Entry Level Curriculum Update – Microbiology

The *Entry Level Curriculum* was created to provide guidance as to the knowledge and skills a new graduate at the MLT or MLS level should possess upon entry into the workforce. In this session, we will discuss changes to the microbiology sections of these recently published documents and how best to utilize these in your curriculum.

Learning Objectives

1. Discuss the usefulness of the Entry Level Curriculum (ELC).
2. Explain changes that occurred in the recent update.
3. Identify and evaluate ways in which the ELC can be incorporated into your curriculum.

Development Process

The first Entry Level Curriculum (ELC) was published in 2002 and created by educators and practitioners using the Body of Knowledge (BOK) published by ASCLS. The ELC was revised during the 2015-16 year by a sub-committee of the Education Scientific Assembly (ESA) Committee for Educational Programs and Initiatives (CEPI). The two main goals with the revision were:

- Use the recently updated (2014 version) ASCLS Body of Knowledge (BOK) and personal expertise in entry level practice to update the curriculum by removing dated topics and adding new items.
- Ensure differentiation of the MLT and MLS curriculum based on the level of education required for each.

There were 4 rounds of revisions in 2015-16:

- 1st revision reviewed at CLEC 2016 and from educators who could not attend
- 2nd revision reviewed by ASCLS members
- 3rd revision to BOD and 2016 House of Delegates
- 4th revision to ASCLS for publication

ELC committee members finalized all documents by applying the Beck/Moon algorithm introduced at CLEC 2016. The algorithm included three basic questions:

- Is it current practice?
- Is it entry level?
- Is it foundational?

In situations where conflicting comments were received, this algorithm provided the criteria for removing dated information from the documents.

Format

The curriculum format is delineated by discipline area within the MLS and MLT levels. Each discipline area is further delineated by major topics using a learning objective format which includes a sequence of concepts, principles/theories, and skills. Taxonomic levels (cognitive, psychomotor, affective) were included to assist new instructors and new programs.

It is understood that all listed technical items may not be available at each educational institution so that in some programs, only cognitive aspects (state, explain, describe) will be taught and at others the psychomotor may also be taught (perform or observe). The committee also expects that some programs will teach beyond what may be included, based upon regional needs of their graduates and availability of resources.

What's New/What Changed?

Molecular diagnostics is a new addition to the 2016 version of the ELC. Other changes included **moving body fluids** from the Chemistry section to create a new Urinalysis and Body Fluids section.

Where there is overlap in some discipline areas, it is **cross-referenced** to another section within the ELC disciplines. For example, microscopic analysis in Hematology, Urinalysis & Body Fluids, and Microbiology are all cross-referenced to the more detailed microscope section in the General Practice document.

Differentiation in MLT vs MLS curriculum was based on the background knowledge (pre-requisite and/or core courses). Different cognitive levels were reflected in the verbs used to elucidate the tasks or knowledge. For example:

MLT version – Identify basic concepts of spectrophotometry

MLS version - Recognize and explain basic concepts of spectrophotometry

In many instances, the verb levels and expectations were the same, for example in performing tests or identifying abnormal results. A specific example is provided on page 3.

Finally, to assist educators in knowing which **items were deleted from the previous edition of the ELCs and which items were added**, **a summary list is included at the end of each discipline section**. This information could be useful when revising and updating course material. The addition/deletion lists for MLS Microbiology are listed on pages 4-5 and for MLT on pages 5-6 of this document.

Uses

The ELC is designed to

- help develop the curriculum for a new program
- assist the new instructor/professor with course development
- update a current program or course

In addition, the document can provide guidance to other organizations for entry level knowledge and skills of the MLS a or MLT graduate.

See example of differences in verb levels between MLS and MLT levels on next page:

MLT	*MLS*
Basic principles **Define terms** used in bio- and molecular technology Level 1 Deoxyribonucleic acid (DNA) relatedness Nucleic acid probes/hybridization Amplification procedures including but not limited to polymerase chain reaction **Organism Identification** Perform confirmatory identification tests (including rapid tests) Level2 **Clinically Significant Organisms** Isolate organisms Level 2 Isolate organisms at the identification levels Heard of it Level 1 Can identify it Level 2 Can assess significance of culture findings based on identification and specimen site Level 3	**Basic principles** Apply the use of bio and molecular technologies to taxonomy and clinical microbiology Level 2 Deoxyribonucleic acid (DNA) relatedness Nucleic acid probes/hybridization Amplification procedures including but not limited to polymerase chain reaction Maldi-TOF (general theory) **Organism Identification** Evaluate confirmatory identification tests (including rapid tests) Level 3 Perform confirmatory identification tests (including rapid tests) Level 2 **Clinically Significant Organisms** Isolate organisms listed below at the following identification levels: Can recall it Level 1 Can identify it Level 2 Can assess significance of culture findings based on identification and specimen site Level 3

Microbiology MLS ELC Additions and Deletions

Additions:

Microbiology

Prions
Staphylococcus lugdunensis
viridans Streptococci
Enterococcus faecalis; Enterococcus faecium; Vancomycin resistant Enterococcus (VRE)
Group D Streptococcus ie S. gallolyticus (previously S. bovis)
Abiotrophia
Moraxella catarrhalis
Edwardsiella tarda
Vibrio alginolyticus
Vibrio parahaemolyticus
Vibrio vulnificus
Aggregatibacter aphrophilus (previously known as Haemophilus aphrophilus/H. paraphrophilus)
Aggregatibacter actinomycetemcomitans (previously known as Actinobacillus actinomycetemcomitans)
Capnocytophaga
Steptobacillus monoliformis
Eggerthella
Orientia tsutsugamushi
Anaplasma phagocytophilum
Coxiella burnetii
Spirillum spp

Mycology

Rhodotorula spp
Saccharomyces spp
Penicillium marneffei
Acremonium spp
Chrysosporium spp
Sepedonium spp
Rhizomucor spp
Cunninghamella spp
Syncephalastrum spp

Parasitology

Heterophyes heterophyes
Metagonimus yokagawai
Naegleria fowleri
Chilomastix mesnili
Trichinella spiralis
Wuchereria bancrofti
Brugia malayi
Loa loa
Mansonella
Onchocerca volvulus
Dracunculus medinensis

Mycobacteria
M. ulcerans
M. xenopi
M. kansasii
M. marinum
M. gordonae
M. scrofulaceum
M. chelonae
M. abscessus
M. leprae

Viruses
SARS related coronavirus
Poliovirus
Coxsackievirus
Enterovirus
Rhinovirus
Echovirus
Hantavirus
Parvovirus B19
Flaviviruses: West Nile virus, St. Louis Encephalitis virus, Dengue virus, Yellow fever virus
MERS
Rift Valley Fever virus

Deletions:
Microbiology
CAMP
Perform confirmatory identification tests (including rapid tests)
- Hemolysis on Horse blood
- Beta-glucaronidase (MUG)

Microbiology MLT ELC Additions and Deletions

Additions:

Catheter tips
Group B selective broths (dropped specific types and added a general category)
Routine enrichment broth category (consolidated enrichment broths instead of specific types)
Stool selective media (consolidated TCBS, Yersinia, and CIN media)
Corynebacterium selective media (Consolidated Bordet Gengou/Reagan Lowe, Loeffler's and Tinsdale media)
Added back anaerobic identification disks
Maldi-TOF and Microarray
Aeromonas sp.

Deletions:

- Bacteriology
  - TM, NYC, Jembec, and ML agar, leaving only MTM agar for choc media types
  - CCFA agar
  - CAMP
  - India Ink
  - Some of the more unusual tests
  - Nutritionally variant Strep.
  - Unusual organisms
  - Mechanism of action for antibiotics
  - E-test
  - Minimum bactericidal concentration (MBC)
  - Standard performance principles to bioassays of body fluids
- Mycology
  - Structural characteristics of mycology
  - Generalized media into groupings – removed specific types (changed to Level 1)
  - Interpretation of fungal smears
  - Periodic acid Schiff, Gomori methenamine silver, hematoxylin and Eosin stains
  - Scotch tape prep and tease prep
  - Correlation of clinical symptoms with fungal identification
  - Some fungal pathogens
- Parasitology
  - Structural terms
  - Malaria consolidated into species instead of specific organisms.
- Mycobacteriology
  - Taxonomic differentiation of Nocardia, Rhodococcus, Streptomyces, and Mycobacterium
  - Phenotypic characterization
  - Microscopic morphology (coccoid, filamentous, beading, cording, ghosts)
  - Colony morphology and identification
- Virology
  - Helical/icosahedral/complex
  - EBV
- Administration
  - Issues of staff performance
  - Budget
  - Implement safety precautions