



**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
**FACULTY OF APPLIED SCIENCE**  
**DEPARTMENT OF APPLIED BIOLOGY AND BIOCHEMISTRY**  
**BACHELOR OF SCIENCE HONOURS DEGREE IN BIOTECHNOLOGY**  
**ENZYME BIOTECHNOLOGY (SBB4202/ SBT4202)**

**Main Examination Paper**

**MARCH 2025**

This examination paper consists of 2 pages

Time Allowed : 3 hours  
Total Marks : 100  
Special Requirements : NIL  
Examiner's Name : MR. N MANGOMA & MR. B MUCHOVO

**INSTRUCTIONS**

1. Answer **Four (4)** questions. Each question carries 25 marks.
2. Where a question contains subdivisions, the mark value for each subdivision is given in brackets.
3. Illustrate your answer where appropriate with large, clearly labelled diagrams.

**MARK ALLOCATION**

<b>QUESTION</b>	<b>MARKS</b>
1.	<b>25</b>
2.	<b>25</b>
3.	<b>25</b>
4.	<b>25</b>
5.	<b>25</b>
6.	<b>25</b>
<b>TOTAL</b>	<b>100</b>

1. Discuss the major techniques employed during bioprospecting for novel enzymes from named environmental sources.
- 2.(a) Describe the following mechanisms of enzyme action, giving the weaknesses and strengths of each model:
  - (i) Transition state complementarity model. (5 marks)
  - (ii) Shifting specificity model. (5 marks)

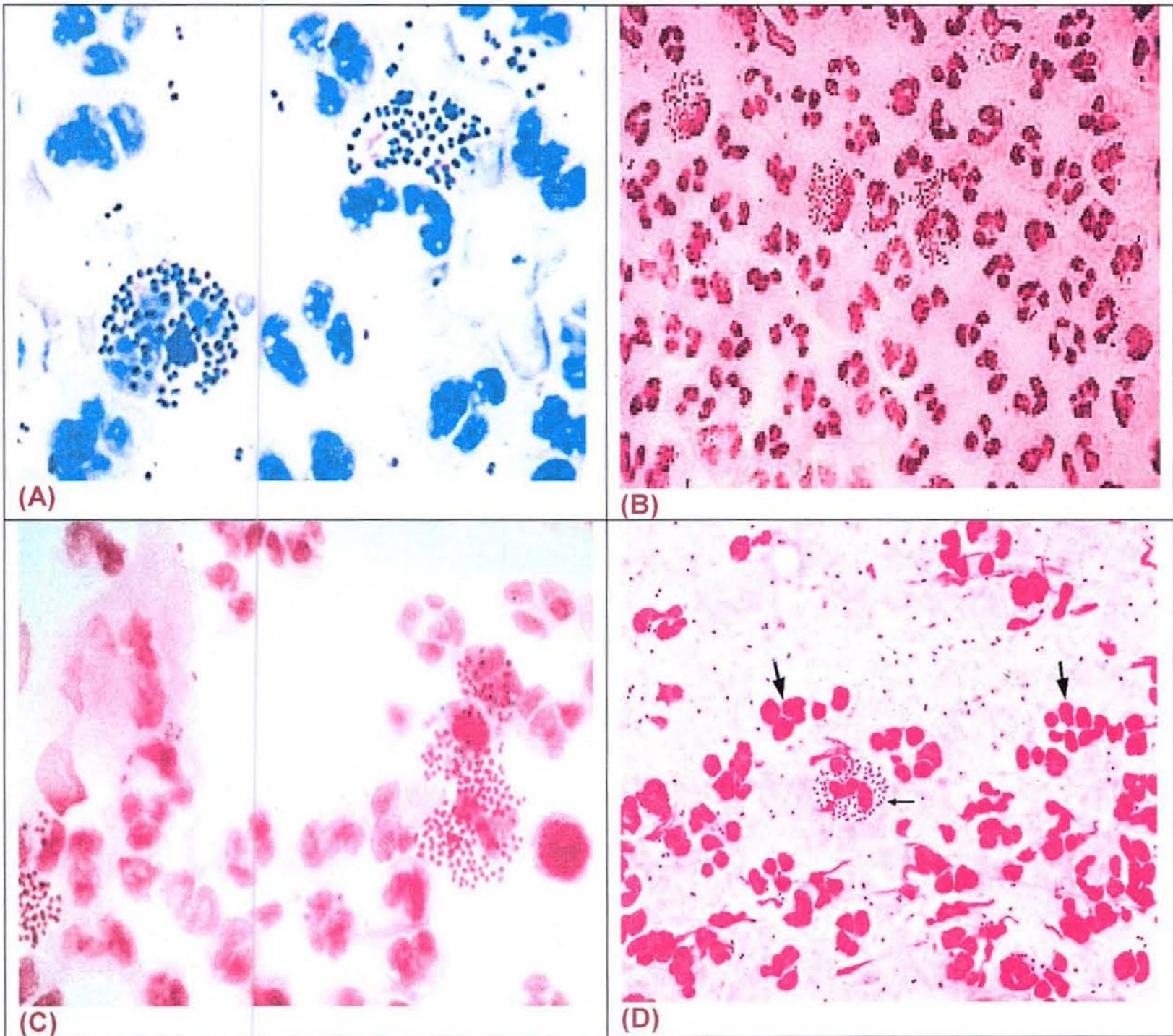
(b) Explain how different analytical techniques have improved our understanding of enzyme structure and function, paving the way for better enzyme application. (15 marks)
3. (a) Outline the advantages and disadvantages of whole-cell biocatalyst systems. (10 marks)
- (b) Explain why microbes are the preferred source of enzymes for industrial and other functions, highlighting their advantages and disadvantages over eukaryotic sources. (15 marks)
4. Describe the following techniques in directed enzyme evolution:
  - (a) Alanine-scanning mutagenesis. (6 marks)
  - (b) Gene-shuffling. (9 marks)
  - (c) Error-prone PCR. (10 marks)
5. Evaluate the different techniques used for enzyme immobilisation.
- 6.(a) Using specific examples discuss the application of enzymes in the following industries:
  - (i) Mining industry. (5 marks)
  - (ii) Recombinant DNA technology. (5 marks)
  - (iii) Pulp and paper industry. (5 marks)

(b) Describe the discovery of ribozymes and explain the mechanism of action of the hammerhead ribozyme. (10 marks)

**END OF EXAMINATION**

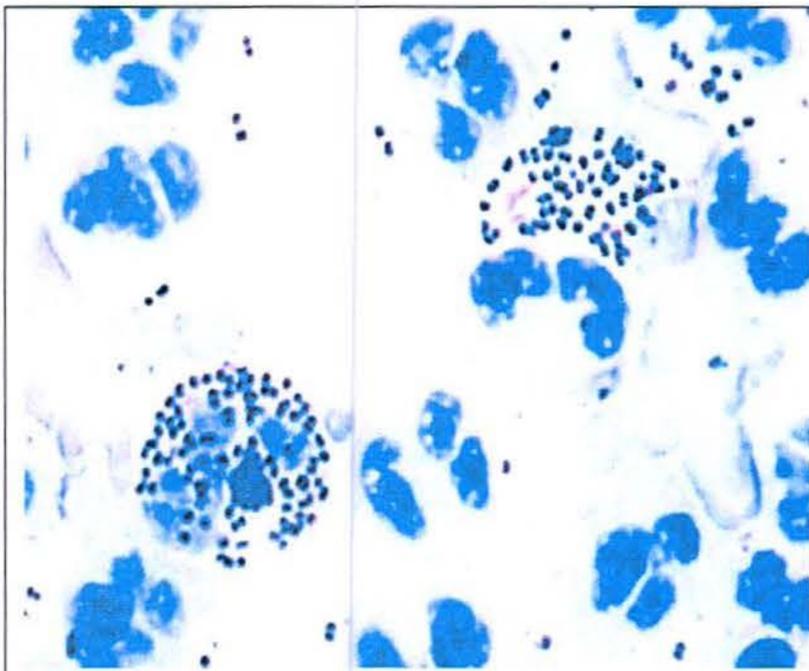
**MEDICAL MICROBIOLOGY MICROGRAPHS OF A PATHOGENIC BACTERIUM**

**QUESTION 6 (a):** Figures: Photomicrographs of *Pathogenic species X* (NOTE: Identify the Genus and species)

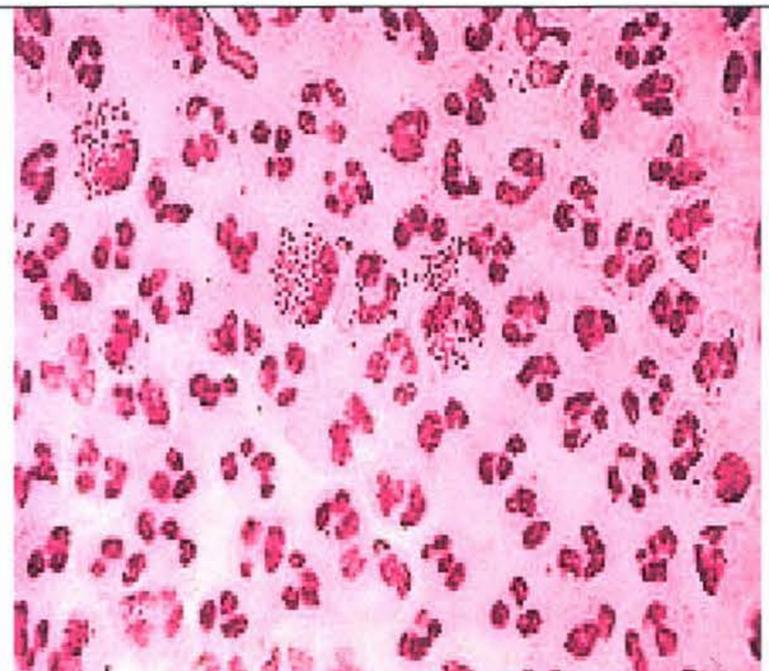


**MEDICAL MICROBIOLOGY MICROGRAPHS OF A PATHOGENIC BACTERIUM**

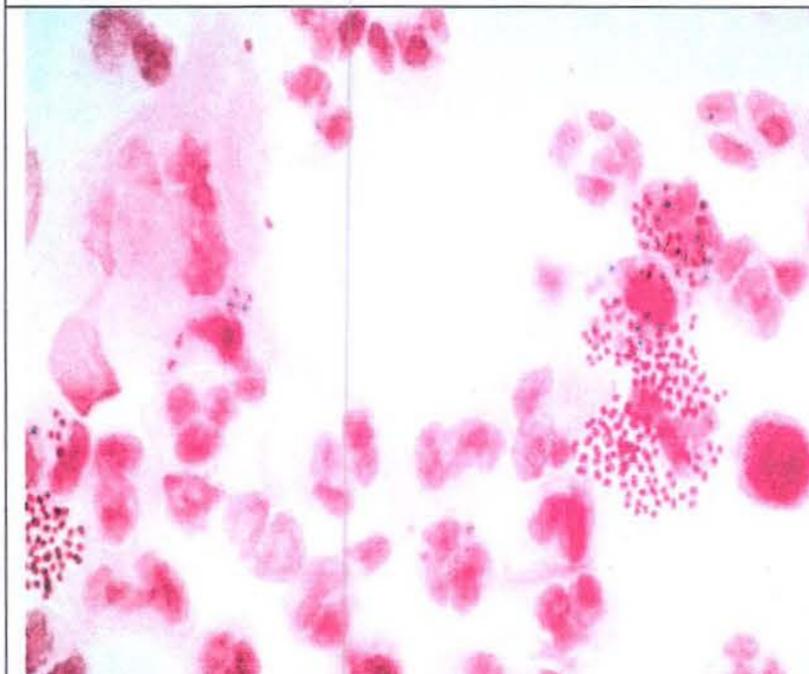
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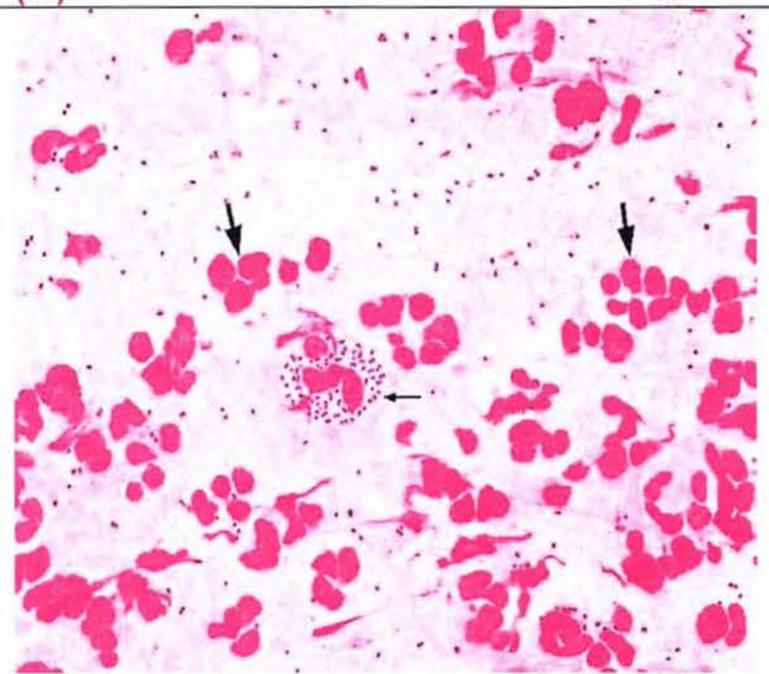
(A)



(B)



(C)



(D)