Bucky's Guide For Pet Rabbits

Rabbits can make excellent pets. Did you know there are 45 different recognized breeds of rabbits in the United States? We are lucky to have such a wide variety of sizes, shapes, & fur types to choose from! Breeds vary in size and weight: Small Breed: 2-6 lbs., Medium Breed: 6-9 lbs. Large Breed: 9-11 lbs. Giant Breed: 11 lbs. & up.

How to Choose A Rabbit

The first step in choosing a rabbit is to learn all you can about bunny's care. After doing that you will have a good idea of what ownership entails. Are you prepared for the responsibility? If so the next step is choosing what kind of rabbit you want. There is an easy answer to this question, pick the breed that you like best! Any breed can make a good pet so spend time considering what breed you find most appealing. Please be sure to give as much thought into the day to day work pet ownership requires as you did into picking the right rabbit. Buying a rabbit is a lifetime commitment and the average lifespan is between 5-10 years.

Where to Get a Bunny?

Most people automatically think pet store when it comes time to get a rabbit, but the best place to start is at a reputable breeder's rabbitry. You can contact the American Rabbit Breeder's Association for a list of local breeders, clubs, and shows. You may wish to begin your search at a local rabbit show. This is a great place to see many different breeds of rabbits and meet the breeders who raise them. If you find a breed and breeder you like you can make arrangements to visit their rabbitry.

Housing

An advantage to rabbit ownership is that there are several options to where bunny can live. Rabbits can be kept indoors and allowed to run freely in the house or have limited out of cage time, they can also be housed outdoors in a hutch. A free roaming house rabbit will take much more time to train than a rabbit who is limited in when and where he gets out of cage time. A rabbit outdoors will have much less interaction with the family than one who is living indoors.

Most owners keep indoor rabbits in an all wire cage while outdoor bunnies usually have a combination wire and wood hutch. Any rabbit housing must take into account the following factors: be comfortable for bunny, escape proof, provides protection from all weather, easy access for owner, easy to clean and maintain, reasonable cost, provides good ventilation, have no sharp projections, provide predator protection, and be durable.

You can purchase a variety of pre-built rabbit cages, some already assembled while others just need to be "J-clipped" together. You can also build your own cage. The basic tools you need to build a cage include wire cutters, J-clip pliers, measuring tape, J-clips, 14 gauge wire, cage tray. The advantage to building your own cage is that you can customize it anyway you want. Some pet owners have created cages with ramps to a second or even third floor.

The cage size will depend on the breed of rabbit you own, a good rule of thumb is to provide a **minimum** of 3/4 square feet (.075 sq. ft.) per pound of adult body weight. Any cage should be at least 12"-18" high so the rabbit can stand up on it's hind legs (12" for small breeds & 18" for large breeds). Most cages use 1"x 2" 14 gauge wire for the sides, and top. The floor wire should be 14 gauge and 1/2"x 1" sized. You should also place a "resting board" in the rabbits cage, this is a piece of untreated wood that the bunny can stand on to rest his feet. If you do not do this you run the risk of the rabbit getting "sore hocks". The larger breeds (15 lbs and up) may be better off with a "slatted" cage floor due to their weight (the slatted bottoms will allow urine and feces to pass thru).

An outdoor hutch can be purchased or built from scratch. It will likely cost much more than an indoor cage. It is important to use quality building materials that will stand up to the elements, however keep any treated wood away from bunny's teeth. Hutches should stand several feet off the ground to prevent predators from getting too close or scaring bunny, prevent moisture build-up underneath, provide good air circulation, and protection against ground dwelling insects.

Hutches are usually composed of two sections, one an enclosed wooden "house" with a solid bottom floor and a waterproof roof. This section should protect bunny from moisture (rain or snow) and wind or drafts. Rabbits can withstand very cold temperatures as long as they stay dry and protected from drafts. Think of this as his "burrow", he should be safe and protected here.

The second section is constructed of wire and some wood with a wire bottom. Some people put a roof on this section which helps keep food dry, provides shade, and protects against rain.

Equipment

In addition to a cage you will also need the following to make life comfortable for bunny: food & water dishes, toys, resting board, slicker brush, toenail clippers, litterbox, rabbit safe litter or wood shavings, carrier cage, harness (for walks outdoors), exercise pen.

Handling

When picking up your bunny he **must** feel secure and supported or he thinks he will fall and will kick and struggle. A rabbit has a very fragile bone structure and kicking can cause a broken back. Never let a bunny struggle, put him down immediately if he begins kicking or struggling and try again when he is calm. When you pick him up **never** hold him by the ears this will hurt your bunny and he won't like you! Place your hand under their body (rib cage shoulder area) and "scoop" him up. Be sure to place your hand under his hind end as soon as possible to provide support so he knows he won't fall. Then hold him against your body, keeping one hand under the hind end, the other ready to stop him if he tries to hop off.

Feeding

A fresh, quality commercial rabbit pellet should be fed in limited quantities. Overfeeding pellets leads to obesity and other digestive system problems. Growing youngsters should be free fed (given all they will eat) until they mature. Adults are fed a limited amount and it varies with breed size. A

medium breed will need 6-8 oz of pellets daily to maintain constant body weight, less feed for a smaller breed and more for a larger. Check with your local breeder for exact amounts. A neutered/spayed rabbit will need even less as their metabolism will require less energy. One of the most attractive features to feeding a pellet based diet is it is easier to provide your rabbit with all the nutrients he needs in a convenient manner. A good commercial rabbit pellet is not soft and "crumbly". Do not keep feed for longer than 6-8 weeks because it will lose nutrients and palatability, always buy small quantities. Be sure feed is not moldy or has foreign substances in it. Keep feed stored in a dry cool place and protected from rodents. Also be sure to sift the feed to eliminate the "dust" from the pellets.

You need to check the label on the brand of feed you choose. The National Research Council lists **minimum** rabbit nutrient requirements for a maintenance diet as 14% crude fiber, 2 % fat, and crude protein 12%. Always check the labels on the feed you buy and only buy feeds that at least meet or better yet, exceed the above minimum amount of fiber, but keep protein and fat level low. Avoid pellets with lots of nuts and seeds in it, they are not good to feed due to a high fat content. You may also wish to monitor the calcium levels in the pellet, some believe that high calcium levels in the diet along with other factors including excessive vitamin D can lead to problems with bladder stones and kidney damage. The National Research Council lists calcium needs as .6%.

Bunny should always have clean, fresh water available. If he can not drink he won't eat. You can also supplement the diet with vegetables, fruits, and treats after he reaches 3 months of age. Quality hay should also be provided for rabbits of any age to prevent digestive system problems.

Behavior

Rabbits all have different personalities but there are some aspects of behavior which are constants. Chewing is a normal rabbit behavior but it can cause problems. You won't be too happy if bunny chews on your good furniture or ruins the baseboards but unless you supervise and bunny-proof you can expect this to happen. Once you realize chewing, digging, urinating, and rabbit droppings are probable behaviors you and bunny will get along fine. You **MUST BUNNY-PROOF YOUR HOUSE** if you allow the bunny to roam. Even if you allow your pet some exercise time in one room you should take the time to bunny-proof. Rabbits **WILL** chew electric cords, or any other cord for that matter, and any wood including furniture and baseboards. Obviously chewing electric cords can seriously injure or kill your pet so be sure they are hidden, removed or covered with something to prevent chewing.

All rabbits also go through an adolescence period as they sexually mature. This period can last several months and is characterized by the following behaviors: aggression especially in does (females), spraying by bucks (males), mounting, and false pregnancies. Maturity helps but many owners now neuter or spay their rabbits which prevents or lessens many of these problems.

How To Litterbox Train

Rabbits usually pick one corner of their cage to urinate and defecate. Place the litterbox in this spot. After bunny begins using the box allow out of cage time, start with short-10-15 minute periods and build from there slowly. It would also be helpful to place a box in the corresponding corner of the room for bunny to use, place some used litter in it.

If bunny has an accident clean up immediately. Some shout "No" and clap their hands when they catch bunny missing the litterbox, some recommend only reward good behavior.

Learning To Speak Bunny Rabbits have a variety of body language and even some vocalizations to communicate with you. Each rabbit is a bit unique so watch your pet and spend time with them to learn how they are communicating to you. Some common rabbit language includes:

Chinning- bunny has scent glands under his chin and will rub items and people to mark them as "his".

Periscoping- bunny sits up on his back legs to get a better look at something

Circling- Bunny hops around you in a circle to show he accepts you. It may mean he is upset at something you are doing, or just wants some affection & attention.

Licking- Not all bunnies are "lickers" but if yours is you are very lucky, he will do this to show he loves you!

Nipping, growling- bunny "anger", usually means he wants you "back-off"

High Jumps- a sign of joy and happiness

Nosing- bunny pushes you or an object away with his nose

Thumping-Rabbits often thump their back feet to signal danger or fear.

Soft teeth grinding or purring- indicates contentment

Honking- soft noise made when bunny is happy or excited

Your bunny will also enjoy toys to play with and they help keep your bunny occupied so less damage occurs to furniture. It also provides mental stimulation for your pet. Good toys are golf balls, pieces of untreated wood (tree branches can be used & be sure to dry the branches of fruit trees), pine cones (dry for one month), canning jar, small plastic pots, bottle caps, hard plastic baby toys, empty can with a pebble in it, empty boxes and old magazines or phone books to tear and shred, cardboard box with an exit and entrance to serve as a playhouse, clay pipe, towel, straw or wicker basket. When choosing a toy make sure it can't be chewed if it is non-edible, can't injure your rabbit, and is not toxic.

Rabbit Diseases

It is very important to check your rabbit daily for **any** signs of sickness. Common signs include going off feed and /or water, diarrhea or loose stools, discharge from nose or eyes, listlessness, decrease in fecal droppings or imbedded hair, any abnormal behavior. A rabbit can become sick very quickly and if treatment isn't provided immediately they could die. Find a qualified veterinarian **BEFORE** there is a problem! Be sure to ask a perspective vet questions about their experience in treating rabbits and get references, you may want to contact local rabbit breeders for their recommendations, and check under "exotics" in the phone book too.

(518)758-2419 e-mail: ranger18@capital.net
//buckysbunnybarn.homestead.com

Bunny's Diet

The subject of diet is often very confusing for pet owner and breeder alike, everyone has a different opinion of what is best and they are all different! I base my recommendations on personal experience, listening to differing opinions, and lots of reading & research. The best way to sort through all the differing diet information is to consider the whys and hows. I believe there are several diet options for rabbits that are all equally effective. In the end it is up to you to create a feeding plan tailored to your pet. The option I've always used is a pellet based diet and that is the one I will focus on.

Water

The most important nutrient your rabbit needs is **water**, access to clean fresh water should always be available. Water can be kept in a bowl or crock, or in a water bottle. I find a water bottle is better for keeping a rabbit's dewlap dry, it also can't be tipped over by bunny. If you use a crock or bowl be sure it is secured so it doesn't get spilled. Be sure to keep bowls or bottles clean and free of bacteria, disinfect often. If your rabbit can't get water he won't eat and even going "off-feed" for 24 hours can be serious for your rabbit. If your rabbit's food level hasn't gone down over 24 hours the first thing you should check is that he has water and can get to it.

The Pellet Based Diet

As the name suggests pellets are the main component of this diet option. A fresh, quality commercial rabbit pellet is fed in limited quantities. The key to successfully feeding this diet is to limit the amount of pellets. This means if bunny eats all his pellets you do not refill the dish until the next feeding time (* unless he is a youngster and still growing). Overfeeding pellets leads to obesity and other digestive system problems. An overweight rabbit is an unhealthy rabbit, the overfeeding of pellets is most often the cause of diet problems in pet rabbits. One of the most attractive features to feeding a pellet based diet is it is easier to provide your rabbit with all the nutrients he needs in a convenient manner. Of course just because you feed a pellet based diet it doesn't mean you can't supplement it with hay, vegetables, fruits, and treats.

Some other factors you should keep in mind are: feed a good commercial rabbit pellet that is not soft and "crumbly". Do not keep feed for longer than 6-8 weeks because it will lose nutrients and palatability, always buy small quantities. Be sure feed is not moldy or has foreign substances in it. Keep feed stored in a dry cool place and protected from rodents. Also be sure to sift the feed to eliminate the "dust" from the pellets. Sometimes sneezing is caused by feed dust and is not a sign of disease. Please be sure to use fresh, quality pellets. Too often a pet owner will use feed that is old or not a good quality and will then start to see problems with their rabbit. I do not recommend buying pellets from supermarkets or department stores unless they can provide the date the feed arrived there. The time it takes to get the feed to the store may result in old feed by the time bunny gets it and of course that would be a problem. A feed store, rabbit equipment company, or breeder are excellent choices for fresh, quality feed. Contact your local breeder for recommendations on the best local places to purchase feed and what brands are good.

How To Choose A Good Feed

Critics of pellet based diets often argue that they were formulated for fast weight gain in meat rabbits and therefore not a good choice for pets. This however does not take into account the different feed formulas now on the market. Most of the major pellet manufacturers offer different pellet formulations for more than just commercial uses. These pellets have different amounts of fiber and protein in order to achieve the desired effects and the pet owner is certainly able to find a mix just right for their rabbit. I use a show formula, which is 15% protein and 20% fiber.

These varying pellet formulas give the pet owner a greater choice and you are better able to provide a healthy diet for your rabbit. But you still need to check the label on the brand of feed you choose. You need to check the percentage of fiber, protein, and fat. The National Research Council lists **minimum** rabbit nutrient requirements for a maintenance diet as 14% crude fiber, 2 % fat, and crude protein 12%. Always check the labels on the feed you buy and only buy feeds that at least meet or better yet, exceed the above minimum amount of fiber, but keep protein and fat level low. Fiber level of 15%-17% is adequate (1). A level greater than 17% retards weight gain which would be desirable in a neutered pet rabbit and fiber levels of 22.5% and higher are used for reducing obesity and hairballs.(1)

Protein levels should be 15%-19% according to Harkness & Wagner(1). Be sure the fiber level is greater than the protein level. Too high protein in the diet creates a greater amount of ammonia in the urine. It would be better to keep protein closer to 15%.

Fat levels should be low, around 3% or less. The higher the fat content of a pellet the worse it is for your bunny (obesity). Avoid pellets with lots of nuts, seeds, etc. in it, they are not good to feed due to a high fat content. Fat does have a role in diet because it is a source of energy and helps increase the feed palatability. You may also wish to monitor the calcium levels in the pellet, some believe that high calcium levels in the diet along with other factors including excessive vitamin D can lead to problems with bladder stones and kidney damage (1). The National Research Council lists calcium needs as .6%.

It is best to find a good feed and stay with it, rabbit digestive systems can be thrown off with changes in feed. If you make a change **do so gradually**. Change of feed over a week is usually fine.

How Much Feed?

After you have a good quality pellet how much do you feed? Again there are varying opinions but it is my experience that you have to end up making adjustments for your individual rabbit. When bunny is young and growing he should be "free-fed" that is given all he will eat, but when he has reached adulthood (5-6 mos. small breeds, 5-8 mos. medium & large breeds, 8-12 mos. giant breeds) you must limit pellets. ARBA recommends at maturity, 2-3 oz of pellets per day for small breeds, 6-8oz. for medium sized breeds, and 8-10oz for large breeds. In the Harkness & Wagner book they recommend a limited once a day pellet feeding of 3-4 oz (2/3 Cup) for a medium sized rabbit to maintain a constant weight. I feed my Netherland Dwarfs around 2-3 oz. daily, again some eat less and some a bit more.

Monika Wegler's book (4) has some interesting recommendations. The daily diet for rabbits up to 6.5 lbs. includes unlimited hay, 1-1.8 oz. pellets, up to 3 oz greens or up to 6 oz green vegetables. She also adds every second or third day a grain source such as whole-wheat or oat flakes and once a week some fruit and dry bread. The diet amounts I've offered should help guide you in determining how much your rabbit needs. Note that with the Wegler diet the pellets are very limited but hay is given in unlimited amounts to provide enough nutrients and fiber. Vegetables are also given in large amounts in order to satisfy the same nutritional needs. So when making adjustments for your rabbit be sure to balance pellets, hay, and vegetables. Most rabbit raisers use fruits and grains only as treats.

Spicing Up The Pellet Based Diet

As I said before just because you're using pellets as the basis of the diet that doesn't mean bunny can't have supplements. It is important to monitor the rabbit's weight and assess the body condition to prevent obesity. Checking body condition is merely feeling your rabbit over his back and hindquarters. If bunny is bony and thin you aren't feeding enough. If the back and hindquarters can't be felt because of a thick layer of fat, you're feeding too much. Investing in a small scale to accurately measure weight isn't a bad idea and may prove helpful to the new bunny owner. You should weigh bunny once a month and write the weight down to for future comparison. It would also be useful to find out what the weight range is for your breed of rabbit. Show weights are listed in the ARBA Standard of Perfection which can be a guide or you can contact a local breeder.

Treats

We give our pets treats to help in training, show love, strengthen bonds, reward, and keep the pet interested in

their environment. Treats can be given but do not exceed 1/4 of the entire days rations in treats or supplements (1 tsp. Is a good amount in most cases). Treats should be fed in moderation as they increase the amount of calories and fat in the diet. You must also consider the size and activity level of your rabbit, the less active the fewer treats that should be given. Treats and fresh greens should be avoided until adulthood to prevent any possible enteric conditions. Some people do start greens early but it is not recommended because the period between 8 weeks old to 3 months is often when problems occur as bunny's digestive system changes. Avoid feeding treats that are salty or "sugary", too much sugar in a rabbits diet may cause enterotoxemia (severe diarrhea and possibly death). Be careful to only give a little and stop if your bunny develops diarrhea. Don't introduce more than one treat at a time, if bunny's system doesn't agree with it you will know exactly which foods to avoid. Avoid Iceberg lettuce, it tends to contain too much water and isn't very good to give to your bunny (diarrhea may be the result). Avocado may be toxic. Raw corn can cause problems and many stay away from any corn. Be careful with foods that can cause gas such as the cabbage group, you may only wish to give a tiny amount. Also never give fruit or vegetables that have pesticides on them, are fermented, moldy, or rotting. If you don't know where the food came from (and what might be on it) don't feed it!

Vegetables and herbs can be given in larger amounts than fruits, supplements, and other treats without causing problems or obesity. Limit fruit to 1 heaping tablespoon per 4 pounds of adult weight. If you feed greens and succulents free choice you can cut down on the amount of pellets by 50% without causing a problem (2). Greens are also good for rabbits off feed to stimulate appetite and keep them hydrated. Most greens are high in water content so large quantities must be fed to meet nutritional needs if they are the only source of nutrients.

Be very careful with starchy treats or those high in carbohydrates, including grains. Starch is the major carbohydrate in grains and too much can cause an overgrowth, or explosion, in the beneficial bacteria present in the cecum, and that leads to major problems. Grains include: plant seeds, corn, wheat, barley, millet, rice, oats, rye, and buckwheat. Oats and barley are lower in energy and higher in fiber, probably the reason many people give a small amount of oats to bunnies under 6 months old and to those suffering with diarrhea. Corn and wheat are high energy grains, which means if they are fed it is only in tiny amounts once in a great while. Oats and corn have the highest fat content(2). According to Rabbit Production grains are "essentially devoid of calcium", so you won't have to worry about what amount of calcium they are adding to bunny's diet. Here is a list of treats that should be fed in small amounts (1 tsp. or less): oats, oatmeal, nuts, sunflower seeds, barley, linseed, commercial supplement (i.e. Doc's Rabbit Enhancer, Showbloom, follow the label instructions on these), Calf Manna, cereal (i.e. Cheerios, bran, corn flakes), and dry bread.

Pet stores also carry commercial treats and as the market for pet rabbits grows so will the different types of treats sold. These treats range from vegetable based to grain based treats but not all are good for bunny. Always check the ingredients listed on the label and listed in order of amounts. If they list ingredients that are high in protein, fat, low in fiber, sugar or fat first they should be avoided.

If you feed bunny a commercial pellet he will get all the minerals and vitamins he needs but you may want to add a supplement like Doc's Rabbit Enhancer which contains odor-bloc to neutralize ammonia levels in rabbit waste, papaya plus enzymes to aid in elimination of fur block, probiotics to replenish beneficial bacterial flora in the rabbit's intestinal tract, and an appetite stimulator. You can also add vitamin and electrolyte supplements during times of stress and as an aid when treating disease. You also don't need to use a salt lick or block if you're feeding pellets. The pellets will contain all the salt bunny needs. If you add salt to the diet care must be taken to provide all the water bunny wants or you risk salt poisoning (7).

What To Watch Out For!

Yes there are foods you have to be careful of in addition to the other items mentioned before. The following information comes from Rabbit Production (2). You shouldn't feed rabbits the following raw: soybeans, broad beans, common beans, pinto, navy, or kidney beans. Raw beans contain lectins which can damage intestinal walls and reduce nutrient absorption. Lectins are destroyed by cooking. Cabbage, cauliflower, kale, rape, mustard can be fed in moderate amounts because they contain goitrogens which inhibits synthesis of a thyroid hormone. Spinach and chard in moderate amounts are okay because they contain oxalates, the substance that makes rhubarb leaves toxic. Some weeds such as milkweed and nightshade are toxic as are garden plants such as lupines, delphiniums, and foxgloves. You should contact your local Co-operative Extension office for a list of toxic plants in your area. Rabbits should be kept away from houseplants unless you're sure they aren't poisonous.

Hay, Your Bunny's Friend

Hay is a good source of fiber and fiber is very important in a rabbit's diet. It is thought to provide protection for the intestines, prevent fur chewing, and prevent enteric conditions by preventing hindgut overload (2). Hindgut overload refers to the condition where too much dietary carbohydrate causes an overgrowth of the normal bacteria found in the cecum, and leads to entereotoxemia (severe diarrhea). Enteric conditions are a leading cause of death in rabbits so you can see the importance of taking simple steps to prevent it.

In addition, too little roughage in the diet may cause cecal impaction (2). Cecal impaction is like constipation, digesting food gets caught in the system and causes a blockage for the rabbit. The passage of food through the digestive system is known as gut motility. A decrease in motility may lead to cecal impaction. This condition is life threatening, treatment may include hydrating the rabbit to get the system moving again or in the worst case surgery which is very risky and often unsuccessful. The rabbit doesn't digest fiber efficiently and it is quickly passed through the digestive system, which is the reason why hay is important to gut motility. Often a rabbit with cecal impaction is given hay to get the gut moving again and the food matter through. Timothy grass or mixed grass hay (fescue, rye, pasture grass, mountain fescue, oat or wheat hay) (6) is the best to give and it can be given in unlimited amounts. Even a little hay is beneficial for rabbits if you want to limit the amount they get. Alfalfa Hay (also called legumes) contains a higher amount of protein and calcium and is good to give to outdoor bunnies and growing young. It is often not advised to feed indoor house rabbits this kind of hay because they may get too much calcium and gain weight on it. Alfalfa is the primary ingredient in pellets. You could also feed a mix of alfalfa hay and grass hay as long as it is mostly made up of the grass. Grass hays have a lower nutritional value than legumes but are also lower in protein and calcium. The calcium levels in general are .2-.4% (2). Providing hay daily is also a good way to prevent hairballs (Trichobezoars), diarrhea, and gives bunny something to chew on. Store hay in a cool dry place and discard if it gets wet or moldy.

An interesting aspect of bunny's diet is referred to as *coprophagy*, this is the process of producing and eating special fecal material (cecotropes). At certain times of the day rabbits produce fecal material that is softer than regular feces and "clumpy", these are also called "night feces". These cecotropes provide rabbits with additional nutrients and the rabbit knows when they are being produced and will eat these directly from the anus. This is a normal and important behavior so don't worry if you catch bunny doing this! If traveling with your bunny be sure to take along his pellets and water, even a change in water can disrupt the digestive system and it's better to be safe than sorry. Rabbit can be very finicky eaters and if something doesn't taste right to them they won't eat or drink it.

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7. Dwarf Digest Oct 1997 Pub. ANDRC "Rabbit Nutrition and the Philosophy of Conditioning" by Dr T.E. Reed, and "Can Roughage Be the Secret to Good Condition"
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Rabbit Education Society
www.rabbited.0catch.com

Rabbit Housing

Where to keep your rabbit is a decision you must make far in advance of purchasing your rabbit. It is best to have bunny's house all set up when you bring him home. An advantage to rabbit ownership is that there are several options to where bunny can live. Rabbits can be kept indoors and allowed to run freely in the house or have limited out of cage time, they can also be housed outdoors in a hutch. A free roaming house rabbit will take much more time to train and care for than a rabbit who is limited in when and where he gets out of cage time. A rabbit outdoors will have much less interaction with the family than one who is living indoors. Also in bad weather you may not devote enough time to your pet if he is housed outside. I recommend keeping your rabbit indoors because it is easier on you and the rabbit and I feel it provides for increased interaction.

The Cage

After you decide where bunny will live you must decide in what will he live. Outdoor rabbits require a much more elaborate cage set-up vs an indoor rabbit. Most owners keep indoor rabbits in an all wire cage while outdoor bunnies usually have a combination wire and wood hutch. Any rabbit housing must take into account the following factors:

- be comfortable for bunny
- escape proof
- provides protection from all weather
- easy access for owner
- easy to clean and maintain
- reasonable cost
- provides good ventilation
- has no sharp projections
- provide predator protection

The cage will likely be the most expensive purchase and forethought prevents future disappointment or additional expense. You can purchase a variety of pre-built rabbit cages, some already assembled while others just need to be "J-clipped" together. You can also build your own cage. The basic tools you need to build a cage include wire cutters, J-clip pliers, measuring tape, J-clips, 1 x 2" 14 gauge wire, 1x ½" 14 gauge wire (for the floor), cage tray. The advantage to building your own cage is that you can customize it anyway you want. Some pet owners have created cages with ramps to a second or even third floor. If you build your own cage be sure to build it according to the drop pan you will be using. Drop pans can be built from scratch but most people purchase one. Pans can either slide under the cage or the cage is placed inside them. Decide which type of tray you want and then check on the size so you can build a cage that fits the pan. Please note that aquariums or any other glass enclosed cage are unsuitable for housing as there is a lack of proper ventilation.

The cage size will depend on the breed of rabbit you own, a good rule of thumb is to provide a **minimum** of 3/4 square feet (.075 sq. ft.) per pound of adult body weight. Any cage should be at least 12"-18" high so the rabbit can stand up on it's hind legs (12" for small breeds & 18" for large breeds). There is no downside to giving your pet rabbit a cage much larger than the minimum for his breed. If your pet will spend most of his time in a cage it's best to give him a large cage. Most cages use 1"x 2" 14 gauge wire for the sides, and top. The floor wire should be 14 gauge and ½"x 1" sized. Place the ½" side facing up when building the cage to ensure droppings fall through and bunny is comfortable.

You should also place a "resting board" in the rabbits cage, this is a piece of untreated wood that the bunny can stand on to rest his feet. If you do not do this you run the risk of the rabbit getting "sore hocks" (see rabbit diseases). The larger breeds (15 lbs and up) may be better off with a "slatted" cage floor due to their weight (the slatted bottoms will allow urine and feces to pass thru). Some owners use other materials instead of a resting board such as cardboard, seagrass mats, carpet, towels, or sheet rock. It is ideal to have a side door and an opening on the top to make removing bunny from the cage easier. Doors should latch securely and a variety of latches are used by rabbit owners. If you add a ramp (or one is included) be sure it is rabbit safe. Some owners have reported rabbits getting feet stuck in wire ramps where the spaces were too large and being injured. A simple ramp made of carpeted wood is another safe alternative.

Another neat idea for your rabbit's cage is placing a box so he can hide in it like a burrow. You can use untreated wood and build a little house or use cardboard. The cardboard will need to be replaced more often as your bunny will chew on it as well. It is helpful to make the roof flat so that your rabbit can climb on top of it. Or you can build or buy a shelf that attaches to the side of the cage.

Indoor cages will have a drop tray or pan to catch urine and feces. This can be a pull out tray or the cage can sit inside the tray. The latter has the advantage of higher sides to prevent spillage of litter and urine. A pull out tray can be easier to clean as one does not have to lift the cage out to clean the tray. In addition to metal, pans also are manufactured in lightweight plastic which doesn't rust and is much lighter than a metal pan. Urine guards are also commonly used on a slide in tray style of cage, however it does not catch 100% of droppings or litter. Somehow rabbits have perfected the "art" of urinating so it goes under the urine guard but stays just above the top of the drop pan. The result is affectionately known as a urine spill. Try using a piece of plastic or inexpensive table cloth on the floor to prevent

stains and make clean up easier. I also have found placing a small container on the floor where you frequently find urine spills helps. *Tips: Urine guards help stop urine and dropping spills, cheap flannel backed vinyl table cloths under cages help make clean up easy, plastic lids or old cookie sheets under bunny's favorite corner help catch urine, tying down food dishes helps prevent tip overs*

The cage tray should be lined with an absorbent material such as newspaper or wood shavings (not cedar) to catch the urine and feces. There are now a variety of rabbit specific litters on the market, each has good and bad points (For a listing look under Litterbox Training).

Alternative Cages-The Indoor Rabbit

Where in your house bunny stays depends on where you feel it will work best. Some people keep rabbits in their living rooms or other high traffic areas. Just be aware that things do spill out of the cage and the drop pans (hay, pellets, shavings, rabbit droppings, and urine). Other indoor areas for your rabbit's cage include enclosed porches/sunrooms, bedroom, basement, or garage. Do not place the cage in direct sunlight or drafts. Do put the cage in an area that is quiet, rabbit ears are sensitive to loud noise! You should also make sure that if you keep the rabbit in a basement or garage that the areas have enough light and that the room is not damp or musty.

Free Range House Rabbits

A free range house rabbit means the rabbit has free run of the house 24 hours a day. While this may sound like lots of fun it is not that easy nor is it all fun and games. "Recommending that people start their rabbit off free-range is a recipe for disaster. Wrecked houses, disillusioned owners, and rabbits banished to a hutch outdoors will follow, which would be a terrible shame when a cage which bunny regards as home is a simple, practical, and humane solution." Carolina James

If you are an inexperienced rabbit owner and would like to set the **goal** of having a free range house rabbit that is a better approach. Give yourself and bunny time to adjust to each other, provide training, and bunny proof. You will have to have your rabbit litterbox trained. A house rabbit is no different when it comes to chewing needs and some amount of damage to your house or furniture is to be expected. You can also expect a normal amount of mess in the form of spilled litter, food, and hay. Even a free range house rabbit needs a cage to retreat to so you will still have that expense. And in some cases it isn't practical to have a free range rabbit, such as in the case of renters. If you don't plan to go totally free range you can still work at allowing access to several rooms in your house. Some owners use a series of baby gates to control where bunny can roam. Even a puppy pen can be useful. Cover several inches of the gate from the bottom up with wire mesh to prevent escapes due to chewing.

Outdoor Housing

Some of the reasons people choose to keep their rabbit outdoors include: space or lease restrictions for apartment dwellers, rabbit proofing difficulties, odors, or chewing. Some pet owners with indoor rabbits keep their pet outside in the summer months. If you keep bunny outdoors you must protect the rabbit from the elements and predators and will have to go out in all sorts of weather to feed and care for him. An outdoor hutch can be purchased or built from scratch. It will likely cost much more than an indoor cage. It is important to use quality building materials that will stand up to the elements, however keep any treated wood away from bunny's teeth. Hutches should stand several feet off the ground to prevent predators from getting too close or scaring bunny, prevents moisture build-up underneath, provides good air circulation, and protection against ground dwelling insects.

Hutches are usually composed of two sections, one an enclosed wooden "house" with a solid bottom floor and a waterproof roof. This section should protect bunny from moisture (rain or snow) and wind or drafts. Rabbits can withstand very cold temperatures as long as they stay dry and protected from drafts. Think of this as his "burrow", he should be safe and protected here.

The second section is constructed of wire and some wood with a wire bottom. Some people put a roof on this section which helps keep food dry, provides shade, and protects against rain. This area will be where bunny can run and get exercise. Any wood the rabbit can reach cannot be treated with any chemicals, nor should it be painted. Rabbits normally chew on the wooden parts in their cage so be sure to check often for escape holes. A door is usually found in the wire section and the wooden section usually has a hinged roof to allow easy access. Be sure to include strong latches to keep predators out. You should also use locks to keep two legged predators out as well. I recommend keeping the hutch in a secure enclosed area at your house. This minimizes the possibility of roaming predators attacking your rabbit.

Summer Care

In addition to predator control you must find an area that will provide plenty of shade in summer. Rabbits can't withstand heat the way they do cold, don't leave a hutch out in the sun. Also check that it is shaded all hours of the day as the sun travels and a morning shaded area could be in direct sun by afternoon. You should also have an indoor cage in case temperatures soar so bunny can be placed in a cooler area. You can also place a frozen water bottle in the cage, but have more than 1 bottle ready in case it takes longer than overnight to re-freeze the first bottle. I use 2 liter soda bottles which last longer in the heat but do take a long time to refreeze.

You can also devise a homemade mister system if you can't afford a commercial unit. Do this by using burlap, plastic milk cartons filled with water, and a fan. The burlap is tacked to the hutch roof and you place the milk cartons (with 1 large hole cut into top and several tiny holes in bottom) on edge. The water slowly drips onto the burlap and the fan causes evaporation.

You can also use a fan but be sure to direct it at only half the cage so bunny can get out of the draft if he wants. Fans are usually used to keep the air circulating around the cage.

You can also use a hose to spray the hutch or rabbit. Be careful to only use a light mist setting so the noise hitting the hutch won't scare bunny. Most rabbits dislike getting wet even if they are hot so use good judgement and don't stress them. An alternative to spraying the rabbit is to simply wipe down their ears with cold water. The ears are designed to help the rabbit cool off.

Winterizing Your Hutch

Winter brings a variety of other concerns for the outdoor rabbit. In winter the main concern is freezing water and wintery storms. In order to keep warm the outdoor rabbit must eat more in cold weather. If their water source freezes they won't eat and can die. People use a number of different strategies to keep water available. Some of these include: changing frozen water at least twice a day, using warm water in the dish at mealtime, and heat cables. Although rabbits tolerate cold much better than heat you should try to make your rabbit as comfortable as possible when temperatures dip. Place a thick layer of hay on the floor of the enclosed hutch section and change every 2-3 days. Another idea is to use a cloth tarp on the hutch to prevent drafts. Staple the tarp to the hutch or use hooks so it can be hung on three sides of the hutch (leave front and top open for air circulation). Don't leave the tarp up all the time but use it at night or when a storm hits. If you bring your rabbit inside for playtime in either winter or summer keep temperature changes to a maximum of 10-15 degrees so you don't end up getting your rabbit sick with extreme changes.

You can keep the rabbit indoors in a garage or porch, or in the living area of your home. If they are kept in a garage or enclosed porch you have the benefit of protecting your bunny from the elements and not worrying about freezing water bottles or going out in the rain, and predators will not be a concern. Just be sure there is light, good ventilation, and not a damp area.

Bunny Proofing And Litter Training

Rabbits can be given free or limited run of the house or certain rooms, it depends on how much training you are willing to give the rabbit and how much destruction you can live with. A free roaming house rabbit will require much more time in training and supervision than a rabbit who is given limited free run time. It is nice that a rabbit owner has a choice in these matters and forethought should be given to this issue. If you leave your rabbit unsupervised, even with extensive house training you can expect bunny will get into something he shouldn't. Many "free range" house rabbit owners still confine their rabbits when they are unable to supervise them.

Rabbits given out of cage time are happier and more fun to be with than rabbits stuck in the cage all day all the time. It gives both rabbit and pet owner more time to bond and interact on a rabbit's level. That's right, be prepared to get down on the floor with your pet! There are several options for out of cage time ranging from the open cage door policy to setting up an exercise pen for bunny.

Chewing is a normal rabbit behavior but it can cause problems. You won't be too happy if bunny chews on your good furniture or ruins the baseboards but unless you supervise and bunny-proof you can expect this to happen. Once you realize chewing, digging, urinating, and rabbit droppings are possible and probable behaviors you and bunny will get along fine. **Y**ou **MUST BUNNY-PROOF YOUR HOUSE** if you allow the bunny to roam. Even if you allow your pet some exercise time in one room you should take the time to bunny-proof. Rabbits **WILL** chew electric cords, or any other cord for that matter, and any wood including furniture and baseboards. Obviously chewing electric cords can seriously injure or kill your pet so be sure they are hidden, removed or covered with something to prevent chewing (bitter Lime or Bitter Apple sprays will help, both are available at pet stores or plastic tubing found in hardware stores, Radio Shack). **ALL** houseplants should be kept out of bunny's reach, and remember to account for their height when standing **and** jumping ability. Many houseplants are toxic and the bunny won't be able to pass up these "tasty" treats, they are herbivores! Rabbits will chew other things to so examine your room/rooms carefully for trouble your bunny could get into. It helps to get down on your knees to explore so you will have a bunny's eye view of dangling cords or spots to hide in.

Some other household dangers for rabbits include: being stepped on, getting caught and hurt under furniture, strings, tinsel, fabric that is chewed and ingested, plastic bags, soft rubber or breakable objects, household cleaners, pesticides, human food, and an open toilet. Don't let your rabbit get behind appliances or behind furniture and keep doors and windows closed.

Another good alternative to bunny proofing whole rooms is using some type of pen to restrict the area your rabbit can roam. The **Petsitter Playpen** available from *The Bunny Hop* was developed by a rabbit breeder to provide a safe exercise area for your rabbit. It features clear acrylic panels, folds to 24" wide for storage, panels slide out for cleaning or to attach the cage to, is usable indoors or out, and can be opened to a 5'8"x5'8" octagon, 4'x4'square, or 2'x6' rectangle. The Petsitter allows you and bunny to see in and out but protects your house from sprayed urine. This will work well for working families and I think it is an excellent product. Other similar products such as puppy pens can also be used.

After giving your bunny out of cage time you will at some point want him back in his cage. There seems to be two different schools of thought on the subject of getting your rabbit back into the cage. Both recommend that you don't chase down your bunny and put him back, this may cause him to associate being put back in the cage as a negative. Most people work on training bunny to come when called and/or a command to return to his cage. Offering a treat is also helpful.

You may have to herd him back in or gently catch him and place him back in his cage. It is very important when catching bunny you do not set up a chase scenario where bunny is running away from you and you are chasing him down. If that happens you are scaring the rabbit and it the attempt to escape he may injure himself. What I do is slowly approach the rabbit, talking calmly and using his name, and begin by petting bunny, then I calmly pick him up and carry back to the cage. If your rabbit is continually running away you may want to back off a little and allow him to relax. This isn't always easy and it may take you several minutes. If bunny is being especially uncooperative you can try placing his cage in the exercise area and gently herd him into it.

The second school of thought is to reinforce to bunny that his cage is his home and allow him to always choose to go back by himself. To reinforce this message it is recommended that you:

-Place food bowls at entrance of cage and fill when bunny is out of cage
-Never take your rabbit out of his cage, allow him to come out himself before lifting
-Don't clean the cage unless bunny is not in it
-Never put your rabbit back in the cage, let him go in himself and herd him in if he is reluctant

Litterbox Training

Many owners litterbox train their rabbits and allow the bunny to roam through the house like a cat or dog. Some rabbits catch on quickly while others need a lot of time. It is important to be patient with your bunny and reward them when they use the litterbox. Treats can also be used effectively in litter training, either as a reward or hay placed in the litterbox to encourage it's use. Unaltered rabbits will not have reliable litterbox habits so the first step is a spay/neuter appointment. Some examples of non-traditional litterboxes inlcude: wooden box, a cardboard box, covered cat litter box, untreated straw or wicker basket, or a small dog bed. If you are having a problem with your bunny kicking litter out of his tray you can try changing litters or using a litterbox with higher sides. If you are finding bunny has trouble getting everything in the litterbox try using a bigger box with higher sides so your rabbit fits in properly.

Litterbox Litter: Be very careful in the choice of litter for bunny's litterbox. Clumping Cat litters can cause serious internal blockage. Make sure bunny is not ingesting his litter, and be careful litter is not too dusty. There are many different types of litters you can use and rabbits can have preferences so don't be afraid to experiment. Some "rabbit safe" litters include pine shavings, sand, paper based (eg: Yesterday's News, Carefresh), Feline Pine, hay, feed pellets (although bunny may overeat using these and wet food pellets often smell worse than the urine). I recommend using the litterbox that has cage wire covering the drop pan (available from KW Cages) that way bunny can't get into the litter and will not have to stand in his waste.

Softwood Shavings:
A rumor perpetuated by some groups is that pine and cedar shavings are dangerous. This isn't true. Scientific studies have found that non-heat treated softwood shavings induce Hepatic Microsomal Enzymes, or basically elevate liver enzymes. This is part of the body's natural function and does not indicate damage or disease due to using shavings. Many substances can induce or inhibit HME, for

example grapefruit induces HME. Currently there is no evidence that pine or cedar shavings cause liver problems. The only respiratory problem they may cause is if your rabbit has an allergy to them and starts sneezing a lot. Heat treated softwood shavings have been found not to induce HME.

The How To Of Litter Training

1) Rabbits usually pick one corner of their cage to urine and defecate, does are much more likely to defecate in only one spot. Place the litterbox in this spot.
2) After bunny begins using the box allow out of cage time, start with short-10-15 minute periods and build from there slowly as litterbox habits improve. It would also be helpful to place a box in the corresponding corner of the room for bunny to use, place some used litter in it.
3) If bunny has an accident clean up immediately. Some shout “No” and clap their hands when they catch bunny missing the litterbox, some recommend not to and only reward good behavior. Others take bunny back to cage or put him in the nearest litterbox so he gets the idea of where to go.
4) Don’t forget to bunny proof any areas bunny is allowed in and supervise your pet when he is out to play.

Training mishaps

Even the best trained bunny can have litterbox mishaps which can be caused by a change in environment, emotional upsets, hormones kicking in with youngsters, or a medical problem. If your well trained bunny begins missing the litterbox you might want to schedule a vet visit to rule out a health problem first. When your bunny urinates in the wrong spot be sure to thoroughly wash the smell out so he doesn’t return to the spot.

If you are having problems with your bunny urinating on rugs you might want to begin by placing a litterbox where he seems to want to go. Place some droppings and used litter in the box so he gets the idea to use it. And then when bunny is correctly using the litterbox you can try gradually moving the litterbox to a more convenient place. If your bunny is blocked from entering certain areas he may try marking the boundary of his "territory", so placing a litterbox there would help.

Another common problem is bunny urinating on your bed or furniture. Some believe it is because these spots are soft and remind bunny of his litterbox, others feel it is a way of marking territory especially if it is on your bed. Some solutions include keeping an extra litterbox close to the furniture or bed. Also teach your bunny the down command to keep him off the bed or furniture or close off access to the room. If you allow bunny on the furniture or bed watch him and if it looks like he is about to urinate clap your hands and shout “No” (or use a water spray) and push bunny to the litterbox. You could also carry bunny and put him into his litterbox so he gets the message not to use the bed. Another suggestion is to bunny proof the bed or couch by placing a waterproof cover on them to make clean up easier.

Free Range House Rabbits

A free range house rabbit means the rabbit has free run of the house 24 hours a day. While this may sound like lots of fun it is not that easy nor is it all fun and games. “Recommending that people start their rabbit off free-range is a recipe for disaster. Wrecked houses, disillusioned owners, and rabbits banished to a hutch outdoors will follow, which would be a terrible shame when a cage which bunny regards as home is a simple, practical, and humane solution.” Carolina James

If you are an inexperienced rabbit owner and would like to set the **goal** of having a free range house rabbit that is a better approach. Give yourself and bunny time to adjust to each other, provide training, and bunny proof. You will have to have your rabbit litterbox trained. A house rabbit is no different when it comes to chewing needs and some amount of damage to your house or furniture is to be expected. You can also expect a normal amount of mess in the form of spilled litter, food, and hay. Even a free range house rabbit needs a cage to retreat to so you will still have that expense. And in some cases it isn’t practical to have a free range rabbit, such as in the case of renters. If you don’t plan to go totally free range you can still work at allowing access to several rooms in your house. Some owners use a series of baby gates to control where bunny can roam. Even a puppy pen can be useful. Cover several inches of the gate from the bottom up with wire mesh to prevent escapes due to chewing.

Odor Control

Rabbits do not smell, however if you don’t clean their cages the ammonia from their urine causes an odor. Sprinkling a little baking soda in the tray will help prevent odor, other ideas include placing a charcoal bricket in the opposite side where the rabbit urinates or feeding your bunny Doc's Rabbit Enhancer (see diet), and I've recently read that peat moss is good too. You will need to clean the tray and cage at least once a week. Rabbit droppings make excellent fertilizer and does not need to be "aged" prior to gardening use. **M**ake sure any feces or fur are removed from the cage wire and it is completely dried before bunny goes back in. Disinfectant should also be used and a good solution is to mix 1 part regular laundry bleach to 5 parts water. If disinfectant is used be sure to completely rinse it off the cage.

Bucky’s Bunny Barn
Valatie NY
//buckysbunnies.tripod.com
Ranger18@capital.net

UTERINE CANCER IN RABBITS

Corinne Fayo-Bucky's Bunny Barn

I would bet many of you reading this have never experienced uterine cancer in your herd. Therefore it is understandable that many breeders doubt the information passed out by many rabbit rescue groups, especially when they throw figures out such as 85% of all unspayed does will get uterine cancer. The veterinarian community is also mute on the subject, some cite book references but do not share their experiences with us. I had my doubts about the high incidence of uterine cancer and set out to find the facts about it. I wish to share what I have learned with all of you in order to better the knowledge of the breeding community.

Uterine cancer is the most studied form and most common of cancers found in rabbits. Many studies have found incidence rates of 1.3%-2.6%, The Biology of Laboratory Rabbits report studies finding numbers such as 16 rabbits with cancer out of 599, 4 in 150, 2 from 400 (1). It appears there is a low incidence of uterine cancer in these studies however the rabbits in these studies were juveniles and not considered old enough to be "cancer-prone". TBLR reports that most rabbits used in research colonies are between 4 and 24 months of age. Cancer occurrence in younger populations is normally a low amount.

Harry S. Greene spent years researching cancer in rabbits and his findings are the source of the infamous 80% figures for uterine cancer incidence. He studied a colony for 30 years and his findings reveal a significant incidence of uterine cancer in older does. "Greene reported that 16.7% of 849 female rabbits (dying of various causes) were found to have uterine adenocarcinoma (Greene, 1958a)." (1). When one examines uterine cancer in the age groups we find the incidence increases with age. Greene reported an incidence of 4.2% in does 2-3 years of age and 79.1% in those 5-6 years old. Other researchers have also found similar results in aged rabbits. "Notwithstanding heredity as a factor, the incidence of uterine carcinoma has been noted to exceed 50% in certain colonies of random-bred females kept past age 5- 6 years." (1).

Dr Barbara Deeb DVM in Washington state reported that in her practice among spay surgeries she performed during 1994-1996, she found 9 out of 16 does over 3 years of age with adenocarcinoma (56.3%). In does 1-3 years old it was 6 out of 37 (16.2%), however 9 (24.3%) in that group had endometrial hyperplasia (precursor to uterine cancer). Does under 1 year of age had no occurrence of uterine cancer, but 4 out of 77 had endometrial hyperplasia. (2).

A pet owner on the Petbunny mailing list has been tracking incidence of uterine cancer among house rabbits. She has a survey pet owners fill out and she is keeping records based on it.

The last update appeared in September of 1997, she had records on a total of 209 rabbits with the average age of 2.9 years. The total incidence is 14%, but does over 3 years old have an incidence of 40% (24 out of 60). Does 1-3 years old have an incidence of 3.2%. There were a total of 18 does over 6 years of age and 8 had uterine cancer (44.4%). This information suggests the occurrence of uterine cancer is much greater than many of us have experienced.

Greene also found that reproductive problems occur in the does prior to tumor detection (3). The reproductive disturbances he reports include: diminished fertility, reduced litter sizes and many dead young, retention of litters, abortion, or resorption. In one fourth of the uterine cancer cases cystic breast changes were also observed. He also found that the incidence vary in relation to age, breed, and other constitutional factors (3). "No instance of the tumor occurred in the Belgian or Rex breeds, and the arrangement of breeds in order of increasing incidence stands as follows: Polish, Himalayan, Sable, Beveren, Chinchilla, English, Marten, Dutch, Havana, French Silver, and Tan." (3). Another interesting note from Greene is that crossbred animals had a total of 21.1% incidence while purebreds had 14.2%. The crossbreds were kept because they showed or transmitted "constitutional variations" while the purebreds were considered "normal".

Greene also found that there was a link between pregnancy toxemia and eventual development of uterine cancer (3). Apparently tissue changes and blood chemical alterations were the same in fatal cases of pregnancy toxemia as "mild" cases. All animals experiencing toxemia later developed uterine cancer. This is the link between endometrial hyperplasia and uterine cancer, it always preceded the development of a tumor in the studies. Greene's paper goes on to suggest that liver function is affected by pregnancy toxemia and can last up to a year.

During this time the inability of the liver to suppress estrogen could ultimately result in tumors. As responsible breeders we should be sure to warn any pet owners who buy a rabbit from us that has had a history of problems, they would be at great risk of developing uterine cancer.

Also of interest is that carcinoma of the cervix in rabbits is apparently non-existent. Greene's laboratory searched for it during autopsies of almost 4,000 does over 2 years of age but didn't find a single case (3). Greene says there is an anatomical basis for this.

Although no one has reported "the" incidence of cancer among the general population of rabbits, pet or breeder, we should pay attention to what the studies are showing us. Adams

(1962) made the observation that the incidence of uterine cancer in breeder rabbits and aged virgin rabbits was the same. Many breeders do not keep their does past breeding age and often will not keep does around who have reproduction difficulties, so this may explain why many have not experienced the incidence. I believe there is enough evidence to support the position that there is a significant risk of uterine cancer in older female rabbits. I believe it is our responsibility to inform pet owners of it and to promote spay and neutering of all pet rabbits. In addition to removing any risk of uterine cancer it also provides a behavioral benefit. Many people who abandon a pet rabbit do so because of hormone driven behavior such as spraying, aggression, and mounting, however spay/neuter can often prevent or lessen these problems.

References:

1) The Biology of Laboratory Rabbits 2nd Ed 1994, Manning, Ringler, Newcomer
2) March 1997 Veterinary Conference in CA Rabbit Medicine and Procedures for Practitioners Program and Abstracts "Neoplasia in Rabbits" pg. 171.
3) Adenocarcinoma of the Uterine Fundus In the Rabbit by Harry S. N. Greene pg. 535-542, Annals New York Academy of Sciences.

ADDITIONAL NOTES:

Domestic Rabbits May/June 1991 pub. by ARBA, "Medical and Surgical Care of the Pet Rabbit" by Robert C Clipsham DVM.
The article mentioned that uterine cancer was one of the most common forms of cancer in rabbits. Ovahysterectomy (spaying) was mentioned as preventative care for does not destined for breeding. As a benefit it also helps to lower what the author referred to as "the very high rate of endometritis and endometriosis documented". It was also mentioned that these reproductive disorders account for a lower expected lifespan for rabbits (6 yrs vs a potential of 15 yrs.)

From e-mail conversations with an experienced rabbit vet, I found out he sees an estimated 20% incidence of uterine cancer in his practice and he does most spays at 5 months of age. He also said that he has read several articles that cite incidence rates of between 14%-35%. He also told me that the mortality rate for spay surgeries should be less than 1% and that he has never lost a doe so far. I have read other sources they state a mortality rate should be less than 1%.

The decision to spay or not is up to you but it is important you research all the factors and talk to your veterinarian. I hope you have found the information on my site helpful in your decision. Personally I recommend spaying for pet rabbits because it will eliminate the possibility of your doe having cancer and there is a behavioral benefit. Just be sure you go to an experienced rabbit vet who has a good (or non-existent) mortality rate for the surgery.

Bucky's Bunny Barn
Netherland Dwarfs for pets or show

91 Whitney Dr
Valatie NY 12184

E-mail Ranger18@capital.net
//buckysbunnybarn.homestead.com

If you liked these sections contact me about Bucky Bunny's Guide to Pet Rabbit Care available on CD (req. Microsoft Office Word to view). The information in these pamphlets are from the book.

The Truth About Pine Shavings

By Corinne Fayo

This article has been reviewed by Carol Green a rabbit breeder with a Ph.D. in Pharmacology and Toxicology, her area of research is drug metabolizing enzymes and she has more than 80 publications in the field. She said the article is accurate.

And by a medical doctor & research writer who had studied the HME system for six months. Her comments to me were; "If all the phenols do is to induce some of the microsomal enzymes, that's nothing to be concerned about."

The great pine/cedar debate has been raging on the internet for quite awhile and many people have been mislead about the use of softwood (pine and cedar) bedding for small animals.
Many people have been spreading incorrect, inaccurate information and have misinterpreted several scientific studies. Actually reading the studies and correctly interpreting them reveal there isn't a danger in using softwood bedding for animals. After reading this article you will learn that treated shavings are safe and even recommended by veterinarians, the effects untreated softwood beddings cause is not harmful to the animals, and the claims they cause problems such as liver disease, damage, or cancer are not correct.

Hepatic Microsomal Enzymes (HME)
The real "debate" is over whether or not untreated pine and cedar shavings are a danger. It has been proven that untreated pine and cedar contain an inducing agent of HME activity. HMEs are by-products of the liver after processing drugs. "It is simply the way the body-or more specifically, the liver-handles many of the elements it comes into contact with each day."(20). I was also lucky enough to run into a medical doctor/research writer who had studied the HME system for six months. Her comments to me were; "If all the phenols do is to induce some of the microsomal enzymes, that's nothing to be concerned about." She continued with "I know that there are lots of things that both induce and suppress microsomal enzymes in humans, and it's no big deal except when it causes a concomitantly administered drug to be metabolized differently. When that occurs, all you have to do is to adjust the dose of the drug appropriately." After reading the studies which are most often quoted as providing evidence untreated shavings are harmful I must state I don't see where any demonstrate a danger. What I have learned from the studies about HME is that there are many factors which can affect this sensitive system and cause an increase or decrease in activity (2,3,4). This is a partial list from one study (4): Table 1 list of factors affecting drug disposition: air exchange and composition, barometric pressure, cage design, cedar and other softwood bedding, cleanliness, coprophagia, diet, gravity, handling, humidity, light cycle, noise level, temperature, age, cardiovascular function, castration and hormone replacement, circadian and seasonal variations, dehydration, disease, fever, gastrointestinal function, genetic constitution, hepatic blood flow, malnutrition, starvation, pregnancy, sex, shock, stress..." "Dirty environments should now be added to the growing list of factors that affect the extremely sensitive hepatic microsomal system for metabolizing drugs. Among others, these factors include, age; sex; strain; litter of origin; painful stimuli; ambient temperature; degree of crowding; time of day or season of drug administration; hormonal; nutritional; and physiological status; and type of bedding." (2)

As you can see by the factors listed many things can set off a change in HME activity. Dr Hawley's article also mentioned grapefruit juice can induce HME, as did the medical doctor I spoke to (20). So why are the scientists so concerned by HME and the inducing effects of pine and cedar? Several studies mentioned the problem of getting standardized test results in pharmacological studies (1,2,3,4). "Differences in the capacity of various beddings to induce may partially explain divergent results of studies on drug- metabolizing enzymes." (1) "These experiments offer an explanation for differences in the results of studies on drug-metabolizing enzymes in mice and rats." (1) "These numerous factors contribute to large day-to-day variations that have become a major problem impeding investigation of drug disposition and response in laboratory animals." (4) "These data suggest that commercial bedding materials differ in their ability to affect microsomal enzymes. Thus, interlaboratory variability in basal enzyme activities reported in the literature may be partly due to bedding materials used in animal cages." (19) "Pharmacological and biochemical investigations of hepatic microsomal enzymes (HME) in rodents have been plagued by large day-today variations in control values for these enzyme activities" (4).
It seems HME activity to the scientists is actually a sort of "background noise" in their experiments, but important to note so test results can be accurately interpreted.

Do the scientists feel untreated pine and cedar should not be used in any laboratory? Not from what I have read in the studies. "Rejection of all softwood beddings because they are potent inducers of hepatic microsomal enzymes does not appear justified." (3). However in an effort to standardize certain test results it is suggested untreated softwood not be used (6).
"Softwood beddings have been used, but the use of untreated softwood shavings and chips is contraindicated for some protocols because they can affect animals' metabolism (Vesell 1967, Vesell and others 1973, 1976)." (6).
"White spruce may provide a relatively inexpensive alternative to hardwood for studies that require bedding that does not alter

barbiturate sleeptime" (3). I think the above quotes illustrate that the inducing effect of untreated softwood shavings is important only to the scientific community in the process of studying drugs and their effects. In addition Dr Hawley writes that "Nearly every commercial laboratory today uses pine, cedar, or other hardwood beddings, except when conducting specific drug metabolism studies." (20).

I did come across an interesting result shown in several studies, accumulation of urine and feces which increase ammonia levels cause a decrease in HME activity (2,3,4). Now we all know increasing ammonia levels can cause damage in our animals. It has been associated with causing increased susceptibility to Pasturella infections and respiratory damage. "The present experiments reveal that drug metabolism in hepatic microsomes was inhibited when urine and feces of rodents were not removed twice daily but permitted to accumulate for 1 week. Inhibition of drug metabolism in rats kept under these conditions may arise from hepatic toxicity due to increased concentrations of ammonia (5) in such environments." (2). May I also point out that I have yet to find in a study a reference to pine or cedar causing hepatic toxicity. Dr Hawley also points out that the presence of these enzymes do not suggest there is damage to the liver (20).

I also found another study which reported that oral administration of praziquantel at a dosage of 1600 mg/kg and 2000 mg/kg caused a significant decrease in 3 drug-metabolizing hepatic enzymes (16). The rabbits who received the dosage of 2000 mg/kg all died within 10-20 hours. In another study rabbits were given aflatoxin to see the effects it would have on liver enzymes (17). None died but body weight gain was altered and again a decrease was noted in some HME, "Biochemical exploration of plasma components revealed a dose-dependent hepatotoxicity characterized by cytolysis and cholestasis." (17). And finally in a study comparing the activity of HME in rats given single or repetitive fluke infections HME decreases were noted (18). Given this evidence I can't come to the conclusion that increased HME activity is a sign of harm being done to a small animal.

Pet owners also argue that untreated cedar and pine cause shortened barbiturate sleeptimes and that would be harmful for an animal undergoing surgery. The increased HME activity does shorten barbiturate sleeptimes in the studies (1,2,3,4) but note that the scientists were testing for this, not performing surgery. The studies have found that sleeptimes were shortest for cedar shavings compared to the softwoods (3,19). There were also differences among different types of pine bedding with white spruce not significantly different than hardwoods but longer than white pine (3). "In other studies, mice kept on pine beddings exhibited hexobarbital sleeptimes intermediate between those of mice kept on red cedar or Douglas Fir (9), and intermediate between mice kept on red cedar or ground corn cobs (10)." (3). Heat treated pine shavings have been shown not to alter sleeptime in comparison to control animals (19).

But does any of the above really affect us and our pets? I don't believe so, there are many factors which affect HME and therefore barbiturate sleeptime (2,3,4,). A study also found increased ammonia levels alter sleeptime and that lowering the room temperature lengthens sleeptime (3). The same study also showed that two different strains of mice studied had significantly different sleeptimes. Also consider this quote "No alteration in the hexobarbital concentration in the brain at the time of restoration of the righting response occurred on any of the softwood beddings tested." (1). "While sleeptimes are decreasing and the microsomal enzyme activity is increasing, the amounts of hexobarbital in the brain on awakening remain unaltered in mice put on softwood bedding; thus, the responsiveness of the receptor sites seems unaffected by softwood bedding." (1). I have not been able to find any scientific references or entries in veterinary books warning of a danger in regard to surgery when animals are exposed to softwood shavings. If altered barbiturate sleeptimes due to softwood exposure were critical during surgery I would think there would be a warning about it.

I also found an interesting section in the Harkness and Wagner book relating to injectable anesthetics in rats. It is stated that sodium pentobarbitol used in rats "poses considerable risk" (7) pg.109. "Pentobaribitol also has poor analgesic properties in rats and produces profound hypothermia and causes excitement on induction (Wixson et al., 1987a,c,d). The young, the females, cooled animals, and possibly the albinos are more susceptible to the drug, whereas males, animals receiving low caloric diets, and animals on cedar bedding are more resistant." (7) Pg 109. The same book also states pentobarbital is not recommend for rabbits.

Heat Treated Shavings

Heat treated pine shavings are fine for use as bedding and litter for small animals including rabbits. The first piece of evidence is the fact that many people have been using pine shavings for years without any ill effect to their rabbit(s). The next pieces are what the veterinary books and others have to say about the use of shavings for litter. Harkness and Wagner Pg 61:

"Bedding, which may be paper, sawdust, or soft pine, aspen, or cedar shavings should be nonallergenic, dust free, inedible, absorbent, nontoxic, and free of pathogenic organisms. Soft pine and cedar wood shavings are used for pet rodent bedding because of their pleasant aroma. However, because volatile

hydrocarbons from these shavings may stimulate microsomal enzymes, they are avoided as bedding material for research animals. Softwood shavings and tissue paper make excellent rodent nesting material" (7) TBLR Pg 29 "Bedding must be used in nest boxes. It may be straw, hay, excelsior, wood shavings, or other such material." (8). Hillyer and Quesenberry pg 292 small rodent section: "Pine shavings remain the most commonly used bedding for small pet rodents in many parts of North America. Corncob products and recycled paper products are excellent for certain rodents such as gerbils and dwarf hamsters. Cedar shavings also are popular but their use is controversial. Cedar has been shown to affect microsomal oxidative liver enzymes. Although these changes affect factors such as drug metabolism, no clinical signs associated with them have been documented." (10) Rabbit Production Pg 90 "The nest box should ...contain bedding of hay, straw, shavings, or similar material." Pg 93 "If the does are being fed a ration consisting only of pellets, they may eat any palatable material used for bedding, and in this case softwood shavings...may be used" (9) If the use of softwood bedding was dangerous why on earth would any of these books mention it as good bedding material. All of these books are recent publications and the studies many cite showing a "danger" were published closer to 30 years ago.

Finally we have evidence treated pine is safe from the scientific studies pet owners often quote from (1,3,4,19). The process of heat treating removes the HME inducing agent as demonstrated in the above mentioned studies. It is also mentioned in the National Institute of Health guide to Laboratory animals "Heat treatments applied before bedding materials are used to reduce the concentration of aromatic hydrocarbons" (6). "By two different experimental approaches Wade et al. (47) showed that cedrol and cedrene were active agents in the inductive response of mice to cedarwood bedding. In the first experiment cedar shavings from which cedrol and cedrene had been extracted...produced hexobarbital sleeping times indistinguishable from those observed in control mice housed on inert corncob bedding." (4). I also offer this quote from an HRS educator I wrote to "There are some shavings which are safe, and these are the kiln-dried pine."

I have also heard the rumor cedar causes cancer. I found three studies (11,12,13) and none of them came to the conclusion cedar bedding caused or contributed to the occurrence of cancer. "From these results, the high incidence of cancer in the C3H-AvyfB strain could not be attributed to the routine use of cedar shavings in the bedding material." (11). "Hepatoma incidence in males at 18 months of age was not affected by the presence or absence of cedar shavings in the bedding " (12). "There was no evidence that the cedar shavings were carcinogenic." (13).

Sorting Through Rumors

The arguments presented by those against softwood bedding often sound convincing on the surface, however closer inspection reveals discrepancies. For example the HRS has made statements that softwood bedding has caused liver disease in rabbits they have fostered and caused the death of rabbits during surgery. I have read the article by HRS founder Marinell Harriman, "Litterboxes and Liver Disease" and question her conclusions. Apparently HRS began investigating softwood bedding after one rabbit died during a routine spay surgery. They maintain that rabbits housed on pine or cedar may risk death during surgery, however they also have made statements that they have not lost many rabbits during spays or neuters. They stopped using softwood bedding after Sarah the rabbit died in 1989 so prior to her death they must not have had problems with surgery on other rabbits exposed to softwood. The article also discussed several foster rabbits had elevated liver enzymes and some had liver disease. Dr Hawley points out that the enzymes tested by veterinarians in a serum or plasma chemistry panel are "leakage enzymes" and not the same enzymes the researchers studied in the softwood bedding experiments (20).

So what could explain the liver disease in the HRS foster rabbits? I checked into liver disease in rabbits, there is very little about it but what I did find is hepatic coccidiosis, which causes an enlarged liver and it is contagious (7,8,9). I would assume the HRS members had adopted the rabbits that had liver disease so it is possible that the rabbits were exposed to hepatic coccidiosis, I feel it is a pretty big leap to assume untreated shavings caused their deaths. From TBLR: Pg 206 long section on hepatic coccidiosis, clinical signs included enlarged liver. pg
267: Liver cancer: "The tumor appears to have little potential as a research model, primarily because of the difficulty of case findings." (8). The common causes of liver spots in rabbits are hepatic coccidiosis, migrating tapeworm larvae, Tyzzer's disease, and colibacillosis (7). So there doesn't seem to be any evidence linking untreated softwoods to liver disease or other problems in rabbits.

Another opponent of softwood bedding is Debbie "The Rat Lady" Ducommun who wrote a long article pointing out the "dangers" of softwood bedding. She stated "Because of the toxic effects of softwood shavings, laboratories have pretty much stopped using them for their animals." Well as we now know this is not the reason some labs would not use them. Also where is the evidence that their effect is toxic? The liver disease connection was also brought up and she stated "unless these animals [rabbits housed on softwood] received full autopsies at death with no sign of enlarged livers or liver disfunction, respiratory infection, or altered immune system, how can they claim

that the pine or cedar did not affect them?" I submit that even with a full autopsy how can you tell softwood did, afterall the animal died of something so we would expect to see problems. An enlarged liver is a sign of hepatic coccidiosis (8) so that can't be used as proof. And we know there are other causes of respiratory infection and other things that can alter the immune system. Also obesity can cause elevated liver enzymes and contribute to problems. An autopsy showing the above problems would not be proof that softwood bedding or HME induction caused liver damage.

I think there has been too much "interpreting" of scientific studies and that is what is causing the great pine/cedar scare. As an example let's look at chloroform. If you have municipal water then you and your animals are being exposed to chloroform. Is this harmful? What do the studies say, "Present in the water supplies of many of our cities in concentrations reaching 311ug/1, according to the Environmental Protection Agency, chloroform has also been identified as a contaminant of the air. Thus chloroform can gain entry and accumulate in organisms by both the oral and inhalational routes. From the point of view of this symposium, the question of the effects on laboratory animals of environmental exposure to chloroform is raised.
Chloroform is toxic to both the liver and kidney of laboratory animals (12), liver tumors arising after chronic chloroform administration (13)." (4).

It looks like it is, and if you have been giving your animals municipal water you are killing them! Make sure you get a full autopsy done after they die and check for liver and kidney damage as well as respiratory problems to "prove" the chloroform was the cause. Oh wait a minute the study says a little more, "Chloroform is only one of a large number of newly identified environmental pollutants to which laboratory animals are being continuously exposed: continuous exposure of laboratory animals to chloroform, as well as to many other environmental pollutants, could affect the responsiveness of these animals under a wide range of experimental conditions." (4). Well I guess the scientists weren't warning us of the dangers of using municipal water afterall, just discussing how it could affect experimental data.

We and our animals are exposed continually to different "pollutants" in our environment, what matters is the health of an individual and the concentration of pollutants they are exposed to. Some chemicals in small concentrations are harmless but in larger doses are lethal. An example of this is benzoic acid in Listerine. Benzoic acid is toxic if ingested in large enough quantities, the amount in Listerine is well below that amount and therefore is safe for use in humans. It is important not to over-interpret what scientific studies are showing us.

In closing I just want to say I still have not read, experienced, or heard anything that leads me to believe the use of pine shavings are harmful to rabbits. What I have read and experienced shows me they are safe. I still won't use cedar because in the past I heard it could be toxic for a rabbit if they ingest too much of it, plus it has a very strong odor. I included many quotes in this article so you are able to read exactly what the scientists have discovered about softwood bedding and the effects on HME. If one closely looks at the evidence offered that pine shavings are harmful you will see the arguments are weak and lack evidence. Dr Hawley reports pet retailers are being subjected to anger from animal rights advocates who accuse them of selling "dangerous" bedding material (20). It's too bad these people didn't first read the studies instead of subscribing to the "I heard it was bad, so it must be true" theory. But those of you reading this now know more than you ever wanted to about softwood shavings and HME!

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“We sell lots of pine and cedar to be used as small animal bedding and have never had a report of anyone's animal getting ill as a result!”
-Howard
McMurrian, President GEM Shavings & Sawdust Co.