

Hormones

Part 2, The Stress Hormones

"The human being can only be understood as a whole."

-Hippocrates

The steroid hormones are one classification of hormones that are secreted by the steroid glands: the adrenals, the testes, the ovaries, and the placenta during pregnancy. Steroid hormones can be grouped into two classes: corticosteroids (typically made in the adrenal cortex) and sex steroids (typically made in the gonads or placenta). Within those two categories, there are five main steroid hormones secreted by these glands which we will cover in the next two modules and include:

- **Androgens** including testosterone and androstenedione
- **Estrogens** including estrone, estradiol and estriol
- **Progestogens** including progesterone
- **Mineralocorticoids** including aldosterone
- **Glucocorticoids** including cortisol

Steroid hormones are classified as fat-soluble and can pass through cell membranes, where they bind to their receptor site *inside* the cell wall (as opposed to water soluble hormones which bind to receptors on the cell wall). Being fat-soluble, it is no surprise that the building block required to create all steroid hormones is also a fat, which is cholesterol.

Approximately 75% of all cholesterol in the body is made within the body (mainly in the liver). The other 25% comes from diet. When there is a growing demand for higher amounts of the steroid hormones, our liver can respond by producing more cholesterol. If the liver cannot keep up with the demand of cholesterol required to meet the need of all the steroid hormones, the body will be forced to choose which steroid hormones are more important than others. Typically, this results in a phenomenon known as the “pregnenolone steal”.

Pregnenolone is considered the “master hormone,” and is used as a precursor for the creation of most of the steroid hormones. As you can see in figure 8a, cholesterol is used to create pregnenolone. If enough pregnenolone is produced to meet all the demands of the steroid hormones, that pregnenolone will be used to create cortisol in the liver, estrogen and testosterone in the gonads, and aldosterone in the adrenals to act upon the kidneys. In this case, hormones are balanced and you feel great! However, all too often, there is dysfunction in the steroid hormone production pathway. Often times this imbalance is created from not enough of the hormones precursor (cholesterol) and/or too high of a demand for hormones (usually chronic cortisol).

Our body was built to successfully manage acute bouts with stress. However, with the busy pace of our modern world, the stress response is often activated for extended periods. With chronic stress that is often unmanaged, the cortisol pathway is prioritized and your body pushes all available pregnenolone to be used for cortisol production, since this is considered life or death. This results in less pregnenolone being available for conversion to the sex hormones and aldosterone for electrolyte balance. The end result? High cholesterol, low/no sex drive and salt cravings!

Steroid Hormone Pathways

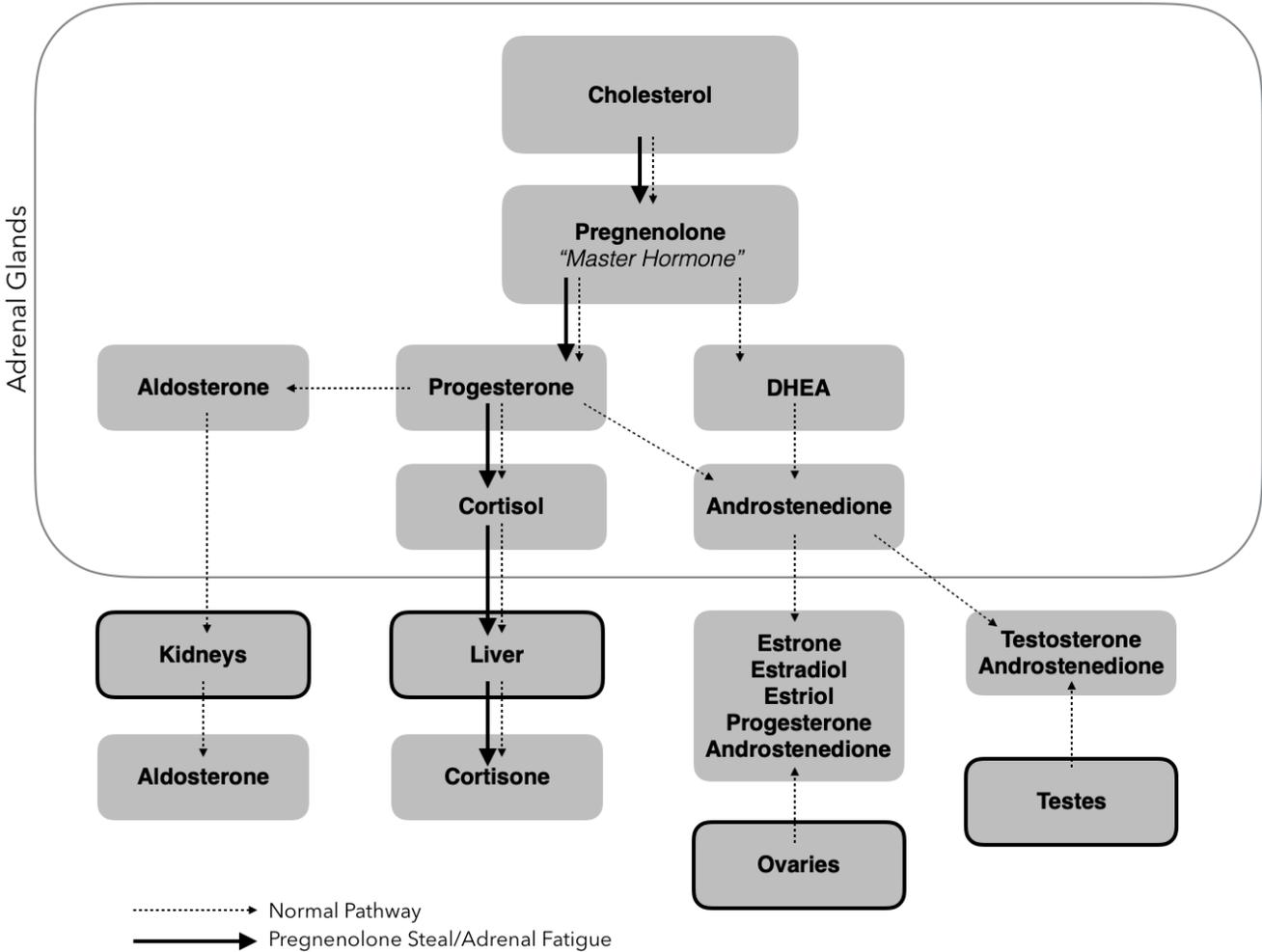


figure 8a- Pregnenolone Steal

CORTICOSTEROIDS

ALDOSTERONE

Aldosterone is a steroid hormone produced by the outer-section (zona glomerulosa) of the adrenal cortex in the adrenal glands. Once released, aldosterone acts on the kidneys to regulate sodium and water in the body. Too much aldosterone can cause high blood pressure, low potassium levels and an increase in blood volume. Too little aldosterone, often seen in people with primary adrenal insufficiency, can cause low blood pressure, increased potassium levels and fatigue.

It is easy to see from the chart in figure 8a how excess stress can cause changes to the levels of aldosterone when the pre-hormones are limited or the body experiences excess chronic stress.

CORTISOL AND ADRENALINE

Stress. In psychological terms, stress is the reaction to something that threatens our physical or mental equilibrium¹. This means that it can come from a ferocious tiger threatening to eat us, or an overdue credit card bill that we don't have the funds available to pay. Genetically, our body is hard wired to deal with stressors in a way that is meant to protect us from things like predators and angry enemies. Historically, these types of threats were typically quick to come and quick to go. Between threats, our body could unwind and had time to recover before another threat revealed itself. Today, most of us no longer have to worry about dangerous animals threatening to eat us, or our neighbors breaking into our house with a spear. Today's threats are much different. In the book *The Adrenal Reset Diet* author Alan Christianson says "within the last few decades our world has gotten more toxic, a lot

noisier, and much faster pace. Our food has more sugar, less fiber, and many more chemicals. We spend less time in sunlight and we sleep less. We take more medications, feel less certain of our financial futures, and have fewer friends.” Not only are all of these things causing increased stress, but the type of stress has turned from acute to chronic. This type of chronic stress has a completely different affect on our adrenal glands than acute stressors.

The adrenal glands are responsible for the production and output of our main stress hormones: **cortisol and adrenaline**. Neither of these hormones were intended to be in the system for the long term. These hormones help you survive immediate threats by raising your blood pressure and shunting blood to your working muscles and brain, so you can fight or flee. In today’s world, where threats are not solved in a single afternoon, these hormones are working overtime to try to protect you. Meanwhile, your blood pressure remains high, your immune system is weakened, your digestive system slows down and does not work properly, your sleep is effected because you are wired (and exhausted), and your ability to learn decreases. There is plenty of scientific evidence that shows how chronic stress plays a sizable role in mental illness and pathological physical states such as high blood pressure, cardiovascular disease, obesity and immunosuppression². This is mostly due to the inflammatory nature of these two stress hormones.

So what can you do about it? Currently, treatment for anxiety and depression involves mostly psychological and pharmacological interventions; however, mind-body interventions are becoming increasingly popular as a means to reduce stress. A great place to start before jumping to supplements and/or medications is

by managing your stress. It has been suggested by many anthropologists that most ancient cultures spent equal or more time in the parasympathetic nervous system (“rest and digest”) than the sympathetic nervous system (“fight or flight”). If you find yourself with a schedule packed with things to do from the moment you wake up until the moment you go to bed, racing thoughts of finances, to-do lists, life commitments constantly moving through your brain, or you don’t have many moments to just sit down and do nothing... you might not be balanced! Taking a look at your schedule/life to find things that can be eliminated and/or places to make time for yourself to decompress from the GO!GO!GO! might be exactly what you need to reduce and or eliminate symptoms of imbalanced hormones.

Meditation is one of those activities that should be considered as part of your daily routine. Meditation is known to drive your autonomic nervous system from the sympathetic into the parasympathetic where body healing and repair can happen. It is well known that the habit of meditation is best when done daily, rather than in large amounts a few times per week or month. In other words, 5 minutes every day is much better than 35 minutes one time per week. There are many books, blogs, podcasts and apps that you can access to help you get started. See some of our recommendations in the references section of the website.

Anything in your life that creates a chronic stress response can create an imbalance in the steroid hormone pathway. Many of these stressors are things that have become part of our normal day-to-day and therefore we don’t look at them as a stress anymore. But how does your autonomic nervous system feel

about that? Some of the areas to really explore when trying to reduce the stress load are:

- lack of sleep, lack of sleep, lack of sleep!
- exposure to toxins (chemicals, molds, etc)
- nutrient poor diet
- poor digestion, which creates a lack of nutrient absorption
- lack of social face-to-face interaction
- guilt, grief, depression, anxiety, lack of self-esteem
- increased financial obligations
- illness
- lack of sleep (did we already mention that?!?)

And the list goes on and on. If you lack a sex drive; crave sweets and salt; get dizzy when you stand up quickly; have achy joints or other body aches; have low blood pressure; suffer from mild depression; require stimulants to get moving in the morning or stay awake in the afternoon; or have been told that your cholesterol is high, these areas need to be explored. Reducing the load on the adrenals and supporting your system with the proper nutrients can help balance your steroid hormones.

TESTING

Testing is a tool that can be used to measure the health of your adrenal glands, especially if you feel unsure about your state of stress. Like all testing, it requires the financial ability to test and a knowledgeable practitioner to help you interpret and create a treatment plan with the results. The gold standard in testing cortisol levels is with a salivary cortisol panel that captures 4 samples per day. Since a healthy cortisol pattern is highest in the morning (that is what wakes us up) and lowest before bed, seeing cortisol levels throughout the day is important to know how well the adrenals are managing daily stressors. Typically, you are able to see a cortisol pattern with test results that can result in 1 of 4 diagnosis:

Healthy Adrenal Function

Phase 1: Hyper-Cortisol This is the first sign that the body is not handling the stress load optimally. On test results, you see high levels of cortisol throughout the day. Symptoms are typically: anxiety, low immunity, restlessness and insomnia.

Phase 2: Resistance Response This phase is often called the “wired and tired” phase. Here, additional hormone irregularities are seen (especially with blood sugar, electrolyte imbalances and low sex hormones) which can lead to mood and sleep issues along with frequent energy crashes.

Phase 3: Hypo-Cortisol Often described as exhausted, at this phase people are typically feeling completely wiped out. Simple tasks become difficult, motivation across the board is lacking, and people are often described as being “tuned out.” Symptoms are typically: depression, chronic pain all over the body, low immunity and additional hormone imbalances.

SUPPLEMENTS

Using exogenous supplements and/or herbs to help your adrenals get additional support can be a helpful tool while you are reducing the chronic load on the adrenal glands. It can not be emphasized enough that certain supplements can make your stress pattern worse if they are used incorrectly. If adding supplements to your daily routine to help ease mental stress and support healthy adrenal function is important to you, talk to a knowledgeable practitioner about your symptoms before starting a protocol. With that said, some of the more common supplements used are:

LICORICE ROOT- For people who do not produce enough cortisol. It has been found to improve energy levels and help regulate cortisol levels.

CURCUMIN- a compound with antioxidant qualities found in turmeric. It has been found to enhance mood and reduce inflammation (especially in the brain). Note: Curcumin extracts are the most potent form of turmeric supplements that will give you the most curcumin compound. Concentrated extracts pack up to 95% curcumin, whereas turmeric in powder form usually contains around 3% curcuminoids³.

PHOSPHATIDYLSERINE- a phospholipid found in cells that influence immune function and muscle metabolism. It has been found to help rebalance cortisol levels following exercise.

ASHWAGANGDA- an adaptogenic adrenal supplement. It has been found to improve resistance to stress along with decreasing depression and anxiety.

The bottom line is that stressful events are facts of life, and not all stress is a bad thing. Learning ways to help manage the impact that chronic stressful events have

on you is a critical piece to finding optimal health, especially if you feel like you cannot change your current situation. You can learn to identify what triggers a stress response in you and how to take care of yourself physically and emotionally in the face of these stressful situations.

HOMework

Part 1: STRESS ASSESSMENT

There are many things to consider when assessing stress levels and whether or not the adrenals are working overtime to keep up. There is not one tool that will give you all of the answers. All symptoms, life style factors, eating habits and sleep patterns should be considered when assessing the health of your adrenal glands.

Stress assessments are just ONE tool that you can use to help determine your stress load. There are many options for stress assessments to help you learn more about your situation. For example, in the book *The Adrenal Reset Diet*, there is a free assessment that can be used. For this weeks homework, we using a free stress assessment from Metagenics. This personalized, psychological questionnaire can assist in evaluating perceived emotional and cognitive distress by tracking symptom frequency. This subjective data can be used along with your other health evaluation tools, to distinguish between stress response types and make successful lifestyle and nutritional changes to help restore balance and increase resilience to stress.

REFERENCES

- 1-2-** Lowman, Amy *Ancient Stress Response vs Modern Life* October 23, 2016. <https://medium.com/mindbodymicrobiome/ancient-stress-response-vs-modern-life-e1a8febc9c5f>
- 3-** Full Script <https://fullscript.com/blog/adrenal-support-supplements>

Name _____ Age _____ Sex _____ Date _____

Stress is a normal part of life. Every day, we're faced with stimuli, called stressors, which can elicit the body's "fight or flight" response, setting off a cascade of physiological reactions and resulting in emotions ranging from mild to intense. But while occasional stress is natural and even healthy, chronic or acute stress can be harmful.

Please take a few moments to discover your body's response to situations you perceive as stressful. By honestly assessing how you feel, your healthcare provider can create a natural stress relief program for your individual needs.

Directions:

Please read each statement and circle the number 0, 1, 2, or 3 that best describes your feelings or reactions throughout the course of the day. Determine the subtotal score for each section, then determine the total scores for sections A-C and C-E. Some questions may appear redundant between sections. There's a reason for each question. Don't spend much time on any one question.

0 = Never true 1= Seldom true 2= Sometimes true 3= Often true

When under stress for two weeks or longer, I...

Section A:

- 1. Get wound up when I get tired and have trouble calming down..... 0 1 2 3
- 2. Feel driven, appear energetic but feel "burned out" and exhausted..... 0 1 2 3
- 3. Feel restless, agitated, anxious, and uneasy..... 0 1 2 3
- 4. Feel easily overwhelmed by emotion..... 0 1 2 3
- 5. Feel emotional — cry easily or laugh inappropriately..... 0 1 2 3
- 6. Experience heart palpitations or a pounding in my chest..... 0 1 2 3
- 7. Am short of breath..... 0 1 2 3
- 8. Am constipated..... 0 1 2 3
- 9. Feel warm, over-heated, and dry all over..... 0 1 2 3
- 10. Get mouth sores or sore tongue..... 0 1 2 3
- 11. Get hot flashes..... 0 1 2 3
- 12. Sleep less than seven hours a night..... 0 1 2 3
- 13. Have trouble falling asleep and staying asleep..... 0 1 2 3
- 14. Worry about high blood pressure, cholesterol, and triglycerides..... 0 1 2 3
- 15. Forget to eat and feel little hunger..... 0 1 2 3

Total points: _____

Section B:

- 1. Find myself worrying about things big and small..... 0 1 2 3
- 2. Feel like I can't stop worrying, even though I want to..... 0 1 2 3
- 3. Feel impulsive, pent up, and ready to explode..... 0 1 2 3
- 4. Get muscle spasms..... 0 1 2 3
- 5. Feel aggressive, unyielding, or inflexible when pressed for time..... 0 1 2 3
- 6. See, hear, and smell things that others do not..... 0 1 2 3
- 7. Stay awake replaying the events of the day or planning for tomorrow..... 0 1 2 3
- 8. Have upsetting thoughts or images enter my mind again and again..... 0 1 2 3
- 9. Have a hard time stopping myself from doing things again and again,
like checking on things or rearranging objects over and over..... 0 1 2 3
- 10. Worry a lot about terrible things that could happen if I'm not careful..... 0 1 2 3

Total points: _____

Section C:

- 1. Have muscle and joint pains..... 0 1 2 3
- 2. Have muscle weakness..... 0 1 2 3
- 3. Crave salt or salty things..... 0 1 2 3
- 4. Have multiple points on my body that when touched are tender or painful..... 0 1 2 3
- 5. Have dark circles under my eyes..... 0 1 2 3
- 6. Feel a sudden sense of anxiety when I get hungry..... 0 1 2 3
- 7. Use medications to manage pain..... 0 1 2 3
- 8. Get dizzy when rising or standing up from a kneeling or sitting position..... 0 1 2 3
- 9. Have diarrhea or bouts of nausea with or without vomiting for no apparent reason..... 0 1 2 3
- 10. Have headaches..... 0 1 2 3

Total points: _____

Section D:

- 1. Have trouble organizing my thoughts.....0 1 2 3
- 2. Get easily distracted and lose focus.....0 1 2 3
- 3. Have difficulty making decisions and mistrust my judgment.....0 1 2 3
- 4. Feel depressed and apathetic0 1 2 3
- 5. Lack the motivation and energy to stay on task and pay attention0 1 2 3
- 6. Am forgetful0 1 2 3
- 7. Feel unsettled, restless, and anxious0 1 2 3
- 8. Wake up tired and unrefreshed0 1 2 3
- 9. Experience heartburn and indigestion0 1 2 3
- 10. Catch colds or infections easily0 1 2 3

Total points: _____

Section E:

- 1. Feel tired for no apparent reason.....0 1 2 3
- 2. Experience lingering mild fatigue after exertion or physical activity0 1 2 3
- 3. Find it difficult to concentrate and complete tasks0 1 2 3
- 4. Feel depressed and apathetic0 1 2 3
- 5. Feel cold or chilled – hands, feet, or all over – for no apparent reason.....0 1 2 3
- 6. Have little or no interest in sex.....0 1 2 3
- 7. Sweat spontaneously during the day.....0 1 2 3
- 8. Feel puffy and retain fluids.....0 1 2 3
- 9. Sleep more than nine hours a night.....0 1 2 3
- 10. Have poor muscle tone.....0 1 2 3
- 11. Have trouble losing weight0 1 2 3
- 12. Wake up tired even though I seem to get plenty of sleep.....0 1 2 3
- 13. Have no energy and feel physically weak.....0 1 2 3
- 14. Am susceptible to colds and the flu0 1 2 3
- 15. Feel dragged down by multiple symptoms, such as poor digestion and body aches.....0 1 2 3

Total points: _____

<i>Add points from sections A, B & C</i>	Total for A, B & C: _____
<i>Add points from sections C, D & E</i>	Total for C, D & E: _____

Lifestyle and Health Status:

- 1. Circle the level of stress you experience on the scale of 1-10, 10 being the worst:
 1 2 3 4 5 6 7 8 9 10
- 2. What do you consider to be the major causes of your stress (for example – spouse, family, friends, work, finances, wedding, pregnancy, legal, commute):

- 3. I eat breakfast _____ times a week. My typical breakfast is: _____
- 4. I take a multiple vitamin/mineral _____ days per week. I take a fish oil supplement _____ days per week.
- 5. I participate in 30 minutes of physical activity such as walking, aerobics (e.g., running), resistance training (e.g., weights, pilates), sports (e.g. biking), or yoga:
 Daily 5-6 times per week 3-4 times per week 1-2 times per week Less than once a week
- 6. I smoke _____ cigarettes daily.
- 7. I drink two or more 8 ounce cups of caffeinated coffee or other caffeinated beverages like energy/diet drinks, colas, or black or green teas:
 Daily 5-6 times per week 3-4 times per week 1-2 times per week Less than once a week
- 8. I drink two or more ounces of alcoholic beverages:
 Daily 5-6 times per week 3-4 times per week 1-2 times per week Less than once a week
- 9. List your current health problems and any over-the-counter or prescription medications that you are now taking:
 Current health problem(s) Date of onset List all current medication(s)

