# History & Biology

## Evolution

## A Wolf in the Fold

## Control Systems

## Nature vs. Nurture

## Elicited Behavior

Evolution

## Tree of Life. % Genes Shared as a Function of Species

## Taxonomy – A Classification of Life

## Dog Human

## Kingdom: Animalia Animalia

## Phylum: Chordata (have backbone) Chordata

## Class: Mammalia (breast feed) Mammalia

## Order: carnivore (4 legs, VV) Primate (thumbs)

## Family: Canidae Hominidae

## Genus: Canis Homo

## Species: Lupus Sapiens (*wise man*)

## Subspecies Familiaris (races)

# Canidae - Family is divided into 2 tribes: *Canini* (related to wolves) & *Vulpini* (related to foxes). Includes Dogs & wolves and:

Fox

* The 37 species have a long narrow snout & a bushy tail.
* Only 12 actually belong to *Vulpes* genus of "*true foxes*".
* By far the most common is the *Red Fox*.
* Other species: *Patagonian*, *Corsac*, *Fennec*, *Arctic*, *Bat-Eared*, etc.

Coyote

* Also known as the *American Jackal* or *Prairie Wolf*.
* Sometimes travel in large groups, primarily hunt in pairs.
* Typical pack consists of ≈6 related individuals.
* Packs are generally smaller & associations between individuals less stable compared to wolves.

Jackal

* Most properly & commonly refers to 3 species: *Black-Backed, Side-Striped, Golden*
* Most common social unit is a monogamous pair.

Cape Hunting Dog

* It is also called the *African Wild Dog, African Hunting Dog, Painted Dog, Painted Wolf, Painted Hunting Dog, Spotted Dog, or Ornate Wolf*.
* Social structure is believed to be even more complex than that of the wolf.

Dhole

* Or *Asian or Asiatic Wild Dog* is native to SE Asia.
* They are more social than wolves & have less of a dominance hierarchy. In this sense, they closely resemble CHDs in social structure.
* They live in large clans which split up into smaller packs to hunt.
* Unlike other canids, there is no evidence of marking (with urine, feces, or scratching of ground).

Dingo

* Australia’s free-roaming wild dog (feral, i.e., previously domesticated & returned to wild).

Etc.

# Primate Evolution - Great Apes or Hominidae. This group includes our closest living relatives. Members of this family share possibly more than 97% of their DNA. Chimpanzees share more genetic material with humans (≈ 99%) than they do with gorillas.

## Science would say that monkeys are more like our cousins than our grandparents.

## Some common primate ancestor that is extinct today gave rise to both monkeys & apes.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Hominoidea | | | | | **Superfamily** |
| **Hominidae – (Great Apes)** | | | | Hylobatidae | **Family** |
| Homininae | | | Ponginae | **Subfamily** |
| Hominini | | Gorillini | **Tribe** |
| Homo- People | Pan- Chimps & Bonobos | Gorilla | Pongo- Orangutan | Hylobates- Gibbons & Siamangs | **Genus** |

## Definitions

## Species - A group of organisms with similar characteristics that can interbreed.

## Species-Specific Inheritance - Is what characterizes a given species (ex. 4 paws or 2 hands with thumbs).

## Individual Inheritance - Is responsible for differences among members of a species. Results in *genetic diversity*.

## Natural Selection - Is analogous to *selective breeding*, however, nature does the selecting.

## Evolution - Is a result of *natural selection* acting on *genetic diversity*. The individuals that can survive & reproduce are the ones that pass their genes to the next generation.

## Example - running speed in canines - (Evolution & Selective Breeding)

## Refers to who reproduces. Either the environment or man can determine this:

## If environment determines, it’s called natural selection or *evolution*.

## When man determines, it’s called *selective breeding*.

A Wolf in the Fold

## Dog History

## Studies of behavior, morphology, & molecular biology all indicate that dogs evolved from wolves. Dogs & wolves both have 78 chromosomes & can interbreed. In fact, Clifford & Green (1991) estimated there to be ≈300k wolf/dog hybrids in the U.S. Furthermore, the DNA sequencing of the dog’s genotype differs from the wolf by only 0.2% & from coyotes by 4.0%.

## Wolves exhibit virtually all of the behavior patterns shown by dogs.

## Domestication resulted from many generations of selective breeding.

## This is estimated to have taken place over the past 14-100k years.

## Wolves are highly social & live in packs of about 2-36 animals. They have a rigid *dominance hierarchy* which allows the pack to function as a coordinated unit (which is necessary for hunting large prey).

## Rather than viewing this simply as domestication, some argue it was a *co-evolution*.

## Co-evolution or Domestication

## Raab (1967) notes “. . . concerning man’s evolution from a pack hunting primate . . . The social organization of wolves, lions, and cape hunting dogs may be more relevant than most primates to that of the human situation.”

## Early man, as a hunter, probably occupied the same ecological niche as the social carnivores & therefore was under the influence of similar selection pressures (a process called *convergent evolution*).

## Cooperative hunting with K9s may have facilitated our coming out of the trees.

## Herding dogs had enormous impact on human agricultural development.

## Thus, *co-evolution* is when organisms change relative to one another over time or the long-term mutual evolutionary adjustment of features of one group to another.

## Another example - Flowering plants evolve in relation to pollinators. Pollinators, in turn, utilize flowers for food. They need each other.

## Theories of Domestication - There are 3 main points of view. Perhaps a combination may best explain the data.

1. Individual Based Selection
   * Individuals were selectively bred.
   * Is more likely toward the end of domestication rather than beginning.
   * Scott & Serpell favor this view.
2. Population Based Selection
   * Dogs evolved as scavengers to humans.
   * Coppinger favors this view.
   * Not of a lot of evidence here.
3. Dog Human Co-evolution
   * Both dogs & humans evolved in adaptive ways because of their relationship.
   * Schleidt favors this view. So do I.

## Consequences of Domestication

1. Increased variability in form.
   * Ex. size, shape, hair length, quality & color.
   * Variability in the dog is greater than in any other canus species.
2. Shorter muzzle & head, smaller brain, smaller teeth, & increased fertility.
3. Retain juvenile characteristics into adulthood called (*Paedomorphosis* or *Neotony*).
   * The adult dog is more comparable in its behavior to a juvenile than to an adult wolf.
4. Atrophy or hypertrophy in the response threshold mediating the expression of a behavior.
   * Ex. Hypertrophy of barking & marking.
   * Another Ex. Dogs tend to be less aggressive than wolves; they are more docile, submissive, & trainable.
   * More socially open & tolerant of strangers.
5. Omission, reordering, or exaggeration of one or more components of a sequence of behavior.
   * Ex1. hunting dogs (pointing, retrieving, etc.)
   * Ex2. herding dogs (eye, stalk, & chase, without bite & consume).
6. As a result of socialization & training, new patterns or combinations may be acquired or species-specific patterns modified.
   * Ex. Dog on it’s back is often soliciting attention rather than being submissive.

Conclusion:

* + A dog is not a wolf, but understanding wolf behavior should be helpful to understanding dog behavior.

Control Systems

* Neurons
* The Synapse
* Brain
* Endocrine System
  1. Also called the Hormonal System.
  2. *Behavioral Endocrinology* is concerned with the effects of hormones on behavior.
  3. Helpful in understanding of:
     + Gender differences in behavior
     + Sexual behavior
     + Developmental (age) differences in behavior
     + The effects of neutering/spaying
* N.S. Divisions
  1. CNS
  + Brain
  + Spinal Cord
  1. PNS
  + Somatic NS
  + Autonomic NS
    - Sympathetic Division
    - Parasympathetic Division
* Autonomic N.S.
* Fight/Flight Response

Nature vs. Nurture

* The Controversy
  + Is behavior genetically determined or is it learned?
  + All Behavior has a Genetic & an Environmental component:   
    G x E = B (so neither can be 0).
  + Thus, behavior is due to an interaction of genes & the environment.
  + It is noteworthy that this interaction continues throughout development.
  + Most scientists today believe behavior to be a result of a continuous & complex interaction of heredity (genetics) & the environment (learning).
  + For some behaviors, genetics plays a more important role than for others (ex. hunting, herding, & bite work vs. obedience & service dog skills).
  + We refer to behaviors that have a strong genetic component as *instinctive*.
* Relevant Concepts
  1. Behavioral Plasticity Continuum - Open vs closed genetic program continuum. In other words, species with bigger brains are more capable of learning & learning plays a more important role in their survival.
  2. Reaction Range - heredity and the environment interact in complex ways. Ex. Cloned dog “*Snuppy*”

Elicited Behavior

* Behavior that occurs in response to specific environmental stimuli.
* Is essentially instincts in detail. We will talk about 2 kinds:
  1. Reflexes
  + Basics
    - Involve 2 components: An eliciting stimulus & a corresponding response that is produced by the stimulus.
    - Typically promotes the well-being of the organism.
  + Simple Reflex Arc - In the simplest case, the reflex involves 3 neurons: Sensory or Afferent Neuron, Interneuron, & Motor or Efferent Neuron
  + Other Reflexes - *These all apply to humans & K9s.*
    - Pupil Constriction - to bright light.
    - Orienting - to a low noise.
    - Startle - to brief loud noise.
    - Salivation - to food in the mouth.
    - Coughing - to irritation of the throat.
    - Sneezing - to irritation of the nasal passages.
    - Vomiting after consuming an emetic.
    - Negative Phototaxis - avoid hot sun.
    - Opposition Reflex - oppose tactile stimuli with force in opposite direction. (Has implications for training (e.g., stand, pulling, recalls).
  1. Modal Action Patterns (MAPs)
  + Response sequences that are species typical (i.e., species-specific reflexes).
  + It is a concept from Ethology.
  + Used to be called *“Fixed Action Patterns (FAPs)”*, but it turns out that are not always so fixed.
  + MAPs have been identified for feeding, maternal & sexual behaviors, territorial defense, aggression & prey capture.
  + Some Examples
    - Dog killing & eating prey. Eye, stalk, chase, bite, shake & toss.
    - Dog marking behaviors: urination/defecation & scratching the ground with hind legs).
    - Dog circles before laying down.
    - Dog burying bone.
    - Canine sexual behavior: Cree & Tsuki
    - Primate grooming (ex. humans & their dirty eyed dogs).