



**dna sport**

optimal sport for life

## genotype report

Name:

Date of Birth:

Sample Number:

Referring Practitioner:

Date Reported:

## Welcome to your dna sport report

The explosion in sports genomics research has revealed multiple connections between genetic variants and trainability. To fulfil your athletic potential it is important to make appropriate choices that best match your unique genetic makeup. This pioneering genetic service provides you with the specific knowledge to make exercise, nutritional and lifestyle choices that best suit your individual needs.

To achieve success in a chosen sport requires a multitude of factors, of which genetics is one part. The advice provided in this report should be used as a guide to help you optimise and personalise your training regime within your chosen sport.

The DNA Sport test looks at various different biological areas that relate to sporting performance. Insight into these areas can be used to personalise your exercise programme in order to gain as much as possible from your training sessions.

Some genes have important functions in more than one biological area or pathway; these genes are only presented in the most relevant section but be aware that they may contribute to more than one outcome.

## Understanding genetics

Before reading your full assessment, please take a few minutes to review this background information. This will help you better understand your results and enhance the value of this personalised report.

### What are genes?

Genes are segments of DNA that contain the instructions your body needs to make each of the many thousands of proteins required for life. Each gene is comprised of thousands of combinations of "letters" which make up your genetic code. The code gives the instructions to make the proteins required for proper development and function.

### What are gene variations?

With the exception of identical twins, all people have small differences (variations) in their genetic code. It is these differences that make each of us unique. An example of a genetic variation is that one "letter" may be replaced by another. These variations can lead to changes in the resulting proteins being made. For example a "C" may be changed to a "G" at a point in the genetic code. When the variation affects only one genetic "letter" it is called a Single Nucleotide Polymorphism, or SNP (pronounced "snip"). Variations can however also affect more than one "letter".

### Are gene variations "bad"?

In general, variations should not be considered good or bad. Rather, genetic variations are simply slight differences in the genetic code. The key is to know which form of the variation you carry in order to make appropriate lifestyle choices.

## How to read this report

The results will give the gene name and variation we tested, as well as a brief description of this gene. You will find your specific result and an explanation of how this may impact your training and/or nutritional requirements. Certain genetic variants are advantageous for athletic performance, while some variants may contribute to an increased risk for injury or a delayed recovery time. Training and nutritional recommendations that may benefit you will also be made, with any additional health recommendations indicated as well. The impact of your specific result can be identified by the DNA Sport symbols.

## Gene impact key:

The test developers at DNAnalysis assign impact factors to each genotype result. These range from NO IMPACT - having no affect on the biological area in question, to MEDIUM IMPACT - where attention should be paid and some dietary and lifestyle changes will need to be made, to HIGH IMPACT - there is a significant impact on the area indicating that cohesive and intensive diet and lifestyle action should be taken. These impact factors are assigned based on current peer-reviewed research, the frequency of the variant in the population, and the contribution of the variant to an altered phenotype. The impact factors do not represent a good or bad variant but rather give an indication of how much your genotype should influence your lifestyle choices.

No impact:



Low impact:



Moderate impact:



High impact:



# Your Genetic Results Part 1

## Injury and recovery

We only need to look around at other individuals that we exercise with to realise that some individuals seem to be 'injury prone', while others are never forced to skip a day of training. Additionally, some individuals are able to recover quickly from exercise and are ready to train hard again after just a days rest whereas some individuals don't seem to 'bounce back' from hard sessions quite so quickly and need a longer break between intense training sessions. Research has revealed that certain genetic variations infer a delayed recovery from hard exercise training, while other variants put some individuals at a significantly increased risk of certain injuries. Injury and recovery are very much intertwined because being slow at recovering from heavy exercise is likely to place you at a greater risk of injury, and this increased injury risk means that you will need to incorporate appropriate recovery strategies into your training programme. Delayed recovery or increased susceptibility to injury means that a balanced, well managed training program is required, with strong emphasis on recovery strategies, conditioning exercises and nutrition.

With regards to injury and recovery, three important biological systems have been well researched and are examined in the DNA Sport test: injury susceptibility (connective tissue remodelling), inflammation and oxidative stress. The table below gives your genetic results for these three categories, with gene explanations following thereafter.

	Gene Name	Your Result	Gene Impact
Injury Susceptibility	COL1A1 G>T	<b>GG</b>	
	COL5A1 C>T	<b>CC</b>	
	GDF5 C>T	<b>CC</b>	
Inflammation	IL6 G>C	<b>GG</b>	
	IL6R A>C	<b>AA</b>	
	CRP G>A	<b>GA</b>	
	TNFA G>A	<b>GG</b>	
Oxidative Stress	SOD2 C>T	<b>CC</b>	
	eNOS G>T	<b>GG</b>	

## Injury susceptibility

Multiple stimuli, including exercise and mechanical load, can lead to connective tissue remodelling. Although remodelling may lead to physical gains, alterations in the structural properties of tissues may also lead to increased injury susceptibility. The variations examined in the DNA Sport test are linked to the ability of soft tissues to repair and remodel following tissue degradation, thus being implicated in injury risk.

### COL1A1 G>T

COL1A1 is one of the major collagens in connective tissues. Altered expression of this gene may lead to injury risk due to a structural change in the properties of the tissue.

YOUR RESULT: **GG**



The G allele leads to decreased expression of COL1A1 and puts you at an increased risk for tendon and ligament injuries. Base strength, conditioning and flexibility training as well as nutritional intervention are important parts of injury prevention.

### COL5A1 C>T

COL5A1 is one of the minor collagens that regulates the formation of new soft tissue fibres. Altered expression of this gene can lead to injury risk.

YOUR RESULT: **CC**



The C allele does not contribute to an increased risk of injury. 'CC' individuals seem to have an increased range of motion, so ensure adequate strength to go along with this flexibility.

### GDF5 C>T

GDF5 plays a role in the development and healing of skeletal, joint, and soft tissues. This gene influences the ability to recover from tissue damage.

YOUR RESULT: **CC**



The C allele does not impact injury risk.

## The inflammatory response

Inflammation is a normal immune response and an essential part of tissue healing following exercise. The release of inflammatory cytokines is controlled by various genes, however when there is a greater than normal increase in inflammatory cytokines following exercise, or a prolonged increase in these cytokines, increased recovery time is required between hard sessions in order to avoid tissue damage.

### IL6 G>C

IL6 is an inflammatory cytokine that stimulates an immune response to strenuous exercise. Excess release of this cytokine can lead to a chronic inflammatory state.

YOUR RESULT: **GG**



The G allele does not influence post-exercise inflammation. Because you do not release excess amounts of IL6, you may have improved muscle repair after eccentric exercise. This gives you an advantage for strength and power training. Adding eccentric loading to your training regime may be beneficial to power development.

### IL6R A>C

IL6R is a cytokine receptor that affects the action of IL6. This gene influences the fatigue experienced with regards to exercise and the ability to recover.

YOUR RESULT: **AA**



The A allele does not influence the inflammation you experience with exercise.

### CRP G>A

CRP increases in response to inflammation and plays a role in activating parts of the innate immune system. Regular moderate intensity exercise and favourable nutritional choices can help reduce baseline inflammatory markers such as CRP.

YOUR RESULT: **GA**



The G allele is linked to moderately higher levels of CRP which is associated with higher levels of inflammation. This will impact the recovery time you require between training sessions. Regular moderate intensity exercise as well as a diet low in saturated fats can lead to improvements in CRP levels.

### TNFA G>A

TNFA, like IL6, is a pro-inflammatory cytokine that stimulates the acute phase reaction of inflammation. Levels of TNFA increase after intensive exercise.

YOUR RESULT: **GG**



Your combination of nucleotides does not influence the inflammation you experience with exercise.

## Oxidative stress

Free radicals are a normal by-product of the biological processes that generate energy, such as those that occur during exercise. They are highly reactive with other molecules, and can damage DNA, proteins and cellular membranes. Anti-oxidants are free radical scavengers that interact with the free radical to ensure that it is no longer a reactive molecule. Long term regular light and moderate intensity exercise leads to an increase in anti-oxidant enzymes, as well as decrease in baseline inflammatory cytokines: beneficial to exercise training, performance and optimal health.

### SOD2 C>T

SOD2 is an anti-oxidant enzyme within the cell, especially the mitochondria. Oxidative stress during intensive training can lead to muscular fatigue and anti-oxidants enzymes are thus very important for physical performance.

### YOUR RESULT: **CC**



The C allele is linked to higher levels of oxidative stress. This could be a risk for developing long term disease if fruit, vegetable and other anti-oxidant intake is not adequate. Low and moderate intensity exercise training can also help to increase baseline levels of anti-oxidant enzymes.

### eNOS G>T

eNOS plays a key role in the regulation of vascular tone and peripheral resistance. Decreased activity of this enzyme has been associated with an increase in free radicals

### YOUR RESULT: **GG**



The G allele does not affect your ability to manage oxidative stress.

## Your injury risk

Based on our analysis and interpretation of your genetics, your DNA Sport tests indicates that it is likely that you have a moderate risk of picking up a soft tissue injury. This means that you will need to be careful, insuring that your training volumes and intensities are appropriate to your fitness level and that you engage in some degree of injury-preventing conditioning exercises. Nutrition also plays a role in injury prevention.



## RECOMMENDATIONS

Your genetic results reveal that you may need to be taking some preventative steps to try and anticipate the strains that will occur on your musculoskeletal system with training. We call this conditioning work 'prehabilitative training' – i.e. injury prevention. Resistance and flexibility training are the cornerstones for prehabilitation, and rehabilitation if an injury does happen. They include classical weight training, plyometrics, Pilates, yoga and specific exercises that have been designed to target particular injury risks.

If you are training regularly it would be worthwhile doing at least one or two sessions per week which are focused on general conditioning, helping to reduce your injury risk. If you are an elite athlete or focused on a specific sport, consider setting up a practice of sport-specific conditioning exercises 3-4 times per week. It is important to consider the most common musculoskeletal injuries that occur in your particular sport and take specific advice from a coach or exercise professional who specialises in your event. For example: runners are prone to Achilles tendonitis, calf strains, hamstring strains, patellar tendonitis, IT band syndrome; cyclists are prone to knee, back and neck pain (although a good bike set up can make a large difference); swimmers are prone to swimmers shoulder and breast-stroke knee.

With regards to nutrition, ensure adequate intake of Vitamin C and Iron as these are important for collagen turnover. A good protein source is important for amino acid building and should be taken in after intense training sessions.

## Your recovery

Based on our analysis and interpretation of your genetics, your DNA Sport tests indicates that it is likely that you are able to recover quickly from hard exercise. This means that you should have the capacity to undertake a heavy training load with frequent inputs of exercise. It should however be noted that hard training comes from a mixture of good genetics and slowly building a training foundation over the course of many years. If you have already been training at a high level for some years, take this as an indication that your body can theoretically handle high loads of exercise under ideal conditions. Otherwise it is suggested that you build up to this level slowly, taking into account your risk for injury.



## RECOMMENDATIONS

Based on the genes we examine in this test, your results indicate that you are likely to recover quickly from hard exercise. You therefore have less need than the average athlete to worry about recovery, but in order to gain maximal returns from your training, it would still be worth taking note of some recovery strategies.

Recovery is classically considered as the time between sessions: according to training theories, we require 2-3 days between hard training sessions. Because you have a fast recovery rate, once a training base is established you may expect to hit 3-4 hard sport-specific sessions per week. Other 'steady' recovery and conditioning sessions can be built around these big 3-4. If you are a seasoned athlete you could potentially progress to a once/day routine with an additional session on some days. Always allow one full day off per week. Recreational athletes with other commitments might wish to max out at a total of 6 sessions per week.

In addition to carefully planning your recovery times between sessions, there are a lot of other factors that you should look to do. Sleep is vitally important and you should try to obtain enough sleep so that you feel refreshed upon rising in the morning. This might be +/- 8 hours at night and a nap in the day is especially useful for optimising recovery. Managing your nutrition is also important for optimal recovery. Because inflammation influences recovery rates, you should look to consume mostly anti-inflammatory foods in your diet and avoid those that are pro-inflammatory.

## Your Genetic Results Part 2

### Performance

It is well established that a high percentage of the variance observed in athletic status can be explained by genetic factors. These genetic factors, as examined in your DNA Sport test, can determine how well you will respond to certain types of exercise training. Although both aerobic training, and strength and weight training are important for overall health and fitness, the ratio of these types of training should vary between individuals, even between those working towards the same goals. The overall results of this genetic test will enable you to focus your training towards the type of exercise that is going to give you the best outcomes for your hard work, whether that be aerobic or power type training.

	Gene Name	Your Result	Gene Impact
Blood Flow and Respiration	AGTT>C	TC	
	ACE I>D	ID	
	BDKRB2 C>T	CC	
	VEGF C>G	CG	
Energy Mobilisation	NRF2 A>G	AA	
	PPARGC1A G>A	GG	
	PPARA G>C	GG	
Fuel Metabolism	ADRB2 Arg16Gly A>G	AG	
	ADRB2 Gln27Glu C>G	CC	
	TRHR T>G	TG	
	CYP1A2 C>A	CA	
Musculoskeletal Properties	ACTN3 R>X	XR	
	VDRT>C	TC	

## Blood flow and respiration

Sporting performance is largely dependent on oxygen diffusion, and thus the vascular and pulmonary systems. Oxygen transport to the musculature is the key determinant of aerobic capacity and resistance to fatigue.

### AGT T>C

This gene is important in the regulation of electrolyte and body fluid balance, as well as blood pressure. Upregulation of AGT potentially leads to vasoconstriction and increased blood pressure. This gene contributes to the development of power.

### YOUR RESULT: **TC**



'TC' does not impact sporting performance.

### ACE I>D

ACE is a potent vasoconstrictor in the renin-angiotensin system. This enzyme is key in blood pressure regulation. ACE impacts aerobic capacity, muscular strength and lean body mass.

### YOUR RESULT: **ID**



'ID' contributes to both aerobic capacity and muscular strength. You are likely to have gains in aerobic capacity from low and moderate intensity exercise, as well gains in power from strength and interval training.

### BDKRB2 C>T

Bradykinin is a vasodilator that acts via the bradykinin B2 receptor. BDKRB2 is involved in blood pressure regulation, having the opposite affect to ACE.

### YOUR RESULT: **CC**



The C allele does not impact sporting performance, however it is associated with increased thirst and fluid loss during pro-longed exercise which should be monitored.

### VEGF C>G

VEGF is involved in the formation and growth of new blood vessels. The levels of VEGF therefore impact blood flow and oxygenation - these factors influence muscle efficiency and aerobic capacity.

### YOUR RESULT: **CG**



This does not impact sporting performance.

## Energy during exercise

In order to avoid fatigue during exercise the rate of energy production needs to match the rate of energy consumption. The mitochondria are the key sites of energy production (in the form of ATP) for muscle fibres, and the oxidative capacity of muscle fibres is directly linked to the formation of new mitochondria.

### NRF2 A>G

NRF2 improves respiratory capacity and the rate of energy production during exercise. This protein is also important in the formation of new mitochondria: the 'power house' of the cell where energy is produced.

YOUR RESULT: **AA**



The A allele does not impact sporting performance. It must however be noted that the 'AA' combination is present in 98% of the population, and only 2% carry a G allele.

### PPARGC1A G>A

PPARGC1A plays an essential role in energy regulation. This gene is expressed in tissues that have high energy demands and is therefore abundant in mitochondria and associated with aerobic capacity. PPARGC1A is also involved in the exercise-induced increase in mitochondria.

YOUR RESULT: **GG**



'GG' is linked to increased expression of this gene as well as Type I (slow twitch) muscle fibre specialisation. 'GG' is also associated with greater mitochondrial biogenesis at baseline and in response to aerobic training. This gives you an advantage for increased aerobic capacity.

### PPARA G>C

PPARA is involved in the uptake, utilisation and break down of fatty acids to 'ATP' - the main source of energy during prolonged exercise.

YOUR RESULT: **GG**



'GG' is associated with greater aerobic performance and significantly higher Type I (slow twitch) muscle fibre specialisation.

## Fuel during exercise

Carbohydrates and fats are the main contributors to the fuel supply that is necessary to perform exercise. These sources are converted to energy, in the form of ATP, when required. Protein is generally involved in the maintenance and remodelling of tissues rather than an energy source to fuel muscles.

### ADRB2 Arg16Gly (A>G)

ADRB2 regulates cardiac, pulmonary, vascular, endocrine and central nervous system functions. Adrenaline acts via ADRB2 to maintain blood glucose levels during prolonged exercise by promoting glycogenolysis. Arg16Gly is involved in the modulation of cardiac output during exercise through vasodilation.

#### YOUR RESULT: **AG**



The A allele is associated with the ability to achieve a moderately higher aerobic capacity with endurance training. Focus on aerobic training that stimulates VO2max and aerobic capacity.

### ADRB2 Gln27Glu (C>G)

Gln27Glu within ADRB2 is associated with aerobic capacity and the ability to lose weight as a result of exercise.

#### YOUR RESULT: **CC**



The C allele is linked to greater aerobic capacity with training. Individuals with this genotype also have a greater ability to mobilise fats for fuel during exercise, which would suggest the ability to lose weight through exercise. Sub-maximal and maximal endurance training is likely to lead to an increase in aerobic capacity. If you wish to gain a more comprehensive understanding of your weight loss responsiveness to exercise we recommend performing the DNA Diet test.

### TRHR T>G

TRHR stimulates the release of thyroid hormones T3 and T4 leading to an increased metabolic rate which is required to mobilise fuels during exercise. The TRHR gene has been linked to lean body mass.

#### YOUR RESULT: **TG**



This does not impact sporting performance.

### CYP1A2 C>A

Caffeine is a central nervous system and metabolic stimulant that is used to reduce physical fatigue. In athletics, moderate doses of caffeine have been known to improve both sprint and endurance performance. CYP1A2 is one of the main enzymes that catalyses the oxidation of caffeine in humans.

#### YOUR RESULT: **CA**



This indicates that you have a reduced ability to metabolise caffeine. A moderate to high intake of caffeinated beverages, such as coffee, is associated with increased risk of heart disease. It is recommended that you rather opt for decaffeinated options. In terms of performance benefits, you may need to take in your caffeine more than an hour before the start of a race in order to gain from the effects.

## Muscle and bone composition

The properties of the musculoskeletal system, including bones, muscles, cartilage, tendons, ligaments and joints, greatly affect our ability to perform. Although these tissues can be potentially altered with training, our genetics forms the base of the structural properties of these tissues.

### ACTN3 R>X

ACTN3 is only present in Type II (fast twitch) muscle fibres and greatly influences power development. ACTN3 also plays a role in muscle fibre type specialisation, diameter and metabolism.

### YOUR RESULT: **XR**



'XR' gives you a moderate advantage when it comes to strength, speed and power training.

### VDR T>C

Activation of VDR leads to the maintenance of calcium and phosphorus levels in the blood and bones, which is necessary for bone formation and replacement, and the preservation of bone mineral density. VDR has been linked to muscle strength.

### YOUR RESULT: **TC**

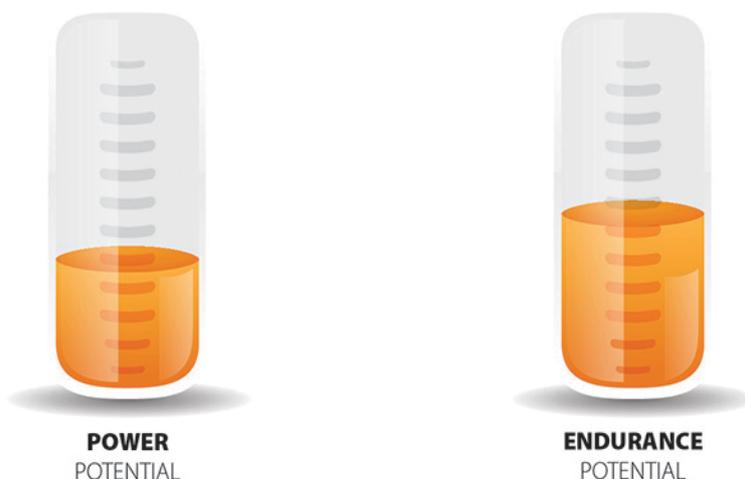


'TC' does not impact sporting performance and is unlikely to influence bone mineral density.

## Your athletic potential

The performance potential graph gives you an indication of your genetic “score” as a potential of the total “aerobic” and “power” points available.

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Based on our analysis and interpretation of your genetics, your DNA Sport tests indicates that to gain the best results from your training you should include exercises that focus on aerobic capacity as well as strength and power training. **This means that you are likely to gain from including long-duration, moderate intensity exercises as well as short-duration, high intensity exercises in your training program.**

Energetically, you will be exercising “aerobically” and “anaerobically”. Aerobic exercising generally constitutes light and moderate intensity activities that can be maintained for a long duration of time. Anaerobic exercise focuses on building strength, speed and power and refers to short duration, high intensity activities. Your results indicate that including both of these types of exercises in your training program is likely to lead to improvements and good returns. Remember that there are many variables that influence our success with regards to training and performance; genetics is one of these variables that should be used to understand the total outcome.

## Key training principles

Your genetic results indicate that you will likely see improvements and gain the greatest returns with a mixture of aerobic and anaerobic based exercise. Your training should ideally include both moderate intensity, long duration and high intensity, short duration exercise activities, focusing on cardiovascular training as well as strength, speed and power training. Conditioning should also be incorporated into your training sessions.

The types of sessions to consider in your training programme include long duration endurance-type training, interval training, strength, speed and power training as well as conditioning and sport specific training if you are involved in a particular sport. Aerobic type training may include long duration running, cycling, swimming, or similar types of cardio exercises, whereas anaerobic type training includes sprinting and interval training, weight training, power training and plyometrics. Your aerobic sessions may vary from 30-60 minutes at a steady pace, to 3 x 10 minute repeats at a hard pace, or sprint and interval training that consists of shorter duration repeats. Remember to include an easy pace warm up before sessions, as well as cooling down sufficiently afterwards. Strength focused weight training may include conventional free weights, machines or power cleans and snatches. Power-based plyometric exercises are also important for individuals wanting to develop explosive strength and speed. With weight training it is important to start with developing basic muscular strength first, and slowly build up to heavy weights in order to avoid injury. High repetition light weight training can also be used to develop muscle contraction efficiency. Your training will however need to be tailored depending on your goal, but always bearing in mind that your success is likely to come from a mixture of moderate and high intensity sessions as well as a mixture within a session. The aerobic fitness as well as strength, speed and power that you will gain from this type of training will be of great benefit to you in both short and long duration events, but if you are involved in a particular sport you need to be aware of the importance of combining this training with sport-specific training. It is also important to include conditioning and stability training into your program. Resistance training, core-stability, flexibility, general conditioning and sport-specific conditioning are all important parts of general fitness, optimal performance and injury prevention. Remember to efficiently manage your recovery time between sessions in order to avoid superfluous fatigue and injury.

What follows is a table which refers to the various levels of cardio training. As someone who has mixed endurance and power potential, we recommend a range of activities that include endurance efforts at Levels 1 to 4 as well as speed and interval training at Levels 5 to 7. Your core sessions should be moderate duration interval sessions at levels 4 and 5.

## Supplementary Information

### Cardio zones training table

The levels referred to in the cardio training table below represent zone training that can be done either with a Heart Rate (HR) Monitor or simply by your Rate of Perceived Exertion (RPE). You will need to test yourself for your Threshold Heart Rate if you wish determine your training levels with a heart rate monitor (see below). RPE is simply a 0-10 scale of how you perceive a training session to be - 0 being nothing and 10 being maximal output. Levels 1 to 4 are considered endurance style training, whereas above level 4 and above is used in short duration speed and interval training exercises.

LEVEL	INTENSITY	% OF THRESHOLD HR	RPE
1	RECOVERY	<81%	<2
2	AEROBIC	81-89%	2-3
3	TEMPO	90-93%	3-4
4	SUB-THRESHOLD	94-99%	4-5
5	SUPRA-THRESHOLD	100-102%	6-7
6	AEROBIC CAPACITY	103-106%	>7
7	ANAEROBIC CAPACITY	>106%	MAXIMAL

### Measuring your threshold heart rate and setting your training zones

Perform a solid warm-up, and then do a 30 minute time trial (all out) on a relatively flat course. Record your average heart rate for the final 20 minutes of the time trial. This is your LTHR. To set your zones, your LTHR is the figure that should go between Level 4 and 5 (100%) in the cardio table above. To work out the other zone heart rates, simply multiply the LTHR by the percentages given.

