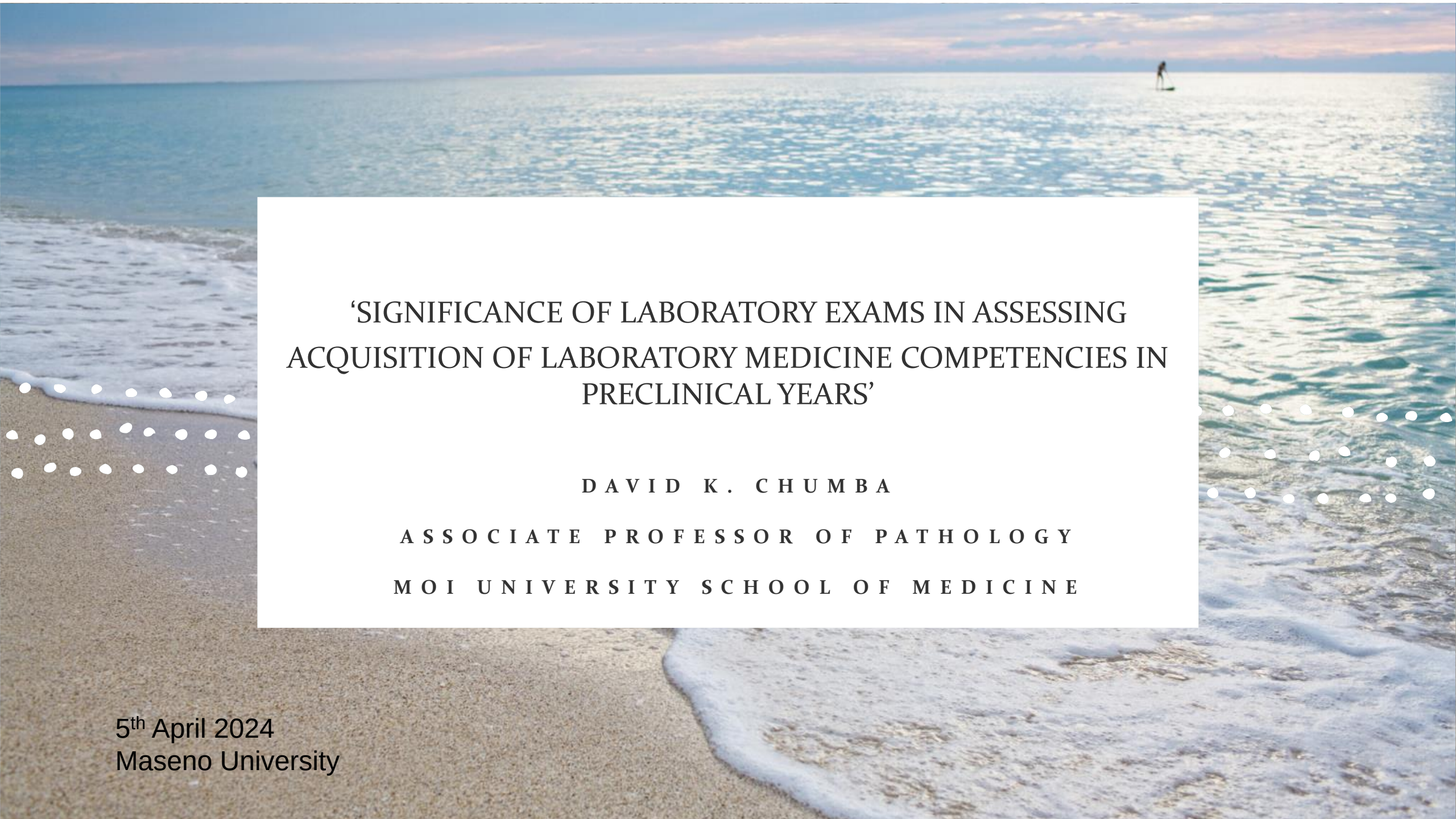

‘SIGNIFICANCE OF LABORATORY EXAMS IN ASSESSING ACQUISITION OF LABORATORY MEDICINE COMPETENCIES IN PRECLINICAL YEARS’

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5th April 2024
Maseno University

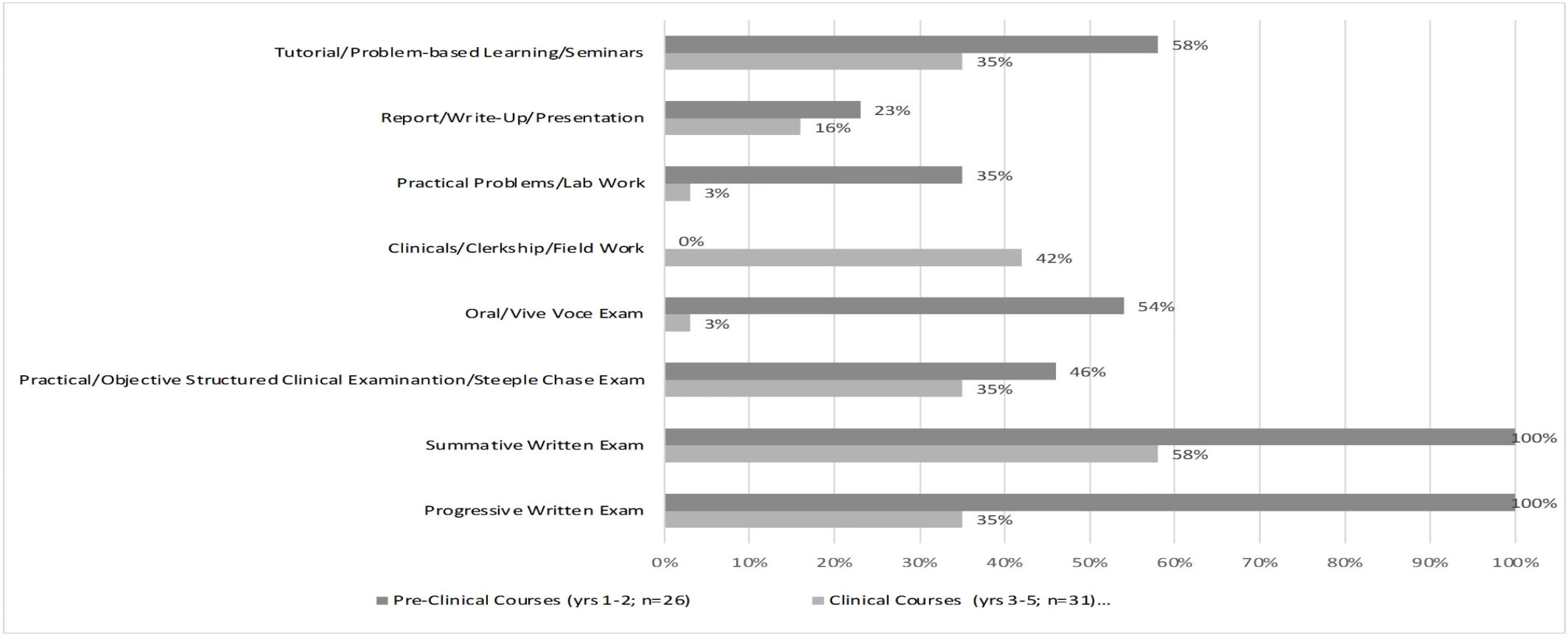
Agenda

- Introduction
- Publications support practical assessments in preclinical years
- example of assessment process
- Case of MUSOM
- Summary & takeaways

Introduction

- **Significance:** implies a quality or character that should mark practical exams as important but that is not self-evident and may or may not be recognized.
- **practical exams** are exams build into assessment of courses in preclinical years
- **Competence:** knowledge, judgment, skill, or strength for a particular duty or in a particular respect
- For a medical students to be considered "competent" they have to **possess** qualities and **demonstrable** attributes necessary to recognize and diagnose a disease process,
- ✓ sufficient medical knowledge
- ✓ acquire critical thinking
- ✓ skill in performing clinical laboratory procedures
- ✓ engage in life-long learning

Evaluation of CBME curriculum in SSA



- McKenzie-White, J., Mubuuke, A.G., Westergaard, S. *et al.* Evaluation of a competency based medical curriculum in a Sub-Saharan African medical school. *BMC Med Educ* **22**, 724 (2022). https://doi.org/10.1186/s12909-022-03781-1
- Relatively little has been written on Medical Education in Sub-Saharan Africa, although there are over 170 medical schools in the region. (Frenk et al 2010)

OSPE

- Objective Structured Practical Evaluation (OSPE) was derived from Objective Structured Clinical Evaluation (OSCE) and modified by Harden (1975–79).
- In an international conference held in Ottawa in 1985, OSCE and OSPE techniques were introduced as a teaching and evaluation tool and its advantages were compared with disadvantages
- OSPE and OSCE are considered by some a gold standard for assessing competence in pre-clinical and clinical laboratory skills
- In many publications, OSPE was found to be a valuable tool to check the depth of understanding and its practice in routine classes and standardization is imperative.

Lakum, N, R. et al Sept 2023

- Abstract

- **Background:** Practical assessments hold a critical role in evaluating medical education. However, achieving objectivity, consistency, authenticity, reliability, and practical usefulness in student evaluations can be a formidable challenge. The Objective Structured Practical Examination (OSPE) stands out as a promising technique tailored to assess performance in a realistic educational setting. OSPE offers a unique approach to aligning assessment methods with the educational objectives of a given activity, making it possible to comprehensively gauge the attainment of pedagogical goals.

- **Objective:** This study aimed to overcome the limitations associated with traditional practical tests and explore the potential advantages of OSPE in improving the objectivity, consistency, authenticity, and reliability of student evaluations in the context of medical education. Through a comparative analysis, this research endeavors to illuminate the practical applicability of OSPE. The primary goal of this research was to introduce and assess the feasibility of employing the OSPE as a formative assessment tool for appraising the practical capabilities of Physiology students.

- **Methodology:** Fifty students from 1st year MBBS were included in this study after their written consent. They were divided into two groups of 25 students each; two practical procedures, (a) hemoglobin estimation, and (b) performing blood group. Students were assessed at two different sessions. Students of each group assessed by the conventional method in the first session were assessed by OSPE in the second session of the same practical and vice versa. At the completion of the assessment process, both students and teachers were asked to rate the various assessment techniques on a Likert scale. Student test results and instructor and student opinions were statistically examined using the paired t-test. A significance level of 0.05 was used.

- **Results:** When evaluated using the OSPE method, students obtained significantly higher mean marks (12.58±2.74) compared to the conventional assessment method (8.44±2.13). A paired t-test confirmed the statistical significance of the improvement in student performance with OSPE ($p<0.0001$). Student feedback indicated strong agreement (92%) that OSPE encourages greater focus on practical examinations and is an effective assessment and learning method. Teachers expressed unanimous agreement that OSPE is a more comprehensive evaluation tool (100%) and better at highlighting student strengths and weaknesses (75%). The majority of teachers (75%) believed that OSPE should be incorporated into future examinations.

- **Conclusion:** The study demonstrates that OSPE significantly enhances student performance and is well-received by both students and teachers as a more effective and comprehensive assessment method.

cont

- **Lakum, N, R. et al.** Objective structured practical examination as tool for formative assessment of practical; a comparative cross-sectional analysis published in 2023, September
- When evaluated using the OSPE method, students obtained significantly higher mean marks (12.58±2.74) compared to the conventional practical assessment method (8.44±2.13).

  A paired t-test confirmed the statistical significance of the improvement in student performance with OSPE ($p<0.0001$).

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  Teachers expressed unanimous agreement that OSPE is a more comprehensive evaluation tool (100%) and

  better at highlighting student strengths and weaknesses (75%).
- The majority of teachers (75%) believed that OSPE should be incorporated into future examinations.

Reem Rachel et al. March 2009

- Abstract
- A single examination does not fulfill all the functions of assessment. The present study was undertaken to determine the reliability and student satisfaction regarding the objective structured practical examination (OSPE) as a method of assessment of laboratory exercises in physiology before implementing it in the forthcoming university examination. The present study was undertaken in the Department of Physiology of Melaka Manipal Medical College, Manipal Campus, India. During the OSPE, students were made to rotate through 11 stations, of which 8 stations were composed of questions that tested their knowledge and critical thinking and 2 stations were composed of skills that students had to perform before the examiner. One station was kept as the rest station. Performance of the students was assessed by comparing the students' scores in the traditional practical examination (TPE) and OSPE using “Bland-Altman technique.” Student perspectives regarding the OSPE were obtained by asking them to respond to a questionnaire.
- The Bland-Altman plot showed that ~63% of the students showed a performance in the scores obtained using the OSPE and TPE within the acceptable limit of 8; 32% of the students scored much above the anticipated difference in the scores, and the rest scored below the anticipated difference in the scores on the OSPE and TPE.
- Feedback indicated that students were in favor of the OSPE compared with the TPE. Feedback from the students provided scope for improvement before the OSPE was administered for the first time in the forthcoming university examination.

cont

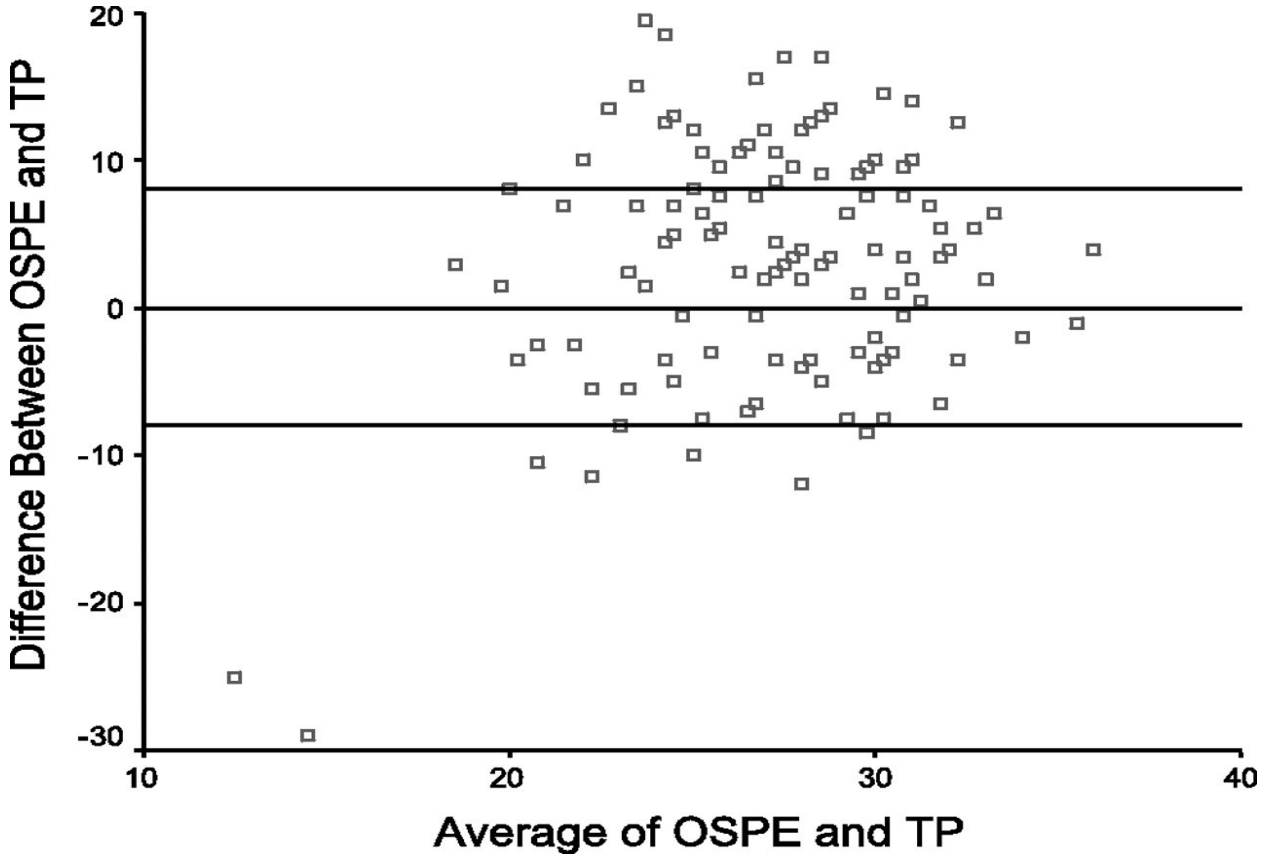

Fig. 1. Bland-Altman plot of the marks using the objective structured practical examination (OSPE) and traditional practical examination (TPE).

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- The bias (=mean difference) ('Limits of Agreement'): bias +/– 1.96 X standard deviation of differences

- Bias and limits of agreement may be superimposed on a Bland-Altman plot for visual presentation of the data.

cont

A model to integrate pathology teaching using technology

2012
SEAJME

Chumba D, Macharia B, Smith J, Wade J

Purpose: Use of technology to integrate pathology teaching in the third year of medical training. The teaching of pathology and disease includes several sections that have been taught by separate departments of immunology, haematology, microbi ology, histopathology and biochemistry. It has been noted that students are not able to integrate the teaching from all these departments. To address this problem we have developed a model to integrate the teaching of the different sections by providing additional cases and materials in the computer laboratory.

Methods: The eight week course of general pathology has been chosen for this model as it is the first section of pathology and the availability of teaching materials in the server of the computer. Three practical sessions are given to each section, histopathology, microbiology, haematology, immunology and clinical chemistry. Additional information was made available to students in the new thin client computer laboratory. A questionnaire was administered at the end of the course to half of the students. The responses which targeted in three areas, content, relevance, and acceptance and analysed.

Results: The eight week course was received enthusiastically by the students. The data indicated that the students generally accepted a computer-based instruction in teaching pathology. There was no improvement in performance of the class at the end of the term examinations as compared to the previous year.

Conclusions: Computer-based instruction is possible in low resource countries. Use of technology can address challenges relating to integration of teaching .This model could serve as a nucleus for more extensive restructuring of teaching in the entire Medical School as well in other Medical Schools in Kenya and the rest of Africa.

(7) (PDF) A model to integrate pathology teaching using technology. Available from: https://www.researchgate.net/publication/336976581_A_model_to_integrate_pathology_teaching_using_technology [accessed Feb 06 2023].

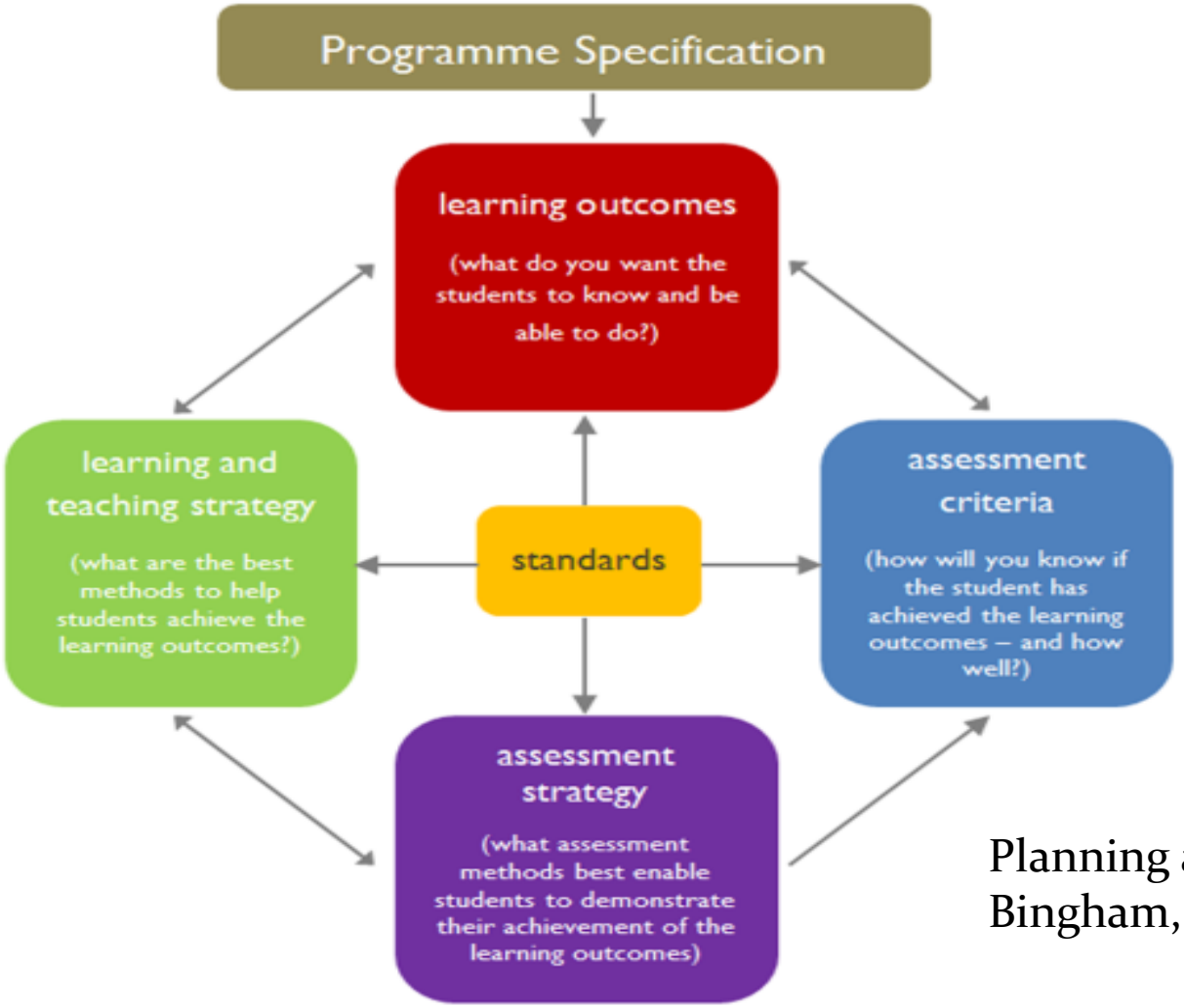
Medical knowledge

Not speculative endeavor but a practical way of knowing

- Epidemiology – Where & When..
- Etiology – What is the cause?
- Pathogenesis - Evolution of dis.
- Morphology - Structural Changes
- Clinical Significance – relate..
- Management
- Prognosis
- Prevention

Pathology

Assessment and Planning



How do you know students Have learnt etiology, morphology and pathogenesis of diseases? Practical!

Planning a unit of study (adapted from Rosie Bingham, 2002)

Assessment criteria

- Assessment Criteria are statements of the key characteristics of performance in the assessment task
- It explains how student responses to assessment tasks will be evaluated.
- **Knowledge-based**: ‘Knowledge of…’ and describe the areas of knowledge that students will be expected to acquire by the end of the unit.
- **Application-based**: ‘Understanding through…’ or ‘Understanding through application of…’ and describe how students should be expected to apply the knowledge they have acquired by the end of the unit.
- **Skills-based**: ‘Technical and applied skills through…’ and describe the technical and transferable skills that students should possess by the end of the unit.

Characteristics

- **The** cornerstone of **CBME is robust, valid** and **reliable** assessment
  - **Alignment**: the deliberate linking of stated learning outcomes, teaching and learning activities and assessment tasks to promote consistency between what is learned and assessed.
  - **Fair:** assessment is assessment that is feasible for the student's level of progression through their program,
  - **transparent** processes
  - constructive **feedback:** timely
- In addition, faculty must be supportive of utilizing optimal assessment methods and should have the knowledge and skills to develop valid assessments (reason for the medical education conference)

Example assessment criteria

Course title: **CELLULAR REACTIONS TO INJURY:**
learning outcomes

- 1. Define hyperplasia, hypertrophy, atrophy, & Metaplasia & list some of their causes.
- 2. Know the differences between reversible & irreversible forms of cell injury.
- 3. Describe the mechanisms of necrosis.
- 4. Describe the various types of necrosis & know some of their causes.

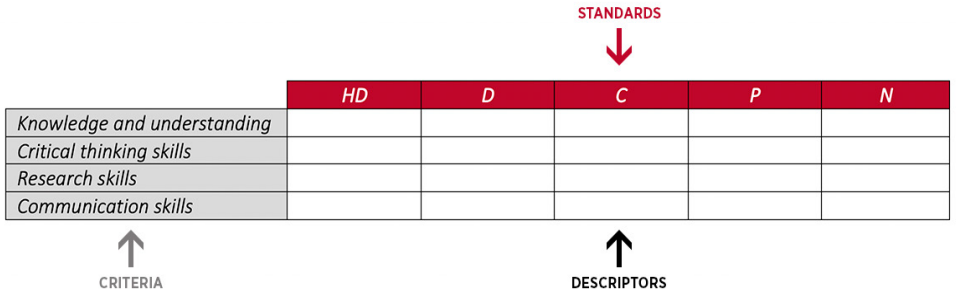
Assessment Criteria

You will have a formative assessment at the end of the course and a summative assessment at the end year where you will be tested on
Your **knowledge of** a cellular response to injurious agents, hyperplasia, hypertrophy, atrophy, & Metaplasia.

Understanding of the underlying causes and mechanism of cell damage difference between reversible and irreversible cell injury, necrosis and apoptosis.

Application of the knowledge of the changes that occur within the cell following injury in diagnosis of disease by being able to **Recognize** the changes that occur following cell injury in tissue. (the practical component: hypertrophic heart, atrophic kidney etc) These will be assessed by summative practical sessions containing 3 stations of gross specimens, 1 station each of microbiology and biochemistry

You must answer 50% of the questions correctly to pass, above 65% to get a credit and above 75% to get a distinction



Cognitive processes to assess

- 1. **Remember** – Retrieve relevant knowledge from long-term memory.

  1.1 Recognizing (eg Recognize the dates of important events in U.S. history)

  1.2 Recalling (eg Recall the dates of important events in U.S. history)

- 2. **Understand** – Construct meaning from instructional messages, including oral, written, and practical

- 3. **Apply** – Carry out or use a procedure in a given situation.

Case of MUSOM

- BACHELOR OF MEDICINE AND BACHELOR OF SURGERY (MBChB) CURRICULUM
- **Background: Course of general pathology (6 units)**
- **Course Outcomes**
- 1. Explain the basic concepts and principles of laboratory medicine
- 2. Describe cell injury, abnormal accumulations, pigmentation and inflammation
- 3. Describe pathology of common infectious and communicable diseases
- 4. Describe the immune mediated disorders of the body
- 5. Explain alteration in growth control and neoplasia.
- 6. Describe the pathology of common genetic disorders.
- 7. Describe the clinical pharmacology of anti-inflammatory, antineoplastic and immunopharmacological agents.
- 8. Explain the use of plasma proteins and enzymes in diagnosis and the role of tumor markers in mutagenesis and
- carcinogenesis

Process

Course Content

- Laboratory Medicine: Principles, concepts, techniques and procedures of laboratory medicine of in: parasitology, bacteriology, mycology, virology, clinical chemistry; immunology; haematology; histopathology; organization of laboratory services in a hospital, and good laboratory practices

- Cell injury: Cell death, necrosis, apoptosis. Sublethal cell injury, degenerations, hyperplasia, metaplasia, accumulations, amyloidosis, melanin and uric acid deposition; calcification, hyalinisation, jaundice. Inflammation: acute and chronic inflammation, special types of inflammation, aetiology and morphology of inflammation, mediators of inflammation, healing and repair

- Infectious and communicable diseases : aetiology, pathology; control and prevention including bacterial, viral, fungal, rickettsial, protozoal, and parasitic; effect on nutritional status; nosocomial infections; notifiable diseases.

- Immune Mediated Disorders: Classification and immunological features of: allergic and hypersensitivity reactions; autoimmune diseases; immunodeficiency disorders. Immunotherapy principles and applications. Laboratory tests for immunological disorders

- Alteration in Growth Control: Nomenclature of tumors: benign and malignant, characteristics, modes of spread, staging and grading; carcinogenesis, molecular basis of carcinogenesis.

- Genetic Disorders: genetic origin. Chromosomal abnormalities. Genetic causes of foetal wastage and neonatal mortality. Ethical issues in genetic counseling. Gene therapy.

- Anti-inflammatory drugs: non-steroidal anti-inflammatory drugs (NSAID); glucocorticoids; immuno-modulatory drugs including cytotoxic and immunosuppressive agents; botulinum toxin ;Cancer chemotherapy: Introduction and principle ,the mechanisms of action, uses and limitations of the major groups of chemotherapeutic agents including alkylating and cross linking agents, antimetabolites, topoisomerase inhibitors, spindle inhibitors and biologicals. New and future therapies. Monoclonal antibodies and conjugates, pro-drugs, vaccines, gene and RNA targeting, aptomers, gene therapy, DNA repair and resistance inhibition. Novel delivery systems. Inhibition of angiogenesis and the metastatic cascade. Radiation and chemotherapy sensitisers and protectors. Special groups including Neonates, Elderly, Pregnant mothers, Patients with concurrent disease conditions.

- Clinical enzymology, plasma lipases, amylases transaminases ALP, ACP Lactate dehydrogenase (LDH), Creatinine Kinase (CK). Electrophoresis patterns and tumor markers.

Overviews
Tutorials
Practical
CAT written

Weighted average

- A weighted average is a method of computing an average where some data points contribute more than others. If all the weights of the data point are equal then the weighted average is the same as the mean.

	Units	%	stations	time allocated
Anatomic pathology:	2.8	47.5%	4	90
Hematology	0.126	6.3%	1	10
Biochemistry	0.34	10.5%	2	20
Microbiology/parasitology	0.34	10.2%	2	15
Immunology	0.34	10.2%	1	15
Pharmacology	0.8	16%	0	30
Total	6	100	10	180

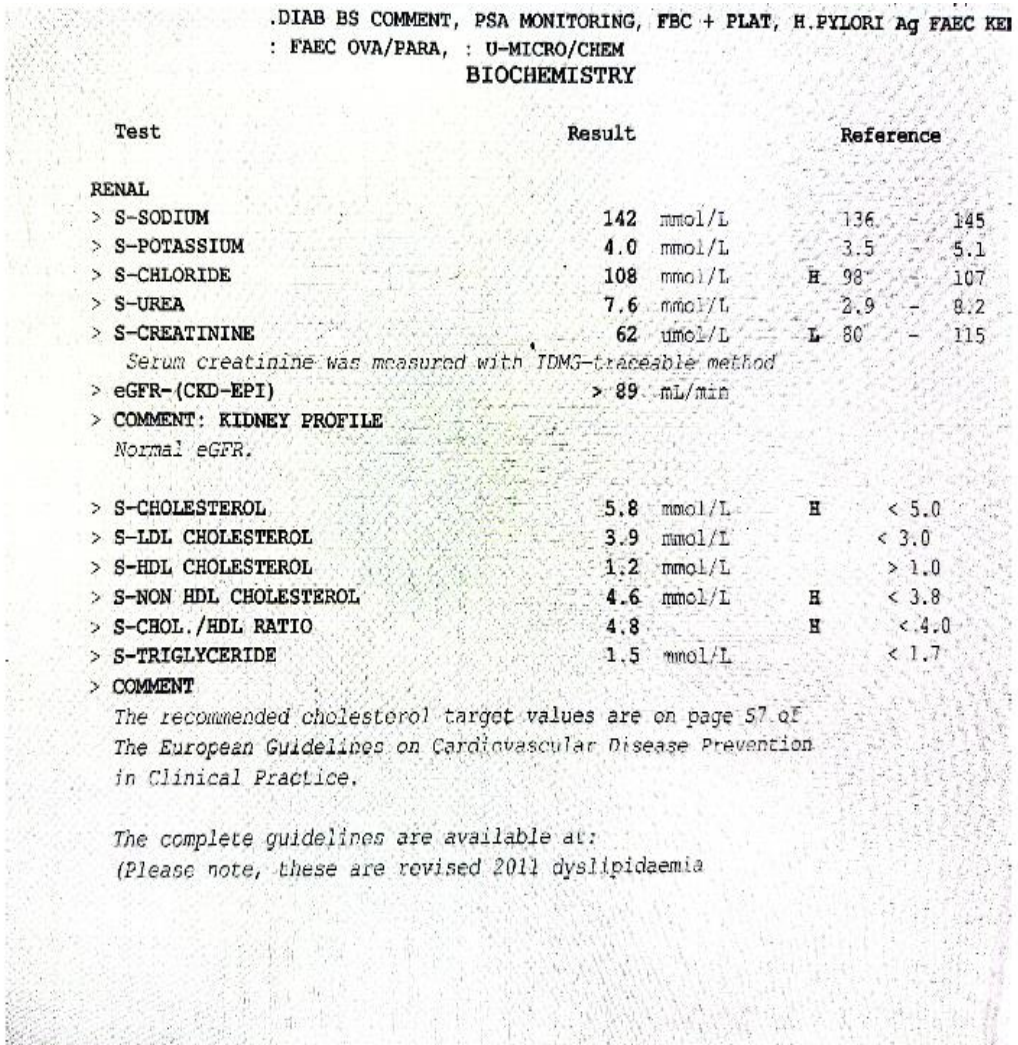
Practical exams: gross specimen “G”

- For each station, we have short answer question or mcq

Identify the tissue shown (1 mark)
Describe the pathology shown (2 marks)
List 3 causes of this pathology (2 marks)

Fatty liver
Sub lethal cell injury
Chemical, microbiological agents, immunological reactions

Biochemistry: SPOT ‘R’



.DIAB BS COMMENT, PSA MONITORING, FBC + PLAT, H.PYLORI Ag FAEC KEI
: FAEC OVA/PARA, : U-MICRO/CHEM

BIOCHEMISTRY

Test	Result			Reference
RENAL				
> S-SODIUM	142	mmol/L		136 - 145
> S-POTASSIUM	4.0	mmol/L		3.5 - 5.1
> S-CHLORIDE	108	mmol/L	H	98 - 107
> S-UREA	7.6	mmol/L		2.9 - 8.2
> S-CREATININE	62	umol/L	L	80 - 115
Serum creatinine was measured with IDMS-traceable method				
> eGFR-(CKD-EPI)	> 89	mL/min		
> COMMENT: KIDNEY PROFILE				
Normal eGFR.				
> S-CHOLESTEROL	5.8	mmol/L	H	< 5.0
> S-LDL CHOLESTEROL	3.9	mmol/L		< 3.0
> S-HDL CHOLESTEROL	1.2	mmol/L		> 1.0
> S-NON HDL CHOLESTEROL	4.6	mmol/L	H	< 3.8
> S-CHOL./HDL RATIO	4.8		H	< 4.0
> S-TRIGLYCERIDE	1.5	mmol/L		< 1.7
> COMMENT				

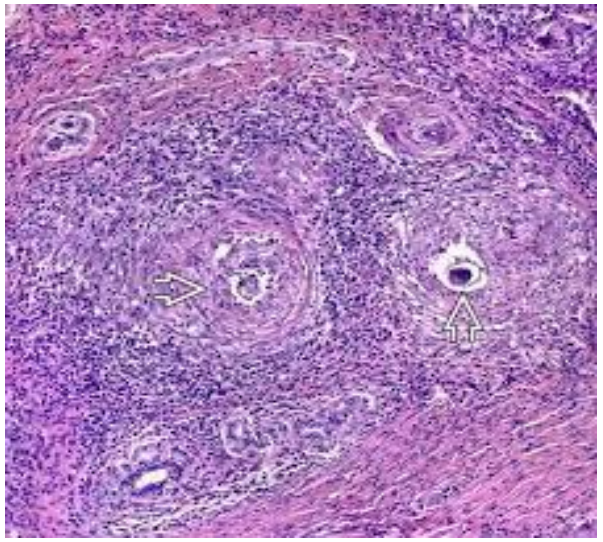
The recommended cholesterol target values are on page 57 of The European Guidelines on Cardiovascular Disease Prevention in Clinical Practice.

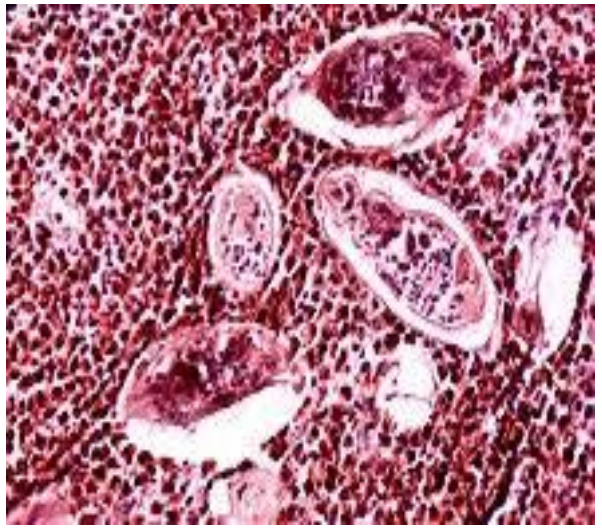
The complete guidelines are available at:
(Please note, these are revised 2011 dyslipidaemia

This is is a print out of renal function tests

- ✓ Indicate normal ranges for each parameter
- ✓ Identify the values that are out of range

Microbiology: Spot marked ”A”



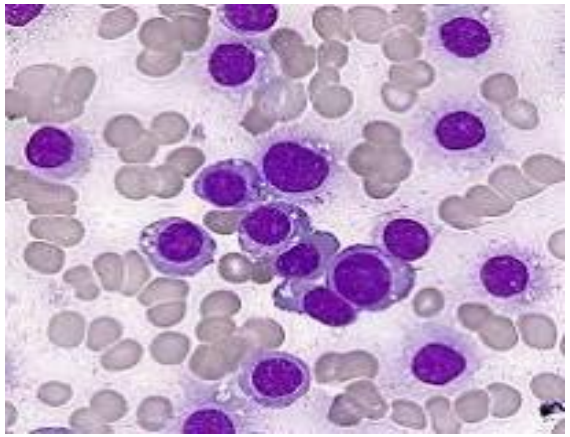


Identify the parasite shown (1 mark) S. Hematobium
State the medical importance of this parasite (2 marks)
State two medical complications of this parasite (2 marks)

Immunology, Test kit labelled “B”

- Test kits to performed two different ELISAs, the Rapid Strep Test was an example of a(n) _____ ELISA; and the test using a mock “patient serum” as the sample was a(n) _____ ELISA.
- Tick the correct answer
  - ✓ Direct; indirect
  - ✓ Indirect; direct
  - ✓ Indirect; indirect
  - ✓ Direct; direct

Hematology: PBF labelled “K”



- ✓ What blood cell is prominently increased?
- ✓ What is the name of the cells shown by arrows
- ✓ What is the likely diagnosis
- ✓ State laboratory tests you would do to confirm diagnosis

Summary

• Anatomic pathology	scorex.475	Submitted practical mark
• Immunology	scorex.102	“
• Microbiology/parasitology	scorex.102	“
• Hematology	scorex.063	“
• Biochemistry	scorex.105	“
• Total	EYE mark	x/50

Practical carries 40%, practical 10%) 10% of total EYE marks, Written 40%, CATs 50% (written

In summary

- Practical exams are considered a gold standard for assessing laboratory skills competence in preclinical years
- It is associated with minimum opportunities to plagiarism/cheating:
- Using traditional practical is good
- But using objective structured practical exam (OSPE) is better!

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Thank you

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Acknowledgments:

- **Faculty**: pathology departments (Anatomic, immunology, biochemistry, hematology and microbiology)
- **Dean** SOM for supporting OSPE
- **Moi University**