

GEMINIGENETICS



Equine Rare Breed Preservation

Skin sample preservation for rare & native breed conservation

www.geminigenetics.com | 01948 668 057

Gemini Genetics

Genetic Preservation For The Future

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GEMINIGENETICS

Established in 2018, **Gemini Genetics is one of the UK's first animal genetic preservation companies**, based on skin sample cryopreservation. Working across a diverse range of animal species, Gemini Genetics is unique in offering regenerative genetic preservation from skin; the latest technology in animal assisted reproduction for animal breeding and conservation.

Our Founding – The Plight of Rare Breed Equines

At Gemini Genetics, we share our facility with world leading equine semen collection and distribution centre, Stallion AI Services. Since 2012, the plight of rare breed equines has been one of the forefront projects of Stallion AI Services and a constant motivation to provide the latest technologies to assist in their survival.

During an annual rare breed conservation event, the idea of saving whole animal genetics via skin samples was put forward as a potential tool to assist Stallion AI Services in their mission to help save rare breed equines. This laid the foundation for the establishment of Gemini Genetics- a revolutionary animal genetic preservation company based on industry leading skin sample cryopreservation for future animal regeneration.

Gemini Genetics now works across the whole domestic animal sector, preserving DNA from skin samples for rare breed equines in addition to cats, dogs and performance horses. Gemini Genetics also assists wild and endangered animal charity, Nature's SAFE, with skin sample processing for some of the worlds most threatened wild animal species, using expertise generated from domestic animal genetic preservation.

Last but by no means least, Gemini Genetics are proud to announce the recent launch of the UK National Livestock Biobank. The latest area of our work with skin sample preservation, to ensure UK & national food security via skin sample cryopreservation for livestock (see page 18 for more details).

This Information Pack

The following information pack details the application of skin sample regenerative genetic preservation to equine rare breed conservation.

Content is intended as an insight into the applications of the technology and a reference guide for those wishing to partake for breed conservation purposes or to save the genetics of a personally valued animal.

Our Genetic Banking Service

The Power Of Skin Samples

At Gemini Genetics, our **genetic banking service is based on skin sample cryopreservation**. We work with skin because it **contains the whole genetic profile of an animal**. This is different to gamete samples (sperm and eggs), which contain only 50% of the DNA of the donor animal. Preserving skin allows you to **capture the complete genetic set** of a valuable individual.

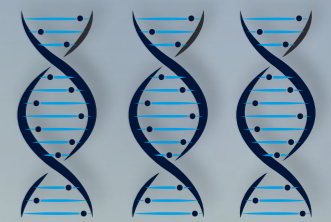
Skin samples can also be cryogenically preserved from all genders, including females and castrated males. This allows you to capture the whole genetic profile of animals whose genetics would otherwise be lost upon their passing (female egg cryopreservation is limited in success and castrated / neutered animals are devoid of gametes).

From a conservation perspective, skin samples can also provide an infinite genetic resource, versus the finite resource of preserved gametes. When preserved gametes are used for animal assisted reproduction, the number of gametes in store reduces upon use. E.g. semen is inseminated, reducing the amount of semen in stock from that animal. Skin samples, however, allow the genetic resource to increase upon use. This is because the cells within a skin sample can be cultured to increase in cell number, thereby increasing, rather than decreasing, the genetic sample from the donor animal.

Well taken skin samples can also be less variable in quality compared to gametes and may provide for easier adaptation of animal genetics for future requirements, versus cryogenically preserved semen, egg and embryo samples.

“...skin contains the whole genetic profile of an animal.”

Why Do We Use Skin?



100% Genetic Match To Original



DNA Can Be Preserved In All Genders (including neutered animals)

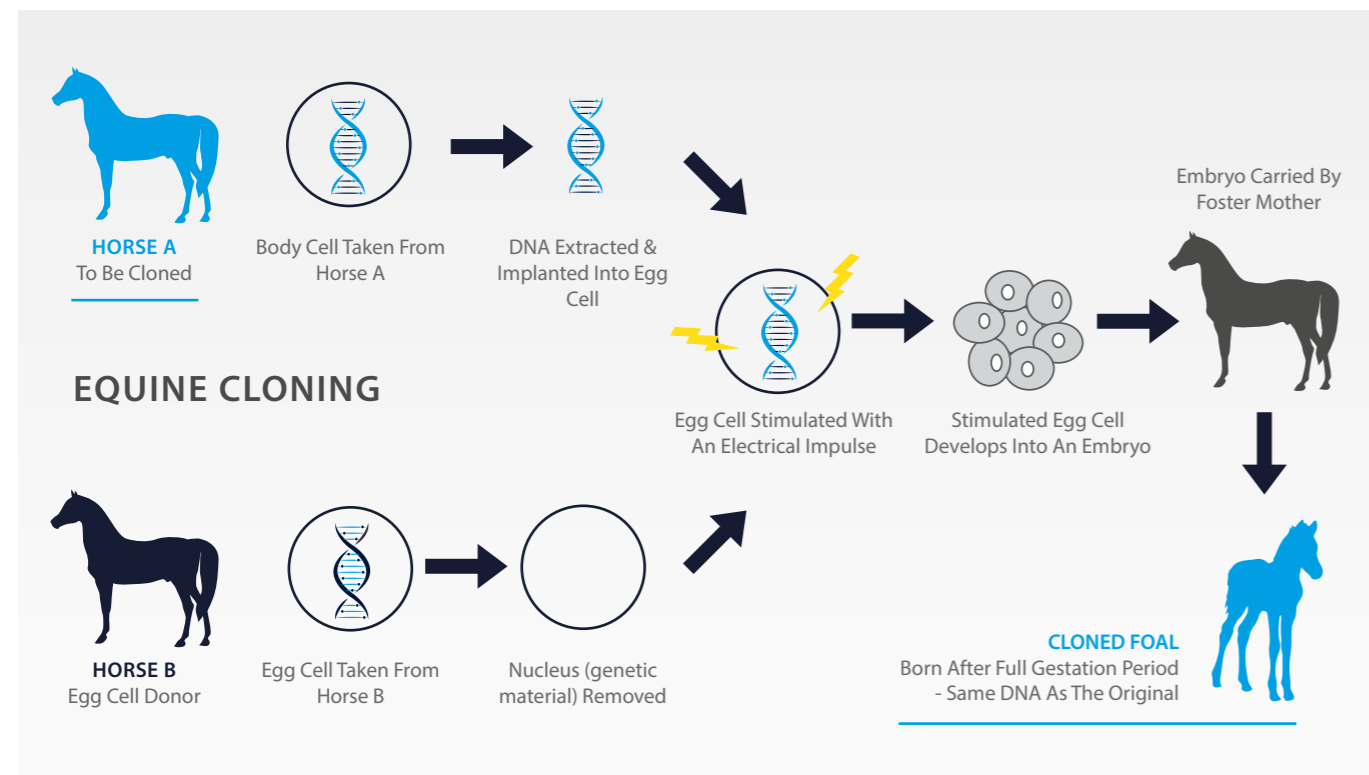
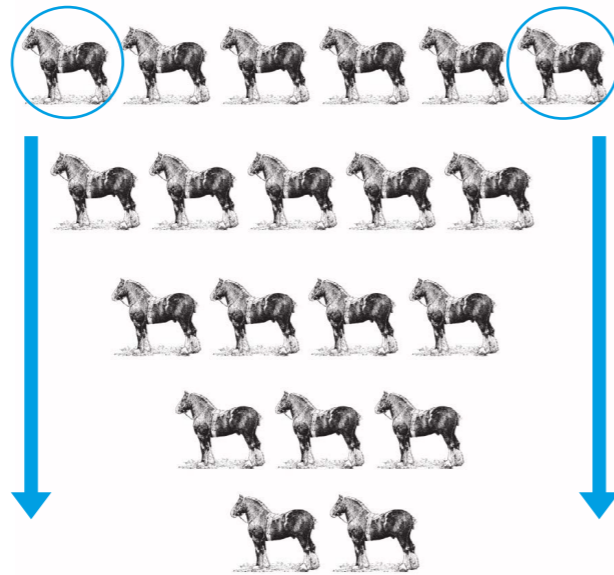


Infinite Resource of DNA

Skin Samples & Animal Conservation

Once a skin sample has been cryogenically preserved, several applications exist for its use in animal conservation.

The most direct application of our service is the reawakening of preserved DNA for animal regeneration. A 'living' gene bank to bring back a population in the future. Or to regenerate and reintroduce individuals to assist in their conservation and prevent species/ breed loss. This type of animal regeneration using skin is known as somatic cell nuclear transfer, or cloning as more commonly known. Cloning refers to the process of genetically replicating an animal. As the image below details, the process involves taking a donor egg cell from an animal of the same species you wish to genetically replicate, and removing the nucleus from that egg cell. This removes the DNA of the egg cell donor. The skin sample taken from the animal you wish to genetically replicate is then cultured to produce individual skin cells. These skin cells contain the whole genetic profile of the animal you wish to replicate. When ready to clone, one of the cultured skin samples is inserted into the enucleated donor egg cell. An electrical impulse is applied to the egg which mimics fertilisation, stimulating the egg to develop into an embryo. That embryo is then transferred to a surrogate mum who carries the clone to term and nurses until weaning age.



The application of genetic replication for conservation is to allow for the re-introduction of lost genetics and genetic diversity, to assist with breed survival and fitness without the need for outbreeding or cross breeding. In the event of a breed/ species genetic narrowing, preserved skin samples can be analysed and individuals least genetically related to the current living population can be selected for genetic replication, to bring back much needed genetic diversity to the living population. (see shire horse image).

A further future use of preserved skin samples is via induced pluripotent stem cell technology. Here, skin cells are reprogrammed to generate sperm and egg cells. This would allow the creation of new population individuals & new genetic sets from the preserved skin cell DNA. This technology is at present most developed in mice species but is subject to significant research and development and holds much promise for the future for animal conservation breeding.

Bring back lost genetics to assist with breed survival & fitness



Equipment & Personnel Needed

Personnel

Veterinarian

A certified veterinarian must take the tissue sample, health testing samples (bloods and swabs) and complete a declaration of health. The vet will also have most of the equipment needed.

Equipment

Chlorhexidine Based Wash

E.g. hibiscrub – for cleaning the area before taking the tissue.

Min. 6mm Biopsy Punch/ Sterile Scalpel

for taking the tissue

Clippers

For shaving hair before taking the tissue

Sterile Bag

To place the tissue sample inside

Polystyrene / Chill Box & Ice Packs

For keeping the sample chilled during transit

Bubble Wrap / Towel

For wrapping the sample in during transit to stop it getting too cold in the chill box

Preserving the animal's DNA



Sample Taking

Samples for genetic preservation can be taken from a live equine upon veterinary discretion and from postmortem animals. Following sample taking or passing of the animal, the samples need to arrive at our facility within 5 days.

Live Sample Taking

Skin samples can be taken from a live equine providing a certified veterinarian deems the sample taking suitable for the individual. Samples should be taken by a certified veterinarian only and under standing sedation and local anaesthetic, and following standard veterinary procedures for aseptic skin sample taking and animal after care. Scan the QR code below for a link to a video on the live sample taking process.

Samples Needed

Samples needed from a live equine are;

- 4 x 6mm skin biopsy punches from crest of neck under the mane
- 20-30 mane or tail hairs, pulled with root attached, for independent DNA profile analysis
- Blood and genital swabs for the relevant health testing (see page 11 for further details)

Sample area should be fully shaven before the samples are taken and washed down with a chlorhexidine based wash (e.g. hibiscrub) followed by a wipe over with alcohol.

Bacterial contamination of the sample site is the main challenge to sample viability so it is very important the area is as clean as possible before the samples are taken.



Scan the QR code to find our easy to follow video instructions



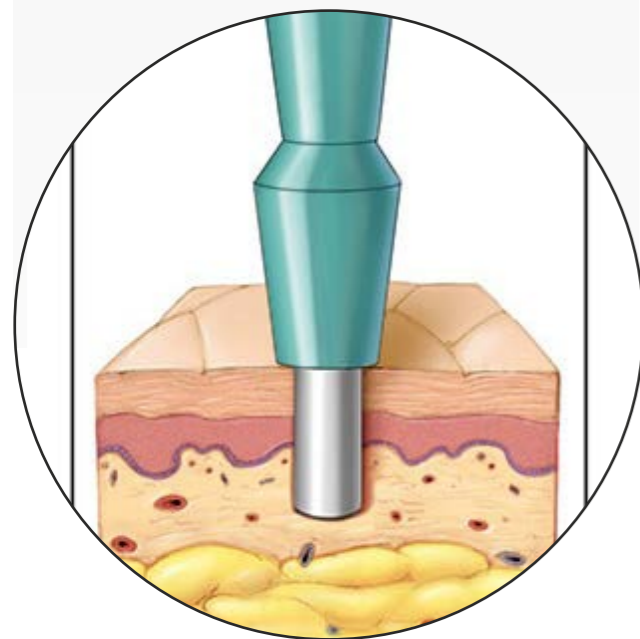
Deceased Animals

Providing the animal's body has been kept cool and out of direct sunlight, samples can be taken up to 5 days after their passing. For smaller animals, this is done by keeping the body refrigerated after the animals passing. For equines, due to their size, refrigeration of the body is unlikely to be possible. Skin samples should therefore be taken as soon as possible after an equine has passed away, or their body kept in a cool, dry and shaded area until samples are taken.

Samples Needed

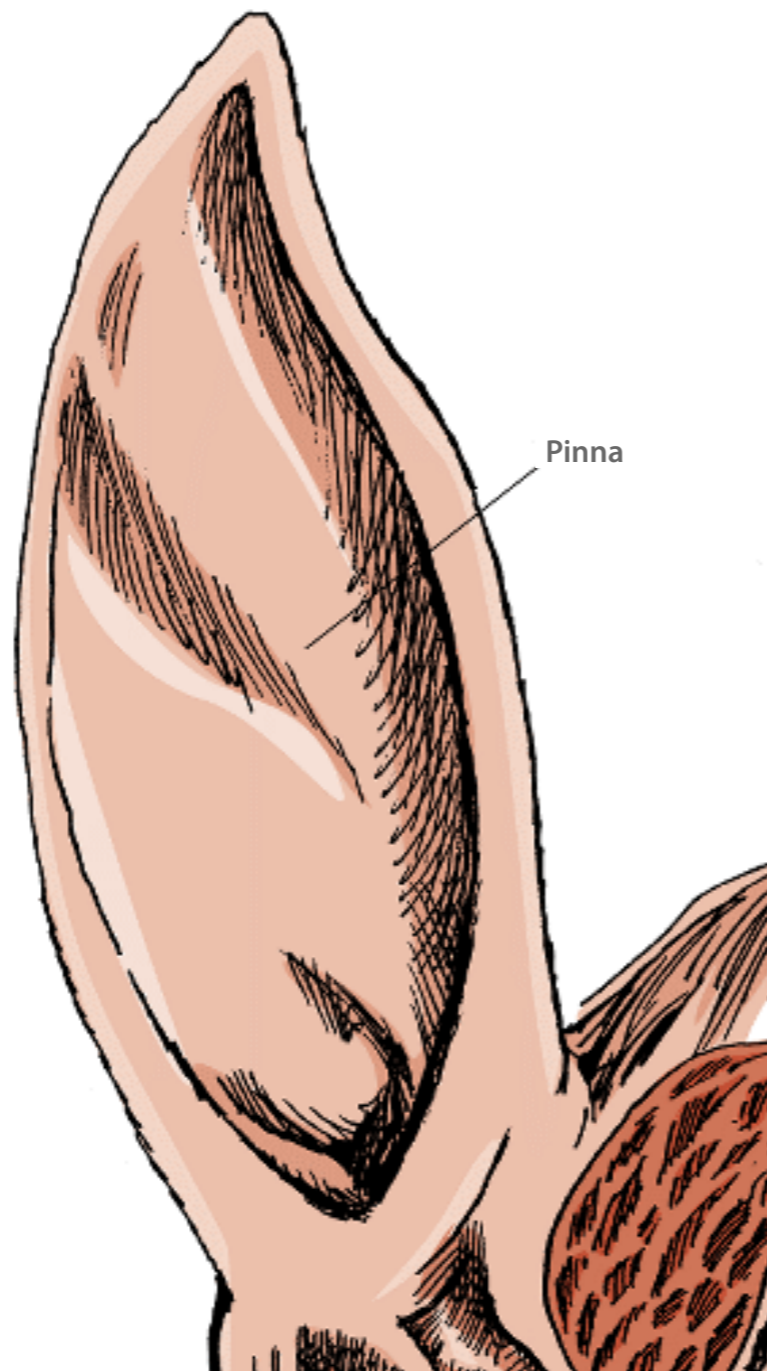
Samples needed from a deceased equine are;

- 2cm x 2cm snip of ear
- 4 x 6mm skin biopsy punches from crest of neck under mane
- 20-30 mane or tail hairs, pulled with root attached, for independent DNA profile analysis
- Blood and genital swabs for the relevant health testing (see page 11 for further details)



Sample area should be fully shaved before the samples are taken and washed down with a chlorhexidine based wash (e.g. hibiscrub) followed by a wipe over with alcohol.

Bacterial contamination of the sample site is the main challenge to sample viability so it is very important the area is as clean as possible before the samples are taken.



Health Testing

Blood and swabs from the penis/clitoris must be taken at the point of tissue sampling and tested for the below diseases.

Blood Sample

- EVA (equine viral arteritis) – SNT
- EIA (equine infectious anaemia) – Coggins test only
- Glanders – CFT @1/5 dilution
- Dourine - CFT @ 1/5 dilution

Penile/Clitoral Swabs

CEM – Contagious Equine Metritis

- **Required penile swabs** - Penile sheath/prepuce, Urethra, Urethra fossa and urethral sinus, Fossa glandis including diverticulum, Pre-ejaculatory fluid. Please ensure swabs are specifically labelled as and taken from the above areas
- **Females** - clitoral swab

Sending Samples

Blood samples

send to VLA Weybridge, New Haw, Addlestone, Surrey, KT15 5NB

Penile / clitoral swabs

send to APHA Penrith, Merrythought, Calthwaite, Penrith, Cumbria, CA11 9RR

Veterinarian must also complete the **Gemini Genetics Equine Declaration of Health and Health Test Certificate**. This is available upon request.

Sample Storage, Packing & Shipping

Once the samples are taken, they should be kept cool but not allowed to freeze i.e. refrigerated at 4 to 5 degrees Celsius. Samples can be sent via a same day service or posted out over night on a next day delivery courier service.

Required packaging equipment = sterile bag, polystyrene box, ice packs, bubble wrap/ towel to prevent samples from getting too cold.

Once the samples are ready to be shipped, they should be placed in a polystyrene / chill box. An ice pack (1 to 2) should be placed at the bottom of the box. A thick layer of bubble wrap / a towel should then be placed over the ice packs and the samples laid on top of the bubble wrap / towel layer. It is really important the samples are not allowed to freeze so please ensure the layer between the ice packs and the samples is sufficient to prevent this. Samples can also be placed inside a padded envelope on top of the bubble wrap / towel layer for added protection.

All packing equipment can be requested from Gemini Genetics.

Samples can then be posted to us via Royal Mail on a guaranteed pre 9am service or a same day pick up can be requested from Gemini Genetics.

Samples Should Be Shipped To;

Gemini Genetics,
Chapel Field Stud,
Ash Lane,
Whitchurch,
SY13 4BP

01948 668 057/ 07710 7780 016
info@geminigenetics.com



Scan the QR code to find our easy to follow video instructions

All Packing Equipment Can Be Requested From **Gemini Genetics**

EQUIPMENT NEEDED



Sterile Plastic Bag



Towel



Bubble Wrap



Polystyrene Box



Ice Packs



Insulated Chill Bag

Case Study: Przewalski's Horse Regenerative Genetic Banking In Action

For the genetic replication side of **our genetic preservation service**, we work with **world leading cloning company**, ViaGen Pets and Equine.



The World's 1st
Cloned
Przewalski's
Horse - Kurt

Born 20 years after the
death of the original horse

“This colt is expected to be one of the most genetically important individuals of his species”

On the 6th August 2020, ViaGen announced the successful birth of the world's first genetically replicated Przewalski's Horse – a colt foal named Kurt

The birth of this very special foal was the combined effort of ViaGen, Revive and Restore and San Diego zoo and was performed to help the endangered Przewalski's Horse population.

With only captive populations now in existence and such populations established from a founding 12 horses, the Przewalski's Horse has been experiencing the effects of their low genetic diversity and initial high rates of inbreeding, resulting in a population less able to adapt to potential stressors or changes to their environment.

Using regenerative genetic preservation, colt foal Kurt was cloned from a genetically important UK – born stallion, Kuporovic, whose cells were preserved by San Diego Zoo in the 1980's. At that time, Kuporovic's pedigree was analysed and identified as having unique ancestry from two wild founders, meaning he, as a breeding stallion, offered significantly more genetic variation than any of his living relatives.

Kurt, born over 20 years after the death of the original, is Kuporovic's exact genetic material revived. As such he

brings back Kuporovic unique genetics and makes them available to the population once again, increasing genetic diversity available to the current population and helping to reset some of the population inbreeding.

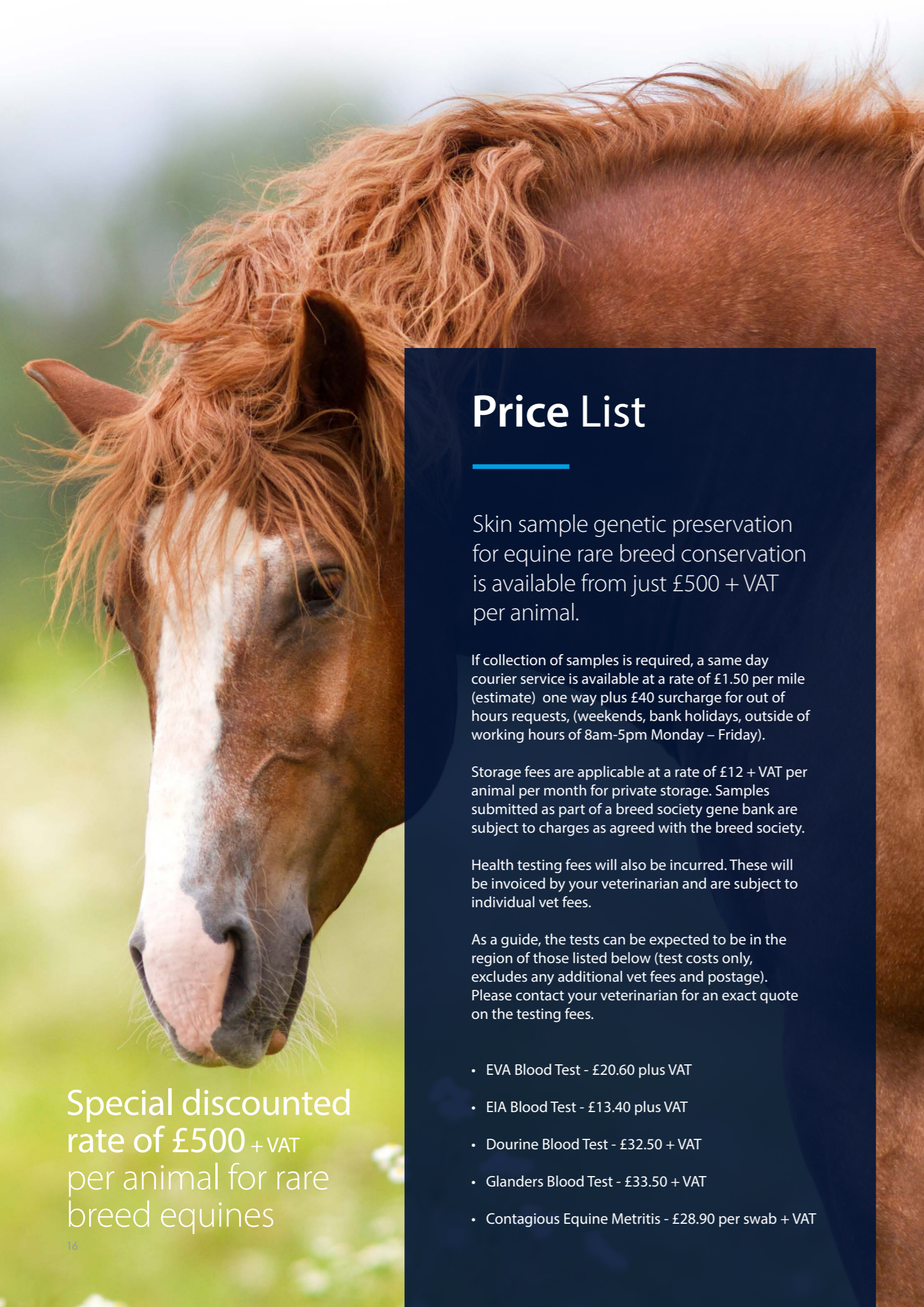
“This colt is expected to be one of the most genetically important individuals of his species” said Bob Wiese Ph.D., chief life sciences officer at San Diego Zoo Global. “We are hopeful that he will bring back genetic variation important for the future of the Przewalski's horse population.”

This exciting project, in an endangered animal population highly comparable to our rare breed equines, demonstrates the potential and application of genetic preservation and animal regeneration in animal conservation. In particular, it highlights how the technology can bring back valuable lost genetics of the past and increase genetic diversity without cross breeding and losing animal purebred status.

“We've gone back at least 40 years to create genetic diversity; its as if all the inbreeding of that time can be reset

(Ryan Phelan, Co-founder, Revive & Restore)





Price List

Skin sample genetic preservation for equine rare breed conservation is available from just £500 + VAT per animal.

If collection of samples is required, a same day courier service is available at a rate of £1.50 per mile (estimate) one way plus £40 surcharge for out of hours requests, (weekends, bank holidays, outside of working hours of 8am-5pm Monday – Friday).

Storage fees are applicable at a rate of £12 + VAT per animal per month for private storage. Samples submitted as part of a breed society gene bank are subject to charges as agreed with the breed society.

Health testing fees will also be incurred. These will be invoiced by your veterinarian and are subject to individual vet fees.

As a guide, the tests can be expected to be in the region of those listed below (test costs only, excludes any additional vet fees and postage). Please contact your veterinarian for an exact quote on the testing fees.

- EVA Blood Test - £20.60 plus VAT
- EIA Blood Test - £13.40 plus VAT
- Dourine Blood Test - £32.50 + VAT
- Glanders Blood Test - £33.50 + VAT
- Contagious Equine Metritis - £28.90 per swab + VAT

Special discounted rate of £500 + VAT per animal for rare breed equines

Other Species

Genetic preservation is available to all domestic species from cats and dogs to performance horses and livestock species. We also work with charity, Nature's SAFE, to perform genetic banking for rare and endangered zoo and wildlife species.



Cats & Dogs Including Working Dogs



Performance Horses Including Geldings



Livestock Species



Zoo Animals

If you are interested in genetic banking from any of these species, please contact Gemini Genetics for more information.

01948 668 057 / 07710 778 016 | info@geminigenetics.com

www.geminigenetics.com

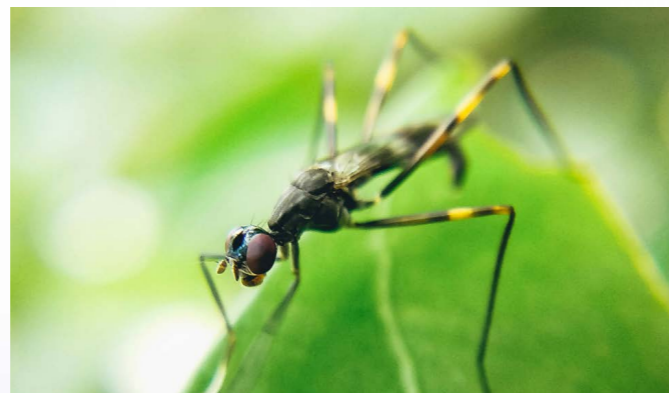


GEMINIGENETICS

UK National Livestock Biobank

From our work with rare breed equines, Gemini Genetics are proud to announce our latest development in the application of skin sample regenerative cryopreservation. The UK National Livestock Biobank is a farm animal gene bank, established to ensure UK livestock breed and herd preservation, and national food security.

Based upon semen and skin sample cryopreservation, we aim to be the equivalent of the Millenium seed bank and other seed stores and repositories. But for our crucial livestock sector. We Exist Because Our Livestock Breeds and Food Security Are At Risk.



Our World Is Changing

Climate changes pose new and significant threats to agriculture and to our farming livestock, including a heightened risk of disease outbreaks.



75% of the world's food comes from just 12 plants & 5 animal species

30% of livestock breeds are at risk of extinction

6 livestock breeds are lost every month

If you are interested in genetic banking from livestock, please contact UK National Livestock Biobank for more information.

01948 668 057 / 07710 778 016 | office@livestockbiobank.com

www.livestockbiobank.com



UK National Livestock Biobank

Complementary Services



Gemini Genetics shares its site with world renowned semen collection and processing centre, Stallion AI Services. As such, the following services are available which are complementary for supporting breed numbers and breed preservation.

STALLION SERVICES

SEMEN FREEZING - Indefinitely preserve your stallion's breeding potential & protect against the unexpected

Semen freezing involves the freezing of sperm cells to a temperature of -196 degrees Celsius. At this temperature, the sperm cells are frozen in a static but viable state. When thawed, the semen is re-awakened to its pre-frozen form and is capable of fertilisation.

Price : Stallion livery (£56.00 per day) plus £195 + VAT per frozen semen collection fee plus £20 per dose frozen.

POST CASTRATION EPIDIDYMAL SEMEN EXTRACTION – last chance semen salvage & preservation! Or planned sperm banking following castration

Post castration epididymal semen extraction refers to the removal of semen from the epididymis of the testes after castration of the stallion. This can be following a planned castration but can also be used in emergency situations e.g. following stallion death or trauma that will prevent future breeding.

Price Option 1: £750 + VAT for procedure being carried out during work hours (7am-5pm) with stallion health tests being back before the castration (i.e. elective castration) plus £25 + VAT per dose frozen.

Price Option 2: £900 + VAT for out of hours processing or off-site processing due to stallion health test results

not being available (i.e. sudden death of stallion and procedure required immediately) plus £25 + VAT per dose frozen.

SEMEN SEXING – the latest technology in semen processing that offers breeders the chance to control the gender balance of future generations & so create a more sustainable foundation for the future population

From the 1st April 2019, Stallion AI Services became the 1st UK equine semen collection centre to offer sexed semen to equine breeders and on 15th July 2020, we achieved a world first – the first ever successful breeding of a Suffolk Punch filly via sexed semen insemination! Sexed semen is currently available on a fresh semen basis to mares standing at Twemlows Hall Stud Farm and on a frozen semen basis where ICSI is used to achieve conception.

Price: Available upon request.

MARE SERVICES

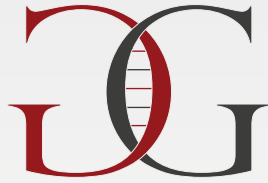
OOCYTE RETRIEVAL - the extraction of egg cells from within the ovary

The eggs are then shipped to Avantea SRL in Italy where they are inseminated with semen via intracytoplasmic sperm injection (ICSI) and either used immediately (transferred into a carrier mare to establish a pregnancy) or frozen down as an embryo for future use. Available at several locations across the UK.

Price: from £500 - £1000 + VAT

For more information on any of these services, please contact Stallion AI Services

01948 666 295 | lab@stallionai.com
www.stallionai.co.uk



GEMINIGENETICS

Contact

For further information on our genetic preservation services, please contact us

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