Meridian Valley LAB

Urine Hormone Interpretation Guide

Leader in preventive medicine since 1976

Meridian Valley Lab's 24-hour urine profiles offer the most comprehensive assessment of a wide array of hormones and metabolites available today. This interpretive guide is intended to assist you in using these panels to guide treatment decisions. The guide provides general information addressing each analyte reported on MVL panels, but is not specific to your patient's results. For a more individualized interpretation, please call Customer Service at 855-405-8378 to set up an appointment for a free consultation with one of our Consulting Physicians. Individualized written interpretations can also be requested for an additional fee.

About our reference ranges

All reference ranges are adult male or female reference ranges. DHEA, testosterone, and Growth Hormone reference ranges are based on normal 18-35 year olds and are therefore "healthy aging" reference ranges. Estrogens on female reports have four reference ranges: Luteal, Follicular, or Mid-cycle phases, and Post-menopausal. Test results for pre-menopausal women are best interpreted when collection is made in the luteal phase. Test results for post-menopausal women who are taking exogenous hormones are also interpreted using luteal ranges. Reference ranges are derived using established guidelines and represent the middle 95% of test results. They are not necessarily the same as "optimal" ranges.

Estrogens

Estrone (E_1)

A moderately potent estrogen. Binds primarily to Estrogen Receptor Alpha (ERα).[1] Estrone is metabolized into 2-Hydroxy Estrone (2-OH E1), 16α-Hydroxy Estrone (16α-OH E1), and 4-Hydroxy Estrone (4-OH E1).

Estradiol (E_2)

The most physiologically active estrogen. Binds to both to ERα and Estrogen Receptor Beta (ERβ).[1] Estradiol, made in the ovary, rapidly converts to estrone. Poor symptom control with estrogen replacement may suggest the need for improving absorption or increasing estradiol.

Estriol (E_3)

Has weak estrogen activity. Considered to be a protective estrogen.[2,3] Most prevalent estrogen in pregnancy. Binds primarily to ERβ.[1,4] Estriol is metabolized from 16–α OH Estrone. This conversion may be mediated by iodine.[5]

Total E_1, E_2, E_3

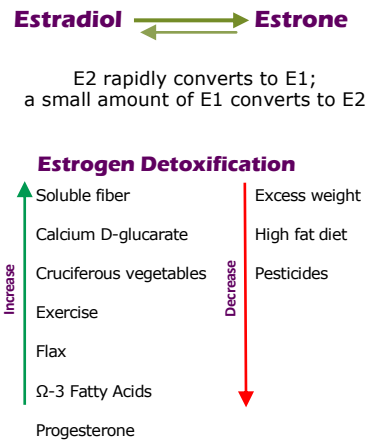
High, out-of-range estrogens are commonly seen with oral or sub-lingual supplemental estrogen. High levels are also seen in pregnancy and with contamination of urine from vaginally or labially-applied supplemental estrogens. Non-bioidentical hormones, such as birth control pills and other hormone-based contraception usually result in suppressed estrogen levels. Individual estrogen requirements vary widely and levels that result in estrogen deficiency symptoms in some women may be adequate for others.

Estrogen Quotient (EQ)

Women with an EQ>1 have a higher survival rate after breast cancer[6], and may be at decreased risk for developing breast cancer. EQ in pre-menopausal women is typically >1.[7] EQ often declines as women enter menopause. An EQ of one or less may be a sign of a need for supplemental iodine.[5]

Estrogen in Male Profiles

Estrogens are an important part of male hormone balance that contribute to bone density, libido, cognition and cardiovascular health.[8-10] Estrogens in men are always evaluated in relationship to testosterone levels. In general, the 24-urine testosterone should be at least four times greater than the total of E_1, E_2, and E_3. (T:E ≥ 4.0) A lower ratio may signal over-aromatization of testosterone to estrogen which is associated with insulin resistance.[11-14] Pharmaceutical aromatase inhibitors will suppress estrogen levels in men and may result in very low levels.



Estrogen Metabolites

2-Hydroxyestrone (2-OH E1)

This metabolite of Estrone is considered protective.[15,16] A comparison with 2-Methoxyestrone, its Phase II liver metabolite, may help with assessing adequacy of methylation processes. (See below.)

16α-Hydroxyestrone (16α-OH E1)

16α-OH E1 is a metabolite of estrone that has some duality: it is both carcinogenic[17] and important for building bone.[18,19] Therefore, very high levels and very low levels are simultaneously undesirable. High levels suggest a need for measures to improve estrogen detoxification. Low absolute levels may increase risk of osteopenia and may indicate a need for supplemental estradiol, especially in women with other risk factors for osteoporosis.

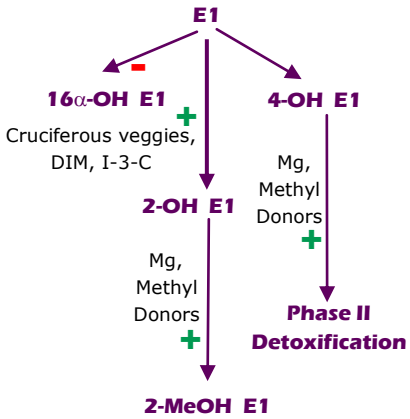
2/16 α ratio

Optimal ratio is between 2-4. Ratios <2 may indicate increased breast cancer risk.[20-24] This may be less significant when overall levels are low. Consider nutrients that push estrogen metabolism toward 2-OH E1. Ratios > 4 may indicate increased risk for osteopenia, especially when absolute level of 16α-OH E_1 is low.[18,19]

4-Hydroxyestrone (4-OH E1)

A very carcinogenic estrogen metabolite, levels low in the reference range are desirable. Additional magnesium[25], liver support, and methylation support may help decrease 4 OH-E1 levels.

Phase I Liver Metabolites	Phase II Liver Metabolites
2-OH E1	2-MeOH E1
16α-OH E1	2-MeOH E2
4-OH E1	



2 Methoxy-Estrogens

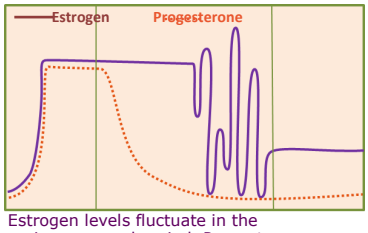
The 2-Methoxy Estrogens are considered to be protective.[26-28] Low levels are usually a reflection of overall low estrogens and may be improved with supplemental estrogen.

2 Methoxy-Estrone (2-MeOH E1)

Metabolized from 2-OH E1. A comparison of 2-MeOH E1 with 2-OH E1 allows insight into methylation pathways. If 2-MeOH E1 value is at least 25% of 2-OH E1 value, methylation is probably adequate.[29] If <25% consider adding methyl donors.

2 Methoxy-Estradiol (2-MeOH E2)

Considered to be one of the most protective estrogen metabolites, 2-MeOH E2 is also produced endogenously in small amounts. It is showing promise in a number of animal and human trials as an adjunctive treatment for several types of cancer. Current scientific understanding suggests it does not bind to estrogen receptors.[30-33]



Estrogen levels fluctuate in the perimenopausal period. Progesterone levels often drop rapidly.

Progesterone

Pregnanediol
Progesterone itself is not readily found in the urine. Instead, this test measures pregnanediol (a progesterone metabolite). Pregnanediol is well-established in research literature as a reliable marker for progesterone levels.[34] Low or low-normal levels of pregnanediol signal less than optimal progesterone. This commonly results in an increase in symptoms occurring in the luteal phase. In the perimenopausal years, progesterone levels tend to fall faster than estrogens, resulting in a relative estrogen dominance. Botanicals or supplemental progesterone can be useful for managing symptoms. Low levels are commonly associated with sleep disturbances, anxiety, stress, and edema. High levels are usually due to high doses of oral progesterone.

Androgens

Consider if androgens are high:

Women: PCOS, especially if coinciding with estrogen dominance, low progesterone and high 5a-Reductase activity.

Men: Check blood viscosity, especially if hematocrit is high normal or high out of range. The most common side effect of exogenous testosterone is an increase in hematocrit.

Dehydroepiandrosterone (DHEA)
DHEA is produced in the adrenal glands and is a precursor to both testosterone and estrogen. DHEA also affects bone density, response to stress, mood and cognitive function, improves insulin sensitivity, and is associated with decreased cardiovascular and cancer risk.[35-40] It peaks in the mid-20s and begins to decline after 30. Longevity is associated with higher than age-normal levels of DHEA.[41] Low levels may be a sign of adrenal stress and/or reduced androgen production. Adrenal support and meditation can increase DHEA levels, or supplementation may be appropriate. High levels are common with PCOS or may be a sign of over-supplementation.

Testosterone in Men
Lower levels in men are increasingly common and can lead to fatigue, apathy, loss of muscle mass and strength. Low or low normal levels in young to middle aged men can be an indicator of environmental toxicity.[42-44] High levels are rarely seen except in cases of over-supplementation. Testosterone metabolizes to more potent androgens via 5α-reductase and aromatizes to estradiol. Testosterone in men should be evaluated in relationship to estrogens in order to evaluate possible over-aromatization. (See Estrogen section)

Testosterone in Women
The main male sex hormone, testosterone is also important for women. Optimizing testosterone in women with low or low-normal levels may improve poor libido, vaginal dryness, muscle mass, and overall sense of optimism and well-being. Low levels may be due to low DHEA precursor or adrenal stress. High levels are common in PCOS or may be a sign of over-supplementation.

5α-Androstandiol , 5β-Androstandiol, Androsterone , Etiocholanolone
5α-Androstandiol and 5β-Androstandiol are metabolites of testosterone via 5α- and 5β-DHT. Androsterone and Etiocholanolone are DHEA metabolites via Androstenedione and the 5α- and 5β-reductase pathways. These androgens allow assessment of 5α-reductase activity. Normal metabolites may be a better indicator of androgen status in a patient with low DHEA and/or testosterone. Low or low-normal metabolites can help confirm low androgen levels. High levels are often seen in PCOS and with over-supplementation.

Glucocorticoids

Treatment Considerations:

Elevated cortisol with an elevated sum of THE+5a-THF+THF suggests excessive cortisol secretion. Stress management interventions alongside calming botanicals and nutraceuticals may be indicated.

Values low in, or below the reference range suggest suboptimal cortisol secretion. Nutrients and adrenal adaptogenic herbs may be of value in this scenario. Hydrocortisone supplementation may be indicated in certain cases.

THE
5α-THF
+ THF
Total

Optimal:
5000-7000 (Women)
8000-10,000 (Men)

Pregnanetriol
Pregnanetriol is a marker for the precursor leading into the cortisol pathway. Very high values may indicate an accumulation from a rate-limiting 21-hydroxylase enzyme deficiency (rare), if cortisol is also low.[45] Low levels with low glucocorticoids may reflect inadequate precursor chemistry as a potential etiology of adrenal hypo-function.

Cortisone
The inactive or "storage form" of adrenal glucocorticoid. Can be reversibly transformed to cortisol. Clinically, cortisone may reflect a measure of adrenal reserve when compared to cortisol. Ideally, cortisone will be about 30% higher than cortisol when both are at optimal levels.[46] Values at the high end or low end of the reference range are generally not optimal.

Cortisol
The active form of adrenal glucocorticoid. Responsible for gluconeogenesis, maintaining blood pressure and modulating immune function. Can be reversibly transformed to cortisone. When compared to cortisone, can provide clinical information about adrenal reserves and any present state of adrenal compensation or decompensation. Values at the high end or low end of the reference range are generally not optimal.

Tetrahydrocortisone (THE), Allo-tetrahydrocortisol (5α-THF), Tetrahydrocortisol (THF)
These three cortisol and cortisone metabolites reflect approximately 50% of the total endogenously produced cortisol. The sum of the three therefore gives an indication of total cortisol production.[47-49] Optimal totals are 5000-7000 for women and 8000-10,000 for men. Higher than optimal totals suggest an excessive cortisol response. Lower than optimal totals can signal decreased adrenal function.

11β-Hydroxyandrosterone, 11β-Hydroxyetiocholanolone
These end-products of cortisol metabolism can help to confirm an overall high or low trend in adrenal corticosteroid health.

Mineralocorticoids

Aldosterone
Aldosterone is the primary mineralocorticoid. Responsible for sodium balance and blood pressure. As a product of the adrenal cortex, aldosterone can reflect adrenal health status. Low levels (<10) may be due to high sodium, dehydration, or stress. High levels may be seen with salt-restricted diets[50] and spironolactone use.[51]

Allo-tetrahydrocorticosterone (5α -THB), Tetrahydrocorticosterone (THB), 11-dehydrotetrahydrocorticosterone (THA)
When low, these mineralocorticoid metabolites are a strong indicator of chronic adrenal fatigue. High levels are associated with acute stress. Together with DHEA and the glucocorticoids, these metabolites afford a comprehensive assessment of adrenal-cortical health.

Numbered references are available on the Meridian Valley Lab website at MeridianValleyLab.com/Hormone-References

Oxytocin/Melatonin / hGH

Human Growth Hormone (hGH)

Secreted from the anterior pituitary gland, hGH is a key anabolic mediator of tissue repair and regeneration. It plays a role in many metabolic functions such as reducing visceral adiposity, maintaining lean muscle mass, minimizing inflammation, improving bone mineral density, decreasing cardiovascular disease mortality and enhancing the overall quality of life.[52-55] General strategies to improve HGH include lifestyle changes, nutrients, and optimizing thyroid and sex hormones. If high levels are seen, consider further workup with serum IGF-1.

Melatonin

Melatonin assists in the body's sleep/wake cycle and is also a very powerful antioxidant.[56] Primary production is in the pineal gland. The GI mucosa is a significant source secondary production, with retina, bone marrow, platelets, skin, and lymphocytes all producing smaller amounts. GI-produced melatonin has paracrine effects and does not enter general circulation. Urinary 6-Sulfatoxymelatonin (MT6s) is the main metabolite of melatonin. MT6s itself has no physiologic activity, but is a good indicator of whole body melatonin production.[57] Low urinary MT6s is an indication for melatonin supplementation. It is normal to see elevated urinary values with supplemented doses higher than 1mg.

Oxytocin

Beyond its actions in pregnancy and lactation, oxytocin modulates the HPA axis[58,59] and helps attenuate the stress response. Oxytocin can mitigate chronic pain and has been used experimentally in chronic pain syndromes.[60] Oxytocin also influences trust, sociability, intimacy and sexual function.[61-63] Oxytocin declines with age and is also important for muscle regeneration and maintenance.[64]

What Affects hGH?

↑	↓
Good quality sleep	Sedentary lifestyle
Vigorous exercise	Excess weight
Resistance training	Inadequate protein
Adequate protein	Poor sleep
Glutamine (older people)	Low endogenous hormones
Arginine (younger people)	

Conditions associated with. . .

Low Melatonin	High Melatonin
Insomnia	Pregnancy
IBS	Narcolepsy
Peptic ulcers	
Breast cancer	

Thyroid

Thyroid Hormones

Free thyroid hormones are readily measured in the urine and are an effective screening tool for thyroid gland dysfunction. Research suggests that 24-hr urinary T3 has excellent correlation with thyroid symptoms.[65] A high or low urinary thyroid hormone measurement may suggest the need for additional serum tests, such as thyroid auto-antibodies and reverse T3.

Nutrients to Support Thyroid Function

Selenium

Iodine

Minerals

Na^+, K^+, Na^+/K^+ Ratio

Sodium has significant effects on the blood pressure and cell to cell communication. Abnormal values indicate mineral imbalance and are correlated with kidney and adrenal function. High levels may contribute to high blood pressure and may be related to low aldosterone levels. Sodium levels low or high in the reference range are not optimal.

Potassium is important in the prevention of hypertension, in muscle contraction, and in cell to cell communication. High levels are uncommon and are usually due to over-supplementation or use of a diuretic. Low levels often indicate low vegetable intake, use of a potassium-sparing diuretic, or poor GI absorption.

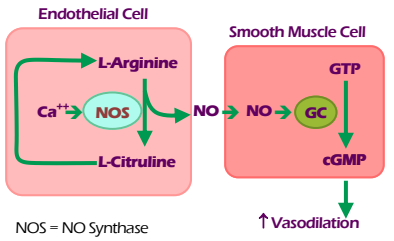
The **Na^+/K^+ Ratio** in urine is optimal at 1.5. Higher levels are associated with an increasing risk of hypertension.[66]

Optimal Urine Na+/K+ Ratio =1.5

Nitrates

Nitrates

Urinary Nitrates are a good indicator of the level of the nitric oxide production in the body. Nitric oxide is absorbed easily and quickly penetrates nearby membranes and cells, sending signals that result in vasodilation. Poor nitric oxide production is thought to play a role in the pathogenesis of both erectile dysfunction and is-chemic heart disease.[67-71] Optimal levels are at or above 2000. High levels are found with specific amino acid therapies or consumption of foods high in nitrates. Nitric oxide production declines after age 40. Supplementation of arginine and citrulline, consumption of healthy nitrate-containing foods, such as beets and arugula, and exercise have been shown to improve low nitric oxide production. [69, 72-77]



NOS = NO Synthase

GC= Guanylate Cyclase

Enzyme Activity

5α-Reductase

5α-reductase influences androgen metabolism and provides important context for androgen excess or deficiency symptoms.

Elevated 5α-reductase activity in men (seen as a ratio right of midline on the graph) is associated with BPH and male pattern hair-loss.[78-79] In women, elevated 5α-reductase activity is associated with hirsutism, acne and PCOS.[80] In both genders, elevated 5α-reductase is associated with insulin resistance and central adiposity.[81]

Lower 5α-reductase activity (seen as a ratio left of midline on the graph) may point to lower androgen expression and symptoms of relative androgen insufficiency. In men, this may include lower libido, fatigue, poor mood and reduced muscle mass.[82] Midline to lower-end 5α-reductase activity in women is normal and not necessarily indicative of a disorder. Patients with low 5α-reductase activity may require higher doses when supplementing androgens than patients with higher 5α-reductase activity.

Natural 5a-Reductase Inhibitors

Zinc

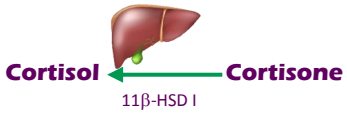
y-linolenic acid (GLA)

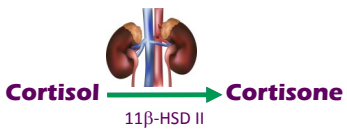
11-β Hydroxysteroid Dehydrogenase I&II

Two isoforms of 11-β Hydroxysteroid Dehydrogenase (11-β HSD) catalyze the inter-conversion of cortisol and cortisone.

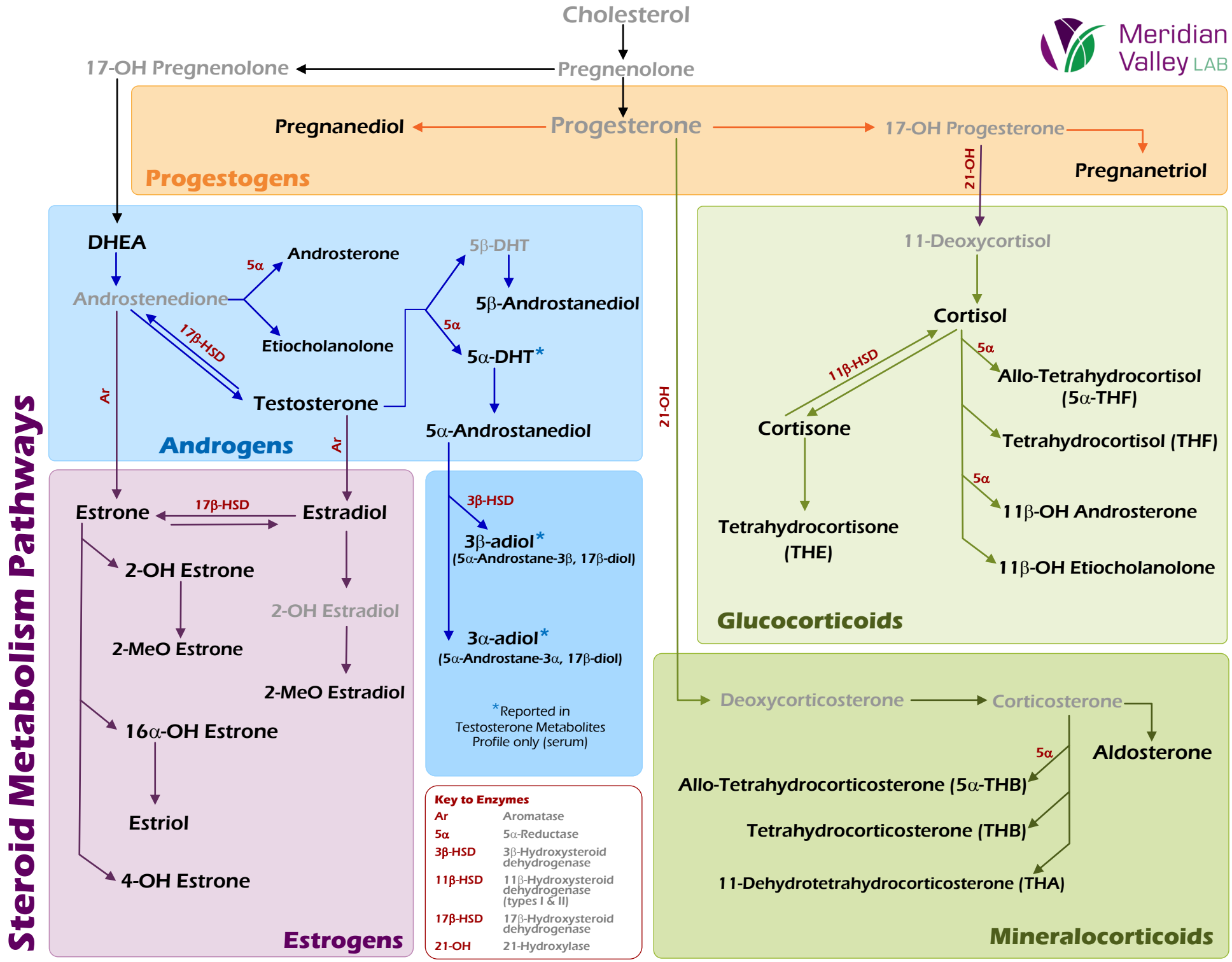
11-β HSD I regenerates cortisol from cortisone in liver, adipose tissue, muscle, pancreatic islet cells, adult brain, inflammatory cells and gonads. 11-β HSD I is primarily a hepatic enzyme and the activity is best measured by the ratio of urinary tetrahydrocortisol+allotetrahydrocortisol to tetrahydrocortisone. An elevation of this ratio, seen as a shift to the right on the graph, is clinically related to central obesity, diabetes, and insulin resistance.[83-86]

11-β HSD II inactivates cortisol in order to prevent it from competitively binding to mineralocorticoid receptors in the kidney. 11-β HSD II also has activity in the placenta, fetus, GI tract, and glandular tissues. 11-β HSD II is primarily a renal enzyme and its activity is best measured by the ratio of cortisol/cortisone. An elevation of this ratio, seen as a shift to the right, may be clinically related to essential hypertension and, less commonly, to Apparent Mineralocorticoid Excess (AME), a rare condition.[83-86]





tel 206.209.4200 | Toll free 855.405.TEST (8378)
fax 206.209.4211
info@meridianvalleylab.com
MeridianValleyLab.com



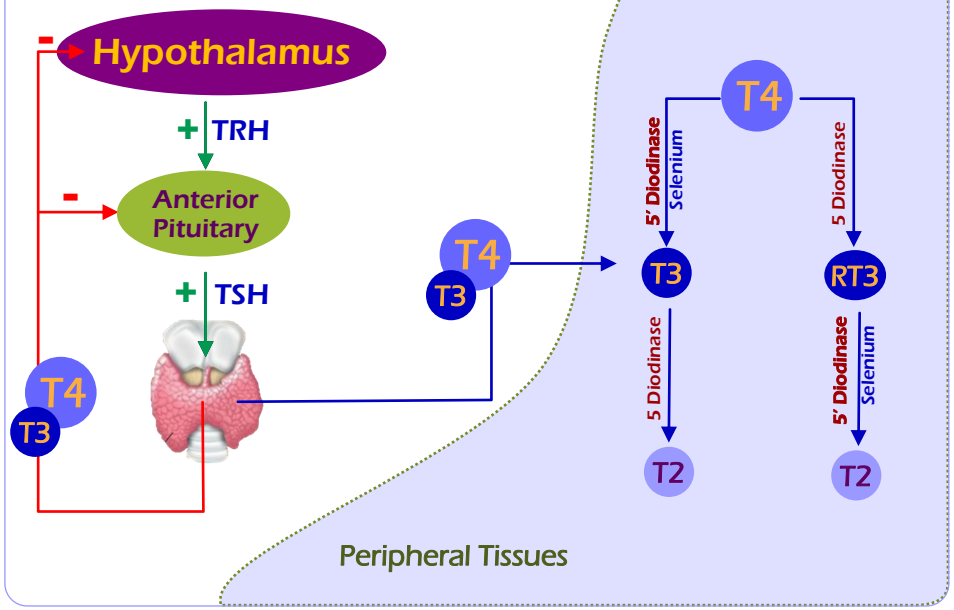
Metabolites in **black** are reported in Meridian Valley Lab panels.

+ Up regulation - Inhibition

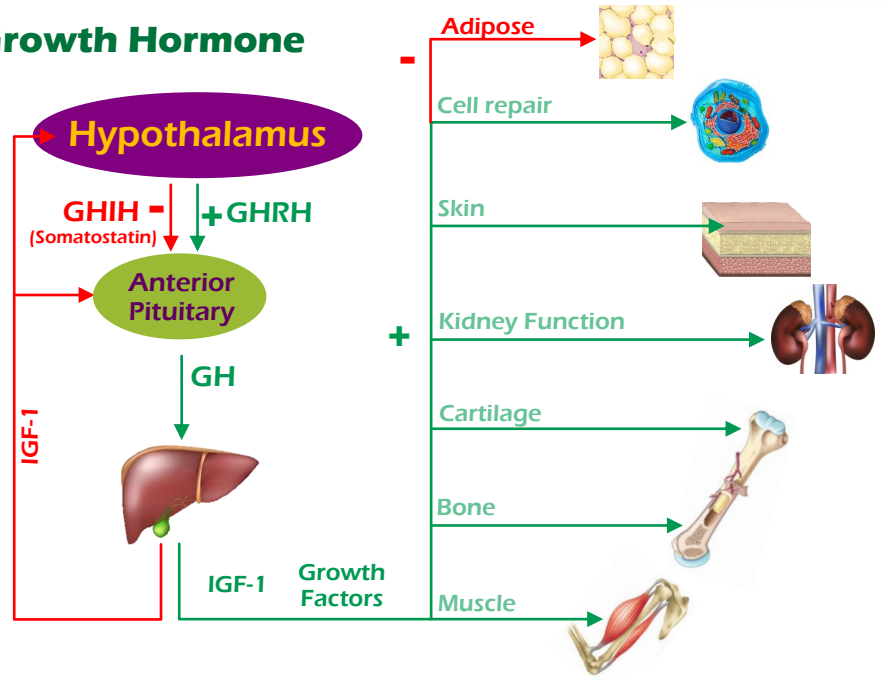
Meridian Valley LAB

Peptide Hormone Pathways

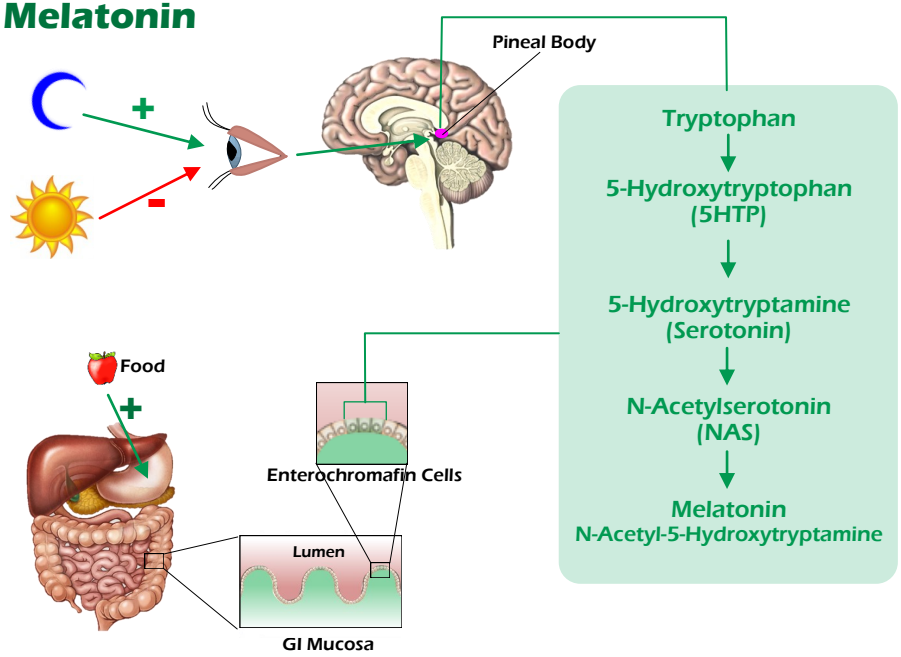
Thyroid Hormones



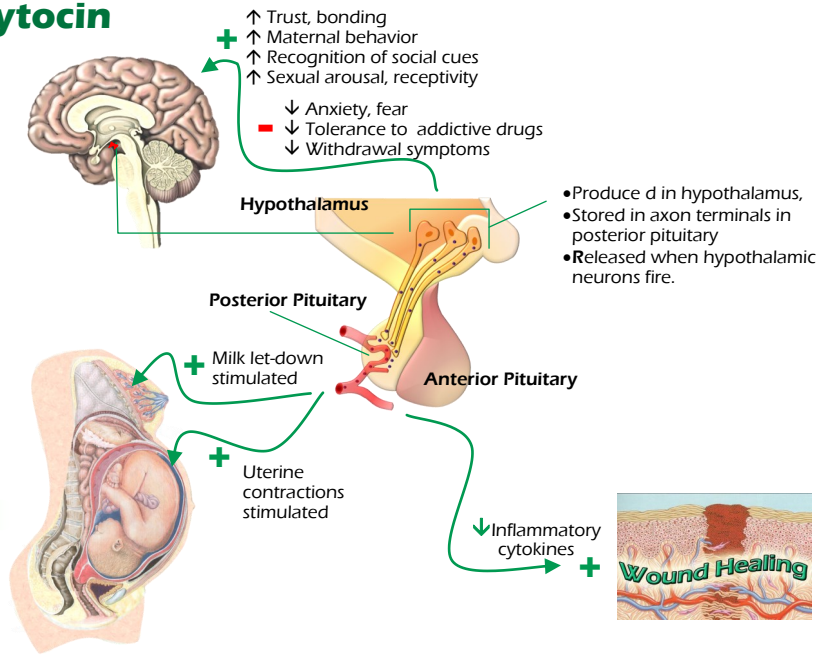
Growth Hormone



Melatonin



Oxytocin



 tel 425.271.9689 | Toll free 855.405.TEST (8378) fax 206.209.4211 | info@meridianvalleylab.com MeridianValleyLab.com