

Yi-Ying Lee, PhD

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SCIENTIST, MICROBIOLOGY and MOLECULAR BIOLOGY

SUMMARY

Focused and results-driven scientist with 10+ years research experience in molecular microbiology laboratories. Outstanding accomplishment with a proven track-record of publications. In-depth knowledge of microbiology; hands-on experience of molecular biological and biochemical techniques. Exceptional ability in research project planning, coordinating and conducting, and development of research protocols. Excellent analytical skills to analyze and interpret complex scientific data and information. Supportive team player to provide practical knowledge and technical assistance to colleagues and decision makers

EDUCATION

PhD in Molecular Microbiology, University of East Anglia, Norwich, UK, 2006

MSc in Microbiology, National Taiwan University, Taipei, Taiwan, 2000

BSc in Plant Pathology, National Taiwan University, Taipei, Taiwan, 1998

RESEARCH EXPERIENCE

Postdoctoral Research

2015-present

University of Maryland Center for Environmental Science, and Institute of Marine and Environmental Technology

Research advisor: Dr. Yantao Li

Research Topic: Genetic engineering of oleaginous microalgae to improve biofuel production.

- Developed genetic transformation methods for oleaginous alga *Nannochloropsis oceanica*.
- Characterized genetic knockdown mutations in triacylglycerol (TAG) production in green alga *Chlamydomonas reinhardtii*.

Postdoctoral Research

2010-2014

Department of Marine Biotechnology, University of Maryland Baltimore County, and Institute of Marine and Environmental Technology

Research advisor: Dr. Robert Belas

Research Topic: Surface sensing in the urinary tract infectious agent *Proteus mirabilis*.

- Developed and conducted the research on how bacteria (using the urinary tract pathogen *Proteus mirabilis* as the model) sense surfaces prior to biofilm formation and infection.
- Applied microbial genetics (recombinant DNA and mutant construction), molecular biology (sequence and gene expression analyses), microbial phenotypic analysis, microscopic (colony and cell morphology examination; fluorescent labelling) and immuno-biochemical methods as research tools.
- Research accomplishment:
 1. Discovered the bacterial flagellar basal body component FliL being a key player in respect

- of the surface sensing and motility.
- 2. FliL serves as a governor to modulate proton flux of a bacterial flagellar motor in response to surface viscosity.
- 3. FliL involves in the temperature- and torque-dependent energetics of flagellar performance.
- 4. The *fliL* gene has dual functions: a structural component in a flagellar motor and a regulatory factor for gene expression.
- 5. Damage in FliL perturbs expression of genes encoding flagellar rod (*flgF* and *flgG*) and filament (*flaA*) and membrane associated protein (*umoA*).
- † - Resulted in 4 peer-reviewed articles in the Journal of Bacteriology (one was highlighted by the editors as an article of significant interest), 6 conference abstracts and 4 research proposals.
- Presented research at the weekly group meetings and scientific conferences (poster or oral presentation at Sensory Transduction in Microorganisms Gordon Research Conference and Bacterial Locomotion and Signal Transduction meetings).
- Supervised undergraduate and graduate students, interns and technicians (total 6 people).
- Maintained lab functions: 1) organizing lab space, 2) scheduling lab duties, 3) managing the lab budget (approx. \$20,000 per year), 4) equipment maintenance, 5) documentation for lab supplies and research materials.

Postdoctoral Research

2006-2010

Department of Microbiology and Immunology, University of Illinois at Chicago

Research advisor: Dr. Philip Matsumura

Research Topic: Study the function of *Escherichia coli* flagellar master regulator FlhDC.

- Incorporated molecular genetics (gene cloning; reporter gene construction), *in vivo* phenotypic characterization, and *in vitro* biochemistry (protein purification and protein-DNA interaction assays) methods to study the functional mechanism of a transcriptional activator that controls bacterial flagellar motility and virulence.
- Research accomplishment:
 1. Revealed asymmetric manner of FlhDC-DNA binding.
 2. FlhDC regulates its target promoters in a two-stage fashion.
 3. Searched for potential targets of FlhDC from the genome.
 4. Analysis of DNA-binding motifs of FlhC protein.
- Produced a peer-reviewed article in the Journal of Bacteriology and meeting abstracts for presentation.
- Presented research at invited seminars and scientific conferences (poster or oral presentation at Bacterial Locomotion and Signal Transduction meetings).

Doctoral Research

2001-2005

School of Biological Sciences, University of East Anglia

Research Advisor: Dr. Stephen Spiro (currently at the University of Texas at Dallas, USA)

Thesis Title: Transcription factor NNR from *Paracoccus denitrificans*.

- Combined methods of gene expression assay, biochemistry (protein expression and purification, protein-DNA binding, spectrometry analysis) to characterize the activation and sensing mechanism of a regulator that controls nitric oxide metabolism of bacteria.
- Cultured bacteria and executed experiments under anaerobic conditions.
- Research accomplishment:

1. Determined NNR as a NO/O₂ dual sensor.
 2. Identified important residues in NNR involved in NO/O₂ signalling mechanism.
 3. Proposed heme as the signalling sensor in NNR by genetic evidence and reconstituted recombinant protein.
 4. Searching for NNR functional partners from the genome of *E. coli*.
- Presented research at department seminars, symposiums and scientific meetings (poster or oral at Microbial Stress Response Gordon Research Conference and European Nitrogen Cycle meeting).
 - Resulted in a peer-reviewed research article in Microbiology (SGM) and 3 meeting abstracts.

Master Research

1998-2000

Institute of Agricultural Chemistry, National Taiwan University

Research Advisor: Dr. Whi-Fin Wu

Dissertation Title: Protein-Protein Interaction of *Escherichia coli* ClpYQ Protease Subunits in Oligomerisation and Substrate Recognition by Using Yeast Two-Hybrid System.

- Established a novel system for studying bacterial in vivo protein-protein interaction in a yeast heterologous system.
- Research accomplishment:
 1. Determined the interaction between the complex subunits and the interaction between the protease and its substrates *in vivo*.
 2. Determined the localization of binding regions and affinity.
- Produced 1 peer-reviewed article in the Journal of Bacteriology and reports to the funding agent.
- † - Assisted new laboratory setting-up, and trained junior laboratory members (7 people).
- † - Received the best poster presentation award at an annual meeting of the Chinese Agricultural Chemistry Society.

SKILLS & TECHNIQUES

- **Microbiology:** Microbial culturing (aerobic and anaerobic), characterization, and sterilization
- **Algal biology:** Cell cultures of microalgae (marine and fresh water), and growth determination
- **Molecular biology:** Gene cloning and recombinant DNA construction, mutagenesis, DNA probes design and applications, RT-PCR, qPCR, and reporter assay
- **Biochemistry:** Recombinant protein expression, protein purification and reconstitution, Western blot, and protein-DNA binding assay
- **Microscopy:** Fluorescent, phase-contrast, and differential interference contrast (DIC) imaging and analysis
- **Analytical chemistry:** Spectrometry, thin layer chromatography (TLC), and gas chromatography-mass spectrometry (GC-MS)
- **Bioinformatics:** GenBank and NCBI database, Sequence analysis, alignment, BLAST, and phylogenetic analysis
- **Computer programs:** ImageJ, Velocity, SwissPdb viewer, Origin, Endnote, Adobe Acrobat, Adobe Creative Suite, and Microsoft Office

SUPERVISION & TEACHING EXPERIENCES

University of Maryland Baltimore County/Institute of Marine and Environmental Technology,
Baltimore, MD, 2010-present

University of East Anglia, Norwich, United Kingdom, 2003

National Taiwan University, Taipei, Taiwan, 1998-2001

- Supervised graduate theses and undergraduate research projects
- Managed and trained lab interns and technicians

University of East Anglia, Norwich, United Kingdom, 2003

National Taiwan University, Taipei, Taiwan, 1998-2001

- Teaching assistant for Molecular Biology and Genetics Laboratory, Advanced Molecular Biology Laboratory and General Microbiology Laboratory
- Preparation and instruction of laboratory section

PUBLICATIONS

Lee, Y.-Y., and Belas, R. 2014. Loss of FliL alters *Proteus mirabilis* surface-sensing and temperature-dependent swarming. *J. Bacteriol.* 197: 159-173. **(Highlighted as an Article of Significant Interest, “Defining the function of flagellar protein FliL offers clues on how cells sense a surface”. *J. Bacteriol.* 197:1.)**

Lee, Y.-Y., Patellis, J. and Belas, R. 2013. The activity of *Proteus mirabilis* FliL is viscosity-dependent and requires extragenic DNA. *J. Bacteriol.* 195: 823-832.

Cusick, K. [†], **Lee, Y.-Y.** [†], Youchak, B., and Belas, R. 2012. Perturbation of FliL interferes with *Proteus mirabilis* swarmer cell gene expression and differentiation. *J. Bacteriol.* 194: 437-447. ([†]Contributed equally)

Lee, Y.-Y., Barker, C.S., Matsumura, P. and Belas, R. 2011. Refining the Binding of the *Escherichia coli* Flagellar Master Regulator, FlhD₄C₂, on a Base-Specific Level. *J. Bacteriol.* 193: 4057-4068.

Lee, Y.-Y., Shearer, N., and Spiro, S. 2006. Transcription factor NNR from *Paracoccus denitrificans* is a sensor of both nitric oxide and oxygen: isolation of *nnr** alleles encoding effector-independent proteins and evidence for a haem-based sensing mechanism. *Microbiology.* 152: 1461-1471.

Lee, Y.-Y., Chang, C.-F., Kuo, C.-L., Chen, M.-C., Yu, C. H., Lin, P.-I., and Wu, W. F. 2003. Subunit Oligomerization and Substrate Recognition of the *Escherichia coli* ClpYQ (HslUV) Protease Implicated by *In Vivo* Protein-Protein Interactions in the Yeast Two-Hybrid System. *J. Bacteriol.* 185: 2393-2401.

PRESENTATIONS

Oral Presentations

Flagellar Basal Body Protein FliL is a Key Factor for Bacterial Swarming and Surface Sensing. 2013 Boston Taiwanese Biotechnology Symposium, June 2013.

Functions of *Proteus mirabilis* FliL in swarming and responding to surface viscosity. Bacterial Locomotion & Signal Transduction XII (BLAST XII) Meeting, January 2013.

Interaction of the transcriptional regulator complex, FlhDC, with its target DNA. Bacterial Locomotion & Signal Transduction X (BLAST X) Meeting, January 2009.

Identification of binding consensus sequence of *Escherichia coli* flagella master regulator FlhDC,

Department of Microbiology and Immunology, National Cheng Kung University, October 2008

The nitric oxide sensor NNR from *Paracoccus denitrificans*. 9th NL-UK Nitrogen Cycle Meeting, August 2003.

Poster Presentations

Lee, Y.-Y. and Belas, R. Loss of *fliL* gene results in Swr⁺ and temperature-dependent motility in *Proteus mirabilis* and *Escherichia coli*. Sensory Transduction in Microorganisms, Gordon Conference. Ventura Beach Marriott (Ventura, USA) January 2014.

Lee, Y.-Y., Cusick, K., Youchak, B., and Belas, R. FliL: a key player in *Proteus mirabilis* swarming and surface sensory transduction. Sensory Transduction in Microorganisms, Gordon Research Conference. Ventura Beach Marriott (Ventura, USA) January 2012.

Lee, Y.-Y., Youchak, B., and Belas, R. FliL, a gatekeeper of *proteus mirabilis* swarming differentiation. Bacterial Locomotion & Signal Transduction XI (BLAST XI) Meeting, Astor Crowne Plaza Hotel (New Orleans, USA), January 2011.

Lee, Y.-Y., Belas, R., and Matsumura, P. FlhDC, the flagellar master regulator, regulates its target promoters in a two-stage fashion. Bacterial Locomotion & Signal Transduction XI (BLAST XI) Meeting, Astor Crowne Plaza Hotel (New Orleans, USA), January 2011.

Lee, Y.-Y., Barker, C., and Matsumura, P. Interaction of the transcriptional regulator complex, FlhDC, with its target DNA. Bacterial Locomotion & Signal Transduction X (BLAST X) Meeting, Camino Real Sumiya Hotel (Cuernavaca, Mexico), January 2009.

Lee, Y.-Y., Shearer, N., and Spiro, S. Transcription activator NNR from *Paracoccus denitrificans* senses both NO and O₂. Microbial Stress Response, Gordon Research Conference. Mount Holyoke College (MA, USA) July 2004.

Lee, Y.-Y., Chang, C.-F., and Wu, W.-F. In vivo protein-protein interactions involved in subunits oligomerization and substrates recognition of the *Escherichia coli* ClpYQ (HslUV) protease by the yeast two-hybrid. The 39th Annual Meeting of the Chinese Agricultural Chemistry Society (Taipei, Taiwan), June 2001. (**Best Poster Award**)

AWARDS AND HONORS

2001 – 2004 International Scholarship, University of East Anglia

2001 Best Poster Winner, 39th Annual Meeting of the Chinese Agricultural Chemistry Society.