

Metabolomics Enabling Tools for Large Studies and Biobank Initiatives – A Precision Medicine Approach - Metabolomics 2019

A Satellite Symposium by Metabolomics Society Precision Medicine Task Group:

Sunday 7:30:00 am-12:15 pm Sunday June 23rd, Marriott Hotel - The Hague Marriott Hotel

RSVP: Metabolomics for Precision Medicine (Satellite 2019) PM-Metabolomics2019@dm.duke.edu

Rima Kaddurah Daouk, Duke University Medical Center

Closed Meeting – Limited number of participants



Scientific Background and Rationale:

The Precision Medicine and Pharmacometabolomics Task Group of the Metabolomics Society has a mission to actively engage the metabolomics community in large and global initiatives that can enable a precision medicine approach to study human diseases and their treatment. At the center of metabolomics is the concept that a person's metabolic state provides a close representation of that individual's overall health status. This metabolic state reflects what has been encoded by the genome, and modified by diet, environmental factors, the gut microbiome and other external influences. The metabolic profile provides a unique way to identify and quantify an individual's biochemical state. It also allows one to easily distinguish deviations from normal physiology and to identify diverse pathophysiologies in a manner that is often not obvious from gene expression analyses. In this regard, metabolomics can play a key role in large biobank studies to inform about disease, disease heterogeneity and variation in response to treatment.

In this Satellite meeting, we will highlight enabling tools for large metabolomics studies that involve biobanks and community studies covering topics such as: 1) the readiness and scalability of metabolomics technologies; 2) sample collection, storage and integrity; 3) metadata needed to inform biochemical data (including patient protection and privacy issues); 4) national resources that capture effects of diet and environmental exposures on the metabolome; 5) enabling tools to study the gut microbiome influences on human metabolome; 6) computational medicine and big data integration. We hope that our proposed satellite meeting will follow up on and inform another satellite meeting "Building International Collaborations in Metabolomics: A Joint Meeting with BBMRI-NL" an event planned for June 22nd. While the BBMRI Metabolomics Consortium and the COMETS consortium plan to share general knowledge about their respective initiatives with hope of creation of global collaborations among biobank initiatives our proposed metabolomics workshop will provide a perspective on enabling tools for large metabolomics studies including profiling of biobank samples. **Together these two meetings can help position metabolomics for more significant impact in the medical field. In particular it will strengthen the interactions between metabolomics, epidemiology and the clinical communities.**

Our proposed workshop will aim to achieve the following: 1. Highlight key developments in the field that enable community studies and biobanks to add metabolomics data to large cohorts. 2. Share community initiatives and resources built that capture effects of diet, exposome and gut microbiome on human metabolome 3. Address issues related to omics data integration and steps that enable a precision medicine approach 4. Create collaborative initiatives that engages metabolomics, clinical, informatics and epidemiology communities to enable large studies that can impact human health. 5. Enable outreach and increased visibility for our Metabolomics Society within the medical communities.

Program: 7:30am to 12:15 pm Sunday June 23rd

7:30am-8:30am light breakfast; 9:20am-9:40am coffee break; lunch and discussion 11:40am-12:15pm

8:00am-8:40am Overview- Metabolomics Needs and Impact in the Medical Field

We will highlight advances in the field that lead to emergence of large metabolomics initiatives progress made and challenges that remain. We will also review contributions of metabolomics to the medical field.

A. Rima Kaddurah Daouk (Duke University Medical Center), **Matej Oresic** (Finland/Sweden) and **Thomas Hankemeier** (Leiden University)– “A decade of metabolomics research and scaling up knowledge - are we there yet?”

B. David Wishart "Moving Metabolomic Discoveries into the Clinic: Lessons from the Front Line"

C. BBMRI-NL, Biobanks and COMETS outcome of Satellite Meeting - Progress and Needs

8:40am-9:20am Advances in High Throughput Metabolomics What is Ready Today for Biobank Studies?

Technology is the tool which provides (semi-) quantitative data on the metabolite composition of human biofluids and tissues. Different technologies provide the capability to report information on tens-to-thousands of metabolites in minutes. These technologies breakthroughs are now allowing the low-cost metabolomic studies of both small and large biobanks. Mass spectrometry and NMR based technologies are commonly used and have shown significant impact in cohort studies. In this session we will describe some of the most recent advances in these areas and describe what is and what is not feasible and what to expect from acquired data. We will provide academia and biotechnology companies' perspective.

A. Academic Perspective: Panel Discussion coordinators- Warwick Dunn, University of Birmingham, UK, **Matthew Lewis**, Imperial College, UK, **David Broadhurst**, Edith Cowan University, Australia - **Thomas Hankemeier**, Leiden University, the Netherlands, **invited guests**

B. Biotech Perspective: Metabolon and Biocrates

9:20am-9:40am Coffee Break

9:40am- 10:10am Pre-analytical Processing and Biobanking Procedures of Biological Samples for Metabolomics Research: A White Paper, Community Perspective

We will present consensus views on current practices and the latest evidence on pre-analytical processes and sample biobanking practices for metabolomic measurements of common biofluids and tissues. This session will highlight progress and areas that require more validation and research. It will also provide evidence-based guidelines on best practices in this area.

Jennifer A. Kirwan (Berlin Institute of Health, Max Delbrück Center for Molecular, Germany)
Michael A. Schmidt (Advanced Pattern Analysis & Countermeasures Group, Research Innovation Center, Colorado State University, Sovaris Aerospace), **Vidya Velagapudi** (Metabolomics Unit, Institute for Molecular Medicine FIMM, HiLIFE, University of Helsinki, Tukholmankatu 8, Helsinki, Finland) **Rick Beger** FDA perspective, **Other Members of Task Group involved in White Paper**

10:10am: 10:30am Impact of the Gut Microbiome on Host Metabolism and Human Health

The gut microbiome functions as a key metabolic organ that plays a vital role in defining or determining gut, liver, heart, immune and brain health. The interplay the host, the gut microbiome, the diet and the helpful/harmful metabolites arising from these interactions is complex. This session will focus on recent developments in gut microbiomics and microbial metabolomics. It will describe new technologies and new

findings arising from this work and highlight how these can enable precision medicine and enhance the research from large cohort studies.

Members of Task Group and invited guests

10:30am-11:00am Metabolome Nutrition Exposome and Precision Health

Lifestyle factors (e.g., stress, smoking, physical activity), use of medications or illicit drugs, dietary intake, and exposure to environmentally relevant chemicals are all part of our exposome that impacts the human metabolome. The intersection between genomics, metabolomics, and the environment (e.g., foods, nutrients, chemicals, drugs, lifestyle factors) is becoming increasingly important to inform about disease and response to treatment and for the development of nutritional intervention at the individual level. Large initiatives are underway that capture effect of exposome and diet on human metabolome and can inform large biobank studies. We will highlight some of these initiatives.

Lorraine Brennan (School of Agriculture and Food Science, University College Dublin, Ireland) "Metabotyping for Precision Nutrition", **Susan Sumner** (University of North Carolina at Chapel Hill, USA) "The Exposome, Metabolome and Precision Nutrition"

11:00am-11:30am The Metabolome as a Phenotypic Readout of the Genome- Lessons Learned from Connecting the Metabolome to the Genome and Proteome"

Metabolites are the canaries of the genome. A single base change at the DNA level can lead to a 1000X fold change in metabolite levels. The exquisite sensitivity of the metabolome to small genomic changes has been the basis to genetic testing for inborn errors of metabolism for decades. Now, thanks to next-generation sequencing, it is possible to conduct full genomic sequencing on large cohorts. Linking genomic changes to changes in metabolite levels is providing new insights into chronic diseases and many previously unknown metabolic disorders. This linkage provides an exceptional opportunity for both advancing precision medicine and enriching the findings of large biobank studies.

Karsten Suhre (Weill Cornell Medicine-Qatar, Qatar), **Gabi Kastenmüller** (Helmholtz Zentrum München, Germany),

11:30am-12:15 pm Discussion Conclusions and Next Steps (over lunch)

Expected Number of Attendees: 50-70 Participants

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White Papers Published by Precision Medicine Task Group

Metabolomics Enables Precision Medicine: "A White Paper, Community Perspective" [Metabolomics](#), September 2016, 12:149.

Pre-analytical Processing and Biobanking Procedures of Biological Samples for Metabolomics Research: A White Paper, Community Perspective (for "Precision Medicine and Pharmacometabolomics Task Group" – The Metabolomics Society Initiative) - DOI: 10.1373/clinchem.2018.287045 Published July 2018