

Omics based *in silico* analysis of microalgae for biofuel production

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Eukaryotic microalgae are attracting a lot of attention due to their potential for sustainable production of biofuel precursors such as lipids, starches, alcohols and hydrogen gas. In addition, they can convert solar energy into biomass using carbon dioxide by photosynthesis. Recently various attempts in biological fields have been made to produce microalgal biofuel. Especially since genome database of *Chlamydomonas reinhardtii* was published in 2007, high throughput omics data of eukaryotic microalgae have been accumulating at a rapid rate. Among omics data, genomics and transcriptomics researches are developing rapidly by development of NGS technologies. Over 30 whole genome sequencing of eukaryotic microalgae were in progress or completed in the JGI (Joint Genome Institute) and transcriptome of *Dunaliella tertiolecta* and *Nannochloropsis gaditana* was characterized by NGS (next generation sequencing). With accumulation of these enormous data, macroscopic view of cellular network has been required requisitely. To date as the one of research tools to gather and analyze huge information, systems biology is worth of remark. Through the use of systems biology, molecular and cellular phenomena of eukaryotic microalgae could be modeled using integrated and interacting network of genes, transcripts, proteins and biochemical reactions under stressful conditions. To enhance lipid productivity from microalgae, *in silico* model of eukaryotic microalgae was reconstructed based on OMICS data. It can make us fully understand the lipid accumulation mechanism within eukaryotic microalgae.

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• EDUCATION

- B.S. in Chemical Technology, Seoul National University, Seoul, Korea, 1981-1985, Research Project: Software Development for DNA Sequence Analysis.
- M.S. in Chemical Technology, Seoul National University, Seoul, Korea, 1986-1988, Dissertation: On-Line Induction of Fermentation with Recombinant Cells: Optimization and Computer Control.
- M.S.E. and Ph.D. in Chemical Engineering, University of Michigan, Ann Arbor, U.S.A., 1990-1994, Dissertation: Photobioreactor Engineering: High-Density Algal Cultures using LEDs.

• PROFESSIONAL EXPERIENCE

- President-Elect, Korean Soc. for Biotechnology and Bioengineering, 2020. 1. – 2020. 12.
- Manager, Korea Regional Branch Office (KRBO), AFOB, 2018.10. – present
- President-Elect, The Asia-Pacific Society for Applied Phycology (APSAP), 2017. 1. – 2019.12.
- Chief Review Board (CRB), National Research Council, 2016. 9. – 2019. 8
- Secretary General, Korean Soc. for Biotechnology and Bioengineering, 2016. 1. – 2016. 12.
- President, Korean Society for Marine Biotechnology, 2012. 1. – 2015.12.
- Inha Fellow Professor (IFP), Inha University, Incheon, Korea, 2010. 3. – present.
- Director, Lipidomics Research Center, Inha University, 2010. 3. – present.
- Director, Marine Bioenergy Research Consortium, Ministry of Ocean and Fisheries, Korea, 2009.12. – present.
- Chair, Energy Engineering Program, Inha University, 2009. 3. – present.
- Executive Board Member, Asian Federation on Biotechnology (AFOB), 2008-present
- Director, Institute of Industrial Biotechnology, Inha University, 2007. 3. – present.
- Director, Technology Transfer Office, Inha University, 2007. 3. – 2008.1.
- Vice Dean, Division of Research, Inha University, 2006. 4. – 2008.1.
- Chair, Dept. of Biol. Eng., Inha University, 2004.3. – 2006.2, 2018.1. – 2019.1, 2020.2. – 2021.2.
- Professor, Inha University, Incheon, Korea, 1997. 3. – present.
- Visiting Scholar, University of California, San Diego, USA, 2003. 2. – 2004. 2.
- Resident Research Associate, NASA, Kennedy Space Center, USA, 1996. 1. – 1997. 1.
- Post-Doctoral Research Fellow, University of Michigan, 1995. 1. – 1995. 12.
- Engineer (part-time), Aastrom Bioscience Inc., Ann Arbor, USA, 1995. 1. – 1995. 6.
- Teaching Assistant, University of Michigan, Ann Arbor, USA, 1992. 1. – 1994. 12.
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Dr. C.-G. LEE is currently an Inha Fellow Professor in Department of Biological Engineering, Inha University, Korea. His field of expertise is on culture of microalgae in various types of photobioreactors and on multi-omics molecular/biotechnological studies of the microalgae based on whole cell genome-scale *in silico* modeling. On top of his research work, he has held a number of administrative positions in the University, in the Korean Government and in academic societies. He is the leader (Director) of National Marine Bioenergy R&D Consortium funded by Korean Government and is the Head of Institute of Industrial Biotechnology as well as Lipidomics Research Center. He served as the President of the Korean Society of Marine Biotechnology and will serve as the President of The Asia-Pacific Society for Applied Phycology. He got his Ph.D. in the Department of Chemical Engineering at University of Michigan in Ann Arbor, USA in 1994 and he worked for NASA, Kennedy Space Center in Advance Life Support Team before joining Inha University.