of student critical thinking by thorough evaluation of published biomarker studies, and on the improvement of writing and presentation skills. The school included an introduction to the different biomarker types and the different omics approaches and their application in the context of biomarker research. Particular emphasis was put on the importance of defining the biomarker context of use in the clinical setting before initiating a research protocol on biomarker discovery and validation. During the course, biomarkers were discussed in the context of academia, industry and clinical applications. The students were introduced to omics approaches in general, and to the specifics of proteomics, metabolomics and genomics in biomarker discovery and validation. Additionally, several talks focused on different methods for biomarker detection and the analytical pitfalls within each technique. Special focus was put on a plethora of mass-spectrometry and immunoassay detection techniques. Particular emphasis was also put on pre-analytical conditions, quality control and the importance of planning for particular implementation contexts. Finally, several examples of current studies on biomarker validation and implementation were given. These examples ranged from biomarkers for obstructive sleep apnea, anxiety and psychiatric disorders to human aging and oxidative stress.

The training school also provided excellent opportunities for interaction between the trainees and the lecturers. Each student gave a short presentation of his or her work, which culminated in several poster sessions and provided many occasions for discussion. The high ratio of lecturers to trainees (24:34) afforded the students several opportunities for fruitful consultation with experts in the field.

Indeed, the training school resulted in multiple collaborations; not only between students and lecturers but amongst the attendees as a whole. During the closing ceremony, awards were given for excellence in poster presentations to Joana Pinto and Eda Aydindogan, and for outstanding academic writing to Tenna Vesterman Henriksen. All the presentations and relevant information regarding the training school are available at the CliniMARK website (<https://clinimark.eu/>).

In conclusion, the CliniMARK meetings and training school resulted in multiple international collaborations across different fields of scientific research. The world of biomarker research can look forward to several publications bridging the gap between biomarker discovery and clinical implementation. The planned publications, the established collaborations, and the courses from the training school indicate that the future of biomarker research is bright. Brilliant new scientists enter the field every day, and with proper guidance, they can contribute significantly to the implementation of biomarkers in the clinical setting.

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Figure 1: CliniMARK Athens meeting participants



Figure 2: CliniMARK training school participants