

ANTHROPOLOGY

Archaeology

A branch of anthropology focusing on the analysis of human material remains in an attempt to reconstruct past cultures

SOME COMMON METHODS

Excavation: Uncovering buried materials from the past so that they may be recorded and analyzed

Survey: Locating artifacts and potential sites through methods such as *ground walking, soil analysis and various remote sensing techniques*

Grid system: A technique used in excavation allowing better recording of the location of artifacts; a grid is mapped out over the excavation area, which is then excavated one layer at a time and mapped according to the grid system

DATING TYPES

Relative dating: The temporal location of artifacts is described in reference to other artifacts to determine a relative age

Absolute dating: Also known as *chronometric dating*; determines the actual age of an artifact in terms of years, centuries, or other units of time

- **Radiocarbon (C-14) dating:** Absolute dating method measuring the half-life and decay rate of C-14 to nitrogen in organic materials

- **Amino acid racemization:** A chronometric dating technique used on organic material; utilizes changes in proteins when an organism dies to calculate the age at death

- **Potassium-argon (K-Ar) dating:** Chronometric dating method measuring the decay of potassium (K-40) to argon (Ar-40) in volcanic deposits

- **Argon-argon (40Ar-39Ar) dating:** Absolute dating technique used in conjunction with potassium-argon dating that estimates relative quantities of argon-39 to argon-40 gases in volcanic deposits

- **Obsidian hydration dating:** Chronometric dating of obsidian artifacts by measuring the water absorbed on worked surfaces of the artifact

- **Thermoluminescence dating:** Absolute dating technique used to determine the age of ceramics, tiles, bricks and any other fired clay artifacts

- **Dendrochronology:** Also known as *tree-ring dating*, this absolute dating technique compares a tree sample that is relevant archaeologically to an established tree-ring chronology for the area to determine the year the wood was first utilized by humans

- **Electron spin resonance:** Chronometric dating method that measures trapped electrons in shell and bone

POTTERY

- All fired clay artifacts made by humans
- Hundreds of types: Food storage vessels, cooking pots, ladles, burial chambers, and pipes, etc.









- Widespread use is one of the most compelling indications of sedentism at a site

- Pottery decoration used in classifying and tracking change in pottery styles



Aztec pottery

TOOL MAKING

0.0-0.01 Million years ago	Upper Paleolithic / Later Stone Age	
		
	Engraver	Borer
0.05	Middle Paleolithic / Middle Stone Age	
		
	Mousterian point	Toothed blade
0.25	Lower Paleolithic / Early Stone Age	
	Acheulean	
		
	Pick	Hand ax
1.7	Oldowan	
		
	Chopper	Flake scraper
2.5		

Tool Traditions

• Oldowan tool tradition:

- The earliest identifiable tool-making tradition, associated with *Homo habilis*, the Oldowan begins the Paleolithic (Old Stone) Age, 2.5 million years ago
- Tools were made by striking a stone core, producing flakes which were used as blades and choppers and the cores were used as hammerstones

- Primary tool produced was the *pebble chopper*

• Acheulian tool tradition:

Tool-making tradition after the Oldowan period, dating from about 1.5 million years ago, associated with *Homo erectus*

- Made the same way as above, but much larger and adhering to more standardized shapes

- Primary tool produced was the *Acheulian hand axe*, a pear-shaped tool

• Mousterian tool tradition:

Tool-making tradition of the Neandertals from 100,000 - 400,000 years ago in Europe, Southwest Asia, Northern Africa

- Tools generally much smaller, more varied and much more skillfully worked than those previous

- Tool makers utilized pressure-flaking techniques in contrast to the earlier percussion-flaking techniques

Tool techniques

- **Levallois:** Found often in the Mousterian tool tradition; flake tools of standard sizes were made by striking a shaped core

- **Blade technique:** Blade produced by striking a core of stones

- **Pressure-flaking:** Bone, antler or wood tools used to press small flakes off a flint core

- Allows for more control over the finished flakes

TRANSITIONAL PERIODS

Paleoindians in the New World

- Literally, "Old Indians"; first group of humans to come to the New World

- Most researchers agree Paleoindians came to the New World sometime before 12,000 years ago, during the Paleolithic ("Old Stone Age")

- Hunted mostly big game animals; known for distinctive fluted arrowhead points

Mesolithic

- Literally, "Middle Stone Age," an archaeological period of time beginning around 12,000 B.C.

- Humans became more sedentary and began to subsist on more stationary food resources

- **Natufian:** A cultural tradition beginning in Southwest Asia during the Mesolithic period

- Comprised of the first people who occupied permanent settlements and began domestication in this area

- **Archaic:** Term applied to Mesolithic cultures in the New World

- Characterized by enormous cultural diversity as populations adapted to different environments

- Caused an array of cultures with unique life-ways and technology

Neolithic

- Literally, "New Stone Age"; established plant and animal domestication beginning about 11,000 years ago in the Middle East

- **Domestication of plants and animals:** Evolutionary process where humans (intentionally or unintentionally) modify plant and animal genetics to better control their exploitation

• Early sites

- Near East

- **Levant:** The Natufians began the domestication of wheat, barley and lentils (about 10,000 B.P.)

- **Europe-Greece:** Cereal and animal domestication as early as 8000 B.P.

- **Africa - Nile River Valley:** Sheep and goat domestication from 6000 B.P.

- **China - Southern and northern:** Early rice cultivation, about 7000 B.P.

- **Southern Mexico - Tehuacan Valley:** Early evidence of maize, about 7000 B.P.

- **South America - Peru**

- **Highland Peru:** Early evidence of beans and maize, about 5500 B.P.

- **Coastal Peru:** Early evidence for gourds, squash and peppers, about 5000 B.P.

- **North America: Southeast U.S.:** Domestication of gourds, 7000 B.P.



Inca ruins

CIVILIZATIONS

Once used to refer to the pinnacle of the evolutionary line of social development, refers today to urbanized, class-segregated, state-level societies

Early sites -

Mesopotamia:

- "The land between two rivers"; between Iran and Arabia and Syria, along the Tigris and Euphrates rivers, where first civilizations flourished from 5600 B.P.

- The early Mesopotamian civilization of **Sumer** witnessed growth of cities into a unified state system

- **Cuneiform:** Early form of writing used to record economic transactions; later used to record stories

QuickStudy

THEORIES FOR THE EVOLUTION OF CIVILIZATIONS

- The Sumerians are widely known for the flood story in the **Epic of Gilgamesh**, paralleling the story of Noah and the flood in the Judeo-Christian Bible
- **Ziggurats**: Large, stepped platform temples; a major feature of this religiously oriented civilization

Egypt:

- One of the first great civilizations
- First unified by the ruler, *Narmer-Menes*, about 5000 B.P.
- State was based on god-like status of the pharaohs
- Scribes used hieroglyphs (a combined pictographic and phonographic form of writing) to record the complex transactions of collection and redistribution processed by the elite ruling class
- **Late Period (1070-332 B.C.)**: Pharaonic power declined and was replaced by the Ptolemaic line, instituted by Alexander the Great in 332 B.C. Roman occupation in 30 B.C. officially ended the great Egyptian civilization

did you know...

Pharaohs commissioned many architectural tributes: some are still standing (including the pyramids)

Indus River Valley:

- **Harappan Civilization**:
 - Around 4700 B.P.; began along the Indus River in South Asia
 - Known for massive citadel walls (made from fired clay bricks) engineered to prevent flooding
 - City streets were well planned; lined with brick faced houses, sometimes 3 stories, many with plumbing
 - Suddenly declined for unknown reasons, approx. 4000 B.P.

China:

- Circa 4000 BP, several rulers gained power and prominence
- Lived in walled towns - in constant competition and war
- Unification of region brought by the *Shang* civilization of the Yellow Valley at 3700 BP; became most dominant state throughout northern China
 - Famous for bronze work

Crete, Greece, and Rome:

- **Minoan**: Flourished around 4000 B.P. by constantly increasing their trade network
 - The eruption of the volcano *Thera* at 3473 B.P. accelerated demise
- **Mycenae**: 3600 B.P.; took over trading routes of the Minoans
 - Rulers acquired much prestige for trading of tin, copper, etc.
 - *Linear B*: Writing system made up of 89 characters established

Mesoamerica:

- **Maya**:
 - Beginning about 4000 BP
 - Complex societies, diverse agricultural techniques (slash and burn in lowlands, terracing and raised fields in highlands); complex belief system
 - Built great cities with pyramids and central plazas such as Teotihuacan, which housed 12,000 people and extended 8 square miles
- **Aztec**:
 - Circa 1100 AD.
 - Developed a great civilization in Mexico
 - Capital city, *Tenochtitlan* had rich central precincts, large residential areas, spectacular markets and gardens
 - Conquered by the Spanish in 1519



Mayan temple

South America:

- **The Inca Empire**:
 - Rule unified majority of South America
 - Primarily based in Peru
 - Control extended throughout the Andes mountains; extraordinary bureaucratic and military organization; collapsed in confrontation with the Spanish at 1534

LANGUAGE

The complete set of sounds and words a culture uses to convey meaning; languages must conform to rules of grammar and syntax in order to convey the intended meaning

- **Linguistics**: Scientific study of language
- **Structural linguistics**: Analysis of a language's structure.
- **Phonetics**: Study of the way speech sounds are produced, transmitted and received
- **Phonemes**: Smallest units of sound that can affect the meaning of spoken language
- **Morphemes**: Smallest units of sound which carry meaning (e.g., words, suffixes, etc.)
- **Morphology**: Study of the way sounds are organized to create units of meaning
- **Syntax**: Rules followed in phrase and sentence making
- **Grammar**: Formal structure dictating syntax and the subtleties of morphemes
- **Paralinguistics**: Study of the sounds, noises and parts of speech that work together with language to comprise communication; for example, pitch, speed, tone, etc.
- **Sapir-Whorf Hypothesis**: Proposed by **Edward Sapir** (1929) and elaborated on by **Benjamin Whorf** in subsequent years; argues languages predispose their native speakers to perceive the world dictated by the language structure
- **Ethnolinguistics**: Study of the interrelationship of language and culture
- **Sociolinguistics**: Study of the use of language in its social context
- **Glottochronology**: Method of dating the historical divergence of related languages by comparing and measuring change in their basic vocabularies

Cultural Anthropology

The study of contemporary human societies

CULTURE

The shared, learned, symbolic, integrated, adaptive set of behaviors, beliefs, attitudes, values and ideals common to a particular group

- **Classic Tylor (1871) definition**: Culture is "that complex whole which includes knowledge, belief, art, law, morals, custom and any other capabilities and habit acquired by man as a member of society."
- **Contemporary definition**: Learned behaviors and beliefs (values, habits, ideals, etc.) shared by members of a society
- **Characteristics**:
 - **Shared**: Cultural knowledge is shared by the group; not an individual phenomenon
 - **Learned**: Culture is constantly learned from other members of the culture
 - **Symbolic**: Shared through symbolic means, such as language and art
 - **Integrated**: The whole of culture is comprised of the interrelation of disparate parts
 - **Adaptive**: Constantly changing; as old traits become maladaptive, they are modified or traded for new ones that more efficiently address old problems
- **Fieldwork**: Research method used to learn about human beings through firsthand observations in their natural cultural environments
- **Participant observation**: A field research technique where an anthropologist lives with, works among and participates with the people of a culture for an extended period of time, usually at least a year
- **Ethnocentrism**: Believing one's own cultural values are supreme over all others
- **Cultural relativism**: Cultural values are thought to be arbitrary standards that should not be used to evaluate cultural behavior; rather, behaviors should be understood within their own cultural context

ENCULTURATION

The process of an individual learning their society's culture

- **Personality**: The set of thoughts, feelings and actions that define an individual
- **Dependence training**: Child-rearing practices promoting dependence and compliance in assigned tasks
- **Independence training**: Child-rearing practices fostering independence, self-reliance and a need for personal achievement
- **Group personality**: Studies undertaken in the 1930s and 40s; attempting to determine the dominant psychological patterns of various cultural groups
 - **Modal personality**: Personality type most frequently present in a group.
 - **National character**: Dominant psychological orientation found among the people of a nation
 - **Core values**: The values of central significance to a specific culture

SUBSISTENCE

The way a group gets its food

- **Adaptation**: Process by which organisms are modified based on interactions with their environment; allows more efficient interaction
- **Foraging**: Also known as hunting and gathering; subsistence on plants and animals naturally occurring in an environment
- **Pastoralism**: Subsistence based on raising livestock (cattle, sheep, goats, etc.)
- **Horticulture**: Small-scale cultivation using relatively simple techniques and tools as well as "slash-and-burn"
- **Agriculture**: Larger-scale cultivation using more complex techniques and tools; relies on permanently cultivated fields, tools such as plows and draft animals, and other technologies, such as irrigation

FAMILY AND KINSHIP

Kin group that resides together comprised of at least one parent and one child

Nuclear family: Family organization comprised of a husband, a wife, and their dependent children living in one household

Extended family: Group of blood-related nuclear families living in one household

Residence types or patterns:

- **Ambilocal residence:** Also known as **bilocal residence**; a married couple living with either of the husband's or the wife's relatives
- **Avunculocal residence:** Married couple residing with the husband's mother's brother
- **Matrilocal residence:** Married couple living with or near the wife's relatives
- **Neolocal residence:** Husband and wife establish their residence anywhere, regardless of the location of their relatives
- **Patrilocal residence:** Married couple living with or near the husband's relatives

Kinship: Relationship between members of a social group related by either blood or marriage

- **Unilineal descent:** Also known as unilateral descent; dictates descent exclusively through either the father's or mother's line
- **Ambilineal descent:** Traced equally through either the mother's or the father's line
- **Bilateral descent:** Traced through both the mother's and the father's lines
- **Matrilineal descent:** Traced through the mother's line only
- **Patrilineal descent:** Traced through the father's line only
- **Lineage:** A set of kin genetically linked to a common ancestor tracing their descent by known links through either male or female lines
 - **Clan:** Also called a **sib**; a set of kin who believe they are genetically linked but can't trace their descent through known links; often made up of several lineages
 - **Phratry:** A unilineal descent group made up of at least two clans believing themselves to be of common ancestry
- **Moiety:** A unilineal, exogamous descent group found in a dual organization society

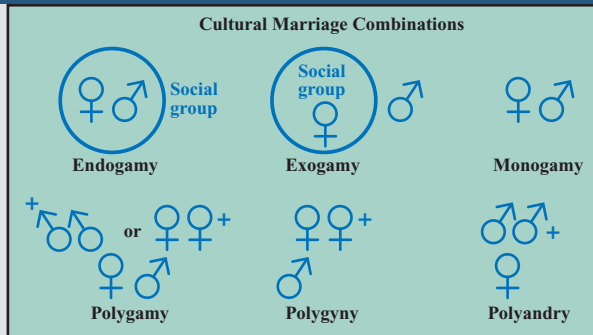
Kinship terminological systems

- **Eskimo system:** Also known as a lineal system; specific terms are assigned to the members of the nuclear family, with all other relatives subsumed under the category of either "aunt," "uncle," or "cousin"
- **Hawaiian system:** Relatives of the same sex and generation are referred to by the same term
- **Iroquois system:** One's father and father's brother are referred to by a single term, as are one's mother and mother's sister, but one's father's sister and one's mother's brother are given separate terms; parallel cousins are classified with brothers and sisters, while cross cousins are classified separately, but (unlike Crow and Omaha kinships) not equated with relatives of some other generation
- **Crow system:** Usually associated with matrilineal descent in which father's sister and father's sister's daughter are called by the same term, mother and mother's sister are merged under another, while father and father's brother are merged under a third; parallel cousins are equated with brothers and sisters
 - **Omaha system:** The patrilineal equivalent of the Crow system; the line of mother's patrilineal kin is equated across generations
 - **Sudanese or Descriptive system:** One's father, father's brother, and mother's brother are distinguished from one another, as are mother, mother's sister, and father's sister; cross and parallel cousins are distinguished as well as from siblings

MARRIAGE

Socially accepted sexual and economic union between individuals in a society

- **Gender:** Differences between males and females based on cultural expectations and experiences; categorizes an individual as masculine or feminine
- **Incest taboo:** Prohibition of sexual relations between related individuals.
- **Affine:** Relative acquired through marriage
- **Consanguine:** Biological, or "blood" relative
- **Endogamy:** Marriage within one's social group (such as one's kin group, caste, etc.)
- **Exogamy:** Marriage outside of one's social group
- **Monogamy:** Two individuals join together and do not have other spouses; **serial monogamy** occurs when monogamy is the norm, but divorce and remarriage are common
- **Polygamy:** Males or females may take more than one spouse
- **Polygyny:** Male is allowed to have more than one wife
- **Polyandry:** Female is allowed to have more than one husband; the most common form is fraternal polyandry, in which a woman marries a set of brothers
- **Exchange:** Formalization of marriage by an economic exchange
 - **Dowry:** Marriage exchange in which the bride's kin gives goods to the groom or his kin
 - **Bridewealth/Bride price:** Marriage exchange in which the groom's kin gives goods to the bride or her kin



ECONOMICS

The study of systems of production, distribution and exchange

- Production:** Development or creation of goods or services
- Distribution:** Process of changing produced goods for consumption; according to economist **Karl Polanyi**, distribution occurs according to one of three types of systems:
- **Reciprocity:** Items of roughly equal value are exchanged without the use of money; there are three types:
 - **Generalized reciprocity:** Neither the value of a good nor the schedule for repayment are specified
 - **Balanced reciprocity:** Both the value of the exchanged goods and the schedules of payment are specified

- **Negative reciprocity:** Giver of the goods attempts to gain the advantage in the exchange
 - **Redistribution:** Exchange process where goods are directed to an economic center to be organized, counted and redistributed
 - **Market exchange:** Value of a good or service is determined by supply and demand, and the medium of exchange is something symbolic (such as money)
- Exchange:** Buying and selling, or trade, of goods or services
- Formalist:** School of thought that argues economic theory is valid cross-culturally
- Substantivist:** School of thought that argues for understanding economic activity in its specific cultural contexts
- Leveling mechanisms:** Customs that keep wealth somewhat equally distributed

ART

Expression of human creative abilities in verbal, ornamental, musical or pictorial forms

- **Folklore:** Set of ballads, myths, folktales, legends, proverbs, riddles and superstitions of a cultural group
- **Myth:** Sacred story attempting to explain nature and creation
- **Legend:** Larger-than-life narrative told as if it were true
- **Tales:** Story created or embellished for entertainment
- **Ethnomusicology:** Analysis of music as an aspect of culture

did you know...

Music is an important aspect of many cultures

NON-KIN GROUPS

Groups or associations of individuals not based on family relations

- **Sex association:** Category of people based on sex
- **Age grade:** Category of people based on age; typically, groups of similar age are organized into **age sets**, which move through a series of age grades together through life
- **Common-interest associations:** Result when those with common interests group together; sometimes membership is required by law, such as the draft or a labor union
- **Class:** Social category whose members are judged as relatively equal based on the predominating system of evaluation
- **Caste:** Group in which membership is determined by birth and marriage and dictated by **endogamy** (marriage within the group)

POLITICAL ORGANIZATION

The way a society is organized around issues of power and economics

- **Band:** A relatively small group of people with a division of labor based on age and sex, with social relations based on egalitarianism; typically found among foraging people
- **Tribe:** A variety of somewhat independent groups united by a common language and culture; generally larger than bands; there may be a chief who speaks for the group, but social relations are still egalitarian, with labor divided along age and sex lines; typically found among farmers and herders
- **Chiefdom:** Several individual communities are hierarchically subsumed under the rule of a centralized chief
- **State:** Centralized political system found in large, complex societies; has the power to coerce its members into maintenance of the hierarchy imposed by the elite ruling class by means of law and physical enforcements
- **Controls:** Customs and practices that regulate societal behavior
 - **Internal controls:** Members of the society are personally responsible for their actions, i.e. individuals act according to a culture's conceptions of what is proper, right, and correct; often rely on belief in supernatural forces that may inflict punishment for improper actions
 - **External controls:** Also known as sanctions; social institutions enforcing social norms and order; such as courts, police and councils of elders
- **Law:** Formal rules or **sanctions** providing the basis for determining guilt, as well as the means or type of punishments

RELIGION

Belief system that posits a human relationship to the supernatural

- **Animism:** Belief that nature is animated by spirit beings
- **Animatism:** Belief in the existence of impersonal supernatural forces
- **Priest or priestess:** Member of a culture serving as a full-time religious specialist
- **Shaman:** Member of a culture who serves as a (usually) part-time religious specialist; believed to have the ability to communicate directly with supernatural beings and powers
- **Ritual:** Patterned acts performed in an attempt to manipulate the spiritual world
 - **Rites of passage:** Performed at specific stages in the life cycle to mark important status changes, e.g., birth, marriage, and death
 - **Rites of intensification:** Performed to return cohesiveness to the group before or during a crisis or before a potential crisis
 - **Rite of reversal:** Allows for a reversal of ordinary roles and obligations of individuals
- **Magic:** Practiced by individuals believed to have the power to psychically manipulate the supernatural and natural world
- **Witchcraft:** Practiced by individuals believed to have a psychic power, often unconscious, that can harm others or cause sickness; **sorcery** is associated with a conscious attempt to adversely affect an individual or group
- **Revitalization movement:** Social movement, often religious, organized to restore a culture to its former, supposedly more desirable, state

CULTURE CHANGE

All cultures experience change over time, depending on their particular circumstances; changes in the environment, foreign contact, and even internally imposed cultural modifications can lead to culture change

- **Innovation:** Utilizing existing cultural elements in a novel manner
- **Invention:** New tool, practice or principle that offers a fresh solution to either an old or new problem
- **Diffusion:** Spread of cultural traits through trade, migration and borrowing; often leads to culture change as old traits are replaced by newly diffused ones
- **Culture loss:** New innovations often lead to the loss of older ones; this can affect a loss of the entire culture as interdependent institutions are modified or thrown away
- **Acculturation:** Forced adaptation resulting from continual contact with other cultures
- **Modernization:** Cultural change experienced by societies that transition to a more Westernized, industrial lifestyle

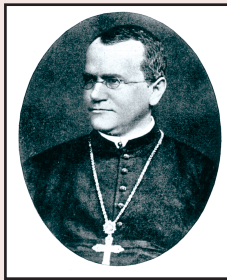
Biological Anthropology

The study of the biological aspect of humans and our ancestors, including molecular biology and genetics, primatology, paleoanthropology and human biology

MENDELIAN GENETICS

Gregor Mendel

- Father of Genetics
- Silesian monk, educated at University of Vienna
- Experimented on heredity in pea plants
- Experiments conducted 1856-1863
- Defined the unit of inheritance (gene) as being discrete
- Work published in 1866, but not recognized until 1900



Gregor Mendel

The Theory

- Describes traits expressed through a single gene, a section of DNA that codes for a particular trait
- A gene may have several different forms or **alleles**
- Observable traits and characters represent the phenotype of the organism
- The genotype is the genetic makeup; those genes that are expressed and unexpressed
 - **Homozygous:** Having the same alleles for a particular trait
 - **Heterozygous:** Having different alleles for a particular trait
- A gene can be dominant or recessive
 - Dominant genes are always expressed when present
 - Recessive genes are expressed only when paired with another recessive gene

Principles of Mendelian Genetics.

- **Principle of Segregation:** In the formation of gametes, homologous chromosomes separate so each gamete is equally likely to contain either member of the original pair
- **Principle of Assortment:** Random distribution of the members of any pair of alleles is independent of the distribution of other pairs in the formation of gametes

Complex Traits

- Most complex traits are affected by multiple genetic and environmental factors
- **Polygenic trait:** Depends on the action of more than one gene

Mutation

- Any heritable change in a gene
- The basic mechanism of evolution

MOLECULAR BIOLOGY AND GENETICS

DNA - The Genetic Code

- **1869:** DNA discovered
- **1920s:** DNA shown to be in chromosomes
- **1944:** First evidence that DNA is the genetic material of an organism
- **1953:** James Watson and Francis Crick discovered the three dimensional structure of DNA
- DNA, deoxyribonucleic acid, controls heredity
 - Molecular structure of DNA is a double helix consisting of a linear sequence of paired nucleotide bases
 - Nucleotides of DNA are adenine, thymine, guanine and cytosine
 - Pairing between nucleotides of DNA is complementary-adenine pairs with thymine, cytosine pairs with guanine

Protein synthesis

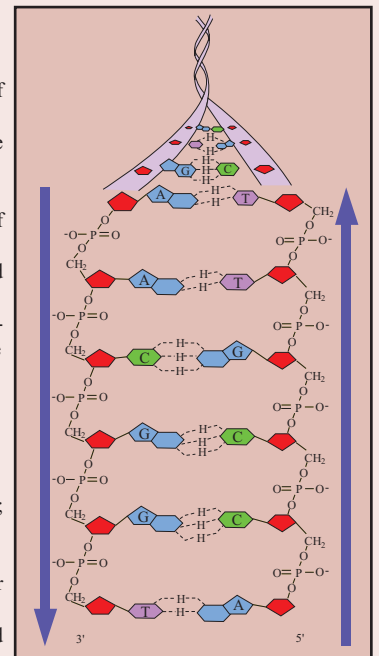
- **DNA codes for RNA (ribonucleic acid)** = transcription
- **RNA codes for proteins** = translation

Transcription

- The production of a strand of messenger RNA (mRNA); complementary in base sequence to a DNA strand
- Base pairing in DNA and RNA
- Complementary base pairing specifies the linear sequence of RNA
- RNA differs from DNA by having a ribose sugar instead of a deoxyribose sugar
- RNA contains the base uracil in place of thymine
- Adenine pairs with uracil; thymine pairs with adenine; guanine pairs with cytosine and cytosine pairs with guanine

Translation

- The genetic code is read as a codon, or series, of three bases from the mRNA strand; each codon codes for a single amino acid
- Each transfer RNA (tRNA) contains a complementary codon to a codon sequence in mRNA; tRNA's position amino acids during translation
- Amino acids are strung together to form a polypeptide chain; the order of the chain determined by the sequence of codons contained in the mRNA
- Occurs on ribosomes, which contain several types of ribosomal RNA (rRNA)



DNA - Genetic code

MITOSIS

- Process where a single, diploid parent cell gives rise to two diploid daughter cells genetically identical to each other and to the original parent cell
- Multi-phase process in which sister chromatids comprising the replicated chromosome separate and are deposited into the cells being formed

MEIOSIS

- A single, diploid parent cell gives rise to four haploid daughter cells genetically distinct from each other and the original parent cell
- Produces gametes
- Multi-phase process includes the possible swapping of genetic material between homologous chromosomes in the process of crossing-over

PRIMATOLOGY

Characteristics

- **Vision:** Primates place a greater emphasis on vision than they do olfaction
- **Forward facing eyes**
 - **Binocular vision:** Overlapping field of vision for each eye
 - **Stereoscopic vision:** Depth perception due to integration of visual information in the brain
 - See in color
- **Large brain relative to body size**
- Female usually produces small litters of one or two offspring
- Increased parental investment in offspring
- Increased period of development, including gestational and postnatal development
- Show a variety of **locomotor modes:**
 - **Arboreal quadrupedalism:** Moving on all four limbs in the trees
 - **Terrestrial quadrupedalism** (knuckle-walking): Moving on all four limbs on the ground
 - **Vertical clinging and leaping:** Moving or jumping between vertical substrates, such as tree trunks
 - **Brachiation** (suspension; semi-brachiation): Moving underneath a substrate by using the arms
 - **Bipedalism:** Moving on top of a substrate with just the hindlimbs
- Locomotion tends to be hindlimb dominated
- Unspecialized molars
- A maximum of two incisors, one canine, three premolars, and three molars on each half of the jaw
- Grasping big toe and thumb
- Nails on all digits instead of claws, and tactile pads on the hands and feet
- Generally limited to tropical regions

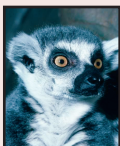
CLASSIFICATION OF PRIMATES

Order: Primates

- **Suborder: Strepsirhini**
 - **Superfamily:** Lemuroidea (Lemurs)
 - **Superfamily:** Lorisioidea (Lorises and Galagos)
- **Suborder: Haplorhini**
 - **Hyporder:** Tarsiiformes (Tarsiers)
 - **Hyporder:** Anthropeoidea
 - **Infraorder:** Platyrrhini (New World Monkeys)
 - **Infraorder:** Catarrhini (Old World Monkeys, Apes and Humans)
 - **Superfamily:** Cercopithecoidea (Old World Monkeys)
 - **Superfamily:** Hominoidea
 - **Family-** Proconsulidae
 - **Family-** Hylobatidae
 - **Family-** Hominidae
 - **Subfamily-** Ponginae (Pongo)
 - **Subfamily-** Homininae
 - **Tribe-** Gorillini
 - **Tribe-** Hominini (Homo sapiens)
 - **Subfamily-** Homininae, incertae sedis

Strepsirhines vs. haplorhines

- **Features of strepsirhines**
 - Shortest developmental period
 - Moist rhinarium (nose pad)
 - Split upper lip (philtrum)
 - Postorbital bar, no postorbital closure
 - Tapetum lucidum (reflective layer behind the retina)
 - Most species are nocturnal (active at night)
 - Unfused frontal bone and mandible
 - Tooth comb
 - Grooming claw on second digit of foot
- **Features of haplorhines**
 - Extended development; humans have the longest pre- and postnatal periods



Strepsirhine (lemur)



Haplorhine (chimpanzee)

- Fused frontal bone and mandibular symphysis
- Postorbital closure
- Upright incisors
- Larger brain relative to body size
- Most species are diurnal
- More complex social behaviors

Behavior and Ecology

Primate Diets

- Types of diets based on primary food source

- **Frugivore:** Fruits
- **Folivory:** Leaves, stems
- **Insectivory:** Insects
- **Gummivory:** Gums and saps
- **Gramnivory:** Seeds, herbs and grains

did you know...

Primates are omnivores, but most species have certain adaptations in their gut and teeth designed for specialization of diet

- Primates aggressively control a specific territory encompassing several feeding areas; a territory may be part of an entire home range of a species
- **Home range:** Area within which an animal normally lives, or the total territory occupied by a group in the course of one year
- Primates aggressively defend territories

Primate Social Groups

- Variables used to define social groups:
 - Mating type
 - Residence group composition
 - Foraging group coherence
 - Philopatry type (permanent residence in natal groups)

Why do primates live in social groups?

- **Resource defense model:** Social groups enhance access to resources
- **Predation model:** Primates live in social groups to reduce vulnerability to predators

Social organization by mating type

- **Solitary (one adult):** A single female and her offspring whose range is overlapped by a single male; the male may have a home range that overlaps those of several different females; males and females generally interact only for mating (ex. orangutans and galagos)
- **Monogamy (one male - one female):** One adult male and one female along with any immature offspring; mating is exclusive within the pair-bond (ex. gibbons, titi monkey)
- **Polyandry (one female - multimale):** One reproductively active female and two or more reproductively active males plus offspring; there may be other mature, related females; however, the single reproducing female actively suppresses their reproduction; males help rear offspring
- **Polygyny (one male - multifemale):** Seen in species where females leave their natal group; lots of female transfer; strong sexual dimorphism (ex. howlers, langurs, gelada baboons, gorillas)
- **Polygyny (multimale - multifemale):** Either sex transfers to a different group when mature; most are female-bonded groups (ex. macaques, baboons, vervets, squirrel monkeys, capuchins, some colobines); complicated system not easily applied (e.g., in chimps, males form a cohesive group whose home range overlaps that of several females)

Social Interactions

- Those behaviors assumed to affect the fitness of one or more individuals
- Usually reduce interactions to the least common denominator - the actor and recipient
- Social Interactions:
 - **Selfish:** Benefits the actor but not the recipient
 - **Mutualistic:** Benefits the actor and the recipient
 - **Altruistic:** Benefits the recipient but not the actor
 - **Spiteful:** Benefits neither the recipient nor the actor

PALEOANTHROPOLOGY

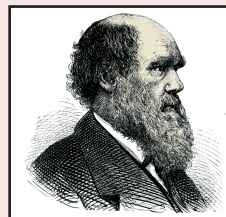
Early Evolutionary Theory

Pre-Darwinian Theory

- **Georges Comte de Buffon (1707-1788)**
 - Proposed the idea of *organic change*; species could change, but not give rise to new species
- **Erasmus Darwin (1731-1802)**
 - Grandfather of Charles Darwin
 - Believed species could change through competition and sexual selection
- **Jean-Baptiste Lamarck (1744-1829)**
 - Provided first persuasive theory of organic evolution
 - **Principle of Use and Disuse:** The more frequently an organ is used, the more prominent it becomes; those less frequently used are likely to diminish altogether in succeeding generations
- **Inheritance of Acquired Characteristics:**
 - Features enhanced or lost through principles of "use and disuse" pass to all offspring, provided the acquired modifications are common in both sexes, or at least to individuals which produce young; (ex. Giraffe predecessors were constantly stretching upward to reach foliage, causing their necks to grow longer; these longer necks are inherited; over the course of generations the necks of all giraffes get longer)
- **Georges Cuvier (1769-1832)**
 - Proposed that species could become extinct
 - Proponent of **Catastrophism:** Features of the Earth are the result of periodic geologic revolutions
- **Charles Lyell (1797-1875)**
 - Proponent of James Hutton's principle of **Uniformitarianism**, which suggested that geologic features are the result of continuous, gradual change

Darwinian Theory

- **Charles R. Darwin (1809-1882)**
 - Proposed the theory of evolution through **natural selection**, which can be broken down into three separate inferences:
 - **Struggle for existence** among individuals
 - Potential exponential increase of populations
 - Populations tend to remain stable in size
 - Limitation of resources
 - **Differential survival** (natural selection)
 - Struggle for existence
 - Variation in physical and behavioral characters
 - Heritability of individual variation
 - Evolution through action of natural selection over many generations
- **Alfred Russel Wallace (1823-1913)**
 - Proposed a hypothesis of evolution through natural selection at the same time, but independently, from Darwin



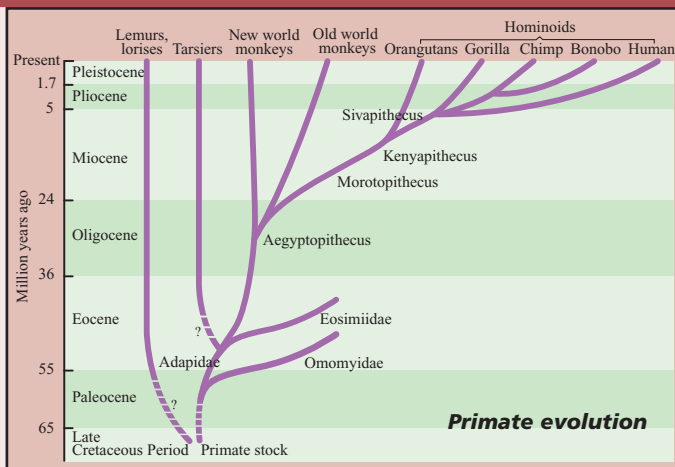
Charles R. Darwin

Mechanisms of Evolution

- **Natural selection:** Differential reproduction or survival of replicating organisms caused by agencies not directed by humans
- **Genetic drift:** A random change in the frequency of alleles in a population
 - **Founder effect:** Occurs when a small population colonizes a new habitat and subsequently increases in number
 - **Bottleneck:** A severe but temporary reduction in population size that reduces the amount of genetic variation
- **Migration (gene flow):** Transfer of genes from one population into another by interbreeding
- **Mutation:** Change in the composition of a gene or the genetic make-up of the organism

Primate Evolution

- **Cenozoic Era**
 - Epochs
 - Paleocene (65-55 mya), Eocene (55-36 mya), Oligocene (36-23.5 mya), Miocene (23.5-5.3 mya), Pliocene (5.3-1.6 mya), Pleistocene (1.6 mya - Present)
- **Primate Origins**
 - Early Paleocene (65 mya)
 - Early primates (ex. *Plesiadapis*) lack the complete suite of features generally associated with extant primates; for this reason some researchers separate out this early group
 - True primates (**strepsirhines**) appear in the fossil record around the early Eocene (55 mya)
- **Hypotheses for primate origins**
 - **Arboreal hypothesis**
 - Primates evolved by adapting to life in trees, which required enhanced vision, grasping hands and feet
 - **Visual predation hypothesis**
 - Early primates first adapted to life in the bushy forest undergrowth and low tree branches
 - Foraging for insects necessitated evolution of enhanced vision, grasping hands and feet, nails for capturing prey
- **True Primates**
 - Appear in the early Eocene
 - Adapids of North America, Europe and Asia
 - During the Oligocene (35-23.5 m.y.a.), haplorhines were the most numerous primates
- **Origin of New World monkeys**
 - The parapihitecid family may be ancestral to the New World monkeys as exemplified by *Apidium* and *Qatrania*
 - Rafting Theory of NW Origins: Suggests primates made it to the New World by rafting from Africa approximately 25 million years ago



- **Evolution of Old World monkeys**
 - Propiipithecid family may be ancestral to Old World monkeys, apes, and humans; or possibly just apes
 - From late Eocene - early Oligocene of Egypt and Oman
 - *Propiipithecus*, *Aegyptopithecus*, *Catopithecus*
- **Evolution of apes**
 - Evolved approximately 20 million years ago
 - **Proconsul**: Earliest apes
 - **Sivapithecus**: Early great apes; relatives of modern orangutans

HUMAN EVOLUTION

- **Trends**
 - **Alteration of skeletal features**
 - Bipedalism
 - Reduction of face (less prognathic)
 - Reduction in molar tooth size
 - Thick enamel on molars
 - Loss of C/P3 complex
 - Well developed second cusp on the lower premolars
 - Change in dental eruption patterns
 - Ape- M1, I1, I2, M2, P3, P4, C, M3
 - Human- M1, I1, I2, P3, C, P4, M2, M3
 - Efficient exploitation of terrestrial habitat
 - Increasing brain size and complexity
 - Tool use
- **Early Hominins**
 - **Late Miocene hominins**
 - *Sahelanthropus tchadensis*
 - Dated between 6-7 million years ago (mya)
 - Found in the Sahel region of Chad
 - Very primitive, may not be a hominin
 - *Orrorin tugenensis*
 - 5.6 - 6.2 million years old from Kenya
 - May be earliest biped
 - *Ardipithecus ramidus*
 - 4.39 - 5.8 million years old from Ethiopia
 - **"Gracile" Pliocene hominins**
 - All possess primitive, ape-like features, including a chimpanzee-sized brain (~400ml)
 - *Australopithecus anamensis*: 3.9 to 4.2 mya from Kenya
 - *Australopithecus afarensis*
 - 2.8 to 4.0 mya from Ethiopia and Tanzania
 - The famed Lucy skeleton is a member of this species
 - *Australopithecus africanus*: 2.5 to 3.0 mya from South Africa
 - *Australopithecus bahrelghazali*: 3.0 to 3.5 mya from Chad
 - *Australopithecus garhi*: 2.5 mya from Ethiopia
 - *Kenyanthropus platyops*: 3.2 to 3.5 mya from Kenya
 - **"Robust" Pliocene hominins**
 - All are characterized by large molars and dish-shaped faces
 - *Paranthropus aethiopicus*: 2.5 to 2.8 mya from Kenya and Ethiopia
 - *Paranthropus boisei*: 1.0 to 2.5 mya from Ethiopia, Kenya and Tanzania
 - *Paranthropus robustus*: 2.0 mya from South Africa

Early Homo

- **Less primitive than the australopithecines**
- **Homo habilis**
 - 1.5 to 2.4 mya from Kenya, Tanzania and South Africa
 - Brain size 660 ml
 - Less primitive than the australopithecines
- **Homo rudolfensis**
 - 1.8 to 2.4 mya from Kenya and Malawi
 - The cranial capacity is approximately 775cc
 - Associated with the Oldowan industry
- **Homo erectus**
 - Dates between 400,000 and 1.8 mya
 - Complex of derived and primitive features, but more like modern humans than earlier species
 - Associated with the Acheulian stone tool industry
 - First hominin species to be found outside Africa
 - Evolved first in Africa, spread to other areas including Europe and Indonesia
 - Cranial capacity on average, was 946cc (727-1225 ml)
 - Shows the earliest and best evidence for the development of complex language
 - First hominin to utilize fire
- **Homo georgicus**
 - Dated at 1.81 to 0.05 mya from Dmanisi (Georgia)
 - Little is known about this species
- **Homo heidelbergensis**
 - Formerly *Archaic Homo sapiens*
 - Existed in Africa, Asia and Europe from 800,000 to 100,000 years ago
 - More robust than modern humans
 - Cranial capacity averaged 1,283 ml (1,100-1,450 ml)
 - Used Acheulian tools; may have used later Mousterian tools
- **Homo neanderthalensis**
 - Lived between 32,000 and 300,000 years ago
 - Range restricted to Europe and the Middle East
 - Possessed many typical archaic features- sloping forehead, low skull, no chin, large brow ridges
 - Bodies were adapted for life in a cold climate
 - Largest average brain size of any known hominin; averaging 1400 ml (1,125-1,750 ml)
 - Associated with the Mousterian tool industry; small-flake tools with evidence of retouching

did you know...

Early **homo habilis** made the earliest discovered stone tools known as the **Oldowan industry**

- Appear to have been nomadic, living in different shelters at different times of the year
- Practice many types of ritualistic behavior, including funeral rituals
- **Homo sapiens**
 - First appear in the fossil record between 200,000 and 160,000 years ago
 - Produced delicate stone tools
 - First evidence of art was the use of red ochre about 70,000 years ago
 - First cave paintings- 32,000 years ago
 - Modern humans expanded into areas not inhabited before by other hominins
 - Australia: 50,000 years ago
 - North America: 25,000 to 15,000 years ago

THEORIES OF MODERN HUMAN ORIGINS

- **Multiregionalism/Coninuity model**
 - Suggests modern humans evolved from regional *H. erectus* populations that exchanged genes
- **Out-of-Africa/Replacement Model**
 - Suggests modern humans originated from a single population in Africa
 - After evolving in Africa, spread to other parts of the world, replacing other hominid species either through competition or assimilation

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