The definition of Biological Robustness is that when the biological system (including animals, plants, and microorganisms) is disturbed by changes in the external or internal environment or some uncertain factors, the ecosystem can still maintain the stability of its structure and function, from which we can see the adaptability of the ecosystem to the environment. Biological Robustness is the characteristic of systems with the ability of recovery, self-repair, self-control, self-assembly, and self-replication. Biological Fragility refers to the tolerance of biological systems or biodiversity to changes in the external or internal environment. The higher the Biological Fragility, the more vulnerable the biological system or biodiversity is to be affected by the change in the external or internal environment. Generally, Biological Robustness and Biological Fragility coexist.

For a highly robust biological system, although the biological system has been greatly damaged, its system can still make adjustments in time and minimize the impact. For example, sea slugs can take photosynthetic cells from food. When injured, they will speed up photosynthesis, absorb nutrients, and help the rapid recovery of their wounds and the normal recovery of their vital signs. On the contrary, for a highly fragile biological system, even a small external or internal influence on the system will cause great changes. For example, in the ecosystem of the tropical rainforest, because the soil of the rainforest is poor, almost all of the nutrients are stored in the plants on the surface. Therefore, once the plants on the surface are destroyed, the nutrients will be lost quickly. Then the surface plants will be difficult to recover, and the entire ecosystem will collapse.

The robustness of biological systems is very extensive. It exists in all levels of biological systems, such as biological groups, individuals, organs, cells, molecules, etc. Biological robustness exists in bacterial chemotaxis, cell cycle, cell signal communication, gene mutation, biological development, gene network, occurrence, development and treatment of diseases, etc. So the research on biological robustness is of great significance. If a creature is not robust, it will not be able to take emergency measures for any sudden changes, which will directly affect its survival ability. For individuals, if the cells and organs in the human body are not robust, then when the virus invades the human body, the human body will not be able to make a counterattack, allowing the virus to reproduce and eventually invade the entire body, ultimately leading to the inability of human survival. For biological groups, if an ecosystem is not robust, it will be unable to cope with external interference or internal mutations, which will lead to the imbalance of the ecosystem.

The consequences of biological fragility will not only affect its survival, but also affect its surrounding environment and the larger ecological environment. Further, the deterioration of the ecological environment will lead to changes in the pattern, process, service functions, etc. of the ecosystem, thus threatening the sustainable development of the ecosystem and social economy. For example, the destruction of the highly fragile tropical rainforest mentioned above will cause the animals living in it to be endangered, make the earth's climate tend to dry, aggravate the global greenhouse effect, melt the two-stage glaciers, raise the sea level, cause extreme weather occurs and other environmental problems. Avoiding biological fragility is also equivalent to how to improve biological robustness. At this stage, scientists are studying the composition of biological genes and other methods to find the root cause of its fragility. And study the gene composition of some highly robust organisms, extract useful genes for in-depth research, and find the opportunity to apply the same principle to highly fragile organisms. Additionally, scientists modify and regulate some of the genes. Recently, in the article "Synthetic acid stress-tolerance modules improve growth robustness and lysine production of industrial Escherichia coli in fermentation at low pH", the authors designed a combination of acid-resistant modules, which can effectively improve the acid tolerance of the strain by fine-tuning the expression of a few genes. The module is composed of the proton consumption system gene (gadE), the protein protection and quality control system gene (hdeB), and the antioxidant enzyme system gene (sodB and katE), and is regulated by the acid response promoter.

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