Biological robustness is a system property to keep a stability of live-body structure and function as uncertainty factor from external and internal variety disturbs it. In biological systems, robustness is the characteristic of systems that have the ability of recovery, self-repair, self-control, self-assembly and self-replication. Biological robustness is best reflected in the adaptation of organisms to the environment. It is a systematic property that can be observed, such as the presence of biological robustness in bacterial chemotaxis. Bacterial chemotaxis refers to a directional movement of bacteria. It is a basic attribute for bacteria to adapt to environmental changes and survive. It enables bacteria to find food sources and evade toxic environments, and has a competitive advantage in survival. Bacteria can adapt to the change of chemical inducer in a wide concentration range, and always adjust their behavior according to the change of chemical inducer concentration.

Biological robustness, as an important characteristic, has become the key to the survival of the system in the event of a crisis. For example, when a dynamically stable ecosystem encounters large or small disturbances ; when cells undergo genetic variation or environmental changes or when a biological organism (human body, etc.) is attacked by the outside world and has lesions in different parts of the body, robustness will not be its optimization, scalability, or stability, but rather a decisive factor. If the robustness of the system is not strong, it is easy to occur a single gene mutation or chromosome variation resulting in the loss of normal function of the individual was eliminated.

Fragility is inherent in the organism itself. In my perspective, fragility can be called the Achilles ' heel. It is a feature opposite to robustness. It originates from glass physics and is used to describe the temperature change rate of structural transformation of glass materials. The response of biological systems to external disturbances can be sensitive, namely fragility, or insensitive, namely robustness. The term fragility was first coined by Timmerman in the field of geology. He believes that fragility is measured by degree, which is the degree, possibility or condition that the system is adversely affected when a disaster occurs[1]. Fragility can be defined as the degree of loss of functionality after a system is threatened. It is susceptible to its own structure and external environment. For example, if you deliberately delete some of the few nodes in the network, it will have a great impact on the connectivity of the entire network. Hence, the network has the fragility.

Once encountering small perturbations in genes or the emergence of pathogens visible under a microscope, biological organisms may face the result of loss of all functions. From the perspective of the whole system, the system should have a trade-off between robustness and fragility to avoid bad results. Evolution and adaptation favor increased robustness to common disturbances, , but this is inevitably paired with increased fragility. For example, During an infection, the cells whose receptors recognize the antigen proliferate and differentiate into antigen-removing effector cells and long lived memory cells. The memory cells give rise to a more rapid and efficient response to a secondary exposure to the same antigen. However, due to homeostatic regulation of the lymphocyte population, the growth of memory cells reduces the naive cell population size. Over time, this has the effect of increasing sensitivity to novel infections[2]. Therefore, we cannot blindly pursue higher robustness, but need to balance robustness and fragility to achieve system stability to avoid bad consequences. From the perspective of fragility, as it is affected by both external and internal factors, we need take all factors and their possible consequences into consideration. Next, according to the purpose of the study, the existing resources and the characteristics of the system, we select appropriate ways (analytical hierarchy process, etc.) to assess the fragility. From this, several factors with greater fragility are found, so more economical and efficient maintenance and prior inspection can be used to prevent the occurrence of bad results.

[1] Timmerman P . Fragility, Resilience and the Collapse of Society. 1981.
[2] Stromberg S P , Carlson J . Robustness and Fragility in Immunosenescence[J]. PLoS Computational Biology, 2006, 2(11):e160.