6.2: Human Adaptations

Adaptations and Adaptability

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 Biological Adaptation

Acclimatization

This form of adaptation can take moments to weeks to occur and is reversible within an individual’s lifetime no matter if it occurs when one is a child or an adult.

Short-term acclimatization can occur within seconds of exposure to a stressor. This type of response quickly reverses when the stressor is no longer present. Imagine stepping out of an air-conditioned building or car into a 90 degree day.
Your body will quickly begin to perspire in an attempt to cool your body temperature and return to homeostasis. When the temperature declines, so will your perspiration. Tanning is another short-term response, in this case to increased UV-radiation exposure especially during summer months, which can occur within hours. Tans are generally lost during the winter when UV-radiation decreases.

### 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 an mark of beauty and enabled girls to find a wealthy spouse.

### Genetics

**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.

### Human Genetic Adaptations and Human Variation

#### Skin Color

Click on this link to watch a fantastic video explaining the interplay of skin color, UV, and vitamin D.
There are two ecological rules, known as Bergmann’s rule and Allen’s rule, that explain the variation in size and shape of bodies and extremities using latitude and temperature.

- **Bergmann’s rule**: Warm-blooded animals tend to have increasing body size with increasing latitude (toward the poles) and decreasing average temperatures.

- **Allen’s rule**: A corollary of Bergmann’s rule that applies to appendages. Warm-blooded animals tend to have shorter limbs with increasing latitude and decreasing average temperatures.

When organisms are more compact, they tend to conserve heat (due to a high mass:surface area ratio). When organisms are more linear, they tend to lose more heat (due to a low mass:surface area ratio).

This has been applied to humans. The idea is that populations toward the pole tend to be shorter and have shorter limbs than do people on the equator. For example, the Inuit people of Canada (pictured above) tend to be shorter than the Maasai people of Kenya (pictured below):
Race

Technically, a race is a biologically classifiable **subspecies**. So, when we are asking, “Do human races exist?”, what we’re really asking is, “Are there biologically classifiable subspecies in humans?”. 

Here’s the American Anthropological Association’s statement on race and the American Association of Physical Anthropologists statement on race. What are they saying?

Basically:

- race is an arbitrary categorization, races are not biologically distinct groups (in other words, race is a cultural construct, not a biological one)
- while groups of people who have lived together for a long time may have some alleles in common (for example, those that code for skin color or hair color), there is more genetic variation within races than there is between races
- the concept of race has historically been a tool that some people use to subjugate others

Further explore the concept of race, its history, and human variation.

References