PraxiLabs
Virtual World of Science Education

# 3D BIOLOGY SIMULATIONS PORTFOLIO

Biology | Chemistry | Physics


Africa's Business Heroes

**Award Winner**

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# Experiments Index

## Molecular Biology – Genetics – Microbiology – Biochemistry



## Biochemistry - Immunology



## Biochemistry – Proteomics

## Biochemistry – Proteomics – Pharmacology – Toxicology



## Biochemistry – Immunology – Microscopy - Cell Culture



## Biochemistry - Bioenergetics



## Molecular Biology – Genetics – Microbiology – Biochemistry - Forensic



## Biochemistry – Pharmacology – Toxicology



## Physiology



## General

Molecular Biology | Immunology | Bioenergetics

Toxicology | Genetics | Microbiology | Forensic

Proteomics | Pharmacology | Cell Culture

Biochemistry | Microscopy | Physiology

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Molecular Biology | Genetics | Microbiology | Biochemistry

## DNA Extraction

### Learning Objectives (ILOs)

- Demonstrate proficiency with the protocol involved in DNA extraction
- Identify the role of specific reagents and equipment in the extraction of DNA
- Practice basic laboratory techniques
- Conclude downstream applications of DNA extraction

## Conventional PCR


### Learning Objectives (ILOs)

- Demonstrate proficiency with the protocol involved in PCR
- Identify the role of specific reagents and equipment in PCR
- Practice basic laboratory techniques
- Conclude downstream applications of PCR

## Agarose Gel Electrophoresis

### Learning Objectives (ILOs)

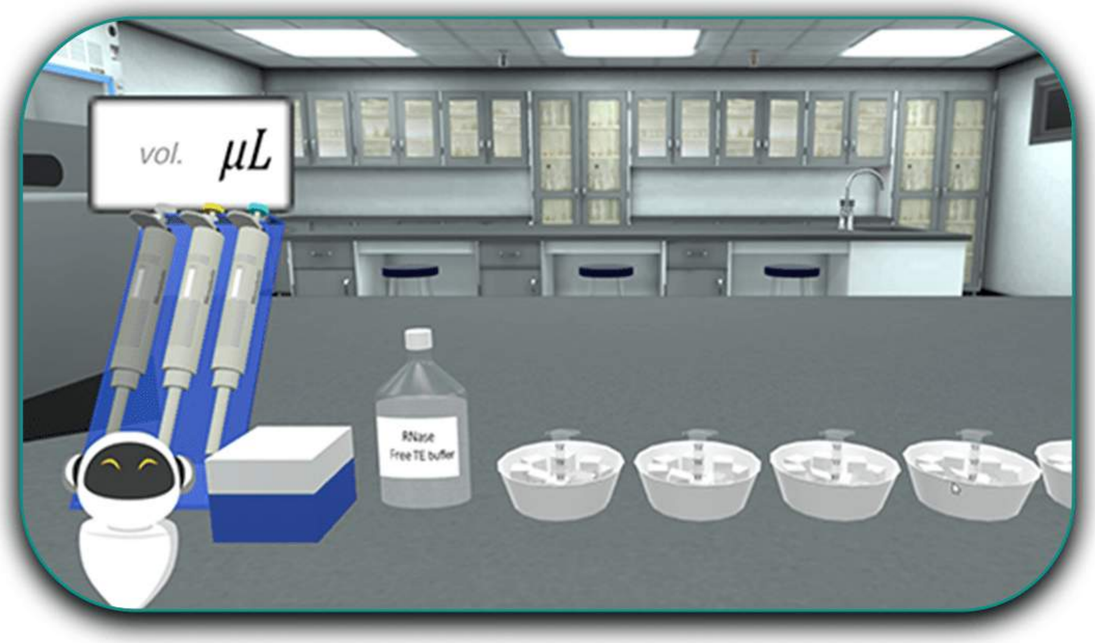
- Demonstrate proficiency with the protocol involved in agarose gel DNA electrophoresis
- Identify the role of specific reagents and equipment in DNA electrophoresis
- Prepare an agarose gel properly
- Visualize and understand the precautions required during sample application in the gel
- Practice basic laboratory techniques
- Conclude downstream applications of DNA electrophoresis

## RNA Extraction


### Intended Learning Outcomes (ILOs)

- Demonstrate proficiency with the protocol involved in RNA extraction
- IIdentify the role of specific reagents and equipment in the extraction of RNA
- Practice basic laboratory techniques
- Conclude downstream applications of RNA extraction

## CDNA Synthesis




### Intended Learning Outcomes (ILOs)

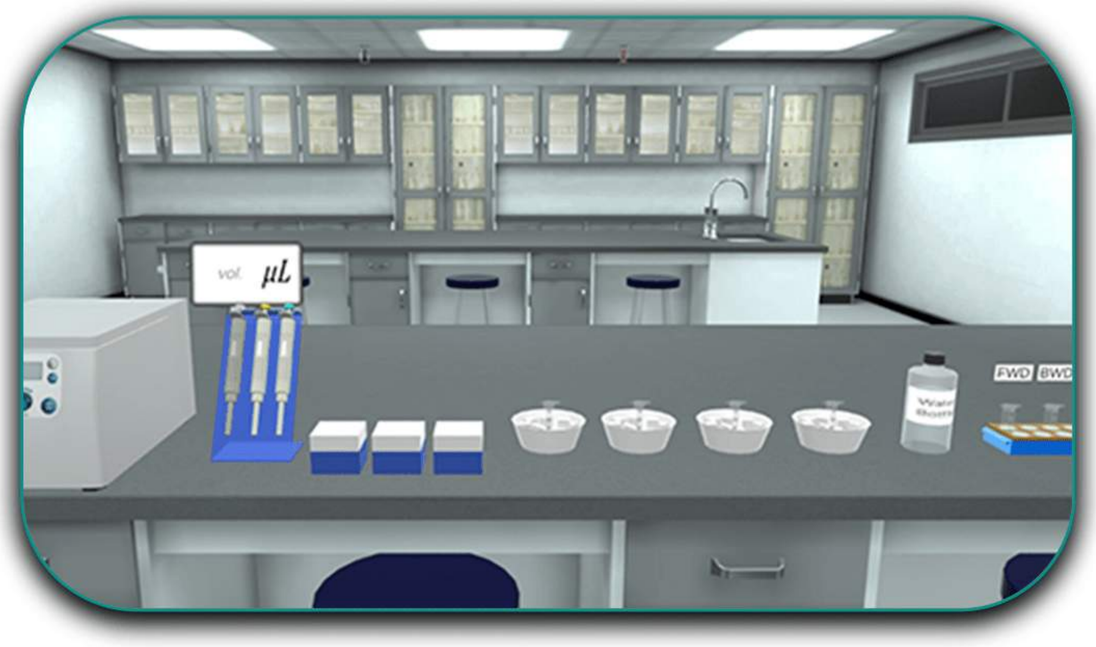
- Demonstrate proficiency with the protocol involved in cDNA Synthesis
- Identify the role of specific reagents and equipment in cDNA Synthesis
- Practice basic laboratory techniques

## Real-Time PCR


### Intended Learning Outcomes (ILOs)

- To identify the steps required to accomplish a successful RT-PCR experiment
- To gain hands-on experience of an RT-PCR protocol

## DNA Sequencing




### Intended Learning Outcomes (ILOs)

- To apply DNA sample purification using exosap IT
- To apply library preparation steps properly
- To understand and apply DNA fragmentation, adapter ligation, clean up and amplification of tagmented DNA
- To practice library normalization, denaturing and dilution
- To perform AMPure beads protocol to purify DNA libraries

# DNA Microarray

## Intended Learning Outcomes (ILOs)

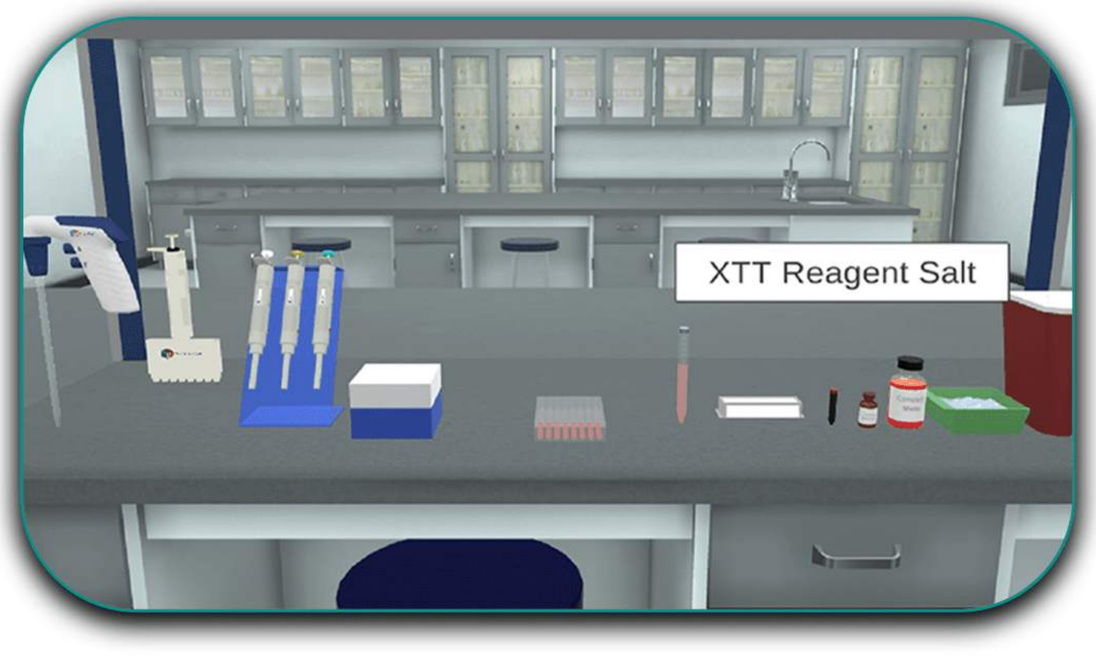
- Perform the steps for RNA amplification
- IPractice the laboratory protocols to synthesize cDNA, cRNA and fragment cRNA prior to hybridization
- Practice the technique for dual labelling of samples for microarray hybridization
- Apply the skills and precautions required for microarray slide handling and sample application
- Identify the benefits of positive displacement pipette
- Practice the process of microarray slide wash prior to detection

# Flow Cytometry Cell Cycle

## Intended Learning Outcomes (ILOs)

- To practice the steps of cell fixation and permeabilization
- To understand the concept of cell cycle analysis using propidium iodide

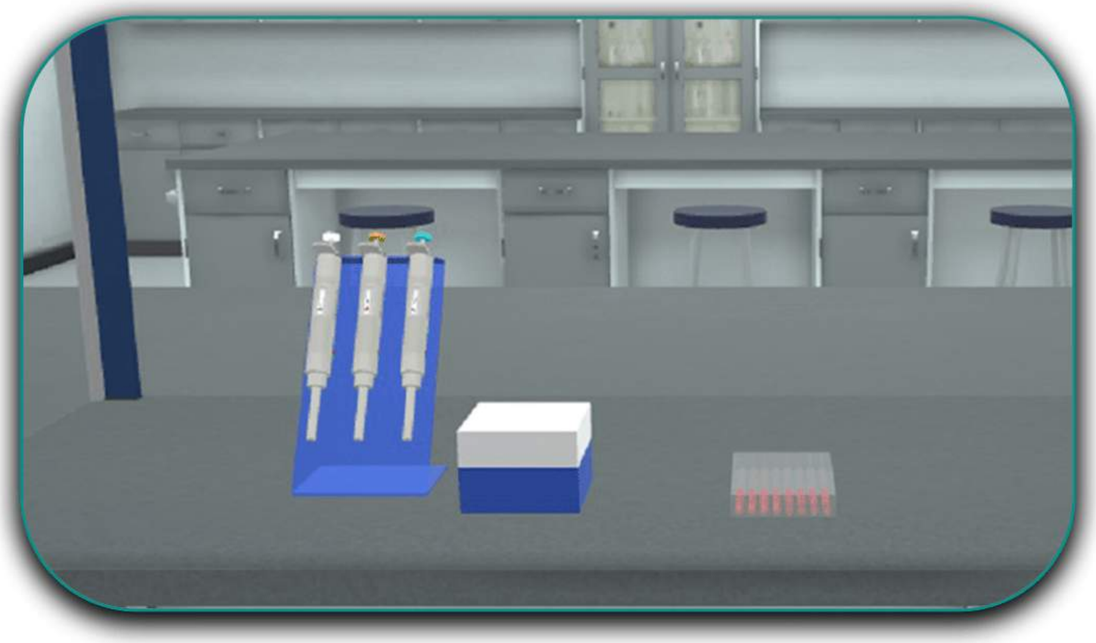
# XTT Viability Assay




## Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 96-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Aspirate the old medium and add the new medium containing the tested chemicals in the appropriate wells
- Add the XTT solution to cells and read the results using the microplate reader after incubation of cells
- Read the results of XTT and calculate the viability percent of cells exposed to different doses of tested chemical(s)

# In Vitro Cell Viability by the Lactate Dehydrogenase Assay (LDH)



## Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment

- Check the confluence and count cells under the microscope

- Dilute the cells to a specific count suitable for seeding in the 96-well plate

- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium

- Aspirate the old medium and add the new medium containing the tested chemicals in the appropriate wells

- Add the LDH assay substrate solution to cells and read the results using the microplate reader after incubation of cells

- Prepare desired concentrations of LDH standard solution in cell culture medium, and draw the standard curve

- Read the results of LDH and calculate the cytotoxicity percent for cells exposed to different doses of tested chemical(s)

# In Vitro Cell Viability by the Alamar Blue Assay


## Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment

- Check the confluence and count cells under the microscope

- Dilute the cells to a specific count suitable for seeding in the 96-well plate

- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium

- Aspirate the old medium and add the new medium containing the tested chemicals in the appropriate wells

- Add the Alamar Blue solution to cells and read the results using the microplate reader after incubation of cells

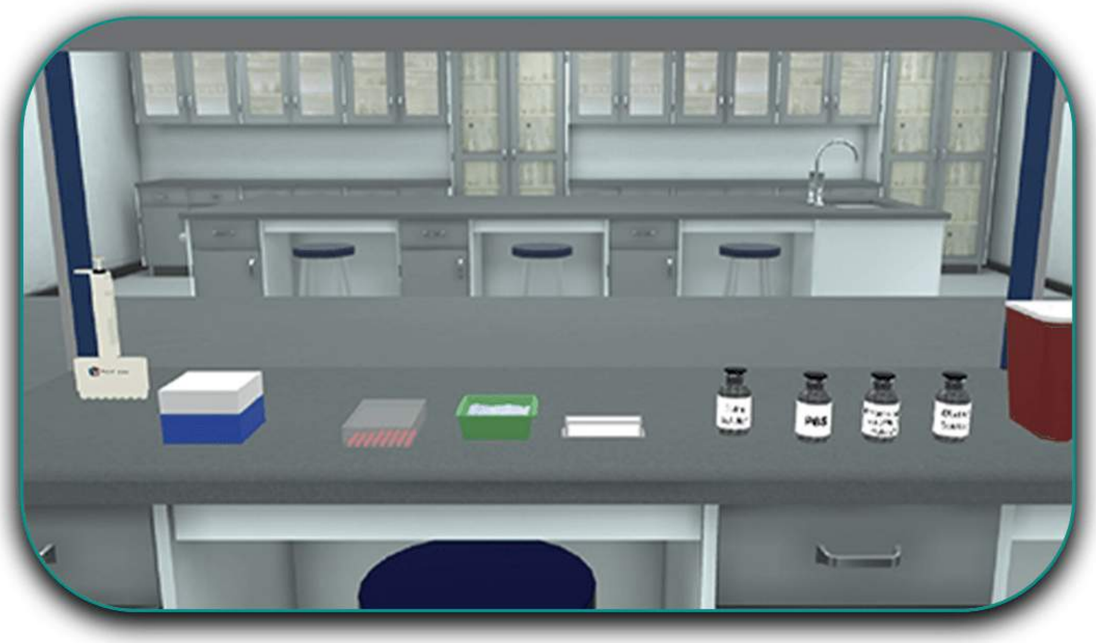
- Read the results of Resorufin and calculate the viability percent for cells exposed to different doses of tested chemical(s)

# In Vitro Mammalian Cells COMET Assay

## Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the cell culturing and sub-culturing
- Work and follow the general safety guidelines for Good Laboratory Practice (GLP)
- Strictly work and follow the Aseptic Techniques of cell culturing
- Thaw cells from Liquid Nitrogen and seed them in cell culture flasks
- Check the confluence, harvest cells, and count them microscopically
- Scaling up the cultured cells for the setting of further experiments.
- Freezing cells in Liquid Nitrogen for long-term storage

# In Vitro Histone H2AX Phosphorylation Assay



## Intended Learning Outcomes (ILOs)

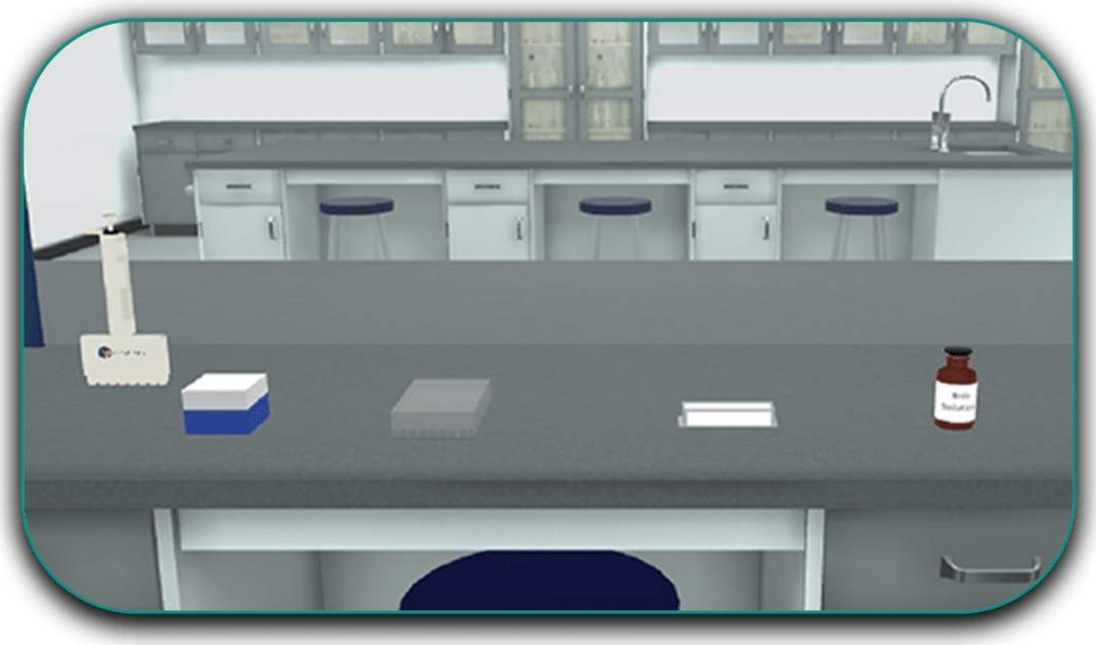
- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 96-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Aspirate the old medium and add the new medium containing the tested chemicals in the appropriate wells
- Add the H2AX Phosphorylation assay substrate solution to cells and read the results using the fluorescent microscope after incubation of cells

# In Vitro 8OHdG DNA Adduct Assay

## Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 96-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Aspirate the old medium and add the new medium containing the tested chemicals in the appropriate wells
- Add the blocking solution, first and secondary antibodies to cells and read the results using the fluorescent microscope after incubation of cells

# In Vitro Bromodeoxyuridin BrdU Assay



## Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 96-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Aspirate the old medium and add the new medium containing the tested chemicals in the appropriate wells
- Add the BrdU assay substrate solution to cells and read the results using the fluorescent microscope after incubation of cells with first anti-BrdU and secondary antibodies

## Annexin V Assay

### Intended Learning Outcomes (ILOs)

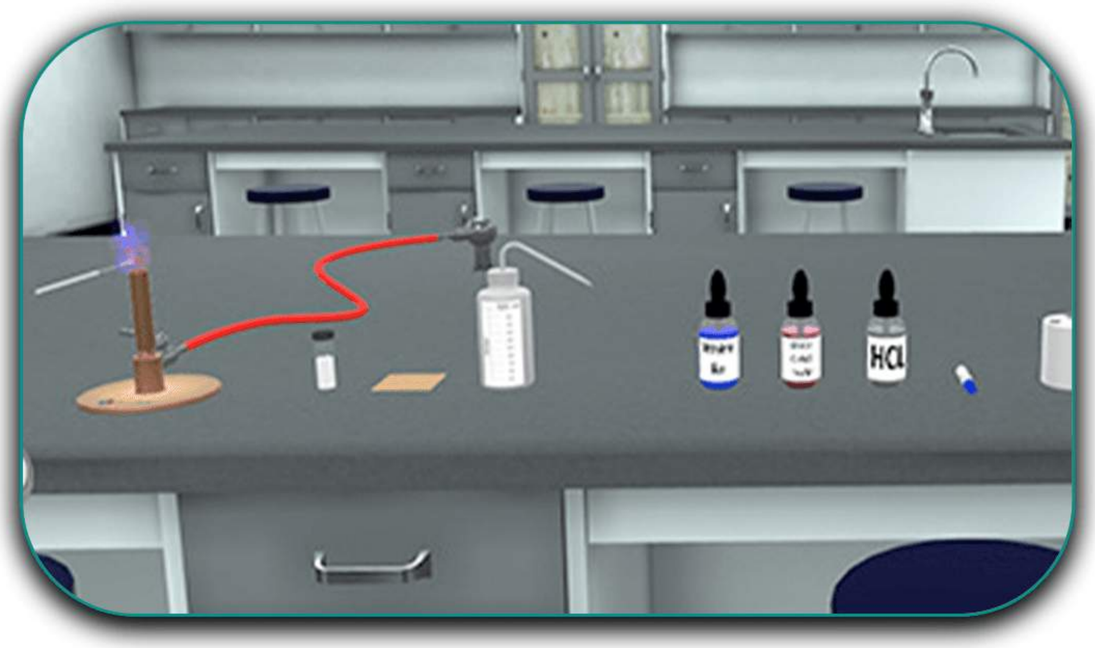
- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 96-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Treat cells with the cytotoxic agent(s) or nanoparticles and observe under the microscope
- Harvest cells with Annexin-V / Propidium Iodide buffer
- Analyze cells by fluorescent microscope and analyze resulted data. Represent and interpret the resulted data graphically using dot plots

## Gram Stain


### Intended Learning Outcomes (ILOs)

- Become proficient at performing the gram stain consistently and accurately
- Differentiate between various shapes, sizes, arrangements, and gram reactions of bacteria
- To differentiate between the two major categories of bacteria: Gram positive and Gram negative
- To understand how the Gram stain reaction affects Gram positive and Gram negative bacteria based on the biochemical and structural differences of their cell walls

## Ziehl-Neelsen Staining Technique




### Intended Learning Outcomes (ILOs)

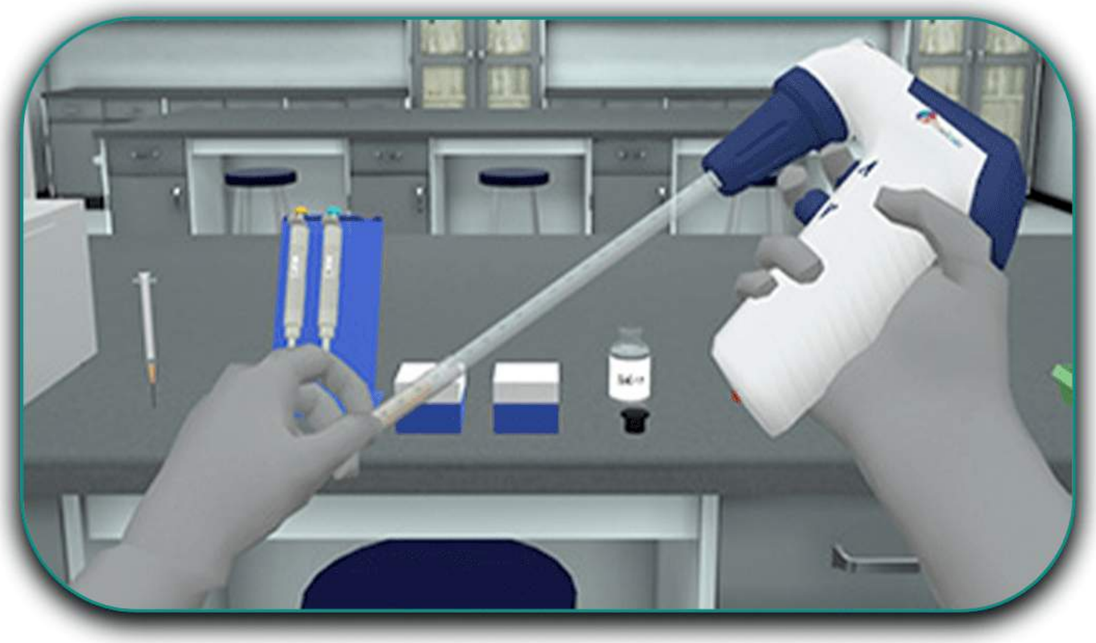
- Become proficient at performing the Ziehl-Neelsen stain consistently and accurately
- To differentiate between acid-fast bacilli and non-acid-fast bacilli
- To stain Mycobacterium species

## Cultivation and Preparation of the Virus in Chick Embryo

### Intended Learning Outcomes (ILOs)

- Become proficient at performing the viral cultivation consistently and accurately
- Student will learn the essential concepts of virology

## Preparation of Washed Red Blood Cells



### Intended Learning Outcomes (ILOs)

- Become proficient at performing preparation of washed RBCs consistently and accurately
- Student will learn the essential concepts of haematological tests

## Haemagglutination Tests

### Intended Learning Outcomes (ILOs)

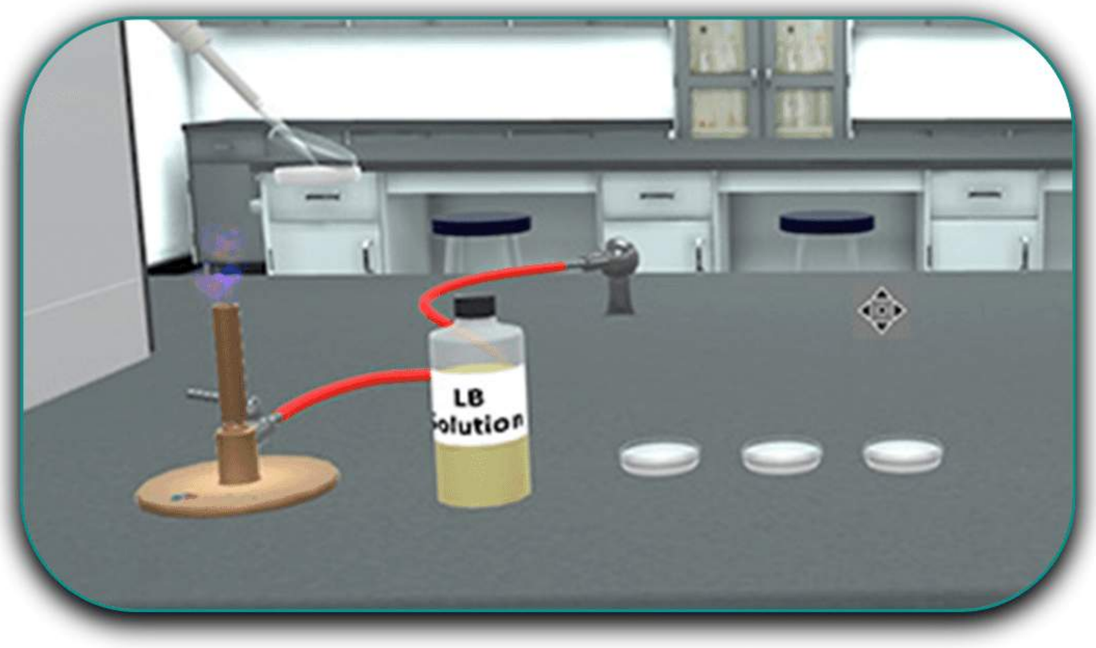
- Become proficient at performing Haemagglutination tests consistently and accurately
- Student will learn the essential concepts of haematological tests

## Cloning-DNA Isolation and Restriction Digestion

### Intended Learning Outcomes (ILOs)

- To Apply the steps of DNA extraction from a culture of Saccharomyces Cerevisiae
- To execute proper restriction enzyme digestion of DNA
- To understand the role of the devices, the reagents and the enzymes used in the process of DNA extraction
- To implement proper storage of samples

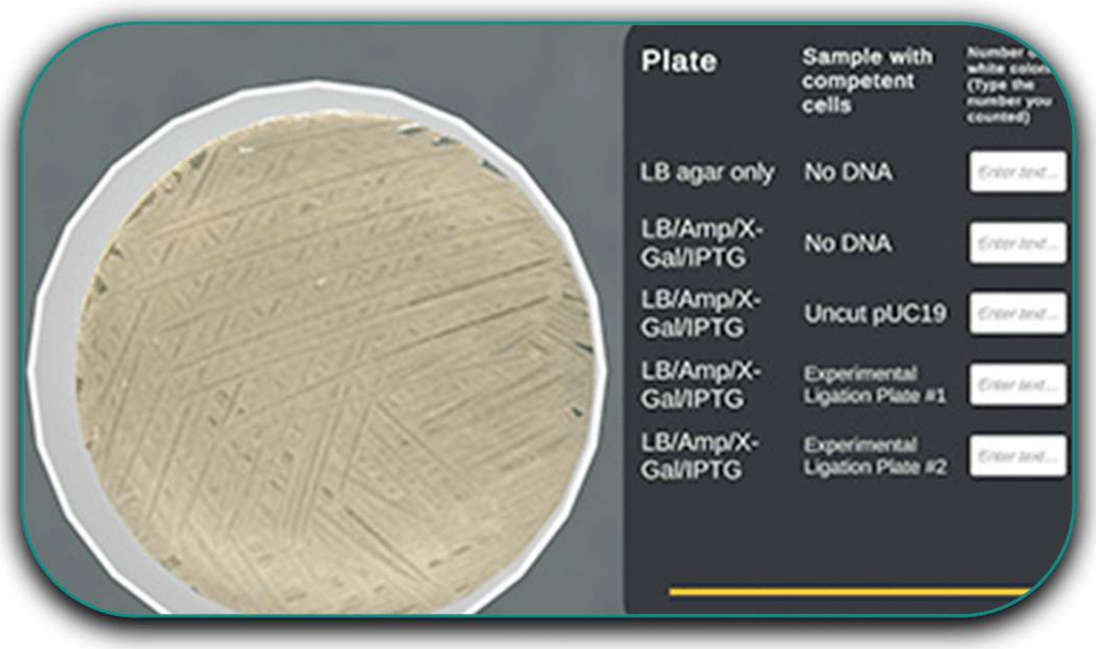
## Cloning-Transformation




### Intended Learning Outcomes (ILOs)

- To understand the role of the devices, the reagents and the enzymes used in the processes of Recombinant DNA molecule synthesis, competent cells preparation, transformation, and plating
- To apply the steps for recombinant DNA molecule synthesis
- To identify the lab setup required for Transformation and Plating procedures
- To execute a proper protocol for transformation and plating
- To perform the sterile technique
- To implement proper storage of samples

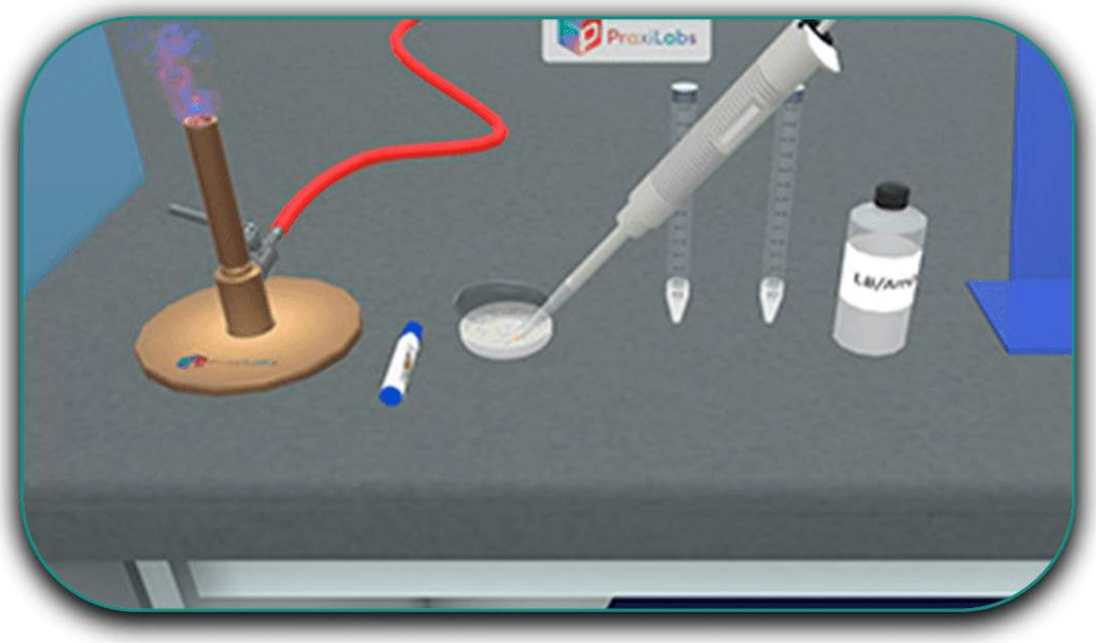
## Cloning-Blue and White Screening




### Intended Learning Outcomes (ILOs)

- To perform blue/white screening
- To interpret the results on each plate
- To calculate the transformation efficiency

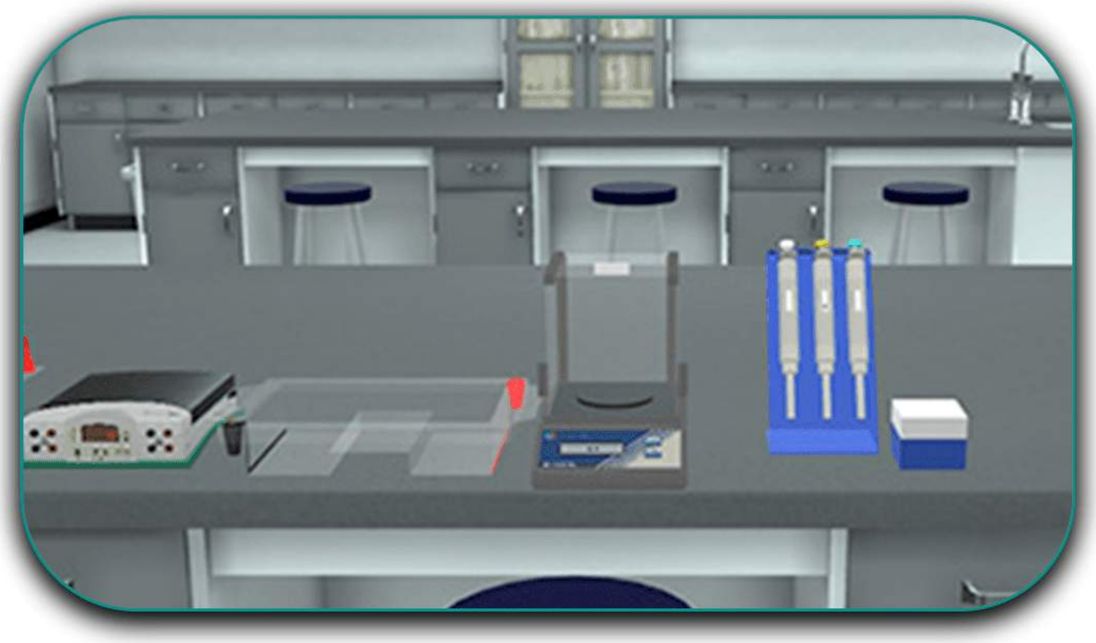
# Cloning-Growth and Isolation of Plasmid DNA using Alkaline Lysis Method



## Intended Learning Outcomes (ILOs)

- To apply the sterile technique while growing the bacterial culture
- To perform properly the steps of plasmid DNA isolation from bacteria using the alkaline lysis method
- To understand the role of the devices, the reagents and the enzymes used in the alkaline lysis method
- To implement proper storage of samples

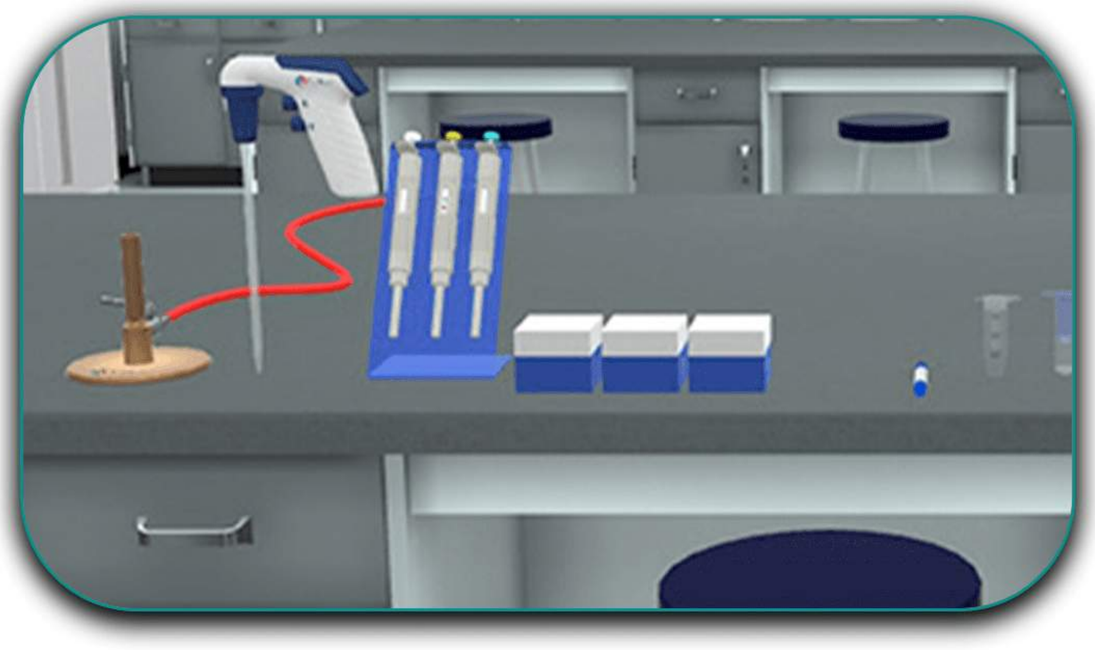
# Cloning-DNA Agarose Gel Electrophoresis of Digested Plasmid and Selection for Sequencing



## Intended Learning Outcomes (ILOs)

- To prepare the agarose gel properly
- To identify the concepts of gel electrophoresis
- To understand the role of the devices and the reagents used in the processes of agarose gel electrophoresis
- To load samples onto the gel
- To execute a proper run of agarose gel electrophoresis

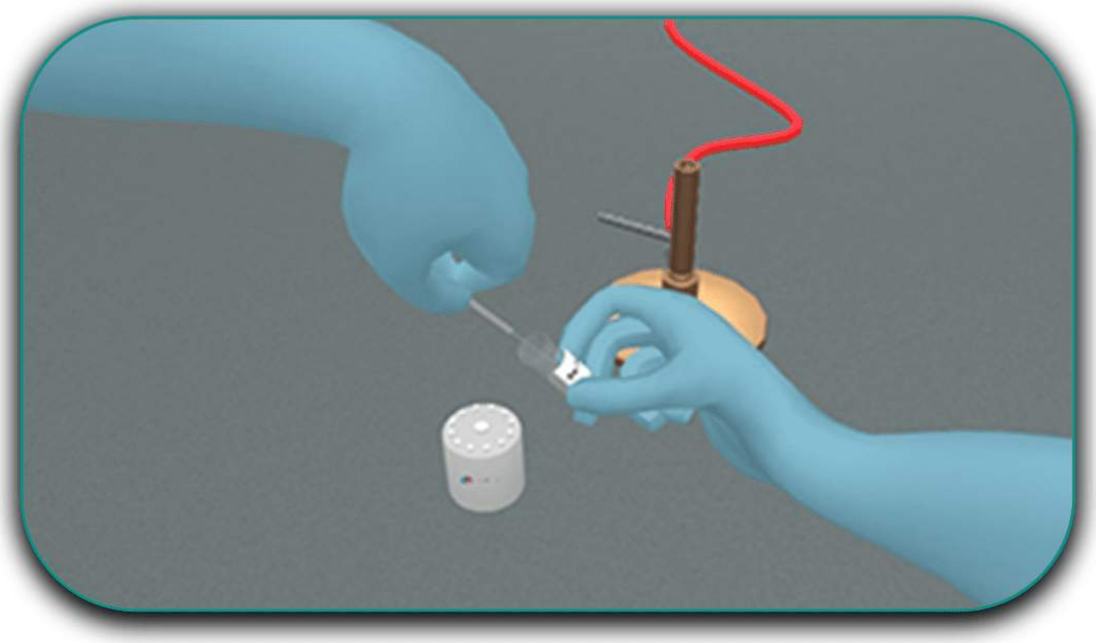
# Cloning-Isolation of Sequencing Grade Plasmid



## Intended Learning Outcomes (ILOs)

- To Apply the steps of high-quality DNA isolation
- To understand the role of the devices, the reagents, and the enzymes used in the process of DNA extraction
- To implement proper storage of samples

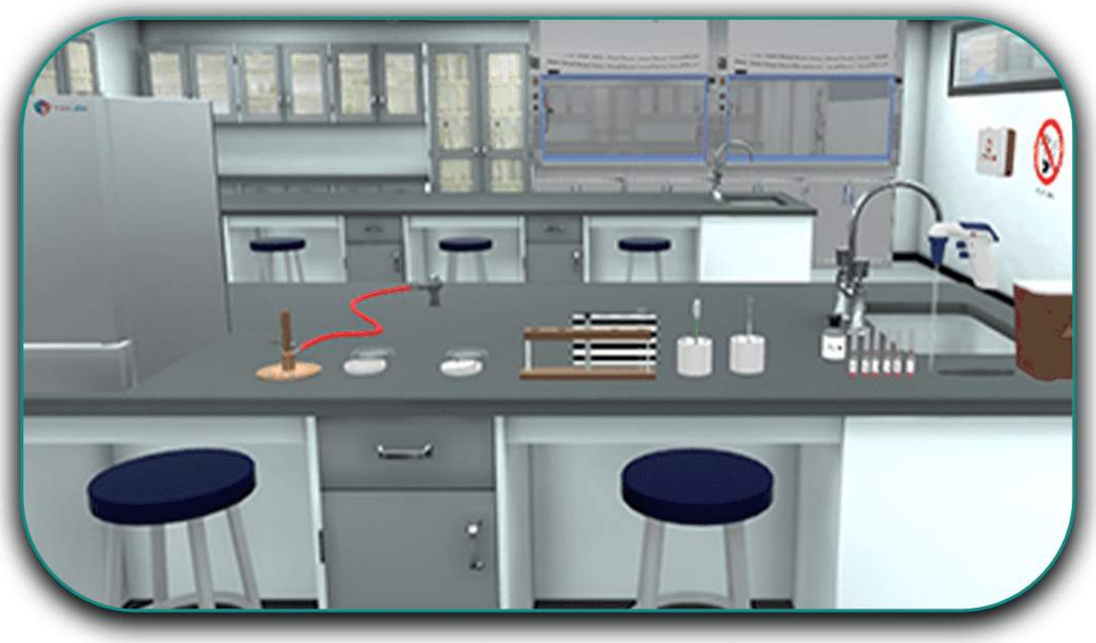
# Bacterial Plating Out Technique Experiment (Streak Plate Method)



## Intended Learning Outcomes (ILOs)

- Become proficient at performing streak plate method consistently and accurately
- Produce isolated colonies of an organism on an agar plate
- Identify the organism: biochemical tests to identify bacteria are only valid when performed on pure cultures

# Antibiotic Sensitivity Test (Disc Diffusion Method)



## Intended Learning Outcomes (ILOs)

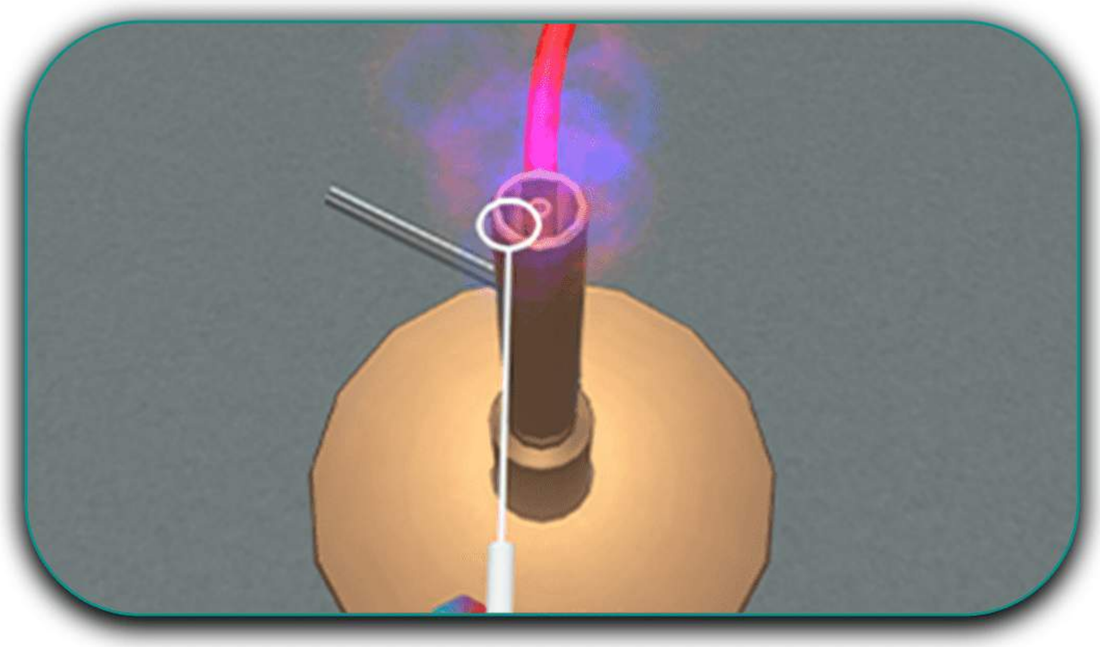
- To utilize specific monitoring techniques to evaluate the susceptibility of a microbe to different antibiotics
- To distinguish the range of activity of an antibiotic
- To perform the test

# Coagulase Test


## Intended Learning Outcomes (ILOs)

- To understand the biochemistry of the enzyme coagulase
- To explain how coagulase confers a survival advantage to bacteria that produce this enzyme
- To describe how pathogenic species of Staphylococci can be differentiated from nonpathogenic species
- To perform a coagulase test

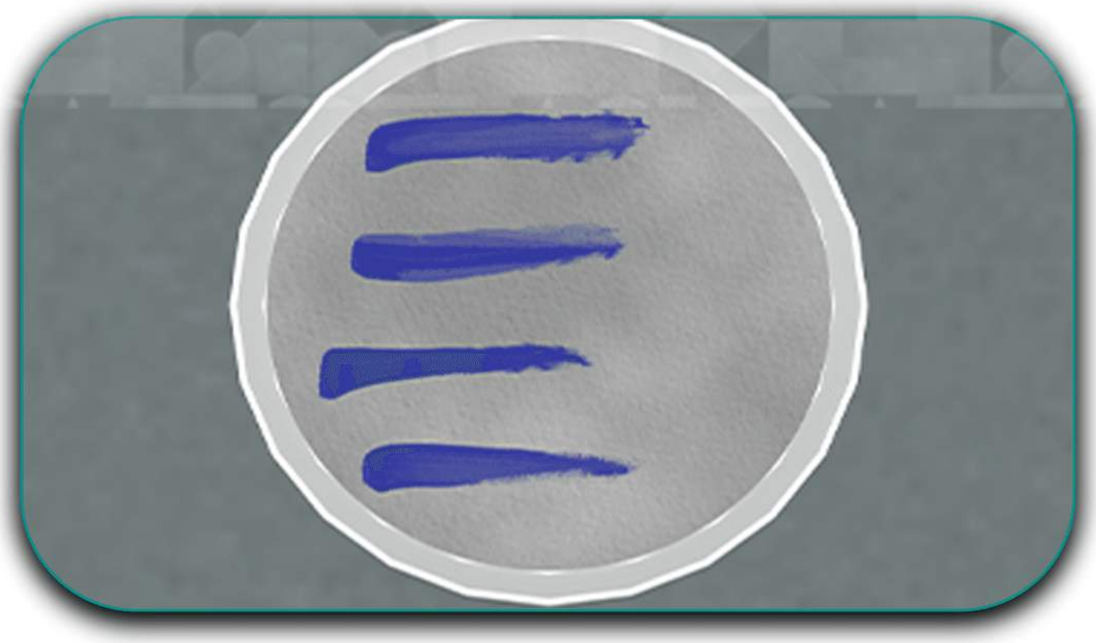
# Catalase Test



## Intended Learning Outcomes (ILOs)

- To understand the biochemical process of hydrogen peroxide detoxification by aerobic bacteria through the production of the enzyme catalase
- To describe how catalase production can be determined
- To perform the test

## Oxidase Test



### Intended Learning Outcomes (ILOs)

- Become proficient at performing the Oxidase test consistently and accurately
- Determine if an organism possesses the cytochrome oxidase enzyme
- Differentiate Neisseria, Moraxella, Campylobacter and Pasteurella species (oxidase positive) from other bacteria
- Differentiate pseudomonads from related species

## Indole Test

### Intended Learning Outcomes (ILOs)

- Become proficient at performing the Indole test consistently and accurately
- Determine if an organism possesses the tryptophanase enzyme
- Differentiate Proteus mirabilis (indole negative) from all other Proteus species (indole positive)
- Differentiate Klebsiella pneumoniae (indole negative) from Klebsiella oxytoca (indole positive)
- Differentiate Citrobacter freundii (indole negative) from Citrobacter koseri (indole positive)

## Spread Plate Technique

New


### Intended Learning Outcomes (ILOs)

- Become proficient at performing the spread plate method consistently and accurately.
- Perform viable plate counts, in which the total number of colony-forming units on a single plate is enumerated.
- Able to calculate the concentration of cells in the tube from which the sample was plated.

## Urease test

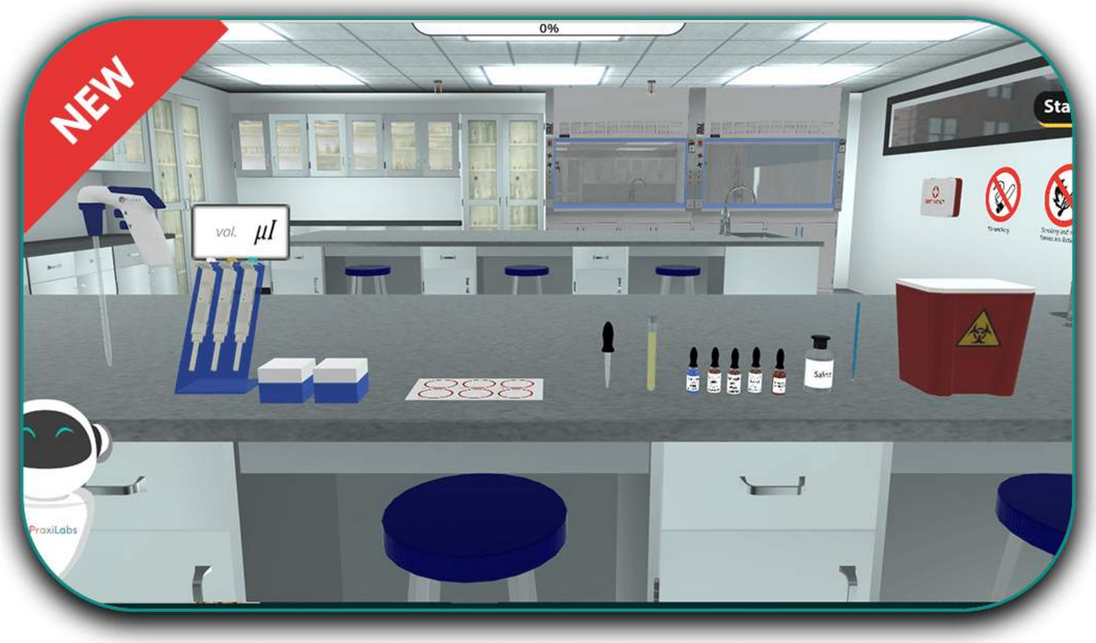
New


### Intended Learning Outcomes (ILOs)

- Become proficient at performing the urease test consistently and accurately.
- Differentiate between different members of lactose non-fermenting enteric microorganisms.

## Widal Test

New




### Intended Learning Outcomes (ILOs)

- To make a presumptive diagnosis of enteric fever, also known as typhoid fever.
- To perform the test.

## ELISA Sandwich


### Intended Learning Outcomes (ILOs)

- To practice the steps of a successful sandwich ELISA

- To explain the importance of the washing steps

## Flow Cytometry

### Intended Learning Outcomes (ILOs)

- To practice the steps of cell fixation and permeabilization

- To understand the concept of cell cycle analysis using propidium iodide

## Production of Monoclonal Antibodies (mAB) – Hybridomas Technique


### Intended Learning Outcomes (ILOs)

- Practice sterile cell culture techniques
- Evaluate the need to passage cells i.e. assess confluency
- Handle mice for immunization, including IV tail injection and intraperitoneal injection
- Practice serial dilution of serum
- Prepare single cell suspension out of the spleen of mice
- Perform the fusion technique using PEG
- Treat Hybridomas with HAT
- Prepare hybridomas for flow activated cell sorting FACS
- Screen hybridoma colonies for specific antibody production using ELISA

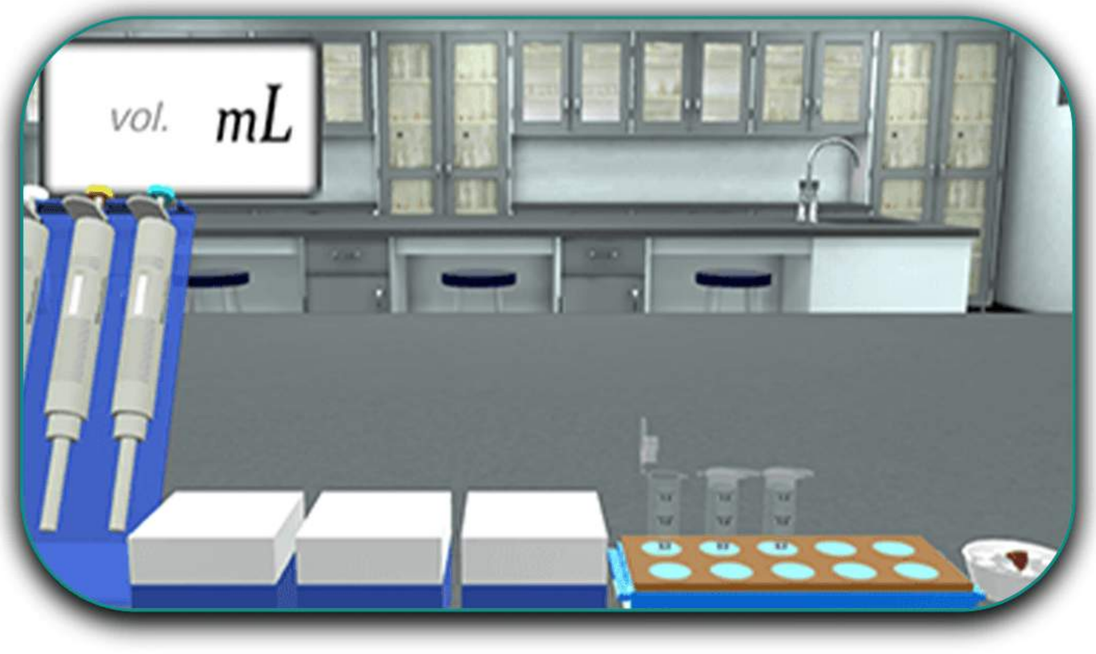
**Biochemistry** **Proteomics**

## Protein Electrophoresis (Polyacrylamide Gel Electrophoresis – PAGE)

### Intended Learning Outcomes (ILOs)

- Practice proper sample preparation for SDS-PAGE
- Prepare polyacrylamide gel properly
- Visualize the results of a successful protein electrophoresis run

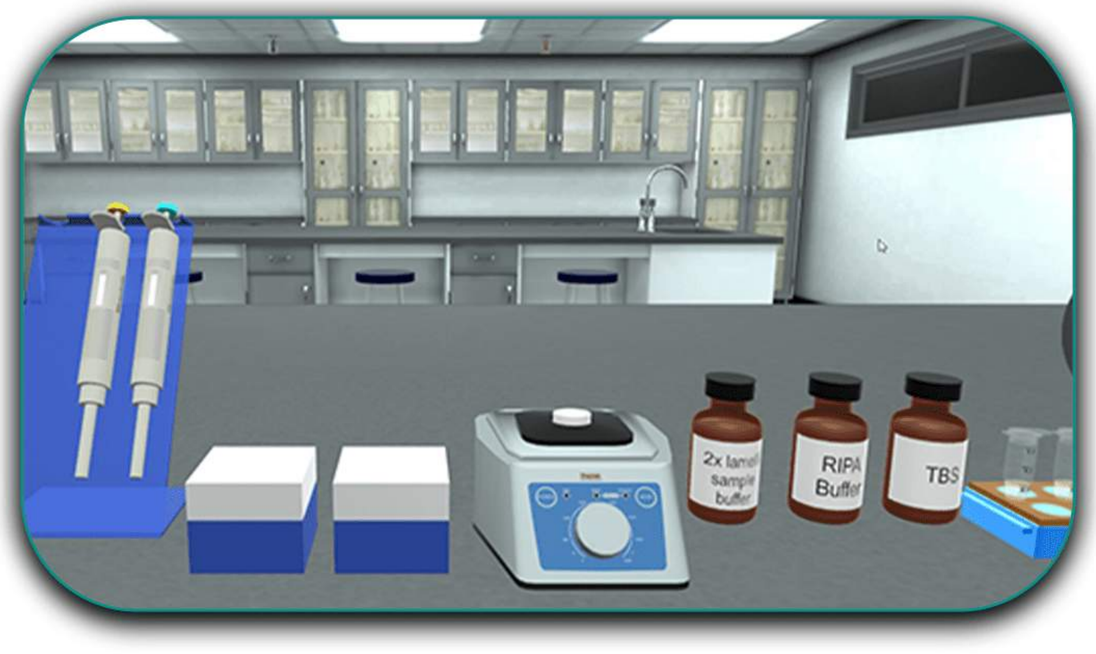
## 2D Protein Electrophoresis (Isoelectric Point Focusing, PAGE)




### Intended Learning Outcomes (ILOs)

- To describe the techniques used in proteomics to analyze and separate proteins
- To apply general guidelines for efficient protein extraction from samples
- To understand the principle of 2D SDS PAGE protein separation
- To practice the set up required for successful iso-electric focusing
- To practice the steps of preparation of SDS PAGE and perform a run
- To visualize the end results on gel and interprete them

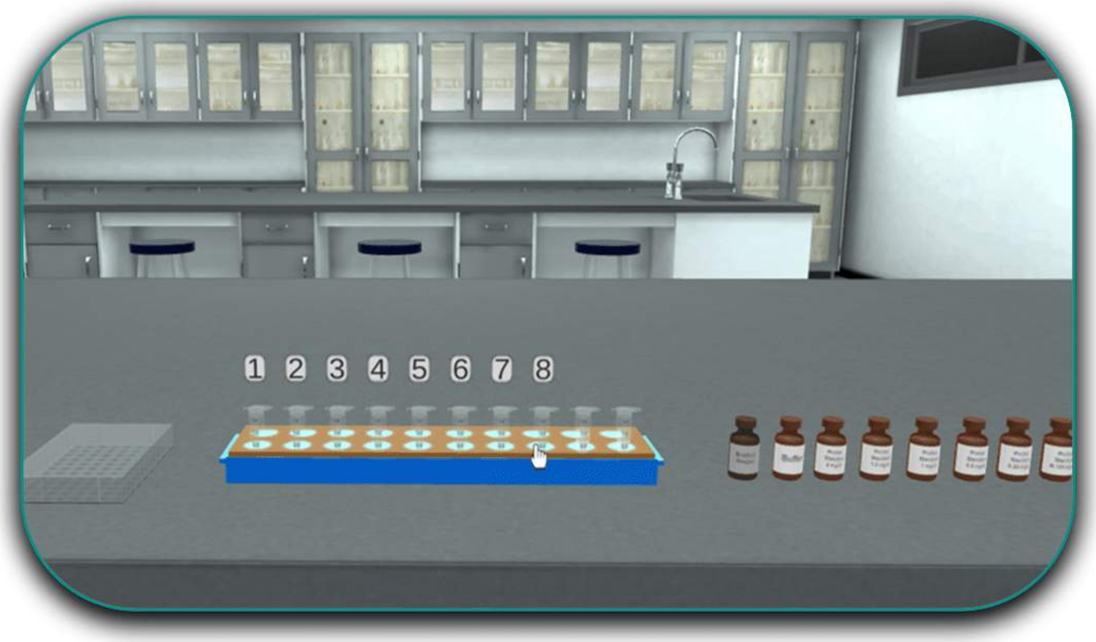
## Western Blot




### Intended Learning Outcomes (ILOs)

- To identify the theory behind western blot technique
- IITo fully comprehend the steps of western blot technique
- To design a complete western blot experiment
- To analyze the visualized protein

# Bradford Assay




## Intended Learning Outcomes (ILOs)

- Identify the amino acids that the Bradford Protein Assay measures

- Describe the color change that occurs when proteins combine with Coomassie dye under acidic conditions

- Perform serial dilutions of standard

- Illustrate the correct standard curve equation for an example BSA standard

- Interpret the standard curve equation when given example data

- Calculate the protein concentration of an example

- Recall the substance commonly used as standards in the assay and the device used to measure the color of the samples

# High Performance Liquid Chromatography


## Intended Learning Outcomes (ILOs)

- To prepare the mobile phase by vacuum filtration

- To prepare protein samples by acid hydrolysis prior to injection

- Perform online OPA/FMOC sample derivatization/ injection

- To list the parameters set for an HPLC run

- To visualize results of HPLC on a chromatogram

## Adherent Cell Culturing using Mammalian Cell Lines

### Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in cell culturing and subculturing

- Work and follow the general safety guidance for Good Laboratory Practice (GLP)

- Strictly work and follow the Aseptic Techniques of cell culturing

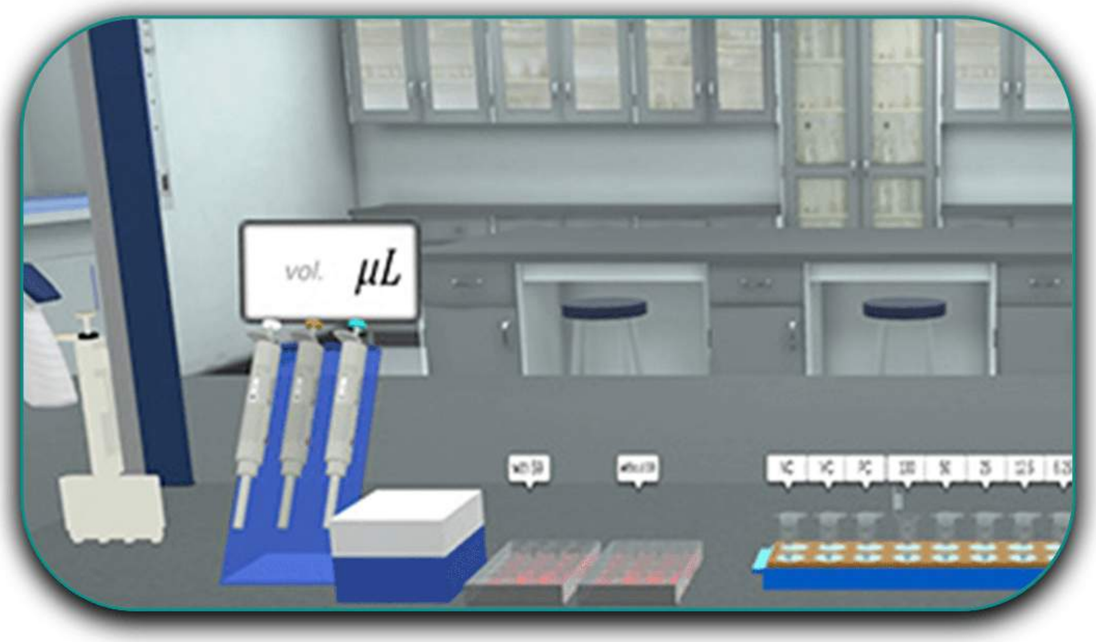
- Thaw cells from Liquid Nitrogen and seed them in cell culture flasks

- Check the confluence, harvest cells, and count them microscopically

- Scale up the cultured cells for setting up further experiments

- Freeze cells in Liquid Nitrogen for long-term storage

## In Vitro Cytokinesis-Block Micronucleus Assay (CBMN Assay)




### Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment

- Check the confluence and count cells under the microscope

- Dilute the cells to a specific count suitable for seeding in the 24-well plate

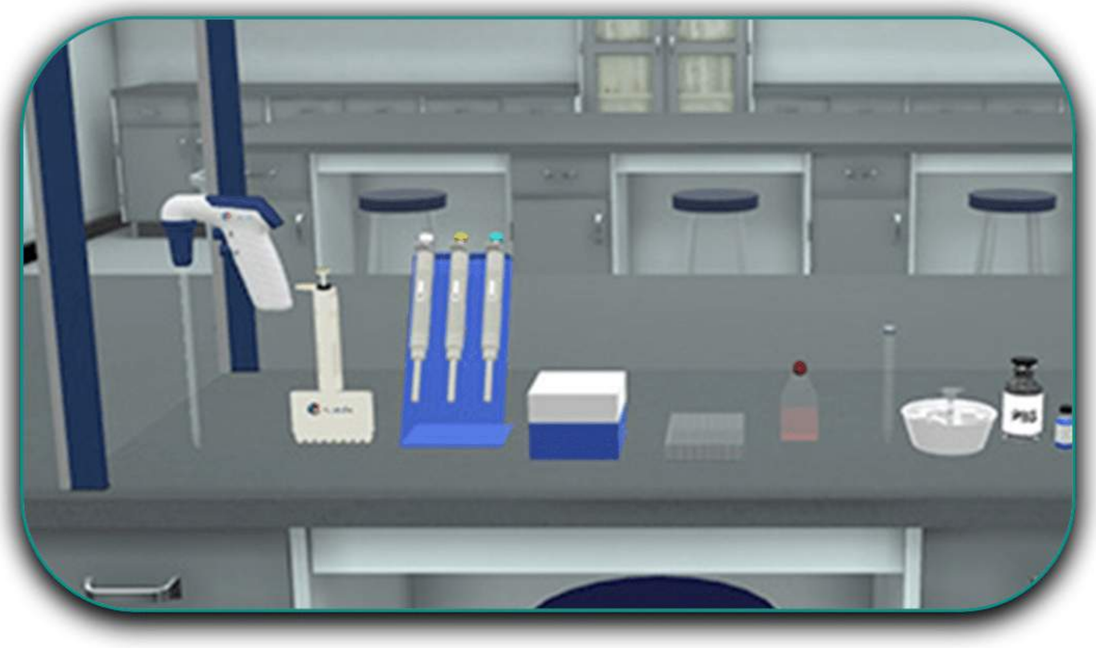
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium

- Treat cells with the genotoxic agent(s) or nanoparticles and observe under the microscope Harvest cells, fix them and stain with Giemsa stain

- Analyze cells by light microscope and evaluate analyzed data

- Represent and interpret the resulting data graphically using dot plots

# In Vitro Chromosomal Aberrations Test



## Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment

- Check the confluence and count cells under the microscope

- Dilute the cells to a specific count suitable for seeding in the 24-well plate

- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium

- Treat cells with the genotoxic agent(s) or nanoparticles and observe under the microscope Harvest cells, fix them, and stain with Giemsa stain

- Analyze cells by light microscope and evaluate analyzed data

- Represent and interpret the resulting data graphically using dot plots

# In Vitro Caspase 3 Activity Assay

## Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment

- Check the confluence and count cells under the microscope

- Dilute the cells to a specific count suitable for seeding in the 96-well plate

- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium

- Treat cells with the cytotoxic agent(s) or nanoparticles and observe under the microscope

- Treatment of cells with the caspase 3 primary and secondary antibodies

- Analyze cells by fluorescent microscope and analyze resulting data

- Represent and interpret the resulting data graphically

# In Vitro Fluorescein Diacetate/Propidium Iodide (FDA/PI) Staining Assay

## Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment

- Check the confluence and count cells under the microscope

- Dilute the cells to a specific count suitable for seeding in the 96-well plate

- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium

- Treat cells with the cytotoxic agent(s) or nanoparticles and observe under the microscope

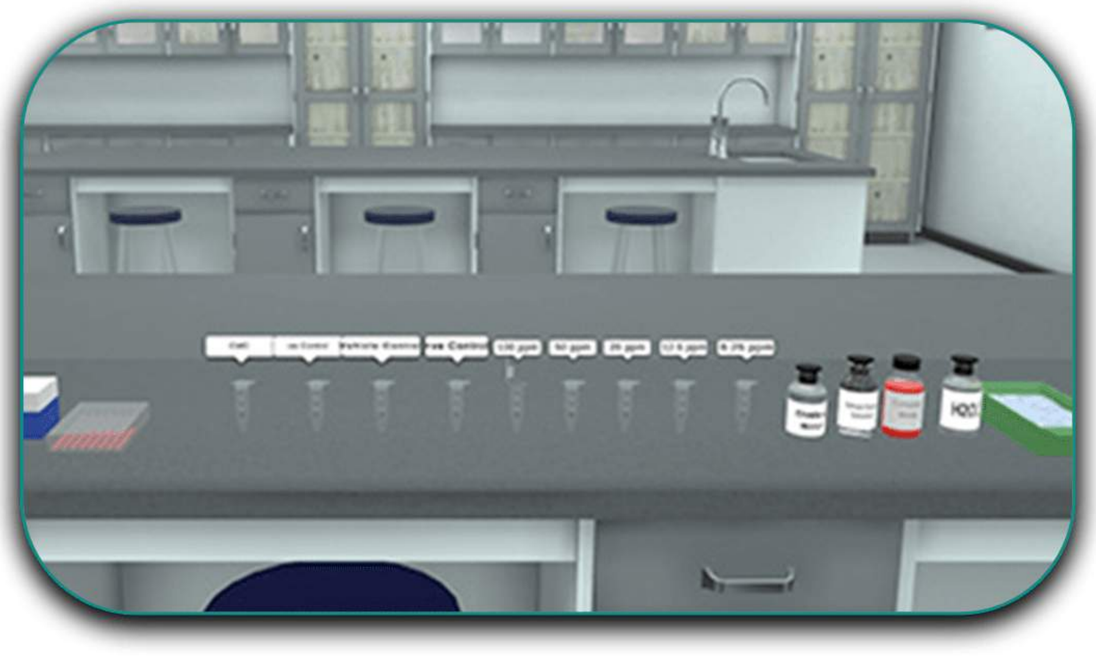
- Treatment of cells with the FDA/PI working solution in cell culture medium

- Count cells with bright green fluorescence (for viable cells), as well cells of bright red fluorescence (for dead cells) using fluorescence microscope

- Calculate the viability percent of viable and dead cells

- Represent the resulting data graphically and present it

# In Vitro Neutral Red Uptake Assay



## Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment

- Check the confluence and count cells under the microscope

- Dilute the cells to a specific count suitable for seeding in the 96-well plate

- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium

- Treat cells with the cytotoxic agent(s) or nanoparticles and observe under the microscope

- Treatment of cells with the Neutral Red-cell culture medium

- De-stain the Neutral Red and preparing the extracted solution for analysis

- Analyze color intensity of de-stain extracts by a microplate reader and analyze resulted data

- Represent and graphically locate the IC50 of the tested nanoparticles

# In Vitro Acid Phosphatase Assay for Cell Viability

## Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment

- Check the confluence and count cells under the microscope

- Dilute the cells to a specific count suitable for seeding in the 96-well plate

- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium

- Treat cells with the cytotoxic agent(s) or nanoparticles and observe under the microscope

- Treatment of cells with the Acid Phosphatase assay solution. Stopping the reaction and developing the color will be calorimetrically measured

- Analyze color intensity of the reaction by microplate reader and analyze resulted data

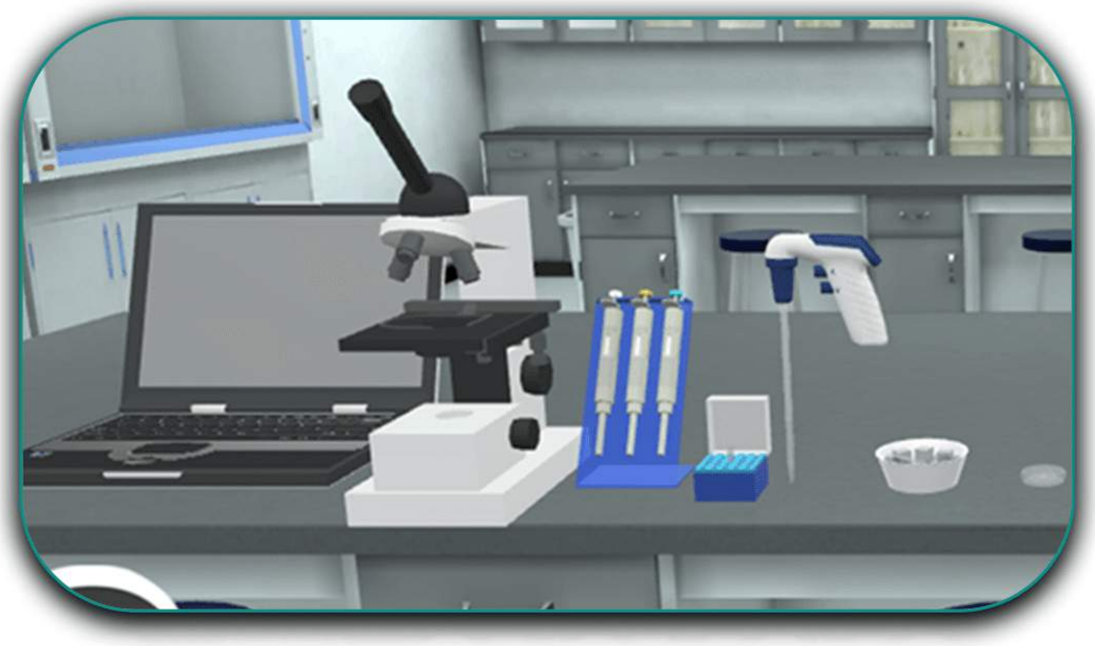
- Represent and graphically locate the IC50 of the tested nanoparticles

## ELISpot Assay

### Intended Learning Outcomes (ILOs)

- To understand the concept of ELISPOT assay
- To practice the steps of ELISPOT assay

## Immunofluorescence Assay Production of Monoclonal Antibodies Experiment



### Intended Learning Outcomes (ILOs)

- To understand the basic concepts of the Immunofluorescence Assay
- To apply indirect Immunofluorescence protocol
- To learn how to perform cell fixation
- To practice the 'washing technique' skill

## Production of Monoclonal Antibodies (mAB) – Hybridomas Technique


### Intended Learning Outcomes (ILOs)

- Practice sterile cell culture techniques
- Evaluate the need to passage cells i.e. assess confluency
- Handle mice for immunization, including IV tail injection and intraperitoneal injection
- Practice serial dilution of serum
- Prepare single cell suspension out of the spleen of mice
- Perform the fusion technique using PEG
- Treat Hybridomas with HAT
- Prepare hybridomas for flow activated cell sorting FACS
- Screen hybridoma colonies for specific antibody production using ELISA

# Biochemistry | Bioenergetics

## Building a Model for Catalytic Interactions


### Intended Learning Outcomes (ILOs)

- The answer to the investigative questions: Why do the biochemical reactions require catalysts? What are the expected results of the experiment in the absence of enzymes in the term of speeding up or slowing down the rate of the reactions or even their occurrence?

## Polarographic Oxygen Respirometry

### Intended Learning Outcomes (ILOs)

- Set up a polarographic oxygen respirometry
- Run a simple biological specimen's response to both the inhibition and the uncoupling of the electron transport chain
- Collect and analyze the raw data
- Plot the data and draw informed conclusions

Molecular Biology | Genetics | Microbiology | Biochemistry | Forensic

## DNA Fingerprinting using Gel Electrophoresis

### Intended Learning Outcomes (ILOs)

- List the steps required for the preparation of an optimum agarose gel
- Evaluate the role and value of chemicals and reagents used in the experiment
- Illustrate the setup required for gel electrophoresis
- Enlist factors that lead to successful sample upload into the gel Visualize DNA fragments
- Identify and distinguish DNA molecules that have been processed by a previous method such as PCR and enzymatic digestion
- Interpret results on a gel UV transilluminator and solve medi-co-legal cases
- Identify the characteristics of restriction sites in a DNA sequence

## Spread Plate Technique

New


### Intended Learning Outcomes (ILOs)

- Become proficient at performing the spread plate method consistently and accurately.
- Perform viable plate counts, in which the total number of colony-forming units on a single plate is enumerated.
- Able to calculate the concentration of cells in the tube from which the sample was plated.

## Urease test

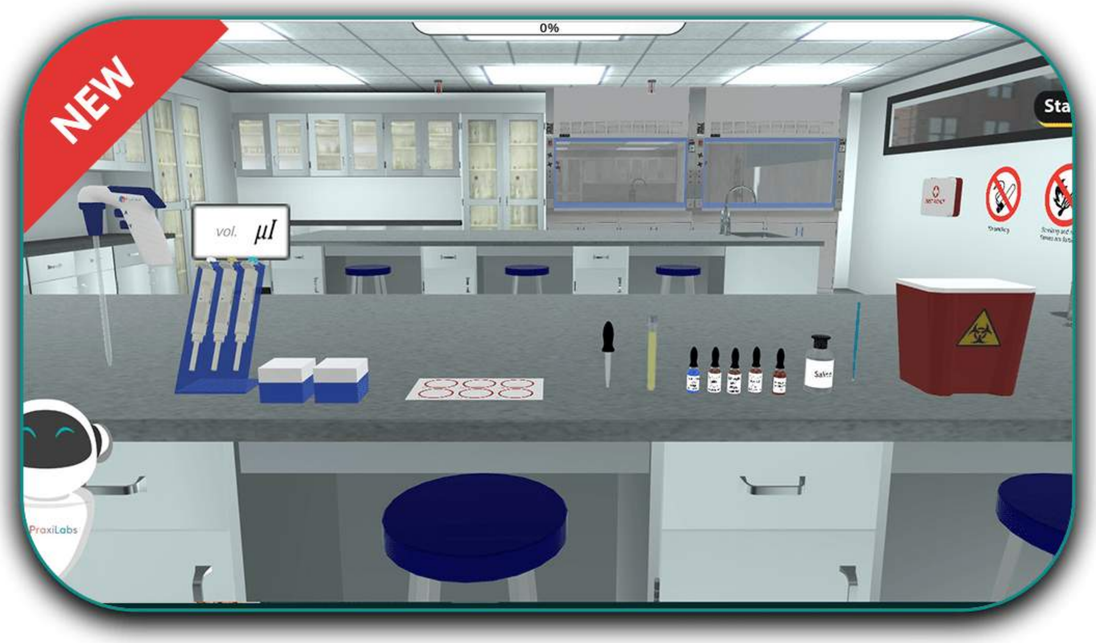
New


### Intended Learning Outcomes (ILOs)

- Become proficient at performing the urease test consistently and accurately.
- Differentiate between different members of lactose non-fermenting enteric microorganisms.

# Widal Test

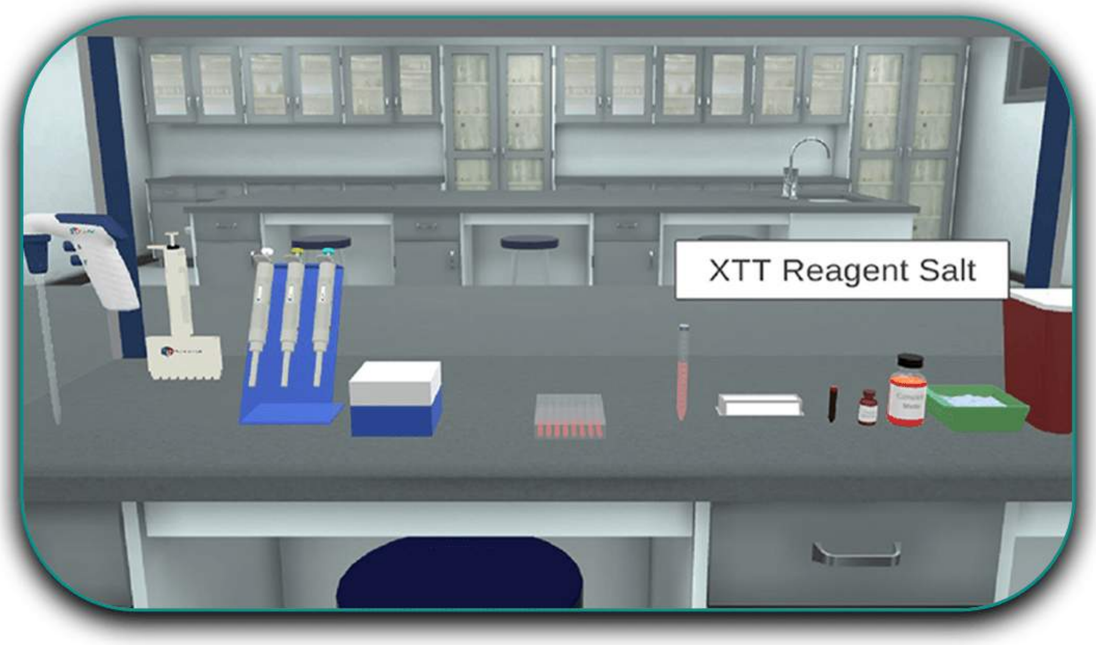
New




## Intended Learning Outcomes (ILOs)

- To make a presumptive diagnosis of enteric fever, also known as typhoid fever.
- To perform the test.

## XTT Viability Assay




### Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment

- Check the confluence and count cells under the microscope

- Dilute the cells to a specific count suitable for seeding in the 96-well plate

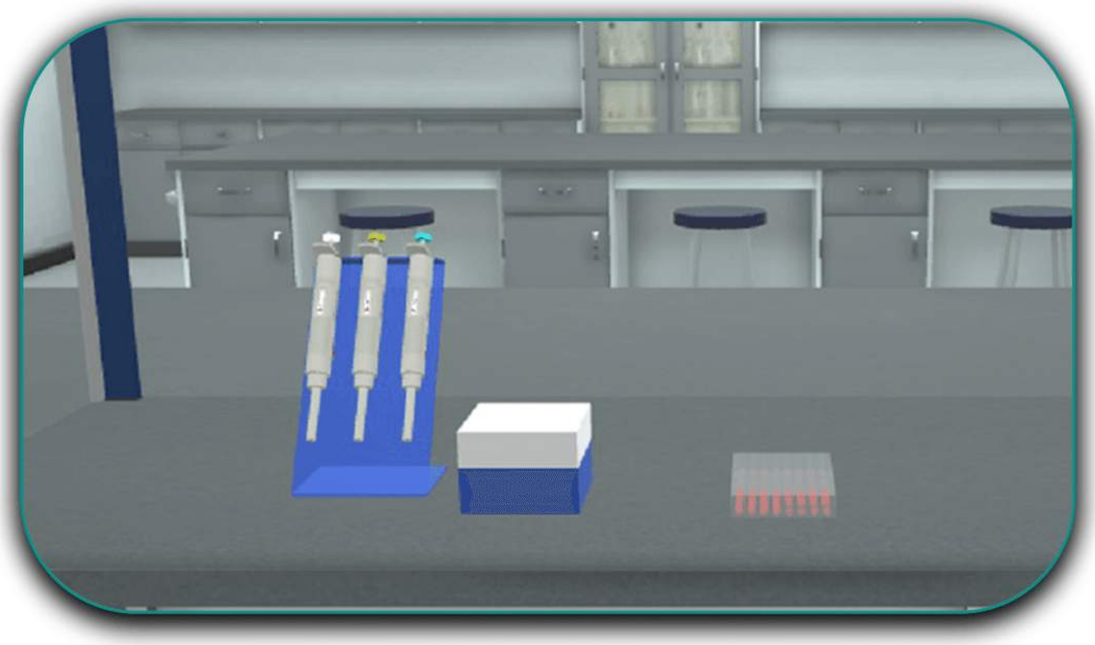
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium

- Aspirate the old medium and add the new medium containing the tested chemicals in the appropriate wells

- Add the XTT solution to cells and read the results using the microplate reader after incubation of cells

- Read the results of XTT and calculate the viability percent of cells exposed to different doses of tested chemical(s)

## In Vitro Cell Viability by the Lactate Dehydrogenase Assay (LDH)



### Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment

- Check the confluence and count cells under the microscope

- Dilute the cells to a specific count suitable for seeding in the 96-well plate

- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium

- Aspirate the old medium and add the new medium containing the tested chemicals in the appropriate wells

- Add the LDH assay substrate solution to cells and read the results using the microplate reader after incubation of cells

- Prepare desired concentrations of LDH standard solution in cell culture medium, and draw the standard curve

- Read the results of LDH and calculate the cytotoxicity percent for cells exposed to different doses of tested chemical(s)

## In Vitro Cell Viability by the Alamar Blue Assay


### Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment

- Check the confluence and count cells under the microscope

- Dilute the cells to a specific count suitable for seeding in the 96-well plate

- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium

- Aspirate the old medium and add the new medium containing the tested chemicals in the appropriate wells

- Add the Alamar Blue solution to cells and read the results using the microplate reader after incubation of cells

- Read the results of Resorufin and calculate the viability percent for cells exposed to different doses of tested chemical(s)

## In Vitro Mammalian Cells COMET Assay


### Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the cell culturing and sub-culturing

- Work and follow the general safety guidelines for Good Laboratory Practice (GLP)

- Strictly work and follow the Aseptic Techniques of cell culturing

- Thaw cells from Liquid Nitrogen and seed them in cell culture flasks

- Check the confluence, harvest cells, and count them microscopically

- Scaling up the cultured cells for the setting of further experiments.

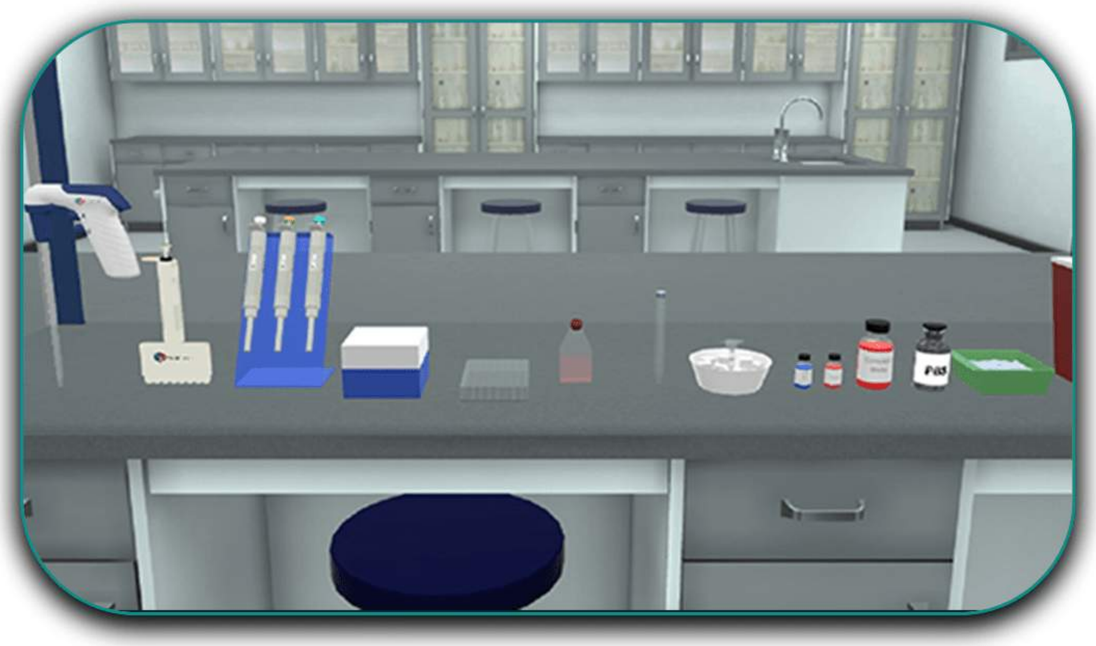
- Freezing cells in Liquid Nitrogen for long-term storage

# In Vitro Histone H2AX Phosphorylation Assay

## Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 96-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Aspirate the old medium and add the new medium containing the tested chemicals in the appropriate wells
- Add the H2AX Phosphorylation assay substrate solution to cells and read the results using the fluorescent microscope after incubation of cells

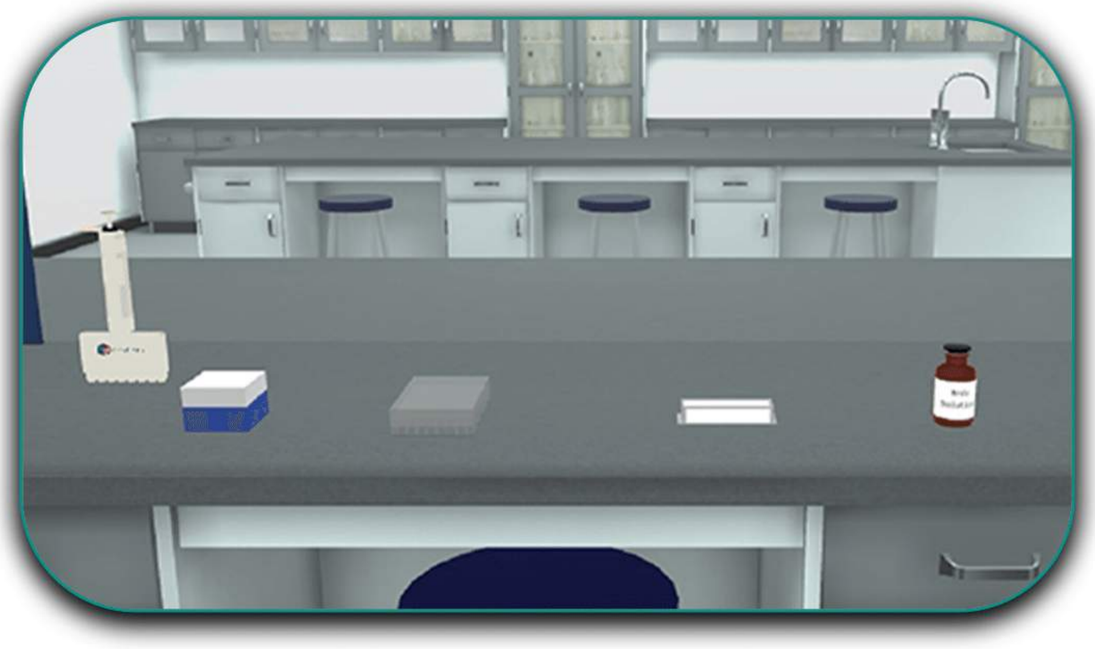
# In Vitro 8OHdG DNA Adduct Assay



## Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment
- Check the confluence and count cells under the microscope
- Dilute the cells to a specific count suitable for seeding in the 96-well plate
- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium
- Aspirate the old medium and add the new medium containing the tested chemicals in the appropriate wells
- Add the blocking solution, first and secondary antibodies to cells and read the results using the fluorescent microscope after incubation of cells

# In Vitro Bromodeoxyuridin BrdU Assay



## Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment

- Check the confluence and count cells under the microscope

- Dilute the cells to a specific count suitable for seeding in the 96-well plate

- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium

- Aspirate the old medium and add the new medium containing the tested chemicals in the appropriate wells

- Add the BrdU assay substrate solution to cells and read the results using the fluorescent microscope after incubation of cells with first anti-BrdU and secondary antibodies

# Annexin V Assay

## Intended Learning Outcomes (ILOs)

- Successfully handle the required instruments and consumables needed in the experiment

- Check the confluence and count cells under the microscope

- Dilute the cells to a specific count suitable for seeding in the 96-well plate

- Calculate the concentration of tested chemicals and prepare the calculated doses in the cell culture medium

- Treat cells with the cytotoxic agent(s) or nanoparticles and observe under the microscope

- Harvest cells with Annexin-V / Propidium Iodide buffer

- Analyze cells by fluorescent microscope and analyze resulted data. Represent and interpret the resulted data graphically using dot plots

## Amylase Test

New


### Learning Objectives (ILOs)

- Handle the required instruments and consumables in the present experiments.
- Determine the time at which I2 solution color changes in presence of SA under different conditions.
- Determine the optimum conditions for detecting SA activity.

## Red Blood Cell Count

New


### Learning Objectives (ILOs)

- Handle the required instruments and consumables in the present experiments.
- Adjust the hemocytometer and assign the RBC medium squares and differentiate them from the other squares under the light microscope.
- Learn how to dilute the blood to enumerate the RBCs using a 40X lens of the light microscope.
- Calculate the total number of RBCs in the diluted blood and multiply it by the dilution factor to calculate the total number of RBCs in one milliliter of the blood.

# General

## Safety Laboratory


### Learning Objectives (ILOs)

- Identify different safety signs
- Distinguish between different types of signs
- Practice a real experiment applying safety measures
- Anticipate right and wrong actions in a science lab
- Examine material safety data sheet
- Decide what to do if small accidents could happen