

Biological robustness is a term that refers to the ability of an organism or system to maintain its function and structure under various types of stress or perturbations. It is often used to describe the resilience of a system to withstand or recover from external or internal challenges, such as environmental changes, disease, or injury. On the other hand, biological fragility is the opposite of robustness, and refers to the vulnerability or susceptibility of an organism or system to break down or collapse under stress or perturbations.

One example of biological robustness is the ability of certain plants to survive and reproduce in extreme environments, such as deserts or polar regions. For instance, the cactus is a plant that is highly resistant to drought and extreme temperatures, due to its specialized adaptations such as thick, waxy leaves that reduce water loss, and a deep root system that allows it to access water from underground sources. This robustness allows the cactus to survive and even thrive in environments that would be lethal for other plants.

On the other hand, an example of biological fragility is the susceptibility of certain species to environmental stressors or diseases. For instance, some species of coral are highly sensitive to changes in water temperature and pH, and are at risk of dying off due to climate change and ocean acidification (Hoegh-Guldberg, et al., 2014). As a result, these fragile species are in danger of extinction, which can have serious consequences for the health and diversity of marine ecosystems.

Biological robustness is an integral part of survival, as it enables organisms and systems to withstand or recover from challenges that would otherwise be lethal. For example, the immune system is a highly robust system that helps protect the body from infectious diseases and other threats. It is able to recognize and eliminate a wide variety of pathogens, and can even adapt and improve its response over time through a process called immunological memory. This robustness is essential for survival, as it allows the body to defend itself against harmful agents that could cause illness or death.

But then, biological fragility can have serious consequences for the survival of an organism or

system. For example, the fragility of certain species to environmental stressors or diseases can lead to their extinction, which can have cascading effects on the health and diversity of ecosystems. In addition, fragility can also lead to the breakdown of systems or processes within an organism, such as the failure of organs or tissues due to injury or disease.

There are several ways that one could avoid fragility or increase robustness in biological systems. For human beings, maintaining a healthy lifestyle, such as eating a balanced diet and getting regular exercise, can help to improve the robustness of the body and its systems, including the immune system. In addition, taking steps to protect the environment and preserve biodiversity can help to ensure the survival and robustness of ecosystems and the species that depend on them. Finally, to avoid fragility, it is important to understand the underlying causes and mechanisms that contribute to an organism or system's susceptibility to disruption. In the case of coral reefs, this may involve reducing greenhouse gas emissions to mitigate climate change, protecting reefs from overfishing and other forms of human-induced stress, and implementing restoration and conservation efforts to promote the resilience of reefs.

In conclusion, biological robustness and fragility are important concepts that describe the ability of an organism or system to withstand or recover from challenges, or to break down or collapse under stress. Biological robustness is an essential part of survival, as it enables organisms and systems to defend themselves against threats and maintain their function and structure. On the other hand, biological fragility can have serious consequences for the survival of an organism, and can lead to the breakdown of processes or the extinction of species. There are several ways that one can avoid fragility or increase robustness in biological systems, including maintaining a healthy lifestyle, protecting the environment, and understanding the underlying causes and mechanisms to implement strategies to promote resilience.

Reference

Hoegh-Guldberg O, Mumby P J, Hooten A J, et al. Coral reefs under rapid climate change and ocean acidification[J]. *science*, 2007, 318(5857): 1737-1742.