Information Resources on the Care and Welfare of Rabbits

AWIC Resource Series No. 31

September 2005

Updates: Housing, Husbandry, and Welfare of Rabbits, 1994

Photo courtesy of the National Institutes of Health.

Compiled and edited by:

Cynthia P. Smith, M.S.
Animal Welfare Information Center
National Agricultural Library
U.S. Department of Agriculture

Published by:
Contents

- Acknowledgments

- How to Use this Document

- Request Library Materials

- Animal Welfare Concerns for Companion and Laboratory Rabbits
  by Anna Meredith

- Animal Welfare Issues for Commercial Rabbit Producers
  by James McNitt, Ph.D. and Janice Swanson, Ph.D.

- Bibliography

These sections should be of interest to researchers, graduate students, extension specialists, and veterinarians. Citations were selected from scientific journals, texts, and proceedings from the years 1994-2005.

- Anesthesia and Analgesia
- Animal Models
- Behavior
- Breeding
- Environmental Enrichment
- Feeding
- General Information
- Health
- Housing
- Laboratory and Clinical Techniques
- Production
- Reproduction
Acknowledgments

The editor gratefully acknowledges Anna Meredith MA VetMB CertLAS CertZooMed MRCVS for her expert review and written introduction to this publication. Her understanding of the needs and current issues regarding the care and welfare of companion rabbits, laboratory rabbits, and rabbits in zoological settings is appreciated. The editor would also like to acknowledge the written contributions of James McNitt, PhD and Janice Swanson, PhD in the area of rabbits used for commercial purposes. Their thorough and thoughtful review of the current literature outlining key areas of concern for the welfare of rabbits raised for production and sale purposes, should provide important information for researchers, production specialists and others.

Special thanks to D'Anna Jensen for the cover design, final editing, formatting, and printing of this publication. Her role in guiding this publication to completion is greatly appreciated.

About this Document

This publication is divided into three major sections: Introduction, Bibliography, and Web Site Resources. A section containing National Agricultural Library Document Delivery Information for U.S. and foreign patrons follows these sections.

Introduction

Two articles written by world experts outlining current issues regarding the care and welfare of companion rabbits, laboratory rabbits, and rabbits raised for commercial purposes are presented.

Bibliography

An extensive bibliography categorized into twelve subject subsections covering all aspects of rabbit care, husbandry, health, and welfare comprise this section of the publication. Citations were selected from searches conducted using a variety of agricultural, medical, and life science databases. Within a subject category citations are arranged alphabetically according to the last name of the primary author. Each citation is listed with a set of keywords that describe useful information about the entry. If a citation is listed from a publication available through the National Agricultural Library (NAL) the NAL call number has been included. Entries were included with publication dates ranging from 1994-2005.

Web Site Resources

Over thirty annotated web site resources relating to the care, welfare, and housing of rabbits are listed. It should be noted that the recommendations on the proper care of rabbits vary widely depending on many factors including what breed, type of housing, and for what purpose the rabbits are kept. The sites include rabbit care and welfare information for companion, commercial, and laboratory rabbits. Resources selected cover: breeds, breeding, housing, health, nutrition, general husbandry and more. All resources are accessible through the internet and are current as of August 2006. Readers are cautioned as to the dynamic nature of the internet and the fact that addresses and content are subject to change.

National Agricultural Library Document Delivery

This section provides information on how to request materials that are included in the collection of the National Agricultural Library (NAL). Please read carefully as there are certain restrictions on media and document types.

All patrons are encouraged to explore local library resources first before contacting the National Agricultural Library. For more details, see http://www.nal.usda.gov/borrow-materials.
Animal Welfare Concerns for Companion and Laboratory Rabbits

by M. Anna Meredith, VetMB, CertLAS, CertZooMed, MRCVS

Head of Exotic Animal Service, Royal (Dick) School of Veterinary Studies
University of Edinburgh, Hospital for Small Animals
Easter Bush Veterinary Centre, Roslin
Midlothian EH25 9RG

The relationship between rabbits and man goes back over 3,000 years and they are used for food, fur, sport, research and as companion animals. Rabbits are increasing in popularity as pets, and in the UK are the third most popular mammalian pet after cats and dogs (Pet Food Manufacturer's Association 2002). Although traditionally a children's pet, rabbits are now more commonly kept by adults as a true companion animal in the home, taking the place of cats and dogs. There is a plethora of information sources for owners about companion rabbits, on the internet and in publications, and understanding of basic husbandry requirements has increased in recent years. Expectations for high quality veterinary care and the availability of pet insurance for rabbits in the UK, has lead to great improvements in medical and surgical care of many animals. However, there are still many welfare issues present, especially regarding diet and its effect on dental and gastrointestinal health, housing and behavioral problems. The number of unwanted companion rabbits rescued by welfare organisations is still high, with owners purchasing young animals on impulse, especially at Easter time, with scant regard to their requirements and the cost of veterinary care, or the behavioral changes that can occur at puberty if animals are not neutered.

The use of laboratory rabbits is generally decreasing and is low compared to the use of rodents. In 2002 the Home Office in the UK recorded 30,280 scientific procedures on rabbits, compared to over 2.2 million procedures on rats and mice (Home Office 2003). Strict legislation controls the welfare of laboratory rabbits in the UK and many other countries. The main welfare issues are that of housing and social requirements, the refinement of laboratory techniques such as anaesthesia and antibody production, and the assessment and alleviation of pain.

The update of this bibliography on Housing, Husbandry and Welfare of Rabbits reflects the enormous advances that have been made over the past decade in our knowledge and understanding of rabbit physiology and behavior, and will be an invaluable tool to veterinarians, researchers, animal technicians and all who work with this fascinating species. This introduction will largely reflect the author's opinion and experience of both companion and laboratory rabbits in the UK.

Housing

Rabbits are highly social animals with complex social behavior based largely on scent. Comparative studies of domesticated rabbits living in groups in large enclosures have shown they retain the full behavioral repertoire of their wild counterparts (Bell 1984). Housing for laboratory rabbits has generally improved greatly over the last decade, with group housing and environmental enrichment now the norm rather than the exception in many laboratories, and several guidelines on best practice for housing are available (Hubrecht 1999, 2000; Stauffacher 2000; Second Report of the BVAAWF/FRAME/RSPCA/UFAW Joint Working Group on Refinement). It is generally accepted that housing rabbits in pairs or groups, preferably in floor pens, can significantly improve their physical and psychological welfare. The
welfare issues for singly housed rabbits are well known, and manifest mainly as stereotypic behavior, such as:

- rhythmic biting of water bottles
- biting, chewing or licking of bars food hoppers, walls and floor
- pawing or digging in the corner
- excessive fur pulling
- rapid circling
- head swaying/weaving and vertical sliding of nose between bars.

Permanently caged animals are also prone to osteoporosis due to inactivity (Claes and Burri 1979), and obesity. Rabbits housed in social groups benefit from both social interactions and exercise, and abnormal behaviors are greatly reduced (Love 1994; Batchelor 1995; Krohn 1999). Rabbits are commonly used for antisera production in laboratories and concerns that stress effects on both high and low-ranking group-housed rabbits may affect immune function have not been proven (Turner et al. 1997), leading to little justification for single housing for this purpose. In addition, health problems such as rhinitis and sinusitis (Asnuffles@) may be reduced, due to better ventilation and reduction in exposure to high ammonia concentrations (Love and Hammond 1991). Group housing can lead to problems such as aggression and stress if the group is unstable, and great care must be taken to ensure that groups are compatible. Intact males in particular are prone to fighting and there are differing opinions on the justification of using surgical neutering to manage this. However, from all the research to date, the benefits of group housing in terms of animal welfare far outweigh any disadvantages and should be used wherever possible. Furthermore, the improvements in physiological and psychological health should result in more physiologically normal experimental models, which may lead to a reduction in the numbers needed in research.

The sense of smell is very important to rabbits and complex information concerning social interactions relating to sex, hierarchy, and mother/infant relationships is communicated via this route (Bell 1986). For this reason the use of strong smelling substrates such as wood shavings should be avoided and partial rather than total cleaning out is preferable to retain a sense of security. Experiments have shown that that rabbits choose straw or shredded paper as a substrate in preference to wood shavings (Turner et al. 1992), and the strong smell of the latter may influence this preference.

Studies have also shown that environmental enrichment has great psychological benefits, especially for singly housed animals (Lidfors 1997). The provision of shelves or boxes to give an area of raised height seems to be particularly beneficial (Hansen 2000; Gerson 2000). The provision of hay has both behavioral (Berthelsen 1999) and health benefits (see below).

For companion rabbits, few guidelines exist, and inappropriate housing can still cause welfare issues, often due simply to owner ignorance or misinformation. The hutch sold in the majority of pet shops are far too small for rabbits to fulfil even basic behavioral requirements such as standing erect on the hind legs and the ability to hop. Rabbits should be kept with a companion wherever possible and allowed regular access to an exercise area. The ability to graze in an outdoor pen has benefits both in terms of exercise and dietary health. House rabbits generally benefit from more interaction with the owner than those kept in hutches, and are usually allowed to roam free in the house. However, chewing of household objects can lead to problems such as electrical burns from cables and gastrointestinal obstruction from ingestion of materials such as carpet. Therefore rabbits should not be left unsupervised and have a safe cage area for confinement when necessary.

**Feeding**

Feeding an appropriate diet to a companion rabbit is probably the single most important factor in maintaining its health. There is a great deal of literature relating to the nutrient requirements of production and laboratory rabbits, but relatively little relating specifically to the companion rabbit. Companion rabbits have the potential for a much longer life span than the short-lived production or experimental rabbit. Many of the diseases commonly seen in pet rabbits can be directly attributed to, or associated with, the feeding of an inappropriate diet and could be largely preventable.

Rabbits are adapted in terms of their teeth and digestive system to eat an herbaceous diet that is high in fiber, low in fat,
and low in starchy carbohydrates. However, rabbits are commonly fed low fiber and high carbohydrate diets, which are linked to:

**Dental disease**
Rabbit teeth grow constantly throughout life. Rabbits on a high carbohydrate and low fiber diet have reduced tooth wear and therefore elongation of the tooth both above and below the gum. This results in irregular wear, distortion and the formation of sharp painful spikes. Severe elongation of the cheek teeth can prevent the mouth from closing fully, which ultimately prevents the incisors meeting properly, causing them to also overgrow. Overgrown distorted teeth are predisposed to infection and the development of facial abscesses. High carbohydrate diets and reduced wear also predispose to caries (cavities).

Opinions vary on the significance of dietary calcium levels on dental disease. Many rabbits are selective eaters of coarse mix, favouring items low in calcium and fiber. This may make them prone to osteoporosis and poor tooth and bone quality. Bone growth, development and maintenance are also dependent on the mechanical stresses to which it is subjected. Rabbits, which do not spend prolonged periods grinding fibrous food, can also show poor jawbone quality.

Not all dental disease is due to diet, and genetic factors are also important. A congenital malocclusion of the teeth, particularly in extreme dwarf and lop breeds, can also be a significant factor. This can have major welfare implications, as affected animals will need incisor trimming at regular intervals. The use of clippers to cut teeth is painful and can result in microfractures of the enamel, loosening of the teeth, exposure of pulp and dental infection (Meredith and Crossley 2000). Burring of the teeth or complete removal of maloccluded incisors is therefore recommended.

**Gastrointestinal disease**
Fiber is critical to the rabbit for gastrointestinal health because it stimulates and maintains normal motility of the gut. Low fiber diets predispose to gut stasis and the formation of hairballs. High starch diets can be incompletely digested due to the rapid gut transit times, and cause a rapid overgrowth in caecal bacteria. This can lead to enterotoxaemia and fatal diarrhoea. This is seen mainly in young, recently weaned rabbits when also fed minimal hay, and combined with the stress of a change of diet and a recent move, for example from a breeder to a pet-shop (Brown 1997; Bennegadi 2001).

**Behavioral problems**
Rabbits in the wild spend many hours a day eating. Low fiber concentrate diets are rapidly eaten and rabbits can develop vices related to boredom, such as increased aggression or repetitive bar biting. Lack of fiber can also lead to fur chewing and barbering.

**Obesity**
The feeding of ad libitum concentrate diets in both laboratory and companion rabbits is a common cause of obesity. This can predispose to serious health problems including arthritis, osteoporosis, faecal retention around the perineum, urine scalding, flystrike and metabolic disease.

The best diet for rabbits is one that mimics as closely as possible their natural grass-based diet in the wild. The bulk of the diet of the pet rabbit should consist of grass (fresh or freeze-dried) and/or good quality meadow/Timothy hay, and this should be available at all times. Education of rabbit owners and laboratory staff is the crucial to improve rabbit welfare by means of dietary improvement. Pet shops and veterinarians, welfare organisations and the media can play a key role in achieving this relatively simple measure, that will have a major influence on rabbit health.

**Neutering**
Surgical neutering of laboratory rabbits is generally not undertaken, although it is used in some long-term situations to prevent aggression in group housed males. In companion rabbits, neutering is generally recommended. Unbred does are
particularly prone to developing uterine adenocarcinoma, and the use of neutering as prevention is recommended. Neutering of both sexes will also prevent many behavioral problems such as territorial aggression and urine spraying that can result in animals becoming unwanted or sent to rescue organisations. The ethical arguments for and against the use of surgical intervention to prevent these problems divides opinion, but the welfare implications of an animal being neglected or abandoned must be borne in mind. It is generally recognised that a neutered female and a neutered male make the most stable social combination for companion rabbits.

**Behavioral Problems**

In both companion and laboratory rabbits individual housing, a barren environment and a concentrated, low fiber diet can lead to behavioral problems such as stereotypic behavior and aggression. Normal territorial behavior, especially in does on reaching sexual maturity, can manifest as cage guarding and biting when approached. Aggression can also be a learned behavior and a common cause is incorrect handling--the rabbit that is picked up in an insecure manner rapidly learns that if it bites the handler it will be put down. Pain is another important cause of aggression, especially in a previously tractable animal. Many behaviors seen as problems by the owner are in fact normal, such as digging, chewing and territorial marking with urine. Advice for behavioral problems is increasingly sought by rabbit owners from both veterinary surgeons and animal behavior counselors (McBride and Wickens 1997; Scott 2001).

**Veterinary Care and Preventive Medicine**

Many rabbit diseases are preventable (see Diet above) and a routine preventive medicine programme should be instituted to include dietary and husbandry advice, routine veterinary examination (Antinoff 1999) and, where appropriate, neutering and vaccination against Myxomatosis and Viral Haemorrhagic Disease. Outdoor rabbits are particularly prone to myiasis (flystrike) in summer months and should be checked regularly.

**Anesthesia and Analgesia**

Rabbits are particularly prone to stress on handling, and sedation or anaesthesia is frequently required for both minor and major veterinary or experimental procedures. Anaesthesia in rabbits is still judged as a relatively high risk procedure, with figures of up to 30% mortality reported (Kramer 1998). Provision of sedation or anaesthesia is an important welfare issue, but can in itself be a source of stress. In particular the use of volatile agents such as isoflurane, sevoflurane and desflurane for induction has been shown to be aversive and result in struggling and apnoea (Flecknell et al. 1999, Hedenqvist et al. 2001). Significant improvements in anaesthetic techniques have been made in the past decade or so, particularly the use of balanced anaesthetic regimes using a combination of agents in order to minimise unwanted side effects, such as medetomidine or xylazine, ketamine and butorphanol with supplementary oxygen (Borkowski and Zaras 1999; Meredith and Crossley 2000). Better peri-operative care, such as maintenance of body temperature, analgesia, fluid therapy, and gastrointestinal support plays a major role in decreasing anaesthetic complications and mortality.

**References**


---

Return to Top

Return to Contents
Commercial rabbit production includes the production of meat, pelts, and wool and the production of live animals for breeding and laboratory stock and for pets.

In the United States, a large number of people involved with rabbits are fanciers-- people who raise rabbits for show purposes. Although this group may not directly seek advice from an Extension agent, they may serve as a source of information and assistance. The American Rabbit Breeders Association, Inc., is one group that deals with many aspects of rabbit production. They set standards of perfection for judging and sponsor a variety of events for rabbit enthusiasts. The Professional Rabbit Meat Association is comprised of rabbit growers producing rabbits for meat and sponsor a newsletter and computer network to provide mutual assistance.

The "Easter Bunny Syndrome" makes commercial rabbit producers particularly vulnerable to criticism. Rabbits are naturally "cute" and possess physical attributes that attract the affection of most people. The production of rabbits as a source of fur has been addressed by animal protection groups (People for the Ethical Treatment of Animals and other groups).

As animal protection actions and concerns continue to rise with regard to the acceptability of standard husbandry practices, people involved in the production and use of rabbits need to be aware of potential problem areas. Several commercial production practices may be targeted as welfare concerns:

- confinement rearing
- post-partum breeding
- wool harvesting methods
- fur production
- transport
- slaughter
- sales

Confinement Rearing
Controversy over the confinement rearing of social species of livestock (calves, poultry, swine) has been a primary welfare issue. Although little attention has been focused on rabbits, it is reasonable to assume that the same complaints of space restriction and social deprivation are tenable. Rabbits are usually caged in groups before sexual maturity and individually as adults. Most fryers (young rabbits harvested for meat), are group-raised littermates. Fryers are marketed at a target age of 56 days but may not attain market weight until 70 days. Commercial rabbit producers house rabbits in caging systems with cage sizes adjusted for breed of rabbit, management system, and intended purpose (e.g., breeding adults vs. laboratory stock). Because of the ventilation problems inherent in multi-deck caging systems, most large rabbitries have a single deck of cages. In the U.S., water is usually provided by an automatic watering system, and food is hand-distributed to each cage (Cheeke, 1987; McNitt, et al., 2000).

Possible welfare concerns may include social deprivation (in the case of singly housed adult breeders), cage sizes and floor types, and stocking densities of group-raised market animals. Adult rabbits generally are not housed in groups. Because of the rabbit's territorial nature, each cage is regarded as an individual's own territory by both sexes. Scent marking occurs, and if other rabbits are introduced, fighting is prevalent (Harkness, 1988; Lukefahr, et al., 2004). Studies have been undertaken in Europe to develop housing systems for breeding groups (Stauffacher, 1986; Dal Bosco, et al., 2004). A 3-year study in Canada indicated that rabbits could be successfully group housed on the floor in a facility with smooth concrete floors and epoxy-treated block walls. The rabbits were grouped at 8 to 9 weeks of age. Grouping older rabbits required the use of tranquilizers or castration to avoid fighting (Love and Hammond, 1991). A New Zealand study reported that group-housed does have a significantly lower proportion of young alive at 21 days postpartum than does individually housed in boxes (Muller and Brummer, 1991). However, further study is needed to assess whether well-being is compromised for certain group members and the overall impact on production.

Work has been carried out to determine the effects of environmental enrichment on rabbit performance. This generally has been positive and enrichment objects introduced into the cages have caused stimulation and increased activity (Huls, et al., 1991; Brooks, et al., 1993; Lopez, et al., 2004; Verga, et al., 2004) but enrichment has not been shown to affect performance (Maertens, et al., 2004; Verga, et al., 2004) although enrichment objects may increase mortality (Mirabito, et al., 2000). Enrichment objects have included wooden dowels, wooden rings, a brass wire ball, hay or straw and empty aluminum beverage cans. Huls, et al. (1991) and Brooks, et al. (1993) provided PVC "tunnels" between two cages so the adult female rabbits could be apart or together. Given such a choice, the rabbits spent 90% of their time together. Finzi, et al. (2000) housed rabbits in units that provided the choice of an exposed cage, an underground cage, or the tube connecting the two. There were no differences in preference among areas and the behavior was not affected by season or reproductive status. Orova, et al. (2004) found that growing rabbits preferred wire net floors rather than deep litter at normal temperatures (16-18EC). A two tier cage provides spatial enrichment without increasing floor space requirement (Finzi, et al., 1996). Margait and Finzi (2000) reported that most of the feeding and drinking occurred on the lower level but there was no statistically significant difference because of the large variation among does.

Studies have also shown that environmental enrichment has great psychological benefits, especially for singly housed animals (Lidfors, 1997). The provision of shelves or boxes to give an area of raised height seems to be particularly beneficial (Hansen, 2000; Gerson, 2000). The provision of hay has both behavioral (Berthelsen, 1999) and health benefits (see below).

In market rabbits, stocking densities have been studied to determine the effect of rabbit density on growth and consumption parameters. High stocking densities may result in rabbits reaching slaughter weights 3 to 5 days later than rabbits housed at lower densities (Maertens and DeGroote, 1984). Singly housed control animals reached slaughter weight an average of 1 week earlier than group-raised rabbits. Fur-plucking and ear-biting were behavioral manifestations attributed to overcrowding. Several studies showed no consistent difference in rate of gain, feed efficiency, and mortality when rabbits were stocked at densities of 930, 465, and 310 cm2 per rabbit in either conventional or large pens (Lukefahr, et al., 1980; Harris, et al., 1981; Prawirodigdo, et al., 1985). Hamilton and Lukefahr (1993) found no significant mean differences in feed intake, feed efficiency, survival rate and uniformity of final weight for rabbits housed at 929, 465 or 310 cm2 per rabbit although the rabbits in the first group had better numerical means for all four traits.
European studies have produced similar results. One study found that 500 cm$^2$ per animal gave the best overall performance results (Ferriera, 1984), while another reported that densities of 583 and 700 cm$^2$ per animal were detrimental (Petersen, et al., 1988). Studies in France have indicated that there are reduced social interactions and locomotory activities with less than about 650 cm$^2$ per animal. It was reported however that even at high densities aggressive encounters were uncommon and mixed sex housing did not result in major problems (Morisse and Maurice, 1996). Similarly, Bell and Bray (1984) found that the sex composition of rearing groups had little effect on weight gain, feed intake or mortality from 30-93 days of age. The incidence of injuries in male rabbits 60 to 80 days of age increased significantly as the size of the group increased from 15 or less to 16-30 or over 40 animals (Bigler and Ester, 1996).

Matics, et al. (2004b) reported that younger rabbits prefer a higher density and, given a choice, will select a more densely occupied area. This has led to the suggestion that younger rabbits (21-42 d) should be housed at a high density and then at a lower density for the finishing period (Matics, et al., 2004a). This housing method reduced mortality among the rabbits (Rashwan, et al., 2004).

In recent years, advocacy of "free-range" systems as an alternative to confinement rearing has become a popular topic in the animal welfare and sustainable agriculture arenas. Some concern has also been raised that wire floors are not a suitable substrate for rabbits and may result in increased incidence of ulcerative pododermatitis (sore hocks) (Drescher, 1992; Drescher and Schlender-Bobbis, 1996). Rommers and Meijerhof (1996) compared several alternative floors for cages. These included slats and several configurations of synthetic meshes. Most resulted in less footpad injuries than wire floors but did not influence the production of the does. Trocino, et al. (2004) found that there was no difference in production rates of rabbits on slatted or wire net floors. Because of the increased expense of the alternative floors, production costs were increased and profits reduced. A study that compared cage-reared to floor-reared meat rabbits found that production performance of rabbits was similar between the two housing systems up to 70 days of age. After 70 days, stocking density became an important factor (Crimella, et al., 1988). Lambertini, et al. (2001) and Metzger, et al. (2003) found that mortality was higher for rabbits reared on litter and that the caged rabbits had higher weight gain, feed efficiency, carcass weight and dressing percentage. A concern is the spread of coccidiosis in floor-reared rabbits.

Finishing fryer rabbits in pens on grass that were moved to a new site each day resulted in slower growth rates and lower carcass and kidney fat weights and required more labor than rabbits finished in cages. This system might be profitable in those cases where the consumer is willing to pay extra for a grass finished product (McNitt, et al., 2003).

Future research that focuses on different production philosophies and their companion systems can help to elucidate the benefits of each system to both humans and animals (Harkness, 1988; Lukefahr, et al., 2004).

**Post-Partum Breeding**

Post-partum breeding is a common practice among rabbit producers in Europe (Camps, 1983). After kindling, does are re-bred within 48 hours. This practice has been condemned by animal protection groups despite the fact that wild rabbits re-breed in the same manner (Lockley, 1954; Harkness, 1988). One British publication does not recommend re-breeding until 3 to 7 days post-partum on welfare grounds (King, 1988). In the United States the majority of producers re-breed at 14 or 35 days post-partum. There is no direct advantage in re-breeding at 1 day versus 14 days post-partum in terms of the total number of kits weaned (Harris, et al., 1982).

**Wool Harvesting**

Wool harvesting practices also have the potential to become an issue. Angora rabbits grow a low-density fine fiber that produces light-weight warm garments. Wool harvesting can be accomplished by shearing or plucking (Schlolaut, 1987; Kilfoyle and Samson, 1988). Some countries have banned the plucking of wool on the grounds of cruelty. Plucking, when done properly, involves the testing and removal of loose hair, preferably during molt. However, some types of Angora rabbits (e.g., German Angora) do not molt readily and should not be plucked (McNitt, et al., 2000). Theoretically, plucking removes only the longest fibers and leaves the undercoat to protect the rabbit. It does, however, damage the follicles and change the composition of the coat, thereby reducing the lifetime wool yield (Schlolaut, 1987;
Kilfoyle and Samson, 1988).

Shearing is more widely practiced in the United States. Proper handling and methods of restraint should be utilized to ensure protection from nicks and cuts during the process. Other welfare considerations include protection from temperature extremes. Rabbits should have from 1/4 to 1/2 inch of wool left on the body and should not be sheared or plucked during particularly cold months. When temperatures drop to 35°F or less, rabbits should be provided with warm quarters and a nest box until the wool has reached at least 1 inch in length (Vermorel, 1988; Vernet, 1988).

Fur Production

The fur industry has been under attack by animal activists for several years, with a dramatic escalation in the past 5 years. Ethical and welfare arguments have been advanced with regard to the necessity for fur garments and the methods used to capture wild fur-bearing animals or to produce and euthanize ranched species (Nilsson, et al., 1980; Commission of the European Communities, 1991). In the United States, few rabbits are commercially grown specifically for their pelts. Most rabbits raised for pelts are of the Rex breed (McNitt, 1988). In the Rex pelt, the guard hairs and underfur are of the same approximate length. This provides a dense, even pelt useful for garment manufacture. The monetary value, however, is not sufficiently high and is generally not a profitable enterprise (McNitt, et al., 2000). Unlike other species of ranched fur-bearers where the pelt is the only product produced, the rabbit carcass can be used for meat. Although this is of little comfort to activists, the general public may be more accepting of the use of the entire animal, rather than killing for just the hide.

Transport

The transport of rabbits to processing facilities can pose welfare questions similar to those raised for other livestock species. Separation, caging, crating and handling practices, mixing, food and water deprivation, noise, temperature, humidity, and other environmental changes are all variables that affect the physical and psychological welfare of animals. Transport has been shown to affect meat in rabbits by increasing the rate of muscle glycogen depletion, which causes dark, firm, dry meat; increasing plasma glucose; increasing liver glycogen (during long hauls); and decreasing liver weights (Jolley, 1990). Having water available reduces live weight and carcass losses associated with antemortem handling (Coppings, et al., 1989). Factors that may affect the transport stress include the type of housing with penned rabbits coping better than caged rabbits (Canali, et al., 2000), sex with females suffering more shrink than males (Trocino, et al., 2003), and transport distance. Longer distances resulted in higher muscle pH, redder carcasses, higher muscle moisture and drip loss, higher water holding capacity and higher shear force (Dal Bosco, et al., 1997). More research is needed to elucidate transport stressors and to recommend improvements. In the meantime, humane handling and hauling practices should be encouraged and practiced.

Slaughter

Humane slaughter has been and will continue to be a concern of both animal user and animal protection groups. Unlike other farm livestock, rabbits are not covered by the Humane Slaughter Act (Anon., 1906); however, interest is high in securing more humane methods for stunning (Anon., 1992). Rabbits that are processed in commercial facilities undergo electrical stunning, which renders the animal unconscious, and then are decapitated. To achieve a suitable level of stunning, a minimum stunning current of 140 mA at 100 V should be used (Anil, et al., 1996). In smaller processing facilities or on-site slaughter, however, manual methods are used. Two methods have been recommended for manual stunning (Arrington and Kelly, 1976; Sandford, 1986; McNitt, et al., 2000). The first method is cervical dislocation. When performed by a competent person, cervical dislocation renders the rabbit unconscious immediately. The second method involves the use of a blunt stick to strike the rabbit behind the ears at the base of the skull. Generally, cervical dislocation is the preferred method for manual stunning. Welfare problems arise when inexperienced personnel attempt to perform the stunning. Care should be taken to properly train personnel before they attempt to manually stun a rabbit. Trainees should learn the proper way to handle the rabbit to reduce excitability and stress; observe the technique being
performed by a competent individual; and perform the technique under supervision until competence is attained.

Sales

There is a real possibility for problems for producers who rear rabbits for sale to laboratories for use in consumer product testing. Consumer product testing procedures that specifically use rabbits, such as the Draize eye irritancy test, have been major animal welfare and rights issues for a number of years. Another important consideration for producers who sell stock for purposes other than food or fiber is compliance with U.S. Department of Agriculture (USDA) regulations under the Animal Welfare Act. Rabbit producers who sell to buyers other than processors or individuals purchasing the rabbits for their own use must be licensed by USDA if their gross sales exceed $500 per year (USDA, 1990). USDA sets facility standards, specifies the management practices that must be followed, and inspects facilities to assure compliance. Public complaints about producers are directed to USDA for consideration. Pet stores, carnivals, and other animal sellers or exhibitors often purchase stock from unlicensed producers because of lower prices. This practice should be discouraged, because it discriminates against licensed producers and leaves the industry open to criticism for non-compliance with the Animal Welfare Act.

Conclusion

Ultimately, it is up to rabbit producers to ensure that they provide for the needs of their rabbits. Proper housing, appropriate and adequate feed, ventilation, clean water, health management, and environments designed to decrease stress are all important contributors to rabbit well-being. Research is needed to further determine factors that contribute to both physiological and psychological well-being of domestic rabbits.

References


Additional information may be obtained from:

**American Rabbit Breeders Association**
8 Westport Court, Post Office Box 426
Bloomington, Illinois 61704
Telephone: (309) 664-7500
Fax: (309) 664-0941
E-mail: info@arba.net
Web: www.arba.net

**Professional Rabbit Meat Association**
Web: www.prma.org

[Return to Top](#)

[Return to Contents](#)
Anesthesia and Analgesia


NAL Call Number: SF604.R37 no. 306

Keywords: ferrets, guineapigs, rabbits, anesthesia, preanesthetic medication, neuroleptics, anesthetics, injectable anesthetics, inhaled anesthetics, dosage.


NAL Call Number: SF405.5.L32

Keywords: 1,2,4 triazol, antiinflammatory drug, immunologic drug, hypnorm, anesthetic drug, laboratory equipment, electrocardiography, clinical techniques, diagnostic techniques, heart rate.


NAL Call Number: SF911 S45

Abstract: Pet rabbits frequently become stressed when handled and may require sedation or chemical immobilization for procedures such as blood collection, IV catheter placement, radiography, deep ear cleaning, and dentistry. Common surgical procedures requiring general anesthesia include spay, castration, gastrotomy, cystotomy, and orthopedic procedures. Rabbits may be difficult to safely sedate or anesthetize. Individual rabbits may have varying sensitivity to the depressant effects of anesthetics. The apparent sensitivity of the rabbit’s respiratory center to anesthetic drugs and the narrow range between anesthetic and toxic doses in this species add to the unpredictable character of rabbit anesthesia. Furthermore, mortality following anesthesia and surgery in sick rabbits is common. Strategically, safe anesthesia of rabbits must include the planning of procedures so that anesthetic time is minimized. Clinicians must be on guard for individual variation in response to drugs. Minimizing the use of cardiovascular depressant agents, use of agents with a high therapeutic index, and careful titration of doses to effect, along with thorough cardiorespiratory monitoring, will permit attainment of appropriate anesthetic depth with the widest margin of safety. This article presents several injectable and inhalant anesthetic protocols that may assist in effective management of many types of rabbit patient.

Keywords: review, anesthesia, methods, anesthetics, hypnotics and sedatives, administration and dosage, adverse effects, pharmacology, animal welfare, physiology, stress, psychological.


NAL Call Number: SF997.5.E95E97

Abstracts: Ferrets, rabbits, and rodents are increasingly being presented to veterinarians for evaluation and treatment. The owners of these animals expect high-level medical and surgical care. Consequently, veterinarians are more often required to provide intensive anesthetic management of these animals. The variability of anesthetic agents used and patient responses are addressed. The consequences of size for anesthetic management are discussed. Successful small mammal anesthesia requires following general anesthetic
principles, awareness of limitations, and maintenance of high standards of care.

**Keywords:** review, rabbits, ferrets, rodents, anesthesia, physiology, monitoring, postoperative care, preoperative care.


**NAL Call Number:** SF405.5 A23

**Abstract:** A comparison was made of two anesthetic protocols for cardiothoracic surgery in rabbits. Eight male New Zealand White rabbits (2.8 to 3.2 kg) were used in a double crossover study. Each rabbit received intramuscular ketamine (35 mg/kg), xylazine (5 mg/kg), and buprenorphine (0.03 mg/kg) or ketamine (35 mg/kg), medetomidine (0.5 mg/kg), and buprenorphine (0.03 mg/kg) on alternate weeks. After intramuscular injection, each rabbit was intubated and placed on 0.75% isoflurane in 1 L O2/min. Palpebral, pedal, and righting reflexes and cardiopulmonary parameters were measured every minute for the first 10 min and every 5 min thereafter. Rabbits were monitored for 20 min of spontaneous ventilation followed by 60 min of intermittent positive pressure ventilation. Intermittent positive pressure ventilation and isoflurane then were discontinued and recovery monitored. Systolic, mean, and diastolic blood pressures were higher in the medetomidine-treated rabbits. Return of the palpebral, pedal, and righting reflexes was prolonged in the medetomidine-treated rabbits. There were no differences in heart rate, respiratory rate, return to spontaneous breathing, and time to extubation between the two groups. These results indicate medetomidine can be safely used in rabbit anesthesia, provides acceptable cardiovascular parameters, and induces a longer anesthetic period than that of xylazine.

**Keywords:** male, breed, New Zealand White, anesthetic protocols, cardiothoracic surgery, intramuscular ketamine, xylazine, buprenorphine, ketamine, medetomidine, buprenorphine, intramuscular injection.


**NAL Call Number:** QL55 A1L3

**Abstract:** The effects of induction of anaesthesia with sevoflurane and isoflurane were studied in rabbits. All rabbits had periods of apnoea (ranging from 30-180 s) during induction which resulted in moderate hypercapnia and acidosis. Arterial pCO\(_2\) rose from 4.1 +/- 0.3 kPa to a peak of 7.6 +/- 0.4 kPa (mean +/- SD) (both agents). All animals showed a significant reduction in heart rate (P < 0.05). Heart rate (HR) fell from 226 +/- 33 to a minimum during induction of 57 +/- 32 (sevoflurane) and 199 +/- 41 to 45 +/- 11 (isoflurane). Most animals struggled violently during induction. Use of sevoflurane did not prevent the breath-holding response seen during induction of anaesthesia with other volatile anaesthetics in this species, and the severe apnoea which occurs may represent a significant hazard. The behaviour of the animals indicated that both sevoflurane and isoflurane are aversive, suggesting that this technique should be avoided whenever possible

**Keywords:** anesthesia, sevoflurane, isoflurane induction, apnoea, hypercapnia, acidosis, behavior, aversive, struggling.


**NAL Call Number:** aHV4701.A952

**Keywords:** mice, rats, guineapigs, rabbits, ferrets, primates, pigs, sheep, dogs, cats surgery, pain, laboratory animals, animal welfare, analgesics.


**NAL Call Number:** SF77.C65

**Keywords:** breed, New Zealand White, laboratory animals, rabbits, adverse effects, analgesics, animal welfare, blood chemistry, cutaneous application, fentanyl transdermal patches, potency, respiration, weight loss.

**NAL Call Number:** SF405.5 A23

**Keywords:** breed, New Zealand White, hepatic and renal biochemical parameters, heart rate, respiratory rate, anesthesia, alanine aminotransferase, alkaline phosphatase, aspartate aminotransferase, blood urea nitrogen, creatinine, diazepam, ketamine, xylazine, autonomic drug, general anesthetic drug, sedative/hypnotic drug, gamma glutamyltransferase, laboratory animal care, laboratory techniques.


**NAL Call Number:** SF914.V47

**Keywords:** breed, New Zealand White, female, anesthesia, blood gases, depth, drug combinations, drug delivery systems, subcutaneous, intramuscular routes duration, ketamine, medetomidine, butorphanol, pH, toe pinch, ear pinch, reflexes, respiration, hypoxemia.


**NAL Call Number:** QL55.A1L3

**Abstract:** The characteristics of two techniques of face-mask induction of desflurane anaesthesia (rapid or slow) were compared with the effects of slow isoflurane induction in five New Zealand White (NZW) rabbits. Slow induction used stepwise increments in vapour setting of 2% for desflurane and 0.5% for isoflurane at 30 s intervals. All animals were anaesthetised using each technique according to a randomized block design with one week between treatments. Observations were made of the quality of induction (any struggling or periods of apnoea) and the latency to, and the duration of loss of the righting and toe pinch reflexes recorded. Changes in respiratory rate, arterial blood gas and cardiovascular parameters were also recorded. Induction and recovery times were shorter with rapid desflurane induction in comparison to isoflurane (loss of righting reflex: 139+/−27 s cf. 205+/−48 s), but both techniques were associated with struggling and long periods of apnoea (> 1 min) during the first 4 min after administration. During this period a significant degree of bradycardia, hypercapnia and hypoxaemia occurred with both techniques, but these and the subsequent effects of rapid desflurane administration were less severe than with isoflurane. Slow induction with desflurane was tolerated best, with little or no deleterious behavioural or physiological effects, however excessively prolonged induction times (loss of righting reflex 337+/−160 s) limits the application of this method. Desflurane, administered rapidly, appears to be a more suitable agent than isoflurane. However, as with isoflurane, anaesthesia should only be induced following oxygen supplementation.

**Keywords:** breed, New Zealand White, anesthesia, isoflurane, respiratory rate, arterial blood gas, cardiovascular parameters, bradycardia, hypercapnia, hypoxemia, oxygen supplementation.


**NAL Call Number:** QL55.A1L3

**Abstract:** We investigated the effects of combinations of the alpha 2-agonist medetomidine with either ketamine or propofol for their overall quality of anaesthesia, including the possible concomitant changes in respiratory and circulatory function in New Zealand White rabbits. Medetomidine was administered at 0.35 mg/kg, intramuscularly. Following sedation, ketamine (5 mg/kg) or propofol (2 and 3 mg/kg) were administered intravenously via the ear vein. Data on reflexes (palpebral, corneal, ear-pinch and toe-pinch), jaw muscle tone and physiologic parameters (heart rate, blood pressure, respiration rate, body temperature) were recorded before and after administration of drugs. Intermittent arterial blood sampling was performed at predetermined intervals before and after anaesthesia. The results show that the ear-pinch and toe-pinch reflexes and the jaw muscle tone are reliable indices to determine surgical anaesthetic depth. A surgical level of anaesthesia could be obtained reliably with the combination medetomidine-ketamine and medetomidine-propofol (3 mg/kg) with a duration of 19 min (variation 10 to 40 min, n = 6) and 11 min (variation 5 to 15 min, n = 6), respectively. Propofol
administered at 2 mg/kg did not produce an adequate anaesthetic level. The data from this study demonstrate a high degree of predictability in achieving a fast induction and adequate anaesthetic depth together with a low incidence of untoward side-effects and a zero mortality with the combinations investigated. The data from the medetomidine-ketamine group show that, although adequate anaesthetic depth of medium duration is achieved, the arterial oxygen tension is reduced to hypoxic levels. With the use of this combination, the supplemental administration of oxygen is advised. With the combination of medetomidine-propofol (3 mg/kg) a short duration anaesthesia of adequate depth was achieved, whereby physiological variables all remained within acceptable ranges. The use of medetomidine-propofol, in combination with the alpha 2-antagonist atipamezole to shorten recovery time, will provide reliable and very versatile anaesthesia in rabbits.

**Keywords:** breed, New Zealand White, alpha 2-agonist medetomidine, intramuscularly, ketamine, propofol, intravenously, anesthesia, respiratory function, circulatory function, palpebral reflex, corneal reflex, ear-pinch reflex, toe-pinch reflex, anesthetic depth.


NAL Call Number: SF405.5.A23

Keywords: rabbits, guineapigs, surgery, laboratory animals, handling, animal welfare, restraint of animals, sedation, hypnosis.


NAL Call Number: SF603.V4

Abstract: In anaesthesiology rabbits and rodents are considered being high risk patients as about 30% of the anaesthetized patients die intra- or postoperatively. Due to the anatomic structures many anaesthetic techniques and patient monitoring are very difficult of even impossible to perform in these animals. For this reason anaesthesia of rabbits and rodents confronts the veterinarian with great problems. The main complications during anaesthesia are discussed and principles of the perioperative anaesthetic management, of anaesthetic techniques as well as patient monitoring are presented.

Keywords: laboratory animals, rabbits, rodents, complications, injectable anesthetics, anesthesia, intraoperative care, German language.


NAL Call Number: 41.8 SCH9

Keywords: rabbits, rodents, pets, anesthesia, analgesics, animal welfare, postoperative care, surgery, German language.


NAL Call Number: 41.8 SCH9

Keywords: pets, rabbits, rodents, analgesics, anesthetics, administration, emergencies, veterinary care, intraoperative care, postoperative care, monitoring, complications, fluid therapy, analgesia, physiology, perioperative care, postoperative care, fluid therapy, German language.


Keywords: inhaled anaesthetics, mucus, respiratory system, bronchi, cilia, ethyl ether, glycolipids, glycoproteins, halothane, isoflurane, mucopolysaccharides, mucoproteins, polysaccharides, postoperative care, adverse effects, trachea.

**NAL Call Number:** SF997.5.R2P48 1997

**Keywords:** anesthesia, anesthetics, German language.


**NAL Call Number:** QL55.A1L3

**Keywords:** breed, New Zealand White, ethics, pain, laboratory animals, opioids, analgesics, buprenorphine, animal welfare, survival time, weight change, virulence, experiments, viral diseases, myxoma virus.


**Keywords:** pets, anaesthesia, mice, rats, hamsters, chinchillas, rabbits, birds, Turkish language.


**NAL Call Number:** QL55.A1L3

**Keywords:** laboratory mammals, endoscopy, endoscopes, trachea.


**NAL Call Number:** SF405.5 A23

**Keywords:** laboratory animals, spine, skeletal system, isoflurane, general anesthetic drug, 5 French polypropylene catheterization, complications, surgical method, direct laryngoscopy, intubation method, surgical anesthesia, anesthesia method, thoracotomy, surgical method, cough reflex.


**NAL Call Number:** QL55.A1L3

**Keywords:** animal welfare, anesthesia, inhaled anesthetics.


**Keywords:** breed, anesthesiology, pharmacology, bronchoalveolar lavage fluid, respiratory system, lung, respiratory system, plasma blood and lymphatics, intensive care medicine, low volume PEEP effect, low volume-ZEEP effect, low volume sigh effect.
Animal Models

NAL Call Number: RM265.A5132
Abstract: With the emergence of beta-lactam antibiotic resistance among strains of Streptococcus pneumoniae, vancomycin has assumed an important role in the treatment of bacterial meningitis. Using the rabbit meningitis model, we evaluated the pharmacokinetics and pharmacodynamics of vancomycin in this setting. Animals were given 80 mg/kg of body weight daily in two or four divided doses to determine the penetration and activity of vancomycin in cerebrospinal fluid (CSF); each regimen was administered with and without dexamethasone. Mean peak (2 h) concentrations in CSF that were four- to eightfold higher than the minimum bactericidal concentration (MBC; 0.5 microgram/ml) for the pathogen were adequate for bacterial clearance. In both groups concentrations in CSF remained higher than the MBC for greater than 80% of the respective dosing intervals, and the penetration of vancomycin into CSF was 20%. Mean concentrations in CSF at 24 to 36 h of therapy were lower than those achieved during the first 12 h, consistent with a decline in the level of antibiotic entry into CSF as inflammation wanes. Rates of bacterial clearance were similar for the two regimens, and for all animals cultures of CSF were sterile by 36 h. The coadministration of dexamethasone significantly reduced the penetration of vancomycin into CSF by 29% and significantly lowered the rate of bacterial clearance during the first 6 h in animals receiving 20-mg/kg doses of vancomycin. For animals receiving 40-mg/kg doses, therapeutic peak concentrations in CSF were obtained even with steroid use, suggesting that the effect of steroids may be circumvented by the use of larger daily doses of vancomycin.
Keywords: animal model, rabbit, anti-inflammatory agents, therapeutic use, antibiotics, glycopeptide, cerebrospinal fluid, pharmacokinetics, cephalosporin resistance, dexamethasone, combination meningitis, pneumococcal, microbiology, outcome assessment, Streptococcus pneumoniae, drug effects.

NAL Call Number: RM265.A5132
Keywords: breed, Japanese White, Kurosawa, Kusanagi Hypercholesterolemic, animal model, hypercholesterolemia, etiology, radiotelemetry, monitoring method, physiological method, conscious, unrestrained, blood pressure, daily pattern, body temperature, cardiovascular parameters, circadian rhythm, heart rate, locomotor activity.

Abstract: To investigate and compare the effects of suramin and mitomycin C on conjunctival wound healing after trabeculectomy in a rabbit model. MATERIALS AND METHODS: Thirty New Zealand White rabbits were divided into three groups, and trabeculectomy was performed on the left eyes under general anesthesia. During the surgery, suramin (250 mg/ml) and mitomycin C (0.4 mg/ml) were applied to the scleral flap site for 2 minutes in groups 1 and 2, respectively. The control animals (group 3) received no pharmacological treatment.
during trabeculectomy. Intraocular pressure (IOP) measurements were recorded before surgery and every 3 days after the operation, starting from postoperative day 1. Three animals from each group were sacrificed on days 15, 20, and 25, yielding a total of 27 eyes for histopathological study. Each specimen was histochemically and immunohistochemically evaluated, and graded. RESULTS: Bleb failure time was significantly longer in both the suramin (15.0 +/- 4.7 days) and mitomycin C (16.7 +/- 5.1 days) groups than in the controls (10.3 +/- 4.2 days) (p < 0.05). Starting from postoperative day 9, the IOP in the suramin and mitomycin C groups was significantly lower than that in the control group (p < 0.05). This difference continued to be significant until day 18 for the suramin group, and until day 24 in the mitomycin C group. Histopathological evaluation showed lower degrees of cellularity, fibrosis, collagen III deposition, and CD3 density in the suramin- and mitomycin C-treated eyes compared to control eyes at all time points (p < 0.05). There was also no significant difference between the suramin and mitomycin C groups concerning these histopathological findings and CD3 density (p > 0.05). Although there were trends towards reduced mean elastic fiber deposition and lower CD20 and CD68 density in both groups of treated eyes, the differences between the treated and control groups were not significant (p > 0.05). CONCLUSIONS: The results of the current study suggest that suramin has beneficial effects on wound healing in glaucoma surgery, and effectively prolongs bleb survival in rabbits. Suramin may be a promising alternative to anti-metabolite therapy in glaucoma surgery.

Keywords: New Zealand White, animal model, rabbits, antimetabolites, pharmacology, comparative study, conjunctiva, pathology, conjunctiva, physiopathology, growth substances, metabolism, intraocular pressure, drug effects, intraoperative care, mitomycin, administration and dosage, suramin, trabeculectomy, wound healing.


Abstract: To determine and compare the effectiveness of octreotide, mitomycin-C and corticosteroids on wound-healing reaction after glaucoma surgery. METHODS: A full thickness scleral trephination was carried out by the same surgeon on four groups of six rabbits. A sponge soaked in mitomycin-C was applied subconjunctivally in group 1 before trephination. Group 2 received corticosteroid drops tid topically for 14 days. Group 3 received subcutaneous octreotide injections tid for 14 days. The control group (group 4) was not given any drug that may interfere with wound healing. All groups received gentamycin drops tid for seven days. The rabbits were Sacrificed on the fourteenth day and the trephination area with overlying conjunctiva was excised. The samples were prefixed with glutaraldehyde, dehydrated and embedded in Araldite Cy 212. Ten semithin sections stained with toluidin blue were analysed for each group. Fibroblast and macrophage counts were performed on the surgical site and subconjunctival area. RESULTS: Intensive fibroblastic activity, increased number of vessels and active macrophages were observed only in group 4. The fibroblast and macrophage densities in this group were significantly higher than the other three groups in which wound healing was modulated (p > 0.001). Mean number of fibroblasts in group 1 was also significantly less than the ones of groups 2 and 3 (p < 0.01). Macrophage densities were similar in groups 1, 2 and 3. No statistical significance was found between groups 2 and 3 by means of fibroblast and macrophage densities. CONCLUSION: Octreotide reduced wound-healing reaction in a similar fashion to corticosteroids or mitomycin-C. These initial results seem promising.

Keywords: animal model, rabbits, male, adrenal cortex hormones, administration and dosage, ciliary body, pathology, comparative study, conjunctiva, pathology, fibroblasts, pathology, filtering surgery, glaucoma, surgery, hormones, administration and dosage, subcutaneous injections, intraoperative care, macrophages, pathology, mitomycin, nucleic acid synthesis, octreotide, postoperative care, wound healing, drug effects.


Abstract: A new recording array system has been developed to record multi-unit activity in rabbit retina. The array consists of individually laid down layers of carbon fiber or tungsten microelectrodes whose center-center spacing can be made less than 100 microm. The array and associated electronics can be constructed by technology typically found in most electrophysiology laboratories. The array is mostly transparent, so that
visual stimuli and microscopic examination can take place through it. The array can be manipulated much like a single electrode, and thus can be used to record from multiple tissue sites. Arrays as large as 32 elements have been used, with success rates of about 50% per electrode, with some electrodes picking up more than one cell. Stable recordings have been held for up to 6 h from groups of ganglion cells in an isolated eyecup preparation. These multi-electrode arrays have been used repeatedly in experiments for several months without any obvious degradation in recording quality. Although the arrays are hand-made, their layered method of assembly allows as many as 32 elements to be assembled.

Keywords: carbon, electric impedance, electrophysiology, instrumentation, microelectrodes, retinal ganglion cells, physiology.


Abstract: With a standardised model we investigated the influence of two different surgical approaches to the rabbit tibia for plate osteosynthesis on resistance to local infection after postoperative inoculation of graduated concentrations of staphylococcus aureus at the implant. The infection rate for the minimally invasive plate osteosynthesis with insertion of the implant in closed, soft tissue tunneling technique was 25% (3/12 animals; ID50 = 6.2 x 10(6) CFU) and for the conventional open approach 38% (5/13 animals; ID50 = 2 x 10(6) CFU). This difference is statistically not significant (with P > 0.05).

Keywords: animal model, rabbits, bone plates, comparative study, fracture fixation, surgical wound infection, microbiology staphylococcal infections, microbial colony count, *Staphylococcus aureus*, growth and development, surgical procedures, tibia surgery, minimally invasive methods, German language.


Abstract: A variety of factors have been reported as inducing the reactivation of latent herpes simplex virus (HSV), among them stress, trauma, and UV radiation. Excimer laser photorefractive keratectomy (PRK) is a surgical procedure utilizing a 193 nm ultraviolet light to alter the curvature of the cornea and hence correct vision. Reactivation of ocular herpes simplex keratitis following such excimer laser PRK has been reported. All published cases of HSV reactivation following excimer laser treatment in humans are reviewed. The present study evaluates whether stress, trauma of the corneal de-epithelialization prior to the laser, or the excimer laser treatment itself to the stromal bed induces this ocular reactivation of the latent HSV, and whether a systemic antiviral agent, valacyclovir, would prevent such laser PRK-induced reactivation of the HSV. METHODS: Forty-three normal 1.5- to 2.5-kg New Zealand white rabbits were infected on the surface of the cornea with HSV-1, strain RE. The animals were monitored until resolution, and then all animals were divided into 5 treatment groups: (1) de-epithelialization only, intraperitoneal (i.p.) saline for 14 days; (2) de-epithelialization plus laser, i.p. saline for 14 days; (3) de-epithelialization plus laser, valacyclovir 50 mg/kg per day i.p. for 14 days; (4) de-epithelialization plus laser, valacyclovir 100 mg/kg per day i.p. for 14 days; (5) de-epithelialization plus laser, valacyclovir 150 mg/kg per day i.p. for 14 days. Animals were evaluated in a masked fashion by clinical examination biweekly and viral cultures biweekly through day 28. RESULTS: The reactivation rates were as follows: group 1, 0%; group 2, 67%; group 3, 50%; group 4, 17%; and group 5, 0%. Viral titers were negative in animals that had no reactivation but persistently positive in those that had reactivation (day 6 through day 28). CONCLUSIONS: Excimer laser (193 nm) treatment can trigger reactivation of ocular herpes disease (67%) and viral shedding in the latently infected rabbit. De-epithelialization alone is not sufficient to cause reactivation or viral shedding. Prophylaxis with intraperitoneal valacyclovir decreases the recurrence rate in a dose-response fashion. At 150 mg/kg per day, there are no recurrences. The presence of persistent viral shedding in reactivated animals may correlate with cases of late HSV recurrence reported in humans undergoing excimer treatment. The data suggest that humans undergoing excimer laser procedures for correction of refractive errors or treatment of corneal scars with a history of herpetic keratitis are at increased risk for reactivation. Such patients, however, may appropriately be considered for prophylactic systemic antiviral medication at the time of the laser procedure in order to decrease the possibility of recurrence.

Keywords: acyclovir, analogs and derivatives, therapeutic use, antiviral agents, keratectomy, photorefractive,
excimer laser, herpetic keratitis, prevention and control, surgery, virology, postoperative care, recurrence, prevention and control, simplexvirus, isolation and purification.


**Abstract:** In nerve injuries, if it is not possible to reinnervate muscle by using neurorrhaphy and nerve grafting technique, reinnervation should be provided by the use of neuroization-directly implanting motor nerve into muscle. A comparative study of three techniques of neurotization is presented in rabbits. In this experimental study, a total of 40 white New Zealand rabbits were used and divided into four groups, each including 10 rabbits. In the first group (control--Group 1), only surgical exposure of the gastrocnemius muscle, main muscle nerve (tibial nerve), and peroneal nerve was done, without any injury to the nerves. In the second group (direct neurotization group--Group 2), the tibial nerve was transected, and the peroneal nerve, which had already been divided into fascicles, was implanted into the lateral head of the gastrocnemius muscle aneural zone. In the third group (dual neurotization group--Group 3), the tibial nerve which had been transected and re-anastomosed, and the peroneal nerve were implanted into the lateral head of the gastrocnemius muscle. In the last experimental group (hyperneurotization group--Group 4), fascicles of the peroneal nerve were implanted into the lateral head of the gastrocnemius muscle. In the experimental study, groups with the tibial nerve transected had less muscular weights than those of groups with the tibial nerve intact. EMG recordings showed that polyphasic and late potentials were frequently seen in groups with the tibial nerve transected. Degeneration and regeneration of myofibrils was observed in such groups as well. New motor end-plates, including vesicles, were formed in a scattered manner in all neurotization groups. As a result, the authors conclude that direct and dual neurotization techniques are useful in peripheral nerve injuries, if it is not possible to reinnervate muscle by using neurorrhaphy and nerve grafting, and that there is no suggested superiority among these techniques.

**Keywords:** comparative study, animal model, rabbits, microsurgery, muscle contraction physiology, muscle fiber pathology, skeletal injuries, skeletal muscle innervation, surgery, nerve transfer, peroneal nerve transplantation, reconstructive surgical procedures, recovery, tibial nerve transplantation.


**Abstract:** GGRGDSPCA synthetic peptide competes for integrin receptor in scar formation after glaucoma filtering surgery in a rabbit model. The purpose of this study was to evaluate the use of this peptide and compare it with mitomycin on glaucoma filtering surgery. MATERIALS AND METHODS: Posterior sclerectomy was performed in both eyes of 17 rabbits. The right eye received GGRGDSPCA (p605) at 0, 4, 8, 12, and 16 days after. Nine left eyes received saline as a control; the remaining 8 eyes received mitomycin C at 0.5 mg/mL intraoperative. Intraocular pressures and biomicroscopy were evaluated as well as bleb function. RESULTS: Intraocular pressure decreased significantly in both the peptide and mitomycin treated eyes in comparison with the saline group (P = 0.0003). Pressure was similar in both groups. The blebs showed filtrating function in a functional analysis at day 21 and 41 in the mitomycin cases as well as in the peptide group. Histologic analysis performed in both peptide and mitomycin groups showed inhibitory effect in fibrocellular and collagen organization with bleb formation. CONCLUSIONS: The p605 peptide showed to be similar to mitomycin C in controlling and improving glaucoma filtering surgery in rabbits. This alternative may potentially be useful for similar purposes in humans for the control of glaucoma and improvement of filtering surgery.

**Keywords:** animal models, rabbits, female, glaucoma surgery, cicatrix, drug therapy, comparative study, filtering surgery, pathology, physiopathology, intraocular pressure mitomycin, adverse effects, therapeutic use, oligopeptides, chemical synthesis, postoperative care, GGRGDSPCA peptide.


**Abstract:** Heel-cord lengthening is commonly performed for contractures in neuromuscular disease. Immobilization after this procedure has ranged from 3 to 8 weeks. A three-part study was performed to determine adequate length of immobilization. Sixteen rabbits had surgical transection of the right gastrocsoleus...
tendon in phase 1. Healing was allowed for 1, 3, 5, or 7 weeks. Tendons were then studied by magnetic resonance imaging (MRI), mechanical testing, or histologic section. A marker for healing was determined by MRI. Seven children underwent percutaneous sliding heel-cord lengthening (PSHCL) in phase 2. Healing was studied by MRI. Based on the marker from phase 1, adequate healing occurred at 3 weeks. Thirty-one children underwent PSHCL for neuromuscular contracture in phase 3. Cast immobilization was maintained for 3 weeks (group 1) and for \( >3 \) weeks (group 2). There was no evidence of rupture or progressive lengthening after cast removal in either group.

**Keywords:** human, child, animal model, rabbits, achilles tendon, pathology, surgery, casts, cerebral palsy, complications, child equinus deformity, etiology, equinus deformity, magnetic resonance imaging, postoperative care, wound healing.


**Abstract:** To evaluate three-dimensional optical coherence tomography (OCT) for use in the assessment of the microsurgical anastomoses of vessels and nerves. MATERIALS AND METHODS: OCT is an optical analogue of ultrasonography and is capable of imaging nontransparent biologic tissue by detecting backscattered infrared light. Cross-sectional in vitro images of rabbit and human vessels and nerves were obtained in as little as 125 msec at 10-micron resolution by using a solid-state laser as a light source. A surgical microscope was integrated with OCT to perform simultaneous imaging with en face visualization. Cross-sectional images were assembled to produce three-dimensional reconstructions of microsurgical specimens. RESULTS: Three-dimensional OCT reconstructions depicted the structure within an arterial anastomosis and helped identify sites of luminal obstruction. The longitudinal spatial orientation of individual nerve fascicles was tracked in three dimensions to identify changes in position. In vitro human arteries and nerves embedded in highly scattering tissue and not visible at microscopy were located and imaged with OCT at eight frames per second. CONCLUSION: The three-dimensional, micrometer-scale, diagnostic imaging capabilities of OCT permit rapid feedback for assessment of microsurgical procedures. OCT technology can be readily integrated with surgical microscopes and has potential for intraoperative monitoring to improve patient outcome.

**Keywords:** human, rabbits, anastomosis, surgical, anatomy, cross-sectional, arteries, human image processing, computer-assisted infrared rays, intraoperative care, lasers, microsurgery, intraoperative monitoring, neurosurgical procedures, optics, instrumentation, peripheral nerves, radiology.


**Keywords:** K562 cell line, rabbit, animal model, eye, sensory system, ocular irritants, in vitro test battery, assessment method, meeting.


**Abstract:** We used an animal model of restrictive strabismus analogous to the fat adherence syndrome in humans to test the efficacy of topical intraoperative mitomycin-C (MMC) in preventing the development of restrictive scar tissue. A cicatricial adhesion was created between the inferior rectus muscle and the inferior orbital rim of each eye in eight rabbits, and passive forced ductions were quantitatively measured with a spring scale. Eight eyes were treated intraoperatively with topical MMC 0.5 mg/mL, the other eight with sterile water. Passive forced ductions were again measured 4 weeks postoperatively and representative orbits were exenterated for histopathologic examination. Significant restriction of motility was produced in six of the eight control eyes. Though prophylactic treatment with MMC may have been beneficial in some cases, on average, the restriction developing in these eyes did not significantly differ from that in the control eyes. In addition, longer exposure times to MMC led to marked orbital inflammation and severe restriction of ocular motility. Finally, histopathologic evaluation of the orbits of the MMC-treated eyes revealed marked fibrosis of perimuscular connective tissues. Although MMC may have a role in the management of fat adherence syndrome, further study is needed to establish safe and efficacious methods of delivery.

**Keywords:** adhesions, complications, pathology, adipose tissue, cicatrix, disease models, intraoperative care,
mitomycin, therapeutic use, oculomotor muscles, physiopathology orbital diseases, complications, postoperative period, strabismus, drug therapy, etiology, surgery.


Abstract: Timing and outcome of antenatal surgical intervention is being explored using fetal animal models. Models that are currently used range from larger animals with fewer offspring and higher cost to smaller animals with larger litters and lower cost. The rabbit is an ideal “small” animal model for experimentation in the third trimester, with a large litter, short gestation and a relatively large fetus. This paper reports methods by which prolonged survival (greater than 110 days) may be achieved in as many as 60% of operated fetuses following complex fetal surgery in the rabbit.

Keywords: animal model, rabbits, abnormalities, surgery, intraoperative care, postoperative care, pregnancy, preoperative care, survival rate, time factors.


Abstract: This study was undertaken to determine if warfarin anticoagulation could be safely continued during surgery and in the perioperative period. An animal model was followed by a prospective human study of all patients on heparin or warfarin at the time of surgery. Twenty-four rabbits underwent laparotomy, during which a controlled liver injury was created and repaired. Group 1 (Warf) was anticoagulated with warfarin to raise the mean international normalization ratio (INR) to 2.5-3.0. Group 2 (Hep) was anticoagulated with heparin to raise the activated partial thromboplastin time to 1.5-2.0 times control. The heparin was then stopped 6 hr prior to surgery and resumed 6 hr postoperatively without a bolus. Group 3 (control) was not anticoagulated and received saline infusion. For the human study, data were collected on 40 patients undergoing 50 operations from October 1996 to January 1998. The results of this study reveal that (1) bleeding was less in the group anticoagulated with warfarin throughout surgery in the animal model, (2) bleeding complications were less in the patients continued on warfarin through surgery than those on heparin (3) older patients may have an increased risk of bleeding, and (4) an INR of >3 at the time of surgery may increase the risk of bleeding.

Keywords: human, rabbits, animal model, anticoagulants, warfarin, adverse effects, therapeutic use, blood loss, surgical, prevention and control, statistics and numerical data, comparative study, heparin, adverse effects, perioperative care, risk factors, time factors, adverse effects.


Abstract: Tendon-bone incorporation of a tendon graft within the bone tunnel is a major concern when using tendon graft for ligament reconstruction. Periosteum consists of multipotent mesodermal cells to form all varieties of connective tissue, including osteogenic and chondrogenic tissues. From our histologic and biomechanical studies in animals, a superior healing process and stronger healing strength can be achieved when periosteum is sutured onto the tendon inserted within a bone tunnel. We applied this idea to anterior cruciate ligament reconstruction to enhance tendon-bone healing. A quadruple-stranded hamstring tendon graft is used. A piece of periosteum, 3 x 3 cm, harvested from the anterior cortex of proximal tibia, is split into 2 rectangle flaps (1.5 x 3 cm each). The periosteum flaps are wrapped and sutured around the tendon graft at the portions near the femoral and tibial tunnel openings. The cambium layer is faced outside to the bone tunnel. Periosteum is easy to harvest from proximal tibia, where is a routine incision for harvesting hamstring tendons. Besides the potential for enhancement of tendon-bone healing, periosteum may be able to seal off the intra-articular opening in a very early period to avoid synovial fluid reflux into the tunnel.

Keywords: animal model, rabbit, anterior cruciate ligament, physiopathology, surgery, biomechanics, bone, nails, femur, surgery, knee joint, surgery, osteogenesis, periosteum transplantation, postoperative care, suture techniques, tendon transfer methods, rehabilitation, tibia surgery, wound healing.

Choi, M.Y.; Auh, S.J.; Choi, D.G.; Chang, B.L. (2001). Effect of ADCON-L on adjustable strabismus surgery in
Abstract: In search of a way to prevent postoperative adhesion after strabismus surgery, an animal study was performed to assess the effect of a gel consisting of a polyglycan ester in a gelatin matrix (ADCON-L).

METHODS: Bilateral recessions of superior rectus muscle (SR) were performed on 16 rabbits. ADCON-L was applied beneath and over the SR in the right eyes of all rabbits, while the operative fields in the left eyes were irrigated with a balanced salt solution (BSS). The adjustment was performed on each SR at 4 and 7 days postoperatively on the same eye. The length and force of the adjustment and the degree of adhesion were recorded. At 3 weeks postoperatively, disinsertional force was measured in several of the eyes, and the other eyes were enucleated. RESULTS: The length of the adjustment was longer and the force of the adjustment was less in the ADCON-L group than in the BSS treated group at 4 and 7 days postoperatively (p=0.00). A significant reduction (p=0.00) in the degree of adhesion was noted in eyes treated with ADCON-L. There was no significant difference in disinsertional force between the two groups. Histopathological evaluation of the muscle revealed decreased fibrosis of perimuscular connective tissue in eyes treated with ADCON-L at 3 weeks postoperatively. CONCLUSION: This study suggests that ADCON-L helps to prevent postoperative adhesion in rabbits and enables adjustment twice within 7 days postoperatively without complications.

Keywords: animal models, rabbit, strabismus surgery, adhesions, prevention and control, gels, therapeutic use, muscular diseases, oculomotor muscles, surgery, postoperative care, postoperative complications, prevention and control, suture techniques.
Abstract: To measure under carefully controlled conditions the effects in the rabbit eye of commonly used therapeutic agents for glaucoma. METHODS: Rabbits were outfitted in one eye with an implantable telemetric pressure transducer and monitored for several months under controlled conditions of light/dark and handling. Effects of tonometry, handling, water drinking, and instillation of topical ophthalmic medications on intraocular pressure were recorded during each 24-hour day/night cycle. RESULTS: Pneumatonometry, animal handling, and water drinking all had an effect on intraocular pressure that in many instances was of the same magnitude as the effects of pharmacologic agents. Dorzolamide and timolol caused a sustained reduction of intraocular pressure during the nocturnal period. Epinephrine had a biphasic effect, causing an immediate pressure elevation followed by a prolonged depression. Apraclonidine, latanoprost, and pilocarpine had no measurable effect. CONCLUSIONS: Continuous telemetric measurement of intraocular pressure in rabbits permits the measurement of uncontrollable artifacts that occur with tonometric measurements and animal handling. If environmental conditions are rigidly controlled, this method is very sensitive for detecting therapeutic effects of candidates for ocular hypotensive drugs. When healthy animals are used, the method appears to be more sensitive for drugs that affect aqueous humor formation than for drugs that affect aqueous humor outflow resistance.

Keywords: husbandry, circadian rhythm, clonidine, pilocarpine, prostaglandins F, sulfonamides, thiophenes, epinephrine, analogs and derivatives, pharmacology, intraocular pressure, drug effects, ophthalmic solutions, telemetry methods, tonometry, ocular methods.


Keywords: animal model, rabbit, Staphylococcus aureus, wound contaminant, antibacterial agents, antibacterial properties, bacterial diseases, disease models, drug therapy, honey, human diseases, penicillins, postoperative care, streptomycin, wound dressings.


Abstract: Brain death (BD) abolishes the infarct-limiting effect of ischemic preconditioning (IP) in rabbits. We wished to define the role of the norepinephrine storm in this observation. METHODS: Rabbits were randomized into six groups of ten animals each. In control group (CTRL), anaesthetized rabbits were subjected to 30 min left coronary marginal branch occlusion and 90 min reperfusion. In CTRL+IP group, anaesthetized rabbits were preconditioned with a 5-min ischemia and 5-min reperfusion sequence before coronary occlusion. In CTRL+NE+IP group, anaesthetized rabbits received a 10 microg/kg norepinephrine injection 90 min before IP. In BD group, rabbits were subjected to 90 min of BD before coronary occlusion. In BD+IP group, brain-dead rabbits were preconditioned before coronary occlusion. In BD+LA+IP group, rabbits received an intra-arterial bolus injection of an alpha and beta adrenoreceptor blocking agent (labetalol, 1 mg/kg) prior to brain death induction and subsequent preconditioning. BD was induced by rapid inflation of an intracranial balloon. At termination of the experiment, left ventricular volume (LVV), myocardial volume at risk (VAR) and infarct volume (IV) were determined with methylene blue and tetrazolium staining, and measured using planimetry. RESULTS: LVV was not significantly different among groups. Myocardial VAR/LVV was not significantly different between groups (CTRL, 22.5+/−6.9%; CTRL+IP, 23.3+/−2.2%; CTRL+NE+IP, 25.9+/−12.7%; BD, 19.9+/−4.8%; BD+IP, 21.7+/−3.1%; BD+LA+IP, 23.4+/−5.8%; P=NS). IV/VAR was significantly reduced in the CTRL+IP group as compared with CTRL and CTRL+NE+IP groups (12.2+/−1.2 vs. 49.7+/−1.7 and 49.3+/−4.7%; P<0.0001). There was no significant difference in IV/VAR between BD and BD+IP groups. In contrast, IV/VAR was reduced in BD+LA+IP compared to BD and BD+IP groups (13.9+/−5.4 vs. 50.0+/−1.4 and 49.6+/−1.5%; P<0.001). CONCLUSION: The loss of infarct-limiting effect of IP in brain-dead rabbits is related to the massive release of norepinephrine that occurs as a consequence of BD.

Keywords: animal models, rabbit, brain death, metabolism, comparative study, coronary disease, physiopathology, surgery, hemodynamic processes, physiology, ischemic preconditioning, myocardial methods, labetalol, pharmacology, myocardial infarction, prevention and control, myocardial reperfusion methods, norepinephrine pharmacology, norepinephrine secretion, preoperative care.


Abstract: This study determined the ability of an upper extremity Tarlov scale, a lower extremity Tarlov scale, and the Durham scale to predict the development of myelopathy and the likelihood of survival in a rabbit model of surgical treatments for cervical spondylotic myelopathy. Forty-eight rabbits were evaluated using the scales after cervical spinal surgery. Logistic regression analysis revealed that all three scales could predict the occurrence of myelopathy. However, only the Durham and lower extremity Tarlov scales also predicted the likelihood of survival. The Durham scale is offered as a useful predictor of myelopathy and survival in an animal model of surgical treatments for cervical spondylotic myelopathy. The lower extremity Tarlov scale is also a useful predictor of outcome; however, the upper extremity Tarlov scale is not recommended.

Keywords: animal models, rabbits, cervical spondylotic myelopathy, cervical vertebrae physiopathology, surgery, comparative study, prognosis, recovery of function, spinal cord compression, spinal osteophytosis.


NAL Call Number: QL55.A1L3

Keywords: animal model, rabbit, rat, laboratory animal science, laboratory animal welfare, intestinal neomucosa, digestive system, regeneration, epidermal growth factor, octreotide, pharmacodynamics, prostaglandin E-2, urogastrone, short bowel syndrome, digestive system disease, serosal patch technique, therapeutic method.


NAL Call Number: RL803.J67

Keywords: animal models, rabbit, dog, mouse, monkey, dermal irritants; dermal toxicants, ocular irritants, corrosion, dermal irritation, ocular irritation, ocular testing, product safety, toxicity testing methods, literature review.


Keywords: laws, regulations, laboratory animal science, laboratory animals, rabbits, animal testing alternatives, animal welfare, eyes, methodology, reviews, toxicity, India.


Abstract: Stimulation with low-power laser (LPL) can enhance bone repair as reported in experimental studies on bone defects and fracture healing. Little data exist concerning the use of LPL postoperative stimulation to improve osseointegration of endosseous implants in orthopaedic and dental surgery. An in vivo model was used for the present study to evaluate whether Ga-Al-As (780 nm) LPL stimulation can improve biomaterial osseointegration. After drilling holes, cylindrical implants of hydroxyapatite (HA) were placed into both distal femurs of 12 rabbits. From postoperative day 1 and for 5 consecutive days, the left femurs of all rabbits were submitted to LPL treatment (LPL group) with the following parameters: 300 J/cm², 1 W, 300 Hz, pulsating emission, 10 min. The right femurs were sham-treated (control group). Three and 6 weeks after implantation, histomorphometric and microhardness measurements were taken. A higher affinity index was observed at the HA-bone interface in the LPL group at 3 (P<0.0005) and 6 weeks (P<0.001); a significant difference in bone microhardness was seen in the LPL group vs. the control group (P<0.01). These results suggest that LPL postoperative treatment enhances the bone-implant interface.

Keywords: animal model, rabbit, aluminum, analysis of variance, arsenic, bone density, radiation effects, ceramics, chemistry, comparative study, dental implants, dental prosthesis design, durapatite, femur pathology, radiation effects, femur surgery, gallium, laser therapy, osseointegration, postoperative care.

Identification of a homologue of a house dust mite allergen in a cDNA library from *Sarcoptes scabiei* var. *hominis* and evaluation of its vaccine potential in a rabbit/*S. scabiei* var. *canis* model. The American Journal of Tropical Medicine and Hygiene 68 (1): 54-60, ISSN: 0002-9637.

NAL Call Number: 448.8 Am326

Abstract: Identification of a homologue of a house dust mite allergen in a cDNA library from *Sarcoptes scabiei* var. *hominis* and evaluation of its vaccine potential in a rabbit/*S. scabiei* var. *canis* model. Menzies School of Health Research, Darwin, Northern Territory, Australia. *Sarcoptes scabiei* (“itch mite”) causes scabies, a disease of considerable human and veterinary significance. Little work has been done at the molecular level because of the difficulty of obtaining mites. We have used mites in skin from the bedding of crusted scabies patients for the construction of a library of 10(5) cDNAs from *S. scabiei* var. *hominis* cloned in the vector pGEX4T-2. We describe the isolation by immunoscreening of 2 clones, one of which (Ssagl) is homologous to and cross-reactive with the house dust mite *Euroglyphus maynei* allergen M-177, an apolipoprotein from hemolymph. Immunohistochemistry revealed that it is located around the internal organs and cuticle of the mite and in eggs. Although it was not found to be protective in a challenge trial, the rabbits did not exhibit typical crust characteristics. This work shows that it is now possible to conduct such challenge trials with cloned scabies antigens.

Keywords: animal model, rabbits, skin disease, *Sarcoptes scabiei*, chemistry, genetics, immunology, amino acid sequence, base sequence cloning, molecular DNA, animal gene library, human immune sera, vaccines.


Abstract: Strabismus surgeons disagree on the optimum timing of the postoperative adjustment in adjustable suture surgery. We compared the peak force necessary for adjustment at various postoperative times using a rabbit model. Twenty-four eyes of 12 rabbits underwent a superior rectus recession of 5 mm using a standard adjustable suture technique. The eyes were randomized to adjustment at 15 minutes, and at 6, 24, and 48 hours postoperatively. The peak force required to advance the muscle 3 mm was measured using a strain gauge. During each adjustment, the peak force was noted to be that required for initial disinsertion of muscle from sclera. The mean peak force required was 14 +/- 5 g at 15 minutes, 37 +/- 10 g at 6 hours, 60 +/- 40 g at 24 hours, and 103 +/- 52 g at 48 hours. There was a significant relationship between the time of adjustment and the peak force required for adjustment (F = 7.8, P = 0.001). Post-hoc analysis showed that the peak force required at 48 hours was greater than that required at 24 hours (P = 0.04), 6 hours (P = 0.003), and at 15 minutes (P = 0.0002). The force required for adjustment at 24 hours and beyond was greater than the maximal force generated by an extraocular muscle. We therefore suggest that the postoperative adjustment should be performed within the first 24 hours.

Keywords: animal model, rabbit, muscle contraction, physiology, oculomotor muscles, surgery, postoperative care, strabismus surgery, suture techniques, time factors.


Keywords: literature review, human, animal models, rabbit, rat, antibiotics, cefotaxime, antibacterial drug, antiinfective drug, ceftazidime, ciprofloxacin, cytokines, endotoxin, antibiotic induced release, gentamicin, imipenem, meropenem, penicillin binding protein, tobramycin, bacteremia, bacterial disease, sepsis, intra abdominal infection, infectious disease, peritonitis, digestive system disease, intensive care, multi organ failure.


Keywords: laboratory animals, methods and techniques, cerebrospinal fluid, leaks, nervous system, clinical investigations, experimental investigations, frontal leakage, nasal septum, respiratory system, skull skeletal system, wound healing, mucosal autografting, application procedures, fibrous transformation, postoperative care, surgical method, therapeutic method.


Abstract: We demonstrated that selectively bred homozygous WHHL rabbits known to show
hypercholesterolemia and severe coronary atherosclerosis also spontaneously develop cerebral atherosclerosis beginning at 9 months of age. These intracranial lesions occurred in the absence of hypertension in 24 of 25 animals at various sites, mainly along arteries at the base of the brain. No lesions were observed in penetrating arteries. Lesions were rich in smooth muscle cells and fibrous tissue, showing only rare fragmentation or disappearance of the internal elastic lamina, and only limited lipid deposition. Few macrophages were observed in these lesions. No significant correlation was seen between severity of cerebral atherosclerosis and age, systolic blood pressure (BP), serum total cholesterol, or triglyceride concentration. Xanthomas of the pia mater were observed in all 25 rabbits. Arterial findings were similar to those in human cerebral atherosclerosis, indicating that the coronary atherosclerosis-prone homozygous WHHL rabbit represents the first animal model for spontaneous cerebral atherosclerosis.

**Keywords:** animal model, rabbits, male, aging, physiology, husbandry, aorta, thoracic, pathology, arteries, blood pressure, brain diseases, etiology, cerebral arteries, coronary vessels, female, homozygote, hyperlipidemia, genetics, intracranial arteriosclerosis, etiology, lipids, blood, pia mater, genetics, receptors, deficiency, severity of illness index.


**NAL Call Number:** Z7994 L3A5

**Abstract:** This study compared five methods, the isolated rabbit eye (IRE), bovine corneal opacity and permeability (BCOP), EpiOcular, fluorescein leakage (FL) and neutral red release (NRR) assays, for predicting the eye irritation potential of hair-care formulations. Ten shampoo and seven conditioner formulations of known ocular irritation potential were tested. Each group included a market-acceptable formulation as a comparative benchmark. Predictions of ocular irritation were made by using classification models (IRE, BCOP and EpiOcular assays) or by direct comparison with benchmarks (IRE, EpiOcular, FL and NRR assays). The BCOP assay was less sensitive than the IRE test in discriminating between formulations of different irritation potentials, and did not perform as well as the other assays in identifying mild formulations. All of the assays appeared to be better at discriminating correctly between the shampoos than between the conditioners. The EpiOcular assay showed the closest concordance between the in vivo results and the in vitro data from cell-based assays (particularly for shampoos). The FL assay also showed a high concordance (particularly for conditioners). There was a tendency for these in vitro assays to over-predict eye irritation potential, but there was no under-prediction and they were particularly successful at identifying mild formulations. The NRR assay was less predictive with both shampoos and conditioners. The results from this comparative evaluation fully support the continued use of the IRE test as a suitable alternative to in vivo eye irritation testing in rabbits, although it also over-predicted the irritancies of several of the formulations.

**Keywords:** shampoos, hair, surfactants, testing, irritant properties, assays, in vitro, eyes, rabbits, cattle, cornea, fluorescein, laboratory tests, coagulation, prediction, accuracy, animal testing alternatives, eye irritation tests, fluorescein leakage assay, neutral red uptake assay, bovine corneal opacity, permeability assay, epiocular assay, animal use replacement.


**Abstract:** Trovafloxacin is a new fluoronaphthyridone chemically and functionally related to members of the fluoroquinolone class of antimicrobial agents. The in vivo efficacy of the drug was compared with that of vancomycin by using the rabbit model of left-sided endocarditis. Rabbits infected with either a nafcillin-susceptible or -resistant test strain were treated with trovafloxacin (13.3 mg/kg of body weight every 12 h) or vancomycin (25 mg/kg of body weight every 8 h) for 4 days. In comparison with untreated controls, both antimicrobial agents effectively cleared bacteremia and significantly reduced bacterial counts in vegetations and tissues of animals infected with either test strain. No resistance to trovafloxacin emerged in test strains during therapy. We conclude that in this model trovafloxacin is as efficacious as vancomycin is and may serve as a viable alternative to vancomycin for use in humans with similar infections.

**Keywords:** anti-infective agents, therapeutic use, drug resistance, drug therapy, endocarditis, fluoroquinolones, naphthyridines, trovafloxacin, staphylococcal infections.

Abstract: The present immunohistochemical study of radiation-induced damage in major blood vessels is based on a multidisciplinary study (Schultz-Hector et al., Radiother. Oncol., 38: 205-214, 1996) investigating the combined effect of IORT of the coeliac axis and upper abdominal ERT. The paper describes the sequential changes occurring in the coeliac artery after IORT with 30 Gy, i.e. during and after combined IORT and fractionated ERT (total dose 40 Gy). Within 24 h after IORT, the arterial wall was found to be invaded by TNF-alpha positive macrophages, which later on disappeared within 7-14 days. At 2 days post-IORT, the medical smooth muscle cells were strongly positive for TNF-alpha and remained positive throughout the observation period of 63 days. At 80 days, a comparison of different IORT dose groups showed that TNF-alpha expression after 20 and 30 Gy IORT plus 40 Gy ERT had subsided, while it was still strongly evident after 40 Gy IORT. Negative reactions in sham irradiated animals or animals treated with ERT alone indicate that TNF-alpha expression was caused by IORT. After > 30 days post-IORT, there was increased collagen type I deposition in the adventitia. In two animals receiving the full ERT course, intimal proliferations involving mainly smooth muscle cells were observed. Our findings indicate that some features typical of radiation induced arteriosclerosis such as periarterial fibrosis and intimal proliferations can occur as early as < 60 days postirradiation. Macrophage invasion as well as TNF-alpha expression in medial smooth muscle cells are known to be important steps in the development of spontaneous atherosclerotic lesions. Therefore, early TNF-alpha induction in the arterial wall by a high local dose of X-irradiation may be regarded as one initiating factor of chronic radiation-induced arteriosclerosis.

Keywords: arteriosclerosis, etiology, metabolism, pathology, celiac artery, pathology, radiation effects, cell division, radiation effects, collagen, comparative study, densitometry, female, immunohistochemistry intraoperative care, adverse effects, muscle, smooth, vascular, pathology, radiation effects, radiation injuries, tumor necrosis factor.


Abstract: The effects of continuous passive motion (CPM) on nerve regeneration following nerve repair were investigated. In 26 rabbits, the medial popliteal nerve was transected and microsurgically repaired. Half of the animals were treated with cast immobilization and the rest with 70 degrees arc CPM. Both treatments were discontinued on day 14. After sacrifice on day 100, no animal showed separation at the suture line. Mean nerve conduction velocity was slightly slower in the CPM than in the immobilization group. Mean fibre density was also slightly less in the CPM group but the difference was not significant. Mean fibre diameters, fibre diameter distributions, and soleus-muscle wet weights were similar in the two groups.

Keywords: action potentials, physiology, analysis of variance, axons, pathology, casts, surgical, comparative study, computer-assisted image processing, immobilization, microsurgery, motion therapy, nerve fibers, postoperative care, tibial nerve surgery.


Abstract: The effects of three different degrees of intraoperative graft tensioning on measures of ex vivo laxity, viscoelastic behaviour, and structural and material failure of isolated healing medial collateral ligament autografts were investigated in a rabbit model. The grafts were orthotopically replaced at one of three different loads (too tight, anatomic, or too loose) and were mechanically evaluated after 0, 12, 24, and 48 weeks of healing. Laxity of the ligament was influenced by intraoperative graft tensioning at time zero. However, after 12 weeks of healing, values for laxity were indistinguishable among the experimental groups. Cyclic load relaxation, a measure of viscoelastic behaviour, was significantly influenced by intraoperative graft tensioning, and this effect persisted even after 48 weeks of healing. Grafts placed under excessive tension relaxed one-third less than grafts placed under abnormally low in situ tension. The relevance of these differences remains to be
determined. Intraoperative tensioning had no significant influence on characteristics of structural or material failure of the graft during the first year of healing. These results suggest that, in this model, control of graft tension at the time of placement and fixation does not improve the failure characteristics of the medial collateral ligament. The structural strength of the grafts collectively improved to nearly normal values after 48 weeks; however, material recovery was less complete. Failure loads averaged 89% of control values, whereas failure stress averaged only 52% after 48 weeks of healing.

**Keywords:** female, elasticity, hindlimb, intraoperative care, medial collateral ligament, physiology, transplantation, stress, tibia transplantation, autologous, methods, viscosity, weight-bearing, wound healing.


**Abstract:** The radiation absorbed dose in the rabbit bone delivered by 153Sm-EDTMP (samarium ethylenediaminetetra methane diphosphonic acid) and 89SrCl2 (strontium chloride) was measured by means of electron spin resonance (ESR). These radioisotopes are used in systemic radiotherapy for palliation of painful bone metastases. The knowledge of the dose is important in order to avoid side effects to the bone marrow. The ESR radiation dose signal was calibrated by the additive dose method using cobalt-60 gamma rays. For 153Sm-EDTMP, the bone doses in three rabbits were (4 +/- 2), (5 +/- 1) and (5 +/- 2) cGy kg/MBq. For 89SrCl2, a dose of (2 +/- 1) cGy kg/MBq was found in one rabbit.

**Keywords:** animal model, rabbit, bone marrow, radiation effects, bone neoplasms, radiotherapy, electron spin resonance, spectroscopy, methods, organometallic compounds, administration and dosage, therapeutic use, organophosphorus compounds, radioisotopes, radiometry, methods, radiopharmaceuticals, samarium, strontium.


**NAL Call Number:** QL55 A1L3

**Keywords:** rabbits, mice, adverse effects, adjuvants.


**Keywords:** laboratory animals, New Zealand White rabbit, CD rat, toxicity, diethanolamine, cutaneous administration, developmental toxicity, skin lesions, reduced food consumption, personal care product, organogenesis.


**Abstract:** To evaluate the efficiency of mitomycin C (MMC) in limiting the postoperative inflammatory response and scarring after strabismus surgery. METHODS: A prospective, two-stage, masked, controlled trial was conducted. In the first stage, the inflammatory response at the extraocular muscle reattachment site was increased after inferior rectus recession in eight rabbits. In the second stage, MMC (0.4 mg/ml) was applied during surgery to the eyes of 22 rabbits with inferior rectus recession. As a control, contralateral eyes were treated with saline solution. Seven weeks later, exenteration was performed, and the sites of muscle reattachment were processed for histologic examinations. The sums of the areas of the granulomas in the extraocular muscle reattachment sites of control and treated eyes were compared. RESULTS: There was no significant inhibitory effect of MMC on the inflammatory response of treated eyes compared with that of control eyes. CONCLUSIONS: The intraoperative use of MMC (0.4 mg/ml) was not effective in controlling the postoperative inflammatory response in rabbit eyes after extraocular muscle surgery. These data do not support the hypothesis that MMC reduces postoperative adhesions after strabismus surgery.

**Keywords:** antimetabolites, therapeutic use, cicatrix, pathology, prevention and control, granuloma, intraoperative care, mitomycin, oculomotor muscles, surgery, postoperative complications.

Moldenhauer, F. (2003). *Using in vitro prediction models instead of the rabbit eye irritation test to classify and label new chemicals: A post hoc data analysis of the international EC/HO validation study. Alternatives to


Orafidiya, L.O.; Agbani, E.O.; Abereuje, O.A.; Awe, T.; Abudu, A.; Fakoya, F.A. (2003). An investigation into the wound-healing properties of essential oil of *Ocimum gratissimum* Linn. *Journal of Wound Care* 12 (9): 331-34, ISSN: 0969-0700. **Abstract:** To investigate the effects of *Ocimum* oil and two antibacterial preparations, Cicatrin (GlaxoWellcome) and Cetavlex (AstraZeneca), on the healing of full-thickness excisional and incisional wounds, created under anaesthesia, on the back of test and control groups of adult albino rabbits. **METHOD:** Treatment was by topical application of the test substances onto the wound surface for 15 days. Observation continued for a further six days. Quantitative parameters of wound healing were determined daily. Swabs were taken from wound sites that appeared not to be healing for identification of wound contaminants and sensitivity tests. **RESULTS:** There was a marked enhancement in the inflammatory and proliferative phases of wound healing in the rabbits treated with *Ocimum* oil, suggesting that the oil facilitated the healing process to a greater extent than the control and reference products. Wounds treated with Cetavlex showed no sign of healing for eight days but responded to *Ocimum* oil after a three-day wash-out period. **CONCLUSION:** The essential oil *Ocimum gratissimum* can promote wound healing. However, large studies will need to be carried out using domestic pigs, followed by clinical trials on human wounds. **Keywords:** laboratory animals, albino rabbits, animal models, wound healing, Bacitracin, Cysteine, Neomycin, plant oils, Nigerio oils, African Traditional, volatile, pharmacology, cutaneous administration.

Osborne, R.; Carr, G.J.; Kohrman, K.A.; Stitzel, K.A. (1999). Examination of the reversibility of corneal opacity using an historical eye irritation database. *Journal of Toxicology Cutaneous and Ocular Toxicology* 18 (4): 349-358, ISSN: 0731-3829. **Keywords:** laboratory animal, cornea, sensory system, eye, sensory system, eye irritants, Draize eye test, toxicity testing method, low volume eye test, toxicity testing method, nonrinse procedure, laboratory method, rinse procedure, Good Laboratory Practice, regulations, animal welfare, corneal opacity, reversibility, historical eye irritation database, human safety assessments, regulatory classifications, training programs, visual clarity.

Abstract: Single or multiple subconjunctival injections of mitomycin-C (MMC) may offer one way of establishing the total dosage of MMC more accurately. The method also allows re-applications later postoperatively. In this experimental, randomized prospective study we compared the effects of a single intraoperative application of MMC at the filtering site and a single postoperative subconjunctival injection of the drug. METHODS: The left eyes of 32 pigmented rabbits were divided into two groups. In the first group we applied MMC intraoperatively (IO) with a 4 x 1 mm surgical sponge soaked in a MMC solution (0.5 mg/ml). In the second group we injected 0.4 ml of the same solution subconjunctivally (SC) immediately after (conjunctival) suture. Post-operative evaluation was carried out every day during the first week, then every three days until day 58. Survival analyses were done for intraocular pressure (IOP) and bleb failure. Log-rank tests were used to compare survival differences between the groups. RESULTS: The IO group showed longer survival parameters than the SC group (p < 0.05), both in the control of IOP and as regards blebs. The histological persistence of fistulas was similar. The IO group, however, had a higher incidence of undesirable side effects. CONCLUSIONS: Our findings suggest IO application of MMC is more effective in reducing fibroblast ingrowth. However, subconjunctival application offers certain advantages such as the possibility of repeating the treatment postoperatively and, therefore, using a smaller initial dose.

Keywords: animal model, rabbit, antibiotics, antineoplastic, administration and dosage, conjunctiva, drug effects, fibroblasts pathology, follow-up studies, injections, intraocular pressure, intraoperative care, iris surgery, mitomycin, administration and dosage, postoperative complications, pathology, prevention and control, sclerostomy.


Abstract: In order to compare the healing of tendon to bone and the healing of bone to bone in a rabbit model, the lateral 4 mm of patellar tendons were detached from their insertion into the tibia either subperiosteally (group I) or with a bone block (group II) and implanted into drill holes in the proximal articular surface of the tibia. The histological and biomechanical features of the graft incorporation were observed at 2, 4, 8 and 12 weeks. Histological patterns similar to normal tendon-bone attachment were seen at the tendon-bone interface in group I by 12 weeks, while direct bony union was seen in group II by 8 weeks. The maximum tensile load and stiffness were significantly greater in group II at 4 and 8 weeks while the difference between the two groups was not significant at 2 and 12 weeks. These findings show that more rapid incorporation of the graft occurs in group II although no significant difference in biomechanical parameters was noted once healing was complete.

Keywords: bone transplantation, adverse effects, rehabilitation, comparative study, disease models, elasticity osseointegration, patellar ligament transplantation, patellar ligament ultrastructure, postoperative care methods, tensile strength, tibia, surgery, time factors, autologous transplantation, adverse effects, rehabilitation, wound healing.


Abstract: Despite the widespread use of radiofrequency-induced shrinkage of collagenous tissues, there have been no animal studies on the effects of postoperative immobilization after such treatment. PURPOSE: To examine the effects of postoperative immobilization after radiofrequency energy treatment, with special emphasis on any tissue length increases. STUDY DESIGN: Controlled laboratory study. METHODS: The right patellar tendon of 60 New Zealand White rabbits was shrunk with a radiofrequency probe. Tendon length was measured intraoperatively before and after shrinkage and via radiographs immediately postoperatively and at 3, 6, and 9 weeks. Twenty rabbits were not immobilized, 20 were immobilized for 3 weeks, and 20 were immobilized for 6 weeks. RESULTS: In the nonimmobilized limbs, the tendon length increased 34.9% at 3 weeks and another 2.5% at 6 weeks, versus 11.2% at 3 weeks and 6.6% at 6 weeks in the immobilized limbs. Ten of the 20 rabbits that were immobilized for 6 weeks were sacrificed at 9 weeks and were found to have a further length increase of 10.8%. At 9 weeks, the tendons of this group were no longer significantly shorter than the tendons from rabbits that had not been immobilized. CONCLUSIONS: Careful postoperative rehabilitation is imperative after radiofrequency-induced shrinkage. Without protection, exposure to normal physiologic loads
places the shrunken tissue at risk of stretching out beyond the preshrinkage length. CLINICAL RELEVANCE: Shrunken tissue is at risk of stretching out after radiofrequency-induced shrinkage.

**Keywords:** animal model, rabbit, catheter ablation, methods, comparative study immobilization, physiology, patella, surgery, postoperative care methods, risk factors support, tendons, physiology, surgery, time factors.


**Abstract:** The purpose of this study was to assess the effects of intraoperative mitomycin-C (MMC) on the function of Baerveldt glaucoma implants in rabbits. METHODS: Bilateral implantations of 200 mm2 Baerveldt drainage devices were performed in 30 normal albino rabbits. One eye, randomly selected, received intraoperative application of MMC at the site of the implant plate for 5 min, via a 6 x 4 x 2 mm cellulose sponge saturated with 0.5 mg/ml of MMC. The opposite eye served as a control. MMC-treated and control eyes (five animals each group) were compared for intraocular pressure (IOP), resistance to flow, flow rates through the implant and histopathological findings at 2, 4, 6, 12, and 24 weeks postoperatively. Resistance to flow and flow rates through the implants were studied after opening the cornea and connecting the drain tube to a micromanometric system. RESULTS: Preoperative IOP did not differ between groups. MMC-treated eyes had lower levels of IOP than did controls at all postoperative times. The differences in IOP were statistically significant up to 8 weeks postoperatively. Resistance to flow was lower in MMC-treated eyes at all times studied, but the differences were statistically significant only at the time points of 2, 4, and 6 weeks. Flow rates through the implant bleb were always higher in MMC-treated eyes, and statistically significant differences were seen at 2, 4, 6, and 24 weeks. Histopathologically, MMC-treated eyes had thinner implant capsules with delayed maturation and less inflammatory infiltrate. CONCLUSION: MMC causes lower IOP and higher perfusion rates through the implant capsule at 2, 4, and 6 weeks postoperatively. Wound dehiscence, bleb leaks, and extraocular muscle injury were observed only in MMC-treated eyes.

**Keywords:** administration, topical animals aqueous humor, secretion comparative study drainage, instrumentation, filtering surgery, glaucoma, pathology glaucoma, physiopathology, glaucoma, surgery, intraocular pressure, drug effects intraoperative care mitomycin, pharmacology, nucleic acid synthesis inhibitors, pharmacology, oculomotor muscles, pathology prostheses and implants, rabbits random allocation sclera, ultrastructure.


**NAL Call Number:** SF405.5 A23

**Keywords:** laboratory mammals, bone fractures, fracture fixation, experimental surgery, case reports, femur, postoperative care, postoperative complications.


**NAL Call Number:** 41.8 IN22

**Keywords:** breed, New Zealand, dexamethasone, immunologic drug, toxicity, levamisole, drug induced immunosuppression, immune system disease, toxicity, cell mediated immunity, humoral immunity, immune response, stress.


**Abstract:** To investigate the effects of the duration of postoperative immobilization on the biological fixation of the graft within bone after anterior cruciate ligament (ACL) reconstruction; we performed ACL reconstruction in 27 rabbits, which were divided into five groups - no immobilization and 1-, 2-, 4-, and 6-week immobilization. All animals were killed 6 weeks postoperatively, and the graft-bone tunnel interface was examined biomechanically and histologically. In the groups with immobilization, in tensile failure tests, most specimens failed through the intraarticular portion of the grafts. There was no significant difference in the
maximum load between these groups. In the no-immobilization group, all specimens failed through pulling of the grafts out of the femoral tunnel, with a lower maximum load than in the other groups. Histologically, new bone formation and occasional collagen fiber continuity were observed at the interface; which consisted of a fibrous tissue. In the no-immobilization group, the graft was partly separated from the fibrous tissue covering the bony wall. It is concluded that no immobilization delays the biological fixation process in the bone tunnel after ACL reconstruction, and that a certain period of immobilization is necessary for the fixation to proceed smoothly.

Keywords: animal model, rabbit, anterior cruciate ligament, pathology, physiology, transplantation, biomechanics femur, physiology, surgery, immobilization, male postoperative care, rabbits, tibia, pathology, wound healing.

NAL Call Number: 410.9 P94
Keywords: animal models, disseminated intravascular coagulation, hemostasis.

Abstract: An animal model for the study of heterotopic ossification was developed and the effects of perioperative radiation were analyzed. In Phase I, New Zealand White rabbits (n = 18) underwent surgery either with or without muscle injury on each hip to establish the most reliable model in which to study heterotopic ossification. In Phase II, rabbits (n = 36) underwent either 400, 800, or 1200 cGy radiation to one hip 24 hours after bilateral hip surgery to establish a dose response relationship for postoperative radiation therapy. In Phase III, rabbits (n = 24) underwent preoperative radiation therapy (800 cGy) at 4, 16, or 24 hours preoperatively to investigate the mechanism of action and efficacy of preoperative radiation therapy. Monthly radiographs were graded by blinded observers for severity of heterotopic ossification. Mean grade, intraobserver and interobserver variability, and statistical significance were evaluated. In Phase II, 17 of 18 rabbits generated heterotopic ossification in both hips, and the mean grade of heterotopic ossification was always greater on the operative side with intentional muscle injury. Variability in the grading was considered excellent. Phase II revealed that 800 cGy was the minimal effective dose. Contrary to hypothesis, Phase III revealed an increasing grade of heterotopic ossification coinciding with a decreasing preoperative time interval, with the difference in heterotopic ossification grade with 24-hour versus 4-hour preoperative radiation being significant. The rabbit model is reliable and reproducible and closely resembles the human clinical situation after hip surgery. Preoperative and postoperative radiation effectively prevented heterotopic ossification formation. The results support the use of preoperative radiation and establish a need for additional investigation regarding the mechanism of action and timing of preoperative radiation therapy.
Keywords: animal model, disease model, rabbit, arthroplasty, hip replacement, adverse effects, methods, radiation, dose-response relationship, ossification, heterotopic, etiology, prevention and control, perioperative care, severity of illness index, single-blind method.

Abstract: To eliminate persistent refractive errors after cataract and phakic IOL surgery, photosensitive silicone IOLs have been developed. These IOL formulations enable precise laser adjustment of IOL power to correct spherical and toric errors post-operatively, after wound and IOL stabilization. Initial experience with these laser adjustable IOLs indicate excellent biocompatibility and adjustability of more than five diopters.
Keywords: human, animal model, rabbit, lens implantation, intraocular methods, postoperative care, methods, prosthesis design, refractive errors, surgery.

NAL Call Number: RM845.J78
Abstract: A high-resolution PET system for small animals was tested for its applicability to the investigation of regional myocardial blood flow (MBF) in rabbits. METHODS: Nineteen measurements were performed in 10 closed-chest anesthetized rabbits at baseline and during infusions of adenosine (0.2 mg/kg/min) and propranolol (0.20-1.20 mg slow infusion) to obtain a wide range of MBF. Myocardial blood flow was assessed both by dynamic 13N-ammonia PET and by colored microspheres. Blood was withdrawn directly from the femoral artery, and arterial 13N activity was measured by coincidence type gamma detection system for the input function. Nitrogen-13 myocardial uptake was calculated by dividing the myocardial 13N activity by the integral value of the input function. RESULTS: Three or four contiguous cross-sectional myocardial images were obtained after 13N-ammonia injection. The left ventricular wall and cardiac cavity were clearly visualized. Moreover, initial passage of the tracer through the heart was obtained with serial 10-sec PET images. Nitrogen-13 myocardial uptake correlated well with flow measured with microspheres (r = 0.88). CONCLUSION: Our cardiac PET system can be used for in vivo imaging and quantitation of MBF in small animals and may play an important role in the future study of animal models of cardiovascular diseases.

Keywords: animal models, rabbits, male, adenosine, propranolol, ammonia, pharmacology, diagnostic use, heart, physiology, myocardium, metabolism, nitrogen radioisotopes, tomography.


Abstract: The main objective of current animal and clinical studies was to assess the efficacy of low level laser therapy (LLLT) on wound healing in rabbits and humans. STUDY DESIGN/MATERIALS AND METHODS: In the initial part of our research we conducted a randomized controlled animal study, where we evaluated the effects of laser irradiation on the healing of surgical wounds on rabbits. The manner of the application of LLLT on the human body are analogous to those of similar physiologic structure in animal tissue, therefore, this study was continued on humans. Clinical study was performed on 74 patients with injuries to the following anatomic locations: ankle and knee, bilaterally, Achilles tendon; epicondylus; shoulder; wrist; interphalangeal joints of hands, unilaterally. All patients had had surgical procedure prior to LLLT. Two types of laser devices were used: infrared diode laser (GaAlAs) 830 nm continuous wave for treatment of trigger points (TPs) and HeNe 632.8 nm combined with diode laser 904-nm pulsed wave for scanning procedure. Both were applied as monotherapy during current clinical study. The results were observed and measured according to the following clinical parameters: redness, heat, pain, swelling and loss of function, and finally postponed to statistical analysis via chi2 test. RESULTS: After comparing the healing process between two groups of patients, we obtained the following results: wound healing was significantly accelerated (25%-35%) in the group of patients treated with LLLT. Pain relief and functional recovery of patients treated with LLLT were significantly improved comparing to untreated patients. CONCLUSION: In addition to accelerated wound healing, the main advantages of LLLT for postoperative sport and traffic related injuries include prevention of side effects of drugs, significantly accelerated functional recovery, earlier return to work, training and sport competition compared to the control group of patients, and cost benefit.

Keywords: accidents, traffic, human, animal model, rabbit, athletic injuries, radiotherapy, disease models, laser therapy, low-level, postoperative care, wound healing, radiation effects, radiotherapy.


NAL Call Number: RM216.M342

Abstract: There seems to be no clear-cut indications for routine TPN support after major elective surgery. The present study was designed to investigate whether TPN could improve the results of standard surgical care for acute peritonitis (laparotomy plus antibiotics). ANIMALS AND METHODS: Peritonitis was induced in 48 New Zealand rabbits (day -2). On day 0, appendectomy and peritoneal lavage were performed, ceftriaxone (250 mg, i.m./24 h.) was started and animals were randomly assigned to receive regular fluids (RF), glucose-based TPN (G-TPN) or isocaloric fat-based TPN (F-TPN) for 6 days. MAIN OUTCOME MEASURES: Balance studies (days 1-3), s-albumin, thyroid hormones and urinary catecholamines were determined at various points of the experiment. At postmortem, wound infection, residual intra-abdominal infection and laparotomy wound breaking strength were recorded. RESULTS: Peritonitis produced a fall in weight, s-albumin and T3. At day 6,
weight-loss was more pronounced in RF than in G-TPN or F-TPN (-7 vs 1.5 vs -1.2%; P=0.0001) but s-albumin and T3 concentrations were similar. Diuresis (377 vs 268 vs 269 mL/3 days; P=0.01) was higher and water balance lower (373 vs 511 vs 480 mL/3 days; P=0.01) in Group RF. Although the differences were not statistically significant (P<0.2), persistent infection and wound breaking strength were slightly worse in the pooled TPN groups compared with the RF group (19 vs 6% and 542 vs 701 g, respectively). CONCLUSIONS: TPN failed to improve relevant biochemical markers and clinical outcome after laparotomy for peritonitis.

Keywords: acute disease, appendectomy, animal models, disease, liver function tests, nutritional status, total parenteral nutrition, adverse effects, peritonitis, chemically induced, mortality, therapy, postoperative care, postoperative complications, prevention and control, random allocation, serum albumin analysis, thyroid hormones, blood, treatment outcome, wound healing.

NAL Call Number: Z7994.L3A5
Keywords: passive cutaneous anaphylaxis test, screening, guinea pigs.

NAL Call Number: SF761.Z4
Keywords: Oryctolagus cuniculus, morphology, chemoreception, carotid body, arteries, carotid artery, anatomy, sensory reception, circulatory system, blood vessels.

NAL Call Number: QL55 A1L33
Abstract: The ISO intracutaneous reactivity test is the standard protocol for determining a medical device’s potential for causing irritation. The authors present data indicating that the number of animals required per test can be reduced from three rabbits to two.
Keywords: welfare, drug evaluation, preclinical, intradermal injections, international cooperation, intradermal tests, irritants, administration and dosage, toxicity, skin, drug effects.

NAL Call Number: Z7994.L3A5
Keywords: laboratory animals, rabbits, cornea, penetration, animal welfare, drug development.

Abstract: A prospective, randomized, double-masked and placebo-controlled study was performed to compare the effects of a single 5-minute intraoperative exposure to aclacinomycin (AMC) 0.4 mg/ml or 0.8 mg/ml with control eyes treated with saline solution on the success of glaucoma filtration surgery in 26 rabbits. Intraocular pressure (IOP), bleb survival, fistula patency and complications were evaluated. The results showed that IOP in the eyes treated with AMC was significantly lower than that in the control eyes from days 5-40 in the 0.4 mg/ml group and from days 5-20 in the 0.8 mg/ml group. The bleb survival lasted significantly longer in the two treated groups than in the control group and in the AMC 0.4 mg/ml group than in the AMC 0.8 mg/ml group. At 40 days, the rate of sclera fistula occlusion was 0% in the AMC 0.4 mg/ml eyes, 43.8% in the AMC 0.8 mg/ml eyes, and 100% in the control eyes. Significant complications, such as anterior chamber inflammation, hyphema, moderate and severe corneal haze, dense corneal neovascularization and mild cataract occurred only in the eyes treated with AMC 0.8 mg/ml. The results indicated that intraocular treatment with AMC at a dose of 0.4 mg/ml had a markedly beneficial effect on IOP, bleb appearance and fistula patency after experimental filtration surgery in rabbits.
Keywords: comparative study, aclarubicin, analogs and derivatives, therapeutic use, drug effects, pathology, filtering surgery, glaucoma surgery, intraocular pressure, intraoperative care, antibiotics, antineoplastic.

**NAL Call Number:** 447.8 J826  
**Keywords:** thyroid and thymic arteries anatomy, comparative study, thymus gland, thymic arteries, morphological variation.

**NAL Call Number:** QL55.J55  
**Keywords:** laboratory animals, specific pathogen free, cecal flora, fertility, rabbit colony establishment, weaning rates.

**NAL Call Number:** QL55.J55  
**Keywords:** diarrhea, cecal flora, mortality, specific pathogen-free, colony establishment.

**Abstract:** In order to study human atherosclerotic plaque burden and composition in vivo, an imaging technique is needed that can directly measure volume and characterize the cross-sectional morphologic components of the atherosclerotic arterial wall. High-resolution magnetic resonance imaging (MRI), which is noninvasive and nonirradiative, has been described as one promising modality to achieve these purposes. MRI allows direct visualization of the diseased vessel wall and is capable of characterizing the morphology of individual atherosclerotic carotid plaques.  
**Keywords:** review, animal model, disease, rabbits, arteriosclerosis, diagnosis, carotid stenosis, pathology, radiography, surgery, endarterectomy, methods, magnetic resonance angiography, contrast media, postoperative period, preoperative care, severity of illness index.

**Abstract:** In an in vitro study, rabbit subconjunctival fibroblasts were cultured and the effects of an antineoplastic drug, hydroxyurea (HU), on fibroblast proliferation and fibroblast attachment was investigated. The effects of HU were compared with those of mitomycin C (MMC). Different concentrations of HU and MMC were added to culture medium. The HU doses which led to 50% of inhibition (ID(50)) and the dose which led to about 90% of inhibition (subtoxic high dose, STHD) were determined to be 8 and 1,000 microg/ml, respectively. ID(50) of MMC and its STHD which led to about 100% inhibition were found to be 0.01 and 1 microg/ml, respectively. Reversibility studies revealed that inhibition disappeared depending on the dose and incubation period of both HU and MMC. In an in vivo study, glaucoma filtration surgery (GFS) was performed in rabbits which were treated with HU (treatment group) and distilled water (control group). Tissue samples were taken from the subconjunctival area treated at 1 h, 1 day, 5 days and 30 days postoperatively. The biopsy specimens were then placed in tissue culture media. Fibroblast outgrowth rates detected in the HU group were found to be significantly lower than those in the control group in the specimens taken at the end of the first hour. The difference was significant on culture days 9-15 in the biopsy specimens taken on day 1 while it was not significant in those taken on days 5 and 30.  
**Keywords:** in vitro, in vivo, rabbits, animals cell adhesion, drug effects, dose response relationship, cultured cells, conjunctiva, cytology, fibroblasts, filtering surgery, glaucoma, surgery, hydroxyurea, mitomycin, administration and dosage, pharmacology, therapeutic use, nucleic acid synthesis inhibitors, postoperative care.

Abstract: To evaluate the corneal toxicity of subconjunctival injection interferon alpha-2b at filtering bleb after sclerectomy in white rabbits. METHODS: Eight rabbits which had been performed sclerectomy were randomly divided into two groups. Each group consisted of four rabbits. Eight eyes in group 1 were subconjunctivally received interferon alpha-2b 5 x 10(5) IU/0.2 ml into filtering bleb from the edge of the filtering site immediately after operation and every postoperative day. The other eight eyes in group 2 were injected with 0.2 ml normal saline. All of the eyes underwent daily examination by slip-lamp microscopy and direct ophthalmoscopy. Sodium fluorescein was used to assess corneal epithelial integrity. On day 3, 4, 7 and 14, every two rabbits (group 1 and 2 each, respectively) were killed and removed cornea immediately to take examination of the viability of corneal endothelium by dual staining with typan blue and alizanin red S. RESULTS: No sign of toxicity in corneal epithelium and endothelium were found following continuously injection interferon alpha-2b at filtering bleb 3-14 days totally for selected doses. CONCLUSION: Subconjunctivally administered interferon alpha-2b at filtering bleb after glaucoma filtering surgery may be a safe drug-applied method.

Keywords: endothelium, corneal drug effects, epithelium, filtering surgery, interferon alfa-2b, administration and dosage, toxicity, postoperative care, sclera surgery.
Behavior


NAL Call Number: 410 Z35B

Keywords: young, conspecific recognition, human handling, olfactory learning.


NAL Call Number: QP84.6.C47

Keywords: circadian oscillator, maternal care, nursing rhythm, parturition.


NAL Call Number: QL55 I5

Keywords: strains, behavior, individual behavioral variation, foraging, hopping, grooming, rest, drinking.


NAL Call Number: QL55 I5

Keywords: strains, behavior, activity assessment, floor pens, group housed, fighting, social interactions, environmental marking, stable group size, individual activity score, ethogram, behavioral assessment.


NAL Call Number: SF756.7 I57 1996

Keywords: group housing, floor, pens, environmental enrichment, behavior, age-related activity.


NAL Call Number: QL55.15

Keywords: video-recorded sessions, behavior, strain differences, age related activity, individually caged, individual behaviors, animal model selection.


NAL Call Number: QL55 15

Keywords: breed, Sandy lop, housing, behavior, enrichment, group housing, floor pens.

**NAL Call Number:** 410 Z35B.

**Keywords:** habitat, parental care, defensive behavior, natural disturbance, human disturbance, altruism.


**NAL Call Number:** HV4701 A557

**Keywords:** cages, hay, enrichment.


**Keywords:** intensive husbandry, meat production, aggression, injuries, behavior, German language.


**NAL Call Number:** 410 Z35B

**Keywords:** maternal care, nursing, milk intake, nipple grasp frequency, rapid odor learning, suckling, nipple search, pheromone.


**NAL Call Number:** SF1.L5

**Keywords:** hybrid males, housing systems, comparison, wire netting, litter, straw bedded, animal behavior, growth, meat quality, stocking density, growth rate, liveweight gain, mortality, dressing percentage, carcass composition, body fat, muscles, pH, color, lipid peroxidation, oxidation, inhibitors.


**NAL Call Number:** SF451.R5

**Keywords:** behavior, housing, animal welfare, carcass quality, meat production, slaughter, transport of animals, Italy, Italian language.


**NAL Call Number:** QL750.E74

**Keywords:** parental care, nursing, natural vs free access nursing, pup survival, growth rate, reproductive productivity, parity effects, survival, population dynamics.


**NAL Call Number:** QH301.B45

**Keywords:** activity, coping strategies, active, passive, animal welfare, body weight, fertility, heritability, reproduction, selection.


**NAL Call Number:** 41.8 B45

**Keywords:** finishing, animal welfare, aggressive behavior, abnormal behavior, housing, group size, performance, health, Germany, German language.
Abstract: To investigate the drinking behaviour of rabbits as well as to prove the suitability of different drinker systems under animal suitable conditions all in all 32 rabbits aged four to eight weeks have been held to test in free choice four drinker types usually applied in practice. The rabbits could choose between swimmer-, low pressure-bowl-, nipple- and automatic minidrinkers. In two passages four animals in each of the four boxes have been held for four weeks and watched by video once a week during 24 hours to register the frequency of the animals’ drinking at the four alternative drinkers. The choice experiments show that the low pressure bowl-drinker has been preferred in frequency, followed by the nipple drinker. The swimmer-bowl-drinker was less frequented, the automatic minidrinker was avoided in tendency. All in all we see, that by offering bowl- and/or nipple-drinkers we present a natural adequate drinking to the rabbits. Both drinker-systems can be assessed as those with respect to animals’ behaviour.
Keywords: husbandry, instrumentation, choice behavior, comparative study, drinking behavior, equipment design, physiology.

Keywords: breed, New Zealand White, feed conversion efficiency, thyroxine, feed intake, drinkers, feeding, aggression, scratching, biting, animal welfare, carcass weight, dressing percentage, liveweight gain, water intake, behavior, nipple drinkers, water troughs, water, sources, iodine, supplements, rabbit feeding, drinking water.

Keywords: reproducing, young, feed intake behavior, growth performance, health status, milk intake, mortality, suckled litter size.

NAL Call Number: 44.8 J822
Keywords: breed, New Zealand white, commercial species, female, male, aggression, ejaculation, urination, environmental temperature, grasping, housing, intensive production unit, kicking, mating, mounting, photoperiod, sexual behavior.

Keywords: commercial rabbit, farm conditions, reproductive performance, behavior, mating, 24-hour observations, Polish language.

NAL Call Number: QL55 I5
Keywords: cages, enrichment.

NAL Call Number: QL750 A6
Keywords: housing, behavior, physical activity.

NAL Call Number: QL750 A6
Keywords: housing, cages, conventional caging, enriched caging, shelter, platforms, animal welfare, space requirements, stress, enrichment, behavior, restlessness, timidity grooming, bar-gnawing.

NAL Call Number: QD415.A1 J6
Keywords: Oryctolagus cuniculus, behavior, social hierarchy, scents, chin gland secretion, 2 phenoxyethanol, role in dominance hierarchies, fixative properties, perfume industry.

NAL Call Number: QL750 A6
Keywords: housing, groups, social dominance.

NAL Call Number: HV4701 A557
Keywords: female animals, floor pens.

Keywords: behavior, female animals, frequency, nursing, lactation, photoperiod, pups, suckling, wild versus domestic rabbits.

NAL Call Number: 41.8 T445
Keywords: rabbits, pigs, behavior, ammonia, infrared imagery, infrared photography, housing, weaning, finishing, breeding, dust, ammonia, German language.

NAL Call Number: 410 Z35B
Keywords: doe, domestic, female, immature, pup, wild, diurnal variation, housing, nursing time, photoperiod.

NAL Call Number: QL55.I5
Keywords: housing, husbandry, animal welfare, behavior, floors, cages, legislation, laboratory animals.

NAL Call Number: QP1.P4
Keywords: birth, parturition, temporal and behavioral patterning, comparative description.

Keywords: animal husbandry, parturition, suckling, weaning, maternal behavior, animal behavior, nesting, reviews, French language.

NAL Call Number: SF1.A53

Keywords: rabbits, dogs, horses, laying hens, human-animal interactions, heart rate, arteriosclerosis, vascular disease, arteriosclerosis, cage rearing, egg production, emotional factors, mortality, Poland, Polish language.


NAL Call Number: QL750 A6

Keywords: laboratory rearing, small animal rearing, behavior, animal welfare.


NAL Call Number: SF1.A53

Keywords: breed, New Zealand White, body temperature, seasons, mortality, preweaning period, stillbirths, housing, nests, behavior, maternal behavior, wire nest boxes, wooden nest boxes.


NAL Call Number: HV4701 J68

Keywords: cages, group size, castration, siblings.


NAL Call Number: QL671.M8

Keywords: Brachylagus idahoensis, Leporidae, home range, long distance movements.


NAL Call Number: QL55 A1L3

Abstract: In studies of learning using rabbits, there has been standardization of behavioural procedures across laboratories. Less attention has been paid to variation that may arise from genetic differences and/or differences in rearing conditions. The present experiment revealed that acquisition of a conditioned reflex can be affected dramatically by such differences. Specifically, the acquisition of a conditioned reflex in New Zealand White (NZW) rabbits from 3 different suppliers was compared. All rabbits received behavioural training in which a tone or a light signalled an electrotactile stimulation of the trigeminal nerve near the rabbits' right eye. This tactile stimulus reliably elicited an eyelink. Repeated presentations of the auditory and visual signals followed by the tactile stimulus yielded the acquisition of a conditioned response (CR), namely closure of the eyelids during the warning period provided by the signal stimuli. Two of the groups showed steady CR acquisition at a rate that matched previous results in other laboratories as well as in the senior author's laboratory. However, the third group of rabbits showed very slow acquisition, and some rabbits failed to show any CR acquisition.

Keywords: husbandry, laboratory animals, genetics, psychology, behavior, animal, blinking, classical conditioning.


NAL Call Number: SF756.7.157 1995

Keywords: mating behavior, cages, groups.

**NAL Call Number:** QL55 A1L3  
**Keywords:** feeding, timing, abnormal behavior, bar biting, housing, group housing, floor pens, cages.


**NAL Call Number:** QL750 A6  
**Keywords:** enrichment, behavior patterns, animal welfare.


**NAL Call Number:** 410.9 P94  
**Keywords:** group housing, single caging, group sizes, management, space allocation, diet, stress, stereotypy, behavior, activity, disease, economic guidelines.


**NAL Call Number:** QL750.E82  
**Keywords:** proteins, IFN [gamma], production in peripheral blood mononucleated cells, glucocorticoid receptor activity, evidence for endocrine links with social environmental changes, plasma corticosterone levels, immune parameter links, social environmental change relations, hormones, social environmental variation relations, agonistic behavior, seminatural conditions.


**NAL Call Number:** SF1.P67  
**Keywords:** breed, New Zealand White and Tan, cortisol, radioimmunoassay, determination method, restricted maximum likelihood method, mathematical method, breeding selection, hanging stress, stress response, genetic variation, heritability, Polish language.


**NAL Call Number:** 49 AR23  
**Keywords:** review, aggressive behavior, breeding, husbandry, production, animal welfare, circadian rhythm, diurnal activity, diurnal variation, female animals, mating, prolactin, pseudopregnancy, stress factors, suckling, weaning weights, management programs, handling, nutrition, availability of water, trough versus nipple waterers.


**NAL Call Number:** QL750.E74  
**Keywords:** *Oryctolagus cuniculus domestica*, chemoreception, defecation, urination, chin marking, frequency relationships, hormones, scent marking, spontaneous and odor induced behavior in males and females, social behavior.


**NAL Call Number:** QL750 I67 1997  
**Keywords:** companion rabbit, prey species, trance state, aggression, socialization, pain, diet, reinforced
aggression, dominance, territorial aggression, trauma, behavior modification, mental and physical stimulation.


NAL Call Number: QL750 A6

Keywords: litter, straw, floor type.


NAL Call Number: SF451.R5

Keywords: animal welfare, behavior, housing, Italian language.


NAL Call Number: SF756.7.E838 2002

Keywords: guinea pig, Mongolian gerbil, golden hamster, field vole, mouse, rat, rabbits, aggression, animal welfare, biological rhythm, birth, communication, development, domestication, ethology, feeding, foraging, housing, mating behavior, ontogeny, parental behavior, social behavior.


NAL Call Number: QP251.A5

Keywords: doe, female, mammary tissue, reproductive system, beta-endorphin, beta-estradiol, bromocriptine, hormone, progesterone, prolactin, nest building behavior, periparturient period, pregnancy.


Keywords: behavior, husbandry, social behavior, Italian language.


NAL Call Number: QL55 A1L33

Keywords: strains, housing, behavior patterns, enrichment, animal welfare.


NAL Call Number: 472 N21

Keywords: milk, reproductive system, mammary pheromone, behavior, inclusive fitness, evolutionary success, maternal care, maternal odor cues, neonatal behavioral cues, newborn feeding behavior, oral grasping behavior, reciprocal female offspring exchange, energy, immunity, information.


Keywords: New Zealand White, hybrid, buck, male, artificial light, natural light, semen collection, sexual activity, spermatological parameters, German language.


NAL Call Number: 41.8 R312

Keywords: companion animal, dog, horse, cat, rabbit, reptile, care, behavior, animal welfare, behavior problems, management, meeting.

Keywords: breed, New Zealand White, ZIKA hybrid, Belgian crossbred and German crossbred, behavior, circadian rhythm, suckling, behavior, video recordings, housing, flat deck cages, get-away-cage, frequency, cages, breeds, breed differences, genotypes, parity, hybrids, light, dark, duration, lactation, German language.

NAL Call Number: SF405.5 A23
Keywords: laboratory mammals, enrichment, toys, behavior.

Keywords: laboratory animals, thesis, behavior, aggressive, animal welfare, cages, physical activity, housing, German language.

NAL Call Number: QL1.D48 v. 31
Keywords: laboratory animals, rabbits, behavior, experiments, housing, husbandry, cages, stocking density.

NAL Call Number: S960.W5
Keywords: avoidance behavior, response to novel objects, auditory stimulus, influencing factors, England.

NAL Call Number: QH301.B56
Keywords: molecular genetics, population genetics, evolution, biochemical variation, dna analysis of population, social groups, social organization, distribution within habitat, England.

NAL Call Number: SF1.A56
Keywords: breed, Pannon White, commercial species, doe, female, growing, kit, newborn, nursing, once a day nursing, twice a day nursing, milk, reproductive system, body weight, carcass composition, food intake, growth, live weight gain, nursing, suckling, weaning.

NAL Call Number: QL55 A1L3
Abstract: Laboratory rabbits kept in barren “traditional” cages tend to develop stereotypic behaviours and bone deformities. We have used an alternative regime, housing adult does as groups of four or five in floor pens (2.5-3 m2) supplied with hiding places and bedding. High- and low-ranking members of each group were identified, and their immunological status compared in terms of blood leucocyte function (chemiluminescence and mitogen tests), complement activity, and antibody production to soluble and cellular antigens. We found no evidence of immunosuppression, either in groups of a “docile” breed (New Zealand White) or Dutch crosses. These results, together with the animals’ general health and ease of handling, lead us to conclude that group-housed does are suitable for raising antisera and other purposes, provided that they are adequately monitored.
Keywords: antibody formation, immunology, animal behavior, physiology, complement activation, housing,
phagocytes, drug effects, metabolism, respiratory burst.

NAL Call Number: 41.8 An78
Keywords: cattle, goats, horses, pigs, sheep, rabbits, dogs, reviews, livestock, assessment, variation, effects, productivity, poultry, breed differences, sex differences, fearfulness, fright, stress, behavior, animal welfare, adaptation, behavior, selection, French language.

NAL Call Number: SF451.R5
Keywords: animal welfare, well-being, adaptation, housing, Italian language.

NAL Call Number: SF451.R5
Keywords: animal welfare, stress, Italian language.

NAL Call Number: 474 N213
Keywords: fitness, stress, behavior, social rank, life expectancy, reproductive productivity, natural selection, fighting, Germany.

NAL Call Number: QL750.A33
Keywords: literature review, physiological techniques, stress levels in social situations, hormones, reproductive behavior, social behavior, wild populations.

NAL Call Number: SF1.K7
Keywords: abnormal behavior, vices, agonistic behavior, animal welfare, Polish language.
Breeding

NAL Call Number: S19.O682
Keywords: meat animals, Gabali, breed, husbandry, carcass composition, meat quality, genetic improvement, native livestock, performance traits, reproductive performance, spermatozoa, Egypt.

Keywords: Burundian, local breed, selection index, analytical method, average daily gain, body weight, genetic improvement, weaning weight.

NAL Call Number: SF84.E8
Keywords: husbandry, history, breeding, reproduction, management, habitats, morphology, French language, Europe.

NAL Call Number: S19.O682
Keywords: meat animals, Zemmouri, breed, husbandry, performance, genetic improvement, carcass composition, climate, native livestock, performance traits, Morocco.

NAL Call Number: S19.O682
Keywords: meat animals, Kabyle, breed, husbandry, carcass quality, meat composition, native livestock, performance traits, reproductive performance, Algeria.

NAL Call Number: 41.8 IN22
Keywords: breed, New Zealand White, agroclimatic condition rearing, genetic parameters, post-weaning body weights, India.

NAL Call Number: 442.8 Z35
Keywords: uterus, reproductive system, analytical method, best linear unbiased prediction selection method, breeding method, uterine capacity selection response.

**NAL Call Number:** S19.O682  
**Keywords:** meat animals, Argente de Champagne, breed, husbandry, carcass composition, native livestock, reproductive performance, French language, France.

**NAL Call Number:** S19.O682  
**Keywords:** meat animals, Strain INRA2066 (France), breed, husbandry, carcass composition, native livestock, performance traits, France.

**Keywords:** meat animals, Fauve de Bourgogne, breed, husbandry, carcass composition, native livestock, performance traits, France.

**NAL Call Number:** 41.8 IN2  
**Keywords:** breed, New Zealand White, kindling season, litter size, birth, weaning, litter traits, litter weight, parity.

**NAL Call Number:** 41.8 IN2  
**Keywords:** breed, New Zealand White, kindling season, litter size, birth, weaning, litter traits, litter weight, parity.

**NAL Call Number:** S19.O682  
**Keywords:** meat animals, Tadla rabbits, breed, husbandry, carcass composition, native livestock, performance traits, Morocco.

**NAL Call Number:** QP251.A1T5  
**Keywords:** somatic nuclear transfer, fertilization method, fetal fibroblast cell nuclei donors, cloning, cloned embryo, in vitro development.


NAL Call Number: 41.8 IN22

Keywords: breed, Soviet Chinchilla, heritability, reproductive efficiency, reproductive performance, agroclimatic conditions, seasonality, Meghalaya, India.


NAL Call Number: 41.8 IN2

Keywords: breed, Soviet Chinchilla, post-weaning body weight, growth performance, parity, litter size, seasonality, India.


NAL Call Number: QP251.A1T5

Keywords: chimeric embryo, cloned embryonic cells, theriogenology, transgenesis, transgenic embryonic cells, meeting.


NAL Call Number: QP251.A1T5

Keywords: transgenic, milk, reproductive system, functional recombinant bovine FSH, theriogenology, transgenesis, meeting.


NAL Call Number: QH301.B45

Keywords: activity, coping strategies, active, passive, animal welfare, body weight, fertility, heritability, reproduction, selection.


NAL Call Number: 41.8 IN2

Keywords: breed differences, Soviet Chinchilla, New Zealand Whites, carcass composition, carcass weight, dressing percentage, floor space, liveweight, offal, housing, slaughter weight.


NAL Call Number: 412.628 D23

Keywords: breeds, history, meat, husbandry, housing, shows, hides and skins, furbearing animals, production, meat production, wool production, pelts, Denmark, Danish language.


NAL Call Number: SF603.V4

Keywords: breed, Zika, intensive husbandry, cage reared, diseases, spine deformities, German language.


NAL Call Number: R180.A53

**NAL Call Number:** S19.O682

**Keywords:** meat animals, Chinchilla, breed, husbandry, native livestock, performance traits, reproductive performance.


**NAL Call Number:** S19.O682

**Keywords:** meat animals, Bauscat, breed, husbandry, adaptation, climate, native livestock, performance traits, reproductive performance, Egypt.


**Keywords:** hygiene, animal welfare, animal health, drug therapy, animal husbandry, Italy.


**NAL Call Number:** 41.8 IN22

**Keywords:** breed, New Zealand White, dam, female, sire, male, carcass traits, dam effects, delivery, season effects, genetic factors, heritability, meat/bone ratio, non-genetic factors, seasonal effects, sire effects, Egypt.


**NAL Call Number:** 41.8 IN22

**Keywords:** breed, Bauscat, Californian, New Zealand White, imported breeds, inbreeding coefficient models, mathematical model, birth weight, economic trait influences; inbreeding, inbreeding depression, litter size, pre weaning mortality, weaning weight, weight gain Egypt.


**NAL Call Number:** SF1.K7

**Keywords:** young rabbit, production, probiotics, profitability, breeding success, fattening period, feeding, mortality, rearing practices, preventive vaccination, feeding hygiene, performance, concentrate diets, dry season, weight gain, dry matter intake, Guinea grass hay, feed, Verano style hay.


**NAL Call Number:** QL55 A1L3

**Keywords:** female, male, breed, strain, Dutch belted, breeding colony, catalase, blood, hematocrit, heritability, sex differences, laboratory animal science, laboratory animal welfare.


**Keywords:** pets, albinos, pets, mice, rabbits, rats, rodents, Japanese language.


**NAL Call Number:** SF1.A66

**Keywords:** New Zealand White, commercial breeding, animal welfare, meat animals, plastic crates, disinfection, feed conversion efficiency, female animals, reproductive performance, finishing, liveweight gain,
pups, housing.


NAL Call Number: SF1.L5

**Keywords**: young rabbits, genetic selection, genetic trends, growth traits, litter size, post weaning daily gain, weaning weight, embryo cryopreservation, embryo transfer.


NAL Call Number: 49 AR22

**Keywords**: embryo, cryopreservation, embryo preservation method, embryo transfer, assisted reproduction method, Spanish language.


NAL Call Number: S19.O682

**Keywords**: meat animals, Caldes, breed, husbandry, carcass composition, native livestock, performance traits, Spain.


NAL Call Number: S19.O682

**Keywords**: meat animals, Prat, breed, husbandry, carcass composition, native livestock, performance traits, Spain.


NAL Call Number: SF1.L5

**Keywords**: longissimus lumborum muscle, muscular system, myofibers, nervous system, semitendinosus muscle, selection, breeding method, genetic method, body weight, carcass traits, pH, rheology, shear force, slaughter.


NAL Call Number: 41.8 IN22

**Keywords**: breed, Flemish Giant, Grey Giant, New Zealand White, Soviet Chinchilla, broiler, crossbred, body weight, carcass traits, litter size, post weaning.


NAL Call Number: S19.O682

**Keywords**: meat animals, Baladi rabbits, breed, husbandry, carcass composition, native livestock, performance traits, Lebanon.


NAL Call Number: QH431.A1A56

**Keywords**: chromosome, R-banding, gene, fluorescence in situ hybridization, genetic method, cytogenetic type I marker map, karyotype.
NAL Call Number: SF55.A78A7
Keywords: wool, rabbit breeding, genetics, 881Afwdarw881G mutation, amino acid sequence, nucleotide sequence, polymerase chain reaction, polymorphism, detection method, molecular marker, black ear coat color.

NAL Call Number: 442.8 Z35
Keywords: strain-1077, strain-2066, genetic selection, litter size, mating scheme.

NAL Call Number: S19.O682 no. 38
Keywords: genetics, breeding, France.

Keywords: breeds, physical characteristics, genetic resources, farming, nutrition, housing, diseases, parasites models, performance characteristics, reproductive efficiency, semen characteristics, fertility, fecundity, lactation, maternal behavior, Mediterranean region, natural resources.

NAL Call Number: S19.O682
Keywords: meat animals, adaptation, Giza White, breed, husbandry, carcass composition, meat composition, climate, genetic improvement, native livestock, performance traits, reproductive performance, Egypt.

NAL Call Number: S19.O682
Keywords: adaptation, Baladi, breed, husbandry, carcass composition, meat quality, native livestock, performance traits, reproductive performance, stress, Egypt.

NAL Call Number: SF55.D4D54 nr. 19
Keywords: genetics, breeding, nutrition, performance, Danish language.

NAL Call Number: 41.8 IN22
Keywords: breed, Black Brown, Soviet Chinchilla, White Giant, broiler, body weight gain, doe weight, genetic factors, litter size, non genetic factors, season, semi-arid region, India.

NAL Call Number: S19.O682
Keywords: meat animals, Carmagnola Grey Rabbit, breed, husbandry, carcass composition, native livestock,

**Keywords:** breed, Pannon White, buck, doe, fat, female, lean, male, EM-SCAN-SA-3152, field equipment, small animal body composition analyzer, TOBEC method, abdominal fat content, body composition, body fat content, genetic selection, growth performance, reproductive traits, scapular fat content, German language.


**NAL Call Number:** 49 AR22

**Keywords:** breeds, local breeds, genetics, Spain, Spanish language.


**NAL Call Number:** S19.O682

**Keywords:** meat animals, Gigante de España, breed, husbandry, carcass composition, native livestock, conservation program, performance traits, Spain.


**Abstract:** This review cover the effects of the following techniques for stimulating ovarian activity: managerial procedures designed to reduce stress, different techniques for separating dams from their litters, manipulation of the light regime, supplementary feeding (flushing), housing close to males.

**NAL Call Number:** SF451.R5

**Keywords:** husbandry, feeding, light regime, reproduction, estrus induction Italy, Italian language.


**NAL Call Number:** 49 J82

**Keywords:** breed, Altex, New Zealand White, commercial, crossbreeding parameter estimates, growth traits, litter traits, meeting.


**NAL Call Number:** 49 J82

**Keywords:** breed, Altex, Altex x New Zealand White, New Zealand White, fryer, average daily gain, breed effects, breeding efficiency, feed efficiency, feed intake, heterosis, litter size, litter survival rate, market weight, postweaning traits, total litter weaning weight, weaning weight.


**NAL Call Number:** 49 J82

**Keywords:** breed, Botucatu, genetic parameter estimation, growth performance, litter traits, reproductive traits, meeting.


**NAL Call Number:** QP251.A1T5

**Keywords:** transgenic, gene construct, donor recipient, embryo transfer method, assisted reproduction method, breeding method, tissue transplantation, embryo transfer, embryonic survival rate, recipient age.

**NAL Call Number:** 41.8 IN22  
**Keywords:** breed, Angora, German, wool, integumentary system, elasticity, wool fiber diameter, textile industry, Turkey.


**NAL Call Number:** SF604 .A76  
**Keywords:** breed, Californian, average daily gain, individual weaning weight, pedigree, ten week weight, trait heritability, Portuguese language.


**NAL Call Number:** SF1.A53  
**Keywords:** embryo, strain, California, New Zealand, blastocyst, embryonic structure, multiple generational cloning, reproductive method, nuclei transfer, reproductive method, meeting abstract.


**NAL Call Number:** S1.R4  
**Keywords:** breed, California, Chinchilla, New Zealand, Semigiant, weaning, feed efficiency, maize soybean alfalfa feed, animal feed, molasses supplement, Cuba.


**NAL Call Number:** S1.R4  
**Keywords:** breed, Caoba, growth traits, environmental effects, genetic effects, weight gain, Cuba.


**NAL Call Number:** S1.R4  
**Keywords:** breed, California, Chinchilla, Flanders Giant, New Zealand White, imported breeds, performance, linear model, mathematical and computer techniques, breed-x-sex interactions, daily gain, environmental effects, final weight, global-productivity, kidding number, litter size at weaning, pre-weaning growth, evaluation, season influence, weight at weaning, weight per age until weaning, weight per post weaning, age, year influence, Canada.


**NAL Call Number:** 41.8 IN22  
**Keywords:** breed, Californian White, body weight, pre-weaning, growth rate, pre-weaning, litter weight.


**NAL Call Number:** 41.8 IN22  
**Keywords:** birth month, carcass traits, dressing percentage, genetic correlations, heritability, meat production, phenotypic correlations, meat product, slaughter.


*Keywords*: breed, Californian, Flemish Giant, New Zealand White, doe, female, crossbreed performance, doe reproductive traits, parity effects, pre-weaning litter traits, purebreed performance, phenotypic correlations.


*Abstract*: The effects of human interaction on domestic rabbits were evaluated through the analysis of animals (up to 267) belonging to fancy breeds (22), a commercial breed (1), and selected strains (2). Microsatellite loci and mtDNA polymorphism revealed that the genetic pool of domestic rabbits studied only originated from that available in France. The good conservation of the original diversity was probably ensured through the multiplicity of samplings from wild populations. Selected strains, because of the breeding strategy, keep a fairly high level of diversity compared to other breeds.

*Keywords*: wild animals, husbandry, methods, genetics, DNA, Mitochondrial, genetics, variation, population.


*Keywords*: New Zealand White rabbit, buck, doe, female, male, humidity, litter production traits, litter size, litter weight, maternal heritability, tropical environment.


*Keywords*: breed Gray Giant, New Zealand White, Soviet Chinchilla, White Giant, broiler, meat breeds, genetic group, kindling period, kindling season, litter size, litter weight, performance, weaning weight.


*Keywords*: breed, Flemish Giant, Gray Giant, Soviet Chinchilla, broiler, inbreeding, litter size, pre weaning litter weight.


*Keywords*: housing, hygiene, nutrition, profitability, meat production, management, rabbit feeding, German language, Germany.


*Keywords*: transgenic founder, cow, dairy, livestock, goat, dairy, sheep, rabbit, pig, transgenic bioreactor, biopharmaceutical production, synthetic method, recombinant human protein production, synthetic method,
production efficiency, literature review.


**NAL Call Number:** SF1.K7

**Keywords:** poultry, rabbits, Angora rabbit production, housing, husbandry, animal welfare, feed supplements, performance testing, Germany, Polish language.


**Keywords:** breed, Angora, animal welfare, domestication, nutrition, fibres, history, wool production, growth, reproduction, genetic improvement, France, French language.


**NAL Call Number:** 41.8 IN22

**Keywords:** broiler, female, male, carcass, genetic groups, meat quality, meat.


**NAL Call Number:** 49 F84

**Keywords:** Egyptian breeds, Black Baladi, New Zealand White, Red Baladi, market age, body length, body shape characters, shared variability, chest width, shank length, thigh circumference.


**Keywords:** breed, Egyptian, Black Baladi, New Zealand White, Red Baladi, Egyptian breeds, body size, chest width, shank length, breed differences, growth.


**Keywords:** breed, New Zealand White, buck, doe, body fat partition, genetic parameters, phenotypic parameters, body length, heart girth, loin width, marketing body weight, selection indexes, weaning body weight.


**NAL Call Number:** SF1.S26

**Keywords:** broiler, large scale breeding, reproduction, number of sucklings, Czech language.


**Keywords:** population, genetics, blood proteins, polymorphic systems, interherd differences, population genetic analysis, intraherd differences, geographic zones, Tyumenskaya, Moskovskaya, Odesskaya regions, Kabardino-Balkarskaya republic, Russian language.


**NAL Call Number:** 41.8 D482

**Abstract:** Some aspects of relevance for animal protection in breeding dwarf (pet) rabbits are enumerated and discussed. The predisposition of these standard dwarfs (Dw/dw) for certain defects and diseases underlines the
partial dominance of Dw; mating of these heterozygous dwarfs is an open neglect of the German animal protection law (section 11b). For feasibility of control breeders (and especially so in commercial pet rabbitries) should be obliged to guarantee unambiguous identification of breeding animals and their progeny.

**Keywords:** female, pet rabbits, animal welfare, legislation, breeding, methods, dwarfism, physiopathology, Germany, German language.
Information Resources on the Care and Welfare of Rabbits

Environmental Enrichment


NAL Call Number: QL55 I5

Keywords: breed, Sandy lop, housing, behavior, enrichment, group housing, floor pens.


Abstract: The increasing emphasis on the provision of environmental enrichment to laboratory animals, vis-a-vis the USDA Animal Welfare Regulations, the Guide for the Care and Use of Laboratory Animals (NRC 1996), and a potential forthcoming policy from the USDA on the subject, can be difficult to accommodate in a toxicology research environment. A summary will be provided of current requirements and recommendations. Then, strategies for meeting regulatory requirements will be described for non-rodent animals used in toxicology research. These strategies will address methods of both social enrichment, such as pair or group housing, as well as non-social enrichment, such as cage furniture, food enrichments, and toys. In addition, the value of positive interactions with staff (e.g., through training paradigms or socialization programs) will also be discussed. Apparent in the discussion of these strategies will be an overarching recognition of the necessity to avoid introducing confounding variables into the research project and to avoid compromising animal health. The roles of the Institutional Animal Care and Use Committee (IACUC) and the attending veterinarian in helping scientists balance animal well-being, the scientific enterprise and the regulatory environment will be described.

Keywords: dogs, rabbits, husbandry, housing, legislation, jurisprudence, standards, social environment, toxicology methods, ethics.


NAL Call Number: HV4701 A557

Keywords: cages, hay, enrichment.


NAL Call Number: QL55 A1L3

Keywords: laboratory mammals, social content, diet, pair housing, husbandry, environmental enrichment.


NAL Call Number: QL55 I5

Keywords: cages, enrichment.

Keywords: natural environment, wild rabbits, social groupings, warrens, behavior, laboratory rabbits, breeds, New Zealand Whites, Dutch, Lops, housing, husbandry, cage design, psychological well-being, behavioral abnormalities, stereotypies, discomfort, distress, pair housing, group housing.


**Keywords:** enrichment, toys, Jingle Ball, Kong toy, Nylabone, food enrichment, Bunny Stix, Bunny Blocks, celery.


**Keywords:** breed, New Zealand White, male, housing, animal welfare, carcass weight, digestive tract, environmental enrichment, gnawing wood, fattening performance, liveweight gain, seasonal variation, Spring, Summer.


**Keywords:** enrichment, behavior patterns, animal welfare.


**Keywords:** polydipsia, environment, enrichment.


**Keywords:** laboratory mammals, enrichment, toys, behavior.
Feeding


Keywords: commercial rabbit mash, diet, feed, performance, maize grain, sweetpotato tuber meal, tropical agriculture.


Keywords: breed, New Zealand White, broiler, feed conversion ratio, fish meal, feed, growth performance, poultry viscera meal.


Keywords: breed, Angora doe, female, protein, dietary, dry matter digestibility, gestation, grass, feed, litter size.


Keywords: breed, New Zealand White, commercial species, fiber, dietary, protein, starch, alfalfa hay, carcass characteristics, corn grain, feed, diet, food conversion, nutrient utilization, soybean hulls.


Keywords: breed, New Zealand White, growing, microbe, cecal flora, fiber, dietary, starch, dietary, total volatile fatty acids, alfalfa hay, feed, corn grain, diet, soybean hulls.

Belenguer, A.; Balcells, J.; Fondievila, M.; Torre, C. (2002). Caecotrophes intake in growing rabbits estimated either from urinary excretion of purine derivatives or from direct measurement using animals provided with a neck collar: Effect of type and level of dietary carbohydrate. Animal Science Penicuik 74: 135-144.

Keywords: breed, New Zealand, growing male, cecum, digestive system, feces, nitrogen, microbial recycling, structural carbohydrates, diet, urinary purine derivatives, excretion, alfalfa hay, feed, barley grain, caecotrophy, composition; digestibility, dry matter intake, growth, maize, grain, neck collar, sugar beet pulp.

Bhatt, R.S.; Bratia, D.R.; Mahajan, A. (1999). Effect of incorporating rice-phak in the diet of Angora rabbits. Indian...
NAL Call Number: SF55.A78A7
Keywords: breed, Soviet Chinchilla, broiler, nutritive value, oat meal, tall fescue hay, body weight gain, growth performance, nutrient utilization, hay.

NAL Call Number: 41.8 IN22
Keywords: breed, German Angora, biological performance, digestibility, maize, feed, mortality, rice bran, maize substitute, rice polish, wool characteristics, wool yield.

NAL Call Number: 41.8 IN22
Keywords: breed, German Angora, lysine, dietary supplementation, methionine, dietary supplementation, dietary vegetable proteins, growth performance, wool yield, live weight gain, mustard cake, feed, protein source, soyaflakes, protein source, sunflower cake, protein source.

NAL Call Number: SF55.A78A7
Keywords: breed, Angora, German x British x Russian, nutrition, digestion, groundnut cake, feed, protein source, soyaflakes, sunflower cake, wool production.

NAL Call Number: 410 Z35B
Keywords: maternal care, nursing, milk intake, nipple grasp frequency, rapid odor learning, suckling, nipple search, pheromone.


**Keywords:** feces, digestive system, ileum, crude protein, ileal cannulation, surgical method, diet, fecal digestibility, feed intake, live weight, organic matter, Spanish language.


**Keywords:** breed, New Zealand x Californian, wheat bran, feed, coarse, digestibility, energy content, fiber content, fine, nutritive value.


**Keywords:** organic chromium, dietary supplement, ration integration, body weight gain, carcass composition, meat yield, fat content, meat digestibility.


**Keywords:** propolis, animal feeding uses, carcass quality traits, analysis, feed utilization, rabbit meat, chemical analysis, meat product, quality, texture, rabbit production, weight gain, Italian language.


**Keywords:** body weight, seasonal changes related to nutrition, food plants, seasonal nutritional quality related to testis weight, food availability, testis seasonal weight changes, relationships, testis, seasonal weight changes in relation to nutrition, evolutionary adaptation, testis weight, nutrition relationships, Indian ocean islands, Kerguelen islands, armor, molloy and mornie, testis weight related to nutrition.


**Keywords:** breed, New Zealand White x Californian, female, doe, diet, non-starch polysaccharides, arabinose, mannose, rhamnose, galactose, glucose, xylose, paprika meal, olive leaves, lucerne hay, soya-bean hulls, ileal apparent digestibility, dietary fiber, fiber source effect.


**Keywords:** n-3 fatty acids, vitamin E, dietary supplement, longissimus dorsi muscle, chemical characteristics, meat, oxidative stability, physical characteristics, frozen, refrigerated.

NAL Call Number: QP251.A1T5

Keywords: semen, storage, spermatozoa, motility, viability, alpha tocopheryl acetate, vitamin E, antioxidant, dietary supplements, dosage, ascorbic acid, antioxidant, artificial insemination, sperm cryopreservation, fertility, oxidative stability, storage temperature.


NAL Call Number: SF604.A76

Keywords: breed, Californian, New Zealand White, female, male, copper, dietary bioavailability, inorganic sources, organic sources, copper carbonate, dietary supplement, copper oxide, copper quelate, daily weight gain, dry matter intake, feed conversion, Portuguese language.


NAL Call Number: SF454.N88 1998

Keywords: breeding, growing, climatic environment, nutrient allowances, nutritional value, thermoneutral zone.


NAL Call Number: 41.8 IN2

Keywords: breed, Californian White cross, New Zealand White, Soviet Chinchilla, crossbred, calcium, glucose, inorganic phosphorus, total protein, biochemical profile, body weight, diet, nutritional status, tropical coastal climate.


NAL Call Number: SF55.A78A7

Keywords: laboratory animals, comparison, digestive function, guinea pig, Syrian hamster, rabbit, rat, cecum, colon, large intestine, rectum, crude protein, digestibility, fiber, digesta passage, digestive function comparison, digestive performance, fermentation site.


NAL Call Number: 47.8 AR2

Keywords: fat, diet, carcass yield, fattening performance, fertility, meat quality, milk, dairy product, rapeseed oil, fats and oils, rearing ability, soybean oil, fats and oils.


NAL Call Number: TX373.M4

Keywords: New Zealand White, breed, rabbit, thiobarbituric acid, reactive substances, vitamin E, dietary supplement, longissimus lumbarum, meat, color, lipid stability.


NAL Call Number: 44.8 J822

Keywords: perirenal fat, serum, blood and lymphatics, conjugated linoleic acid, dietary supplement leptin, lipid, total cholesteroltriglycerides, carcass characteristics, growth, sunflower oil.

Corino, C.; Mourot, J.; Magni, S.; Pastorelli, G.; Rosi, F. (2002). Influence of dietary conjugated linoleic acid on

**NAL Call Number:** 49 J82  
**Keywords:** breed, New Zealand White, male, female, cholesterol, lipids, plasma leptin, dietary conjugated linoleic acid, food supplement, growth, lipid metabolism, lipogenesis, meat quality, carcass characteristics, longissimus lumborum muscle.

**NAL Call Number:** 44.8 J822  
**Keywords:** breed, New Zealand White, adipose tissue, lipogenic enzyme activity, skeletal system, liver, digestive system, lipogenic enzyme activity, acetyl CoA carboxylase, conjugated linoleic acid, glucose-6-phosphate-dehydrogenase, expression., sunflower oil.

**NAL Call Number:** QP251.R48  
**Keywords:** commercial species, male, breed, California, semen quality, reproductive system, sperm, morphology, motility, vigor, selenium, dietary supplement, Portuguese language.

**NAL Call Number:** QL750.E74  
**Keywords:** parental care, nursing, natural vs free access nursing, pup survival, growth rate, reproductive productivity, parity effects, survival, population dynamics.

**NAL Call Number:** TX511.F62  
**Keywords:** vitamin E, docosahexanoic acid, oxidative stability, dietary intake, lipid oxidation, meat, chemical composition, energy content, homogenized, lipophilized.

de Arruda, A.M.V.; Lopes, D.C.; Ferreira, W.M.; Rostagno, H.S.; de Queiroz, A.C.; et al. (2002). *Digestibilidade aparente dos nutrientes de racao contendo diferentes fontes de fibra e niveis de amido com coelhos em crescimento.* [Nutrients apparent digestibility in diets with different starch levels and fiber source for growing rabbits.] *Revista Brasileira de Zootecnia* 31 (3): 1166-1175, ISSN: 1516-3598.  
**NAL Call Number:** SF1.R45  
**Keywords:** growing rabbits, feed, apparent nutrient digestibility, dietary starch level, dietary fiber source, corn grain, feed, alfalfa hay, soybean hull, Portuguese language.

**NAL Call Number:** SF454.N88 1998  
**Keywords:** amino acids, dietary requirements, fat supplementation, feed formulation, fiber substitution, protein to energy ratio, recommended nutrient concentration, starch substitution.

**NAL Call Number:** SF454.N88 1998  
**Keywords:** breeding, fur production, meat production, feeding, nutrition, digestive system, feed evaluation,

**NAL Call Number:** SF1.A64  
**Keywords:** doe, female, fiber, dietary starch, dietary low starch/fiber ratio, nutritional method, feed intake, health, lactation, milk production, mortality, weaning.


**NAL Call Number:** 49 F84  
**Keywords:** breed, White New Zealand, growing, male, young, energy retention, feed digestibility, feed intake level, dry matter, organic matter, crude protein.


**NAL Call Number:** SF95.A9  
**Keywords:** husbandry, homeopathic therapy, therapeutic method, animal production, growth, positive effects, feed additives, ignatia, medorrhinum, tuberculinum, farming, Spanish language.


**NAL Call Number:** S1.R4  
**Keywords:** male, White Semigiant x New Zealand, commercial hybrid, feed, sugarcane meal, effects on gastrointestinal tract, randomized design, morphometry, digesta content, caecal content, stomach weight, liver weights.


**Keywords:** breed, White New Zealand, commercial species, female, metabolic plasma, blood and lymphatics, serum, blood and lymphatics, T-3, T-4, estradiol, glucose, insulin, progesterone, total cholesterol, triglycerides, urea, heart puncture, blood collection method, canola meal, feed, lactation, pregnancy, soybean meal.

**NAL Call Number:** SF981 P72 1997  
**Keywords:** rabbits, pets, pet care, nutrition.


**Keywords:** nutrition, diet, habitat.


**Keywords:** breed, New Zealand White, feed conversion efficiency, thyroxine, feed intake, drinkers, feeding, aggression, scratching, biting, animal welfare, carcass weight, dressing percentage, liveweight gain, water intake, behavior, nipple drinkers, water troughs, water, sources, iodine, supplements, rabbit feeding, drinking water.

Fairham, J.; Harcourt-Brown, F.M. (1999). **Preliminary investigation of the vitamin D status of pet rabbits.** *The

**Keywords:** breed, New Zealand White, female, male, growth, recovery yeast, feed additive, nutritional value, rotational cylinder dried, Portuguese language.


**Keywords:** breed, New Zealand x Californian, commercial species, doe, female, milk, reproductive system, digestible protein, diet, dry matter intake, food intake, lactation, litter-weight, lucerne, milk yield, parity, parturition, temperature.


**Keywords:** breed, New Zealand White crossbreds, feeding, rabbit milk, yields, heat stress, liveweight gain, mortality, litter weight, reproduction, feed intake, fibre, intake, environmental temperature, milk yield, nutrition.


**Keywords:** breed, California, New Zealand White, bioavailability, zinc carbonate, dietary supplement, inorganic zinc source, zinc oxide, dietary supplement, zinc quelate, organic zinc source, zinc sulfate, inorganic zinc source, weight gain, Portuguese language.


**Keywords:** cattle, chicken, broiler, layer, pig, rabbit, meat products, eggs, poultry product, energy efficiency, gross energy, crude protein, milk, dairy product, nutrient use, pork, meat product, poultry meat, poultry product, rabbit meat, meat product.


**Keywords:** breed, Hungarian Giant, female, ovary, reproductive system, body composition, feed restriction, ad libitum feeding, feeding intensity, live weight, sexual maturity, Hungarian language.


**Keywords:** breed, Hungarian Giant, female, ovary, reproductive system, body composition, feed restriction, ad libitum feeding, feeding intensity, live weight, sexual maturity, Hungarian language.
Keywords: breed, New Zealand White, crude protein, digestibility, fat, ash content, body composition, body weight, corporeal development, dry matter content, feeding intensity, sexual maturity, water consumption.

Keywords: pets, chinchillas, gerbils, guineapigs, hamsters, mice, rabbits, rats, squirrels, nutrition, nutrient requirements, feeding, management, Hungarian language.

Keywords: young rabbits, lactating females, dietary fiber, starch, body condition, feeding strategy, health status, lactation, nutritional needs, weaning, French language.

NAL Call Number: QP251.A5
Keywords: female, does, feeding, restricted, ad libitum, milk production, conception rate, adipose tissue, ovulation rate.

NAL Call Number: 389.9 N953
Keywords: sucking, milk, reproductive system, availability, feeding pattern, litter size, effect.

NAL Call Number: SF95.147
Keywords: male, chinchilla rabbits, body weight gain, carcass quality, feed intake, growth performance, palm kernel oil, feed, dietary supplementation, fats, oils, tropical conditions.

Keywords: breed, New Zealand White, commercial species, growing rabbits, copper, zinc bacitracin, antibacterial drug, antiinfective drug, carcass weight, diet, feed conversion, feed intake, growth, performance, weight gain, Portuguese language.

Keywords: breed, New Zealand White, digestibility trials, digestibility coefficient, crude energy, crude protein, dry matter, dry matter based diet, performance, nutritional value, sunflower meal, soybean meal, feed, Portuguese language.

Keywords: laboratory animal, guinea pig, mouse, rat, rabbit, laboratory animal diets, electron beam sterilization, decontamination method, sterilization method, linear accelerator, laboratory equipment, powder diet, nutritional method, solid diet, nutritional method.

NAL Call Number: SF1.A64

Keywords: cecum, content weight, digestive system, fermentation traits, caecal pH, volatile fatty acid concentration, uronic acids, dry matter intake, fiber digestion, growing period, neutral detergent fiber, lignification, diet, chemical composition, nutritive value.


NAL Call Number: 49 J82

Keywords: cecum, digestive system, feces, stomach, neutral detergent fiber, lignification, nitrogen, recycling, starch, alfalfa hay, feed, fiber source, cecal fermentation, cecotrophy, diet, fiber digestion, olive leaves, feed, pH, paprika meal, sodium hydroxide treated barley straw, soybean hulls, sunflower hulls.


NAL Call Number: 49 J82

Keywords: breed, New Zealand White x California, cecal fermentation, defatted grape seed meal, feed, dietary inclusion, fiber source, nutritive value, digestion, mortality, performance.


NAL Call Number: 49 J82

Keywords: breed, New Zealand White x California, alfalfa hay, feed, barley straw, sodium hydroxide treated, cell wall digestibility, dry matter intake, fiber digestion efficiency, fiber rate of passage, fiber source, olive leaves, paprika meal, particle size, soybean hulls.


NAL Call Number: SF1.A56

Keywords: commercial species, female, immature, mature, young, diet, fiber, dietary starch, digestion, energy requirements, feeding strategy, lactation, nutritional requirements, weaning, literature review.


NAL Call Number: SF1.L5

Keywords: dietary fiber level, effects of, husbandry, ileum, digestive system, rectum, acid detergent fiber, starch, volatile fatty acids, bacterial fibrolytic activity, organic matter.


NAL Call Number: 49 F84

Keywords: breed, New Zealand White, growing, lignocellulose, starch, dietary level, digestible fiber replacement, fecal digestibility, nutrient retention, rate of passage.


NAL Call Number: SF1.L5

Keywords: digestive system, dietary fiber intake, digestive health, fiber digestibility.

Keywords: cellulose, dietary intake, lignin dietary intake, lignocellulose, quality, protein, digestion, daily weight gain, dry matter, digestibility, food intake, growth performance, morbidity, mortality.


NAL Call Number: 389.9 N953
Keywords: New Zealand White, male, muscle, muscular system, lipid content, lipid metabolism, feed restriction, effects, rabbit meat.


NAL Call Number: SF95.A55
Keywords: young rabbits, early weaned, feeding trials, crude protein, dietary intake, digestibility, enzyme supplement, neutral detergent fiber, starch, heat processing, feed processing method, average daily gain, dry matter, feed efficiency, growth performance, feed, peas, wheat, soyabean meal, starter diet.


NAL Call Number: 49 J82
Keywords: early weaned, 25 days of age, lactose, starch, starter diet, carbohydrates, digestion, early weaning, fiber, food supplement, growth performance, average daily gain, feed efficiency, gut histology, cecal fermentation traits, diarrhea.


NAL Call Number: SF601 I4
Keywords: tooth diseases, teeth, osteodystrophy, abscesses, vitamin deficiencies, vitamin D, mineral deficiencies, calcium, diets, restraint of animals, radiography, dentistry, incisors, malocclusion, tooth trimming.


Keywords: rabbits, guinea pigs, gerbils, hamsters, mice, rats, chinchillas, husbandry, feeding, ancestry, physiology, German language.


NAL Call Number: 410 Z35B
Keywords: doe, domestic, female, immature, pup, wild, diurnal variation, housing, nursing time, photoperiod.


NAL Call Number: 41.8 IN22
Keywords: breed, Dutch x New Zealand, commercial species, crossbred, forage, nutrition, crude fiber, crude protein, dietary, ether extract, diet, dry matter digestibility, feed conversion ratio, growth, liveweight gain, soaked, Acacia albida pods.


NAL Call Number: SF997.5.E95E97
Abstract: The feeding recommendations for the pet or house rabbit include grass hay fed ad libitum, dark leafy green vegetables fed at one cup per 5 pounds of body weight, and a maximum of 1 cup of high fiber pellets per
5 pounds of body weight. These recommendations are based on the feeding behavior, anatomy, and gastrointestinal physiology of the rabbit. Feeding this diet reduces the occurrence of common gastrointestinal tract disease in the house rabbit. This article reviews the feeding behavior, anatomy, and gastrointestinal physiology of the rabbit.

Keywords: review, feeding, nutrition, dietary fiber, administration, dosage, physiology.


Keywords: protein, dietary, body weight, carcass characteristics, diet, dietary energy, meat composition, nutrition.


Keywords: concentrates, crude fiber, nutrition, digestive system, physiology, rabbit, German language.


Keywords: poultry, cattle, horses, rabbits, care, health, animal welfare, nutrition, dry matter intake, water consumption, water requirements, water restriction, literature review, German language.


Keywords: feeding, nutrition, calcium, administration, dosage, feeding behavior, physiology, species specificity, German language.


Keywords: carbonic anhydrase, alimentary acid base load analysis, analytical method, minimal invasive, nutritional method, physiological method, food mineral content, nutrition, rabbit chow, respiratory control.

NAL Call Number: QL55 A1L3
Keywords: feeding, timing, abnormal behavior, bar biting, housing, group housing, floor pens, cages.

NAL Call Number: SF95.I47
Keywords: breed, Angora, weanling, ether extract, nitrogen retention, body weight, crude fiber retention, feed cost economy, lucerne hay, feed, nutrient digestibility, wool yield.

NAL Call Number: SF95.I47
Keywords: breed, German Angora, performance, body weight, white clover hay, feed, pelleted feed replacement, wool yield.

NAL Call Number: SF95.I47
Keywords: breed, Angora, weaner, body weight, nutrient utilization, sun dried robinia leaves, feed, dietary level, wool yield.

NAL Call Number: 49 F84
Keywords: cecum, digestive system, cell wall polysaccharide, digestibility, commercial feed, particle size, digestive efficiency, feed grinding, growth performance.

NAL Call Number: SF1.P77
Keywords: cecum, digestive system, colon, digestive system, animal performance, compound feed, feed, digestibility, grinding intensity, particle size, digestion, feed utilization, literature review, French language.

NAL Call Number: SF454.N88 1998
Keywords: breed, Angora, feeding management, nutritional recommendations, wool production.

NAL Call Number: SF1.L5
Keywords: husbandry, developing countries, commercial species, fryer, nutrition, crude protein, ash, carcass
yield, diet, feed, dry matter, feed to gain conversion, growth rate, molasses block, pelleted commercial feed, forage based diets, hay, supplements, sugar cane, molasses blocks, subtropical climate.


NAL Call Number: SF97.F39 2000
Keywords: pets, birds, rats, dogs, cats, rabbits, aquarium fishes, ornamental fishes, aviary birds, reviews, nutrition, nutrient requirements, feeding.


NAL Call Number: SF454.N88 1998
Keywords: nutrition, feeding management, nutrient requirements, raw materials.


NAL Call Number: SF454.N88 1998
Keywords: raw material grinding, feed processing method, diet number, feed conservation, feed management, feed storage, feeding systems, intensive production, pellet quality, pellet size.


NAL Call Number: 10 J822
Keywords: three month old, cecum, cecal contents, digestive system, in vitro fermentation, RNA, nitrogenous substrate, casein, nitrogenous substrate, gliadin, glucose, gluten, mucin, zein.


NAL Call Number: 410 AC88
Keywords: food plants, seasonal composition, browsing impacts, impact on habitat, browsing impact on food plants, forest, seasonal diet composition, Hungary.


NAL Call Number: 41.8 IN2
Keywords: breed, New Zealand White, broiler, digestible crude protein, total digestible nutrients, nutritional evaluation, analytical method, concentrate pellets, animal feed, dry matter intake, growth, mulberry leaves, feed, organic matter.


NAL Call Number: SF454.N88 1998
Keywords: grinding, feed processing method, mixing feed, molasses addition, pelleting, feed manufacturing, feed presentation, liquid additives, pellet quality, weighing.


NAL Call Number: 41.8 IN22
Keywords: leaf, cauliflower, breed, New Zealand White, male, nitrate toxicity, sewage water, soil contamination.

**NAL Call Number:** SF55.A78A7

**Keywords:** breed, New Zealand White, sorghum, forage crop, grain crop, maize, crude protein, tannin, chatechin equivalent, feed conversion efficiency, feed digestibility, feed intake, weaning weight, weight gain, Kenya.


**NAL Call Number:** SF601.145

**Keywords:** breed, Soviet Chinchilla, broiler, kit, crude protein, dietary, nitrogen, digestibility, excretion, intake, apparent nitrogen balance, average daily gain, body weight, growth performance, meat production.


**NAL Call Number:** SF1.A56

**Keywords:** commercial species, growing rabbits, basal diet, nutrient requirements, feed, sunflower hulls, food efficiency, food intake, cecal fermentation, growth rate, mortality, weaning.


**NAL Call Number:** SF95.A55

**Keywords:** weanling, butyric acid, lignin, dietary intake, propionic acid, neutral detergent fiber, volatile fatty acid, alfalfa hay, performance, average daily gain, feed intake, lactation, milk production, soya bean hulls, wheat straw.


**Keywords:** New Zealand, doe, female, crude fiber, dietary, diet, digestible energy, energy intake, feeding behavior, lactation.


**NAL Call Number:** SB111.A2T76

**Keywords:** monkey pod, rain tree, ornamental, live weight, daily feed intake, potential livestock feed source, shade tree, *Samanea saman* pods, feed, autoclaved, digestibility, quality, raw, packed cell volume, hemoglobin, red blood cell, white blood cell, tropical agriculture.


**NAL Call Number:** SF601.A47

**Keywords:** calcium, furazolidone, antibiotic, feed additive, polyether ionophore, lasalocid antibiotic, polyether ionophore, maduramicin, monensin, polyether ionophore, narasin antibiotic, polyether ionophore, nitrogen, salinomycin, tiamulin, polyether ionophore, cardiomyopathy, heart disease, cardiopulmonary clinical signs; inotrophy; poultry litter, feed, Brazil.

Onifade, A.A.; Adejumo, D.O.; Onipede, E.O.; Obiyani, R.I.; Abu, A.O.; Abanikannda, O.T.F.; Babatunde, G.M.; Abubakar, A. (1999). **Comparison of the performance of, hematology and serum chemistry of rabbits fed supplementary antibiotics or copper or yeast or *Leucaena leucocephala*.** *Journal of Animal Science* 77 (Suppl. 1): 200, ISSN: 0021-8812.


NAL Call Number: SF95.I47
Keywords: breed, New Zealand White, Soviet Chinchilla, broiler, bajra, feed, dietary level, energy supplement, barley, broken rice, damaged wheat, growth performance, jowar, maize, production economics, semi-arid environment.

NAL Call Number: 41.8 IN22
Keywords: breed, broiler, protein, supplementation, utilization, cottonseed cake, feed, diet, chemical composition, groundnut cake, guar meal, mustard cake, performance, rapeseed meal, soybean meal.

NAL Call Number: 41.8 IN22
Keywords: rabbit, broiler, cafeteria system, concentrate pellets, growth performance, roughage.

NAL Call Number: SF604.R37 no. 306
Keywords: digestive system, gastrointestinal diseases, diets, nutrition, diarrhea, bezoar, digestive system diseases.

Keywords: breed, New Zealand nutrition, protozin, multi enzyme, feed additive, daily gain, fattening period, live weight, meat, ash content, calcium content, composition, fat content, mineral content, pH, phosphorus content, protein content, quality, water content, Bulgarian language.

Keywords: breed, Pannon White, suckling, weaning, induction, pseudopregnancy, kit production, feed intake, GnRH, insemination, milk yield, animal husbandry.

NAL Call Number: SF95.I47
Keywords: breed, New Zealand White, Soviet Chinchilla, blood, albumin, calcium, cholesterol, creatinine, hemoglobin, iron, phosphorus, urea, dry matter intake, mean cell volume, growth rate, packed cell volume, subabul leaf diet.

NAL Call Number: SF95.I47
Keywords: juvenile, broom grass, feed, dried, ground, concentrate mixture, daily weight gain, dry matter intake, growth rate.

Rohilla, P.P.; Bujarbaruah, K.M. (2001). Carcass characteristics of rabbits fed Morus alba leaves. Indian Veterinary
**Journals**

**NAL Call Number:** 41.8 IN2  
**Keywords:** *Morus alba* leaves, diet, carcass characteristics, diet, concentrate feed.

**NAL Call Number:** 41.8 IN22  
**Keywords:** broiler, crude protein, dietary intake, average daily gain, body weight gain, dry matter intake, feed conversion efficiency, feed costs, growth performance.

**NAL Call Number:** 41.8 IN2  
**Keywords:** banana leaves, feed, evaluation, growth.

**Keywords:** reviews, birth weight, diets, energy intake, energy requirements, feed intake, nutrition programs, reproduction, reproductive performance, nutrition, husbandry.

**NAL Call Number:** 41.8 IN2.  
**Keywords:** breed, New Zealand White, rabbit, digestive tract, heart, circulatory system, liver, spleen, blood and lymphatics, immune system, testes, reproductive system, Ajar seed kernel incorporated diet, feed, pathological effects.

**NAL Call Number:** SF15.S7 A52  
**Keywords:** urine, excretory system, fat, dietary intake, metabolizable energy, dietary intake, urinary excretion, nitrogen, Spanish language.

**Keywords:** commercial species, breed, White New Zealand, female, male, fumaric acid, acidifiers, fumaric acid, oligosaccharide mannose, carcass characteristics, high starch diets, performance, carcass characteristics, Portuguese language.

**NAL Call Number:** SF1.R45  
**Keywords:** breed, New Zealand white, female, male, acidifiers, dietary supplement, fumaric acid, dietary supplement, oligosaccharide mannose, dietary supplement, growth performance, Portuguese language.

**NAL Call Number:** SF1.R45
Keywords: breed, New Zealand White, crude protein, rotative roller yeast drying, food processing method, yeast spray dry method, food processing method, daily weight gain, feed:gain ratio, mortality, soybean meal, feed, yeast, feed additive, Portuguese language.

NAL Call Number: SF1.R45
Keywords: Manihot esculenta, cassava, forage, female, male, feed, chemical composition, digestibility, nutritive value, growth performance, Portuguese language.

Keywords: adult, breed, New Zealand White, commercial species, female, juvenile, feed, canola meal, soybean meal, diet comparison, crude protein, daily weight gain, feed conversion, live weight, performance, reproductive period, weaning period.

NAL Call Number: DISS F2000366
Keywords: doctoral dissertation, nutrition, diet, German language.

Keywords: pets, rabbits, golden hamsters, chinchilla and guineapigs, urine, blood composition, blood picture, body weight, animal welfare, nutrition, succulent plants, organic matter, green feed, pelleted feeds, apples, carrots, drinking water, water intake, water metabolism, thesis, German language.

Keywords: genetics, breed, differences, California, New Zealand White, feeding, stress, housing, crowding, vitamins, supplements, ascorbic, acid, retinol, feed intake, feed conversion, efficiency, carcass weight, blood chemistry, antioxidants, carcass composition.

Keywords: weaners, sweet potato forage, crude protein, crude fiber, ash content, meat carcass yield, performance, protein, feed chemistry, concentrate mash, feed.

NAL Call Number: SF55.I4J68
Keywords: breed, New Zealand x California, grower, cassava peels, feed, unsoaked, soaked, feed intake, maize, water consumption.


**Keywords:** breed Soviet Chinchilla, female, male, carcass evaluation, concentrate feed, feeding system, green lucerne, animal feed, growth performance.


**Keywords:** breed Hyla 2000, Hyplus, young rabbits, five weeks old, caprylic acid, milk compound, dietary supplement, growth performance, mortality.


**Keywords:** mortality, digestibility, nutrients, meat composition, vitamins, vitamin supplements, ascorbic acid, drinking water, supplements, heat stress, feeding, German language.


**Keywords:** fern, poisonous plant, toxicity, Dryoptaris juxtaposita, Polystichum squarrosum, Pteridium aquilinum, bladder, excretory system, kidney, liver, digestive system, small intestine, spleen, blood and lymphatics, immune system, testes, reproductive system, adenosine deaminase, catalase, creatinine, serum, glutathione S transferase, hemoglobin, urea, serum, lymphocytosis, body weight, erythrocyte sedimentation rate, grain mixture, feed, heteropenia, lipid peroxidation, mortality, packed cell volume.


**Keywords:** New Zealand White, breed, Schleichera oleosa leaf meal, green paragrass, feed concentrate, feed, average daily gain, feed efficiency.


**Keywords:** breed, Pannon White, commercial species, doe, female, growing, kit, newborn, nursing, once a day nursing, twice a day nursing, milk, reproductive system, body weight, carcass composition, food intake, growth, live weight gain, nursing, suckling, weaning.


**Keywords:** diets, drinking water, fattening performance, probiotics, feeding, housing, reproduction, sucrose, supplementary feeding, Italian language, Italy.

NAL Call Number: SF604.K42
Keywords: breed, New Zealand White, male, weanling, cholesterol, serum, protein, sodium valproate, GABA agonist, oral administration, carcass quality, feed efficiency, feed intake, growth rate.

NAL Call Number: SF451.R5
Keywords: housing, feeding, probiotics, Italian language.

Keywords: pets, rabbits, hamsters, guineapigs, rats, mice, gerbils, nutrition, pet foods, dietary supplements, nutrient requirements, energy, protein, fats, fatty acids, minerals, vitamins, nutritional disorders.

NAL Call Number: SF1.R45
Keywords: breed, New Zealand White, female, male, housed, individual wire cages, digestive system, amylase, maltase, starch, cassava, corn, ileal digestibility, total digestibility, Portuguese language.

Keywords: growing rabbits, compensatory growth, feed consumption, mortality, nutrient digestibility, oocyst shedding, parasite incidence, quantitative restriction, restricted feeding time, slaughter parameters, time restriction.

NAL Call Number: 49 AR22
Keywords: feed, diet, cereal offals, energy source, maize grain, millet, sorghum, gross energy, digestible energy, fat, average daily gain, protein utilization.

NAL Call Number: SF1.R45
Keywords: breed, White New Zealand, growing, acid detergent fiber, dietary, crude protein, neutral detergent fiber, starch, corn starch diet, nutritional method, dry matter, gross energy, nutrient apparent digestibility, organic matter, Portuguese language.

NAL Call Number: SF1.R45
Keywords: breed, White New Zealand, growing, cecum, digestive system, propionic acid, starch, dietary, volatile fatty acids, corn starch diet, nutritional method, carcass yield, cecal microbial activity, feed intake, feed, gain ratio, pH, weight gain, Portuguese language.

NAL Call Number: 41.8 IN22
Keywords: nutrition, feed, forage, Azadirachta indica, Zea mays, breed, Soviet Chinchilla, White Giant, roaster,
carcass characteristics, concentrate, de-oiled groundnut cake, nitrogen, animal feed supplement, diet, ground maize, neem seed kernel cake, feed supplement.


NAL Call Number: SF55.A78A7
Keywords: broiler rabbit, forage, blood, lymphatics, cecum digestive system, fermentation, intestine, kidney, liver, lung, histopathology, immune system, alanine aminotransferase, alkaline phosphatase, aspartate aminotransferase, creatinine, glucose, heart, hemoglobin, total protein, urea nitrogen, neem seed kernel cake, animal feed.


NAL Call Number: 41.8 IN22
Keywords: male, broiler, nitrogen, deoiled groundnut cake, growth, neem seed kernel cake.


Keywords: breed, Soviet Chinchilla, White Giant, broiler, Azadirachta indica, intensive feeding, meat production, carcass characteristics, neem seed kernel cake, feed, graded dietary level effect.


NAL Call Number: 47.8 AR2
Keywords: doe, kid, assigned kid number, complete kid exchange, litter weight at birth, milk performance.


NAL Call Number: 41.8 K67
Keywords: pets, complete feeds, compound feeds, teeth, feeding behavior, nutrient requirements, pelleted feeds, crude fiber, water intake, German language.


Keywords: rabbit diseases, furbearing animals, breeding, nutrition, physiology, feeding.


NAL Call Number: 49 J82
Keywords: doe, body weight, body fat, energy balance, high fiber, low energy, diet, lactation, postweaning feeding.


Keywords: breed, New Zealand White, semen, reproductive system, sperm, motility, reproductive system, alanine aminotransferase, ascorbic acid, dietary supplement, aspartate aminotransferase, free radicals, fructose, glutathione S transferase, hydrogen ion, lactate dehydrogenase, thiobarbituric acid reactive substances, vitamin

NAL Call Number: QP251.A5

**Keywords:** breed, New Zealand White, male, semen, semen quality, reproductive system, sperm, motility, reproductive system, alanine aminotransferase, aspartate aminotransferase, ascorbic acid, dietary supplement, free radicals, fructose, glutathione S transferase, hydrogen ion, lactate dehydrogenase, thiobarbituric acid reactive substances, vitamin E, body weight gain, feed intake, lipid peroxidation.


**Keywords:** laboratory animals, comparison, digestive function, guinea pig, Syrian hamster, rabbit, rat, cecum, digestive system, hindgut, large intestine, rectum, small intestine, alpha amylase activity, digestive enzyme, secretion, crude protein, dietary, digestibility, fiber, dietary, pepsin activity, digestive enzyme, secretion, protease activity, digestive enzyme secretion, basal diet, feed, digesta passage, digestive function comparison, hindgut fermentation.


**Keywords:** diet, intake, feed supplements, premixes, herbs, molasses, probiotics, growth stimulants, weight gain, milk replacers, Polish language.
Information Resources on the Care and Welfare of Rabbits

General Information

   **Keywords:** rabbit meat, hides and skins, leather, breeds, feeding, housing, diseases, marketing, animal products, processed animal products.

   **NAL Call Number:** HD9438.R4A8 1997
   **Keywords:** meat industry, trade, meat inspection.

   **Keywords:** proceedings, meat animals, genetics, reproduction, nutrition, diseases, meat production, animal welfare, feeding, diseases.

   **Keywords:** nutrition, pathology, production, animal welfare.

   **NAL Call Number:** Videocassette no. 2792
   **Abstract:** Shows basic techniques for humane treatment of laboratory rabbits.
   **Keywords:** laboratory animals, humane techniques, animal welfare.

   **NAL Call Number:** SF453.B462 2001
   **Keywords:** breeding, selection, housing, space requirements, birthing techniques, feeding, behavior, health concerns.

   **Keywords:** history, natural migration, genetics, palaeogenetics, parasitology, historiography, diachronic maps, skeleto-morphological analysis.

   **NAL Call Number:** 41.8 M69
   **Keywords:** anatomy, physiology, normal values, rabbit feeding.

**Keywords:** husbandry, production, health, nutrition, feeding, reproduction, breeds, breeding, housing, rabbit meat, hides and skins, hair, rural development, diseases, animal products, meat, production, socioeconomic development.

**NAL Call Number:** SF453.W67 1996


**Keywords:** housing, farming, disease prevention, animal welfare.


**Keywords:** sexual reproduction, breeding, nutrition, feeding, physiology, management, broiler production, fattening, carcass quality, fur production, Angora.


**Keywords:** disease, housing, care, production, German and English language.


**Keywords:** history, taxonomy, domestication, production around the world, breeds, facilities, housing, management, economics, nutrition, feeding, diseases, health, reproduction, behavior, genetics, breeding systems, genetic selection, herd improvement, coat color genetics, showing, pet rabbits, animal welfare, small farm development, production in developing countries, Rex fur production, Angora wool production, meat production, slaughter, meat and skin preparation, marketing rabbits and rabbit products.


**Keywords:** anesthesia, analgesics, behavior, breeding, housing, biology, dental caries, dentition, diagnostic techniques, diet, digestive tract, drug formulations, drug therapy, handling, nutritional support, sex differences, surgery, surgical operations, tooth diseases, trauma.


NAL Call Number: SF605 N672.
Keywords: restraint, calming methods, venipuncture, administering medications, antibiotic use, sedation, anesthesia, trimming teeth.

NAL Call Number: SF453.P3823 2003
Keywords: pets, care, housing, husbandry, feeding, health, behavior, training.

NAL Call Number: SF453.P472 1998
Keywords: breeds, production, genetics, French language.

NAL Call Number: DISS F1995156
Keywords: doctoral thesis, German language, veterinary science.

NAL Call Number: SF997.5 R2R335 2000
Keywords: diseases, health, husbandry, nutrition, clinical examination, skin, reproductive system, neonatal rabbit, urinary system, respiratory system, digestive system, musculoskeletal system, teeth, head and neck, neurological and neuromuscular disorders, viral diseases, behavior, anesthesia, surgery, drugs and treatments, zoonotic aspects.

NAL Call Number: SF453.S33 1996
Keywords: pets, breeds, history, color photos, handling, management, housing, equipment, nutrition, feeding, reproduction, breeding, genetics, commercial rabbit industry, biology, welfare, health, disease.

Keywords: chinchillas, gerbils, guineapigs, hamsters, mice, rabbits, rats anatomy, housing, breeding, digestive system, nutrient requirements, restraint of animals, sex determination.

NAL Call Number: SF745.S63 1998
Keywords: practical reference, care, management, housing, feeding, restraint, breeding, kindling, abscesses, cannibalism, coccidiosis, conjunctivitis, ear mites, enteritis, heat exhaustion, hutch burn, lice, mange, mastitis, pneumonia, ringworm, snuffles, sore hocks, wet dewlap, worms.

Keywords: animal welfare, bacterial diseases, biology, parasites, viral diseases.

**NAL Call Number:** SF453.S932 1995

**Keywords:** production, reproduction, breeding stock, housing, equipment, care, feed, feeding, breeding, record keeping, diseases, slaughter, dressing.


**NAL Call Number:** SF453.T285 1999

**Keywords:** pets, breeds, history, care, behavior, biology, housing, health.


**Keywords:** comprehensive works, history, biology, colonizing species, Europe.


**Keywords:** cats, rabbits, hamsters, gerbils, rats, mice, guineapigs, chinchillas, ferrets, amphibia, reptiles, birds, dogs, domestic animals, pets, fish, classification, history, careers, veterinarians, veterinary medicine, technicians, feeding, training, grooming, breeds, diseases, housing, reproduction, zootechny, husbandry.


**NAL Call Number:** SF997.5.R2W46 1996

**Keywords:** diseases, German language.


**NAL Call Number:** SF991.S59 2004

**Keywords:** laboratory tests, techniques, interpretation, blood count and bone marrow examination, erythrocyte, leukocyte disorders, hemostatic abnormalities, serum chemistries, point of care instruments, electrolyte and acid-based disorders, urinary disorders, endocrine, metabolic, and lipid disorders, gastrointestinal disorders, fluid accumulation disorders, respiratory disorders, immunologic disorders, reproductive disorders, neurologic disorders, infectious disease, cytology of neoplastic and inflammatory masses, diagnostic toxicology, therapeutic drug monitoring appendices, listing of referral laboratories, reference values, color illustrations, appendices, tables.


**Keywords:** breeding, feeding, nutrition, animal welfare, behavior, housing, temperature preference, diseases, disease control, production, husbandry.


**Keywords:** breeds, New Zealand White, Pannon White, Danish White, meat animals, fur bearing animals, pets, husbandry, physiology, reproduction, feeding, diseases, housing, slatted floors.

NAL Call Number: DISS F1999053.
Keywords: dissertation, anesthesia, isoflurane, sevoflurane, comparison.
Health


NAL Call Number: QH541.5 D4J6

Keywords: heat stress, husbandry, Egypt.


Keywords: housing, animal health, respiratory diseases, digestive disorders, rabbit diseases, ventilation, heating, environmental control, isolation, rabbit droppings, animal diseases, *Staphylococcus*, French language, France.


Abstract: As rabbits gain increasing popularity as house pets, more rabbit owners are seeking basic preventive veterinary care. Although a knowledge of the unique anatomic and physiologic characteristics of pet rabbits is essential, annual examination and review of diet and husbandry are as important as with any other species. Many disease states can be detected or prevented with routine veterinary care. Despite all the advances in diagnostic testing in veterinary medicine, there will never be a substitute for a complete physical examination.

Keywords: review, pets, diseases, prevention and control, physical examination, veterinary care.


Keywords: bone, skeletal system, spine, skeletal system, X-ray, examination method, Convention STE 123 of the European Council, abnormal bone development, caged housing conditions, French language.


Keywords: mathematical techniques, pathological techniques, viral disease, epidemiology modelling, control implications, viral diseases, rabbit calcivirus disease, epidemiology, mathematical modeling, control implications, Australasia, Australasian region.


NAL Call Number: QL55 I5

Keywords: animal welfare, body weight.


Keywords: guineapigs, rats, hamsters, gerbils, rodents, rabbits, reviews, eye diseases, Italian language.

Keywords: diarrhea, digestive system disease, fiber deficiency, nutritional disease, health risk index, analytical method, digestion, mortality, nutritional status, sanitation.

NAL Call Number: SF602.P6
Keywords: pets, echography, diagnosis, French language.

Keywords: rabbits, rodent, pets, ringworm, Microsporum canis, Microsporum gypseum, Microsporum persicolor, Trichophyton mentagrophytes, treatment, antifungal agents, chlorhexidine, clinical aspects, dermatomycoses, diagnosis, disinfection, iodine, ketoconazole, lesions, natamycin, sulfur, thiabendazole.

Abstract: A general account is given of the helminths and protozoa found in the intestines and liver of lagomorphs and pet rodents. Detection, diagnosis, pathogenicity and treatment are discussed.
Keywords: pets, rodents, rabbits, helminths, diagnosis, drug therapy, detection, pathogenicity, parasites, French language.

NAL Call Number: SF602.P6
Keywords: pets, dystocia, parturition complications, rodents, French language.

NAL Call Number: SF602.P6
Keywords: pets, rodents, rabbits, dermatomycoses, Microsporum, Trichophyton, epidemiology, diagnosis, zoonoses, therapy, deuteromycotina, fungi, infectious diseases, skin diseases, French language.

Keywords: pets, chinchillas, guineapigs, rabbits, rodents, dystocia, parturition, surgery.

NAL Call Number: S960.W5
Keywords: viral diseases, rabbit hemorrhagic disease, disease incidence effect on demography, population dynamics, observations and impact of disease, significance for control, effects of viral disease incidence, Australia.

Keywords: gastrointestinal diseases, cecum, stomach, mouth, concretions, bezoar, digestive tract motility,
colon, enterotoxaemia, intestinal diseases, obstruction, enteritis, *Escherichia coli*, *Salmonella*, *Pseudomonas*, *Campylobacter*, *Clostridium spiroforme*, ileus.


**Keywords:** pets, case reports, fractures, fracture fixation, Italian language.


**Keywords:** pets, skin diseases, diagnosis, neoplasms, clinical examination, Italy, Italian language.


**NAL Call Number:** 41.8 V641

**Abstract:** A serological survey of 238 rabbits for antirabbit haemorrhagic disease virus (RHDV) antibodies was made in an industrial rabbitry where no signs of the disease had been reported for four years. Seroconversion was repeatedly detected and was due to a calicivirus antigenically related to RHDV but without its pathogenicity. There was a seroprevalence of 33.3 per cent among young animals at weaning at 31 days old, 27.6 per cent at five to seven days after weaning, 56.1 per cent at 13 to 14 days after weaning, 90.3 per cent at 19 to 20 days and 100 per cent at 32 to 33 days after weaning, and all the breeding rabbits were seropositive. In the last group and in the young at weaning, the anti-RHDV antibodies were mainly class IgG, but they were IgM and IgA at 13 to 14 days after weaning. In older fattening rabbits, there was a decrease of IgM and IgA and an increase of IgG confirmed seroconversion without any specific signs of rabbit haemorrhagic disease. On the basis of these results, the probable time of infection of the meat rabbits with this non-pathogenic virus was immediately after weaning.

**Keywords:** husbandry, antibodies, viral immunology, caliciviridae infections, hemorrhagic disease virus, prevalence, serology.


**NAL Call Number:** 436.8 Ex7

**Keywords:** coccidia, *Eimeria media*, diagnostic techniques, identification, new method.


**Keywords:** pets, cats, rabbits, turtles, rodents, reptiles, disease transmission, rabies, treatment, vaccines, zoonoses, *Pasteurella multocida*, *Bartonella henselae*, *Yersinia*, *Campylobacter*, *Salmonella*, *Toxoplasma*.


**NAL Call Number:** S960.W5

**Keywords:** *Oryctolagus cuniculus*, viral diseases, rabbit hemorrhagic disease, New Zealand, Australia.


**NAL Call Number:** SF997.5.E95E97

**Abstract:** Rabbit medicine, and dentistry in particular, is still at an early stage of development. With an understanding of the underlying oral physiology it is possible to devise an appropriate treatment regime for most dental problems after the nature and extent of disease has been assessed. Although many of the dental problems that are seen in practice cannot be cured, most can be controlled or managed to allow the affected rabbit to
maintain a good quality of life. The continuously growing nature of the teeth makes recurrence and progression of problems the norm, so owner education and ongoing monitoring of animals is essential. By assessing the effects, beneficial or otherwise, of our treatments and communicating this to others, we will develop our knowledge and skills. Several treatments that are suggested in this article must be considered as “experimental” because they have not been assessed in large numbers of animals. If they work for you, or more importantly, if you find unexpected complications with a treatment method (as has happened with the use of calcium hydroxide paste treatment of abscess cavities) then please publicize the fact so that others can avoid the problem. Until the message on prevention can be reliably transmitted to owners, we will continue to have oral and dental problems to manage. After confidence and experience has been gained in anesthetizing rabbits it is possible to refine one's dental skills to be able to rapidly perform a thorough examination and basic treatments. Major and complex treatments require careful consideration because they may add to the animal's problems, rather than improving the situation. The best method for learning rabbit dentistry is to routinely perform postmortem examinations following euthanasia of affected animals, and spend an hour or two practicing handling the instruments and performing procedures on a cadaver. If you are not confident in your ability or do not have the best equipment for the job, the client should be informed and offered the opportunity to be referral to a “specialist.”

**Keywords:** dental care, veterinary, anatomy, histology, tooth diseases, pathology, therapy.

**NAL Call Number:** 41.8 J8292
**Keywords:** *Psoroptes cuniculi*, infestation, skin lesions, otitis externa, ears, abdomen, ivermectin, insecticides, case reports.

**NAL Call Number:** SF601.I45
**Keywords:** adult, breed, White Giant, crossbreed, local breed, climate, humidity, physiological response, pulse rate, rectal temperature, respiration rate, temperature, West Bengal, India.

**NAL Call Number:** QL55 A1L33
**Keywords:** laboratory animals, appetite, intake, feed dispensers, pelleted feeds.

**NAL Call Number:** SF602.P6
**Keywords:** pets, rats, hamsters, guineapigs, gerbils, rabbits, neoplasms, treatment, symptoms, French language.

**NAL Call Number:** 41.8 K67
**Keywords:** foot diseases, dermatitis, skin diseases, histopathology, pathology, classification, disease control, etiology, animal welfare, pododermatitis, German language.

**NAL Call Number:** 448.8 P21
**Keywords:** *Besnoitia oryctofelisi*, protozoan parasite, new species, hosts on rabbits, experimentally infected, mice, gerbils, rabbits, cats, cell cultures, Argentina.


**Keywords:** rabbit meat, animal welfare, drug residues, disease control, nutrition, feeds, drinking water, hygiene, meat production, zoonoses, husbandry, Italy.


**NAL Call Number:** 41.8 K67

**Keywords:** antibodies, central nervous system, kidney diseases, uveitis, eye diseases, symptoms, blood chemistry, hematology, oxytetracycline, dexamethasone, vitamin B complex, inflammation, treatment, renal function, drug therapy, parasites, protozoal infections, Encephalitozoon cuniculi, protozoa, German language.


**Keywords:** hygiene, animal welfare, animal health, drug therapy, animal husbandry, Italy.


**Keywords:** household pets, dog, cat, rabbit, guinea-pig, disease vector, host, disease vector, group A streptococci (Gram-Positive Cocci), human pathogen, eye secretions, disease transmission, zoonosis.


**Keywords:** Oryctolagus cuniculus, population Control, biological control, Myxomatosis, virus, history, Australia.


**NAL Call Number:** SF602.P6

**Keywords:** pets, rodents, rabbits, ringworm, drug therapy, oral administration, application methods, dermatomycoses, infectious diseases, mycoses, skin diseases, therapy, French language.


**NAL Call Number:** QL55 A1L33

**Keywords:** pets, rabbits, case reports, diagnosis, surgery, clinical aspects, eyes, conjunctiva, membranes, eye diseases, topical application, corticoids, ciclosporin, postoperative care, postoperative complications, drug effects, regrowth.


**NAL Call Number:** SF601 I4

**Keywords:** pets, rabbits, rodents, treatment, anesthesia, antibiotics, toxicity, dosage, rodents, blood sampling, drug therapy.


**NAL Call Number:** 41.9 W64B

**Keywords:** wild rabbits, viral diseases, bovine diarrhea virus, antibodies recorded, immune response, Germany,
Europe.

**Keywords:** pets, hematology, blood chemistry, Japanese language.

**Keywords:** pets, rabbit diseases, *Pasteurella multocida*, Gracilicutes, bacteria, prokaryotes, Japanese language.

**Keywords:** pets, tooth diseases, teeth, fractures, Japanese language.

**Keywords:** pets, rabbits, guineapigs, hamsters, rats, mice, gerbils, Chinchilla, squirrels, ferrets, skunks, parakeets, parrots, pigeons, tortoises, snakes, lizards, fish, diagnosis, viral diseases, fungal diseases, parasites, risk, health, zoonoses, veterinary products, German language.

**NAL Call Number:** RA648.5.E46
**Keywords:** breed, Dutch Belted, New Zealand White, enterohemorrhagic *Escherichia coli* (EHEC), bacterial disease, commercial vendors, local petting zoo, fecal samples, zoonosis, bacterial disease, transmission.

**NAL Call Number:** SF601 C66
**Keywords:** rabbits, rodents, *Pasteurella, Bordetella bronchiseptica, Streptococcus pneumoniae, Mycoplasma*, infectious diseases, drug therapy, treatment, bacterial diseases, antibiotics, fluoroquinolones.

**NAL Call Number:** 41.8 J8292
**Keywords:** letter, animal welfare, dentistry, methods, surgery.

Gres, V; Voza, T; Chabaud, A; Landau, I. (2003). **Coccidiosis of the wild rabbit (*Oryctolagus cuniculus*) in France.** *Parasite* 10 (1): 51-57, ISSN: 1252-607X.
**NAL Call Number:** QL757.P3737

**NAL Call Number:** SF451.R5
**Keywords:** meat animals, husbandry, housing, indoor, outdoor, livestock farming, pathogens, production data, farm licensing, public health, Italian language, Italy.

**NAL Call Number:** 41.8 V641
**Keywords:** husbandry, disease outbreaks, veterinary care, fibroma virus, pathogenicity, epidemiology,
poxviridae infections, epidemiology, tumor virus infections, Italy.

NAL Call Number: SF602.P6
Keywords: pets, physiology, health, diagnosis, veterinary medicine, French language.

Keywords: pets, physiology, nutrition, blood specimen collection, veterinary practice, restraint of animals, clinical examination, Italian language.

NAL Call Number: SF602.P6
Keywords: pets, feeding, diets, natural, commercial, blood chemistry, hematology, clinical examination, restraint, physiology, anatomy, reproduction, hematology, blood sampling, radiography, pet foods, reviews.

NAL Call Number: 41.8 J8292
Keywords: parathyrin, hematology.

NAL Call Number: 41.8 V641
Abstract: Pet rabbits are frequently treated by veterinary surgeons but most of the literature is based on diseases encountered in laboratory or commercial rabbits. Many pet rabbits suffer from dental abnormalities and 40 clinical cases of diseases associated with teeth problems are reviewed. The clinical and radiological examination of the oral cavity of conscious and anaeesthetised rabbits is described and the treatment of dental disorders is discussed. Post mortem studies of 20 of the skulls revealed bone of poor quality. Deformed teeth with little or no enamel were found during clinical examination and post mortem. The poor quality of the teeth and bone was not related to malocclusion. Distorted growth of the crowns led to lacerations to the tongue or inside the cheek, causing anorexia, weight loss and problems with grooming. Distorted growth of the roots resulted in penetration of the weakened bones of the maxillae, mandibles and orbits. Osteomyelitis, abscess formation or infections of the lacrimal duct or nasal cavity were a result of this disease process. The cause of the defective teeth and poor bone quality was not determined but preventative measures are proposed.
Keywords: abscess, diagnosis, anorexia, lacrimal apparatus, mandible, pathology, osteomyelitis, diagnosis, paranasal sinus disease, tooth, pathology, radiography.

NAL Call Number: 41.8 V641
Keywords: calcium, tooth diseases, mineral deficiencies, diet, calcification, feeding preferences, mineral metabolism, guidelines, surveys, phosphorus, vitamin D, nutrient content, pet foods, urolithiasis, osteodystrophy, rabbit feeding.

NAL Call Number: 41.8 V641.
Abstract: The results of a serological test for Encephalitozoon cuniculi in 125 pet rabbits are reviewed, together with follow-up studies of clinical cases. Blood samples were taken from 38 asymptomatic rabbits and 87 rabbits showing neurological, renal or ocular signs suggestive of encephalitozoonosis. In the asymptomatic group, six
of 26 (23 per cent) apparently healthy rabbits, sampled as part of a health screen, were seropositive; of the remaining 12 asymptomatic rabbits, sampled because they lived with seropositive companions, eight (66 per cent) were seropositive. Fifty-eight of the rabbits with clinical disease showed neurological signs, including head tilt, seizures, ataxia and swaying; three of them also showed renal signs and two showed ocular signs, and these five rabbits were all seropositive. Head tilt was the most common neurological sign in 21 of 23 (91 per cent) of the seropositive cases. All nine rabbits with ocular lesions were seropositive. In follow-up studies of clinical cases, the rabbits showed variable responses to treatment with albendazole, fenbendazole, antibiotics or corticosteroids, and some cases recovered without treatment.

Keywords: pet rabbits, parasitology, *Encephalitozoon cuniculi*, diagnosis, drug effects, adrenal cortex hormones, therapeutic use.


Keywords: rabbits, gerbils, guinea pigs, hamsters, chinchillas, pets, sampling, blood, application methods, drugs, sex, handling, German language.


Keywords: rabbits, guinea pigs, gerbils, hamsters, mice, rats, chinchillas, husbandry, feeding, ancestry, physiology, German language.


NAL Call Number: SF605 N672

Keywords: veterinary medicine, heart rate and rhythm, blood pressure, hypolemia, intravenous catheterization, intra-osseous catheterization, electrolytes, blood transfusion, endotoxemia, respiratory rate, arterial blood gases, endotracheal intubation, nutritional indicators, dental problems, nasogastric intubation, total parenteral nutrition, product information.


NAL Call Number: QL55.S322

Keywords: laboratory animals, mice, rats, hamsters, guinea pigs, gerbils, rabbits, monitoring, health, diseases, infection, environmental factors, feeding, housing, disease transmission.


NAL Call Number: SF601.V44

Keywords: *Staphylococcus aureus*, pathogen, strains, bacterial disease, infected commercial rabbitries, randomly amplified polymorphic DNA analysis, analytical method, diagnosis, prevention virulence.


NAL Call Number: SF601.V44

Abstract: *Staphylococcus aureus* infections are a major problem in rabbitries. The main manifestations are subcutaneous abscesses, mastitis, pododermatitis and septicemia. Two patterns of infection can be distinguished. In the first type, clinical signs remain limited to a small number of rabbits in a flock. This type has little economic importance and is caused by low-virulence *S. aureus* strains. In the second type, the disease shows an epidemic spread. Consequences are poor production results, infertility and death. This leads to chronic problems and a subsequent decline in production. The latter type is caused by high-virulence strains. Biotyping,
phage typing and RAPD typing contribute to the characterisation of high-virulence S. aureus strains. Administration of antibiotics, disinfection of the environment and vaccination are not able to solve the problems. Therefore, the only effective measure is to cull the entire flock and to restart with a new rabbit population after thorough disinfection. Limiting the introduction of new rabbits in existing rabbitries and reducing contacts between rabbitries to an absolute minimum are currently the only way to face this most difficult problem.

**Keywords:** husbandry, disease outbreaks, prevention and control, microbiology, staphylococcal infections, epidemiology, pathology, prevention and control, growth and development, pathogenicity.


**NAL Call Number:** SF981.E96

**Keywords:** clinical aspects, dental health, diagnosis, pets, postoperative care, surgical operations, tooth diseases.


**NAL Call Number:** 41.8 Au72

**Keywords:** *Eimeria*, coccidia, mammalian hosts, protozoan parasite prevalence, parasite identification guide, first records for Australia, Western Australia.


**NAL Call Number:** 410 J828

**Keywords:** pests, domestic cat, house mouse, European rabbit, viruses, biocontrol agent, competitor, pathogen, myxomatosis, fungal disease, viral infection, viral disease, sterilization, pest control, method, viral vectored immunocontraception [VVIC], contraception method, pest control method, biological control, birth rates, competition, demographics, epidemiology, genetic engineering, host suppression, host parasite models, mortality rates, non spatial models.


**Abstract:** Wound healing can be enhanced and wound infections prevented, often by simple, inexpensive, readily available means. Preoperative evaluation for impediments to healing, such as malnutrition, vasoconstriction, hyperglycemia, and steroid use, allows correction prior to operation. Intraoperatively, the surgeon should concentrate on surgical technique, appropriate antibiotic use, and prevention of vasoconstriction (volume, warming). Postoperatively, the focus should be on prevention of vasoconstriction through pain relief, warming, and adequate volume resuscitation and on maintaining nutrition and normoglycemia. These approaches apply as well to chronic wounds. Additionally, maintenance of a moist environment, correction of local vasospasm with sympathetic blockade or warming, and stimulation of angiogenesis through aggressive debridement or hyperbaric oxygen therapy enhance healing of chronic wounds.

**Keywords:** review, human, rabbits, anesthesiology, cicatrix, physiopathology, growth substances, physiology, human, intraoperative care, ischemia, complications, prevention and control, oxygen consumption, postoperative care, preoperative care, surgery, surgical wound infection, wound healing.


**Keywords:** thesis, radiography, intensive husbandry, exercise, bones, German language.


**Keywords:** breed, New Zealand White, animal care, infection, *Pasteurella multocida*, pathogen, host, male, toxin vaccine, antibacterial drug, efficacy, intranasal administration, potassium thiocyanate extract vaccine,
pasteurellosis, bacterial disease, microsphere vs. unencapsulated vaccine, mucosal immune response, systemic immune response.

NAL Call Number: SF604.J87
Keywords: pets, case reports, neoplasms, microscopy, lungs, kidneys, uterus, respiratory diseases, adenocarcinoma.

Keywords: human, case report, rabbit, asthma, antibody specificity, immunoglobulin E, blood.

NAL Call Number: QL55 A1L33
Abstract: Besides the well known allergens, several other risk factors may exist for health in a laboratory animal unit. The exposure to these factors may be significant in animal units with poor general or local ventilation systems. Moreover, means to prevent the distribution of airborne contaminants may be limited in animal units housing rabbits or other bigger laboratory animals. Airborne contaminants in conventional laboratory rabbit rooms were sought to evaluate the occupational exposure of animal care personnel. Concentrations of airborne dust, bacteria, fungi, ammonia and endotoxins were measured during 2 days in three phases: before working activities began, during them and afterwards. Both stationary and some personal samples were taken. All of the contaminants sought were found in the rabbit room air. When compared to reported levels in farm animal production areas, the concentrations measured were generally low. However, moderate or high levels of airborne bacteria and fungi were found occasionally during work routines. Airborne contaminants should be considered as a potential occupational health risk for persons working with laboratory animals.
Keywords: air microbiology, air pollutants, occupational hazards, ammonia, analysis, husbandry, laboratory animals, dust, endotoxins, occupational exposure, analysis, pilot projects, ventilation substances, occupational endotoxins.

Keywords: abscesses, anesthesia, castration, entropion, enucleation, fracture fixation, ovariectomy, preoperative care, surgery, surgical operations, wound treatment.

NAL Call Number: S960.W5
Keywords: fertility, imposed fertility control on females, epidemiology, natural viral disease, viral diseases, myxomatosis, epidemiology, implications for effects of fertility control, viral disease epidemiology, fertility control, Western Australia, Wellstead.

Keywords: New Zealand White, Zobor, Nitran breed, genetic strain, displacement, stress, lipids, organs, cholesterol, animal welfare, housing, breeds, kidneys, liver, serum, lipid metabolism, breed differences, triglycerols, husbandry, cage changes.

welfare and the treatment of small and exotic pets.] *Suomen Eläinlääkärilehti* 103 (3): 146-147, ISSN: 0039-5501.

**NAL Call Number:** 41.8 F49  
**Keywords:** pets, aviary birds, hamsters, gerbils, rodents, reptiles, rabbits, behavior, animal welfare, veterinary practice, exotic pets, small mammals, Finnish language.

**NAL Call Number:** 41.9 W64B  
**Keywords:** viral diseases, rabbit hemorrhagic disease virus, spread of disease following accidental release, Australia, monitoring study.

**NAL Call Number:** 41.8 V641  
**Keywords:** husbandry, methods, caliciviridae infections, prevention and control, disease outbreaks, hemorrhagic disease virus, immunology, virology, viral vaccines, Benin.

**NAL Call Number:** QD415.A1X4  
**Keywords:** growth promoting agents, meat residue, endocrine disruptor, fetal toxicity, hormone, drug, metabolism, pharmacokinetics, placental barrier passage, reproductive toxicity, toxin, melengestrol acetate, trenbolone acetate, high performance liquid chromatography, maternal dosing, drug administration method.

**Keywords:** husbandry, production, health, nutrition, feeding, reproduction, breeds, breeding, housing, rabbit meat, hides and skins, hair, rural development, diseases, animal products, meat, production, socioeconomic development.

**Keywords:** intensive husbandry, salmonellosis, disease, *Salmonella typhimurium*, France, Italian language.

**NAL Call Number:** SF451.R5  
**Keywords:** diseases, hygiene, housing, Italian language.

**Lindsey, M.J. (2000).** Adverse experiences to veterinary immunobiologicals and the profession’s duty of care. *Australian Veterinary Practitioner* 30 (3): 111-119, ISSN: 0310-138X.  
**NAL Call Number:** SF601.A9  
**Keywords:** pet animals, cats, dogs, rabbits, adverse effects, maternal antibodies, safety, vaccination, vaccines, veterinary products.

**Keywords:** human, children, birds, cats, dogs, rabbits, bacterial infections, diagnosis, etiology, bites, complications, risk factors, mycoses, protozoan infections, virus diseases.

NAL Call Number: SF604.R37 no. 306

Keywords: pets, ferrets, mice, rabbits, emergencies, small animal practice, diagnostic techniques, diagnosis, treatment, therapy, case reports, body temperature regulation, hematology, blood chemistry.


NAL Call Number: SF451.R5

Keywords: nest boxes, statistical methods, mortality, weight gain, animal performance, biological contamination, cladosporium, wool, paper, respiratory diseases, veterinary hygiene, microbiological analysis, housing, biological analysis, contamination, deuteromycotina, fungi, hygiene, Italy, Italian language.


NAL Call Number: 41.8 IR4

Keywords: handling, restraint, small animal practice, veterinary practice, pets, fractures, lacrimal apparatus, skin, thorax, abdomen, mouth, limbs, diagnostic techniques, clinical examination.


NAL Call Number: SF1.L5

Keywords: heat stress, seasonal effects, conception rate, disease resistance, embryonic development, energy metabolism, feed efficiency, feed intake, growth, litter size, litter weight, milk production, mortality, physiological performance, productive performance, reproductive performance, spermatogenesis.


NAL Call Number: 41.9 W64B

Keywords: age, mortality patterns, viral disease relationships, weight, immune response, viral diseases, rabbit viral hemorrhagic disease myxomatosis, epidemiology, patterns of mortality, development of immunity, immune response, antibodies to viral diseases, development in wild population, mortality, viral disease impacts, epidemiology, mortality patterns and immune response, France.


NAL Call Number: SF601 P7

Keywords: intensive forestry, Myxoma virus.


Keywords: myxomatosis, laboratory animals, legislation, regulations, symptoms, pathogenesis, disease surveillance, veterinary services, disease control, Italian language.

**Escherichia coli.** Veterinary Research 30 (2-3): 203-219, ISSN: 0928-4249.
**NAL Call Number:** SF602.A5
**Keywords:** *Escherichia coli*, enteropathogenic pathogen, colibacillosis, bacterial disease, diarrhea, bacterial disease, digestive system disease, pathogenicity island, literature review.

**NAL Call Number:** 41.8 IN2
**Keywords:** breed, Angora, female, host, male *Sarcoptes scabiei*, parasite, mange, integumentary system disease, parasitic disease, diagnosis, management, case study.

**Keywords:** digenea, cestoda, nematoda, mammalian hosts, mammalian host, records and prevalence, Spain.

**NAL Call Number:** SF996.15
**Keywords:** rabbits, rodents, parasites, diseases and disorders, surveys, cause of death, mortality, Sweden.

**Abstract:** As much as we hate to admit it, even the gentlest of our friendly pets can harbor harmful pathogens, and although the fact is not widely known, pet-associated infections can significantly affect the health of humans. In this article, Dr Morrison focuses on pets and their accompanying potential zoonoses, outlining how these diseases can be transmitted to humans and how the infections are treated. Special attention is paid to rabies and toxoplasmosis, which have attained particular notoriety over time.
**Keywords:** human, children, child welfare, birds, cats, dogs, ferrets, fish, rabbits, reptiles, rodents, review, microbiology, parasitology, virology, transmission, bites, patient education, physician’s role.

**NAL Call Number:** 41.8 N483
**Keywords:** viral diseases, rabbit hemorrhagic disease, first confirmed records after introduction, south island, introduced viral disease, first confirmed records for New Zealand.

**NAL Call Number:** SF1.I4
**Keywords:** viral diseases, rabies, viral disease record, first record for India, West Bengal, Calcutta.

**NAL Call Number:** 41.9 W64B
**Keywords:** viral diseases, rabbit hemorrhagic disease, escape from quarantine station, mortality, population size, initial impact of viral disease epidemic, viral disease escape from quarantine station, initial impact on population, Australia.

**NAL Call Number:** SF981.E96
**Keywords:** pets, rabbits, ferrets, treatment, spine, physical therapy, spinal diseases, chiropractice.


Online: http://www.blackwell-science.com/products/journals/jnltitle.htm

NAL Call Number: SF891 V47

Keywords: *Taenia serialis*, exophthalmos, eye diseases, symptoms, clinical aspects, case reports, treatment, cysts, histology.


NAL Call Number: SB950.A1V4

Keywords: viral diseases, rabbit calicivirus disease, rabbit hemorrhagic disease, biological control agent escape, population size, biological control agent impact, control agent escape, release and impact on populations, Australia.


NAL Call Number: 41.8 N483

Keywords: viral diseases, rabbit hemorrhagic disease virus, viral molecular characterization, New Zealand.


NAL Call Number: 41.8 IR4

Keywords: caecotrophy, clinical aspects, diagnosis, diets, digestive disorders, digestive system, digestive system diseases, digestive tract, digestive tract motility, enteritis, feeding, teeth, therapy, tooth diseases.


NAL Call Number: SF601.A47

Keywords: calcium, furazolidone, antibiotic, feed additive, polyether ionophore, lasalocid antibiotic, maduramicin, monensin, narasin antibiotic, nitrogen, salinomycin, tiamulin, cardiomyopathy, heart disease, cardiopulmonary clinical signs, inotrophy, poultry litter, feed, Brazil.


NAL Call Number: SF605 N672

Keywords: fluid therapy, catheter placement, fluid maintenance, nutrition, pain management, gastric obstruction, endotracheal intubation.


NAL Call Number: SF77 C65

Keywords: laboratory mammals, hip dysplasia, floor type.


NAL Call Number: 410.9 P94

**NAL Call Number:** SF997.5.E95E97

**Abstract:** Emergency and critical care principles are similar for all mammals; however, the physiology and natural behavior of rabbits create an animal that is easily stressed and requires specialized handling techniques. This article reviews diagnostic and therapeutic techniques, nutritional support, and pain management for urgent care of pet rabbits. Common differential diagnoses for emergencies are briefly reviewed by the clinical presentation. A table of drug dosages used for urgent care is provided.

**Keywords:** disease, diagnosis, therapy, emergencies, stress.


**Keywords:** digestive disorders, diarrhea, disease prevention, treatment, disease control, enteritis, enterotoxemia, intestinal diseases, stress, enzyme deficiencies, photoperiod, cecum, pH, water quality, etiology, lesions, diagnosis, vaccination, parasitoses, antibiotics, disease transmission, helminthoses, coccidiosis, animal husbandry, animal welfare, legislation, anthelmintics, parasites, helminths, *Escherichia*, Rotavirus, *Cryptosporidium*, *Escherichia coli*, *Eimeria*, coccidia, protozoa, *Clostridium piliforme*, *Bacillus piliformis*, French language.


**NAL Call Number:** Videocassette no. 3195

**Abstract:** A lecture utilizing slides on the pathology of various diseases of laboratory rodents and rabbits.

**Keywords:** disease, rodents, rabbits, laboratory animals, pathology.


**NAL Call Number:** 41.8 D482

**Abstract:** An enzootic of listeriosis in a rabbitry is reported. *Listeria monocytogenes* serotype 1/2a was isolated from the organs of a doe, which had died of septic metritis. From aborted fetuses of two other does *Listeria monocytogenes* serotype 1/2b and 4b were cultured, respectively. In feed samples of the rabbitry *Listeria monocytogenes* strains of the serotypes 1/2b and 4b besides the apathogenic *Listeria* species *Listeria seeligeri* and *Listeria innocua* were detected. Serological studies with agglutination test and complement fixation test on double serum samples of does, which had aborted, pointed to listeric infections as the cause of abortion. A doe, which had aborted and failed to become pregnant again, showed serosal adhesions of both uterine tubes and a sterile pyometra. Therefore, previous infection of the uterus by *Listeria monocytogenes* should be considered as a cause of infertility.

**Keywords:** abortion, bacteremia, diagnosis, housing, infertility, female, *Listeria*, isolation and purification, diagnosis, uterine diseases, German language.

**NAL Call Number:** SF604.R37 no. 306  
**Keywords:** rabbits, rodents, chinchillas, guineapigs, dentistry, tooth diseases, teeth, mouth diseases, disease prevention, treatment.

**NAL Call Number:** SF604.R37 no. 306  
**Keywords:** digestive system, gastrointestinal diseases, diets, nutrition, diarrhea, bezoar, digestive system diseases.

**NAL Call Number:** SF604.R37 no. 306  
**Keywords:** rabbits, rodents, urinary tract diseases, urogenital system, female genital diseases, male genital diseases, neoplasms.

**NAL Call Number:** SF601 C66  
**Keywords:** clinical examination, radiography, blood sampling.

**Keywords:** anorexia, diagnosis, drug therapy, dyspnoea, fatty liver, gastrointestinal diseases, haematuria, heart diseases, infectious diseases, intensive care, paresis, reproductive disorders, splayleg, stress, tooth diseases, urolithiasis, Spanish language.

**NAL Call Number:** QL55 A1L3  
**Keywords:** mouse, rat, hamster, gerbil, guinea pig, rabbit, guidelines, animal welfare, physiology, health status, laboratory animal science, standards, veterinary, records.

**NAL Call Number:** SF601 C66  
**Keywords:** rabbits, ferrets, rats, mink, mice, pets, aviary birds.

**NAL Call Number:** SF997.5 R2R35 2000

**Keywords:** diseases, health, husbandry, nutrition, clinical examination, skin, reproductive system, neonatal rabbit, urinary system, respiratory system, digestive system, musculoskeletal system, teeth, head and neck, neurological and neuromuscular disorders, viral diseases, behavior, anesthesia, surgery, drugs and treatments, zoonotic aspects.


**NAL Call Number:** SF605 N672

**Keywords:** digestive system diseases, nutritional deficiency, nutritional requirements, dental disease, physiology, signs of disease, hair ball disease, trichobezoars, foreign objects, bacterial infection, viral infection, parasitic infection, enteritis, liver disease, hepatic lipidosis, coccidiosis.


**NAL Call Number:** QL55.S322

**Keywords:** laboratory animals, mice, rats, rabbits, adaptation, reviews, animal welfare, transport of animals.


**NAL Call Number:** SF604.J342

**Abstract:** This paper deals with 16 cases presented from April to December 2001 and diagnosed clinically as rabbit syphilis, because they showed distinct lesions around the nose and/or mouth, responded to chemotherapy, and the “Rapid Plasma Reagin” test was positive. Twelve cases exhibited initial symptoms and four were relapses. Lesions around the genitalia and/or anus as well as the nose and/or mouth were seen in 8 cases, and 6 cases indicated sneezing. Fifteen cases were successfully treated with oral administration of chloramphenicol, and one was treated with long-acting penicillin by intramuscular injection. The mean age of onset was 8.8 months. As none of these cases had any mating history, the disease was likely to be maternally transmitted.

**Keywords:** disease, diagnosis, disease transmission, vertical, skin pathology, skin diseases, anti-bacterial agents, administration and dosage, therapeutic use, chloramphenicol, penicillins, syphilis, drug therapy.


**NAL Call Number:** SF604.J342

**Keywords:** blood urea nitrogen, high levels, bacterial infection, bacterial disease, gastrointestinal disorder, digestive system, heart disease, liver disturbance, molar teeth, overgrowth, dental and oral disease, neoplasia, neoplastic disease, neurological disease, nervous system disease, urolithiasis, urologic disease, uterine disorder, reproductive system, husbandry, failure, mortality, prognosis.


**NAL Call Number:** SF604.J342

**Abstract:** Since the RPR (rapid plasma regain) test was found to be useful for the diagnosis of rabbit syphilis, serological survey by this test has been carried out in Japanese companion rabbits. A hundred virgin household rabbits kept alone and without signs and history of syphilis were examined by RPR test from April 2001 to March 2002, in Tokyo, Japan. The test was positive in 35 cases and negative in 65 cases. RPR negative rabbits should be selected for breeding to prevent the spread of rabbit syphilis in companion rabbits in Japan.

**Keywords:** pet rabbits, disease, syphilis, evaluation study, diagnosis, testing, rapid plasma regain, Japan.
**Keywords:** human, case report, rabbit, asthma, antibody specificity, immunoglobulin E, blood.

**NAL Call Number:** SF981.E96
**Keywords:** pets, rodents, guineapigs, rabbits, Psittaciformes, ferrets, skin diseases, exotics, dermatology, aviary birds.

**NAL Call Number:** SF996.5.L33 2002
**Keywords:** animal welfare, health, diagnostic techniques, laboratory animals, microbiology, quality controls.

**NAL Call Number:** SF604.J342
**Keywords:** *Escherichia coli*, pathogen, isolated from laboratory animals, research laboratories, commercial laboratory animal breeders, laboratory specimens, guinea pig, mouse, rabbit, rat, ampicillin, antibacterial drug, antiinfective drug, drug resistance, cephaloridine, chloramphenicol, gentamicin, kanamycin, streptomycin, sulfadimethoxine, tetracycline, drug therapy, genetics, Japan.

**Keywords:** conservation measures, viral disease epidemiology implications, age, susceptibility, resistance relationships, reproduction, sexual activity influence on viral disease, sex differences, viral disease prevalence, viral diseases, rabbit viral hemorrhagic disease, prevalence, management implications, prevalence, susceptibility, resistance, epidemiology, myxomatosis, epizootiology, Spain.

**NAL Call Number:** 41.8 IN2
**Keywords:** *Paramphistomum cervi*, Digenea, mammalian hosts, new host record, experimental infection.

**NAL Call Number:** 41.8 V641
**Keywords:** adenocarcinoma, surgery, female, hysterectomy, ovarietomy, postoperative care, treatment outcome, uterine neoplasms.

**NAL Call Number:** SF996.5.L33 2002
**Keywords:** animal welfare, bacterial diseases, biology, parasites, viral diseases.

**Keywords:** pets, rabbits, rodents, myiasis, parasites, diagnosis, treatment.


Tynes, V.V. (2001). Managing common gastrointestinal disorders in pet rabbits. Veterinary Medicine 96 (3): 226, 228, 232-233, ISSN: 8750-7943. NAL Call Number: 41.8 M69 Keywords: treatment, diagnosis, digestion, feeding, bezoar, obstruction, enteritis, parasitism.


Vangeel, I.; Pasmans, F.; Vanrobaeys, M.; De Herdt, P.; Haesebrouck, F. (2000). Prevalence of dermatophytes in asymptomatic guinea pigs and rabbits. Veterinary Record: Journal of the British Veterinary Association 146 (15): 440-1, ISSN: 0042-4900. NAL Call Number: 41.8 V641 Keywords: guinea pigs, rabbits, arthrodermataceae, isolation and purification, dermatomycoses, epidemiology, housing, prevalence.


Keywords: rabbits, rodents, dental disease, care, diagnosis, treatment, pathology, dentition.


Keywords: pets, lymphoma, diagnosis, case reports, neoplasms, histopathology, lymph nodes, German language.


Keywords: Oryctolagus cuniculus, viral diseases, rabbit hemorrhagic disease, population control, habitat utilization, surface range rabbits, warren based rabbits.


Keywords: breed, New Zealand White, liver pathology, hepatic coccidiosis, parasitic disease, differential diagnosis, symptoms, histopathology, microscopy method, unexpected deaths, origin of outbreak.


Keywords: pets, diagnosis, radiography, poultry, rodents, mammals, birds, reptiles, guineapigs, rabbits, pigeons.


Keywords: birds, reptiles, rabbits, ferrets, guineapigs, rodents, zoonoses.


Keywords: wild rabbits, parasites, diseases and disorders, rabbit hemorrhagic disease virus (RHDV), antibodies, New Zealand.
Housing


**Keywords:** housing, animal health, respiratory diseases, digestive disorders, rabbit diseases, ventilation, heating, environmental control, isolation, rabbit droppings, animal diseases, Staphylococcus, French language, France.


**Keywords:** New Zealand White breed, housing, husbandry, carcass composition, carcass quality, carcass weight, carcass yield, selection criteria, selective breeding, slaughter weight, Egypt.


**Keywords:** breed, New Zealand White, housing, environmental impact, type of roofing, concrete roof, double metal sheets, single metal sheet roof, age differences, feed conversion efficiency, feed intake, growth, hematocrit, liveweight, seasonal variation.


**NAL Call Number:** SF402.3.A7 2001

**Keywords:** furbearing animals, pets, animal diseases, housing, nutrition, animal products, animal welfare, disease control, genetics, quality, reproduction, rabbits.

Autissier, C.; Bougneux, P.; Chayer, J.; Pouchelon, E. (2002). Observation des rachis de lapins hébergés sur de longues périodes dans les conditions de stabulation conformes celles préconisées dans l’annexe A de la convention STE 123. [Observation of rachis in rabbits during long periods in caged conditions conforming to those described in annex A of the STE 123 convention.] *STAL* 27 (2): 143-151, ISSN: 0339-722X.

**Keywords:** housing, animal welfare, legislation, lack of justification, cages, cage size, platforms, abnormal bone development, rachis, study validation, x-rays, French language.


**Keywords:** meat animals, feeding, housing, interconnected sheds, multiple-purpose flat-deck cages, air conditioning


**NAL Call Number:** QL55 15

**Keywords:** breed, Sandy lop, housing, behavior, enrichment, group housing, floor pens.

**NAL Call Number:** QL55 I5  
**Keywords:** body weight, weight losses.


**NAL Call Number:** SF1.A66  
**Keywords:** breed, New Zealand White, meat animals, housing systems, comparison, double-tiered, galvanized metal cages, pens on deep litter, multi-tiered wooden cages kept outdoors, animal welfare, carcass composition, carcass weight, feed intake, finishing, growth, liveweight gain, pens, performance traits.


**NAL Call Number:** SF1.L5  
**Keywords:** hybrid males, housing systems, comparison, wire netting, litter, straw bedded, animal behavior, growth, meat quality, stocking density, growth rate, liveweight gain, mortality, dressing percentage, carcass composition, body fat, muscles, pH, color, lipid peroxidation, oxidation, inhibitors.


**NAL Call Number:** S542.A8A34 no. 99  
**Keywords:** breed, Canberra, half lop rabbits, fryer rabbits, deep litter housing, stocking densities, fattening performance, feed conversion, efficiency, feed intake, stocking density, Papua New Guinea.


**NAL Call Number:** 41.8 IN2  
**Keywords:** New Zealand White, Soviet Chinchilla, breeds, meat animals, housing, hutches, breed differences, coccidiosis, floor space, morbidity, mortality, seasonal variation, summer, India.


**NAL Call Number:** 41.8 IN2  
**Keywords:** breed differences, Soviet Chinchilla, New Zealand Whites, carcass composition, carcass weight, dressing percentage, floor space, liveweight, offal, housing, slaughter weight.


**NAL Call Number:** 41.8 B45  
**Abstract:** ZIKA-fattening rabbits in groups of 4, 8, 16, 32 and 64 animals (5 rabbits/m2) have been proved in 6 repetitions with all together 144 animals during the fattening period of nine weeks in regard to their fattening performance, health and behaviour. The aim was to find an optimal group size for fattening rabbits with respect to animal welfare. The results show, that fattening performance and health of the rabbits have not been influenced remarkably by group size, whereas behaviour was different in so far, as the rabbits in groups of 16 showed a greater percentage of relaxed positions as well as a remarkable smaller percentage of aggressive behaviour. Therefore the group with 16 fattening rabbits is that, which can be advised for the fattening of rabbits in the Hohenheimer group housing.
NAL Call Number: SF451.R5
Keywords: housing, animal welfare, production, intensive rabbit rearing, cage flooring, wall design, water dispensers.

NAL Call Number: SF95.A55
Keywords: breed, New Zealand White crosses, feeding, rabbit milk, yields, heat stress, liveweight gain, mortality, litter weight, reproduction, feed intake, fibre intake, environmental temperature, milk yield, nutrition.

NAL Call Number: SF451.R5
Keywords: housing, traditional systems, modern systems, caging, outdoor rearing, cement rearing units, Italian language.

NAL Call Number: 49.9 Eu7 no.79
Keywords: husbandry, breeding, extensive farming, reproduction, animal welfare, Southern Europe.

NAL Call Number: SF1.A66
Keywords: New Zealand White, commercial breeding, animal welfare, meat animals, plastic crates, disinfection, feed conversion efficiency, female animals, reproductive performance, finishing, liveweight gain, pups, housing.

NAL Call Number: SF1.A66
Keywords: cages, cage design, galvanized wire-mesh cages, plastic cages allowing visual contact, non-transparent plastic cages, indoor rearing, outdoor rearing, conception rate, fattening performance, feed conversion, feed intake, finishing, liveweight gain, housing, reproductive performance, Poland.

Keywords: housing, design, husbandry, farm structure, natural light, lighting parameters, open angle of incident daylight, span of incident daylight and incident angle, Chinese language.

NAL Call Number: QL55 I5
Keywords: cages, enrichment.

NAL Call Number: S1 M57
Keywords: housing, design, construction.


NAL Call Number: QL55 A1L3

Abstract: The recommendations for minimum floor area given in the European Convention for the Protection of Vertebrate Animals used for Experimental and other Scientific Purposes (1986), as well as in the Publication on the Planning and Structure of Animal Facilities for Institutes Performing Animal Experiments of the Society for Laboratory Animal Science (GV-SOLAS 1989), are plotted in a double logarithmic system in order to get an allometric function of recommended floor area to body weight. Both recommendations correspond very well with the so-called metabolic body weight seen at the allometric exponent of 0.73 and 0.70 respectively. Thus the recommendations in general attribute the floor space according to the metabolic body weight of the animal.

Nevertheless, despite this general rule, some species are recommended less space than others when measured on this allometric scale. Thus it must be questioned why, for example, rabbits, chicken and pigs are recommended less space than other species. The general allometric measure seems at least to be a good scale for the comparison of recommended floor space, and for the discussion of species-specific needs for more or less space.

Keywords: cats, dogs, guinea pigs, rodents, rabbits, primates, swine, chickens, husbandry standards, laboratory animals.


NAL Call Number: QL750 A6

Keywords: housing, cages, conventional caging, enriched caging, shelter, platforms, animal welfare, space requirements, stress, enrichment, behavior, restlessness, timidity grooming, bar-gnawing.


NAL Call Number: QL750 A6

Keywords: housing, groups, social dominance.


NAL Call Number: HV4701 A557

Keywords: female animals, floor pens.


NAL Call Number: QL55 I5

Keywords: housing, husbandry, animal welfare, behavior, floors, cages, legislation, laboratory animals.


NAL Call Number: QL1.D48 v. 31

Keywords: laboratory animals, rodents, rabbits, experiments, housing, husbandry, animal welfare, enrichment.


NAL Call Number: SF451.R5
**Keywords:** housing, cages, cage changing, conception rate, litter size, mortality, reproduction, stillbirths, Italy, Italian language.

NAL Call Number: SF756.7.I57 1995  
Keywords: mating behavior, cages, groups.

Keywords: New Zealand White, Zobor, Nitran breed, genetic strain, displacement, stress, lipids, organs, cholesterol, animal welfare, housing, breeds, kidneys, liver, serum, lipid metabolism, breed differences, triglycerols, husbandry, cage changes.

NAL Call Number: SF1.A66  
Keywords: breed, New Zealand White, animal welfare, female animals, floor area, milk production, pens, rabbit housing, reproductive performance, size, space requirements.

NAL Call Number: QL55 A1L3  
Keywords: feeding, timing, abnormal behavior, bar biting, housing, group housing, floor pens, cages.

NAL Call Number: 40.28 K9  
Keywords: production, housing, cages, sheds, structures, microclimate, Russia, Russian language.

NAL Call Number: SF402.3.A7 2001.  
Keywords: housing systems, comparison, cages, cage raised, group housed, pen raised, wheat straw litter, wood shavings litter, meat animals, meat quality, carcass quality, carcass weight, dressing percentage, fat, feed conversion efficiency, feed intake, finishing, growth rate, liveweight gain, mortality, protein content, slaughter weight, stocking density, water content.

NAL Call Number: SF451.R5  
Keywords: husbandry, cages, deep-litter pens, feed conversion efficiency, dietary protein, litter, liveweight gain, performance, feeding, stocking density.

Keywords: husbandry, production, health, nutrition, feeding, reproduction, breeds, breeding, housing, rabbit meat, hides and skins, hair, rural development, diseases, animal products, meat, production, socioeconomic development.

**Keywords:** aggressive behavior, housing, wire-walled pens, carcass yield, fattening performance, mortality, pens, French language.


**NAL Call Number:** SF1.Z6

**Keywords:** breed, Hyla, housing, seasonal variation, outdoor cages, air-conditioned sheds, environmental temperature, liveweight gain, feed intake, winter, spring, summer, organs, body weight, carcass composition, carcass yield, feed conversion efficiency, Italian language.


**NAL Call Number:** SF451.R5

**Keywords:** diseases, hygiene, housing, Italian language.


**NAL Call Number:** 410.9 P94

**Keywords:** group housing, single caging, group sizes, management, space allocation, diet, stress, stereotypy, behavior, activity, disease, economic guidelines.


**NAL Call Number:** QL750.E82

**Keywords:** proteins, IFN [gamma], production in peripheral blood mononucleated cells, glucocorticoid receptor activity, evidence for endocrine links with social environmental changes, plasma corticosterone levels, immune parameter links, social environmental change relations, hormones, social environmental variation relations, agonistic behavior, seminatural conditions.


**NAL Call Number:** SF451.R5

**Keywords:** housing, nests, nest box lining, litter, wool, paper, contamination, growth, bacteria, fungi, mortality, Italian language.


**Keywords:** breed, Hyla and Grimaud hybrids, New Zealand White, finishing, cages, fattening, performance, mortality, respiratory diseases, strains, growth, housing, outdoor rearing systems, caging, husbandry, seasons,
heat stress, Italy.


Keywords: meat animals, housing, sheds, cages, nest boxes, “all in, all out” system, husbandry, production systems, France, French language.


Keywords: livestock, housing, pest control, insects, French language, France.


NAL Call Number: HV4701 A557

Keywords: meat animals, finishing, cages.


NAL Call Number: SF402.3.A7 2001

Keywords: production, reproduction, breeding, nutrition, management, milk yield, growth, meat carcasses, probiotics.


NAL Call Number: SF402.3.A7 2001

Keywords: disease, housing, care, production, German and English language.


NAL Call Number: SF1.183

Keywords: housing, feed conversion, feed conversion efficiency, feed intake, finishing, growth rate, liveweight gain, mortality, sex differences, skin lesions, stocking density, trauma.


NAL Call Number: SF02.3.A7 2001

Keywords: New Zealand White, housing, deep litter, pen-housed, cage-housed, carcass composition, carcasses, dressing percentage, fat, legs, liveweight, meat quality, pens, pH, protein, rabbit meat, water content.


NAL Call Number: 41.8 B45

Abstract: Investigations of slatted floor keeping of rabbits in an air conditioned chamber with multitgas monitoring over a period of more than two month have shown that the average values per week were on a low level between 575 and 685 ppm (carbon dioxide), 3.4 and 5.6 ppm (ammonia) resp. Concentration of ammonia reached in maximum 12.3 ppm for a short time. Nitrous oxide concentration was measured on a global value (253 up to 317 ppb). A slight tendency of increasing CO2 and NH3 values with the begin of light period--obviously related to increased locomotoric activity--approximately was observed. In slatted floor keeping
calculated emission of ammonia was very low (0.23 gram per 500 kg an hour).

**Keywords:** air conditioning, air pollution, ammonia, analysis, carbon dioxide, gases, housing, nitrous oxide, time factors, German language.


**NAL Call Number:** HD1417.T76

**Keywords:** breed, Chinchilla, New Zealand White, Dutch housing, comparison, conventional hutch with cage system versus non-conventional floor housing system, meat animals, body weight, cost benefit analysis, economic evaluation, housing, Nigeria, West Africa.


**NAL Call Number:** SF451.R5

**Keywords:** animal welfare, behavior, housing, Italian language.


**NAL Call Number:** QL750 A6

**Keywords:** litter, straw, floor type.


**NAL Call Number:** SF451.R5

**Keywords:** meat animals, drinking water, female fertility, light, meat quality, housing, temperature, ventilation, water quality, water temperature, Italian language, Italy.


**Keywords:** housing, stocking density, growth, feed conversion efficiency, mortality, stress, feed intake, Spanish language, Venezuela.


**NAL Call Number:** SF451.R5

**Keywords:** meat animals, housing, sheds, “all in-all out” system, husbandry, carcass weight, contamination, disinfection, fattening performance, feed conversion, hygiene, liveweight gain, performance, bacteria, Italy, Italian language.


**Keywords:** housing, mortality, disease prevention, French language.


**NAL Call Number:** SF604.A76

**Keywords:** growing rabbits, body weight, daily ration consumption, daily weight gain, feed gain ratio, production performance, rearing conditions, stocking density, total meat production, Portuguese language.


**NAL Call Number:** SF77 C65

**Keywords:** laboratory mammals, hip dysplasia, floor type.


**NAL Call Number:** 41.8 V644

**Keywords:** climate, physiology, housing, climatic factors, environmental temperature, Hungarian language.


**Keywords:** breed, New Zealand White, finishing, amino acids, liver, longissimus dorsi, muscles, protein synthesis, free range husbandry, lipids, nucleic acids, body weight, Bulgarian language.


**NAL Call Number:** QL55 A1L33

**Keywords:** strains, housing, behavior patterns, enrichment, animal welfare.


**NAL Call Number:** SF451.R5

**Keywords:** intensive rabbit breeding, meat animals, manure, removal, animal welfare, toxic gases, costs, droppings, housing, belt conveyors, noise, Italian language, Italy.


**Keywords:** females, female fertility, litter size, behavior, animal welfare, housing, management, cages, cage size, weaning weight, French language, Netherlands.


**NAL Call Number:** SF402.3.A7 2001

**Keywords:** housing, group size, density, floor space, finishing, behavior, aggression, skin lesions, weight gain, trauma, bones, bone strength.


**Keywords:** laboratory animals, thesis, behavior, aggressive, animal welfare, cages, physical activity, housing, German language.

Rivista di Coniglicoltura 37 (3): 11-15, ISSN: 0010-5929.

Keywords: housing, tunnels, protective structures, plastic tunnels, environmental control, domestic animals, livestock, Italian language.


Abstract: Laboratory rabbits kept in barren “traditional” cages tend to develop stereotypic behaviours and bone deformities. We have used an alternative regime, housing adult does as groups of four or five in floor pens (2.5-3 m²) supplied with hiding places and bedding. High- and low-ranking members of each group were identified, and their immunological status compared in terms of blood leucocyte function (chemiluminescence and mitogen tests), complement activity, and antibody production to soluble and cellular antigens. We found no evidence of immunosuppression, either in groups of a “docile” breed (New Zealand White) or Dutch crosses. These results, together with the animals’ general health and ease of handling, lead us to conclude that group-housed does are suitable for raising antisera and other purposes, provided that they are adequately monitored.

Keywords: antibody formation, immunology, animal behavior, physiology, complement activation, housing, phagocytes, drug effects, metabolism, respiratory burst.


Keywords: animal welfare, well-being, adaptation, housing, Italian language.


Keywords: rabbit diseases, furbearing animals, breeding, nutrition, physiology, feeding.


Keywords: housing, hutches, sheds, cages, husbandry, litter size, meat production, Greece, Italian language.
Information Resources on the Care and Welfare of Rabbits

Laboratory and Clinical Techniques


**NAL Call Number:** SF405.5.A23

**Keywords:** oral administration, restraint of animals, behavior, animal welfare.


**NAL Call Number:** QL55.A1L3

**Keywords:** laboratory animal, mouse, strain, NMRI, dog, breed, beagle, rabbit, New Zealand, reference data, principal physiological indicators, inter laboratory comparisons, species related reference data, sex differences, hematology, organ weight to body weight ratio, serum biochemistry.


**NAL Call Number:** SF406.I58 2001

**Keywords:** laboratory animal, care and use, scientific research, hamster, cat, dog, ferret, guineapig, marmoset, mouse, rat, rabbit, rhesus monkey, housing, environment, management, routine procedures, technology, animal welfare, breeding, caging, euthanasia, experimentation, feeding, handling, health status, hygiene, identification, laboratory safety, physical development, sexing, watering, careers, animal technology, legislation, Animals Scientific Procedures Act of 1986.

Bayans, M. (1998). *Some Preferred Techniques for the Laboratory Rabbit. [Quelques Techniques Choisies Pour Le Lapin De Laboratoire.]* Canadian Association of Laboratory Animals Science: Winnipeg, Canada. VHS video cassette (17 min).

**NAL Call Number:** Videocassette no. 2792

**Abstract:** This is the second video in our species specific series on laboratory techniques. Safe handling and restraint for injections, blood sampling and anesthesia with resuscitation methods are demonstrated. This training video is designed as a teaching aid to refine, replace and reduce the numbers of rabbits used for demonstration purposes. The target audience includes animal health technologists, graduate students, laboratory assistants and members of animal care and use committees. For more information go to: [http://www.calas-acsal.org/](http://www.calas-acsal.org/).

**Keywords:** laboratory techniques, injections, anesthesia with resuscitation, animal welfare.


**NAL Call Number:** SF602.P6

**Keywords:** pets, echography, diagnosis, French language.


Abstract: Nuclear magnetic resonance (NMR) spectroscopy and imaging can be used to investigate, noninvasively, a wide range of biological processes in systems as diverse as protein solutions, single cells, isolated perfused organs, and tissues in vivo. It is also possible to combine different NMR techniques enabling metabolic, anatomical, and physiological information to be obtained in the same experiment. This review provides a simple overview of the basic principles of NMR and outlines both the advantages and disadvantages of NMR spectroscopy and imaging. A few examples of potential applications of NMR spectroscopy and imaging are presented, which demonstrate the range of questions that can be asked using these techniques. The potential impact of using NMR techniques in a biomedical research program on the total number of animals required for specific investigations, as well as the number of animals used in research, are discussed. The article concludes with a personal perspective on the impact of continuing improvements in NMR technology for future applications in animal research.

Keywords: review, mice, rabbits, rats, anatomy, cross-sectional, animal welfare, laboratory animals, physiology, alypsia, cytology, magnetic resonance imaging, magnetic resonance spectroscopy, research methods, tumor cells.


Keywords: healthy pet rabbits, blood serum, blood chemistry, urea, creatinine, alkaline phosphatase, parasites, immunodiagnosis, electrolytes, enzymes, urea, creatinine, blood sugar, alkaline phosphatase, protozoal infections, Encephalitozoon cuniculi, German language.


Keywords: guineapigs, mice, rabbits, rats, reptiles, animal welfare, euthanasia, Hungarian language.


Keywords: rabbits, reptiles, rodents, animal welfare, euthanasia, techniques, German language.
NAL Call Number: SF602.P6
Keywords: pets, physiology, health, diagnosis, veterinary medicine, French language.

NAL Call Number: SF405.5 A23
Abstract: Although the use of Freund's Complete Adjuvant (FCA) has been discouraged for the production of polyclonal antibodies, little clinical evidence supports the belief that FCA necessarily affects the well-being of immunized rabbits. We designed the present study to determine whether immunization at multiple sites with small volumes of Freund's adjuvant affects rabbit well-being. We injected 18 female New Zealand White rabbits (six animals per group) with antigen in FCA, Freund's Incomplete Adjuvant, or physiologic saline in the following volumes and routes: 0.02 to 0.03 mL intradermally in each of 30 to 40 sites and 0.1 mL subcutaneously in each of two sites. The body weight, temperature, complete blood count, and behavior of the rabbits in the home cage, upon handling, and in an open field did not differ significantly among the immunization groups during the 7-week assessment period. Only the degree of induration around injection sites differed: as expected, FCA induced the greatest response at the injection sites, but the sites were neither ulcerative nor necrotic, nor did palpation of the sites induce any apparent discomfort to the rabbits. We conclude that FCA may be used safely and humanely in rabbits if small volumes are injected intradermally or subcutaneously in multiple sites.
Keywords: animal welfare, behavior, physiology, blood cell count, body temperature, body weight, Freund’s adjuvant, administration and dosage, adverse effects, immunology, heat shock proteins, histocytochemistry, immunization, intradermal injections, subcutaneous injections, kidney pathology, liver pathology, lung pathology, muramidase.

Keywords: rabbits, gerbils, guineapigs, hamsters, chinchillas, pets, sampling, blood, application methods, drugs, sex, handling, German language.

NAL Call Number: SF405.5 A23
Abstract: We have adapted the RadioVisioGraph (RVG), a digital radiography system designed for dentistry, to become a versatile research tool in a small research facility. We have used this modified digital imaging system in our institution to assess bone fractures and ossification in rabbit tibias in which titanium posts were placed in close proximity to one another, to evaluate bone fill in rats with experimental cranial critical-size defects, and to ensure the proper placement of oral gavage tubes in rodents. This method provides instantaneous digital radiographs, thus not requiring a dedicated X-ray suite or film-processing equipment, and reduces scatter radiation by < or =95%. The use of this technology in a small research facility has greatly improved the quality of both the care our animals receive and the research data we obtain.
Keywords: rabbits, rats, animal welfare, bone, radiography, equipment design, injuries, dental, tibial fractures, digital.

NAL Call Number: QR180.3.D4

Abstract: The quality control testing of clostridial veterinary vaccines currently requires large numbers of animals. Alternative in vitro test methods are being investigated by researchers in industry and by regulatory authorities in many countries. Monoclonal antibodies that neutralize Clostridium perfringens alpha toxin, C. perfringens beta toxin, C. perfringens epsilon toxin, and C. sordellii lethal toxin as well as a monoclonal antibody directed against C. chauvoei flagellar antigen have been developed by the Center for Veterinary Biologics Laboratory for use in antigen quantification assays. A proposal to create an international standard collection of clostridial-specific monoclonal antibodies is made.

Keywords: mice, Inbred BALB C, rabbits, guinea pigs, animal welfare, monoclonal antibodies, therapeutic use, antigens, bacterial analysis, bacterial toxins, immunology, clostridium, veterinary, Clostridium perfringens, enzyme-linked immunosorbent assay, hybridomas, immunoassay methods.


NAL Call Number: SF605.N672

Keywords: veterinary medicine, heart rate and rhythm, blood pressure, hypolemia, intravenous catheterization, intra-osseous catheterization, electrolytes, blood transfusion, endotoxemia, respiratory rate, arterial blood gases, endotracheal intubation, nutritional indicators, dental problems, nasogastric intubation, total parenteral nutrition, product information.


Abstract: This study describes a modified catheterization technique with subcutaneously implanted port catheters to be inserted in a retrograde manner across the aortic valve into the left heart ventricle through the right carotid artery to measure organ perfusion. MATERIALS AND METHODS: The specially designed arterial port catheters were implanted in New Zealand rabbits (n = 11, 3.7 +/- 0.1 kg [mean +/- SEM]) under iv anesthesia (medetomidine/ketamine) and single-shot perioperative antibiotic therapy. Hemodynamics were registered continuously during the operation via an ear artery catheter. RESULTS: Implantation of ports was performed in all animals (11/11) without major complications (mean operation time: 70 +/- 3 min). We did not observe catheter-associated arrhythmia, fall in mean arterial pressure (MAP before and post OP: 70 +/- 2 and 68 +/- 2 Torr, respectively), or change in arterial oxygen saturation (SaO2 before and post OP: 89 +/- 3 and 95 +/- 2%, respectively). With a specifically modified microsurgical insertion technique, cerebral blood supply was effectively preserved as evidenced from postmortem histological examinations, cerebral blood flow determination with fluorescent microspheres, and measurement of S-100b protein serum concentrations, a specific marker of neuronal damage. The positioning of the catheter tip in the left ventricle was found to be correct in 10/11 animals. CONCLUSIONS: Repeated and a traumatic microsphere injections into the left ventricle have become feasible by transcutaneous puncture of subcutaneous port systems over several weeks under light sedation. Hence, this new approach (i) avoids the necessity of repeated intracardiac injections and port insertions via thoracotomy, thus reducing the perioperative stress for the animals, and (ii) allows for the first time minimally invasive repetitive and chronic measurements of regional organ blood flow under various experimental settings.

Keywords: breed, New Zealand, catheterization technique, aortic valve, left heart ventricle, right carotid artery, organ perfusion, hemodynamics, perioperative stress reduction.


Keywords: abscesses, anesthesia, castration, entropion, enucleation, fracture fixation, ovariection, preoperative

**NAL Call Number:** QA141.A1E97

**Keywords:** carbonic anhydrase, alimentary acid base load analysis, analytical method, minimal invasive, nutritional method, physiological method, food mineral content, nutrition, rabbit chow, respiratory control.


**NAL Call Number:** 41.8 IR4

**Keywords:** pets, postmortem examinations, diagnosis, rabbit diseases.


**NAL Call Number:** 41.8 IR4

**Keywords:** pets, hematology, blood chemistry.


**NAL Call Number:** 41.8 IR4

**Keywords:** handling, restraint, small animal practice, veterinary practice, pets, fractures, lacrimal apparatus, skin, thorax, abdomen, mouth, limbs, diagnostic techniques, clinical examination.


**NAL Call Number:** 41.8 IR4

**Keywords:** pets, sex determination, pregnancy diagnosis, blood specimen collection, radiography, pathology.


**NAL Call Number:** 41.8 IR4

**Keywords:** pets, drug therapy, application methods, injection, topical application.


**NAL Call Number:** SF981.B78 2002

**Keywords:** pets, ornamental fishes, aviary birds, amphibia, birds, chinchillas, ferrets, gerbils, guineapigs, hamsters, lizards, mice, pigeons, rabbits, rats, snakes, tortoises, turtles, anesthesia, anatomy, diseases, husbandry, diagnosis, diagnostic techniques, drug therapy, euthanasia, exotics, handbooks, restraint of animals, surgical operations.


**NAL Call Number:** QL55.A1L3

**Keywords:** cat, dog, ferret, guineapig, hamster, mouse, primate, rabbit, rat, sheep, footpad, British Veterinary Association Animal Welfare Foundation [BVAAWF], Royal Society for the Prevention of Cruelty to Animals [RSPCA], Universities Federation for Animal Welfare [UFAW], administration route, intra articular administration, drug delivery method, intracerebral administration, intradermal administration, intramuscular administration, intranasal administration, intraperitoneal administration, intratracheal administration, intravaginal administration, intravenous administration, oral administration, osmotic minipumps, refining.
procedures, laboratory method, respiratory administration, subcutaneous administration, topical administration, Fund for the Replacement of Animals in Medical Experiments [FRAME], animal suffering, distress, good practice, pain, substance administration.

NAL Call Number: QL55.A1L3
Keywords: rabbits, guineapigs, Marmota monax.

NAL Call Number: SF605.N672
Keywords: fluid therapy, catheter placement, fluid maintenance, nutrition, pain management, gastric obstruction, endotracheal intubation.

NAL Call Number: SF405.5.A23
Keywords: laboratory animals, declawing, scratch prevention, human safety, Biosafety Level 4.

NAL Call Number: SF604.R37 no. 306
Keywords: ferrets, rabbits, rodents, guineapigs, small animal practice, diagnosis, diagnostic techniques, therapy, drug therapy, clinical examination.

NAL Call Number: SF405.5.A23
Keywords: legs, tendons, postoperative care, casts.

NAL Call Number: QL55.A1L3
Keywords: laboratory mammals, endoscopy, endoscopes, trachea.

NAL Call Number: SF991.S59 2004
Keywords: laboratory tests, techniques, interpretation, blood count and bone marrow examination, erythrocyte, leukocyte disorders, hemostatic abnormalities, serum chemistries, point of care instruments, electrolyte and acid-based disorders, urinary disorders, endocrine, metabolic, and lipid disorders, gastrointestinal disorders, fluid accumulation disorders, respiratory disorders, immunologic disorders, reproductive disorders, neurologic disorders, infectious disease, cytology of neoplastic and inflammatory masses, diagnostic toxicology, therapeutic drug monitoring appendices, listing of referral laboratories, reference values, color illustrations, appendices, tables.


Production

NAL Call Number: TX373.M4
Keywords: brain, electronarcosis, stunning, electrophysiology, insensibility, slaughter, animal welfare.

NAL Call Number: 47.8 AR2
Keywords: New Zealand White, breed, male, carcass characteristics, meat, quality, selection traits, body weight, marketing age.

NAL Call Number: 281.8 IN32
Keywords: breed selection, health, housing, husbandry, meat production, management, non-intensive rearing, farm size, Italy, Italian language.

NAL Call Number: S542.A8A34 no. 99
Keywords: meat animals, husbandry, production, fattening performance, mortality, feeds, production possibilities, farmer training, education, subsistence farming, Papua New Guinea.

Keywords: husbandry, farms, semi-intensive, production systems, meat animals, economics, mortality, Venezuela, Spanish language.

NAL Call Number: SF402.3.A7 2001
Keywords: nutrition, production, consumer education, consumer information, farm management, market economics, housing, surveys, technical progress, technical training, Tunisia.

**Keywords:** breed, Angora, German x British x Russian, nutrition, digestion, groundnut cake, feed, protein source, soyflakes, sunflower cake, wool production.

**Keywords:** breed, New Zealand White, birth, season, daily body weight gain, post weaning, growth efficiency, litter size, parity, sex.

**Keywords:** breed, New Zealand White, carcass characteristics, carcass weight, chest weight, dressing percentage, forefeet weight, foreleg weight, head weight, hindfeet weight, live weight, organ weight.

**Keywords:** housing, meat production, type of cage, density, wire-grill, straw, Italy, Italian language.

**Keywords:** meat producing animals, meat produce, food storage and preservation, husbandry, muscle physiology, rabbit meat, Italian language.

**Keywords:** small farms, production, husbandry, reproduction, litter traits, breed differences, Poland.

**Keywords:** meat production, history, husbandry, management, slaughter, exports, imports, rabbit meat, production, economics, Czech Republic, French language.

**Keywords:** breed, Soviet Chinchilla, broiler breed, commercial species, slaughter, applied and field techniques, carcass characteristics, carcass weight, dressing percentage, feeding, housing, live weight, meat production, India, Asia.

**NAL Call Number:** SF402.3.A7 2001
**Keywords:** small farm production, family farming, meat animals, disease, feeding, diet, housing, coccidial infection, drugs, lesions, litter size, mange, slaughter weight, weaning weight, Greece.


**Keywords:** breed Canberra half lop rabbits, fryer rabbits, deep litter housing, stocking densities, fattening performance, feed conversion, efficiency, feed intake, stocking density, Papua New Guinea.


**NAL Call Number:** SF601.I45

**Keywords:** broiler breed, carcass traits, effect of season, growth, average daily gain, weekly gain.


**NAL Call Number:** 41.8 IN2

**Keywords:** air temperature, feeding, housing, body temperature, body weight, dry matter, growth rate, liveweight, liveweight gain, performance traits, pulse rate, rectum, relative humidity, respiration rate, wind speed, India.


**Keywords:** breeds, history, meat, husbandry, housing, shows, hides and skins, furbearing animals, production, meat production, wool production, pelts, Denmark, Danish language.


**Keywords:** rabbit meat, animal welfare, drug residues, disease control, nutrition, feeds, drinking water, hygiene, meat production, zoonoses, husbandry, Italy.


**NAL Call Number:** SF451.R5

**Keywords:** production costs, valuation, breeding, husbandry, finishing, Italy.


**NAL Call Number:** 41.8 IN22

**Keywords:** breed, New Zealand White, dam, female, sire, male, carcass traits, dam effects, delivery, season effects, genetic factors, heritability, meat/bone ratio, non-genetic factors, seasonal effects, sire effects, Egypt.


**Keywords:** young rabbit, production, probiotics, profitability, breeding success, fattening period, feeding, mortality, rearing practices, preventive vaccination, feeding hygiene, performance, concentrate diets, dry season, weight gain, dry matter intake, Guinea grass hay, feed, Verano style hay.

Finzi, A. (2001). **Allevamenti non convenzionali.** [Non-traditional rearing of rabbits.] *Rivista di Coniglicoltura* 38
**Keywords:** husbandry, breeding, extensive farming, reproduction, animal welfare, Southern Europe.

**Keywords:** meat animals, husbandry, dams, mothers, finishing, mortality, France, French language.

**Keywords:** waste management, feces, urine, ammonia production, biogas production, carbon dioxide, carbon monoxide, hydrogen, methane; minerals, nitrogen, oxygen, plug flow digester system, production method, anaerobic digestion, biological fermentation, economics, industrial rabbit breeding facility, meat production, microbial activity, organic material, pH level, reproduction, temperature, waste production, French language.

**Keywords:** meat animals, husbandry, housing, indoor, outdoor, livestock farming, pathogens, production data, farm licensing, public health, Italian language, Italy.

**Keywords:** rabbit meat, housing, management, nutrition, prices, meat production, litter size, French West Indies, French language.

**NAL Call Number:** SF451.R5
**Keywords:** economic analysis, economies of scale, profitability, housing, production costs, farming systems, comparisons, production type, farm size, markets, Italy, Italian language.

**Keywords:** breed, New Zealand White, male, housing, animal welfare, carcass weight, digestive tract, environmental enrichment, gnawing wood, fattening performance, liveweight gain, seasonal variation, Spring, Summer.

**NAL Call Number:** S1 M57
**Keywords:** small animal rearing, housing.

**Keywords:** adaptation, husbandry, production, broiler rabbits, birth weight, body weight, bucks, economics, female animals, green fodders, growth rate, income, marketing, performance traits, feeding, housing, reproduction, reproductive efficiency, reproductive performance, survival, weaning weight, India.
**NAL Call Number:** 41.8 IN22
**Keywords:** breed, Black Brown, Soviet Chinchilla, White Giant, broiler, body weight gain, doe weight, genetic factors, litter size, non genetic factors, season, semi-arid region, India.

**NAL Call Number:** SF402.3.A7 2001
**Keywords:** housing systems, comparison, cages, cage raised, group housed, pen raised, wheat straw litter, wood shavings litter, meat animals, meat quality, carcass quality, carcass weight, dressing percentage, fat, feed conversion efficiency, feed intake, finishing, growth rate, liveweight gain, mortality, protein content, slaughter weight, stocking density, water content.

**NAL Call Number:** SF1.A64
**Keywords:** breed, German Angora, female, male, melatonin, hair follicle, integumentary system, skin, wool, hormone drug, body weight, feed consumption, wool fiber quality, wool production.

**Keywords:** aggressive behavior, housing, wire-walled pens, carcass yield, fattening performance, mortality, pens, French language.

**Keywords:** husbandry, production, health, nutrition, feeding, reproduction, breeds, breeding, housing, rabbit meat, hides and skins, hair, rural development, diseases, animal products, meat, production, socioeconomic development.

**NAL Call Number:** SF1.A53
**Keywords:** breed, New Zealand White, arm length, carcass traits, post-slaughter, pre-slaughter, carcass weight, chest circumference, dressing percentage, forearm length, live body weight, meat deposition, estimation, thigh circumference, trunk length.

**NAL Call Number:** SF1.A53
**Keywords:** breed, Danish White, carcass, female, male, chest circumference, lean yield, live body weight, meat performance, pelvis width, slaughter.

**NAL Call Number:** SF402.3.A7 2001
**Keywords:** meat animals, husbandry, production, farming, sustainable farming, small-scale farmers, reviews.

ISSN: 0021-8812.

NAL Call Number: 49 J82

Keywords: guinea pig, rabbit, rodents, local breeds, alternative farming systems, international animal agriculture, teaching methods, subsistence farming, integrated farming systems, small farming methods, malnourishment, world hunger, poverty.


NAL Call Number: SF402.3.A7  2001

Keywords: case studies, farmers, feeding, housing, nutrition, poverty, villages, community development, meat production, projects, husbandry, French language, Cameroon.


Keywords: breed, hybrid, Hyla and Grimaud, New Zealand White, finishing, cages, fattening, performance, mortality, daily gain, respiratory diseases, strains, growth, housing, husbandry, seasons, heat stress, Italy.


Keywords: behavior, animal welfare, cages, carcass weight, carcass yield, environmental enrichment, feeding behavior, stereotypic activity, finishing, liveweight gain, mortality, performance traits, trauma.


NAL Call Number: SF451.R5

Keywords: meat animals, housing, intensive production, animal welfare, artificial insemination, crossbreds, disease control, meat quality, feeding.


NAL Call Number: SF454.N88  1998

Keywords: raw material grinding, feed processing method, diet number, feed conservation, feed management, feed storage, feeding systems, intensive production, pellet quality, pellet size.


Keywords: review, aggressive behavior, breeding, husbandry, production, animal welfare, circadian rhythm, diurnal activity, diurnal variation, female animals, mating, prolactin, pseudopregnancy, stress factors, suckling, weaning weights, management programs, handling, nutrition, availability of water, trough versus nipple waterers.


Keywords: commercial, female, male, electrical stunning, slaughter method, video recording, recording method, alternative frequencies, clonic phase recovery, corneal reflex, recovery stage, hindleg posture, biceps femori, longissimus dorsi, muscular system, muscular pH, painful stimuli response, resumption to rhythmic breathing, spontaneous physical activity, tonic phase.

Keywords: meat animals, housing, sheds, cages, nest boxes, “all in, all out” system, husbandry, production systems, France, French language.


**Keywords:** game birds, fishes, ostriches, pigeons, rabbits, legislation, organic farming.


**NAL Call Number:** SF402.3.A7 2001

**Keywords:** production, reproduction, breeding, nutrition, management, milk yield, growth, meat carcasses, probiotics.


**Keywords:** housing, feed conversion, feed conversion efficiency, feed intake, finishing, growth rate, liveweight gain, mortality, sex differences, skin lesions, stocking density, trauma.


**NAL Call Number:** SF402.3.A7 2001

**Keywords:** New Zealand White, housing, deep litter, pen-housed, cage-housed, carcass composition, carcasses, dressing percentage, fat, legs, liveweight, meat quality, pens, pH, protein, rabbit meat, water content.


**Keywords:** pigs, sheep, cattle, deer, rabbits, legislation, stunning, animal welfare, slaughter, United Kingdom.


**Keywords:** breed, Chinchilla, New Zealand White, Dutch, housing comparison, hatch, cage system, floor rearing, meat animals, body weight, cost benefit analysis, economic evaluation, Nigeria, West Africa.


**NAL Call Number:** QL750 A6

**Keywords:** litter, straw, floor type.


**Keywords:** farming industry, feed utilization, fertility, maturation, prolificacy, breeding, meat, quality, Poland, Polish language.


**NAL Call Number:** SF451.R5

**Keywords:** meat animals, housing, sheds, “all in-all out” system, husbandry, carcass weight, contamination, disinfection, fattening performance, feed conversion, hygiene, liveweight gain, performance, bacteria, Italy, Italian language.
NAL Call Number: SF453.5.A8R33 1999
**Keywords:** meat production, fur production, guidelines, housing systems, legislation, codes of practice, planning a farm operation, environmental concerns, disease considerations, animal welfare, waste management, transport.

NAL Call Number: SF451.R5
**Keywords:** meat animals, meat quality, performance, cages, open air housing, dry matter, feed intake, growth rate, mortality, winter, feed conversion, summer, housing, Italian language.

NAL Call Number: 41.8 IN22
**Keywords:** birth month, carcass traits, dressing percentage, genetic correlations, heritability, meat production, phenotypic correlations, meat product, slaughter.

NAL Call Number: 23 Au783
**Keywords:** breed, Californian, Flemish Giant, New Zealand White, crossbred, growth traits, average daily gain, body weight, litter variance, slaughter traits, carcass weight, dressing percentage purebred, slaughter traits, Australia.

NAL Call Number: SF55.A78A7
**Keywords:** disease incidence, feed cost, growth rate, meat production, production traits, economic values, rabbit farming, Australia.

**Keywords:** breed, New Zealand White, finishing, amino acids, liver, longissimus dorsi, muscles, protein synthesis, free range husbandry, lipids, nucleic acids, body weight, Bulgarian language.

NAL Call Number: 41.8 IN22
**Keywords:** broiler, crossbred, micro-livestock, heterosis, meat characteristics.

NAL Call Number: 41.8 IN2
**Keywords:** breed Gray Giant, New Zealand White, Soviet Chinchilla, White Giant, broiler, meat breeds, genetic group, kindling period, kindling season, litter size, litter weight, performance, weaning weight.


**NAL Call Number:** 41.8 IN22

**Keywords:** breed, Flemish Giant, Grey Giant, New Zealand White, Soviet Chinchilla, commercial species, crossbred, crossbreeding, applied and field techniques, genetic techniques, laboratory techniques, birth month, body weight, heterosis, litter size, pre weaning.


**Keywords:** housing, hygiene, nutrition, profitability, meat production, management, rabbit feeding, German language, Germany.


**NAL Call Number:** SF402.3.A7 2001

**Keywords:** reviews, birth weight, diets, energy intake, energy requirements, feed intake, nutrition programs, reproduction, reproductive performance, nutrition, husbandry.


**NAL Call Number:** SF1.A53

**Keywords:** breed, New Zealand White, regression equation, production, arm length, heritability, body weight, carcass bone weight, prediction, carcass composition, carcass fat weight, carcass length, carcass meat weight, prediction, carcass weight, chest girth, forepart width, genotype-phenotype correlation, head weight, intensive rearing conditions, lumbar muscle weight, meat deposition, pelvis width, perirenal fat, post-slaughter traits, pre-slaughter traits, rump length, thigh spiral circumference.


**NAL Call Number:** 41.8 IN22

**Keywords:** broiler, female, male, carcass, genetic groups, meat quality, meat.


**NAL Call Number:** SF1.S26

**Keywords:** broiler, large scale breeding, reproduction, number of sucklings, Czech language.


**NAL Call Number:** HV4711.A588 1997.


**Keywords:** confinement rearing, breeding, wool harvesting, fur production, transport.


**Keywords:** thesis, animal welfare, housing, management, health, diseases, breeding, nutrition, hygiene, slaughter, marketing, mortality, German language.

Keywords: breed, New Zealand, kidney, excretory system, liver, digestive system, muscle, muscular system, glutathione, inbreeding, breeding method, age effects, race effects, slaughter method effects.


Keywords: meat animals, livestock farming, husbandry, agricultural research, Hungarian language, Hungary.


Keywords: small animal rearing, feeding, housing.


Keywords: meat producing animals, housing, economics, meat production, small farm, family based, myxomatosis, feeding, slaughter, viral haemorrhagic disease, Italian language, Egypt.


Keywords: breed, Hyla combination, broiler, fertility, growth performance, litter size, milk production, performance traits, reproductive performance, Czech language.


Keywords: health, animal welfare, environmental assessment, environmental legislation, environmental protection, finishing, intensive livestock, farming, manures, site selection, waste management, Australia.


Keywords: housing, hutches, sheds, cages, husbandry, litter size, meat production, Greece, Italian language.


Keywords: breed, Grand Chinchilla, New Zealand White, Termond White, female, male, offspring, fattening, reproductive performance, test station data, slaughter, Polish language.


Keywords: breed, Grand Chinchilla, New Zealand White, Termond White, buck, doe, fattening performance, feed conversion, litter size, progeny performance, reproductive performance, slaughter performance, slaughter
weight, warm carcass weight, Experimental Station in Chorzelow, Polish language, Poland.


NAL Call Number: SF1.K7

Keywords: breed, Grand Chinchilla, New Zealand White, Termond White, male, testing station method, evaluation method, breeding value, offspring fattening performance, offspring slaughter performance, reproductive performance, evaluation.


NAL Call Number: SF1.K7

Keywords: breeding method, model rabbit farm, deep litter housing, meat production, reproduction, fattening, slaughter performance, feeding, National Research Institute of Animal Production, Balice, Poland, Polish language.


NAL Call Number: SF1.K7

Keywords: small commercial farms, disease prevention, reproduction, mating, fertility, nutrition, weaning, husbandry, Polish language.


NAL Call Number: SF1.K7

Keywords: breed, Alaskan, Californian, Grand Chinchilla, New Zealand Red, New Zealand White, Termond White, buck, doe, performance testing, applied and field techniques, fattening performance, litter size, litter weight, reproductive performance, slaughter value, Experimental Station in Chorzelow, Polish language, Poland.


NAL Call Number: SF1.K7

Keywords: breed, Grand Chinchilla, New Zealand, White, Termond White, buck, doe, female, male, body weight, breeding value, fattening performance, feed conversion, hot carcass weight, litter size, reproductive performance, slaughter value, test station data, Polish language.


NAL Call Number: SF451.R5

Keywords: animal welfare, transport of animals, meat hygiene, meat quality, Italian language.


NAL Call Number: SF1.L5

Keywords: fat, dietary intake, dietary source, animal selection programs, carcass, meat product, meat quality, slaughter age, slaughter weight.
Reproduction


**NAL Call Number:** 410 Ac84

**Keywords:** Lepus californicus, Oryctolagus cuniculus, Romerolagus diazi, North American wild lagomorphs species, comparative study, male, reproductive organs, size, weight, sperm, morphology, testis, accessory glands of male, sperm ducts, epididymus.


**Keywords:** sexual maturity, females, light regime, housing, males, proximity of males, estrous cycle, estrus, litter size, pseudopregnancy, kindling rate.


**NAL Call Number:** 442.8 Z35

**Keywords:** uterus, reproductive system, analytical method, best linear unbiased prediction selection method, breeding method, uterine capacity selection response.


**NAL Call Number:** SF981.E8

**Keywords:** chinchillas, gerbils, guineapigs, hamsters, mice, rabbits, rats, anesthesia, anesthetics, anti-infective agents, castration, drug therapy, estrus cycle, postoperative care, pseudopregnancy, reproduction, sexual maturity, sterilization, surgery, surgical operations, techniques.


**NAL Call Number:** SF602.P6

**Keywords:** pets, sterilization, drugs, surgical operations, French language.


**Keywords:** castration, reproduction, anesthesia, surgery, rodents, rats, gerbils, rabbits, hamsters, French language.

Bousses, P.; Chapuis, J.L. (1998). *Deferred seasonal increase in testes weight under poor nutritional conditions in*

**NAL Call Number:** QL1.J68  
**Keywords:** body weight, seasonal changes related to nutrition, food plants, seasonal nutritional quality related to testis weight, food availability, testis seasonal weight changes, relationships, testis, seasonal weight changes in relation to nutrition, evolutionary adaptation, testis weight, nutrition relationships, Indian ocean islands, Kerguelen islands, armor, molloy and morne, testis weight related to nutrition.

**Keywords:** castration, surgery, ovariectomy, genitalia, anatomy, Italian language.

**Keywords:** pets, sex diagnosis, hamsters, gerbils, rats, mice, guineapigs, chinchillas, rabbits, Italian language.

**Keywords:** husbandry, artificial insemination, reproduction, semen, Italian language, Italy.

**NAL Call Number:** QP251.A1T5  
**Keywords:** semen, storage, spermatozoa, motility, viability, alpha tocopheryl acetate, vitamin E, antioxidant, dietary supplements, dosage, ascorbic acid, antioxidant, artificial insemination, sperm cryopreservation, fertility, oxidative stability, storage temperature.

**NAL Call Number:** QP251.R48  
**Keywords:** commercial species, male, breed, California, semen quality, reproductive system, sperm, morphology, motility, vigor, selenium, dietary supplement, Portuguese language.

**NAL Call Number:** S1.R4  
**Keywords:** breed, California, chinchilla, New Zealand White, Semi Giant, productive indicators, environmental effects, fertility, birth traits, total and born alive, still births, weaning traits, mortality at weaning, percentage litter weaned, number weaned per litter, litter weight, average individual weight, GLM model, mathematical and computer techniques, analysis of variance, fertility, kindling month, mixed feeding conditions, mortality, pre-weaning performance, environmental effects, reproductive performance.

**NAL Call Number:** 49 F84  
**Keywords:** spermatozoa, reproductive system, conservation time, fertility, number, refrigeration, preservation method, French language.

**NAL Call Number:** QH351.I58
Keywords: reproductive system, accessory glands of male, vasicular gland, morphofunctional studies, histology, anatomy, morphological analysis, Spanish language.

Keywords: breed, New Zealand White, Rex crosses, liveweight gain, gestation period, heterosis, litter size, litter weight, seasons, weaning weight, crossbreeding, conception rate, female fertility, growth, body weight, intensive husbandry, parity.

NAL Call Number: QP251.A5
Keywords: breed, Gigante de Espana, doe, embryo, female, gonadotropin releasing hormone, corpora lutea, endocrine system, reproductive system, oviduct, intramuscular injection, repeated surgical embryo recovery, experimental method, surgical method, embryo production, ovulation.

NAL Call Number: QP251.A5
Keywords: female, does, feeding, restricted, ad libitum, milk production, conception rate, adipose tissue, ovulation rate.

NAL Call Number: 44.8 J822
Keywords: breed, New Zealand white, commercial species, female, male, aggression, ejaculation, urination, environmental temperature, grasping, housing, intensive production unit, kicking, mating, mounting, photoperiod, sexual behavior.

NAL Call Number: SF1.A66
Keywords: cages, cage design, galvanized wire-mesh cages, plastic cages allowing visual contact, non-transparent plastic cages, indoor rearing, outdoor rearing, conception rate, fattening performance, feed conversion, feed intake, finishing, liveweight gain, housing, reproductive performance, Poland.

NAL Call Number: 41.8 IN2
Keywords: breed, New Zealand White, Soviet Chinchilla, broiler, commercial species, pregnant mare serum gonadotropin, fertility drug, hormone, drug, parental administration, conception rate, kidding, litter size, meat, meat product.

NAL Call Number: QP251.A1T5
Keywords: non-transgenic, transgenic, semen fertility, sperm chromatin stability, theriogenology, transgenesis.

NAL Call Number: 410 J828
Keywords: pests, domestic cat, house mouse, European rabbit, viruses, biocontrol agent, competitor, pathogen, myxomatosis, fungal disease, viral infection, viral disease, sterilization, pest control, method, viral vectored
immunocontraception [VVIC], contraception method, pest control method, biological control, birth rates, competition, demographics, epidemiology, genetic engineering, host suppression, host parasite models, mortality rates, non spatial models.

NAL Call Number: SF451.R5
Keywords: housing, cages, cage changing, conception rate, litter size, mortality, reproduction, stillbirths, Italian language.

NAL Call Number: S960.W5
Keywords: fertility, imposed fertility control on females, epidemiology, natural viral disease, viral diseases, myxomatosis, epidemiology, implications for effects of fertility control, western Australia, wellstead, viral disease epidemiology, implications for impact of fertility control.

NAL Call Number: SF756.7.I57 1995
Keywords: mating behavior, cages, groups.

NAL Call Number: SF402.3.A7 2001
Keywords: artificial insemination, reproductive performance, change, PMSG, HCG, estrus, induction, parity, fertility, litter size, cages, lactation, biotechnology.

NAL Call Number: 49 J82
Keywords: breed, Botucatu, genetic parameter estimation, growth performance, litter traits, reproductive traits, meeting.

NAL Call Number: QP251.A5
Keywords: doe, female, mammary tissue, reproductive system, beta-endorpin, beta-estradiol, bromocriptine, hormone, progesterone, prolactin, nest building behavior, periparturient period, pregnancy.

NAL Call Number: SF1.A64
Keywords: breed, New Zealand x Californian, doe, female, early weaning, feed efficiency, fertility, lactation, litter size, mating, mortality, parturition interval, reproductive performance.

Nottola, S.A.; Macchiarelli, G.; Motta, P.M. (1997). The angioarchitecture of estrous, pseudopregnant and pregnant rabbit ovary as seen by scanning electron microscopy of vascular corrosion casts. Cell and

Abstract: Proposals to manipulate the fertility of wild, free-living animals extend the domination humans already exercise over domesticated animals. Current lethal methods for population control include poisoning, trapping, hunting, dogging, shooting, explosives, fumigants, and deliberately introduced disease. Animal welfare interests are based on individual animal suffering, but those interests are often overshadowed by labelling of groups of animals as pests, resource species, national emblem or endangered species. Public concern for animal welfare and acceptance of new population control methods will be influenced by such labels. The animal welfare implications of new population control technology must be balanced against the existing inhumane lethal methods used. It will be difficult to resolve the dilemma of a mechanism for disseminating a fertility control agent that will cause some animal suffering (e.g. a genetically-manipulated myxoma virus for European rabbits), yet may reduce future rabbit populations and therefore the number suffering from lethal methods. An Animal Impact Statement is proposed as a tool to assist debate during development of fertility control methods and for decision making prior to their use. A comprehensive and objective Animal Impact Statement may introduce an ethic that moves the pendulum from attitudes that allow sentient animals to be destroyed by any and all available means, towards a more objective selection of the most effective and humane methods.

Keywords: review, wild animals, animal welfare, contraception, ethics, pest control, Australia.


Keywords: New Zealand White, breed, doe, artificial insemination, laboratory techniques, kindling rate, lactation, litter size, male exposure, parturition, relocation effect, reproductive performance, sexual receptivity.


Abstract: An experiment was performed to study the effect of litter size before weaning on subsequent body development and composition, feed intake, and reproductive performance of young rabbit does with the objective to improve reproductive performance. Litter size (LS) before weaning (treatment) was 6, 9, or 12 kits. After weaning (30 d), 58 female kits per treatment (in two successive replicates) were reared and fed for ad libitum intake to 14.5 wk of age (end of rearing). At 14.5 wk of age, receptive does were inseminated. Nonreceptive and nonpregnant does were inseminated at 17.5 wk of age. The experiment ended when the second litter was weaned. Part of the animals was slaughtered to determine body composition at the end of the experiment (replicate one) and at the end of rearing (replicate two). At weaning, BW differed among treatments (P < 0.05; 855, 773, and 664 +/- 15 g for LS6, 9, and 12, respectively). Compensatory growth was observed. At the end of rearing, LS12 does were smaller (P < 0.05) than LS9 and LS6 does (3,524, 3,778, and 3,850 +/- 48 g, respectively). After first lactation, no difference in BW among treatments was found. Compared with LS6, empty body weight (BW minus gut, bladder, and uterus content) of LS12 contained more (P < 0.05) nitrogen (32.5 vs 31.1 +/- 0.3 g/kg), more (P < 0.05) ash (30.7 vs 28.3 +/- 0.6 g/kg), and less (P < 0.05) fat (168.6 vs 200.2 +/- 8.6 g/kg). No differences in body composition among treatments were found at the end of the experiment. During rearing, LS12 had the lowest (P < 0.05) daily feed intake (152, 164, and 169 +/- 2 g/d for LS12, 9, and 6, respectively). During the reproductive period, no differences in feed intake among treatments were found. Kindling rate (the number of kindlings per number of inseminations) was not influenced by treatment. In the first parity, total litter size (number of alive and stillborn kits) was lower (P < 0.10) for LS12
than for LS9 (6.4 vs 8.6 +/- 0.5, respectively). When first mating was delayed by 3 wk, an increased (P < 0.05) total litter size was found regardless of treatment (7.5 and 9.4 +/- 0.3 for 14.5, and 17.5 wk, respectively). Decreasing litter size before weaning from nine to six kits did not alter future reproductive performance. Based on results of this study, it seems advisable to perform a limited standardization level (at nine kits) after kindling and postpone first mating to an older age (17.5 wk) to improve reproductive performance.

**Keywords:** husbandry methods, body composition, energy intake, female, litter size, growth and development, reproduction, weaning, weight gain.


**Abstract:** A retrospective study was performed to evaluate the relationships between BW at first insemination and subsequent body development, feed intake, reproductive performance, and culling rate of rabbit does. Young rabbit does are vulnerable to body energy deficit in first lactation, resulting in decreased reproductive performance and high replacement rate. Heavy does at first insemination might be able to benefit from the extra amount of BW to cope with the energy deficit during first lactation. Data of three experiments were used in which does were given ad libitum access to feed during rearing and inseminated at 14.5 wk of age. The first two parities of each doe were recorded. Does were categorized in three groups based on their BW at 14.5 wk of age (first insemination): heavy (BW > or = 4,000 g), medium (BW 3,500 to 4,000 g), and small (BW < 3,500 g). Among does that kindled, differences in BW at first insemination were related to differences in voluntary feed intake and body growth rate during rearing. Heavy does consumed more feed per day (+ 45 g/d, P < 0.001) and had a higher BW gain (+ 12 g/d, P < 0.001) than small does from weaning (4.5 wk) to 14.5 wk of age. Body weight at first insemination did not affect BW, feed intake, and culling rate during the first two parities. Heavy does were heavier at first insemination and remained so throughout the reproductive period, but they followed a similar BW curve as medium and small does. A higher BW at first insemination (14.5 wk of age) improved litter size in the first parity (8.9, 7.7, and 6.4 for heavy, medium, and small does, respectively, P < 0.05). Extra BW at start of reproduction improves litter size in the first parity but does not contribute to an improved feed intake or increased BW development during reproduction.

**Keywords:** female, husbandry, body composition, body weight, physiology, eating, energy intake, lactation, litter size, parity, growth and development, reproduction


**Keywords:** milk, reproductive system, mammary pheromone, behavior, inclusive fitness, evolutionary success, maternal care, maternal odor cues, neonatal behavioral cues, newborn feeding behavior, oral grasping behavior, reciprocal female offspring exchange, energy, immunity, information.


**Keywords:** New Zealand White, hybrid, buck, male, artificial light, natural light, semen collection, sexual activity, spermatological parameters, German language.


**Keywords:** ovulation, syringes, fertility, risk contamination, animal welfare, pregnancy, animal breeding, veterinary equipment, French language.


Web Site Resources

Website addresses change periodically. The selected sites listed are current as of August 2006. It should be noted that the recommendations on the proper care of rabbits vary widely depending on many factors including what breed, type of housing, and for what purpose the rabbits are kept. The following sites include rabbit care and welfare information for companion, commercial, and laboratory rabbits.

Animal Ethics Infolink
This website has been developed by the Animal Research Review Panel and NSW Agriculture’s Animal Welfare Unit. Its aim is to assist researchers, teachers and members of Animal Ethics Committees to access information about the operation of the Animal Research Act 1985, Animal Research Regulation 1995 and The Code of Practice in New South Wales. Included under the Animal Care section of this site is a link to a full text document entitled Guidelines for the Housing of Rabbits in Scientific Institutions August 2003. The document reviews housing, both group and single, pen design, management, care, handling, environmental enrichment, and record keeping for rabbits kept at scientific institutions.

Animal Welfare Information Center (AWIC)
http://awic.nal.usda.gov
National Agricultural Library, 10301 Baltimore Ave., Room 410, Beltsville, MD 20705, Tel: (301) 504-6212, Fax: (301) 504-7125, Contact us: http://awic.nal.usda.gov/contact-us
The Animal Welfare Information Center (AWIC) located at the U.S. Department of Agriculture's National Agricultural Library provides reference services primarily for patrons using animals covered by the Animal Welfare Act. AWIC produces bibliographies on the welfare and husbandry of dogs, cats, rabbits, rodents, swine, cattle, horses, sheep, poultry, and other species. The Animal Welfare Information Center Bulletin contains articles on environmental enrichment programs, refinement techniques, regulatory issues, and more. Full text information to many important regulatory documents are provided.

Database on Refinement of Housing and Handling Conditions and Environmental Enrichment for Animals Kept in Laboratories
http://www.awionline.org/Lab_animals/biblio/refine.htm
An annotated database of articles, abstracts, book chapters, and books, on all aspects of refinement and environmental enrichment strategies for laboratory and farm animals are available at this site. The database is regularly updated and information on rabbits is included.

Audio Visuals Relating to Animal Care, Use and Welfare
This document is a listing of audiovisuals related to animal care that are currently in the National Agricultural Library (NAL) collection. All audio visuals are available to others on an interlibrary loan basis (see Document Delivery Services for more information and restrictions). They cannot be purchased from NAL. If you would like copies of the materials, please contact the producer. Use the find command in your browser and search on the word "rabbit" to find audiovisuals relating to the humane care and use of rabbits.

Biology of the Rabbit
http://www.lvma.org/rabbit.html
One in a series of publications aimed at educating the general public, developed by the Louisiana Veterinary Medical Association. This resource covers the biology of a rabbit, taxonomy, origin and habitat, uses, handling, anatomy, physiology, nutrition, reproduction, and diseases.

**Care of Rabbits**  
http://www.spca.bc.ca/AnimalCare/rabbitcare.asp  
Produced by the British Columbia Society for the Prevention of Cruelty to Animals, this fact sheet is aimed at pet owners and provides general information on the care of rabbits. Topics covered include housing, food and water, handling, exercise and medical problems.

**Code of Recommendations for the Welfare of Livestock: Rabbits**  
http://www.defra.gov.uk/animalh/welfare/farmed/  
This document is produced and made available by the Department for Environment, Food & Rural Affairs (DEFRA), United Kingdom. Click on the rabbit icon and follow the link to welfare code. These recommendations are aimed at those involved with the rearing of rabbits, and focuses on the importance of high standards of animal husbandry. Topics covered include housing, emergency precautions, accommodation, floors, ventilation, lighting, mechanical equipment, space allowances, feed and water, toe nail trimming, marking, handling and slaughtering, and care of rabbits that are kept outside.

**Comfortable Quarters for Rabbits in Research Institutions**  
http://www.awionline.org/pubs/cq02/Cq-rabbits.html  
Full text article discussing improvements that can be made in the housing of laboratory rabbits kept in research institutions. Topics covered include pen design, species specific behaviors, social interaction, dominance hierarchies, physical substrates, environmental enrichment, bedding, straw, shavings, shredded paper, gentle handling techniques, and human animal interaction.

**CSIRO Crusader Meat Rabbit Production**  
This site focuses on research and development of meat rabbit production in Australia. Links to full text articles on common rabbit diseases with photos, spreadsheets on expected farm income, information on rabbit breeds, husbandry, equipment, and other information.

**Digital Resources for Veterinary Trainers**  
http://www.digires.co.uk/products  
This site offers a large range of teaching materials - both digitized 35mm slides and digital video clips for those involved in training laboratory animal staff. Teaching materials are made available for purchase through the University of Newcastle, United Kingdom. Subject coverages of the materials include care, handling, husbandry, welfare, anesthesia, and surgical procedures of rabbits and other laboratory animal species.

**DORA: Diseases of Research Animals**  
http://www.radil.missouri.edu/info/dora/frame1.htm  
DORA (Diseases of Research Animals) is a teaching resource compiled by faculty and graduate students in the Laboratory Animal Medicine Area Program, Research Animal Diagnostic Laboratory (RADIL), University of Missouri. Information provided for ferrets, gerbils, guineapigs, hamsters, mice, rabbits, and rats. This resource contains images, bibliographical references, and slides. Disease diagnosis, treatment, control, etiology, transmission, clinical signs, and pathologies are reviewed.

**Exotic pet vet.net**  
http://www.exoticpetvet.net/  
This site is owned and administered by two veterinarians with many years of exotic pet experience. The site contains information on the general health, diseases, and medical care of exotic pets including rabbits.

**House Rabbit Society**  
http://www.rabbit.org/  
The House Rabbit Society is an international nonprofit organization that rescues rabbits and educates the public on
rabbit care and behavior. This site contains many quality photos and is very comprehensive. Information is presented on the general care, diet, litter training, housing, mental health, caring for babies and orphans, grooming, handling, and environmental concerns for companion rabbits.

**How to Care for Rabbits**  
[http://www.humanesociety.org/animals/rabbits/tips/rabbit_tips.html](http://www.humanesociety.org/animals/rabbits/tips/rabbit_tips.html)  
A fact sheet produced by the Humane Society of the United States. Basic information for the rabbit pet owner on housing, litter training, feeding, toys, and providing a safe environment.

**Humane Husbandry Criteria for Rabbits**  
[http://www.awionline.org/farm/standards/rabbits.htm](http://www.awionline.org/farm/standards/rabbits.htm)  
The Animal Welfare Institute outlines humane husbandry standards for farm animals including rabbits. The premise of AWI's humane husbandry program is that animals are allowed to behave naturally. The infliction of pain and fear are strictly prohibited. The major benefits of these criteria are increased space available to each animal and the increased opportunity for social interaction, comfort, and physical and psychological well-being. Housing, social interaction, physical substrates, environmental factors, lighting, hutch, cages, breeding, nesting, feeding, handling, transport, and slaughter guidelines are covered.

**Missouri Alternatives Center**  
[http://agebb.missouri.edu/mac/links/index.htm](http://agebb.missouri.edu/mac/links/index.htm)  
Through this site links to extension guide sheets from university research centers in the United States are made available. Information on raising meat rabbits, running commercial rabbitries, nutrition, housing, and slaughter methods are included. Click on “R” and follow the link to “rabbits.”

**Pan-American Rabbit Science Site**  
Comprehensive site containing articles written by Robert McCroskey, from the Canadian Centre for Rabbit Production Development. Information is provided on rabbitry management for home or commercial meat production including recommendations on feeding, housing, breeding, health, disease and slaughter. Access to an in house database containing literature citations on rabbit production is available for a nominal fee. Links to other rabbit production science resources listed.

**The Rabbit**  
This is an overview article written by veterinarian Anna Meredith, Head of Exotic Animal Services, Royal (Dick) School of Veterinary Studies, University of Edinburgh, covering the biology, husbandry, common clinical conditions and veterinary management of rabbits.

**Rabbit Medicine**  
[http://www.exoticpetvet.net/smanimal/rabbit.html](http://www.exoticpetvet.net/smanimal/rabbit.html)  
An article written by veterinarian Margaret A. Wissman, outlining basic information on breeds, life span, reproduction, feeding, and health.

**Rabbit Pathology**  
[http://oslovet.veths.no/teaching/rabbit/pathology/text.html](http://oslovet.veths.no/teaching/rabbit/pathology/text.html)  
This collection of photographs on rabbit pathology is made available on the Web by the Laboratory Animal Unit, Norwegian School of Veterinary Science. Images of various diseases and conditions affecting the teeth, intestines, kidneys, brain, and skin of the rabbit are included.

**Rabbit References**  
This site was developed by dedicated pet rabbit owners. The rabbit reference sections contain links to information resources regarding rabbit health and medicine, care and feeding, health hazards, rescue and adoption, and rabbit related mailing lists.
RabbitRehome.org.uk
http://www.rabbitrehome.org.uk/rabbitcare.asp
Information on the basic care of the pet rabbit including housing (indoor and outdoor), diet, handling, and companionship.

Rabbit Research Center at Texas A&M University Kingsville
http://users.tamuk.edu/kfsdl00/rabb.html
Description of the Rabbit Research Center at Texas A&M University Kingsville. An overview of the facility, research, management, breeds of rabbits, and outreach programs.

Rabbit Welfare Association
http://www.rabbitwelfare.co.uk/
The Rabbit Welfare Association is a UK-based organization for those who own or are interested in rabbits. The Association works with UK veterinarians to promote better veterinary care for both house rabbits and outdoor rabbits.

Raising Healthy Rabbits
Southern States feed company provides an online guide to raising healthy rabbits. The focus of the guide is on rabbit nutrition and health. Topics covered include: selecting stock, building hutches, breeding, gestation, birth, record keeping, feed and water requirements, diseases, and parasites.

Raising Rabbits for Fun and Food: A Primer on Backyard Meat Rabbit Raising Practices
http://www.rudolphsrabbitranch.com/rrr.htm
A backyard rabbit meat producer shares information on raising meat rabbits for family consumption. Tips listed on breeding, feeds, feeding, and watering, how many rabbits to start with, housing, climate, performance goals, diseases, drug use, by-products and other markets, identification, sanitization, slaughtering and butchering, and start-up cost considerations. A listing of meat rabbit breeders, a recommended reading list, and related web links are available.

UFAW/RSPCA guidance on Refining Rabbit Care: A Resource for Those Working With Rabbits
http://www.rspca.org.uk/researchrabbits
A Resource for Those Working With Rabbits in Research.

VeterinaryPartner Home Page
http://www.veterinarypartner.com/
VeterinaryPartner.com provides reliable, up-to-date animal health information from the veterinarians and experts of the Veterinary Information Network (VIN). Quality information on rabbit care, health, surgery, feeding, behavior, and exercise written by Susan Brown, DVM.

World Rabbit Science Association (WRSA)
http://world-rabbit-science.com/
The World Rabbit Science Association is an international association that federates national and regional associations (branches) with the objectives of: exchanging knowledge and experience among members in all parts of the world who are contributing to the advancement of various scientific aspects of rabbit production; to promote the extension of knowledge by encouraging teaching, scientific research, practical experimentation, the collection and publication of useful statistics and documents in relation to rabbit production; to promote world rabbit congresses alone or in cooperation with other international bodies; and to cooperate with the FAO and other world organizations interested in rabbit meat, pelt or fur production.

Yahoo! Groups: rabbitvetlist
http://groups.yahoo.com/group/rabbitvetlist/
An unmoderated discussion group for clinical discussions on rabbit health. Associated with the British Housepet Rabbit Association (BHRA), membership of this discussion forum is restricted to veterinary professionals and invited laypeople. Hosted by Yahoo Groups.