

Obituary

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Scientific footprints: In memory of crocodile expert, Professor Bi-Hui Chen (1931–2022)

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At 10:00 am on 28 August 2022, we received the sad news that our beloved supervisor, Professor Bi-Hui Chen (陈壁辉), a world-renowned expert on the Chinese alligator (*Alligator sinensis*), passed away from multiple organ failure at the age of 91 (Figure 1).

Professor Bi-Hui Chen was born in September 1931 in Pinghe County, Fujian Province, China. His father was a successful businessman and landowner, which allowed his parents to send him to the prestigious Xiamen Shuangshi Middle School in Xiamen. Many of his classmates were Chinese children from other countries in Southeast Asia. This early introduction to different lifestyles and customs greatly broadened his vision and knowledge. During his time in middle school, Bi-Hui also became increasingly interested in science and the great wonders and mysteries of nature, with many natural laws yet to be explored or understood. This laid the foundation for his future goals and interests.

Following his father's hope that he would study biology and then medicine, Bi-Hui passed the entrance exam for admittance to the Department of Biology of Xiamen University in 1950. However, given his deep fascination with the complex, profound, and strange phenomena of the living world, he gave up the idea of transferring to medicine, instead graduating with a major in zoology in 1954. He was subsequently assigned to work in the Biology Department of Anhui Normal University, where he served as a full-time teacher. In 1956, he was successfully admitted to the National Animal Ecology Research Class in Northeast Normal University, under the tutelage of two experts from the former Soviet Union. This class trained 36 experts, who became the backbone of animal ecology teaching and scientific research in China. Bi-Hui was promoted to full professor in 1986 and

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Figure 1 Professor Bi-Hui Chen (陈壁辉), herpetologist and “father of the Chinese alligator”, 1931–2022

retired in 1999.

After graduating from the Animal Ecology Research Class in September 1958, Bi-Hui returned to Anhui Normal University during the massive steelmaking era in China. At that time, research was difficult to carry out, so Bi-Hui spent time collating the traditional hunting methods of southern Anhui through interviews and data collection (Chen, 1959). After the steelmaking era ended, Bi-Hui began to study the animal resources of Anhui Province, focusing on fish and mammals, which he continued to study through the cultural revolution. From 1973 to 1974, he participated in the Yangtze River aquatic resources survey organized by the Ministry of Fisheries. He compiled his own teaching materials and provided theoretical training for aquatic technicians in the Anqing and Wuhu regions. At the same time, he provided technical and practical guidance, surveyed 105 species of fish in southern Anhui (oral record by Chen, research papers could not be published under personal names during this period),

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and collected ecological data on various mammals in Anhui (Wang et al., 1966). After the cultural revolution, Bi-Hui focused on the resources and basic ecology of terrestrial vertebrates, including sika deer (Chen & Li, 1979a), silver pheasant (Li & Chen, 1979), Yangtze River dolphin (Chen & Li, 1980), finless porpoise (Li & Chen, 1980), and serow (Chen, 1980a). These studies provided the earliest first-hand ecological data of mammals in Anhui. Bi-Hui also explored the reasons for the endangerment of large Indian civets and proposed various conservation measures (Chen, 1980b), and further studied the ecology of amphibians and reptiles, such as *Rana tigrina* (Chen et al., 1982) and *Mauremys mutica* (Wang et al., 1982), and the metabolism of five species of turtles in southern Anhui (Xia et al., 1982). Subsequently, he and his colleagues published two seminal works, notably Anhui Amphibians and Reptiles Fauna (Chen, 1991) and Anhui Mammals Fauna (Wang, 1990) (participated in compilation). These publications made important contributions to the study of mammals, amphibians, and reptiles in Anhui Province and China.

In 1976, Bi-Hui began to carry out research on Chinese alligators. After investigating their area and number, he found that the distribution of Chinese alligators in Anhui was greatly reduced, and thus proposed that a dedicated nature reserve and artificial breeding program should be established and implemented (Chen, 1977; Chen & Li, 1979b). This timely suggestion led to the establishment of the Anhui Alligator Provincial Nature Reserve in 1980 and its promotion to a National Nature Reserve in 1986. In 1980, according to the China-US Science and Technology Agreement, the United States sent experts to China to study the Chinese alligator. The Ministry of Forestry appointed Bi-Hui as the leader of this joint research group. In 1981, together with American researcher Mona Watanabe, Bi-Hui and colleagues conducted various field surveys on Chinese alligators and carried out a series of studies on the species, including its distribution (Li & Chen, 1981), population (Chen et al., 1981a), reproductive ecology (Li et al., 1980, 1981a), artificial hatching and rearing (Li et al., 1981b), feeding habits and overwintering (Chen et al., 1981b), and other related research (Chen et al., 1982). Based on these studies, Bi-Hui published the first book on the *Chinese alligator* (Chen et al., 1985) and received the National Natural Science Award in 1987 due to his pioneering research work in the field of Chinese alligator ecology.

In 1982, Bi-Hui and others from the Chinese Alligator Breeding Research Center at Xuanchen succeeded in artificially breeding Chinese alligators. In 1984, Bi-Hui made a breakthrough in large-scale artificial breeding (Chen & Wang, 1984), and later solved the challenge of breeding young alligators with hard yolks (Chen & Wang, 1989), clarified the relationship between metabolic rate and seasonal change (Chen et al., 1985), and resolved the artificial feeding of hatchlings and young alligators (Gu et al., 1987; Zhang et al., 1986). These important achievements enabled the species to be preserved, for which Bi-Hui was granted the Second Scientific and Technological Achievements award by the Ministry of Forestry in 1987.

Bi-Hui also studied various functional and structural characteristics of the Chinese alligator, including the tongue

gland (Chen et al., 1989; Pan et al., 1997), olfactory organ (Wu & Chen, 1992), visual organ, optic nerve (Wu et al., 1993a, 1993b), and the kidney (Pan et al., 1995), as well as the physiological basis of its digestive system and other internal organs (Zhang et al., 1999). He also studied its embryogenesis (Hua et al., 2004) and developmental patterns of various organ systems, such as the stomach (Hua et al., 1996) and nervous system (Yang & Chen, 2001), as well as the embryonic developmental of sensory organs (Hua et al., 1994a, 1994b). For these achievements, he was awarded the third-class Science and Technology Progress Award of the former National Education Commission in 1995 and the second-class Science and Technology Award of Anhui Province in 2003.

During his work, Prof. Chen published 103 academic papers and nine books. He was also committed to disseminating scientific knowledge and encouraging public awareness and understanding of the Chinese alligator. He published more than 10 popular science publications, introducing the Chinese alligator and calling for its protection (Chen, 1983, 1986; Chen et al., 1984). Due to his outstanding achievements, he was honored as the "Father of the Chinese alligator". He was awarded the "National Education System Model Worker and People's Teacher Medal" by the State Education Commission of the People's Republic of China in 1986, and the "Young and Middle-aged Experts With Outstanding Contributions" by the Ministry of Personnel of the People's Republic of China in 1988. He was further granted the Special Government Allowance by the State Council of the People's Republic of China in 1991 and awarded second prize of the Xianzi Zeng Education Fund in 1993. Twenty-five years after his retirement, the President of Anhui Normal University presented him with the "Lifetime Achievement Award of Anhui Normal University" in 2014.

As a scientist with a deep sense of responsibility, Bi-Hui actively undertook academic work and served as a member of the Crocodile Specialist Group of the IUCN Species Survival Commission. He was invited to become a Member of the National Technical Committee for Investigation and Monitoring of Terrestrial Vertebrates by the Protection Department of the Ministry of Forestry, as well as the Executive Director of the Chinese Herpetological Society, Vice President of Anhui Society of Zoology, and President of Anhui Wildlife Protection Association. He also served as an editorial board member on several journals, including "*Acta Herpetologica Sinica*" and "*Chinese Journal of Wildlife*". During his tenure, he worked hard to impart his knowledge and wisdom.

Professor Chen dedicated his life to education and the scientific research of vertebrates, most especially the conservation of Chinese alligators. Even after his retirement, he devoted himself to research and published his monograph *Research on the Chinese Alligator* in 2003 (Chen, et al., 2003). I had the honor of becoming Prof. Chen's graduate student in 1988, obtaining a master's degree in 1991. After graduation, I remained at Anhui Normal University as a teacher, working alongside Prof. Chen. Professor Chen was an excellent supervisor, very strict with scientific research, writing, and communication but also encouraging and willing to go to great lengths for his students. I remember we once

had to teach an animal ecology course to our graduates. However, in the middle of winter, it was too cold to attend classes at the laboratory. To ensure the students were not disadvantaged, Prof. Chen instead conducted his lessons in the student dormitory. These events had a considerable impact on my attitude towards science and attitude towards graduate guidance thereafter.

Professor Chen helped and mentored 10 graduate students in total. When he stayed with his students, he always talked about how to approach the study of scientific problems and what scientific problems were worth studying. He not only shared his research experience but also his sense of joy. In life, he always smiled and gave people a sense of affinity. When he suffered from a certain blood disorder in later life, he remained optimistic and fought against the disease for 30 years. His enthusiasm, optimism, and persistent scientific spirit in work and life affected us all. We mourn his death with deep regret and sadness.

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