4-H SKILLS FOR LIFE ANIMAL SERIES

National 4-H Curriculum
BU-08050

# On The Cutting Edge

Level 3

## Veterinary Science Project Activity Guide

### Grades 9–12

Name _____

County _____

REVIEWED & RECOMMENDED
National 4-H Curriculum

Level 3

# On the Cutting Edge

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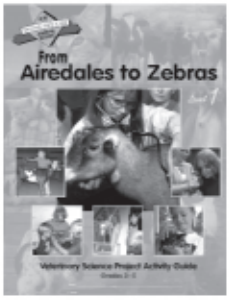


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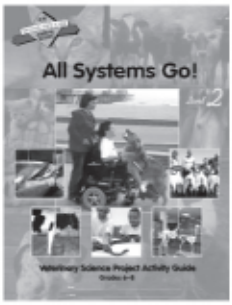


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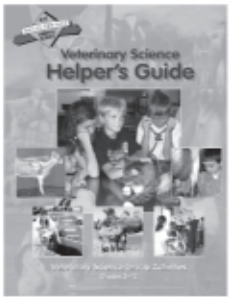


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The Normal Animal

# Bond, Animal Bond

***Project Skill:*** *Discovering the bond between humans and animals*

***Life Skill:*** *Community service*

***Educational Standard:*** *NS.9–12.3 Life Science: Interdependence of organisms*

***Success Indicator:*** *Describe the positive relationships that exist between humans and animals.*

In 2002, about 62% of United States households had pets. Americans acquire more pets and livestock every year, and these animals are typically considered a part of the family whether they are a dog, cat, ferret, fish, bird or horse. The bonds that exist between humans and animals are much broader and more interesting than you may have imagined. In this activity, you will evaluate why animals are important to humans and in return, why humans are important to animals.

*Animals and humans can develop deep bonds of trust and affection.*

## Hop To It!

Think about the connections between animals and humans. In Chart A, write some ways people help animals and some ways animals help people.

Next, research and contact an animal service organization of your choice. Accompany a member of the service organization on a community service appointment. For example, you might get involved with a group that takes animals into nursing homes and join the group for at least one day of activities. Summarize what you learn and experience in Chart B.

Note: Not just any animal can go into care facilities or be a service animal—investigate what it takes for an animal to be recognized as this special type of pet.

### A. How Animals and Humans Benefit Each Other

| How animals help people | How people help animals |
|---|---|
| | |
| | |
| | |
| | |
| | |

### B. Summary of My Animal Service Organization Research and Experience

| | |
|---|---|
| Organizations I researched | 1. |
| | 2. |
| | 3. |
| Activity in which I participated | |
| My observations and thoughts | |

"A dog is a human's best friend."

## Take the Pulse

Discuss these questions with your helper.

**Speak!** (share what you did)

- Which service organizations did you research?
- Which service organization did you shadow for the day, and what did you do?

**Ferret it Out** (process what's important)

- What is your definition of the human-animal bond?
- How do service animals differ from pets?

**Bare Bones** (generalize to your life)

- Where and when have you seen animals make a positive difference in someone's life?

**Mooving Ahead** (apply what you learned)

- How can you teach other youth how important animals and humans are to each other?
- What would you say to someone who doesn't believe that animals should be kept as pets or service animals?

Explore more at
www.4-hcurriculum.org
National 4-H Curriculum

**Scope** *this out!*

Miniature horses are being used like seeing eye dogs to help blind people.

Having a pet reduces your heart rate and blood pressure.

Americans have 78 million cats, 65 million dogs and 192 million fish!

**Resources:**
Small Animal Care and Management. 2nd Ed. 2002. D.M. Warren (Editor). Delmar Thomson Learning, Albany, NY.

**Acknowledgement:** Activity written by Kimberly Ange.

## Vital Information

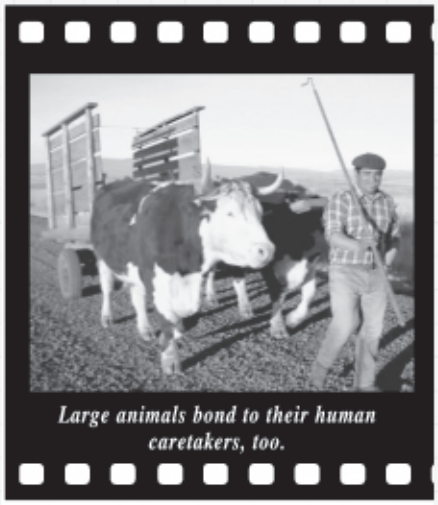
# Animal Benefits

The United States has experienced a huge growth in animal ownership over the past several decades. With this boom in animal ownership, people have begun to understand the enormous benefits that animals and humans offer each other.

Children learn valuable life lessons caring for their pets. The sick and elderly experience improved health and increased longevity when they have regular animal companionship. In addition, animals assist people with disabilities, including deafness, impaired vision, seizures, physical and mental impairment. Evidence has even shown that animals used in prison settings help convicts learn compassion and other essential life skills that can help them become rehabilitated.

### Human Animal Bond

Despite all these amazing benefits, perhaps the most important human-animal connection is the relationship that exists between average animal owners and their pets. People typically consider their pet part of the family and they exercise together, play together, relax together and help each other unwind after a hard day at work, school or life in general.



*Large animals bond to their human caretakers, too.*

Humans help animals by giving them care, attention, shelter and food. People need to be educated about the benefits that animals and humans have on each other's lives. The human-animal bond is truly amazing and it is something that should never be taken for granted.

## Booster Shots

1. Repeat the activity with another service group.
2. If you have a pet, try to get it certified with a service organization. Keep a journal about the process and your experience.
3. Investigate why some people think humans should not own pets, eat animals or control animals in any way. Present what you learn to your group or helper.

# TherioWHAT?

All animals must reproduce or their species will die out. Reproduction is a fascinating process, where an amazing number of things have to work together to result in the miracle of life. This activity will help you investigate the reproduction of various species as you investigate the species of your choice in more depth.

***Project Skill:*** *Investigate the mammalian reproductive process*

***Life Skill:*** *Learning to learn—using resources*

***Educational Standard:*** *NS.5–8.3 Life Science: Reproduction and heredity*

***Success Indicator:*** *Describe the cycles, organs and hormones involved in animal reproduction.*

## Hop To It!

Using whatever resources you can find, complete the two charts. Biology textbooks, Web sites and resource people may help you find the answers you need.

### Female Reproductive Characteristics

| Species | What female is called | Age at *puberty* | Length of *estrous cycle* | Length of estrus period | Length of gestation |
|---|---|---|---|---|---|
| Dog | | | | | |
| Cat | | | | | |
| Horse | | | | | |
| Cattle | | | | | |
| Sheep | | | | | |
| Rabbit | | | | | |
| Goat | | | | | |
| Pig | | | | | |
| Hamster | | | | | |
| Chicken | | | | | |
| Ferret | | | | | |
| Your choice | | | | | |

### Reproductive Terms and Definitions

| | |
|---|---|
| ___1. Uterus | A. Female reproductive organ that produces ova (eggs) and the hormones for reproduction |
| ___2. Fertilization | B. Hormone produced by mature follicle; promotes development of female characteristics and estrus behavior |
| ___3. Ovary | C. Hormone produced by the corpus luteum that is required for the maintenance of pregnancy |
| ___4. Follicle | D. Male sex hormone produced by the Leydig cells in the testes |
| ___5. Progesterone | E. Secreted by the pituitary gland. In females it causes ovulation and the development and maintenance of the corpus luteum. In males, it causes testicles to produce testosterone. |
| ___6. Lutenizing hormone | F. Transport tube, reservoir, and maturation site for sperm connecting the testicles to the vas deferens |
| ___7. Estrogen | G. Female reproductive organ that contains the developing fetus; the womb |
| ___8. Penis | H. Cells in the testes that secrete testosterone |
| ___9. Leydig cells | I. Structure on an ovary that contains a developing egg, fluid and surrounding cells; produces estrogen |
| ___10. Testosterone | J. The male organ of copulation |
| ___11. Epididymis | K. The process of sperm combining with an egg |
| ___12. Urethra | L. Carries urine from the bladder to the exterior of the body; also carries semen in males |

## Take the Pulse

Discuss these questions with your helper.

**Speak!** (share what you did)

- What resources did you use to do this activity?
- What was the most interesting new thing you learned?

**Ferret it Out** (process what's important)

- What do all species have in common? What is different?
- Why do veterinarians and animal caregivers need to learn about animal reproduction?

**Bare Bones** (generalize to your life)

- What similarities and differences are there between animal reproduction and human reproduction?
- What aspects of animal reproduction have you witnessed and in what species?

**Mooving Ahead** (apply what you learned)

- How can an animal's ability to reproduce be controlled temporarily? Permanently?
- How can you learn more about reproduction in animals?

• Altricial • Corpus luteum • Estrogen • Estrous Cycle • Fertilization • Follicle • Follicle stimulating hormone • Gestation period • Hormone • Implantation • Luteinizing hormone • Oocyte • Ovary • Penis • Placenta • Precocial • Progesterone • Puberty • Semen • Sperm • Testes • Testosterone • Urethra • Uterus • Vas deferens

**Scope** *this out!*

Uncontrolled breeding of dogs and cats results in 3 to 4 million animals being euthanized every year in the United States.

Theriogenology is the study of reproduction in animals. It means "origin of the beast."

*Explore more at*

**www.4-hcurriculum.org**

National 4-H Curriculum

**Acknowledgement:** Activity written by Colleen Brady.

## Vital Information

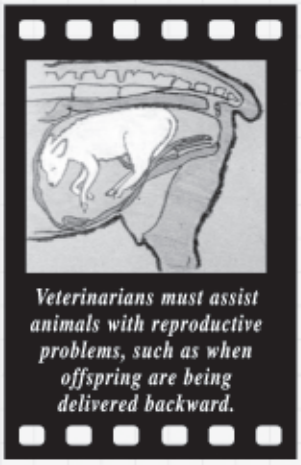
# The Birds and the Bees

Reproduction is a complex process! Although there are many variations between species, here is an overview of a typical mammalian reproductive cycle. In the female, follicle stimulating hormone stimulates the oocytes on the ovary. The oocytes develop into mature eggs that are released from the ovary in response to an increase of luteinizing hormone. This hormone changes ovarian cells that surrounded the egg into the corpus luteum. The follicle produces estrogen and the corpus luteum produces progesterone.

If healthy sperm are in the reproductive tract and contact the egg, fertilization may occur. After fertilization, implantation of the developing embryo will occur and the fetus will remain in the uterus for the duration of the pregnancy. Eventually, the placenta will develop; it helps provide the developing fetus with nutrients and oxygen.

Testosterone is the main hormone that controls male reproduction. It is produced by cells in the testes. Sperm are produced by other cells in the testes. The vas deferens conduct the sperm from the testes to the urethra, which provides a path through the penis for semen to travel during mating for deposition into the female reproductive tract.

If a pregnancy does not occur, the female will return to estrus after a certain amount of time. If pregnancy does occur, the female will stay out of estrus through the gestation period and will deliver offspring, unless a miscarriage occurs.



*Veterinarians must assist animals with reproductive problems, such as when offspring are being delivered backward.*

Most female animals are spontaneous ovulators, which means they ovulate according to a well-established cycle, regardless of the presence of a male or mating. However, female cats, ferrets and rabbits are induced ovulators. These animals come into heat but do not ovulate until they are bred; this makes them very efficient at reproduction because the timing of mating is much more flexible.

There is a wide range of maturity of offspring at birth. Puppies and kittens are altricial, which means they are blind and deaf and need a lot of care from their mothers. Foals and calves are more precocial—they can stand within an hour and move freely. Although they are dependent upon their mother for milk, they are much more independent than puppies or kittens.

## Booster Shots

1. Make an educational poster about the reproductive tracts and cycles of a species of your choice.
2. With your group, visit a zoo and talk with caretakers about reproduction of zoo animals.
3. Investigate artificial insemination, embryo transfers and cloning. Share what you learned with your helper.

# May the Best Gene Win

***Project Skill:*** *Investigating breeding and genetics*

***Life Skill:*** *Acquiring and evaluating information*

***Educational Standard:*** *NS.9–12.3 Life Science: Molecular basis of heredity*

***Success Indicator:*** *Describe how genetics influence breeding programs.*

Genes make up every living thing in this world, including you! They direct your body's functions, determine the color of your eyes and are responsible for every physical feature of your body. Life could not exist without them. Genetics holds great importance in the animal world. Breeders, trainers and veterinarians study and use genetics for many purposes. Understanding how genes work is crucial to the development of effective breeding programs. This activity will help you investigate the power of genetics.

## Hop To It!

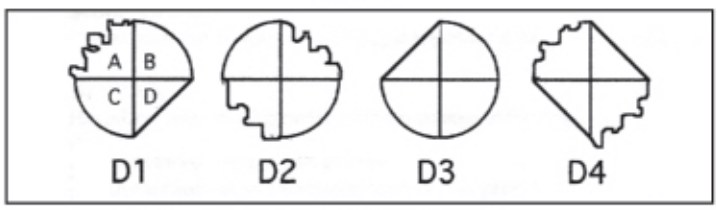
Below are six circles that are divided into four quarters. Each circle represents one animal; "D" indicates a dam and "S" indicates a sire. Each animal has four genes that are represented here like pie pieces. Some genes are associated with above-average performance (a positive trait), some with averageness and some with below-average performance (a negative trait). All of the regularly-shaped pie pieces, the "good genes," have a value that will be referred to as a [+]. All of the genes that have a straight edge are the average genes. They are shaped like triangles and have a value of [√]. All of the genes that have a wavy edge are the poor genes. They have a value of [-]. Trace each "animal" out on a separate sheet of paper; make them bigger if you want. Cut out the animals but do not cut the pie pieces apart. Label your animals as they are labeled below.

Separate the dams and sires, then select D1 and S1. Lay them next to each other, making sure they are oriented in the same way. Combine the animals' genes. For example, D1's gene A is a [-] and S1's gene A is a [+], so their offspring, K1, would have a [-] [+] gene A. When all of K1's genes have been determined, exchange the values for numbers by using the value key. Add the four numbers to come up with the total value for K1. Repeat the "breeding" with D1 and S2 for K2. The object is to determine which sire would produce a better offspring with which dam. Do this with all four dams to create eight different offspring (K1–K8) and record the scores in the table below. Which offspring has the best genetics?

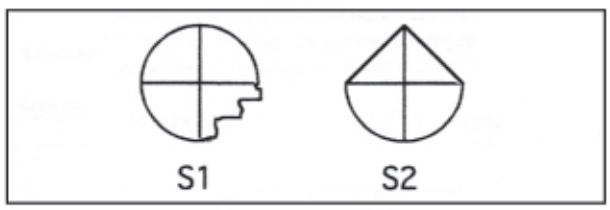
**VALUE KEY**

plus + plus = plusplus = 5
plus + check = checkplus = 4
plus + minus = plusminus = 3
check + check = checkcheck = 2
check + minus = checkminus = 1
minus + minus = minusminus = 0

**DAMS**




**SIRES**




| | Scores | | | |
|---|---|---|---|---|
| | D1 | D2 | D3 | D4 |
| S1 | K1 = | K3 = | K5 = | K7 = |
| S2 | K2 = | K4 = | K6 = | K8 = |

Explore more at www.4-hcurriculum.org
National 4-H Curriculum

## Take the Pulse

Discuss these questions with your helper.

**Speak!** (share what you did)

- How did you feel as you worked through this activity?
- Which D-S pairs produced the highest and lowest genetic scores?

**Ferret it Out** (process what's important)

- Why might one sire and dam pair produce better offspring than that sire with another dam?
- Why do veterinarians and animal scientists need to learn about genetics?

**Bare Bones** (generalize to your life)

- What genetically-based diseases are you familiar?
- What physical traits did you inherit from your parents?

**Mooving Ahead** (apply what you learned)

- If you planned to breed your animal, what traits would you look for in its mate to produce a genetically-superior offspring?
- What kinds of jobs require knowledge about genetics?

Heredity • Punnett square • Genotype • Phenotype

DocTalk

**Scope** *this out!*

If you stretched out all your DNA and put it together end to end, it would reach to the moon and back...seven times!

**Acknowledgement:** Activity written by Ashley Conway.

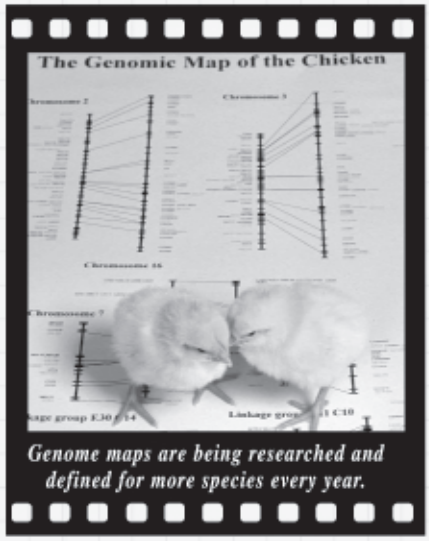
## Vital Information

# It's All in the Genes

DNA is one of the most interesting and highly complicated aspects of nature. Where did you get the genes that make you look the way you do? You received half of your traits from your mother and half from your father. Your mother got half from her father and half from her mother. Both of her parents received half and half from their parents and so on and so forth.

### Importance of Genetics

The laws of heredity extend to the animal and plant worlds, too. Animal breeders' jobs revolve around focusing on desirable traits in an animal and matching them with other excellent traits in another animal, while trying to minimize the offspring's less-than-desirable traits. The object is to get the best possible result. To do this, you need to know an animal's strong and weak points as well as what you want to improve on. You also have to understand how genetics work.




*Genome maps are being researched and defined for more species every year.*

In 1857, Gregor Mendel performed an experiment that helped explain the fundamentals of genetics. Using pea plants, he described the laws of heredity. Review his work to learn about the beginning of our understandings of how genes determine traits.

### Punnett Square

The Punnett square is a helpful tool and visual aid. The square depicts how genes from parents with different genotypes interact to create the offspring's genotype, which determines its phenotype.

### Genetically-based Diseases

There are many genetically-based diseases or conditions of animals. Some of them include Spider Lamb, Elso Heel, seizures, Scrapie resistance and susceptibility, cataracts, Lethal White Syndrome, Manx tails, Hemophilia, intersex condition and polledness. Learn about these conditions and discover others, too.

## Booster Shots

1. Select a species and learn about various genetic diseases of that species. Report your findings to your group or helper.
2. Learn to use a Punnett Square. Create some examples and teach others about how the square works.

# Swell Cell Organelles

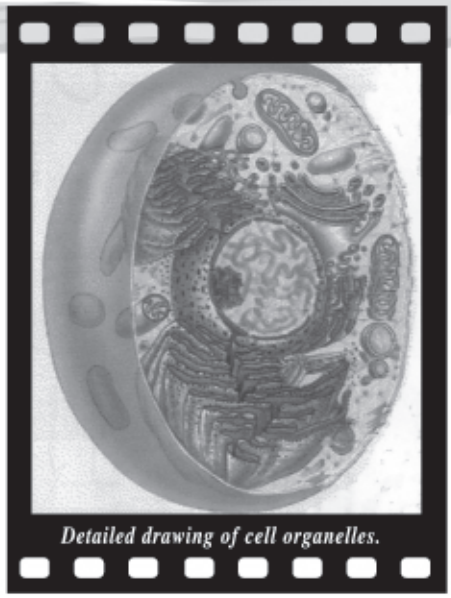
***Project Skill:*** *Identifying cell structure and function*

***Life Skill:*** *Acquiring and evaluating information*

***Educational Standard:*** *NS.9–12.3 Life Science: The cell*

***Success Indicator:*** *Describe ten cell structures and their functions.*

Skin, fat, muscles, blood, nerves, and bone—what do they have in common? They are all part of the body. However, they have very different jobs to perform. How else are these different tissues alike? They are made up of cells! This activity will help you develop a deeper understanding and appreciation of the nature, structure and function of cells—the building blocks of life!



*Detailed drawing of cell organelles.*

## Hop To It!

Make a multi-color poster of the basic structures of a cell. Label each organelle and describe its function. Include pictures or drawings of different types of cells (e.g., liver cells, skin cells, muscle cells, nerve cells, etc.) and provide information specific to each type of cell. In the space below, record the information you included on your poster. Alternatively, tape a photo of your finished poster to this page. When you are done, share your poster with your helper or others in your group and perhaps enter it in your county fair.

### Cell Structures and Their Functions

| Cell Structure | Function |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

**Scope** *this out!*

Bacteria are cells that can reproduce and live in cultures in a laboratory environment.

A virus is a non-cellular pathogen that is an intracellular parasite.

*On a microscopic level, these animals are more similar than they are different!*

## Take the Pulse

Discuss these questions with your helper.

**Speak!** (share what you did)

- What cells and cell structures did you investigate?
- Where did you find the information you needed?

**Ferret it Out** (process what's important)

- Why is it important to know how cells function?
- How do cells "know" what to do?

**Bare Bones** (generalize to your life)

- How will knowing about cells help you understand animal health and diseases?
- What current news stories involving cells have you heard?

**Mooving Ahead** (apply what you learned)

- Explain how the food you eat is eventually used by cells.
- Describe how cells reproduce.

Nucleoid • Nucleolus • Nucleoplasm • Detoxify • Prokaryotic • Eukaryotic • Organelles • Cytoplasm • Cytosol

DocTalk

Explore more at
www.4-hcurriculum.org
National 4-H Curriculum

**Acknowledgement:** Activity written by Geri Parsons, Cleon Kimberling and Susan Kerr.

## Vital Information

### The Original Cell Phone

Every living organism is composed of one or more cells. Prokaryotic cells such as bacteria are simple and have only a nucleoid; Eukaryotic cells have a true nucleus surrounded by a membranous structure. Both types of cells have similar organelles within a mass of cytoplasm. Here are the most common structures and their functions:

**Cell Wall**—the rigid structure that surrounds the cell and provides support and protection

**Nucleus**—includes the nucleolus, nucleoplasm and nuclear envelope; contains the cell's genetic material

**Cytoplasm**—includes all cell contents except for the nucleus

***Cytosol***—liquid portion of the cytoplasm in which organelles are suspended

**Cytoplasmic Membrane**—surrounds the cytoplasm; has interconnecting channels and vesicles that control what substances enter and exit the cell

**Ribosomes**—make and assemble proteins

**Rough Endoplasmic Reticulum**—produces various proteins that will be secreted or included in membranes or lysosomes

**Smooth Endoplasmic Reticulum**—makes steroid hormones, detoxifies some organic compounds, moves glucose and stores calcium

**Golgi Complex**—transports and modifies materials; sorts and targets their delivery within or outside the cell

**Secretory Vesicles**—transport hormones and other products to the cell surface for excretion

**Lysosomes**—use enzymes to digest materials such as bacteria and debris

**Peroxisomes**—use enzymes to break down toxic products the cell itself makes

**Mitochondria**—convert food to energy for the cell

**Centrioles and Centrosomes**—align chromosomes during cell division

**Microtubules**—support cells and help them hold their shape

**Microfilaments**—assist with contractility and motility of items inside cells

**Cilia and Flagella**—hair-like structures that project from the surface of the cell to help it move or perform other functions

There are numerous types of cells within the body and even within one body system. These cells may group together to make up tissues. Together with tissues, cells can make organs. All organs work together to perform functions for the body that are necessary for life!

## Booster Shots

1. Research RNA and DNA and their importance to animals. Discuss what you learn with other youth.
2. Research and discuss stem cells, mitosis and meiosis. Create another poster about the process of cell reproduction.

# Behave!

One of the most common reasons people abandon their animals is because the animal does not behave properly. These animals are unruly or aggressive and their owners cannot handle them. Sometimes these animals are given away, which only passes the problem along to someone else. In this activity, you will discover that animal behavior is a reflection of training, which is the owner's responsibility. A well-behaved animal is a result of a good partnership between the animal and its owner!

***Project Skill:*** *Researching animal behavior*

***Life Skill:*** *Learning to learn—researching resources*

***Educational Standard:*** *NS.9–12.3 Life Science: Behavior of organisms*

***Success Indicator:*** *Describe three different aspects of behavior or training in the species of their choice.*

## Hop To It!

Research and record your answers to the following questions about animal behavior and training. Write more extensive answers on a separate piece of paper and staple to this page. Share what you discovered with friends, family, project helper or anyone who needs help understanding their animals.

1. List two books and two Web sites that deal with animal behavior.
2. List at least five ways that animals communicate with each other or humans.
3. What are three basic things you should teach a dog? Why?
4. How old should a dog be when it starts training? Can you teach an old dog new tricks? If so, how?
5. Research the term "fear biter" and describe how such a dog acts.
6. Describe three types of cat misbehavior.
7. Why do some pet birds pluck out their feathers? What can an owner do to prevent this?
8. Investigate three common horse vices. Describe their cause and prevention.
9. Describe how a male cat's behavior changes as it matures.
10. Explain what is meant by positive reinforcement, negative reinforcement, avoidance behavior and stimulus-response behavior. Give an example of each.
11. List the key aspects of housebreaking an indoor pet.
12. Give an example how each of the five senses is involved with goat reproductive behavior.
13. What are behavioral signs of overcrowding in populations of gerbils, pigs or chickens?
14. Suggest an appropriate breed of dog for each of the following tasks: service, draft, guarding property, guarding livestock, herding livestock, racing, hunting, search/rescue and police work.

**Scope** *this out!*

Animals are trained to sniff out bombs, find lost people, help find criminals, help solve arson investigations, help people with disabilities, protect livestock and property and much more!

The most common feline misbehavior is urinating or defecating outside the litter box.

## Take the Pulse

Discuss these questions with your helper.

**Speak!** (share what you did)

- What resources were helpful?
- Which type of animal did you enjoy learning about the most? Why?

**Ferret it Out** (process what's important)

- Why is it important to understand animal behavior?
- How can you use knowledge about behavior to help you train an animal?

**Bare Bones** (generalize to your life)

- What animals do you know that are poorly behaved?
- What animals have you trained? What have you taught them to do?

**Mooving Ahead** (apply what you learned)

- What can you do to help people select the best breed and species for their lifestyle and goals?
- What advice would you give to a new pet owner?

Arson • Negative reinforcement • Personality testing • Positive reinforcement • Socialization

Explore more at
www.4-hcurriculum.org
National 4-H Curriculum

DocTalk

**Resources:**
Animal Domestication and Behavior. 2002. Price, E.O. Oxon, UK; New York : CABI Pub.

The Dog: Its Behavior, Nutrition, and Health. Case, L.P. 1999. Iowa State University Press.

Small Animal Care and Management. 2nd Ed. 2002. D .M. Warren (Editor) Delmar Thomson Learning, Albany, NY.

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## Vital Information

# Training the Trainer

About 6 to 8 million unwanted, abandoned or lost pets enter animal shelters each year within the United States. Many of these animals are abandoned because their behavior is unacceptable to their owners. Sadly, much animal misbehavior is created by owners who did not understand their animals, selected the wrong species or breed for their situation, or did not take the time to train the animal. It takes a good owner to have a good pet!

### Positive and Negative Reinforcement

Animals develop similarly to humans—they have baby, juvenile, adult and geriatric periods when their behaviors and abilities will differ. For example, a young puppy cannot learn how to fetch immediately. Training takes time and trainers must understand how to communicate with animal in various life stages. Owners must strive to make training fun and enjoyable so animals learn to please and not fear their owners. Positive reinforcement works well. This type of training rewards animals for good behavior. An example is giving a puppy a treat when it urinates outside. The opposite approach, negative reinforcement, would punish the puppy for urinating inside; this approach could make the puppy fearful and distrusting of the owner.

### Behavior Patterns

Animals have different behavior patterns related to their species, breed and environment. Some animals may develop dominant personalities and others may be timid throughout their lives. Once an owner learns more about their animal's personality, it is easier to know what type of approach to take to train that animal. Talking with and observing veterinarians, animal trainers and animal behaviorists at work are all great ways to learn more about animal behavior and training.

*Normal behavior is taken into consideration in the design of zoo animal habitats, such as this wolf den area.*

Good pet ownership and training begins with selecting the right species and breed for your intended use, performing personality testing, participating in socialization and obedience classes and spending lots of time with your animal. Good pets don't just happen—they are created through partnerships with responsible owners!

## Booster Shots

1. Observe a professional animal trainer or behaviorist at work in your area. Give a presentation on what you learned.
2. Watch the movie "Babe" with your group and discuss the behaviors the animal actors had to be trained to do.