合成生物学 Synthetic Biology

- 教师介绍 Faculty

WENLIN AN （安文林）

Distinguished Professor, PhD
Affiliation: College of Life Science and Technology
Work Phone: +86 188 1141 0197
E-mail: 2016880015@mail.buct.edu.cn
Research Fields: Synthetic biology; Cancer therapy; Neurodegeneration; Immunology

Education

November, 2001- August, 2005
Karolinska Institute, Stockholm, Sweden
PhD in Neuroscience with focus on Neurodegeneration

September, 2000 – July, 2003
Capital University of Medical Sciences, Beijing, China
PhD in Neurobiology

September, 1994 – July, 1997
Capital University of Medical Sciences, Beijing, China
MS in Physiology

September, 1989 – June, 1994
Nantong Medical School, Jiangsu, China
BS in Preventive Medicine

Work Experience

September, 2016 - present: Distinguished Professor
College of Life Science and Technology, Beijing University of Chemical Technology, Beijing,China

January, 2010 - May, 2015: Senior Research Scientist
MRC Centre for Developmental Neurobiology, Kings College London, London, United Kingdom

April, 2006 - December 2009: Career Development Fellow

MRC Laboratory of Molecular Biology, Cambridge, United Kingdom

July, 1997 - March, 2001: Research Assistant

Department of Neuropharmacology, Xuanwu Hospital, Beijing, China

Representative Publications

1. **An WL**, Jackson RE, Hunter P, Gogel S, Diepen M, Liu K, Meyer MP., Eickholt BJ. **Engineering FKBP-Based Destabilizing Domains to Build Sophisticated Protein Regulation Systems**. PLoS One, 2015, 10(12): e0145783.
2. **An WL,** Chin JW. **Orthogonal Gene Expression in Escherichia Coli.** Methods in Enzymology, 2011, 497: 115-34.
3. Gautier A, Nguyen DP., Lusic H, **An WL**, Deiters Alexander, Chin JW. *. **Genetically Encoded Photocontrol of Protein Localization in Mammalian Cells.** JACS, 2010, 132(12): 4086.
4. Zhao S, Xu W, Jiang W, Yu W, Lin Y, Zhang T, Yao J, Zhou L, Zeng Y, Li H, Li Y, Shi J, **An WL,** Hancock SM., He F, Qin L, Chin JW, Yang P, Chen X, Lei Q, Xiong Y, Guan KL*. **Regulation of Cellular Metabolism by Protein Lysine Acetylation.** Science, 2010, 327: 1000-1004.
5. **An WL**, Jason W. Chin. **Synthesis of orthogonal transcription-translation networks**. PNAS, 2009, 106: 8477-8482.
6. Pei JJ, **An WL**, Zhou XW, Nishimura T, Norberg J, Benedikz E, Götz J, Winblad B. **P70 S6kinase Mediates Tau Phosphorylation and Synthesis**. FEBS Lett., 2006, 580:107-114.
7. **An WL,** Bjorkdahl, Liu R, Cowburn RF, Winblad and Pei JJ. ***Mechanism of Zinc-induced Phosphorylation of p70 S6 Kinase and Glycogen Synthase Kinase 3 in SH-SY5Y Neuroblastoma Cells.** J. Neurochem.,**2005**, 92:1104-1115
8. **An WL,** Cowburn RF, Li L, Braak H, Alafuzoff I, Iqbal K, Grundke-Iqbal I, Winblad B, Pei JJ.**Up-regulation of Phosphorylated/activated p70 S6 Kinase and its Relationship to Neurofibrillary Pathology in Alzheimer's Disease.** Am J Pathol., 2003,163:591-607.
9. Pei JJ, Gong C-X**, An WL,** Winblad B, Cowburn RF, Grundke-Iqbal I, Iqbal K. **Okadaic-acidinduced Inhibition of Protein Phosphatase 2A Produces Activation of Mitogen-activated Protein Kinases ERK1/2, MEK1/2, and p70 S6, similar to that in Alzheimer's disease.** Am J Pathol.,2003,163:845-858.

课程介绍 About Course

Synthetic biology is a multidisciplinary field that involves molecular and cellular biology, biochemistry, bioinformatics, engineering and etc. Its ultimate goal is to solve the issues regarding energy, materials, health and environment by designing and constructing non-natural life systems with specific functions. This course is mostly established for foreign MS students and will be taught in English. The objectives of this course are:

- to help students understand the fundamental theories and knowledge of synthetic biology
- to develop students' ability to independently analyze, calculate and solve practical problems related to biological system design in biology and biotechnology.

Outlines:

CHAPTER 1 Introduction to Biology (8 hours)
CHAPTER 2 Basic Concepts in Biotechnology （4 hours）
CHAPTER 3 Enabling Technologies （4 hours）
CHAPTER 4 Minimal Genome and Synthetic Life （4 hours）
CHAPTER 5 Parts, Devices and Systems （4 hours）
CHAPTER 6 Modeling Synthetic Biology Systems （8 hours）
CHAPTER 7 Applications of Synthetic Biological Systems （8 hours）
CHAPTER 8 Biosecurity and Biosafety of synthetic biology (6 hours)

Final Exam (2 hours)

课程大纲 **Syllabus**

Instructor: Dr. Wenlin An
Course Code:
Hours: 48
Credits: 3
Prerequisites: Biochemistry, Biology
Description: Synthetic biology is a new discipline emerging in the scientific, social, and business arenas and is attracting national attention by promising advances in numerous areas, such as biofuels and pharmaceutical development, agriculture and bioremediation. The field is best understood as the application of engineering principles to biological systems and is therefore inherently interdisciplinary, with a strong foundation in biology, engineering, computer science and biotechnology. This course is intended to provide an introduction of the basic principles that lie at the heart of synthetic biology. The main aim is to prepare the English speaking students with the fundamental theories and advanced knowledge of synthetic biology in the 21st century.

Textbook: Synthetic Biology—A Primer (Ed.: Paul S Freemont and Richard I Kitney, World Scientific Press, ISBN: 978-1-84816-862-6)

References:

1. Synthetic Biology, Tools and Applications. H Zhao Imprint Academic Press, May 2013, ISBN :9780123944306
2. A brief history of synthetic biology. D. E Cameron, C J. Bashor & J J.Collins, Nature Reviews Microbiology 12, 381–390 (2014)
3. Systems and Synthetic Biology, Singh, Vikram, Dhar, Pawan K. (Eds.), Springer, 2015. ISBN 978-94-017-9514-2

General Syllabus:

CHAPTER 1 Introduction to Biochemistry (8 hours)
Part 1: Concept of synthetic biology, basic knowledge of molecular biology, primary metabolism pathways, Kreb cycles, PP pathway, Fermentation, Calvin Cycle
Part 2: Secondary metabolism and typical metabolites, Introduction of metabolic engineering, strategies of improving production of desired metabolites by re-routing fermentation pathways, examples of metabolic pathways to produce amorphadiene.

CHAPTER 2 Basic Concepts in Biotechnology （4 hours）
Cloning, vectors, transformation, operon, screening, bacterial host engineering, approaches for gene or genome editing

CHAPTER 3 Enabling Technologies （4 hours）
Description of the concepts of enabling, standardization, biobricks, and discuss the ways/methods/approaches to design and assembly biobricks to make logic circuits for practical use, for example, application in environment.

CHAPTER 4 Minimal Genome and Synthetic Life （4 hours）
Comparison of the differences and relationship between system biology and synthetic biology and discussion on the approaches to integrate them to create artificial functions; Concepts of minimal genome and the approaches to synthesize a minimal genome by using 'Hail Mary' minimal genome construction as an example

CHAPTER 5 Parts, Devices and Systems （4 hours）
Description of the characterization and encapsulation of different cellular parts, logic gates, and the ways to design and construct the basic devices and modules, circuits and eventually complex systems.

CHAPTER 6 Modeling Synthetic Biology Systems （8 hours）
Part 1: Introduction of the basic knowledge of bioinformatics biological research on the web; sequence analysis, genomics and proteomics
Part 2: Description of the synthetic biology software suite, computer-aided synthetic biology, in silicon simulation and perturbation.

CHAPTER 7 Applications of Synthetic Biological Systems （8 hours）
Part 1: Description of the concepts of digital cell, metabolic balance analysis, computational strain design, and discuss the application of synthetic biology in fatty acid biosynthesis.
Part 2: Synthesis of a wholecell

CHAPTER 8 Biosecurity and Biosafety of Synthetic Biology (6 hours)

Part I: Most recent progression of synthetic biology and cutting-edge biotechnology
Part II: Concerns on the biosecurity and biosafety of applied synthetic biology, and policy legislation on biosafety; Strategies regarding bio-defense in the age of synthetic biology.

Final Exam (2 hours)
Grading:
Report:40 %,
Final Exam:60%

- 教案 **Teaching Plan**
- 视频 **Video**