Plusvital

Powered by Equinome

Genetic Test Report

Client Name:
Grampians Racing

Report Region:
Australia/New Zealand

Report Generated:
2021-05-20

plusvital.com

sales@plusvital.com

+353 (0) 12350001

Test Results Summary

Result: Australia/New Zealand

Sample ID	Horse Name	Sire	Dam	Year of Birth	Sex	Speed Gene Test	Distance Plus Test	Dirt V Turf Test
Zoumatic		Zoustar	Prismatic	2017	Female	C:C	Short	Turf Pro
Sleek '19		Preferment	Sleek	2019	Female	C:T	Short	Turf Pro

Plusvital

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Racing GenePak Result

Client Name:
Grampians Racing

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Australia/New Zealand

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Plusvital Powered by Equinome

Racing GenePak

Result: Australia/New Zealand

Horse Details

Horse Name	Sire	Dam
	Zoustar	Prismatic

Sample ID	Sex	Country of Birth
Zoumatic	Female	Australia

Year of Birth	Month of Birth
2017	August

SPEED GENE TEST

Speed Gene Test — C:C — Sprint / Mile — Plusvital

DISTANCE PLUS TEST

Distance Plus Test — AUS — C:C — Short — Plusvital

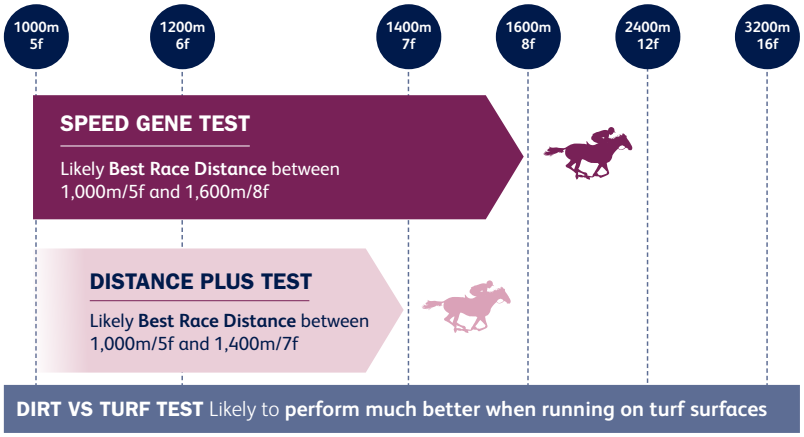
DIRT VS TURF TEST

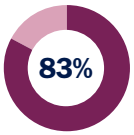
Dirt -v- Turf — TURF PRO — Plusvital

- ✓ C:C Short horses will likely achieve their optimal performance if trained and raced as a sprint type with a particular preference for 1000-1400m races
- ✓ Recommend targeting 1000-1200m races as a two-year-old, and races of 1400m or less as an older horse
- ✓ Likely to breed sprint or middle distance types
- ✓ Turf Pro horses show a strong preference for running on turf surfaces, being three times more likely to win on turf than dirt surfaces

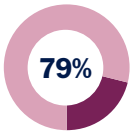
Use this result for Horses in Training

HORSES IN TRAINING





83 % of **C:C horses** have a **Best Race Distance** of less than 1,600m/8f
(Group/Listed races)



79 % of C:C Short horses have a **Best Race Distance** of 1,000-1,400m/5-7f
(Group/Listed races)

The Distance Plus Test refines the Speed Gene Test distance range prediction ✓ Likely Super Sprinter ✓ Early Maturing

C:C horses are likely to appear more muscular

By comparison with T:T horses at the same age, two-year-old C:C horses develop:

7% **More muscle mass**

9.5% **More Type IIB muscle (fast twitch) fibres**

About the Speed Gene Test | Distance Plus Test | Dirt Vs Turf Test

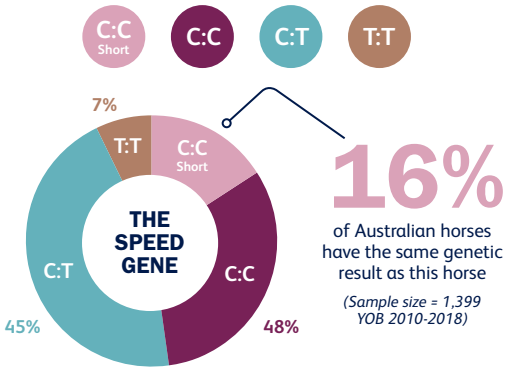
Racing GenePak

Result: Australia/New Zealand

About the Speed Gene Test

- The Speed Gene Test examines differences in the myostatin gene to make a prediction of a horse's best race distance
- The myostatin gene is a major determinant of race distance aptitude because it influences:
  - Skeletal muscle growth
  - The proportion of fast twitch (glycolytic, Type IIB) muscle fibres required for short bursts of power and the proportion of slow twitch (oxidative, Type I) muscle fibre types required for stamina
- Race distance aptitude is almost entirely determined by the genetic make-up of this gene
- Test result is based on the combination of "C" and "T" genetic variants, one inherited from each parent

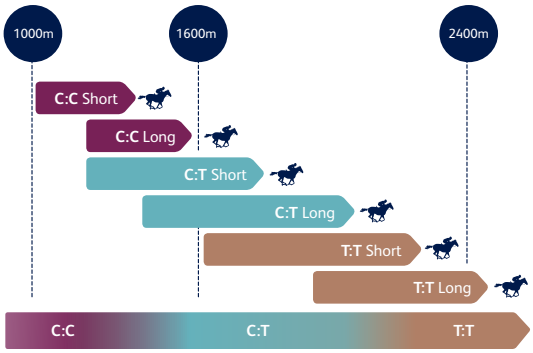
There are three possible combinations of the Speed Gene variants, with one Distance Plus sub-variant:



About the Distance Plus Test

- The Distance Plus Test looks at 50,000 genetic markers to provide an enhanced level of information when combined with the Speed Gene Test
- Refines the predicted optimum race distance, sub-categorising the Speed Gene Types into "Short" or Long" (e.g. C:T Short or C:T Long)

Average Best Race Distance
(179 Group/Listed Winning Horses - AUS/NZ Only)



As well as the most influential gene, myostatin, many other genes with functions in anabolic processes, insulin signalling, the hypoxic response and fat metabolism, contribute in a small way to distance aptitude.

This test uses genes from the whole genome to more precisely predict likely best race distance in a particular race region.

About the Dirt Vs Turf Test

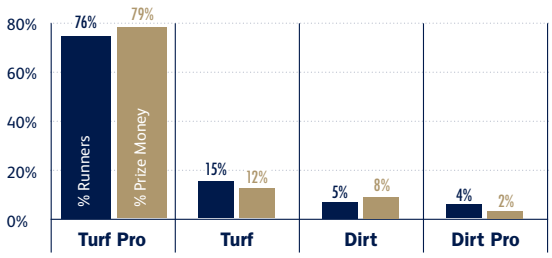
- Identifies a horse's genetic preference for a turf or dirt race surface
- Result categorises horses into one of four categories:
  - **Dirt Pro** (Strongly prefer dirt surfaces)
  - **Dirt** (Prefer dirt surfaces)
  - **Turf** (Prefer turf surfaces)
  - **Turf Pro** (Strongly prefer turf surfaces)

Many consider surface preference to be indicated by pedigree and physical type since sires are often ranked according to the success of their progeny on different surfaces. However, it is often unclear until a horse has raced a number of times as to which surface it is best suited to.

Similarly, some stallions can produce progeny with different surface preferences and with the global movement of stallions, pedigree may not always be the best indicator of a horse's surface preference type.

THREE-YEAR-OLDS & OLDER: DIRT VS TURF TEST

% of Runners vs Prize Money



Turf Flat races, Australia & New Zealand, 2010-2018 (Sample size = 1,696)

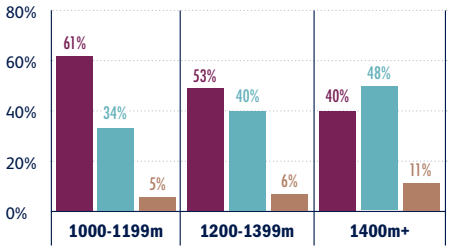
The vast majority of Australian runners are Turf Pro. Turf Pro horses greatly over-perform on Australian Turf surfaces.

Observations of this result for Horses In Training

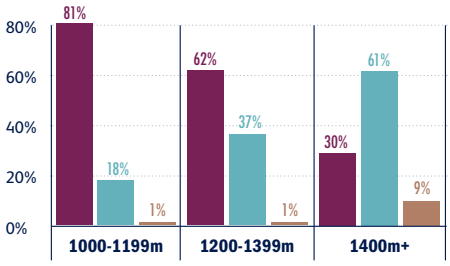
Observations of this result for Horses In Training

TWO-YEAR-OLDS

% of Runners by distance by Speed Gene type



% of Prize Money by distance by Speed Gene type



C:C
C:T
T:T

Flat races, Australia & New Zealand, 2010-2018 (Sample size = 715)

Two-year-old C:C horses perform best at 1000-1199m

- **At 1000-1199m, C:C horses over-performed,** winning 81 % of the prize money available, despite providing 61 % of the runners at this distance
- **At 1200-1399m, C:C horses over-performed,** winning 62 % of the prize money available, despite providing 53 % of the runners at this distance
- **At 1400m+, C:C horses under-performed,** winning 30 % of the prize money available, providing 40 % of the runners at this distance

THREE-YEAR-OLDS

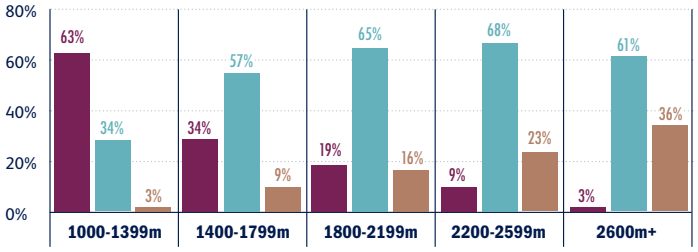
Three-year-old and older C:C horses perform best at distances less than 1800m

- **At 1000-1399m, C:C horses over-performed,** winning 75 % of the prize money available, despite providing 63 % of the runners at this distance
- **At 1400-1799m,** C:C horses won 34 % of the prize money available, despite providing 34 % of the runners at this distance
- **At 1800m+, C:C horses under-performed,** winning 7 % of the prize money available, despite providing 16 % of the runners at this distance

Strike Rate and % Winners

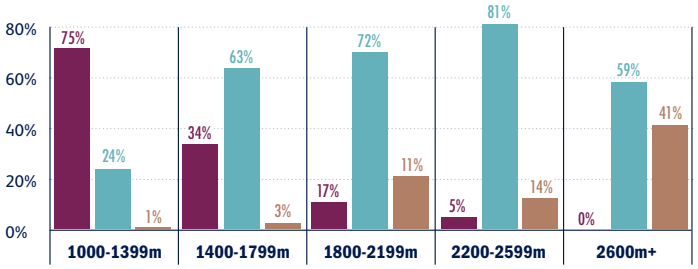
- A higher percentage of C:C horses won 1000-1399m races, outperforming C:T and T:T horses at these shorter distances
- C:C horses recorded a higher strike rate in shorter distances races, outperforming T:T horses at distances less than 1800m

% of Runners by distance by Speed Gene type



C:C
C:T
T:T

% of Prize Money by distance by Speed Gene type



Flat races, Australia & New Zealand, 2010-2018 (Sample size = 1,740)

Use this result for Young Stock | Breeding

Racing GenePak

Result: Australia/New Zealand

Use this result for Young Stock

YOUNG STOCK

C:C horses are likely to be more precocious and early maturing

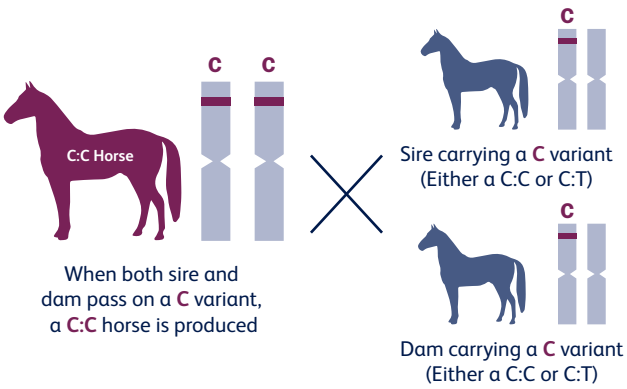
- 50 % of C:C horses had their first run within 34 months of their date of birth, one month earlier than the average for the general population

Use this result for Breeding

BREEDING

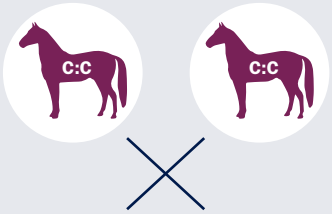
- Horses inherit one copy of the myostatin gene, containing either a "C" or "T" variant, from both the sire and the dam
- Different combinations can arise from the same mating depending on the variant that is passed on
- A C:C horse has inherited a C variant from both the sire and the dam

This explains why full siblings can be completely different types of horse, and why race distance or precocity cannot be reliably predicted from pedigree alone.



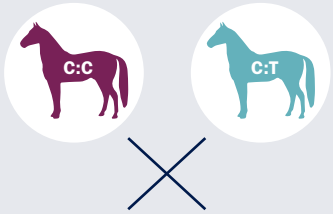
Possible mating outcomes for this horse

If this C:C horse is paired with another C:C horse:



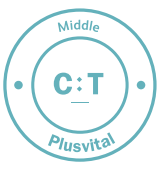
100%
Chance to produce a

If this C:C horse is paired with a C:T horse:

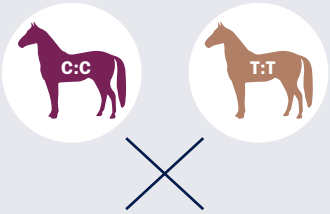


50%
Chance to produce a

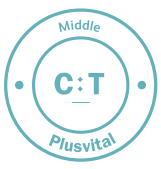
50%
Chance to produce a



If this C:C horse is paired with a T:T horse:



100%
Chance to produce a



To learn more about the research behind the Speed Gene Test, please visit the following link:
https://www.plusvital.com/equine-genetics/equine-research/

Plusvital Powered by Equinome

Racing GenePak

Result: Australia/New Zealand

Horse Details

Horse Name	Sire	Dam
	Preferment	Sleek

Sample ID	Sex	Country of Birth
Sleek '19	Female	Australia

Year of Birth	Month of Birth
2019	August

SPEED GENE TEST

Speed Gene Test C:T Middle Plusvital

DISTANCE PLUS TEST

Distance Plus Test AUS C:T Short Plusvital

DIRT VS TURF TEST

Dirt -v- Turf TURF PRO Plusvital

- ✓ C:T Short horses will likely achieve their optimal performance if trained and raced as a middle distances type with a particular preference for 1200-1800m races
- ✓ Recommend targeting 1200-1400m races as a two-year-old, and races of 1600-1800m races as an older horse
- ✓ Can breed sprint, middle distance or staying types depending on mare/sire
- ✓ Turf Pro horses show a strong preference for running on turf surfaces, being three times more likely to win on turf than dirt surfaces

Use this result for Horses in Training

HORSES IN TRAINING

1000m 5f | 1200m 6f | 1400m 7f | 1800m 9f | 2200m 11f | 3200m 16f

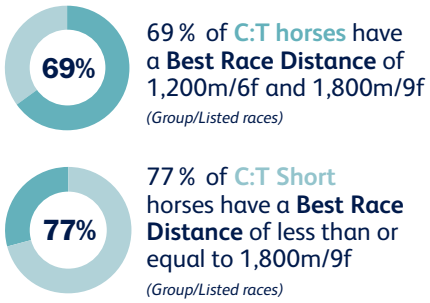
SPEED GENE TEST

Likely **Best Race Distance** between 1,200m/6f and 1,800m/9f

DISTANCE PLUS TEST

Likely **Best Race Distance** of less than or equal to 1,800m/9f

DIRT VS TURF TEST Likely to **perform much better when running on turf surfaces**



69 % of C:T horses have a **Best Race Distance** of 1,200m/6f and 1,800m/9f *(Group/Listed races)*

77 % of C:T Short horses have a **Best Race Distance** of less than or equal to 1,800m/9f *(Group/Listed races)*

The Distance Plus Test refines the Speed Gene Test distance range prediction ✓ Likely Miler Middle Distance ✓ Most Versatile Type

By comparison with T:T horses at the same age, two-year-old C:T horses develop:

2% **More muscle mass**

4.8% **More Type IIB muscle (fast twitch) fibres**

About the Speed Gene Test | Distance Plus Test | Dirt Vs Turf Test

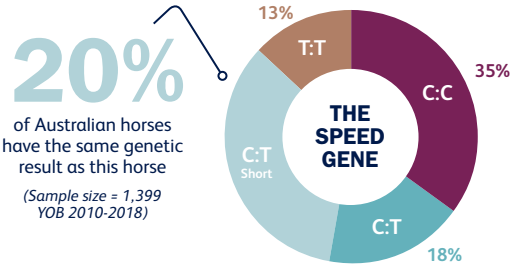
Racing GenePak

Result: Australia/NewZealand

About the Speed Gene Test

- The Speed Gene Test examines differences in the myostatin gene to make a prediction of a horse's best race distance
- The myostatin gene is a major determinant of race distance aptitude because it influences:
  - Skeletal muscle growth
  - The proportion of fast twitch (glycolytic, Type IIB) muscle fibre required for short bursts of power and the proportion of slow twitch (oxidative, Type I) muscle fibre types required or stamina
- Race distance aptitude is almost entirely determined by the genetic make-up of this gene
- Test result is based on the combination of "C" and "T" genetic variants, one inherited from each parent

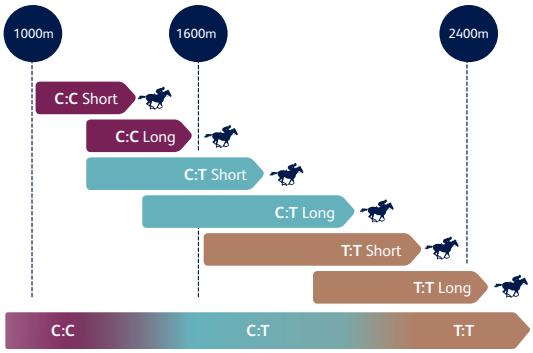
There are three possible combinations of the Speed Gene variants, with one Distance Plus sub-variant:



About the Distance Plus Test

- The Distance Plus Test looks at 50,000 genetic markers to provide an enhanced level of information when combined with the Speed Gene Test
- Refines the predicted optimum race distance, sub-categorising the Speed Gene Types into "Short" or Long" (e.g. C:T Short or C:T Long)

Average Best Race Distance
(179 Group/Listed Winning Horses - AUS/NZ Only)



As well as the most influential gene, m ostatin, many other genes with functions in anabolic processes, insulin signalling, the hypoxic response and fat metabolism, contribute in a small way to distance aptitude.

This test uses genes from the whole genome to more precisely predict likely best race distance in a particular race region.

About the Dirt Vs Turf Test

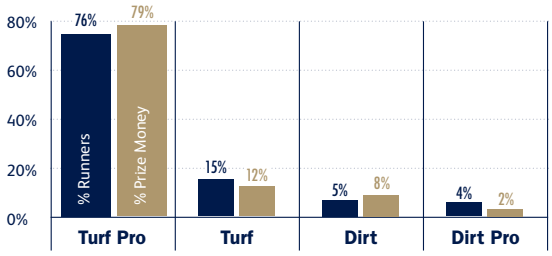
- Identifies a horse's genetic pre erence for a turf or dirt race surface
- Result categorises horses into one of four categories:
  - **Dirt Pro** (Strongly prefer dirt surfaces)
  - **Dirt** (Prefer dirt surfaces)
  - **Turf** (Prefer turf surfaces)
  - **Turf Pro** (Strongly prefer turf surfaces)

Many consider surface preference to be indicated by pedigree and physical type since sires are often ranked according to the success of their progeny on different surfaces. However, it is often unclear until a horse has raced a number of times as to which surface it is best suited to.

Similarly, some stallions can produce progeny with different surface preferences and with the global movement of stallions, pedigree may not always be the best indicator of a horse's surface preference type.

THREE-YEAR-OLDS & OLDER: DIRT VS TURF TEST

% of Runners vs Prize Money



Turf Flat races, Australia & New Zealand, 2010-2018 (Sample size = 1,696)

The vast majority of Australian runners are Turf Pro. Turf Pro horses greatly over-perform on Australian Turf surfaces.

Observations of this result for Horses In Training

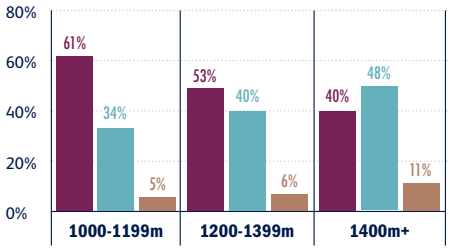
Racing GenePak

Result: Australia/NewZealand

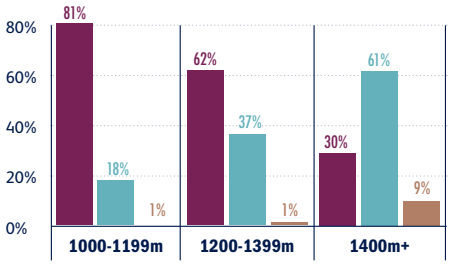
Observations of this result for Horses In Training

TWO-YEAR-OLDS

% of Runners by distance by Speed Gene type



% of Prize Money by distance by Speed Gene type



C:C
C:T
T:T

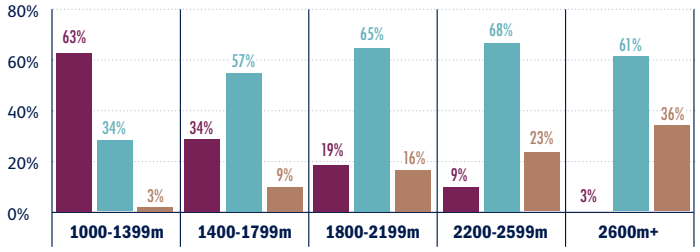
Flat races, Australia & New Zealand, 2010-2018 (Sample size = 715)

Two-year-old C:T horses perform best at 1400m+

- **At 1000-1199m, C:T horses under-performed,** winning 18 % of the prize money available, despite providing 34 % of the runners at this distance
- **At 1200-1399m, C:T horses under-performed,** winning 37 % of the prize money available, despite providing 40 % of the runners at this distance
- **At 1400m+, C:T horses over-performed,** winning 61 % of the prize money available, providing 48 % of the runners at this distance

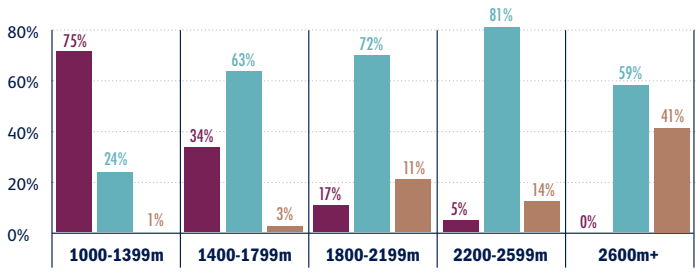
THREE-YEAR-OLDS

% of Runners by distance by Speed Gene type



C:C
C:T
T:T

% of Prize Money by distance by Speed Gene type



Flat races, Australia & New Zealand, 2010-2018 (Sample size = 1,740)

Three-year-old and older C:T horses perform best at 1400m-2599m

- **At 1000-1399m, C:T horses under-performed,** winning 24 % of the prize money available, despite providing 34 % of the runners at this distance
- **At 1400-2599m, C:T horses over-performed,** winning 68 % of the prize money available, despite providing 60 % of the runners at this distance
- **At 2600m+, C:T horses under-performed,** winning 59 % of the prize money available, despite providing 61 % of the runners at this distance

Strike Rate and % Winners

- A higher percentage of C:T horses won at 1400-2399m races relative to C:C and T:T horses
- C:T horses recorded a higher strike rate than C:C and T:T horses in races at 1400-2399m, outperforming T:T horses at shorter distances

Use this result for Young Stock | Breeding

Racing GenePak

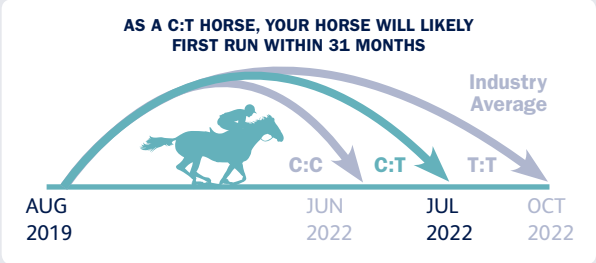
Result: Australia/NewZealand

Use this result for Young Stock

YOUNG STOCK

C:T horses precocity in line with the industry average

- 50 % of C:T horses had their first run within 35 months of their date of birth, which is a month longer than C:C horses, and four months shorter than T:T horses, but mirrors the average for the general population

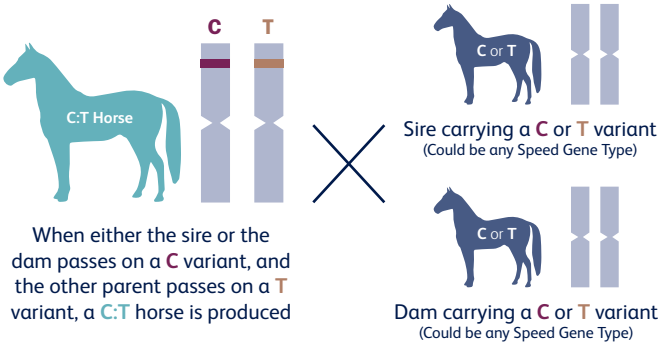


Use this result for Breeding

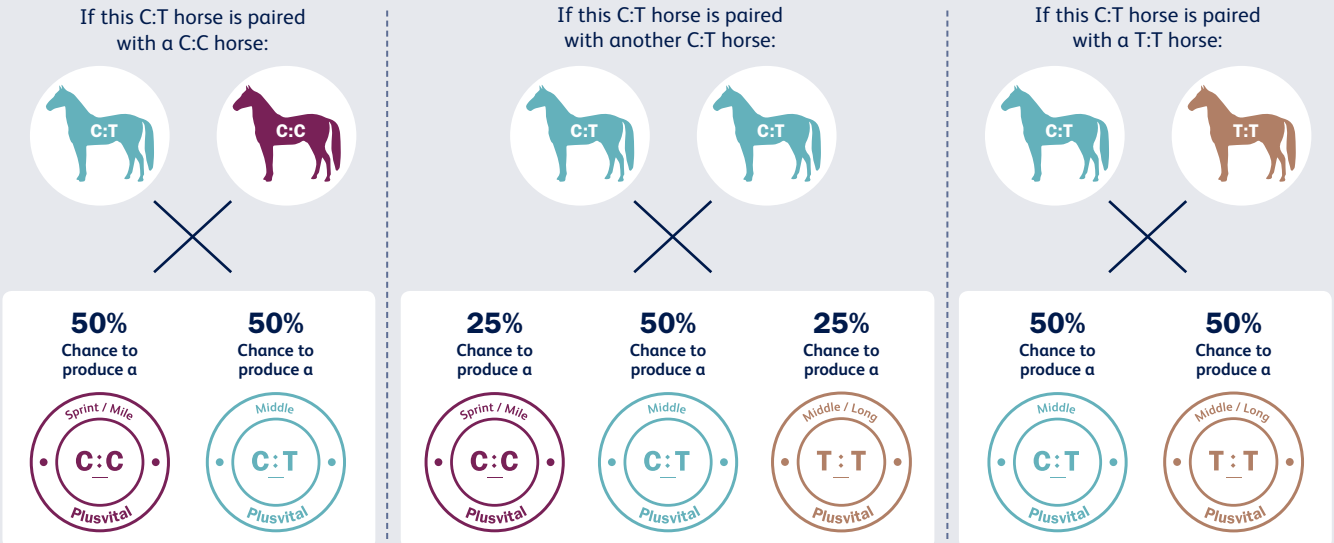
BREEDING

- Horses inherit one copy of the myostatin gene, containing either a “C” or “T” variant, from both the sire and the dam
- Different combinations can arise from the same mating depending on the variant that is passed on
- A C:T horse has inherited a C variant from either the sire and the dam, and a T variant from their other parent

This explains why full siblings can be completely different types of horse, and why race distance or precocity cannot be reliably predicted from pedigree alone.



Possible mating outcomes for this horse



To learn more about the research behind the Speed Gene Test, please visit the following link:

https://www.plusvital.com/equine-genetics/equine-research/

Racing GenePak Explained

Region:
Australia/New Zealand

plusvital.com sales@plusvital.com +353 (0) 12350001

Speed Gene Test
Explained

What is the Speed Gene?

The **Speed Gene** refers to the myostatin gene, which controls the development of muscle in the horse. There are three different Speed Gene types commonly known as **C:C**, **C:T** and **T:T** in reference to the underlying genetic make-up of a horse. These different types lead to differences in muscle development.

Muscle growth manifests in racing performance – in particular the Speed Gene type of a horse has been shown repeatedly in published research to correlate with the optimum race distance for a horse.

The Speed Gene type also influences precocity due to the different rate of muscle growth. Yearling sales performance can be affected as a result of differences in the maturation rate of the horse.

Speed Gene Type	Muscle Development	Optimal Race Distance
C:C	More muscle, quicker to develop muscle with more fast-twitch muscle fibre	Sprint Races
C:T	Average muscle and growth, with a balance of fast-twitch and slow-twitch muscle fibre	Middle Distance Races
T:T	Slightly less muscle, with more slow-twitch muscle fibre	Middle / Long Distance Races

Is the Speed Gene really about speed?

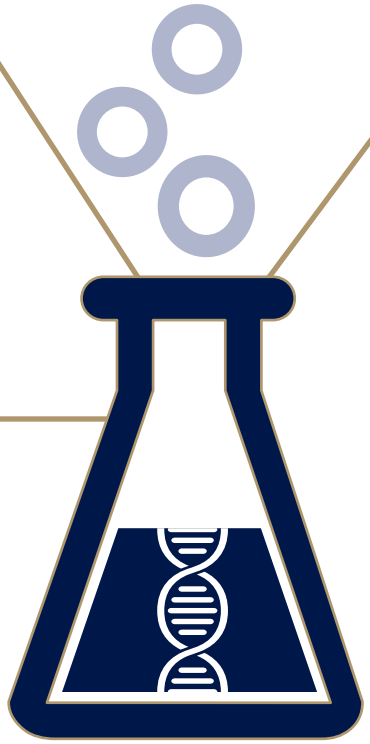
Not exactly. While the Speed Gene has been shown to be associated with measured speed, the primary purpose of the Speed Gene is to accurately tell the optimum distance a horse should be raced at.

Does this tell me if a horse is more likely to be elite?

No. This test is not designed to identify elite performance potential, but rather identify the conditions under which each individual horse can perform to its maximum potential.

Will this test tell me if my horse has the Speed Gene?

No. All horses have the Speed Gene. This test will tell you which type of Speed Gene variant your horse has and you can use this information to make training, racing and breeding decisions.



More on the Speed Gene Test Explained

When was the Speed Gene discovered?

2009 — Discovery of the Speed Gene

2010 — Launch of the Speed Gene Test

2015 — Equinome acquired by Plusvital

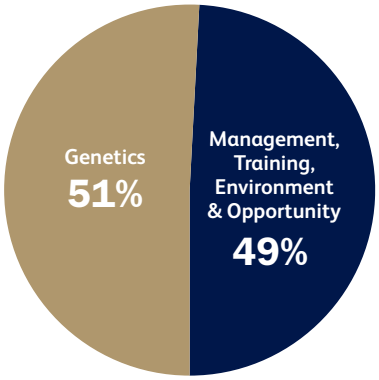
2019 — 40+ papers published supporting the Speed Gene Test

The **Speed Gene** was discovered in 2009 at University College Dublin, Ireland, by Plusvital CSO Prof Emmeline Hill. Relying on access to DNA samples from co-operation with trainers and breeders in Ireland and internationally, Prof Hill's research team started to build up a valuable set of reference samples. As well as evaluating differences in the DNA sequence, the researchers investigated differences in gene expression in the skeletal muscle of the horse and began to understand the metabolic changes that occur in response to exercise and training. This research led to the publication of the world's first description of a gene contributing to a specific performance related trait in Thoroughbreds – what we refer to as the Speed Gene.

How can I be confident in the science behind the Speed Gene Test?

Since the publication of the original scientific paper that described the discovery of the Speed Gene, researchers around the world have published more than 40 scientific papers that support the original findings and show how the gene works in horses. This includes papers from independent research groups in Ireland, Australia, Japan and the USA. The original research was based on observations of the racing performance of 150 Thoroughbreds. Now, the interpretation of our research is based on race records from more than 3,000 Thoroughbreds, including more than 800 Group and Listed race winners.

Surely genetics is only part of the story?

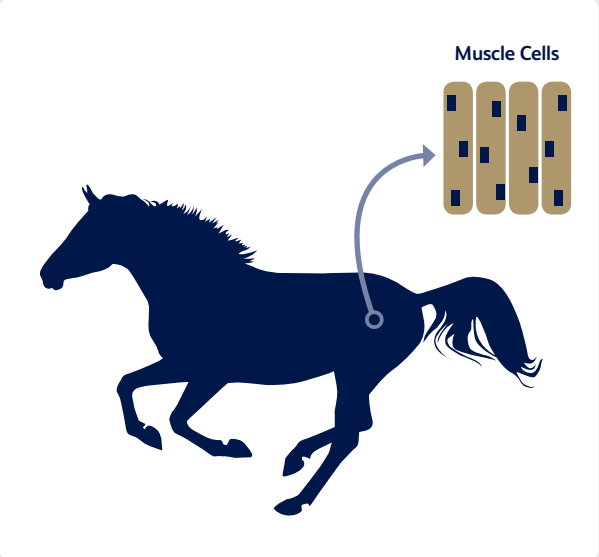


Correct. The variation in Best Race Distance (BRD) for Thoroughbreds is due to the combination of genetics and environment (i.e. everything else including the trainer, training regime, jockey, track conditions, etc). The heritability of a trait describes the genetic contribution to the variation in the trait. Over 50% of the variation in Best Race Distance is due to genetics with the majority of this attributed to differences in the myostatin gene (i.e. the Speed Gene). In other words, the genetics of the horse plays a bigger role in contributing to its Best Race Distance than all the other factors put together.

What this means in practice is that, although marginal differences in Best Race Distance can be attributed to environmental elements such as race placement and training, the best outcomes will occur when a horse is trained and raced according to its Speed Gene type.

More on the Speed Gene Test Explained

How can one gene be responsible for all this?



The Speed Gene is not solely responsible for the genetic predisposition of a horse to a certain race distance. However, it has been conclusively shown in recently published research that the Speed Gene is the main genetic determinant of optimum race distance, with other genetic variants only refining the optimum distance range. These other genes are related to the metabolism of the horse.

Plusvital's Distance Plus Test incorporates the influence of these other important genes and allows us to recommend a more refined distance range. However, there is no escaping the fact that while other genes have some influence, the Speed Gene is by far the most important factor.

What is Myostatin?

Myostatin is a muscle protein that controls the development of the different muscle fibre types (i.e fast and slow twitch). The 'C' variant is associated with a higher proportion of fast twitch (glycolytic) muscle fibres, required for short bursts of speed. The 'T' variant is associated with a higher proportion of slow twitch (oxidative) muscle fibres, required for stamina.

The presence of the mutation ('C' variant) leads to a horse that is generally more precocious and better suited to sprint distance races. In the absence of the mutation ('T' variant), muscle develops at a regular rate and more slow twitch (oxidative) fibres are produced, leading to a horse that is better suited to races requiring more stamina.

How accurate is the Speed Gene Test?

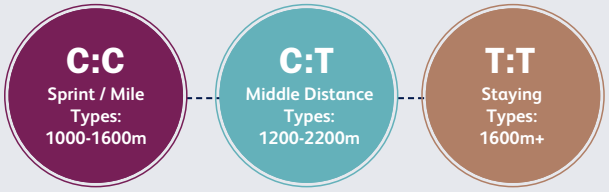
The statistical association between myostatin and race distance ($P = 4.51 \times 10^{-110}$) is as strong as the most highly genetically influenced traits in humans, including eye colour and the probability of an individual going bald. It has been shown on numerous occasions that you are more likely to be hit by lightning every day for the next year than it is that the Speed Gene is not associated with a horse's Best Race Distance.

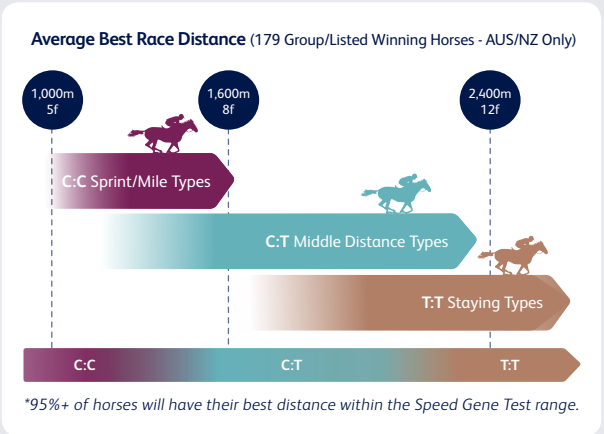
The most recent scientific research evaluated the race records of more than 3,000 Thoroughbreds across the globe and confirmed that the distance ranges recommended by the **Speed Gene Test** strongly correlate with Best Race Distance for the majority of horses included within the study.

What does Best Race Distance mean?

Best Race Distance is defined as the distance of the highest grade of race won by an individual horse. **The Speed Gene Test** predicts the best race distance for a horse over its lifetime, if trained for its optimum race distance and given the opportunity to race at that distance range.

The **Speed Gene Test** classifies horses into three genetic types:





**95%+ of horses will have their best distance within the Speed Gene Test range.*

More on the Speed Gene Test Explained

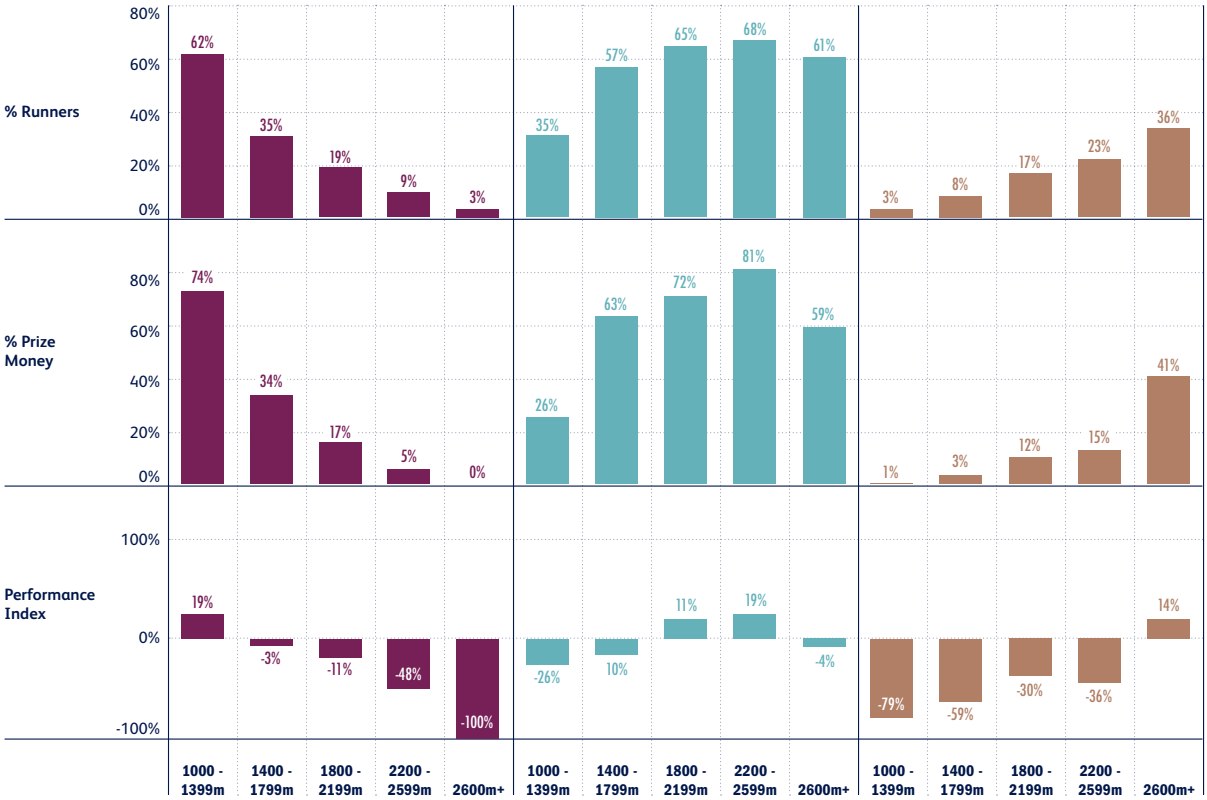
The Speed Gene Test in practice

OVERPERFORMANCE / UNDERPERFORMANCE BY DISTANCE

% Runners vs prize money by distance by Speed Gene type (Lifetime)

The below graphs show the results of an analysis of 1,785 individual runners involved in races in Australia and New Zealand between 2010-2018. The results show the difference in the % of Prize Money won vs the % of Runners at a particular distance.

The graph clearly shows the value provided by the Speed Gene Test



Flat races, Australia & New Zealand, 2010-2018 (Sample size = 1,785)

C:C

C:C horses perform best at 1000-1399m, outperforming C:T and T:T horses at the shorter distances, but relatively under-performing over longer distances.

C:T

C:T horses perform best at 1400-2399m, over-performing relative to C:C and T:T horses at these distances, but under-performing versus C:C horses over shorter distances.

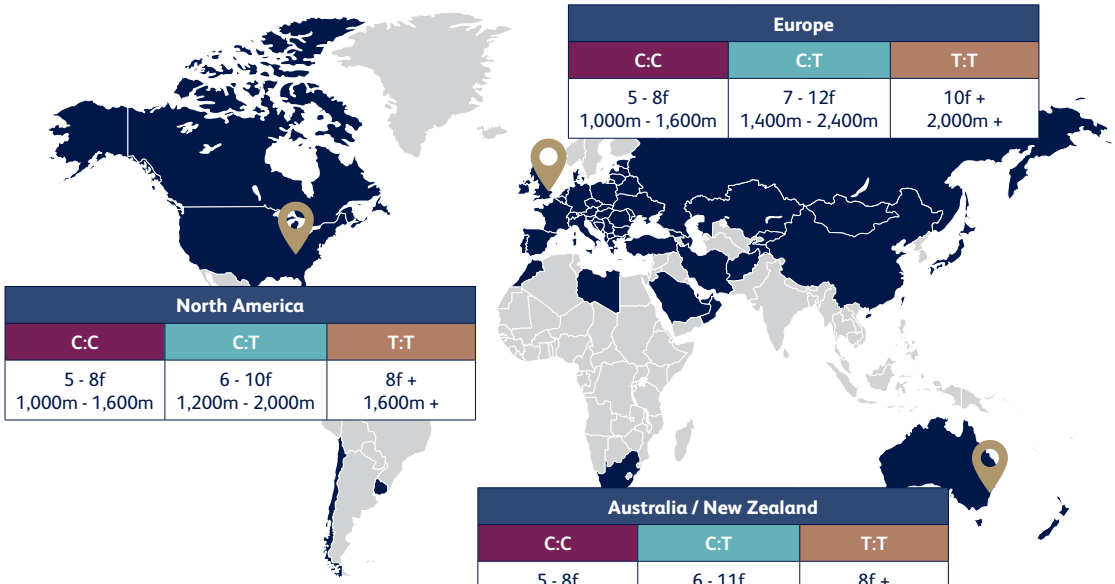
T:T

T:T horses perform best at 2400m+, over-performing at the longer distances, but under-performing relative C:C and C:T horses in races over shorter distances.

More on the Speed Gene Test Explained

Does the Speed Gene test apply to all regions?

Yes. However, there are regional variations in the **Speed Gene Test** distances due to differences in the pattern of racing in each region. We have carried out research on the Speed Gene in the UK, Ireland, USA, Australia, South Africa and Japan. In all cases, the Speed Gene type correlated with race distance (i.e. C:C types were best suited to sprint races, C:T to middle distance and T:T types to middle/long distance). The specific ranges are different for each region, which reflects the different pattern of racing.



Europe		
C:C	C:T	T:T
5 - 8f 1,000m - 1,600m	7 - 12f 1,400m - 2,400m	10f + 2,000m +

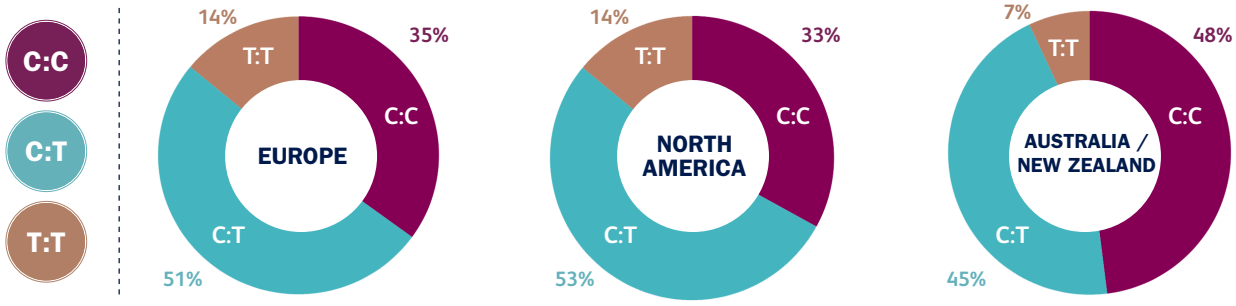
North America		
C:C	C:T	T:T
5 - 8f 1,000m - 1,600m	6 - 10f 1,200m - 2,000m	8f + 1,600m +

Australia / New Zealand		
C:C	C:T	T:T
5 - 8f 1,000m - 1,600m	6 - 11f 1,200m - 2,200m	8f + 1,600m +

Distribution of Speed Gene type by region

The charts below show the distribution of Speed Gene types in three principle racing regions based on analysis of more than 3,000 horses. In all regions, approximately half the horses are C:T or middle distance types. In Europe and USA, approximately one in three horses are C:C sprint types. However, in Australia/New Zealand, almost half of the horses are C:C sprint types. This difference is likely due to breeding decisions driven by the different pattern of racing.

T:T (staying) types make up the lowest percentage in each of the regions. 14% of horses in Europe are T:T horses, but this drops as low as 7% for T:T horses in Australia/New Zealand. The pattern of racing with a focus on sprint distances in Australia/New Zealand is likely the cause of this difference.



More on the Speed Gene Test Explained

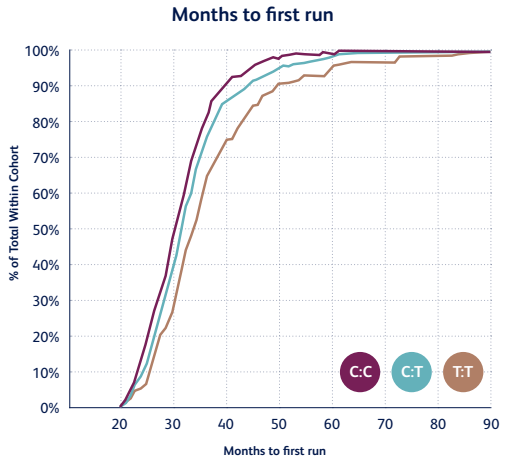
The Speed Gene Test in numbers

PRECOCITY

As the muscle development of a horse has been shown to be dependent on myostatin, the **Speed Gene Test** is also manifested in the precocity of a horse.

In general, C:C types develop more muscle quicker, so they tend to be more forward-looking and precocious. They perform better at breeze-up trials and are more likely to reach the race track earlier than other types. On the other hand, T:T types are typically a bit more backward and take longer to make it to the racetrack.

Often T:T types will race for the first time towards the end of the two-year-old season or even at the beginning of the three-year-old season. C:T horses tend to be average in terms of precocity, neither early or late developing. C:C horses tend to be earlier performers.



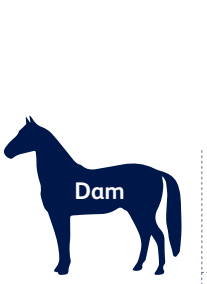
- **50% of C:C horses** had their first run **within 34 months** of date of birth
- **50% of C:T horses** had their first run **within 35 months** of date of birth
- **50% of T:T horses** had their first run **within 38 months** of date of birth

How are Speed Gene variants inherited?

Each horse has two copies of the myostatin gene, one copy inherited from the sire and one copy inherited from the dam. During the formation of the germ cells (egg and sperm) only one of the variants will be present. When the egg and sperm fuse to form an embryo, the combination of the genetic variants carried by the egg and sperm will determine the genetic make-up of that horse. If for instance the dam is a C:T, half of her eggs will contain the 'C' variant and half will contain the 'T' variant.

Similarly, sperm cells from stallions that are C:T have 50% chance of being 'C' or 'T'. The combination of the egg type and sperm type is determined by random chance, and in a mating between a C:T mare and C:T stallion, all three combinations of genetic type can be produced. From a C:T× C:T mating, there is a 25% chance the foal will be C:C, 50% chance the foal will be C:T and 25% chance the foal will be T:T.

Possible mating outcomes for each Speed Gene type:



Dam \ Sire	C:C	C:T	T:T
C:C	100% C:C	50% C:C 50% C:T	100% C:T
C:T	50% C:C 50% C:T	25% C:C 50% C:T 25% T:T	50% C:T 50% T:T
T:T	100% C:T	50% C:T 50% T:T	100% T:T

Can't I infer this information from the pedigree?

No, not to the same level of confidence. Pedigree effectively tries to infer which traits are passed on through the generations, so it is essentially a crude attempt at genetics. However, genetics determines what specific gene types have been passed on, and therefore, is a better predictor than pedigree. As genes are inherited in pairs, one from the dam and one from the sire, it is very common for full siblings to inherit different combinations of gene variants, and thus, they can be completely different types of racehorses. This is the reason why genetic testing is more accurate than pedigree alone.

In the case of the **Speed Gene Test**, we regularly encounter trainers/owners who mistake the Speed Gene type of their horse, despite a thorough understanding of the pedigree and other information from the gallops, racetrack, etc. This can result in racehorses being run at distances which are unlikely to produce the best result for that racehorse.

More on the Speed Gene Test Explained

Is there an impact on sales prices?

Yes. In yearling sales and breeze-up trials, C:C horses tend to achieve higher sales prices. This is likely because C:C horses are more forward looking, with greater muscle mass, resulting in better breeze-up times. We have no data to indicate whether the Speed Gene impacts on sales prices for foals, horses-in-training or breeding stock.

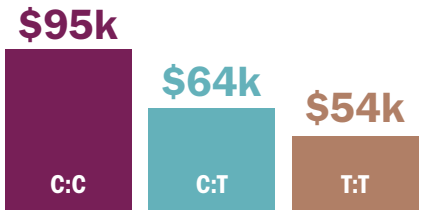
We do not however operate our testing services within the sales environment since our clients have concerns about the potential to alter the value of horses in the sales ring. In respect of this, we provide services for breeders in advance of the sales and for owners of horses once the horse is in their possession. The disclosure of genetic information should be wholly at the discretion of the owner of the horse.

The Speed Gene Test in numbers

USA

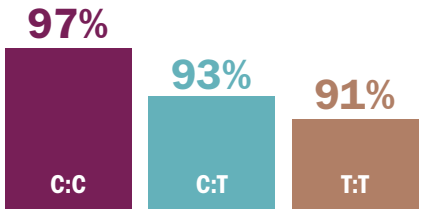
Fasig-Tipton Midlantic Hit Sales Case Study

Average Sales Price



On average, C:C types sold for $30,989 more than C:T Types and $40,518 more than T:T types. C:T types also sold for $9,529 more than T:T.

Average Clearance Rates



C:C type horses had higher clearance rates (97%) compared to C:T types (93%) and T:T types (91%).

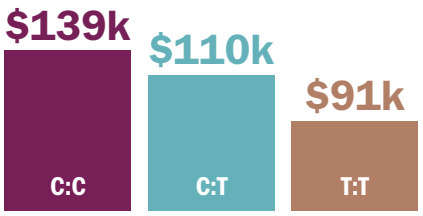
The Speed Gene Test in numbers

AUSTRALIA

Magic Millions / Inglis Yearling Sales Case Study

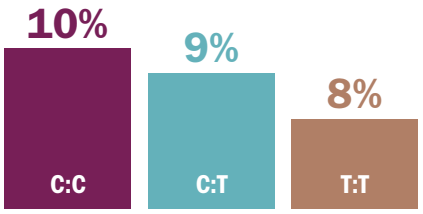
During multiple Magic Millions and Inglis Yearling sales in 2014, Plusvital carried out a study of 528 yearlings.

Average sales price per horse (AUS)



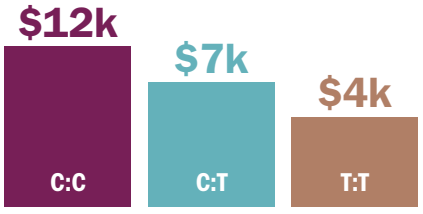
On average, C:C types tended to sell for 27% more than C:T types and 53% more than T:T types.

Median return per horse (Earnings Vs Sales Price)



All the Speed Gene types also had a proportionally similar return on their sales price, with C:C types representing a 10% return, in comparison with 9% for C:T types and 8% for T:T types.

Median Earnings (AUS)



Similarly, C:C types tended to earn 64% more than C:T types and over three times as much as T:T types. However, a lack of representation in the study population of T:T types in particular, as well as a shortage of opportunities to run at longer distances may contribute to these figures.

More on the Speed Gene Test Explained

What else can genetic testing tell me?

Plusvital offers a range of state-of-the-art genetic tests for Thoroughbred horses to support breeding, training and race entry decisions.

Distance Plus Test	Dirt Vs Turf Test	Elite Performance Test	Raced/Unraced Test	Projected Height Test
Refines **Speed Gene Test** distance range prediction, separating horses into short or long (e.g. C:C Short, C:C Long, etc)	Identifies if a horse is more likely to be suited to dirt or turf racing	Predicts genetic potential for elite performance with three outputs: • Genomic Racing Value • Genomic Breeding Value • Genomic Inbreeding Value	Identifies if a young horse has a higher likelihood of having at least one racecourse start	Predicts mature height at withers within 2.54cm

Tailored nutrition for Speed Gene types

As well as influencing muscle growth and differentiation, myostatin genetic types have been shown to be associated with the production of co-enzyme Q10 (CoQ10), the principle factor required in muscle for the efficient conversion of oxygen to energy. T:T horses naturally produce less CoQ10.

Plusvital EnerGene-Q10 has been scientifically formulated to contain a highly bioavailable form of CoQ10 to support more efficient energy production in a horse's muscle. The formulation also contains antioxidant properties to assist with recovery following intense exercise.

In a published scientific study, we found that T:T horses (i.e. suited to exercise requiring stamina) had significantly lower cellular levels of CoQ10 than C:C horses (i.e. suited to sprint exercise). Subsequently, field trials have shown that supplementation with EnerGene-Q10 results in increased levels of CoQ10 in muscle cells, which is particularly important for exercise requiring greater aerobic energy production.

Learn more about EnerGene-Q10 and Plusvital's scientifically-based supplement range:

www.plusvital.com/equine-supplements/