

Application and hindrance of synthetic biology technology in Chinese industrial development

-- Interview report on Prof. Lin Zhanglin

The "14th five-year national plan for scientific and technological innovation" ([2016] no.43) points out that synthetic biology is a disruptive science and technology that can lead industrial transformation and is a strategic and forward-looking major scientific issue. Therefore, it is necessary to focus on and develop, so as to achieve major scientific breakthroughs and seize the commanding heights of world scientific development, and promote the development of advanced and efficient biotechnology and agricultural biological manufacturing through the development of synthetic biology.

Synthetic biology is a comprehensive subject that utilizes the knowledge and techniques of chemistry, physics, molecular biology and informatics. Its existence is a subversive technological innovation of life science. Its subversive significance lies in that biotechnology no longer stays in simple simulation of life, but enters a new stage of complex and repeatable simulation of life phenomena, quantitative and controllable regulation of life metabolic system and artificial design of life individuals. Its research direction is how to turn life into a system that can be

engineered, modular and chassis, and build an engineered life through engineering design, module combination and chassis transformation. Finally, it realizes the engineering of life and the engineering of life, and realizes the continuous cycle from design, synthesis and detection. Synthetic biology will help solve the medical, resource, environmental and ecological problems facing mankind.

Synthetic biology plays a key role in industrial biotechnology. The technology and ideas of synthetic biology are of great significance in industrial biotechnology, which aims at using biochemical reactions of microorganisms for industrial production to obtain products such as various compounds or fuels that people need. In industry, the microbial factory modified by synthetic biology technology has the characteristics of low cost and little pollution to produce specific metabolites. In agriculture, synthetic biology technology can not only modify crops to make them have better shape, but also improve the planting environment to make them more suitable for planting. Synthetic biology plays an important role in biopharmaceuticals, treatment and detection in pharmaceutical industry. In addition, synthetic biology technology has great application value or potential in energy, materials, information and other fields. However, there are still some defects in the development and industrial ecology of synthetic biology in China, compared with some

developed countries in Europe and America.

Synthetic biology has important academic position and national strategic position. In order to gain an in-depth understanding of how synthetic biology promotes industrial production and economic construction and the difficulties encountered in its further development, qualitative in-depth interviews are used to report the main results of the interviews as follows.

1. Research methods, objects and design

1.1 Research methods

This study adopts the interview research method of social survey method, and adopts in-depth interview and non-frame questioning. The researcher designed relevant questions for the research topic. During the interview, the interviewees were asked to state their answers and express their opinions on this question within a limited time. After the interview, the researchers summarized and refined the answers of the interviewees, and completed the writing of interview records with the interviewees' review and approval.

1.2 Research objects

The researchers invited professor Lin Zhanglin, dean of the school of biological science and engineering of south China university of technology, to interview them.

South China University of Technology (SCUT) is one of the top institutions in the field of synthetic biology research in China. In November 2018, SCUT participated in the establishment of the synthetic biology committee of the Chinese society of biological engineering.

Prof. Lin Zhanglin is the Changjiang scholar distinguished professor, 973 chief scientist and dean of school of biological science and engineering, south China university of technology. Nearly 5 years mainly engaged in synthetic biology microbial art module (research) and biological pharmaceutical (long the efficient preparation of peptide drugs, important P450 enzymes) the application of basic research, in the relevant aspects and the development of a number of original and advanced ideas and methods, presided over the research on adaptation of microorganisms and plants synthetic biology active components and its application in industry and agriculture of national "973" project, in order to improve our country's large biological manufacturing capacity, energy saving and emission reduction of strategic technology reserve

highly active agriculture. His research work has received high attention from academic peers and leading enterprises such as DSM, Bayer and COFCO.

Professor Lin Zhanglin has participated in the industrial biotechnology and industrial planning of the relevant departments of the state for many years, and is one of the authors of the synthetic biology roadmap of China. Together with academician Ouyang Pingkai, he organized the compilation of "translation series of industrial biotechnology". As the vice President of Guangdong biological industry association, he pays close attention to the national industrial scientific and technological innovation and co-authored the road of scientific and technological innovation and national power. In recent years, he started to devote himself to the commercialization of biopharmaceutical.

Professor Lin Zhanglin has many years of experience and authority in the field of synthetic biology research and practical application, and his opinions are quite representative.

1.3 research design

To design interview questions is the key to this study, the researchers

through the study of the current development of Chinese industrialization of synthetic biology, from "development and application status", "block" in the process of development, "development needs social support", "strategic significance for the development of synthetic biology technology" four aspects to design the three and a half open with an open question. In order to obtain the required complete information, the researcher will use the key words in the introduction of question design in the following text and "could you please give an example to illustrate? And other words to prompt.

1.3.1 what do you think of the current development status of synthetic biology technology in China and its main application in China?

This problem is aimed at the research on the development and application of synthetic biology technology in China. This paper mainly investigates the development ecology of synthetic biology in academic field and production and application, which industries synthetic biology is mainly applied in at present, what kind of influence it has on people's life, and what are the advances and deficiencies compared with the development environment and current situation of synthetic biology in foreign countries.

1.3.2 what do you think are the obstacles to the development and application of synthetic biology technology in China?

The problem is aimed at the obstacles in the development and application of synthetic biology in China. This paper mainly investigates the obstacles encountered in the development of synthetic biology in China and their sources, including the social factors in the academic field and the obstacles in the application of achievements, and analyzes the sources and causes of the obstacles. To understand the shortcomings of the current development environment of synthetic biology in China.

1.3.3 what efforts or assistance do you think are needed for the further development of synthetic biology in China?

This question is proposed on the basis of question 1.3.2, aiming at the obstacles encountered in the development of the field of synthetic biology, the solutions proposed by the authoritative leaders in the field of synthetic biology, and the social support required for the concrete implementation of this method. This paper reviews the problems existing in the development ecology of synthetic biology and its industrial application.

1.3.4 please briefly introduce the strategic significance of the development of the field of synthetic biology to the community of Shared future of the nation and mankind.

The question is an open-ended, pictorial description of the strategic implications for the future development of synthetic biology, a hot research discipline. This question is highly subjective, but it reflects the effect that synthetic biology technology will produce in the future and the significance of its development to human destiny, which is considered by the authority in this field. It has important reference value for the development direction of the field of synthetic biology.

2. Interview results and analysis

2.1 Synthetic biology industry is still in the primary stage of development, opportunities and challenges coexist

At present, synthetic biology technology is mainly applied in the field of drug synthesis and fine chemical synthesis. High-value products developed by Tianjin institute of microbiology, Wuhan university, Shanghai institute of life sciences, south China university of technology

and other important institutions now play an important role in people's production and life, but the degree of development and influence of synthetic biology industry still has a huge room for improvement.

For yeast, the study of genome synthesis of corynebacterium glutamate may lead to a new revolution in biological manufacturing. In addition, the study of synthetic biology in the field of agriculture is expected to achieve plant resistance, resistance to salt and alkali and other good characters. The new biological materials created by the combination of synthetic biology technology and materials research field have various excellent properties. Enzymes and the strain is the core of industrial biotechnology, its status in industrial biotechnology as the chip to the electronic technology, from the point of the present research situation, in the further future, synthetic biology for strains of intelligent design study if can successfully combined with artificial intelligence, can achieve strains for the upgrading of core technology, industrial biotechnology big leap. The possible application of synthetic biology technology in various fields has been written into Chinese "145th five-year plan", and its combination with manufacturing, agriculture, materials, artificial intelligence and other fields may be a very important direction of future application.

Nowadays, the development of synthetic biology industry in China also

faces great challenges. As one of the most cutting-edge scientific technologies, synthetic biology industry cannot develop in any country or region without the globalized economic trade and scientific research system. However, the current "trade war" between China and the United States may hinder its development. In the short term, it may bring some benefits to one side or the other, but in the long run, it is detrimental to the development of a community with a Shared future for mankind.

2.2 Synthetic biology has a good ecological development, but there are still some defects in evaluation criteria and financing mechanism

At present, the development of the field of synthetic biology technology has been strongly supported by the state. China has set up a number of national key research and development projects of synthetic biology, which provide a key condition for the current development of synthetic biology, that is, sufficient funding for scientific research. At present, synthetic biology in China ranks the second place in the world in terms of scientific research achievements and technology applications. In the long run, the field of synthetic biology in China has the potential to keep pace with the world-leading us. Therefore, under the background of sino-us trade frictions, the field of synthetic biology has also become a point of confrontation, which indirectly reflects that the field of synthetic biology

in China is not only in good development condition, but also suitable for the better development of the whole industry.

However, compared with the developed countries, there are still two defects in the field of synthetic biology in China. One is the distortion of evaluation indicators. In the traditional academic evaluation system of our country, there is a problem that papers and patents are too important or even the only criteria, which leads to a large number of researchers separating academic research and practical application of industrialization into two parts with little correlation, while ignoring the objective fact that cutting-edge research should be precisely combined with industrial application. This problem is not only an academic problem, but also an issue of The Times. As a developing country, China must face and overcome this problem. If we can learn from the leading American experience in this field, and better combine the cutting-edge research with industrial application, it will be of great benefit to the development of science and related industries. Second, the company's financing difficulties. In fact, there is a long way from the research achievement laboratory to the market, and there is no paper to be published in this way. Only with certain support and investment from the market can scientific research achievements be better introduced into people's lives. This is also one of the core reasons for the slow

development of the biotechnology industry in China, which also leads to the continuous low demand for talents in the biotechnology sector, and the fresh graduates majoring in biology are faced with huge employment pressure. This problem has been paid attention by the country, and the science innovation board of China is an attempt to solve this problem. If the financing channel can be improved and the gap between the laboratory and the market can be filled, the development of the field of synthetic biology will surely make a great leap forward.

2.3 Synthetic biology needs more science and reason

For the high and new technologies represented by synthetic biology, it is more necessary to discuss the contribution that the field can make to the society rather than the help that the society can provide to the field. The further development of synthetic biology and its better access to the society, the premise of entering into people's lives is to prove to the society that it is useful to the society, which also means that the relevant personnel in the field of synthetic biology need to do more science popularization and improve the public awareness. Public awareness is low for synthetic biology at present, the development of synthetic biology has "thrust type" and "pull" effect - for unknown question in the field of making the public was pushed away from the front of synthetic

biology technology, and false speech and views will pull to the public stance against further development in this field. This phenomenon has appeared in the field of transgenic engineering in China and caused serious consequences. The reason is that there is no rational publicity and popularization of this technology field, which leads to the wrong cognition of this field that is difficult to reverse, and the whole transgenic industry has lost a lot of development opportunities.

2.4 Synthetic biology will have a huge impact on academic research, technological development and industrial production

The development of synthetic biology will have a significant impact on the development of the community with a Shared future for mankind.

First, the innovation of academic research means, synthetic biology has the potential to become the basic research method of biotechnology in the future. Synthetic biology is different from the traditional method of molecular biology to analyze the biological system, but by designing the biological system and accumulating the understanding of the biological principles in the process, this perspective can provide new ideas for the further study of biological science. Second, the development of the field of technology. The basic process of industrial development of "learn-creation-industrialization" can be extracted from the history of

human industrial development. Take the synthetic chemical industry as the basis of human modern material civilization as an example. After learning the principles of chemistry from the natural world, human beings created many synthetic chemicals, and finally established today's brilliant synthetic chemical industry. Synthetic biology is now walking in the same development route, synthetic biology will be a future in technology and industry is an important landmark, has important purpose but manageable create some new life, create more economic value and employment opportunities for the society, for the life of people bring great changes. The third is the innovation in industrial production. Synthetic biology technology can be used to produce many products that people use in daily life, such as meat, eggs, milk and other agricultural products. It has the advantage of controllable process and result, lower cost and reduce pollution emission in the production process, which will have an important impact on the production and life of human beings. And the realization of these changes are not happen overnight, and the further development of synthetic biology is not a revolutionary process, but a process of permeability, so as long as give the enough time in the field of synthetic biology, synthetic biology will in all aspects of people's lives to change, to the development of the community of human destiny.

3. Summary and discussion

At present, China is in a period of deepening reform and opening up and industrial transformation. It is urgent to attach importance to the steady development of new and high technology. The development of new and high technology is not only the progress of science, but also the progress of society. Team with south China university of technology, dean of the school of biological science and engineering Lin Zhang winds, in-depth interviews, to the current synthetic biology development present situation, problems and measures taken, but in the future society will play the role of synthetic biology has carried on the discussion and analysis, proposed to improve the evaluation index, improve the financing environment, strengthen the science popularization suggestion, about the future of synthetic biology in China and other high and new technology development and industrialization has reference value. There, however, the present study also sample cover range is not wide, quantitative research methods, research results are difficult to application problems, future research team will use to the support from relevant departments, on the basis of this research survey more involved in the process of further development in the field of synthetic biology, strengthen the quantitative research and qualitative research, close

combination of theory and practice, promote the results of the ground.

Synthetic biology, as an important scientific field in the future pointed out in the "145th national plan for scientific and technological innovation", has an important strategic value on a global scale and will have an important impact on people's lives. The investigation and research results of the research team on relevant people in the field of synthetic biology will help the field of synthetic biology and the community to understand and communicate with each other, and contribute to the progress of the field of synthetic biology.