VITAGEN-X

PRECISION NUTRITION

Thyroid Genetic Panel

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Gene List

Understanding your genetic report

What is DNA?

DNA is your body's instruction manual, controlling every single function from when you were only made up of a few cells, until now. It looks like a twisted ladder, made up of two halves - you inherit one half from your mother, the other from your father. This combination is what makes you, you.

Each 'rung' of the ladder contains two 'letters' of DNA code called ***nucleotides*** which bond together in pairs: **A (adenine)** and **T (thymine)** bond together**,** as do **C (cytosine)** and **G (guanine).**

Genes are portions of the ladder which use combinations of the contained code to perform specific functions.

SNPs

Over time, due to environmental and lifestyle shifts, minor changes called **single nucleotide polymorphisms (SNPs)** occur in the DNA code and are passed down from parent to child, from generation to generation. Remember the nucleotides? Well, a C might be replaced by a T, changing the instructions given to a gene.

Some changes are positive, making us stronger and more resilient (like being able to digest milk after infancy), some negative (like being likely to store more fat as a result of past famine or food shortage) and some make no difference at all.

SNPs can be passed down on just one side of your ladder, from one parent, or from both, enhancing the effect. They are generally what we are looking for when we test your DNA.

Results

Your results are shown by a combination of the letters **ATCG** along with a traffic light system to indicate if the result is potentially good, neutral or less favourable.

Identical letters (e.g. TT or CC) mean you are either what is called the **"wild type"** with no genetic variants (or SNPs) OR you have **both** genetic variants (from both parents). A combination of letters (e.g. CT) means you have one inherited genetic variant.

A green result indicates either no variants or a positive genetic variant

An amber result usually indicates one genetic variant present, and thus potentially a mildly negative impact

A red result indicates a potentially negative impact either due to both variants being present or a "wild type" result that is not as beneficial as the variant

Example of your genetic results

GENE	RESULT	IMPACT & ADVICE
GENE CODE - Gene Function Explanation of the role the gene plays and what effect genetic variants might have, symptoms etc.	TT	An explanation of your result, how you might be affected along with diet and lifestyle advice
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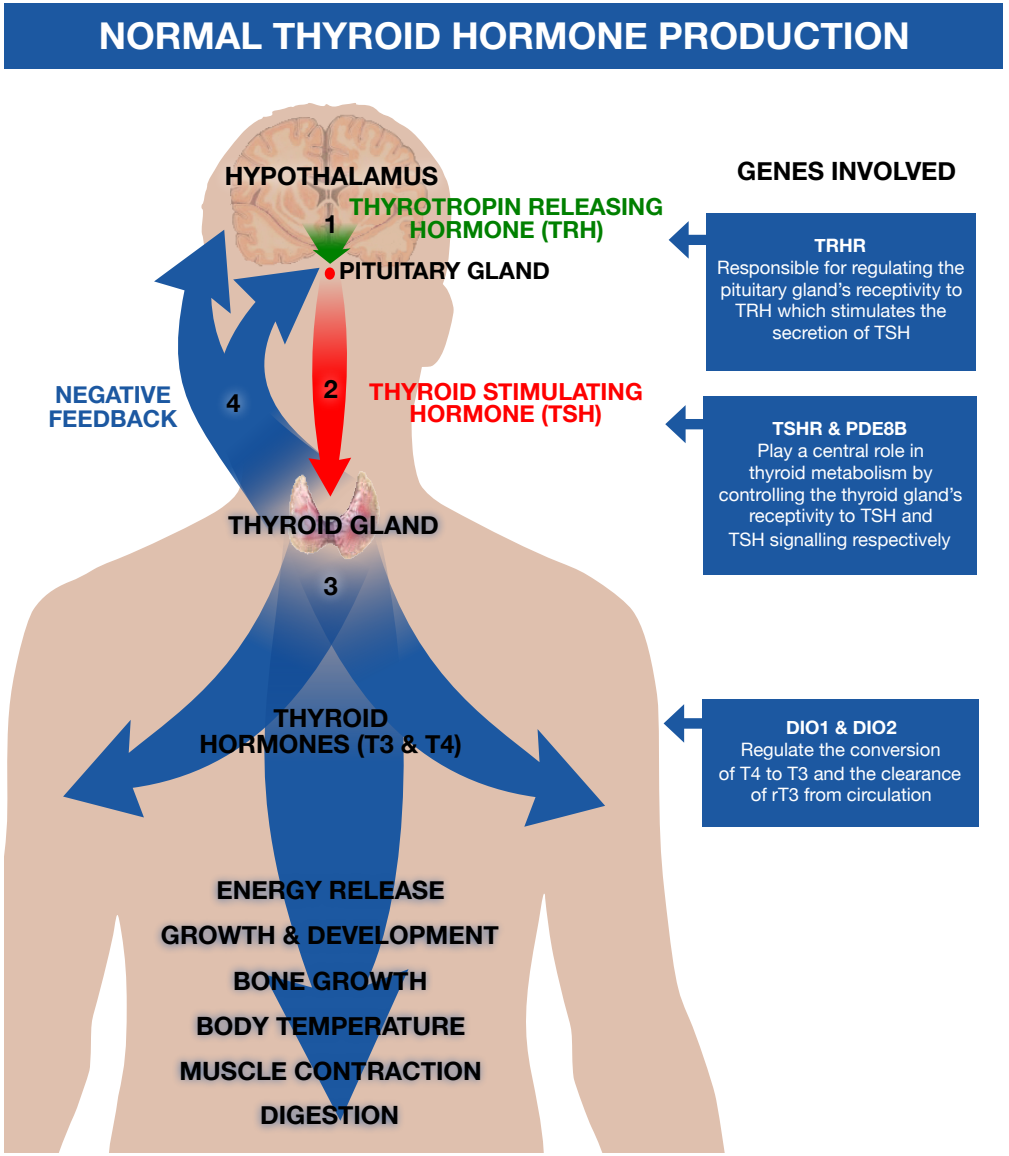
Thyroid Function

Your thyroid gland is responsible for regulating a number of bodily functions, including your metabolism (energy production), body temperature, growth and repair, muscle contraction and digestion processes. The thyroid cells are the only cells in the body which can absorb iodine. They combine iodine with the amino acid tyrosine to produce two main thyroid hormones: **thyroxine (T4)** and its active counterpart, **triiodothyronine (T3),** which are then released into the blood stream.

T3 is critical to making every system in your body work at the right speed. Although T3 is the more active thyroid hormone, the thyroid gland produces much more T4 than T3. T4 is converted to T3 when needed. Too much T3 will cause enzymes to convert it into reverse T3 (rT3), an inactive form. If you produce too much or too little thyroid hormone, your whole body will be affected. Balance is key.

Thyroid hormone balance is maintained via negative feedback. When thyroid hormone levels fall too low, (1) the hypothalamus (in the brain) produces **thyrotropin releasing hormone (TRH)** which stimulates the pituitary gland (also in the brain) to (2) release **thyroid stimulating hormone (TSH)**. TSH stimulates the thyroid to (3) produce more thyroid hormones (T4 and T3). As soon as levels increase again, the pituitary responds by (4) decreasing production of TSH.

Genes play a vital role in regulating this mechanism. Studies into genetic inheritance suggest that up to 67% of circulating TSH and thyroid hormone levels are genetically determined (Panicker, 2011).



Thyroid Disorders

Hypothyroidism (underactive thyroid)

This occurs when the thyroid gland produces too little thyroid hormone. Symptoms include persistent fatigue, moodiness, depression and anxiety, dry hair and skin, puffy face, brain fog, hoarse voice, weight gain, constipation, muscle weakness, aches and pains, sensitivity to cold, heavy periods, thinning hair and loss of outer eyebrow hair. Thyroid function blood test results usually show elevated TSH along with low T4 and T3.

Hashimoto's Thyroiditis (HT)

"Hashimoto's" is an autoimmune condition and is one of the most common causes of hypothyroidism. Autoimmune disorders occur when your immune system produces antibodies that attack your own tissues. In this case, the thyroid gland, and the antibodies cause it to function poorly. HT has a genetic link and tends to run in families. Test results usually show high levels of thyroid peroxidase antibodies (TPOAb) in particular, and possibly thyroglobulin antibodies (TGAb).

Hyperthyroidism (overactive thyroid)

This is the situation when the thyroid gland produces too much thyroid hormone. Symptoms include nervousness, insomnia, racing heart, bulging eyes, unexplained weight loss, sweating, muscle weakness, frequent bowel movements, thin and brittle hair, intolerance to heat, fine tremor of hands or fingers, enlargement of the thyroid gland (goiter), changes in menstrual cycle, erectile dysfunction or reduced libido. Lab results usually show extremely low TSH with elevated FT4 and FT3.

Graves' Disease (GD)

GD is the most common cause of overactive thyroid. Like Hashimoto's, it is also an autoimmune disease, however, unlike Hashimoto's, Graves' causes the thyroid to over-secrete thyroid hormones. This type of hyperthyroidism also tends to run in families and occurs more often in young women. The most noticeable symptom of Graves' Disease is a condition known as Graves' opthalmopathy, an inflammation of the eyes and swelling of the tissue behind the eye that causes them to bulge. Thyroid function blood results will usually reveal TPOAb and/or TGAb.

Secondary Hypo or Hyperthyroidism

Secondary hypothyroidism or hyperthyroidism occurs when a dysfunction of the hypothalamus or pituitary gland causes the thyroid to under or over produce thyroid hormones - by under or over secreting TSH. Thyroid function tests will generally show low TSH, T4 & T3 or high TSH, T4 & T3 respectively.

Thyroid Disruptors

Stress

Cortisol is an essential hormone produced by the adrenal glands (located near the kidneys), with many functions - it is released in small amounts to promote wakefulness and in larger amounts in response to physical and emotional stress. High cortisol levels lower TSH, reduce the conversion of T4 to T3, and increase inactive rT3. Since T3 and rT3 compete for binding sites in cells, high rT3 may make remaining T3 even less effective.

Inflammation & infection

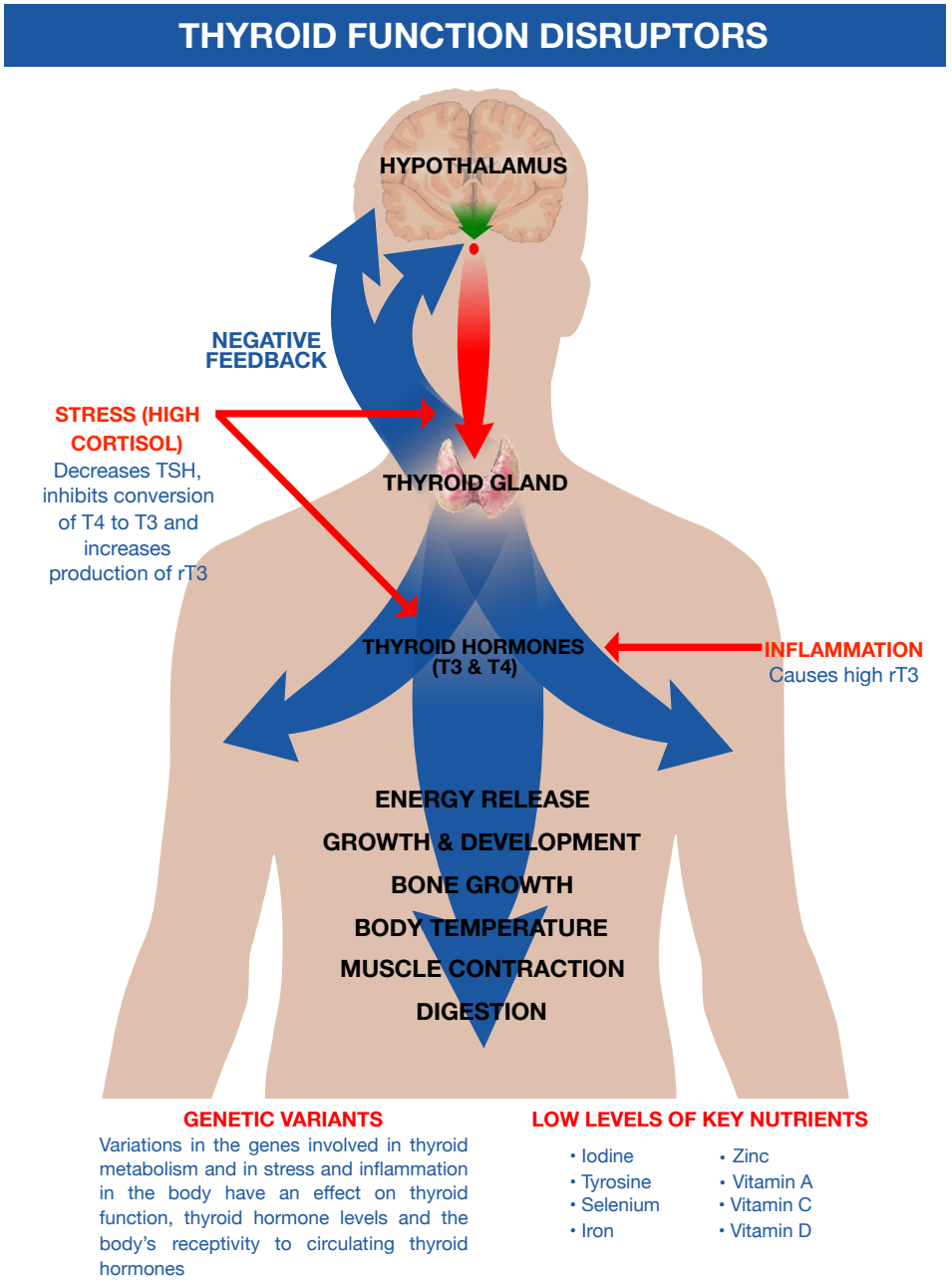
Prolonged inflammation, due to infection or persistent irritation, causes the body to convert T4 to inactive rT3 and may reduce the body's receptivity to thyroid hormones, creating symptoms of hypothyroidism (even though standard thyroid function results for TSH, T4 and T3 might be normal). Chronic inflammation is also linked to the development of autoimmune conditions, such as Hashimoto's and Graves' diseases.

Lack of key nutrients

Iodine and tyrosine are required components of thyroid hormones. Iron is important for the production of thyroid hormones too, and low levels are associated with hypothyroidism. Selenium and zinc are important for the conversion of T4 to T3. Selenium deficiency results in increased production of rT3, and zinc is also vital for the hypothalamus to respond to low circulating thyroid hormone levels. Vitamin D may have a protective effect against the development of autoimmune diseases, as well as osteoporosis (a result of long term hyperthyroidism). Vitamin A aids TSH production in the pituitary gland.

Genetics

Recent evidence suggests that genetic factors are likely to play a major role in thyroid function and that this accounts for roughly 50% of the variations seen between individuals in serum thyroid levels (Medici et al, 2015)



Your thyroid genotype and advice:

GENE	RESULT	IMPACT & ADVICE
COMT - Inactivation of Stress Hormones and Oestrogen COMT is one of the main inactivating enzymes of stress hormones and oestrogen in the body. COMT variants cause slow clearance of stress hormones and oestrogen leading to high oestrogen and stress hormone levels which may also be linked to thyroid hormone dysfunction.	**GG**	Healthy clearance of stress hormones and oestrogen. You are less likely to experience thyroid dysfunction as a result of poor oestrogen and stress hormone detoxification.
DIO1 - Thyroid Hormone Activation "D1" is largely expressed in the liver and kidneys. It is responsible for the clearance of rT3 from circulation, and for facilitating the conversion of T4 to T3 in plasma and surrounding tissue. This process requires selenium and iodine for optimum function. Here we look at two variants linked to poor conversion of T4 to T3 and reduced clearance of rT3.	**CA**	The "C" result is associated with increased DIO1 gene function and expression resulting in healthy conversion of FT4 to T3 and reduced circulating rT3 levels. Ensure adequate iodine and selenium intake to support this pathway optimally.
	TT	Likely to have low DIO1 activity and therefore decreased clearance of rT3 from circulation and low conversion of T4 to T3. Ensure adequate intake of iodine and selenium to support this pathway.

Your thyroid genotype and advice:

GENE	RESULT	IMPACT & ADVICE
DIO2 - Thyroid Hormone Activation "D2" is importantly expressed in the central nervous system, pituitary, brown fat tissue and muscle, and responds to changes in thyroid levels. D2 is responsible for the 'local' conversion of T4 to T3 in the thyroid, placenta and brain. It requires selenium and iodine to function optimally. Here we look at two different variants linked to decreased T4 and low mood in certain individuals.	**TC**	The C result is associated with anxiety and depression in many cases in those taking thyroxine (T4) hormone replacement. This is reversed with combined T4/T3 therapy.
	TT	Decreased rate of TSH-stimulated FT4 thyroid secretion, normal T3 release
FKBP5 - Cortisol Regulation FKBP5 is an important stress-regulating gene responsible for lowering cortisol levels after a stress response. Variants are associated with prolonged and increased symptoms of stress, which may be due to delayed lowering of cortisol levels.	**CC**	Healthy cortisol regulation. You are likely to be less negatively affected by stress and the impact it has on the body, including thyroid hormones.
PDE8B - TSH Signalling PDE8B is found in the thyroid but not the pituitary, and is involved in TSH signalling. It is thought that the variant decreases the response of the thyroid gland to TSH stimulation	**GA**	You may be susceptible to reduced thyroid sensitivity to TSH stimulation which could result in a need for higher TSH levels in order to produce normal levels of thyroid hormones (T4 and T3).

Your thyroid genotype and advice:

GENE	RESULT	IMPACT & ADVICE
TNF-a - Inflammation TNF-a is an inflammatory cytokine that helps regulate the immune reaction involved in inflammation, giving rise to fever and inhibiting tumour growth. If poorly controlled, it may be implicated in a number of autoimmune disorders. Variants in TNF-a are associated with overreactive immune responses and prolonged inflammation.	**AA**	The "A" result increases likelihood of overreactive inflammatory immune response. This means you are at increased risk of chronic inflammatory and autoimmune conditions, including Hashimoto's thyroiditis or Graves' disease.
TSHR - Thyroid Stimulating Hormone (TSH) Receptor The TSHR gene plays a central role in thyroid metabolism by controlling the thyroid gland's receptivity to TSH. Variants in this gene have been linked to hyperthyroidism, particularly to Graves' Disease (GD).	**GG**	The "G" result is linked with decreased risk of developing thyroid stimulating hormone receptor antibodies (TRAb), a known cause of Graves' Disease, and therefore a reduced risk of developing GD.
TRHR - Thyrotropin Releasing Hormone (TRH) Receptor Responsible for the body's receptivity to TRH which stimulates the secretion of TSH from the pituitary gland. In turn, TSH stimulates the production of thyroid hormones from the thyroid gland. TRH is an important part of the negative feedback loop that ultimately regulates thyroid hormone levels. Variants have been shown to affect TSH levels.	**GG**	The "G" result has been associated with a less responsive negative feedback mechanism. Carriers of this genotype may show higher circulating TSH:T3/4 ratio due to delayed reduction of TRH and TSH in the presence of healthy thyroid hormone levels. This may mean that the body is subjected to a less efficient response to changing thyroid hormone requirements.

Nutrients for Hypothyroidism

- ☑ ***Iodine:*** sea vegetables (kelp, nori, wakame), ocean fish, iodised salt, yoghurt
- ☑ ***Tyrosine (protein):*** eggs, meat, beans, seeds, cheese
- ☑ ***Selenium:*** Brazil nuts, spinach, sardines, turkey, beef liver
- ☑ ***Iron:*** liver, animal meat, seafood
- ☑ ***Zinc:*** wild-caught salmon, organic organ meat, pumpkin & chia seeds, almonds, oysters
- ☑ ***Magnesium:*** spinach, chard, pumpkin seeds
- ☑ ***Vitamin A:*** Cod liver oil, carrots, sweet potatoes, dark green leafy veg
- ☑ ***Vitamin D:*** Seafood, liver, eggs, mushrooms and sunshine!
- ☒ ***Fluoride:*** depletes iodine
- ☒ ***Soy:*** large amounts block TH absorption

Nutrients for Hyperthyroidism

- ☑ ***B Complex:*** particularly B1 & B6
- ☑ ***Vitamin C:*** berries, citrus fruit, papaya, bell peppers, guava, kiwi
- ☑ ***Vitamin D:*** Seafood, liver, eggs, mushrooms and sunshine!
- ☑ ***Vitamin E:*** almonds, spinach, avocado, sunflower seeds
- ☑ ***Calcium:*** spinach, kale, white beans, bony fish
- ☑ ***Antioxidants:*** berries, turmeric, dark chocolate
- ☑ ***Omega-3:*** Oily fish, egg yolks, cod liver oil, seeds
- ☑ ***L-carnitine:*** Beef, chicken, cheddar (if not dairy-intolerant), asparagus
- ☑ ***Probiotics:*** healthy gut bacteria may help with the elimination of excess circulating TH
- ☒ ***Suspected food allergens*** such as dairy, gluten, soy and chemical food additives
- ☒ ***Iodine***

Lifestyle Recommendations

- ☑ ***Stress management:*** make time for relaxation and to do things you enjoy
- ☑ ***Exercise:*** Improves cellular sensitivity to thyroid hormones. Aim for at least 30 mins, 5 days a week
- ☑ ***Sleep:*** Adequate sleep helps to balance thyroid hormones. Aim for 7-9 hrs a night. Keep a routine, switch off all electronics 2 hours before bed
- ☒ ***Alcohol:*** drink in moderation. Alcohol has been shown to suppress thyroid function and can block absorption of vital nutrients
- ☒ ***Smoking:*** bad for health in general and is a risk factor for Graves' Disease
- ☒ ***Caffeine:*** caffeine increases cortisol production, consume in moderation. If taking thyroid medication, wait at least 60 minutes before drinking tea or coffee (blocks absorption)