

Lecture at NTU Nov., 2018

## Biological production of 3-hydroxypropionic acid from glycerol

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Due to the increasing concerns on global warming and depletion of fossil resources, the use of biomass in the production of fuels and chemicals gets more attention. Among various chemical compounds, we have been working on acid (3-hydroxypropionic acid and butyric acids) and alcohols (1,3-propanediol and 2,3-butanediol) with the purpose of commercial application. To develop suitable microbial cell factories, we identified appropriate host strains, selected genes, and established synthesis pathways in the selected hosts. Furthermore, to improve product titer, yield (on substrates and/or raw material) and production rate, we improved synthesis pathway by regulation of gene expression, deletion of competing pathways, disruption of degrading pathways for the final products and/or intermediate, optimization of energy metabolisms, and properly expressed secretion pathways. In addition, major enzymes were extensively engineered by site-directed mutagenesis and directed evolution. The strains were examined under bioreactor conditions in the collaborating companies. This lectures summarizes and discusses our progress with emphasis on 3-hydroxypropionic acid.