

I consider biological robustness to be a property of an organism that retains its degree of stability despite stimuli from environmental changes and uncertain disturbances such as genetic variation, and refers to the ability of an organism to maintain its original state after a sustained perturbation.

I consider the vulnerability of organisms to be their ability to withstand changes in external conditions, with higher vulnerability meaning that organisms are susceptible to change due to external conditions and lower vulnerability meaning that organisms are not susceptible to change due to external influences.

An example of biological robustness: take Corona Virus Disease 2019, which has had the greatest impact on us in the last three years. At the beginning of the epidemic, the rate of death and severe illness was so high that humans were at great health risk if they were infected, causing great disruption to the human system. Due to the robustness of the organism, antibodies have evolved and the entire human system has gradually regained stability and human activity has gradually returned to its original state.

An example of biological vulnerability: we are now exposed to radiation all the time, but the human body can only withstand a maximum of 7 sieverts of radiation; a dose of around 2 sieverts can cause premature death, and 6 sieverts can cause immediate death. The biological vulnerability is evident when every 1 sievert of radiation received by the body increases the rate of cancer by 0.0165.

Why is biological robustness an integral part of survival?

Because once an organism does not have robustness, it will find it difficult to survive in its natural environment, and the robustness of organisms is the cornerstone of their survival. For example, if an organism is not robust, it will not be able to adapt to certain changes in the environment, such as droughts and floods, and will die. Like a tree, if the tree is not robust and its roots do not actively grow towards wet areas, then in the event of a regional drought, the tree will die because there is not enough water.

Or, if an organism is not robust, if some of its cells mutate, the organism will die because of these mutations. For example, if the body is not robust enough to deal with all kinds of diseased cells in the body, then if a very small number of cancer cells appear in the body, they will divide indefinitely without the control of immune cells and eventually lead to the death of the body.

What are the consequences of fragility and how to avoid it?

The consequence of this vulnerability is that the life activities of living organisms are thus restricted. For example, humans cannot live in an environment with high levels of radiation, which means that human life activities can only take place in an environment with low levels of radiation and cannot make use of the various resources available in a highly radioactive environment. At the same time, if the environment evolves towards high levels of radiation, it is likely that humans will become extinct or die in large numbers as a result. At the same time this vulnerability also means that other organisms can take advantage of it to limit it. For example, the HIV virus can cause a lot of damage to the human body, but humans can use its vulnerability to heat, dryness

or chemical disinfectants to kill it as well as to stop it from reproducing and spreading, and from the virus' point of view, this vulnerability becomes a good way for humans to control it.

In order to avoid this, we can study organisms that do not have this vulnerability, for example, humans can study organisms that can survive in high radiation environments in order to find the necessary conditions to survive in high radiation environments. Or we could look for ways to protect organisms from this vulnerability, such as the various radiation-resistant machines that humans have. Or research to avoid or reduce the consequences of this vulnerability. The vulnerability of humans to various viruses, for example, can be countered by research into treatments to counteract this vulnerability.