:insideview
profile feature

Dr. Yingjin Yuan, *Vice President, Tianjin University*

The National Collaborative Innovation Centre of Chemical Science and Engineering (Tianjin), a partnership between Tianjin University and Nankai University, was established in 2012. It is one of the first 14 institutions selected for a national initiative that promotes collaborative innovation in universities. Led by Yingjin Yuan, vice president of Tianjin University, Synbio, the synthetic biology research platform, of the centre is leading synthetic biology research in China. Here, Yuan, a leading expert in bioengineering and the chief scientist of state 973 and 863 programmes on synthetic biotechnology, discusses his team's research and his plan for the research platform to attract international synthetic biologists.

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: How do you integrate education and research at the SynBio research platform?
We are keen to integrate frontier science into student training. Another attraction of Sc2.0 for me is its "Build A Genome" (BAG) course. I think it is a great model to help students gain familiarity with molecular biology and computational approaches to genomic problems, while developing their troubleshooting skills. Following the model, we have set up our own BAG course at Tianjin University. This is an innovative educational programme that engages undergraduate students in the Sc2.0 project. By producing building blocks for synthetic chromosomes, students obtain first-hand experience essential to promote their independent research skills. We also support students to participate in the iGEM competition, another great model that integrates scientific innovation with student training. The microbial fuel cell is an award-winning invention at iGEM by our students. In 2014, the Ministry of Education approved our PhD program on synthetic biology, the first of its kind in the world.

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.

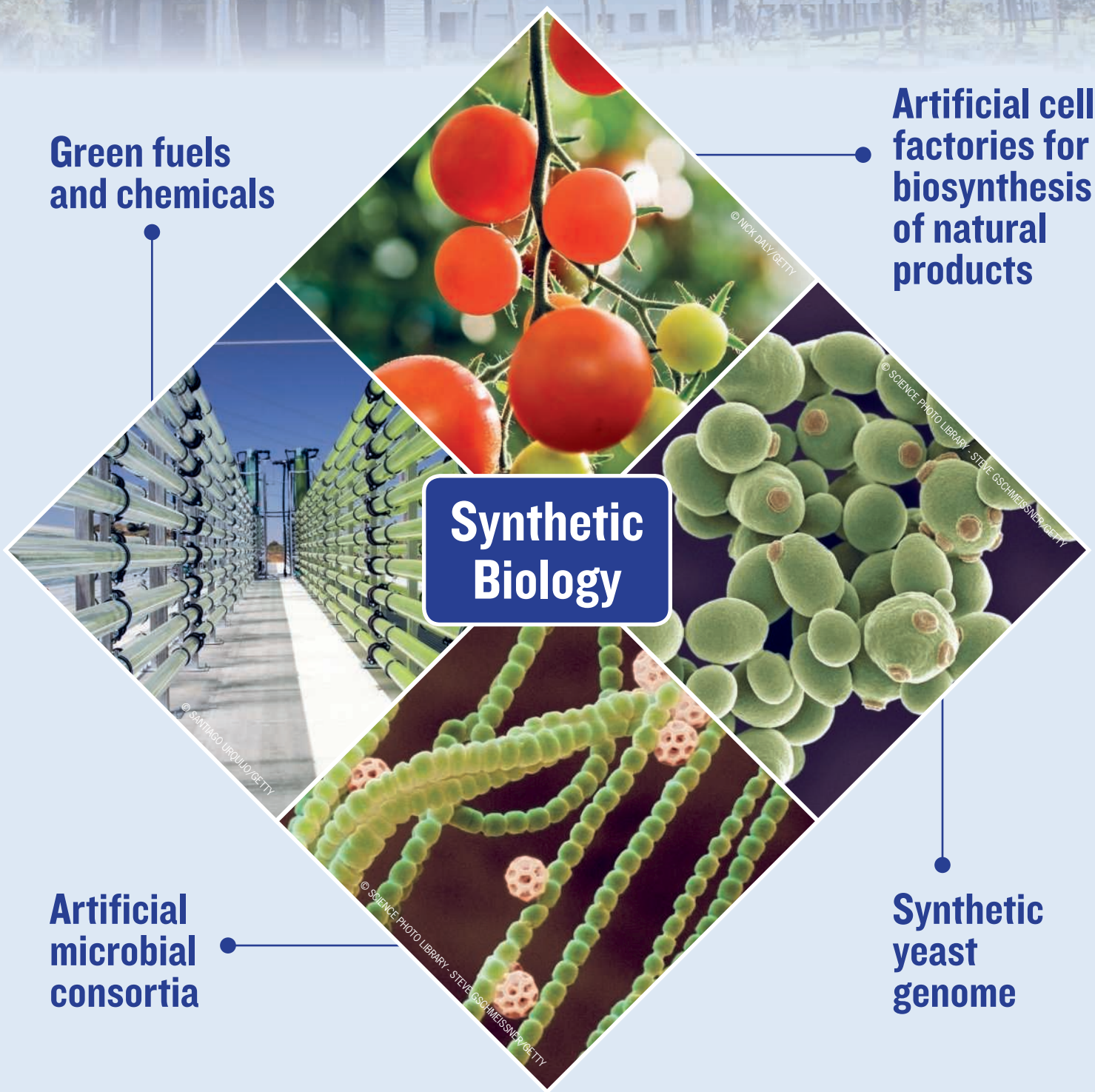
Recently, we have won the Science Fund for Creative Research Groups from the National Natural Science Foundation of China to build an innovative research team on synthetic biology and bioprocessing engineering, the first of such a team in China. Our excellent research environment has already attracted 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 Biology

Artificial microbial consortia

Synthetic yeast genome