

Pursuing innovation in a new era

This year marks a significant milestone as we celebrate the 75th anniversary of our nation, alongside the 65th anniversary of the Kunming Institute of Zoology (KIZ) and the 75th anniversary of the Chinese Academy of Sciences (CAS). This juncture provides an opportunity to reflect on our progress over the past five years and strategically enhance our culture of innovation, while pursuing new aspirations (Yao & Shen, 2019). It is a critical moment to advance innovation and take decisive steps toward leadership in this new era.

Over the past five years, KIZ has experienced a transformative phase, defined by the creation of a detailed blueprint, the implementation of major reform and innovation, and substantial growth leading to new developments and notable achievements. Reflecting on the successes and challenges of the 13th Five-Year Plan, the mission of KIZ has been refined for the 14th Five-Year Plan, with a focus on our unique features. Efforts remain closely aligned with national strategic priorities, particularly in biodiversity conservation and the sustainable utilization of biological resources. As a result, three core research directions have been identified: animal diversity, conservation, and resource utilization; mechanisms underlying the development and regulation of complex animal traits; and the construction and application of non-human primate (NHP) disease models (Figure 1A). These areas are deeply rooted in the geographic and historical context of KIZ (Yao & Shen, 2019) and constitute fundamental questions at the forefront of zoological science. Through the application of cutting-edge technologies for NHP phenotypic and genomic analyses, biodiversity monitoring, conservation efforts, and targeted exploration of genetic resources, KIZ has established itself as a world-class center for fundamental research and the innovative utilization of biodiversity resources. Notably, the institute has become a key hub for scientific talent and a leading source of groundbreaking discoveries.

In the past five years, KIZ has implemented numerous strategic and reformative initiatives to enhance its core competitive capacity and capabilities, with a focus on mission-oriented basic research while addressing national priorities. A series of major scientific and technological (S&T) projects were launched, accompanied by the implementation of critical reforms and development measures. Institutional structures were also reorganized, and resources were integrated to support rapid growth and development.

First, KIZ completed the construction of three world-class NHP facilities, including the National Research Facility for Phenotypic and Genetic Analysis of Model Animals (Primate

Facility), National Resource Center for Non-Human Primates, and Kunming National High-Level Biosafety Research Center for Non-Human Primates at KIZ (Figure 1B). These facilities became operational within the past few months and have already achieved remarkable results. Notably, the Primate Facility, designed to foster technological innovation and international collaboration, supports comprehensive research using NHPs (Yao & Construction Team of the KIZ Primate Facility, 2022). As a national large-scale research infrastructure, it has the capacity to conduct high-quality, world-class, full-scale, full lifecycle studies on NHPs. The facility provides an integrated platform for the precise and automated collection and analysis of phenotypic and genetic data, based on large-scale, standardized production and breeding colonies of NHPs, enabling advanced research on NHP disease models, NHP biology, and conservation (Yao & Construction Team of the KIZ Primate Facility, 2022). Supported by the Primate Facility, researchers from China and overseas initiated the Primate Genome Project (PGP) (Wu et al., 2022), resulting in remarkable scientific breakthroughs (Guo et al., 2023). Currently, the facility provides key support for several ongoing projects, including the monkey ENCODE project, monkey brain imaging and mapping (BIM) project, and monkey phenome project. The potential for future landmark achievements and discoveries from the Primate Facility is promising. Similarly, the Kunming National High-Level Biosafety Research Center for Non-Human Primates has been crucial in the global fight against COVID-19. The center successfully developed diverse animal models, including NHPs, tree shrews, hamsters, rats, and transgenic mice, to evaluate the efficacy of more than 10 SARS-CoV-2 vaccines. Researchers were able to characterize and validate the antiviral efficacy of numerous compounds, molecules, and drug candidates, while also elucidating the molecular and pathological mechanisms of COVID-19. The positive outcomes from these efforts over the past years have clearly demonstrated the strategic foresight and lasting impact of the initiatives.

Second, significant progress has been made in enhancing focus on evolutionary biology and restructuring key laboratories, including the State Key Laboratory of Genetic Resources and Evolution and Key Laboratory of Animal Models and Human Disease Mechanisms of the Chinese Academy of Sciences, to accelerate the formation of innovation hubs. The restructuring of the Key Laboratory of Genetic Evolution and Animal Models began in 2022, receiving approval for construction from CAS on 19 September 2023, followed by a formal defense for state key laboratory status on 2 September 2024. The restructured facility emphasizes three core research directions: (1) decoding the genetic basis and development of complex animal traits; (2) developing automated and artificial intelligence-assisted phenotyping and genetic analysis technologies for large animals; and (3) creating large animal

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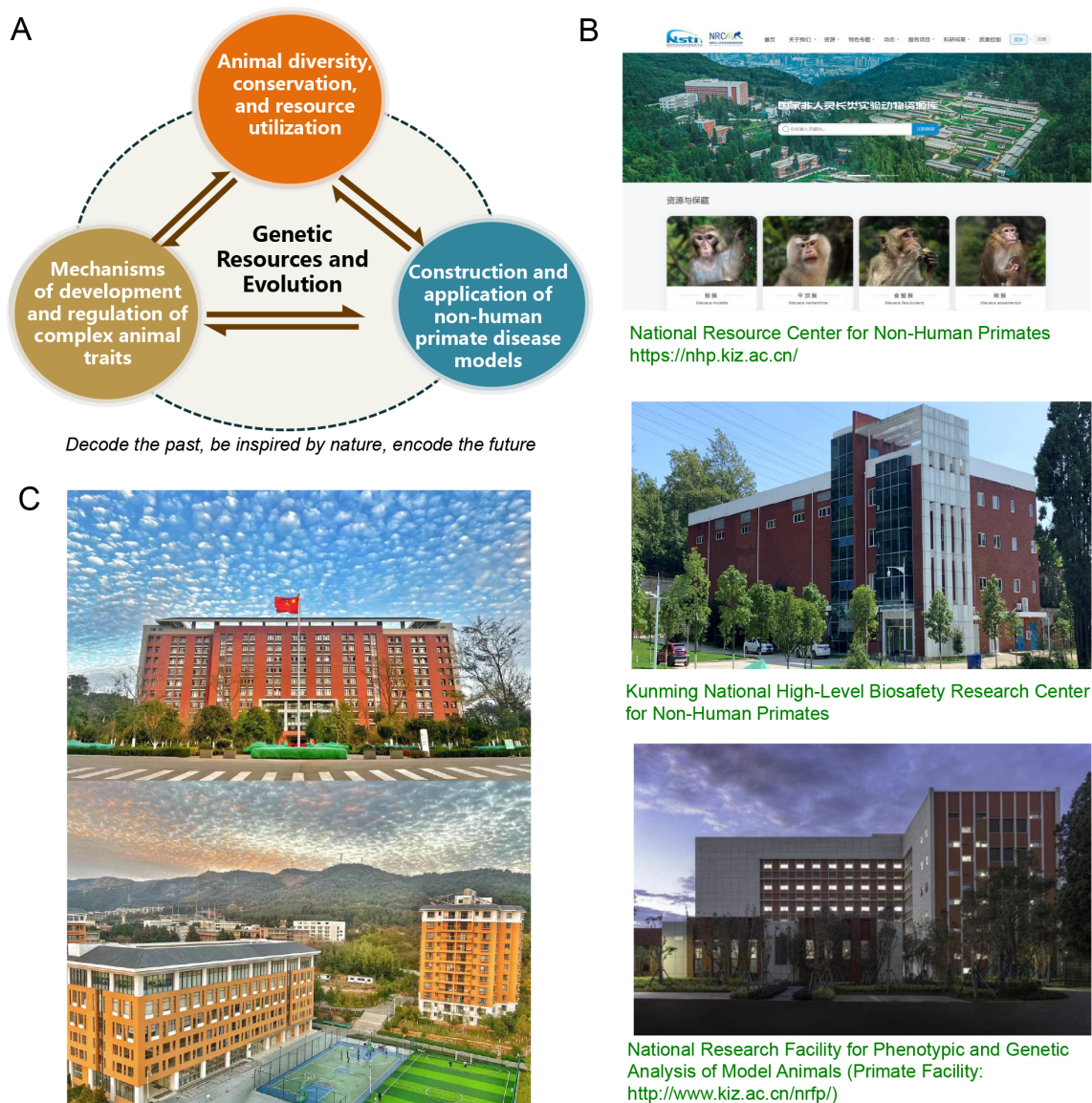


Figure 1 Overview of research directions, facilities, and the new campus at the Kunming Institute of Zoology (KIZ)

A: Core research directions of KIZ during the 14th five-year period. B: Non-human primate research facilities. C: Aerial view of the newly constructed KIZ campus. Images courtesy of KIZ colleagues.

models for human diseases such as Alzheimer's disease, Parkinson's disease, and other disorders. The goal is to connect insights from evolutionary studies with applications that will drive future innovations. A comprehensive system is being developed, spanning basic research to preclinical applications, utilizing large animal models such as NHPs, dogs, and pigs. The primary goals are to achieve precision, standardization, automation, and scalability in large animal model research, accelerating and strengthening global research efforts and establishing leadership on the international stage. The new state key laboratory is thus positioned to drive major advancements in basic research and foster critical technological breakthroughs. At the same time, structural reforms have been implemented to optimize operational efficiency and support the creation of an innovation framework. Notably, the integration and collaborative development of institute-level research centers, such as the Biodiversity Center, Evolution & Development Center, Genetic Resources Center, and Non-human Primate Center, has strengthened interdisciplinary collaboration,

reinforced the foundation of the institute, and improved competitiveness, thus serving as a central driver for innovation.

Third, a new campus was constructed to improve our capacity to operate as a first-class institute (Figure 1C). Comprehensive support from all management departments and technical service centers has further boosted capabilities for high-impact research and talent recruitment. A series of pioneering institution-level projects were initiated, establishing a robust foundation for guiding key projects funded by the Ministry of Science and Technology of China in later stages. The restructuring of entire teams has transformed the institute into a more cohesive and attractive hub for talent, supported by an integrated recruitment and training program that promotes collaboration among research teams, human resources, and personnel units. In total, 35 and 19 special research positions have been created at the CAS and institute levels, respectively, with 66% of these roles filled by researchers aged 40 years or younger. These appointments have sparked creativity and helped stabilize teams, enabling

focus on national strategic needs and fundamental research. An evaluation and appointment system has also been established to align with the innovative activities of researchers, alongside an advanced classification system for assessing S&T talent. Implementation of the “Climbing Program” for young researchers and enhancement of the student training program has created an environment that nurtures rapid growth and essential contributions to mission-oriented tasks. Currently, KIZ hosts a dynamic and competitive research team of over 450 staff and researchers, with an average age of 37 years, and more than 430 doctoral and master’s students. Building on the success of the journal *Zoological Research* (Yao & Zhang, 2022), a new journal, *Zoological Research - Diversity & Conservation* (ZRDC) (Yao & Zheng, 2023; Yao et al., 2024), has been launched to meet the growing needs in biodiversity and conservation research and to broaden our impact in the field. In summary, despite limited resources, the institute has effectively nurtured major national scientific initiatives, driven significant achievements, and established talent hubs, thereby enhancing overall efficiency and capacity.

Supported by a synergistic technological innovation model driven by both NHP facilities and key laboratories, significant strides have been made over the past five years in advancing major national scientific initiatives. This dual framework has fostered a series of impactful S&T breakthroughs aligned with our mission, generating a dynamic wave of innovation. One area of progress involves wildlife diversity surveys and studies on evolutionary patterns, contributing substantially to biodiversity conservation and strengthening ecological security in key regions. Notable advancements have also been made in the collection, preservation, and management of animal genetic resources, particularly for domestic animals, with a strong emphasis on sustainable utilization. The origins and regulatory mechanisms underlying complex traits, such as adaptation to harsh environments in high-altitude regions and echolocation in animals, have also been explored using cutting-edge technologies, methods, and interdisciplinary approaches. In parallel, a series of NHP models have been developed to dissect human disease mechanisms, facilitating the discovery of innovative drug development through the study of bioactive and lead molecules derived from animal systems. These efforts have led to groundbreaking research, with findings published in high-ranked journals such as *Science* (He et al., 2021; Ma et al., 2019; Qiao et al., 2021; Shao et al., 2023), *Cell* (Bi et al., 2021; Luo et al., 2021), and other renowned publications (Chai et al., 2022; Fang et al., 2023; Li et al. 2020; Wang et al., 2020), underscoring the significant impact of our work.

In conclusion, through unwavering determination and collective effort, the 14th Five-Year Plan of KIZ has been successfully realized under the guidance of the CAS headquarters and with the dedicated support of all members of KIZ. This achievement, marked by a series of landmark breakthroughs, stands as a significant accomplishment in celebrating the 65th anniversary of KIZ and the 75th anniversary of the CAS and our beloved country. Achieving these milestones was no small feat, and we extend our sincere gratitude to all contributors at KIZ and those who have supported its progress. As we face an accelerating global technological revolution and the urgent need to secure leadership in basic research and technological innovation, we remain committed to strategic planning, institutional

reformation, and platform development, as well as the cultivation and recruitment of top talent. These efforts will continue to strengthen our capabilities and position in the field. We look forward to a promising and bright future in this new era, with full confidence in the opportunities ahead.



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REFERENCES

- Bi XP, Wang K, Yang LD, et al. 2021. Tracing the genetic footprints of vertebrate landing in non-teleost ray-finned fishes. *Cell*, **184**(5): 1377–1391. e14.
- Chai J, Lu CQ, Yi MR, et al. 2022. Discovery of a wild, genetically pure Chinese giant salamander creates new conservation opportunities. *Zoological Research*, **43**(3): 469–480.
- Fang MQ, Li Y, Liao ZY, et al. 2023. Lipopolysaccharide-binding protein expression is increased by stress and inhibits monoamine synthesis to promote depressive symptoms. *Immunity*, **56**(3): 620–634. e11.
- Guo YT, Shao Y, Bi XP, et al. 2023. Harvesting the fruits of the first stage of the Primate Genome Project. *Zoological Research*, **44**(4): 725–728.
- He K, Liu Q, Xu DM, et al. 2021. Echolocation in soft-furred tree mice. *Science*, **372**(6548): eaay1513.
- Li H, Su LY, Yang LX, et al. 2020. A cynomolgus monkey with naturally occurring Parkinson's disease. *National Science Review*, **8**(3): nwaa292.
- Luo X, Liu YT, Dang DC, et al. 2021. 3D Genome of macaque fetal brain reveals evolutionary innovations during primate corticogenesis. *Cell*, **184**(3): 723–740. e21.
- Ma HX, Zhai JL, Wan HF, et al. 2019. In vitro culture of cynomolgus monkey embryos beyond early gastrulation. *Science*, **366**(6467): eaax7890.
- Qiao JX, Li YS, Zeng R, et al. 2021. SARS-CoV-2 M^{pro} inhibitors with antiviral activity in a transgenic mouse model. *Science*, **371**(6536): 1374–1378.
- Shao Y, Zhou L, Li F, et al. 2023. Phylogenomic analyses provide insights into primate evolution. *Science*, **380**(6648): 913–924.
- Wang MS, Thakur M, Peng MS, et al. 2020. 863 genomes reveal the origin and domestication of chicken. *Cell Research*, **30**(8): 693–701.
- Wu DD, Qi XG, Yu L, et al. 2022. Initiation of the primate genome project. *Zoological Research*, **43**(2): 147–149.
- Yao YG, Construction Team of the KIZ Primate Facility. 2022. Towards the peak: the 10-year journey of the National Research Facility for Phenotypic and Genetic Analysis of Model Animals (Primate Facility) and a call for international collaboration in non-human primate research. *Zoological Research*, **43**(2): 237–240.
- Yao YG, Jiang XL, Li SQ. 2024. Why we need a new journal in diversity and conservation. *Zoological Research: Diversity and Conservation*, **1**(1): 1–2.
- Yao YG, Shen H. 2019. From our roots, we grow. *Zoological Research*, **40**(6): 471–475.
- Yao YG, Zhang Y. 2022. *Zoological Research* shines in the East. *Zoological Research*, **43**(1): 1–2.
- Yao YG, Zheng YT. 2023. ZR and ZRDC embrace a new era. *Zoological Research*, **44**(1): 1–2.