INSIDE VIEW: THE NATIONAL COLLABORATIVE INNOVATION CENTRE

factories, enabling low-cost and efficient effects. Our goal is to construct artificial cell pathway of salvianic acid A, another medically antioxidant nutritional chemical, and are close fuels. For example, we have achieved a high natural products, chemicals, medicines and have successfully constructed a series of yeast chromosomes. Built on this work, we Synthetic Yeast Genome Project (Sc2.0), Q: What attracted you to synthetic biology? Synthetic biology is an emerging field that integrates biology and engineering, particularly, chemical engineering. Having studied biochemical engineering since the 1980s and with a PhD in the field, it is natural for me to focus on this. I am interested in applying engineering principles to design and synthesize biological components. Synthetic biology also offers an unprecedented opportunity to engineer biosystems to fuel us, feed us, and heal us. I formed a research group on synthetic biology at Tianjin University in 2006, when we were invited to participate in the International Genetically Engineered Machine Competition (iGEM), a premier international student competition in synthetic biology, initiated by MIT. We won the gold medal next year, and since then we have been expanding our team and promoting synthetic biology research in China.

Q: What are some major projects at the SynBio Research Platform? Genome synthesis is an important sub-field of synthetic biology. As a key partner in the Synthetic Yeast Genome Project (Sc2.0), one of our research thrusts is synthesizing yeast chromosomes. Built on this work, we have successfully constructed a series of heterogeneous biosynthesis pathways for natural products, chemicals, medicines and fuels. For example, we have achieved a high yield of purified lycopene, an important antioxidant nutritional chemical, and are close to commercializing the production. We also developed the novel artificial biosynthetic pathway of salvianic acid A, another medically valuable derivative known for its antioxidant effects. Our goal is to construct artificial cell factories, enabling low-cost and efficient production of a wide range of products.

Our research is also geared towards providing solutions to societal challenges, such as energy security and environmental pollution. Engineering of artificial microbial consortia and exoelectrogens achieved high-performance microbial fuel cells. We have also constructed synthetic pathways of several green fuels and chemicals in photosynthetic cyanobacterial systems.

Q: How did you get involved in Sc2.0? The Sc2.0 is an ongoing international scientific collaboration aimed to build the world’s first synthetic, designer eukaryotic genome. It is organized by Jef Boeke from New York University, who was a professor at Johns Hopkins University back then. I first learned about Sc2.0 through Boeke’s postdoc and was highly attracted by the potential influence on fundamental science and its industrial applications. The synthetic genome has increased genome stability and genetic flexibility, while maintaining cell fitness. By re-designing the yeast genome, we can promote our understanding of fundamental properties of chromosomes, gene content and genome structure, addressing some key evolutionary questions and even regulating the process of life. So I tried to promote the programme and got deeply involved. We are responsible for synthesizing yeast chromosomes V and X, and our participation accelerated the whole programme.

Q: What are the attractions of SynBio platform to synthetic biologists? Tianjin University is the host of a synthetic biology module library, SynbioML, which contains around 8,000 artificial synthetic genetic parts, 20,000 functional modules and 1,000 chassis for diverse applications. Researchers can easily search for modules on the website and obtain them for free for further design and construction. We have also built up state-of-the-art infrastructure with advanced equipment. Furthermore, as one of the first four research platforms under the National Collaborative Innovation Centre of Chemical Science and Engineering (Tianjin), we can leverage the centre’s rich resources and offer ample opportunities of research collaborations, including cross-disciplinary and international collaborations. The establishment of an international collaborative research centre on synthetic biology will bring in more of such opportunities.

Recently, we have won the Science Fund for Creative Research Groups from the National Natural Science Foundation of China to build an innovative research team on synthetic biology and bioprocessing engineering, the first of such a team in China. Our excellent research environment has already attracted a group of talented researchers, many from abroad. We look forward to being a top attraction to talented researchers in the field.
Synthetic Biology Research and Education
@ Collaborative Innovation Center of Chemical Science and Engineering (Tianjin)

Green fuels and chemicals
Artificial cell factories for biosynthesis of natural products
Synthetic yeast genome
Artificial microbial consortia