

## Chapter 1 : Understanding Female Infertility and Growth Hormone Deficiency

*Growth hormone deficiency happens when the pituitary gland in the brain does not make enough growth hormone. This handout will explain growth hormone deficiency, the signs and causes of growth hormone deficiency, how we test for it and how we treat it.*

Studies have determined that a GH peak cutoff of 7. As much as a third of HIV-infected individuals are estimated to have an inappropriate response to GHRH-arginine stimulation testing [2]. When an abnormally low IGF-1 is detected, it may be prudent to formally rule out pituitary insufficiencies and determine whether pituitary imaging is warranted; however, in most scenarios, the GHD may likely be ascribed to a known history of HIV. Normal GH levels play an important role in the maintenance of body composition. In this regard, GHD is associated with accumulation of visceral fat and loss of lean body mass. The visceral fat depot is associated with increased cardiometabolic mortality [4]. Studies demonstrate that HIV-infected individuals have increased visceral adipose tissue VAT accumulation when compared to non-HIV individuals [5] and are at risk for acquired lipodystrophy [6]. Several mediators have been implicated in VAT accumulation, including non-contemporary antiretroviral therapies, the HIV virus itself, chronic inflammation and immune activation, or perturbations in hormone systems, particularly the GH axis. Moreover, HIV-infected individuals are at risk for age-related disease, not limited to cardiovascular disease, and some have hypothesized that impairment in the GH axis could be related to a phenotype consistent with premature aging [3]. Indeed, studies in the non-HIV population have determined that GH replacement can play a significant role in improving metabolic outcomes, related to improvements in body composition, dyslipidemia, inflammation, cardiovascular and bone health [], which could serve as an important treatment paradigm in HIV lipodystrophy. Overnight frequent sampling among HIV-infected individuals with and without lipodystrophy and healthy individuals demonstrated that the HIV group with lipodystrophy had reduced basal and mean GH concentration, as well as GH pulse amplitude, while GH pulse frequency and IGF-1 levels were normal when compared to the HIV non-lipodystrophy and healthy control groups [14]. A sex-specific mechanism remains unclear. The differences in GH physiology could be attributed to endogenous estrogen, which is recognized to decrease IGF-1 and therefore reduce inhibitory feedback on GH. HIV-infected women accounts for the observed differences in GH physiology [17]. Restoration of GH physiology could have the potential to decrease the risk of morbidity and mortality in HIV if there is visceral fat reduction and reduced cardiometabolic risk. Overall, few treatment strategies exist to decrease cardiometabolic risk in HIV. A randomized controlled trial was conducted to assess the effects of low dose GH average dose 0. SAT reduction could be detrimental if there is clinical evidence of lipoatrophy, as SAT is a vital storage depot for triglycerides. Moreover, continued loss of fat in the limbs or face in HIV-associated lipodystrophy is not typically desired and can have negative effects on quality of life. GH treatment is currently not approved for use in HIV-associated lipodystrophy. Use of a GHRH analogue takes advantage of the fact that adequate endogenous pituitary reserve may be present among HIV-infected individuals, which can be augmented with an exogenous hypothalamic peptide. In addition, stimulating pulsatile GH secretion maintains the negative feedback system from IGF-1 signaling. Compared to GH, tesamorelin is thought to have neutral effects on glucose and therefore may avoid worsening insulin sensitivity. The majority of studies evaluating tesamorelin have enrolled HIV-infected individuals regardless of their baseline GH status. Data from a randomized controlled trial of over HIV-infected individuals demonstrate a significant VAT reduction by In addition to targeting VAT accumulation, a 6 month study demonstrated modest effects on liver fat reduction in those HIV-infected individuals randomized to tesamorelin vs. Liver fat reduction is mechanistically plausible, as treatment with a GHRH analog may have direct effects on liver fat through reducing hepatic de novo lipogenesis or indirect effects through oxidation of the visceral fat depot. Evidence also suggests there could be modest benefit on inflammation in HIV [26], which needs to be elucidated further and may be related to VAT reduction. Based upon these published data, tesamorelin is currently the only FDA approved medication for use in HIV-associated lipodystrophy, particularly for those with evidence of lipohypertrophy. The medication is a once daily subcutaneous injection

usually prescribed by an endocrinologist. While the medication is generally tolerated, rare side effects include injection site reactions, arthralgias, myalgias, and peripheral edema. Observational studies are currently ongoing to determine the long term benefits and safety profile of tesamorelin. Further detailed studies are needed to understand the effects of GHRH analogues on other indices of cardiometabolic disease as well as cardiovascular mortality in HIV. Moreover, future investigations should determine whether similar cardiometabolic benefits may be achieved in other disease populations in which there may be relative GHD without evidence of pituitary disease and an increased risk of cardiometabolic disease, such as generalized obesity.

**Chapter 2 : Understanding Growth Hormone Therapy For Children | Norditropin® (somatropin) injection**

*Understanding HGH Understanding Growth Hormone (HGH) Human growth hormone (hGH or GH) is a protein produced in the body that's important not only during childhood but also throughout adulthood.*

This handout will explain growth hormone deficiency, the signs and causes of growth hormone deficiency, how we test for it and how we treat it. What is Growth Hormone Deficiency? Growth hormone deficiency is when the pituitary gland a small gland in the brain that controls other glands in the body does not make enough growth hormone. This makes your child grow more slowly. What are the Signs of Growth Hormone Deficiency? The most common signs of growth hormone deficiency in childhood are short stature shorter height than usual and decreased growth growing slower than usual. Children who have growth hormone deficiency might also have the following signs: Increased body and belly fat Decreased amount of muscle Delayed bone age found through an X-ray called a bone age Low blood sugar usually in infants and very young children What Causes Growth Hormone Deficiency? We often do not know what causes growth hormone deficiency, and every child is different. Some common causes of growth hormone deficiency include: We test for growth hormone deficiency in many ways. These are a bone age X-ray, a blood test, growth hormone stimulation testing and a brain MRI. We test children for growth hormone deficiency ONLY if they not growing properly AND we have ruled out other causes for their slow growth. Children with growth hormone deficiency often have immature bones relative to their age, which would be called a delayed bone age. For example, your child might be years-old, but his or her bones might have the maturity level expected for a 9-year-old – this would be called a delayed bone age. Your body makes these proteins when your body releases growth hormone. Growth hormone stimulation test For this test, we will give your child medication through an IV a small tube that goes into a vein. We do this test ONLY when we think there is a high chance that your child has growth hormone deficiency. See the back of this handout to learn more about this test. It also tells us whether it is safe to treat your child with growth hormone medication. Then, we will give your child medication through the IV that makes his or her growth hormone levels increase. A growth hormone stimulation test takes between hours. We only do this test if we think there is a high chance that your child has growth hormone deficiency. How do we Treat Growth Hormone Deficiency? We treat growth hormone deficiency with a medication called growth hormone. The growth hormone acts just like the growth hormone that your body makes naturally. You will usually give your child growth hormone through an injection a shot at home. The needle for the shot is very small. Many children say they get used to the feeling of the shot after a few times. You will give your child the growth hormone until he or she has stopped growing. While your child is taking the growth hormone, he or she will need lab tests and doctor visits every months. This is to make sure your child is taking the right dose and to make sure there are no side effects. Many children who have growth hormone deficiency do not have it once they are teenagers. When your child has stopped growing, he or she will most likely go off growth hormone for at least one month. Then, we will retest him or her for growth hormone deficiency. If tests show that he or she still has growth hormone deficiency, your child might start taking a lower dose again once he or she is a teenager. You can find more information about growth hormone deficiency at these resources: The Human Growth Foundation is a non-profit organization that supports people with growth disorders. They keep up-to-date, accurate information about many health topics.

## Chapter 3 : Growth Hormone Deficiency Symptoms

*GENOTROPIN is a prescription product for the replacement of growth hormone in adults with growth hormone deficiency (GHD) that started either in childhood or as an adult.*

What Is Growth Hormone Deficiency? It more commonly affects children than adults. The pituitary gland is a small gland about the size of a pea. Some of these hormones control thyroid activity and body temperature. GHD occurs in roughly 1 in 7, births. The condition is also a symptom of several genetic diseases, including Turner syndrome and Prader-Willi syndrome. You may grow concerned if your child is not meeting height and weight growth standards. Growth hormone deficiency is treatable. Children who are diagnosed early often recover very well. If left untreated, the condition can result in shorter-than-average height and delayed puberty. What Causes Growth Hormone Deficiency? Children with cleft lips or cleft palates often have poorly developed pituitary glands, so are more likely to have GHD. These tumors are normally located at the site of the pituitary gland or the nearby hypothalamus region of the brain. In children and adults, serious head injuries, infections, and radiation treatments can also cause GHD. This is called acquired growth hormone deficiency AGHD. In some instances, sexual development is halted. Many teens with GHD experience low self-esteem due to developmental delays such as short stature or a slow rate of maturing. Reduced bone strength is another symptom of AGHD. This may lead to more frequent fractures, especially in older adults. People with low growth hormone levels may feel tired and lack stamina. They may experience sensitivity to hot or cold temperatures. A variety of psychological symptoms can occur, including: Adults with AGHD are at greater risk for diabetes and heart disease. If they suspect GHD, a number of tests can confirm the diagnosis. A blood test can measure growth hormone in the body. A blood test with a lower-than-normal result is not enough evidence to make a diagnosis. Growth plates are the developing tissue at each end of your arm and leg bones. Kidney and thyroid function tests can determine how the body is producing and using hormones. If your doctor suspects a tumor or other damage to the pituitary gland, an MRI imaging scan can provide a detailed look inside the brain. Growth hormone levels will often be screened in adults who have a history of pituitary disorders, have a brain injury, or need brain surgery. Testing can determine if the pituitary condition was present at birth or brought on by an injury or tumor. Since the mids, synthetic growth hormones have been used with great success to treat children and adults. Before synthetic growth hormones, natural growth hormones from cadavers were used for treatment. Side effects are generally minor, but may include: Often, children who have too little growth hormone in their youth will naturally begin to produce enough as they enter adulthood. However, some remain in treatment for their entire lives. Your doctor can determine if you need ongoing injections by monitoring hormone levels in your blood. Make an appointment with your doctor if you suspect that you or your child is deficient in growth hormones. Many people respond very well to treatment. The sooner you start treatment, the better your results will be.

## Chapter 4 : Understanding Growth Hormone

*Lab values that may indicate low growth hormone are insulin-like growth factor - 1 (IGF-1) and insulin-like growth factor binding protein - 3 (IGFBP-3). These levels may be tested by your medical practitioner to establish a baseline value and diagnose an HGH deficiency.*

You will need to fast for 10 to 12 hours before the test. During the Test An IV will be placed in a vein in your arm or hand. The procedure will feel very similar to having a blood sample taken. The major difference is that after the needle is inserted, a tiny tube called an IV is left inside the vein. There may be some discomfort when the needle pierces the skin and some bruising afterward, but the risks and side effects are minimal. An initial blood sample will be taken through the IV. This and all subsequent samples will most likely be collected using the same IV line. You will be given a growth hormone stimulant by IV. This is a substance known to encourage an increase in GH production. The most commonly used stimulants are insulin and arginine. Several more blood samples will be taken at regular intervals, usually over a period of a few hours. The entire procedure usually takes about three hours. After the Test Your blood samples will be analyzed at a laboratory to see whether your pituitary gland produced the expected amount of GH in response to the stimulant. The results for a growth hormone stimulation test show the concentration of growth hormone in the blood sample. This concentration is expressed in terms of nanograms of GH per milliliter of blood. This is how the results are usually interpreted: You do not have growth hormone deficiency. Between 5 and 10 Nanograms of GH Per Milliliter of Blood In most cases, growth hormone deficiency cannot be definitively diagnosed or ruled out. This range can be considered inconclusive. However, in some cases, any measurement above 7 is considered normal. This will depend on the lab. You will most likely be diagnosed with GHD. This will supplement the growth hormone levels that naturally occur in your body. The hormone is administered by injection. You will need to regularly meet with your doctor. They will monitor your progress and adjust the dosage as needed. Children will often experience fast, dramatic growth during treatment. In adults, treatment can lead to stronger bones, more muscle, less fat, and other benefits. There is some risk of side effects when on synthetic growth hormone, such as headaches and muscle and joint pain. Serious complications are rare. The dangers associated with treating GHD are usually surpassed by the potential benefits.

### Chapter 5 : Understanding Growth Hormone Deficiency - Massachusetts General Hospital, Boston, MA

*Understanding Growth Hormone. For the serious trainer, maximizing the opportunities for muscle growth and repair are essential. Maintaining low levels of body fat for health reasons are of great importance as well.*

Buy Now Understanding Growth Hormone For the serious trainer, maximizing the opportunities for muscle growth and repair are essential. Maintaining low levels of body fat for health reasons are of great importance as well. A scientific approach to constructing a formula for success includes: Timing of meals How much rest is needed Proper supplement protocol How to make use of the resources our body provides for us naturally Bodybuilders and strength athletes are well aware of the benefits of naturally occurring hormones and how to harness their powers. One of the most respected hormones responsible for taking your physique to the next level is growth hormone GH. What Is Growth Hormone? Growth hormone is a protein comprised of close to amino acids that are secreted by cells called somatotrophs in the anterior pituitary gland. It is a catalyst for growth, as it plays a major role in stimulating the liver, and other tissues, to produce IGF-1, which in turn, promotes lean muscle tissue, strong bone density, revived skin elasticity and fat loss. With the above knowledge, athletes can turn their attention to boosting their natural growth hormone levels in a variety of ways to promote growth, recovery, and maximize performance. Due to the nocturnal secretion of growth hormone, the most significant rise in natural levels occur at night, so it was once believed that weight training in the morning was the best time. However, if you take into consideration our circadian rhythms, the best time to weight train would be in the evening when your core body temperature is at its highest. There is a direct link between the intensity and volume of your training, and the levels of GH produced. Choosing compound exercises like squats, bench press and dead lifts that involve more than one muscle and joint are recommended. Also, train heavy and rep out until muscular fatigue or failure. This type of training is extremely taxing on your body and it will respond with an enormous flush of GH into your blood stream. The last thing to keep in mind is that GH is delivered via pulsatile release, which means the more frequently you train, the more fit you become. This is important for two reasons: The magnitude of the pulsatile release of GH is directly related to your fitness level. Amino acids such as arginine, lysine and ornithine are all powerful secretagogues that increase natural GH levels by stimulating the pituitary gland. A top quality protein mixed with fast-digesting carbohydrates is exactly what your body needs post workout. A supplement protocol such as this will definitely help you boost GH levels and bring about the muscle-building results you desire. As I mentioned at the beginning, GH is secreted in its greatest amount at night, so a good, deep sleep is the last piece of the puzzle. When you rest, you grow. Getting eight hours of sleep at night facilitates that GH to create an anabolic environment for maximum recovery, which is at its core, growth. Eating clean can also promote healthy GH levels; plenty of slow carbs during the day, and fast carbs post workout, combined with lean protein sources at each meal will keep all systems functioning at their peak levels. Stimulating natural GH is a practice all serious trainers need to be aware of. For incredible results and massive gains “train hard, train heavy, get lots of sleep, and supplement your diet to support growth and recovery” and you will take your physique to the next level. Antonio, Jose, Chromiak Joseph A. Share this post Author: Along with being an Associate Professor of Communications, Dana is also a certified fitness consultant and a regular columnist for Muscle Insider.

## Chapter 6 : Understanding Growth Hormone Deficiency in Adults

*Understanding Growth Hormone Deficiency It's important to understand that not everyone with growth hormone deficiency will have the same symptoms. Some people will only have 1 or 2 symptoms, while others can have multiple symptoms.*

This chemical is responsible to great extent for growth of the human body as the name indicates and proper cell reproduction. Lower levels results in a stunting of the body growth failure due to slow rate of growth of the body and higher levels result in diseases known as Gigantism in children and Acromegaly in adults , both resulting from excessive growth of all body parts due to the excessive release of GH. It also raises the blood glucose levels by inhibiting the action of insulin and providing extra glucose for the body tissues to the accelerate growth rate. GH also stimulates the break down of body fat, leading to increased utilization of body fat reducing it quickly in the body. Bone growth occurs as a result of stimulation of protein synthesis in the bones.

**Two Types of Growth Hormone Deficiency**

**Growth Hormone Deficiency in Children** GH deficiency in children results into short stature, small penis, increased body fat and obesity, high-pitched voice, and episodes of low blood sugar levels and faintness due to relatively unopposed insulin action in lowering the blood sugar levels. My sister is growing! There are a number of diseases responsible for GH deficiency or failure of GH to produce its effects. Children with these conditions typically exhibit features of acquired short stature with normal or elevated blood levels of GH. Emotional and social deprivation lead to growth retardation accompanied by delayed speech and excessive eating behavior. A nurturing environment restores growth rates.

**Presentation and Diagnosis** Short stature is a common presentation of growth hormone deficiency in children. Skeletal maturation is best evaluated by measuring a radiologic bone age estimating the bone age by looking at x-ray of the wrists. Final height is calculated using various formulas and then present height is compared with it.

**Laboratory Investigation** GH deficiency is best assessed by examining the response to stimuli that result in release of GH, including exercise, insulin injection, and other pharmacologic tests that increase GH. Molecular analyses for known diseases should be undertaken when the cause of short stature remains undiagnosed or when additional clinical features suggest a genetic cause. You may need to add additional medication if the pituitary gland is defective or underdeveloped. Taking certain HGH enhancers may help because of the additional amino acids they provide but you should consider speaking to your family health care professional first. This disorder usually is caused by damage to areas of brain responsible for synthesis and secretion of GH.

**Presentation and Diagnosis** The clinical features include changes in body composition, lipid metabolism, and quality of life and cardiovascular diseases. Body composition changes are common and include reduced lean body mass, increased fat mass with selective deposition of fat into the organs of abdomen, and increased waist-to-hip ratio. Increased blood level of fats, heart failure, hypertension, and increased plasma fibrinogen levels also may be present. Bones become weak, with resultant increased fracture rates. Patients may experience social isolation, depression, and difficulty maintaining gainful employment.

**Laboratory Investigation** The tests include GH levels after stimulation of growth hormone release as described for children.

**Why Genf20 Plus can help!** When the pituitary gland is sluggish at producing HGH it can be stimulated into producing more GH by taking key amino acids that trigger it into a producing factory! Much the same as we drink coffee to help stimulate our senses in the morning, it wakes us up and an amino acid like L- Arginine will have the same effect on the pituitary gland. Also there are many types of amino acids that have a direct effect on the production of HGH and on each other actually enhancing how each one works. See Genf20 Plus ingredient list to learn more how these can enhance the natural production of human growth hormones.

**Chapter 7 : Understanding Human Growth Hormone (HGH)**

*Human growth hormone is a big brittle molecule that comprises amino acids linked in a specific order and good form. For this reason, there is no room for differences! HGH produced in the US or in Europe generally has a much more expensive price than the HGH produced in China or Hong Kong.*

Female Infertility and Growth Hormone Deficiency The ability to conceive a child does not always come easily for every woman. There are many different factors that can inhibit this problem. As medical science continues to study and evolve, other avenues for possible treatment are uncovered. One such area involves understanding female infertility and growth hormone deficiency, and how they may be intertwined with one another. To begin with, the chemical in the body known as somatotropin growth hormone, GH is a amino acid single-chain polypeptide that is produced and secreted by the anterior portion of the pituitary gland. GH, IGF-1 which is produced in the liver upon receipt of growth hormone stimulus , and GHRH growth hormone releasing hormone increase the sensitivity of the ovaries to gonadotropin stimulation. Follicular development and the conversion of androgen into oestrogens are also enhanced. GH works in both a direct and indirect via its IGF-1 connection method. The more medical science explores the connection between female infertility and growth hormone deficiency the better able we are to find ways to improve this situation for a positive outcome. For those wishing to explore this avenue further, blood testing is provided by Kingsberg Medical to determine if low GH levels are an issue. Growth Hormone Deficiency and Infertility Connection The connection that we see between these two conditions is evident when examining the oocytes eggs that have been harvested from follicles. Those that come from women with normal GH levels are more fertile than those with low GH concentration. Growth hormone has been proven to enhance the quality of oocytes through the acceleration of cytoplasmic and nuclear maturation. When we look at female infertility and growth hormone deficiency as a connection, of sorts, we see that by increasing the level of somatotropin in the body through the use of HGH human growth hormone therapy we can improve ovarian stimulation in some cases. There is also a possibility of combining this approach with hMG and hCG to improve follicle growth, and hopefully the pregnancy rate in patients who have been diagnosed with hypogonadotropic hypogonadism. This approach has been shown to reduce the dosing requirement of gonadotropin, the duration of hMG treatment, and has improved the overall success rate seen in these patients. Careful review must always be done between doctors dealing with and treating female infertility and growth hormone deficiency. As with any type of therapy, this is not warranted for all women dealing with issues of fertility. Every case is to be taken independently. Trying Growth Hormone Injections for Infertility It may be exciting to think about trying this approach if all else has failed. While it may be beneficial for some women, there is a starting point that must be looked at before going any further. The diagnosis of GH deficiency requires blood testing for a number of different conditions. This is done in order to rule out other problems that might be the cause of any possible symptoms. Please realize that if difficulty with conception is the only issue, female infertility and growth hormone deficiency may not be intertwined. There are going to be other concerns that occur when GH levels are low, such as fatigue, weight gain, loss of muscle tone, memory decline, and much more that could be present. We suggest checking out some other pages on this website that explain the symptoms associated with low somatotropin production for further information on this subject. This will help determine if it is even worthwhile to pursue this avenue of testing. For those who do believe that HGH injections may be beneficial, our doctors will order the necessary blood panels to be tested, and a quick visit to a local lab will provide the necessary answers. Receiving treatment for female infertility and growth hormone deficiency relies on all participating medical practitioners to work together for the good of the patient. To that end, we will also need a complete report from a recent physical examination, as well as the completion of a medical history questionnaire. This form can be accessed through our website for added convenience. It is natural for stress levels to be increased at this time. Unfortunately, stress also inhibits proper GH secretion. As we explore a final word about this topic, it is important to remind every woman to take care of herself during this time “ physically and emotionally. Engaging in a regular exercise program is also recommended, as is consuming a nutritious diet consisting of

an array of fresh preferably organic, where possible vegetables and fruits, lean proteins, heart-healthy grains, and avoiding fats and sugars whenever possible. A good rule to follow here is that if you cannot pronounce an ingredient, you should not be consuming it. Although these recommendations may not assist with increasing the chance of conception, they will help maintain higher levels of growth hormone in the body for those who are not dealing with a decline. Unfortunately, once a decline is noted, and is too severe for natural methods such as those just listed, supplementation with HGH therapy will often be required. The doctors and clinical staff at Kingsberg Medical are happy to answer any questions about female infertility and growth hormone deficiency that you might have. Please feel free to contact us during regular business hours by phone, email, or the contact form on this page. As always, we offer complimentary consultations to men and women concerned about any type of hormone deficiency and replacement therapy. We are here to help.

**Chapter 8 : Understanding Growth Hormone Therapy**

*Growth hormone (GH) is a hormone that is essential for normal growth and development in children. It promotes proper linear bone growth from birth through puberty. In both children and adults, growth hormone helps regulate the rate at which the body both produces energy from food and makes lipids, proteins, and glucose (sugar).*

The success achieved over the last thirty years by bodybuilders has not gone unnoticed, as anti-aging medicine has grown from a cottage industry to a recognized sub-specialty. Anabolic steroids are based upon testosterone, being ringed molecules that dissolve well in oil. GH is a protein composed of amino acids. GH does not dissolve well in oil; instead it dissolves in water. When used as a drug, GH is dissolved in water, and then injected under the skin several times a week. It travels quickly through the system, affecting nearly every type of cell in the body fat, muscle, heart, bone, etc. Though access to GH as a drug is restricted to a select few people, every healthy person has a supply of the hormone. GH is produced and stored in a specialized gland located near the base of the brain called the pituitary gland. That would allow everyone to lower body fat, increase muscle size and reduce recovery time. Scientists continue to study human growth hormone production and release, as the role of the hormone in aging and other conditions becomes evident. Like other endocrine hormones, GH release is controlled by a feedback system - under some conditions it is stimulated, under others it is blocked. GH release is rather complex, especially when compared to testosterone. Testosterone is controlled using a fairly simple "negative feedback system" involving a three part axis - hypothalamus a portion of the brain , the pituitary gland and the testes. This is sensed by the hypothalamus, causing it to release gonadotropin releasing hormone GnRH. GnRH travels to the pituitary, stimulating the release of luteinizing hormone LH into the bloodstream. LH travels to the testes, stimulating production of testosterone, raising blood levels. When testosterone levels rise, the hypothalamus senses the change, shutting off the release of GnRH. This in turn shuts down the release of LH from the pituitary and testosterone release from the testes is reduced until blood levels fall and the cycle is repeated. This triad GnRH - LH - testosterone is relatively simple in that each of the hormones is directly linked with the others. GH is much different, and unfortunately, much more complex. The control of testosterone is relatively simple in that one hormone testosterone from one organ testes is monitored. When low levels of testosterone are sensed by the hypothalamus, word is sent chemically to the pituitary and a signaling hormone is released that stimulates the testes to produce more. When too much testosterone is present, that is sensed by the hypothalamus and word is passed to the pituitary, which stops releasing the signaling hormone and the testes go into a rest mode. GH affects more than one organ and is stimulated by more than one signaling hormone. So researchers were left to wonder, how is GH release controlled? To this date, that question has not been fully answered, but a fairly clear picture has been developed. The pituitary gland is the primary source for GH in the body. Being a protein hormone, GH is stored in special cells in the pituitary gland, contained in tiny hormone filled bubbles. The released GH enters the circulation, traveling to all the tissues of the body. In some tissues, GH stimulates growth, such as muscle and bone. In the example of the testosterone feedback cycle, LH - the signaling hormone released by the pituitary gland, does not act on any other tissues than the testes. GH on the other hand, affects many different tissues. The primary action of LH is the release of testosterone, which is monitored by the hypothalamus. GH increases the production and release of IGF Receptors on the hypothalamus monitor IGF-1, which has been shown to increase somatostatin and decrease GHRH release with a net effect of decreasing GH release from the pituitary gland. Imagine a car where you have one foot on the brake and the other on the gas at all times. When you press the brake harder, the car stops. If you let up on the brake and step on the gas, the car accelerates forward. However, GH seems to respond to environmental factors as well, such as hunger, exercise, arginine, etc. It was later discovered that a separate type of receptor is present on the hypothalamus and pituitary, called the GH secretagogue receptor. Ghrelin signals when the stomach is empty and stimulates hunger and feeding. Though ghrelin increases GH, a fat reducing hormone, it also increases appetite and fat storage. Part of the weight loss success experienced by people who have gastric bypass surgery weatherman Al Roker, singer Carnie Wilson is due to a sharp drop in ghrelin levels after the

surgery. Pharmaceutical companies have developed several different secretagogues, with positive clinical studies, but no licensed products have been released to the U. Many bodybuilders are aware of the ability of L-arginine to increase GH release. It appears that L-arginine does not directly stimulate GH release; rather it blocks somatostatin release and makes the pituitary gland more sensitive to GHRH. The effects of L-arginine are due in part to one of its metabolites, nitric oxide. Nitric oxide appears to stimulate one of the cellular reactions that take place in the pituitary after GHRH has signaled for GH release. When nitric oxide levels are high, the response to GHRH is greater. If the conditions do not support GHRH release at the same time, nitric oxide appears to have little effect on GH levels. The understanding of GH release goes much deeper, with several pathways and messengers being involved inside the pituitary cells. Though a few people might find discussions of phospholipase C, IP3 and protein kinase C riveting or the identification of porosomes amazing actually, it was an amazing discovery, for most the inner workings of the pituitary cells will always remain a black box. One would think that the expanded knowledge of the control and release of GH would lead to new treatments for obesity, GH deficiency and aging related disorders. Yet, little has developed along these lines. The primary reason is that there is an ample supply of GH that is safe, effective and well understood. Until a need arises for means of treating pituitary deficiency directly, or the medical community understands that there are many people who have normal GH levels, but desire optimal GH levels, it is unlikely that pharmaceutical companies will devote the resources necessary to develop such drugs. It would be interesting to see what benefits some of the shelved projects, such as the secretagogues might provide to the growing population of healthy, but driven adults in the U.

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