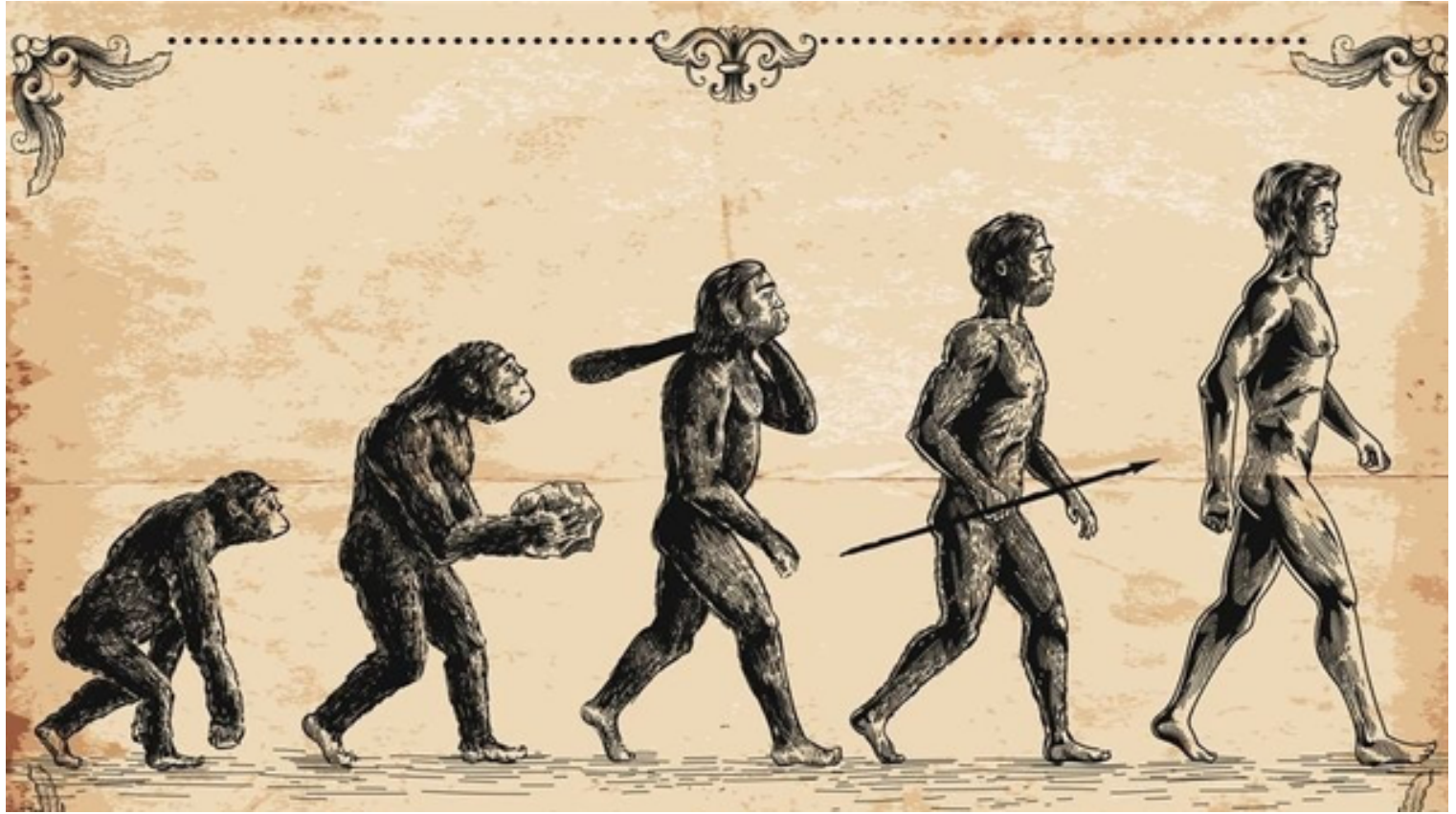


## Law of increasing functional information

By IAS Toppers | 2023-10-19 15:50:00



## Law of increasing functional information

Scientists have proposed a **new evolutionary law** that can explain the **evolution** of **living** and **non-living** entities, from **minerals** to **stars**.

[ref- britannica]

### **About the Law of increasing functional information:**

- The law of increasing functional information states that "**the functional information of a system will increase** if many different configurations of the system **undergo selection** for one or more functions".
- It **applies** to systems that are **composed of many components** that can be **arranged** and **rearranged** in multiple ways, and that are selected based on function, which is defined as **the capacity to contribute to a goal or purpose**.
- The law implies that only a **few configurations survive** the **selection process**, while most are eliminated or discarded.
- It suggests that **evolution is not limited to life on Earth**, but is a **fundamental property** of the **universe** that can be observed in **other complex systems**, such as minerals, planets, stars, galaxies, and even the cosmos itself.
- It provides a framework for understanding the **origin** and **emergence of complexity** and **order in nature**, as well as the potential for discovering new forms of life or intelligence in the universe.
- It is being hailed as a **missing law because** it fills a gap in the **existing scientific laws** that **describe the behavior** and **dynamics of natural systems**.

### **Highlight of the study:**

- **Natural systems, living and non-living entities**, evolve to states of **greater patterning, diversity** and **complexity**.
- As life evolved from **single-celled** to multi-celled organisms, Earth's minerals, for example, became more complex and diverse.
  - This, in turn, drove biological evolution.
- The evolution of life from **single-celled** to **multi-celled organisms** led to **increased complexity** in **Earth's minerals**, contributing to **greater diversity**.
  - This, in turn, played a role in driving **biological evolution**.
- **Biodiversity** and **mineral diversity** are **interlinked**, with each influencing the other.
  - These two systems interacted to **shape the life**.
- The universe generates **novel combinations** of **atoms, molecules, cells**, etc.
  - Those combinations that are **stable** and can go on to engender even more novelty will **continue to evolve**.

### **How does the evolution occur?**

- Evolution occurs when a **new configuration** or a **new arrangement** of **atoms** and **molecules** works well and functions improve.
- Selection of function is a key to **evolution**.
- **Darwin** defined **function** as **primarily** with **survival** but the new study highlights at least **3 kinds of functions** that **occur** in **nature**.

**Functions that occur in nature:**

- The 1<sup>st</sup> function is **stability**, which means systems made up of stable arrangements of atoms or molecules will continue to survive.
  - For example, atoms are selected for their stability **against nuclear decay**, and molecules are selected for their **stability against chemical reactions**.
- The 2<sup>nd</sup> function includes **dynamic systems** with **energy supply**.
  - For example, cells are selected for their ability to **metabolize** and **reproduce** and **organisms** are selected for their ability to adapt and survive.
- The 3<sup>rd</sup> function is **novelty**, which is the tendency of evolving systems to **explore new configurations** or **arrangements** that can give rise to **new behaviors** or **characteristics**.
  - An example of novelty in evolution is the transition of **single-celled organisms** to using **light** for **food production**.
  - Other instances of novelty include the emergence of new behaviors in multicellular species, like **swimming, walking, flying, and thinking**.

### Role of early minerals:

- **Early minerals** on Earth **possessed** a **stable arrangement** of **atoms**, which acted as **foundations** for the **evolution** of the **next generations** of **minerals**.
- These minerals were then **incorporated** into **life**.
  - For example, minerals are present in living organisms' **shells, teeth** and **bones**.
- In the early years of the Solar System, **Earth hosted** around **20 minerals**.
- Over the course several **billion years**, through increasingly complex **physical, chemical**, and **biological processes**, the number of known minerals on Earth has expanded to nearly 6,000.

### Evolution of stars:

- The **first** stars that was formed after the Big Bang had **two main elements- Hydrogen** and **helium**.
- Those **earliest stars** used these ingredients to make about **20 heavier chemical elements**.
- The next generation of stars consequently produced almost **100 more elements**.