

The Activities of TUBITAK UME Chemistry Group Laboratories in the Field of Laboratory Medicine

The JCTLM membership of Ulusal Metroloji Enstitüsü (UME), the National Metrology Institute of Turkey is a part of the legal entity under The Scientific and Technological Research Council of Turkey (TUBITAK), has been granted in the JCTLM Executive Committee meeting in December 2012.

In Turkey, Ministry of Health, Medicine and Clinical Instrument Departments have been establishing control mechanisms for clinical diagnostic measurements including all clinical tests and instruments. Additionally, clinical test/instrument producers and accredited testing laboratories require certified reference materials in addition to the proficiency testing schemes for quality control purposes. Drug and food supplement producers also need primary level measurement services to evaluate their products. According to the needs of diagnostic market, TUBITAK UME plans future metrological activities to promote the concept of traceability of measurement results in Laboratory Medicine to the SI or to other internationally agreed units.

TUBITAK UME Chemistry Group Laboratories have been conducting metrological activities under the umbrella of Consultative Committee for Amount of Substance – Metrology in Chemistry and Biology (CCQM) since 2001. These laboratories were enrolled in more than 50 international measurement comparisons within CCQM and EURAMET in the areas of environment, food and health and CCQM membership of TUBITAK UME was approved in October 2012. In addition to environment and food area, during the last five years, new facilities were established and new reference measurement systems were developed according to the customer needs in Laboratory Medicine area.

International Measurement Comparison Studies in the field of Laboratory Medicine:

Chemistry Group Laboratories have participated to several international measurement comparison studies in the field of Laboratory Medicine (Table 1). Bioanalysis Laboratory has been attending CCQM Bioanalysis Working Group (BAWG) (BAWG was recently divided into working groups of Nucleic Acid (NAWG), Protein (PAWG) and Cell (CAWG)) activities since 2010. More resources will be devoted to the development of new reference measurement systems Laboratory Medicine area.

Table 1. Past CCQM and EURAMET international measurement comparison studies.

CCQM-P117.a	Purity assessment of 17 β -Estradiol
CCQM-K55.c	Characterization of Organic Substances for Chemical Purity (Valine)
CCQM-K6.2	Determination of Total Cholesterol in Human Serum
CCQM-K11.2	Determination of Glucose in Human Serum

CCQM-K12.2	Determination of Creatinine in Human Serum
CCQM-K132	Vitamin D in serum
EURAMET 1185	Determination of Selenomethionine in Human Serum
CCQM-K107	Elements and Se Speciation in Human Serum
CCQM-K115/P55.2	Peptide Purity Determination - Synthetic Human C Peptide (HCP)
CCQM-P58.1	Fluorescence in ELISA (Stage 2)- cTnI Cardiac Troponin I Measurement
CCQM-P94.2	Quantification of DNA methylation
CCQM-P103.1	Measurement of Multiplexed Biomarker Panel of RNA Transcripts
CCQM-P137	Clinical Amylase Measurement
CCQM-P155	Multiple Cancer Cell Biomarker Measurement

By using the expertise and services in clinical measurements, Chemistry Group Laboratories applied for calibration and measurement capabilities (CMC) tables and several measurement capabilities were approved, such as 25-hydroxyvitamin D₂-D₃ in serum, calcium, potassium, magnesium elements in serum and selenomethionine in serum. New CMC entries are planned with the development of new reference measurement materials and services in the field of Laboratory Medicine.

Projects in the field of Laboratory Medicine:

Chemistry Group Laboratories have been collaborating in health related EMRP and EMPIR projects and contributing to the studies in the development of new measurements protocols and certified reference materials:

- EMRP-Metallomics: Metrology for Metalloproteins, 2012-2015

- EMRP-INFECT-MET: Metrology for monitoring infectious diseases, antimicrobial resistance, and harmful micro-organisms, 2012-2015

- EMRP-Bio-SITrace: Traceability for biologically relevant molecules and entities, 2013-2016

- EMPIR-AntiMicroResist - Novel methods and materials for the detection, traceable monitoring and evaluation of antimicrobial resistance, 2016-2019

- EMPIR-ReMIND - Role of metals and metal containing biomolecules in neurodegenerative diseases such as Alzheimer's disease, 2016-2019

A certified reference material preparation project “25-OH Vitamin D₂ and D₃ in serum” started in 2012 and the CRM is on sale. The application of this CRM for listing in JCTLM database was also submitted recently.

The project titled “Development and Production of Certified Reference Materials and Quality Control Materials for Newborn Screening and Measurements Routinely Performed by Clinical Biochemistry Labs for Amino Acids and Organic Acids” is a certified reference material production project that was financially supported by TUBITAK started in 2014. Zivak Technologies is an LC-MS tests and instrument producer is also an industrial partner in the project. The project aims to produce and certify about 50 amino acids and 50 organic acids in human plasma and in urine, respectively.

A dual collaboration project, “Korea-Turkey collaboration project on the development of an international standard system for the measurement of gene methylation”, was also decided to be financed by both party institutions and started in 2016.

Future Perspectives in Laboratory Medicine:

TUBITAK UME Chemistry Group Laboratories collaborate with public and private institutions to develop the measurement procedures in the field of industrial, legal and scientific metrology in the field of Chemistry and Biology. In Bioanalysis Laboratory, large biological molecules and cells are measured in biological systems using reference measurement systems. In addition to the small biological molecules, Organic Chemistry Laboratory utilizes the measurement power of qNMR as a new reference measurement system for intact proteins, peptides, amino acids, organic acids, hormones, lipids, and other metabolites. Inorganic Chemistry Laboratory develops new measurement protocols with the use of a new clean laboratory and instrumentation. After establishing measurement capabilities, priority will be given to the preparation of the certified reference materials according to the needs of clinical laboratories (Table 2). Proficiency Testing schemes will be extended to the field of Laboratory Medicine.

Table2. Certified Reference Materials Planning at TUBITAK UME

25-OH Vitamin D ₂ and D ₃ in serum (2012-2014) on sale
Aminoacids for neonatal screening (2015-2018) started
Organic acids for neonatal screening (2015-2018) started
HbA1c (2016-2020)
Cholesterol in serum (2017-2020)
Creatinine in serum (2017-2020)
Glucose in serum (2017-2020)
Elements in serum (2017-2020)

Hemoglobin variants in blood (2018-2021)
DNA Metylation RM (2018-2020)
Hormones (2018-2025)
Proteins (2018-2025)