

Establishing a More Scientific Athlete Selection System

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“The right selection of athletes is half the success in training.”

High-level scientific training, a favorable training environment and extraordinary personal attributes are the three prerequisites to become world champion.

Only the most “talented” athletes can stand atop the international sport pantheon. Therefore, athlete selection has become an integral part of competitive sports.



I. Review of China's Researches on Athlete Selection

China attaches great importance to athlete selection.

As early as the late 1970s and early 1980s, China began to conduct the first large-scale research on athlete selection in the history of the People's Republic of China.

From perspectives of sport anatomy, physiology, biochemistry, biomechanics, psychology and specialized theory, China has been promoting research on sports in terms of morphology, physiology and biochemistry, psychology and competitive ability of some sports.



In 1975, 5175 athletes participating in 11 events at the 3rd National Games were tested in regard to 23 morphological indexes. The outcome was published in the Research on the Body Morphology of China's Athletes, which provided the basis for the morphological selection of athletes.

The research explored the variations in height and secondary sexual characteristics of young athletes, and paved the way for their selection.



From the mid and late 1980s to the early 1990s, research on the scientific selection of athletes developed rapidly in China.

In 1980, a research project, the “Research on the Selection of Excellent Young Athletes”, was organized and implemented. It mobilized 8 institutions and involved 239 researchers, who collected 102 indexes from 14,871 athletes and acquired 748,000 figures. 123 articles were written, and the *Collection of Studies on the Selection of Excellent Young Athletes* was published.



In 1985, the “Research on the Selection of Excellent Young Athletes” was listed as a key project during the 7th Five-Year Plan.

In 1987, the National Research Cooperative Group on Scientific Selection of Athletes was established.

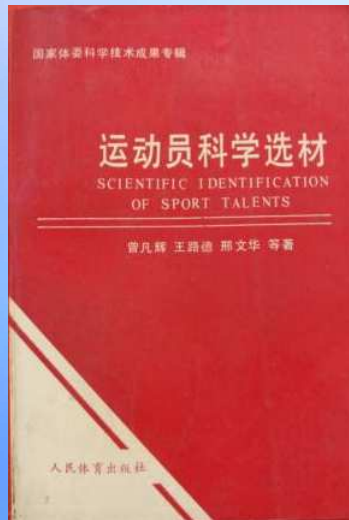
In 1988, the National Conference for the Scientific Selection of Athletes conferred, and the State Physical Culture and Sports Commission’s Central Group for the Scientific Selection of Athletes was established. It was responsible for drawing up national scientific selection plans, providing guidance, and coordinating scientific selection in China.



Universities for physical education and research institutes directly subordinated to the Central Group for the Scientific Selection of Athletes, and 13 municipal and provincial institutes jointly organized a second large-scale research on the scientific selection of athletes.

It developed standards for the selection of young athletes in 15 sport events, including track and field, swimming, gymnastics, weightlifting, basketball, football, volleyball, table tennis, badminton, shooting, bicycle, judo and canoeing.





A monograph, *Scientific Selection of Athlete*, was published. It proposed work procedures for the scientific selection of athletes as well as selection standards and testing principles for the scientific selection of young athletes based on the Chinese national conditions. It created a theory with Chinese characteristics and provided methodology for the scientific selection of athletes in China.



In 1994, the “Structural Module for the Competitiveness of Excellent Athletes and Selection Standards” research group was established. It conducted researches on the selection standards for 6 sport events, including wrestling, judo, bicycle, shooting and rowing.



By this time, research and practical work for the scientific selection of athletes in China had basically covered all events included in the Olympic Games and the Asian Games. It contributed greatly to the theoretical system of the scientific athlete selection in China, and offered invaluable experience for the conduction of large-scale selection processes.



In 2001, Beijing won the bid for the 2008 Olympic Games. Research on the scientific selection of athletes was listed at the top of the 10 research areas proposed by the High-tech Olympic Action Plan, and received funding from the Ministry of Science and Technology's "National Scientific and Technological Project" and the "Olympic Science Project" for its setting up. The "Research on the Scientific Selection of Outstanding Athletes for the Olympic Games" was launched, covering table tennis, diving, canoeing, badminton, gymnastics rhythmic, gymnastics, bicycle, boxing, baseball and softball, fencing, judo, free style wrestling, taekwondo, archery and weightlifting, for a total of 15 sport events.



To promote the application of research results, the project group compiled the Report on the Research on the Scientific Selection of Outstanding Athletes for the Olympic Games as a reference for research. They also compiled the Practical Guide for the Scientific Selection of Outstanding Athletes for the Olympic Games for coaches, researchers and managers.

The *Report* included the index system for selection, the selection standards, and a systemic theoretic framework for a backup talent pool of outstanding athletes, as well as tracking and monitoring of the talent pool for the aforementioned 15 sport events.

The *Practical Guide* included features of the competitiveness structural model, selection standards, selection indexes, detailed rules and regulations on testing, grading standards for individual events and comprehensive grading methods for these 15 sport events.



In 2008, the research group implemented the “Research on the Specialized Selection of Potentially Advantaged Events and Basic Training of Youth Athletes”. By researching body morphology, physiological functions, physical attributes for special sports event, technical and tactical skill levels and psychological features of outstanding athletes in trampoline, hockey, tennis, jogging, long-distance running, rowing, long-distance swimming and synchronized swimming, it aimed to build an index system and systematic selection standards for the specialized selection of athletes as well as selection standards.



The research group tested about 300 indexes of 1,112 athletes on potentially advantaged events. The sample covered over 70% of all athletes for China's potentially advantaged events. Various competitiveness indexes for these athletes were acquired.



The research group established a specialized selection system for outstanding athletes in China based on potentially advantaged events that included three aspects:

- 1) Structural Model for the Competitiveness of Athletes,
- 2) Index System for Athlete Selection,
- 3) Comprehensive Grading Standards for Athlete Selection.

They have been programmed into computer software for the sports teams to use during selection.



II. New Progress of China's Researches on Athlete Selection

China started applied research on athlete selection in the 1970s, and a relatively scientific selection system that integrated morphology, kinesiology, kinematics and psychology has been established, and it has made great contributions to China's Olympic strategy. However, the accuracy and prospective of the selection system still need to be improved.



The theoretical basis for athlete selection is genetics.

With the development of the molecular biological technique, it is now possible to find certain genetic markers for athlete selection and include these into the existing athlete selection system. This guarantees the improvement of athlete selection.



Gene marking refers to the marking of genetic material based on the mutation of the nucleotide sequence within the genetic material of different organisms, and is related to the phenotype of gene function. It is the direct reflection of the genetic polymorphism of DNA.

Gene markers are neither affected by the environment nor limited by the genetic expression. They are abundant in quantity and genetically stable.



Researches on the application of gene markers for athlete selection began in the 1990s. At present, the Bouchard Laboratory in the U.S., the Perusse Laboratory in Germany, and the North Laboratory in Australia, have all obtained funds from their respective governments to conduct related researches.



In China, the first institution to work on genes related to athletic ability was the laboratory started by Ma Lihong at the Tianjin Institute of Physical Education. Later, a research group led by Chang Yun at the China Institute of Sport Science of the General Administration of Sport of China also conducted researches on genes, including CNTF, ACE, mt DNA, among others.

Since 2003, the Hu Yang research group at the Beijing Sport University has been dedicated to applying research on genetic markers for athlete selection, and has gotten fruitful results.



The gene chip is the most widely applied and most mature technology in terms of biochip technology. It can be used to screen and establish patterns of the heredity and variation of genes related to physical attributes in athletes. Hence, it enables discussions on the features of functional genomes' expression profiles in relation to the physical attributes of athletes in different events, as well as on the patterns of genetic heredity and variations in relation to physical attributes connected with athletic ability. Thus, it allows the polymorphic analysis of functional genomes related to physical attributes.



The gene chip technology allows the screening of outstanding genes related to athletic ability in athletes. By extracting DNA from the athlete's genome and hybridizing it with the gene chip, a genetic map of the athletes can be formed. By comparing the two genetic maps, we can find the differences in the ways the athlete's DNA and the gene chip express themselves.

Via the polymorphic analysis of the functional genomes of physical attributes, a genetic map of the athletes and their physical attributes can be formed, and it is thus possible to establish a chip system applicable to the future selection of the physical attributes of outstanding athletes.



The establishment of the system will allow a more scientific and accurate evaluation of personal physical attributes and athletic ability. At present, research remains at the exploratory stage. Genetically mapping outstanding athletes would allow for map comparison with candidates, thus making it possible to determine what sports event best suits them.



Chinese scholars have already conducted tests on the DNA polymorphism of athletes with great strength, speed and endurance in order to find out the differences between different genome groups and spot specific genes to clone the genome and make probes. Through probe hybridization, people could test the attributes of the tested athletes.



By testing whether the tested athletes have the same specific genes as the outstanding athletes, we could find sports talents with potential. Basing ourselves on current work on gene pools, we could preliminarily establish a chip diagnosis system for athlete selection in China after screening a large quantity of outstanding athlete samples.

We hope that in the near future, we could make some breakthroughs in diagnosing genes related to athletic ability and in selection of athlete's genes.



III. Thoughts on Future Selection of Athletes in China

The research on the selection of outstanding athletes and selection of athletes for potentially advantaged events implemented in 2001 and 2008 provided a good foundation for today's selection of adult athletes.

The research on the selection of young athletes implemented in 1985 and the selection standards no longer applies today, as the physical constitution of Chinese people has already changed drastically. The selection standards need to be reviewed.



With the support of the Youth Division of the General Administration of Sport of China, the Beijing Sports University has established a research group to investigate and research the current situation in terms of athlete selection in China and propose a work program for the future selection of young athletes.



In 2015, the research group began to establish a young athlete selection index system for events such as football, basketball, volleyball, swimming and track and field (long-distance running and walking race), and worked out selection standards.

In 2016, it also conducted athlete selection for events such as badminton, table tennis and short-track speed skating. The work program is as follows:



1) For events for which researches on athlete selection have already been conducted, the research group should revise selection standards after conducting tests;

2) For events yet to be researched on, the research group should select a selection index through lateral comparison studies based on the current methodology for researches on selection index systems, and work out new selection index standards.



3) The research group should also conduct vertical tracking study for certain events. For example, it should test long-distance runners and walkers every two years, build a gene pool, and explore the “success law” for young athletes.



Conclusion:

1) China attaches great importance to athlete selection. After three periods of development, it has established a selection system that covers three aspects: Structural Model for Athlete's Competitive Ability; Index System for Athlete Selection; and Comprehensive Grading Standards on Athlete Selection.



Conclusion:

2) The theoretical basis for athlete selection is genetics. Studies on gene marker will become the indispensable direction of researches on athlete selection. The development of the gene chip technology will bring forth fundamental changes to the selection of outstanding athletes.

3) The emphasis of future athlete selection will be placed on the establishment of a selection index system for young athletes, as well as making and revising selection standards.



THE END

Thank you!

