



# **Online Hands-on Workshop: "Flow Cytometry – Principles, Techniques & Applications"**

 **Duration:** 4 Weeks (20 Sessions, 5 days/week)

 **Target Audience:** Biology, Biotechnology, Microbiology, Biochemistry, and related students

 **Mode:** Live Virtual Sessions + Recorded Lectures + Practical Data Analysis

---

## **Workshop Objectives:**

- ✓ Understanding the **fundamental principles and instrumentation of flow cytometry**
  - ✓ Learning **sample preparation, staining, and compensation techniques**
  - ✓ Hands-on experience with **flow cytometry data analysis** using **FlowJo/FCS Express**
  - ✓ Application of flow cytometry in **cell cycle analysis, immunophenotyping, apoptosis assays, and cancer research**
  - ✓ Troubleshooting common experimental challenges
- 

## **Week 1: Introduction to Flow Cytometry & Basics**

### **Live Sessions & Demonstrations:**

- ◆ **Basics of Flow Cytometry: Working Principle & Instrumentation**
- ◆ **Overview of Fluorophores, Excitation, and Emission Spectra**
- ◆ **Sample Preparation: Fixation, Permeabilization & Staining Methods**
- ◆ **Compensation, Gating Strategies & Controls**

### **Hands-on Practical (Virtual Lab & Data Analysis):**

- 🔗 **Virtual Flow Cytometry Simulation** – Understanding how a sample is processed
  - 🔗 **Single-Color Flow Cytometry Data Analysis (FlowJo/FCS Express)** – Gating & Histograms
  - 🔗 **Creating Fluorescence Compensation Controls in Analysis Software**
- 

## **Week 2: Immunophenotyping & Cell Viability Analysis**

✦ **Live Sessions & Demonstrations:**

- ✦ Introduction to **Fluorescent Antibodies & Immunophenotyping Panels**
- ✦ Designing an **Antibody Panel for Multi-color Flow Cytometry**
- ✦ Cell Viability & Live-Dead Discrimination Assays

✦ **Hands-on Practical (Virtual Lab & Data Analysis):**

- ✦ **Multi-Color Flow Cytometry Gating (CD Markers Analysis for Immunophenotyping)**
  - ✦ **Cell Viability Assay Data Analysis (Live-Dead Staining & Annexin V/PI Assay)**
  - ✦ **Plotting & Interpreting Multi-Color Flow Cytometry Data**
- 

## **Week 3: Cell Cycle, Apoptosis & Functional Assays**

✦ **Live Sessions & Demonstrations:**

- ✦ Understanding **Cell Cycle Analysis (PI Staining for DNA Content)**
- ✦ Apoptosis & Necrosis Detection using **Annexin V/PI Assay**
- ✦ ROS Detection & Functional Assays

✦ **Hands-on Practical (Virtual Lab & Data Analysis):**

- ✦ **Cell Cycle Analysis Using Propidium Iodide (PI) Staining in FlowJo**
  - ✦ **Apoptosis Detection Using Annexin V/PI & Data Interpretation**
  - ✦ **Reactive Oxygen Species (ROS) Detection & Mitochondrial Membrane Potential Assay**
- 

## **Week 4: Advanced Applications & Troubleshooting**

✦ **Live Sessions & Demonstrations:**

- ✦ Applications of Flow Cytometry in **Cancer Biology, Immunology & Drug Discovery**
- ✦ Single-Cell Flow Cytometry & Mass Cytometry (CyTOF)
- ✦ Best Practices in **Experimental Design, Troubleshooting & Data Reporting**

✦ **Hands-on Practical (Virtual Lab & Data Analysis):**

- ✦ **Case Study: Analyzing Flow Cytometry Data from Cancer Research**
  - ✦ **Flow Cytometry Panel Design – Interactive Exercise**
  - ✦ **Live Q&A and Data Troubleshooting Session**
- 

## ✦ **Special Features of the Online Workshop:**

- ✓ 📄 **Certificate of Completion**
- ✓ 🖥️ **Hands-on Data Analysis with FlowJo/FCS Express Software**
- ✓ 📊 **Real-world Case Studies & Flow Cytometry Applications**
- ✓ 📄 **Downloadable Protocols & Sample Data for Practice**
- ✓ 🛠️ **Panel Design & Experiment Planning Exercises**
- ✓ 🗣️ **Guest Lectures by Flow Cytometry Experts**

---

## **Final Week Mini-Project & Assessment**

To ensure a practical learning experience, the **final week** of the workshop will include a **mini-project** where participants apply their acquired knowledge to **analyze and interpret real flow cytometry data**.

---

### **🔗 Mini-Project: "Flow Cytometry Data Analysis & Interpretation"**

🎯 **Objective:** Participants will work with a **real or simulated dataset** from a research study (e.g., immunophenotyping, apoptosis detection, or cell cycle analysis) and apply learned techniques to analyze, interpret, and present their findings.

#### **🌟 Step 1: Project Selection (Day 18-19)**

Participants can choose from one of the following datasets:

- 1 **Immunophenotyping of Human Blood Cells** – Identification of CD4+ & CD8+ T-cells
- 2 **Cell Cycle Analysis in Cancer Cells** – Identifying G0/G1, S, and G2/M phases
- 3 **Apoptosis Assay (Annexin V/PI Staining)** – Evaluating early & late apoptosis
- 4 **ROS Detection in Oxidative Stress Studies** – Measuring ROS levels

#### **🌟 Step 2: Data Analysis (Day 19-20)**

Participants will:

- ✓ Apply **gating strategies** using FlowJo/FCS Express
- ✓ Perform **compensation, fluorescence intensity analysis, and population gating**
- ✓ Interpret **dot plots, histograms, and density plots**

#### **🌟 Step 3: Report Preparation & Submission (Day 20)**

- ✓ **Prepare a short scientific report (2-3 pages) or PowerPoint presentation**
- ✓ Include **figures, histograms, and key results**
- ✓ Discuss the **significance of findings and troubleshooting approaches**

#### **🌟 Step 4: Presentation & Q&A (Final Day)**

- ✓ **Participants will present their findings (5 minutes each)**
- ✓ **Panel Discussion with Flow Cytometry Experts** for review & feedback

---

## **📄 Final Assessment & Certification Criteria**

- ✓ **Active participation in hands-on sessions & quizzes**
- ✓ **Successful completion of the mini-project**
- ✓ **Submission & presentation of analyzed flow cytometry data**

🎓 Participants will receive a "Certificate of Completion" with a grade based on participation and final project performance.

---

#### ∞ Additional Support

- ✓ Participants will receive **sample datasets & access to FlowJo/FCS Express for analysis**
  - ✓ **Discussion forums & troubleshooting help** will be available throughout the workshop
  - ✓ Top presentations will be **featured in a digital showcase**
-