

實驗室晶片導論 (2013/2)

(Introduction to Lab-On-a-Chip)

543 U6970 (3 credits, 臺灣大學應用力學館109教室, Tue. 14:20 ~ 17:10)

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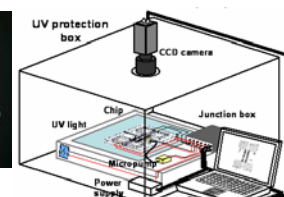
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實驗室晶片(Lab-on-a-Chip)是將原本在實驗室不同階段之操作流程整合並微小化在一片晶片上。利用這種技術，醫生在幾分鐘的問診過程中可同時快速診斷出病人的疾病，並對症下藥；生化實驗人員可以避免直接曝露於有害試劑的危險下工作；另外，實驗室晶片具有可自動化與平行化操作處理的特色，所以可用於快速篩選或合成新藥與產品，並增加實驗的可信賴度；而由於在晶片上僅需極少量的試劑，更可減少試劑用量、縮短操作處理時間及減低操作成本。目前已有越來越多的實驗改在實驗室晶片上進行，例如血液分離、電泳(electrophoresis)分離、聚合酶鏈鎖反應(Polymerase Chain Reaction, PCR)、核酸的定序反應分析等等，而拋棄式的塑膠晶片則有漸成設計主流之趨勢。本課程將提供對此一深具未來性之科技有興趣的同學們(大學部及研究所)，一個結合「理論與實作」和「研究與應用」四合一的試煉機會。在課程中，除講授實驗室晶片所需的基礎知識、實驗設計與量測方法外，也將邀請不同應用領域的傑出專家，透過其所提出該領域裡的實務問題需求及方向輔導與討論，讓同學們結合不同專業組成跨領域團隊(每隊最多3人)，以實際動手完成不同的實驗室晶片專題，來訓練同學們以目標為導向之團隊合作能力，同時開啟未來可能之研究方向。

Course Contents :

1. Introduction to LOC & term project assignment (1 week)
2. Specificity of enzyme catalytic mechanism & Antibody technology (2 weeks)
3. Micromixers, microreactors, Droplet-based biomicrofluidics and Lab-on-a-chip (2 weeks)
4. Behavior Genetics: What we have learned from *Drosophila*. (2 weeks)
5. Mid-term project review & discussions (1 weeks)
6. Cantilever-sensor for biosensing & bead-based microfluidics (2 weeks)
7. Electro-Microfluidics (2 weeks)
8. Stem cell and translational medicine (2 weeks)
9. Bioenergetics & Plasma membrane (2 weeks)
10. Final report of Selected topics (1 week)



Design example of term projects:
published in *Electrophoresis*
2011, Vol. 32,
p.423-430.



Final report of Selected topics @ 2011

References:

1. Lab-on-a-Chip, Miniaturized System for (Bio) Chemical Analysis and Synthesis, E. Oosterbroek and A. Van den Berg (Editor), Elsevier, 2003.
2. Introduction to microfluidics, Patrick Tabeling, Oxford University Press, 2005
3. Fundamentals and applications of microfluidics, Nam-Trung Nguyen, Steven T. Wereley, Artech House, 2006
4. Microfluidics for biotechnology, Jean Berthier, Pascal Silberzan, Artech House, 2006
5. Microfluidic, J. Ducree and R. Zengerle, Classnote of IMETK, Albert-Ludwigs-University Freiburg, Germany.
6. Process Engineering in Biotechnology, A.T. Jackson, Prentice-Hall Inc., 1991
7. Journal and conference papers
8. Project: <http://www.excellence.fju.edu.tw/plan/2.1.1.c/content01/index.htm>.

Grading Policy: Term project report 80% and presentation 20%

(Note: Do not hesitate to contact me whenever you have any questions about this course.)