# Difference Between Allostasis and Homeostasis

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## Key Difference - Allostasis vs Homeostasis

The allostasis is the process of achieving stability through physiological changes and behavioral changes. This can be achieved by changing the Hypothalamus-Pituitary- Adrenal-axis hormones (HPA), alteration of the autonomic nervous system, cytokines, and the other systems. And generally, it is adaptive in nature. Allostasis is a very important process for animals. It controls the internal viability amid changes in the outside environment. The allostasis compensates various problems in the body. It provides compensation during compensated heart failure, compensated kidney failure, and compensated liver failure. But these allostatic states are fragile and can be decompensated quickly. Homeostasis is a property of system within an organism that normally regulates a variable like the concentration of a substance in a solution at nearly the constant state. Homeostasis regulates body temperature, pH, and concentration of $Na^+$, $Ca^{2+,}$ and $K^+$. **The key difference** between allostasis and homeostasis is, **Allostasis is the process of achieving stability through physiological, behavioral changes amidst changing conditions while the Homeostasis is simply the maintenance of a stable internal environment in an organism despite the changes occur in the external environment.**

# What is Allostasis?

The concept of allostasis was first described by Sterling and Eyer in 1988. It is an additional process to reestablish the homeostasis. The nature of concept explains that the allostasis is an endogenous system to maintain a stable internal environment within an organism. The name allostasis was coined from Greek, meaning that "remaining stable by being variable." The allostasis theory explains that an organism is actively adjusted to the predictable and unpredictable events.

The allostatic load is the "wear and tear" that accumulates in an individual as a result of continuous exposure to chronic stress. Based on these two types of allostasis, overload conditions are explained.

- Type 1- It occurs when energy demand exceeds the supply. It activates emergency life history stage. And it serves driving the animals away from the normal life history stage to a survival mode. Until allostasis overload decreases and regains the energy balance.
- Type 2- This begins when there is sufficient energy consumption accompanied by social dysfunction and conflict.This is the case in human society, and also in certain situations affecting animals in captivity. Type 2 allostasis overload does not create any escape response. It can only be counteracted by learning and changes in the social structure.

As a reaction to allostasis overload, the stress hormones like epinephrine and cortisol are secreted. Together with other physiological reactions such as increasing myocardial workload, decreasing smooth muscle tone in the gastrointestinal tract, and increasing coagulation. These

reactions effect adaptively benefit way in the short term. It can activate neural, neuroendocrine or neuroendocrine-immune mechanisms. But long-term excessive activation is detrimental to the body. It causes an increase in blood pressure and heart rate.

The physiological responses to acute threats are effective and are considered as adaptive across species. But chronic activation of stress responses by overexposure to violence, trauma, poverty, war, the low and high-rank hierarchy in society disrupts the homeostasis of the system and creates overexertion of physiological system. Allostasis overload can be measured by chemical imbalances in the autonomic nervous system, central nervous system, neuroendocrine and immune system.

# What is Homeostasis?

The metabolic processes in the organisms can only be initiated under specific chemical and environmental conditions. So, homeostasis is simply the maintaining stable internal environment in an organism despite the changes occur in the external environment. The best homeostasis mechanism in humans and other mammals is known as regulating the composition of extracellular fluid with regard to pH, temperature, and concentrations of $Na^+$, $K^+$, $Ca^{2+}$ ions. It does not imply that if something is regulated by homeostasis mechanism, the value of the entity should be steady during entire health period. For example, the core body temperature is regulated by thermosensors in the hypothalamus of the brain.

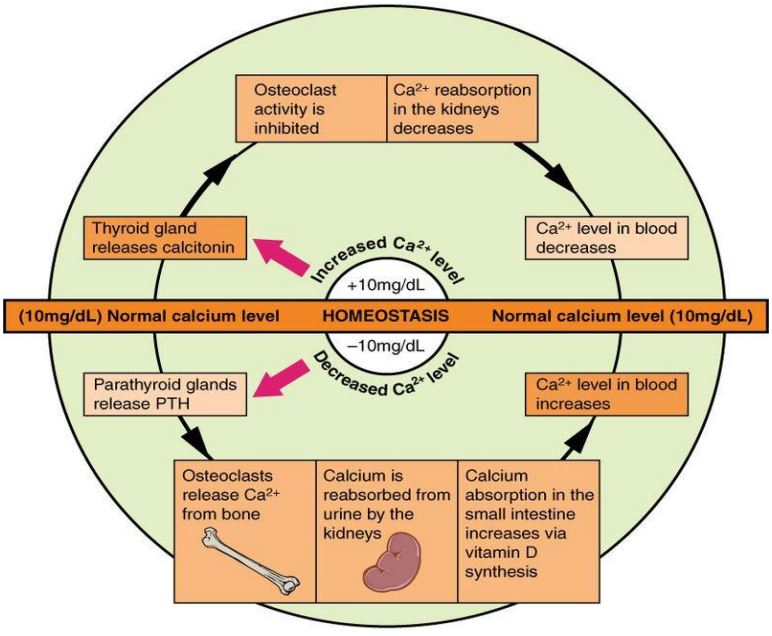


**Figure 01: Calcium Homeostasis**

The setpoint of the regulator is regularly reset. But the core body temperature varies during the course of the day. A very low temperature in the afternoon and high temperature in the day are observed. Specifically, the temperature regulators setpoint is reset in infection conditions to produce fever.

The every action in the body does not control by homeostasis mechanism. For example when blood pressure drops, heart rate increases and when blood pressure rises, heart rate decreases. Here the heart rate is not governed by homeostasis mechanism. The other example is the rate of sweating. Sweating is not controlled by homeostasis mechanism.

Controlled systems which operate during homeostasis

- **Core body temperature**: Temperature controls by the thermoreceptors locate in the hypothalamus of the brain, spinal cord, and internal organs.
- **Blood glucose level**: Blood glucose level is regulated by the sensor beta cells in pancreatic islets.
- **Plasma $Ca^{2+}$ level**: The $Ca^{2+}$ level is controlled by chief cells in parathyroid gland and parafollicular cells in the thyroid
- **The partial pressure of oxygen and carbon dioxide**: The partial pressure of oxygen is controlled by peripheral chemoreceptors in the carotid artery and aortic arch. The partial pressure of carbon dioxide is regulated by central chemoreceptors in the medulla oblongata of the brain
- **Blood oxygen content**: The oxygen content is measured by kidneys.
- **Arterial blood pressure**: The baroreceptors in the walls of the aortic arch and carotid sinus are monitoring the arterial blood pressure.
- **The extracellular sodium concentration**: The plasma sodium concentration is controlled by juxtaglomerular apparatus of the kidney.

# What are the Similarities Between Allostasis and Homeostasis?

- Both processes can be observed in the organisms.
- Both processes control the internal environment.
- Both processes control the internal viability and stability.
- Both processes are extremely important for the protection and the survival of organisms.

# What is the Difference Between Allostasis and Homeostasis?

| Allostasis vs Homeostasis | |
|---|---|
| Allostasis is the process of achieving stability through physiological, behavioral changes during the changing conditions. | Homeostasis is simply the maintaining stable internal environment in an organism despite the changes that occur in the external environment. |
| **Visibility** | |
| Allostasis is evident, especially under stressful conditions. | Homeostasis is a general phenomenon of organisms which response to variables in order to regulate the composition of the extracellular fluid (internal environment). |

| Reliance on environment | |
|---|---|
| Allostasis relies on environmental changes. | Homeostasis does not rely on environmental changes. |
| **Responses** | |
| Allostasis creates chronic responses which are detrimental to the organisms. | Homeostatic responses are not detrimental, and it regulates the set point of concentration, pH, and temperature. |
| **Regulation of organs and systems** | |
| Allostasis is regulated by neuroendocrine, autonomic nervous and immune systems. | Homeostasis is regulated (monitored) by regulators and sensors located in the hypothalamus of the brain, spinal cord, internal organs, kidneys, carotid artery and aortic arch. |
| **Reactions** | |
| Allostasis responds to a sudden stressful condition. | Homeostasis is general responses to ongoing physiological variables. |

# Summary - Allostasis vs Homeostasis

The allostasis is the process of achieving stability (or homeostasis) through physiological changes and behavioral changes. And generally, it is adaptive in nature. Homeostasis is a property of system within an organism that normally regulates substance in a solution at nearly the constant concentration state. The homeostasis does not necessarily regulate all actions in the body. Homeostasis regulates body temperature, pH, and concentration of $Na^+$, $Ca^{2+,}$ and $K^{+,}$ etc. This is the difference between allostasis and homeostasis.

**Reference:**

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**How to Cite this Article?**

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