Module definition	
Module code	MUF
MDF Version	1.0
MDF Date	September 2020
Course details	
Module Title	Measurement Uncertainty Fundamentals
Learning Pathway	Measurement Uncertainty
Module Lead	Stephen MacDonald
Contact	stephen@pathologymu.com
Course Delivery	
Learning type	- Live presentations - Online presentations - Virtual tutorials
Student requirements	
Requirements	- Internet connection - Access to Zoom or Microsoft Teams (Individual cohort requirements specified upon registration) - Access to spreadsheet software (Excel, Google Sheets)
Pre requisites	None
Study commitment	
Expected study time	2-3 hours per week
Course duration	8 weeks
Module synopsis	

This module will provide attendees with the fundamental theoretical knowledge and practical application of skills to integrate their existing knowledge with the advancing application of measurement uncertainty. Laboratory scientists are continually challenged to improve processes and provide evidence for appropriate assessment of the performance of the assays

they run. This module demonstrates that a coordinated approach can empower the laboratory scientists to provide objective evidence that their assays continue to provide clinically actionable and analytically acceptable results.

Upon completion of this module, attendees are expected to demonstrate a sound fundamental knowledge and application of MU in their workplace. They will develop the central concepts and principles that are required throughout MU assessment. Upon completion delegates will naturally progress to the next level in the MU pathway - advanced techniques (Module II - MAU) and finally applications of measurement uncertainty (Module III - MUAP).

Content outline

This module focuses on Fundamental aspects of MU assessment:
- The science of measurement - essential to understand analytical concepts throughout the module
- Fundamental statistics to ensure familiarity with the terms we are required to know for MU estimation
- Identifying and quantifying uncertainty contributors
- Critically evaluating the methods available to quantify uncertainty from those contributors
- Approaches for Quantitative and Qualitative assays

Key resources

Online	pathologymu.com pathologyuncertainty.com

Learning Outcomes

All modules provided at pathologymu.com follow the same framework of 6 steps as a pathway to achieve the module learning outcomes. For MU Fundamentals they are:

Type	Standard to achieve
Knowledge and Understanding	Upon successful completion of this module, delegates will have developed a full understanding of the terminology, principles and theories that underpin Measurement Uncertainty evaluation. Specifically, statistical concepts and the framework of building an uncertainty budget will allow delegates to be able to apply their knowledge their own assay repertoire
Comprehension	By the end of the module the delegates shall be confident in applying their gained skills and knowledge to established

	methodology and be able to transfer that knowledge to new, as yet unseen contexts Delegates will be able to explain, and justify, what approaches have been taken in their local approach stemming from the learning here
Application	From the outset of the module delegates shall learn what techniques should be applied under what circumstances and will be able to apply the techniques they have learnt following best practices. This will produce analytically robust and clinically useful interpretations of all assays
Analysis	Upon completion of the quantitative and qualitative topics delegates shall obtain the critical skills required to determine what is working and what is not while being able to troubleshoot problems, and improve already embedded processes
Synthesis	Application of the skills learnt during the course project will encourage every delegate to have the confidence to work autonomously, including having the skill set to develop new systems in their own repertoire
Evaluation	Upon completion of this first module delegates will have all the skills required to develop and implement a holistic approach to continual evaluation and improvement in performance.

Learning structure	
Live Presentations	**Hours: 2** **Details:** These sessions facilitate familiarisation with the delivery material of the course and an introduction to expectations for the attendees and the facilitator. The course project is introduced and attendees are encouraged to formulate a plan for delivery of the project
Online presentations	**Hours:** 20+ hours of online instructional content. **Learning outcomes:** All learning outcomes **Details:** Each topic is presented in a sequential pathway, each topic building on the previous. Topics are opened weekly.

Virtual tutorials	**Hours: 4** **Learning outcomes:** **Details:** These sessions are specifically designed to supplement the online learning throughout the course. The facilitator will review all content and extend the topics whilst at the same time approaching any content that needs clarification. Each session represents a checkpoint in the pathway. Successful completion of the online content and tutorial session is dependent on the learning objectives being achieved.
Assessments	
Formative Assessments	**Method:** Online quizzes and short exercises to support learning and develop the skills being taught in the online and tutorial sessions. A scientifically proven methodology for guaranteeing information retention and understanding is used. Constant feedback is provided to ensure understanding at all stages **Learning Outcomes:** All learning outcomes **Weighting:** 0%, but required to be completed to progress to the next topic
Summative Assessments:	**Method:** Submission of small reports demonstrating understanding and application of the taught course content. Each major topic within the module will be assessed separately and aggregated results being applied to the final achievement **Learning Outcomes:** All learning outcomes **Weighting: 20 %, (2 submissions of 10%)**
Course Project	**Method:** Delivery of a group project demonstrating critical evaluation of the course content and appropriate application to a methodology of the cohorts choosing. This will culminate in a submission to a peer reviewed publication. **Learning Outcomes:** All learning outcomes **Weighting:** 80%
Course completion	Attendees will receive a pass/fail for the module. Successful completion of this module automatically allows the attendee to progress to the next level of the pathway - Measurement Uncertainty Advanced (MUA).