The evolution of teaching strategies by discipline faculty: some examples

Kathryn G. Miller

Biology Department

The course

- Biology 3191: Molecular mechanisms in development
  - Writing-Intensive
  - Read primary literature (no textbook)
  - Analytical essays
  - Foster understanding, organization, synthesis of ideas and information

My goals for the course

Goal:	Why:
Developmental biology concepts and molecular mechanisms	Interesting area of Biology; many different aspects of biology encompassed within
Science discovery process	Knowledge construction in field, how is new knowledge created?
Relationship between evidence and ideas	Understanding not facts
Express ideas clearly, use empirical support	Understanding not facts; transferable skills

Why Writing Intensive?

- Active rather than passive
- Understanding instead of facts
- Ask questions and engage in dialog, not acquire information
- Bean 'Engaging Ideas' (2001), p. 29-31
  - "What…..students need to understand is that for expert writers, the actual act of writing causes further discovery, development, and modification of ideas."

Teaching writing and teaching in the discipline

Expert writer's process: unanswered questions and a dialog with the 'material'

1. Starting point: perception of a problem
2. Exploration
3. First draft
4. Reformulation and revision
5. Editing

Tools

- Primary literature
- SMARTBOARD
- Tablet PC's/classroom network
- Telesis
- Writing assignments
  - Journal
  - Analytical essays
  - Reflections on writing and content
  - Research paper
- Analysis of reading assignments in class
- Discussion not lecture
- Group work in class
- Analysis of writing examples in class
  - Writing issues
  - Content
    - Background information
    - Arguments/evidence

Examples slide from ppts used in class

Amit et al. (2000) "Clonally derived Human Embryonic Stem Cell Lines Maintain Pluripotency and Proliferative Potential for Prolonged Periods in Culture." **Developmental Biology 227**: 271-278.

Reading assignment #1; posted on Telesis

Developmental Biology 227, 271–278 (2000)
doi:10.1006/dbio.2000.9912, available online at http://www.idealibrary.com on IDEAL®

Clonally Derived Human Embryonic Stem Cell Lines Maintain Pluripotency and Proliferative Potential for Prolonged Periods of Culture

Michal Amit,* Melissa K. Carpenter,† Margaret S. Inokuma,† Choy-Pik Chiu,† Charles P. Harris,‡ Michelle A. Waknitz,§ Joseph Itskovitz-Eldor,* and James A. Thomson§,¶

*Department of Obstetrics and Gynecology, The Rambam Medical Center, and Faculty of Medicine, Technion, Haifa 31096, Israel; †Geron Corporation, 230 Constitution Drive, Menlo Park, California 94025; ‡Texas Children's Hospital, Baylor College of Medicine, Houston, Texas 77030; and §The Wisconsin Regional Primate Research Center and ¶Department of Anatomy, School of Medicine, University of Wisconsin, Madison, Wisconsin 53715

Embryonic stem (ES) cell lines derived from human blastocysts have the developmental potential to form derivatives of all three embryonic germ layers even after prolonged culture. Here we describe the clonal derivation of two human ES cell lines, H9.1 and H9.2. At the time of the clonal derivation of the H9.1 and H9.2 ES cell lines, the parental ES cell line, H9, had already been continuously cultured for 6 months. After an additional 8 months of culture, H9.1 and H9.2 ES cell lines continued to: (1) actively proliferate, (2) express high levels of telomerase, and (3) retain normal karyotypes. Telomere lengths, while somewhat variable, were maintained between 8 and 12 kb in high-passage H9.1 and H9.2 cells. High-passage H9.1 and H9.2 cells both formed teratomas in SCID-beige mice that included differentiated derivatives of all three embryonic germ layers. These results demonstrate the pluripotency of single human ES cells, the maintenance of pluripotency during an extended period of culture, and the long-term self-renewing properties of cultured human ES cells. The remarkable developmental potential, proliferative capacity, and karyotypic stability of human ES cells distinguish them from adult cells. © 2000 Academic Press

Key Words: human embryonic stem cells; basic fibroblast growth factor; cloning; telomeres.

INTRODUCTION

Human pluripotent cell lines have been derived from preimplantation embryos (embryonic stem cell lines, ES cells; Reubinoff *et al.*, 2000; Thomson *et al.*, 1998) and from fetal germ cells (embryonic germ cell lines, EG cells; Shamblott *et al.*, 1998) that for prolonged periods of culture maintain a stable developmental potential to form advanced derivatives of all three embryonic germ layers. Human ES cell lines have widespread implications for human developmental biology, drug discovery, drug testing, and transplantation medicine. For example, current knowledge of the postimplantation human embryo is largely based on a limited number of static histological sections, and because of ethical considerations, the underlying mechanisms that control the developmental decisions of the early human embryo remain essentially unexplored. Although the mouse is the mainstay of experimental mammalian developmental biology, there are significant differences between early mouse and human development. These differences are especially prominent in the extraembryonic membranes, in the placenta, and in the arrangement of the germ layers at the time of gastrulation. The yolk sac, for example, is a robust, well-vascularized extraembryonic tissue that is important throughout mouse gestation, but in the human embryo, the yolk sac is essentially a vestigial structure during later gestation (Kaufman, 1992; O'Rahilly and Muller, 1987). Human ES cells should provide important new insights into the differentiation and function of tissues that differ significantly between mice and humans.

In addition to advancing basic developmental biology, human ES cells should have practical, applied uses. The differentiated derivatives of human ES cells could be used for: (1) identification of gene targets for new drugs, (2)

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Examples slide from ppts used in class

Abstract of Amit et al.

Work in groups (3-5)

Main question being addressed

Main conclusions

Why is this work important?

10 mins

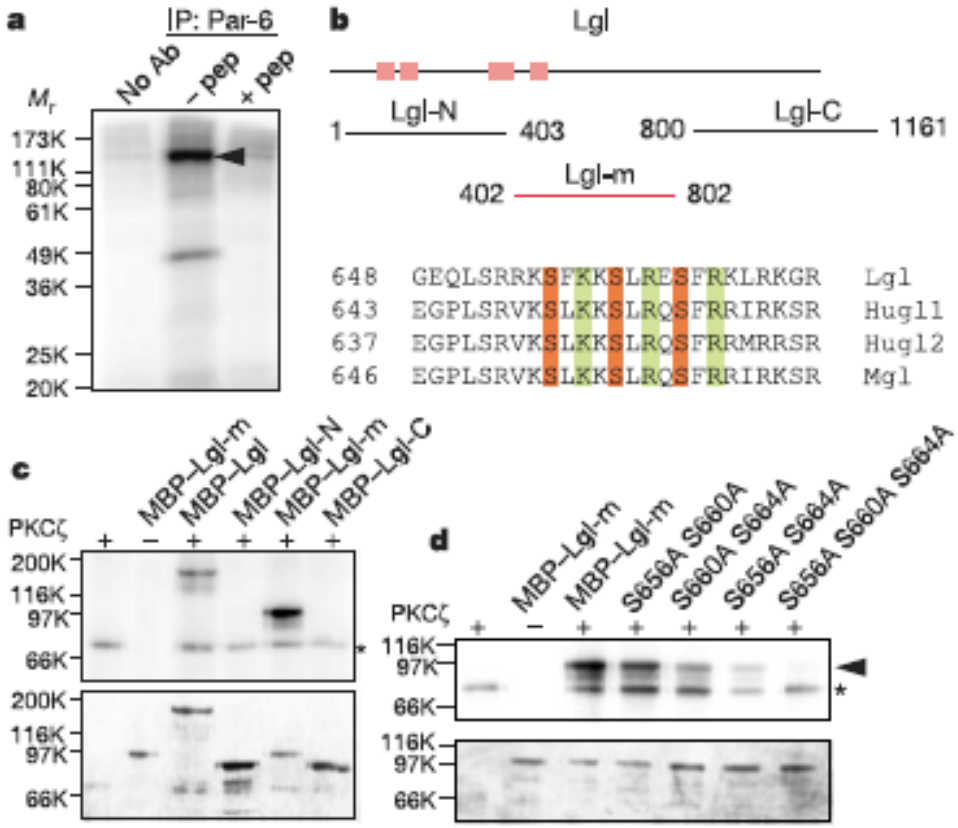
Examples slide from ppts used in class

Abstract of Amit et al.

- Main question
- Sub-questions
- Main conclusion
- Sub-conclusion

Discussion of primary literature

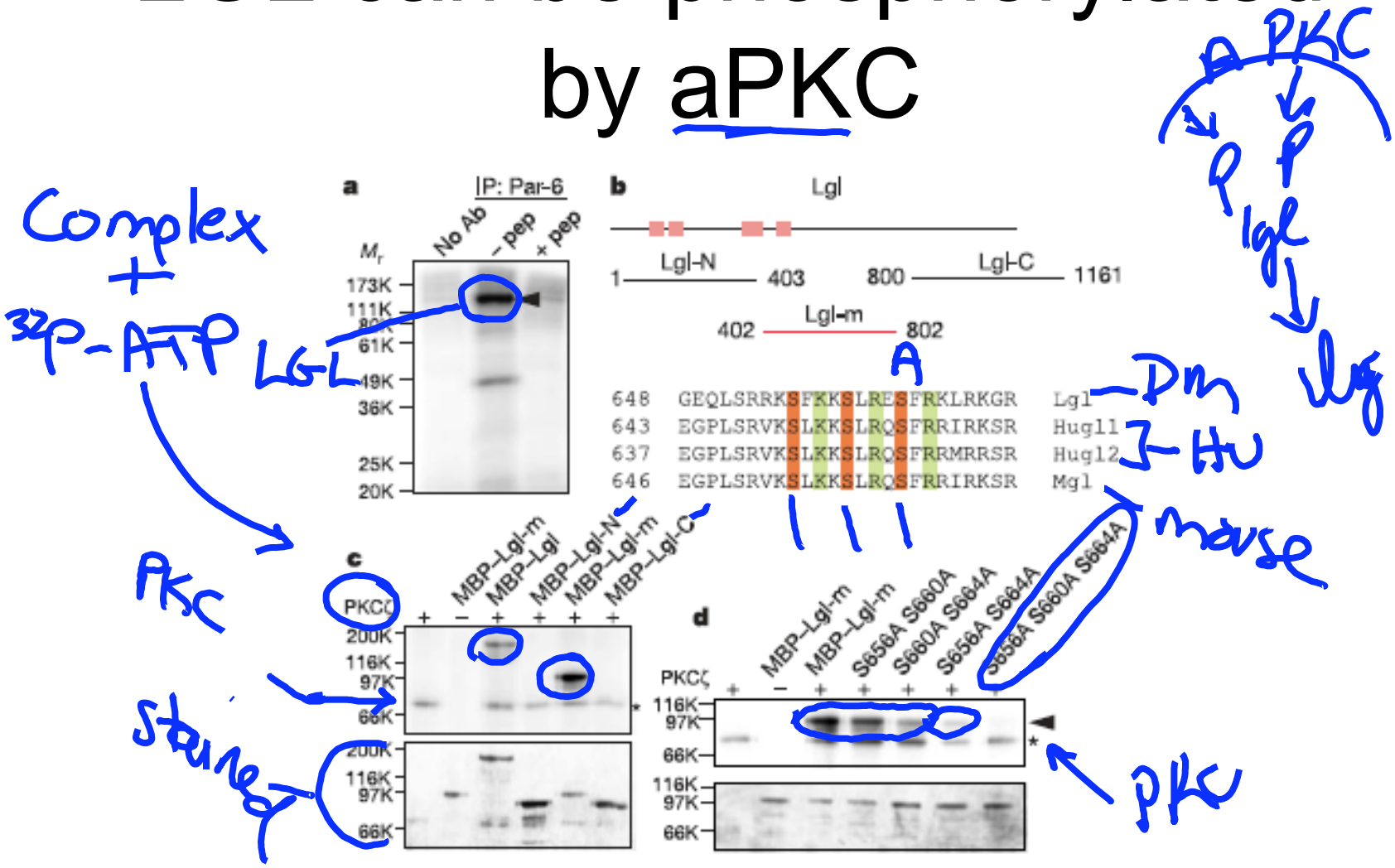
LGL can be phosphorylated by aPKC



Betschinger et al. (2003) Nature 422:326

After class:

LGL can be phosphorylated by aPKC



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Evolution of a course

- What do you want your students to know / be able to do six months (or 5 years) after the course?
- Changing your teaching:
  - Go slow. You don't have to do it all in one semester
  - Learn about what others are doing that works
  - Try different approaches, use those that work for you
  - Keep a teaching journal
  - Help your students understand why you are doing what you are doing (metacognition)
  - Use formative assessment as well as summative assessment
  - Use information from education specialists and cognitive scientists about how people learn to improve student learning

Thank you for listening

Additional questions/thoughts:

miller@wustl.edu