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2:30-3:00 p.m.

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Genetic engineering in a model cyanobacterium

Cyanobacteria are model photosynthetic organisms for understanding photosynthesis, and have potential in direct conversion of CO_2 to fuels, chemicals, and materials. This is due to their excellent genetic system, enabling precise gene insertion, deletion, and editing. Synthetic biology tools have been developed in select strains such as Synechocystis 6803, and used to redirect metabolic flux to target metabolites. On the other hand, how the engineered pathway interacts with host metabolism is also very important. As an example, expression level of a heterologous ethylene forming enzyme has been manipulated by a series of promoters and ribosome binding sites, so that this enzyme level is no longer the rate limiting step, and 20% of fixed carbon is directed to ethylene production. In continuous light, ethylene productivity shows diurnal rhythm that is abolished by overexpression of a clock gene, indicating that the internal diurnal clock exerted control on metabolic flux to ethylene. Another example is the glycogen synthesis mutant which may enable the redirection of carbon flux to an engineered pathway, yet has its own phenotypes such as metabolite overflow because glycogen synthesis is involved in maintaining cellular energy balance.