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Cave Research

Think about caves globally

Li Ma[1,2,*]

[1] Department of Biology, University of Maryland, College Park, MD 20742, USA
[2] Department of Biological Sciences, University of Cincinnati, Cincinnati, OH 45221, USA
* Correspondence: mal2@ucmail.uc.edu

Caves offer countless opportunities for research and new discoveries. The mysterious world of caves has always fascinated scientists, especially geological and biological scientists. Many milestones in research about the cave life has been during the last decade. As a biological scientist, I would like to highlight the important discoveries of this field by publishing a special issue on cave biology research.

Many different kinds of creatures live in caves, including planarians, mollusks, arthropods, and even vertebrates. Most of these obligate cave dwellers have unique features, such as lack of eyes and pigmentation. I will discuss two famous cave species, *Astyanax mexicanus* and *Sinocyclopedia* as model systems to summarize the recent developments in these fields. These two species have received considerable attention by researchers during the last decade.

The tetra *Astyanax mexicanus*, a single species consisting of eyed surface-dwelling (surface fish) and many con-specific blind cave-dwelling (cavefish) morphs, is an excellent system for understanding the genetic changes that drive morphological and behavioral evolution. Because of the perpetual dark environment and food limitation, *Astyanax* cavefish have evolved a series of constructive and regressive changes. The constructive changes include an increase in the number and distribution of taste buds and teeth, olfactory neurons, and cranial neuromasts (the sensory organs of the lateral line), the size of the mouth and jaws, and retention of significant amount of fat in the body. The regressive changes include the degeneration of eyes, a reduction in melanin pigment, as well as reduced schooling behavior, aggression, and sleep. The *Astyanax* cavefish genome sequence has been finished and published (Nat Commun. 2014 Oct 20; 5:5307. doi: 10.1038/ncomms6307). In this research, the first de novo genome was presented and candidate genes underlying eye loss were identified based on their location in quantitative trait loci (QTL). The research will shed light on understanding of the evolutionary processes and human eyes associated diseases, such as cataracts and macular degeneration.

Another model animal at the forefront of cave animal research is the cyprinid genus *Sinocyclocheilus*, which is endemic to the massive southwestern karst area adjacent to the Qinghai-Tibetan Plateau of China. Whole-genome sequencing and comparative analyses of three distinct species *S. grahami*, *S. rhinocerous*, and *S. anshuiensis* were recently completed. These species are surface-dwelling, semi-cave-dwelling, and cave-restricted, respectively. Divergence times and population history analyses of these species reveal that their speciation and population dynamics are closely related to the stages of uplifting of the Qinghai-Tibetan Plateau. The work provides insights into genetic mechanisms of cave adaptation and also supplies a fundamental resource for better comparative understanding of cavefish biology.

Cave research can engage us in some of the most exciting and intellectually challenging pursuits. Cave research must be inclusive of all who can contribute to the cave research, must expand into new frontiers. To meet the demands of the future, it is becoming increasingly important for scientists and the public to know about and understand events related to caves, however, only a limited number of journals makes it difficult for cave scientists to contribute to the solutions of global problems. Accordingly, we launch a new journal- *Cave Research*- that reports on new findings and trends in cave research within a global perspective. *Cave Research* aims to re-unite and integrate the various disciplines that look at caves from different perspectives and provide the basis for a comprehensive understanding of cave science on all levels of analysis. The published contents will include research articles, insightful reviews, hypothesis articles, educational primer articles, and reviews of recent meetings in the field. *Cave Research* has a vital interest in research progress around the world, including protecting caves as natural resources cave. It is imperative that the international communities of cave researchers use *Cave Research* as a publication vehicle for their latest achievements. *Cave Research* provides a unique opportunity to publish high quality research and review articles on cave-related issues that will be internationally accessible to any reader at no cost.

We hope to inspire multiple ways to improve the communication of information and concepts, and increase the discoverability in cave research. We pledge to make data more open, easier to access, and useful in revealing the beautiful and mystery of the underground world! Our mission is to advance cave research and serve the public.

References

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