

# Clinical Chemistry

## LECTURE

### INTRODUCTION - LAB MATH

#### **PATHOLOGY (LABORATORY)**

##### **Purpose & Functions**

To assist the Clinicians in

- Confirming or rejecting a diagnosis
- Providing guideline in patient management
- Establishing a prognosis
- Detecting disease through case finding and/or screening
- Monitoring follow-up therapy

##### **3 Sections**

#### **A. CLINICAL PATHOLOGY**

Deals with fluids & blood

#### **B. ANATOMICAL PATHOLOGY**

Deals with tissues

- Histopathology
- Immunohistochemistry

| Clinical Laboratory Sections |  |
|------------------------------|--|
| Section                      | Purpose  |
| Hematology                   | Cell counts  |
| Blood Bank                   | Blood transfusion                                    |
| Serology / Immunology        | Antigen-antibody reaction                            |
| Clinical microscopy          | Cell counts & examinations of other body fluids      |
| Microbiology                 | Examinations for bacteria, fungi, virus, & parasites |
| Special Chemistry            | Deals with cytogenetics                              |
| Clinical Chemistry           | Measurements of the amount of chemicals              |

#### **CLINICAL CHEMISTRY**

- One of the busiest sections of the clinical lab
- Measurement of the amount of chemicals or quantitative analysis of metabolites in body fluids, particularly blood
- Clinicians request for the test

##### **MLS/CLS are expected to:**

- Accurately perform the test
- To ensure valid results

##### **MLS/CLS must:**

- Understand the principle of the tests
- Understand the physiology of the body systems involved
- Know how to interpret the result
- Realize the medical use/relevance of the test

##### **Consequences of Inaccurate Procedure:**

- Oversight of a disease
- Mismanagement of the patient

##### **Tests may be done:**

#### **A. Individually**

#### **B. Panels**

- Groups of individual tests,
- Related to each other (belonging to one organ)
- Or which demonstrate multi-system involvement

- Which screen for the specific cause among diseases with shared or common presentations

#### **CLINICAL LABORATORY CALCULATIONS**

##### **Metric System**

- Most commonly used in scientific measurements
  - Decimal based systems
- If solutions are not prepared accurately:
- Experiments may fail
  - A waste of time and money
- Biological experiments are particularly sensitive to alterations in chemical composition of solutions
- Enzymatic reactions are extremely sensitive to alterations in pH, and salt concentrations
  - Incorrectly prepared media may inhibit bacterial growth
  - DNA migration in agarose gels can be altered by inexact calculations

| Standard metric Units for expression |        |
|--------------------------------------|--------|
| weight                               | grams  |
| length                               | meter  |
| volume                               | liter  |
| time                                 | second |

The metric system has the advantage that fractional parts of measurements can be derived by multiplying the standard by some power of 10.

| UNIT                  | SYMBOL | STANDARD           |
|-----------------------|--------|--------------------|
| <b>Length</b>         |        |                    |
| meter                 | m      | 1000 mm            |
| centimeter            | cm     | 10 mm              |
| millimeter            | mm     | 1/10 cm            |
| micrometer            | μm     | 1/1000 cm          |
| nanometer             | nm     | 1/1,000,000 cm     |
| <b>Volume</b>         |        |                    |
| liter                 | L      | 1000 mL            |
| milliliter            | mL     | 1/1000 L           |
| microliter            | μL     | 1/1,000,000 L      |
| <b>Mass</b>           |        |                    |
| gram                  | g      | 1000 mg            |
| milligram             | mg     | 1/1000 g           |
| microgram             | μg     | 1/1,000,000 g      |
| nanogram              | ng     | 1/1,000,000,000 g  |
| <b>Temperature</b>    |        |                    |
| Celsius               | °C     | 100°C = 212°F      |
| Fahrenheit            | °F     | 32°F = 0°C         |
| <b>Pressure</b>       |        |                    |
| atmosphere            | atm    | 101,325 Pa         |
| torr                  | torr   | 133.322 Pa         |
| millimeter of mercury | mmHg   | 133.322 Pa         |
| <b>Energy</b>         |        |                    |
| joule                 | J      | 1000 mJ            |
| calorie               | cal    | 4.184 J            |
| kilocalorie           | kcal   | 4184 J             |
| <b>Force</b>          |        |                    |
| newton                | N      | 1000 mN            |
| dyne                  | dyn    | 10 <sup>-5</sup> N |

| UNIT                  | SYMBOL | STANDARD           | SELECTED DERIVATIVE |
|-----------------------|--------|--------------------|---------------------|
| meter                 | m      | 1000 mm            | —                   |
| centimeter            | cm     | 10 mm              | —                   |
| millimeter            | mm     | 1/10 cm            | —                   |
| micrometer            | μm     | 1/1000 cm          | 1000 nm             |
| nanometer             | nm     | 1/1,000,000 cm     | —                   |
| liter                 | L      | 1000 mL            | —                   |
| milliliter            | mL     | 1/1000 L           | —                   |
| microliter            | μL     | 1/1,000,000 L      | —                   |
| gram                  | g      | 1000 mg            | —                   |
| milligram             | mg     | 1/1000 g           | —                   |
| microgram             | μg     | 1/1,000,000 g      | —                   |
| nanogram              | ng     | 1/1,000,000,000 g  | —                   |
| degree Celsius        | °C     | 100°C = 212°F      | —                   |
| degree Fahrenheit     | °F     | 32°F = 0°C         | —                   |
| atmosphere            | atm    | 101,325 Pa         | —                   |
| torr                  | torr   | 133.322 Pa         | —                   |
| millimeter of mercury | mmHg   | 133.322 Pa         | —                   |
| joule                 | J      | 1000 mJ            | —                   |
| calorie               | cal    | 4.184 J            | —                   |
| kilocalorie           | kcal   | 4184 J             | —                   |
| newton                | N      | 1000 mN            | —                   |
| dyne                  | dyn    | 10 <sup>-5</sup> N | —                   |

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