Medical Laboratory

NTQF **Level III**

Learning Guide 22

Unit of Competence: Collect and Process Medical Samples

Module Title: Collect and Process Medical Samples

LG Code: HLT MLS4 _LO1-08

TTLM Code: HLT MLS4TTLM 0919v1

LO1. Apply concept of physiology and anatomy

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 5 to 11.
3. Read the information written in all Information Sheets. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish all Self-check according to learning session separately
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to next Information Sheet. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to pervious Learning Activity.
7. Submit your accomplished Self-check. This will form part of your training portfolio.
8. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
9. Accomplish the all Self-checks.
10. After you accomplish self check proceed to operation sheet if available.
11. If you perform operation procedure correctly proceeds to LAP. test if available

Information Sheet-1	Apply concept of physiology and anatomy

Learning out comes (objectives):

At the end of this module the trainee will be able to:-

- Identify human anatomy and physiology
- Understand the type and nature of samples
- Identify the time of sample collection and collection sites

1.1. Concepts of human anatomy and physiology

1.1. What are Anatomy and Physiology?

- Anatomy: the word anatomy is derived from a Greek word "Anatome" meaning to cut up. It is the study of structures that make up the body and how those structures relate with each other.

  The study of anatomy includes many sub specialties. These are Gross anatomy, Microscopic anatomy, Developmental anatomy and Embryology.

  Gross anatomy studies body structure without microscope. Systemic anatomy studies functional relationships of organs within a system whereas Regional anatomy studies body part regionally. Both systemic and regional approaches may be used to study gross anatomy.
  Microscopic anatomy (Histology) requires the use of microscope to study tissues that form the various organs of the body.
  - ✓ Gross (macroscopic) anatomy: the study of structures large enough to be seen with the naked eye
  - ✓ Regional anatomy: all the body structures (muscles, bones, blood vessels, nerves, etc.) in a given body region , such as the abdomen or leg, are examined at the same time
  - ✓ Systemic anatomy: body is studied system by system
    - ✓ Example: when studying the cardiovascular system, you would examine the heart and the blood vessels of the entire body
  - ✓ Surface anatomy: internal body structures as they relate to the overlying skin
    - ✓ Used when identifying the bulging muscles beneath a bodybuilder's skin, and clinicians use it to locate appropriate blood vessels in which to feel pulses and draw blood
  - ✓ Microscopic anatomy: the study of structures that are too small to be seen with the naked eye

    -Cytology: study of individual cells

-Histology: study of tissues

- ✓ Developmental anatomy: the study of the change in body structures over the course of a lifetime
  - ✓ Embryology: concerns developmental changes that occur before birth

- Physiology: the word physiology derived from a Greek word for study of nature. It is the study of how the body and its part work or function.
  - ✓ Renal physiology: concerns kidney function and urine production
  - ✓ Neurophysiology: explains the workings of the nervous system
  - ✓ Cardiovascular physiology: examines the operation of the heart and blood vessels

While anatomy provides us with a *static image of the body's architecture,* physiology *reveals the body's dynamic nature*

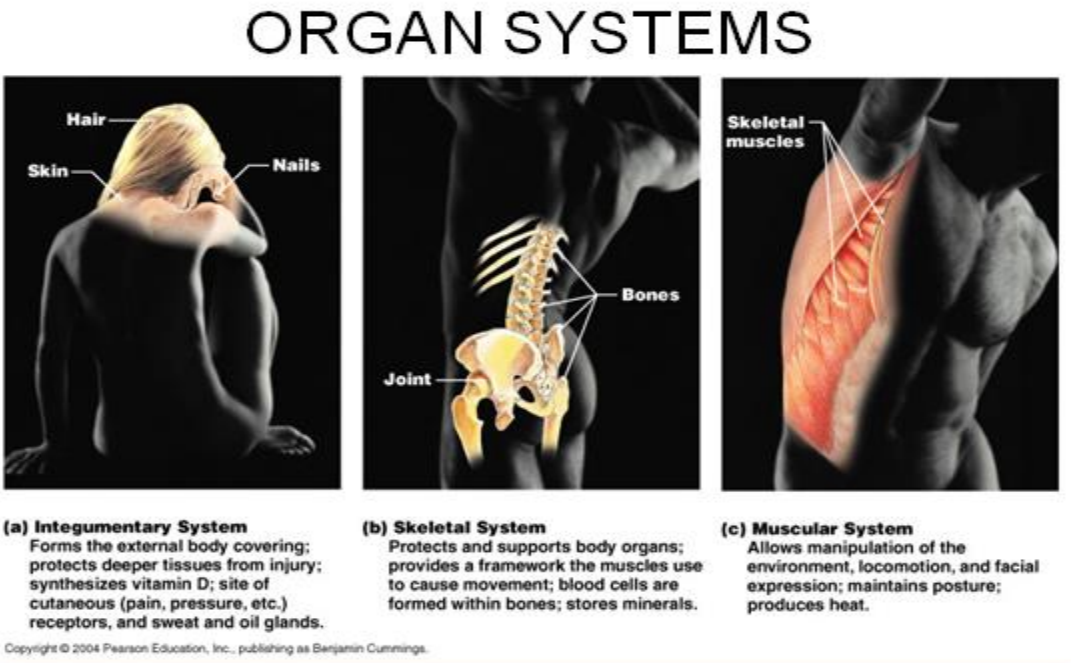
1.1.1. Levels of Structural Organization

- Chemical level is the simplest level of organization:
  - Atoms, tiny building blocks of matter, combine to form molecules such as water and proteins
  - Molecules combine in specific ways to form organelles, which are the basic unit of living cells
  - Cells are the smallest units of living things
    - All cells have some common functions, but individual cells vary widely in size and shape, reflecting their unique functions in the body.
- Cellular level: smallest unit of life, and varies widely in size and shape according to the cell's function
- Tissue level: groups of similar cells having a common function
  - Four basic tissue types: each tissue type has a characteristic role in the body
    - Epithelium: covers the body surface and lines its cavities
    - Muscle: provides movement
    - Connective: supports and protects body organs
    - Nervous: provides a means of rapid internal communication by transmitting electrical impulses
- Organ level: made up of discrete structures that are composed of a least two groups of tissues that work together to perform a specific function in the body
  - Stomach: epithelium lining, muscles, blood vessels, connective tissues, nerve fibers, etc.
- Organ system level: a group of organs that work closely together to accomplish a specific purpose
  - Respiratory and circulatory system, digestive and circulatory systems
- Organismal level: the total of all structures working together to promote life
  - The living human being

1.2. Maintaining Life

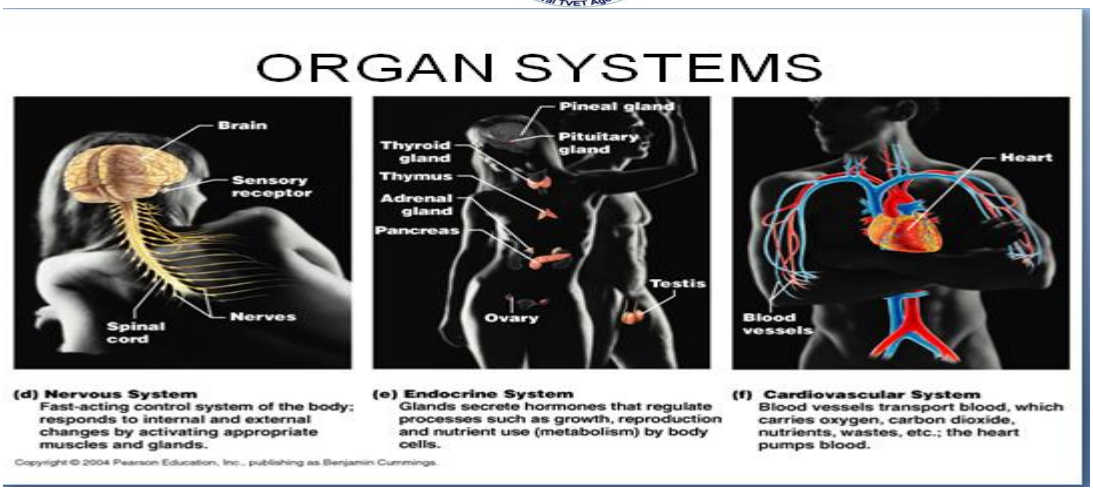
Necessary Life Functions

- Maintaining Boundaries: allows an organism to maintain separate internal and external environments, or separate internal chemical environments
  - Integumantary System or Skin
- Movement: allows the organism to travel through the environment, and allows transport of molecules within the organism
  - Skeletal, Circulatory, Muscular Systems
- Responsiveness: or irritability, is the ability to detect changes in the internal or external environment and respond to them
  - Muscular System



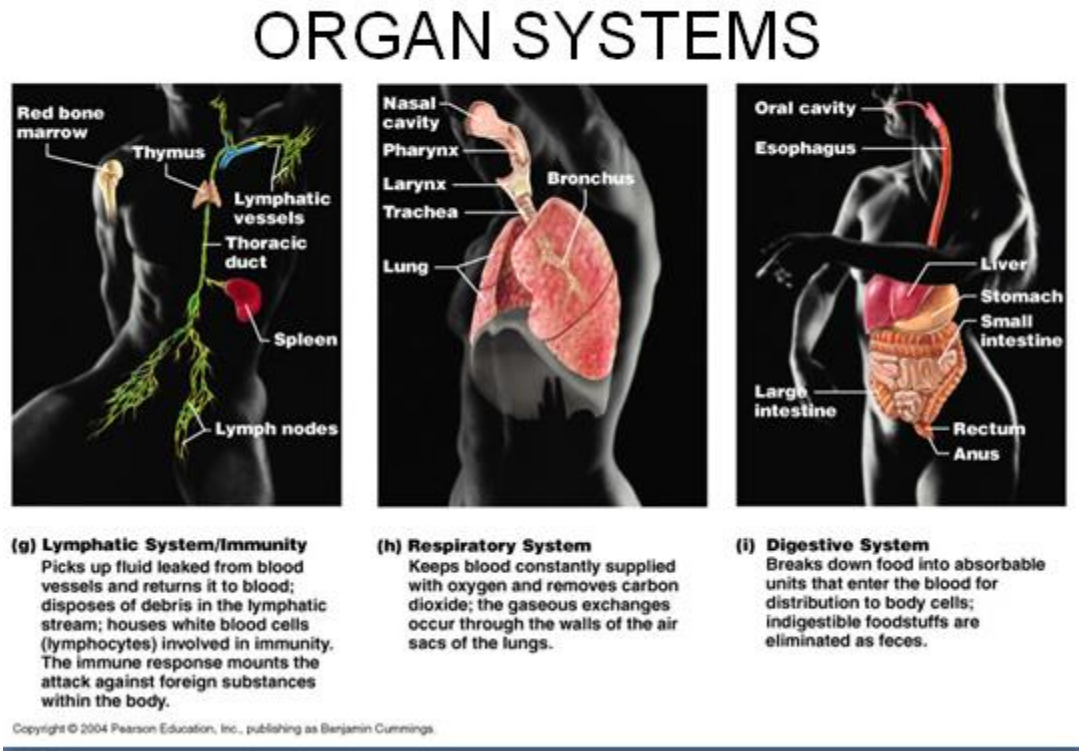
Fg. 1.1. Integumenatry **Fg. 1.2.skeletal** **Fg. 1.3. Muscularsystem**

- Nervous System:
  - Responsiveness to external and internal environments by activating muscles and glands
- Endocrine System:
  - Regulating body functions such as: growth, reproduction, and nutrition
- Cardiovascular System:
  - Transportation of nutrients, waste, gases, and hormones throughout the body



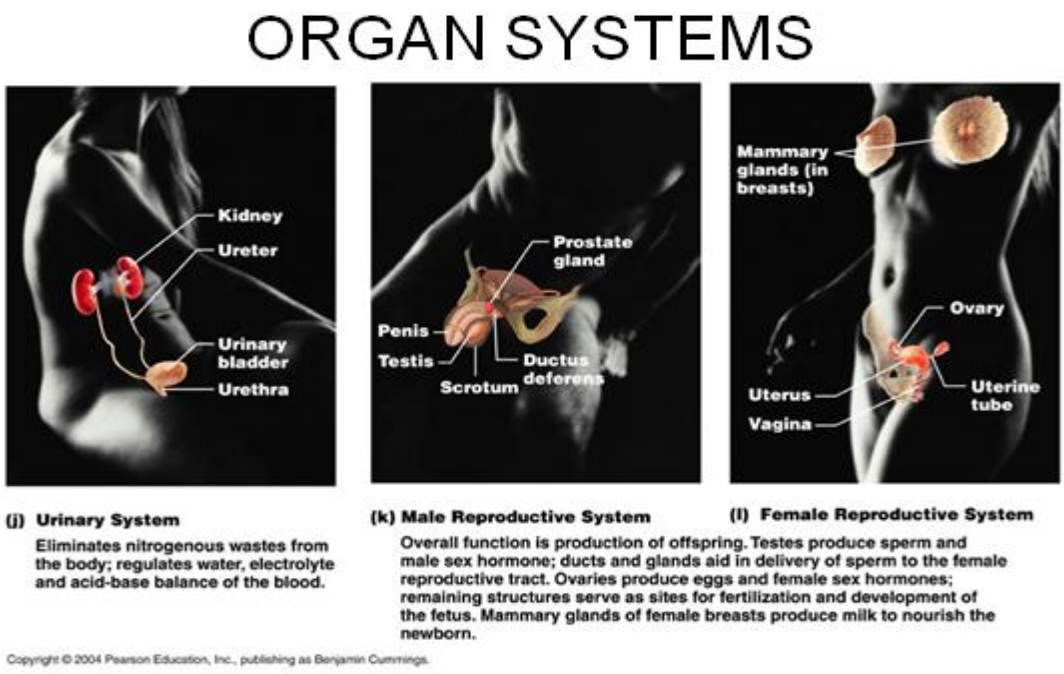
Fg. 1.4.Nervous **Fg. 1.5. Endocrine** **Fg. 1.6. Cardiovascular system**

- (Lymphatic System/Immunity:
  - Body defenses
- Respiratory System:
  - External and internal gas exchanges
- Digestive System:
  - Breakdown and absorption of nutrients



Fg. 1.7. (Lymphatic **Fg. 1.8.Respiratory** **Fg.1.9. Digestive system**

- Urinary System:
  - Absorption of waste from the blood and elimination
- (k): Male Reproductive System:
  - Production of sperm
- (l): Female reproductive System:
  - Production of eggs



Fg. 1.10.Urinary Fg. 1.11. Male reproductive Fg. 1.12. Female reproductive system

Self-Check 1	Written Test

Answer the Following Questions (2 point each):

1._____ is the science that study of structures that make up the body and how those structures relate with each other.

A. Anatomy
C. Biology
B. Physiology
D. Chemistry

2. The System allows the organism to travel through the environment, and allows transport of molecules within the organism

A. Urinary
B. Digestive
C. Nervous
D. Integumantary System or Skin

3. Groups of similar cells having a common function

A. Cell
C. Tissue
B. Organ
D. Organism

4. Types of science used for study of nature. It is the study of how the body and its part work or function

A. Anatomy
C.A and B
B. Physiology
D. None

5. List four basic tissue types

A. _____
B. _____
C. _____
D. _____

Note: **Satisfactory rating - 10 points Unsatisfactory - below 10 points**

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

Short Answer Question1._____2._____ 3._____ 4._____
5._____,_____,_____,_____

Information Sheet-2	Types of specimen and purpose of sample

1.2. Type and nature of samples are identified

1.2.1. Types of specimen

There are different types of common clinical specimen collected and/or analyzed in the diagnostic laboratory. These should include:

- Stool
- Urine
- Body discharges
- Blood
- Skin slip, skin slit and skin scrapping
- Cerebrospinal Fluid(CSF)
- Swabs (eg .throat swab)

COLLECTING SAMPLES FOR CLINICAL TESTING	SAMPLE TYPES
Routine clinical samples	Whole Blood Plasma Serum Red Blood Cells (RBC) Urine
Non-Routine Liquid Biological Samples	CSF Breast Milk Exudates Lavage Fluid Oral Fluid
Non-Routine Solid Biological Samples	Stool Meconium Hair Nails
Samples - Metals Analyses	Whole Blood Plasma Red Blood Cells (RBC) Serum Urine

Table 1.1. Types of specimen

Notes about Shipping Temperature: Ship specimens chilled unless indicated otherwise in the Labs Test procedure SOP.

Notes About Specimen Labeling: Please use water-resistant ink when labeling specimens. Include the following information on each specimen:

1. Name of the patient (subject, employee or patient)
2. ID# or case number
3. Specimen type (blood, serum, urine, hair, etc.)
4. Date and time specimen was obtained

Collecting Samples for Clinical Testing

The following are general considerations for specimen collection, appropriate collection containers for specific testing and guidelines for sample submission.

For trace element, volatile compound analysis, specimen types other than blood, serum, plasma or urine, read additional instructions.

Collecting Routine Clinical Specimens

Note: The use of serum/plasma separator tubes is not recommended for use when collecting specimens for testing to be performed at NMS Labs. The use of these tubes can compromise test results.

Whole Blood refers to whole blood drawn into evacuated tubes (e.g., Vacutainer® tube) containing anticoagulant.

Plasma should be obtained by drawing blood into an anticoagulant, evacuated tube. Invert tube at least eight times to mix, immediately centrifuge for approximately 10 minutes at 3000 rpm, and carefully transfer the supernatant plasma into a labeled plastic container (polyethylene vial).

Serum should be obtained by drawing blood into an evacuated tube containing no anticoagulant and with a non-coated interior. Allow 20 minutes for clotting. Immediately centrifuge for approximately 10 minutes at 3000 rpm and carefully transfer the supernatant serum into a labeled, plastic container (polyethylene vial).

- Red Blood Cells (RBC) should be prepared from whole blood using the procedure for plasma specimens. Transfer the plasma from the centrifuged red blood cell fraction and submit the red blood cells, labeling the specimen accordingly.
- Urine specimens should be collected in a plastic (polyethylene) bottle. Do not fill bottle past the shoulder. Close with a screw cap, which has a self-sealing liner (e.g., 50ml bottle and cap).

- Collecting Non-Routine Liquid Biological Specimens

While not all biological fluids are found in large volumes, make every effort to collect as much as possible. Place fluid into a labeled screw-capped plastic container for shipping.

- Collecting Non-Routine Solid Biological Specimens

    - ✓ Stool: Collect an entire bowel movement and place into a clean, labeled 40 mL polyethylene bottle. Fill no more than 2/3 of the bottle. Write the total original weight on the label (mass or volume) of the specimen. Freeze. View frozen sample shipping instructions.

- ✓ Meconium: Collect at least 5 grams, approximately 1 tablespoon, of the black-tarry Meconium sample and place into a clean 40 ml polyethylene bottle. The sample may be combined several times from each evacuation up to approximately 72 hours or when the sample starts to turn yellowish-green.

- Collecting Samples for Metals Analyses

  Specimens collected for trace-metals analyses must be protected from contamination during collection. Conduct specimen collection in a clean, dust free environment using appropriate certified metal-free collection containers. To reduce specimen contamination, powder-free gloves are recommended during collection. It is recommended that unexpected elevated results be verified by testing another specimen. Blood, Plasma, or Red Blood Cells (RBC): To flush the collection device of metal contaminants, always draw a plain red top tube (no additive) first. Secondly, draw 7 mL of blood into a trace-metal free, EDTA Royal Blue Top Tube, unless otherwise indicated in the online test catalog specimen collection instructions. Always check the online test catalog for the most up to date collection requirements. Invert the Blue Top tube at least 8 times to ensure adequate mixing of the EDTA anticoagulant to prevent clotting. Discard the first red top tube appropriately unless being used for non-metals testing.

For RBC or Plasma samples, centrifuge the blood sample as soon as possible after collection for approximately 10 minutes at 3000 rpm. Place plasma into an acid washed plastic screw capped vial. Leave the RBCs in the original tube and replace stopper.

- ✓ Serum: To flush the collection device of metal contaminants, always draw a plain Red Top Tube (no additive) first. Secondly, draw 7 ml of blood into a trace-metal free, evacuated tube containing no anticoagulant. Refer to the online test catalog for the most up to date collection requirements. Allow the specimen to clot for at least twenty (20 minutes). Centrifuge for approximately 10 minutes at 3000 rpm and transfer all of the serum into an acid washed plastic screw capped vial. Discard the first red top tube appropriately unless being used for non-metals testing.
- ✓ Urine**:** Collect 20 mL of urine directly into a labeled trace-metal free (acid-washed, deionized water-rinsed, air-dried), polyethylene bottle with a plastic lined screw cap or an acid washed collection container. Always check the online test catalog for the most up to date collection requirements.
- ✓ Nails: Nail clippings may contain analytes of interest, which were deposited during the growth of the nail. Nail clippings (at least 0.5 g) from each finger or toe should be collected and packaged separately in acid washed plastic bottles. Each bottle should

be labeled with the weight, if known, of the nail collected and its source, e.g., right index finger.

Self-Check 2	Written Test

Answer the Following Questions (2 point each):

1. List common clinical specimen used in laboratory
2. Types of blood specimens obtained by drawing blood into an anticoagulant_____
3. Specimen labeling include the information

_____,_____,_____,_____

Note: Satisfactory rating - 6 points Unsatisfactory - below 6 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2._____

3._____,_____,_____,____

Information Sheet-3	Time of sample collection and collection sites

1.3. Time of sample collection and collection site

1 .3.1.Time of collection:

The time of collection provide best chance of recovery of the causative agent .For sputum and urine the preferred time is early in the morning soon after the patients awaken.

For blood specimen the time of collection should be when the patient's temperature begins to rise.

- Collection of specimens before the administration of antimicrobial:

Because antimicrobials limits recovery of pathogens if specimen is collected after the administration of anti-microbial.

- Age of specimens:

Age of the specimen directly influences the recovery of protozoan organism

- Stage of the disease at which the specimen is collected

Enteric pathogens are present in great numbers during the acute or diarrheal stage of intestinal infection

1.3.2. Site selection consideration:

- Clinician should locate right anatomic site & select appropriate tests &specimens based on:
  - ✓ Physical examination (sign & symptoms)
  - ✓ Radiological examination
- Laboratory personnel should collect specimens from actual infection site with little external contamination by using aseptic technique and sterile container and should collect specimens from right site:
  - ✓ To prevent contamination of specimen &
  - ✓ To protect the patient from infection
- Sites of Infection where the Specimen is likely to become contaminated during collection

✓ Sample from lower respiratory tract can be contaminated from Oro-pharynx
✓ Sample from bladder can be contaminated from urethra
✓ Sample from cervix can be contaminated from vagina

Self-Check 3	Written Test

Answer the Following Questions (2 point each):

1. For sputum and urine the preferred time is specimen collection is
   A. Early in the morning soon after the patients awaken.
   B. At any time of the day
   C. Random

2. For blood specimen the time of collection should be when the patient's.
   A. Only at Early morning
   B. After treatment
   C. When body temperature begins to rise
   D. At any time

3. Why laboratory personnel should collect specimens from actual infection site?

Note: Satisfactory rating - 6 points Unsatisfactory - below 6 points
You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

1._____
2._____
3._____
_____
_____

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