

A Young Physicist Grown Up in Adversity

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At the 1980 doctoral qualifying examination of the Physics Department of Columbia University, Chinese students Chen Chengjun scored first. Not only he scored 20% higher than the second one, but also broke all records of previous qualifying exams in the Department's history.

Who is Chen Chengjun? He was once a technician in Agricultural Machine Building Plant in the Suburb of Tangshan, once a middle-school physics teacher in the suburb of Tangshan never on the podium, and once a top student at Peking University being persecuted gravely.

Ah! Top Student

In 1954, just over his 17th birthday, Chen Chengjun was admitted to the Physics Department of Peking University with excellent records.

He was widely recognized as the best student of that year. For example, in a mathematics class, the instructor drew a periodic waveform on the blackboard, and asked students to write down analytic expressions for it. In the instructor's mind, the answer should be two expressions for different segments. Chen Chengjun wrote down a single mathematical expression for the entire waveform. The instructor was puzzled and finally verified the correctness of the formula.

Chen Chengjun had broad interests in humanities, such as piano playing, painting and drawing, history and philosophy. But what attracted him most was the physics laboratory and the physics library. In his mind, physics is the forefront of human exploration of Nature. He often did extra experiments beyond the requirements of the instructors. Since entering the University, he was addicted to read the original works of Newton, Faraday, and Maxwell. After learned German language in the Department of Western Languages of Peking University in 1955 and 1956, he started to read original papers of the founders of quantum theory and quantum mechanics, including Einstein, Heisenberg, and Schrödinger.

In the middle of 1957, the “anti-rightist campaign” started. Just 20 years old, Chen Chengjun was condemned as an “anti-communist-party anti-socialism extreme right-wing element”, and was severely persecuted. In early 1958, he was banished from Peking University, down-transferred to Beijing Glass Factory for ideology reform through manual labor.

Facing such a grave setback, he pondered along thoughts of ancient wisdom and examples of historical figures who endured unthinkable hardship and eventually succeeded. He concluded that a setback has a duality. It may spiritually destroy a person, and may harden a person's resolve to be vindicated in the future. There is no alternative but to seize every bit of precious

time to continue study, especially theoretical physics and foreign languages. He believed that knowledge is power, and knowledge would eventually come into effect.

In Beijing Glass Factory, he chose to do super-heavy manual labor as a furnace operator. Every day he was required to carry two tons of coal from the coal yard to the furnace, and to carry one ton of ash to the garbage yard. He considered it as an intensive sports activity. The rest of time is almost free. While he was guarding the furnace, he used charcoal as pen to derive mathematical formulas and to write new words in foreign languages on the ground.

In September 1963, the persecution of “anti-communist-party anti-socialism extreme right-wing elements” was temporarily relaxed. He was allowed to return to Peking University to finish his bachelor’s degree.

After five years of “labor reform”, he returned to the classroom again. His academic performance was surprisingly excellent. After participating exemption exams, he passed the requirements for English and chemistry courses. Having extra time, he asked Professor Zhao Guangzeng, the head of Peking University’s Spectroscopy Laboratory, to do some meaningful work. Professor Zhao gave him a long review article in French. In just a few days, he completed a Chinese translation of the review article. Professor Zhao wrote a comment on the Chinese manuscript:

"Such an excellent student should be educated with focus."

Professor Zhao gave Chen Chengjun a research project to design and build a hydrogen arc lamp for the study of the ultraviolet spectroscopy of solid state materials. He did the project brilliantly and wrote a valuable report. However, in the left-wing campaign of 1964, Professor Zhao was criticized for supporting an “anti-communist-party anti-socialism extreme right-wing element”, and the special research project for Chen Chengjun was terminated.

In the Summer of 1965, Chen Chengjun received his Bachelor’s degree. At that time, every student at graduation was forcefully assigned a job by the Communist Party Committee. The plan for the assignment was publicly announced. All his classmates were assigned to research institutes, universities, mostly in central cities like Beijing and Shanghai. Chen Chengjun alone was down-transferred to Tangshan, a small city, as a secondary school teacher. Before leaving Peking University, an official in charge of job assignment solemnly declared to him, that this down-transfer is a persecution to force him to concentrate on ideology reform, and to prevent him from doing any scientific research.

"Real gold does not fear the test of fire!" Chen Chengjun's answer amazed that job-assignment officer.

Rugged Mountainous Road

In the Fall of 1965, Chen Chengjun came to the City of Tangshan, waiting several days for the Tangshan Education Bureau to assign him a job in a secondary school. Finally, he was told: Because he was an “anti-communist-party anti-socialism extreme right-wing element”, he was

not allowed to teach in the City. He was assigned to Wangpanzhuang Middle School in the suburb, a rural primary school recently expanded to include a junior middle school class.

Carrying his luggage, Chen Chengjun walked on the dirt-paved road to Wangpanzhunag Middle School. Again, because of his political status, he was not allowed to teach even there.

In 1966, the Great Culture Revolution started. Chen Chengjun was again confined, criticized, and tortured. His most precious time was spent in endless self-criticism and confessions.

After the turmoil of the Great Culture Revolution cooled down, Chen Chengjun continued to march into physics. While the various factions of the Red Guards indulged in endless struggles, he was neglected. With the Little Red Book as a cover, he continued his study. Unexpectedly, he received true love from a girl seven years his junior with a scholarly but politically depressed family background. They married in 1969.

A Significant Invention

During the Culture Revolution (1966-1977), all schools in China were closed. Having free time, Chen Chengjun started to visit local farming communities, making friends, and looked for what he could help them with his scientific knowledge.

Then in Hebei Province, an urgent problem was drought. Many rivers were completely dry. For irrigation, the only hope was to drill deep wells (100 meters plus) and pump water up. However, drilling rigs, similar to those for oil wells, were very expensive. Chen Chengjun studied the principles of existing drilling rigs, and proposed a novel design which could be manufactured by local machine shops. It requires manual control, not automatic, but of superior efficiency. The novel design requires large roller bearings. Chen Chengjun visited several local machinery warehouses, and found a number of such large roller bearings. Chen Chengjun drafted design drawings to accommodate available components and local machining capabilities. With the local machine shops enthusiastically working with him, soon the first indigenous drilling wig was built. It showed high speed and efficiency. In a short period of time, a dozen identical drilling wigs were made after Chen's design. Hundreds of wells were then drilled to relieve the drought.

The second project Chen Chengjun took was to design and build a carrier-wave broadcasting system through the existing telephone lines for the local rural government. That project was also very successful, and the local rural government was pleased.

The local rural government then enlisted Chen Chengjun to a more difficult technology venture: to design and build injection-pump test benches for the tractor service stations.

Diesel engines are extensively used in tractors, trucks, and various types of ships. The heart of the Diesel engine is a fuel-injection pump. Those injection-pumps require periodic testing and adjustment, using a dedicated instrument called injection-pump test bench. The accuracy and reliability of injection-pump test bench dictate the performance and efficiency of Diesel engines. The best injection-pump test benches are manufactured by Bosch of Germany, but prohibitively expensive. The injection-pump test benches made in China or from the Soviet-bloc countries are

of inferior quality, not really usable. That was a problem not only in the suburb of Tangshan, but also in all areas of China.

At that time, in Tangshan Tractor Station (later renamed as Agricultural Machine Building Plant in the Suburb of Tangshan), several technicians were experimenting with an indigenous injection pump test bench, only with limited success. As per a recommendation of the local government, Chen Chengjun was transferred from the middle school to Tangshan Tractor Station to become the leader of technical development team until 1978.

After studying the designs of various injection-pump test benches, Chen Chengjun made a bold proposal: to design and manufacture an all-electronic injection-pump test bench. It includes an electronic speedometer, a magnetic continuous variable transmission controlled by electronic circuits, a digital counter for the measurement of injection volume, and an electronic flash unit for injection angle measurements. Again, Chen Chengjun drafted all the engineering drawings, worked on the electronic circuits in person, including debugging. Despite the limited machining capabilities available, within a month, a prototype of all-electronic injection-pump test bench was completed. All the functions projected were achieved.

In July 1970, the all-electronic injection-pump test bench appeared in a Hebei Province industrial exhibition. In Spring 1971, an improved version participated in a national industrial exhibition organized by the Ministry of Machine Building, and attracted much attention. In 1974, Chen Chengjun wrote a 25-page technical report on the novel test bench, which was highly appreciated by the Ministry of Machine Building. In early 1975, the Ministry of Machine Building decided to make the all-electronic injection-pump test bench a national standard. They initiated a national design team, and appointed Chen Chengjun as the leader.

After two years of hard work, collaborating with several large Diesel-engine manufacturers, the new all-electronic injection-pump test bench passed many rigorous field tests. On June 4, 1977, the Ministry of Machine Building organized a national conference of certification. The new all-electronic injection-pump test bench was officially named as 12PSD55 injection pump test bench and certified as a national standard. The all-electronic injection-pump test bench was awarded by Hebei Provincial Science Congress and China National Science Congress in late 1977.

A Talent Rediscovered

After the death of Mao in 1976, Deng Xiaoping started a new policy of opening to the world, and reemphasizing science and technology. In early 1978, the Chinese Academy of Sciences issued an announcement to solicit postgraduate students. Chen Chengjun read the announcement with excitement, then sent an application. His application was accepted, and he was invited to take an entrance exam at the Chinese Academy of Sciences. He scored first in the exam, and was much higher than the second applicant. Professor He Zuoxiu, a renowned high-energy physicist and the perspective thesis advisor, was amazed by his performance.

At that time, the admittance was also highly relying on the letter of political appraisal by the Communist Party Committee of applicant's organization. The letter stated thusly:

"This person was determined as an anti-communist-party anti-socialism extreme right-wing element in 1958. Since joining the workforce, he never reformed his ideology, never respected the authority of the Communist Party. His political performance has always been very poor ..."

On a meeting of the Communist Party Committee of the Institute of Natural Science History of the Chinese Academy of Sciences, a heated discussion was launched on the question of whether to accept Chen Chengjun as a postgraduate student. Professor He Zuoxiu was invited to attend the party committee as the potential advisor.

With one hand holding Chen Chengjun's excellent examination paper, another hand holding the political appraisal letter from Tangshan Agricultural Machinery Plant, Professor He Zuoxiu made an insightful speech: "Chen Chengjun's test scores are too prominent. It is very difficult to find any fault in his physics answers. And his social science answers are also very good ..."

"Regarding his history as an anti-communist-party anti-socialism extreme right-wing element, I think the great invention he made for the country showed his real personality. The rude remark from the Communist Party Committee of his Plant was too absurd to worth any attention".

At the meeting, the Communist Party Committee of the Institute of Natural Science History supported Professor He Zuoxiu's opinion, and Chen Chengjun was admitted. A talent was rediscovered. Because he is excellent in both social science and physics, he was assigned to do research on the History of Twentieth-Century Physics.

In the Spring of 1979, T. D. Lee, a Nobel-Prize winning physicist and professor of Columbia University, came to China to recruit graduate students. He asked every applicant to take last-year's Physics Department Ph.D. qualifying exam. Some 20 students and researchers were chosen by the Chinese Academy of Science to participate in the exam. Chen Chengjun was not on the official list due to his political history as an anti-communist-party anti-socialism extreme right-wing element. Professor He Zuoxiu proposed to allow Chen Chengjun to take the exam as a bystander. The official understanding was, even if Chen Chengjun passed the exam, he would not be allowed to go abroad to enter Columbia University.

During the exam, something unexpected happened. The absentminded proctor did not know that the qualifying exam has three sections, each one takes four hours. He distributed all three exam papers to the participants. Almost immediately, T. D. Lee found the mistake. Enraged, T. D. Lee said that the exam papers cannot be taken back once opened. He asked everyone to do whatever possible in four hours. Chen Chengjun was the only one who passed the three qualifying exams in four hours. T. D. Lee said, "I will admit Chen Chengjun first. All others take a second exam". Thus, initially as a bystander in the exam, Chen Chengjun became the first graduate student from mainland China admitted by the Physics Department of Columbia University.

In the qualifying exam of the Physics Department of Columbia University Spring 1980, Chen Chengjun won the first place. Professor C. S. Wu, who presided over the examination, told him that his written examination was 20% higher than the second, and he broke the records of all previous doctoral qualifying exams of Columbia's Physics Department. Chen Chengjun thus could start his doctorate research immediately.

The Value of Life

Recently, we sent a letter to Chen Chengjun in New York, asked about his believes on the value of life. He replied thusly: "When it comes to the value of life, the ultimate criterion is how the activities of a person contribute to the benefit of the people, especially on society's productivity. This is an eternal historical criterion. As for myself, in the coming decades, as long as I am active, I will exert myself in science and technology to serve mankind."

Chen Chengjun also sent us his new Chinese translation of Henry Wadsworth Longfellow's Psalm of Life for young friends in China. Hereby we quote two paragraphs:

Not enjoyment, and not sorrow,
 Is our destined end or way;
But to act, that each to-morrow
 Find us farther than to-day.

Let us, then, be up and doing,
 With a heart for any fate;
Still achieving, still pursuing,
 Learn to labor and to wait.

(Excerpted from an article on October 18, 1980, Hebei Daily)