

IMPORTANCE to HUMANITY

- Direct:
 - honey
 - bee pollen
 - royal jelly
 - bees wax
- Indirect: **pollination**

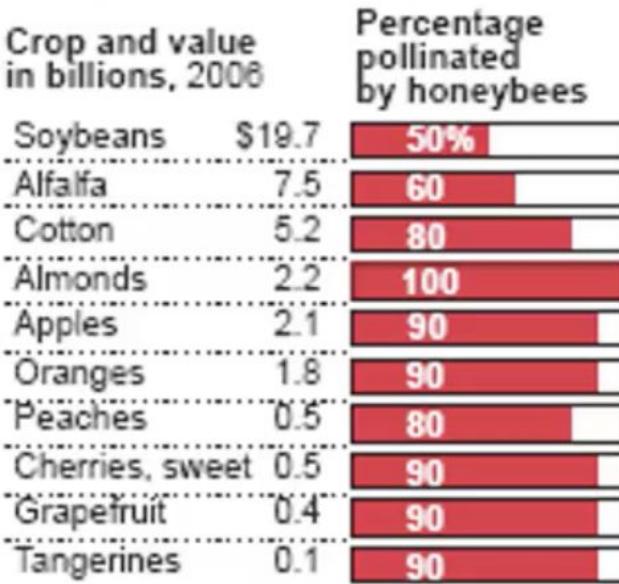


Livelihood for producers (2016 statistics)

- 54,000 colonies in Wisconsin
- 3.35 million pounds of honey
- \$8.17 million (value of production)

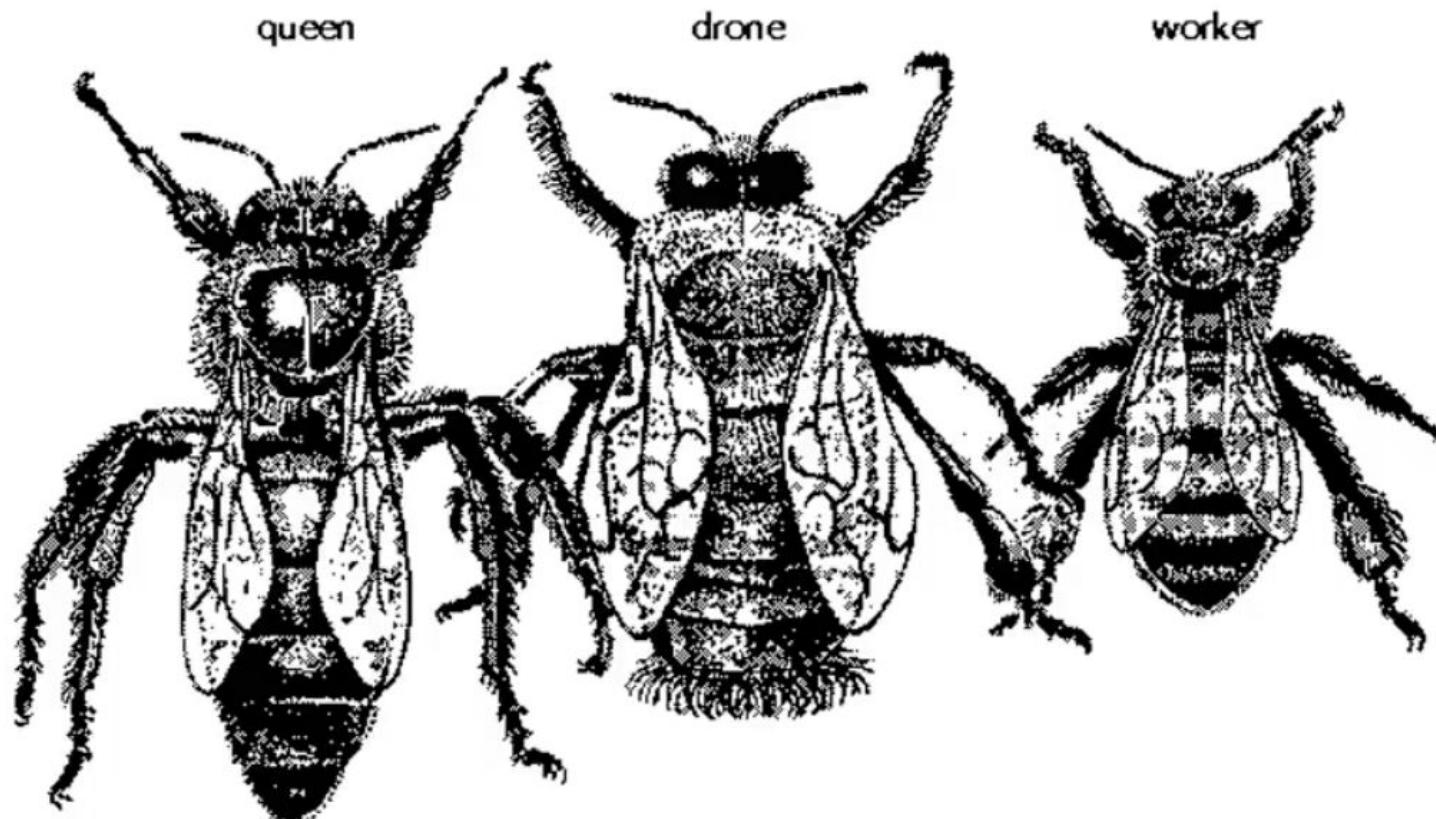
Not just honey

Many valuable agricultural products are dependent on honeybee pollination.



SOURCE: U.S. Dept. of Agriculture; AP
Roger A. Morse and Nicholas W.
Calderone, Cornell University

SOCIAL STRUCTURE



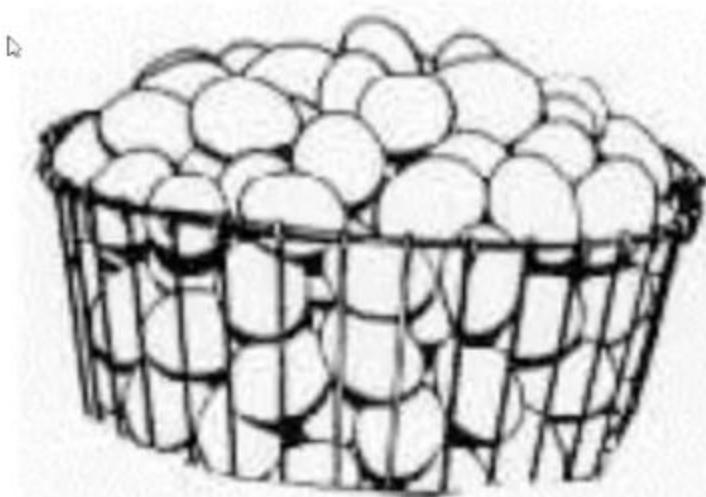
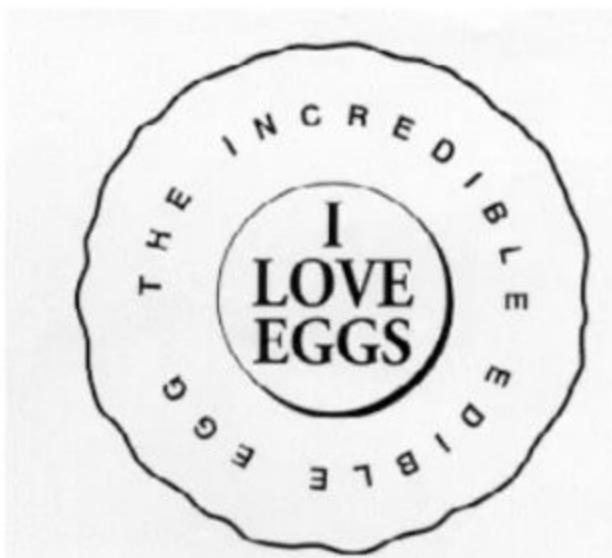
QUEEN

- Mother to all in the hive
- Generally only one per hive
- Fully functional female
- Larger than workers
 - (longer and thinner than drones)
- Long life (several years possible)
- Produced by feeding **royal jelly**



QUEEN

- Only bee to lay eggs
- May lay 2000 - 3000 eggs per day (at peak) !



DRONE

- Larger and wider than others
- No stinger, short tongue
- Very good antennae
- Best of times - Worst of times
- Life of luxury, BUT.....

DRONE

- Life is short
 - Drones are killed in the fall
- Only real purpose is to store genetic material
- Develop by parthenogenesis



PARTHENOGENESIS

- Egg is not fertilized
- Haploid egg (one copy of DNA) spontaneously develops
- Development continues like a normal embryo
- Result: males really just multiply and deliver queen's genetic material
- Queen 'determines' sex of offspring

BEE REPRODUCTION

- Virgin queen makes mating flight
- Several drones mate with her in flight
- Queen goes back to hive
- Can be done artificially



SCIENCEphotOLIBRARY

REPRODUCTION (cont.)

- Queen lays an egg in each cell
- Egg hatches into larva
- Workers feed larvae (brood)
 - mixture of pollen and nectar
 - about 6 days
- Workers cap cell
 - pupa form
 - about 12 days
- Emerges as adult worker bee (21 days from egg)

WORKERS

- Smallest bee
- Most abundant (3,000 to 60,000 in a hive)
- Female, but undeveloped



What is the bright yellow thing
on the side of this bee?

- A. beeswax
- B. pollen
- C. nectar
- D. eggs
- E. a tumor



WORKERS

- Have:
 - pollen baskets
 - wax glands
 - scent glands
 - barbed stinger
 - long tongue



WORKERS

- Duties:
 - wax secretion
 - **brood** rearing
 - attending to queen
 - guarding hive entrance
 - nectar and pollen collection
 - Provides all necessary nutrients for bees (other than water)
 - bees work both day and night

WORKERS

Lifespan depends on time of year

- during summer, may be one month
 - wear out from flying, etc.
 - wings last approx. 500 miles
- ↳
- late fall bees will live through winter

HOW DO THEY MAKE HONEY?

- Collect nectar into “honey stomach”
- Enzymes are added
- Deposited in cells in hive
- Water is evaporated
- When dry enough, cell is capped with wax

A honey bee will die
if it stings you.

A. True

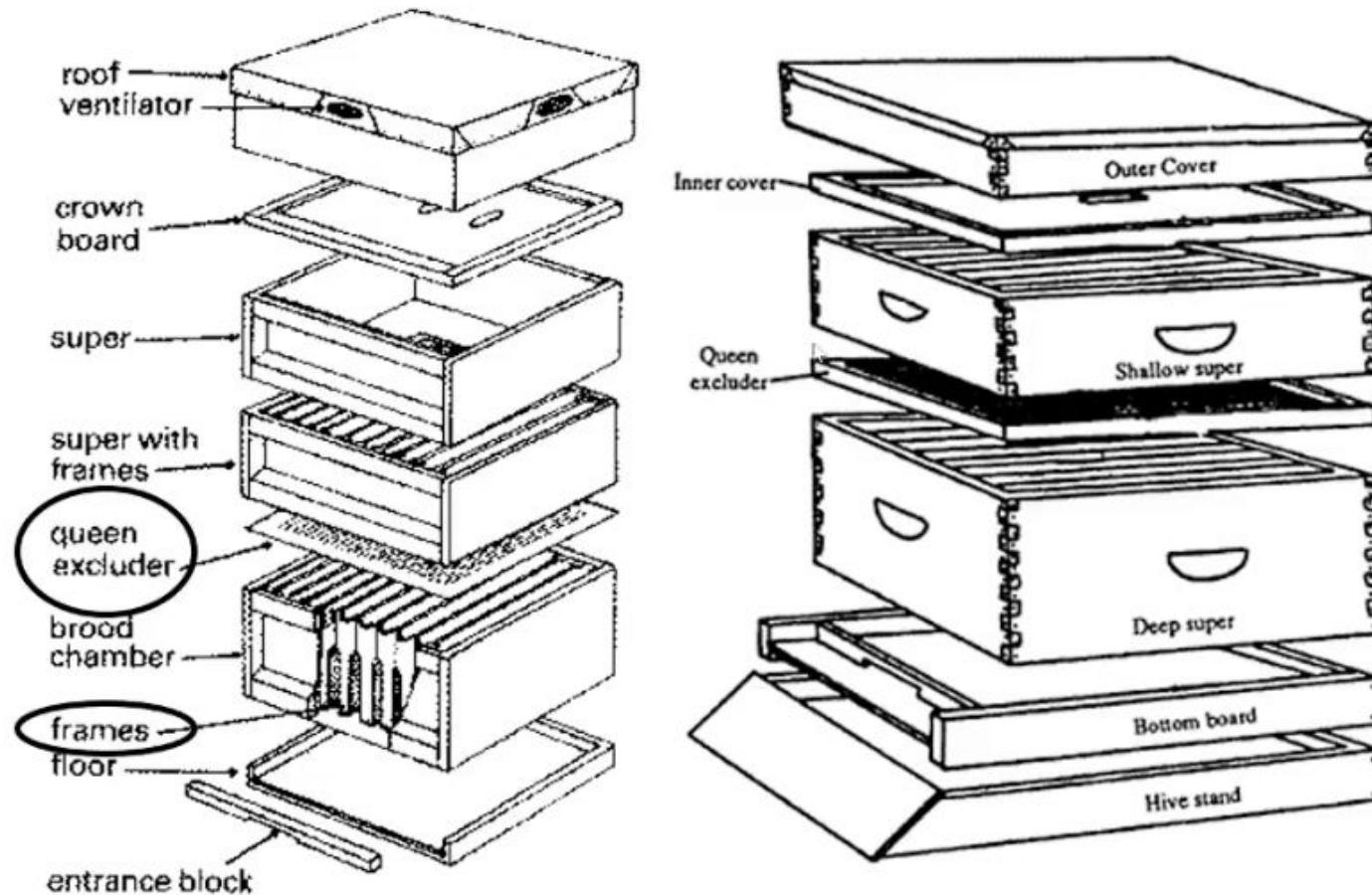
B. False

RACES OF BEES

- Several in book
- Different races have different characteristics



EQUIPMENT



Elements of a beehive

Need for Hive Tool

- Bees keep hive clean
- Patch holes, stick things together with **propolis**

SMOKER

- Contains smoldering material
- Air is added with bellows
- Smoke calms bees, makes them less likely to sting

SWARMING

- Important for proliferation of species
- Most common time for swarming
 - late spring
 - 10 a.m. to 2 p.m.
- Causes
 - overcrowded hive
 - old queen
 - imbalanced population
 - genetics



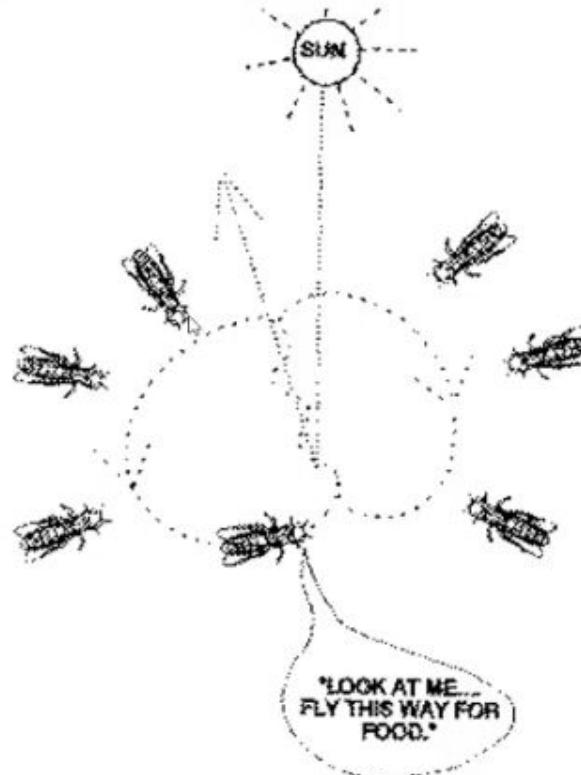
SWARMING

- Swarm is made up of:
 - queen, commonly a virgin
 - workers, mostly young
 - drones, mostly young
- Methods of Prevention
 - Keep open brood area (add more chambers)
 - Keep a productive young queen



COMMUNICATION

- Dancing
 - Karl von Frisch won Nobel Prize (1973)
 - details in book
- Chemical
 - Pheromones
 - details in book



BEE'S 'DANCE' TO TELL
THEIR FRIENDS WHERE
THEY HAVE FOUND
NECTAR OR WATER.

LOCATION

- Off ground
 - Facing east in summer
 - Facing south in winter
 - Sheltered from prevailing winds
 - Sheltered from direct afternoon sun
-
- Often wrap or insulate in winter

CURRENT PROBLEM

- CCD – Colony collapse disorder
- Nearly all feral hives have died
- Many “farmed” colonies, also
- Lots of proposed causes:
 - Varroa mites
 - Israeli acute paralysis virus
 - Nosema fungus
 - GMO plants
 - Pesticides
 - Cell phone radiation
 - Global warming
 - Imidacloprid -- insecticide
 - Combination of two or several of these*

Llamas/Alpacas and Goats

Comparison and Contrast





Angora Goat:
Mohair fiber

Fiber



Cashmere Goat:
Cashmere fiber



Angora fiber



Other Types of Goats

Meat



Dairy
WI #1 dairy goat state



Other Types of Goats

- “Fainting” goats
 - *Myotonia congenita*
 - Muscles lock up when surprised, excited



SCIENTIFIC CLASSIFICATION

- Goat:
 - *Capra hircus*
 - Family *Bovidae*
- Llama:
 - *Lama glama*
 - Family *Camelidae*



TERMINOLOGY

	<u>Goat</u>	<u>Llama</u>
• Baby	kid	cria
• Female	doe	?
• Male (intact)	buck	stud
• Male (castrated)	wether	gelding



NUTRITION

• RUMINANTS

- stomach has 4 compartments (3 for llama)
- rumen: large, fermentation vat
- microorganisms digest food
- animal “eats” microorganisms and their products
- can digest cellulose (grass, leaves, etc.)



NUTRITION

• RUMINANTS

- stomach has 4 compartments (3 for llama)
- rumen: large, fermentation vat
- microorganisms digest food
- animal “eats” microorganisms and their products
- can digest cellulose (grass, leaves, etc.)



REPRODUCTION

	<u>Goat</u>	<u>Llama</u>
• Puberty	4-5 mo.	18-36 mo.
• Mating	standing	kush
• Ovulation	spontaneous	induced
• Gestation	145-155 d.	330-375 d.
• Births	twins	singles



WHICH OF THE FOLLOWING IS AN INDUCED OVULATOR?

- A. llama
- B. ferret
- C. cat
- D. rabbit
- E. All of the above.



REPRODUCTION

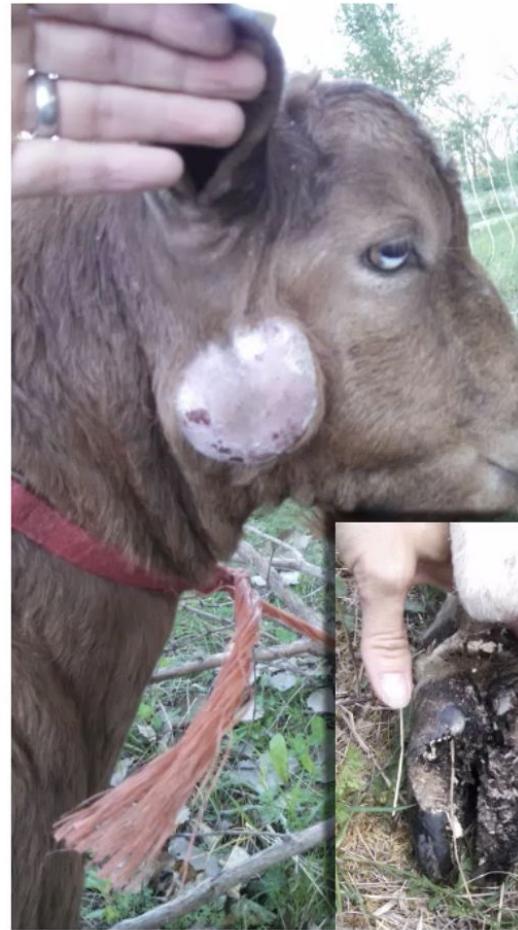
Short Day Breeder (goat):

**Decreasing photoperiod
causes breeding season**



DISEASES

- Protozoal
 - Coccidiosis
- Bacterial
 - Mastitis
 - Brucellosis
 - CL/cheesy gland
 - Hoof rot



DISEASES

- Fungal
 - Ringworm
 - Hoof rot
- Parasites
 - Barberpole worm
 - Brain worm
 - Liver fluke



NEGATIVE POINTS

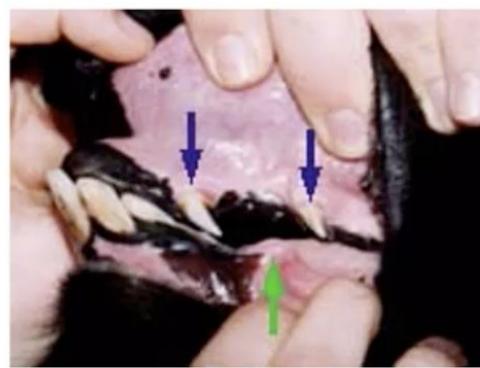
- **Llamas/Alpacas**
 - Berserk Male Syndrome
 - Males, usually
 - Human imprinting
 - Breeding season chest ramming, biting, territorial charging, stomping, screaming
 - Suggestion:
 - leave crias alone for first few months, don't bottle feed
 - Neuter males before puberty
 - Spitting
 - Fighting teeth



SPIT HAPPENS



Fighting Teeth



NEGATIVE POINTS

- Goats
 - Horns
 - Buck odor



ALPACAS

- First imported to U.S. in 1984
- Relatives of llamas
- Estimated 100,000 in U.S. today



Alpacas

- About 36 inches tall
- Weigh about 120-180 lbs.
- Gestation length – 11 months
- Weight at birth – 12-22 lbs (cria)
- Hair produced – 5-10 lbs / year
- Average lifespan – 15-25 years



BEWARE!

- Bred females -- \$12,000 to \$30,000
- Herd sires up to \$250,000
- Typical Market Situation for “New” Animals
- Product is hair – limited market
- Bubble has burst



Introduction to Horses

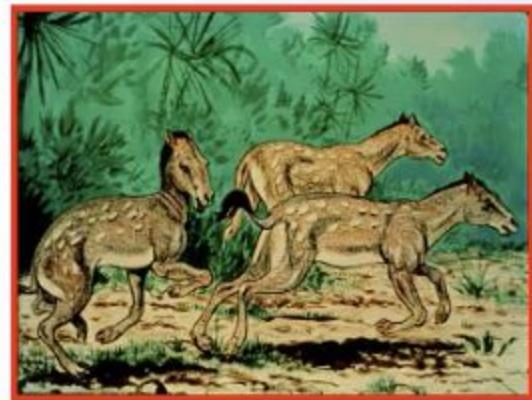


Liv Sandberg
Extension Horse Specialist
UW-Madison



Theory of Evolution of the Horse

- Eohippus “dawn horse”
(prehistoric)
 - earliest known ancestor of modern horse
 - 15” at withers
 - four padded toes in front and three behind
 - browser; change in teeth



Domestication of the Horse

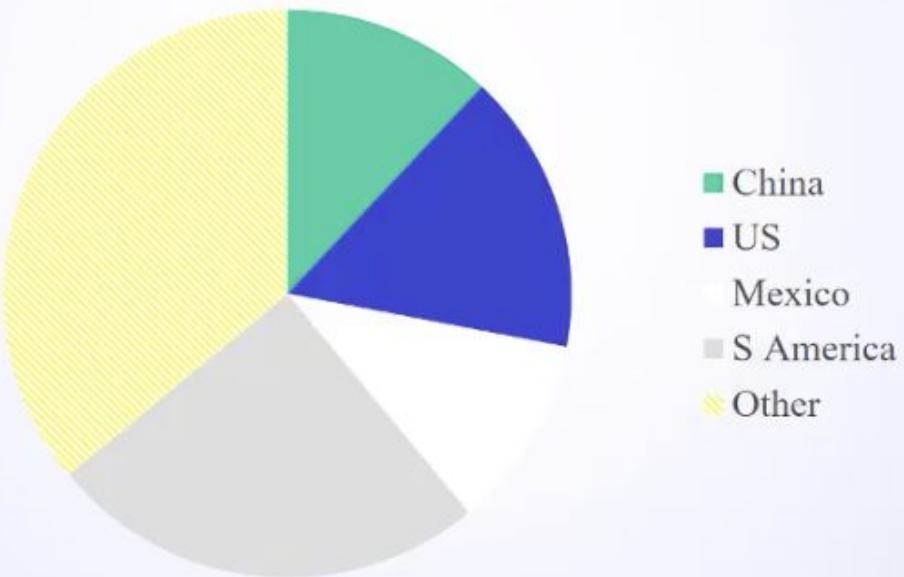
- Domesticated in Near East
 - between 4500 and 2500 B.C.
 - food animal
 - work
- *Equus caballus*- present day horse



World Distribution

58 million (2012)

World Distribution



US History of the Horse

- Early 1500's
 - Horses brought to US by Spanish conquistadors
 - Uses:
 - travel
 - field work
 - War mounts
 - Mining
 - pony express
 - sport

U.S. Horse Industry

- Current horse numbers are 30% of highest head count 80 years ago
 - 1915 - 26 million head
 - 1959 - 3 million
 - Currently - 6.5 million
- Leading States in number of horses
 - TX, OK, KY, CA
 - WI ~ 13th

Wisconsin Horse Industry

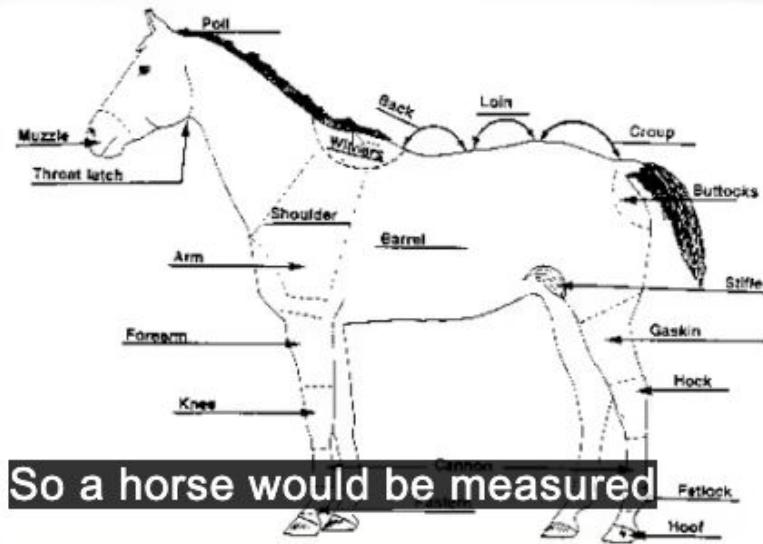
- Wisconsin NASS
 - (National Agricultural Statistics Services)
 - 2007 = 120,000 head
 - 2012 = 103,500
- Primary uses:
 - Pleasure, trail riding, breeding, showing
- < 10 % Work
- Large economic impact!!

Basic Horse Terminology

Young female	Filly
Young Male	Colt
Mature female	Mare
Mature intact male	Stallion
Mature castrated male	Gelding
Young horse of unknown gender	Foal

Horse Categories

- Measuring Height
 - Measure at withers
 - “Hands”
 - 1 hand = 4 inches



Basic Horse Categories

- Draft Horses
- Light Horses
 - Sport, Warmbloods
- Ponies
- Miniatures
- Asses (donkeys, burros)
 - Mules

Horse Categories

- Draft horses
 - 1,500 to 2,000 lbs
 - Large, wide, muscular
 - War horses, hauling commodities, farm tillage



- Light horses
 - 850 to 1,500 lbs
 - Smaller, less muscular
 - Riding, driving, livestock handling



Horse Categories

- Ponies
 - Less than 14.2 hands
(58 inches)
- Miniature horses
 - Small size horses
 - Max. height for registration is 32"
 - Smallest was 15" tall



Equine Categories

- Donkey (a.k.a. ass or burro)
 - Close relative of horse
 - Male = Jack
 - Female = Jennet, Jenny
- Mule/Hinny
 - Offspring from crossing donkey & horse
 - Mules and Hinneys
 - reproductively sterile
 - visual sexual characteristics appear normal.
- Zebra crosses
 - Zorse
 - Zedonk



Primary uses for horses?

- Work
- Pleasure
- Competition
- Aesthetics
- Human-Animal Bond
- Zoos, circuses
- Meat
 - Human consumption
 - Byproducts



Therapeutic Programs





Youth Activities





Mounted Patrol



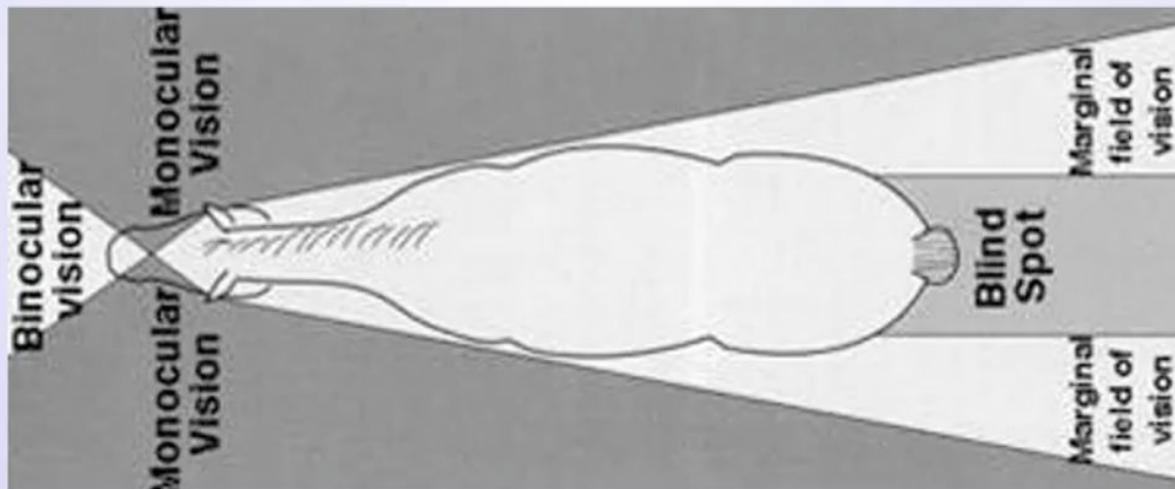
Natural Behavior of the Horse

- Flight response
- Herd animal
- Dominant hierarchy



Field of Vision

- Monocular vision primarily (up to 215 degrees)
 - Each eye independent, can see different pictures
 - Panoramic view (to sides, front, back)
- Binocular vision
 - Eyes work together – adjust head on distant objects



Hearing/Ears of the Horse



- Very keen sense of hearing
- Used to locate activity
- Indicator of behavior of horse

Care of the Horse

- Grooming
- Veterinary care
- Feeding
- Hoof care
- Parasite management



Care of the Horse



- Grooming
 - Hair coat
 - body, legs, mane/tail
 - Routine cleaning of feet
 - Check for problems, eyes, ears, cuts, lameness, etc
 - 60-65% weight on front feet
 - Check vital signs
 - Body condition



Care of the Horse

- Foot Care
 - Hoof wall grows $\frac{1}{4}$ inch per month
 - Trim feet every 8 weeks
 - Shoes: as needed for protection or show requirement

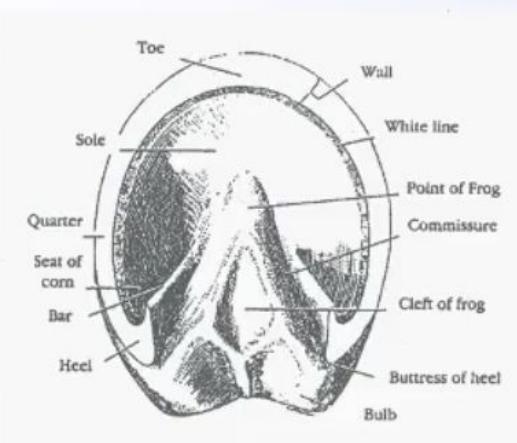


Figure 1: The Parts of the Hoof



Care of the Horse

- Veterinarian: annual check up
 - Vaccination, parasite & health care protocols
- Common equine disease:
 - Contagious: influenza, strangles, EHV (equine herpes virus), rabies
 - Non-contagious: Eastern or Western equine encephalomyelitis, West Nile virus, tetanus, equine infectious anemia, lymes disease

Care of the Horse



- Internal parasites:
 - Decrease feed efficiency
 - Blockage of digestive tract
 - *Manure management*
 - *Deworming protocol*
- External parasite:
 - Mites
 - Lice
 - Ringworm
 - Mosquitos/flies
 - Ticks
 - *Grooming*
 - *Topical treatments*
 - *Bathing*

Digestive System of the Horse

- Gastrointestinal tract
 - Hindgut fermenter
 - 8 - 19 qts. Stomach (9%) **[SMALL!!]**
 - monogastric
 - 28-36 qts. Cecum (15%), 4 ft.
 - Fermentation
- Eating/grazing patterns
 - Continuous grazers & selective grazers
 - Graze up to 80% of the time
 - Eats ~ 1.5-2.5 % of BW every day



Common Horse Feeds

- Roughages
 - Pasture
 - Hay
 - Grass or legume hay
- Concentrates
 - Grains (oats, barley, corn, etc.)
- Supplements
 - Protein
 - Vitamins/Minerals
 - Other

Reproduction of the Horse

- Seasonally polyestrous
- Gestational length
 - 11 months
- Birth weight
 - Range from 70-140 lbs
- Weaning
 - 3-8 months



Who wants a horse?

- Ownership
 - Purchase price
 - Facilities to house
 - All expenses and responsibilities
 - Daily care
 - Securing feed, vet, farrier, etc
 - Readily available
 - > 20 year commitment!

Boarding or Leasing

- Boarding
 - Ownership of horse
 - Purchase price
 - Payment for care, feed, etc
 - Facility options vary greatly
 - No restrictions on use of horse
- *Leasing*
 - *Payment for use of horse*
 - *Partial care expenses*
 - *Not responsible for daily care*
 - *Restricted use of horse*
 - *Opportunity to 'try on' horse ownership*

Arabian Horse



Morgan Horse



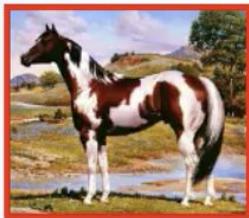
Standardbred



- Appaloosa



- Pinto
- Paint



- Palomino



- American Buckskin

Color Breeds



Pony of the America (POA)



▷



Tennessee Walking Horse

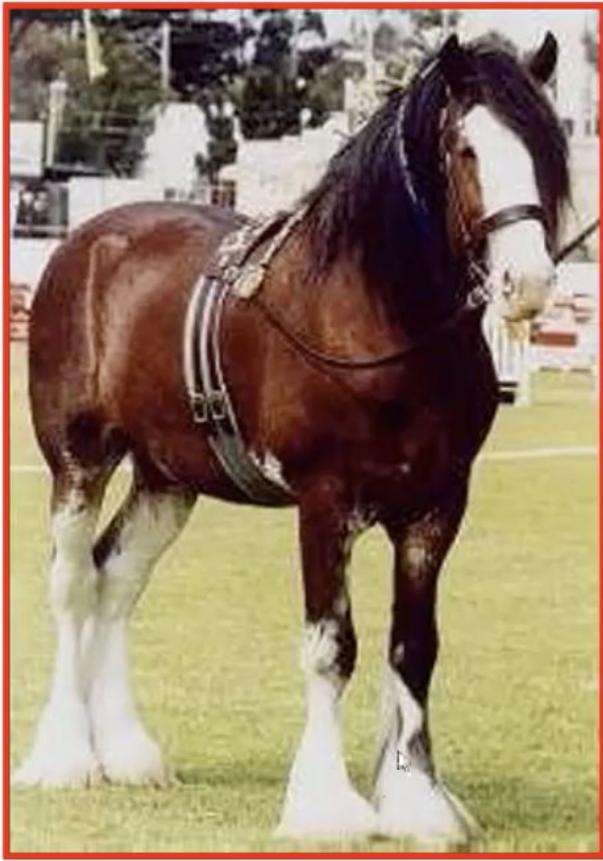


Lipizzans



Shetland Pony





Clydesdale



©1997 Oklahoma State University

Percheron



© 1997 Oklahoma State University

Friesians



Przewalski's Horse

(oldest species of horse in existence today)



© 1997 Oklahoma State University
Photographer: Tracy Sweetman

18



© 1997 Oklahoma State University
Photographer: Tracy Sweetman

SCIENTIFIC CLASSIFICATION



Compare the world to a library.

- Some organisms are books.
- Some are videotapes.
- Some are audiocassettes.
- Some are pictures, etc.

Now, imagine these without any organization!

Suppose you have to
design a system of
classification.

How would you
do it??





PRETTY



UGLY



BIG



LITTLE



WILD



DOMESTICATED



HERBIVOROUS



CARNIVOROUS



- Swedish monk named Carolus Linnaeus.
- Lived from 1707-1778.
- Developed a system of classification.
- Divided things by differences.
- Grouped things by similarities.
- Mostly on visual characteristics.



Binomial System of Classification

- (Domain)
- Kingdom
- Phylum
- Class
- Order
- Family
- Genus
- Species

Examples

	cat	dog	goldfish
Kingdom	Animalia	Animalia	Animalia
Phylum	Chordata	Chordata	Chordata
subphylum	Vertebrata	Vertebrata	Vertebrata
Class	Mammalia	Mammalia	Osteichthyes
Order	Carnivora	Carnivora	Microcyprini
Family	Felidae	Canidae	Cyprinidae
Genus	Felis	Canis	Carassius
Species	<i>catus</i>	<i>familiaris</i>	<i>auratus</i>

Why bother?

- Why should we learn this?
 - allows us to converse on a global basis
 - helps us avoid regional names
 - clears up legal questions
 - lets us guess about animal's habits, needs, etc.

What is this?



Orconectes virilis l



- Crayfish
- Cray Fish
- Craw Fish
- Craw Dad
- Mud Bug
- Red-Claw
- Freshwater lobster
- Freshwater crab
- Yabbies (Australia)

WANTED

GIANT AFRICAN SNAIL



LOOK FOR THEM! REPORT THEM!
888-397-1517

A major landscape and agricultural pest, even eats stucco on homes

Public health threat - known to carry rat lungworm
that may cause meningitis in humans

Able to reproduce rapidly - one snail can lay 1,200 eggs in a year
Can grow to up to 8 inches in length - no natural enemies

We need your help to stop this pest!

www.freshfromflorida.com/pl



PIG / HOG



Why Latin?

- early scientists were also priests, monks
- “dead” language
 - (sort of!)

How “Dead” is the system?

- Biotechnology, and continued exploration are changing things
 - Some animals are found to be more related to others than previously thought
 - Some are much less related than previously thought
 - New organisms are discovered, as well
- Sometimes, it’s just agreed to change things, too!



Other Systems

- Several systems
- Many are “tweaks” of this system
 - Often changes as more knowledge becomes available
- 3 Domain system
 - *Archaea*
 - *Bacteria*
 - *Eukaryota*

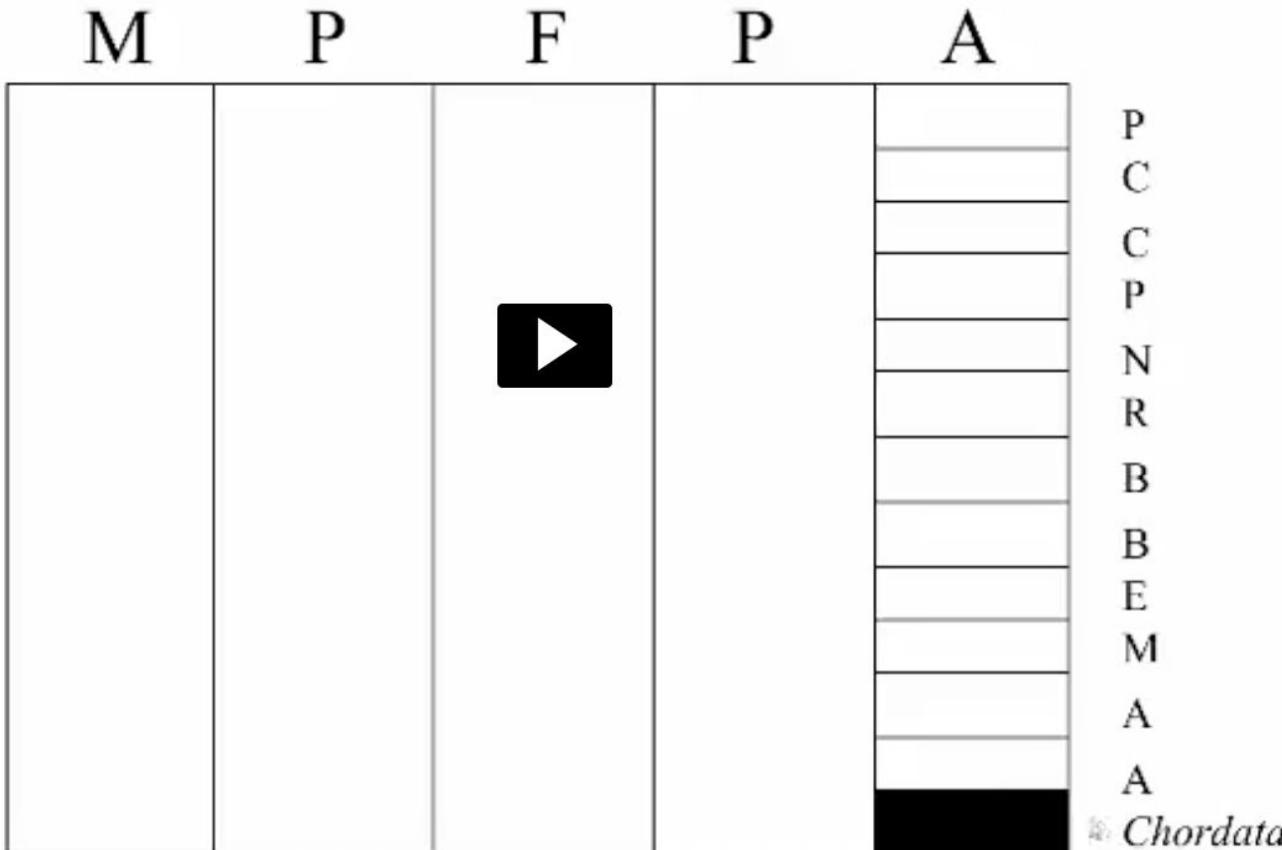
Some Rules to Follow

- Italicize or underline all terms
- Capitalize (except species)

Species and Beyond

- Species – traditionally, organisms that can mate and produce fertile offspring
- Levels below species
 - Subspecies
 - Breeds
 - Varieties
 - Races
 - Strains

FOCUS OF THIS COURSE



CHORDATA

- Subphylum *Vertebrata*
- Classes:
 - (3 classes) Fish
 - *Amphibia* Frogs, etc.
 - *Reptilia* Snakes, turtles, lizards, etc.
 - *Aves* Birds
 - *Mammalia* Mammals

Mammalia

- Many orders
- We've focused on:
 - *Rodentia*
 - *Lagomorpha*
 - *Insectivora*
 - *Carnivora*
 - a few others

MAIN POINTS

- Organization is important
- Remember a few simple rules
- Though it seems like we cover a lot of animals, we really are only focusing on one very small corner of biology.

CREATIONISM and EVOLUTION

|_x

- Topic in the U.S. news recently
- **Technically, none can be “proven”**
- Need to define some things

What is “science”?

- Essential characteristics:
 - Guided by natural law
 - Has to be explanatory by reference to natural law
 - **Testable** against the observable world
 - Conclusions are tentative, that is, are not necessarily the final word
 - **Falsifiable**

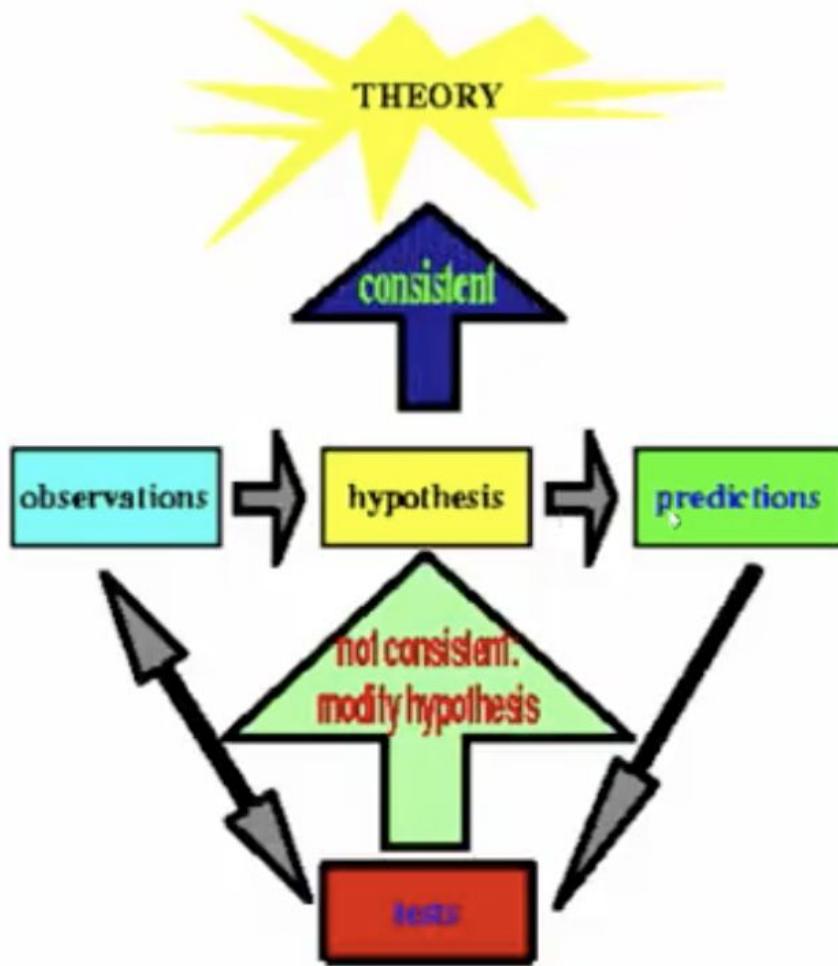
according to U.S. district court Judge William Overton, 1982

WHAT!?

- Scientific knowledge should be explainable based on what can be observed
- We should be able to test hypotheses about nature
- If something shows our hypothesis is wrong, we must be willing to change or discard the hypothesis

Scientific Method

- We propose an hypothesis
- Predict future events or results of other tests on basis of that hypothesis
- Conduct tests to evaluate validity
- Eventually, a hypothesis may become “theory”
- It still is “falsifiable,” though it has been tested many times and is well-accepted



Creationism

- Can not be tested.
- Is not falsifiable.

SO,...

- Everyone is entitled to their religious views and faith.
- Creationism can not really be called a science.

Intelligent Design

- Blend of evolution and creationism
- Admits that evolution is occurring
- Says some things are “irreducibly complex,” so some intelligent being must be imposing influence
- Still has same distinction from science

COMMENTS ON EVOLUTION

- Individuals can't "evolve"
- Evolution isn't a simple, planned event
 - Natural variation is present
 - Outside influences can affect reproductive rate of certain variants, so population changes over time



INTRODUCTION TO CATS





UGLIES
T
CAT?



BACKGROUND

- Order *Carnivora*
 - presence of 2 canine teeth
 - short digestive tract
- Family *Felidae*
- *Felis catus* or *Felis domesticus* or *Felis silvestris catus*
- Maybe derived from European wild cat:
Felis silvestris



Dr. David Steele via The Herald-Bulletin



BACKGROUND

- Probably first domesticated in Egypt (?)
- Domesticated almost 5,000 years ago
- Evidence of cat (*F. silvestris*) buried with owner from 9500 years ago on island of Cyprus
- Cats (not necessarily domestic) are indigenous to all continents except Australia (and Antarctica)
- Over 330 recognized breeds



TERMINOLOGY

Female

Queen

Male

Tom

Young

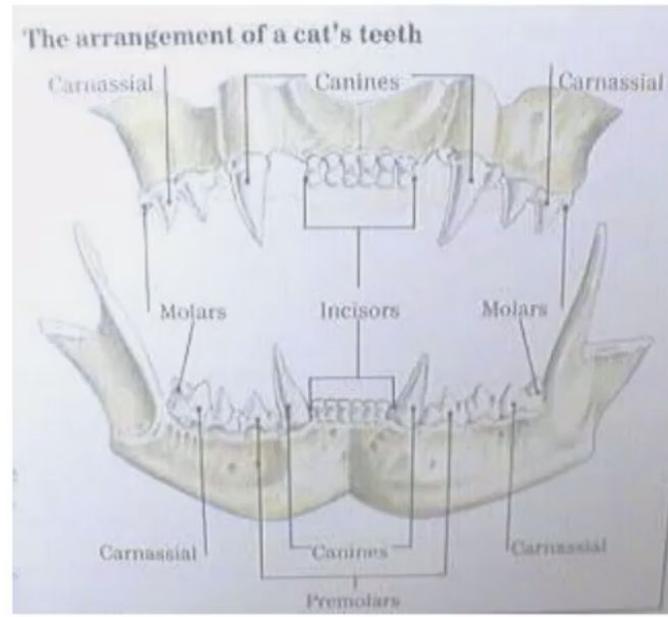
Kitten

In shows, spayed and castrated cats are sometimes called **alters** or shown in alter classes.



ANATOMY

- Mentioned teeth
- Body is designed to be a fast-running predator
 - digitigrade
 - retractable claws
 - more vertebra
 - lack a collarbone
 - strong jaws



SENSES

- Sight
 - good *
 - binocular vision
 - poor sense of color
 - poorer at distance ↗
 - better in low light
 - *tapetum lucidum*



SENSES

- Hearing
 - much better than humans at high frequencies
 - may be able to hear rodents chewing
- Smell
 - better than ours, probably
 - Cats ~ 200 million receptors, humans ~ 5 million
 - not as good as a dog
 - ~ 400 million



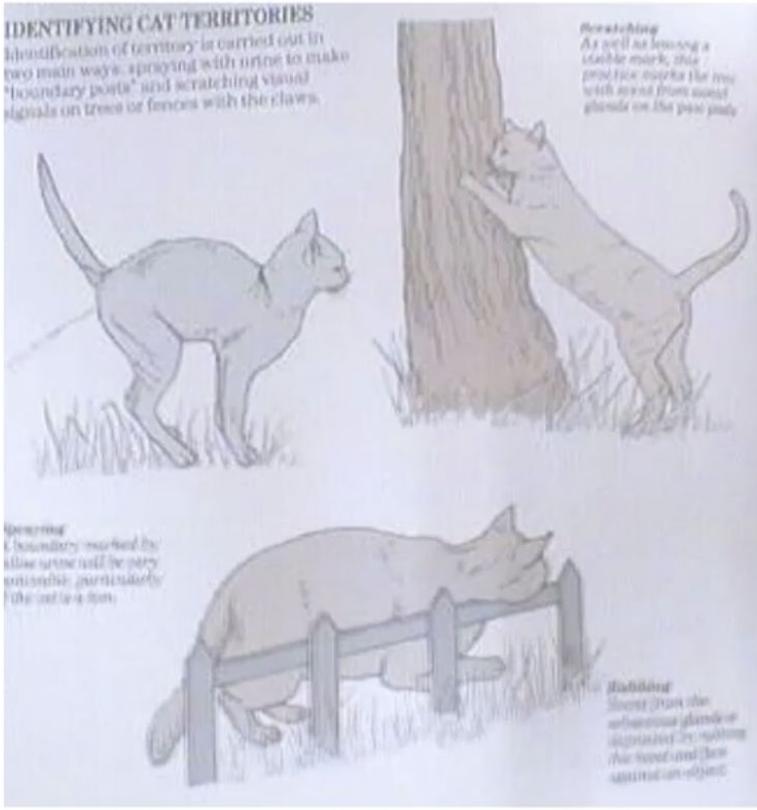
SENSES

- Taste
 - no “sweet” receptors
 - fewer taste buds
- Jacobson’s organ
(vomeronasal organ)
 - especially for sexual odors
 - Flehmen response



SENSES

- Glands
 - only have sweat glands on pads of feet
 - scent glands



Press **esc** to exit full screen

SENSES

- Balance is exceptional



18:51 / 39:44

SENSES

- Cats also use their whiskers to “feel” their way
- Carpal hairs on forelegs used as well



LIFESPAN

- Average - 15 years +
- Record - 38 years, 3 days
(maybe)



CHOOSING A CAT AS A PET

- Things to consider:
 - Cats are usually inexpensive (sort of)
 - Keeping a cat may be VERY expensive
 - LOTS of things you may need or want to get

CHOOSING A CAT AS A PET

- Consider:
 - feed
 - vet bills
 - grooming
 - litter box cleaning
 - time to play or exercise cat
- Also consider, the cat may not pay a lot of attention to you!



MORE ON EXPENSES

- Feed
- Litter
- Medical expenses
 - Altering (or dealing with kittens!)
 - Vaccinations
 - Dental
 - Accidents, other ailments, etc.
 - Disposal when it dies



Costs	Cat	
Annual Costs		Capital Costs
Food	\$115	Spay/neuter \$145
Recurring medical	\$160	Other initial medical \$130
Litter	\$165	Collar/Leash \$10
Toys/Treats	\$25	Litter box \$25
License		Scratching post \$15
Health Insurance	\$175	Cage \$40
Misc.	\$30	Carrier bag
Annual Total	\$670	Crate Aquarium Eqty. Training class
		Capital Total \$365
Special Costs		
1. Premium brand dry kibble		
2. Exam, vaccinations, heartworm preventative & topical flea/tick preventative		
3. Scoopable litter for cats, scooped daily; hardwood shavings or recycled paper products for rabbits, guinea pigs and small mammals, changed at least weekly		
4. Insurance coverage varies: some policies cover spay/neuter, vaccinations and heartworm medication. The annual deductible will also vary depending on the policy.		
5. Deworming, basic blood tests & microchip		
First year total \$1,035		



EQUIPMENT

- Bed
- Scratching post
- Litter box
- Feed dish
- Water dish
- Carrying crate
- Toys
- Collar (with nametag)





Grooming Equipment



TRAVELING

- Train kittens to handle car-rides
- Have a good crate
- Kittens should view crate as “secure area”



OTHER CONSIDERATIONS

- Cats like to be at (human's) eye height or higher.
- Good to give them a sleeping area at that height.



ALTERING CATS

- Neuter toms
- Spay queens
- Do it unless you plan to breed them AND have a demand for the kittens.
- Feral cats wreak havoc on birds, small animals, etc.
- Stops some unwanted behaviors
 - spraying
 - “tom-catting”
 - obnoxious crying while in heat



ALTERING CATS

- Health benefits
 - Eliminates uterine cancers
 - Eliminates testicular cancers
 - Decreases incidence of mammary tumors
 - Roaming cats are more likely to be run over



DECLAWING

- Removes defense if cat is left outside
- Cats will scratch on something
 - sharpens claws
 - stretches muscles
 - marks scents
- Can trim claws regularly
- Claw covers are available
- Only need to remove front claws



CAT BREEDS

Abyssinian



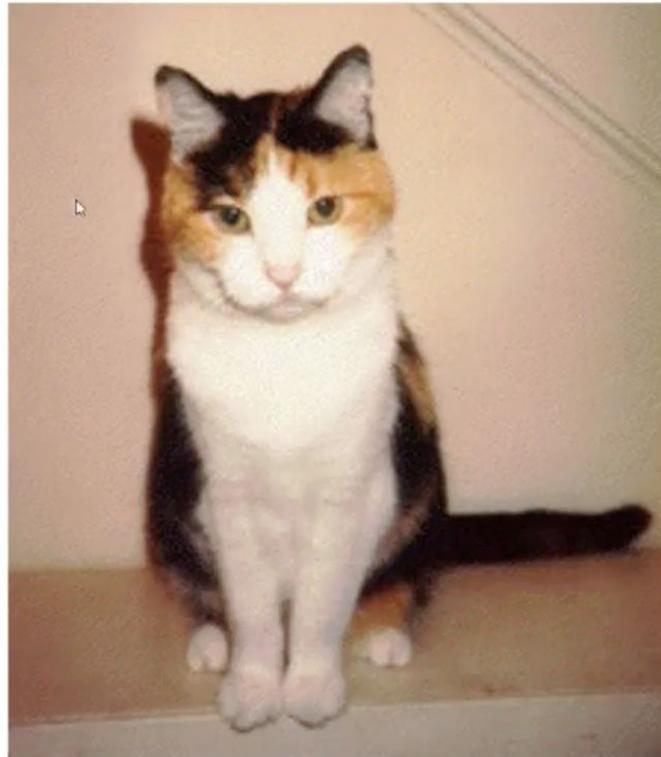
CAT BREEDS

Birman



CAT BREEDS

- Calico or tortoiseshell
- Not really a breed

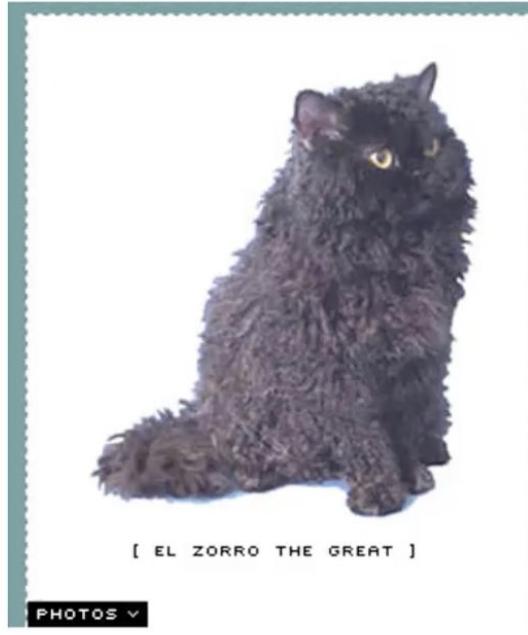


CAT BREEDS

- Devon Rex



Selkirk Rex



Laperm



“Sparse Fur”



CAT BREEDS

- Manx



CAT BREEDS

- Maine Coon



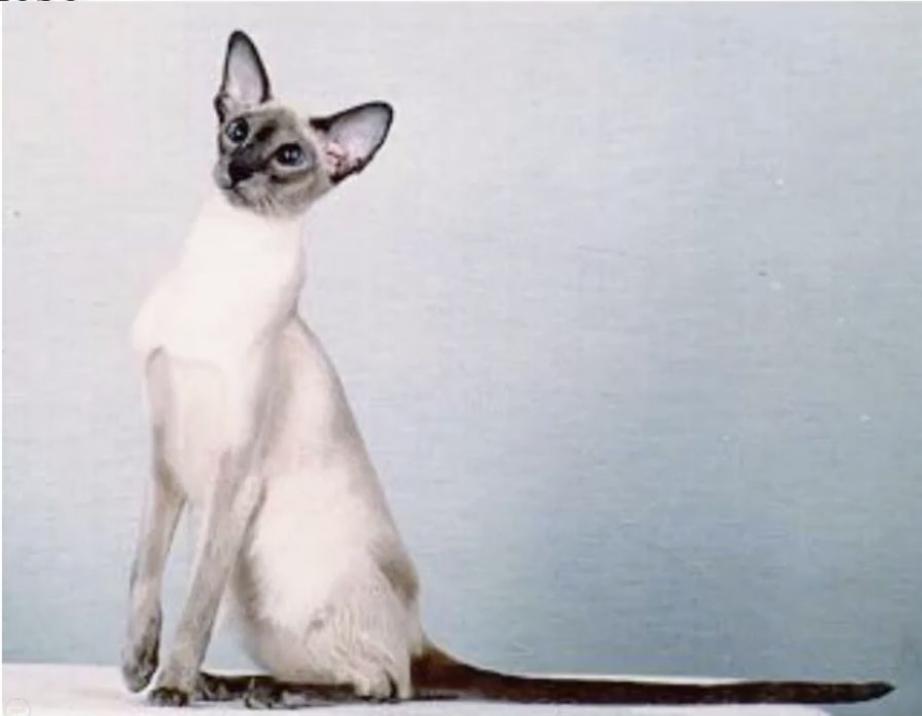
CAT BREEDS

- Ocicat



CAT BREEDS

- Siamese



CAT BREEDS



- Persian



CAT BREEDS

- Russian Blue



CAT PHEROMONE

- Feliway
 - Claims to mimic “facial pheromone”
 - Uses
 - Calm cats
 - Discourage urination in unwanted areas
 - Limit aggression
 - Actual ingredient (?)

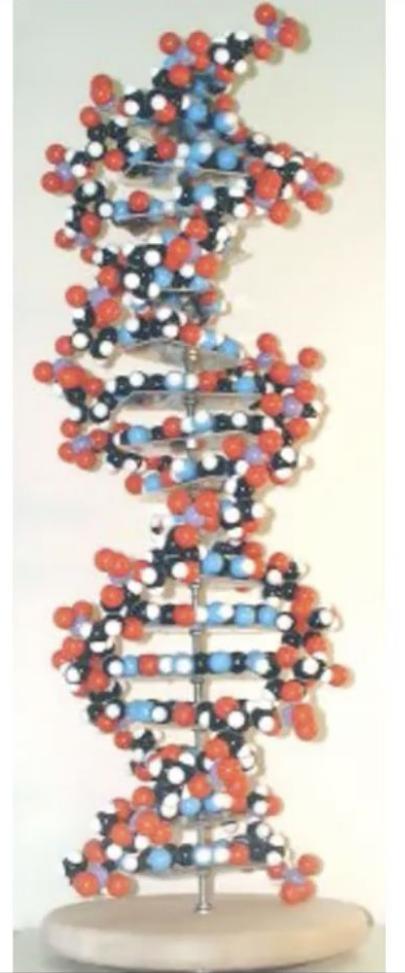


CATNIP

- Plant
- Nepetalactone
- Mildly hallucinogenic for cats
- Affects about 80% of cats
- Safe



INTRODUCTION TO GENETICS



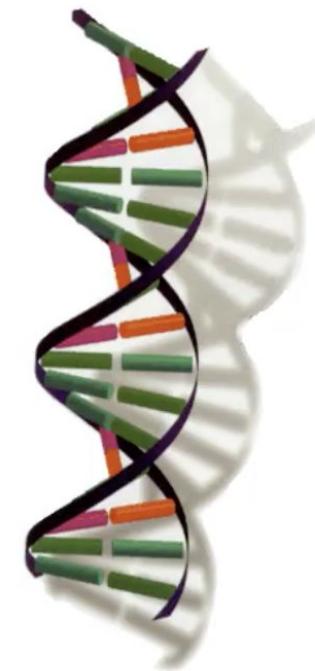
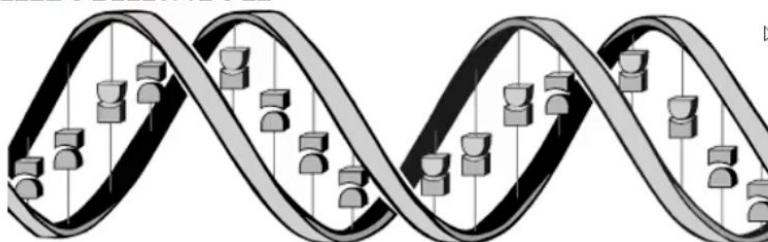
In cats, there is a gene that controls hair color. The allele for grey hair is recessive to the allele for black hair. If a heterozygote female cat mates with a grey male cat and then has 8 kittens, how many of the kittens would we expect to be grey?

- A. 0
- B. 2
- C. 4
- D. 6
- E. 8

INTRODUCTION TO GENETICS

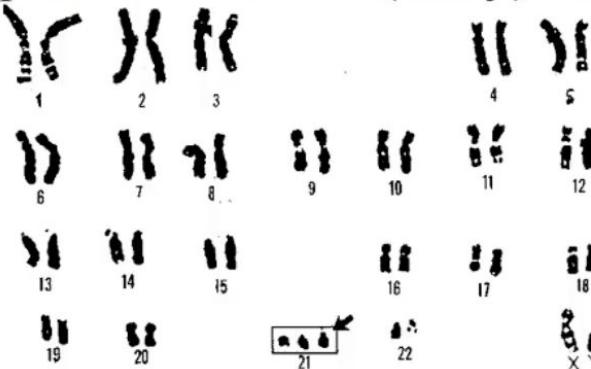
DNA -- deoxyribonucleic acid

- made up of a chain of sugar and phosphates
- nucleotides attached to this chain
- order of these nucleotides carries information



CHROMOSOMES ..

- located in nucleus of cells
- long chains of DNA
- carry information for lots of traits
- individual bits of info. are called genes
- number (per cell) varies between species
- exist in pairs in somatic (body) cells



NUMBER OF CHROMOSOMES

Humans	46	(23 prs.)
Cats	38	(19 prs.)

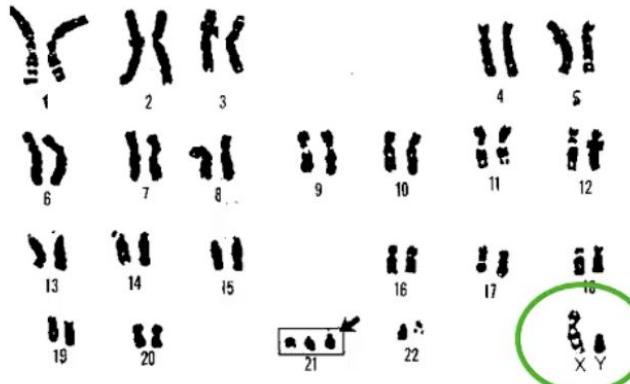
46 is the diploid number
23 is the haploid number

44 (36 for cats) are autosomes
2 are sex chromosomes



SEX CHROMOSOMES

- Female is X X
- Male is X Y
- Y is much smaller
- Y carries little info.
- Reversed in birds

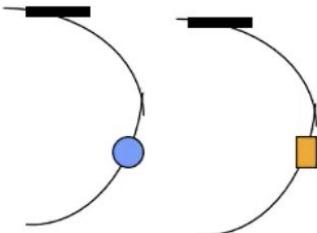


GENES

- small parts of chromosomes
- control one specific trait or part of a trait
- may be in different forms on the pair of chromosomes
- different forms (of same gene) are called alleles
 - *homozygous* - both alleles are the same
 - *heterozygous* - alleles are different



EXAMPLES



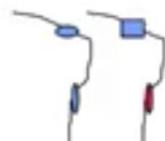
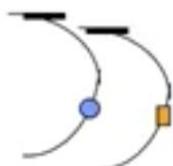
GAMETES (SPERM AND EGGS)

- are haploid
- only contain 1 copy of each chromosome
- **random (50/50 chance) of which one it contains**

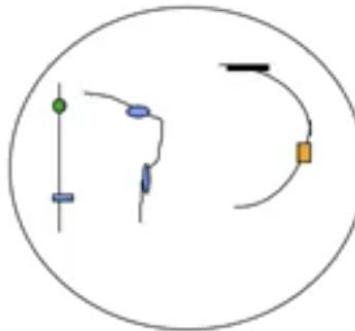
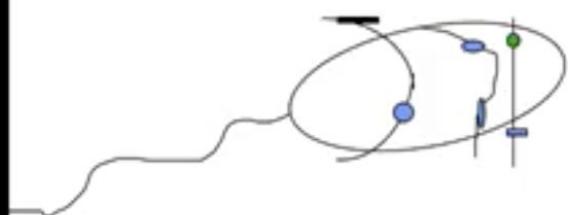


can then only contain an X or a Y chromosome

EXAMPLES

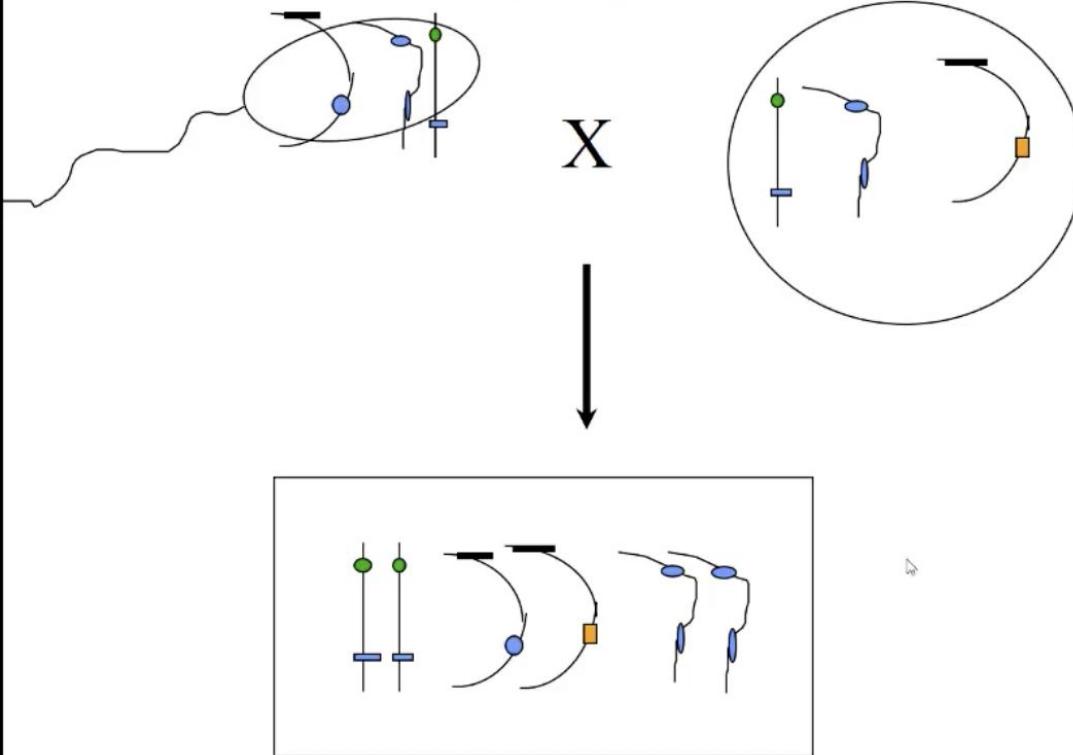


(i)



(v)

EXAMPLES



DOMINANT AND RECESSIVE

If effect of one allele covers up effect of another allele,
we say it is a dominant allele.

The allele whose effect was covered up,
we call a recessive allele.



Now, let's symbolize genes with letters.

- Alleles of a gene will have the same letter.
- Dominant alleles will be capitalized.
- Recessive alleles will be lower-case.

If more than two alleles exist for a gene,
we will use super-scripts.

Ex. E, e^b , e^c



If we know:

- dominance relationship of alleles
- genotypes of parents (sire and dam)

we can predict:

expected phenotype of offspring



SAMPLE PROBLEM

There is a trait which is controlled by the gene we'll call A.

The dominant form of the gene is A
and the recessive form is a.



What should we expect the offspring to be like if
we cross two heterozygous parents?



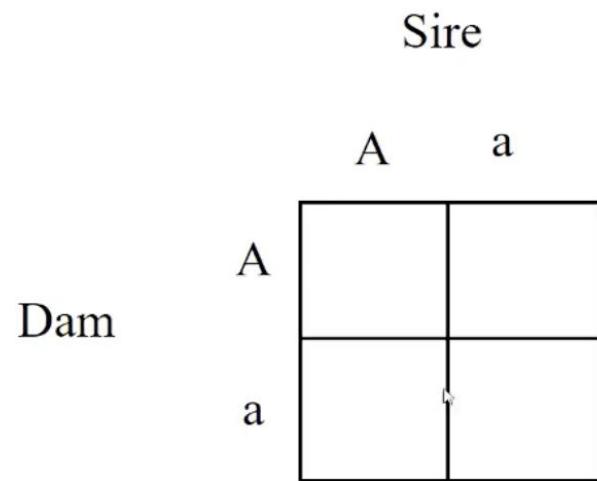
STEPS TO FOLLOW

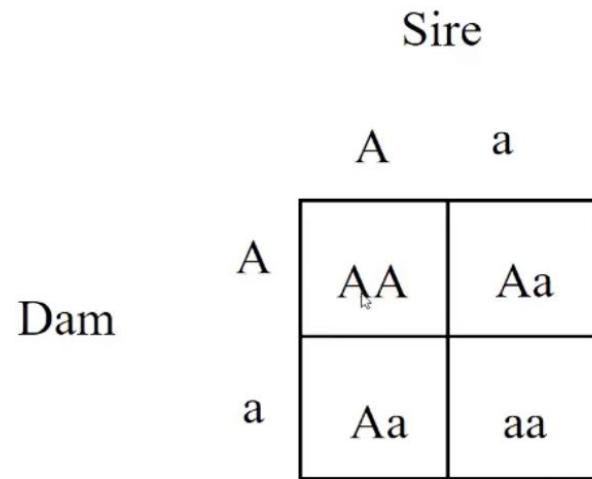
1. STOP and think.
2. Determine what alleles parents can transmit.
3. Draw an appropriate Punnet square.
4. Place one parent's alleles on the left side and other's on top.
5. Copy top parent's alleles down and left parent's across.
6. Determine phenotypes and frequencies.



	<u>Genotype</u>	<u>Gametes</u>
Sire	Aa	A, a
Dam	Aa	A, a







Sire

	A	a
Dam	A	AA Aa
	a	Aa aa

Offspring
Genotype
Phenotype

1 AA Dom

2 Aa Dom

1 aa Rec



ANOTHER EXAMPLE

Black (BB or Bb) is dominant to chocolate brown (bb).



Cross a homozygous black queen with a
heterozygous black tom.



	<u>Genotype</u>	<u>Gametes</u>
Sire	Bb	B,b
Dam	BB	B



		Sire	
		B	b
Dam	B	BB	Bb
	B	BB	Bb

<u>Offspring</u>	<u>Genotype</u>	<u>Phenotype</u>
1	BB	Dom
1	Bb	Dom



These can get much more complex
when you combine effects of
more than one gene.

47



	<u>Genotype</u>	<u>Gametes</u>
<u>Sire</u>	AaBb	AB, Ab, aB, ab
<u>Dam</u>	AaBb	AB, Ab, aB, ab



Sire

		AB	Ab	aB	ab	
		AB	AABB	AABb	AaBB	AaBb
Dam	AB	AABb	AAbb	AaBb	Aabb	
	Ab	AaBB	AaBb	aaBB	aaBb	
	aB	AaBb	Aabb	aaBb	aabb	
	ab					

# Offspring	Genotype	Phenotype
1	AABB	DomDom
2	AABb	DomDom
1	AAbb	DomRec
2	AaBB	DomDom
4	AaBb	DomDom
2	Aabb	DomRec
1	aaBB	RecDom
2	aaBb	RecDom
1	aabb	RecRec



Sire

		ABC								
		ABC	AABBCC							
<u>Dam</u>	ABC	AABBCC								
	ABc	AABBcC								
	AbC	AABbCC	AABbCc	AAAbCC	AaBbCC	AAAbCc	AaBbCc	AabbCC	AabbCc	
	aBC	AaBBCC								
	Abc	AABbCc	AABbcc	AAAbCc	AaBbCc	AAAbcc	AaBbcc	AabbCc	Aabbcc	
	aBc	AaBBCc								
	abC	AaBbCC								
	abc	AaBbCc								



CROSS INVOLVING SEX CHROMOSOMES

Same principles are used.

Remember that either X or Y will be passed on by male.

Remember that one X or the other X will be passed from the female.

Y chromosomes are small and usually don't carry an allele.



SO, males will only have one copy of a sex-linked gene.

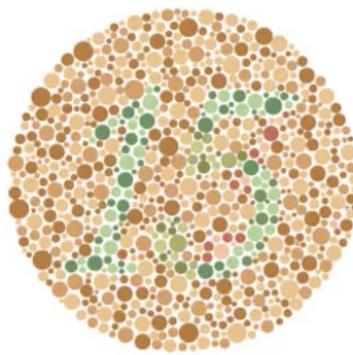
Females will have two.



ARE YOU COLOR BLIND?

- A. yes
- B. no
- C. I don't know.

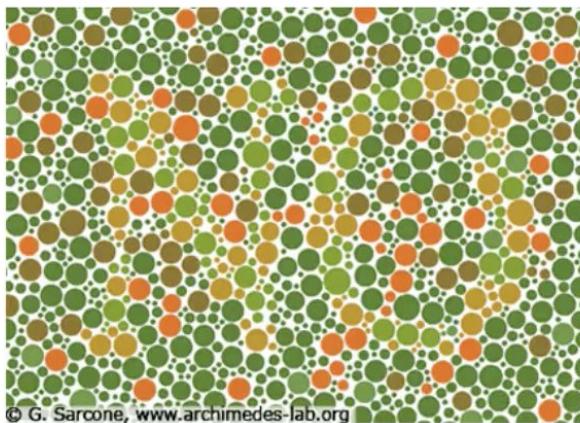
ISHIHARA TESTS



▷



REVERSE ISHIHARA



© G. Sarcone, www.archimedes-lab.org



Red-green color-blindness is an example
of a sex-linked trait.



“Normal” vision (ability to see colors) is dominant
to color-blindness.

Cross a male with normal vision with a female
with normal vision, but who is
heterozygous (often called a “carrier”).



	<u>Genotype</u>	<u>Gametes</u>
Sire	$X^R Y$	X^R, Y
Dam	$X^R X^r$	X^R, X^r



	X^R	Y
X^R	$X^R X^R$	$X^R Y$
X^r	$X^R X^r$	$X^r Y$



SIRE

		X R	Y
DAM		X R	X R X R normal female
		X r	X R X r carrier female
			X R Y normal male
			X r Y affected male

We would expect:

All females to have normal vision.

(1/2 of females would be carriers.)

1/2 of males to have normal vision.

1/2 of males to have color-blindness.



HOW CAN WE GET A COLOR-BLIND FEMALE?

- A. the mother must be color-blind
- B. the father must be color-blind
- C. the father must be color blind and the mother must be a carrier or be color-blind
- D. both parents must be color blind



CALICO CAT COLORING

The orange gene (O, o) in cats is sex-linked.

The presence of O causes orange (yellow) coloring.

The presence of o causes non-orange (often black) coloring.

Neither allele is dominant. We say that they are codominant.



Genotype

XO XO

XO Xo

Xo Xo

XO Y

Xo Y

Phenotype

orange female

calico female

non-orange female



orange male

non-orange male

EXAMPLE CROSS

Suppose a black tom mates with a calico queen.

If the queen has 4 kittens, what sex and color should we expect them to be?



Genotype XO XO XO Xo Xo Xo XO Y Xo Y Phenotype

orange female

calico female

non-orange female

orange male

non-orange male

QUEEN
(calico)

X^O
 X^o

TOM
(black)

X^o

Y

$X^O X^o$ calico female	$X^O Y$ orange male
$X^o X^o$ black female	$X^o Y$ black male



		TOM (black)	
		X ^o	Y
X ^o			
QUEEN (calico)		X ^O X ^o calico female	X ^O Y orange male
X ^o		X ^o X ^o black female	X ^o Y black male

We expect: 1/2 males and 1/2 females.

1/2 of females would be calico.

1/2 of females would be black.

1/2 of males would be orange.

1/2 of males would be black.



The orange / non-orange gene is sex-linked in cats.
It is co-dominant. The O allele gives orange color
and the o allele gives non-orange color.

If an orange queen mates with a non-orange tom, can
we determine the sex of the kittens by their color?

- A. yes
- B. No
- C. I have no idea what you're talking about.



HOW CAN A BREED (OR SPECIES) BE CHANGED GENETICALLY?

- Mutations
- Selection
- Out-crossing
- Genetic drift
- Isolation
- “Genetic modification”



HOW CAN A BREED (OR SPECIES) BE CHANGED GENETICALLY?

- Mutations
 - naturally occurring
 - probably common
 - many are recessive, so seldom appear phenotypically
 - many “die out” quickly



HOW CAN A BREED (OR SPECIES) BE CHANGED GENETICALLY?

- Selection
 - Huge factor with domesticated breeds
 - Control who mates to produce future generations
 - Frequency of new alleles (mutations) can be changed quickly



