JCTLM
Accurate results for patient care

Database Newsletter

https://www.bipm.org/jctlm/ Issue 9 | April 2022

We are pleased to present the ninth issue of the Newsletter which reports on the successful 2021 JCTLM-ICHCLR-IFCC online Workshop on *Overcoming challenges to global standardization of clinical laboratory testing*; highlights of a selection of JCTLM Members' biennial activity reports; the activities of the JCTLM TEP WG and TF-RMSI; new entries in the database; the 2022 call for materials, methods and services nominations; and call for applications for new experts for participation in the activity of the JCTLM review teams in various fields of measurement.

1 Summary of the Workshop on "Overcoming challenges to global standardization of clinical laboratory testing: reference materials and regulations."

Greg Miller, Organizing Committee Chair

The workshop was jointly organized by the IFCC Scientific Division, the International Consortium for Harmonization of Clinical Laboratory Results and the JCTLM. The organizing committee members were: Philippe Gillery, Christa Cobbaert, Elvar Theodorsson, Gary Myers, Ian Young, Joe Passarelli, Robert Wielgosz and Greg Miller.

The workshop met virtually with seven sessions over 5 days on 6-10 December 2021. Approximately 400 people from 65 countries participated in the sessions that were staggered to cover the same topic twice in two different time zones. The meeting organizing committee is currently preparing a full report of the meeting discussions and recommendations. The participants agreed that effectiveness of test results for patient care is the primary goal for standardization and the guiding principle for optimized practices supporting standardization. The goal for the workshop report is to publish recommendations focused on how improved collaboration and cooperation among all stakeholders regarding certified reference materials (CRMs) and regulations in different countries will contribute to globally standardized medical laboratory results.

The participants discussed the issue that before starting a standardization project for a measurand, an assessment should be performed to determine the clinical impact of the current state of results agreement, the potential benefit of standardization on clinical care, and the resources and total cost needed to complete standardization. Collaboration between clinical care providers, laboratorians, *in-vitro* diagnostics (IVD) producers and regulators is needed to improve understanding of the standardization process, the role of different stakeholders, and its value to promote safe and effective clinical laboratory tests.

One major topic for the workshop was clarifying best practices for fit-for-purpose matrix-based CRMs. Participants agreed that definition of the measurand and recognizing the molecular structure actually measured by IVD devices is important when developing a CRM. IVD manufacturers need an assured supply of a CRM, with a backup supplier, but excessive redundancy of suppliers may not be the best use of limited resources. Prioritization of measurands for which new CRMs are needed should involve collaboration among clinical laboratories, clinical practice groups, IVD manufacturers, NMIs and other producers. Commutability of matrix-based CRMs with clinical samples is an essential property that consumes a substantial fraction of the resources required to develop a CRM. Listing CRMs or other reference materials known not to be commutable would be useful for IVD manufacturers. The content of CRM certificates varies and may make getting necessary information difficult especially when there is no accompanying detailed report on characterization of a CRM. Agreeing on a standard content and format for a CRM certificate and/or report would assist IVD manufacturers with regulatory submission documentation.

The second major topic for the workshop was challenges meeting regulatory requirements in different countries. Most countries have a regulatory agency that is responsible to promote safe and effective patient care including approval of the performance of IVD medical devices (measuring systems) used for clinical laboratory testing. One key challenge for standardization of medical laboratory testing is the cost for regulatory submissions in multiple countries. Consequently, IVD manufacturers have been reluctant to adopt some standardization initiatives developed by professional societies. The cost is related to the amount of data required for regulatory review when a calibration hierarchy is modified to achieve standardized results for clinical samples. Requirements for data submission are different among different regulatory agencies. Regulators promote a risk-based assessment to determine how much data is needed, on a case-by-case basis, to review the impact of recalibration on safe and effective patient care. A desirable goal is developing shared requirements for documentation when a calibration hierarchy is modified to achieve standardized results for clinical samples, and no other changes are made to an IVD device. Standardized documentation requirements for this special case would make regulatory submission simpler and less expensive.

2 JCTLM members activity reports for the biennial Members' and Stakeholders' Meeting

Gary Myers, JCTLM Executive Committee Member

At each biennial JCTLM meeting members and stakeholders are requested to provide reports to the JCTLM Executive Committee of their work conducted during the past two years (2020-2021 in this case) in promoting traceability in laboratory medicine and towards implementing reference measurement systems which are applicable to their activities. The JCTLM Executive received 29 reports from the following National and Regional Members and Stakeholder Members:

National and Regional Members:
- American Association for Clinical Chemistry (AACC)
- Russian Scientific Research Institute for Metrological Service (VNIIMS)
- All-Russian Scientific Research Institute for Optical and Physical Measurements (VNIIOFI)
- China Accreditation Service for Conformity Assessment (CNAS)
- Health Sciences Authority (HSA)
- European Commission-Joint Research Centre (JRC)
- National Institute of Metrology (NIM)
- National Institute of Standards and Technology (NIST)
- National Metrology Institute of Japan, AIST (NMIJ/AIST)
- National Metrology Institute of Turkey (TÜBİTAK UME)

Stakeholder Members:
- Association for Quality Management in Laboratory Medicine (AQMLM)
- Autobio Biochemistry Co., Ltd., Reference Laboratory, Beijing (Autobio BJ)
- Autobio Diagnostics Co., Ltd., Reference Laboratory, Zhengzhou (Autobio)
- Centers for Disease Control and Prevention (CDC)
- Dirui Industrial Co., Ltd. (Dirui, China)
- Guangzhou Wondfo Biotech Co., Ltd (Wondfo)
- Institution for Standardisation and Documentation in the Medical Laboratory (INSTAND e.v.)
- Interdepartmental Centre for Metrological Traceability in Laboratory Medicine (CIRME)
- Japan Association of Clinical Reagents Industries (JACRI)
- Korean Association of External Quality Assessment Service (KEQAS)
- Maccura Biotechnology Co., Ltd (Maccura)
- MedicalSystem Biotechnology Co., Ltd (MedicalSystem)
- National Center for Clinical laboratories (NCCL)
- RB Diagnostic Private Limited (RBDiagnostic)
- RCPA Quality Assurance Programs (RCPA QAP)
- Reference Institute of Bioanalysis (RfB)
- Ref4U, Laboratory of Toxicology, Faculty of Pharmaceutical Sciences, Ghent University (Ref4U)
- Shanghai Center for Clinical Laboratory (SCCL)
- Wales External Quality Assessment Scheme (WEQAS)

The JCTLM Executive Committee thanks our members for submitting reports of their important activities that continue to advance traceability in laboratory medicine. We encourage our readers to review the reports posted on the JCTLM website.

The full individual reports can be accessed and reviewed at: https://www.bipm.org/fr/committees/jc/jctlm/activity-reports.

A selection of representative activities by members to promote traceability in laboratory medicine:

AQMLM:

AQMLM has conducted Zoom meetings during 2020-2021, with the following themes, many of which included reference to traceability of measurements:

1. September 2020: EQA Q&A
2. October 2020: Validation & Verification
3. December 2020: Setting Quality Specifications Based on Biological Variation
4. January 2021: De-mystifying Measurement Uncertainty
5. February 2021: Evaluating Assay Performance Characteristics
6. April 2021: Diagnostic Sensitivity & Specificity, Prevalence and Predictive Value

Instand e.V.:

The calibration laboratory of Instand e.V. is active in Working Groups of the IFCC for HbA2 (WG-HbA2), procalcitonin (WG-PCT) and Commutabilty (WG-C). In addition, Instand e.V. has been an active member for many years in the IFCC Network on Standardisation of HbA1c. To further promote the concept of metrological traceability the calibration laboratory of Instand e.V. is involved in the EURAMET European Metrology Network Traceability in Laboratory Medicine (TraceLabMed) and in the associated EMPIR-project 18NET02.

RCPA QAP:

The RCPA QAP has been running a fully commutable EQA material for clinical chemistry and immunoassay for four years. Each year the programme extends the number of measurands. RCPA QAP is currently analyzing these data to identify analytical systems and measurands where common reference intervals and patient monitoring between laboratories can be supported.

NIM, China:

NIM and BIPM plan to co-organize the fourth TQ-MSQS International Conference (Therapeutics and Diagnostics: Measurements, Standards, Quality and Safety) in 2022 in the city of Chengdu. Based on the valuable experiences from the previous three conferences held from 2016-2020, NIM and BIPM will focus mainly on how to establish a better relationship among IVD producers and reference laboratories in China. In addition, several satellite symposiums will be held, which can establish a platform for end-users and standard researchers to discuss issues relating to measurement and standardization activities.

VNIIM:

In 2020-2021 period VNIIM became a member of the ISO/TC 212 "Clinical laboratory testing and in vitro diagnostic test systems" and TC48 "Laboratory equipment", of the GOST

R TC380 (a GOST R mirror committee of ISO TC212) and performed technical translation to Russian of the following ISO standards:

1. ISO 17511:2020 “In vitro diagnostic medical devices — Requirements for establishing metrological traceability of values assigned to calibrators, trueness control materials and human samples”
2. ISO 21151:2020 “In vitro diagnostic medical devices — Requirements for international harmonisation protocols establishing metrological traceability of values assigned to calibrators and human samples”
3. ISO/TS 20914:2019 “Medical laboratories — Practical guidance for the estimation of measurement uncertainty”
4. ISO 15195:2018 “Laboratory medicine — Requirements for the competence of calibration laboratories using reference measurement procedures”.

A representative selection of member activities to develop Reference Method Procedures:

JRC:

The JRC supports the development of a reference measurement system (RMS) for a panel of clinically relevant serum apolipoproteins (apo) A-I, B, C-I, C-II, C-III, E and apo (a) which is done within the IFCC working group on Apolipoproteins by Mass Spectrometry. The RMS will be based on peptide-calibrated, LC-MS/MS reference measurement procedure (RMP) and commutable serum-based reference materials (RM). The candidate RMP has been developed and a correlation and initial commutability study has been performed. The candidate RMP correlates well with the immunoassay-based measurement procedures with results in nmol/L. Only RMs based on unspiked human serum pools have the potential to be good candidates for a future certified reference materials (CRM).

HSA:

HSA has developed or is in the process of developing the following reference method procedures:

1. LC-IDMS/MS method for determination of SARS-CoV-2 antibody concentration
2. LC-IDMS/MS method for 17β-estradiol in human serum (in progress)
3. LC-IDMS/MS method for procalcitonin in human serum (in progress)

MedicalSystem Biotechnology Co., Ltd:

Medicalsystem Biotechnology has developed an isotope dilution LC-MS/MS method as a candidate reference method for the measurement of tacrolimus, sirolimus, everolimus and cyclosprione A in human whole blood.

A representative selection of member activities to develop Certified Reference Materials:

NIST:

NIST continues to develop new and renewal CRMs to support comparability in laboratory medicine. CRMs currently in development include:

1. SRM 917d Glucose
2. SRM 956e Electrolytes in Frozen Human Serum
3. SRM 967b Creatinine in Frozen Human Serum – Low Level
4. SRM 2921a Human Cardiac Troponin Complex
5. SRM 3666 Albumin and Creatinine in Frozen Human Urine
6. RM 8121 Cardiac Troponin I in Frozen Human Plasma

TÜBİTAK UME:

A 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” has been completed and two different CRMs are available: UME CRM 1314 and UME CRM 1315 were certified for 29 amino acids in lyophilized plasma and 37 organic acids in lyophilized urine, respectively. These CRMs have been submitted for listing under JCTLM CRM database for higher-order reference materials.

JRC:

Produced and released two RM for antibodies against SARS-CoV-2 in human serum (EURM-017, EURM-018) in December 2020. These RM are initially intended to be used as quality control materials in immunoassays measuring IgG or total antibodies and virus neutralization assays. Additional studies to investigate the possibility to certify the concentration of IgG against the different viral antigens present in the commercial immunoassays are currently ongoing.

NCCL:

Secondary reference materials “Aldosterone in frozen human plasma” (GBW 09283, GBW 09284, GBW 09285) have been developed.

A primary reference material for Aldosterone (GBW 09282) has been developed.

3 Open access educational materials on traceability in laboratory medicine

Elvar Theodorsson, JCTLM WG-TEP Chair

The book "Traceability in Chemical Measurement" edited by Paul de Biévre and Paul Günsler (1) has remained a major source of information on traceability in Analytical Chemistry including Laboratory Medicine since its publication in 2005 together with the Eurachem/CITAC guide (2) and general metrology books (3).

The following ISO and CLSI standards and regulatory documents have created a recently updated framework for manufacturers and laboratory organizations alike to re-double the efforts for improved traceability of measurement results in Laboratory Medicine.

ISO 15193:2009 In vitro diagnostic medical devices -- Measurement of quantities in samples of biological origin -- Requirements for content and presentation of reference measurement procedures.
ISO 15194:2009 In vitro diagnostic medical devices -- Measurement of quantities in samples of biological origin -- Requirements for certified reference materials and the content of supporting documentation.
ISO 17511:2020 In vitro diagnostic medical devices — Requirements for establishing metrological traceability of values assigned to calibrators, trueness control materials and human samples.
ISO 21151:2020 In vitro diagnostic medical devices – Requirements for international harmonization protocols establishing metrological traceability of values assigned to calibrators and human samples.
ISO/TS 20914:2019 Medical laboratories — Practical guidance for the estimation of measurement uncertainty
CLSI EP30-A Characterization and Quantification of Commutable Reference Materials for Laboratory Medicine.
CLSI EP14-A2 Evaluation of Matrix Effects
The IVDR of the EU (Regulation (EU) 2017/746 of the European Parliament and of the Council of 5 April 2017 on in vitro diagnostic medical devices).

The JCTLM realizes the need for updated educational materials, which provide for example knowledge and understanding of the principles and procedures laid down in the ISO and CLSI standards listed above.

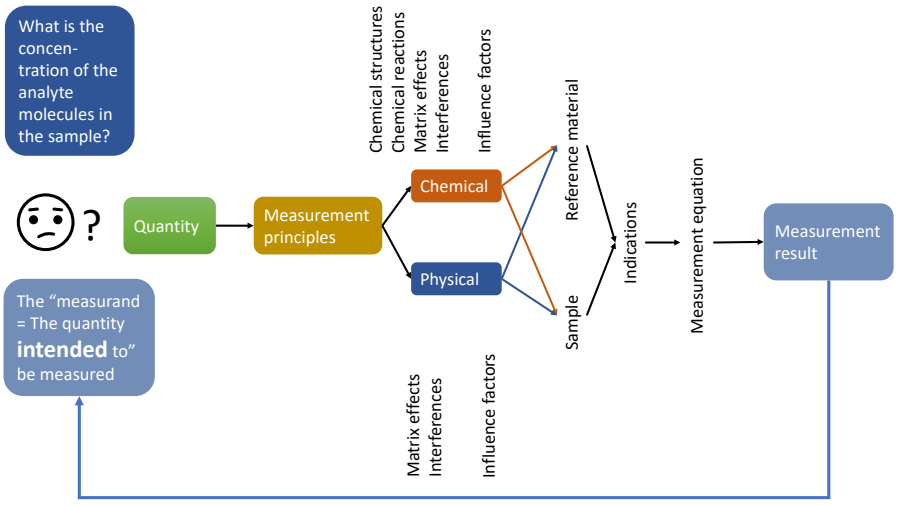
Elvar Theodorsson on behalf of the JCTLM working group on Education and Promotion is writing documents on Traceability in Laboratory Medicine aimed at this purpose https://www.jctlm.org/resources/. New chapters revised by the JCTLM working group on Education and Promotion are published as open access.

The following chapters are already published:
1. Introduction
2. Traceability in Laboratory Medicine in brief
3. Metrological traceability and equivalence of measurement results in Laboratory Medicine
4. Harmonization as a method for standardization in Laboratory medicine
5. Essential concepts and terms
6. Question and answers for enhancing the understanding metrological traceability
7. Historical developments underpinning traceability in Laboratory Medicine
8. Glossary

The intention is to increase the number of chapters and to improve them in harmony with developments in the field and in response to suggestions for improvements from the readers.

References

(1) De Bièvre P, Günzler H. Traceability in Chemical Measurement. Berlin: Springer; 2005. xi, 297 pp.
(2) Ellison SLR, Williams A. Eurachem/CITAC Guide: Metrological Traceability in Chemical Measurement. A guide to achieving comparable results in chemical measurement. Eurachem and CITAC - Cooperation on International Traceability in Analytical Chemistry; 2019.
(3) Bulska E. Metrology in chemistry: Springer; 2018.



A figure attempting to illustrate the paradox in Laboratory Medicine that the users/customers of the laboratories order and expect the measurement of "analytes" but are actually "instead" provided with results of the measurements of "measurands". Understanding why this is so and what it means for Laboratory Medicine and its users is at the core of what "Traceability in Laboratory Medicine" attempts to accomplish.

4 JCTLM Task Force on Reference Measurement System Implementation (TF-RMSI)

Mauro Panteghini, JCTLM TF-RMSI Chair

According to the ISO 17511:2020 standard, to transfer trueness from higher-order references to commercial calibrators, IVD manufacturers have two possibilities:

- Option 1: directly calibrating their internal procedures for calibrator value assignment with a suitable certified reference material (CRM), or
- Option 2: aligning to a reference measurement procedure (RMP) by a comparison study.

While the first option requires commutable CRM for calibration, the latter asks for use of an appropriate panel of clinical samples, whose values are assigned by the RMP, and their resulting measurement uncertainty (MU) based on the inherent MU characteristics of the RMP and the specific value transfer protocol employed.

The TF-RMSI examined the JCTLM-listed CRMs, including the assessment of their commutability and the estimate of MU of certified values, and the trueness and reproducibility characteristics of JCTLM-listed RMP measurements, related to 13 common laboratory measurands. In particular, the MU of the retrieved higher-order references were evaluated for their potential to be small enough to avoid significantly affecting the MU of clinical samples, when uncertainties from IVD calibrator and end-user measuring systems are combined and compared to analytical performance specifications (APS) for the total MU budget derived according to internationally recommended models (Table).

As a major outcome of the study, a synopsis of higher-order CRMs and RMPs listed in the JCTLM database for the selected measurands, including their main characteristics for implementing traceability and fulfilling APS for suitable MU, was produced. Traceability to the highest metrological levels can be established by IVD manufacturers within the defined APS for most measurands: glucose and creatinine, by using both options described above, and total hemoglobin, alanine aminotransferase (ALT), urea, total bilirubin, HbA_{1c}, 25-hydroxyvitamin D3, and potassium by using option 2. It is important to note that when different higher-order references are available, in making a choice IVD manufacturers should consider their suitability in terms of MU by selecting ones with less impact on the total MU budget. For instance, serum sodium and calcium are similar showing that traceability of an IVD measuring system to ion chromatography as RMP is the only approach giving a realistic possibility to fulfil the APS for the total MU budget. Conversely, the MU of the current IVD measuring systems for serum chloride has almost no possibility to fulfil APS for the total MU budget on clinical samples, regardless of the higher-order reference selected. To this regard, it would be interesting to determine whether the use of the ion chromatography as RMP may improve the associated MU and permit the MU for chloride to get close to the APS as already observed for other ions.

A gap analysis, highlighting what is missing from the JCTLM database, was provided. In particular, commutable CRMs for total hemoglobin, ALT, urea, bilirubin, and 25-hydroxyvitamin D3 are still lacking.

Selected reference

- Panteghini M, Braga F, Camara JE, Delatour V, Van Uytfanghe K, Vesper HW, Zhang T; JCTLM Task Force on Reference Measurement System Implementation. Optimizing available tools for achieving result standardization: value added by Joint Committee on Traceability in Laboratory Medicine (JCTLM). *Clin Chem.* 2021;**67**:1590-605.

Table. Model allocation and recommended analytical performance specifications (APS) for standard measurement uncertainty (MU) on clinical samples and at higher-order reference level for the evaluated measurands.

Measurand	APS model	APS for standard MU on clinical samples, %[a]		Allowable standard MU for higher-order references, %[b]	
		Desirable	Minimum	Desirable	Minimum
B-Total hemoglobin	Outcome-based	2.80	4.20	0.93	1.40
P-Potassium	Biological variation	1.96	2.94	0.65	0.98
P-Sodium	Biological variation	0.27	0.40	0.09	0.13
P-Chloride	Biological variation	0.49	0.74	0.16	0.25
P-Alanine aminotransferase	Biological variation	4.65	6.98	1.55	2.33
P-C-reactive protein	State of the art	3.76	5.64	1.25	1.88
P-Glucose	Outcome-based	2.00	3.00	0.67	1.00
P-Creatinine	Biological variation	2.20	3.30	0.73	1.10
P-Urea	Biological variation	7.05	10.6	2.35	3.53
P-Total calcium	Biological variation	0.91	1.36	0.30	0.45
P-Total bilirubin	Biological variation	10.5	15.7	3.50	5.23
B-HbA_{1c}	Outcome-based	3.00	3.70	1.00	1.23
S-25-hydroxyvitamin D3	Outcome-based	10.0	15.0	3.33	5.00

B, blood; P, plasma; S, serum.

[a] Derived from Braga F, Panteghini M. *Clin Chem Lab Med* 2021;**59**:1362-8.

[b] Estimated as one third of APS for standard MU for clinical samples.

5 New entries in the JCTLM database - www.bipm.org/jctlm/

The JCTLM review process conducted in 2021 has resulted in eleven new entries in the JCTLM Database for available higher-order certified reference materials, as well as two new published reference measurement methods, and 21 new measurement services delivered by reference laboratories. The new entries are listed below:

New entries for available Certified Reference Materials

Analyte Category	Analyte*	Matrix/Material
Enzymes	Alanine aminotransferase (ALT) Lactate dehydrogenase isoenzyme 1 (LD1) Creatine kinase isoenzyme MM (CK-MM)	buffer
Enzymes	Creatine kinase alpha-Amylase	blood serum
Non-peptide hormones	Estriol (non conjugated) at five levels of concentration	blood serum
Non-electrolyte metals	Chromium	whole blood

*Complete information for each certified reference material entry can be retrieved by clicking on the Analyte name.

New entries for Reference Measurement Methods

Analyte Category	Reference Measurement Method *(JCTLM Identification Number*)*
Blood cell counting	Flow cytometry based reference method for determination of erythrocyte concentration in blood (JCTLM C16RMP1)
Proteins	UPLC-tandem mass spectrometry method for analysis of amyloid beta 1-40 in human cerebrospinal fluid (JCTLM C16RMP2R)

*Complete information for each method entry can be retrieved by clicking on the JCTLM identification number.

New entries for Reference Measurement Laboratory Services

Analyte Category	Analyte*	Location of laboratory
Enzymes	Alanine aminotransferase (ALT) Aspartate aminotransferase (AST) Creatine kinase (CK) Lactate dehydrogenase (LDH) Gamma-glutamyltransferase (GGT) Alpha-amylase (AMY) Alkaline phosphatase (ALP)	China
Electrolytes	Calcium Potassium Magnesium Sodium Lithium	China
Non-peptide hormones	Testosterone	United Kingdom
Metabolites and substrates	Glucose Urea Uric acid Homocysteine	China

*Complete information for each reference measurement service can be retrieved by clicking on the Analyte name.

6 JCTLM 2023 Workshop on EQAS schemes supporting traceability in laboratory medicine

The JCTLM 2023 Workshop will be themed *EQA schemes supporting metrological traceability in Laboratory Medicine*.

The focus will be on identifying the challenges that impede EQA schemes in the quest for metrological traceability and developing solutions to overcome these hurdles. The format will heavily involve audience involvement using the same process that was effective with the 2021 Workshop.

The programme is developing but will include topics such as the following:

- Barriers to EQA schemes being used to support traceability
- Overcoming the obstacles to traceability - EQA materials
- EQA providers share and aggregate data
- Regulatory versus Aspirational EQA schemes
- What do participants pay for?
- Dialogue and Education

There will be a publication after the meeting containing all the critical discussions. As well, leading up to the workshop, there will be a series of articles in the Q&A section of Clinical Chemistry dealing with many critical barriers. These will allow broader discussion of these and, hopefully, facilitate solutions.

The topics will include:

1. Are possible regulatory demands for commutable materials only EQA feasible at present?
2. Regulatory or aspirational EQA
3. What to do with EQA results in regulatory and aspirational EQA
4. Quo Vadis EQA?

More details will follow as we approach 2023.

The JCTLM TEP WG involved with the development of the programme is Mauro Panteghini, Elvar Theodorsson, David Ducroq, Anja Kessler, Piet Meijer, Anne Stavelin, Sverre Sandberg, Vincent Delatour, Graham Jones, Gary Myers, Greg Miller, Maxim Vonsky and Tony Badrick.

7 Open Call for Nominations - JCTLM Reference Materials, Methods and Services

Nominations are solicited for certified reference materials, reference measurement methods and services for laboratory medicine and *in vitro* diagnostics for listing in the JCTLM database.

JCTLM invites producers of materials, authors of method publications, and calibration laboratories that provide reference measurement services to submit nominations for review and possible inclusion in the JCTLM database.

Submissions should be sent to the JCTLM Secretariat (jctlm@bipm.org) by 31 May 2022 using the procedures and forms available at:

https://www.bipm.org/en/committees/jc/jctlm/jctlm-nominations-and-review

8 Call for experts participation in the activity of the JCTLM Review Teams

The JCTLM has been working for twenty years in maintaining a database of certified reference materials, measurement methods, and services that relate to the in vitro diagnostic area. This database results and relies on the important contribution from individuals/experts who volunteered to participate in the activity of the JCTLM Review Teams, and in identifying and evaluating nominations against agreed criteria.

With the increasing numbers of nominations that are submitted in various fields, the JCTLM is seeking additional experts to contribute to the following review teams: Drugs, Electrolytes and Blood gases, Enzymes, Vitamins and micronutrients, and Nucleic acid to support current and future nominations in the cancer and human genetic measurement area.

Submission of the nomination/application form (DBWG-P-06-F-01) for JCTLM Review Team Membership can be made at any time to the JCTLM Secretariat (jctlm@bipm.org).

9 Future meetings and events

Therapeutics and Diagnostics: Measurements, Standards, Quality and Safety' Workshop in China, July 2022
The 4th TD-MSQS international Workshop on Research and Quality Assurance will be held on 11-13 July 2022, in Chengdu, Sichuan (China). This Workshop is organized jointly by the National Institute of Metrology (China) and the BIPM under the auspices of the JCTLM.

Workshop on the developments in reference measurement systems for C-reactive protein and the importance of maintaining currently used clinical decision-making criteria, Milan (Italy) on 1 December 2022
The Workshop is organized by the Centre of Metrological Traceability in Laboratory Medicine (CIRME) under the auspices of the JCTLM.

Future JCTLM meetings in December 2022
(Date and venue to confirmed)

- Review Meeting of the JCTLM Database Working Group
- Meeting of the 24th JCTLM Executive Committee