

Endurance Riders of Alberta



Endurance Riders Handbook

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PREFACE

This is a lengthy article, well worth reading. For a shorter description of endurance requirements, read ERA's "Introduction to Endurance Riding" written by ERA and distributed to all new members to assist them in learning the ropes.

This handbook has been largely borrowed from AERC. The AERC handbook was produced in 1991. It has a few erroneous references such as horses being "sound at a walk" when current rules require being sound at a trot. Ensure to read the manual with this in mind.

The AERC manual can be viewed at the AERC web site at: <http://www.aerc.com>. The handbook is at: <http://www.aerc.org/handbook.html>

ERA is rewriting the manual to comply with ERA's current rules and current knowledge. Dr. Trish Dowling, DVM has been writing articles in Horse's All for the past two years with the intent of developing them into a handbook when they are complete.

This document consists of the AERC handbook with Dr. Dowling's articles inserted in the chapters where they apply.

Riders should read the information in the Veterinary Handbook and the Ride Management Handbook included in the Membership Manual supplied to all ERA members.

Notes in italics are generally editorial comments by the assembler of this document for ERA - Wayne Delbeke..

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Chapter 1: Introduction to the AERC

The American Endurance Ride Conference was founded in 1972 as a national governing and record keeping body for long distance horse riding. Over the years, it has developed a uniform set of rules and guidelines designed to provide a standardized format and strict veterinary controls. At the same time, it has striven to avoid the rigidity and complexity that characterize the rule books of many other equine organizations, and has in fact encouraged individualism in it's members and diversity in it's competitions.

Basically, rides sanctioned by the AERC must abide by the following simple rules:

- 1 . The ride must be at least 50 miles in length per day.
2. The horses must be under the control of veterinarians experienced with horses or endurance rides.
3. The ride must be open to any breed or type of horse or mule.
4. Equines entered in the ride must be at least five years old.
5. There is no minimum time limit for completion.
6. All riders who successfully complete the ride must receive an award.
7. The winner is the rider who successfully completes the ride in the fastest time.
8. An award must be available for the horse judged to be in the Best Condition.
9. A junior rider is a rider under the age of 16 as of the first day of the competition season (Dec. 1). All juniors must be accompanied by an adult throughout the ride.

NOTE: - ERA Season is October 16 to October 15 due to our climate and AGM timing, and coordination with TRAC.

The following does not apply to ERA and has been struck out.

~~Endurance rides have five divisions. There are four weight divisions for senior riders: featherweight (up to 165 lbs.), lightweight (161 to 185 lbs.), middleweight (186 to 210 lbs) and heavyweight(211 lbs. and up). These weights include tack. The junior division is for children under 16. Riders earn points for year end awards in their weight divisions. Individual rides usually provide awards for weight divisions as well as for overall placings, up to top ten. The Best Condition Award is earned by the horse judged by the veterinary team to have finished in the best condition, based on a score which is derived from a combination of considerations, including riding time, weight carried, and physical state. Only the first ten horses to finish are eligible for this award.~~

Endurance riding is a sport which has many levels of appeal. For some it is a highly competitive and challenging athletic endeavour. For others it is a recreational activity combining a camping trip with a trail ride. For yet others it involves a search to experience our American heritage, to discover the country as our forefathers once did - from the back of a horse. Because endurance riders recognize the prime importance of finishing the event on a sound and healthy horse, the motto of the association is "To finish is to win."

Chapter 2: Attending a Ride

I. GENERAL OVERVIEW

Throughout this book you will find detailed information about all aspects of endurance riding. This chapter will give a general overview of the format of a competition. It is specifically designed for someone who has never attended a ride and doesn't know what to expect when he gets there.

Reduced to its most basic explanation, an endurance ride is a marathon for horses. It is run over a pre-marked, pre-measured trail. Although it is a race with awards based on the fastest riding times in the different divisions, many people compete not to race, but to finish within the maximum time allowed (twelve hours for a fifty miler and twenty-four hours for a hundred miler). There are designated rest stops along the way, with veterinary examinations required at each one. In the course of a fifty mile ride there will usually be four checks (including the post ride check), with roughly twice that number being common for a hundred mile ride. At the checks, the horse must show that he is able to safely continue, with that judgment being made on the basis of specific metabolic and mechanical recovery factors known to be significant (among other things, the pulse must recover to 64-72, the temperature must be no higher than 103 degrees F., and the horse must be basically sound at the trot). The length of time allowed for the rest periods varies with the distance covered up to that point, weather, terrain, and other factors: most commonly it ranges from fifteen minutes to one hour. At the conclusion of the ride, the horse must pass a final inspection, with recovery factors based on roughly the same requirements as those of the vet check.

One hour after the conclusion of their finish, the first ten horses are judged for the Best Condition award, an honour designed to reward superior care during the competition. Aside from the open rides of at least fifty miles, there are novice rides of twenty-five to thirty-five miles designed for beginners. A successful ride begins long before the competition, not only with proper conditioning of the horse, but also with planning and preparation for the trip. You should contact the management well in advance of the ride date and get an application with information about it. You want to be sure it is still being scheduled, to find out if there are any special requirements, and to clarify the directions. Some rides have an entry limit or a pre-registration deadline, and if you just show up you might not be allowed to enter.

The following paragraph relates to the US. If travelling to the US, you will need health papers as described.

All states require you to have a health certificate and proof of a negative Coggins test; some require a brand registration. If you are stopped by the authorities and don't have what you need, you will be fined and you might even have your horse and trailer impounded. Ride management also usually requires a negative Coggins test. Be sure your paperwork hasn't expired. Health certificates are only good for a few days, and a Coggins is valid from six months to a year, depending on the state (usually they are good for a year). Your veterinarian can provide the health certificate and Coggins papers; brand registrations are provided by state authorities. Your horse doesn't actually need a brand to get a brand registration, it's just a document showing ownership

of the horse. If your horse is registered, bring along a photocopy.

After you have your paperwork in order, start packing your truck and trailer. Refer to Appendix I to see what you will need. It's a good idea to use a checklist to make sure you don't forget something important. After a while you will probably organize all of your endurance ride gear in tack boxes and the like to make the packing and unpacking chores easier. Don't forget to take along all of the things you need for your own comfort.

Trailering to the ride is covered in Chapter Seven. Give yourself ample time to get there, allowing for unforeseen problems such as flat tires. It helps considerably to arrive at the camp site well before dark

II. PRE-RIDE ACTIVITIES AT CAMP

When you arrive, check in with ride management before parking your rig. It's a real pain to finish unpacking everything only to be told you've parked in a restricted location and have to move. Then, set up your camp.

Be sensitive to the ecology of the area, especially if the camp is on public lands. Follow any "keep off" directions to the letter, and never tie your horse to a tree. Nothing seems to alienate a forest ranger faster than finding a tree damaged by a horse's having chewed off the bark, or by long nails or screw eyes having been pounded deep into the trunk. Actions speak louder than words when it comes to showing the authorities that endurance riders are responsible custodians of the land and its resources. (*Tree huggers are permissible in many parks in Canada. These can be made out of an old cinch to avoid scarring a tree.*)

Once you get set up and have your horse comfortable, go and check in. There will be a table or tent where you submit your application and pay your entry fee. You will pick up any ride materials there. On a "no frills" ride this could be nothing more than a vet card; if it is a big ride there could be a packet full of programs, free samples, maps, vet books, etc. Be sure to read over any printed ride rules you are given, as they could contain important changes from what you expected. Be sure you know where and when to bring your horse for the pre-ride check, and also the time and location of the rider's meeting.

At most rides you can present your horse for the pre-ride exam as soon as the veterinarians get there. It's a good idea to go early and get this over with, as there could be a long line later. If you do find a long wait and your horse is "antsy", show some courtesy and keep him off to the side so he won't be a problem or a hazard to the other horses. Don't forget to bring your vet card or booklet. Your horse must be presented in hand, un-tacked. If the weather requires a blanket, you will be asked to remove it during the exam. Full details on what the vet looks for and how the exam is conducted are covered in Chapter Twelve.

Sometime during the afternoon it's a good idea to saddle up and go for a short ride (a couple of miles is sufficient). This loosens the horse up after his trip, helps settle him into the camp routine,

and gives you a look at the start and finish of the trail. If you've come very far, you should do this before the vet exam; the exercise will limber your horse up and reduce any filling that might have built up on the trailer. Another benefit of this excursion is that you will find out early if you brought all of the necessary tack and equipment. If not, you will still have time to beg, borrow or steal substitutes. It will also make you locate where you put everything, and have it all adjusted and ready to go well in advance of the starter's whistle.

There will be some kind of pre-ride meeting, usually held the evening before the competition. Bring a chair, light, pen, paper, and something on which to write. Listen attentively and if there is anything you don't understand, don't hesitate to ask. Some times at the pre-ride briefing the management will ask first time riders to stand up and introduce themselves. This is a nice way to say welcome, and serves to assure new people that everyone will be on the alert to help them out during the ride if they should need it.

The briefing usually covers the trail (and informs you of any special conditions or hazards); the number, type, and location of the vet checks (and the length of each leg of the ride in miles); vet check and crew procedures; vet check criteria; and any special rules or requirements. All of the vital information is supposed to be supplied in writing, but don't count on it. Some rides give you little, if any, information in writing, and depend on the rider's meeting to cover it all. A misunderstanding here could result in your taking a wrong loop or getting lost. Pay particular attention to the way the trail is marked and to the vet check procedures. If you're still unclear about anything, contact ride management after the meeting and ask for further information. There is usually a central campfire built in the area where the briefing takes place, and if you have everything in order for the next day, you can enjoy a few hours of socializing before you go to bed. Don't hesitate to pull up a chair, even if everyone there is a stranger. It won't take long before you're part of the group. Endurance riders love to re-hash anecdotes, and they're always happy to have a fresh ear to bend! Don't stay up too late, however. It's pretty hard to enjoy an endurance ride without having had a good night's sleep.

III. RIDE DAY

Allow yourself plenty of time to tack up in the morning before the ride starts. Many rides begin before dawn, so you might have to get ready in the dark. If you've never done this before it can be quite an experience. Things look altogether different by flashlight, and feeling around for that errant piece of equipment isn't likely to get your day off to a good start. If it's getting down to time to go and you have to hurry to get ready, it's all too easy to get a pad on crooked or to get a buckle in the wrong hole. Messing up here could cost you an accident.

You should begin warming up your horse about fifteen minutes before the start. Just lead him around at a walk for a few minutes, then mount up and ride first at a walk and then at a trot. Alternate walking and trotting a few times, and then keep walking until the start. That's enough if you plan to do a slow ride (which, if you're reading this chapter, is what you should be doing!). Experienced riders planning a fast race will want to do a more thorough warm-up. Don't get in the front of the pack just before you start - you could get run over! Especially at

some of the fast fifty milers, a few people will be taking off as if they were on the way to a fire. Another danger with being up front is that many horses, especially if they are green, can be unexpectedly difficult to control. If your normally quiet horse is magically transformed into a raving lunatic at the start of the ride, get out of the way and dismount. Let the crowd get out of sight and wait until your horse gets a grip on himself. Then you can remount and proceed in a more dignified manner! Pacing the ride is covered in Chapter Ten, but at this point the main thing for you to remember is to take it slow. If you trot the easy parts of the trail and walk the tougher ones, you will be able to finish within the maximum time allowed.

Always be on the alert for the trail markings, even when you're riding back in a long line of horses - in fact, especially when you're in along line of horses. It's not unusual for a group of riders to go miles out of the way because the rider in front missed a ribbon and everyone else just followed along.

Many kinds of ribbons are used. Because you listened closely at the rider's meeting (you did listen, didn't you?), you will know what to expect on the trail. You might be following surveyor's ribbons hung from tree branches (when there are trees), or Surveyors' ribbons stuck on the ground (when there are not). The management might use limestone arrows on the ground to point the way, or put lime stripes across the trails you don't take. Signs, permanent or temporary, might be used, such as paper plates with arrows, or U.S. Forest Service signs denoting official horse trails. Ribbons might be colour coordinated for different loops of the trail (although some rides use up leftover ribbons and have all colours of the rainbow out there). Most rides try to put all the ribbons on the right side, except for when you are turning left. Many rides use three or more ribbons close together, or three ribbons tied on the same branch, to denote a turn. If you are unclear on any of the details of how the trail is marked, be sure to ask for a clarification before you begin.

It seems that getting lost happens most often in the first five miles, when people are bunched up and sometimes moving too fast (and when the rising sun sometimes gets in their eyes just at the crucial turn), or late in the ride when they are tired and not paying attention. If you do find yourself off the trail, turn around and go back to the last marker you saw and then go forward again looking carefully for the marker you missed. Don't try to make up the lost time all at once; you will just tire out your horse and make matters worse. If you should become hopelessly lost, the best plan is to stay in one place and wait for someone to rescue you (see Chapter Nine). One of the things that characterizes endurance riding is a high degree of sportsmanship, and that includes courtesy to other riders on the trail. Basically, the "golden rule" applies - treat others as you would like them treat you. For example, if someone overtakes you as you are riding along a narrow trail, ask if they want by. If they do, pull over to the side and allow them to pass safely. If you overtake another rider and plan to pass, always call ahead and let them know. A simple "passing on your left" works fine. If your horse has a tendency to kick if another horse runs up on him, put a red ribbon in his tail; if he bites, put a red ribbon in his mane. Then, try to cure him of that obnoxious (and dangerous) habit!

If you are riding with other riders and you come to a creek, try to let everyone have access to the water. Don't drop your sponge right next to another horses muzzle. Most important wait until all

the horses are finished drinking before riding off. Many horses will not drink if their buddies are leaving them.

If you're leading your group and you see a hazard, call a warning to the riders behind you. For example, "hole on the right" or "slick rock." Of course, if you come upon a downed rider or a rider having some kind of problem, try to help out or ask if you can notify anyone at the next vet check.

As the ride progresses, try to estimate how far you've gone, and keep an eye on your time so you will have some idea of when you should be coming into a vet check. When you see the check up ahead, slow to a walk so that your horse will come in to it with his pulse already down to criteria. Most vet checks are run as 'gates' into a hold. This means that your hold time begins as soon as your horse is "down" to the pulse requirement; in other words, as soon as he passes the 'gate" (see Chapter Eleven, Pit Crewing, for details). Your mission is therefore to spend as little time as possible getting through the "gate", and hence the suggestion that you should come into the check at a walk.

IV. AFTER THE RIDE

After you finish, remember that your horse must pass a post ride vet exam before you qualify to complete the ride. Cool him out carefully, keeping him moving enough to prevent stiffness or cramping from setting in. If you have gone slowly, your horse will probably already be cool and dry when you arrive at the finish. **If the ride allows you to get the completion exam done as soon as the pulse is down to criteria, you should do so.** Don't use any liniments or medications until after this exam. If your horse isn't recovering as fast as you think he should, or if he looks as if he won't recover by the deadline, don't hesitate to ask someone for advice and help.

After the final exam, you can apply liniments or a body brace if you want (**unless you are eligible for the BC Condition award**, in which case you will have to wait until this exam is done). Blanket the horse if appropriate for the weather conditions, and in general try to make him comfortable. Provide him with plenty of hay, water, and free choice salt. Wait until after he has rested another hour or so before giving him his grain feeding (See Chapter Eleven on Pit Crewing).

If you have a long trip home ahead of you after the ride, it's best to camp over. The next morning both you and your horse will be rested and in a better frame of mind to face the drive. In the unlikely event that your horse has had any trouble during the ride, especially if he needed veterinary attention, it is foolhardy to leave camp the same day. Transporting an ill or exhausted horse often results in an intensification of the condition, and laminitis(founder) is not an uncommon sequel to serious cases.

V. AWARDS PRESENTATION

Most rides provide a meal after the competition, and awards are usually handed out at this time. For the twenty-five and fifty milers there will probably be a dinner presentation; for the hundreds, it will normally be a breakfast presentation the next morning.

The number, quality and diversity of the awards will vary greatly from ride to ride, depending on the budget and size of the event, and to some extent on the whim of the management. Everyone who successfully completes the ride will receive an award of some kind. Anything from a certificate to a silver belt buckle might be given, and items like flashlights, tee shirts, brushes, key chains, etc., are common. An award will be available for the horse judged to be in the best condition, and this is a highly coveted honour. Most rides provide awards for the first place winner overall, and some give top ten overall awards. ~~Others provide awards based on the AERC weight divisions~~, and there will usually be junior awards. Sometimes, rides give recognition to various breeds, to the rider who came the greatest distance to attend, etc.

At the presentation, people are usually encouraged to say a few words when they accept their awards, and sometimes the group is entertained with stories and anecdotes. Everyone has a tale to tell about the day's trials and tribulations, and after the dinner people often linger to visit and 'kick back'.

Even though you've taken good care of your horse throughout the day, you should not neglect to see to his needs periodically through the evening. Keep water, hay and salt at his disposal at all times, and if he is confined to a picket line, take the trouble to walk him for ten minutes or so at least a few times before you go to bed.

VI. PACK IT IN: PACK IT OUT

At a moment in our history when there is great competition for recreational trail use, it is very important that endurance riders act responsibly when using public land. Before you leave camp, be sure to clean up after yourself and your horse. Collect all your garbage, and if there is no disposal site, back home with you it goes. Scatter piles of hay and manure. In short, leave the area at least as nice as you found it. If the park ranger should drop in while the ride is going on, be courteous and express your appreciation for being able to use the park. Rangers have many user groups to accommodate, and their authority must be respected. They are usually happy to work with you if you give them a chance, and very often they take real delight in seeing the area in their jurisdiction being appreciated and enjoyed.

VII. THE TRIP HOME

Be considerate of your horse on the trip home, making sure that he is neither too hot nor too cold. Give him periodic breaks (at least every four or five hours), and offer him water frequently (see Chapter Seven and Eleven). When you get home, unpack the rig and put everything away so

you can find it again. Clean up the tack and clean out the trailer too. Putting off this chore will just make it more difficult and unpleasant when you finally get around to it. Turn your horse out for a few days of pasture rest before you resuming conditioning. Then, start planning for the next ride!

Chapter 3: Selecting an Endurance Horse

Ask a dozen successful endurance riders what they look for in an endurance candidate and you will probably get a dozen different answers. Ask them how they found their star performers, and if they are truthful they will probably admit that it was just plain dumb luck. The scientific mind might well ask why this is so, given the fact that so much is known about the relation of form to function. Couldn't a knowledgeable person just measure all the horse's physical components for ideal proportions and angles, add it up and make the right choice?

Unfortunately, the problem is much more complicated than that, for regardless of how well the horse is put together, no matter how well he moves, and no matter how nicely the personality seems suited to endurance work, there is no way (short of testing at a university that specializes in such things - such as Kansas State), to anticipate how efficiently the metabolic system will respond to the rigours of the hundred mile endurance test. We can't know in advance how well his heart will be able to pump; we can't measure the way the lungs will respond; we can't foretell the way the body chemistry will function.

Due to the relatively low prices endurance horses command and the late age at which they begin to compete, it is not economically feasible for people to breed them, although a few do it for personal satisfaction or for other reasons of their own. And while there are a few bloodlines that consistently perform above average, truly outstanding individuals tend to pop up out of nowhere rather than to be predictable products of certain gene pools.

With no bloodlines being especially prominent, and with so much that is vital to performance being hidden from view, what guidelines can then be used when shopping for an endurance horse? There are a number of empirical theories: generally they are highly speculative and, inevitably, glaring exceptions can easily be brought to mind. Nevertheless, empirical theories usually have at least some degree of merit, so it would be worthwhile to mention a few of the more popular ones. You can make of them what you will.

I. OLD ENDURANCE RIDERS' TALES

Some very successful (but perhaps foolhardy) riders regularly scan the classifieds for ads that might read, 'spirited, for experienced rider only.' Just how "spirited" the horse is might become apparent as soon as you meet the prospective seller, who is wrapped in casts and covered with stitches! The reasoning behind the endurance rider's being interested in this type of situation is that (1) the price will be right, and (2) the horse is a renegade that has successfully thwarted anyone's efforts to conquer him. He has a fighting spirit. Such a horse might simply be bored to distraction with the job his owner has picked out for him (perhaps dressage, western pleasure, or some other tedious enterprise). It's possible that the horse just needs a career change, and if this is the case, endurance might be his cup of tea. On the other hand, reclaiming a horse with an attitude problem is a very risky business. A novice rider on the wrong side of thirty might be well advised to beef up his hospital and disability coverage before undertaking this particular type of project!

Some riders look for a horse that has a dominant personality in the company of other horses -one that leads the pack. Some feel that an aloof attitude is preferable. Perhaps a socially independent horse might be a better bet than a domineering one, if for no other reason than he would be less likely to quit when he got by himself on the trail.

Many people feel that a very low resting pulse rate (less than 30) indicates an exceptionally efficient metabolic system. However, it is very difficult to get a the resting rate on a horse, and in any case many (perhaps most) top endurance horses seem to have more average counts.

A hearty appetite is an important asset to an endurance horse. Nobody would argue that point. Running hundreds of miles requires huge amounts of fuel, and it stands to reason that a horse that is easily thrown off his feed will not be able to function satisfactorily. There are some big exceptions to this rule, however, and you should think twice before writing off a finicky eater. Another popular theory, especially among people who raise horses in the higher altitudes, is that horses raised where oxygen is in short supply will develop a superior ability to use whatever is available. Indeed, ever since the Olympics were held in Mexico City, altitude training has become a standard tool for human athletes. On the other hand, if a mountain raised horse were faced with dealing with other extreme climatic conditions, such as heat and humidity, the advantages of the altitude training might be more than offset by that individual's unpreparedness to face the problem of heat dissipation.

Now that you have been introduced to a few of the more or less questionable theories, let's move on to more concrete considerations. We will start with breeds, age and personal background, and then move on to conformation.

II. BREEDS

When it comes to breeds, it's obvious that as a group Arabians do the best. On the other hand, individuals from any breed can excel in endurance, and not all Arabians are suitable candidates.

III. AGE

The optimum age for a green prospect is probably somewhere between three and four. A younger horse is too young to break, and a mature one doesn't respond as fully to conditioning. An eight year old, overweight individual that has spent his life standing in a stall, stuffing himself on alfalfa and sweetfeed, is going to take a long time to get fit. Still, if you see a horse that you really like, don't dismiss him simply because of age. Endurance horses often compete well into their teens, so there might still be time to get a lot of enjoyment from him.

IV. SIZE

There is no ideal size for an endurance horse. Ponies can do very well, as can horses of sixteen hands or so. Most good endurance horses run around fifteen hands, but since this is a common height for Arabians, this measurement probably has no special significance. The size of the horse should be appropriate for the size of the rider, however. No one could expect a pony to be competitive carrying a two hundred pound man. Small, lightweight riders obviously have an advantage in that they have a greater range of sizes from which to choose.

V. ENVIRONMENT

The environment in which a horse is raised can have a significant impact on his future performance. An endurance horse should have grown up in a situation that allows him to express his equine nature. In other words, it is good for the horse to have grown up with plenty of room to play with others of his kind. He should have had plenty of good grass and hay from which to choose, but not have been overfed. He should have been allowed to defend himself against the elements and otherwise to have developed in a way that has prepared him to cope with hardship and discomfort. This is not the same thing as having grown up neglected in somebody's back lot, or in an over grazed field, with no attention to regular de-worming and hoof care.

VI. MEDICAL HISTORY

When selecting an endurance prospect, it is very helpful to know his medical history. Has he been wormed regularly? Has he ever had any serious injuries? Has he ever had any mysterious bouts with colic? Has he ever had any pulmonary infections? Such problems might be caused by, or be the result of, internal abnormalities that could affect future performance.

VII. CONFORMATION

A horse with a great metabolic system will be able to excel in endurance, at least for a while, even if his conformation is faulty. On the other hand, perfect conformation will never be able to make up for a poor metabolic system. Nevertheless, if the horse is going to remain sound for very long he will have to be well put together, and the higher your competitive goals, the more important correct conformation becomes. Although space does not permit a thorough discussion of all aspects of conformation, there are some points that need to be made.

If good conformation could be summed up in one word, that word would probably be balance. The horse should give the impression that all of his parts fit together smoothly and in proportion to each other. A moderately long neck with a nice shape might help the horse to carry himself in a more balanced way, at least to some extent, but by and large the head and neck are important more from an aesthetic point of view than from a functional one. A deep heart girth is traditionally thought to indicate large heart and lung capacity. Hindquarters should be large in proportion to

the rest of the body, and should give the impression of strength even in the unconditioned individual. The back should be shaped in such a way as to enable it to hold a saddle comfortably. An extremely long back tends to be weak and prone to soreness. The bony structure should be sturdy, perhaps even somewhat coarse. The muscles should not be thick or bulging. We are looking for a marathon runner, not a weightlifter, and the body build should reflect that.

The feet of the endurance horse are very important. The walls should be dense and thick, with a smooth, waxy surface rather than a ridged, split or chalky one. Even in a foot that has been neglected, there should be no significant splitting and cracking. Viewed from the front, with the foot still on the ground, look for a foot that is shaped like a cow bell (gradually getting wider from the coronary band to the ground). In addition, there should be no dishes, flares, etc. The heels should be wide apart, and the frog should be prominent and rubbery. Viewed from the bottom, the hoof should be slightly longer than it is wide. A sunken frog and contracted heels might be indicative of a serious problem, navicular disease for example, or might only mean that the farrier has been doing some bad shoeing for a prolonged period of time. How the horse moves, the size and shape of the hoof, and the angle of the pastern might provide further clues about the seriousness of the condition.

A symmetrically shaped foot is necessary for the leg column to operate correctly. Such a foot reflects that the horse is landing evenly, as he should, over the centre of that structure. This in turn means that with every stride the impact is being taken up through the middle of the leg column rather than off to one side or the other. Over a period of time, uneven impact is extremely destructive to joints, ligaments and tendons. A symmetrical foot means one that is bisected by the frog, with each half being a mirror image of the other.

Finally, size is an important consideration when judging the endurance foot. A disproportionately small foot is a disadvantage because the weight carrying area will not be as adequate for handling the concussion.

Scanning the conformation of the forehand, you should look for a big shoulder, a long forearm and a short cannon. The knee and ankle should be large and bony, without mushiness or filling. The knees should face clearly forward, not be put on the leg column with an outward or inward twist. Viewed from the front of the horse a vertical line dropped from the top of the centre of the forearm should pass through the centre of the knee, ankle and pastern, and end up at the centre of the toe. Knees that turn either in or out are likely to cause some degree of uneven break over and faulty flight path of the legs. Ankles present the same problem if they are crooked. Base narrow or base wide legs are structurally faulty. Offset knees are fairly common in Arabs, but they usually do not pose too great a problem, especially if the condition is not extreme. Calf knees are also common in Arabs, and this, unfortunately, is more likely to cause trouble somewhere down the road. Similarly, a horse that is "tied in" below the knee is more subject to unsoundness. Good pasterns are important and the ideal ones are medium in length and have the same angle as the hoof (this is known as an unbroken hoof/pastern axis). Pasterns that are extremely sloping place an undue amount of pressure on the supporting superficial flexor tendon and suspensory apparatus. On the other side of the coin, a steep, upright pastern usually produces a jarring effect on the legs and feet (especially if the other joint angles don't help compensate).

The master principle to keep in mind when considering conformation is that the front legs act as support columns and must absorb, with as little trauma as possible, the impact of landing. Like any support columns, they are only as strong as their weakest part. Imperfections that would never be a problem to the soundness of a show horse might be disastrous to the endurance horse: you have to be picky if you want a good one.

Moving to the hindquarters, you should keep in mind that the primary function here is to propel rather than to support. Good size relative to the rest of the body is very important. Viewed from the side, hocks should be wide and set on the leg fairly low. Sickie hocks predispose the horse to injury because of the excessive strain they place on the back of the legs. Cow hocks, unless they are so extreme that they cause the horse to hit his ankles, are not really a problem.

Assuming that the horse has passed the standing inspection, the next step is to see how he moves. The trot is the most important gait to consider. If there are any break over problems, this is where they will show up. The way the horse stands and the shape of the foot should have already given you some good clues as to the flight path that the leg will follow, but watching the actual movement will provide the proof.

What you hope to see is that the foot breaks over at the centre of the toe as it leaves the ground. The leg should then follow through with a straight flight path, with the hoof hitting the ground evenly over its centre. Horses with irregularities in their way of going, such as winging in or out, crossing over, etc., have a lot of wasted movement. Furthermore, they are likely to impact the ground to the side of the hoof, causing strain to the leg. If deviations in the flight pattern are extreme, they might even result in one limb striking the other.

Watching the flight of the hind limbs, the main concern is that the horse travels widely enough so that he does not interfere with his other hind leg and does not over-reach and grab either of his front legs. While it is true that a number of successful endurance horses interfere, you must realize that this problem will be a difficult one with which to contend.

Looking at the horse from the side as he moves, you want to see a long, low, forward sweeping stride: high knee and hock action are a waste of energy. The horse should look free and loose in his shoulders and hips, like a gunslinger, and he should have a good over stride at the walk. Short, tight strides will get you nowhere, and will work you and the horse both to death. An average stride is acceptable if the break over is correct, but a really big, powerful, floating trot that covers a lot of ground with effortlessness is a thrill to ride.

VIII. PERSONALITY

If the horse trots out in hand to your satisfaction, the next move is to take him for a spin, and this is where matters of personal preference take over. Because of the tremendous amount of time you will be spending with your endurance horse, it is imperative that you like his personality as well as his mechanical and metabolic make-up. If you don't enjoy riding him, whether he is gifted or not, the partnership is never going to gel.

Some people like a relaxed, laid back sort of fellow, while others prefer one that is more "ready". Most endurance riders don't consider a lazy horse much fun to ride, but on the other hand, a very tense horse that is on the borderline of being out of control, even in a non-threatening situation, is likely to come unglued in a real race. Many beginners think that an uncontrollable horse is one that just "loves to run". Nothing could be farther from the truth. The best horses are generally self-possessed and businesslike about their work. They can concentrate on the job at hand and, when they are well trained, will usually leave the rider with little to do but steer and otherwise stay out of the way.

IX. PRE PURCHASE EXAM

After riding the horse, if you are in love and know you can't live without him, the next move is to get the veterinarian to check him over. Be sure he understands how you intend to use the horse. Ideally, the vet should be familiar with endurance riding and the demands that it involves. Usually one with a lot of practical field experience will be able to give you better advice than a team of experts from a research facility.

Happy hunting and good luck!

The above is the AERC writeup. The following is a write up by Trish Dowling, DVM provided to ERA for this handbook.

Choosing the Endurance Horse - T. Dowling, DVM

With the motto of the sport being "To finish is to win", any sound and reasonably fit horse (donkey or mule) can do well in endurance riding. Many people get started in this sport on whatever particular horse they own at the time and are quite successful. However, the seriously competitive ranks of the sport are dominated by Arabians and Arabian-crosses. The success of Arabians in long distance events is due to a combination of factors: size, muscle fiber type and proportion, skin thickness, and hoof quality. Studies of top winners show the typical competitive horse to range from 14.2 to 15.2 hands, fairly typical of most Arabians. Horses under 14.2 tend to be unsuitable for the average adult rider, and as body thickness increases with height, horses over 15.2 tend to be less efficient at cooling and cardiovascular recovery. The ideal muscle type of a distance athlete is long, sloping and flat. The thick muscling of western stock type breeds is less efficient at dissipating the heat generated with exercise and contains predominantly *fast twitch* muscle fibers, which are designed for anaerobic (without oxygen) work at short distances. Arabians have more *slow twitch* muscle fibers, which are designed to work aerobically for long periods of time. Breeds such as Thoroughbreds, Standardbreds and Saddlebreds have an overall balance of *intermediate* type muscle fibers. Thin skin, with an abundance of surface blood vessels, is also a trait of Arabians and Thoroughbreds, and allows rapid cooling. Hoof size and quality has been a neglected trait in some breeds, while for their size, Arabians typically have large hooves with thick, strong hoof walls. So while as a breed, Arabians

excel in the sport, there are numerous examples of other types of equines competing quite successfully - this year's Best Condition Award at the notoriously difficult Tevis Cup was won by a 17 hand mule! (1999)

When you begin your search for the ideal distance horse, investigate any prospect's early environment. Avoid the "hot house tomatoes" that spent their early formative years confined to a stall, in favour of the pasture-raised horse. He may look less shiny and glamorous, but his musculoskeletal system has had healthy stress that builds the foundation needed for long distance work. Make sure that he's been on sound health and nutritional programs as well.

When you go to check out a prospect, start from the ground up. Don't be fooled by a flashy colour or pretty head. The old saying, "No foot, no horse" is absolutely true for distance horses, so being very particular in this area will save you a lot of grief in the long run. Look for a good hoof size relative to the horse's body. The hoof horn should be of good quality; beware of thin hoof walls, cracking or peeling horn, or evidence of "white line" disease. The sole should be slightly concave, as flat-footed horses bruise more easily on rocks and stones. Make sure that the feet are similar in size or shape. A small hoof indicates unequal weight bearing and may be a sign of a chronic lameness problem. Horses with less than ideal hooves may still make good competitors, but may require much more care and expense with special shoes and pads.

Working upwards from the hooves, critically evaluate the prospect's leg conformation. Flaws that would not affect performance of a show ring horse, may seriously limit the career of an endurance horse. So look for medium length pasterns for strength with shock absorption. Cannon bones should be relatively short in relation to the forearms to take advantage of mechanical efficiency. They should also be sturdy in proportion to the horse's weight - the ideal circumference (measure the leg just below the knee, including tendons) is 8 inches for 1000 lbs. A long sloping shoulder is also ideal for shock absorption and a comfortable ride, and should end in well developed and well placed withers for ease of saddle fitting. On the hind limbs, the hocks should be well angulated, but avoiding the extremes of "sickle hocks" or "post-legged". The hindquarters should be in balance with the other parts of the body, and long, sloping muscle is ideal. The loins should be short and strong and lead into a barrel that is deep through the heartgirth but not overly wide. The depth of heart girth provides ample room for heart and lungs to work efficiently. Extra width through the barrel limits the efficiency of "radiator" cooling, and may limit movement of the forelimbs and result in girth galls. The back should be relatively short and level, leading into the well-formed withers. Be very particular in this area, as problems with saddle fitting increases with the distance you compete at and may cause major problems. When evaluating a prospect that has been in work, look for patches of white hairs along the back and withers that indicate problems with saddle fit.

After thoroughly examining the horse at rest, evaluate his movement. A distance horse needs to have an efficient, ground covering stride. Avoid energy wasting high action, or

rough, pounding action. Observe the horse coming and going at the walk and trot and watch for any evidence of conformation faults that cause interfering. Slight interference becomes much more significant as the horse tires over long distances. Ride the horse if possible to see if his gaits are comfortable and if he is responsive to you. Remember you will spend many hours in the saddle, so you need to make sure that you will enjoy riding this horse!

Also spend time evaluating his personality and temperament in as many situations as possible. Watch for evidence of vices or bad habits. He should have a bold and willing attitude, but not be dangerous or uncontrollable. He should handle the stresses of new situations and travelling. Make sure that he eats and drinks well under most circumstances. The athletic effort of endurance riding requires replenishing body stores to maintain condition. The finicky eater or fussy drinker will drive you crazy at rides and this may limit his competitive ability more than a conformation fault.

When you've done your homework and thoroughly evaluated your prospect, contact a veterinarian who is familiar with the sport to carry out a pre-purchase examination. A complete pre-purchase examination does cost money, but it's a valuable investment and may save you money and heartache in the long run. It is not the job of the veterinarian to "pass" or "fail" your prospect, but simply to conduct a complete examination and document the horse's condition. A veterinarian who is familiar with endurance riding will be able to give you valuable advice on whether or not the prospect is suitable for the goals you have in mind.

Chapter 4: Feeding the Endurance Horse

Long distance effort is almost exclusively an aerobic (oxygen burning) slow-twitch fibre exercise (as contrasted to the fast-twitch needs of track racing). Fat stores and their circulating products (free fatty acids, triglycerides) are the energy fuels for endurance. They are derived primarily from forage (hay, grazing) rather than concentrates (grain). Pure fats (vegetable oil, animal fat) can be fed to horses to maximize fat availability, but only the front-runners under intense energy demand can make reasonable use of this kind of added energy source.

Please use all the subsequent information given in this article as rules of thumb, not as absolutes, and vary it according to the individual response of your horse.

I. FEEDING FOR TRAINING

Distance horses need reserves of water, energy and electrolytes to enable them to perform for 5 to 15 hours of serious effort. Keeping the gut filled with high quality foodstuffs will meet these needs. The average 1000 pound horse requires approximately 15 Mcal (Mcal = 1,000 cal) of energy per day for normal body maintenance. The additional energy needed for the average mile of exercise may be calculated by several different complicated formulas, but approximates 0.75Mcal per mile. The average horse will only consume 25 to 30 pounds of foodstuffs (approximately 2.5% to 3% of body weight) per day. He is more likely to consume only 25 pounds because of time and appetite restrictions. The average hay has from 0.8 to 1.1 Mcal per pound, depending on the type of hay and the stage at which it was cut. Pasture is a better energy provider than hay when compared on a dry matter basis, but unfortunately growing grass is as much as 1/3 water and therefore would require three times as much poundage to achieve a similar amount of calories. Horses should be allowed free access to all the hay(a mixture of grass and legumes is best) or grass they want at all times; however, it is unlikely that they will eat enough to meet their caloric requirements when they are in a hard training period. Concentrates (grains) are therefore required. Concentrates range in calories from oats (1.5 Mcal/pound) to barley (1.64 Mcal/pound) to corn (1.75 Mcal/pound). The daily energy requirements of a horse averaging 100 miles of training and competition per week could be calculated as follows:

Maintenance: 15.0 Mcal/day x 7Days/week = 105 Mcals
Exercise: 0.75 Mcal/mile x 100 Miles = 75 Mcals
Total: 180 Mcals

To meet these needs, you might feed, for example, approximately eight pounds of oats (1.5 Mcal/pound x 8 = 12 Mcal) and 17 pounds of timothy hay (0.8 Mcal/pound x 17= 13.6Mcal). This will provide approximately 26 Mcal/day for approximately 180 Mcal / week. Don't forget to vary the amount of grain fed each day according to the horse's work schedule - more on heavy work days, less on off days.

Fat may also be added to increase the caloric content per pound of consumption. Fat has 2 1/2 times as much energy per pound as grains (carbohydrates). Normal commercial mixes contain

about 2 1/2 % crude fat, while the equine athlete can tolerate as much as 10 to 15% fat (in the form of vegetable oils) in his diet. Following exercise the high-fat diet also appears to promote the metabolization of the free fatty acids before utilizing the available glucose stored in the blood and muscle. This leaves a larger reservoir of glucose available to combat fatigue. Care must be taken when initiating a high-fat program. Avoid rancid fats and used animal fats as they are potentially toxic. A vitamin E supplement (about 4,000 units daily) is advisable when feeding high levels of fat. The daily level should start at a few ounces and be increased gradually. The level should also be decreased gradually when the horse is removed from competition and high level training.

(NOTE: feeding of fat is hotly debated, there is some indication of elevated heart rates and reduced gut sounds in endurance horses on high fat diets. Recent research suggests backing off feeding of fats a few days before a ride.)

II. VITAMINS, MINERALS AND OTHER NUTRIENTS

Protein is probably the most over heralded nutrient in the adult horse's diet. If you feed almost any reasonable quality diet, sufficient amounts of digestible protein will be present. Exercise seems to have little or no effect on protein requirement. The little that is lost through sweat seems to be adequately met by the increased food consumption required by the increased exercise.

Most of the necessary trace minerals will be in the pasture, hays and grains. The content may vary with soil concentrations, type of foodstuff and processing of that foodstuff. Therefore a free choice accessibility to a trace mineral salt block or lick may be advantageous. During heavy and prolonged exercise, excessive amounts of sodium, chloride, potassium, calcium and magnesium are lost through extensive sweating. An additional supplement of these minerals given the day prior to competition may be helpful. An equal mixture of Lite salt (1/2 sodium chloride and 1/2 potassium chloride) and table salt (sodium chloride) would give the proper proportions of the mentioned minerals. Mix three parts of this mixture to one part of a calcium additive such as ground limestone to produce a good supplement. Two ounces of this supplement given with feed three or four times on the day prior to the competition may prove beneficial. Commercial supplements are also available. Free choice water at all times is essential!

A diet of reasonable quality forage, hay and grain will usually supply all the necessary vitamins. If there is any question of deficiency, the water-soluble vitamins (primarily the B complex) which are stored in the body for only a few days, may be supplemented with harm possible only to your pocketbook. The fat-soluble vitamins A, D and E are stored for long periods and shortages do not pop up overnight. Excessive supplementation of these can prove toxic. In some areas of the country (check with your county extension agent) forages are vitamin E and Selenium deficient, so inquire and supplement appropriately!

III. FEEDING DURING COMPETITION

On the day of competition it is disadvantageous to feed your horse any concentrates within four hours before the start of the ride. You should feed a moderate quality grass hay the night prior to

the ride. During distance competition, horses get hungry, sometimes even ravenous. Forage best meets the needs of this hunger, since it stimulates additional fat mobilization, steadies the blood sugar levels, adds to water and salt concentration and delivery, and occupies more 'chew time'. Use a light or moderate quality grass hay, not a rich, heavy duty legume. Grain meals during competition give less fill, require more water for digestion, trigger unwanted carbohydrate use and risk damage to gut bacteria essential for roughage digestion. Sloppy bran and carrot feeds are an acceptable substitute for hay or grass, but are not an improvement on it. Let your horse drink all he wants at every opportunity, and eat grass and hay steadily, but not so wolfishly as to choke. With the tremendous amount of sweat loss, especially in hot humid climates, there is probably benefit to giving him electrolytes (Na, K, Cl, Ca and Mg) at each vet check. Two ounces of the previously mentioned mixture at each stop may help. There is not enough scientific data available to prove that this supplementation is helpful, but many experienced vets recommend it. If the trail is barren of edible forage, for a 100 mile competition you might take a few pounds of hay with you out of the last few vet checks, feeding your steed as you go so that you might keep all systems functioning.

NOTE: Providing electrolytes is now an essential component of successful endurance riding. It is recommended that electrolytes be given approximately once per hour, regardless of speed. The horse that is going slowly may need more electrolytes than the speedier horse. Note also that not all electrolytes are created equal. Check the strength of the electrolytes you are using. The sweeter, less concentrated forms may require as much as three times as much dry powder as the stronger forms. See also Appendix III

IV. FEEDING AFTER COMPETITION

After hard work the gut is more receptive to energy concentrates and the horse needs rapid replacement of his energy stores. More grain may be fed with less risk by feeding many small meals of concentrates at hourly intervals. At 0.75 Mcal per mile it would take one pound of corn (1.75 Mcal per pound) to replace the energy used for every 2 1/2 miles of competition. The first 12 hours after the ride is the most effective time to refuel, but don't exceed 15 pounds within 8 hours. For a 100 miler your horse will use up 90+Mcal(15 Mcal maintenance plus 75 Mcal in work) in one day. This is equal to more calories than in a 50 pound sack of corn. It will take 3-5 days to refuel.

Enough science! Let your horse eat all the forage he wants. Train and compete consistently, sensibly and progressively. Watch his weight and attitude: if either start to slip, add some grain and ease up on demand until that gloss of coat, that gleam in his eye and bounce in his gait return. No super diet will turn an also ran into a champion, but a Proper diet could keep a champion from becoming an also ran. The most important difference in the ability to perform is in the horse's genes. Next come training and nurture. The longest and best careers are built on selecting a suitable candidate, training him progressively, using him sensibly, and feeding him rationally.

The above is the AERC writeup. The following is a write up by Trish Dowling, DVM provided to ERA for this handbook.

Feeding the Endurance Horse

During a race, endurance horses perform prolonged, low-intensity work, fuelled by muscle glycogen as their energy source. Fatigue occurs when muscles become depleted of glycogen stores. Therefore, energy is the most important nutritional component of the diet, and your feeding strategy must reduce the demand on muscle stores of glycogen and supply the energy demands of competition. According to the National Research Council (NRC), energy demands for working horses are 25-100% above their maintenance requirements. But many factors influence an endurance horse's energy requirements, such as the horse's fitness, body weight, training level, rider's weight and skill, environmental factors (temperature, humidity), work duration, terrain, age and muscle fibre composition. Therefore, the NRC requirements should only be used as a guideline, and you should determine the appropriate feed intake by carefully monitoring your horse's body weight in light of the work he is doing. Below is an example of a well-balanced endurance horse diet.

Forage: The basis of an endurance horse diet should start with high quality forage - hay and/or grass. Horses evolved as grazing animals, continuously eating grass and leaves. Fibrous materials largely bypass the horse's small intestine, for digestion by bacterial fermentation in the large intestine. Fibre in hay and grass is important for normal function and motility of the horse's digestive tract, and a diet low in fibre can cause colic problems. An additional benefit of feeding hay to the endurance horse, is that the horse will drink more and retain more water prior to the competition. This roughage/water/electrolyte reserve in the horse's large intestine can be drawn upon when needed during the race.

The hay of a competitive horse should be a mostly grass hay. In western Canada, a mid-bloom timothy hay is ideal. Alfalfa hay contains excessive amounts of protein and calcium. The excess protein is inefficiently used for energy and increases the work load of the kidneys. Feeding excessive amounts of calcium on a regular basis to the endurance horse causes the normal mechanisms for mobilizing calcium stores from the bones to become sluggish. Then during an endurance race, when the horse does need to rapidly replace the calcium lost in sweat, the normal mechanism does not respond adequately and the horse may suffer from the effects of low blood calcium. So feed a grass hay on a regular basis or keep the endurance horse on good grass pasture, and offer small amounts of alfalfa hay only during the ride when extra calcium is required.

In this sample ration, beet pulp is added as a source of soluble fibre. Beet pulp is available as a dehydrated pellet, which is usually soaked in water and allowed to expand prior to feeding. It can be fed dry without causing digestive upset, but endurance riders prefer to feed it re-hydrated as an additional method of getting water into the horse. Beet pulp provides greater energy than the timothy hay and it compliments the water/electrolyte reservoir of fibre. Most horses will learn to like the sweet taste of beet pulp if you start by adding small amounts of it to the grain ration. The wet beet pulp is also useful to dilute and disguise additions to the ration such as

medications, electrolytes and fat.

Grain: With the athletic performance required of endurance racing, a forage only diet does not meet the horse's energy needs and concentrates must be fed. The quality and quantity of carbohydrates in the diet are important. Quality carbohydrate sources include balanced grain mixes that contain a blend of energy sources such as oats, barley and corn. But there are limits on how much carbohydrates a ration should contain for performance horses. If during a single feeding, excessive carbohydrates are fed, some will bypass digestion by enzymes in the small intestine and will reach the horse's large intestine. In the large intestine, carbohydrates are digested by the bacterial flora, resulting in an abundance of lactic acid and gas production. Lactic acid lowers the pH of the large intestine and alters the normal bacterial flora, and along with the gas, may cause colic. Therefore, the grain portion of an endurance horse's diet should be split into as many small portions as possible over the day to maximize digestion in the small intestine.

Another caution in feeding concentrates prior to a race is the potential for insulin rebound. Rapid absorption of sugars from a high carbohydrate meal will cause a large surge of insulin about 90 minutes post-meal. This excessive insulin release can cause blood sugar levels to drop precipitously. To prevent this hypoglycemia from occurring during the race, concentrates need to be fed at least 3-4 hours prior to the start, and then small amounts are fed at frequent intervals during the race.

Glycogen loading, a dietary protocol used by human athletes who eat large pasta meals before a competition, does not seem to be an effective way of generating energy reserves for endurance horses. Horses naturally have higher muscle glycogen levels than humans, so there is less potential for super-compensation in horses. In addition, it is difficult to feed large amounts of highly digestible carbohydrates to horses without causing colic and laminitis.

Fat: One of the most recent developments in the feeding of equine athletes is the addition of fat to the diet. Fat contains more energy than an equal weight of carbohydrates. Because fat increases the energy density of the diet, the total feed intake needed will be less to meet the endurance horse's energy demands. Fat also appears to preserve glycogen stores longer and moderates the insulin surge and rebound hypoglycemia seen with feeding carbohydrates during endurance exercise. High fat-low carbohydrate diets reduce the incidence and severity of exertional rhabdomyolysis ("tying up") in some horses.

(See previous note on reducing fat supplementation before a ride. An ongoing debated topic.)

Commercial horse feeds contain only small amounts of fat, usually less than 3%. Fat can be slowly added to the concentrate portion of the horse's diet up to 10%. Horses require up to 21 days to adjust to a fat supplemented diet. Adding fat to the diet on the day of the race is of limited benefit. There are commercial horse feeds available that

contain added fat, but there are advantages to top-dressing the fat. When you top dress the feed with corn or canola oil, you can manipulate the energy portion of your horse's diet easily. For example, if the horse's energy demands are reduced temporarily, you can easily cut back on the amount of fat added. Also, purchasing corn or canola oil in large quantities and top-dressing is less expensive than a high fat commercial feed. Feeding fat also increases the palatability of the feed, helps with the absorption of vitamin A and vitamin D, provides essential fatty acids that improve skin and hair coat, and it controls dust and fines in feed. However, corn and canola oil can easily become rancid. So bulk supplies should be stored in a cool place and kept in a tightly closed container to reduce oxidation. Even though it may smell fine to you, if your horse starts refusing feed with added fat, then the oil is likely to have become rancid.

Additional Supplements: There are numerous supplements available for performance horses. These supplements are most appropriately used to correct some specific deficiency or imbalance in a horse's diet. If you feed a commercially formulated horse feed and good quality hay or pasture, it is highly unlikely that your horse's diet will be deficient in vitamins or minerals. Owners and trainers like to feed supplements as "insurance" for optimum athletic performance. Over supplementing is usually harmless and merely a waste of money, but in some cases an excessive amount of a nutrient may cause toxicity and decrease performance.

Endurance Horse Diet

Total Diet: 2.25%-3.0% of Body Weight (BW)

Forage:	1.5%-2.25% BW or 60%-75% of total diet
Timothy Hay	18 lbs as fed/day (or good quality pasture)
Beet Pulp	3 lbs as fed/day
Grain Ration:	0.5%-1.25% of BW or 25-40% of total diet
Grain mix	6.0 lbs as fed/day (14% crude protein)
Fat	
Corn or Canola oil	0.6 lbs as fed/day

Total: 27.6 lbs/day (suitable for a 900 lb horse)

Zwaan Farm Feeding Strategy: We offer our horses high quality grass/alfalfa hay at all times at a ride. If they will eat it wet, we soak the hay in order to get any extra water into them. We feed a normal grain/beet pulp/canola oil feeding the evening before the race. One of us gets the early morning wake up call, to offer a small meal of predominantly beet pulp (with some grain and oil) about 3 hours before the start time. At vet checks, we continue to offer free choice hay and small amounts of a sloppy mash of beet pulp and some grain. We take advantage of any good grass at any check point. After the race, we allow the horses several hours to drink and fill up on hay, then usually split the regular evening ration into two portions, giving the first about dinner time and the second before we call it a night!

Chapter 5: Tack

Using the right tack can make the difference between finishing a ride with a happy, healthy horse and finishing (if you finish at all), with a horse suffering from a sore back, girth galls, or worse. It can also make the difference between an enjoyable ride for you and an experience akin to a session in a medieval torture chamber. Endurance riders have learned much about what works and doesn't work, and this chapter will try to pass along some of that experience.

At a typical endurance ride you'll see nearly every kind of saddle known to man or beast. Many beginners ride a traditional Western saddle, but it is a poor choice. First it is heavy, and any extra weight is a penalty for a horse going 25 to 50 miles or more. Worse, most Western saddles put the rider's weight too far to the rear, leading to early fatigue and soreness. They are designed to keep the rider in place while working cattle, not to provide balance and comfort for miles and miles. Roping saddles are even worse in this respect. Another flaw of Western saddles is that the rigging is too far forward, contributing to girth soreness or galls. Again, the heavy double-rigged roping saddle is the worst of all in this regard. The stiff fenders and stirrup leathers of the Western saddle might wear like iron, but can rub a rider's legs raw (endurance riders don't wear chaps). Finally, the saddle horn, necessary for roping, just gets in the way on endurance rides and is a hazard in a fall.

English saddles are lighter and put the rider's weight more forward than Western saddles. They offer closer contact with the horse than Western saddles, but riders sometimes feel less secure in them. Some English types are more suited to endurance than others. In general, "hunt" type saddles are the most appropriate. The biggest shortcoming of English tack is a lack of proper distribution of the rider's weight; that is, many of them don't spread the rider's weight over a large enough area of the horse's back.

Australian stock saddles have a strong following. Most of these are high quality, give the rider a firm seat, and seem to work well for endurance riding. However, many are quite heavy.

McClellan saddles have a lot to offer the endurance rider, but comfort is not one of them. This saddle was used by the cavalry, and was designed to be good for the horse with no compromises toward rider comfort. In fact, it's been said of this saddle's designer that he loved horses and hated men. If you find them satisfactory for your own body, you might not find a better saddle for keeping your horse happy.

There are a number of saddles on the market today specifically designed for endurance. They fall into three broad categories: those based on Western designs, like the Sharon Saare, Frost Center Ride, Skyhorse, and original OrthoFlex; those based on English designs such as the Win-Tek, and those based on McClellan designs such as the original Stonewall.

Actually, many of these are hybrids borrowing from each traditional type. For example the Stonewall Clifer has an English- like seat, with McClellan style rigging, and Western style stirrups. Ortho-Flex, an innovative and quality product, has models reminiscent of the old Plantation

saddles, only with a close-contact, English design.

So which one is best for you? There's no easy answer for that. First of all, the saddle must fit your horse, and every horse is an individual. Weight might or might not be an important consideration for you, but no endurance tack should weigh over thirty pounds - unless you're trying to make a minimum weight for a race with those requirements.

If you like the close contact and very light weight of an English design, the Stonewall Clifer or the Australian Win-Tek might be a good choice. If you prefer Western design and can tolerate a little more weight, then the Ortho-Flex, Sharon Saare, Frost or Skyhorse might suit you.

There are many improvements today on the traditional western stirrups or English 'irons.' There are several lightweight designs with extra-wide platforms for your foot; a narrow stirrup is likely to cut off the circulation to your toes resulting in painful cramps and numbness. Some designs use springs, rubber blocks, or flexible materials to add shock absorption to the stirrup. Others include safety features such as open sides or breakaway fastenings to prevent being dragged in a fall. Almost any of these special designs will be lighter, safer, or more comfortable than traditional stirrups.

Pads are another important concern for your horse's back. The traditional Western blanket doesn't work very well. It has little resiliency and covers too large an area. As to material, natural wool pads with a foam lining often work the best. If you can't afford wool, Kodel is the next choice. Several manufacturers make pad liners that vary in thickness and/or density over different parts of the horse's back, and these might help the saddle to sit level and therefore aid the rider in maintaining a balanced seat. Some saddles have a custom made pad built in to achieve the same result.

(Skito, Toklat, and Cloud Nine make excellent foam pads that cushion and protect the horse's back and actually - personal opinion - make it more comfortable for the rider.)

Don't make the mistake of thinking 'more is better' and use two or even three pads; thick pads won't cure problems caused by an ill-fitting saddle. Too many pads or pads which are too thick allow the saddle to roll. A stack of pads can also cause the back to retain a lot of heat.

Whatever type pad you use, the shape of the pad should match that of the saddle. Especially in hot weather, you don't want to cover any more of the horse's back than necessary.

Breast collars, cruppers, and bridles come in nylon, leather, and Bioplastics. Ordinary nylon gets stiff from absorbing salt and dirt, and is hard to keep clean. Bioplastic is nylon with a smooth plastic coating; it washes clean easily, doesn't become stiff, and usually does not rub the horse. It is available in many widths and colours, and more and more suppliers are making horse tack out of it. Traditional leather can cause chafing and will need regular care to stay soft and pliable. However, leather will break in case you have a fall, and this is a good safety feature. Serious accidents can result from the rider being hung in the tack.

A good breast collar can help hold the saddle in place, preventing it's sliding back or rolling sideways. However, any breast collar which goes straight across the chest of the horse can make the shoulder muscles sore (especially on a 100 mile ride). These don't do much to prevent the saddle from shifting sideways, either. You should use a design in which the collar is shaped like the letter "Y, with the stem of the "Y" between the front legs, and with the branches going up the front of both shoulders to the saddle. This works much better without soring the horse. Most horses don't need cruppers, but if your horse has low withers a good crupper can keep you from finding yourself riding his ears on a steep downhill! If you decide to use one, be sure to accustom your horse to it at home. In fact it's not a good idea to try out any new equipment at a ride.

There are as many different bit and bridle designs as there are riders. Some serve as a combination halter and bridle, and these are very convenient at vet checks. Many people prefer a hackamore to a bit for endurance riding; it allows the horse to drink and graze easily on the trail. The ease of drinking is especially welcome at shallow streams and puddles. Be careful, though, in the type of hackamore you use - if it has long shanks it can make drinking even more difficult than a bit does. Use the shortest shanks you can find. With a calm or well-trained horse you can use a pony hackamore that has no mechanical leverage at all, and shanks so short they don't extend below the horse's muzzle.

Of course, whatever tack you use, be sure it fits the horse and that you keep it clean and in good repair. A little thought, planning, and care in choosing and fitting your tack will make a big difference in performance on the trail.

The above is the AERC writeup. The following is a write up by Trish Dowling, DVM provided to ERA for this handbook.

Tacking Up the Long Distance Horse

Just as any breed of horse, donkey or mule can compete in endurance and competitive trail riding, there are few rules dictating tack and equipment. In fact, saddles are not required at all! Of course most people do use saddles, but the point is that riders are free to use the equipment and tack that work best for them. Endurance Net (www.endurance.net) is a website devoted to distance riders and features many vendors of tack and equipment and offers secure, on-line shopping. Many have on-line catalogues where you can see photographs of equipment described in this article.

Saddles

English, western, Australian and specifically designed endurance saddles can all be seen at the rides. Saddles designed for endurance and trail riding come equipped with extra "D" rings for attaching a crupper and saddle bags. Saddles can be made of leather or synthetic materials like Cordura, and may have wooden, steel, ralide or plastic trees. The Sports Saddle is a treeless saddle, consisting of a pommel and cantle

attached to a pad. It is popular with lightweight riders and for horses who have back trouble with regular treed saddles. Heavyweight riders often look for the lightest possible saddles, while featherweight riders may have trouble making weight with an English or other lightweight saddle at rides with weight requirements (usually a minimum weight of rider and tack of 165 pounds). The Boz saddle comes with a hollow, plastic tree that can be filled with lead shot to allow a rider to make weight.

No matter what style of saddle appeals to you, what matters most is that the saddle fits you and your horse. The size of the tree (length and width) and the angle at which it contacts the horse's back determines how well the saddle fits the horse. The size and shape of the seat and twist, and where the stirrups hang on the tree determines how well the saddle will fit the rider. To check a saddle for fit, place it on the horse's back without pads. Three fingers width should easily fit between the horse's withers and the pommel of the saddle. If the gullet is too narrow, when you sit in the saddle, the narrow gullet will press the long muscles of your horse's back bones and cause pain. If the saddle tree is too wide, the saddle will bruise the withers. If the tree is too narrow, the saddle will pinch the horse behind the shoulder. A tree with long bars will gouge behind the shoulder and in the hip area of a short-backed horse. A short tree on a long-bodied horse will press on the loins and cause rubs and soreness. The cinch/girth should attach to the saddle such that there is 3 to 4 fingers width between the horse's elbow and the cinch/girth. With the cinch/girth loose, you should be able to slide your hand along the back for the full length of the saddle without a pinched feeling. If you find a space under the saddle where it does not touch your hand, then the saddle is "bridging". A bridging saddle confines the rider's weight to the front and back edges of the tree and can really sore a horse.

Minor saddle fitting problems become increasingly major concerns as the rider goes longer distances and spends more time in the saddle. Check for dry spots after riding hard enough for your horse to work up a sweat. Dry spots under the saddle pad indicate saddle pressure severe enough to prevent the sweat glands from functioning. White hairs show up with a new coat from pressure spots that damage the hair follicles. Bald patches or sheared hairs are common over the loins, and also indicate poor saddle fit.

Expect to pay between \$750 and \$2500 for a new saddle suitable for long distance riding. Used saddles will be cheaper, but be sure to check them for hidden damage to the tree. Beware of bargain saddles, as that "bargain" may end up costing you a great deal in vet bills and delays and disappointments in training and competing!

Girths and cinches also come in a wide variety of styles and materials. It usually takes experience to determine what material will work best for your horse without chafing or galling. Neoprene cinches/girths are popular with distance riders. They are designed to be worn slightly loose, and as the horse sweats under the neoprene, it provides a lubricant that allows the neoprene to slide freely over the horse's skin. However, some horses will have skin reactions to neoprene and can develop a rash where it contacts skin. String girths or fleece covered cinches/girths are often used on horses that gall

easily. Natural fibres such as wool are preferred as they dissipate heat better than synthetic materials. Girths and cinches usually run from \$25 to \$100.

Saddle pads are available in a wide range of styles and materials. Pads have two primary functions: 1) to protect the saddle from the horse's sweat, and 2) to protect the horse's back from a saddle that doesn't fit perfectly. However, there is a limit on how far a pad can go to correct a poorly fitting saddle. The pad should extend as little as possible from under the saddle, to allow for maximum cooling. Natural fibre pads are preferred for long distance riding, as they dissipate heat better than synthetic materials, however they are more expensive and require more care. Rubber or rubber-covered gel pads should not be placed directly against your horse's skin, as they hold in heat and can cause scalding. When washing saddle pads, use natural detergents or minimal amounts of soap and be sure to rinse well. Soap residues can cause skin reactions in some horses. Expect to pay from \$50 to \$250 for a well made saddle pad.

Any type of bridle, reins, stirrup leathers and breastcollars can be used on distance horses, but the most popular tack is made with Biothane, a polyurethane-covered nylon webbing. Biothane is almost as pliable as leather and comes in a huge array of colours that can be custom made to suit any rider's tastes. Biothane doesn't crack or peel in heat or cold, never fades, and doesn't absorb sweat. It doesn't rub your horse, as it slips when it is wet. The best thing about Biothane tack, is that you can clean it by throwing it in the washing machine or on the top rack of your dishwasher! Biothane is used to make many different styles of bridles, but a popular style has a built in halter with clips on the cheek pieces that hold the bit. This allows the rider to quickly drop the bit at rest checks to allow the horse to eat and drink comfortably, without having to carry a separate halter. Covered with pebble rubber, Biothane makes excellent reins. Some riders prefer reins made of mountain climbing rope, which is soft, flexible and incredibly strong. This rope is more suitable than Biothane for a tailing rope, as Biothane is too stiff to fold up easily in a saddle bag.

Any style of bit is also acceptable. So as not to discourage horses from eating and drinking whenever possible, many riders prefer bitless bridles: bosals, mechanical hackamores, vosals and sidepulls. Vosals are a cross between a mechanical hackamore and a bosal, that works off of nose and jaw pressure with a scissor action. It can be used with neck or direct reining. A sidepull is basically a halter with rings, and the horse is directed with nose pressure.

Breast collars are frequently used to help keep the saddle from slipping backwards when climbing hills. The "V" shaped breastcollar is preferred, as the horizontal type breastcollar can impinge on the horse's windpipe on steep hills. Running martingales are often used, especially to gain some extra control when your horse is excited at the start of the race. Standing martingales are not used, as they are dangerous if the horse gets into a situation where he must get his head down to save himself, such as when swimming a river. Some riders also use cruppers, a soft padded loop that goes around the tail and attached to the back of the saddle. The crupper prevents the saddle from

sliding forward on low withered horses and mules.

There are several brands of stirrups designed for long distance riding, with a wide base of support for the rider's foot and thick cushioning to disperse the rider's weight over the entire ball of the foot. Some stirrups have a rubber donut or suspensory mechanism at the connection to the stirrup leather to absorb. These types of stirrups typically cost \$75 to \$100. Stirrup cushions are also available with a canvas cover that allows you to wrap them around traditional English or western stirrups. All of these ways of cushioning your feet also help reduce fatigue of your knees and ankles on long rides.

Most endurance and competitive trail riders start into the sport with the tack that they already own. Only lots of miles and wet saddle pads will truly let you know what equipment really fits and holds up with hard use; then you can begin to try the pieces of specialized tack to make long distance riding even more comfortable for both you and your horse.

I. PRELIMINARY CONSIDERATIONS

In conditioning, the ultimate goal is to develop to maximum potential whatever natural athletic ability any given individual possesses. The object of this chapter is to acquaint the reader with the basic principles of conditioning and to suggest some methods and time frames appropriate for preparing a horse for competition in an endurance test.

Science, methodology and time charts are not the whole story, however. Conditioning horses is as much an art form as a science. There is an old saying that “the eye of the master maketh the horse fat.” For our purpose, it is more appropriate to say “the eye of the master maketh the horse fit.” The best trainers concern themselves with more than pulse rates and blood counts, although these things are surely important. The best trainers have developed an intuitive “feel” for how the horse is doing overall. They know whether an individual prefers routine or diversity. They know the difference between the horse being lazy or being bored, between being eager or actually being fearful. They know if the horse likes his work - and if he doesn't they worry about how to get him to like it. “Know your horse” is the best piece of advice you'll probably ever get, although it might be some time before you understand what it means. You should also occasionally ask yourself what your horse thinks of you.

Finally, all the knowledge and intuition in the world won't count for much unless the conditioning program is conscientiously applied. Every one has duties that will sometimes interrupt the schedule, but it is all too easy to let one missed day become two, and for the whole program to become haphazard. If you skip one day you can't make it up by riding twice as hard the next. If you are serious about what you are doing you must maintain your momentum.

Before getting started, the rider should realize that any endurance prospect has a limit to his innate ability, and that this limit might not be sufficient to satisfy the rider's competitive goals. Recognizing this problem and coming to terms with it is perhaps the most difficult thing any horseman will ever do. You can't make a Kentucky Derby winner out of a plow horse, no matter how hard you try. If your goal in endurance riding is to find a companion that can carry you quietly across the miles while you enjoy the beauty of the countryside, your needs will be quite different from the ambitious individual who plans to win next year's national championships.

Decide honestly what you want to do and choose your weapons accordingly.

If you are in satisfactory health, you should consider jogging to improve your own fitness, because when you become fatigued you will not ride as well. Someone who is off balance or tense from pain will adversely affect the performance of the horse, causing him to tighten or twist his back, or compensate in other ways. This added effort accelerates fatigue and increases the likelihood of injury.

Aside from developing your overall fitness, jogging will also acquaint you with how it feels to work hard physically. It gives you a much better empathy with your horse when you are both

undergoing the same remodelling. Lack of time is no excuse for not jogging, because you can run alongside your horse as you warm him up every day. However, just as with the horse, your exercise program should be carefully constructed and implemented. Consult a knowledgeable person to help you get started with a schedule appropriate to your present state of fitness. While it is true that many successful endurance horses have never seen the inside of a schooling arena, and that many successful endurance riders hope never to see one again, there can be no doubt that such work is beneficial if correctly done. joggers often notice that while they get fit from their activity they also tend to get stiff. The same holds true for endurance horses. Elementary schooling in an arena (dressage) is a good way to get the horse to stretch and bend. Specific exercises can also help strengthen specific physical weaknesses, resulting in a horse that is better balanced overall and therefore less prone to injury. Last but not least, it trains the horse to be more disciplined and responsive to your demands.

Teaching your horse to jump a small course of fences can also be beneficial. Like dressage, it helps the horse learn to use his body in different ways and to handle himself better. Besides, you are bound to encounter obstacles on endurance rides from time to time, and if your horse has at least been exposed to the basics, you are less likely to get stranded someday on the wrong side of a log.

II. WHERE TO BEGIN: 0 TO 90 DAYS

Before you begin any conditioning program, be sure your horse has been recently wormed and has his feet in good working order. Assuming he is already broken to ride, and assuming that he is healthy and neither too thin nor obese, you can start by riding 2 or 3 miles at about 5m.p.h.. If you have already been riding the horse on a fairly regular basis for sometime, then you can probably double the beginning mileage.

Most people prefer to work five days a week, allowing two rest days. All of your work for the first two to three months will be slow rarely faster than a canter. Depending on your personal preferences and what is available, you may want to ride trails, make some rounds in a field, or hack, off down a country road. Don't forget to do a certain amount of basic arena schooling. This need not take up your whole days routine, but 20 or 30 minutes twice a week incorporated into the other work will be of great benefit. Concentrate on teaching transitions from one gait to another, prompt (but smooth and calm) reactions to the aids, lateral and longitudinal bending, etc. Offer as much variety as you can in your program. Riding over hills is excellent exercise, requiring somewhat different muscular effort than flat terrain. The more places you can go to work, the better. At these early stages, however, take it easy. Young, unfit horses have neither the balance nor the strength to negotiate difficult terrain well. Be especially conservative as you tackle downhill grades; they are very destructive to juvenile joints.

On days that you add distance to your mileage, compensate by cutting back on the speed you usually travel. On days when you go a little faster than yesterday, cut back on the total mileage. If you go for a tough, hilly ride, don't make it the longest distance your horse has ever attempted. Just use common sense whenever you up the ante.

The most accurate single indicator of condition is the horse's pulse rate, and this is why endurance riders are so preoccupied with their stethoscopes and heart monitors. A necessary first step in learning to condition a horse is in learning to take his pulse. To use your stethoscope (which you can purchase at most drug stores or through your veterinarian), stand on the left side of the horse and put the round flat piece behind and slightly above the elbow. Some individuals are easy to hear; others are more difficult. If you cannot pick up the ticking sound with your horse at rest, exercise him and try again. Exercise will make the beat louder and faster. Most horses will have a resting count of 32 to 44 beats per minute (BPM), but after a short canter it will probably double. As you listen you will hear a "lub-dub" sound. This counts as one beat, i.e., lub-dub, lub-dub, lub-dub, = 3 counts.

Many endurance riders use heart monitors mounted on the horse both when they condition at home and when they compete. These monitors are a costly (\$300 and up) piece of equipment, but they can be very useful. They are a big step up in determining working rates, because by the time you stop your horse, dismount, and get out your stethoscope and watch, the rate will have already dropped significantly. A heart monitor is also essential if you want to do interval training later on.

How quickly the heart rate drops when you stop work reflects the capacity of the horse to perform at that level. No matter what the horse is doing he should be able to recover to the low seventies within ten minutes of the time he finishes his exercise. If he drops to sixty or so within ten minutes after a conditioning ride, it may mean that he has not worked hard enough to produce any cardio-vascular conditioning. However, during a competition, you should expect to recover to the low sixties within ten minutes of coming into a vet check. If it takes you much in excess of 10 minutes to recover to the low seventies on a ride, then you are probably going faster than you should. If you do not recover during a ride within 30 minutes of the time you arrive in a check, you will usually be eliminated. Aside from over-work, a poor recovery can indicate pain from illness or injury. If your horse usually recovers to 68 or 72 within ten minutes of a particular workout, and then one day hangs at 86, you'd better try to determine why.

Don't be unduly alarmed if a poor recovery should pop up on the first spring day that the temperature soars. Winter coats and hot weather make poor bedfellows. Boggy footing is another reason your horse might not recover within the usual time frame. Use common sense to try to get to the bottom of uncharacteristic responses. If a 'poor' recovery cannot be readily attributed to weather, footing or other such variables, it is very likely that you've pushed harder than you should.

When you begin conditioning your horse, you should have at least one place to ride where you know exactly how far you are going. You can measure a spot with a surveyor's wheel (you can rent one from a rent-all), a vehicle, or even rolls of string (use cotton -it is biodegradable.). Experiment and see how long it takes your horse to cover the distance at different gaits. Does he walk at 3 m.p.h.? Does he trot at 8 or 12 m.p.h.? How slowly can he canter? How fast is his hand gallop? You must develop a feel for times and distances so that you can pace yourself in competition. You should also check your horse's pulse reactions at various times. Become so familiar with how they work that you can accurately estimate what the rate will be. It's all part of knowing your horse.

The basic principle in conditioning is called progressive loading. It means systematically exposing the horse to small but steadily increasing levels of demand. Once complete adaptation to a particular level has been achieved, no further training effect can be expected of that level. Only increased demands will result in further progress. Your job each day is to determine how much more difficulty to add, and to recognize when adaptation has been achieved. Keep in mind that while you want to constantly challenge the horse's metabolic upper limits, if you go too far too fast, constructive stress becomes destructive strain. Breakdowns usually occur after a series of strains finally overpowers the body's ability to adapt.

The backbone of any conditioning program is Long Slow Distance (LSD) work. LSD is jogging for horses, involving use of a steady rate of energy expenditure over increasing distances. It is aerobic work, meaning that the body is able to perform at that level without going into oxygen debt. LSD teaches the body to use more oxygen, increasing both its ability to carry it to the cells and also to extract it once it gets there. As training progresses, the maximum rate at which the heart can perform aerobically moves upwards (from below 120 up to about 150 or so). In other words, the fitter the horse becomes, the faster he can go without becoming fatigued. In the beginning, the "S" in LSD will be about 5 m.p.h.. Gradually you will be able to increase this to around 12 mph, depending on your horse. Distances will also increase, starting with two or three miles and moving to 15 or so. Aside from speed and distance, you can increase the difficulty of LSD work by increasing the difficulty of the terrain.

Throughout the first three months of work, the primary objective is to lay down a solid foundation for developing not only the cardiovascular and muscular systems, but also the bony frame (including the tendons, ligaments and cartilage).

All the horse's systems strengthen and thicken in response to progressively increasing demands, but they vary in the speed of their responses. Soft joints, tendons and cartilage are just beginning to respond when the muscles are already up to full power (bony structures take four to five times as long to condition as muscles), so you must make haste slowly. Pushing too hard early in the program is the easiest way to put a quick end to a promising prospect. Just be patient. If your endurance prospect is a fully mature animal, his bones will be less subject to improvement by conditioning than those of the adolescent. However, to some extent, you can still strengthen the elasticity of the joint cartilage, tendons and ligaments through the principle of progressive loading. As with the young horse, figure on roughly ninety days of LSD before you get into more demanding work.

By the end of the third month, if everything has been going well, the maximum mileage you can do at one time might be as high as 20. The maximum speed might be up to 10 mph. A relatively conservative theoretical schedule for the week might be as follows:

Monday: (a) LSD, 6 miles at 8 mph
 (b) arena work, 30 minutes; emphasis on smoothness of transitions, even bending, etc.

Tuesday: Cross country hilly ride of approximately 10 miles (two hours or so)

Wednesday: (a) LSD, 5 miles at 10 mph
(b) 20 minutes of arena work, concentrating on stretching

Thursday: Cross country hilly ride of 12 miles (approximately 2 1/2 hours)

Friday: LSD, 5 miles at 10 mph

Always be on the alert for signs of excessive stress. If a normally eager horse becomes dull, if he goes off his feed or if his stride becomes a little shorter than usual, you should be on full alert. Most horses express how they feel very honestly. Your logical response to these signs is to give a few days off and then come back with more modest demands. Drop back to whatever level of work the horse can comfortably accommodate.

It is very tempting during these first months of rather boring work to convince yourself that it would be just as beneficial to do the recommended amount of mileage, but at a faster than recommended speed. You are strongly cautioned against this, inviting though it might be. Increase distance if you feel that your horse can do more but do not imagine that faster works will serve your long term goals. It must be repeated that joints, tendons and ligaments are very unforgiving of abuse. Once damage has been done, a truly full recovery is unlikely.

III. PHASE TWO: NINETY DAYS TO NINE MONTHS

After two Or three months of long slow distance rides, you can begin to incorporate an occasional day of more strenuous work into your program. The object is to increase the horse's anaerobic threshold, or the point at which his system must go into oxygen debt to perform (pulse of 150 or so). If you train at this level twice a week for 1/2 hour, it will dramatically increase your horse's cardiovascular proficiency.

Start off with easy gallops and gradually increase the level of difficulty by adding to the length and number of repetitions. For example, on the first day you might want to do 2 miles of warm-up, then gallop 1/3 mile. Follow with 2/3 miles of easy canter to allow for partial pulse recovery. Repeat the gallop-canter sequence three more times for a total of four miles. Finish by trotting a mile or two to allow for gradual cooling off. By the end of the month you might have worked up to 6 gallop sets, utilizing the format of 1/2 mile gallops and 1/2 mile canters.

Another term frequently used in sports medicine is 'fartlek'. Roughly translated from Swedish it means 'speed play'. It involves a random assortment of stresses at the anaerobic level (sprints, hill work, galloping), intermixed with periods of aerobic recovery (target pulse = 80). Almost any kind of trail ride or venture across country can be adopted to fartlek conditioning. You can also use these opportunities to expose your horse to as many different types of footing as possible. Trot down a gravel road, canter up a hill, walk down the other side, gallop across a field pick your way through a bog trot down a narrow forest path, etc. Aside from the cardiovascular benefits of this work, you will learn a lot about Your horse's personality. Different individuals have different preferences and talents. Some like to pick their way through the woods; others like

to gallop down long stretches of dirt roads. Some can handle mud but not rocks; others are like mountain goats but hate to get their feet wet. It's part of the fascination of the sport to see what each horse enjoys or dislikes.

As you condition you will simultaneously be training your horse to take natural obstacles, like logs and creeks, in stride. You should also make sure he has been introduced to cattle and other farm animals, as well as to traffic, joggers, dirt bikes, and motorcycles. Riding with an older, quiet companion is the best way to introduce your youngster to the terrors he will encounter once he is away from the security of home.

Towards the end of the first six months of training you can begin to trot and canter down some moderate hills. Go carefully, however, because this type of activity is still very stressful to joints. Practice only until you are comfortable that you and your horse can manage to maintain control. Later on, in competition, you can use this skill to gain ground. Some horses are naturally well balanced and are easily able to scamper down a hill like deer. Others, probably due to conformation, never get very good at it. If your horse doesn't seem to improve with practice, he is probably the latter type. In this case you might as well leave the problem unsolved. Repeated efforts are not likely to make matters better, and may in fact lead to lameness.

As you experiment with times, distances, and training techniques, always bear in mind that it is of no use to have a cardiovascularly fit horse if he is not also a mechanically sound one. The longer and harder you ride, the more careful you must be about watching out for signs that anything out of the ordinary is going on. You should memorize the way your horse's legs feel when you run your hands down them. Is there a small filling there today that wasn't there yesterday? Does one leg feel a little warmer than the others? Do the hooves show signs of unusual stress? Does the stride seem a little choppy or uneven? Is the appetite failing off? Does he play with his companions in the pasture, or is he too tired to bother? Even if you can't point your finger to anything specific, when your "horseman's intuition" tells you something is about to go sour, give your horse and yourself a few days off.

After five or six months of work, a week's schedule might look something like this:

Monday: LSD, 6 miles at 10 mph

Tuesday: 2 hours across country

Wednesday: (a) LSD, 10 miles at 10 mph
(b) 20 minutes arena work; emphasis on figures (10 metre circles, serpentines, etc.)

Thursday: 3 miles at trot, 2 miles at gallop, 1 mile trot, 2 miles gallop, 2 miles trot

Friday: (a) LSD, 5 miles at 10 mph
(b) 20 minutes arena work, emphasis on stretching and bending

Perhaps the best known "new" technique for conditioning at the anaerobic level is called interval

training. Its first proponent was Tom Ivers, who borrowed it from human athletics and adopted it to flat and harness racing. Simply stated, “intervals” are repeated, controlled speed works, separated by slower jogging periods. These periods allow for partial pulse recoveries. The physiological goal for interval training is to stimulate the energy pathways the horse will need for speed competition. It is the repeated raising of the pulse rate past the anaerobic threshold (approximately 150 and up) rather than the length of time that it is maintained that is supposed to achieve the training effect. During the jogging interval the pulse is allowed to return to 100 to 120. It is critical to the program that these intervals are repeated only until a higher relief pulse during the relief phase or a higher working pulse during the work phase signals fatigue. There are three variables that can be utilized to increase difficulty: 1) the speed of each bout, 2) the length of each relief period, and 3) the total number of repetitions.

The beauty of the interval training concept is that the work is tailored specifically to the individual's pulse recoveries, not to a pre-set time or distance.

While extreme bursts of speed are rarely required for endurance riding, there are occasions when anaerobic ability is called for. Interval training has the potential to help with that. The rider should take care, however, not to overdo speed work. He must also be aware that to be effective, interval training requires an on-board heart monitor for precise pulse monitoring.

Experiment with all the tools of conditioning - gallop sets, interval training, fartleks, heart monitors, blood counts, etc. It's fun and fascinating, but it's also very easy to get so wrapped up in charts and monitors that you lose touch with your horse. Be aware of the methods, but be conservative in their use: one day a week of speed work is enough, even with a veteran athlete, and two really strenuous days of work should be separated by a lighter day. No matter where you are in your conditioning program, rely heavily on LSD. Also, once a horse has achieved a certain level of conditioning and started competing, you will be approaching the point at which rest can be more beneficial than more work.

If your horse ever develops a lameness problem, consult a good equine veterinarian. If you question his diagnosis, get a second opinion. Give the horse whatever time off is recommended, and when you resume work, start back gradually. Don't get discouraged when you encounter some “down time”; everyone goes through a certain amount.

Remember to be flexible and imaginative in tailoring a program to your individual horse. Every one is different. Some horses thrive on a heavy work schedule - others can't handle it and don't need it. Some horses don't show much of an aptitude for endurance work at first, but eventually come around and develop into real stars. Remember that the “eye of the trainer” makes all the difference.

Extremes in weather pose special hazards to horses in a strenuous conditioning program, and as such deserve to be noted separately. The effects of a combination of high heat and humidity, especially early in the spring when the body has not yet had a chance to adapt, can be devastating. Even veteran riders are sometimes shocked by the extent to which these factors can influence performance. Any time that the combined temperature and humidity total 150 or more, you

should consider conditions to be dangerous. If you notice that your horse's breathing is becoming very rapid (130 breaths per minute or more), he might be overheating. Take his temperature, and if it is 104 degrees F or more, you'd better quit whatever you are doing. A temperature much above this is getting dangerous, and you should take steps to remedy the situation as fast as possible. Cold water, even ice water, applied to the veins of the legs and neck, is usually an effective course of action.

If you have a horse that is unfit, overweight, heavily muscled or thick bodied, or if he is a "senior citizen", be especially careful when heat stroke season comes around.

Make sure that your horse has an ample supply of water and salt at his disposal at all times, but especially in the hot weather. You may also want to supplement the free choice salt with extra electrolytes in the feed.

The other side of the coin is wet, cold weather, and this also requires some special precautions. Warm up and cool down more carefully under these conditions. When you get back to the barn, if your horse is still steaming, cover him up and walk him dry. Keep in mind that stress from the extremes of conditioning can make the endurance horse more prone to chills and colds. Give him the extra consideration he has earned when the weather is extreme.

After about six months of steady conditioning you should be ready to scout out a fairly undemanding 25 mile competition. The object of the mission will be to see how your horse handles the unfamiliar situation, as well as the distance. You'll want to see how he behaves in company, whether he will eat and drink away from home, etc. Relaxation, even boredom, is your goal. No matter what happens, you must not race or lose your temper. Perhaps your horse is perfectly capable of covering this particular 25 miles in 1 1/2 hours, but that isn't the issue. You are teaching him that endurance riding is a non-threatening situation, that he can trust you to keep him safe, and that it doesn't matter what is going on around him. The ideal scenario is to find someone who plans to go slowly and is on an old veteran endurance horse. Pace with them, and your horse will probably calm down as the day unfolds.

If your horse goes mental at the beginning of the race, you might have to let the herd get out of sight before you even mount up. Once you get started down the trail keep everything as low key and as relaxed as possible. This is not to say that you should dawdle along, however. On the contrary, be businesslike. Aim to keep your horse trotting at a steady rate. Gauge it so that when you arrive at the vet check the horse's pulse will be right on target. If you have been practising at home, you will know just how fast to go to do this. If your horse has not recovered to normal ranges (low 40's) within the rest period, you've been going too fast.

You can expect that things will be a little rough at first. Perhaps your horse will shy at everything in the woods. Perhaps he will whinny at night at camp and keep everybody awake. Perhaps he will refuse to drink any water all day and will view every creek crossing as a threat to his life. Just be patient. Remember that it's all new to him. Give him a chance to understand how you expect him to behave. It may take only a few rides, or it may take a lot, but until you feel like you have the situation under control you should not try to move up to the more taxing 50 milers.

IV. MOVING ON: NINE MONTHS AND UP

After 9 to 12 months of steady conditioning and 3 or 4 novice rides you should probably be able to handle a 50 miler, both physically and emotionally. However, at this point it would be wise not to have any fixed aspirations as to your placing. Be very aware of how your horse feels after he completes a ride; that will be your signal about how soon to do it again and whether you can be more demanding next time.

Somewhere in your second season you can tackle your first hundred miler, and if you finish in good shape you can pat yourself on the back for a job well done. You have now arrived as a real endurance rider and proved your competence as a horseman.

Once you let your horse go out of training at the end of the season, the first thing he will begin to lose is his speed. Studies have shown that this process begins to take place after about the first three weeks. Within about four to six weeks he begins to lose muscle tone, and between three and six months his endurance will have begun to decline.

To bring the horse back into a work program after he has already been fully conditioned at some previous time, you should schedule 30-45 days of LSD for gradually building back up, and another 30-45 for coming back into full performance mode.

Evaluating the Horse's Heart Rate: Part 1: The Stethoscope

by Trish Dowling, DVM

In both endurance racing and competitive trail riding, the horse's heart rate is relied upon by the veterinarian to determine the horse's fitness and physical ability to continue down the trail. To optimize your success in either sport, you need to be familiar with your horse's heart rate and its relationship to his whole cardiovascular function, both at rest and in response to exercise. This article describes how to become proficient with a stethoscope in Part 1, and discusses "on-board" heart rate monitors and the cardiac recovery index in Part 2.

Stethoscopes

If you are planning on becoming a competitive distance rider, you should purchase a good quality stethoscope and become comfortable in auscultating (listening to) the normal heart sounds of horses. A good stethoscope will have comfortable ear pieces angled forward to fit snugly in your ear canals. The tubing may be forked single tubing (Littman™) or double (Sprague Rappaport™), but should be about 12 to 15 inches long. The longer the tubing, the more sound is lost as it travels to your ears. If your stethoscope tubing is longer than 15 inches, I suggest you remove the chest piece and trim the tubing. The chest piece frequently has two sides, a diaphragm side and a bell side. There will be a metal tube that attaches the chestpiece to the tubing, and it will rotate to allow you to listen from the diaphragm or the bell. If it is a single sided stethoscope, it will have a diaphragm. The diaphragm side is used for routine auscultation of the horse's heart. Find a stethoscope that is comfortable to your ears and use it frequently. Inexpensive stethoscopes can be purchased for under \$20, but their sound quality is very poor. A really good stethoscope will cost over \$100; my personal choice is a Littman™ Master Cardiology, made by 3-M Medical Products. Check with your veterinarian or physician for where to purchase one. When trying out your stethoscope, you need to realize that the ear is not equally sensitive to all sound frequencies, and there is considerable variation from person to person. So one person may be able to hear certain heart sounds better than another person. When first learning to auscultate, be sure to start in a quiet environment. Even low background noise can obscure the sounds you are trying to hear.

Auscultating Your Horse

When first learning to auscultate a horse, it will help if you choose a relatively narrow-chested horse and exercise it first to increase the heart rate. The horse's heart is positioned on the left side of his chest, so position yourself on the left side of the horse and have the horse stand with its left foreleg extended forward. Before even trying to listen with your stethoscope, place the palm of your hand on the side of the horse's chest at the level of his elbow and see if you can first feel the heart beating. Move your

hand around until you determine where you feel the heart beats most strongly. On some horses, you may have to push your hand forward between the horse's elbow and the chest wall to find the best spot. Now place the diaphragm of the stethoscope at that point and begin listening to the heart sounds. Your first impression should be that you hear two sounds: "Lup-dup". They should sound close together and come at regular intervals. These are the first and second heart sounds. The first heart sound corresponds to closing of the mitral and tricuspid valves after blood is moved from the horse's atria into the ventricles. The second heart sound corresponds to closing of the pulmonic and aortic valves after the horse's ventricles have contracted and forced blood out into the lungs and the rest of the circulation. Two additional heart sounds can be heard at rest in normal horses. The fourth heart sound is sometimes heard just before the first heart sound, and a third heart sound can sometimes be heard as a soft sound following the second heart sound. The first and second sounds are the most clearly heard and are used to calculate the horse's heart rate, but it's a good skill to be able to hear the other normal sounds. When in doubt about normal versus abnormal heart sounds, ask your veterinarian to check your auscultation findings.

To calculate the heart rate, count pairs of "Lup-dups" starting with the first pair as "zero". Count for 15 seconds, then multiply by four to get the number of heart beats per minute. Practice listening to many horses of different body types so that you can appreciate the differences in heart sounds between normal horses.

Heart Rate in the Resting Horse

In general, the larger the animal, the slower the resting heart rate. The heart rate in the resting horse is usually in the range of 25 to 40 beats per minute (BPM). In comparison, the resting heart rate in humans is about 80 BPM and in cats is often greater than 160 BPM. In human athletes, the resting heart rate decreases with fitness. This has not been found to be true in horses, because of their already slow rates, and one should not evaluate endurance prospects on the basis of a resting heart rate. The normally slow heart rate of the horse is due to strong activity of the vagus nerve. The vagus nerve is part of the parasympathetic nervous system, which is responsible for normal, "housekeeping" functions of the body in a relaxed state. When faced with a "fight or flight" situation, the sympathetic nervous system releases epinephrine (adrenaline), which overrides the vagal tone and can rapidly increase the horse's heart rate to a maximum of 220-240 BPM.

When listening carefully to the resting horse, you may notice that the rhythm of "Lup-dups" speeds up and slows down at regular intervals. This slight change in rhythm is called a "sinus arrhythmia" and is caused by movement of the horse's chest as he breathes and is perfectly normal. Because of the strong activity of the vagus nerve, some fit horses will "drop beats" at rest. What you will hear is "Lup-dup, lup-dup, lup-dup,.....lup-dup, lup-dup, lup-dup". If you listen very carefully, in the pause where you should hear a "Lup-dup" you will hear a very soft fourth heart sound. This "AV block"

rhythm is normal and common in horses with a slow resting heart rate as long as it disappears when the horse's heart rate increases with exercise. Heart diseases will cause several different types of auscultable sounds such as murmurs or clicks, but some sounds can be normal. Have your veterinarian check any unusual heart rhythms or sounds.

After getting to know your horse's normal heart rate at complete rest, evaluate it again as you tack him up for a ride. With the anticipation of a ride, most horses will elevate their heart rates to 48 to 60 BPM. This is close to the recovery heart rate that will be expected during the vet checks of a competition. Get to know what is normal for your horse. Any elevation from his normal "saddled and ready to work" rate should be investigated as a potential sign of stress from overwork from the previous day, or an impending lameness or colic problem.

Heart Rate after Exercise

The dynamics of the horse's heart rate during work will be covered in Part 2 of this article which focuses on the use of on-board heart rate monitors. During training, get to know your horse's normal heart rate recovery after exercise. Take the heart rate with your stethoscope immediately after dismounting and again at 5 and 10 minute intervals. The heart rate will normally drop very rapidly in the first minute after exercise stops, then it decreases more gradually to a resting rate. You should get to know what is normal for your horse for any degree of work. In general, if the horse's heart rate recovers to 60 BPM within 10 minutes of rest, then the horse is fit for this level of stress. If the heart rate is > 72 BPM after 10 minutes of rest, then the horse is either hot or the distance or speed of the work he has just done has exceeded his physical tolerance. During a competition, the rider should increase efforts to cool the horse and use the veterinary examination to make sure the horse is fit to continue the ride. In training, the rider should consider shortening that day's work or decreasing the intensity or speed. If the heart rate recovers to < 52 BPM within 10 minutes, then the horse's work is too easy and will not have had a significant conditioning effect. At the end of a ride or training session, this slow of a heart rate is a desirable sign of an appropriate warm down from exercise.

Heart Rate Recovery During Competition

In competitive distance riding, rides are won by skilfully managing your horse into and out of vet checks. Most rides use a "gate into hold" method of evaluating the condition of the horses. When the rider arrives at the vet check (like entering a "gate"), his time is recorded. Whenever the rider decides that his horse meets the heart rate criteria for continuance on the trail (usually 60-68 BPM), he presents the horse to the Pulse & Respiration team for measuring heart rate and respiration. The horse must meet the criteria within 30 minutes after reaching the check point from the trail, or it is

disqualified and treated if necessary. Very fit horses achieve heart rates below 70 BPM within five minutes of rest. These horses rarely show other significant signs of metabolic fatigue. A recovery of 66 within 20 minutes and 60 within 30 minutes are reasonable expectations. Once the heart rate criteria is met, the “hold” or rest time officially begins. The “gate into a hold” method provides an advantage to the physically fit horses. They recover more quickly and are able to begin the mandatory hold period sooner than less fit horses. Horses are released from the vet checks at a time appropriate to their individual fitness levels and “hyper” horses are prevented from being run into the ground trying to keep up.

Ultimately, your horse’s recovery is determined by his level of fitness, but you can help your horse to recover more quickly to the heart rate criteria. One of the factors that determines the heart rate will be the heat load generated by the working muscles. On a hot horse, the heart rate will stay elevated to pump blood to the skin blood vessels for cooling. Cooling your horse can make a dramatic difference in heart rate recovery. Remove your saddle and take advantage of shade or cooling breezes at the hold site. Keep the horse moving at a slow walk to flush heat and lactic acid from the muscles. Sponge or scoop water on the horse’s neck over the large jugular veins, on his chest and down the insides of the legs where the major blood vessels lie. Heat is transferred to the water layer by conduction, so the water should be promptly removed with a sweat scraper and a new layer of water applied. Repeat this process until the horse’s chest no longer feels hot to the touch. Avoid putting water on the back and muscles of the hindquarters, as rapid cooling can cause these muscles to cramp. Once your horse meets criteria, you have the rest of the hold time to take care of him and yourself and to present to the veterinarian for the rest of the examination to make sure your horse is still fit to continue down the trail.

Evaluating the Horse’s Heart Rate: Part 2: The Heart Rate Monitor

Part one of this article dealt with learning to use a stethoscope during training or while competing in endurance or competitive trail rides. Using a stethoscope does require that you be on the ground with your horse at a standstill. The recent development of inexpensive, yet easy to use on-board HRMs allows riders to evaluate their horse’s heart rate during exercise and competition. Heart rate monitors are a valuable tool for training your horse and managing him through an endurance race or competitive trail ride. A simple and accurate HRM can now be purchased for less than \$150.

The Heart Rate Monitor

The most popular equine heart rate monitors are human ones modified to be used on a horse. The HRM consists of a two electrodes attached by wires to a transmitter that sends a signal to an LCD wristwatch that displays the measured heart rate in beats per minute (BPM). The left electrode is placed just behind the horse’s withers on the left

side, so the electrode is positioned in the area where the stirrup leathers attach to the saddle. Velcro on the back of the electrode patch allows the electrode to stick to the saddle pad and stay in place. The right electrode is attached to the girth on the right side with a Velcro band so that it is positioned just below the right elbow. The transmitter can be placed in a pouch that attaches to the breast collar or D-rings of the saddle. To get good contact of the electrodes in order to pick up the electrical signals of the heart, the horse's skin must be wet with sweat or an electrode paste or aloe vera gel. In winter, it helps to shave the hair in the area where the electrodes are positioned to get good contact. Contact can be lost if the girth loosens during the ride, and should be checked if the HRM readings become erratic. (See photos)

When the electrodes are properly positioned to pick up the heart beats, the transmitter sends heart rate readings to the wristwatch every 6 to 10 seconds. With sudden changes in heart rate (like climbing a hill), there will be a few seconds lag time for the wristwatch to display the current rate. The transmitter can send a signal up to 3 feet, so the wristwatch is usually worn on the right wrist, so that you can still get accurate readings while leading your horse on foot. The most simple HRM's only display the heart rate. More expensive models have features such as time/date, stopwatch, light for night riding, and programs that download to a computer for analysis of the horse's heart rate over the whole exercise period.

The Working Heart Rate

With exercise, the HR quickly increases to supply the horse's muscles with oxygen and nutrients and to remove metabolic wastes. With extreme exertion, increasing the HR allows the horse to increase the output of blood from the heart sixfold. For conditioning the long distance horse, you predominantly want to maintain your horse's working HR at less than 160 BPM. This is considered the aerobic range, where the muscles most efficiently use oxygen. At a HR greater than 160 BPM, the muscles begin to work anaerobically, no longer using oxygen efficiently and producing lactic acid. As the lactic acid is produced faster than it can be neutralized, it causes muscle fatigue. Some anaerobic work periods should be included in your horse's training to prepare him for the demands of hills or sprints to the finish line.

You need to use your HRM consistently during training and competition in order to know what is normal for your horse and how his cardiovascular fitness changes with conditioning. Remember, a horse's resting HR does not change with increasing fitness, but his working HR will decrease for a given level of exercise and his HR recovery will become faster. So when your horse is unfit, he may cover a given terrain and distance with a working HR of 120-150 BPM, but as his fitness increases, you will find that he can perform the same work with a HR of 90-110 BPM. Some horses work at a higher HR than others, so you need to compare your horse only to himself, not to other horses. Each horse finds a certain working HR at which his muscles most efficiently propel him down the trail. The lower this HR, the less oxygen the horse consumes to

fuel muscles and the less energy is expended.

The development of the on-board HRM allowed riders to fully appreciate the effect of gait on the working HR. In the early days of distance riding, most of the trail was covered at the trot because it was thought to be the most cardiovascularly efficient gait, and safest, as two legs are on the ground at any time. However, when riders began using HRM monitors, they noticed that many horses' HRs easily climbed to 135-150 BPM at a fast, extended trot, but once they changed to the canter, the HRs dropped back to 115-125 BPM. So competitive riders learn what gaits and speeds are most efficient for a particular horse and plan their ride strategy accordingly. It is not uncommon to see riders cantering for significant portions of the ride.

Using the Heart Rate Monitor in Competition

During competition, you can use the HRM to know when to speed up or slow down. If your HRM reading is unusual or erratic for the work your horse is doing, first make sure that the leads and electrodes are properly placed and connected. If nothing is wrong with the HRM, then you need to assess your horse. An unusual increase in HR may be the first warning of an impending lameness, muscle cramp or colic. Check your horse over carefully before deciding to ignore an unusual HRM reading.

If you know from using your HRM how quickly your horse recovers, use the HRM to plan your strategy in reaching pulse criteria at a vet check. It can help you to decide to trot on into the check, or that you will need to walk your horse into the check in order to meet criteria within the time limit. For example, I know that if my horse's HR is 80-90 BPM walking into a vet check, then all I have to do is dismount and sponge cool water on his neck and insides of his legs and he will usually be at pulse criteria. Any higher HR, then I had better allow him to walk a longer distance into the check to allow heat to dissipate from his muscles.

If you don't remove your saddle at the check, you can use the HRM to know that your horse has reached criteria and you can call for an official pulse check. If you remove your tack, you will need to use your stethoscope. In some competitions, if your horse has not reached criteria when you call for the official check, there is an automatic wait time before you can ask for a recheck. Using your stethoscope or a heart rate monitor will save you precious time in during a competition and can help you manage your horse to improve your chance of winning!

Chapter 7: Trailering

The basics of good trailering are not complicated, but only too frequently they are overlooked. One of the realities of endurance riding is that you must frequently haul your horse long distances to competitions, so you should have a good understanding of how to make travel as safe as possible for your horse and yourself. Beyond that, because of the extremely stressful nature of the sport, it is vital for optimum performance that the horse arrives in camp as fresh as possible for the start of the ride, and that he is not subjected to unnecessary trauma and discomfort on the trip home.

(It has been suggested that trailering is the equivalent of a fast paced walk for the horse. So, 6 hours of trailering is the equivalent of six hours of walking. Studies have demonstrated significant weight loss during trailering - up to 50 pounds over 10 hours. Some pundits suggest one day of rest prior to competition for every 10 to 12 hours of trailer time.)

During the trip, one of the most important things to consider is ventilation. If the weather is cold, the doors and windows should be closed, and only the vents open to allow for air circulation. In hot weather it is absolutely imperative to have enough air flow to keep heat from building inside the vehicle. No matter how expensive or attractive your trailer is, unless it has a design that allows for ample movement of air, it is unsuitable for your horse. A hot trailer is inhumane and potentially even life threatening.

Thick rubber floor matting is also an important consideration. Most trailers do not have a system of shock absorbers, and thick matting can serve to alleviate concussion. In addition, heavy mats do not roll up and slide around on the floor like thin ones can, and they therefore provide much more secure footing. It may also be a good idea to bed the trailer down in straw or shavings if your horse is unwilling to urinate on a bare floor mat.

(Watch the lining of the walls. Some linings are screwed on. If the lining gets pulled loose, the screws can cut the horses' legs like a knife.)

Take care that your trailer allows your horse enough room to be comfortable. He should be able to stand without having his face jammed into the front of the vehicle, and without having to have his tail crammed up against the back door. Since most rides take place during the fly season, either put a fly sheet on him or be sure he has room to use his tail to brush them away. Keeping the trailer sprayed will also help control this problem. When you hang up a hay net in the trailer, don't stuff it so full that it takes all his head room away.

(Be careful with hay nets. Horses can get their feet tangled in them if they are hung too low. Mesh hay bags work very well as they let small particles and dust out, but will not cause entanglement like hay nets.)

During the trip it is very important to get your horse off the trailer from time to time. Many people feel that it is best to unload every four hours or so. During these breaks the horse should

be watered, walked, allowed to graze and relieve himself, and trotted a few times in hand. Horses frequently will not drink while on the trailer, and especially in hot weather, water loss can have serious consequences. Also, many horses will not urinate in the trailer, resulting in discomfort and unnecessary stress. Another reason for getting the horse off is the accumulation of detritus in his airways. A horse must lower his head below the level of his shoulders to cough and clear his throat, and he may not be able to do that in the trailer. Regular breaks are especially important for poor haulers, giving them a chance to relax tense muscles and stretch a little.

Since many of your breaks are likely to be at rest areas on the interstate, there are some points of etiquette that you should keep in mind so that you will avoid getting in trouble with the public in general and the highway patrol in particular. First, try to get off to yourself to unload. Sometimes people will want to come over to talk and look at the horse, and frequently children will be anxious to pet him. Be polite, but assume that they are unfamiliar with equine behaviour, and remember that you are responsible if they should get stepped on, kicked, etc.

As you water your horse and walk him around, stay away from the picnic area or anywhere that the grass is kept mowed. Dump any leftover water down a drain or around shrubbery. Once you have re-loaded, be sure you shovel up any manure and hay.

Many KOA's allow you to stay overnight with a horse and this is truly a privilege you should not jeopardize. By all means be considerate. The manager will show you where you can park and you must follow his directions to the letter. Don't assume that the other campers like your horse as much as you do. Be especially thorough in cleaning up manure and spreading out any piles of leftover hay. Give the area a good dousing with fly spray before you leave.

(Local Chambers of Commerce, automobile associations, and various campgrounds can assist you en route to find "horse camping" spots. There are books available on horse camping, and software packages for travel that can assist you to locate information. In the western US, most small communities have rodeo grounds with stalls and camping facilities. They can usually be located through the Chamber offices, or at local service stations. Large truck stops are used as stops by a number of riders as they often have water, grass and an area to exercise the horses.)

Since unloading and re-loading during trips is often done in frightening surroundings, it is imperative that the horse be well schooled in this before being taken away from home. He should step right up into the trailer when asked, with no fuss, every time. The effort spent on this will be well worth it and should not be neglected.

Leg wraps or shipping boots are good ways of protecting your horse during trips. If using wraps, however, be sure to put cotton quilting underneath them; otherwise they might be so tight that they cause circulation impairment. Also, be sure to cover the coronary band, as horses frequently step on themselves in this area.

To tie or not to tie the head - this depends. Some horses trailer so well they don't need it; others require restraint, especially when there are two travelling together. However, if you should have an accident, the horse is more likely to be hurt if he is tied. Always use a 'panic snap' on the rope

and a safety breakaway or leather halter. Get in the habit of always releasing the horse's head before opening the trailer doors. A horse that starts to back out only to hit the end of the rope can panic and be seriously hurt. Conversely, always latch the door before tying the horse when you load.

(Some horse trailer vehicle combinations are not totally stable when horses are able to move about. Wide track trailers are more stable than narrow trailers. Be aware of the capability of your vehicle and trailer before starting out on long trips.)

If your horse is a poor hauler, constantly having trouble keeping his balance, you should experiment to see if you can't improve the situation. Many horses can't seem to keep their footing in a two horse trailer with a partition. If you travel alone you might try taking the partition out or fastening the end of it over to the side. This gives the horse an opportunity to spread his legs out so that he can brace himself, especially on turns. Even if you are trailering with two horses, as long as they are compatible, you might be better off without the partition. Given a free choice, horses will usually stand kitty-cornered (*often facing rearwards. Many European trailers actually provide for rear facing loading.*), perhaps because it allows them a little more room. They also enjoy being able to see out, just as you do. Many horses travel better in a stock trailer than in the confines of a two horse trailer or van. Do whatever it takes to make your horse a happy traveller, even if it means getting a new trailer or remodelling the old one.

Another important consideration in safe trailering is good driving habits. Because of the physics involved in a towed vehicle, a trailer sways more than the truck pulling it and consequently puts more lateral force on the occupants - like 'cracking the whip'. Moreover, since the horse can't anticipate stops, starts, or turns, he is likely to get off balance. Perhaps the worst jolt you can give him is not slowing down for dips going into driveways or gas stations. If you've never ridden in a moving trailer, try it some- time. It can really open your eyes.

If your horse has to constantly fight to keep his feet and brace himself against repeated jostling, he'll arrive at the ride already used up. Taking an hour or so longer on the road may therefore make a lot of difference in his performance. Likewise, when you go home, you can turn an already tired horse into an exhausted and sick one unless you are careful. The key to good trailer driving is to anticipate, start and stop smoothly, slow down gradually before sharp curves, and enter driveways with caution. Watch well up ahead and practice defensive driving.

Regardless of how well you drive, there is always the possibility that you could have an accident. It is therefore a good idea to be prepared. Be sure to carry the tools you might need to break open a damaged door. Carry a long, stout rope that can be tied to the horse to pull him free. Take along an emergency vet kit, including some injectable tranquillizer. Be sure you know how to use it. Finally, always carry a fire extinguisher. Most people who have travelled extensively with horses have had some misfortune directly related to failure to see about routine maintenance of their trailer. This need not happen to you. Perhaps the most common problem is rotting boards in the floor. Be sure you check this from time to time, especially around the back door and the edges where moisture accumulates. When you have flooring replaced, ask the repairman to leave a space between the boards so water and urine can drain through. Use wood that resists rotting,

oak for example; avoid pine or other softwoods.

Make sure the brakes and lights work every time you get ready to go somewhere. Trailer lights are notoriously unreliable. The trailer hitch should be bolted to the truck frame, not merely attached to the bumper. After a good deal of wear the inside of the hitch can wallow out over the ball to the point where the trailer can jump off. Have this checked regularly by someone who specializes in trailers. Safety chains must be heavy duty to be any real help.

Because trailers often sit for long periods of non use, you may have what looks like a good tire in reality be a dry rotted one. Make sure your tires are in good shape, and always carry a spare. Since flats often occur on the side of the trailer where the horse is riding you might want to make a practice of carrying a single horse on the right side. This means that if you do have a flat, you will be more likely to be changing it on the side of the vehicle that is away from passing traffic.

What kind of vehicle you use to pull your trailer will depend largely on your pocketbook- however, there are some bare minimums you should keep in mind. Be sure your vehicle is heavy enough to pull the weight of your horse and trailer. Full sized trucks equipped with a towing package are usually the best bet, short of a motor home. Extra large cooling systems and heavy duty shocks are necessary features. You should also be sure that your brakes will be adequate to stop the weight you're pulling. Compact trucks and cars are not very satisfactory, even for pulling a light trailer.

(Good trailer brakes properly set up are critical for safe stopping. The trailer brakes should be capable of stopping the vehicle on their own. With the trailer brakes on, the vehicle should not be able to start from a stop.)

You should also pay attention to where the exhaust from your truck goes. Does it spew right into your trailer? Do you think you could run fifty miles after inhaling carbon monoxide for eight hours? You may have to re-route your exhaust pipe if you feel that this is a problem for you. All too often trailering to the ride is something people undertake without the planning or consideration that go into many other aspects of endurance competition. But problems here can jeopardize not only the enjoyment of the weekend but the horse's very life. A little attention to detail here can not only prevent an unpleasant experience for your horse, but will give you an uneventful and happy trip.

Before departing, do a walk around of your trailer. Make sure all the doors are closed and properly latched. In the last few years, there have been several incidents of horses coming out of trailers on the move at highway speeds. There was at least one in Alberta in 2000, and one in the US where a horse jumped out of a trailer after getting untied, turning in a horse trailer, then jumping through the opening between the rear bottom door and the roof of the trailer. Horses have also jumped out the man doors, through feed windows and through front access panels. Check, then double check all possible means of egress. And don't let your horse stick his head out those unbarred feed windows. A passing semi or a sign post could take his head off.

Chapter 8: Camping With Your Horse

I. CAMPING SUPPLIES

Camping with a horse is a little more involved than camping by yourself, but with planning and practice you can devise ways of doing it safely and comfortably.

Facilities at ride camps vary widely. Some camps are set up at commercial stables or state recreation areas with all the amenities, while others are held in open fields with no amenities at all. Unless you know in advance what will be available, it is safest to assume that you will have to provide everything, including drinking water for your horse. Always bring an ample supply of hay, grain and electrolytes with you; it's better to have some left over than to run short.

Be sure to bring along horse blankets, fly sheets, and insect repellents. Some camps are infested with flies and without protection your horse will be miserable. On other occasions, the weather can take a sudden turn for the worse, and without a blanket your horse will be shivering while his blanket is home in the barn.

For many people the camping part of endurance riding is very enjoyable, while for others it is just a necessary inconvenience. The former are likely to put a lot of time and money into outfitting and erecting their ride camp, devising complicated tent arrangements, complete with 'patios' and lounge chairs, picnic tables, barbecue grills, etc. The latter are more likely to sleep in the back seat of their pickup trucks and bring a bologna sandwich. No matter what your preferences, however, you will find that you will require an alarming amount of equipment and supplies to camp with your horse. It's also very likely that you will find yourself forgetting at least one vital item per trip. One practical way of avoiding this aggravation is to make out a checklist of things you will need and then refer to it as you pack up. Rookie campers may want to use Appendix I in this manual as a guide.

There are many ways to keep your horse at a ride. The most obvious and easiest is to simply tie him to the horse trailer but that is by far the poorest method, and definitely not recommended. Trailer tying prevents the horse from moving around much, and almost guarantees filling and crampy muscles by morning. Also, a horse tied to a trailer cannot lie down.

A much better method than trailer tying is a high picket line. This involves the use of a stout rope tied six feet or more off the ground. A steel ring is placed on the rope, and the horse is tied to the ring. This allows the horse to walk the length of the line, which is much more comfortable for him. Feed and water buckets can be hung at each end of the line for safe and easy access. You can tie several horses to one picket line by putting "stoppers" in the rope (short pegs that won't allow the rings to pass) to keep them separated. If you use a picket line, be sure to tie the horse short enough that he doesn't get his legs tangled. Any horse that is tied, whether to a trailer or a picket line, should have some form of emergency release; a "panic snap" or safety halter is very important.

Arguably the safest and most comfortable arrangement is a corral or paddock. Corrals can be made of metal or PVC plastic pipe. These can be transported on the side of the trailer and erected in a few minutes at the campsite. However, they do not allow much room for movement, and unless they're staked down a horse can lift them off the ground. A better choice is an electric fence corral. Such a corral is made by using electrically charged tape, strung on plastic or fibreglass poles. The tape is made of nylon with fine wires woven in to carry the electricity; a battery operated fence charger electrifies the tape. This kind of paddock can be any size or shape desired, can be put up or taken down easily, and allows the horse maximum freedom to move about with the least chance of getting tangled in something. The only drawback is that a panicked horse can run through the electric fence so the paddock might not be secure for animals with this tendency.

(Some people use a corral with electric tape to keep the horses from running through the fences. A new type of trailer tie is available with a steel arm out from the trailer, and appropriately tied, the horse can wander about a bit and lie down.)

II. LOCATING A CAMP SITE

When picking out your camping spot during hot weather, try to anticipate where the sun will be in the afternoon, and look for a shady place. If you're using a paddock, it's ideal if part of the paddock is out in pasture and part in the woods for shade. It's a good idea to find out before you park where the water supply is; it's not fun carrying water buckets a quarter mile back to your camp!

Another consideration, especially if you have a big, heavy rig is getting out again if there is a rainstorm. Many camps turn into a sea of mud after a storm, and if you park at the bottom of a hill you'll need a tractor to tow you out. Parking where you have a dear downhill run back to the road can save you a lot of trouble.

Ride management often ropes off the most desirable areas, to keep people from parking there. They are not being inhospitable, they just need to have central areas with enough open space for ride briefings, vet checks, awards presentations, and the like. They need to reserve space for their workers, too, and they like to keep them together. You must respect these flagged-off areas even if you have to go a little farther to a less desirable spot.

Before parking, locate the finish line and avoid parking close to it. The additional traffic and noise there can be bothersome to you, and is likely to be upsetting to your horse. It is also unwise to set up camp close to the trail, since sometimes in a racing finish, horses will unexpectedly slam on the brakes when they recognize they are going past their living quarters. More than one race has been lost because a horse got "home" before he got to the finish line!

If you have a big rig with a generator, remember that one of the attractions of endurance rides is the peacefulness of camping out in the wilderness. Don't spoil that for everyone around you by running a loud generator at all hours. Few people mind a generator running during the day, but

by the time people are going to bed at night generators should be shut off. If you just can't live without your AC power, park off away from the rest of the camp where you won't bother anybody.

There are many variations on camping styles, and all veteran riders have their own little tricks.

Look around and ask questions; people are eager to help.

Chapter 9: Rider Survival

Most endurance riders are in good physical condition. Those who are not usually eliminate themselves after a few physically demanding rides. However, staying in good condition, especially for the duration of a difficult hundred miler, requires the exercise of common sense. This begins with eating appropriate amounts of carbohydrate loaded foods, and drinking adequate amounts of appropriate fluids to maintain good hydration. Avoid drinking diuretics such as soda pop, coffee and alcohol - plain water is a good choice. Considering that getting lost is always a possibility, anyone requiring medication should carry enough in a secure pocket to last at least 48 hours.

Beyond these usual practices, riders should consider in advance how best to deal with an emergency and take precautions accordingly. If you should become hopelessly lost and/or thrown from your horse, and you have taken no precautions, the consequences could be disastrous. A major problem for such a rider can be hypothermia (subnormal body temperature). In bad weather, at night (especially in the mountains), hypothermia can become critical and even life-threatening.

(Remember, it is easy to become separated from your horse. Keep emergency material in your fanny pack. Emergency supplies on your horse are not much good if your horse has run off.)

One obvious defence against hypothermia is appropriate clothing. Arrange for tie-downs on the saddle by which you can secure most of your clothing, but you should also carry something extra on your body. If you are thrown from your horse and he gets away from you, the extra gear on the saddle isn't going to be very useful. For an underlayer, next to the skin, the rider should wear silk or polypropylene, which you can find at a skiing supply store. Cotton will hold perspiration and just make you colder when the temperature drops. Over your regular clothes, you should wear a warm, lightweight jacket (down is good), and on top of that you should wear something waterproof (such as Gortex). A helmet is not only useful for protecting your head from injury in a fall, it is also waterproof and will help conserve body heat.

In addition to clothing, you can carry a lightweight survival kit attached to your body. It should include a whistle (you can blow for help long after your voice gives out), a large plastic garbage bag (it's waterproof), a mylar blanket (the kind football spectators like to use- it retains heat and yet it is very small and lightweight), a small can of lighter fluid, a box of waterproof matches, a small metal cup (you can heat water in it), and a glow bar (it is much lighter than a flashlight and will last longer). All these items together weigh less than one pound.

Now let's assume that you have been thrown from your horse and that he has gotten away. Although unhurt, you are hopelessly lost. The temperature is dropping fast and it is late at night. You should hang up your glow bar where it can be seen from as far away as possible. Build yourself a fire with your waterproof matches and lighter fluid, and wrap yourself up in all your clothing, your mylar blanket and the garbage bag. Stay wrapped up and stay put. It is easier for rescue teams to find you if you are a stationary target. Also, assuming that you are suffering from some degree of fatigue and fear, it is very unlikely that you will have the presence of mind to

improve your location. You could, in fact, wander farther off course, and in the darkness you could have an accident and become injured. Blow your whistle from time to time: the sharp sound carries for quite a distance. Once it becomes apparent to your pit crew or the ride management that you are seriously overdue at a check, a search party will be sent out to look for you. It is only a matter of time until you are found, but until then you should stay calm, stay in one place, and stay as warm as possible.

I. HAVE REALISTIC EXPECTATIONS

Having realistic expectations simply involves not asking your horse for more than he is able to give safely, either in competition or in training. Some horses are so naturally talented that they can run up front and even finish in first place with only a little conditioning. The problem is that such a horse has not had time for his bones, ligaments, joints, and cartilage to come up to maximum strength. Breakdowns are very common in those individuals whose natural cardiovascular superiority lulls their riders into the false impression of preparedness. Studies suggest that it takes the bony frame four to five times as long to come to full fitness as the muscular system (which takes about 90 days). So, if you want your horse to have the best possible chance of maintaining long term soundness, you will have to give him the required time to develop (see Chapter Six).

Assuming that you have conditioned thoroughly and well at home, you will probably have a very good idea of your horse's capacity to perform in competition, especially if you are an experienced rider. It does not make sense to imagine that your horse can maintain a 10 mph average on a 50 mile ride if he is unable to do 25 miles at that speed at home. Adrenaline and herd instinct may carry him along with the fastest moving group early in the ride, but it is unlikely that these factors will account for much after the first vet check.

II. RIDE YOUR OWN RIDE

“Ride your own ride” has been preached by more people - and gone straight in and out more ears - than any other advice in endurance riding. Time and time again, even the most experienced riders fail to heed this advice, even though they might have frequently given it to others. Every horse is an individual, and each has his own optimum pace. In addition, every horse has some kinds of trail over which he does best, and other kinds of trail where he is not as competitive. If your horse is strong in the hills but does not have a lot of speed, then make your time in the hills. If your horse can maintain a relatively fast pace over flat terrain, then flat terrain is the place to move out. If you have a surefooted, flexible horse that can fly through a narrow, twisting woods trail, make sure you're first in line going into the woods.

By knowing your own horse's capabilities, his strengths and weaknesses, and by pacing to take maximum advantage of the strength while minimizing the penalties of his weaknesses, you can finish much better than by just following the leader. If you want to ride with others because its more fun than riding alone, choose companions who are going at a pace within your horse's capabilities.

III. KEEP ENERGY EXPENDITURE CONSTANT

Keep energy expenditure constant during the ride. This is one of the most important keys to success, and one another one that is often violated. To understand why this is so important, you need to know something of how a horse's muscles work. Simply stated, there are two types of energy production, aerobic and anaerobic. In aerobic metabolism, enough oxygen is delivered continuously to the muscles for the complete burning of carbohydrates (glycogen), free fatty acids and triglycerides. The maximum pulse rate at which a fit horse can work aerobically is in the range of 150 beats per minute. Aerobic work can continue for long periods with little or no need to rest. Anaerobic metabolism comes into the picture when the fit horse works hard enough to produce a pulse rate over 150 or so (in the unfit horse, the cross over into anaerobic metabolism will come at a lower pulse. See Chapter Six). Work of this nature depends on stored muscle enzymes to burn glycogen fuel. Because oxygen is not fully utilized, waste products like lactic acid accumulate rapidly and the body tires quickly. Anaerobic metabolism, as you can easily deduce, is a wasteful way to use the "fuel" your horse has in his tank. Your job is to set your cruise control at the optimum aerobic level and keep it there.

The maximum speed at which your horse can run aerobically varies with the elevation, grade, footing conditions and weather. You must go more slowly uphill, even on a gentle grade; the steeper the grade, the more slowly you must ride to maintain constant energy expenditure. Even though horses commonly prefer to rush up a steep hill, you as the rider must insist on a slower pace. You might even need to get off and lead up very steep grades to keep your horse within the aerobic boundary.

Don't be lulled into not adjusting your speed for a long gentle climb. If you run yourself, you know how failing to slow down a little for a slight grade can take its toll. It is a common mistake for endurance riders not to compensate for a long gradual incline, so be sure to look ahead and pay attention.

Trail conditions also affect the energy requirements. A rocky winding trail takes more energy than a straight smooth trail. Soft footing takes more energy than firm footing, with deep sand and mud the most tiring of all. Going too fast in deep footing also risks serious injury, particularly late in the ride when the horse is already quite fatigued.

Watch the trail ahead, evaluate its effect on your horse, and adjust your speed accordingly. The only time in the entire ride your horse should run anaerobically is in the sprint to the finish line. If you are fortunate enough to have a heart monitor you will be able to more accurately evaluate your horse's stress level. However, to use a monitor wisely takes practice and knowledge of your horse - you can't ride only by the numbers from a book.

IV. LISTEN TO YOUR HORSE

This brings us to the last rule; namely, listen to your horse. A good horseman doesn't necessarily need any special equipment to know how things are going, because the horse communicates in many ways. As horses tire, their strides will generally shorten and they will cover less ground at the same gait. They often stumble more, and recover with less agility (one reason tired horses are more prone to injury). There could be attitude changes, although some horses are so competitive that they will run aggressively until they drop, while others will act tired when there is plenty left in the tank. Common attitude changes include less willingness to respond to the rider's aids and reduced desire to keep up with the other horses (resulting in the need to constantly urge the horse on).

There are other more subtle signs of fatigue that you must learn to interpret, and this is where intimate knowledge of the personality and habits of the individual horse are important. For example, if your horse normally drinks water before the first vet check and then one day fails to do so, you should be on your guard. If your horse is normally eager and then for no apparent reason suddenly loses interest in the contest, he is probably in pain or discomfort of some sort. If a normally pleasant horse turns crabby and ill-tempered, there must be an explanation somewhere. It's up to you to be able to interpret your horse's 'language'.

By listening to your horse you will probably be able to avoid letting a borderline problem become serious. Usually you can re-group, slow your pace, and complete the ride safely. However, if you have reached the point at which your horse has lost interest in his surroundings or has stopped eating or drinking, he is already dangerously fatigued and could be in need of veterinary attention (see Chapter Twelve).

Your job as a horseman is to select an endurance candidate whose talents suit him for the job at hand, train him conscientiously and well, and ride sensibly according to the rules outlined above. There is never any guarantee in long distance competition and bad luck strikes even the most caring and competent riders. However, if you let common sense and compassion be your guides when technical knowledge or experience fail you, you should have little trouble finishing your endurance day with a smile and a healthy horse.

Chapter 11: Pit Crewing

Although some riders take great pride in their ability to perform 'solo', most prefer to have the help of a pit crew. The crew can consist of one or more people, usually family members or friends. The crew assists the rider in many ways over the course of the event, primarily, he takes over the care of the horse at the vet checks, leaving the rider free to see to his own personal needs. The pit crew's job can be quite casual if the rider's goal is a nonchalant scenic tour of the countryside. On the other hand, for a competitive rider in a difficult race, the pit crew can easily make all the difference in the outcome.

For the novice pit crew, the easiest way to learn the trade is to find out who the most successful riders are, watch what their crews do, and ask a lot of questions. Word gets around quickly about who has the best crews. Offer to help one of these a few times. Most would love to have an extra hand.

The difficulty of the pit crewing job can be vastly complicated if the ride is a hundred miler where all the checks are scattered over a mountain range and up virtually impassable, rutted out, dry creek beds that pass, more or less, for roads. Its even more challenging if there is no water, if none of the 'roads' have names, if there are no gas stations for the next hundred miles, and if the ride management forgot to do the vet check maps. Like endurance riders, pit crews must cultivate an unorthodox sense of humour to survive. With any luck the novice crew will have as a first mission, a fifty miler where all the checks are in camp.

I. PRE RIDE CARE

The pit crew's day begins with the pre-ride feeding for the horse. To get the maximum benefit, this should be done four hours prior to the start of the ride. If the competition begins at 6:00 am, this means the feeding is at 2:00 am! In practice, horses are often fed about two hours before the ride without apparent ill effects. Naturally the horse should have all the water and hay through the night that he wants, and most people also give a couple tablespoons of electrolytes with the feed (See Chapter Four).

What you will need during the day will depend to some extent on the weather. If it is cold and wet, the horse will need blankets and a rainproof cover. The rider will probably want a full change of clothes (especially dry socks), an extra jacket, and towels. If the weather is hot and dry, you will need water by the barrel. Routinely, you will need a stethoscope, a thermometer, sponges, buckets, electrolytes (and some means of administering them), hay, a halter and lead rope, clean saddle pads, spare tack (in case anything breaks), and lots of drinks and food for the rider. It's also good to have an extra set of horse shoes and the tools required to put them on. Incidentals such as aspirin or Advil, Vaseline (for tack rubs or skin burns) (*udder paste works very well*), duct tape (for all kinds of instant repairs), and tissue will also come in handy. If the ride is a hundred miles, a few flashlights and extra batteries might be necessary. If you are going to have to do a lot of driving during the day to get to the vet checks or to meet your rider at points in between, make

sure you've got a full tank, and that your vehicle is in good working order. The ultimate humiliation for a pit crew is to run out of gas somewhere in the middle of the wilderness.

Most vet checks are run as a gate into a hold. This means that your required hold time does not begin until after your horse has recovered to a pre-specified pulse count, or passed the 'gate'. Usually this count is somewhere between 72 and 64 (*Some times reduces to 60 to 56 to slow things down early on a long ride and protect the horses*). After the horse has had his pulse checked and his time marked on a card, he will proceed to the vets where he will have his metabolic and mechanical fitness to continue evaluated more fully. The rider and crew are then free to do whatever they like until the hold period is over. The duration of the hold time varies-greatly, depending on how many miles have been covered up to that point, the length of the ride, and the weather conditions. Most commonly, the hold time runs between fifteen minutes and one hour.

The flat hold method is still occasionally used rather than the gate hold. Under this plan, everyone is held for the same period of time, regardless of how long it takes the horse to recover to criteria. Because this encourages riders to turn the race into a series of sprints, and because it does not penalize overriding, the flat hold is not encouraged by the AERC.

(See Ride Management Manual for a description of the various types of gates and holds.)

As soon as the race starts and the riders are out of camp, you should begin getting everything ready for the first vet check. You should position all your equipment as closely as possible to the vetting area, but out of the way of the traffic flow. Sometimes it's a bit tricky to get a good spot, and the early bird has the best chance. Don't wait until it's almost time for the horses to be arriving before getting set up. If the day is going to be hot, a shady spot is imperative. Get oriented to which direction the sun is going, and decide where its going to be when the horses come in. Get everything you think you could possibly need and organize it in one place. You don't want to waste your vet check running back and forth to get forgotten items. Set up at least three buckets of water, two for drinking and one for sponging. Have more water handy if the weather is hot, because you're going to be using a lot. Set out a fat flake of hay. Line up your electrolytes, a halter and lead, and the drinks and food you think your rider is most likely to want. Put the stethoscope around your neck or you will probably misplace it, and get a fix on how the vet check is laid out. Where are the in timers, the pulse takers, the vets, and the out timers? Sometimes it takes a while to comprehend the overall picture, as things are not always clearly demarcated. If other horses begin to come in and you don't expect your rider for a while, watch how they are doing. See if you can figure out which vets seem the most competent. This might seem like an odd piece of advice, but the reality of endurance riding is that vets vary widely in their ability. You'll want to go to a good one and stick with him all day if you can.

II. CARE OF THE HORSE DURING THE VET CHECK

As soon as your horse comes in, immediately get his vet card marked with his arrival time and take a pulse. If it's already down to the requirement, say 68, call for your time to be recorded by

the in timer. If the count is pretty close, say 72, and you anticipate that it will reach 68 any second, just keep the stethoscope on him while the rider quietly offers him water. If the pulse is running in the high 70's or 80's, its probably going to take at least a few minutes before it gets down. In this case you should go ahead and take the tack off and start sponging. If the horse is hot, lots of water is the best way to get a pulse down quickly. However, be on guard about using water, especially cold water from a mountain creek or hose, if the day is chilly. Also, some horses are very prone to cramping if they get much water on the muscles of the croup and back. If you know your horse is like this, it's best to blanket these areas and only wet the neck and legs. If the horse takes as much as ten minutes or more to get down, it's a good bet that he's going too fast for his present ability. Your rider needs to know how long the recovery time is and adjust his goals accordingly. A recovery time of around five minutes or less is an indication that the horse is being ridden sensibly. *(Sometimes walking a horse a bit will help the pulse to drop.)*

It is not a good idea to let the horse eat anything until after he gets vetted, as this often causes the pulse to hang. Sometimes it's best to walk him around slowly rather than letting him stand, especially if the pulse is still quite high.

Vets normally aren't concerned about the respiration count; it's the quality of the breathing rather than the rate that is important. A panting horse is preferable to one taking long gasping breaths. Panting could indicate, however, that the horse is over-heating, so a temperature should be taken. Temperatures below 103 degrees are usually considered safe enough for the horse to pass the vetting. A few rides still require a specific respiration count to be met before getting an in time. If you have a horse that pants you are always well advised to call the ride management ahead of time and find out how they intend to handle it (See Chapter Twelve). *(Most of our vets recognize the difference between a 'panting' horse that is getting rid of heat, and a horse that is gasping for breath from over exertion. Rapid shallow breathing is common in many experienced endurance horses and helps to cool the horse.)*

The usual practice at endurance rides is to have your in time written on your vet card as soon as you call. If the pulse timer counts you over the required maximum, say 68, then you may get a penalty of some sort. For example, you may not be allowed to ask for a check for another five minutes. So be sure you are down before you call. If you are sure and you know the timer has miscounted, don't hesitate to ask for a re-check. Most people will accommodate you on this. If they won't do so, you must accept their decision and try again later.

When you call for time, be as close as possible to whoever is going to check you. If you are right on 68 and have to walk more than a few steps, you may be 70 when you get there. Walk slowly and quietly to where you must go, and try to stay away from any commotion. Don't let the horse drop his head to eat, as this could also put him over. Attention to these details can get you a minute or more advantage over someone who isn't so careful, and sometimes this can ultimately be very significant.

After passing the pulse taker, the next step is to present the horse to the vet. Pay careful attention to his remarks, and if he asks you any questions, be completely honest in your answers. Always pass on any comments to your rider. When you get your vet card back, look it over. Usually there

are spaces for all the various metabolic and mechanical factors to be graded. If you notice any low marks, you might want to ask the veterinarian how concerned he is about these conditions. What constitutes a 'C' to one vet might be a 'B' or a 'D-' to another, so it's best to ask if you have any doubts.

Interpreting metabolic conditions is not as easy as counting a pulse or knowing when a horse is lame, but the rider and crew should make it their business to learn as much as they can about it. Sooner or later you will find yourself in a situation where you will need to make your own judgments. In particular you should know if your horse is behaving uncharacteristically. What could normally be a cause for concern in most horses might not be significant with yours, and vice versa (See Chapter Twelve).

The Cardiac Recovery Index, or 'Ridgway Trot' has proven to be a very useful tool for determining when a horse is becoming over-stressed. Its unique value is that it detects problems at their onset, before other indicators register that a danger zone has been crossed.

The CRI is performed as follows. The horse's pulse is taken and the time is noted (for example, pulse--68; time=1:03:07). The horse is then trotted in hand approximately 125 feet (about 45 steps) away from a point and then turned around and trotted back. After 60 seconds have passed from the initial pulse taking, the pulse is re-checked. It should be no higher than the first reading (for example, pulse--68; time=1:04:07). An accurate pulse count is imperative or the test will not be valid. If the pulse has increased the second time it is checked, there is cause for concern. While a four beat per minute increase (68 to 72) is not alarming, as the increase grows so should concern. A 68 to 80 reading, for example, would be fair warning that the horse is in enough distress that continuing the ride would be risky. Generally speaking, if the veterinarian gets a poor CRI reading, he will ask the rider to come back again for a re-check. At that time the CRI would be repeated, and unless it had normalized, the horse would probably be pulled from the ride. The veterinarian would most likely evaluate the horse as a whole before making his decision, but poor metabolic readings or lameness inevitably seem to accompany a poor CRI.

If the veterinarian does not use the CRI, and if you and the rider for some reason feel that your horse is not doing well, you should perform the CRI yourself. Remember that you, not ride personnel, are responsible for your horse's welfare. Rides often must employ veterinarians with little or no experience with endurance competition, and in these cases you are, in reality, almost on your own in evaluating your horse's condition. The CRI is very easy to use, even for the novice, so don't let this important tool be wasted.

(More detailed information on the CRI is contained in the Veterinary Handbook and the Ride Management Handbook.)

Assuming that you have passed the vetting and everything is within normal ranges, you should take your card to have it marked for your out time. Be sure that your watch is synchronized with the official ride time, and that when you get your card back the correct time is entered. Even at the best of rides mistakes are sometimes made, so it pays to check. Make a point of putting your card in the same place all the time, it's very easy to lose it in the rush of getting everything done. If you haven't already done so, you can take the tack off now and give your horse electrolytes. Since there is some debate about value of this practice, it must be explained in some detail. As the

horse sweats, he loses water and electrolytes (sodium, potassium, calcium, magnesium, and chloride). Losses and imbalances commonly result in cramping, and occasionally in colic and tying up. In the most extreme cases, death can result. Supplementation is designed to offset these problems just as drinking fluids Gatorade is designed to help human athletes. Disagreement comes, at least in part, because of the impossibility of determining accurately the horse's needs during the ride. Naturally the dosage depends on the horse's constantly changing metabolic state. Theoretically there is a danger of over-concentration of the salts in the horse's stomach. In such a situation, osmosis would draw precious fluids out of already dehydrated tissues and into the gut, making matters worse. *(Recent studies are clear on the need to provide electrolytes to the endurance horse. Large volumes of fluid and electrolytes are typically lost during the first 25 miles of a ride and never regained. See Ecker et al in electrolyte studies at the Equine Research Centre at Guelph, Ontario. More information on electrolytes is contained in an Appendix III.)*

If the horse is significantly dehydrated and has quit drinking, dosing with electrolytes could certainly be unwise; but when this state has been reached, it is time to withdraw from the ride in any case. Most veterinarians feel that under any other circumstances electrolytes probably do help. Further, many believe that it is dangerous to compete without them, especially in hot and/or humid weather. Even though there is no laboratory on the trail to measure the horse's exact needs, we know that he is losing water and salts. If the process goes on too long, imbalances could reach dangerous proportions. As long as the horse is still drinking, it is very unlikely to overdose by giving a few tablespoons at each check (See Chapter Twelve). *(Note - if the horse is NOT dehydrated, many researchers and vets believe that electrolyting will encourage drinking. This seems to be supported by anecdotal evidence in Alberta.)*

The most common method of administering electrolytes is by dissolving the powdered form with water. The mixture is put in a coke bottle, syringe or other convenient container and the horse is dosed with it. Molasses, applesauce, or other sweet tasting substances can be used instead of water to make it more palatable. For some horses it works best to mix powdered electrolytes with a small handful of feed. Usually it is more acceptable when it is dampened with water. Occasionally a horse will resist all efforts to give him electrolytes, and if he is forced to take them, will promptly sulk and refuse to eat or drink anything else for the remainder of the vet check. With this kind of horse it's best to wait until almost time to go back out on the trail before electrolyting. If the horse has not drunk very well at the check, it is probably best not to electrolyte him. *(Some, including some very high level riders, believe that as long as the horse is not dehydrated, giving a lot of electrolytes will encourage a horse to drink, in addition, they tend to feed a LOT of electrolytes and use yogurt and Malox or "Neigh-Lox" to counter act the action of the heavy salt dose on the horse's stomach. Remember to wash the horse's mouth and lips out after electrolyting to avoid salt burns. Most riders pre-load with electrolytes starting two to three days before a ride. As some people suggest, at worst you will be creating expensive urine, and at best you are ensuring your mount has the salts he needs available to him.)*

~~You can buy commercially prepared paste electrolytes that are more convenient to use, but they are expensive. Also, such products are usually designed for use on horses recently sick from disease. The reason for concern here is that such preparations are intended to correct a state of acidosis, whereas dehydrated endurance horses are in a state of alkalosis. Also, there are no~~

~~indications on the tube of what dosage to use. Again, this would depend on the horse's current state of hydration. General practice is to give one half to one tube at each check.~~

(Today there are many good electrolytes available in many forms. Cost is a significant issue.)

A good procedure for the remainder of the rest period is to adjourn to the nearest patch of green grass and let the horse graze. If there is a creek or pond nearby, the grass along the banks is ideal. Such grass is especially high in moisture content, besides being a rich source of potassium. Particularly on hundred milers, when the horse goes virtually all day and part of the night with little to eat, grass is the best and safest way to keep the intestine working. If no grass is available, dampened hay is a good second choice (see Chapter Four).

(Well soaked beet pulp with a bit of grain and is commonly fed in Alberta, often with some electrolytes added.)

You should check the pulse at least once after the initial vetting to make sure that it is continuing to come down. Ideally, it should return to the 40's before time to go back out, but it's not unusual for some horses to hang in the high 50's or so, especially towards the end of the ride. Anything over the low 60's is a good indication that the horse has done about all he can, so beware of further stressing him. If you vetted out at 64 and you later find that the pulse has gone back up, especially if the increase is marked (72 or higher), it's very likely that you have real trouble brewing. In such a situation you should ask for veterinary help.

The colour and flow of a horse's urine is an important indicator of his condition. Some horses won't urinate until they get off to themselves a little, and usually they prefer to be in tall grass or underbrush of some sort. The power of suggestion can also work wonders, so if your horse hasn't gone yet and you're concerned about it, be on guard for another horse that is urinating and then lead yours to that same spot. Watch especially for unusual colour. Dark amber is probably OK, but coffee colour is not. Port wine colour is caused by the presence of myoglobin and is a result of tissue breakdown associated with cramping and tying up. Under no circumstances should you leave camp if your horse is in this condition. Ask a veterinarian for help (See Chapter Twelve). Be aware that just because your horse is bringing up the rear in an endurance ride, it doesn't necessarily follow that he is under less stress than the others. There is so much variation in ability and conditioning that it can be harder for one individual to do five mph than for another to do fifteen mph. In practice horses running off the pace are just as likely to get into trouble as the leaders.

When it's about five minutes before time to go, tack up and get to the area where the trail leaves camp. Your rider can go as soon as he is released by the out timer. Once he is off, you can clean up the mess you probably made and start getting ready for the next check. If you plan to meet your rider at a road crossing somewhere between checks, get together the things you'll need and allow plenty of time to find the spot. Take a lot of extra water if you have containers, in case you encounter other competitors who might need some. In these cases, it adds to the fun of pit crewing if you share a ride with another crew whose horse is pacing with yours. Sometimes crews combine forces to cover several points where the riders cross roads. For example, one crew can meet riders at point A; another can meet them at point B. One of the attractions of endurance

riding is that participants and crews generally can be relied upon to help each other out, even when it's inconvenient or downright dangerous. Loaning tack, shoeing the competitor's horse, braving the wilderness to retrieve a lost competitor during storm in the middle of a night, sacrificing a placing to help a junior rider finish - it's all part of the endurance riders brother-hood. Hopefully, in our rapidly evolving sport, this is one feature that will not change.

III. PASSING FINISHING CRITERIA

As soon as the horse crosses the finish line, the crew should get the tack off and do the usual routine for getting the pulse down. ~~There is no hurry this time, however, as you have up to an hour to reach criteria.~~ *The horse must reach pulse and respiration criteria within 30 minutes of crossing the finish line or be disqualified.* Also, keep in mind that after any ride, but especially after a hundred miler, you are dealing with a very tired animal. Fatigued, dehydrated muscles are very prone to cramping and chilling especially if the temperature for the horse if the recovery is gradual. Be careful with overusing water, especially cold water. As soon as the pulse is down it's wise to proceed immediately to get your completion exam. Most rides only require the horse to be down to a ~~68~~ 64 pulse and sound at a ~~walk~~ trot to pass. The trend, however, is to require soundness at the trot, and the longer the horse stands around, the more likely he is to become stiff and sore. *(The criteria are out of date. AERC and ERA require the horse to be sound at a trot. The typical pulse rate is 64 at the finish for Endurance. In the Limited distance, this is sometimes reduced to 56 or 60 to discourage racing.)*

IV. BEST CONDITION

If you have finished top ten, you will also be eligible for the Best Condition award, and you will have to present your horse again one hour after finishing (*or some other specified time*). How you deal with your horse during this period can be quite individualized. For example, if your horse has a tendency to cramp, you will want to walk him, massage him, put warm covers on his back and croup, and do whatever else you can to keep him loose. If your horse's pulse hangs until he urinates, and he won't go until he's left alone, you will want to put him in a secluded spot and go away. If your horse overheats easily and the day is hot, you are going to be looking for a lot of water. In short, you must cater to your horse's particular needs, and try to make him as comfortable and happy as possible.

If you don't have any special problems or concerns, the best thing to do is to let the horse wander and graze, just as you did during the checks. Take a few minutes to wash off the trail grime and brush out his mane and tail. Keep water at his disposal and give him a final dose of electrolytes (unless this upsets him, in which case you should postpone it). Provide dampened hay if there is no grass. Dry feed can cause a dehydrated horse to choke. From time to time have him trot to warm him back up a little. It helps if you have schooled your horse at home for trotting out on the line. Not only should he follow willingly on a straight line but also on a circle in both directions. *(Teach your horse to lead from both sides, especially on circles.)*

V. POST RIDE CONSIDERATIONS

After the final vetting, if the pulse has returned to 60 or less, it's time to give the horse some hay and secure him for the night. Electric fence paddocks provide the most comfortable conditions (*some rides do not allow electric fences in case of horses breaking out, especially with blankets on, insulating them from the shock*), as the horse is free to move around, roll or lie down at will. If you must tie him to a picket line, you should go back a few times over the next couple of hours and walk him for ten minutes or so. You should also re-check the pulse at least one more time to make sure all is well. Before going to bed, give the horse his grain. Many people like to make a sloppy bran mash mixed with carrots, apples, and other treats, and the horses seem to love it. Even regular grain mixes can have water added and this also seems to meet with a favourable reaction. Naturally, plenty of water should be constantly available. A dry blanket will help keep the horse comfortable if the weather is chilly or wet. (*Soaked beet pulp is popular, many give extra rations after a ride.*)

If the horse's pulse begins to rise again after his post ride exam, it will be necessary to monitor his condition very carefully. Occasionally horses finish reasonably well only to develop problems later. The first warning sign is a rising pulse, and a vet should be consulted. Early detection and treatment can keep a minor problem from becoming serious.

The morning after the race, you should trot the horse out. Give him at least ten or fifteen minutes of exercise before loading him up for the trip home. Look for any unusual filling or swelling, and in general try to get a fix on how he feels. Notice, for example, whether he ate his breakfast and how his stool looks. You expect an endurance horse to be tired after a ride, but if he looks exhausted you know he's been asked to do too much.

(A horse should be well used, but not 'used up'. - Dr. Dick Barsleau)

VI. TRAILERING HOME

If you have a long trip home, its best to stop every four or five hours and give the horse an opportunity to get out of the trailer and walk around a little. Offer water and give him a few minutes to graze at these stops. If the weather is hot, be sure that the trailer is well ventilated. If you stop at a restaurant to eat, open all the windows and half doors to maximize air flow. By all means park in the shade. If the weather is cold, be sure the horse has a blanket. (*Many horses will drink in the trailer - use a soft rubber feed dish for safety.*)

As you can see, there is much more to pit crewing than carrying a bucket of water. The crew is an integral part of the team, and once you've mastered the trade you will have a job for as long as you like - possibly longer. And what is your return for this undying devotion? You'll get the satisfaction of knowing that the horse likes you a lot better than he likes his rider.

Chapter 12: Veterinary Considerations

Because of the potential for extreme stress that distance riding entails, it is vital that competitions be monitored by veterinarians experienced in this particular athletic pursuit. Their word is final in all matters pertaining to the safety and welfare of the horses. However, while their primary responsibility is to keep risks within reasonable boundaries, they function as much more than policemen or emergency room doctors. They also serve as counsellors and coaches for the riders, helping them to get the best performance from their horses on any given day, and at the same time educating them on how to improve future efforts.

I. PRE-RIDE EXAM

The rider's first experience with the veterinarian will be at the pre-ride exam. This exam is usually performed on the Friday afternoon prior to the Saturday competition. The veterinarian's responsibility at this point is very simply to judge which horses are in satisfactory condition to start and which ones are not. The pre-ride exam is also the time when the vet familiarizes himself with each horse, noting any peculiarities in gait or pre-existing conditions that he feels might become more significant as the ride progresses. From the rider's point of view, the pre-ride exam provides the first impression of the vet's expertise. Ideally, it is a time for the establishment of mutual respect and good will.

Because it is so important for the rider to understand the significance of all the various tests that the vet can perform to determine the horse's condition, this chapter will attempt to explain it all in some detail. Once you understand how things work, it will be possible for you to make sound evaluations of your own when there is no vet around to help you.

At the beginning of the exam, a temperature will be taken. Normal temperatures range from 99 degrees F to 101.5 degrees F, with most horses at 100 degrees F to 100.5 degrees F. Any horse with a significantly elevated temperature will be closely evaluated to determine if that temperature is due to possible illness, or if it is more likely due to recent exercise or some other innocent factor.

The vet will next listen to the heart and lungs with a stethoscope. Most horses have a heart rate of 32 to 44 beats per minute. Anything over 44 would probably be viewed with concern unless the elevated rate could readily be attributed to excitement and 'nerves'. Many horses have some slight irregularities in their heartbeat, and these usually are not significant. Typically, the vet would simply make a note of it on the rider's card, and monitor it for adverse changes during the ride. If the vet detects any congestion in the lungs when he listens to the horse's breathing, he would doubtlessly inform the rider and disqualify the horse.

The hydration of the horse is checked by looking at the mucous membranes, capillary refill time, and skin elasticity. Sometimes horses arrive at camp already significantly dehydrated, and this can give the vet cause for concern. (*See comments under trailering.*) In these cases the rider would

probably be given an opportunity to encourage the horse to drink over the next several hours and then have him checked again. During the course of an endurance ride, even a fit, healthy and fully hydrated horse is bound to undergo a great deal of fluid loss. Starting with one that is already in a deficit would not be safe, particularly if the dehydration were accompanied by other signs of metabolic incompetence. *(Studies show that horses have large fluid losses particularly during the first 25 miles of a ride, then most will start to recover, but they do not normally fully recover. In a study of several hundred horses, only one horse recovered to its pre-ride weight over the course of a 100 mile race and a specified recovery period. A weight loss of 50 to 100 pounds is not unusual.)*

For your part, in order to avoid having the horse arrive in camp in this condition, be sure he always has fresh water at home. On the trip to the ride, offer him a drink at least every four hours. Finally, don't make the mistake of overriding your horse the week before a competition. Always give him two or three days of very light exercise before a ride so that he will arrive at camp rested and at his fighting best - not exhausted from eleventh hour conditioning efforts.

The skin pinch is one method of determining hydration. It is performed by pinching the horse's skin with the thumb and forefinger over the point of the shoulder (not over the neck). In a fully hydrated horse, the skin will pop back immediately. As the horse becomes progressively more dehydrated, the skin will stay puckered up for progressively longer periods.

A capillary refill test is performed by applying thumb pressure to the gums, removing the thumb, and then observing the time it takes for the blanched area to return to the same colour as the surrounding membrane. This test indicates the ability of the heart to replenish its capillary system, and is a very important tool in assessing metabolic condition. Recovery normally takes less than two seconds at the pre-ride exam.

The mucous membranes that are observable are those of the inner eyelids and gums. Pink moist gums indicate proper blood perfusion of the tissue. Variations in normal include paler membranes, or membranes with a yellowish or greyish cast. Frequently the gums and membranes around the eyes do not coincide in colour, with the gums being paler. Changes from the base line are usually significant.

Gut sounds are heard in the flank and abdominal areas. These sounds are perceived as slight, gurgling or rumbling. They will be recorded in the vet book as normal, hyperactive, slight, diminished, or non-existent.

During the pre-ride exam the horse will be observed for tack related sores and palpated for excessive tenderness. Legs should be checked for overt problems, such as filling in the joints or tendons, interference marks, or other swellings suggesting that the horse might suffer harm from competing. Any minor problems will be noted in the vet book and observed through the ride for signs of degeneration. Progressive deterioration could be cause for elimination from the ride. In evaluating soundness, the vet will want to see the horse trot in a straight line ~~and in a circle to both the left and right~~. Grossly lame horses are not permitted to start a ride, but horses with slight irregularities of movement may be allowed to go. In the latter case, the veterinarian would try to determine whether competition would be likely to make matters worse. Horses with tendon,

ligament or joint problems would be poor risks; horses slightly 'off' because of muscle soreness or a cut would probably perform adequately.

In examining horses before the ride, obviously lame or sick ones are readily eliminated. In borderline cases, the vet is likely to let the horse start but keep a close watch on him during the ride. Most distance horses show some degree of wear and tear, and they are able to safely compete in spite of their accumulated liabilities. Endurance vets are aware of this and tend to make allowances.

II. RIDER BRIEFING

The veterinarians's next responsibility before an endurance competition is to conduct a pre-ride briefing. During this briefing he explains how the vet checks will work and what recovery criteria the horse must meet before being allowed to continue. Usually rides require a pulse recovery somewhere between 60 and 68. The vet will specify the length of hold time for the various checks, a consideration which is usually worked out with the management well in advance of the ride. If the vet has any special concerns (bad weather, for example) he will advise the riders accordingly. Finishing criteria will also be explained at the pre-ride briefing, and any questions answered.

III. VET CONTROL DURING THE RIDE

A. Metabolic Factors

During the ride the vet will rely heavily on pulse recovery to assess fitness to continue. As a rule, a fit horse that is being ridden comfortably within its ability to perform will recover very quickly, often within a few minutes, to a heart rate of ~~68~~ 64 or below. All horses not being overridden should recover to ~~68~~ 64 or less within ten minutes. After a 30 minute rest, if the horse has not recovered to whatever pulse that particular ride requires, he will **probably** be eliminated. A more subtle indication of a horse's condition is the quality of the heartbeat. The pulse should be regular and strong, not wandering, faint or erratic. (*In ERA, a horse that does not meet pulse criteria in 30 minutes is disqualified from competition.*)

Respiration rates vary widely depending to some extent on weather conditions. Some horses are 'panthers', and will show elevated breathing rates even at rest when the weather is hot and humid. Panting is not necessarily an indicator of trouble, but temperature should usually be taken on such horses to make sure they are not overheating, and the lungs should be ausculted (listened to with a stethoscope). As long as the temperature is below 103 degrees F, and as long as pulse and other signs of recovery are prompt and progressive, elevated respiration rates are generally not considered a problem. (*As noted previously, most of the vets doing ERA rides understand the difference between a panting horse dissipating heat, and a stressed hard breathing horse gasping for oxygen.*)

All horses at work develop elevated temperatures: 102 degrees F to 103 degrees F is common and expected. However, once the temperature exceeds 105 degrees F there is cause for concern, especially if it fails to drop after the horse has had a chance to rest. Water can be effectively used to help the horse cool. In extreme cases ice water might be employed with good effect. Ice water, however, should be applied only to the large vessels of the neck and legs, as it is likely to cause cramping if used over the croup or back. Most rides require the horse to be no higher than 10,3 degrees F before he goes back out on the trail. *(The Olympics at Atlanta, and the practices of the Australians have shown that cold water can be applied to the large muscles WHEN IT IS HOT without particular concern. However, you do need to take care over long term cooling. Normally the first 20 minutes after arriving at a vet check is not a problem as it typically takes this long for heat to dissipate from deep in the muscles. However, after this length of time, continued cooling can lead to cramping and other problems.)*

Some fit and otherwise competent endurance horses do not regulate heat very well; you will find out very quickly whether yours is one of these. Poor heat tolerance can manifest itself in many unpleasant ways, from cramping to colic or worse. It is a condition inherent in the individual and will probably become more pronounced as he ages. Horses that compete in hot climates, particularly if high humidity is also likely, are especially subject to risk.

The vet will check all the horse's hydration factors at each stop during the ride. You will find that when one of these metabolic indicators is poor, then the others will also be poor. Of all the hydration factors, capillary refill is probably the most significant. Capillary refill time prior to the ride is typically one to two seconds. During the ride, refill time of two seconds or less is ideal, but 2 1/2 to 3 1/2 seconds is usual and expected. A refill time of 5 seconds or more is alarming. Mucous membranes in the fresh horse will usually be pink and moist, although slightly yellow or greyish gums are also sometimes noted. Variations from normal would be a paler, whitish colour indicating inadequate perfusion; a bluish, cyanotic colour suggesting inadequate oxygenation of the blood; or a dark brick red colour suggestive of severe congestion of the membranes, with inadequate movement and oxygenation of the blood within these tissues. The brick red membranes associated with an extremely prolonged capillary refill is cause for great concern, because at this point the body's circulatory system is greatly compromised.

The skin pinch test as an indicator of hydration is usually not considered as important as either the capillary refill time or mucous membrane colour. Generally speaking, however, the skin can be expected to rebound within 3 seconds, even at the end of the ride.

During a ride, especially during a 100 miler when horses go for long periods with little to eat, gut sounds usually diminish. Reduced gut sounds are of little concern in an otherwise fit and alert horse. However, reduced or absent gut sounds, if accompanied by other obvious signs of fatigue or distress, may indicate gut paralysis caused by clinically significant fluid loss and/or electrolyte imbalance.

You must remember that the heat produced by endurance exertion elicits huge amounts of sweat. When percent of humidity and degrees of temperature together total over 150, enormous and even critical amounts of fluids and electrolytes are lost. Hemoconcentration (decrease in the

volume of plasma in relation to the number of red blood cells) reduces perfusion (oxygen and fuel delivery; waste and heat removal) and is the largest contributor to general exhaustion syndrome. Calcium depletion leads to muscle hyperexcitability as evidenced by 'thumps' (synchronous diaphragmatic flutter) and muscle cramps. Potassium depletion leads to weakness and eventually to prostration.

Cramping and accompanying muscle pain generally take two forms. The first is a form still often referred to as 'azoturia' and is usually the more serious. It commonly takes place early and suddenly after the onset of exercise. Its cause is multi-faceted and still poorly understood. It can be related to feed program, hormone balance, mineral and electrolyte balance, or inability to remove lactic acid buildup rapidly enough from the muscles. In extreme cases, the horse will be very reluctant to move, and, if forced, will show great distress. The urine may appear port wine in colour because of the release of myoglobin from damaged muscle cells. If this severe form occurs on the trail, you should send for help and wait where you are for it to arrive. Deep massage of affected muscles is helpful while you are waiting. If your horse urinates at a vet check and you notice that the urine is dark in colour, you should ask a vet to take a look.

The less severe and non-life threatening form of muscle pain exhibits itself as muscle spasms or cramps and is most often noticed in the hind legs. This form usually occurs late in the ride and is commonly triggered by loss of fluid and electrolytes from heavy exertionally induced sweating. Massage, careful replacement of fluids and electrolytes, and rest, will usually take care of the problem. With early recognition and care the horse might be able to continue.

A very useful tool for determining whether or not to let borderline cases out of a vet check is the Cardiac Recovery Index, otherwise known as the CRI or the Ridgway trot. A full and detailed explanation of the CRI is given in Chapter Eleven. Aside from the various tests that can be used to evaluate the condition of the horse, the veterinarian will also use his powers of observation, just as you should. Some degree of dullness in expression and manner, some loss of spring to the gait, and some inattention to the rider's aids, for example, are signs of general fatigue that can be expected. However, when these signs progress to the extreme, disaster can result. Obvious indications of crisis include dark red, congested gums, cold extremities, capillary refill delayed beyond 5 seconds, gasping respiration, pulse persistently above 70, disoriented behaviour, unwillingness to move, obliviousness to pain from insect bites or the rider's aids, and loss of interest in food or water.

B. Mechanical Factors

Just as is the case at the pre-ride exam, an obviously lame horse is readily disqualified at the vet check, while a marginally lame one will require a judgement call. There are occasions when a horse that only takes one or two questionable steps will be eliminated because the vet feels that continuing the ride could cause irreparable damage to the horse (by damaging a tendon or ligament, etc.). On the other hand, a horse that shows a consistent slight limp might be allowed to continue if the lameness were clearly due to a superficial injury, loss of a shoe, or some other temporary and relatively insignificant factor. Any lameness that increases in severity during the ride would be cause for disqualification.

IV. POST RIDE VET EXAM

All horses must pass a post finish line vet check in order to earn a completion. According to AERC rules, all horses should recover to a pulse of no greater than ~~68 to 72 within one hour of finishing the ride.~~ ***(ERA requires that the horses meet the pulse criteria, normally 64 beats per minute, within 30 minutes of completion.)*** They must not have required veterinary treatment and they must be sound at a walk ~~Some rides have stricter criteria, such as requiring the horse to be sound at a trot.~~ AERC recommends that horses be sound enough 'to continue'. In all AERC sanctioned limited distance rides, the horses must recover to a pulse no greater than 60 within 1/2 hour of finishing. *(ERA sometimes sets Limited Distance as low as 56.)* Additionally, novice horses must be judged 'fit to continue.' This means that they must have satisfactory recovery in all metabolic parameters, and they must not have 'an irregularity of gait consistently observable at a walk and/or a trot....' if that 'irregularity is thought to cause pain or threaten the athletic future of the horse'.

V. BEST CONDITION EXAM

The highly coveted Best Condition award is decided according to a formula which takes into account the riding time, weight carried during the ride, and condition as determined by the vet score. Only the first ten horses to finish are eligible for this award. The veterinarian may elect not to give a Best Condition award if he feels there are no horses in good enough shape to deserve it. The weight and time is included to account for the amount of work the horse was required to do. Clearly, a horse that finished a ride in four hours worked harder than one that finished in six. Likewise, one that carried 200 lbs. worked harder than one that carried 120 lbs. The weight/time/vet score formula tries to balance all the factors, but the emphasis is heavily on the veterinary evaluation.

There is a total of 800 points available, that is, a horse who finished first, carrying the heaviest rider, and who received a perfect vet score, would get 800 points. 100 points of this is in the weight category. A horse carrying the most weight automatically gets 100 points. All others get deducted 1/2 point for each pound less than the heaviest rider weighed. For example, if the heaviest rider weighed 230 lbs., that horse would get 100 points in the weight category. If the next heaviest rider weighed 170 lbs., that horse would get 70 points (because he would get $230 - 170 = 60$; $60/2 = 30$; $100 - 30 = 70$).

There are 200 points in the time category. The horse that finishes first gets maximum points. All others get a deduction of 1 point for each minute they finish behind the first horse. For example, if the winner finished in 4 hours he would get 200 points. If the second place horse finished in 4 hours and 30 minutes, he would get 170 points ($200 - 30 = 170$).

The remaining 500 points are in the vet score. The BC form for this section is broken down into two major divisions; namely, standing evaluation and moving evaluation.

The standing evaluation is subdivided into:

1. Recovery 1 to 10 points
2. Hydration 1 to 10 points
3. Lesions Producing Pain/Discomfort 1 to 10 points

The movement evaluation is sub-divided into:

4. Soundness 1 to 10 points
5. Quality of Movement 1 to 10 points

Each of these scores is multiplied by 10, so there is a 100 point maximum in each subdivision. Totals from these 2 divisions are added to weight and time scores to arrive at the final grand total.

Although the weight and time factors are entirely objective, this is not the case for the veterinary evaluation. The degree of subjectivity of this award obviously varies, not only according to the ability of the attending veterinarian to recognize the horse's true metabolic and mechanical condition, but also according to that vet's opinions about which factors are more important and which ones are less so. Having put those cards squarely on the table, let us turn to the Best Condition form and review some of the ways horses logically earn or lose points.

1. Recovery: As you have already learned, the ability of a horse to recover promptly and progressively to a low heart rate is an excellent indicator of both his immediate condition and of his fitness to continue. Thus a horse that could recover to a rate of 56 at the one hour post ride BC check would get a better score than one that recovered to 60. **Further, the AERC Veterinary Committee recommends that the Cardiac Recovery Index (taken either 10 or 15 minutes after crossing the finish line) be used as an adjunct in scoring pulse recovery.** *(Bolding added. ERA recommends this process to assist veterinarians to evaluate the comparative condition of the top ten horses. A horse that has an 'inverted' CRI at the final check is not subject to elimination as it is not 'going on' but comparison of the results will be useful to the veterinarian in evaluating the horses for best condition.)* This measurement is not usually used to eliminate the horse from the rest of the BC exam; however, if the recovery pulse were borderline to start with (for example, if the recovery pulse were 72 in a ride requiring a recovery to 72), and then the CRI were also poor (72-80, for example), many veterinarians would not feel the horse should be considered *(for Best Condition)*. Respiration rate per se is of little value in the scoring. However, evidence of pulmonary congestion or difficulty in breathing is scored heavily against the horse. Body temperature, like respiration, is of limited value in scoring recovery unless it remains over 103 degrees F. at the one hour exam.

2. Hydration: The parameters used to evaluate hydration include mucous membranes, capillary refill, gut sounds, skin rebound and jugular refill. How to evaluate these factors has already been discussed. A fully hydrated horse should receive maximum points and a severely dehydrated one should receive few points, if any. Once again, the vet has the discretion to excuse any horse from BC judging that he finds to be overstressed.

3. Lesions Producing Pain: In determining the horse in best condition at the time of examination, the exhibition of pain is of marked consequence. It is not totally a question of whether the pain is

long or short term, but how much pain the lesion is creating at the time of examination. In the case of BC, the horse is being compared with the other eligible horses, as well as against the standard of a sound and metabolically normal horse. Swellings and/or heat in joints, tendons, ligaments, and backs are considered in this category. Also important are cuts and burns from tack rubs, interference marks and collisions with trail debris. Clearly, damage to bones, ligaments and tendons is extremely significant - although horses with this type of problem would likely be lame and therefore not eligible for consideration in the first place. A back raw from tack rubs or sore from muscle strain, though not life threatening can cause a horse great pain and discomfort and therefore is normally scored strongly against him for purposes of BC. Interference marks can be slight or can be extremely painful. In some cases interference can be so severe as to be crippling. Scratches from close encounters with sticks and stones are not especially significant; on the other hand, deep cuts or collisions so severe that they cause pain and swelling can't be ignored. Different veterinarians are obviously going to attach different clinical significance to some of these items - based on their experiences and philosophies - and thus are going to score differently in this category.

4. Soundness: A lame horse is automatically disqualified from BC consideration, so it may seem odd that this category exists at all. An explanation is in order. For the sake of convenience, equine veterinarians classify lameness into grades. Grade I is the mildest form; grade V is the most extreme.

Grade I is defined as: lameness difficult to observe. Not consistently apparent regardless of whether the horse is circling, going up or down a hill, trotting on a hard surface, etc.

Grade II is defined as: lameness difficult to observe at a walk or trot on a straight line, but consistently apparent under certain circumstances (such as circling etc.).

Grade III is defined as a consistently observable lameness at a trot under all circumstances.

Grade IV is defined as an obvious lameness with marked nodding.

Grade V is defined as: minimal weight bearing on one leg, or inability to move.

Grades III to V are automatically excused from BC judging; Grades I and II usually are not. The 'soundness' score should reflect the significance of the gait impairment as well as the degree of impairment at that moment. A horse that merely has a peculiar way of going may appear slightly 'off', so it is very important for the vet to have made notes, whether mental or otherwise, about how each horse moved at the pre-ride exam.

5. Quality of movement: This category judges the amount of impulsion or 'spring' left in the horse's gait, as well as his willingness to trot in hand. A horse that drags back or needs outside urging to trot will be penalized. It's up to the rider to school the horse to trot out promptly in hand so that he doesn't lose points unnecessarily in this category. The horse should trot freely both in a straight line and in a circle. In judging impulsion, the vet must be able to differentiate between a tired horse and one that is just a poor mover. Once again, he will have to compare the

post-ride trot with the pre-ride trot to arrive at a valid deduction.

VI. CONCLUSION

The object of this chapter has been two-fold. First, it has attempted to enumerate the veterinarian's duties from the pre-ride exam through the Best Condition evaluation. Secondly, it has sought to explain, as specifically as possible, the various metabolic and mechanical factors and their relative importance. As the ultimate guarantor of the horse's safety, it is important that the rider understands these evaluations and takes on the responsibility for learning how to make them himself. Remember, the horse you save may be your own.

Drug Testing in Endurance and Competitive Trail Horses

Trisha Dowling, DVM, MS, Diplomate ACVIM & ACVCP

In the United States and Canada, the rules of endurance and competitive trail rides require that the horses compete entirely on their natural abilities without being influenced by any drug, medication or veterinary treatment. When competing horses are tested, the “no drug” rule means that no traces of a drug or drug metabolite shall be found. Simple confirmation of the presence of any drug is evidence that the rule has been broken. While this is a simple and straightforward policy, drug testing methods are now advanced enough to detect very small amounts of drugs for long periods of time after they have been administered, at concentrations that have no effect on performance.¹ Violations of the drug rule in distance riding are usually due to carelessness or inattention to dose or dosage form, misunderstanding of the directions or not waiting a suitable “withdrawal time” before entering a horse in a competition. It is extremely rare in these sports for a positive drug test to mean that someone intentionally tried to alter the outcome of a race. But with a “no drug” rule, finding a minute amount of a drug in the blood or urine of an endurance or CTR horse is equivalent to saying that anyone who has a minute amount of alcohol in their blood is guilty of drunk driving! While there is no acceptable excuse for finding narcotics, amphetamines or mood-altering drugs only approved for humans in the blood of competing horses, the occasional detection of trace levels of antihistamines, bronchodilators or nonsteroidal anti-inflammatory drugs is much more understandable. Therefore, when a positive drug test result occurs in a ride governed by the American Endurance Ride Conference, AERC rule 13.1 B allows for input of the Veterinary Committee so that disciplinary action can be scaled according to the type and amount of drug detected. Most Canadian distance riding organizations have no mechanism for veterinary input and scaling of the disciplinary action. Obviously, most riders would prefer to avoid positive drug tests. Because of the variability in doses and elimination rates of drugs, horse to horse variation in drug elimination, and the variation in drug testing methods, it is very difficult for veterinarians to give advice to riders as to when it is safe to enter a ride after their horse has been given a drug for an appropriate medical reason. If competitive horses are to receive proper veterinary care, then information on detection times must be available to veterinarians and competitors. This article discusses the reasons for the uncertainty in drug detection times and offers guidance in determining appropriate withdrawal times prior to a competition.

(NOTE - to date, ERA has never had a positive drug test. We hope that this will continue.)

Amount of Drug Given

The amount of a drug given to a horse has a great effect on drug withdrawal time. For some equine medications, the doses are very small yet for others, the amount of drug given is very large. For example, the pain reliever butorphanol is usually dosed at 500 micrograms to a 1000 lb horse, while the dose of phenylbutazone (“bute”) to the same horse would be 3 grams. A milligram is 1/1000th of a gram, and a microgram is 1/1000th of a milligram. Therefore, that’s a six thousand-fold difference in the number of butorphanol molecules injected in to the horse’s

body compared to the number of bute molecules. Obviously, the more molecules of drug given, the easier it is going to be to detect the drug in blood or urine.²

Drug Elimination Rate

Drug elimination is the removal of the drug from the horse's body by all routes. Most drugs are eliminated in the urine by the kidneys, but some drugs may also be eliminated in bile through the intestinal tract and through sweat, tears, saliva and other body secretions. Horses get rid of drugs by halving the drug concentration in their blood at a constant rate over time. For any drug, this is determined by administering a dose of the drug to a test group of horses then taking repeated blood samples. The concentrations of the drug in the blood are measured, and when the concentrations are graphed over time, the drug's "elimination half-life" can be calculated. Figure 1 is an example of the antibiotic oxytetracycline, given intravenously to a horse. The concentration of the drug in the horse's blood is measured and plotted logarithmically over time. The elimination half-life ($t_{1/2}$) is defined as the amount of time it takes for the drug's concentration to decrease by one half. In Figure 1, the concentration of oxytetracycline in the horse's blood decreases by one half every 4 hours, therefore the $t_{1/2}$ of oxytetracycline is 4 hours. This rate of elimination of oxytetracycline stays constant over time until the drug can no longer be measured in the blood. Values for the $t_{1/2}$ of drugs used in horses can be found in veterinary textbooks such as Plumb's *Veterinary Drug Handbook* (3rd Edition, Iowa State University Press, 1999).

The value for $t_{1/2}$ depends on the chemical properties of the drug and the mechanisms that the horse's body uses to get rid of the drug. Values for different drugs can range from minutes for drugs like prostaglandin F₂" (Lutalyse®) to hours for phenylbutazone to days for long-acting tranquilizers like reserpine. In Figure 2, the amount of drug is plotted against the number of half-lives. Note that after 10 $t_{1/2}$'s, 99.9% of the drug has been eliminated from the horse's blood, but it will take about 70 $t_{1/2}$'s to clear all the drug molecules from the body.² In general, the detectability of a drug in a horse depends on the amount of drug administered and the speed at which the horse eliminates the drug. If the drug is administered in gram amounts, such as phenylbutazone, and it has a long $t_{1/2}$, then it will be detectable in blood or urine for a relatively long period of time. On the other hand, if it is administered in milligram or microgram amounts and it has a very short $t_{1/2}$, then it is likely to only be detectable for a short period of time.

Biological Variability Between Horses

One of the major reasons for the difficulty in making drug withdrawal time recommendations is the variability between horses in the way in which each handles a given drug. When a group of horses are dosed with a drug, they spread the drug concentrations out in a peculiarly skewed fashion, with a cluster of levels at the lower end of the distribution, but a longer tail at the higher concentrations. Figure 3 shows the plasma concentrations of 49 horses 24 hours after they all got the same dose of phenylbutazone.² While the majority of horses had blood levels less than 7.25 : g/ml, 4 horses had blood levels between 8.85 and 12.05. So if withdrawal recommendations are made from studies using small numbers of horses, they will tend to miss the horses that contribute

to the high tail of the distribution curve. So be cautious regarding withdrawal recommendations made from studies using small numbers of horses. It appears that you have to test at least 50 horses to get an accurate picture of the skewness of the blood level distribution.

Drug Testing Methodology

Drug testing laboratories in the United States and Canada may be privately owned or government run and predominantly deal with samples from race horses, where there are strong economic incentives to “fixing” the outcome of a race. Depending on the jurisdiction, drug testing protocols may require urine or blood samples. As of July 1, 2000, blood or urine samples from AERC rides in California will be tested at the KL Maddy Equine Analytical Chemistry Laboratory at the University of California. For the rest of the United States, only blood samples are collected and submitted to a private laboratory in Philadelphia. In Canada, blood or urine samples may be collected and are submitted to two government approved private laboratories. For most drugs that are of concern in endurance and competitive trail riding, blood samples are ideal in that they are easily collected and the amount of drug in the blood can be correlated with its effect on performance. Urine testing is a better method to simply determine whether or not a horse has been given a drug, since most drugs are eliminated in the urine, it tends to contain higher levels of drugs for a longer period of time than blood samples. However, urine is slow and difficult to collect from typically dehydrated trail horses and drug levels in urine can not be used to determine if a horse had a blood concentration of drug that was therapeutic or performance altering.²

One of the major problems with a “no drug” policy is that there is no standardization between testing laboratories as to which testing methodology is used and they can arbitrarily start using a more sensitive test.³ In effect, the testing laboratory decides how rigorous the “no drug” policy will be when they select the testing method. Most of the private laboratories utilize thin layer chromatography as their drug screening methodology and confirm positive tests using liquid chromatography-mass spectrophotometry or gas chromatography-mass spectrophotometry.⁴ However, enzyme-linked immunoabsorbent assay (ELISA) tests have been developed for a number of drugs that are frequently abused in racetrack situations.³ When ELISA testing methodology is applied to urine samples, extremely small amounts of drug can be detected long after the other methods would give a negative test. An example of this is screening for the presence of flunixin meglumine (Banamine®). By thin layer chromatography, the detection time of flunixin in urine is 2 days after a typical intravenous dose. If an ELISA test is used, flunixin can be detected in urine for at least 15 days.⁵ Unfortunately, veterinarians and riders are unlikely to know what screening test is being used or may not know that the screening test (and therefore the detection time) has been changed until notified by a client of a drug violation.

Interfering and Naturally Occurring Substances

Depending on the testing laboratory, there are some drugs that are not performance-altering by themselves, but they interfere with the some testing methods. The presence of such an interfering substance will cause the some laboratories to call a “positive”. This is not uniform between testing

laboratories, but the usual interfering substances are dipyrone, sulfa antibiotics, isoxsuprine, thiamine and benzimidazole dewormers (eg, fenbendazole [Panacur®], oxifendazole [Anthelcide EQ]). As stated previously, most of the laboratories are primarily screening for drugs with the potential to alter the outcome of track races, so they use common sense in what they will call as a “positive” and do not concern themselves with dewormers, fly repellents, menthol and nutritional supplements. Riders are often concerned regarding supplements containing yucca, which does contain salicylates similar to salicylic acid (better known as aspirin). Salicylates also occur in some grasses and hays and horse urine naturally contains large quantities of salicylates. In the 1980's the official racing laboratory of Agriculture Canada conducted research trials to establish an accepted concentration limit for salicylic acid in blood and urine.⁶ These standards have been validated and accepted as international thresholds.¹ When fed as directed, yucca supplements are highly unlikely to add enough salicylate to result in a positive test for aspirin.

So What's a Rider to Do?

An endurance rider should always work in conjunction with their veterinarian to provide the best medical care for their horse. Valid medical therapy should never be withheld out of fear of a positive drug test. Common sense and some understanding of the properties of drugs and the limitations of drug testing will help riders and veterinarians to avoid drug rule violations. Before giving any drug to a horse during competition season, the rider and veterinarian should consider the following:

1) What is the total drug dose? Drugs that are given in small amounts (micrograms) will be less likely to cause positive tests than drugs given in larger amounts (milligrams or grams).

2) What is the route of administration of the drug? Drugs will be cleared most quickly after an intravenous injection. Orally administered drugs in horses may bind to hay in the gastrointestinal tract which tends to slow the absorption rate, thereby slowing the elimination rate. Also, horses may spit pastes or granules out into water or feed buckets and consume the drug at a later time. So avoid oral bute or Banamine® products in competitive horses. Injectable phenylbutazone must be given by careful intravenous injection, so usually requires a veterinarian to administer it, but it will be eliminated more quickly and consistently than the oral products. Drugs that are administered by the intramuscular route must be absorbed from the muscle site into the blood stream before they can be eliminated. Drugs like procaine penicillin G, the typical white penicillin product available without a prescription, are formulated to be very slowly absorbed to provide long-acting levels of penicillin. However, the slow absorption of the procaine, which is a local anaesthetic (Novocaine®) causes it to be very slowly eliminated from the horse's body. Positive tests for procaine are very common and the testing laboratory can not determine a positive test that results from the use of the antibiotic preparation from an unethical use of Novocaine® to deaden pain and mask a lameness.

3) What is the elimination half-life ($t_{1/2}$) of the drug? The numerical value for $t_{1/2}$ can be found for most drugs used in horses in veterinary pharmacology text books. Remember that 99.9% of a drug will be gone from the horse's blood in 10 $t_{1/2}$ s, but remember to also consider the total

amount of drug given. Drugs with $t_{1/2}$ values of minutes are cleared very rapidly from the horse's body and usually do not result in much risk of positive drug tests. Try to avoid drugs with values of $t_{1/2}$ of many hours or days. When you can choose between similar drugs for the same purpose, try to pick the drug with the smallest total dose and the shortest elimination half-life. For example, the dose of bute is in grams and the $t_{1/2}$ of bute is 8 hours, while the doses for flunixin (Banamine®) and ketoprofen (Anafen®, Ketofen®) are in milligrams and their $t_{1/2}$'s are an hour.

4) Look for published detection times for drugs. The following table contains drugs that are commonly used for valid medical purposes in competitive horses. Detection limits are published by the Canadian Pari-Mutuel Agency⁶ (last updated in 1994), the Australian Equine Veterinary Association⁷ (1992) and the American Association of Equine Practitioners⁵ (1999). Most of the detection limits have been determined using small numbers of horses, so this information should be used only as a general guide for determining when it is safe to enter a treated horse in endurance competition. Note the extreme variation in some of the reported drug detection limits. This is mainly due to test methods varying between testing laboratories. The Canadian detection times are shorter than some others because the Canadian Pari-Mutuel Agency has made a deliberate effort to limit the sensitivity of their test methods to levels of drug that are performance altering.³ The Canadian detection times may not be valid for testing done in the United States or other countries. A veterinarian should consider the detection time and other information available as well as his/her knowledge of the particular horse's physiology to advise a rider on an appropriate drug withdrawal period prior to a competition. However, all liability for a positive drug test still lies with the rider/owner of the horse. Pharmacologists at the KL Maddy Equine Analytical Chemistry Laboratory in California are happy to advise riders or veterinarians if they have any specific concerns regarding drug withdrawal times (530-752-8700).

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2. Tobin, T. Uncertainty in the "detection times" for drugs in horses. *Equine Veterinary Science*, 6:124-128, 1986.

3. Tobin, T; Harkins, J.D.; & Sams, R.A. Testing for therapeutic medications: analytical/pharmacological relationships and limitations on the sensitivity of testing for certain agents. *Journal of Veterinary Pharmacology and Therapeutics*, 22:220-233, 1999.

4. Blake, JW & Tobin, T. Testing for drugs in horses. *Equine Veterinary Science*, 6:93-97, 1986.

5. Sams, R. Guidelines for drug detection times. The American Association of Equine Practitioners, Lexington, KY, 1999.

6. Canadian Pari-Mutual Agency. Schedule of Drugs. Ottawa, ON, 1994.

7. Australian Equine Veterinary Association, Detection of therapeutic substances in racing horses. Artarmon, NSW, 1992.

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See Separate Table of Drug Detection Times attached or referenced to this document.

Appendix I: Check List of Supplies

See also write up under ERA's "Introduction to Endurance Riding"

The following is mostly from AERC with a few modifications here and there -

People Camping Supplies

Tent	Pickup and Cap	Camper	Motorhome	Fifth Wheel with Living Quarters	Local Tree
Bedding	Lantern	Flashlights	Folding Chairs	Alarm clock	
Drinking Water	Food	Cooler/Ice Chest	Cooking Gear		
Cooking Fuel	Batteries	First Aid Kit	Changes of Clothes	Windbreaker/Jacket	
Extra Windbreaker/Jacket	Sweats Hat	Gloves			
Bandana	Sunscreen	Lip balm	Soap	Towels	
Toothpaste and Toothbrush	Toilet Paper	Tissues		Shaving Gear	
Makeup(;-0)	Beer (eh!)	Guitar		Sense of Humour	

Horse Camping Supplies

Hay	Hay bag	Feed Tub	Grain, supplements	Beet Pulp (if you use it)
Soaking Container		Electrolytes	Syringes for Electrolytes	
Apple Sauce, Molasses, dfkldla	to mix with electrolytes	Salt/Minerals		
Blankets and Coolers	Leg and Tail Wraps	Shipping Boots		
Head Bumper	Rubber Bands and chamois for braiding			
Picket Line, paddock, fence	Tree "huggers"	Garbage Bags		
Rope	More Rope	Horse drinking water	Buckets	
Sponges	Grooming Gear	Shovel, apple picker, rake		
Bulk Water Containers for hauling if necessary				
Insect repellent	Health Certificates and Travel Papers if needed			
Shipping Manifest or Brand Inspection Certificate	as required by law in Alberta			

Horse Vet Supplies

Absorbine	DMSO*	Listerine Mouthwash (Liniment)	Other Liniments
Banamine*	Dipyrone*(for colic)	Prednisone*(excellent for allergic reactions such as bee stings)	
		Gentamycin (sp?) eye powder	
Oral "bute"*	Oral painkiller*	Vet wrap	Bandages
Sterile pads	Nitrofurazone ointment or powder	Dyes Liquid Bandage or equivalent	

Other medical supplies as suggested by various articles on emergency horse care and your veterinarian. Do not use any of the above if you have not studied the application. You may do more harm than good. You should understand that some topical applications of antibiotics slow the healing process, some injections cause huge areas of muscle damage.

** Do not use before final vet check. See the head vet if in doubt before using **any medication**, feed or topical application especially if you do not know the contents. Remember, even chocolate or soda pops can look like a drug in a test.*

Pit Crew Supplies

Bulk water containers	Cooler/ice chest with food and drinks	
Extra buckets	Duct tape and nylon string	Sponges and Towels
Spare Tack	Knife	Horse blankets and coolers
Umbrella (Rain or Sun)	Easyboots	Spare horseshoes
Farrier supplies	Stethoscope and thermometer	Folding chairs
Electrolytes	Toiletries	Flashlight and batteries
Glow sticks	Hay, feed, feed tub, hay bag	Watch with second hand or a stop watch

Tack

Halter and lead rope	Spare halter	Bridle or halter bridle and reins		
Spare bridle and reins		Saddle	Saddle pad	Spare saddle pad
Cinch or girth	Spare cinch or girth		Sponge attached to saddle	
Scoop attached to saddle		Leather strings for repairs - or binder twine		Leather punch
Canteen bag or Pommel bag attached to saddle for electrolytes, duct tape, flashlight, collapsible saw, water bottles, syringe for electrolytes, windbreaker or rain coat, spare knife, and other supplies (grain, horse crunch)				
Breast collar and crupper		Heart Monitor or stethoscope		"Carry an Easyboot or get a sense of humour."

Head lamp if needed and you use one

Rider Supplies

Protective head gear

Layered clothing appropriate to weather conditions. Remember: "If you don't like the weather in Alberta, wait five minutes."

Camel back for liquid supply on long rides

Fanny pack with : Baggies for map and vet card, stethoscope, sun glasses, gloves, emergency kit with mylar blanket, knife, bandages, wound ointment, nylon string, water proof matches, fish hooks, needles, lighter, fire starter, miniature flashlight, glow stick, whistle, safety pins, some high energy food such as a power bar, lip balm, pain killers, hoof pick, arnica, and any other emergency supplies you think appropriate for the distance you will be from civilization.

Note: the mylar blanket in addition to being warm, makes an excellent reflective marker that can be easily spotted from the air. (Been there, done that, bought the t - shirt, see Ya Ha Tinda photos on the ERA Web Site.)

Appendix II: Glossary

Aerobic: A horse's muscular system getting energy from a chemical reaction using oxygen, delivered by the blood. Can continue as long as enough fuel and oxygen are available.

Anaerobic: A horse's muscular system getting energy from a chemical reaction not using oxygen. Used for short burst of high speed, quickly builds up toxins and exhausts the muscles.

Anaerobic threshold: The speed at which a horse's muscular system changes from aerobic to anaerobic reactions; the highest speed he can maintain for a long distance.

Anal Tone: the muscle tone of the anus; loss of anal tone is a sign of fatigue.

Arrival Time: The time a horse and rider physically arrive at a vet check.

Azotouria: see Tying Up.

BC: Best Condition.

Best Condition: an award based on the horse's physical condition as determined by the ride vets, riding time, and weight carried.

Borium: a hard material applied to horseshoes, for greater wear and traction.

Cantle Bag: A storage pack attached to the cantle of the saddle.

Capillary Refill: the time, in seconds, it takes the horse's gum to rectum to a pink color after it has been blanched with thumb pressure.

Cardiac Recovery Index: an metabolic evaluation where the horse's pulse is taken, the horse is trotted out 125 feet and back, and the pulse is taken again exactly one minute from the beginning of the trot. Failure of the pulse to recover to or below the original value is an indication of potential problems.

CRI: Cardiac Recovery Index, explained above.

Crupper: a device attached to the saddle and running under the horse's tail to keep the saddle from sliding forward.

Dehydration: loss of bodily fluids through sweating, without adequate replacement by drinking. An endurance horse on a hot day can lose over 50 pounds of water. Necessary electrolytes are lost, too. Excessive dehydration can be life-threatening.

Easyboot: A temporary, clamp-on "horseshoe."

Electrolytes: Ions of Salts, necessary for bodily functions and lost in the sweat. Excessive loss can cause cramping, "thumps," and even become life threatening. Commonly these are Calcium, Sodium, Potassium, Magnesium, and Chloride.

Elevator: A ride which allows riders starting one distance to change to a longer distance ride upon completion of the shorter.

Endurance Ride: A ride of 50 or more miles length, held over a specified course under strict veterinary control, with no minimum time limit.

Fanny Pack: A storage pack carried around the rider's waist.

Fartlek: speed play, a type of conditioning utilizing randomly mixed speeds and distances.

Fixed Hold: A type of vet check where the horse remains a fixed amount of time between his arrival time and his out time.

Founder: see laminitis.

Gate: A type of vet check where the hold time does not start until the horse reecovers to the set pulse criteria.

Grade I Lameness: a barely discernable lameness seen inconsistently or intermittently while the

horse is being trotted.

Grade II Lameness: a slight, inconsistent lameness that usually is more consistent when the horse is trotted in one direction and is non-existent or almost unobservable when the horse is trotted in other directions.

Grade III Lameness: a consistently observable lameness when trotted in all directions. Normally results in disqualification.

Gut Sounds: the sounds of the intestinal system (random gurgling noises). Often diminishing with fatigue, their total absence can indicate a serious metabolic problem with the horse.

Hold Time: The time a horse and rider must remain in a vet check.

Interval Training: repeated short bursts of high speed interspersed with recovery periods; an advanced conditioning method for horses that already have a solid LSD foundation.

IV: Fluid given intravenously to a sick or dehydrated horse; may contain electrolytes and/or medications.

Laminitis: inflammation of the laminae of the hoof. Extremely painful condition requiring immediate veterinary treatment, as it is life-threatening. Early signs are heat in the hooves and a "tucked up" stance where the horse holds his hind hooves close in under himself and the forefeet out in front.

Limited Distance Ride: A ride of 25 to 35 miles length, held in conjunction with an Endurance ride as a training ride for novice riders and young horses.

LSD: Long Slow Distance, the fundamental conditioning tool.

Novice Ride: See Limited Distance Ride.

Mucous Membranes: the inside of the mouth, eyelids, etc. Their color and moisture are signs of dehydration and fatigue.

Out time: The time a horse and rider are authorized to leave a vet check.

Panting: Rapid, shallow respiration that a horse uses to help cool himself. Not a sign of any problem if the horse's other parameters are good.

Pit Crew: People who assist the rider and help care for the horse.

Post-Finish Vet Check: the vet exam after the finish line; the final exam before a horse qualifies as completing the ride.

Pre-Ride Vet Check: the vet exam before the start of the ride, where the fitness of the horse to compete is determined.

Pulled: Disqualified from the ride; not permitted to continue riding.

P&R: Pulse and Respiration. Although the term P&R is generally used to describe recovery at gates, only the pulse is required to reach a fixed criteria for the hold time to begin. As some horses pant, respiration is evaluated by the vet during the vet exam.

P&R Crew: Ride officials who check the horse's pulse and respiration rates at a vet check.

P&R Time: At gate type vet checks, the time the horse is presented for his exam.

Road Founder: founder (laminitis) caused by concussion, usually from too much high speed on hard surfaces during a ride. May take several days to show up after a ride, and in severe cases is life threatening.

Riding Time: The time from the start of the ride until the horse and rider cross the finish line, excluding the hold times.

Skin Pinch Test: a test for dehydration; pinch a fold of skin between your fingers and note the number of seconds it takes to flatten back out. The longer the time, the greater the dehydration of the horse. Over three to four seconds indicates potentially serious dehydration. To be accurate

on endurance horses, this test should be applied at the point of the shoulder, not up on the neck.

Stop & Go: A gate type vet check with no hold time; as soon as the examination is successfully completed the rider can leave.

Thumps: a rhythmic contraction of the diaphragm muscles, in time with the horse's heartbeat. Caused by electrolyte imbalance.

Timer: Ride official who records arrival and P&R times and clocks riders out of vet checks.

Trot-By: A vet check where the riders ride past at a trot and stop only if asked to do so by a ride official. Vets observe the horses as they pass, primarily for lameness.

Trot-Out: A process where the horse is trotted in hand for inspection by the vets, usually done at vet checks.

Tying Up: A life-threatening condition(azotouria), usually occurring in the first few miles of a ride, where a horse's muscles cramp so badly he can barely move. An emergency requiring immediate veterinary care, and not moving the horse. Not to be confused with cramping, which occurs after many miles of stress.

Vet Check: A checkpoint along the trail where the horses are examined by ride veterinarians to determine their fitness to continue. See Chapter Nine.

The following information is from the Equine Research Centre web page.

The Equine Research Centre at Guelph, Ontario, Canada - www.erc.on.ca

Preventing Dehydration in the Performance Horse

by Gayle Ecker. Excerpt from Focus on Endurance, Equine Research Centre

Replacing the Losses

Ion losses through sweat can generally be readily replenished by a good quality diet for sedentary horses or horses undergoing low level, or short-term work. However, horses in training (and therefore sweating) several days a week, and regularly involved in intense or prolonged activity during competition, may become chronically deficient in electrolytes, because there may not be enough in the feed to replace those losses. Horses involved in long-term, higher intensity work may lose electrolytes at a rapid rate (10 to 15 L of sweat per hour) and the sudden decrease in electrolytes can cause the muscle problems and heat stress injuries.

Ways You Can Help Your Horse

Ways in which chronic and acute losses of electrolytes and fluids may be minimized or eliminated are listed here.

1. During the week, make sure the horse has a high quality diet and add electrolytes only if the horse has been working at intensities and durations causing moderate to high sweat losses. Lower losses are easily replenished by normal amounts of these ions in the feed and hay. Always make sure that the horse has access to a clean salt block. It may be advisable to break the block up into smaller pieces and place these in the grain bin. Some owners have a small container fixed in the stall to hold free-running salt. Excess electrolytes during the week will not be stored up for the event on the weekend and are not advised. Excess electrolytes will be excreted in the urine.
2. One to two hours before the event (or before a long trailer ride), it may be beneficial to give the horse a dose of electrolytes to build up a reservoir in the gut. Do not give electrolytes to a horse that is already dehydrated. A high concentration in the gut may actually pull water from the blood, increasing the dehydration of the body. Attempt to give about four gallons of water before or after the dose, or give the dose in the water if the horse will drink it.

Feeding hay four to five hours before the event may also increase the water in the gut which would be available to the horse when dehydration develops. *(Most ERA riders now feed significant quantities of well soaked beet pulp before and during a ride to assist in water*

retention in the gut. Anecdotal evidence suggests that some horses on a high moisture diet seem to take longer to start drinking during ride, perhaps due to the water available in the gut. Whether this is a good or bad thing is not determinable. As mentioned under selection of an endurance horse, the ones that drink a bit at every stop are preferable to the fickle drinkers, although there are many excellent performers in this latter category.)

3. Do not use electrolyte preparations with glucose or other sugars listed as one of the first few ingredients. The high sugar will cause a surge of glucose in the bloodstream which in turn causes a release of insulin. The insulin causes an uptake of glucose from the blood and could cause the horse to become hypoglycemic while it is exercising. It is important to have a small amount of glucose in the gut as this helps the gastric uptake of sodium and water. It would be better to give small amounts of glucose frequently than to give large amounts at any time as this would avoid the "peaks and valleys" of blood glucose. Also, avoid high fat supplements as this may slow down the absorption of electrolytes in the gut. Fat supplements are beneficial during training as part of the diet, but should not be given during exercise or during rest breaks.

4. Supplement fluids and ions early in an endurance ride or when you know the horse will be needing electrolytes. You may increase the sodium level and the horse may start drinking sooner as a result. If the weather is hot, don't wait until the horse shows signs of dehydration before administering electrolytes. If you wait until the horse "looks" like it

needs electrolytes, it will have some level of dehydration by that time and less blood is available to the gut for normal function. Also, if an electrolyte mix is given without an adequate amount of water (about four gallons), the high concentration of ions may actually pull water into the gut, and this takes more water out of the blood, further dehydrating the horse.

5. For horses experiencing high sweat losses, do not use an electrolyte supplement containing bicarbonate. Generally, due to the sweat loss, the horse is already alkalotic, and the bicarbonate would increase this.

6. Once the event is over, do not stop giving electrolytes. The horse may still be sweating for some time after the event to reduce body temperature. It may be more important to get the electrolytes into the horse after the event. If a horse consumes water only, this can actually "dilute" the blood, further lowering the plasma concentrations. If the horse is already dehydrated and low in potassium due to sweat losses, then this condition can be worsened by feeding the horse large amounts of hay. The hay requires a lot of water for digestive enzymes and will pull water and potassium into the gut, worsening the effects of dehydration. Allow the horse to drink water with ions until satisfied before providing hay and feed, i.e. replace fluids and ions first, then provide the feed.

7. Ensure that you are helping the horse to cool itself. The blood flow is shunted away from the gut to the muscles and skin when the horse is overheated in order to assist with heat loss through sweating. Monitor the rectal temperature of the horse and the vasodilation of the skin to ensure the horse is cooling out. Once the horse is cooled out, there will be more blood available to establish normal blood flow to the gut. The intake of electrolytes assists in the restoration of cell and plasma volume, and this aids in cooling and reduces work of the heart by keeping blood

volume high.

8. Monitor the clinical parameters yourself to help determine if electrolyte solutions are necessary. Ask your veterinarian to teach you to perform skin pinch, capillary and jugular refill and mucous membrane testing as well as listening for gut sounds. These will help you to determine if the horse needs more electrolytes and fluid. If these parameters are not showing an improvement about half an hour after the horse has had fluid and electrolytes, then a second dose of electrolytes may be necessary as long as the horse has had a good drink of water.

9. Encourage higher fluid intake by making up a "slush" or sloppy mash of the feed mixed in with lots of water, and perhaps pieces of apples and carrots. You may want to experiment with different flavours such as apple or orange to see if the horse likes it.

10. Frequent small doses of supplements are preferable to one or two large doses. Make sure the horse has access to water and possibly some electrolytes at least every two hours. The electrolyte powder can be mixed up with water and some apple sauce and squirted into the horse's mouth (open the side of the lip and squirt it to the back of the mouth with the head held up) using a 60 cc syringe with the nib cut off. Tip: 35 mm film canisters make an easy way of measuring and carrying electrolytes as they hold one ounce or approximately 30 grams. Or mix the electrolytes into a sloppy mash which you are using to feed the horse. If a slurry or mash high in electrolytes is used, ensure that as much water is consumed as possible in the one hour preceding and following.

11. If your horse refuses to drink even though you have given it lots of time, you might try putting a tablespoon of salt onto the tongue or into the lip of the horse. The salty taste sometimes causes the horse to start drinking.

If you are new to events which might require supplementation of electrolytes, discuss the needs with your veterinarian and with other riders who have been competing successfully. Their routines will not be exactly what your horse needs, but it gives you a place to start and, by trial and error, you will learn to adjust the dosages to suit the needs of your horse.

The above is from "Focus on Endurance"

A detailed book is available from the Equine Research Centre as noted below:

<http://www.erc.on.ca/focus.htm>

Focus on Endurance I & II

This combined issue is full of practical approaches to preventing problems in competing horses, particularly those in endurance sports such as racing, long distance riding, three-day eventing and driving.

Thermoregulation and Electrolyte Management in the Endurance Horse,
by Dr. Kerry Ridgeway, Equisport Enterprises, CA
Building Endurance Through Nutrition,
by Gayla Pollack-Lipson, Ralston-Purina Nutrition Specialist
Plasma Electrolyte Levels on Endurance Horses at Competition,
by Gayle Ecker, Equine Research Centre
The Vet Check,
by Dr. Art King, Agriculture Canada
Conditioning After a Lay-off,
by Gayle Ecker, Equine Research Centre
The Heart Rate Monitor: A Valuable Addition to the Trainer's Toolbox,
by Jerry R. Gillespie, Kansas State University
Slow Horses: I'm Running as Fast As I Can,
by Gayle Ecker and Dr. Mike Lindinger, University of Guelph
Fast Horses: More Than One Way to Lose!,
by Dr. Mike Lindinger and Gayle Ecker
"Thumpers Et Al": A Selection of Case Studies,
by Dr. Mike Lindinger and Gayle Ecker
Getting Horses Loaded The Smart Way! Methods of Supplementing Fluid and Ions for the
Exercising Equine,
by Gayle Ecker
An Update on Supplementing Fluid and Ion Losses in the Endurance Horse,
by Gayle Ecker

Of interest to many disciplines, Focus on Endurance I & II is now available from the Equine Research Centre.

Focus on Endurance I & II book: \$15.95 plus applicable taxes.

Focus on Endurance I & II audio tapes: \$27.00 each plus applicable taxes.

Focus on Endurance I & II book and audio tapes: \$65.00 plus applicable taxes.

To purchase, visit the ERC's On-line Bookstore or contact the ERC.

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Appendix IV: Detection Time of Drugs
