In silico metabolic engineering The relationship model GRNs In silico modeling GPR Rules The gene knockout scheme The optimal mutant strain The regulatory-metabolic network model G1 G2 G3 G4 G5 G6 G7 G8 G9 G10 $\mathcal{F}: (GRNs, MNs) \to y$ Metabolic Networks (MNs) The wet lab experiments The screening process to select the best mutant strains Production in the bioreactor scale Production in shake flask-scale The overproduction of the desired compound

A general procedure in silico metabolic engineering for predicting the optimal mutant strain and guiding the wet lab experiments.