As prey animals, horses are naturally wary of the unknown. Despite many centuries of domestication, they still retain their instinct to run away when frightened. In the wild, this instinct may save them from danger. But in domesticated animals, it poses a threat to horses and their handlers.

Three methods are commonly used to reduce fearful responses in horses.

**Habituation.** This is one of the simplest forms of learning. The undesirable behaviour is reduced or abolished by repeatedly exposing the animal to the stimulus that causes the behaviour.

Animals learn to ignore things that would have caused them to run away, when they find that they do not present a threat. For example, flags flapping in the breeze may frighten a young horse. An older horse that has lived with flags flying nearby may hardly notice them.

**Desensitisation.** The horse is exposed to a weakened form of the fear-inducing stimulus, which does not provoke the fear response. When the horse has fully accepted this first step, the strength of the stimulus is increased gradually, until the horse is no longer afraid of the original stimulus.

**Counter-conditioning.** This method trains the animal to do something that is incompatible with the undesired response. So, for example, a reward (food) is given when the horse is engaging in an activity, such as standing calmly, that is incompatible with the undesirable behaviour.

Which of these is the best way to teach horses to react calmly in a potentially frightening situation? A study led by Dr Janne Christensen looked at three ways of training horses not to run away when frightened.

Twenty-seven two-year-old Danish warmblood stallions were studied. They were placed one at a time in a test arena, which contained a feed container. Opposite the feed container was a folded white nylon bag. This provided the frightening stimulus. While the horses were eating, someone standing out of their line of sight pulled on a piece of string to open the bag, making it move.

The horses were divided into three groups. Nine horses were exposed to the full frightening stimulus during the test period until they no longer responded to it. (Habituation) The horses were exposed to the stimulus only once during each training session, and they received five training sessions daily. Between
In dogs and cats, pheromones have been used successfully to treat anxiety and phobias. Pheromones are substances secreted by the body, which have an effect on the behaviour of other animals of the same species.

All lactating female mammals release substances called appeasing pheromones. Their function is to calm, and provide reassurance to the offspring, especially in unknown situations. They contribute to the foal bonding with the mare. Could pheromones have a place in calming anxious horses?

Research in France has looked at the value of a synthetic equine appeasing hormone (EAP)* in overcoming fear in horses. Dr Christelle Falewee and others, working at the Pherosynthese Research Centre, have been studying the effect of EAP on the horse’s response to a standard behavioural test.

Forty horses of various breeds, age and gender were used in the study. Some horses were calmer than others. Before starting the trial, an experienced trainer graded them into three categories of reactivity (fearfulness) - calm, showing signs of fear or likely to shy - according to their likely reaction when exposed to a potentially frightening situation.

The researchers found that desensitisation was the most effective method for reducing fearfulness. The horses needed fewer training sessions to reach the stage where they did not react to the stimulus. All of the horses trained by the desensitisation method successfully learned not to react in a fearful way.

On the other hand, some horses trained using the other two methods never did learn not to be startled by the stimulus. They continued to react at the end of the study.

Dr Christensen suggests that the gradual approach of desensitisation allows the animals to learn more easily. She concludes that desensitisation is the most effective and gentle method for training horses to reduce fearful reactions to frightening situations.

For more details see:
Training methods for horses: habituation to a frightening stimulus.
JW Christensen, M Rundgren, K Olsson.

The horses were divided in to two groups. The researchers tried to make sure they were similar in composition for sex, age and reactivity.

Each horse received two sprays per nostril 18 minutes before being led out of its stall for the test. One group of horses was treated with a synthetic equine appeasing pheromone (EAP) sprayed up the nostrils. The other group was treated with a spray that did not contain the pheromone, but was identical in all other respects. None of the people involved in the study knew which spray contained the EAP until the study was over.

Horses were tested by assessing their willingness to be led through a...
Equine Science Update

Can you really tell anything about the character of a horse by looking at its face? Research from Poland suggests that a horse’s appearance may give an indication of its temperament.

Dr Aleksandra Görecka and colleagues studied the relationship between the position of whorls (cowlicks) on the horse’s head and the horse’s manageability. A full report of their work is to be published in Applied Animal Behaviour Science.

Fifty-five yearling or two-year old Polish Konik horses were used for the study. Thirty-one had been reared until weaning under either semi-natural conditions in a forest reserve. The rest had been managed under conventional stable conditions.

The position of the hair whorl on the face was recorded: above upper eye level (high); between the eyes (medium); below lower eye level (low); and double or elongated whorls.

They found that horses treated with EAP performed better. They stopped less frequently when they were faced with the fringed curtain and hesitated for a shorter time. These horses also had lower average heart rate and maximum heart rate, both during the test and throughout the trial.

The researchers suggest that EAP could be useful to help with potentially stressful tasks. It could have applications in situations such as shoeing, transporting, a change of environment, or when introducing new types of work. As it takes about 20 minutes for it to take effect, the EAP would be most useful for predictable stressful events.

* Pherocalm® (France, Germany), Modipher EQ® (USA).

For more details see:

Effect of a synthetic equine maternal pheromone during a controlled fear-eliciting situation.
Christelle Falewee, Emmanuel Gaultier, Céline Lafont, Laurent Bougrat, Patrick Pageat.

Whorl position and temperament.

Can you really tell anything about the character of a horse by looking at its face? Research from Poland suggests that a horse’s appearance may give an indication of its temperament.

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The position of the hair whorl on the face was recorded: above upper eye level (high); between the eyes (medium); below lower eye level (low); and double or elongated whorls.

They found that in most horses, the facial whorl lay between the eyes. Horses with a high whorl position were significantly more difficult to handle than horses with whorls in either a low or medium position.

Elongated and double whorls were found only in the forest-reared animals. Horses with this type of whorl took longer to approach a novel object than horses with whorls in a low or medium position.

The response to being startled was not related to the position of the whorl. Neither did the researchers find any relationship between position of whorl and heart rate during the tests.

They suggest that horses with a high facial whorl might be expected to be more stubborn when handled without being more flighty when startled. Horses with double or elongated whorls may be more cautious, although not more difficult to handle or easily startled.

For more details see:

A note on behaviour and heart rate in horses differing in facial hair whorl.
Aleksandra Görecka, Małgorzata Golonka, Michal Chruszczewski, Tadeusz Jezierski.
Research shows that oral hyaluronan gel reduces swelling in joints after surgery.

Joint damage is a common cause of lameness in horses. It may be caused by physical injury, or may result from developmental abnormalities such as osteochondrosis. One of the signs of damage within the joint is effusion (an increase in synovial fluid within the joint).

Hyaluronan (HA) is a glycosaminoglycan, a large molecule that forms part of the structure of articular cartilage and is present in joint fluid. It has been used to treat joint disease by injection directly into the joint, and more recently by intravenous administration. Its use in these circumstances has been tested and found to be beneficial. For the past few years an oral preparation of HA has been available for use in horses. Although there have been anecdotal reports of its efficacy, there has been no conclusive proof of its value.

Now a study has found convincing evidence that HA administered by mouth can improve the condition of joints after arthroscopic surgery for osteochondrosis.

The study was carried out by Dr Brady Bergin and colleagues at the Rood and Riddle Equine Hospital in Lexington Kentucky. Forty-eight Thoroughbred yearlings that had been admitted for arthroscopic surgery for osteochondritis dessicans of the hock were chosen for the study. Only those individuals with mild or no effusion before surgery were included. After surgery, half of the horses were given 100mg HA gel* daily. The others received a placebo.

All horses had two weeks box rest followed by a further two weeks box rest and hand walking. No one involved in giving the treatment or assessing the response knew which horse received the HA or the placebo until after the end of the study.

Thirty days after surgery, Dr Bergin examined the horses and assessed the treated joints. He gave each joint a score for the amount of joint effusion that was present, on a scale from 0 (no effusion) to 5 (greater than a tennis ball).

Joints treated with oral HA were significantly less swollen 30 days after surgery than were joints that had received the placebo.

A full report of the research appeared in the Equine Veterinary Journal. The work’s significance was recognised when it was presented with the Journal’s annual Clinical Evidence Award, sponsored by the Home of Rest for Horses. The award is given to the paper published in the EVJ that is judged to be of outstanding merit. To be eligible for the award, studies have to be based on naturally-occurring conditions, and provide strong clinical evidence relating to specific treatments.

* “Conquer” Kinetic Technologies, Lexington Kentucky.
Value of oral glucosamine and chondroitin supplement.

Many products are now available that claim to protect joint cartilage when given by mouth. But do oral supplements really help maintain healthy joints? Until recently there has been little work in horses to justify such claims.

A new study has looked at the value of oral supplementation with glucosamine and chondroitin in competition horses.

Dr Martha Rodgers VMD is a veterinarian in private practice in Lexington Kentucky, who specialises in equine lameness. She has recently concluded a long-term study into the value of regular supplementation with glucosamine and chondroitin on soundness in working show hunters and jumpers.

She studied ten working show hunters and jumpers that had been trained by the same trainer over an eight-year period. For the first two years of the study, the horses received no supplementation. But for the last six years, each horse had been given an oral supplement (which gave 3.9g glucosamine and 1.2 g chondroitin per dose) twice daily. *

To assess the value of the supplement on the incidence of lameness, she reviewed the clinical records to see how often the horses had been treated for hock pain.

Dr Rodgers examined the horses if the trainer complained of soreness, improper gait transitions or lack of jumping impulsion. She evaluated the gait, and used flexion tests, radiographic changes and intra-articular anesthesia to determine the source of the pain. If a diagnosis of distal tarsal pain was confirmed she injected the tarso-metatarsal and distal hock joint with corticosteroids and hyaluronan.

She found that the number of times she needed to inject the joints fell while the horses were receiving the glucosamine / chondroitin supplement. The frequency of distal tarsal joint injections fell from an average of 1.7 injections a year when the horses were not receiving glucosamine / chondroitin, to 0.85 injections a year once they were receiving the supplement. There was a marked reduction in frequency of injections after 5 - 8 months of treatment.

Distal tarsitis is a progressive disease. It would be expected that with increasing age and the demands of show horse performance the horses would need more therapy, not less Dr Rodgers points out. In the light of this, the overall drop in the number of injections required and the decrease in injection frequency over the eight year study period can be seen as an even more convincing argument for the beneficial effects of long-term supplementation.

Regular, twice daily administration of a combined glucosamine / chondroitin supplement resulted in longer duration of soundness and fewer joint injections. Six to eight months of regular administration were needed before the favourable response was seen.

*GL5500 GLC Direct, Paris KY. www.glcdirect.com

For more details see:

Effects of oral glucosamine and chondroitin sulfates supplementation on the frequency of intra-articular therapy of the horse tarsus.
M R Rodgers
Heat damages tendons.

Cooling the legs of horses after exercise may be a simple but effective way of preventing tendon damage, according to latest research from Japan.

Dr Yoshinao Hosaka and colleagues at the Rakuno Gakuen University, Hokkaido, found that an increase in temperature causes changes in tendon cells that could lead to damage to the tendon.

They used tendinocytes, from equine superficial digital flexor tendon, grown in tissue culture. These cells are responsible for maintaining the extracellular matrix of the tendon, by producing collagen and other components of the matrix. By changing the incubation temperature, the researchers were able to study the effect of heat on the tendinocyte survival and the production of inflammatory mediators.

They found that increased temperature affects both the survival of tendinocytes and their production of inflammatory mediators.

Fewer cells survived as the temperature increased, and with prolonged exposure to high temperatures. At 40°C there was little effect on cell survival. But as the temperature increased to 42°C or 45°C there was a marked fall in survival rate and an increase in the number of abnormal cells.

The researchers showed that heated tendinocytes rapidly produced the inflammatory mediator TNFα. It also caused increased production of the precursor of MMP-9, MMP-9 (also known as Gelatinase B) is believed to be important in breaking down the collagen fibres and glycosaminoglycans in the extracellular tendon matrix.

The core of the tendon suffers the greatest increase in temperature during exercise. It is also the most common site of tendon breakdown.

The findings of the study show that increased temperatures have adverse effects on the survival of the tendinocytes and promote the production of substances that could lead to disruption of the extracellular tendon matrix. They support the idea that the increase in temperature caused by exercise could play a role in the development of tendon damage.

The good news is that cooling the heated tendinocytes reduced the level of pro-MMP-9 synthesis. So cooling the tendon after exercise might limit the development of tendonitis.

“The results of this study are of particular clinical importance for the prevention of tendon degradation possibly by control of the tendon temperature in the animal” says Dr Hosaka.

For more details see:

Effect of heat on synthesis of gelatinases and pro-inflammatory cytokines in equine tendinocytes.

Veterinarians should be aware of a new disease that is being seen at endurance rides warns Dr Lluís Monreal. Speaking at the 2006 British Equine Veterinary Association Congress he described the signs of Exercise-induced Encephalopathy (EE).

Two distinct forms of the condition have been identified.

Immediate EE. Signs are apparent when the horse arrives at the vet gate or compulsory halt. Affected animals show signs of excitation, aggression, dementia, and seizures. Immediate EE is thought to be due to primary brain damage, possibly as a result of lack of oxygen. According to Dr Monreal this form of the disease is very difficult to manage.

Delayed EE. Horses look normal on arrival at the finish. But several hours later they show severe and progressive neurological signs. Delayed EE is thought to be due to secondary brain damage. It may be due to reperfusion injury - leading to secondary brain oedema and increased intracranial pressure. This form of the disease can be controlled if treated properly.

What should be done when a case is detected? Clinical assessment is required to differentiate EE from colic and other problems. The cardio - respiratory parameters should be monitored frequently. Continuous neurological exams should be performed, checking both the mental status and behaviour, and brain stem reflexes such as pupillary light reflexes and oculocephalic movements. Complete blood work is also required.

The objectives of treatment are to reduce cerebral oedema (swelling of the brain), and prevent an increase in intracranial pressure (ICP), and treat metabolic disorders.

Dr Monreal suggested important steps to take, and pitfalls to avoid, in treating horses with exercise-induced encephalopathy before transferring the horse to a hospital with an intensive care unit.

Most cases show signs of renal failure. This impairs the efficiency of emergency treatment and worsens the neurological progression. Multiple organ failure may occur as a result of disseminated intravascular coagulation.

Dr Monreal concluded that treating vets at endurance rides must be aware of, and prepared for dealing with, this serious emergency. Management of affected horses requires continuous examination and monitoring of blood samples. The main priority is to be prepared and have adequate equipment and drugs available.

Do:
- Hyper oxygenate
- Maintain mean arterial blood pressure
  a) Give fluid therapy with isotonic saline and colloids.
  b) Avoid hypotensive drugs if possible
  (A fall in blood pressure makes cerebral oedema worse, and increases the intracranial pressure.)
- Prevent excitation and seizures:
  a) Give glutamate inhibitors (e.g. phenobarbitone). (Glutamate is the main excitatory neurotransmitter. Brain damage tends to lead to an increase in glutamate.)
  b) Give anti-convulsants, such as diazepam, if required.
- Give diuretics to reduce the intracranial pressure (e.g. mannitol). If mannitol does not stimulate urine production due to renal failure, add furosemide. But be careful not to let the mean arterial pressure drop.
- Give DMSO
- Assess progress continuously.

Don’t:
- Give glucocorticoids
- Give diuretics without fluid therapy.
- Give dextrose/ glucose solutions
- Give hypotonic solutions (such as lactated Ringers solution), which can increase cerebral oedema.
- Give bicarbonate solutions
- Give hypertonic (7.5%) saline solution
- Use ketamine when anaesthesia is required,
Roughage plays an important part of the horse’s diet. But in many parts of the world, horses only have access to pasture at certain times of the year. To ensure a continuous supply of roughage throughout the year it is necessary to preserve the forage in some form.

Traditionally, hay was the main method of storing forage for horses. But if poorly conserved, it can be of variable nutritional value. It can also become contaminated with mould spores, which contribute to airway disease. Consequently other forms of preserved grass have become popular, such as silage and haylage.

Each type of preserved forage has its advantages. But do horses prefer hay, haylage or silage?

Studies that have looked at this in the past have compared the voluntary intake of forages from different sources. Recent research has examined whether horses preferred hay, silage or haylage produced from the same crop of grass.

The research was carried out in the Department of Animal Nutrition and Management at the Swedish University of Agricultural Science in Uppsala. Dr Cecilia Müller and Dr Peter Udén investigated the preference of horses for four different forages; hay, two haylages and silage.

The forages used in the study came from the same grass field and were cut at the same time. Silage was baled at 350 g dry matter (DM)/kg, haylage with low dry matter was baled at 550 g DM/kg and haylage with high dry matter was baled at 700 g DM/kg. Hay was put on a barn-drier when the dry matter level in the field had reached 700 g/kg. The hay was dried in the barn for nine days to 870 g DM/kg. Small bales (80cm x 48cm x 36cm) were used for all forages.

The researchers monitored the chemical composition and microbial content of the grass immediately before baling and from the bales as they were fed.

The horses were kept at pasture for 3 months before and during the study except for the 2-hour experimental sessions when they were offered the four different forages.

The study extended over 5 days a week for 4 weeks. Four horses were offered 1kg DM of each of the forages and the researchers observed them for 2 hours. They recorded which forage the horses chose to eat first, the time spent eating each forage, and whether the horses finished all of a particular forage.

They found that the horses preferred the silage. It was the first choice forage on 85% of occasions. Horses also spent more time eating silage (about 28 minutes) and ate more of it (0.9kg DM /day) than any of the other forages.

Hay was the least favoured forage. On average, only 0.23 kg DM of the 1kg DM offered was eaten. Horses spent less time eating hay (about 7 minutes) and never completely finished eating the hay they had been offered. The two types of haylage gave intermediate results.

Although there have been previous studies on horses preference for different forages, this particular study was interesting because all of the forages tested were produced from the same grass at the same time. It suggests that the method of preservation of forage has an impact on the horse’s preference.

For more details see:

Preference of horses for grass conserved as hay, haylage or silage. CE Müller, P Udén Animal Feed Science and Technology (2007) 132, 66-78.
Ileus, the lack of gastro-intestinal tract motility, is a common complication of colic surgery in horses. Fluid accumulates within the intestines, backing up to the stomach. Distension of the stomach causes pain and may delay the return to normal gut activity. There is also a risk that the stomach may rupture.

So an important part of the post-operative management of colic patients is to relieve any build up of pressure in the stomach.

Fluid can be siphoned out of the stomach through a nasogastric tube. Some horses resent having a tube passed up the nostrils. So it is often tempting to leave it in place, rather than have to pass it several times.

However, recent work suggests that leaving the nasogastric tube in place may actually have an adverse effect on gut motility.

A study carried out at Ontario Veterinary College at Guelph investigated the effect on gastric emptying of leaving a nasogastric tube in place for 72 hours.

Dr Antonio Cruz and colleagues used acetaminophen (also known as paracetamol) to measure the rate at which fluid leaves the stomach. Acetaminophen is absorbed only when it reaches the small intestine. So by measuring the concentration of acetaminophen in the blood, the researchers could assess the rate of stomach emptying.

They wanted to follow as closely as possible the conditions that are likely to arise in clinical cases of ileus. So food and water were withheld for the duration of the study and the horses were maintained on intravenous fluids. Nevertheless the investigation was carried out on healthy horses.

Horses with ileus may respond differently.

Horses were given acetaminophen at the start of the study and 12, 30, 48 and 72 hours later. In the “control” group a nasogastric tube was passed only when it was needed to give the acetaminophen. In the “treatment” horses the nasogastric tube was left in place throughout the investigation.

The researchers took blood samples to measure the concentration of acetaminophen at regular intervals over the two and a half hours after each dose.

They found that the peak concentration of acetaminophen was significantly higher in the control group than in the horses with the indwelling nasogastric tube left. The acetaminopen took significantly less time to reach peak concentration in the control group compared with the treatment group.

So gastric emptying was significantly slower when the stomach tube was left in place.

All horses in which the tubes were left in place had abnormalities of the nasal passages - hyperaemia, ulceration and bleeding.

The researchers concluded that, in managing post-operative colic cases, repeated nasogastric intubation might be better than using an indwelling stomach tube.

For more details see:

Effects of indwelling nasogastric intubation on gastric emptying of a liquid marker in horses
Antonio M Cruz, Ronald Li, Dan G. Kenney, Gabrielle Monteith.

A second set of Detection Times has been published by the UK’s Horseracing Regulatory Authority (HRA).

The HRA cooperates with its counterparts in France, Ireland, Italy and Germany through the European Horseracing Scientific Liaison Committee (EHSLC) to harmonise the policies and procedures for dope testing in those countries.

In response to the need for more information on the time taken for drugs to be eliminated, the EHSLC has been investigating the detection times of commonly-used medications. Detection times for some non-steroidal anti-inflammatory drugs and furosemide were made available earlier this year.

Tests have been carried out at various facilities throughout Europe and in Hong Kong. Groups of horses are tested every 24 hours after treatment until the drug is no longer detected. The detection time is the time at which the concentration of the drug (or its breakdown products) in the urine, is not detected using routine or standard methods, in all the horses in the study.

The second group of drugs studied include a local anaesthetic (mepivicaine), a sedative (detomidine), and more non-steroidal anti-inflammatory drugs. The results are now available on the HRA website.

It is important to remember that detection times are not the same as withdrawal times. An additional safety margin should be added to allow for individual variation.

However, the figures will give some welcome guidance to veterinarians who have to advise on whether a horse is likely to test positive if treated in the days before a race.

For more details see: www.thehra.org
Recommended procedures to aid in the control of equine venereal diseases have been published by the Horserace Betting Levy Board (HBLB). The Codes of Practice for 2007 have been updated in the light of recent experience of disease in UK and the Republic of Ireland.

The booklet contains advice on the control of Contagious Equine Metritis, Klebsiella and Pseudomonas infections, and offers recommendations for controlling Equine Viral Arteritis, and Equine Herpes virus. Guidelines on Strangles are also included.

The revised Code for Equine Viral Arteritis (EVA) has tightened up the recommendations regarding the blood testing of mares prior to breeding. It is now recommended that all mares, whether to be bred naturally or by AI, be shown to have a negative result to a blood sample taken after 1st January and within 28 days before starting breeding activities.

The growing use of artificial insemination (AI) has prompted the inclusion of a checklist to help mare owners ensure that semen used for AI, either imported or collected in the UK, is free from disease.

Advice on Equine Infectious Anaemia (EIA) has been added following the recent outbreak of the disease in the Republic of Ireland. A Code of Practice on EIA produced by the UK Government’s Department of the Environment Food and Rural Affairs (Defra), is included as an insert with the booklet. It describes the disease and gives advice to owners on the prevention of EIA in horses travelling to countries where the disease occurs.

We risk serious problems of anthelmintic resistance, unless we change our worming practices now, warns Dr Gerald Coles.

Dr Coles of the Bristol Veterinary School was speaking at the Thoroughbred Breeding and Racing Seminar held in Cheltenham in November 2006. He discussed the current state of anthelmintic resistance, especially as it relates to Thoroughbred breeding.

How common is resistance? The short answer is that we don’t know, he says. However, the number of reports of anthelmintic resistance has been increasing.

Most significant is the problem of resistance in the cyathostomins, or small redworms. Resistance among cyathostomins to the benzimidazole group of wormers is believed to be widespread. Resistance to pyrantel is much less common, at least in the UK, although it is common in the USA.

And now there are signs of emerging resistance to the third major group of anthelmintics, the macrocyclic lactones (MLs). Evidence presented at the 2005 Conference of the World Association for the Advancement of Veterinary Parasitology in New Zealand suggested cyathostomins were developing resistance to ivermectin and moxidectin.

But it is not only the cyathostomins that are developing resistance. As long ago as 1999, Dr Coles reported pyrantel-resistant large strongyles. And earlier this year he reported the death of a foal infected with ivermectin-resistant Parascaris equorum.

Parascaris equorum, the large roundworm of foals, can kill before eggs are found in the faeces. But, we can no longer rely on MLs to keep foals clear of worms, says Dr Coles. Parascaris equorum is commonly resistant to ivermectin. In foals that are infected with ivermectin-resistant Parascaris, he suggests using a five-day course of fenbendazole.

The macrocyclic lactones (MLs: ivermectin, moxidectin) are superb drugs, says Dr Coles, but not for much longer. So how can we slow the development of resistance to the macrocyclic lactones?

He advises:

Concentrate chemotherapy on wormy horses.

Some horses are naturally wormy. Others regularly pass only a few worm eggs in the faeces even if not being treated. By identifying the wormy horses, treatment can be concentrated on the ones that will benefit the most. Only treat horses with more than 200 eggs per gram of faeces.
Equine Science Update

**Know the resistance status of your horses.**

Do a faecal egg count reduction test (FECRT). Coles suggests repeating a faecal worm egg count (FWEC) after dosing to ensure that the drug used has been effective. The interval between treatment and the second test depends on the drug used. After pyrantel, the second test should be carried out one week after dosing. If the FWEC is not reduced by at least 90%, then the worms are resistant to pyrantel. For benzimidazoles the interval between treatment and the second test should be 2 weeks.

Resistance is present if there is not at least 95% reduction in FWEC. For ivermectin the second test should be 3-4 weeks after treatment. Resistance is present if there is not at least 99% reduction in FWEC.

Don’t buy in resistance.
The most important thing is quarantining new horses. Don’t spend good money buying resistant worms. The last thing you want to do is introduce ML resistant worms to your pasture.

Newly arrived horses should be kept in a stable or quarantine paddock until they have been shown not to carry resistant worms.

If the horse has pyrantel-resistant worms it may be possible to remove them by treating with moxidectin followed by five day of fenbendazole. However, if ivermectin-resistant worms are identified Coles recommends getting rid of the horse. At the very least the horse should remain in a separate paddock.

Use alternative methods of worm control wherever possible.

Collecting faeces twice a week in summer, or once weekly in winter, can reduce pasture contamination. Graze the pasture with cattle or sheep. They can vacuum up the equine worm larvae. Avoid overgrazing.

“There is hope”, Dr Coles concludes, “but you need to act now.”

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**Parascaris equorum eggs resistant to heat and cold.**

A good hard frost can not be relied upon to kill the eggs of the large horse roundworm, according to recent research.

The large roundworm of horses, *Parascaris equorum*, is found throughout the world. It is a common parasite of foals. Older foals develop immunity to it, and it rarely causes problems in adult horses.

Under optimum conditions, *Parascaris equorum* eggs become infective within about two weeks of being passed in the faeces.

Infecive eggs contain larvae, which hatch within the foal’s intestines. The larvae penetrate the gut wall and migrate through the liver and lung before passing up the trachea and back to the intestines. They may cause a mild cough and nasal discharge during the migratory phase.

The adult worms live in the small intestine. They may grow up to 50cm in length. A heavy infection leads to failure to thrive, and may cause intestinal impaction or rupture. Deaths have been reported in foals up to 4 months of age.

*Parascaris equorum* produces vast numbers of eggs. A single female may produce over 200,000 eggs a day. The eggs have a sticky outer coating, which may adhere to the mare’s skin providing a source of infection for the foal. The eggs are particularly resistant to extremes of climate and may survive for many years in stables and on pasture.

Just how resistant the eggs are was the subject of an investigation carried out in the Czech Republic. Professor Bretislav Koudela and Dr Stepan Bodecek, of the University of Veterinary and Pharmaceutical Sciences in Brno, looked at how the viability of *P. equorum* eggs was affected by exposure to high or low temperatures.

Tubes containing 5000 *P. equorum* eggs, suspended in water, were exposed to temperatures from -80°C to 100 °C. They were then incubated to see how many of the eggs produced viable larvae.

Koudela and Bodecek found viable *P. equorum* eggs in suspensions frozen to - 20°C. Even after being maintained at
Paraascaris equorum eggs.
Photo kindly supplied by Prof Bretislav Koudela.

that temperature for a week, over 75% of eggs produced live larvae. So it can no longer be assumed that freezing conditions will render the eggs non-infectious.

The eggs survived high temperatures especially when exposure for only a short time. Over a third of eggs survived exposure to water at 60°C for a minute. But when the exposure time was increased to 5 minutes, no viable eggs were found.

The large numbers of *Paraascaris equorum* eggs produced, and their resistance to a wide range of temperatures, makes correct pasture management (picking the droppings) and appropriate use of anthelmintic treatment vital to prevent heavy infections developing.

For more details see:

Effects of low and high temperatures on viability of *Paraascaris equorum* eggs suspended in water.
B Koudela, S Bodecek