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OPINION

Reproduction

# National Natural Science Foundation of China leads the comprehensive development of basic research in the field of male reproductive health in China

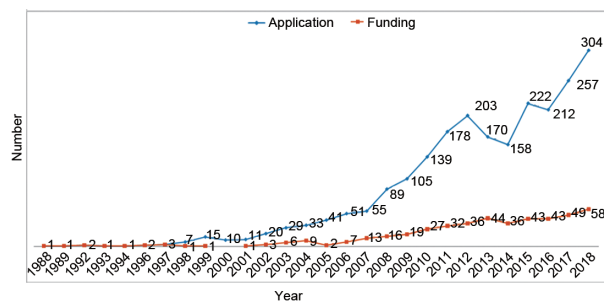
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“**R**eproductive health” was officially redefined as humans and their individual activities related to reproduction throughout their lives, which should be in good health in physical, psychological, and social aspects.<sup>1</sup> The basic research on male reproductive health in China can be traced back to the 1960s.<sup>2</sup> Since the National Natural Science Foundation of China (NSFC) began systematic support for basic research on male reproductive health in 1988, the field has been systematically developed in China. In this regard, we analyze the role of the NSFC on the development of basic research in the field of male reproductive health in China.

Statistics show that between 1988 and 2018, the NSFC funded a total of 484 items related to male reproductive health, with a total funding of 19 million Chinese Yuan. As a result, the basic research in the field of male reproductive health has gradually established a research platform, from small to large and from weak to strong and has cultivated a research team and made gratifying progress.

The NSFC-funded projects in male reproductive health field can be mainly classified as three types, that is, General Program, National Science Fund for Young Scholars, and National Science Fund for Regional Scholars. The total number of these three types of projects is shown in **Figure 1**. The number of applications for male



**Figure 1:** Overall application and funding of the NSFC in male reproductive health field in China, including General Program, National Science Fund for Young Scholars, and National Science Fund for Regional Scholars from 1988 to 2018 (data from the database of NSFC). NSFC: National Natural Science Foundation of China.

reproductive health increased from 1 in 1988 to 304 in 2018, with a total of 2320 items; the number of funded projects also increased from 1 in 1988 to 58 in 2018, with a total of 457 items, and the amount of funds reached 169 million Chinese Yuan.

**Figure 1** also depicts that the development trends of basic research on male reproductive health supported by the NSFC can be divided into three stages. The first stage is 1988–1998. It was the period that the NSFC started to support basic research in male reproductive health. During this period, the number of applications for the General Program and the Regional Project (funds for young scholars have not yet been established) has grown slowly, and the number of applications for the project in 1998 was only 7. The research content of the project is only sporadic involving sperm formation and maturation and male sexual dysfunction. The second stage is 1999–2009. The NSFC promoted the steady development of basic research in male reproductive health. During this period, the number of applications increased

year by year, reaching 105 in 2009. The scientific issues involved have gradually expanded to include structural, functional, and developmental abnormalities in the male reproductive system; male reproductive system damage and repair; male reproductive system inflammation and infection; male reproductive endocrine abnormalities and related diseases; male reproductive system hereditary diseases; male sexual dysfunction to multiple aspects of sperm dysplasia; and male infertility. The research teams represented by Peking University, Fudan University, Nanjing Medical University, Huazhong University of Science and Technology, Zhongshan University, Shanghai Jiao Tong University, Chongqing Medical University, and Sichuan University have gradually emerged. It is necessary to point out that in 1999, the NSFC established the National Science Fund for Young Scholars aiming to support young scientists and technicians to conduct basic research work independently.<sup>3</sup> In 1999, there were two applications for the National Science Fund for Young Scholars in

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the male reproductive health field. By 2009, the number of applications reached 24, and seven projects were funded. The research directions involved erectile dysfunction, promoting sperm technology, genetic/endocrine/metabolism/aging and other male infertility, spermiogenesis, maturity and abnormality, environment/nutrition/lifestyle and male infertility, etc., which have effectively promoted the growth of young researchers in this field. The third stage is 2010–2018. It saw comprehensive and rapid growth of basic research in male reproductive health promoted by the NSFC. During this period, with the establishment of the Ministry of Medical Sciences in 2010, basic research on male reproductive health has also developed rapidly. The number of applications for funds has increased year by year, from 139 in 2010 to 304 items in 2018. Topics of the projects cover male reproductive system structure; function and developmental abnormalities; male reproductive system injury and repair; male reproductive system inflammation and infection; male reproductive endocrine abnormalities and related diseases; male reproductive system hereditary diseases; male sexual dysfunction, sperm dysplasia; male infertility, etc., which embodies the comprehensive and coordinated development of basic research in this field.

It can be clearly seen from **Figure 1** that there is a significant decline in the number of applications in 2014. This is due to the adjustment of the NSFC's policy, that is, to guide more rational and healthy fund reporting and to promote the benign nature and healthy growth of fund application projects,<sup>4</sup> since 2014, applicants who have failed to receive funding for the projects for 2 consecutive years (this time refers to the years 2012 and 2013) have suspended the 1-year project qualification. Meanwhile, the project leader who was funded in the previous year should not apply for the same type of science fund project in the next year. Under the restrictions imposed by this regulation, the total number of applications in the past 2 years has declined slightly, but the number of projects funded has continued to grow steadily.

In addition to the above-mentioned three types of fund projects, the NSFC has also funded some basic research that leads the key development directions in this field through a number of heavily funded research projects. Key projects support science and technology personnel engaged in basic

research to conduct in-depth and systematic innovative research on the existing research directions or discipline growth points, attach importance to interdisciplinary research, promote discipline development, and promote breakthroughs in several important fields or scientific frontiers. The international (regional) cooperative research and exchange project was funded in 2006. Based on the frontiers of international science, the staff effectively utilizes international scientific and technological resources and conducts substantive international (regional) cooperative research and academic exchanges on the principle of equal cooperation, mutual benefit, and sharing of results so as to improve China's scientific research level and international competitiveness services.

The core competency of basic research is talent. In addition to the ability of the Science Foundation to support young researchers to independently conduct research projects for innovative research, the Science Foundation has also established a series of highly funded talent projects, including the National Outstanding Youth Science Fund Project, etc., which focus on supporting scientific research leaders at different stages of their academic research career to stand out. Specifically, the National Outstanding Youth Science Fund project focuses on supporting young scholars who have achieved outstanding results in basic research to independently research directions and gradually develop into outstanding academic leaders at the forefront of the discipline.

The NSFC Talent Projects supported two distinguished young scholars and one excellent young scholar in the field of male reproductive health, that is, National Science Fund for Distinguished Young Scholars in 2011 on "Spermiogenesis Abnormality and Male Infertility" and in 2015 on "Meatogenesis and Related Diseases" and National Science Fund for Excellent Young Scholars in 2012 on "Spermiogenesis Abnormalities and Male Infertility." By supporting the above high-intensity talent projects, the NSFC has concentrated on the outstanding backbone and academic leaders in the field of sperm dysplasia and male infertility and promoted the rapid development of basic research in this field.

In recent years, the NSFC has promoted a series of initiatives for the development of basic research on male reproductive health. Sperm dysplasia and male infertility and male

sexual dysfunction were the most funded areas, accounting for 52.5% and 20.1% of the total number of supported projects in male reproductive health, respectively.

Over the past 30 years, the support from the NSFC has made the basic research of male reproductive health in China more and more systematic. It has gradually established various research platforms, trained research teams, and academic leaders and achieved a series of impressive research outcomes.

At present, the research on male reproductive health is of important strategic and practical significance in China. On the one hand, China has a large population and is one of the countries with high birth defects in its offspring. According to incomplete statistics, China has an annual birth defect population of 900 000, a considerable part of which is caused by male factors.<sup>5</sup> On the other hand, from the perspective of population strategy, with the opening of the national family planning policy, the infertility population, especially the male infertility population, is increasing. It is imperative to further increase efforts to support male infertility and the health problems of offspring caused by male factors. Under the impetus of fund-raising reforms in the new era, the Science Fund will further lead scientists to explore and innovate; focus on the frontiers and develop new paths; breakthrough the bottlenecks from practical scientific issues; and further promote the comprehensive development of basic research in the field of male reproductive health in China.

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