Chapter 12: Modern Human Adaptation and Variation
Course updates

1. Quiz 4 - take home: covers chapters 9-11
   - Available: Wednesday, December 6 @ 5 pm
   - Due: Sunday, December 10 before 12 am

2. Final and essay 2: Last day of class

3. Today: Modern human variation and adaptation (Ch 12)
   - The concept of race and human variation
   - Biocultural evolution and adaptations
   - Modern environmental conditions affecting humans
Final info

- Study guide and potential short answer questions online

30 multiple choice
8 true or false
7 short answer questions

10 questions = ch 1-7
14 questions = ch 8-10
14 questions = ch 11-13

12 possible short answer questions will be on the study guide
9 will be offered on the final
7 of the 9 must be answered for full credit

3x5 note card (both sides) is allowed
Biocultural evolution
-Humans live in a cultural environment

Sickle-Cell Trait: Selection favored malaria resistance
-agriculture introduced mosquito breeding sites to human populations ~2 kya

Lactose intolerance: Selection favored tolerance to milk products in pastoralists
-Cultural dependence on milk increased the frequency of lactose tolerance via natural selection
Adaptive significance of human variation

- Adaptation includes environment and culture
- Physiological responses to environmental change are influenced by genetics

**Solar radiation and skin color**
Solar radiation, vitamin D, and skin color have been shaped by natural selection

General pattern: people with darker skin are found near the equator (tropic areas) and people with lighter skin are found in northern latitudes
Adaptive significance of human variation

Skin color is influenced by melanin - pigment produced in the epidermis. Melanin absorbs ultraviolet radiation (UVR) protecting against damaging effects like skin cancer.

Darker skin
Natural selection favored darker skin near the equator in response to high levels of UVR. -also prevents the degradation of folate (important B vitamin) - prevents neural tube defects in development.
Adaptive significance of human variation

Lighter skin
Natural selection acted rapidly against darker skin when humans moved into the northern latitudes
- lower levels of UVR relaxed natural selection's favoring heavily pigmented skin
- Vitamin D production in skin stems from the interaction between UVR and skin cells
-- protection from rickets
Adaptive significance of human variation

- Adaptation includes environment and culture
- Physiological responses to environmental change are influenced by genetics

**Acclimatization:** any physiological response to environmental change

Examples: tanning in response to ultraviolet radiation and increased hemoglobin production to exposure to hypoxia

Developmental acclimatization can arise due to exposure to environmental changes during growth
Thermal environment

Heat retention and loss and mass-to-surface ratios

**Bergmann's rule:** relationship of body mass to surface area
Colder environment = greater body mass
Selective advantage:
release less heat (small skin surface area)

**Allen's rule:** shape of body and appendages to surface area
Colder environment = shorter appendages
Selective advantage:
release less heat (small skin surface area)
Thermal environment

Responses to heat
Evaporative cooling: all humans dissipate heat (sweating)
Vasodilation: capillaries on the skin's surface widen to increase blood flow - radiates body heat
Thermal environment

Responses to cold: heat retention and production

Short-term responses: shivering, increased metabolic rate, and vasoconstriction

Long-term responses: prolonged vasoconstriction (if frostbite isn't a concern) and alternating between vasoconstriction and dilation (if frostbite is a concern)
Adaptations to high altitudes

High altitude - 25 million people live at altitudes of 10,000 feet

Environmental pressures: more intense solar radiation, cold, low humidity, wind, reduced nutritional base, and hypoxia

**Hypoxia**: oxygen deprivation due high altitudes
- causes fatigue, dizziness, poor memory performance, death via heart failure

Responses to hypoxia: increased respiration rate, heart rate, and red cell production

Development acclimatization: high altitude natives (Tibetan populations) undergo slower growth and maturation, possess larger chests, heart, more efficient diffusion of oxygen to body tissues
Ch 12

Concept of race
-racial categories aren't useful when studying humans because in-group genetic variation is greater than variation between groups.

-INSTEAD refer to human populations

-race is instead socially constructed
Contemporary Interpretations of Human Variation

Polytypic: humans are composed of local populations that differ in their expressions of one or more traits
- vary morphologically but genetically very similar
The Pleistocene Epoch

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