

## Exploiting the carotenoid and triacylglycerol biosynthesis pathways of red yeast for industrial production of high-valued fatty acids and terpenoids

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### Abstract

Under nitrogen starvation and abundant supply of carbon source, red yeast *Rhodotorula toruloides* is able to accumulate large amount of carotenoids and triacylglycerol (TAG, or oil) inside the cells in high density fermentation, both are synthesized from the precursor acetyl-CoA. To take advantage of its naturally strong flux for fatty acid and carotenoid biosynthesis, our group has pioneered the development of robust genetic manipulation and gene expression tools. Through reverse and forward genetic approaches, we systemically dissected the pathways involved in fatty acid, TAG and carotenoid biosynthesis, regulation and energy metabolism. Our large collection of mutants have proved very useful for turning this host into efficient producers of novel fatty acids and terpenoids with introduction of minimal number of foreign genes. Currently, technologies for alpha/gamma-linolenic acid, astaxanthin are looking promising for upscaling and commercialization. The success and challenges in engineering a one-pot production system for essential oil in red yeast will be discussed.

### Brief Biography

Lianghui Ji obtained his Ph.D in plant molecular biology from the University of Adelaide, Australia. He did his postdoctoral training on plant molecular virology and

fungal genetics. He established his independent research group at the Temasek Life Sciences Laboratory (TLL) in 2003, an affiliate of National University of Singapore and Nanyang Technological University. He has been a Research Director and Senior Principle Investigator since 2013. His group has broad interests on translational research, trying to harness the metabolic power of certain isolated fungi, bacteria and algae strains. He has 4 patents licensed to 3 commercial partners or startups. Over the past 7 years or so, his group has been focusing on developing *Rhodotorula toruloides* and *Aureobasidium melanogenum* as a metabolic engineering and synthetic biology platform. Towards this goal, he has filed 9 more international (PCT) patents and has developed a series of promising technologies for commercialization.

## **Brief CV**

Lianghui Ji

### **Education:**

BSc.Ag Agronomy, South China Agricultural University, China, 1984

Ph.D. Plant Molecular Biology, University of Adelaide, Australia, 1993.

### **Professional Career:**

2013-present, Temasek Life Sciences Laboratory(Singapore), Director/Senior Principle Investigator

2008-2012, Temasek Life Sciences Laboratory(Singapore), Associate Director

2005-2007, Temasek Life Sciences Laboratory(Singapore), Assistant Director

1984-1987, China National Rice Research Institute, Research assistant

### **Research Interests:**

Metabolic Engineering and Synthetic Biology

Process Engineering

Directed Evolution and Genome Editing of Microbial Genomes

### **Selected publications**

Ji L\*, et al, BMC Microbiology 2018, 18(1):14.

Ji L\* et al, Microbial Cell Factories 2016, 15(1) 200.

Ji L\* et al, Biotechnology for Biofuels 2015, 8: 222.

Ji L\* et al, Microbial Cell Factories 2015, 14: 170

Ji L\* et al, BMC Microbiology 2014, 14:50 <sup>[1]</sup><sub>[SEP]</sub>

Ji L\* et al, Biotechnology for Biofuels 2013, 6: 140. <sup>[1]</sup><sub>[SEP]</sub>

Ji L\* et al, Applied Microbiology and Biotechnology. 2013, 97:719-729. <sup>[1]</sup><sub>[SEP]</sub>

Ji L\* et al Bioresource Technology. 2011, 102:3927-33. <sup>[1]</sup><sub>[SEP]</sub>