

定量細胞生物學 (Quantitative Cell Biology, LSMM6243)
Wednesdays W7W8

Instructor:

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Office Location: Life Science Building I, Room 527

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Course Description:

本課程介紹如何運用定量工具進一步瞭解細胞。內容包含細胞與分子生物學、定量實驗方法、訊息傳遞網路，以及癌症研究的最新進展。跨領域的內容對同學來說或許是個挑戰，但也是這門課有趣的地方。期待有生物或工程背景的同学加入，讓我們協助你開拓其他領域的視野。

This course will explore how the insights of quantitative tools have illuminated the complex phenomena of cells. We will study molecular and cell biology, quantitative experimental methods, signaling network, and novel approaches in cancer research. The multidisciplinary context is a challenge, but also part of what makes our course special. This course requires no previous knowledge of biology and engineering, but does assume competency in one of these fields. The idea is that students will need to work hard in the fields they are not familiar with, and help one another when someone needs help.

Course Requirements and Expectations:

There is no textbook for this course. The required readings are scientific articles, which are available as PDF files in the course website. Students are required to read papers before class starts and come prepared for discussion. Expect to spend a minimum of ninety minutes reading per paper.

Grading:

Course grades will be determined as follows:

Lectures:

Participation (ask/answer questions) total **40%**;

- Scientific articles relating to each class period will be posted on iLMS. Students are required to read these materials before each class period and prepare questions for each reading.
- Each student will be required to ask/answer at least 5 questions in class during lectures over the course of the semester (30 points)
- Outstanding participation (multiple insightful questions or comments) (10 points)

Journal clubs:

- Rotating figure presentation **50%** (40 points + 10 points);
- Journal participation (discussion points, journal club paper questions, peer

feedback) **10%**; Each student will be required to ask at least one question per journal club session.

Schedule:

09/13 – Lecture 1: Introduction –Why We Should Care About the Numbers

09/20 – Lecture 2:

09/27 – Lecture 3:

10/04 – 放假 (中秋節)

10/11 – Lecture 4:

10/18 – Lecture 5:

10/25 – Lecture 6:

11/01 – Lecture 7:

11/08 – Lecture 8:

11/15 – 停課 (全校運動大會)

11/22 – Journal club 1:

11/29 – Journal club 2:

12/06 – Journal club 3:

12/13 – Journal club 4:

12/20 – Journal club 5:

12/27 – Journal club 6:

01/03 – Journal club 7:

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Reading Assignments:

- 09/13 – Lecture 1: Introduction –Why We Should Care About the Numbers
- 09/20 – Lecture 2:
Enemchukwu, N.O. *et al.* Synthetic matrices reveal contributions of ECM biophysical and biochemical properties to epithelial morphogenesis. *The Journal of cell biology* **212**, 113-124 (2016).
- 09/27 – Lecture 3:
Bartosh, T.J., Ullah, M., Zeitouni, S., Beaver, J. & Prockop, D.J. Cancer cells enter dormancy after cannibalizing mesenchymal stem/stromal cells (MSCs). *Proceedings of the National Academy of Sciences of the United States of America* **113**, E6447-e6456 (2016).
- 10/04 – 放假 (中秋節)
- 10/11 – Lecture 4:
Shaffer, S.M. *et al.* Rare cell variability and drug-induced reprogramming as a mode of cancer drug resistance. *Nature* **546**, 431-435 (2017).
- 10/18 – Lecture 5:
Paek, A.L., Liu, J.C., Loewer, A., Forrester, W.C. & Lahav, G. Cell-to-Cell Variation in p53 Dynamics Leads to Fractional Killing. *Cell* **165**, 631-642 (2016).
- 10/25 – Lecture 6:
Hill, S.M. *et al.* Context Specificity in Causal Signaling Networks Revealed by Phosphoprotein Profiling. *Cell systems* **4**, 73-83.e10 (2017).
- 11/01 – Lecture 7:
Chitforoushzadeh, Z. *et al.* TNF-insulin crosstalk at the transcription factor GATA6 is revealed by a model that links signaling and transcriptomic data tensors. *Science signaling* **9**, ra59 (2016).
- 11/08 – Lecture 8:
Janes, K.A. An analysis of critical factors for quantitative immunoblotting. *Science signaling* **8**, rs2 (2015).
- 11/15 – 停課 (全校運動大會)
- 11/22 – Journal club 1:
Muranen, T. *et al.* Starved epithelial cells uptake extracellular matrix for survival. *Nature communications* **8**, 13989 (2017).
- 11/29 – Journal club 2:
Frick, C.L., Yarka, C., Nunns, H. & Goentoro, L. Sensing relative signal in the Tgf-beta/Smad pathway. *Proceedings of the National Academy of Sciences of the United States of America* **114**, E2975-e2982 (2017).
- 12/06 – Journal club 3:
Stewart-Ornstein, J. & Lahav, G. p53 dynamics in response to DNA damage vary across cell lines and are shaped by efficiency of DNA repair and activity of the kinase ATM. *Science signaling* **10** (2017).
- 12/13 – Journal club 4:
Soragni, A. *et al.* A Designed Inhibitor of p53 Aggregation Rescues p53 Tumor Suppression in Ovarian Carcinomas. *Cancer cell* **29**, 90-103 (2016).

12/20 – Journal club 5:

Wang, C., Christin, J.R., Oktay, M.H. & Guo, W. Lineage-Biased Stem Cells Maintain Estrogen-Receptor-Positive and -Negative Mouse Mammary Luminal Lineages. *Cell reports* **18**, 2825-2835 (2017).

12/27 – Journal club 6:

Tripathi, V. *et al.* Direct Regulation of Alternative Splicing by SMAD3 through PCBP1 Is Essential to the Tumor-Promoting Role of TGF-beta. *Molecular cell* **64**, 549-564 (2016).

01/03 – Journal club 7:

David, C.J. *et al.* TGF-beta Tumor Suppression through a Lethal EMT. *Cell* **164**, 1015-1030 (2016).