Health monitoring of purpose bred laboratory rabbits in Sweden: Major findings

by *R. E. Feinstein* and *C. Rehbinder.*
The National Veterinary Institute, Uppsala.

INTRODUCTION

Diseases of laboratory animals decrease the efficiency and quality of breeding colonies and, zoonotic diseases constitute a hazard to animal caretakers and laboratory personnel. Diseases could exert a profound influence on experimental procedures hampering the obtention of experimental results and making them unreliable (*Fujiwara* 1980, *Rehbinder* 1986). Accordingly, different methods have been used in order to define the health of laboratory animals (*Rabstein* 1962, *Tuffery* 1962, *Weisbroth & Scher* 1969, *Wood & Seamer* 1980, *Fujiwara* 1980, *Small* 1984, *Adams* 1987). The National Veterinary Institute, Uppsala, has developed a health monitoring program, for rabbits, aimed at the detection of both infectious and non-infectious diseases.

We present herein the most relevant findings derived from a health monitoring study of purpose bred laboratory rabbits in Sweden. Our results show, on the one hand, that clinically healthy rabbits may be affected by various health problems, the commonest being respiratory and intestinal diseases, and on the other they also point at the need and use of a health monitoring based on a multiple diagnostic approach.

MATERIAL AND METHODS

Animals: The present survey included 108 laboratory rabbits from 9 colonies. Each breeder submitted only one group that comprised 6 young and 6 adult rabbits of both sexes. The vast majority of them were of the New Zealand White breed, born and maintained under different conventional conditions. Only one colony was provided with strict barriers. Body weights were quite variable, ranging from 0.7 till 3.1 kg.

Procedures: The rabbits were killed by intramuscular injection of 0.5 ml/kg B.W. of Fluanison-Fentanyl (Hypnorm, Janssen Pharmaceutica) followed by intracardial injection of 60 mg/kg B.W. of pentobarbitone (Mebumal, ACO Läkemedel). Immediately after sacrifice a complete necropsy was performed and samples were obtained for different studies.

Bacteriology: The following sites were sampled for bacteriology (aerobs and anaerobs): Conjunctiva, nasal cavities, middle ear, pharynx, lung, spleen, duodenum, jejunum, ileum, colon, caecum, appendix and liver. Samples from nasal cavities, pharynx, middle ear and lung were also cultured for *Mycoplasma spp.* Skin samples were cultured for *Dermatophytes.*

Virology: Samples from ileum and intestinal contents were investigated for *Coronaviruses* by electronmicroscopy and for *Rotaviruses* by an ELISA method.

Parasitology: Ectoparasites were investigated on skin and external ears, and endoparasites in stomach, intestine, liver, and lungs. Infection of the protozoans *Toxoplasma gondii* and *Encephalitozoon cuniculi* was diagnosed on blood samples by means of an india-ink immunoassay (*Waller* 1977).

Microscopical studies: Samples for histology were obtained from: Lungs, heart, stomach, duodenum, jejunum, ileum, colon, caecum, appendix, mesenteric lymph nodes, liver, spleen, kidneys, urinary bladder, testes or uterus, parotid and lacrymal glands, brain, cerebellum, and skeletal muscle (semitendinosum). In addition, samples were obtained from any observed macroscopical lesion.

Tissues were fixed in 10% buffered formalin pH 7.4. After processed to paraffin wax 4 um thick sections were cut and stained with haematoxylin and eosin. Selected sections were also

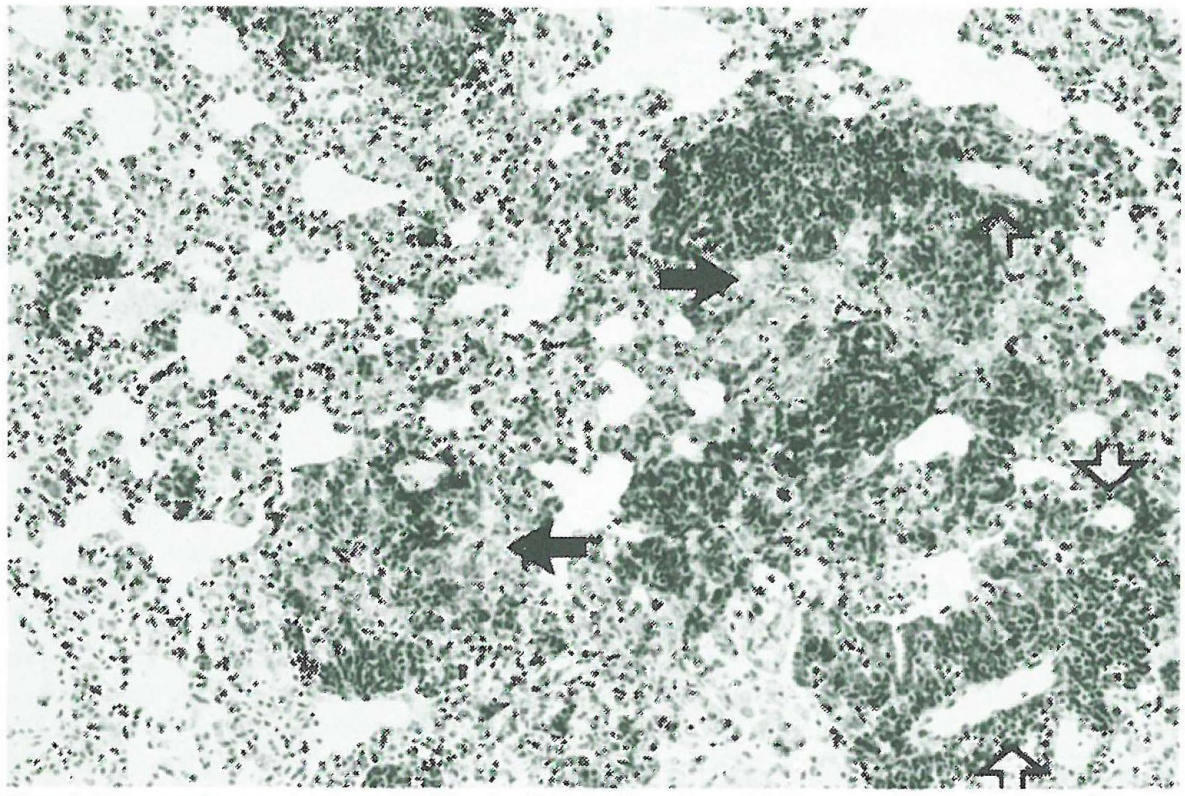

Plate 1. Pneumonic areas in a lung positive for *B. bronchiseptica* exhibiting alveolar spaces filled with macrophagic cells (arrows) and mononuclear infiltrations in alveolar septae and around blood vessels (hollow-arrows). Giemsa, × 32.

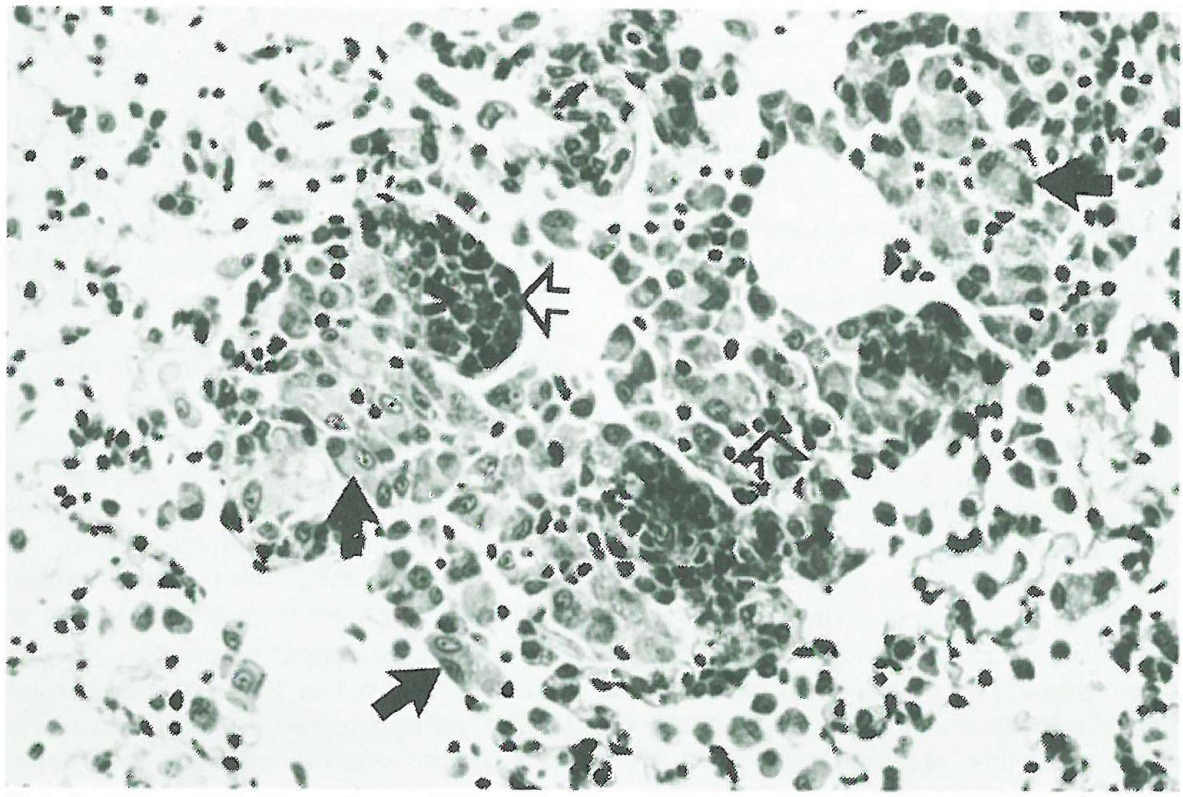

Plate 2. A consolidated focus from a *B. bronchiseptica* postive lung displaying large macrophagic cells in alveolar septae and luminae (arrows) and discrete infiltration of mononuclear leucocytes (hollow-arrows). Giemsa, × 80.

stained with Giemsa, Gram, PAS, van Gieson, von Kossa and Ziehl-Nielsen.
A visit to the colonies after the completion of the post-mortem studies provided information about installations, breeding, feeding, sanitary standards and health problems.

RESULTS

The organs most frequently affected by lesions were lungs and intestines, followed by the liver.
Lungs: Macroscopical changes were rare. They appeared as a variable number of irregularly distributed white or greyish rounded areas, 3-5 mm in diameter.
Microscopical examination revealed a frequent occurrence of lung lesions in all the groups. The commonest finding consisted of a focal chronic interstitial pneumonia, (Plate 1 and 2). Briefly the lesions consisted of focal infiltrations of mononuclears, monocytes, and macrophages, irregularly distributed throughout the lung parenchyma. Some of the rabbits also presented a variable number of granulocytes in the exudate. Small and middle size vessels exhibited discrete to marked cuffing by mononuclear cells and occasional granulocytes. Similar infiltrates were frequently noticed along the bronchial tree and were associated with focal areas of necrosis of the epithelium. The bronchial associated lymphoid tissue (BALT) displayed mild to severe hyperplasia. A marked enlargement of BALT led to a compression of the adjacent lung parenchyma.

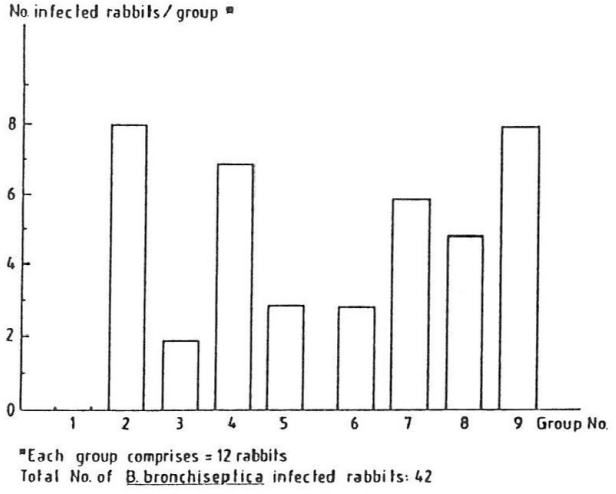

Fig. 1. Occurence of B.bronchiseptica.

Bacteriology of respiratory organs revealed *Bordetella bronchiseptica* in 42 rabbits from eight of the groups (figure 1). This bacterium was also found in colonies with good sanitation and infected rabbits always displayed lung lesions. However, similar changes were also observed in rabbits with negative respiratory bacteriology. *B.bronchiseptica* was most frequently isolated from nasal cavities (figure 2), and in several rabbits it was recovered from different

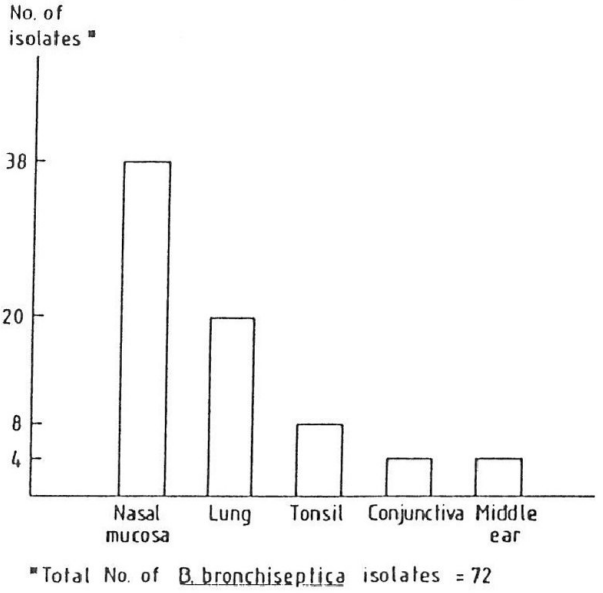

Fig. 2. Occurence of B.bronchiseptica at different locations.

locations along the respiratory tract. *B.bronchiseptica* was cultured both from young and adult rabbits and we did not observe any association between age of rabbits and isolation of *B.bronchiseptica* from a particular location. The only group negative for *B.bronchiseptica* presented the lowest requency of lung lesions. Numerous rabbits exhibited *Streptococci spp.* and *Staphylococci spp.* in the upper respiratory organs, but never in lungs.
Mycoplasma spp. were isolated from the nasal mucosa of two rabbits from different groups. These rabbits displayed focal chronic penumonia and in both of them *B.bronchiseptica* was also recovered from nasal cavities.
Neither *Pasteurella spp.* nor lung parasites were oberved in the present study. Thirtysix rabbits with chronic lung lesions were negative for respiratory bacteriology.

Intestines: Several rabbits in various groups displayed macroscopical changes such as oedema of the intestinal wall and intestinal catarrh. Occasionally the intestine presented irregular white areas of a variable size that were observable from the serosal side. Histology revealed that the commonest lesion was chronic enteritis (figure 3) usually associated with intestinal coccidioisis. The intestinal mucosa evidenced from mild to severe changes consisting of mucosal oedema, abnormaly shaped and atrophic villi and infiltrates of mononuclear leukocytes and granulocytes. Eosinophils were prominent in many of the rabbits. The epithelial linning in areas of variable extension exhibited degenerative and necrotic changes. Extra and intracellular stages of *Eimeria spp.* were observed in different portions of the intestine including the appendix (Plate 3).

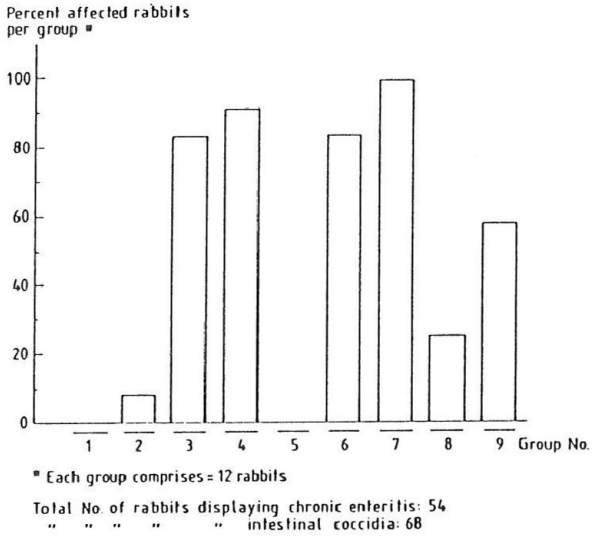

Fig. 3. Frequency of chronic enteritis.

The virological analysis revealed *Coronaviruses* in 16 rabbits from three colonies. *Coronavirus* infected rabbits displayed chronic enteritis but they all had intestinal coccidia.

Infection of *Rotaviruses* was not observed.

Intestinal bacteriology revealed *Bacteroides spp.* in every rabbit. Most rabbits harbored either *Bacillus spp.* or *Escherichia coli,* but the simultaneous presence of both of them in the same intestinal portion of one and the same rabbit was unusual. *E.coli* was recovered from the large intestines of 53 rabbits. Sixteen of them also harbored *E.coli* in the small intestines and of these, 12 displayed intestinal cocci-

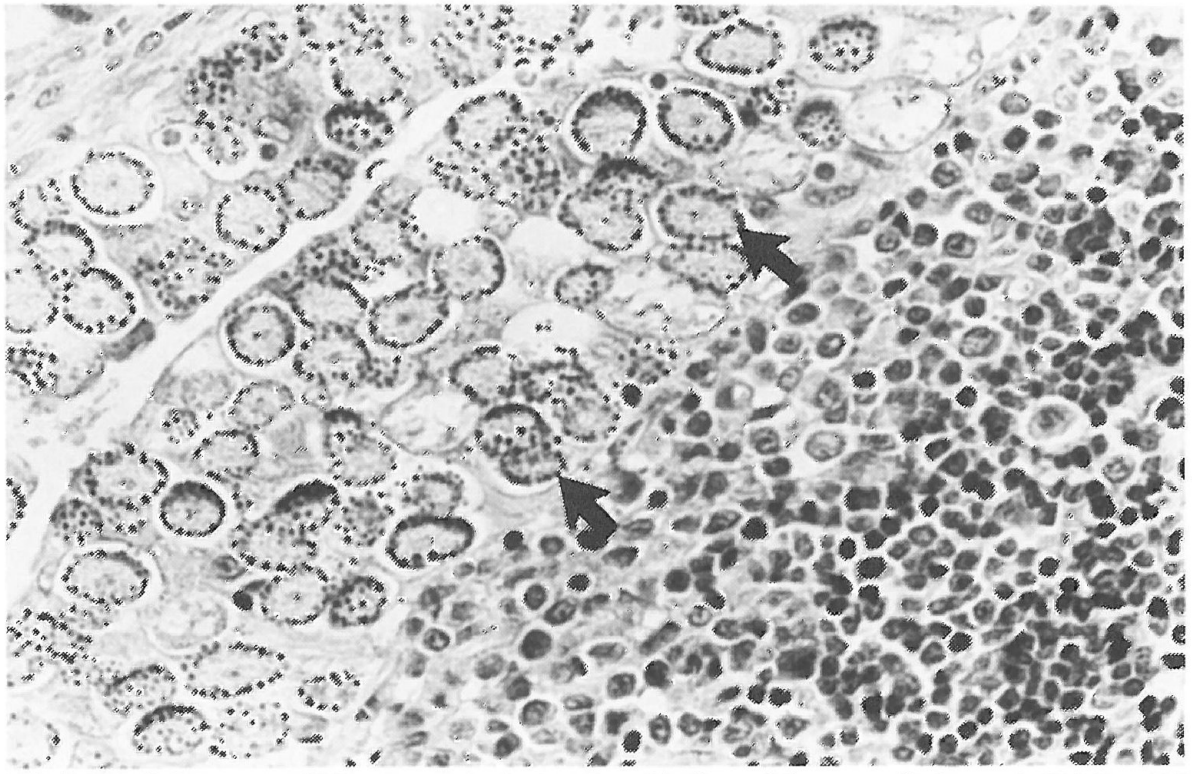

Plate 3. Intracellular stages of *Eimeria spp.* in the lymphoepithelium of the appendix (arrows). H & E, × 128.

diosis. *Clostridium spp.* were isolated from 10 rabbits from 5 colonies. In addition, all the young, but not the adult rabbits in one of the groups exhibited rich growth of *Candida albicans* from both the small and the large intestine.

Parasitology of the intestine revealed protozoan and metazoan parasites in all but the only colony provided with barriers. Parasitological findings are summarized in figure 4. *Eimeria spp.* were observed in seven of the groups.

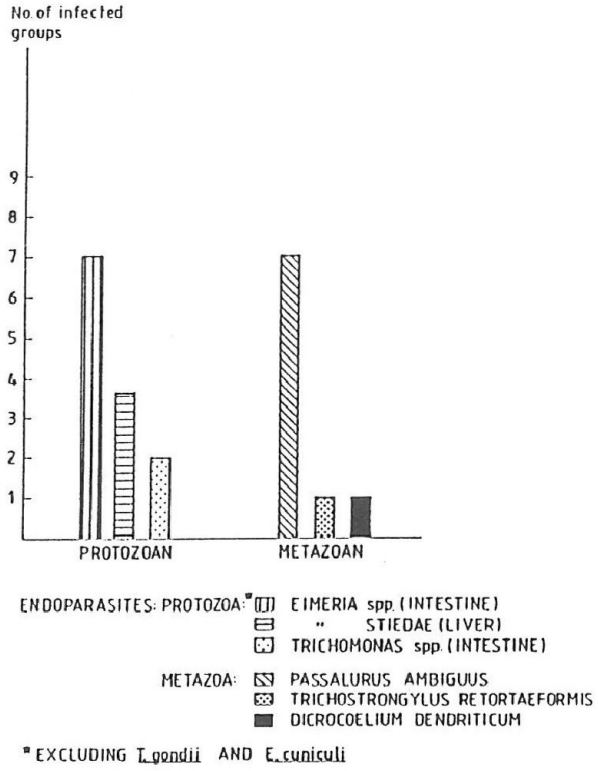

Fig. 4. Occurence of endoparasites.

E.media had the highest frequency, followed by *E.perforans, E.magna, E.piriformis,* and *E.exigua,* respectively. In addition, stages of *E.stiedae* were recognized in four groups (see later). *Trichomonas spp.* were noticed in nine rabbits from two colonies, that also had intestinal coccidia.

The pinworm *Passalurus ambiguus* was present in seven colonies. *Trichostrongylus retortaeformis* was detected in four rabbits of one group.

Appendix: Adult rabbits from three colonies exhibited histological changes characterized by formation of multinucleated giant cells in the appendiceal lymphoid tisues. A detailed description of these changes is published elsewhere (*Feinstein & Nikkilä,* 1988).

Liver: The commonest finding was hepatic coccidiosis. Macroscopical examination revealed characteristic hard whiteyellowish nodules in rabbits from five colonies (fig. 5). Histologically, we observed a chronic cholangitis, often associated with hyperplasia of the bile duct epithelium. Stages of *Eimeria stiedae* were ubiquitous in four of the groups. The findings were confirmed by parasitology.

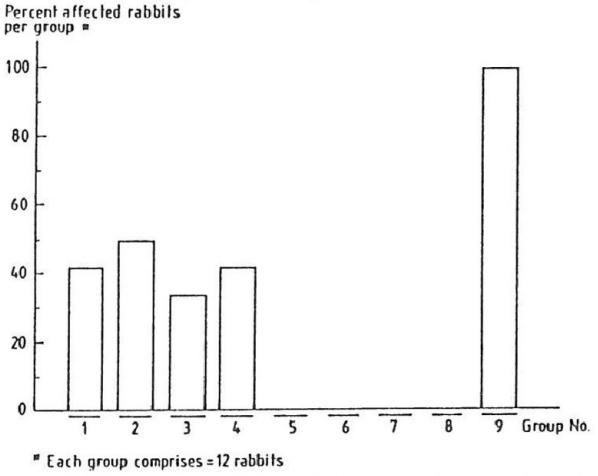

Fig. 5. Frequency of hepatic lesions due to eimeria stiedae.

Rabbits in four groups exhibited a low number of randomly distributed, irregular white or greyish liver zones, 1 to 5 mm in diameter. Microscopically, most lesions were diagnosed as focal coagulative necrosis, and few cases as focal purulent hepatitis. Giemsa stained sections were negative for *Bacillus piliformis.* The etiologies of these changes could not be determined. In addition, the fluke *Dicrocoelium dendriticum* was found in the bile ducts of one rabbit, but pathological effects due to this parasite were not noticed.

Ectoparasites. Parasitological findings are presented in fig. 6. A simultaneous infection with *Cheyletiella parasitivorax, Listrophorus gibbus,* and *Psoroptes cuniculi* was observed in one colony. Four colonies exhibited both *C.parasitivorax* and *L.gibbus.* Two colonies displayed *C.parasitivorax* and *P.cuniculi.*

Two groups were free of ectoparasites.

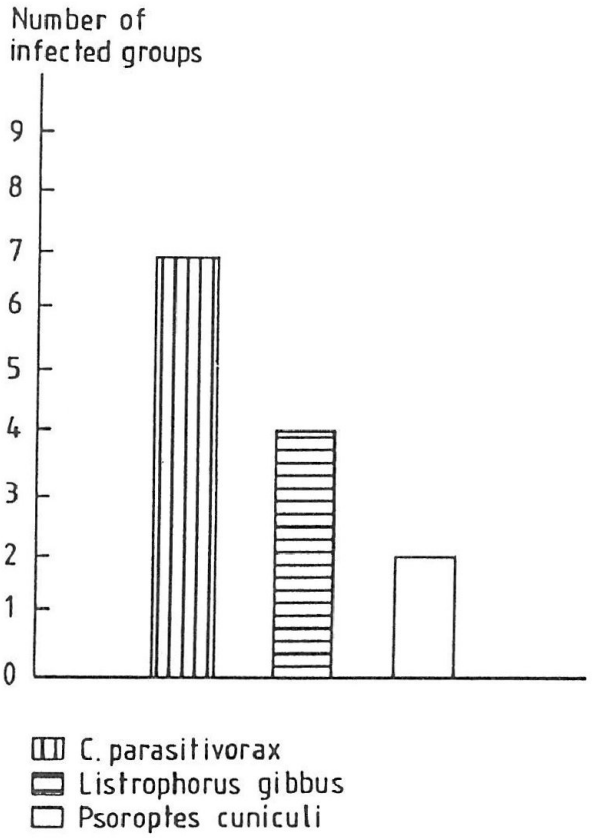

Fig. 6. Occurrence of ectoparasites.

Other findings

One rabbit positive for *Encephalitozoon cuniculi* antibodies displayed severe focal chronic interstitial nephritis and lymphocytic meningoencephalitis. *E.cuniculi* organisms were readily observed in gram-stained sections of the brain (Plate 4). One rabbit was positive for *Toxoplasma gondii* antibodies, but lesions atributable to this parasite were not found.

Three rabbits presented focal chronic gastritis. One rabbit displayed focal purulent myocarditis and another one focal chronic interstitial nephritis. The etiologies could not be determined.

Eight rabbits from three colonies presented elevated irregular plaques in the wall of the ascending aorta and arc. Histologically the lesions appeared as heavily mineralized areas of degeneration and necrosis in the internal part of the tunica media and in the intima.

Visits to the colonies

Information derived from the visits is presented in Tables I and II. The best colony was the

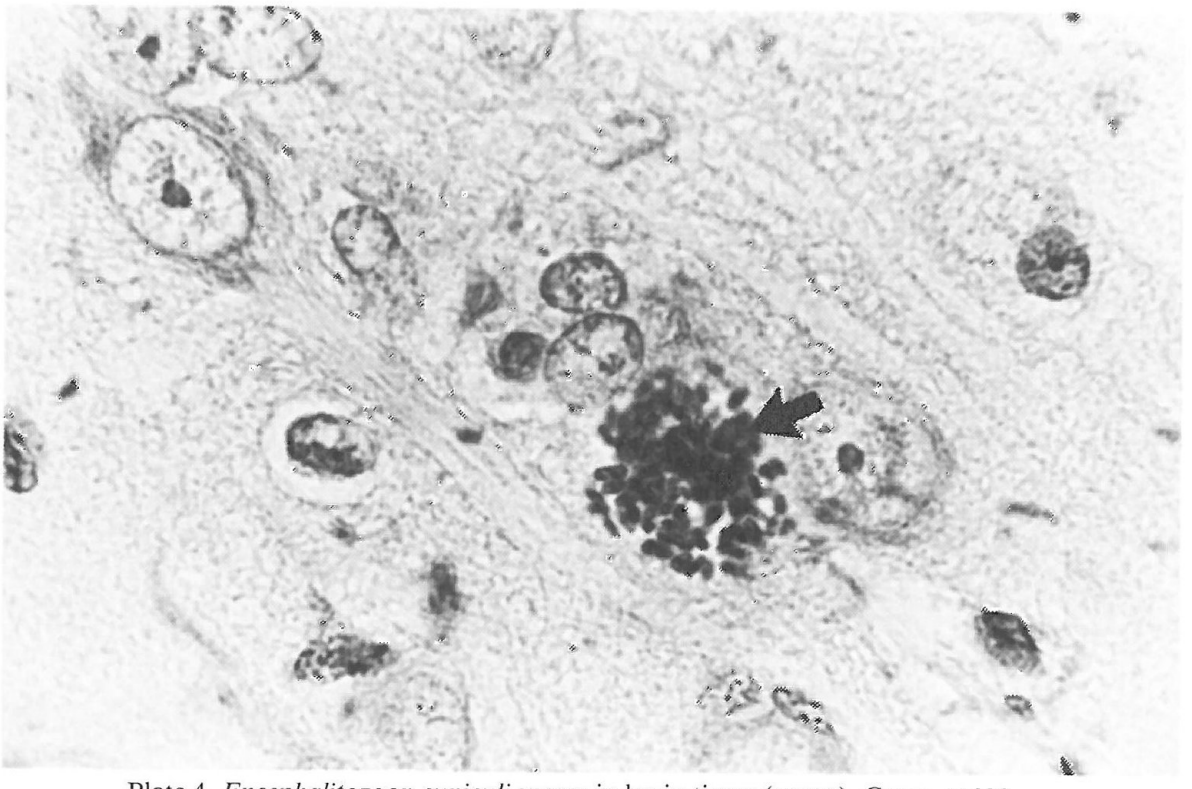

Plate 4. *Encephalitozoon cuniculi* spores in brain tissue (arrow). Gram, ×320.

Table I. Housing

	COLONY:							
	1	2	3	4	5	6	8	9
Type of construction	Old remodelled stable. Animals outdoors during summer	Old remodelled swine shed	Old remodelled cowshed. Animals outdoors during summer	Old remodelled swine shed	Specially constructed	Specially constructed	Old remodelled stable	Remodelled stable
Ventilation	Windows, open conduit for outgoing air	Specially constructed. No filters. Fan for ingoing air	Windows, conduit for outgoing air	Specially constructed. No filters. Fan for ingoing air	Full barrier filters and fans. Controlled climatic conditions	Several fans in air inlet. Thermostate for heating ingoing air	Specially constructed. Fans	Only windows
Cleaning equipment	High pressure cold water	Mechanical Brush and showel	High pressure cold water; seldom used	High pressure cold water	High pressure steam	High pressure cold water	High pressure cold water	Brush and showel
Handling of manure	Manual, daily	Manual, once each 2-2⅔ month	Manual, irregular	Manual, irregular	Manual, daily	Mechanical, daily	Manual, daily	Manual, once/week
Protection of fodder against rodents	No	Rat poison under bags	No	No	Yes	No	No	No
Sterilizing or other treatment of fodder and water	No	No	No	No	Autoclaved	No	No	No
Breeding of other animals	No	Swine	Guinea pigs	Horses, dogs	Several species of laboratory animals	Several other species	Hamster	Guinea pigs
General hygenic conditions	Rather good	Very poor	Very poor	Very poor	Excellent	Rather good	Rather good	Poor

Table II. Sanitary aspects

	COLONY:							
	1	2	3	4	5	6	8	9
Regular health-monitoring	No	No	No	No	Yes	No	No	No
Regular necro psies of dead animals	No	No	No	No	Yes	Occasional	Occasional	No
Disease problems in the past	Diarrhoeas at weanling	Respiratory, diarrhoeas	Not controlled	Enteric coccidiosis, respiratory	Somewhat low fertility	Diarrheas	Keratitis Weanling diarrhoeas	Respiratory Diarrhoes
Current disease problems as recognized by the breeder	Diarrhoeas at weanling	Colony closed down	Not controlled	Diarrhoeas, respiratory	None	Bordetella, Coccidiosis	Weanling diarrhoeas	Ectoparas. Weanling diarrhoeas
Mortality of offspring	Ca. 10%	30-40%	Not recorded	Ca. 40%	<1%	1-2%	10%	10%
Regular veterinary service	Not but at occasion	Not but at occasion	No	Yes 4-6 times per year	Yes	Yes Quaterly	Yes regular	No
Routines at outbreaks of disease	No treatment Diseased animals are killed and thrown away	Different treatments	None	Continously treating for coccidia, endo- and ectoparasites	No outbreak recorded	Treatment according to veterinary advise	Diseased animals are killed	Treating all animals in the litter or cage. Severly diseased animals are killed and thrown away
General quality of colony	Poor	Bad	Very bad	Bad	Very good	Good	Poor	Bad

Colony no 7 was not visited

only one provided with strict barriers, regular health monitoring and rutine necropsy of dead animals. Its rabbits were free of ecto- and endoparasites but not of *B.bronchiseptica* and pulmonary lesions. The rabbits from two other colonies with acceptable sanitary standards were free of ectoparasites but not of intestinal parasites, *B.bronchiseptica* and lung lesions. The rest of the colonies evidenced varying deficiencies of installations and sanitary practices.

DISCUSSION

Our study revealed a marked variation regarding the overall health condition in the various colonies. Chronic inflammatory lesions of the lungs, however, was the most frequent finding. Several rabbits in most of the groups also displayed chronic intestinal lesions. Comparable results were reported by others (*Mack* 1962, *Soave* 1963). Frequently, rabbits were simultaneously affected by both diseases, as observed by *Ostler* (1961).

Lungs:

B.bronchiseptica was recovered from rabbits with chronic inflammatory lung lesions in eight of the groups. *Pasteurella spp.* were not isolated. Yet, *B.bronchiseptica* was more frequently isolated from the nasal mucosa than from pneumonic lungs. This could be explained by the affinity of *B.bronchiseptica* for respiratory ciliated cells (*Bemis et al.* 1977, *Bemis* 1986) but it could also reflect differences in our sampling methods. While a swabb was rubbed over large areas of nasal mucosa lung samples consisted of a portion of tissues. Since lung lesions were patchy and macroscopical changes were rarely observed it is possible that a number of the samples originated from areas of the lung that did not contain bacteria. *Yoda et al.* (1982), found that *B.bronchiseptica* was cleared from lung and trachea of experimentally infected rabbits but not from nasal cavities, and concluded that a complete recovery of the infection appeared to be rare. The developement of a carrier state is poorly understood, but marked functional and morphological alterations were reported in alveolar macrophages of *B.bronchiseptica* infected rabbits (*Zeeligs et al.* 1986). Respiratory problems in the rabbit have been linked to *Pasteurella spp.* while *B.bronchiseptica* has been attributed a role varying from an opportunistic bacteria found in healthy rabbits to a frank respiratory pathogen, itself capable of producing disease. (*Webster* 1924, *Alexander et al.* 1952, *Hagen* 1959, *Flatt* 1974, *Yoda et al.* 1982, *Watson et al.* 1984). It is apparent from our study that clinically healthy carriers of *B.bronchiseptica* frequently exhibited microscopical lung lesions. However, further studies are required in order to clarify the cause of such changes. The secondary role attributed to *B.bronchiseptica* in rabbit respiratory disease is perhaps derived from studies that did not include systematic histological analysis of the lungs. Thus, our results also point at the importance of histopathology in health monitoring. Without microscopical examination most of the present lungs would have been considered normal.

B.bronchiseptica also infects humans and it has been repeatedly isolated from persons that had had contact with infected rabbits. Therefore, we share the opinion of Wissner (1960), that there are many reasons for scientists to work with animals free of *B.bronchiseptica.*

The only group free of *B.bronchiseptica* also displayed chronic lung lesions but their prevalence and severity were lower than for the other groups. A visit to this colony revealed other factors that could account for respiratory disease, such as poor hygiene and severe deficiencies in the ventilation with high concentration of NH_3 in the air of the stables. It is presently considered that viruses do not play a role in the genesis of respiratory diseases of rabbits. Yet, such a possibility could help to explain the occurrence of lung lesions in 36 rabbits that were negative for respiratory bacteriology.

Intestines:

Intestinal disturbances constitute an important group of diseases which could be produced by infectious and non-infectious aetiologies, and may or may not be manifested by clinical signs

such as diarrhoea (*Mack* 1962, *Cowie-Whitney* 1970 & 1976, *Grobner* 1982). In our study, numerous rabbits displayed intestinal coccidiosis. *Eimeria* infections are a well recognized problem (*Ostler* 1961, *Flynn* 1973, *Pakes* 1974, *Peeters et al.* 1981, *Kraus et al.* 1984). We frequently observed emaciation and chronic enteritis but no signs of diarhoea. Coccidiosis was usually associated with poor conditions of hygiene and, except for one group, it occurred simultaneously with other parasites. *Weisbroth & Scher* (1969), listed coccidiosis among the infections that could be eliminated from a colony by means of cesarean derivation and barriers.
In addition to *Eimeria spp.* we noticed *Coronaviruses* and *E.coli,* agents that have been reported in rabbits with intestinal disturbances (*Cowie-Whitney* 1976, *Lapierre et al.* 1980, *Osterhaus et al.* 1982, *Eaton* 1984, *Peeters et al.* 1984). However, *Coronavirus* infected rabbits also presented coccidiosis and the lesions were those of *Eimeria spp. E. coli* was isolated from large intestines of rabbits with and whitout enteritis, but from small intestines mainly of rabbits with enteritis. Smith (1965) observed that *E.coli* was infrequently recovered from the intestines of clinically healthy NZW rabbits. Our findings agree with *Neil* (1966), who pointed that in healthy rabbits *E.coli* was confined to the large bowel, while in cases of enteritis it could be cultured from both the large and small intestine. *Peeters et al.* (1984) found *E.coli* in 40 percent of diarrhoeic rabbits, but in the weaned rabbits of their study doudenum and jejunum mostly remained free of colonization. *Licois and Guillot* (1980), and *Peeters et al.* (1984), recalled that coccidiosis is one among various factors that could increase the number of *E.coli* in the faeces of weanling rabbits. *Ostler* (1961), isolated a non haemolytic *E.coli* from all levels of the intestine in 5 to 8 week old rabbits with enteritis and *Peeters et al.* (1984) produced enteritis in weanling rabbits by administration of a non invasive strain of *E.coli* that was unable to produce enterotoxins. Diarrhoea was present in all the dosed rabbits and mortality was high. Since we observed chronic enteritis but not diarrhoea, we conclude that *E.coli* played, if any, a role secondary to that of coccidiosis. This, however, does not contradict the importance of *E.coli* in the genesis of other types of enteritis.
The pinworm *Passalurus ambiguus* was ubiquitous, but as was reported by *Flynn* (1973), we did not observe pathological effects attributable to it. Low numbers of the nematode *Trichostrongylus retortaeformis* were found in four clinically healthy rabbits of one group that also had intestinal coccidia. *T.retortaeformis* could produce anemia and death (*Soulsby* 1968).
The occurrence of endoparasites reflected the hygienic standards at the rabbitries. Accordingly, the only colony with strict barriers was free of parasites. Two colonies with good sanitation presented infections with one type of parasite (*Coccidiosis* in one case and *P.ambiguus* in the other). The rest of the groups evidenced a simultaneous infection by various types of parasites, which was linked to defficiencies of hygiene.
Appendix: The appendix is an important component of the Mucosal-Associated Lymphoid System of the rabbit (*Befus & Bienenstock* 1982). The formation of multinucleated giant cells in the appendiceal lymphoid tissues of rabbits is a previously unreported finding and a detailed description is published elsewhere (*Feinstein & Nikkilä* 1988). The causes and significance of such changes are presently unknown. An infectious etiology was not found and the role, if any, of other factors such as the type of diet and sterilization of fodder remains to be clarified. Our findings in the appendix illustrate, again, on the importance of histopathology for health monitoring.

Liver:
The most frequent liver change was hepatic coccidiosis' characteristic lesions being observed in five groups. Parasitology revealed *E.stiedae* in four groups. The only group with lesions that was negative for *E.stiedae* had been treated for coccidiosis a few days before the examination. Rabbits with *E.stiedae* always evidenced infections by other parasites.

Similarily to intestinal coccidiosis, *E.stiedae* was associated with deficient hygiene. The aetiology of other liver changes such as coagulative necrosis and focal purulent hepatitis was not determined, but infectious agents were not found.

Ectoparasites:
Ectoparasites are a well recognized problem in rabbitries (*Kraus* 1974). *P.cuniculi* was reported as the commonest ectoparasite in domestic rabbits (*Kraus et al.* 1984), but in our study, the fur mite *C.parasitivorax,* that could also affect humans (*Gluckstein* 1974), was the most frequent. Infections with more than one type or mite occurred very frequently, and they appeared related to poor sanitation. *P.cuniculi* was always accompanied by characteristic lesions of ear mange, but fur mites were associated with skin changes in a few rabbits only. Two colonies with good hygienic conditions were free of ectoparasites. Both had specially designed buildings and one of them, strict barriers.

Other findings:
One rabbit presented chronic inflammatory lesions of the kidneys and brain associated with *E.cuniculi.* Another rabbit was positive for *T.gondii* antibodies but lesions attributable to this parasite were not observed. Both rabbits were asymptomatic. These infections are zoonotic (Gluskstein, 1974), and they should not be allowed in a colony. The India ink immunoassay (*Waller* 1977) is a convenient method for the identification of asymptomatic carriers of *E.cuniculi* and *T.gondii* since it permits an accurate diagnosis on blood that could be easily obtained from live rabbits.
The mineralized lesions in the ascending aorta and arc of eight NZW rabbits were similar to those described by others (*Garbarsch et al., Lindsey & Fox* 1974). The lesions have been linked to genetic factors but the exact cause is unknown. These changes could constitute a conflicting element in vascular and certain nutritional studies.
Our study showed that clinically healthy rabbits could carry different infectious and non infectious diseases. In general, the health of the rabbits reflected the sanitary conditions at the colonies. However, *B.bronchiseptica* infection, chronic lung lesions in rabbits negative for respiratory bacteriology, and appendiceal and aortic changes, were also observed among animals from the best rabbitries. A definition of the health of rabbits is not a simple task. If accurate information is required the method used should be based on histopathology, bacteriology, parasitology and virology. In Sweden, such diagnostic and health monitoring program is available from the National Veterinary Institute, Uppsala. Its application has already provided necessary information for definig laboratory rabbits and hopefully, this will lead to an improvement of their health.

Summary
Post-mortem examinations were performed on groups of 12 rabbits from nine colonies. The most frequent pathological changes found were chronic inflammatory processes in lungs and intestines. *Bordetella bronchiseptica* was frequently isolated and *Pasteurella spp.* were not observed. Most cases of enteritis were associated with *Eimeria spp.*, but *Trichomonas spp.* and *Coronaviruses* were also noticed. The pinworm *Passalurus ambiguus* was found in seven groups and the nematode *Trichostrongylus retortaeformis* in one.
Rabbits from five colonies evidenced hepatic coccidiosis. Among ectoparasites, *Cheyletiella parasitivorax* was found in seven groups and *Listrophorus gibbus* in four. The ear mite *Psoroptes cuniculii* was recorded in two groups.
One rabbit exhibited *Encephalitozoon cuniculi* antibodies and another one *Toxoplasma gondii* antibodies. Among other findings, the ascending aorta and arc displayed calcified plaques in eight rabbits from three colonies and the appendiceal lymphoid tissues evidenced multinucleated giant cells in adult rabbits of three groups. A good correlation was found between the health of the rabbits and the hygienic standards at the colonies.

Sammenfattning
Hälsoinventering av destinationsuppfödda laboratoriekaniner i Sverige.
Huvudfynd:
En komplett obduktion inkluderande histologi, bakteriologi, parasitologi och virologi utfördes på grupper om 12 destinationsuppfödda laboratoriekaniner från 9 uppfödare.
De mest frekvent förekommande patologiska föränn-

dringarna var kroniska inflammatoriska processer i lunga och tarm. Lungförändringar förelåg hos djur från alla uppfödare. *Bordetella bronchiseptica* isoleras från respirationsorganen på kaniner från 8 uppfödare. *Pasteurella spp.* blev ej isolerat från något djur. De flesta fallen av tarmförändringar förelåg i anslutning till infektion med coccidier (*Eimeria spp.*) därtill påvisades *Trichomonas spp.* i 2 och Coronavirus hos 3 uppfödningar. Springmask (*Passalurus ambiguus*) fanns i 7 och tunntarmsinfektion med rundmask (*Trichostrongylus retortaeformis*) i 1 uppfödning. Djur från 5 uppfödningar hade leverskador orsakade av levercoccidios (*Eimeria stiedae*).

På djur från 7 uppfödare påvisades skabbkvalstret *Cheyletiella parasitivorax* medan i 4 uppfödningar påvisades ett annat skabbkvalster (*Listrophorus gibbus*). Öronskabb (Psoroptes cuniculi) påvisades hos djur från 2 uppfödare.

Hos 1 kanin, serlogiskt positiv för *Encephalitozoon cuniculi,* påvisades fokal kronisk interstitiell nefrit och nonpurulent meningoencefalit.

Antikroppar emot *Toxoplasma gondii* förelåg hos en kanin utan att vävnadsförändringar kunde påvisas, vilka kunde hänföras till denna parasit.

Bland övriga fynd kan framhållas aortaförkalkningar hos 8 kaniner från 3 uppfödare.

Efter det att undersökningarna av djuren genomförts besöktes uppfödningarna. Det förelåg en stark korrelation mellan hälsotillstånd och uppfödningarnas hygieniska standard.

Yhteenveto / K. Pelkonen

Yhdeksästä koloniasta peräisin oleville 12 kanin ryhmille suoritettiin kuolemanjälkeinen tutkimus. Yleisimmät patologiset löydökset olivat krooniset tulehdukset keuhkoissa ja suolistossa. *Bordetella bronchiseptica* voitiin eristää monesta näytteestä, *Pasteurellaa* ei löytynyt yhdestäkään. Useimpiin suolistotulehduksiin liittyi *Eimeria spp.,* joistakin löytyi myös *Trichomonas spp.* ja *Corona*-viruksia. Seitsemästä ryhmästä löydettiin kihomatoa *Passalurus ambiguus* ja yhdestä sukkulamato *Trichostrongylus retortaeformis.*

Viidestä koloniasta olevista kaneista löytyi maksakokkidioosia. Ulkoloisia löytyi myös, seitsemästä ryhmästä *Cheyletiella parasitivorax* ja neljästä ryhmästä *Listrophorus gibbus.* Kahdesta ryhmästä löytyi korvapunkki *Psoroptes cuniculi.*

Yhdellä kanilla oli *Encephalitizoon cuniculi*-vastaaineita ja yhdellä muulla *Toxoplasma gondii*-vastaaineita. Kahdeksasta kanista kolmesta eri koloniasta löytyi kalkkeutumia aortan nousevasta osasta ja aortankaaresta ja kolmen ryhmän aikuisissa kaneissa oli umpilisäkkeen imukudoksessa monitumaisia jättisoluja. Kanien terveydentila ja kolonioiden hygieninen taso olivat hyvin korreloituneet.

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