# Integration of laboratory and lecture in an advanced cellular biology course

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## Introduction

The laboratory portion of biological science courses should support and integrate with lecture and other course components. However, both students and instructors often treat these as separate and non-related entities. Students fail to see the connections and relevance between lab and lecture and are unable to apply information learned in one setting to the other. Curriculum is also often designed so that each portion can be delivered independently and by different instructors, negating the value of presenting the concepts in an authentic and cohesive manner.

**Goal:** Design an advanced cell biology course where content connects and applies authentically across all course components.

**Approach:** Use 'investigation of cellular differentiation' as the overall theme to direct lecture content and laboratory activities and to design assessments .

- Present lecture content to support and explain laboratory activities and cellular mechanisms
- Analyze cellular differentiation primary literature for written and oral lecture assignments
- Perform hypothesis driven laboratory exercises based on primary literature
- Design examinations that synthesize lab and lecture content

## Assessment

**Lecture**

- Analysis of primary literature assignment : **5%**
- Poster presentation: **15%**
- Midterm Exam: **20%**
- Final Exam: **30%**

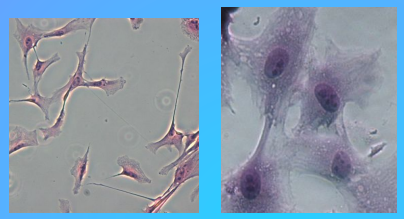
**Laboratory**

- Laboratory report: **15%**
- Laboratory Final: **10%**
- Weekly lab analysis: **5%**

## Laboratory

**Skills and activities related to studying differentiation**

- Vital staining and fluorescent labeling of cells
- Mammalian tissue culture
- Enzymatic assays
- Quantification of protein levels
- SDS-PAGE and immunoblotting



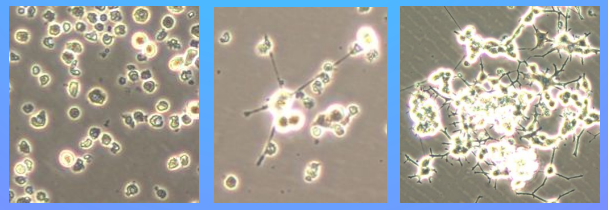
**Hematoxylin and Eosin Staining of MDCK Cells**

## Laboratory Report

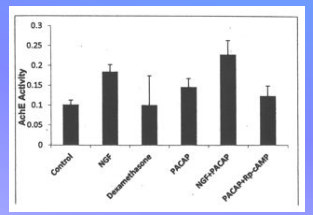
**Investigation of differentiation in PC12 cells**

- Examination of morphology: Neurite outgrowth (4 weeks)
- Measurement of enzyme activity: AChE (2 weeks)
- Visualization of protein expression: GAP-43 (2 weeks)

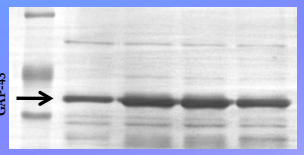
**Student generated data for PC12 cell project**



Control NGF NGF + Forskolin




Acetylcholinesterase Activity




GAP-43 Immunoblot

## Lecture

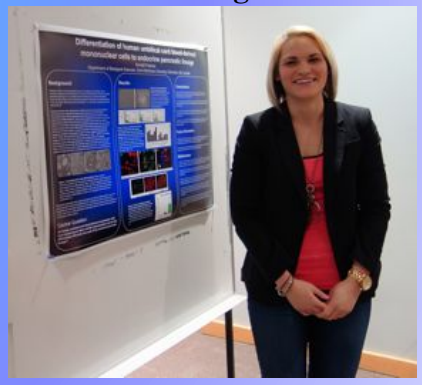
**Presentation of lecture topics relates to course theme :**

- Experimental techniques
- Cellular lineage and differentiation
- Signal transductions pathways and synaptic signaling
- Protein trafficking
- Apoptosis and cellular division
- Extracellular matrix

**Activities:**

- Cellular differentiation poster and written assignment: analysis of primary literature
- Examination questions require students to interpret data and design experiments based on main course theme

## Poster Assignment



**Poster assignment includes analysis of primary article, an annotated bibliography, oral presentation, and peer critiques**

## References

Adler, E.M. , Gough, N.R., and Blundon, J.A. (2006) Differentiation of PC12 cells. *Science STKE* tr9

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