Modern Human Biological Variability

Concept of Race
Physical Anthropology

• Sub-field of Anthropology concerned with human biology and evolution

• Developed to explain the extent of physical variation among living peoples
Human Biological Variability

- **POLYGENIST’S SCHOOL**
  - Different groups encountered were in fact different species
  - “different creations”
  - variability solved!

- **MONOGENIST’S SCHOOL**
  - We are all one species!
  - Development of the concept of Race
Biological Races

• Variability seen in typological terms, that is, “types” or “varieties” of humans

• Physical anthropology became involved in developing the “correct” racial taxonomy
Classification of Human Groups

• Folk Taxonomies
  – classification of some class of phenomenon based on cultural traditions
  – Do not always correspond to reality
Folk Taxonomies of Race in American Culture

• European, African, Asian, American Indians, Hispanics

• Are these categories reflections of reality?

• Yes and No!
Folk Taxonomies of Race in American Culture

• Yes =
  • “Social” Race
    – Social reality
    – reflected in many forms of behavior

• No =
  • Biological Race
    – No biological reality
    – No racial classification scheme has any more scientific merit than any other!
    – Ethnocentric ideas!
Biological Race

• A population differing in the FREQUENCY OF CERTAIN ALLELES from other populations within the same species.

• Genetic definition

• Since we cannot determine allele frequency, we rely on PHENOTYPIC characteristics
  – ex. Skin color
Problems with Race Classifications

• Typologies are seen as static, stable divisions in humankind

• Based on folk taxonomies of cultural tradition
Problems with Race Classifications

• Gene flow reduces variation!

• There are no, and never have been “pure” races

• Gene Flow is the Rule!
Problems with Race Classifications

- White Americans have about
  - 5% African genes, 3% native American gene
- Black Americans have about
  - 20% European genes; 3% Native American
- Native Americans have about
  - 30% European genes; 5% African genes
Problems with Race Classifications

- Early anthropologists were looking for statistical averages to define racial groups

- However, they ignored
  - 1) Range of Variation
  - 2) Adaptation to the Environment
    - Traits existed because of Natural Selection
Problems with Race Classifications

• Physical traits evidenced in people around the world were NOT aspects of a TYPE

• But, GENETIC ADAPTATIONS TO ENVIRONMENTS
Skin color

• Dark skin
  – advantageous near the equator; greater degree of ultraviolet radiation
  – Folic Acid

• Light-colored skin
  – advantageous away from the equator
  – protection from cold
  – Vitamin D regulation
  – ex. neanderthals
The Effect of Environmental Factors on Skin Color

**ENVIRONMENT**
- Tropical Climate
- Temperate Climate
- High Cold

**SELECTIVE FORCE**
- High Solar Radiation
- Low Solar Radiation

**TRAIT SELECTED AGAINST**
- Hyper-Vitaminosis D
- Skin Cancer: Malignant Melanoma

**TRAIT SELECTED FOR**
- Light Skin Color
- Dark Skin Color

- Frostbite
Clinal Distributions

• Continuous change in a biological trait or trait frequency over time and space

• expressed in GRADATIONS

• Geographic generalizations do exist, but, there are no boundaries between one expression of a trait and another

• ex. Blood types; skin color
Clinal Distributions

• Trait boundaries are ARBITRARY

• Different traits give different divisions

• No concordance

• Cluster of traits are useless as criteria
Problems with Racial Types

- Biological traits show no concordance
  - clusters of traits useless

- Maybe more variation within defined racial groups than between
CULTURE

• Major adaptive mechanism

• products of cultural ability
  – social systems, technology, etc.
GENETICS

• Basis for human biological variability

• All populations are constantly evolving
  – gene frequencies are constantly changing each generation
  – gene frequency cannot be displayed in an individual
Human biological races

• Are at best a statistical abstraction

• Based on frequency of certain allele characters observed in small populations

• No stable divisions of humans

• Human races do not exist in nature as units of study in science
Important Points to Remember

• Biological variation = DYNAMIC EVOLUTIONARY PROCESSES

• As social barriers are erected & broken down = gene flow patterns change

• Environmental conditions alter = natural selection shifts

• Mutations are always occurring
Human Morphology & Behavior

• Are the products of the dynamic interaction between

• CULTURAL
• BIOLOGICAL
• ENVIRONMENTAL VARIABLES
Interests of Science Today

• HOW human biological variation came about in terms of the EVOLUTIONARY PROCESSES which created it?

• WHAT biological traits are POLYMORPHIC & determine their GENETIC BASIS?

• WHY is a trait polymorphic?
POLYMORPHIC TRAITS

- **SIMPLE**
  - controlled by a single gene
  - # of alleles
  - stable throughout life
  - ex. Blood groups

- **COMPLEX**
  - controlled by many genes
  - traits are unstable
  - environment & developmental changes
  - ex. Skin color; stature
Example of SPT

• large set of SPT (30 or more) = blood groups

• ABO System:
  – I gene
    • Ia, Ib, Io
ABO Blood System

- 6 GENOTYPES
  - AA
  - AO
  - BB
  - BO
  - AB
  - OO

- 4 PHENOTYPES
  - type A
  - type A
  - type B
  - type B
  - type AB
  - type O
Simple Polymorphic Trait

- Use blood types in Paternity Cases
### Punnett Square

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**Michael Jackson**
- Type A

**Billie Jean**
- Type B
- Son: Type O
Simple Polymorphic Traits

• Important = easy to trace

• useful for purposes of comparing populations at the genetic level!
Complex Polymorphic Traits

• More difficult to trace
  – multiple genes are involved
  
  – inability to determine exact number

  – they undergo environmental and developmental influences
CPT

• SKIN COLOR = varies with regard to amounts of sunlight striking the earth’s surface at different latitudes

• NOSE FORM = relationship with the temperature and moisture content of the air

• BODY BUILD = selected to some extent according to ave. temperature in an area
Complex Polymorphic Traits

• Important = in reconstructing the evolutionary history of human polymorphic traits
Why are there genetic differences?

• We don’t know completely

• All we can do is indicate traits and genes that seem to be distributed because of ADAPTATIONS to environments

• And, carried along by the movements of people and reflect ANCESTRY
ADAPTATION + ANCESTRY

= HUMAN POPULATION

DIFFERENCES

Both processes may act together