FORM – OCEANEXT 2019

Keynote's name, position, country

Hanhua Hu, Professor, China

Keynote's short bio (5 lines) :

Sept. 1996-July 2001 Ph.D in Hydrobiology, Institute of Hydrobiology, Chinese Academy of Sciences (CAS)

Aug. 2001-Feb. 2004 Assistant Professor, School of Life Sciences, Xiamen University

Jan. 2002-Feb. 2004 Postdoctoral, Institute of Process Engineering, CAS

Jan. 2008-Jan. 2010 Postdoctoral, Département de biologie, École normale supérieure, Paris, France

Mar. 2004-now Associate Professor (-Dec. 2014), **PI (July 2011-), Professor (Jan. 2015-)**, Deputy Director of Center for Algal Biology and Applied Research (Mar. 2019-), Institute of Hydrobiology, CAS

References (with links) :

Ge F, Huang W, Chen Z, Zhang C, Xiong Q, Bowler C, Yang J, Xu J, **Hu H***.**2014**. Methylcrotonyl-CoA carboxylase regulates triacylglycerol accumulation in the model diatom *Phaeodactylum tricornutum*. ***The Plant Cell***. 26(4): 1681-1697.

Pan Y, Yang J, Gong Y, Li X, **Hu H***. **2017**. 3-hydroxyisobutyryl-CoA hydrolase involved in isoleucine catabolism regulates triacylglycerol accumulation in *Phaeodactylum tricornutum*. ***Philosophical Transactions of the Royal Society B-Biological Sciences***. 372(1728): 20160409.

Li X, Pan Y, **Hu H***. **2018**. Identification of the triacylglycerol lipase in the chloroplast envelope of the diatom *Phaeodactylum tricornutum*. ***Algal Research***. 33: 440-447.

Abstract (300 words) :

Triacylglycerol accumulation and catabolism in *Phaeodactylum tricornutum*

The asynchrony between lipid accumulation and growth of microalgae limits the scale of microalgae as biofuel feedstock. Nitrogen starvation redirects carbon flux from pathways leading to protein and carbohydrate synthesis into lipid storage pathways, but all fluxes of carbon into the three major carbon sinks are also considerably decreased and thus halts growth. Efforts to engineer microalgae that can accumulate biomass and overproduce lipids are vital for the development of microalgal biofuel through enhancing carbon sequestration and directing carbon flux to lipid. In *Phaeodactylum tricornutum*, accumulation of triacylglycerols (TAGs) under nitrogen stress is a consequence of re-allocation of carbon mainly from the intermediates of TCA cycle. Furthermore, carbon skeletons from enhanced branched-chain amino acid (BCAA) degradation under nitrogen deficiency feed into the TCA cycle and contribute to TAG biosynthesis in this diatom. Silencing of *propionyl-CoA carboxylase* (*PCC*) in *P. tricornutum* redirects propionyl-CoA, the intermediate of isoleucine (Ile) / (valine) (val) catabolism, to acetyl-CoA then enters the TCA cycle, while overexpression of *3-hydroxyisobutyryl-CoA hydrolase* (*HIBCH*) accelerates the Ile degradation. Therefore, increasing TAG accumulation was obtained without significantly compromising cell biomass in *PCC* knockdown mutants and *HIBCH* overexpression lines. Dramatic increase in growth and TAG content was observed in *P. tricornutum* cultivated with BCAAs as the sole nitrogen sources, which indicated that more of the fixed carbon was partitioned to lipids. Supplementation with tryptone to the f/2 medium also gave rise to increased growth and overproduced lipids in the stationary growth phase. In addition, 18 lipases involved in TAG catabolism were identified in *P. tricornutum* and most of then are important for maintaining lipid homeostasis. Although downregulation of TAG lipases could decrease TAG degradation thus enhancing TAG accumulation, slower growth has also been found in the lipase mutants. The presentation will outline the suitable strategies for engineering microalgae to increase lipid productivity.