

Yihang Xing

2022.12.20

### **Question 1**

Biological robustness is the ability of an organism to maintain its normal functioning despite changes to its environment or internal conditions. An organism can remain resilient, even when exposed to extreme or unusual situations (Kitano 20). This resilience is often the result of natural selection, which has allowed certain species to evolve to become better adapted to their environment. Biological robustness is an essential factor in the survival of a species, as it will enable them to survive in various conditions and environments.

Biological fragility, on the other hand, is the inability of an organism to maintain its normal functioning when exposed to extreme or unusual conditions. A fragile organism will likely suffer from disease, injury, or death when exposed to conditions outside its normal range. Fragile organisms may also be more susceptible to environmental changes, including temperature, light, and moisture changes. When an organism is fragile, its survival is more likely to be threatened in a changing environment.

Biological robustness and fragility are both important for the survival of a species. Many species have evolved to become more robust, allowing them to survive and adapt to changing conditions. However, for some species, fragility can be a significant survival disadvantage. Therefore, species need to have the right balance of robustness and fragility to thrive in their environment. This balance is determined by natural selection and the organism's environment.

### **Example of robustness**

An excellent example of biological robustness is the human immune system. The body is constantly exposed to various pathogens, such as viruses, bacteria, fungi, and parasites. However, our bodies can respond effectively to these threats, activating a complex network of immune cells, proteins, and other molecules, which work together to identify, isolate, and destroy these foreign invaders. The immune system is highly robust, allowing us to recover quickly from illnesses and infections and protect against most disease-causing organisms.

### **Example of fragility**

example of biological fragility is the human brain. Although the brain is incredibly complex and capable of performing various tasks, it is extremely vulnerable to damage. Traumatic brain injuries, strokes, and tumors can cause lasting neurological damage to the brain, leading to a wide range of physical and cognitive impairments ((Stalder et al., 10). In addition, diseases such as Alzheimer's and Parkinson's have a devastating impact on the functioning of the brain, as they gradually destroy neurons and disrupt the brain's normal functioning. As such, the brain is a perfect example of how fragile the human body can be.

### **Why biological robustness is an integral part of survival.**

Biological robustness is integral to survival because it enables organisms to deal with environmental changes and unexpected events. An organism can maintain its functions and characteristics despite stressors, such as extreme temperatures, changes in food sources, and other external factors (Kitano 30). By having a robust biological system, organisms can adapt to changes in their environment and continue to survive. Robustness also allows organisms to survive in unpredictable environments. When an organism can maintain its functions despite changes in the background, it can handle new and unknown conditions better. This ensures that the organism can survive and reproduce even in the face of environmental change.

When an organism is robust, it is better able to handle changes in its environment and maintain its functions. This allows the organism to survive and reproduce, ensuring the continuation of its species. Robustness also allows organisms to survive extreme conditions, such as long periods of cold or heat, and changes in food availability. In this way, robustness is essential for the long-term survival of species. Robustness also allows species to survive in changing environments (Kitano 40). When a species is robust, it can adapt quickly to new conditions. This allows the species to survive in environments that are different from the ones in which it originally evolved. Robustness is also important for the survival of a species in the face of competition from other species, as robust organisms are better able to survive in a competitive environment.

### **Consequences of fragility**

The most common consequence of fragility is mortality. When an organism is fragile, it is more likely to suffer from disease, injury, or death due to environmental changes. This can significantly impact the health of the organism and its population. Fragility can also lead to reduced reproductive rates and a decrease in the diversity of the species, as those individuals most vulnerable to external disturbance are the least able to reproduce (Stalder et al., 15). Fragility can also have a damaging effect on the environment. Fragile organisms are more likely to become extinct due to environmental pressures, decreasing biodiversity. Fragility can also lead to the spread of diseases, which can cause further environmental damage.

### **Works Cited**

- Kitano, Hiroaki. "Biological Robustness-A Principle in Systems Biology." *Open Systems Science*. IOS Press, 2010. 17-51.
- Stalder, J. F., et al. "Fragility of the epidermis and its consequence in dermatology." *Journal of the European Academy of Dermatology and Venereology* 28 (2014): 1-18.