



(NEJM)
Knowledge+ | **AACC**
Learning Lab

FOR LABORATORY MEDICINE

NEJM
Knowledge⁺ | **AACC**
Learning Lab



THE LEADING AUTHORITY IN
LABORATORY MEDICINE



GLOBAL PARTNER IN
EDUCATION TECHNOLOGY



PUBLISHER OF THE
*NEW ENGLAND
JOURNAL OF MEDICINE*

AACC Learning Lab for Laboratory Medicine on NEJM Knowledge+ is an adaptive e-learning product for preparation for certification, competency assessment, and continuing medical education. The program is sectioned into the following six major pillars in Laboratory Medicine*.

1

CLINICAL CHEMISTRY

Covers principles in laboratory medicine, analytical techniques and instrumentation, pathophysiology of various organ systems and the corresponding analytes.

2

MOLECULAR DIAGNOSTICS

Covers principles of molecular biology, nucleic acid techniques and applications, pharmacogenetics, forensic testing, molecular tumor markers, monogenic and polygenic basis for common and rare diseases.

3

TRANSFUSION MEDICINE

Covers testing in the blood bank, transfusion service techniques, indications for transfusion, blood products and modifications, adverse events associated with transfusion of blood products, and transfusion reactions.

4

HEMATOLOGY AND COAGULATION

Covers analytical techniques and instrumentation, hematopoiesis, iron metabolism (including hemoglobin, iron, bilirubin, anemia), red and white blood cell disorders, platelet disorders, porphyrins and porphyrias, hematologic neoplastic disorders, hemostasis and coagulation.

5

MICROBIOLOGY

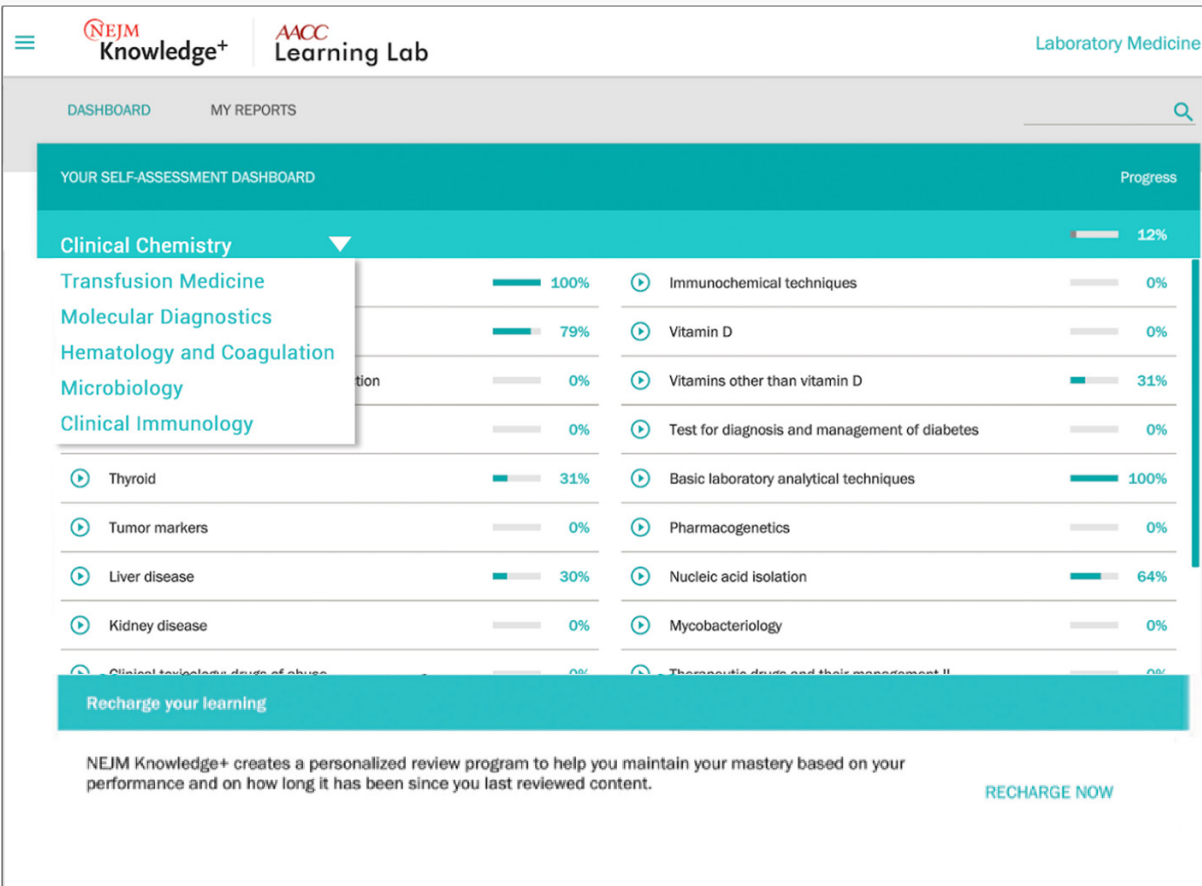
Covers microbes (bacteriology, mycobacteriology, virology, mycology, parasitology, prions) and associated infectious diseases, anti-infectives, antiparasites, infection control, and diagnostics as well as infection control and disease surveillance.

6

CLINICAL IMMUNOLOGY

Covers primary immunodeficiencies, allergic diseases, organ-specific and systemic autoimmune diseases, and monoclonal gammopathies.

*A listing of the curricula of the six sections is included in the Appendix.



When completed in 3 years, this program will consist of approximately 120 courses spanning across all disciplines of laboratory medicine thus becoming the *de facto* backbone of all training programs and the main source for providing continuing education credits in the field.

UNIQUENESS OF AACC LEARNING LAB



COLLABORATIVE EFFORT

AACC Learning Lab is a collaborative effort between NEJM Group, the most trusted and respected name in medical science, AACC, a recognized leader in laboratory medicine, and Area9, a global leader in education technology.



ADAPTIVE LEARNING

AACC Learning Lab utilizes adaptive learning. Through a series of questions while timing the learner and asking about the level of confidence in the answer, sophisticated algorithms identify the areas in which the learner is not proficient and provides targeted learning materials.



MICRO LEARNING

AACC Learning Lab enables learning in small blocks of time since most professionals are not always able to find the time needed to read long review articles.



MOBILE

AACC Learning Lab enables learning wherever you are as the program can be accessed on mobile devices.



PEER COMPARISON

AACC Learning Lab allows the learners to monitor their progress and provides comparison to peer groups.



LIFE-LONG LEARNING

AACC Learning Lab is a life-long learning companion.

WHAT IS A COURSE?

Courses for the six sections are based on curricula that are used by experienced and board-certified professionals from the various disciplines in laboratory medicine and approved by the NEJM Knowledge+ group. Each course consists of three separate components: learning objectives, probes, and learning resources.



LEARNING OBJECTIVES

Learning objectives are granular and utilize Bloom's taxonomy. They range in complexity from *describe* or *define* to *deduce* and *analyze*. Each course contains 100-150 learning objectives to cover the topic of interest.



PROBES

There are nine different types of questions to choose from including multiple choice, fill in the blank, matching, and a clinical case. Morphologies, chromatograms, tables, electrophoretic patterns and other images can be used in these questions. There are at least two questions for each learning objective. Based on continuous analyses of how learners are responding, more depth will be developed.



LEARNING RESOURCES

They provide explanation for the answer in the form of a video, image, pathway, text (possibly read by a professional reader) and they also include a reference to support the explanation. There is at least one learning resource for each learning objective. Based on continuous analyses of how learners are responding, more depth will be developed where appropriate.

TARGET AUDIENCE



Primary Audience

LABORATORY MEDICINE PROFESSIONALS

Laboratory medicine professionals at all levels (MD, PhD, and MT). Approximately 20% of the courses are defined as easy, 60% intermediate, and 20% difficult.



Secondary Audience

CLINICIANS

Because of the granular nature of each course and the richness of available materials, specific courses targeting clinicians of certain specialties or general practitioners can be constructed from existing courses. For example, NEJM Knowledge+ Internal Medicine Board Review contains one course in endocrinology and another in infectious disease. AACC Learning Lab contains 6 courses in endocrinology and 21 courses in microbiology.



NADER RIFAI, PHD

EDITOR-IN-CHIEF, *CLINICAL CHEMISTRY*
CO-EDITOR, AACC LEARNING LAB

CHRISTINA ELLERVIK, MD, PHD

CO-EDITOR, AACC LEARNING LAB



FACULTY

The program is created under the editorship of
Nader Rifai and Christina Ellervik

Each of the six sections has two editors, with the exception of Clinical Chemistry which has three, and Clinical Immunology which has one. Currently, over 90 practicing professionals, primarily from academia, from the US, UK, Canada, Iceland, Denmark, Norway, Australia, Croatia and Singapore are participating in this project.

CREATION OF A COURSE

After the identification of an author by one of the editors and a 45 minute phone call with Nader Rifai to explain the program and the vision, the following steps take place:

- 1** **OUTLINE**

Author develops a detailed outline of the course for review by editors.
- 2** **TRAINING**

Author is trained on the platform and the writing style.
- 3** **MONITORING**

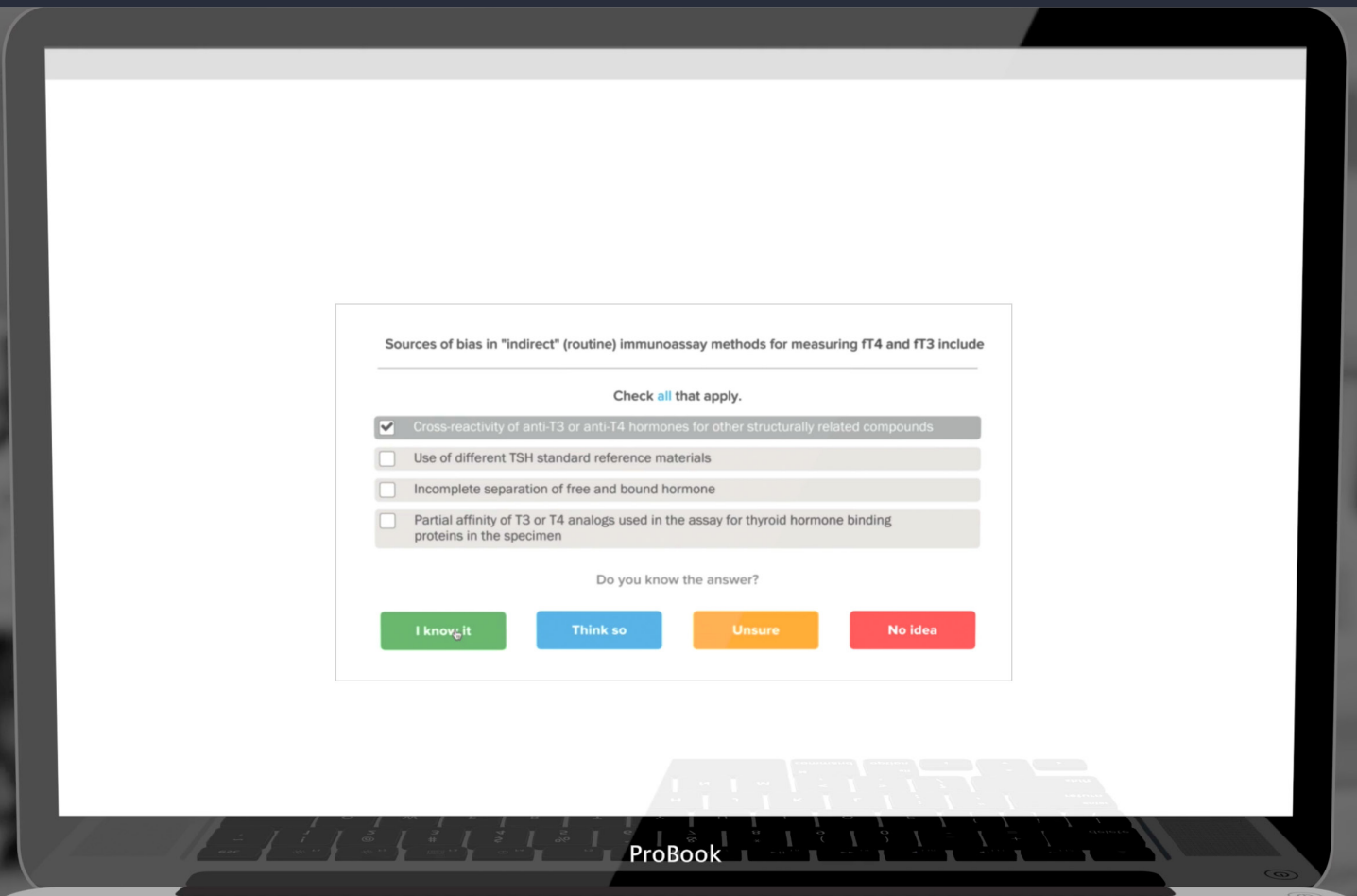
Author's progress is monitored by the Area9 editorial specialist and editors. Approximately 15 one-hour conferences usually take place during the development of a course.
- 4** **REVIEW**

When the course is completed, it is reviewed by the Area9 editorial specialist, the editors involved, and an external reviewer, if needed.
- 5** **BETA TESTING**

After the author responds to the reviewers comments, the course undergoes beta testing by 3-5 individuals.
- 6** **SUBMISSION**

Finally, the course is submitted to NEJM Knowledge+ for review.

It takes about 300 hours to complete a course (4-6 months) by an author. The review process takes approximately 2 months. This program follows the same review process developed for other NEJM Knowledge+ programs.



The Area9 adaptive learning platform is recognized as the most advanced in the world and is used by millions of learners yearly.



UTILITY OF AACC LEARNING LAB

The AACC Learning Lab was built with two major goals:

- To be used by all laboratory medicine professionals
- To be used by laboratory medicine professionals in the three entities:
 - Hospital labs
 - Commercial labs
 - IVD industry

This program is useful in:

- Preparing for certification exams
- Assessing competency on a personal and institutional level

Employers will find the program not only useful in teaching their employees various aspects of laboratory medicine, but also in providing them with an assessment of their employees' knowledge level and competency.
- Maintaining certification by obtaining the required CE and CME credits

Employers may find this program as the most cost effective means for their employees to obtain the desired credits since they will be able to use the program when workload is low or on their own time.
- Staying current in an ever expanding and fast moving field
- Providing a life-long learning companion

APPENDIX

CLINICAL CHEMISTRY COURSES	
Management	Laboratory safety
	Laboratory management
Variability assessment	Statistical methodologies in laboratory medicine
	Biological and preanalytical variability
	Quality control of the examination process
Analytical principles	Basic laboratory analytical techniques
	Chromatography
	Mass spectrometry
	Proteomics
	Immunochemical techniques
	Point of care testing
	Calculations
Proteins	Protein electrophoresis
	Serum enzymes
	Tumor markers
	Amino acids, peptides, and proteins
Nutrition	Vitamin D
	Vitamins other than vitamin D
	Metals: Trace and toxic
	Nutrition
Therapeutic drugs management and toxicology	Therapeutic drugs and their management I
	Therapeutic drugs and their management II
	Clinical toxicology: Drugs of abuse
	Clinical toxicology: Other than drugs of abuse
Body fluids	Body fluids
Endocrinology	Bone and mineral metabolism
	Catecholamines and serotonin
	Pituitary function and pathophysiology
	The adrenal cortex
	Thyroid
	Tests for diagnosis and management of diabetes
	Reproductive endocrinology and pregnancy and its disorders
Cardiovascular	Lipids and lipoproteins
	Cardiac biomarkers
Kidney	Kidney disease
	Disorders of water, electrolytes and acid-base metabolism
Gastroenterology	Liver disease
	Exocrine pancreas
Newborn screening	Inborn errors of metabolism I
	Inborn errors of metabolism II

HEMATOLOGY AND COAGULATION COURSES

General	Automated hematology and general approach to the peripheral blood smear
	Normal and abnormal peripheral blood and bone marrow morphology
	Lymph node pathology: normal, reactive, malignant and metastatic
	Spleen and thymus: neglected organs in hematopathology
Red cells	Anemia (microcytic/normocytic/macrocyclic and hemolytic/hypoproliferative)
	Hemoglobin electrophoresis/HPLC
	Hemoglobinopathies, thalassemias, and RBC cytoskeletal and enzyme defects
White cells	White blood cell abnormalities (quantitative and qualitative)
Hemostasis/coagulation/platelets	Laboratory diagnosis of disorders of bleeding including platelets
Coagulation	Laboratory diagnosis of disorders of bleeding and thrombosis including platelets
Neoplastic	Acute myeloid leukemia
	Myelodysplastic syndromes, myeloproliferative neoplasms, and hybrid disorders
	Precursor lymphoid neoplasms (B and T lymphoblastic leukemia/lymphoma)
	Mature B-cell neoplasms
	Mature T-cell and NK-cell neoplasms
	Hodgkin lymphoma
	Lymphoproliferative disorders associated with primary and iatrogenic immune deficiency
	Histiocytic and dendritic cell disorders (not just neoplasms)
Ancillary diagnostic techniques	Flow cytometry immunophenotyping principles and applications to diagnosis, prognosis, therapy and monitoring of leukemias, lymphomas, and primary and acquired immune deficiencies
	Cytogenetics and molecular genetics of hematolymphoid disorders, both benign and malignant

MOLECULAR DIAGNOSTICS COURSES

Foundational genomics	Principles of molecular biology
	Genomes and variants
Molecular diagnostics techniques	Nucleic acid isolation
	Resolution and detection of nucleic acids (non-sequencing based)
	Sequencing-based techniques
	Cytogenomics
Molecular oncology	Cancer genetics concepts and laboratory testing
	Solid tumor genomics
	Familial Cancer Syndromes
	Genomics of hematopoietic and lymphoid malignancies
	Blood-based cancer detection

MOLECULAR DIAGNOSTICS COURSES CONTINUED

Genomics	Molecular detection of Mendelian inherited disorders
	Non-Mendelian disorders
	Mitochondrial genetics
	Pharmacogenetics
Hereditary disorders	Hereditary pulmonary disorders
	Hereditary cardiovascular disorders
	Hereditary dermatologic disorders
	Hereditary endocrine disorders
	Congenital hearing loss
	Hereditary hematologic disorders
	Hereditary neurologic disorders
	Hereditary neuromuscular disorders
	Hereditary skeletal disorders
	Hereditary renal disorders
Immunology	Molecular immunology
Prenatal screening	Circulating fetal nucleic acids
Human identification	Molecular determination of identity

MICROBIOLOGY COURSES

Infectious diseases and preanalytical considerations	Infectious syndromes
	Microbiology specimens
Microbiology and antimicrobials	Bacteria
	Bacterial diagnostics
	Bacterial infections
	Antibacterials
	Mycobacteria & diagnostics
	Mycobacterial infections & antimycobacterials
	Viruses
	Viral diagnostics
	Viral infections & antivirals
	Fungi & diagnostics
	Fungal infections
	Antifungals
	Parasites
	Parasitic diagnostics
	Parasitic infections and antiparasitics
Antimicrobial susceptibility	
Biosafety and infection surveillance	Biosafety
	Infection surveillance
Laboratory management	Management of the clinical microbiology laboratory

TRANSFUSION MEDICINE COURSES

Blood donation

Blood groups and pre-transfusion compatibility testing

Red blood cell transfusion

Platelet transfusion

Plasma components and derivatives

Hemolytic Disease of the fetus and the newborn

Acute transfusion reactions

Therapeutic apheresis

Delayed transfusion reactions

Transfusion support for hematopoietic stem cell and solid organ transplantation

CLINICAL IMMUNOLOGY COURSES

Primary immunodeficiencies

Allergic disease

Organ-specific autoimmune diseases

Systemic autoimmune diseases

Monoclonal gammopathies



[AACC.ORG/LEARNINGLAB](https://aacc.org/learninglab)