Engineering Yeast: Synthetic Modularity at the Gene, Circuit, Pathway and Genome Level

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Synthetic biology seeks to understand and derive value from biology via its re-design and synthesis using engineering principles. After a decade of work to improve DNA assembly and the control of gene expression, synthetic biology can now tackle cell-scale problems. By applying modular assembly from a kit of parts we can design complex genetic circuits that reprogram how yeast grows or endow yeast cells with new metabolic pathways that produce valuable molecules such as antioxidants and antibiotics. Or is aim to convert yeast into a prototyping factory for new phenotypes, and this will be aided by a modular synthetic version of the *S. cerevisiae* genome that enables evolution of gene content on cue. A part of the global Sc2.0 project to assemble a human-designed yeast genome, our lab is working on assembling synthetic chromosome XI and has already begun exploiting the new possibilities that it offers. After 2 years, we've nearly completed our 665 kb chromosome and have also developed new lab and software tools that will enable the future of genome engineering and yeast synthetic biology.