Metabolomics Quality Assurance and Quality Control Consortium (mQACC): Reference and Test Material Working Group

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mQACC OVERVIEW

The Metabolomics Quality Assurance and Quality Control Consortium (mQACC) was established in February 2018 with the goal to develop a collaborative effort among relevant stakeholders in academic, industrial, and government institutions to address key quality assurance (QA) and quality control (QC) issues in the untargeted metabolomics field. The consortium currently includes representatives from the United States, Europe, and Asia, including instrument manufacturers, commercial metabolomics laboratories, and government and academic stakeholders.

mQACC Mission Statement

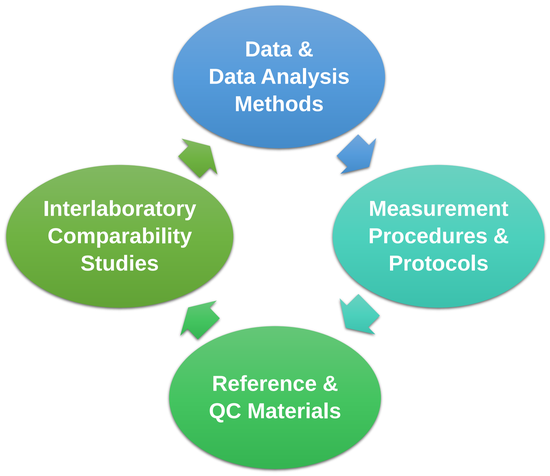
- To engage the metabolomics community to communicate and promote the development, dissemination, and harmonization of best quality assurance (QA) and quality control (QC) practices in untargeted metabolomics.

mQACC Objectives

- To establish mechanisms to enable the metabolomics community to adopt QA/QC best practices
- To promote and support systematic training in QA/QC best practices for the metabolomics community.
- To **encourage the prioritization and development of reference materials** applicable to metabolomics research.

*For continued advancement of the metabolomics field, the **underlying chemical measurements must be reproducible**.*

***Harmonization increases reproducibility** and thus **comparability** of results amongst studies, enabling data aggregation and sharing in addition to meta-analysis.*



REFERENCE AND TEST MATERIAL WORKING GROUP

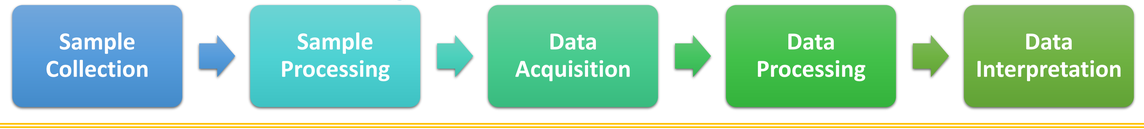
The immensity of metabolomics research leads to the introduction of many sources of variance throughout experimental workflows. Furthermore, analytical data from instrumental platforms can be more variable than the actual biological changes being probed. As such, the field has begun to educate researchers on the importance of using reference and test materials. Many laboratories create in-house quality control (QC) materials to control and normalize intra-laboratory variability, but the supply is usually limited and not suitable and/or not intended for use in inter-laboratory comparisons, which are needed for translation of metabolomic findings and biological discoveries.

Thus, the metabolomics community urgently needs reference and test materials that can be used for measurements across laboratories and data standardization from different instrumental platforms. The mQACC Reference and Test Material Working Group is actively working **to develop prototype materials** that can be utilized across most, if not all, instrumentation platforms and employed for interlaboratory comparisons. Additionally, we are **defining the measurement challenges that different types of reference and test materials have the potential to address**, as well as **establishing best use practices for test and reference materials**.

Reference and Test Material Working Group Objectives

- Develop reference and test materials for use in interlaboratory comparisons
- Establish a single reference material for use with most (if not all) instrumental platforms
- Determine and articulate how reference and test materials should be used
- Organize, conduct, and analyze interlaboratory studies of prototype reference/test materials and data
- Outreach to the metabolomics community to further define needed reference and test materials

Untargeted Metabolomics Workflow



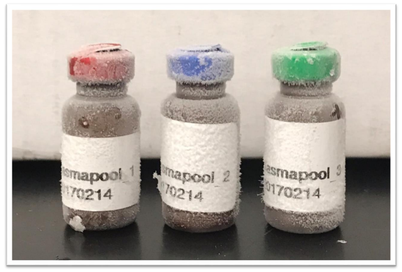
- Stable, valid metabolomics results are needed across all workflow steps.
- Reference materials specific for validation of metabolomics fingerprints/profiles are critically needed.

DEVELOPMENT OF REFERENCE AND TEST MATERIALS

The mQACC Reference and Test Material Working Group was **tasked with producing 2–3 reference materials quickly** for metabolomics community use. mQACC determined that **blood- and urine-based materials are needed most**. In addition, the working group would like to work with collaborators to create a synthetic solution reference material.

Prototype materials currently underway, in partnership with the National Institute of Standards and Technology (NIST), include plasma and urine reference material suites. NIST–mQACC Reference and Test Material Working Group interlaboratory comparison exercises will be administered to obtain community consensus data of these materials.

Plasma Reference Material Suite

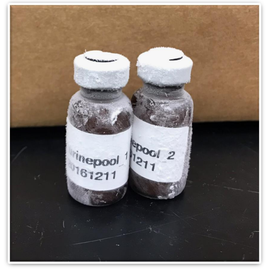


The suite of plasma reference materials comprises different metabolic health states: type 2 diabetes, hypertriglyceridemia (high TG), and young, normal African-American (AA).

Donor Demographics

	SRM 1950	Diabetic (Pool 1)	High TG (Pool 2)	Young, AA (Pool 3)
No. of Individuals	100	11	11	16
Age (years)	40–53	34–68	31–72	20–25
Sex (Male/Female)	52/48	55/45	100/0	50/50
Race	77% White 12% African-American or Black 2% American Indian or Alaskan Native 5% “Other”, 15% Hispanic	55% White 36% African-American or Black 9% Asian	55% White 36% African-American or Black 9% Hispanic	100% African-American or Black
Fasted	Yes	Yes	Yes	Yes
Anticoagulant	Lithium Heparin	Lithium Heparin	Lithium Heparin	K2 EDTA
Glucose (mg/dL)	<85	143	109	N/A
Triglycerides (mg/dL)	N/A	124	367	N/A

Urine Reference Material Suite



The suite of urine reference materials comprises smoker’s and non-smoker’s human urine with no history of diabetes.

Donor Demographics

	Smoker	Non-smoker
No. of Individuals	6	3
Age (years)	28–47	33–63
Sex (Male/Female)	0/100	0/100

FUTURE ENDEAVORS

- A short survey will be disseminated to the mQACC membership and the larger metabolomics community to further evaluate currently used reference and test materials and better understand reference and test material needs.
  - Our efforts and future plans will be documented in a forthcoming publication to include data from the survey.
- A NIST–mQACC Reference and Test Material Working Group interlaboratory comparison will be administered during late Summer/Fall 2018 for the NIST plasma reference material suite…
  - To obtain consensus metabolite identities and metabolite fold changes between the different phenotypes
  - To create a chemometric scoring metric and metabolic profile uncertainty metric to assess interlaboratory similarities and differences

See Poster #329 for more information.

What metabolomics reference and test materials do you think are critically needed?