Biological Robustness and Fragility

To discuss robustness and fragility in biology, it is first necessary to clarify the original meaning and relationship between the two. Robustness can be seen as the ability of something to survive abnormal or dangerous situations. Fragility can be thought of as a subject's susceptibility to damage and loss. But in biology, when discussing the definition and correlation of the two, it is necessary to bring into the complex and changeable biological environment. In biology, robustness refers to the anti-disturbance ability of complex biological systems in the "survival of the fittest, survival of the fittest" evolution theory, resistance to environmental and genetic disturbances. It promotes the evolution of organisms to a certain extent. Biodiversity is an accurate expression of biological fragility, whether it is the ability to withstand objective changes in the external environment or the internal environment. The interrelationship between biological robustness and biological fragility can be demonstrated and discussed through examples. For example, how to properly balance robustness and fragility between cancer cells or tumor cells. Cancer cells are notoriously difficult to eradicate with conventional chemical drugs. It is understandably robust to these agents but extremely vulnerable to some chemotherapeutic agents [1]. Its fragility and robustness are relative, not absolute.

An example of biological robustness that can be cited is the human immune system. The human immune system is very strong. It can respond quickly to various pathogens, and memory cells can generate new mechanisms to deal with new challenges, ensuring that the body can recover from infection and develop a stronger immune system. immune system. Important evidence and examples of biological vulnerability can be provided by extinct animals, such as the extinct thylacine, which was caused by a dramatic decline in population due to heavy hunting by humans. The last thylacine died in 1936. The extinction of animals, unable to withstand the stress of human activity, is a testament to the fragility of organisms.

Biological robustness can be said to form a homeostatic mechanism for the survival of organisms to a certain extent. Organisms are affected by genetic and environmental changes over time, but they also evolve mechanisms to function properly in the face of these unforeseen challenges. The features underlying these mechanisms and mechanisms can be summarized as biological robustness [2]. Traits will be affected to some extent by genetic and environmental factors, such as some coding enzymes and signaling pathway genes in genetic factors. Environmental factors include the cycle and time of photosynthesis accepted by organisms, temperature and humidity, nutrients required for normal growth of organisms, etc. Homeostatic mechanisms seek to maintain dynamic stability among these dependent variables against deleterious genetic and environmental factors. Robustness also masks and controls deleterious factors, such as genetic mutations that have no effect on phenotype, known as "recessive genetic diversity." Robust balancing mechanisms can ensure that the human body will not develop diseases due to genetic mutations or environmental changes. Active operation of homeostatic mechanisms can be facilitated by establishing mathematical models linking genetics and environment.

The consequences of biological fragility are complex and severe. Consequences included include: loss of biodiversity, declining populations and changes in ecosystem functioning.

Measures that humans can take include: protecting wildlife habitats, reducing pollution and unnecessary resource extraction and development, and controlling the spread of non-native invasive species. Furthermore, to further reduce vulnerability, genetic diversity within populations of organisms can be enhanced, increasing the resilience of individual organisms. The serious consequences of biological fragility can be avoided through, for example, captive breeding and reintroduction programs to increase genetic diversity, restore habitats degraded or destroyed by humans, and sustain wild populations. Management and protection to reduce the possibility of ecological environment exposure to pollutants.

References:

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