

2012 Breeding Contract

Indelible Image, ApHC, 654416

Smith Show Horses
3415 14th Str NW
West Fargo, ND 58078
888-801-1685
Mark & Gail Smith (Stallion Owners)

1. **Stallion.** Subject to the other terms and conditions of this Agreement, Stallion Owner will ship Mare Owner named below, semen from the following stallion, Indelible Image for the sole purpose of inseminating mare listed below.
 - 1.1. Stallion: **Indelible Image, ApHC**, Registration Number, **654416**, _____
_____ (mare owners name)
_____ (street address), _____ (city), _____ (state), _____ (zip)
2. **Mare Information**
Registered name of mare: _____
Breed Registry _____, Registration Number, _____ Year foaled: _____
Mare's Sire _____ Mare's Dam _____
Is Mare currently in foal? Yes/No Anticipated foaling date? _____
3. **Mare Owner's Representations and Warranties**
 - 3.1. **Mare's Health and Breeding Soundness.** Mare Owner represents and warrants that except as noted below, Mare is breeding sound and will continue to be in such condition at the time of any and all inseminations pursuant to this Agreement. Mare owner has secured suggested tests for genetic defects.
 - 3.2. **Mare Owner's Use of Semen.** Mare Owner agrees that all semen shipped pursuant to this Agreement shall be used for the sole purpose of inseminating Mare. Mare Owner understands and agrees that other uses, such as inseminating an equine other than Mare, are material breaches of this Agreement and will terminate all rights of Mare Owner and obligations of Stallion Owner under this Agreement, unless stallion owner provides specific changes in writing.
 - 3.3. **Mare Owner must notify Stallion owner** of any required permits needed by the state the Mare owner resides in.
 - 3.4. **Mare Owner's Responsibility to Monitor Mare's Fertility.** Mare Owner understands that it is Mare Owner's sole responsibility to monitor Mare's heat cycles and ovulation and to order shipped semen from Stallion Owner pursuant to Section 6.3.
 - 3.5. **Mare Must Be Inseminated by Licensed Veterinarian or recognized Breeding facility.** Mare Owner understands that Stallion Owner will only ship semen pursuant to this Agreement to a veterinarian licensed to practice in the state where Mare is located or a recognized breeding facility, and insemination of Mare with semen shipped pursuant to this Agreement may only be performed by such person. Mare Owner will be solely responsible for all costs and expenses associated with insemination of Mare.
 - 3.6. **Recommended Pregnancy Testing.** At 14-16 days following each insemination of Mare pursuant to this Agreement, Mare Owner will arrange to have Mare checked for pregnancy. If Mare is determined to be in foal at the initial pregnancy check, Mare Owner should arrange to have Mare checked for pregnancy again at 30 days following the applicable insemination. All such pregnancy testing should be performed via ultrasound by a veterinarian licensed to practice in the state where Mare is located. Mare Owner is solely responsible for all costs and expenses associated with such pregnancy testing.
 - 3.7. **Fertility Testing.** If Mare is not in foal after 3 semen shipments pursuant to this Agreement, Mare Owner agrees to have Mare's reproductive status evaluated by a veterinarian licensed to practice in the state where Mare is located. Mare Owner understands that Stallion Owner is under no obligation to ship any additional semen pursuant to this Agreement until such evaluation is complete and a copy of the veterinarian's report is delivered to Stallion Owner. If Mare is unsuitable for breeding, the conditions of Section 3.8 will apply.
 - 3.8. **Substitutions of Mare.** Mare Owner understands that regardless of the circumstances, Mare Owner may not substitute another equine for Mare pursuant to this Agreement without the advance written permission of Stallion Owner, and it will be in Stallion Owner's sole discretion whether to accept any substitute mare. If Mare becomes unavailable for breeding during the Breeding Season (as defined in Section 6.2) or dies before giving birth to a Live

Foal and Stallion Owner does not approve the substitution of another mare, Stallion Owner will promptly refund the Breeding Fee to Mare Owner (but will not refund the Booking Fee or any shipping fees paid by Mare Owner pursuant to Section 6.5). If Mare Owner does not come up with an acceptable mare to complete the contract, no Breeding Fees will be returned and the contract will be considered completed.

3.9. Embryo Transfers. Mare Owner understands that transfer of any embryo resulting from semen shipped pursuant to this Agreement will require Stallion Owner's advance written permission. Failure to obtain such permission prior to the transfer will void the limited live foal guarantee set forth in Section 9. If embryo transfers result in more than one pregnancy, Mare Owner must pay the Stallion Owner the Booking Fee and the Breeding Fee for each pregnancy.

4. Booking Fee. For this contract to be valid, Mare Owner must deliver a booking fee of \$250.00 (the "Booking Fee"). If Mare Owner fails to deliver the Booking Fee this contract will be null and void. The Booking Fee serves to reserve a breeding for Mare to Stallion and is therefore non-refundable. The Booking Fee will be credited toward the Breeding Fee.

5. Breeding Fee. Mare Owner agrees to pay Stallion Owner a breeding fee of \$750.00 (Breeding Fee). Mare Owner understands and agrees that the Breeding Fee and Booking Fee must be paid in full before Stallion Owner will ship any semen to Mare Owner.

5.1. Multiple and Returning mare discount. A second mare booked in the same year; or a mare returning the year immediately following their initial breeding (current foaling Year) **will receive a \$250 discount.**

6. Semen Collection and Shipping. Upon proper notification from Mare Owner pursuant to Section 6.3, Stallion Owner agrees to use reasonable efforts to collect and ship Stallion's semen to the person specified in Section 12.3.

6.1. Preferred Collection and Shipping Days. Stallion Owner's preferred days for semen collection and shipping are Monday, Wednesday, and Friday. It may be possible to collect on additional days, however, there is no guarantee we will be able to accommodate that request based on availability, schedule of the stallion.

6.2. Breeding Season. Subject to the other specifications in this Section 6, dates available for semen collection and shipping will begin on February 1, 2012 and end on July 1, 2012. (Breeding Season).

6.3. Notice Required for Semen Shipment. When requesting semen collection and shipment,

- Mare Owner must notify the following party no less than 1 day prior to the date that Mare Owner would like a shipment sent.
- Mare Owner must confirm all requests for semen collection and shipment no later than 9:00 a.m. the day of the collection in Stallion Owner's local time zone.
- Mare Owner must provide a valid address for delivery in Section 12.3.

Mare Owner understands that Stallion Owner and manager may not be able honor service requests not made in accordance with the specifications in this section. Only the following methods of requesting semen shipment pursuant to this section will be honored:

Authorized Recipient for Shipment Requests: Gail Smith

Email: smithshowhorses@aol.com

Telephone Number: 888-801-1685 cell

6.4. Delivery Service for Semen Shipments. Stallion Owner offers semen shipment through Fed Ex

6.5. Fees for Collection and Semen Shipping Services. Mare Owner agrees to pay the fees for semen collection and shipping. All fees must be paid in full before Stallion Manager will collect or ship semen.

7. Unavailability of Stallion for Breeding. The following sections shall apply only in the event that Mare is not in foal the first year of breeding or covered in extension of the breeding contract.

7.1. Stallion's Death, Injury or Illness; Poor Semen Quality. In the event that Stallion becomes unavailable for semen collection and shipment due to Stallion's death, injury or illness, or Stallion's semen is of poor quality or otherwise not viable for shipment, Stallion Owner or Manager will promptly notify Mare Owner.

7.2. At Mare Owner's option, Mare Owner may:

- (i) Request semen from the following stallion owned by Stallion Owner, provided that Stallion Owner is still the owner of such stallion at the time of Mare Owner's request:

An Awesome Secret, ApHC, Registry Number 619357,

- (ii) If circumstances apply Mare Owner may request an extension of the breeding contract.

8. Responsibilities upon Birth of Foal.

8.1. Mare Owner's Responsibilities. Promptly upon Mare giving birth, Mare Owner shall notify Stallion Owner of the birth and provide Stallion Owner with such information and documentation as Stallion Owner may request.

8.2. Stallion Owner's Responsibilities. Upon receiving notice from Mare Owner pursuant to Section 8.1 that Mare has given birth to a Live Foal (as defined in Section 9) as a result of Mare's insemination with Stallion's semen pursuant to this Agreement, Stallion Owner will provide Mare Owner with a breeding certificate to register Mare's offspring with the ApHC. Until such time as Mare Owner has fulfilled all of Mare Owner's obligations pursuant to this Agreement, including payment in full of all fees and providing documentation pursuant to Section 8.1, Stallion Owner may refuse to provide documentation required to register Mare's offspring and may alert the appropriate breed registries that Mare's offspring should not be registered.

9. Limited Live Foal Guarantee. If Mare does not give birth to a Live Foal as a result of insemination with Stallion's semen during the Breeding Season, Mare Owner will have the right to request semen shipments for Mare pursuant to Section 6 during the range of dates specified by Stallion Owner in the calendar year following the Breeding Season. A "Live Foal" is a newborn foal that stands and nurses without assistance and lives for a period of 24 hours or more after its birth.

9.1. Mare Owner's Notification Obligations. If Mare aborts during her pregnancy or gives birth to a foal other than a Live Foal, Mare Owner must so notify Stallion Owner within 5 days of such abortion or birth or ASAP and promptly provide Stallion Owner with such documentation as Stallion Owner may request.

9.2. Conditions that Will Void the Live Foal Guarantee. The following conditions will void the limited live foal guarantee set forth in Section 9:

- Stallion becomes unavailable for breeding as described in Section 7, in which case the terms of Section 7 will apply
- Mare Owner's obligations pursuant to Section 9.1 are not fulfilled,
- Mare Owner sells Mare to another party or parties,
- Mare Owner breaches any representations and warranties or fails to fulfill any obligations pursuant to Section 3.
- Mare's failure to give birth to a Live Foal is due to the actions or inactions of Mare Owner, or that of Mare Owner's agents, employees, contractors or family members, including the failure to vaccinate.

10. Payment Terms.

10.1. Acceptable Forms of Payment. All payments due to Stallion Manager must be made pursuant to one of the following methods: Cash, Personal Check, Visa, MasterCard, PayPal, Money Order, Cashiers' Check, Bank account wire transfer

10.2 Changes in Fees. From time to time, Stallion Owner may change the fees set forth upon written notice to Mare Owner. Mare Owner agrees to pay such revised fees within reason.

10.3 Payment Due Dates. Mare Owner must pay the Booking Fee, the balance of the Breeding Fee and all fees due in full before Stallion Manager will collect or ship semen to Mare Owner.

10.4 Penalty for Returned Checks. If any check issued by Mare Owner to Stallion Owner is returned for insufficient funds, Mare Owner must immediately pay Stallion Owner cash in the amount of the check, plus any bank charges that Stallion Owner may incur as a result of the returned check.

11. Mare Owner's Assumption of Risks.

11.1. Stallion Owner Not Responsible for Shipment or Collection Failures. Mare Owner understands that if Mare Owner does not request semen pursuant to the specifications of Section 6 and/or Mare Owner is in breach of, or has failed to fulfill obligations pursuant to, any portion of Section 3, Stallion Manager will not ship semen to Mare Owner. Mare Owner also understands that Stallion Manger may be unable to collect viable semen from Stallion from time to time because of illness or other reasons, and therefore Stallion Owner may be unable to honor one or more particular shipment requests from Mare Owner. When demand for semen shipment exceeds available supply, as may occur from time to time during the busiest times of the Breeding Season, Stallion Owner will honor requests for shipment in the order in which they are received and as a result, Stallion Owner may be unable to honor one or more particular shipment requests from Mare Owner. Stallion Owner will use reasonable efforts to deliver semen shipments in accordance with Mare Owner's requests that comply with the terms of Section 6; however, Stallion

Owner cannot be responsible for delivery failures due to delivery service error, weather, war, acts of God or other circumstances beyond Stallion Owner's control. Mare Owner agrees to hold Stallion Owner, Stallion Owner's agents, employees, shareholders, directors, family members and contractors (collectively, the "Stallion Owner Parties") harmless for any damages, including special and consequential damages, occurring in connection with failure of collection or shipment of semen.

11.2. Stallion Owner Not Responsible for Risks of Breeding Mare. Mare Owner understands that horse breeding is an inherently unpredictable activity, and that despite Stallion Owner's efforts, Mare may not be inseminated or become pregnant. Mare may become pregnant but not give birth, or Mare's foal may be stillborn, have defects or become ill, injured or die. Mare may also suffer injuries, illness or death in connection with insemination, pregnancy or foaling. Mare Owner assumes all such risks and agrees to hold the Stallion Owner Parties harmless for any damages, including special and consequential damages, arising in connection with this Agreement.

11.3. Stallion Owner Not Responsible for Genetic Traits or Conditions. Mare Owner also understands that Mare's offspring may inherit one or more undesirable, unknown genetic traits or conditions from Stallion. This stallion has tested negative for HYPP and carries PSSM n/P1, genetic gene (see attached article). Owner assumes all such risks and agrees to hold the Stallion Owner Parties harmless for any damages, including special and consequential damages, arising in connection with this Agreement.

11.4. Smith Show Horse Satisfaction Guarantee. Although, we are not able to guarantee a foal without genetic defects (currently known and unknown) We will offer a **Satisfaction Guarantee regarding any Genetic Defects identified by DNA attributed to the stallion.** See full attachment below.

12. Contact Information and Notices. Notices given pursuant to this agreement must be in writing to the addresses below and will be delivered via a method that provides evidence of receipt.

12.1. Notice to Stallion Owner. Notice to Stallion Owner must be sent to:

Name: Mark and Gail Smith
Street Address: 3415 14th St NW
City, State, Zip: West Fargo, ND, 58078
Telephone Number: (888) 801-1685

12.2. Notice to Mare Owner. Notice to Mare Owner must be sent to:

Name: _____
Street Address: _____
City, State, Zip: _____
Telephone Number: _____

12.3. Shipping Information for Semen. Semen must be shipped to:

Name: _____
Name of Veterinary Practice: _____
Street Address: _____
City, State, Zip: _____
Telephone Number: _____

12.4. Changes of Address and/or Phone Numbers. Until all obligations under this Agreement are completed, each party shall have the duty to notify the other parties immediately upon a change in address and/or phone numbers. If a party does not provide the other parties with notice of such changes, a notice delivered to the last address given under this Agreement shall be considered proper notice provided that the other conditions of this section have been met.

13. Assignment or Transfer. Except as specified in Section 7.2, no party may assign or transfer this Agreement without the prior written consent of the other parties.

14. Entire Agreement. This Agreement contains the entire agreement among the parties. Any modifications or additions must be in writing and signed by all parties to the Agreement. No oral modifications will be considered part of the Agreement unless reduced to writing and signed by all parties.

15. Governing Law and Venue. This agreement shall be governed by the laws of North Dakota. The parties hereby agree that any legal action under the Agreement must be brought in Cass County, North Dakota.

16. Attorneys' Fees and Other Expenses. In any legal actions brought in connection with this Agreement, the prevailing party(ies) will be entitled to prompt payment of expenses from the other party(ies) following final adjudication in favor of the prevailing party(ies). For the purpose of this Section 16, "expenses" will include the following costs actually incurred by the prevailing party(ies): attorneys' fees, retainers, court costs, transcript costs, fees of experts, witness fees, travel expenses, duplicating costs, printing and binding costs, telephone charges, postage, delivery service fees, and all other disbursements.

Stallion Owner:
Signed: _____
Name (printed): _____
Date: _____

Mare Owner:
Signed: _____
Name (printed): _____
Date: _____

Please include a copy of registration papers.

Collection and Shipping Fees

- Shipping and insurance fee, per Federal Express shipment **\$ 250.00**
- Shipping fees will be collected on the mare owners Credit Card or Fed Ex Number...All fees will be collected before semen is shipped **Actual shipping costs will be paid by mare owner**

On site Breeding

- Board and mare care \$10/day **\$ 300/month**
- Any related Veterinary Bills will be billed directly to the mare owner

**It is our goal to get your mare settled in the most timely manner.
We appreciate your business and we take our commitment to you seriously.**

Thank you for including us in your breeding decision.

Smith Show Horses Breeding Satisfaction Guarantee

In addition to certain guarantees provided by law, Smiths Show Horses guarantees your satisfaction with our breeding services and the resulting foal from either of our stallions, An Awesome Secret or Indelible Image. Because in the current equine market and the new genetic markers discovered through DNA testing and the continued discoveries by Science, and our intent to offer the best breeding service in the industry, if you are not satisfied with your foal due to a genetic defect, we will offer a new breeding to either of our stallions. We not only want you to be satisfied with your baby, we want you to be proud to own it and show it off.

Smith Show Horses Breeding Satisfaction Guarantee Details:

1. If your foal tests positive to any known genetic defect listed below from An Awesome Secret or Indelible Image, simply call us toll-free at (888) 801-1685. All you need to do is provide a test from a recognized lab (Animal Genetics in Florida or The University of Minnesota) made under this guarantee. We encourage you to test early so you will not lose anytime scheduling your current year breeding. After we have received all of the tests on your foal through email or regular mail we will immediately make arrangements get your mare bred as soon as she is ready to breed. Unfortunately, we cannot refund or credit any money for veterinary breeding fees, collection costs, shipping fees, or testing.
2. If you want to exchange the foal for a new breeding, you must let us know your intentions within 60 days of foaling so we can make arrangements for breeding for your mare during the current breeding season. Any price difference between the original contract and current contract will be waived. If it is not possible to return that year the breeding maybe extended to the next year. *See Section 4*
3. Please note that we cannot guarantee the results or outcome of your foal. For instance, we have no control over the mare or the genetic conformation contributed to the foal. As breeders we understand that there are unexpected results the show up from generations of bloodlines contributing to the appearance and genetic make-up of the foal. For that reason we restrict the Satisfaction Guarantee to DNA based genetic testing such as HYPP, PSSM, Herda, GBED or additional DNA discoveries made after signing this contract.
4. Although we feel conformation includes genetically inherited traits, this guarantee is limited to DNA genetic defects that would be unknown without testing. The guarantee is limited to the year immediately following the initial breeding unless subsequent breeding goes beyond the current year breeding season. Any extension to the guarantee must be in writing and signed by the mare owner and Smith Show Horses.
5. We encourage all mare owners to test their mares for any defects they feel could be a problem. We, at Smith Show Horses are dedicated to provide you with a genetically superior foal without defects. Our guarantee only covers DNA based testing satisfaction issues caused by our breeding stallions - not changes to your situation or your mare's contribution to the foal.
6. Any known DNA testing done on the stallions, An Awesome Secret and Indelible Image will be provided to the mare owner before signing any contracts.
7. Other considerations under the Satisfaction Guarantee

Stallion Owner:

Signed: _____
Name (printed): _____
Date: _____

Mare Owner:

Signed: _____
Name (printed): _____
Date: _____

Addendum to the _____ Breeding Contract.

Update: PSSM in Horses

By Kentucky Equine Research Staff • September 29, 2011

Diet and exercise are the foundations of managing a horse with PSSM.

At the 2011 Texas Equine Veterinary Association (TEVA) conference, one of the leading researchers in equine muscle problems, Stephanie Valberg, D.V.M., Ph.D., of the University of Minnesota College of Veterinary Medicine, brought the audience of veterinarians up to date on polysaccharide storage myopathy (PSSM), one cause of tying-up.

What Is Tying-Up?

The most common signs of tying-up are muscle stiffness and cramping, sweating, and reluctance to move. Valberg said about 3% of exercising horses of a variety of breeds are affected.

When tying-up happens on a regular basis, it is termed recurrent exertional rhabdomyolysis (RER or chronic tying-up). RER can be caused by several muscle problems. According to Valberg, three genetically identifiable causes of muscle malfunction are exertional rhabdomyolysis type 1, PSSM type 1, and malignant hyperthermia. She warned that there might be other unrecognized causes of RER.

PSSM

"While some horses sporadically develop exertional muscle damage as a result of nutritional, training, or environmental factors, others develop RER in spite of a sound diet and environment," noted Valberg. "Many of these chronic cases are due to an intrinsic and inherited dysfunction of muscle metabolism or muscle contraction."

In 1992, Valberg first reported PSSM as a distinct muscle disease in horses. Her reports were based on finding abnormal polysaccharide in skeletal muscle biopsies.

"Sugar is stored in skeletal muscle in the form of a highly branched polymer called glycogen, which is sensitive to digestion by the salivary and pancreatic enzyme amylase," she explained. "In the original group of horses diagnosed with PSSM, an increase in normal amylase-sensitive glycogen was discovered along with an abnormal amylase-resistant polysaccharide that was less branched than normal glycogen. Later the term PSSM was applied to biopsies with increased normal amylase-sensitive glycogen without the presence of abnormal polysaccharide."

In short, horses with this genetic problem are unable to normally store and use sugar in skeletal muscles.

Since those first studies, there has been much progress made in diagnosing PSSM. In fact, more than one form of PSSM exists today. Laboratory tests determine which specific genetic mutation is causing the tying-up.

"For clarity, the form of PSSM caused by a GYS1 (a specific gene) mutation is now termed type 1 PSSM, whereas the form of PSSM that is not caused by the GYS1 mutation and whose origin is yet unknown is now termed type 2 PSSM," explained Valberg.

Type 1 PSSM

Research has shown that the genetic mutation at GYS1 responsible for type 1 PSSM can be found in more than 20 breeds of horses.

"It is estimated to have emerged as far back as 1,600 years ago, when the great horse was being developed from European draft and light horse breeds to carry knights with heavy armor into battle," noted Valberg.

She noted in her presentation that the highest prevalence of PSSM appears to occur in draft horses derived from Continental European breeds (90% prevalence of PSSM in Trekpaards, a draft breed, with 40% of tested Belgian Trekpaards being homozygous for the trait). In contrast, she said the prevalence of PSSM is low in United Kingdom-derived breeds such as Shires and Clydesdales. In today's horse breeds, Valberg stated that the estimated prevalence of type 1 PSSM in halter-bred Quarter Horses is the highest in that breed (28% affected), with the general Quarter Horse population ranging from 6-10% affected. Racing Quarter Horses seem to have the lowest frequency of type 1 PSSM within the breed. Paint and Appaloosa horses have a type 1 PSSM prevalence of 6-8%, according to research findings.

"The prevalence of type 1 PSSM is very low in light horse breeds such as Arabians and Thoroughbreds," said Valberg.

The basic problem with the genetic mutation that causes type 1 PSSM is that skeletal muscles of PSSM horses have 1.5-4 times higher concentrations of glycogen than normal horse muscle. The persistent glycogen synthase activity in type 1 PSSM muscle appears to disturb the normal flux of muscle energy metabolism during exercise, explained Valberg.

While the complete cycle of how the genetic mutation causes problems in the storage and use of muscle glycogen is under investigation, it is known that diet and exercise can be used to manage the problem in many horses.

A diet high in nonstructural carbohydrates (NSC) will cause a horse with the genetic problem that causes type 1 PSSM to be more likely to have clinical signs, or more severe clinical signs, of tying-up. Some horses with type 1 PSSM are asymptomatic, but most horses with the genetic defect will begin to show signs of PSSM by six years of age. Valberg cautioned that the signs of PSSM can begin as early as one year of age and as late as the mid-teens.

In postulating why this genetic mutation has become more prevalent in some breeds, it has been noted that owners of horses with type 1 PSSM often describe their horses as having a calm and sedate demeanor.

Clinical signs of chronic PSSM

Valberg gave the following descriptions of the clinical signs of type 1 PSSM.

Light breeds. Chronic signs of type 1 PSSM in riding horses include a lack of energy when under saddle, reluctance to move forward, stopping and stretching as if to urinate, and a sour attitude toward exercise. Horses may have a combination of low-grade reluctance to exercise, poor performance, and repeated episodes of tying-up. The range of severity of clinical signs of PSSM can be wide, with some horses being asymptomatic and others completely incapacitated. Serum creatine kinase (CK) activities are often elevated in untreated Quarter Horses, even when horses are rested. When horses are symptomatic, CK will usually increase by 1,000 U/L or more 4 hours after light exercise (15 minutes of exercise at a trot). The median CK and aspartate aminotransferase (AST) activity for all PSSM Quarter Horses with muscle biopsies submitted to the University of Minnesota was 2,809 and 1,792 U/L, respectively. Affected Quarter Horse and Paint Horse foals and weanlings may develop rhabdomyolysis without exercise.

A small number of Quarter Horses and Paint horses have both the GYS1 mutation and a genetic mutation (RYR1) for malignant hyperthermia (MH), which results in particularly severe signs of tying-up and a limited response to diet and exercise changes. In horses with the RYR1 mutation, during an episode of tying-up they can experience excessively high body temperatures and sudden death can occur.

Drafts and draft crosses. The average age of draft horses diagnosed with PSSM is about eight years. Many draft horses with PSSM are asymptomatic. Signs of severe rhabdomyolysis (muscle damage) and myoglobinuria (red to brown urine) may occur in horses fed high-grain diets, exercised irregularly with little turnout, or undergoing general anesthesia. Other signs of PSSM in draft horses include progressive weakness and muscle loss resulting in difficulty rising in horses with normal serum CK activity. Pronounced weakness is more prevalent in homozygotes for the GYS1 mutation. Gait abnormalities such as excessive limb flexion, fasciculations, and trembling are also reported in draft horses. Although the condition shivers was previously attributed to PSSM, a recent study found no causal association between these two conditions. The median serum CK and AST activities in draft horses from which muscle biopsies were sent to the University of Minnesota was 459 and 537 U/L, respectively.

Diagnosis

Blood or hair samples can be used to test for PSSM, MH, and other genetic diseases of horses. Muscle biopsies might be needed to definitively diagnose a problem. For more information in the United States, visit the [University of Minnesota Veterinary Diagnostic Laboratory page](#). In Europe, contact [Laboklin](#). MH testing is also conducted at the University of California at Davis.

Valberg and coworkers have assembled a list of [frequently asked questions](#) that can help horse owners understand PSSM.

Type 2 PSSM

Some horses with PSSM do not have the genetic mutation and are called type 2 PSSM cases. There is ongoing research to learn more about these horses. Valberg said about 28% of cases of PSSM diagnosed by muscle biopsy in Quarter Horses do not have the GYS1 mutation.

"Type 2 PSSM seems to be more common in higher performance horses such as barrel racing, reining, and cutting horses compared to the high prevalence of type 1 PSSM in halter horses," said Valberg. "About 80% of cases of PSSM diagnosed by biopsy in Warmbloods have type 2 PSSM. Breeds affected include Dutch Warmblood, Swedish Warmblood, Hanoverian, Friesian, Selle Francais, Westfalian, Canadian Warmblood, Irish Sport Horse, Gerdlander, Hussien, and Icelandic horses. Many other light breeds have also been diagnosed with type 2 PSSM including Morgans, Standardbreds, and Thoroughbreds.

"Type 2 PSSM also occurs in Arabians; however, in my experience this breed is distinct in that it often has amylase-resistant rather than amylase-sensitive polysaccharide but is negative for the GYS1 mutation," said Valberg.