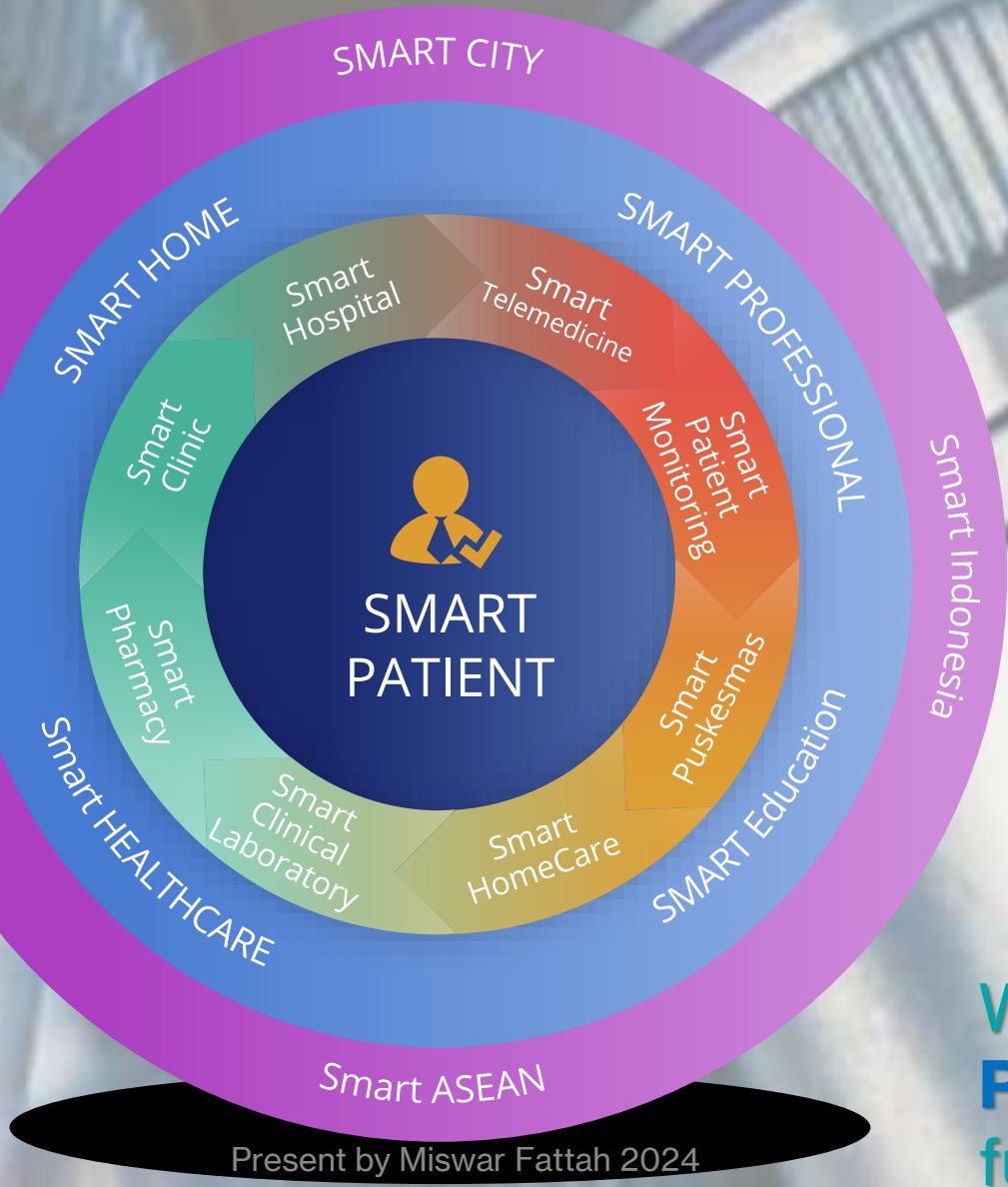
Competency Alignment: Educators and Graduates in TLM

Dr Miswar Fattah, MSi

FUTURE HEALTHCARE



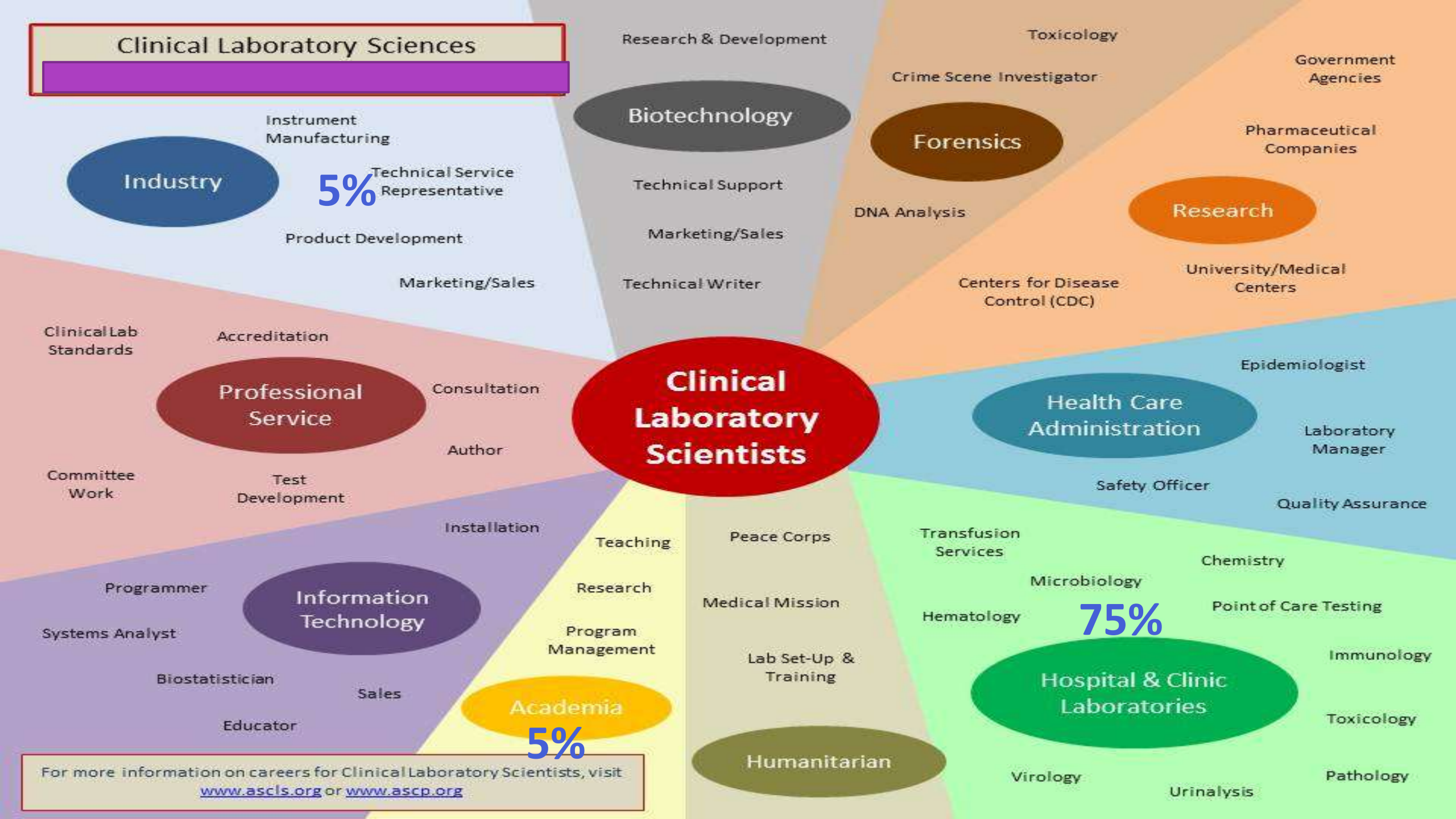
"Medical Laboratory Scientists are the life force of healthcare's future."

We NEED **Medtech Professional** to face future healthcare

Trends in Eduction

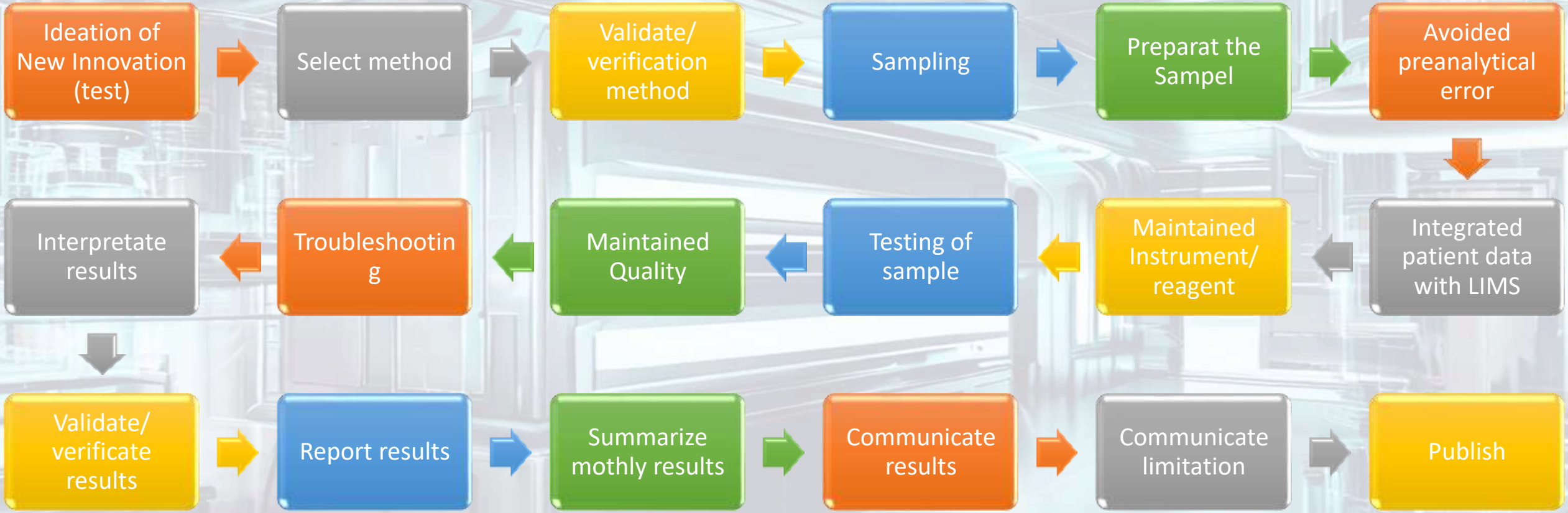
- Online Learning
- Hybrid Learning
- Blended Learning
- Personalized Learning
- Project-based Learning (PBL)
- Gamification
- Bite-sized Learning (Microlearning)
- Collaborative Learning
- Social Emotional Learning (SEL)
- Maker Learning
- Digital Citizenship & Digital Literacy

Clinical Laboratory Sciences

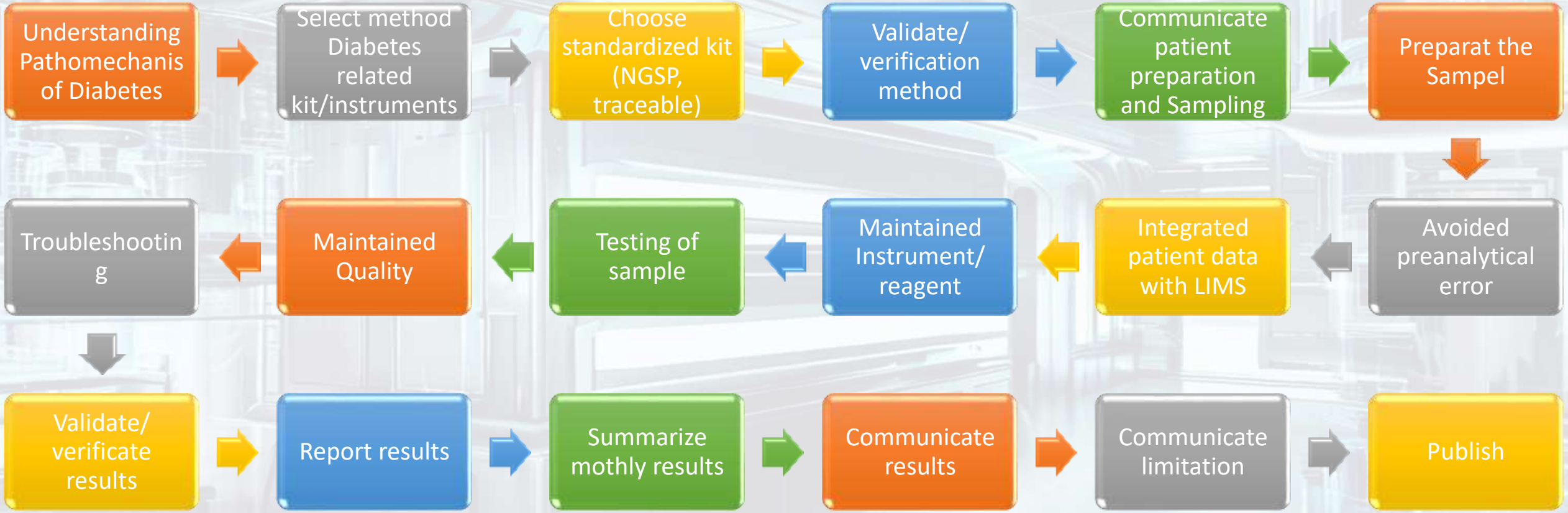


For more information on careers for Clinical Laboratory Scientists, visit www.ascls.org or www.ascp.org

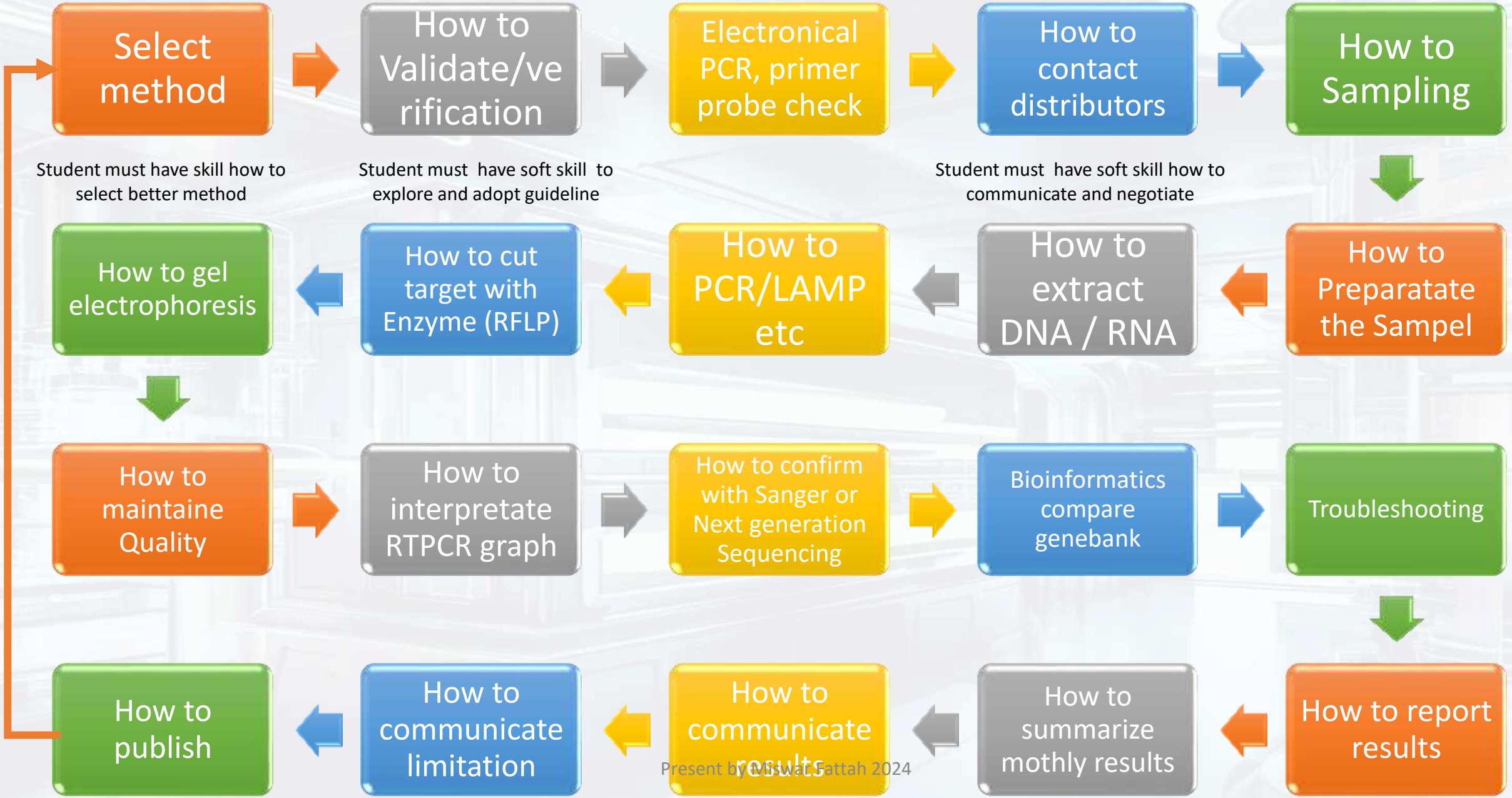
Role of Medical Laboratory Science in Clinical Laboratory

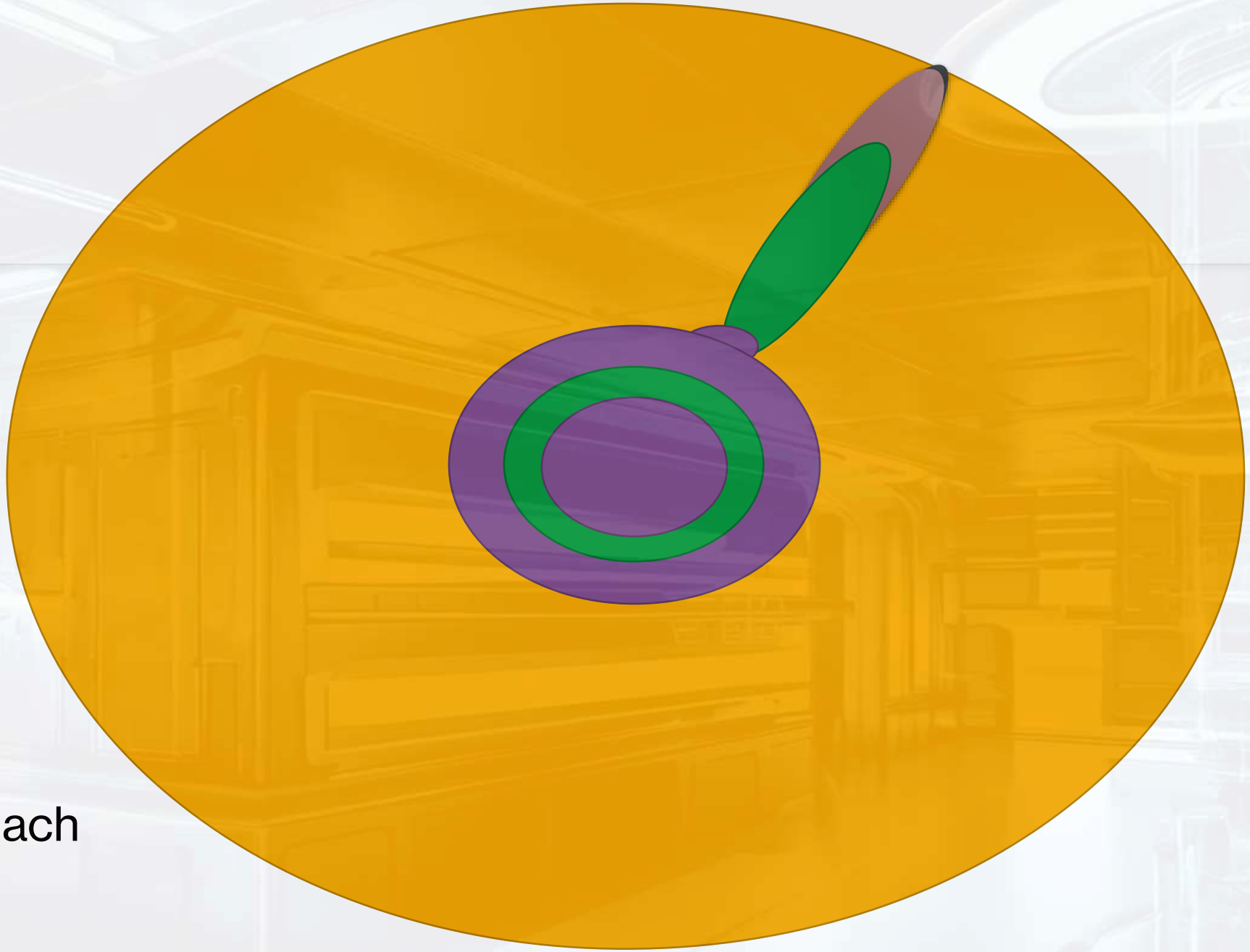


Role of Medical Laboratory Science in Diabetes



Role of Medical Laboratory Science in Clinical laboratory





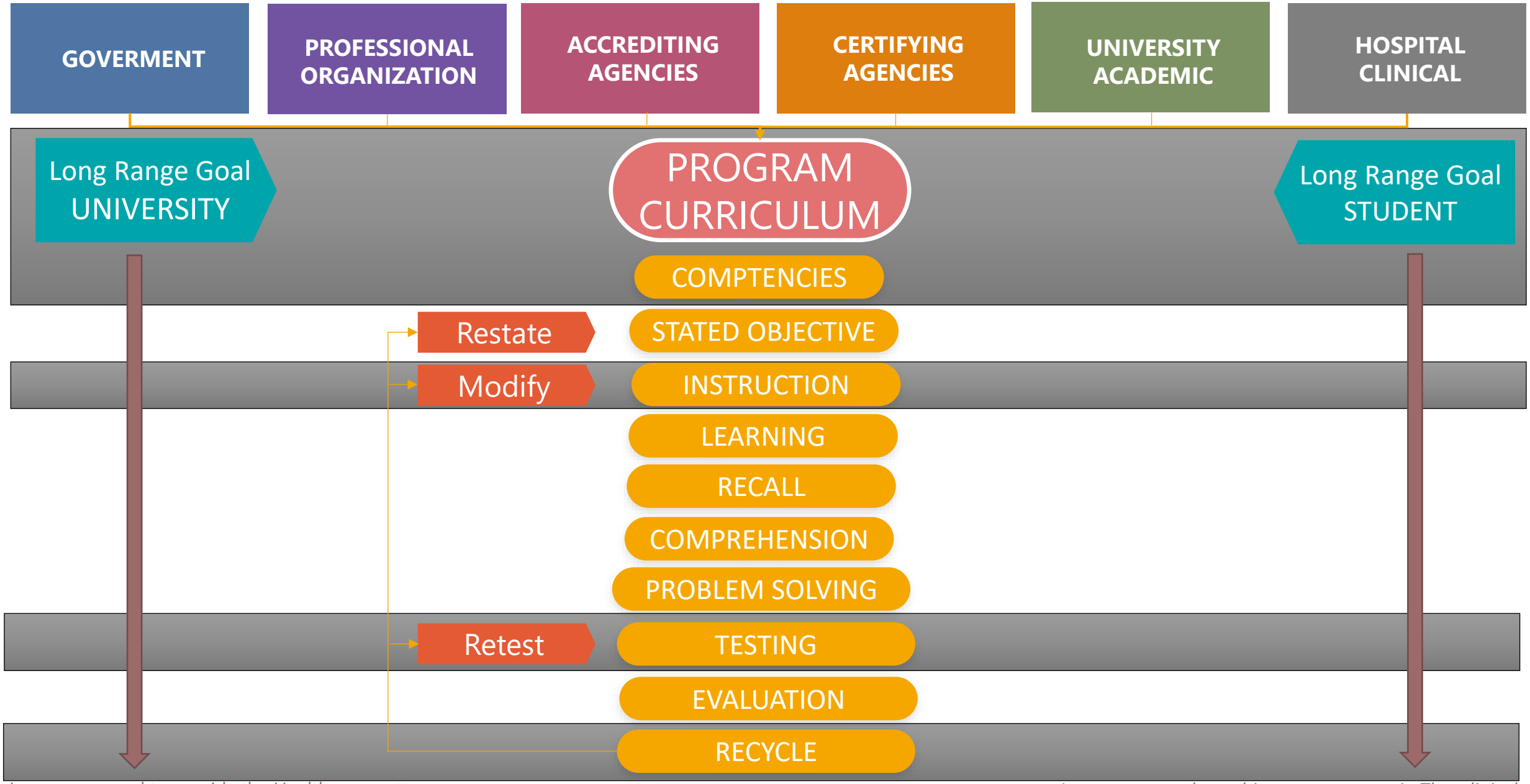
Different Knowledge in each level Education

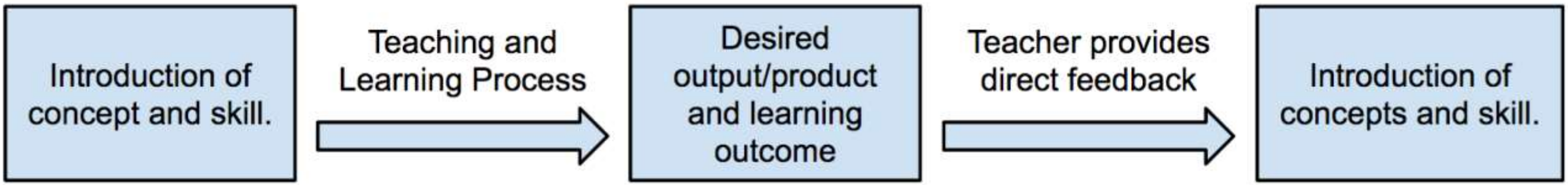

Bachelor
Master
PhD

Magister Degree

Present by Miswar Fattah 2024

OVERVIEW EDUCATIONAL PROCESS




Introduction of concept and skill.
Teaching and Learning Process
Desired output/product and learning outcome
Teacher provides direct feedback
Introduction of concepts and skill.

Education perspective

A. Diploma's Degree in Medical Laboratory Science

1. Curriculum Overview
2. Core Competencies
3 Entry Roles

B. Master's Degree in Medical Laboratory Science

1. Advanced Curriculum and Specializations
2. Enhanced Competencies
3. Leadership and Specialized Roles

Doctoral Degree in Medical Laboratory Science

1. Research-Focused Curriculum
2. Expertise and Innovation
3. Academic and-Level Leadership Roles

Core Responsibilities in Clinical Laboratories

A. Diplomas's Degree Holders

- 1. Routine Diagnostic Testing
- 2. Basic Quality Control Procedures
- 3. Sample Collection and Preparation

B. Master's Degree Holders

- 1. Diagnostic Testing and Analysis
- 2. Advanced Quality Control and Assurance
- 3. Research and Development Initiatives
- 4. Data and Clinical Correlation

C. Doctoral Degree Holders

- 1. Cutting-Edge Research and Innovation
- 2. Development New Diagnostic Tests
- 3. High-Level Data Analysis and Interpretation
- 4. Publishing Research Findings


NGS MiSeq


Digital PCR


Flow Cytometry


GCMS


ICPMS


ICPMS

HPLC UV
Fluoroscence


LCMSMS


HS LCMSMS


FTIR


Headspace GCMS


QTOF


NGS Nextseq


Sanger Seq


Mass array

Cancer Molecular & Advanced Immunology Laboratory

Mass Spectrometry & Separation Science Laboratory

IHC

Fully automation molecular


SoftPATH LIS

Molecular Predictive & Diagnostic Lab

Anatomical Pathology Laboratory


Digital pathology


Microarray

QPCR

Auto Karyotyping analyzer

Research Laboratory

Advance Microbiology


MALDI Biotyper Sirius One

Full wavelength Microplate reader

Luminex

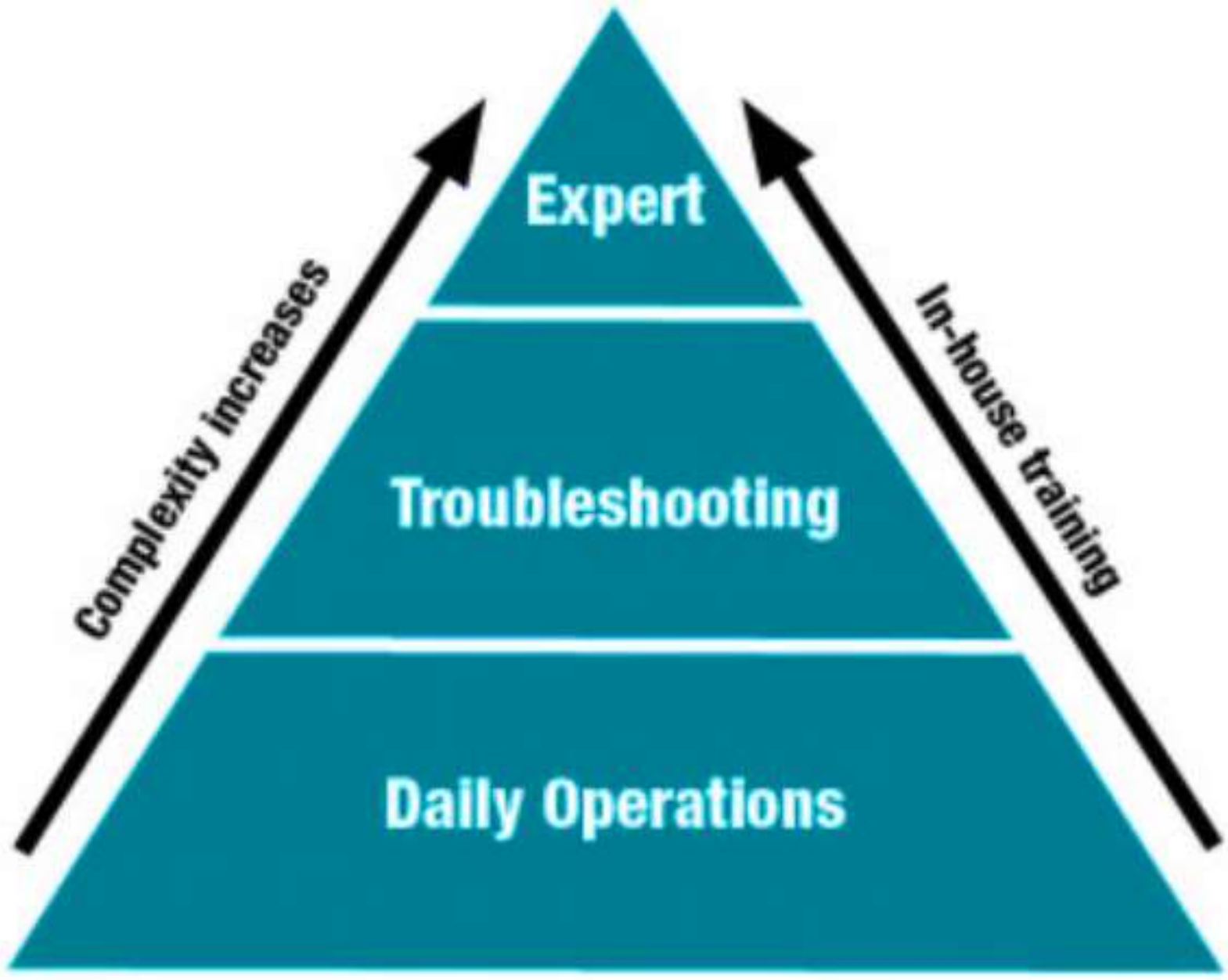
Flow-through Hybridization

Prodia Next Generation Laboratory

+more

Bioinformatic tools

Present by Miswar Fattah 2024


Expert
Troubleshooting
Daily Operations
Complexity increases
In-house training

Advanced Roles and Special

A. Diplomas's Degree Holders

- 1. General
- 2. Basic Specializations (e.g., Phbotomy, Basic Microbiology)

B. Master’s Degree Holders

- 1. Clinical Laboratory Management
- 2. Molecular Diagnostics .
- 3. Transfusion Medicine
- 4. Cytogenetics
- 5. Histopathology

C. Doctoral Degreeers

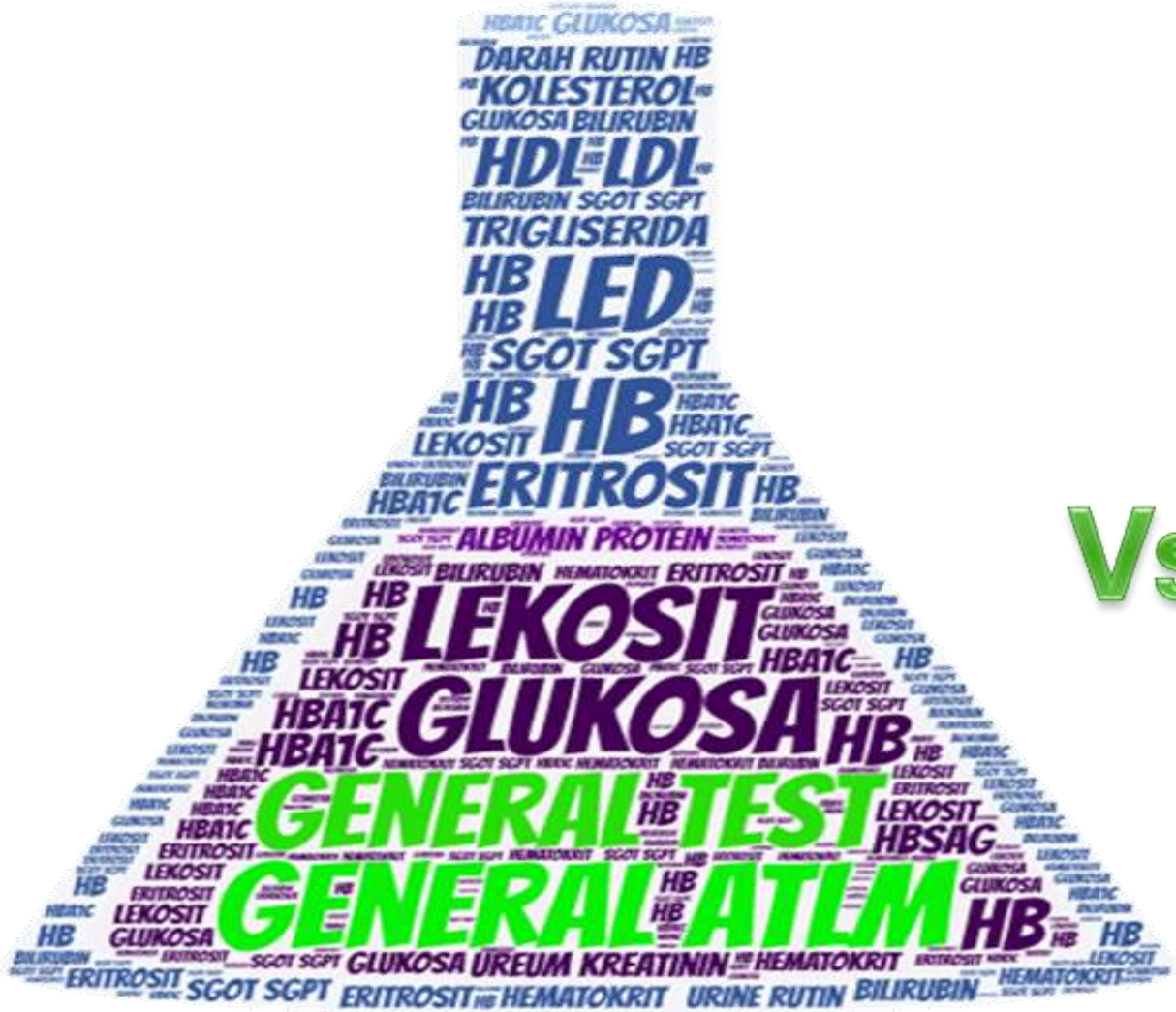
- 1. Principal Investigator in Research Projects
- 2 Academic Faculty Positions
- 3. High-Level Clinical Consultancy
- 4. Policy and Standards Development

Medical Laboratory Technologies

- Blood Bank Technology
- Chemistry Technology
- Clinical Animal Technology
- Clinical Laboratory Aide
- Clinical Laboratory Assisting
- Cytotechnology
- Hematology Technology
- Histologic Technology
- Medical Laboratory Technology
- Medical Technology
- Microbiology Technology
- Medical Laboratory Technologies, Other

Specialitstic or Specific Job title

Pathology Assistant	Cytogeneticist	Cytogenetic Technologist	Cytotechnologist (CT)	Histotechnologist (HTL) or Histologist	Histologic technician (HT)	Phlebotomist (PBT)
Master's degree and board certification	Doctoral degree (e.g., MD or PhD) and board certification	Bachelor degree (B.A. or B.S) in the sciences or clinical/medical laboratory scienceCG certification recommended	Bachelor degree and completion of accredited CT program	Bachelor degree and completion of accredited HTL program	High school degree and completion of accredited histology program	High school degree and training or work experience
Gross examination and dissection of tissue samples sent to anatomic pathology lab; assist with autopsies	Performs cytogenetic analyses to diagnose chromosomal abnormalities in human genetic diseases	Prepares biological specimens for cell culture and microscopic analyses as part of cytogenetic studies; assists the cytogeneticist	Examines human cells under microscope for signs of pathology (e.g., Pap smears for signs of cancer); with appropriate experience, may supervise a cytology laboratory	Prepares tissue samples for microscopic examination by pathologist and performs complex procedures; can supervise histologic technicians and, with appropriate experience, may supervise histology laboratory	Prepares sections of body tissues for microscopic examination by pathologist, processes tissue biopsies, assists histotechnologists	Collects blood samples from patients for lab tests


HBA1C GLUKOSA
DARAH RUTIN HB
KOLESTEROL
GLUKOSA BILIRUBIN
HDL LDL
BILIRUBIN SGOT SGPT
TRIGLISERIDA
HB LED
SGOT SGPT
HB HB
LEKOSIT
HBA1C
ERITROSIT
ALBUMIN PROTEIN
BILIRUBIN
HEMATOKRIT
LEKOSIT
GLUKOSA
HBA1C
SGOT SGPT
GENERAL TEST
HBSAG
GENERAL ATLM
GLUKOSA UREUM KREATININ
HEMATOKRIT
ERITROSIT SGOT SGPT
ERITROSIT HEMATOKRIT
URINE RUTIN
BILIRUBIN

Vs


ZN SE HG CU PB
CYTOGENETIC CYTOGENETIC
VITAMIN B1 B2 B6
CYTOGENETIC
ZN SE HG CU PB
HER2NEU KIDNEY STONE
TRACE ELEMENT
KIDNEY STONE
HER2NEU
T CELL T CELL
BINDING PROTEIN
T CELL
KIDNEY STONE
NK CELL ACTIVITY
CYTOGENETIC
TRACE ELEMENT
GENETIC VARIANT
SPECIAL TEST
SPCIAL ATLM
FATTY ACID PROFILE T CELL
METHYLATION PROFILE

Roles & Responsibilities in the Lab

Laboratory Director

Doctoral degree (e.g., MD or PhD); sometimes a medical laboratory scientistBoard certification recommended

Directs and manages all lab operations and ensures quality patient care; Interprets test results, with consulting pathologist

Technical Supervisor

Doctoral degree (e.g., MD or PhD); may be Master's or Diplomas's degree with experienceBoard certification recommended, May be the same person as the lab director

Provides oversight of technical and scientific functions of the lab

General Supervisor

May be the same person as the lab director or technical supervisor, Depending on lab and experience, MLS/MT or MLT may qualify

Provides oversight of day-to-day functions of the lab

Medical Laboratory Scientist (MLS) or Medical Technologist (MT)

Bachelor degree in clinical/medical laboratory science or life sciences and completion of accredited MLS/MT program, Licensure/certification may be required by employers

Performs routine tests;develops new test methods under supervision; performs quality control tests; becomes group or team leader; supervises, teaches, delegates

Medical Laboratory Technician (MLT)

Associate degree and completion of accredited MLT or certificate programLicensure/certification may be required by employers

Performs routine tests and quality control tests under supervision on MLS/MT

Interdisciplinary Collaboration

Diplomas's Degree Holders

1. Supporting Role Patient Care Teams
2. Basic Communication with Healthcare Providers .

Master’s Degree Holders

1. Leadership in Interlinary Teams
2. Advanced Communication and Reporting
3. Consultation with Physicians on Complex Cases

Doctoral Degree Holders

1. Leading Multidisciplinary Research Teams
2. Level Consultation and Policy Advisement
3. Enhancing Healthcare Practices and Guidelines

Ethical and Legal Considerations

Bachelor:

1. Universal Ethical Standards
2. Patient Confidentiality
2. Compliance with Regulations

B. Master’s Degree Specifications

1. Ethical Leadership
2. Advanced Professional

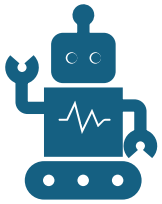
Doctoral Degree

1. Specific Considerations
1. Research Ethics
2. Publication Integrity
3. Policy Regulatory Compliance

Technological Advancements and Innovations

Diplomas's Degree Holders

1. Operation of Standard Laboratory
2. Result validation
3. Method Verification



B. Master’s Degree Holders

1. Implementation of Automation and validation/verification complex test
2. Integration of Data analytics and Diagnostics
3. Leading Genomics and Personalized Medicine Projects .

Doctoral Degree Holders

1. Innovating New
2. Developing Advanced Diagnostic Tools
3. Pering Research in Genomics and new biomarkers in Laboratory Medicine

Challenges

Diplomas's Degree Holders

- 1. Entry Challenges
- 2. Opportunities for Advancement

Master Degree Holders

- 1. Addressing Skill Shortages
- 2. Continuing Education and Professional Development
- 3. Future Trends Leadership Roles

Doctoral Degree Holders

- 1 Securing Research Funding
- 2. Balancing Research and Clinical
- 3. Shaping the Future of Medical Laboratory Science.

Case Studies and Real-World Applications

A. Diplomas's Case Studies

1. Routine Diagnostic Impact

B. Master Degree Case Studies

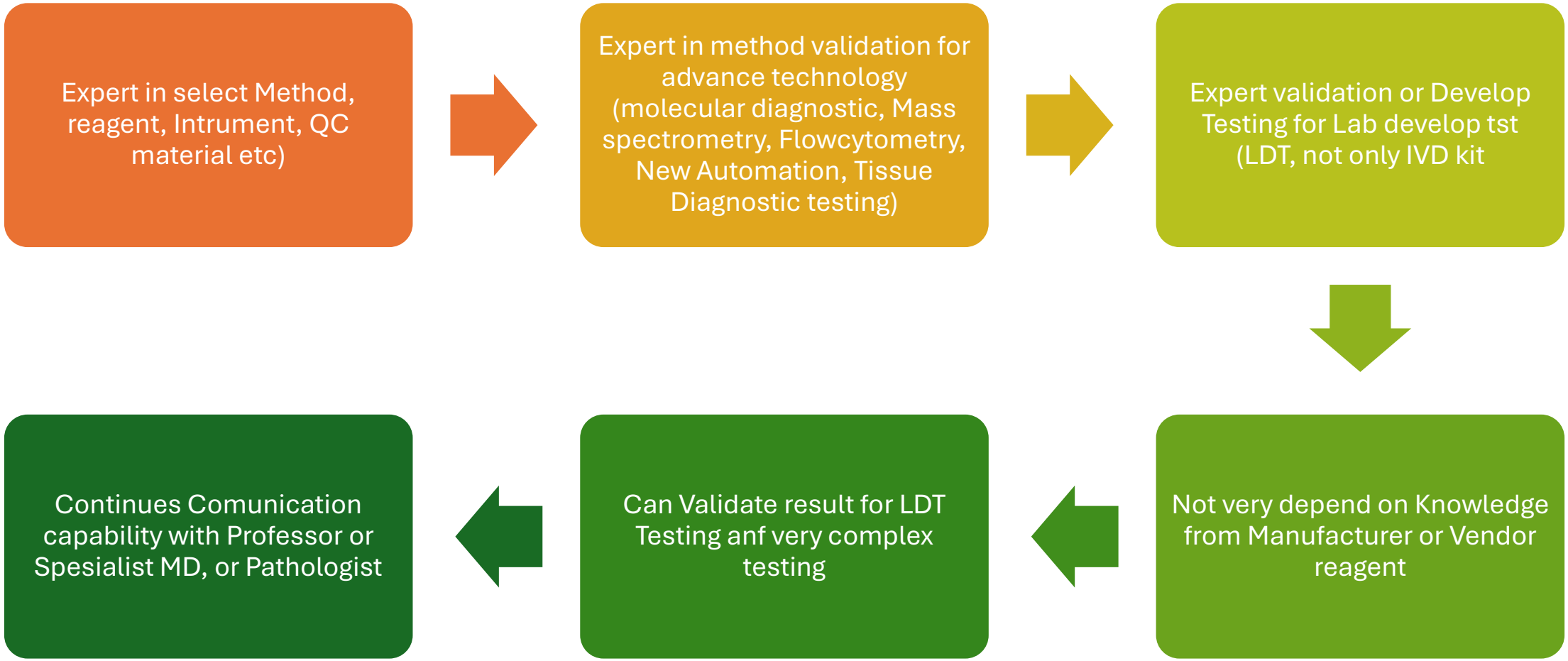
Complex Diagnostic Impact . Research Contributions

Success Stories in Patient Outcomes .

Doctoral Degree Case Studies

1. Groundbreaking Research
2. Innovations in Diagnostic Techniques
3. Influ Publications and Policy Changes.

Master Degree in Laboratory Medicine Focus

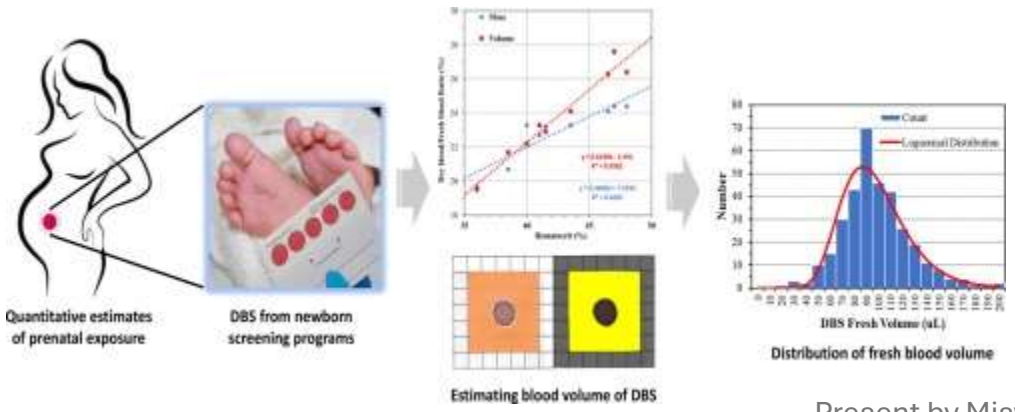


Illustration

Molecular diagnosis

Extraction of viral RNA Viral RNA was extracted from the infected serum samples using the QIAamp viral RNA mini kit (Qiagen, Germany), according to the manufacturer's protocol. Briefly 560 µL of buffer AVL was added to 140 µL of infected material (serum) and vortexed for 15 s and the mixture was incubated at room temperature (15–25 °C) for 10 min. After washing twice, finally RNA was eluted in 70 µL of elution buffer in collection tube and stored at − 80 °C until use.

Dengue complex one step reverse transcription-polymerase chain reaction (RT-PCR) The confirmation of dengue specific RNA was carried out by a one step RT-PCR protocol using Sigma's Enhanced avian HS RT-PCR kit (Sigma, USA) following the manufacturer's instruction. The PCR amplification was carried out in a final volume of 25 µL using the viral RNA as template. Briefly PCR mix contain 2.5 µL 10X PCR buffer, 1.5 µL $MgCl_2$ (3 mM),0.5 µL dNTP (200 mM each), 0.5 µL Reverse Transcriptase (0.4 units/µL), 0.5 µL RNAse inhibitor (0.4 units/µL), 0.5 µL TaqDNA polymerase (0.05 units/µL), 0.5 µL of respective forward (5′-TCAATATGCTGAAACGCGCGAGAAACCG-3′) and reverse primers (5′-TTGCACCAACAGTCAATGTCTTCAGGTTC-3′) targeted towards C-prM gene, 5 µL extracted viral RNA and 13 µL of molecular biology grade water. The PCR amplification was carried out in a final volume of 25 µL in a thermal cycler (Bio-Rad, USA). The thermal profile comprised of reverse transcription at 48 °C for 45 min, initial denaturation at 95 °C for 2 min followed by 35 cycles at 95 °C for 1 min, annealing at 55 °C for 1 min, extension at 72 °C for 2 min and final extension at 72 °C for10 min.



Master Degree have capability to convert method from journal to real SOP in routine Clinical Laboratory

Include decine interpretation

Software needed

Cost Calculation etc

Advances in medical science occur at a **dramatic rate**, leading to new knowledge and technology that **changes** clinical laboratory practice

Transportation

Land Use

Census Tracts

Structures

Postal Codes

Raster Imagery

Exposome

Signs and Symptoms

Genome

Epigenome Metabolome

Microbiome Proteome

Other Types of Patient Data

Individual Patients

Pre-natal testing	• To evaluate risk of genetic disorders or birth defects
Newborn screening	• Recessive genetic disorders
Carrier testing	• to determine if an individual—usually a prospective parent—carries a specific autosomal recessive disease gene
Predictive testing	• to assess predisposition to particular diseases
Diagnostic testing	• to diagnose, confirm, classify, stage or rule out a particular genetic condition, before or after symptoms appear
Treatment monitoring	• to evaluate efficacy of treatments such as chemotherapy
Companion diagnostic testing	• to test whether an individual expresses the target for a particular drug or therapy
Pharmacogenetic or pharmacogenomic analysis	• to help in selecting an appropriate dosage or drug


Education System
Skill Gap
Laboratory Medicine

Medical Laboratory Science Education in Australia: An Academic Review

Original Research | Open access | Published: 30 April 2024

(2024) Cite this article

Medical Science Educator

academics also specialize in MLS subjects that require in-depth practical expertise such as clinical chemistry, hematology, transfusion science, medical microbiology, and histopathology and have a research interest in MLS [3]. However, not all academics that teach in MLS programs have a university qualification in MLS or have experience as a clinical Medical Laboratory Scientist in a pathology laboratory. Previous literature has reported the level of appointment and research track level of Australian MLS academics [3]; however, there is a paucity of literature that describes the demographics of MLS academics, their qualifications, and previous experience as a clinical Medical Laboratory Scientist.

AJLM
African Journal of Laboratory Medicine
www.ajlmonline.org
AOSIS | ASLM

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PMCID: PMC5637778
PMID: 29043162

Biomedical laboratory science education: standardising teaching content in resource-limited countries

Wendy Arneson,[✉1] Cathy Robinson,[1] and Bryan Nyary[2]

Results

The new teaching materials were implemented and faculty, students and other stakeholders reported successful outcomes.

Conclusions

These approaches to updating curricula may be helpful as biomedical laboratory schools in oth countries address gaps in the competencies of entry-level graduates.

'The materials become uniform throughout the country, which benefits both faculty and students.' (SP1, Department Chair)

'Students say they are better able to understand and learn the subject matter because the lectures and labs are more organised and more interactive.' (SP1, Department Chair)

'Students report that they know exactly what is expected of them and that they are better prepared for exams from the wording of the objectives.' (SP1, Department Chair)

'The laboratory schedule for each lecture/course helps avoid ambiguity and ensures lab space is available as needed.' (SP1, Department Chair)

'The only reported drawback so far comes when faculty only use the outline materials on the PowerPoint® slides and do not provide supplementary information. This makes more in-depth learning difficult for students without access to textbooks or the Internet.'(SP1, Department Chair)

Potensi akar masalah kompetensi tidak sesuai kebutuhan

Dosen tidak kompeten	Latar belakang Pendidikan tidak sesuai	Dosen tidak mengetahui kondisi di Lapangan	Fasilitas minimum tidak terpenuhi	Uji kompetensi tidak sesuai kebutuhan di lapangan
Perlu ada pelatihan dosen: how to teach TLM untuk semua dosen baru dan dosen lama secara berkala minimum 3 tahun sekali	S2 ATLM dan latar belakang Pendidikan yang direkomendasikan kolegium sebagai bacground dosen untuk setiap mata kuliah kunci	Rasio Dosen latarbelakang TLM >50%	Kolaborasi dengan Industri minimum ada 3 per institusi	Soal disimulasikan Bersama Industri, (puskesmas, RS, lab mandiri etc)

Challenge Education in Laboratory medicine

- Lack of **standardization** of **Educators**
- Lack of **Standardization of Textbook** & teaching guide
- Limited introduction **international guideline**
- Lack of Laboratory Facility
- Lack of utilization of **animation, video or good visual appearance**
- Lack of review curriculum **inline with Industry** (hospital lab etc)
- **Research not focus** on clinical Laboratory


Chemist, biologist, public health, pharmacist, others
Skill Gap
Education System
Laboratory Medicine

"**Our passion** lies in cultivating the **expertise of medical technologists**, guiding them to **excel in their crucial role** in patient care. That is **our sole focus**."

"**Our mission is clear**: we educate individuals to **excel as medical technologists**, not to pursue **other scientific paths**. The **lab is our domain**"

"As **educators of medical technology**, we shape **problem-solvers, not theorists**. Our goal is to **produce adept professionals for the clinical laboratory**"

"**Teaching medical technology** is about **nurturing the skills and mindset essential for success** as a medical technologist, **not veering into unrelated scientific realms**."

Limitation & Strength of Educator with Vocational Background

Theoretical Depth

Lack deep theoretical understanding, explaining complex concepts effectively

Research Experience

Vocational background limited compare to Basic scientists have extensive research experience, teaching current advancements and critical thinking skills, and are well-versed in grant writing

Curriculum Development

Vocation have limited in developing a curriculum that encompasses detailed scientific knowledge and ensures coherence between theoretical learning and practical application

Critical Analysis and Problem Solving

Vocational background limited compare to Basic science training fosters critical thinking and problem-solving skills for methodical troubleshooting.

Practical Skills

Highly skilled in practical laboratory work, offering valuable real-world tips and insights.

Clinical Relevance

Understand clinical applications and patient care implications of lab tests

Professional Readiness

Insight into lab operations, preparing students for the workforce

Networking and Industry Connections

Industry connections for student opportunities like internships and jobs.

Pitfalls and Strategies for **Educators Transitioning** to Medical Laboratory Science (1)

1. Overemphasis on Theoretical Knowledge

Pitfall: Focusing too much on theoretical concepts without **emphasizing practical applications** and **real-world relevance** in **medical laboratory science**.

Strategy: Incorporate **case studies, simulations, and hands-on activities to bridge the gap between theory and practice**, providing students with a **holistic understanding of laboratory medicine**.

2. Limited Exposure to Clinical Settings

Pitfall: Lack **of firsthand experience in clinical laboratory environments** may result in challenges in **contextualizing theoretical concepts for students**.

Strategy: Arrange site visits to clinical laboratories, invite guest speakers from the field, **or collaborate with practicing laboratory professionals** to provide students with exposure to **real-world laboratory settings and practices**.

3. Misalignment with Curriculum Expectations

Pitfall: **Difficulty in aligning teaching approaches** and content delivery with **the specific requirements and competencies outlined** in the **medical laboratory science curriculum**.

Strategy: Engage with **program coordinators, attend curriculum development workshops**, and **seek feedback from peers to ensure that teaching practices align** with **program goals and student learning outcomes**.

Pitfalls and Strategies for **Educators Transitioning** to Medical Laboratory Science (2)

4. Technological Challenges:

Pitfall: Limited familiarity with **specialized clinical laboratory software**, **data management systems**, and **digital tools used in medical laboratory science education**.

Strategy: Invest time in learning relevant laboratory software, attend **training sessions on digital platforms**, and **collaborate with tech-savvy colleagues** or IT support to integrate **technology effectively into teaching practices.**

5. Interdisciplinary Communication Barriers

Pitfall: Difficulty in communicating complex scientific concepts to students from diverse educational backgrounds or in collaborating effectively with **healthcare professionals from different disciplines**.

Strategy: Offer interdisciplinary workshops, encourage student participation in team-based projects, and promote open dialogue to foster mutual understanding and effective communication among all stakeholders.

6. Limited Understanding of Ethical and Legal Aspects

Pitfall: Insufficient knowledge of the ethical considerations, privacy regulations, and legal aspects specific to medical laboratory practice.

Strategy: Incorporate discussions on ethical dilemmas, patient confidentiality, and legal compliance into classroom activities, and seek guidance from institutional ethics committees or legal advisors when addressing complex issues.

Clinical Laboratory Educator Conference

The CLEC is the premier annual event for professionals in medical laboratory education.

Gain insights from content experts on evolving topics in the field.

Take home practical strategies and innovative teaching techniques to enhance student learning.

Present by Miswar Fattah 2024

Highlight CLEC

From Trainer to Teacher: Supporting a Successful Transition

From the 2024 Clinical Laboratory Educators Conference (Recorded 2/22/2024)
Presented by Ryan Collison, SC(ASCP)CM, and Barbara Zingale, MSIT, MLS(ASCP)CM

The transition from being a good trainer to a great educator can be daunting. This presentation will provide challenges in that transition, our strategies used to make strong, independent faculty, and the resources we have used to develop them while teaching in a hospital-based MLS program.

LEARNING OBJECTIVES
At the conclusion of this presentation, participants will be able to:

- Describe the opportunities and challenges of transitioning from trainer to educator
- Develop resources for new educators to facilitate their learning
- Design a standardized training program for new educators

Highlight CLEC

Teaching Strategies and Methods of Delivery for CLS Courses across all Academic Levels

From the 2024 Clinical Laboratory Educators Conference (Recorded 2/23/2024)
Presented by Rajkumar Rajendran, DCLS, MLS(ASCP), Juan Ulises Rojo, PhD, MLS(ASCP)MB, and Niti Vyas, DCLS, MLS(ASCP)CM

Our institution offers Bachelor, Master, and Doctorate degrees in Clinical Laboratory Sciences in presential and remote modalities. These different academic levels and classroom modalities present various challenges in delivering and assessing CLS course materials. We'll discuss these challenges and some of the ways we address them.

LEARNING OBJECTIVES
At the conclusion of this presentation, participants will be able to:

- List teaching strategies that are used to deliver CLS courses at the Undergraduate and Graduate levels
- Discuss examples of methods used to assess student learning at various levels.
- Recognize and describe various ways to evaluate effective teaching strategies and course delivery methods for CLS courses at all academic levels.

Highlight CLEC

Focus on Learning Tools

From the 2024 Clinical Laboratory Educators Conference (Recorded 2/22/2024)
Presented by Lauren Brooks, PhD, MLS(ASCP)CM, and Margot Alvey, MS, MLS(ASCP)CM

Featuring two 30-minute sessions:
Bringing Hemostasis to Life: Hands-on Modeling of Coagulation
Come learn about a hands-on model for introducing and reinforcing the concepts of hemostasis. Bring to your classroom a new way to engage students with primary hemostasis and the coagulation cascade, including modeling coagulation testing and evaluating results based on various patient pathologies.
Stand up and Step up: Motivating Students to Study through the Table-Top Quiz and Mini Exam
External motivators are often necessary to enhance students' study habits. Attend this session to learn about two unique assessment tools—the table-top quiz and the mini exam—and how they can lead to improved study habits, student confidence, and exam performance in your didactic courses.

LEARNING OBJECTIVES
At the conclusion of this presentation, participants will be able to:

- Design a hands-on model of hemostasis for their students. Assess students' gains in knowledge of and self-reported confidence on the material. Describe the impact visual and active learning provides as a complement to lecture based learning.
- Discuss challenges students and instructors face with instilling consistent and effective study habits. Explain the format and purpose of the Table-Top Quiz and the Mini Exam. Value the positive impact of these evaluation tools on students and instructors.

Highlight CLEC

Shifts in Students' Needs: Time to Recalibrate the Curriculum

From the 2024 Clinical Laboratory Educators Conference (Recorded 2/23/2024)
Presented by Yon Choi-Gomes, MAEd, MLS(ASCP), and Robina Colclough-Davy, MS, MLS(ASCP)CM

CLEC 2024

With a program that has existed for over 60 years, the curriculum needed a redesign. Through feedback mechanisms from our students, alumni, and clinical preceptors, we were able to recognize our deficiencies and contemporize our program.

LEARNING OBJECTIVES
At the conclusion of this presentation, participants will be able to:

- Highlight the history of the Clinical Laboratory Sciences program
- Identify the deficiencies or unnecessary excess in the current curriculum
- Examine how to enhance the curriculum by adding or eliminating courses

New Educator's Workshop: Rachel L. Morris, Ph.D. MLT(ASCP)cm

Originally planned as a 2.5 hour, in person workshop, this outline could be developed into online learning modules or webinar presentations on each topic. Additional topics could be added upon request.

Learning Objectives:

- develop measurable learning objectives and design learning experiences to support student achievement of the objectives
- design various types of assessments to evaluate student achievement of desired outcomes
- generate and utilize a plan for teaching and learning improvement based on self-reflection and analysis of various types of feedback

Part 1: A Look at Learning Objectives

- This section includes how to write learning objectives for MLS courses. It includes how to write specific and measurable objectives based on learning targets for students. We also review learning domains and Bloom's Taxonomy of Learning. Resources are given for further learning and two learning activities allow participants to practice what they are learning.

Part 2: Designing Learning Activities

- This section is about creating learning experiences and activities for students in MLS. We focus on making activities authentic, accessible, and inclusive. We also discuss how using creativity- ours and that of others- can help us create strong activities that support learning goals and prepare students for assessment. Resources are given for further learning and two learning activities allow participants to practice what they are learning.

Part 3: Assessment

- This section of the workshop focuses on creating assessments that match the learning objectives. We discuss types of assessments: diagnostic, formative, and summative. We also discuss rules for writing a authentic, accessible assessments that reflect the learning goals. Resources are given for further learning and one learning activity allows participants to practice what they are learning.

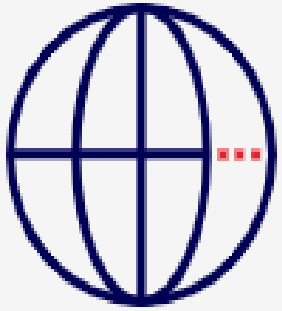
Part 4: Reflective Practice

- In this section, we introduce the idea of reflective practice in education. We model a step-by-step process for educators to use to solve problems in the classroom and improve their teaching year by year. Student finish this section by creating a plan for improving one learning experience and share out their plan to encourage one another

Need to Improve in Education Process

Industry connected

Learn from practising industry professionals with extensive experience and contact networks.



Global opportunities

Undertake 10-13 weeks of professional practice in an overseas laboratory.

Professional accreditation

Qualify for professional membership of the Australian Institute of Medical and Clinical Scientists.

Steps to Help Teachers Prepare Students as Medical Technologists

Professional Development in Medical Laboratory Technology

- Courses and Certifications
- Online platforms like Coursera, edX, and professional organizations (arup, adlm, PATELKI etc)
- Shadowing and Internshipsshort-term internships in clinical labs to gain hands-on experience.

Collaborative Teaching and Mentoring

- Team Teaching: Pair teachers with experienced medical technologists i
- Mentorship Programs: Establish mentorship programs where novice teachers are guided by seasoned professionals

Curriculum Design and Educational Resources

- Curriculum Alignment with industry
- Educational Materials: Use textbooks, laboratory manuals, online resources, and multimedia tools

Utilizing Technology

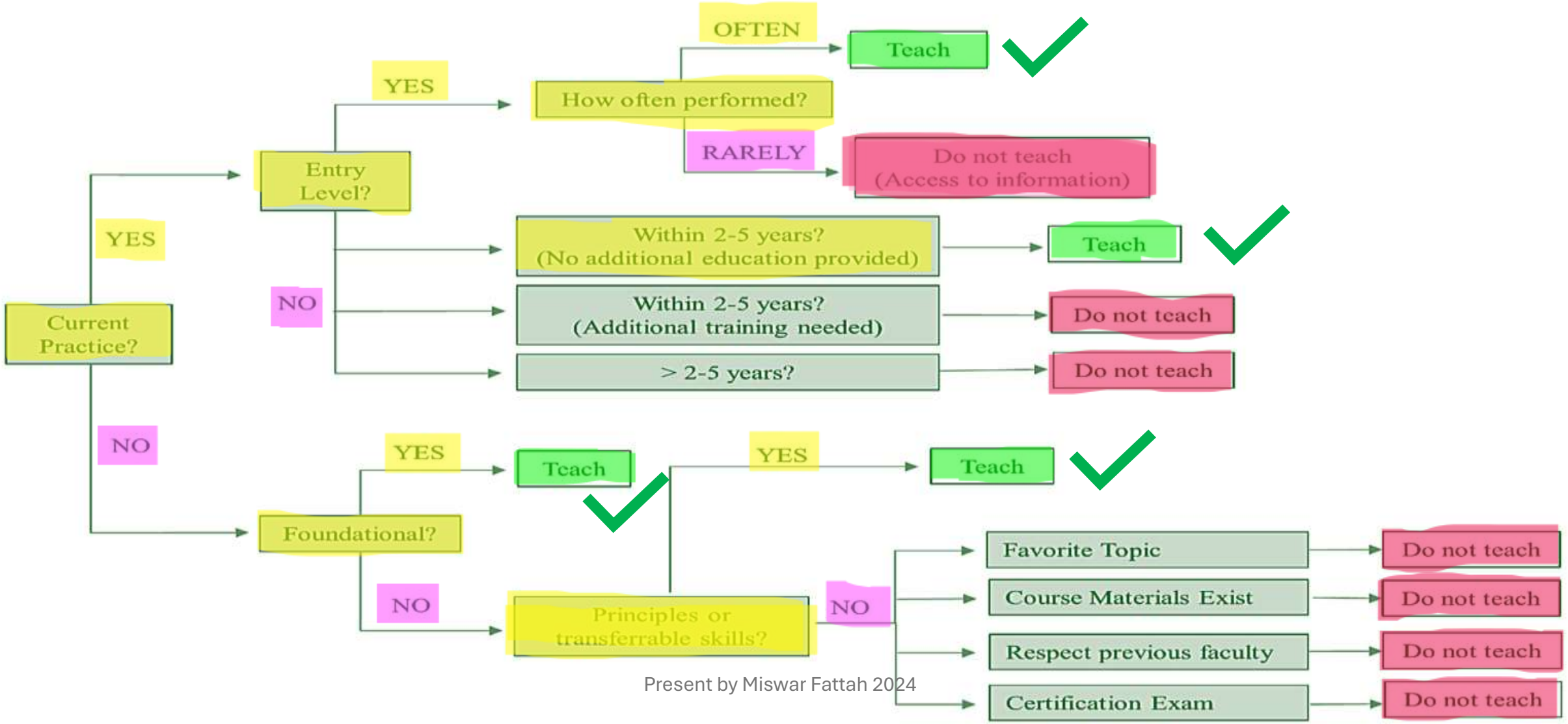
- Educational Software: Use educational software and laboratory information systems (LIS) to teach theoretical and practical aspects
- Online Resources: Leverage online resources such as webinars, virtual laboratories, and interactive platforms to enhance the learning experience

Role Model

- Every educator should have a role model in the field of education
- And A Role models in laboratory medicine can serve as inspiration and guidance
- Encourage students to discover their own role models through sharing yours

An Algorithm for Curriculum Decisions in Medical Laboratory Science Education

S. Beck, T. C. Moon, American Society for Clinical Laboratory Science. 30, 105–111 (2017).

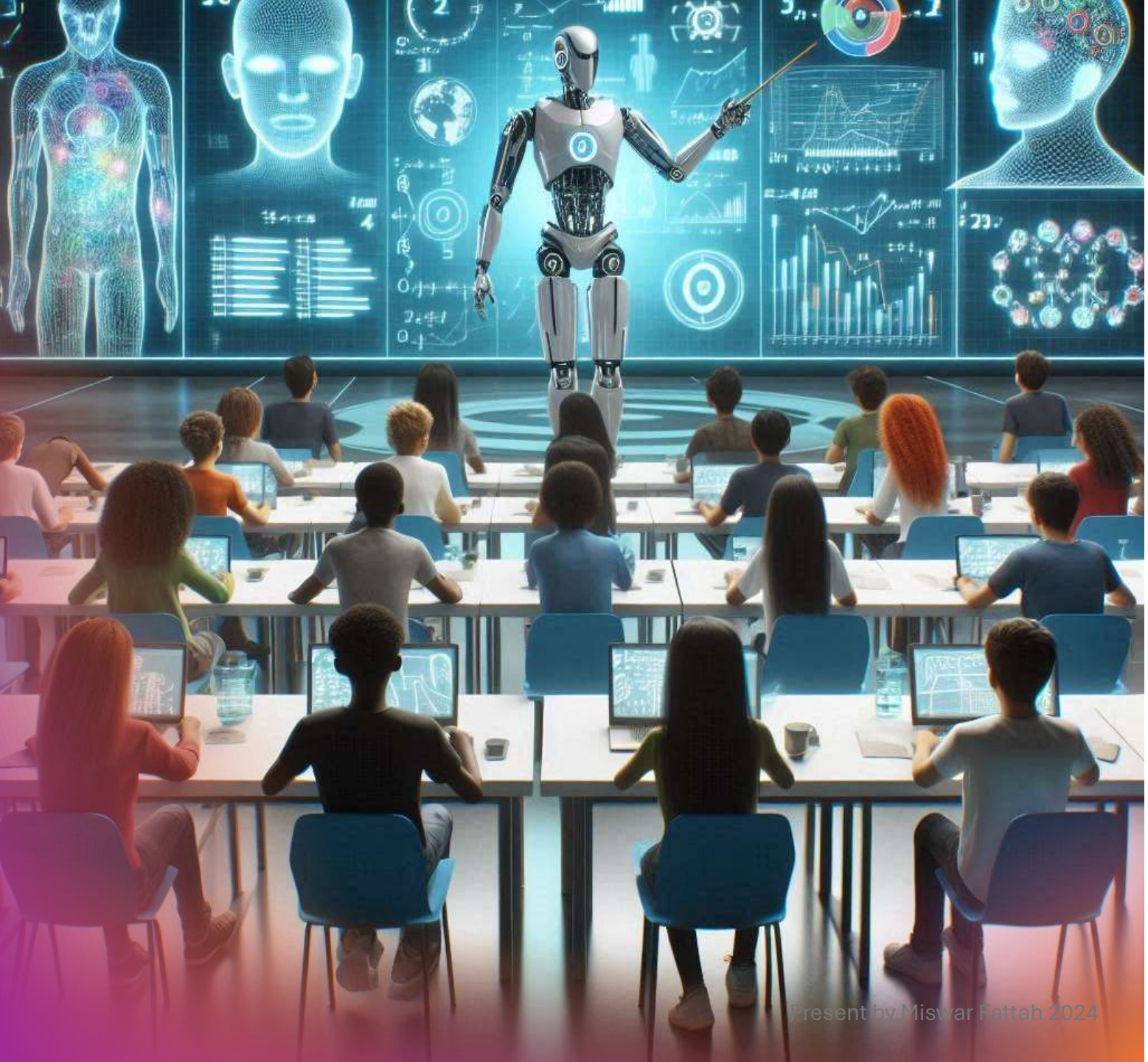


Present by Miswar Fattah 2024

An Algorithm for Curriculum Decisions in Medical Laboratory Science Education

S. Beck, T. C. Moon, American Society for Clinical Laboratory Science. 30, 105–111 (2017).

Topic/Skill	Question/Consideration	Answer
Manual Chemistry Assays	Is it current Practice?	No
	Does is lay a foundation?	Yes ➔ **Teach**
Manual Complete Blood Count	Is it current Practice?	**No**
	Does it lay a foundation?	No
	Does it demonstrate a principle or transferrable skill?	Yes ➔ **Teach**
Microscopic Evaluation of Agglutination (Immunohematology)	Is it current Practice?	No
	Does it lay a foundation?	No
	Does it demonstrate a principle or transferrable skill?	No➔**Do not teach**
Urine protein sulfosalicylic acid precipitation test (SSA)	Is it current Practice?	No
	Does it lay a foundation?	No
	Does it demonstrate a principle or transferrable skill?	No➔**Do not teach**



To **prepare students for entry level practice** and **careers in the clinical laboratory profession**, MLT and MLS **educators need to continually review** their **curricula to decide** what should be **added or deleted**.

Steps to Help Teachers Prepare Students as Medical Technologists

Professional Development in Medical Laboratory Technology

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- Encourage students to discover their own role models through sharing yours

Example Role Model

Published: 21:45, October 03, 2022 | Updated: 21:49, October 03, 2022

Dennis Lo: Golden era awaits HK youth in biomedical research

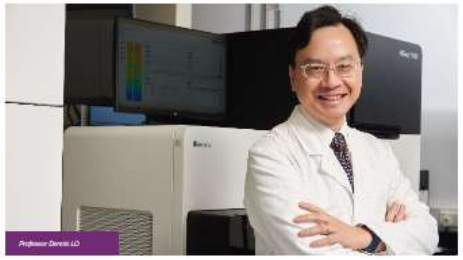
By William Xu in Hong Kong

This undated photo shows Dennis Lo Yuk-ming, a professor at the Chinese University of Hong Kong's Faculty of Medicine. (FRENTEE JI / CHINA DAILY)

CUHK Professor Dennis LO Receives 2021 Breakthrough Prize, an Honour Renowned as the "Oscars of Science"

11 September 2020

Professor Dennis Yuk Ming LO from the Faculty of Medicine at The Chinese University of Hong Kong (CUHK Medicine) was just announced as a winner of *the 2021 Breakthrough Prize in Life Sciences* for discovering that fetal DNA is present in maternal blood and can be used for the prenatal testing of Down syndrome and a variety of genetic diseases. Prof Lo's prenatal testing technology is now performed over 7 million times annually with women in over 50 countries. The Breakthrough Prize, renowned as the "Oscars of Science", aims to honour paradigm shifting research in the categories of Fundamental Physics, Life Sciences and Mathematics and was created and funded by founders of a number of leading enterprises in the global technology sector in 2013. The awardees are nominated in an open online process. Each laureate receives US$3 million (equivalent to HK$24 million) in prize money, which is the most generous science award to date and attracts considerable attention in the global scientific community.



Laboratory Dream to collaborate

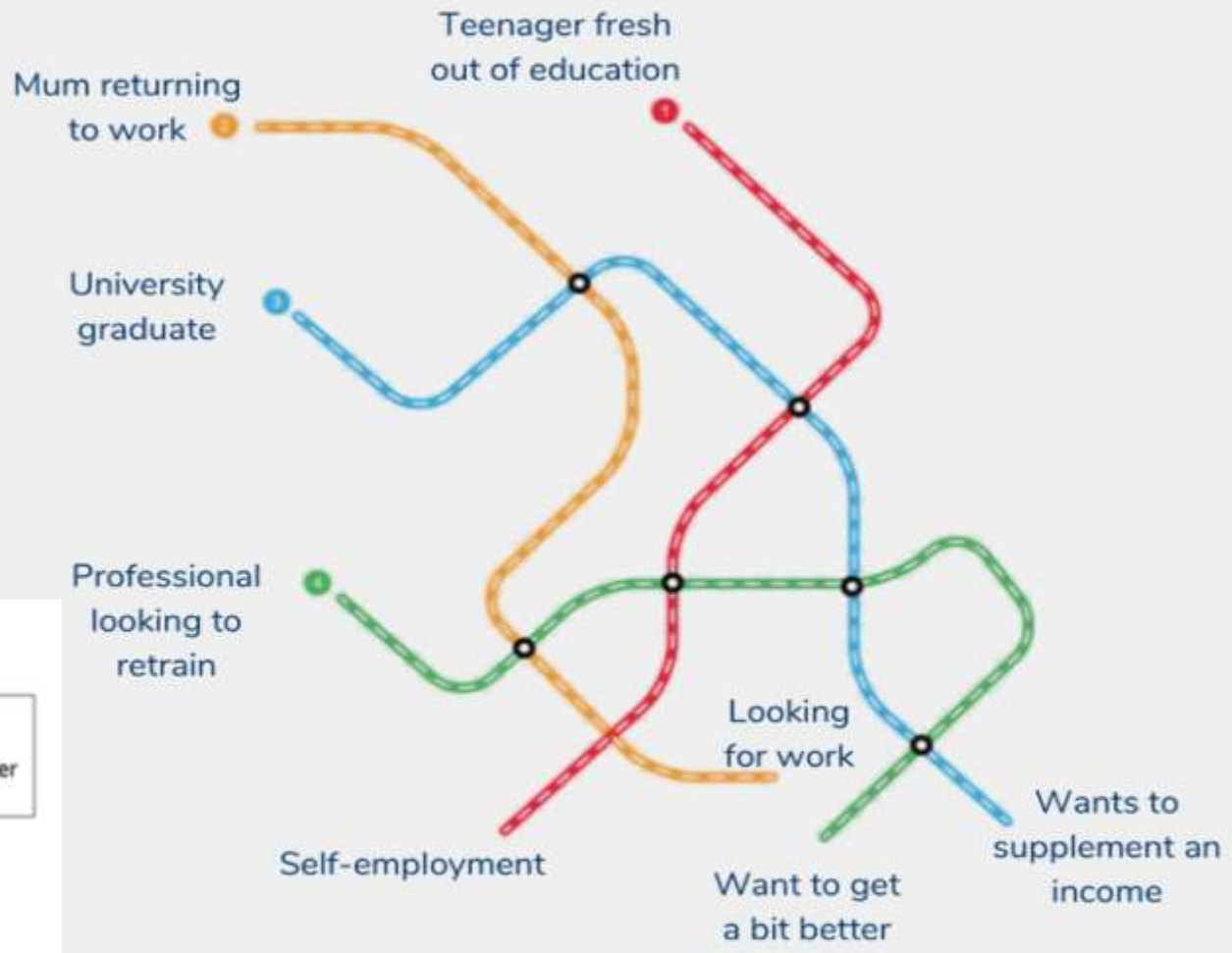
The tendency to **add new content** to MLS and MLT curricula **without removing outdated material leads to curriculum saturation and overcrowding**, making it **difficult for students to effectively learn** and **retain information**.

Expectation

Has an interest

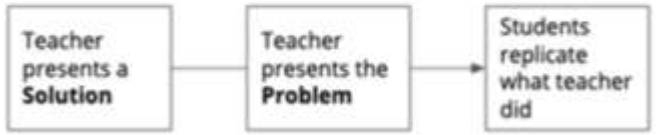
Becomes an Expert

Reality

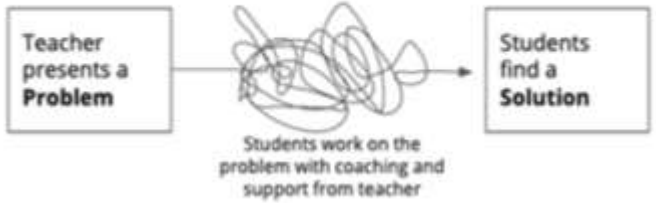


These are examples of starting points and end destinations, fathers can return to work and it is not just teenagers that leave education

Linear education



Non-linear education



Non-linear education to Bridge the Skills Gap.

Education for Outcomes not for Certificates

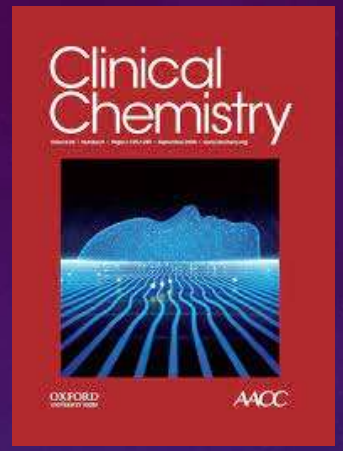
Program Book

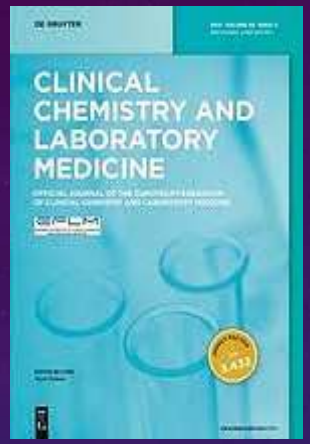
Package Insert

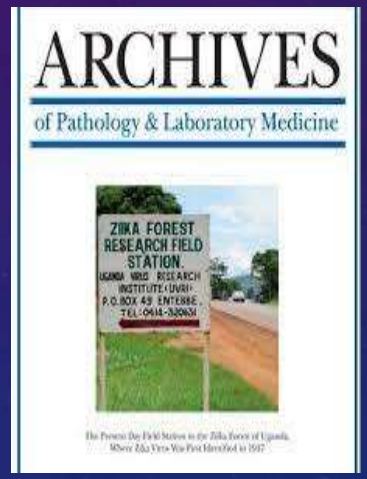
Source of Information

Journal

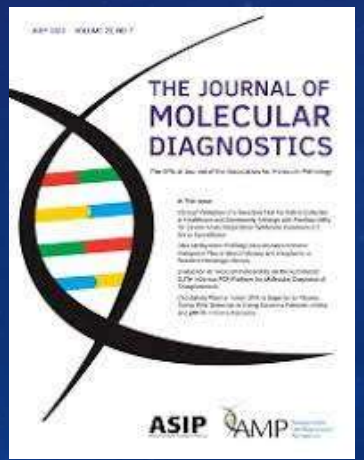
Guideline





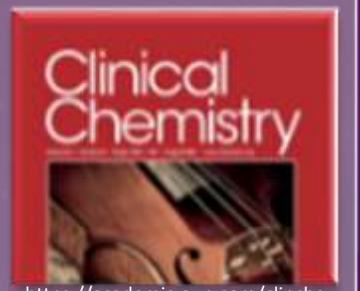


Clinical Chemistry
Clinical chemistry & Lab Med
Annals of Laboratory Medicine
Clin chim acta
Arch pathol Lab Med
Clin Biochem
Blood
Journal of Clinical Microbiology
The Journal of Molecular Diagnostics
applied laboratory medicine



https://meeting.aacc.org/abstracts/annual-meeting-abstract-archive

AACC annual meeting



https://academic.oup.com/clinchem

Clinical Chemistry Journal:

https://www.degruyter.com/journal/key/cclm/html

Clinical chemistry & Lab Med

https://www.annlabmed.org/main.html

Annals of Laboratory Medicine

https://www.journals.elsevier.com/clinica-chimica-acta

Clin chem acta

https://meridian.allenpress.com/aplm

Arch pathol Lab Med

https://www.journals.elsevier.com/clinical-biochemistry

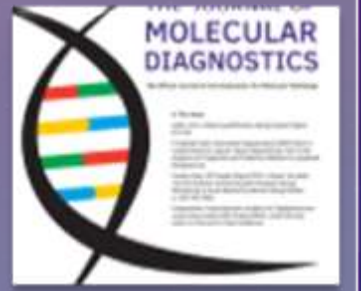
Clin Biochem

https://ashpublications.org/blood

Blood Journal

https://journals.asm.org/journal/jcm

Journal of Clinical Microbiology:

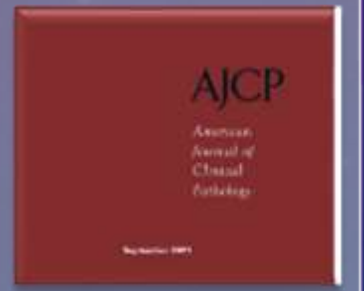


https://www.jmdjournal.org/

The Journal of Molecular Diagnostics:

https://academic.oup.com/jalm

Applied laboratory medicine:



https://academic.oup.com/ajcp

American Journal of Clinical Pathology:

https://onlinelibrary.wiley.com/toc/10982825/2021/35/7

Journal of Clinical Laboratory Analysis

https://onlinelibrary.wiley.com/journal/15524957

Cytometry Part B: Clinical Cytometry

https://www.journals.elsevier.com/journal-of-mass-spectrometry-and-advances-in-the-clinical-lab

Journal of Mass Spectrometry and Advances in the Clinical Lab

https://biochemia-medica.com/en

Biochemia Medica

https://www.tandfonline.com/loi/ilab20

Critical Reviews in Clinical Laboratory Sciences

http://clsjournal.ascls.org/

Clinical Laboratory Science Journal

Revolusi Sistem pendidikan ATLM

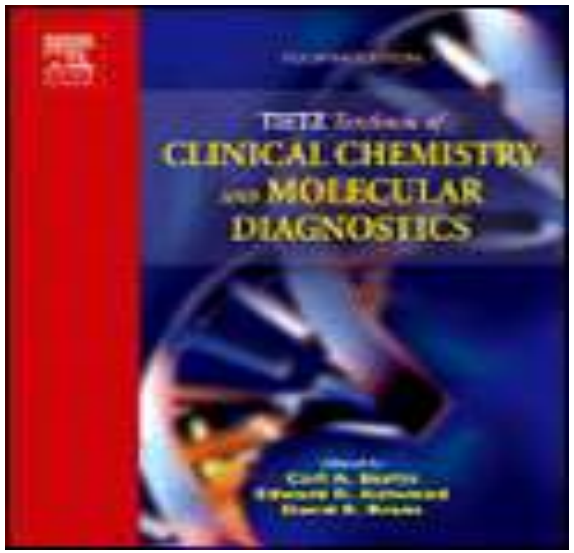
- Pengetahuan dan teknologi di Indonesia 5-10 tahun terlambat
- Perlu Revolusi sistem training dan pendidikan yang mengakomodir laju perubahan

Ide sampai selesai Karya ilmiah

(2 – 4 tahun)

2 – 3 Tahun

3 – 5 Tahun



- Penggunaan original artikel dalam pembelajaran..... UNTUK >=S1& D4

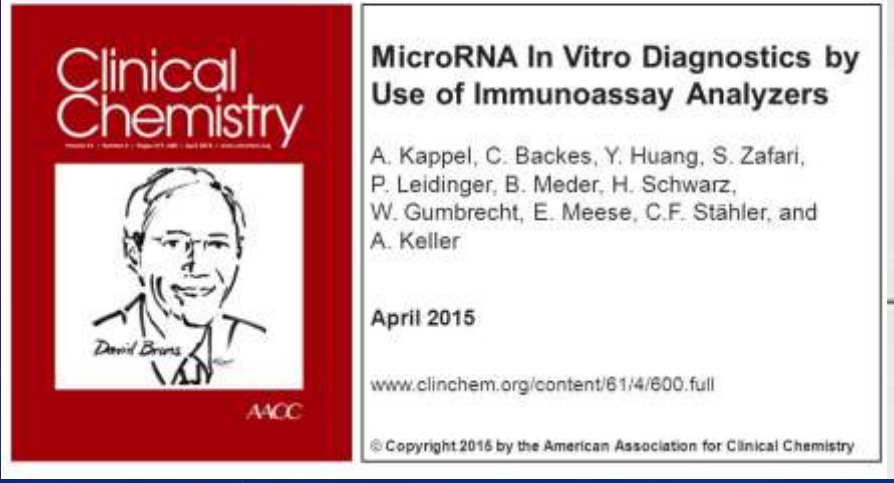
INTERNATIONAL JOURNAL CLUB (EDUCATORS & STUDENT)

Nursing Times Journal Club

- Something of **interest** to all participants
- **Recently published** (preferably within the last 1-2 years)
- Links to the overarching **purpose** of the club
- A topic that will evoke **discussion**

AACC

Journal Club



INTERNATIONAL JOURNAL CLUB (EDUCATORS & STUDENT)

12 or fewer members	Regular scheduled meetings	High member interest and motivation	A suitable number of articles to review
Use of structured critical appraisal checklist	Begins with a short briefing	A leader that keeps the group on task	Relevant, recent and interesting clinical articles
Active discussion of issues that arise	Formal teaching of critical appraisal skills	Participants come prepared/pre-reading	Food and coffee provided

1. Describe the relevance of the paper to your interest/work.
2. Summarise the study and the research question(s).
3. State the importance and relevance of the research question.
4. Describe the methods.
5. Critically appraise, with comments on importance, validity and limitations.
6. Summarise the results.
7. Describe how the results are applicable to the wider

Digital Knowledge

Online Course

- TEDX
- Coursera
- Codecademy
- My open campus
- Udacity
- Udemi

Online Conference

- TED
- Mayo clinic
- Arup
- AACC Trainee Council

SKKNI PATELKI

KODE UNIT : Q.8686903.105.1

Melakukan Inovasi Terhadap Pengembangan Tes Biomarker Penyakit Berbasis Laboratorium

ELEMEN KOMPETENSI	KRITERIA UNJUK KERJA
1. Melakukan pengumpulan data terkait biomarker penyakit berbasis laboratorium	1.1 Data terkait biomarker penyakit berbasis laboratorium yang sudah ada dikumpulkan. 1.2 Biomarker penyakit berbasis laboratorium yang akan dikembangkan didata selengkapnya.
2. Melakukan analisis kajian terkait pengembangan biomarker penyakit berbasis laboratorium	2.1 Kajian tentang pengembangan biomarker penyakit berbasis laboratorium dianalisis. 2.2 Hasil analisis kajian terkait pengembangan biomarker penyakit berbasis laboratorium dicatat pada *form* atau *log book*.
3. Merencanakan kegiatan penelitian atau inovasi terkait pengembangan biomarker penyakit berbasis laboratorium	3.1 Kegiatan inovasi terkait pengembangan biomarker penyakit berbasis laboratorium direncanakan sesuai dengan norma dan kaidah penelitian ilmiah. 3.2 Rencana kegiatan inovasi terkait pengembangan biomarker penyakit berbasis laboratorium dicatat pada *form* atau *log book* dan diverifikasi oleh pihak yang berwenang.
4. Melaksanakan kegiatan penelitian terkait inovasi terhadap pengembangan biomarker penyakit berbasis laboratorium	4.1 Kegiatan penelitian terkait inovasi terhadap pengembangan biomarker penyakit berbasis laboratorium dilaksanakan sesuai dengan norma dan kaidah penelitian ilmiah. 4.2 Laporan kegiatan penelitian terkait inovasi terhadap pengembangan biomarker penyakit berbasis laboratorium ditulis sesuai dengan norma dan kaidah

KEPUTUSAN MENTERI KETENAGAKERJAAN
REPUBLIK INDONESIA
NOMOR 170 TAHUN 2018
TENTANG
PENETAPAN STANDAR KOMPETENSI KERJA NASIONAL INDONESIA
KATEGORI AKTIVITAS KESEHATAN MANUSIA DAN AKTIVITAS SOSIAL
GOLONGAN POKOK AKTIVITAS KESEHATAN MANUSIA BIDANG
TEKNOLOGI LABORATORIUM MEDIK

5. Mendokumentasikan hasil kegiatan terkait inovasi terhadap pengembangan biomarker penyakit berbasis laboratorium	5.1 Hasil yang telah didapat, dicatat ke dalam sistem informasi laboratorium. 5.2 Kerahasiaan informasi hasil dan data laboratorium dijamin keamanannya. 5.3 *Log book* diamankan sesuai prosedur yang relevan.
6. Mempublikasikan dan mendaftarkan hak atas kekayaan intelektual terkait inovasi terhadap pengembangan biomarker penyakit berbasis laboratorium	6.1 Hasil inovasi terhadap pengembangan biomarker penyakit berbasis laboratorium dipublikasikan melalui jurnal nasional terakreditasi, jurnal internasional atau pertemuan ilmiah nasional maupun internasional. 6.2 Hasil inovasi terhadap pengembangan biomarker penyakit berbasis laboratorium didaftarkan untuk pengurusan hak atas kekayaan intelektual.

12 primary topic research in Laboratory Medicine

- Analytic Techniques and Applications
- Data Analytics and Informatics
- General Clinical Chemistry
- Hematology and Coagulation
- Laboratory Management and Leadership
- Microbiology and Infectious Diseases
- Molecular Diagnostics
- Laboratory Stewardship and Patient Safety
- Preanalytical and Post-analytical
- Precision Medicine
- Special Patient Populations
- Toxicology and Therapeutic Drug Monitoring

Details primary topic research in Laboratory Medicine (1)

Analytic Techniques and Applications

technologies such as chromatography, electrochemistry, immunology, mass spectrometry, point-of-care testing, spectrophotometry, and other techniques

Data Analytics and Informatics

automation, bioinformatics, EMRs, information systems, machine learning, omics studies, and other approaches to the collection, processing, and analysis of laboratory information

General Clinical Chemistry

universal lab issues such as standardization, and biorepositories. This topic also includes areas in the pathophysiology of organ systems including, for example, endocrinology, gastroenterology, and nephrology

Hematology and Coagulation

concepts of hematology and coagulation in laboratory medicine such as in vitro diagnostic assays and management of patients with bleeding and thrombotic disorders. This topic also includes transfusion medicine.

Laboratory Management and Leadership

billing and reimbursement, ethics, quality management, laboratory developed tests, method validation, regulatory issues, and other aspects of managing a laboratory. This topic also includes laboratory leadership areas such as building next generation pipeline, staff management, and supervision

Microbiology and Infectious Diseases

concepts, techniques, and applications related to microbiology such as antimicrobial stewardship, infectious diseases, vaccine development, microbiome studies, virology, and bacteriology.

Details primary topic research in Laboratory Medicine (2)

Molecular Diagnostics

utilizing molecular techniques such as next generation sequencing, PCR, and microarrays to identify variants at the DNA and RNA levels in hereditary and acquired diseases including cancers. Includes genomic and genetic topics in molecular diagnostics

Laboratory Stewardship and Patient Safety

minimizing risk and improving outcomes through error prevention, detection, root-cause analysis, process improvement, and patient-centered laboratory services. This topic also includes patient-centered testing such as selecting tests, interpreting results, and meeting regulatory standards that take the patient and patient's financial responsibilities into consideration

Preanalytical and Post-analytical

areas outside sample analysis that affect test results and patient care. This includes topics in the preanalytical and post-analytical phases such as decision support tools, test utilization, sample collection (including phlebotomy), specimen and analyte stability, transportation and storage, intraindividual variability, and results reporting (including reference intervals).

Precision Medicine

areas of laboratory medicine in which diagnostic and/or therapeutics are tailored to the individual.

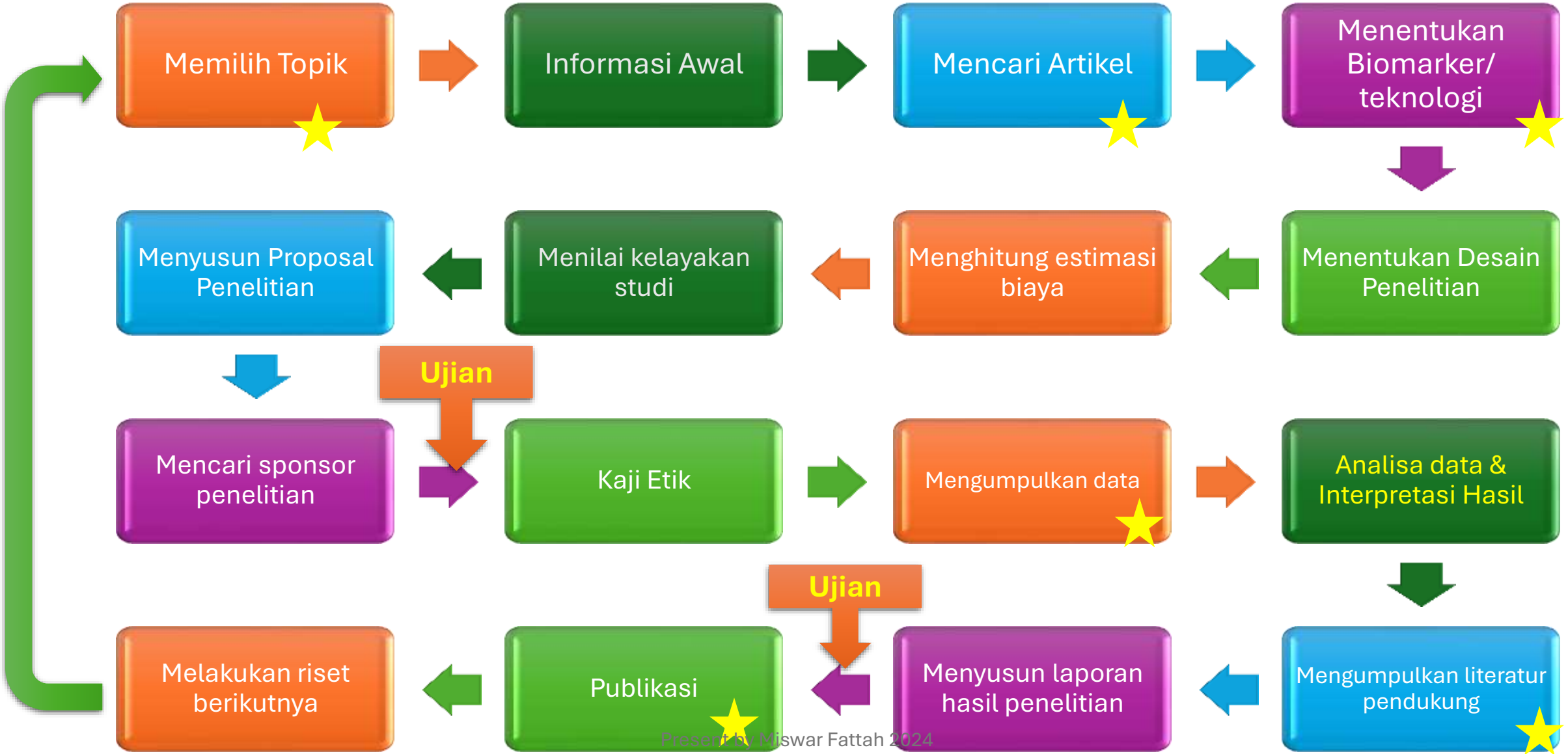
Special Patient Populations

laboratory topics that are related to pediatric, maternal-fetal, geriatric, and transgender patient populations as well as any other special patient population requiring special consideration

Toxicology and Therapeutic Drug Monitoring

topics related to therapeutic drug and/or toxic compound kinetics and dynamics, drugs of abuse, drug effects, patient compliance, clinical presentations in different exposure conditions, in vivo compound toxicity, and considerations for measuring these analytes

Proses Penelitian



Tingkat kedalaman penelitian

D3	• Menyelesaikan masalah dengan **mengimplementasikan pengetahuan dan keterampilan yang dipelajar**i (keterampilan umum)
D4	• menyelesaikan sebuah masalah dengan **mengimplementasikan pengetahuan dan ketrampilan yang telah dipelajarinya** selama kuliah (**konsep teoritis bagian khusus dalam bidang pengetahuan dan keterampilan tersebut secara mendalam**)
S2	• **Mengembangkan**" pengetahuan/teknologi yang sudah ada sebelumnya sehingga menghasilkan luaran yang "Inovatif" yakni sesuatu yang baru hasil dari pengembangan yang sudah ada dan sudah melalui **proses uji-coba atau validasi**
S3	• **menguasai dan menerapkan berbagai aspek dan ketrampilan Metode Penelitian** yang **berlaku di disiplin ilmunya**. • **Menemukan atau mengembangkan teori/konsepsi/ gagasan ilmiah baru** (kreatif, original, dan teruji)

STANDAR NASIONAL PENDIDIKAN TINGGI No 44 tahun 2015

Scope of Research in Laboratory medicine

Core of Lab Med

- Microbiology
- Hematology & Coagulation
- Clinical Chemistry
- Molecular diagnostic
- Anatomical pathology
- Immunology
- Toxicology
- Laboratory management
- Quality Assurance

Application

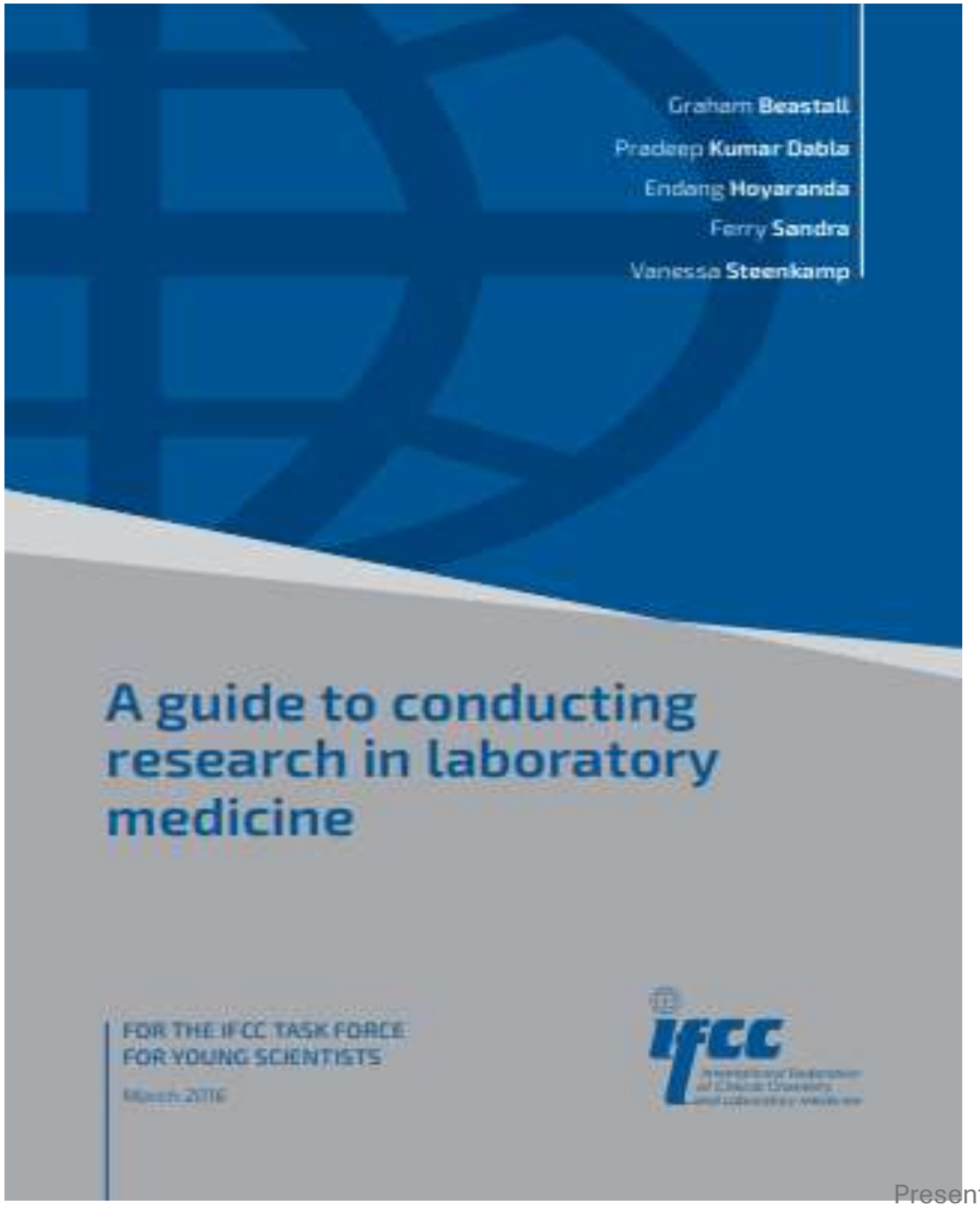
- Basic materials or principles
- Analytical techniques
- Test utilization or testing-related health or financial outcomes
- Instrumentation
- Data processing
- Statistical analyses of data
- Laboratory animal to solve problems of human disease

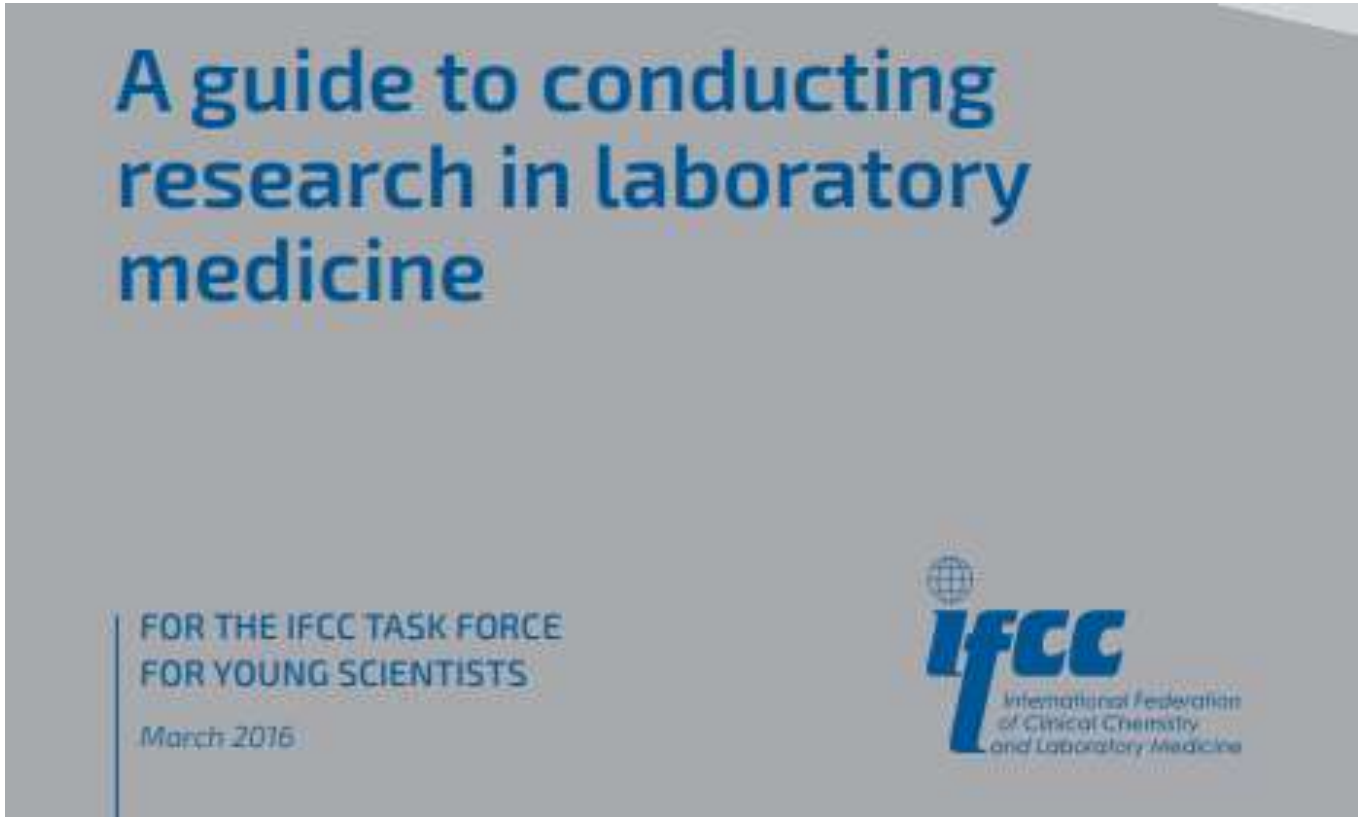
Proses

- Method development or validation
- Preanalytical
- Analytic
- Post analytic

Test purpose

- Prediction / Risk
- Screening
- Diagnosis
- Monitoring
- Prognosis
- Targeted therapy





https://www.ifcc.org/media/410341/Research_Guide_IFCC_complete.pdf

Perbedaan riset D3, D4, Magister dan Doktoral

Jenjang	Waktu	Novelty	Contribution	Cakupan	Jenis pertanyaan	Variabel	Jumlah kata	Kemandirian
D3	1-3 bulan	Tidak wajib	menerapkan sebuah (satu) teori.	Permukaan/kulit	Apa?/deskriptif	1-2 variabel	10k-15k	60%
D4	4-6 bulan	Tidak wajib	menerapkan atau menguji sebuah teori.	Permukaan / kulit	Apa?/deskriptif	1-2 variable	10k-20k	60%
S2	6-12 bulan	Tidak wajib	mengembangkan teori dan canggih pada saat aplikasi	Lebih dalam/daging	Mengapa? / membutuhkan beberapa Apa?	3-4 variable	20K-30K	80%
S3	4 tahun	Harus ada kebaruan	Paham dna memberikan kontribusi teoritis	Sampai kedasar/tulang	Bagaimana / membutuhkan beberapa mengapa?	>5 variabel	80K-100K	90%

Example Deep of Research in laboratory medicine

D3

- evaluation of the lipid profile of Tuberculosis patients
- Reference interval D-Dimer in first trimester of pregnancy

D4

- evaluation of the lipid profile of Tuberculosis patients undergoing Anti-tuberculosis therapy
- Bhattacharya method determine reference interval Ddimer in Pregnancy

S2

- Relationship Lipid profile & hsCRP of Tuberculosis patients undergoing Anti-tuberculosis therapy
- Impact of variability of assay to reference interval of D Dimer in pregnancy

S3

- Interaction of lipid metabolism , Inflammation , Resistance of MTB of Tuberculosis patients undergoing Anti-tuberculosis therapy
- Prognostic Genetic Markers for Thrombosis in Pregnancy: A Focused Analysis on D-Dimer, PAI-1 & Fibrinogene

Example Deep of Research in laboratory medicine

D3

- Implementation Westgard multirole for Creatinine measurement in 4 government hospital in Semarang
- Effect of Pneumatic tube to kalium testing

D4

- Implementation westgard multirole & monitoring lot to lot variation in 4 hospital in Semarang
- Effects of a pneumatic tube system on the hemolysis of blood samples: Role of hemolytic Index

S2

- Adjusting Quality Control Chart Limits for WBC, RBC, Hb, and PLT Counts to Reduce Daily Control Risks in Hospital Laboratory.
- Preanalytical influence of pneumatic tube delivery system on results of routine biochemistry and haematology analysis.

S3

- Bayesian statistic tools & Algorithm Risk based quality control improvement of Westgard multirole
- Genetic Variability of Red Blood Cell Hemolysis in Sickle Cell Anemia and impact to other diagnostic test

Meeting the Challenges of Precision Medicine: Leveraging High Competency in Laboratory Medicine

Preparing for Tomorrow's Challenges: Closing the Competency Gap

Thank you