

Biological robustness is a common property of varieties of biological systems or individuals, it refers to the ability to maintain the structure or function when exposed to internal or external interferences. It is a vital feature, which explains the flexibility and adaptability when living organisms immigrate to a new environment. However, the complexity of biology is one we cannot underestimate. Except for the existence of biological robustness, there is fragility in contrast, which denotes the fragile side of the organisms: To a certain extent, the changes taken by biological systems or individuals might be destructive, and will lead to the death of the individual or the ruin of systems.

To present the robustness of an individual, one great example is gene mutation. As a pervasive mechanism, generations of people have undergone gene mutation in their somatic cells or germ cells. Nonetheless, humans have not been in crisis as a result of gene mutation. What gene mutations can affect: human genes, proteins, cells, immune system...are still performing in a way that benefits the survival of mankind. Their favorable presence and function of them are maintained and are not replaced by genes with “bad” phenotypes despite the interference from the gene level. Besides, the resistance against multiple bacteria and viruses (the immune system takes credit) is another evidence that there is robustness in an individual. Since this is a universal feature, we can also notice some similar phenomena in biological systems. For example, a huge blaze broke out in a forest, after which the population density decreased and thus sunlight is more abundant than before. As a result, the seeds pulled out new buds and bloomed. However, the robustness of biological systems is limited and sometimes fragility would take the upper hand. For instance, in the arctic tundra, there are very few types of animals and plants. Therefore, unlike rain forest, the food chain and the structure of nutrient here is too simple, making it hard to maintain, when encountering ecological damage such as extensive damage of lichen. If lichen, what most of the creatures in the arctic tundra rely on, is destroyed in large areas, the biological robustness outmaneuvers robustness and the system would collapse.

The earth is an enormous biological system that is experiencing changes every moment,

and robustness is the reason it keeps in great condition to run. If robustness no longer exists, the stability of the earth system would disappear. Each interference would bring a huge impact that affects the survival of various organisms. An originally stable system would become ruined and the most deadly thing is, it is unable to recover. Only with biological robustness can the transformations on earth not be damaged but benign interactions and are ultimately beneficial to survival. Therefore, biological robustness is an integral part of survival.

As mentioned above, what would happen as a result of biological fragility is physiological impairment (for organisms) or systematic collapse (for systems). The immune system protects the human body from getting invaded by outer pathogens. However, in certain cases, an individual, a bacteria, or a virus would break the defensive army and cause severe damage to his/her body. And despite the robustness of the biological system, a relatively simple transformation might bring fatal consequences to a system, that is difficult to undertake and recover from. To avoid those situations, it is required that the systems should be complicated enough, in food chain and structure of nutrients. Thus, it would be difficult to break them completely. For individuals, it would also be the “complexity principle”. One should make his source of nutrients diversified (fruit, vegetable, meat, etc.) and be living in multiple healthy ways (stable food supply, regular exercise, abundant rest). Hence, the fragility could be avoided and robustness could prevail.