

THE MEDICAL ACADEMY NAMED AFTER S. I. GEORGIEVSKY OF VERNADSKY CFU

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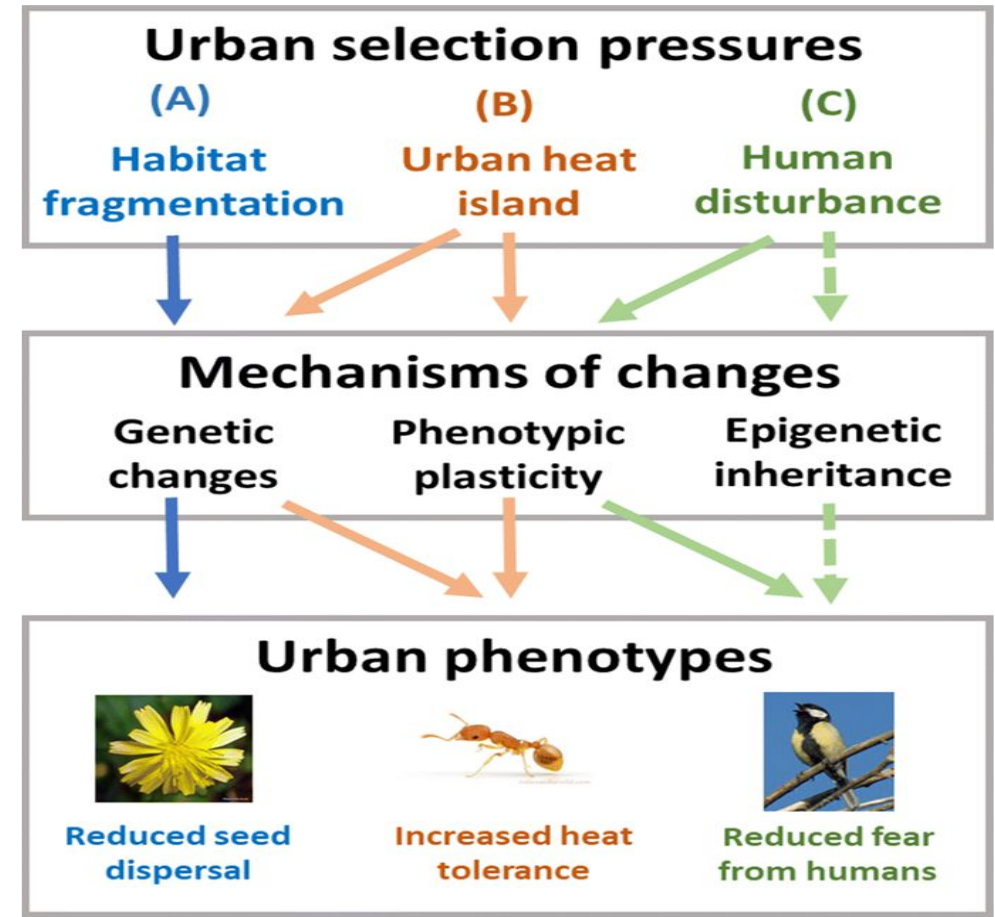


- **HUMAN ADAPTATION TO ENVIRONMENTAL CONDITIONS. NOTIONS OF HUMAN ADAPTATION AND ACCLIMATIZATION, MECHANISMS OF ADAPTATION. ADAPTATION IS BIOLOGICAL AND SOCIAL.**



INTRODUCTION

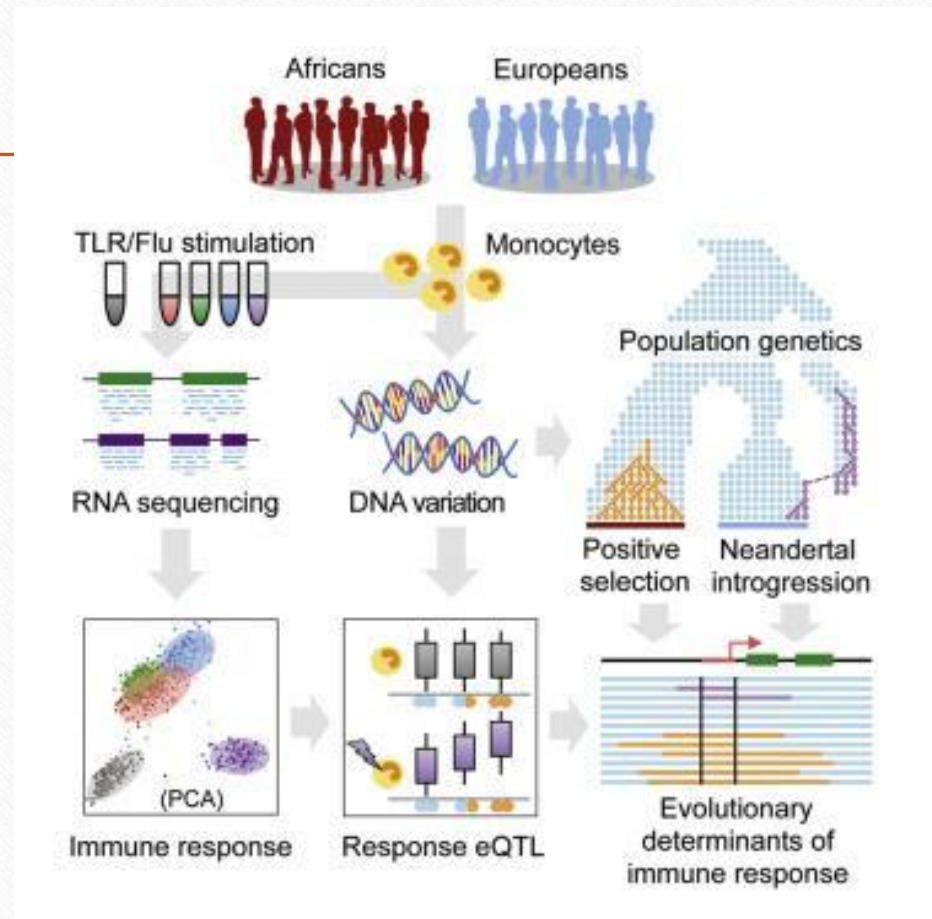
- Humans have biological plasticity, or an ability to adapt biologically to our environment. An adaptation is any variation that can increase one's biological fitness in a specific environment; more simply it is the successful interaction of a population with its environment. Adaptations may be biological or cultural in nature. Biological adaptations vary in their length of time, anywhere from a few seconds for a reflex to a lifetime for developmental acclimatization or genetics. The biological changes that occur within an individual's lifetime are also referred to as functional adaptations.



- What type of adaptation is activated often depends on the severity and duration of stressors in the environment. A stressor is anything that disrupts homeostasis, which is a “condition of balance, or stability, within a biological system...” (Jurmain et al 2013: 322). Stressors can be abiotic, e.g., climate or high altitude, biotic, e.g., disease, or social, e.g., war and psychological stress. Cultural adaptations can occur at any time and may be as simple as putting on a coat when it is cold or as complicated as engineering, building, and installing a heating system in a building.

TYPES OF HUMAN ADAPTATION

- Genetic adaptations can occur when a stressor is constant and lasts for many generations (O'Neil 1998-2013). The presence of the sickle cell allele in some human populations is one example. Keep in mind that genetic adaptations are environmentally specific. In other words, while a particular gene may be advantageous to have in one environment (AKA a genetic adaptation), it may be detrimental to have in another environment. z Ac

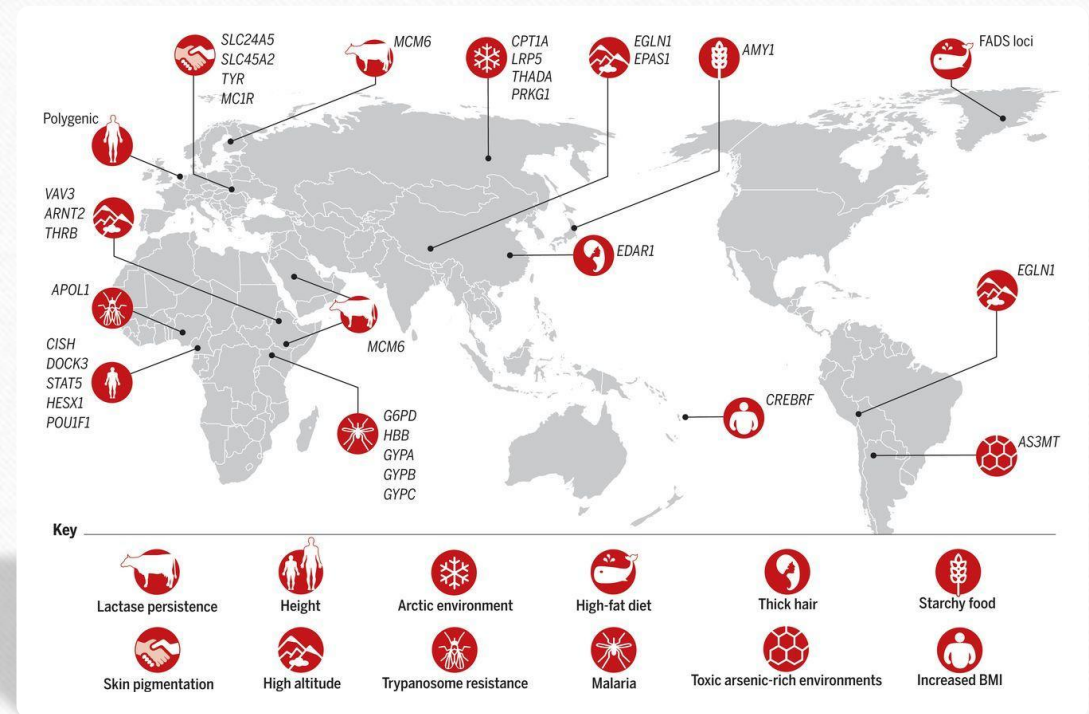


Developmental Acclimatization

- - Developmental acclimatization occurs during an individual's growth and development. It's also called ontological acclimatization or developmental adjustment. Note that these cannot take place once the individual is fully grown. There is usually a “magic time window” of when the acclimatization can occur. This adaptation can take months to years to acquire.
 - A famous example of this is those who have grown up at high altitude vs. those who have moved to high altitude as adults. Those who were born at high altitude tend to develop larger lung capacities than do those who were not born at high altitude, but moved there later in life. However, developmental adjustment occurs in response to cultural stressors as well. Intentional body deformation has been documented throughout human history. The ancient Maya elite used cradle boards to reshape the skull. Foot binding in China, now an illegal practice, was considered a mark of beauty and enabled girls to find a wealthy spouse.

Human genetic adaptations and human variation

- ■ Skin color
- ■ Body size and shape
- ■ Race



DEFINATION OF HUMAN ADAPATION:

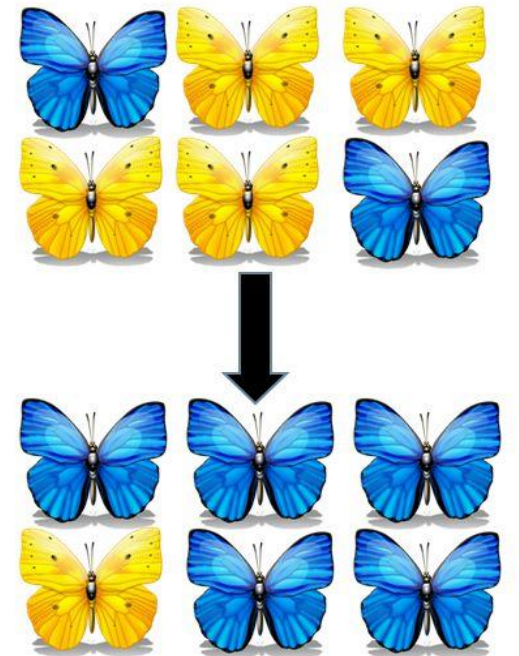
- ■ Any alteration in the structure or function of an organism or any of its parts that results from natural selection and by which the organism becomes better fitted to survive and multiply in its environment. ■ a form or structure modified to fit a changed environment. ■ the ability of a species to survive in a particular ecological niche, especially because of alterations of form or behavior brought about through natural selection.

EXAMPLES FOR HUMAN ADAPTION

- Some genetic variation present in populations does not affect fitness one way or another. ... If this difference does not affect their survival and reproduction one way or the other, then the variants are not adaptations; they are simply neutral variation that is maintained by mutation and genetic drift

Title Box 1: What is genetic drift?

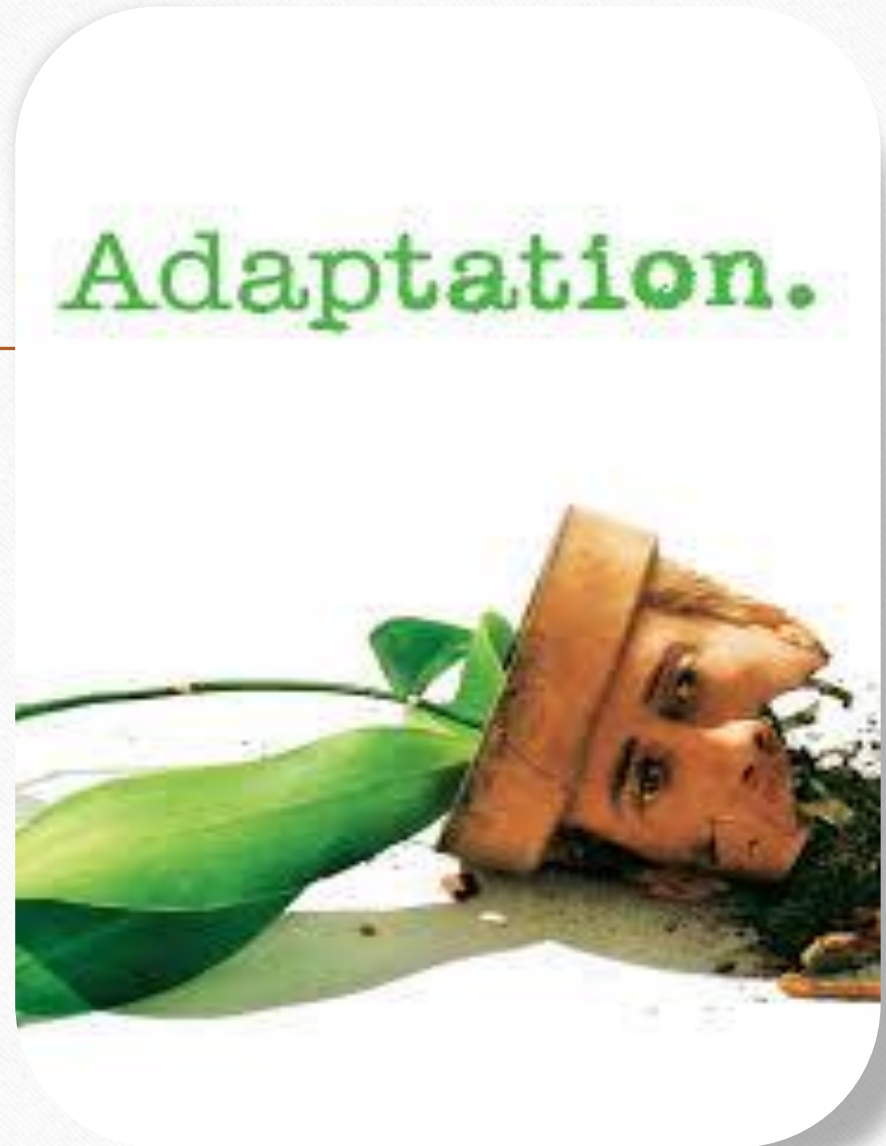
- Changes in a **small population's** allele frequency due to **random chance**
- **Not** based on **fitness** its about luck



Adaptation

- ■ Adaptation to environmental change, including biodiversity change, is both a new imperative in the face of global climate change and the oldest problem in human history. Humans have evolved a wide range of adaptation strategies in response to localised environmental changes, which have contributed strongly to both biological and cultural diversity. The evolving set of locally driven, ‘bottom-up’ responses to environmental change is collectively termed ‘autonomous adaptation,’ while its ob

- This adaptation processes-to-pathways framework is then deployed to consider human responses to biodiversity change caused by an aggressive ‘invasive’ plant, *Lantana camara* L., in several agri-forest communities of southern India. The results show that a variety of adaptation processes are developing to make *Lantana* less disruptive and more useable—from avoidance through mobility strategies to utilizing the plant for economic diversification. However, there is currently no clear synergy or policy support to connect them to a successful long-term adaptation pathway. These results are evaluated in relation to broader trends in adaptation analysis and governance to suggest ways of improving our understanding and support for human adaptation to biodiversity change at the household, community, and regional livelihood levels, especially in societies highly dependent on local biodiversity for their livelihoods



Acclimatization of human adaptation

- Developmental acclimatization

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Types of Adaptation

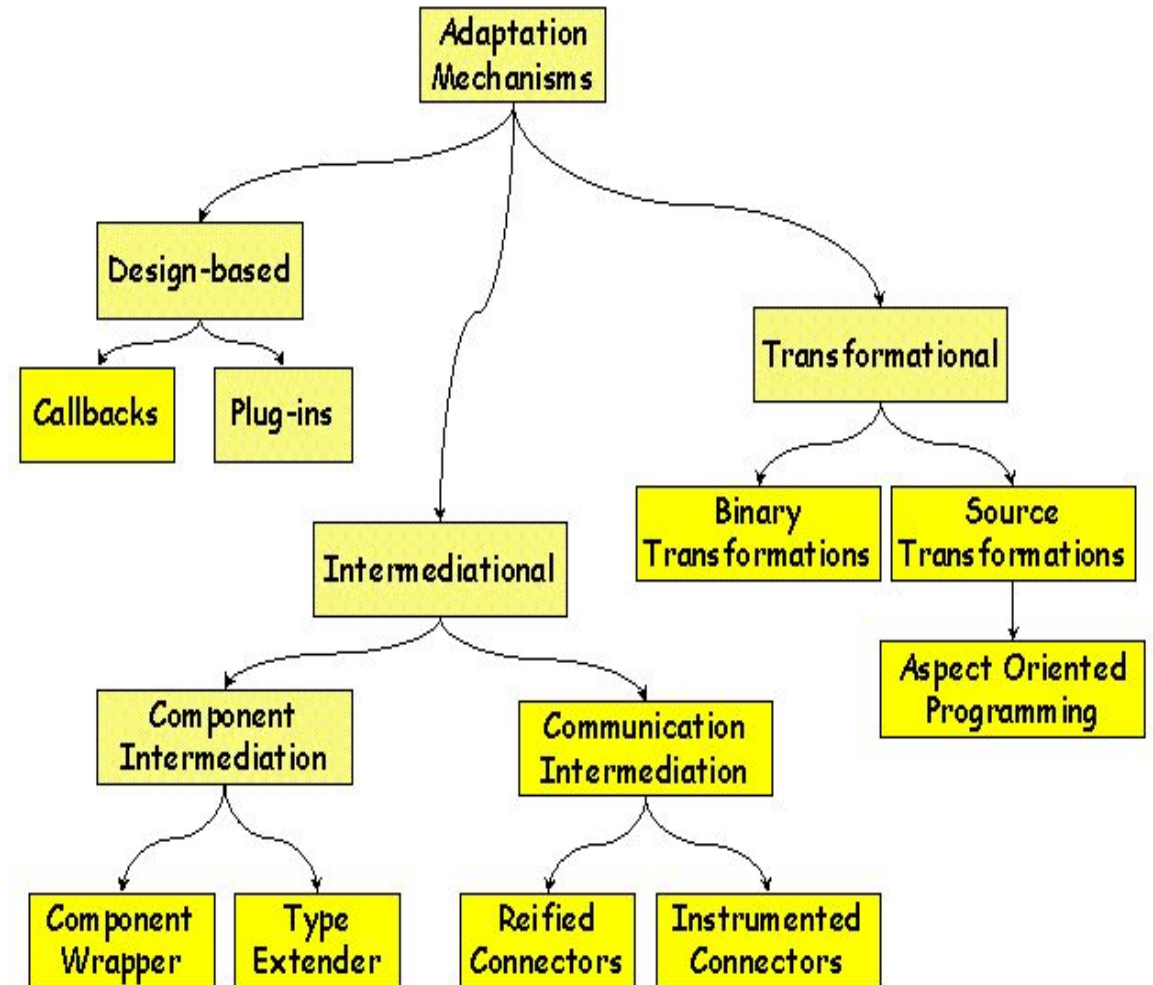
- **Acclimation:** Short-term changes that occur very quickly after exposure to a stress (sweating, shivering).
- **Acclimatization/Short-term physiological adaptation:** Physiological changes that take longer, from days to months (more red blood cells when one moves to high altitudes).

Mechanism of adaptation

- Wallace believed that the evolution of organisms was connected in some way with adaptation of organisms to changing environmental conditions. In developing the theory of evolution by natural selection, Wallace and Darwin both went beyond simple adaptation by explaining how organisms adapt and evolve. The idea of natural selection is that traits that can be passed down allow organisms to adapt to the environment better than other organisms of the same species. This enables better survival and reproduction compared with other members of the species, leading to evolution.
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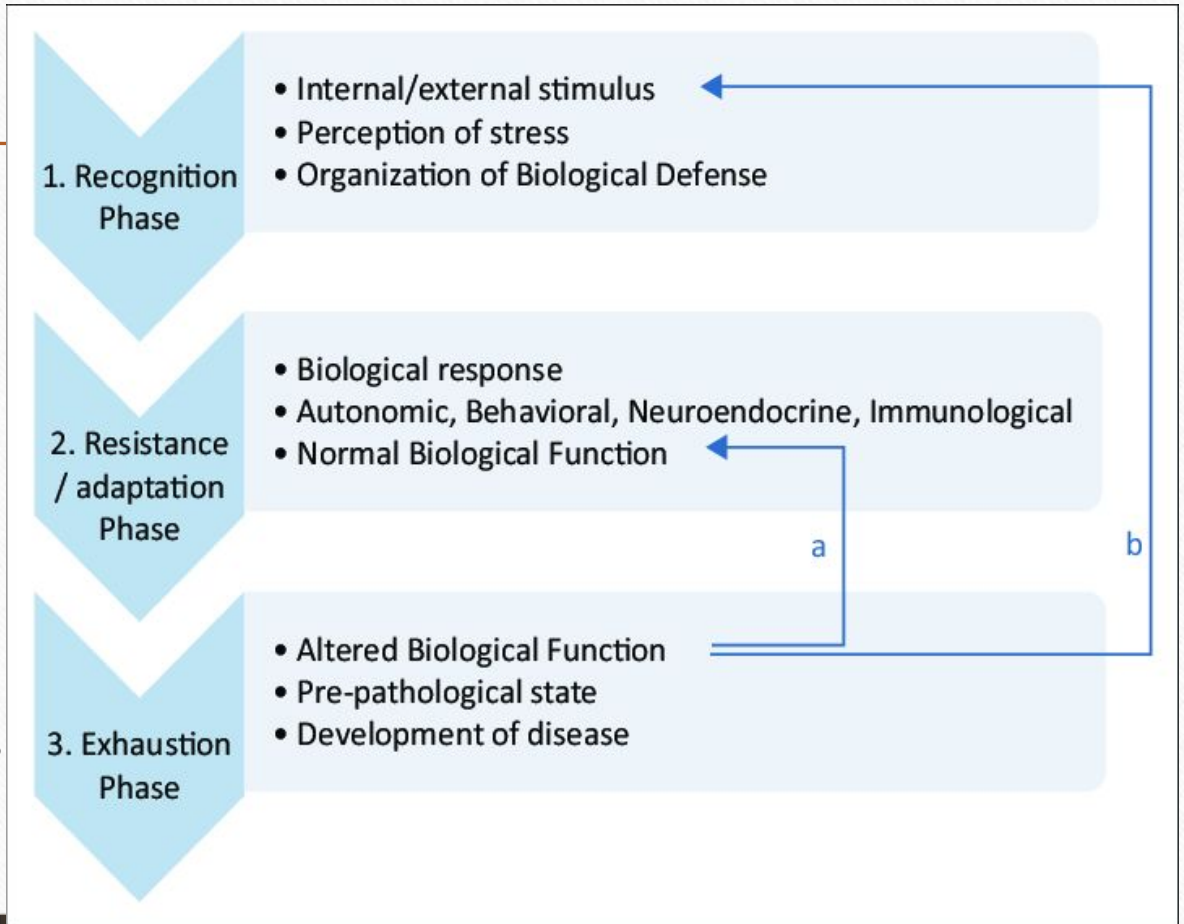
- Organisms can also exhibit behavioral adaptation. One example of behavioral adaptation is how emperor penguins in Antarctica crowd together to share their warmth in the middle of winter.
- Scientists who studied adaptation prior to the development of evolutionary theory included Georges Louis Leclerc Comte de Buffon. He was a French mathematician who believed that organisms changed over time by adapting to the environments of their geographical locations. Another French thinker, Jean Baptiste Lamarck, proposed that animals could adapt, pass on their adaptations to their offspring, and therefore evolve. The example he gave stated the ancestors of giraffes might have adapted to a shortage of food from short trees by stretching their necks to reach higher branches. In Lamarck's thinking, the offspring of a giraffe that stretched its neck would then inherit a slightly longer neck. Lamarck theorized that behaviors acquired in a giraffe's lifetime would affect its offspring. However, it was Darwin's concept of natural selection, wherein favorable traits like a long neck in giraffes survived not because of acquired skills, but because only giraffes that had long enough necks to feed themselves survived long enough to reproduce. Natural selection, then, provides a more compelling mechanism for adaptation and evolution than Lamarck's theories.

- They can adapt biologically, meaning they alter body functions. An example of biological adaptation can be seen in the bodies of people living at high altitudes, such as Tibet. Tibetans thrive at altitudes where oxygen levels are up to 40 percent lower than at sea level. Breathing air that thin would cause most people to get sick, but Tibetans' bodies have evolved changes in their body chemistry. Most people can survive at high altitudes for a short time because their bodies raise their levels of hemoglobin, a protein that transports oxygen in the blood. However, continuously high levels of hemoglobin are dangerous, so increased hemoglobin levels are not a good solution to high-altitude survival in the long term. Tibetans seemed to have evolved genetic mutations that allow them to use oxygen far more efficiently without the need for extra hemoglobin.

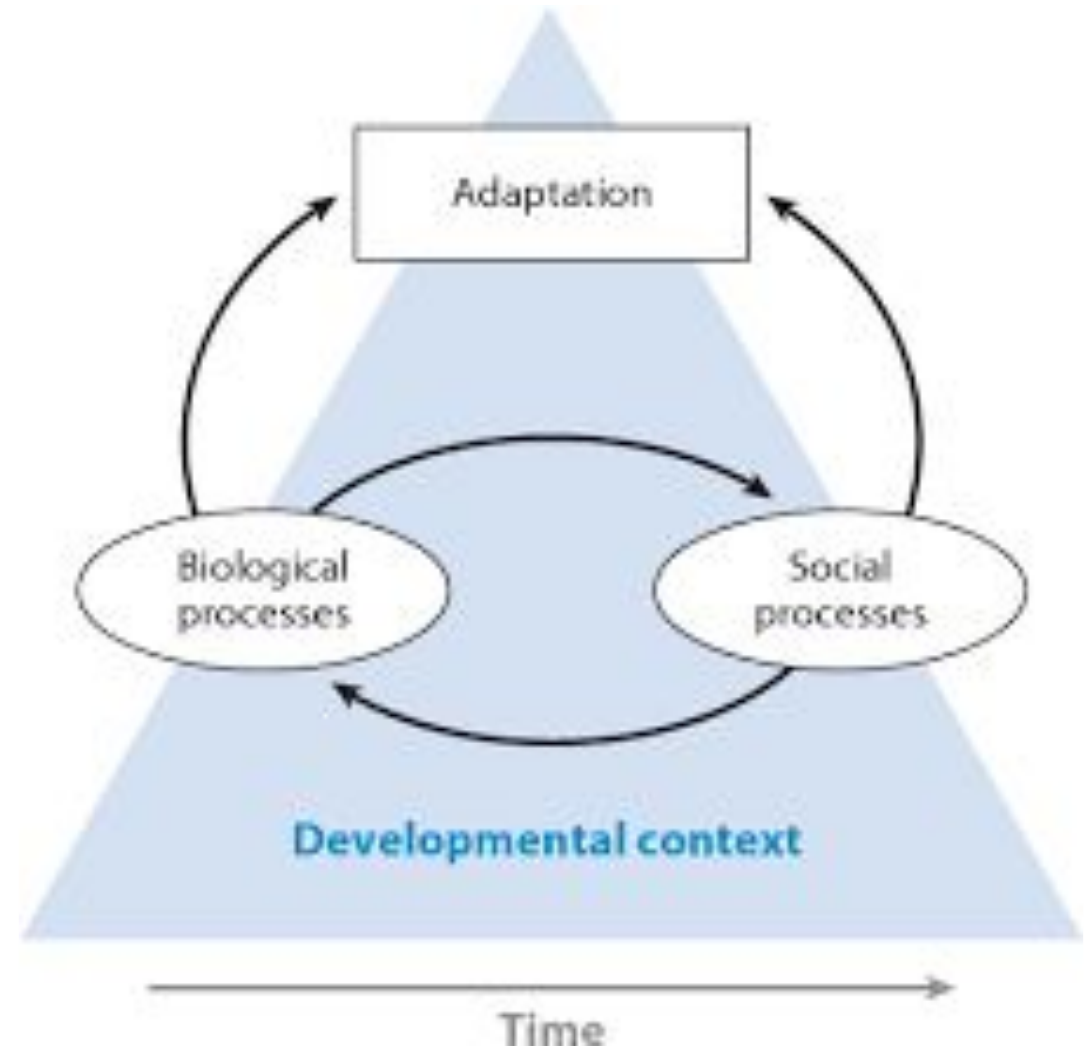


Adaptation is biological and social

- To globally summarize, biological adaptation can be defined as “is adapted a living being.” This short cut that was inspired by Laborite (1976) introduced the idea that, if a being lives and reproduces, it is because it has adjusted its biological functions to its external conditions. Morin adheres to this general idea by affirming that adaptation is the prime and general condition of all existence (Morin, 1985). In greater detail, biological adaptation designates above all a process that can be transposed at an individual level, resulting from genetic organization at a cellular level. Thus, the immune system is capable of perception and acquisition on a physiological level. This process is then qualified as “acclimatization” or “apprenticeship” (Prochiantz, 1997; Stewart, 1994). Adaptation is biological and



- The LEGO bricks analogy is often used to explain how each essential, elementary functions are insured by distinct biological modules which are exquisitely adapted to their particular role (see for instance Csete et Doyle, 2002). This modular organisation is robust and at the same time flexible: when a new trait emerges, natural selection does not start from scratch, but from the available modules: existing organs, tissues and cells, existing genes and gene networks. By combining modules—the LEGO bricks— within an organism it is possible to make something new. A common theme that has emerged from analyses in evolutionary biology is thus that organisms are robust and flexible systems. If the surroundings of an organism change, its developmental systems provide the ability to adapt to achieve and maintain some function (Breuker, 2006). Robustness and flexibility are thus two antinomic properties that result from modularity. This “property of the systems that are susceptible to deforming themselves in a coherent and autonomous manner in order to respond to internal and external stress,” (Lambert and Rezsöhazi, 2004, p.304) is called plasticity and is seen as the real “adaptive capacity” of life.



- At a species level, the concept of adaptation is the result of a long term evolution produced by natural selection. The spatial scale can reach that of a population, an ecosystem or even Earth, as maintained by the Gaia hypothesis in its definition of the Earth as “a dynamic, physiological system that includes the biosphere and maintains our planet in harmony with life” (Lovelock, 1969, p.30). However, biological adaptation also describes the product (state, character) of the evolving processes. Gould and Vrba, in particular, see a character as an adaptation if it fulfils a role for an individual in the present whereas Bock (1980) defines a character as an adaptation if it contributes to the reproductive success of the individual. These subtleties guide Reeve and Sherman (1993) to emphasize the importance of defining adaptation in an appropriate way in relation to the problem addressed. The interactions between the organisms and their environment and the mechanisms of adaptation are now better understood.

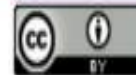
KEY ELEMENTS OF HUMAN *NICHE-ADAPTATION CO-EVOLUTION*

EMERGENT HUMAN NICHE

- **TERRESTRIAL** habitats
- **OMNIVOROUS** variable prey spectrum
- **EXTRACTIVE** technologically aided interaction with prey and the physical habitat
- **SOCIALLY INTENSE** environment
- **MULTISCALAR TEMPORAL, SPATIAL, and SOCIAL STRUCTURE** of embodied routines, life histories and cultural symbolic systems

KEY ADAPTATIONS IN THE GENUS *HOMO*

- Cultural symbolically structured, embodied notions and memories about society, landscape, and time
- Sharing of information and opinions, including social judgments
- Joint-attention soliciting, giving, and monitoring behaviors
- Tool-making and tool use for extraction, transportation, and processing of resources
- Transfers of high-quality food resources to juvenile offspring
- Bipedal locomotion



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Youtube links :

- ■ <https://www.youtube.com/watch?v=dtvGUWG3Rbk>
- ■ <https://www.youtube.com/watch?v=sLMZwwhSZQg>

Thank
you

A decorative graphic featuring the words "Thank you" in a white, cursive, brush-stroke font. The text is surrounded by colorful floral and leaf motifs in shades of red, teal, and brown. The background is black with small white dots. The entire graphic is mounted on a wooden surface.