09720LS 110301 Introduction to Life Science

生命科學導論

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Time：W7、W8、W9（15:20-18:10）

Room：LSII R109，生科二館 109 教室

Week	Date	Topic	Instructor	Reference	
1	02/25	永保青春 I	WANG, HORNG-DAR	1. 尋覓抗老藥丸 2. 啓動長壽基因	科學人 ８：72-78 科學人 ５０：24-31
2	03/04	永保青春 II	WANG, HORNG-DAR	1. 尋覓抗老藥丸 2. 啓動長壽基因	科學人 ８：72-78 科學人 ５０：24-31
3	03/11	我的基因你的專利	WANG, HORNG-DAR		
4	03/18	哺乳動物的興起	HUANG, HAI-MEI	鯨魚的演化 鯨魚如何征服海洋 哺乳動物的興起 雲豹的身世傳奇 當貓遇到人 貓的演化 狗的演化	國家地理雜誌 2001 年 11 月：64-77 科學人５：76-86 國家地理雜誌 2003 年 4 月：8-37 科學人６６：70-73 科學人６６：62-69 科學人６６：54-62 國家地理雜誌 2002 年 1 月
5	03/25	**Examination I**	TA 高慈佑 蔡儒瑩		
6	**04/01**	**停課　校際活動週**			
7	04/08	人類勇闖新天地	HUANG, HAI-MEI	吃素吃葷大有關係 猩猩的世界 勇闖新天地 人類最偉大的遷徙旅程	科學人１２：84-96 科學人６：90-96 科學人２２：78-87 國家地理雜誌 2006 年 3 月：30-43
8	04/15	人種、膚色、語言	HUANG, HAI-MEI	區分人種有意義嗎？ 人種與歷史 膚色深淺大有關係 瀕臨滅絕的人類語言	科學人２３：56-63 科學人２３：64-65 科學人１０：108-116 科學人８：48-56
9	04/22	終結疾病 I	HUANG, HAI	追尋癌症的根源 癌，隨染色體起舞 癌症基因大解碼 馴服血管治腫瘤	科學人 18：64-78 科學人 18：64-78 科學人 62：50-65 科學人 76：70-77
10	04/29	終結疾病 II	HUANG, HAI	帕金森新解答 爲漸凍人找回溫暖	科學人 42：46-55 科學人 70：94-104
11	05/06	**Examination II**	TA 蔡儒瑩		

12	05/13	感覺與反應	YEH, SHIH-RUNG		眼睛如何幫腦看 爲何要睡覺 夢的奧秘 你可以聽見顏色嗎	科學人６３：32-39 科學人２２：56-62 科學人２２：63-65 科學人１６：100-108
13	05/20	來一顆更棒的腦	YEH, SHIH-RUNG		尋找聰明藥丸 解開大腦基因之謎 精神疾病無所遁形 馴服壓力	科學人２０：40-49 科學人２０：50-54 科學人２０：96-103 科學人２０：84-94
14	05/27	**停課　（端午節）**				
15	06/03	成癮的大腦	YEH, SHIH-RUNG		成癮的大腦 酒癮會遺傳嗎？ 酒癮不只是遺傳 腦、大麻、新感受 電視癮，真有其事！	科學人２６：44-49 科學人６３：54-69 科學人６３：70-73 科學人３５：70-77 科學人２：76-83
16	06/10	Biological Machines, Cell Mechanics and Nanotechnology	WAGNER OLIVER		1. van den Heuvel MG, Dekker C. “Motor proteins at work for nanotechnology 2. Kasza K.E. et al. “The cell as a material”	***Science***. 2007. 317:333-6 ***Curr Opin Cell Biol***. 2007. 19:101-7
17	06/17	Biological Machines, Cell Mechanics and Nanotechnology	WAGNER OLIVER		1. van den Heuvel MG, Dekker C. “Motor proteins at work for nanotechnology 2. Kasza K.E. et al. “The cell as a material”	***Science***. 2007. 317:333-6 ***Curr Opin Cell Biol***. 2007. 19:101-7
18	**06/24**	**Examination III**	TA 李庚道 張茜毓			

Syllabus

Non-Life Science Undergraduate Teaching Module by Oliver Wagner, 王歐力 助理教授

Title:

"Biological Machines, Cell Mechanics and Nanotechnology" (offered in English)

Abstract

The eukaryotic cell contains a large variety of molecular machines that perform different kinds of mechanical work: to push the cell forward on a substrate, divide cells and chromosomes, duplicate DNA and transport organelles and other material within the cell. Biomolecular motors such as the motor protein kinesin convert chemical energy into mechanical forces enabling it to stepwise move on biological nano-tubes, called microtubules. This process make possible to actively transport designated cargo such as vesicles, RNA or viruses to predetermined locations within the cell. In nanotechnology, biological motors can be employed for many lab-on-a-chip applications such as nanofluidic systems for biosensing, active materials that can rearrange their components and of molecular lifts and escalators for nanometer-scale manufacturing. Mechanical forces play an essential role in cellular processes as input, output and signals. Various protein complexes in the cell are designed to handle, transform and use such forces. For example muscle proteins and the extracellular matrix can withstand considerable stretching forces while hearing-related and mechanosensory proteins can transform weak mechanical stimuli into electrical signal. In this class I will discuss the basics of the molecular and mechanical properties of the cell skeleton that is composed of nano-tubes, mini-fibers and micro-springs to provide cell shape, growth and movements. I will introduce the diversity and molecular function of motor proteins and the forces they produce in the pico-newton range. We will learn about biomotors that work for DNA replication and gene expression, to pump ions along a membrane and to model the final shape of a pre-mature protein. Last but not least, I will give examples of molecular machines developed for nanotechnological applications.

Articles to prepare:

1) van den Heuvel MG, Dekker C. "Motor proteins at work for nanotechnology". ***Science***. 2007. 317:333-6.

2) Kasza K.E. et al. "The cell as a material". ***Curr Opin Cell Biol***. 2007. 19:101-7.

Keywords: Cytoskeleton, actin, microtubules, intermediate filaments, muscle contraction, sarcomere, kinesin, myosin, flagella, rheology, visco-elasticity, mitosis, cell motility, polymerization, molecular devices, catenanes, rotaxanes, nano-factory