

Genomics, Transcriptomics & Proteomics

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Learning Objectives:

1. Advanced Omics Methodologies:

- Compare traditional Sanger sequencing with short-read (e.g., Illumina) and long-read platforms (e.g., PacBio, Oxford Nanopore), discussing how different underlying principles affect performance.
- Describe the RNA-Seq workflow—including recent advances in single-cell and spatial transcriptomics—to understand gene expression and cellular heterogeneity.
- Outline key principles of mass spectrometry-based proteomics, highlighting improvements in sensitivity and throughput.

2. Critical Evaluation of Study Design:

- Assess the strengths and limitations of various omics platforms (genomics, transcriptomics, proteomics) based on factors such as read length, error rate, throughput, and cost, and discuss how these factors guide technology selection for specific research needs.

Session Overview

1

Total Duration: 2.5 hours

Format: Group-based immersive VR plus web research, followed by application challenges

2

Phase 1: Immersive Exploration & Role Rotation

75 minutes

3

Phase 2: Application Challenges

60 minutes

4

Wrap-Up & Final Reflection

15 minutes



Materials & Group Setup

Equipment:

- 8 Meta Quest 3 VR headsets (two per group)
- Internet-enabled laptops/tablets for web research
- Shared document for collaborative note-taking

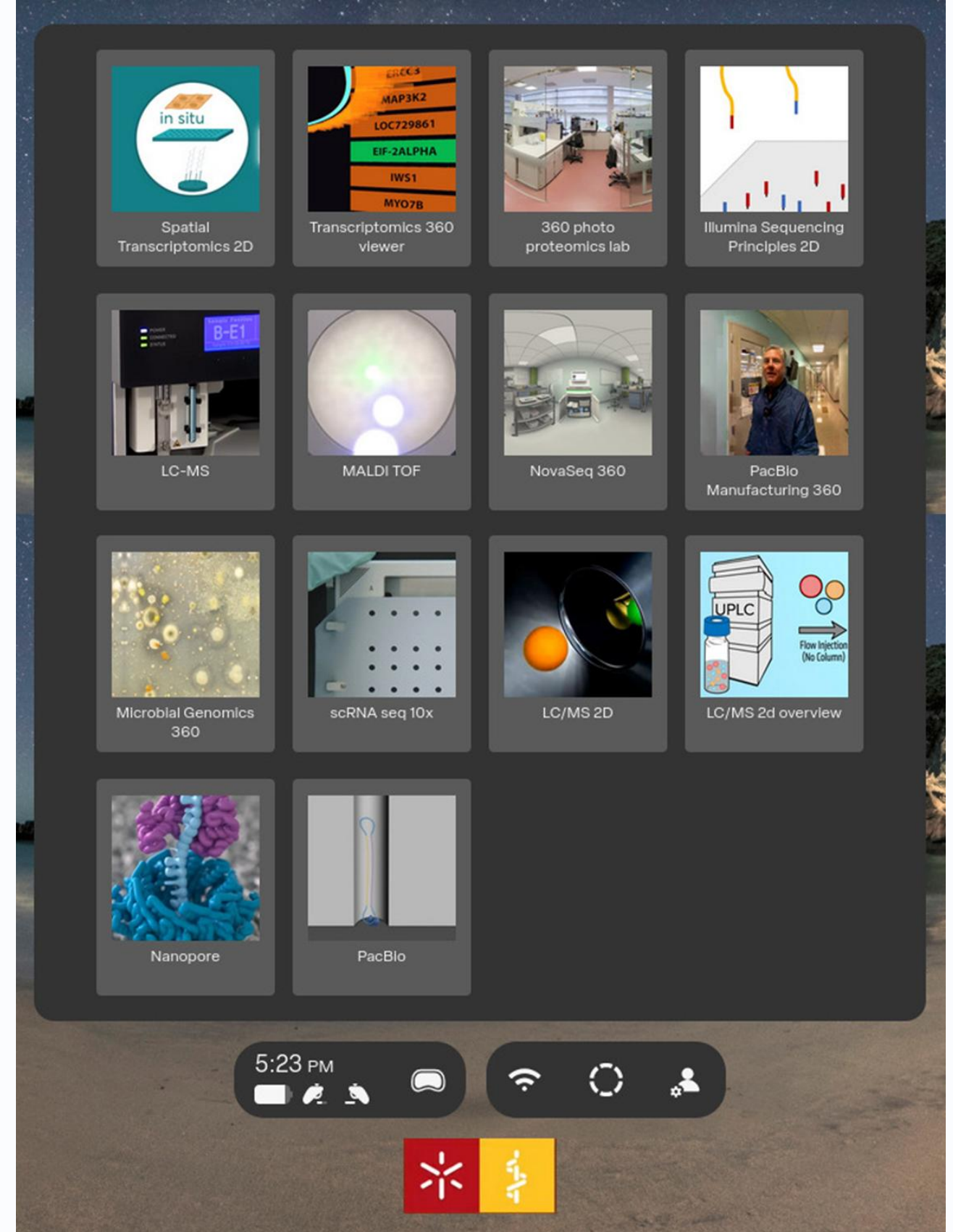
Group Organization:

- Students divided into 4 groups
- In each round, within group:
 - 2 Viewers (VR)
 - Web Search/Note-Takers
- Rotate roles each round so every student gets a turn as VR Viewer.

Resources

14 Videos:

- Genomics: Nanopore, PacBio, NovaSeq, Illumina, Microbial.
- Transcriptomics: Spatial, Transcriptomics, scRNAseq
- Proteomics: LC-MS, MALDI TOF





Phase 1 – Immersive Exploration & Role Rotation (75 Minutes)

Role Assignment

Each group designates two “VR Viewer” and “Web Search/Note-Takers.”

Role Rotation

Roles will rotate so every student experiences VR content.

Collaborative Learning

Share insights from both VR experiences and web research.



Phase 1 – Immersive Exploration & Role Rotation (75 Minutes)



Round 1 (Genomics -25 min):

- Viewers watch Genomics VR Videos.
- Web Searchers search for:
 - Sanger Sequencing
 - Illumina Sequencing
 - PacBio Sequencing
 - Oxford Nanopore Sequencing
- Group discussion & note-taking (≈10 minutes).



Round 2 (Transcriptomics -25 min):

- Viewewr watches Transcriptomics VR Videos.
- Web Searchers search for:
 - Smart-seq2
 - 10x Genomics Chromium System
 - Visium (10x Genomics)
 - MERFISH/seqFISH+
- Group discussion & note-taking (≈10 minutes).



Round 3 (Proteomics -25 min):

- Viewer watches the Proteomics VR Videos.
- The other two search the web for:
 - Liquid Chromatography-Mass Spectrometry (LC-MS)
 - Tandem mass spectrometry
 - MALDI-TOF (Matrix-Assisted Laser Desorption/Ionization Time-of-Flight)
- Group discussion & note-taking (≈7 minutes).

Phase 2 – Application Challenges (60 Minutes)

Task Overview

Each of the 4 groups focus on their specific research challenge. Using insights from Phase 1, each group discusses and selects the optimal omics technology for their challenge, writing a brief justification.

Independent Work

Groups work independently for 50 minutes on their assigned problem.

Presentation

Each group then presents a 2–3-minute summary of their solution.

Discussion

Use the remaining time for peer discussion and feedback.





Wrap-Up & Final Reflection



Share Key Takeaways

Each group shares key takeaways on how technology strengths and limitations influence study design.



Q&A Session

Open floor Q&A for final clarifications and reflections.



Learning Method Reflection

Reflect on how immersive VR and targeted web research enhanced your understanding.



Thank you!