Entry Level Curriculum Update – Urinalysis & Body Fluids

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 urinalysis & body fluids 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 Urinalysis/Body Fluids are listed on pages 4-5 and for MLT on pages 6-7 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:

Renal Physiology	Renal Physiology
Describe the process of glomerular filtration Hydrostatic and oncotic forces Glomerular filtration barrier (GFB) Capillary endothelium Basement membrane Podocyte filtration diaphragms "Shield of negativity"	Describe the process of glomerular filtration Define hydrostatic and oncotic forces Define glomerular filtration barrier (GFB) Define glomerular filtration rate
Describe how glomerular filtration rate is calculated Creatinine clearance eGFR	
Describe the process of urine formation Tubular reabsorption and secretion Active and passive transport	Describe the process of urine formation Tubular reabsorption and secretion Define active and passive transport
List the solutes that are reabsorbed by the nephron	List the solutes that are actively reabsorbed by the nephron
List the solutes that are secreted by the nephron	List the solutes that are passively reabsorbed by the nephron
Identify the nephron location and mechanism of reabsorption or secretion for each solute	List the solutes that are secreted by the nephron
Explain changes in solute composition as ultrafiltrate passes through the nephron	State the nephron location of secretion for each solute
Explain the changes in osmolality as the ultrafiltrate passes through the nephron	Explain changes in solute composition as ultrafiltrate passes through the nephron
Explain tubular transport capacity (T_m) in relation to renal threshold level	Define tubular transport capacity in relation to renal threshold level
Describe secretory mechanisms that regulate acid-base balance Hydrogen ion secretion to recover bicarbonate Hydrogen ion secretion to form acids Hydrogen ion secretion to form ammonium ions	Summarize secretory mechanisms that regulate acid-base balance Hydrogen ion secretion to recover bicarbonate Hydrogen ion secretion to form acids Hydrogen ion secretion to form ammonium ions
Discuss the mechanisms that maintain hypertonicity/osmotic gradient of renal medulla physiology Countercurrent multiplier mechanism Countercurrent exchange mechanism	Discuss mechanisms that maintain osmotic gradient of renal medulla Countercurrent exchange mechanism Role in urine formation and concentration

Urea cycle Role in urine formation and concentration Explain changes in urine volume and solute composition Volume and composition of normal urine Role of ADH/vasopressin in water reabsorption Describe the renin-angiotensin-aldosterone system Describe physiologic factors involved in determining the volume of urine excreted Anuria Oliguria Polyuria	Discuss changes in urine volume and solute composition Volume and composition of normal urine Role of ADH/vasopressin in water reabsorption Define the renin-angiotensin-aldosterone system Define urine volume terminology Anuria Oliguria Polyuria

MLS ELC Renal (Urinalysis)
Added and Deleted items

Additions:

Describe the process of glomerular filtration – including shield of negativity

State the clinical features of nephrotic syndrome and state diseases that are associated with this syndrome

Describe Specimen Collection technique - Timed collection

Specimen preparation - mix specimen

Observe and comment on abnormal urine odor, if applicable

Distinguish between normal urine odor and that associated with old, unpreserved urine

Dip and remove strips in urine appropriately and correctly, time and read, and interpret reactions

Apply criteria for results that require confirmatory testing and/or dilutions

Albuminuria by reagent strip

Creatinine by reagent strip

Discuss the advantage and disadvantages of Cystatin C for determination of renal clearance

Differentiate eGFR and GFR

Recognize and identify factors that can influence eGFR results (age, muscle mass, pregnancy, ethnicity, race)

Describe the chemical composition of most renal calculi

Body Fluids

BAL

Fecal occult blood

Deletions:

Explain the function of the mesangium of the glomerulus

Diagram renal blood circulation

Identify characteristics of fasting urine specimen types

Assemble worksheets and other documenting materials

Observe and record temperatures of heating blocks and water baths

Dispense standardized volume of sediment to glass microscope slide and apply appropriate coverslip

Perform and record confirmatory tests - Sulfosalicylic acid for protein & Watson-Schwartz for urobilinogen/porphobilinogen, clinitest, acetest, ictotest

For qualitative metabolic screening tests Select most appropriate chemical method for clinical situation

For qualitative metabolic screening tests - Apply criteria for results that require confirmatory testing and/or dilutions

Qualitative metabolic screening tests: Hoesch test for porphobilinogen, Watson-Schwartz for urobilinogen/porphobilinogen, Ferric chloride test for ketones, Ammoniacal silver nitrate test for homogentisic acid, Nitroprusside test for ketones

Describe and utilize various microscopic techniques - Interference contrast microscopy

Maintain daily and cumulative QC documentation

Retain result documentation as required for accreditation

Participate in continuing education programs; Enhance pertinent knowledge; Annually document competency *(not needed for entry level)*

Renal calculi – locate chemical tests to determine chemical composition

Quality Management in the Urinalysis Laboratory (covered in management section)

Body Fluids

Amniotic – bilirubin (Δ 450), microviscosity

MLT ELC Renal (Urinalysis)
Added and Deleted items

Additions:

Specimen Collection technique - Timed collection

Specimen preparation - mix specimen

Reagent Strip Chemical Testing - Dip and remove strips in urine appropriately and correctly, time and read, and interpret reactions

Ascorbic acid by reagent strip

Microalbumin by reagent strip

Creatinine by reagent strip

Renal Function Tests - Creatinine Clearance, Estimated Glomerular Filtration, Cystatin C, $Beta_2$Microglobulin

Differentiate eGFR and GFR

Describe the chemical composition of most renal calculi

Deletions:

Diagram glomerulus

Diagram renal blood circulation

Role of renal blood circulation related to renal function

Define capillary endothelium, basement membrane, podocyte filtration diaphragms

Explain the changes in osmolality as the ultrafiltrate passes through the nephron

Countercurrent multiplier mechanism

Urea cycle

Physiologic factors involved in determining the volume of urine excreted

Pathogenesis of glomerular damage

Compare and contrast acute and chronic renal failure

Clinical features of tubular dysfunction diseases

Verify acceptability of work area, equipment and supplies

Assemble worksheets and other documenting materials

Evaluate and select methodology

Dispense standardized volume of sediment to glass microscope slide and apply appropriate coverslip

Sulfosalicylic acid for protein

Watson-Schwartz for urobilinogen/porphobilinogen

Qualitative metabolic screening tests & substances detected to correlate with metabolic disease

Explain purpose of macroscopic tests to health care personnel

Interference contrast microscopy

Advantages/Disadvantages of microscopy types

Special stains (eosinophils, lymphocytes, etc.)

Record maintenance for accreditation

Continuing education participation

Renal calculi chemical composition testing

Quality Management in the Urinalysis Laboratory

Miscellaneous Body Fluids