

Low Testosterone Linked to Arterial Stiffness

Collagenous tissues provide structure, elasticity and bulk to blood vessels. The principle types of collagenous tissue are collagen--white fibers that provide structure and support and elastin--yellow fibers that are elastic and flexible. Stiff collagen replaces pliable elastin in blood vessels as people age. Arterial stiffness causes hypertrophy of the arterial muscles, which promotes arterial disease. Physical inactivity and diets high in salt promote arterial stiffness. Researchers from the National Institutes of Health studied hormone changes and arterial stiffness in men for 33 years. Those with the greatest decreases in testosterone experienced the greatest increase in arterial stiffness. Changes in DHEA or serum hormone binding globulin didn't predict changes in arterial health. The study helps explain why men with lower levels of testosterone as they age have a greater risk of coronary artery disease. (American Journal of Physiological Metabolism, Sept 13, 2005 article in press)

Blechman, S., & Fahey, T. (2005). Low Testosterone Linked to Arterial Stiffness. *Muscular Development*, 42 (12), 120.

High resistance Training Increases GH and Testosterone.

Elite Olympic weightlifters are incredibly strong and quick, but the vast majority of these athletes have modest muscle development and muscle definition. Modern bodybuilders often weigh close to 300 pounds or more, yet have very little body fat. Finnish and American researchers found that growth hormone and testosterone--two highly anabolic hormones that determine the extent of muscle hypertrophy--increased in response to heavy maximum resistance exercise (five sets of 10 reps max weight in five exercises), but didn't change during explosive training or sub maximum heavy resistance exercise. This study helps explain why multiple high repetition sets to exhaustion promote muscle hypertrophy, while explosive training or sub maximum training doesn't. The take home message is to push muscles to the max during training if you want them to grow. (Journal of Strength and Conditioning Research, 19:566-571, 2005).

Blechman, S., & Fahey, T. (2005). High-Resistance Training Increases GH and Testosterone. *Muscular Development*, 42 (12), 98.

Growth Hormone Prevents Muscle Wasting in AIDS patients

Immune boosting medications have extended the lifespan of HIV infected patients and given them hope of living a normal life. Muscle wasting and physical deterioration remain a major challenge to their survivability and quality of life. Many of these patients are so fatigued and de-conditioned that they have little capacity for work or recreational activities. Canadian researchers found that HIV infected men given growth hormone supplements (6 milligrams per day) for three months increased lean mass by 9 pounds., boosted sub maximum endurance capacity by 4 percent and lost five and a half pounds of fat. The subjects also reported less fatigue and increased energy levels. These are impressive results because the patients were deteriorating physically before the treatment and they didn't weight train during the experiment. They used very high doses of GH. One third of the subjects had to use lower doses because they developed joint pain and numbness, but most tolerated the drug well. GH can increase muscle mass and physical performance--at least in HIV infected patients who take high doses of the drug. (American Journal of Physiological Endocrinol Metabolism, 289: E494-E503, 2005).

Blechman, S., & Fahey, T. (2005). Growth Hormone Prevents Muscle Wasting in AIDS Patients. *Muscular Development*, 42 (12), 156.

Low Testosterone Shortens Lifespan.

Men have more heart disease than women before age 60. Many scientists reasoned that since men have much higher levels of testosterone than women, the hormone must be linked to heart attacks. Well, think again. Mountains of research show just the opposite. Low levels of testosterone increase the risk the heart disease, impair sexual performance and cause premature death. University of Washington researchers --in a study of war veterans over 40-- found that death rates in men with the lowest testosterone levels (less than 240ng/100ml) were 75% higher than in men with normal levels(450ng/100ml). Other studies link low testosterone levels with poor metabolic health. For example, men with higher waist size had lower levels of testosterone. Men with waist circumferences greater than 40" had 30% lower testosterone levels than men with waists less than 37". Large waist size depressed testosterone most in men 25-50 years old- the time when they're most sexually active. These studies provide more evidence for the value of hormone replacement therapy in middle aged and older men. (Archives Internal Medicine, 166: 1660-1665, 2006).

Blechman, S., & Fahey, T. (2006). Low Testosterone Shortens Lifespan. *Muscular Development*, 43 (11), 106.
Growth Hormone Cuts Fat and Eventually Improves Blood Sugar Control

Growth hormone supplementation is a common treatment for combating the effects of aging, obesity and insulin resistance. Researchers from Stanford University concluded in a literature review that growth hormone is effective for decreasing total body

fat and abdominal fat in overweight, middle-aged adults. Insulin resistance increases in patients during the early phases of treatment. This means the body has difficulty regulating blood sugar. Abdominal fat is highly related to insulin resistance. Growth hormone decreases ab fat, which gradually decreases insulin resistance and improves blood sugar control. Almost all studies on growth hormone supplements have been conducted on older, sedentary, obese men and women. Fit people are less likely to experience growth hormone side effects in blood sugar control than people who don't exercise. Many fit people (old and young) take growth hormone supplements. Unfortunately, we know very little about how these drugs affect them. (Growth Hormone IGF Research, 16: S62-S67, 2006)

Blechman, S., & Fahey, T. (2006). Growth Hormone Cuts Fat and Eventually Improves Blood Sugar Control. *Muscular Development*, 43 (11), 146.

Growth Hormone Supplementation Good for the Heart

Growth Hormone levels decrease with age. People with growth hormone deficiency have an increase risk of heart disease and associated risk factors such as abdominal fat deposition, high levels of blood fats (cholesterol, triglycerides), decreased HDL (good cholesterol), blood clotting problems, blood vessel inflammation, insulin resistance and poor blood flow control. Many have weak, poorly functioning hearts. Italian researchers--in a literature review--concluded that long term growth hormone supplementation reduces total body and abdominal fat, improves blood fat profiles and blood sugar control and enhances the health of the cells lining the blood vessels. In older, obese adults, growth hormone supplementation improves cardiovascular health and prevents heart disease. (Growth hormone IGF Research, 16: S41-S48, 2006)

Blechman, S., & Fahey, T. (2006). Growth Hormone Supplementation Good for the Heart. *Muscular Development*, 43 (11), 146.

No Established Link between Testosterone Supplement and Prostate Cancer

Testosterone replacement therapy is mainstream medicine for improving the quality of life in men over 40. Benefits include increased muscle mass, bone mineral density, feelings of well being, sex drive and vitality, and decreased depression and body fat. Many physicians have reservations about prescribing testosterone because they fear an increased risk of prostate cancer or enlargement. Reducing testosterone levels is a primary treatment method for men with established prostate cancer. Cancer researchers from the University of Colorado Health Sciences Center--in a review of literature--found no evidence that testosterone supplementation increased the risk of prostate disease. They warned that testosterone supplements are contraindicated in men with established prostate cancer. Men should be closely monitored during the first year of treatment followed by periodic examinations after that. (International Journal Impotence Research, 18:323-328, 2006).

Blechman, S., & Fahey, T. (2006). No Established Link Between Testosterone Supplements and Prostate Cancer. *Muscular Development*, 43 (11), 146.

Growth Hormone is the New Fountain of Youth

Legions of baby boomers are approaching old age and their basic philosophy on aging is that it's better to burn out than to rust out. They're more active and affluent than any generation in history and are looking for ways to turn back the clock. Many see growth hormone therapy as a true Fountain of Youth. Lifestyle magazines are peppered with tales of the rich and famous who use growth hormone to cut fat, increase muscle mass and improve appearance. Dr. Susan Kaweski, from the Plastic Surgery Educational Foundation in San Diego, CA, urged caution about growth therapy. In studies of older adults, about 35% of subjects dropped out because of side effects such as joint pain, carpal and tarsal tunnel syndromes (finger and foot numbness), insulin resistance (blood sugar regulation problems) and water retention. Most studies show highly favorable effects from HGH therapy, such as increase muscle mass, decreased fat (particularly in the abdomen), tighter skin, reduced blood cholesterol and enhanced sex drive. Growth hormone supplementation is particularly effective in older adults who also exercise and eat healthy diets. HGH is very expensive, so it's available to only more affluent people. This may change in the future as supplements become more popular with the general population. (Plastic Reconstructive Surgery, 118: 253-255, 2006).

Blechman, S., & Fahey, T. (2006). Growth Hormone is the New Fountain of Youth. *Muscular Development*, 43 (11), 144.

Growth Hormone Therapy Enhances effects of statins on Blood Fats

Physicians prescribe statin drugs, such as Lipitor, to reduce LDL cholesterol (the bad cholesterol) and prevent coronary artery disease. Likewise, many older adults and body builders take growth hormone to reduce body fat. British researchers found that cholesterol and LDL cholesterol decreased in response to statin or growth hormone therapy and the effects were greater when the drugs were taken together. Neither statins nor growth hormone had any effect on HDL cholesterol (the good cholesterol) or triglycerides (blood fats). A German study found that growth hormone therapy did not change LDL size--an important factor

influencing its effect on heart disease. The researchers concluded that growth hormone therapy provides additional benefits to people taking statin drugs for preventing heart disease. (Clinical Endocrinology, 67:623-628, 2007; Growth Hormone IGF Research, 18:264-266, 2008).

Blechman, S., & Fahey, T. (2008). Growth Hormone Therapy Enhances Effects of Statins on Blood Fats. *Muscular Development*, 45 (9), 96.

Low Testosterone Disturbs Sleep

Sleep disturbances cause daytime sleepiness, accidents, constant fatigue, depression, heart rhythm disturbances and irritability. A study from the Department of Medicine at the University of California, San Diego showed that older men with low testosterone levels had lower sleep efficiency, woke up more often at night, spend less time in deep sleep and had lower blood oxygen levels at night than men with normal testosterone levels. Many physicians are reluctant to prescribe testosterone to aging men because they fear it will lead to sleep disturbances and other side effects. Scientists from Southern Illinois University, in a review of literature, concluded that little evidence links testosterone therapy to sleep apnea (a serious sleep disorder). The link between the two was first presented in 1978 and based on observations in a few patients. Millions of men have been treated successfully with testosterone therapy and have not suffered an increased incidence of sleep apnea. They concluded that while sleep apnea is commonly listed as a side effect of supplemental testosterone, the link between the two is weak and inconsistent. Low testosterone levels can lead to poor sleep quality, but the problem might be remedied with testosterone supplements. (Journal of Clinical Endocrinology and Metabolism, 93: 2602-2609, 2008; Journal of Sexual Medicine, 4: 1241-1246, 2007)

Blechman, S., & Fahey, T. (2008). Low Testosterone Disturbs Sleep. *Muscular Development*, 45 (10), 102.

Growth Hormone Increase Muscle Mass and Decreases Fat in Middle Aged Adults

Growth Hormone is extremely popular with older adults trying to slow down the aging process, and with young adults, bodybuilders and power athletes who want to build muscle and lose fat. GH is expensive and mainstream medicine has discouraged people from using it. We are beginning to see long term studies of GH use in nonathletic adult populations. Japanese researchers from the Kobe University Graduate School of medicine found that GH improved body composition in middle aged adults with few side effects. Low doses of GH (.3mg per day; dose varied according to IGF-1 levels) increased lean mass (mainly muscle) by about 5% in men and women and decreased fat by 2.4% in women and 8.9% in men. A study published in 2007 by Swedish researchers found that middle aged men and women given daily injections of GH for 10 years (.47 to .98mg per day) increased muscle mass, maintained body fat and improved blood markers of general health (cholesterol, HDL, and hemoglobin A1c). Both studies concluded that GH therapy caused positive changes in body composition with minimal side effects. (Growth hormone & IGF Research, 18:307-317, 2008; Journal of Clinical Endocrinology Metabolism, 92:1442-1445, 2007).

Blechman, S., & Fahey, T. (2008). Growth Hormone Increased Muscle Mass and Decreases Fat in Middle-Aged Adults. *Muscular Development*, 45 (10), 132.

Testosterone and Growth Hormone Work Best Together

Growth hormone has direct and indirect effects on muscle growth. While it boosts muscle hypertrophy directly, much of its effects on growth results from tissue growth factors (secondary hormones), such as insulin-like growth factors 1 and 2 (IGF-1, IGF-2), GH stimulates the liver and other tissues to release IGF-1. Testosterone increases muscle size by speeding protein synthesis, stimulating the formation of satellite cells (promote muscle cell healing and growth) and increasing the number of cell nuclei (increase the capacity of the muscle cells to make new protein). Australian researchers led by Dr. Ken Ho found men gained more muscle, lost more fat and had higher levels of muscle growth factor IGF-1 when they took GH and testosterone together than when they took either hormone by itself (GH dose: .5 milligrams daily for two weeks; a single dose of testosterone, 250 milligrams). The study showed the importance of managing more than one hormone at a time during hormone replacement therapy in aging males. (American Journal Physiology of Endocrinology Metabolism, In press, published online, July, 2005)

Blechman, S., & Fahey, T. (2005). Testosterone and Growth Hormone Work Best Together. *Muscular Development*, 42 (10), 160.

GH Reduces Abdominal Fat

The Growth Hormone (GH) secret is out. It's well known that celebrities and movie stars use GH to cut fat and look hot. Athletes have known about its fat-cutting properties for years. Athens was the GH Olympics, as witness by the legions of unusually cut

athletes in many of the events. The price of GH has dropped from astronomical to merely expensive, which will make it available to ordinary people who desperately want to lose weight. Swedish researchers found that giving low doses of GH (one IU per day) to post-menopausal women for 12 months decreased abdominal fat deposition. Muscle mass, thigh muscle area, reduced total cholesterol and LDL (the bad cholesterol), and blood sugar control (increased insulin sensitivity) also improved. Quality of life was the same for both groups at the end of the study. GH is an effective weight loss supplement for aging women. (Journal of Clinical Endocrinology Metabolism, 90: 1466-1474, 2005)

Blechman, S., & Fahey, T. (2005). GH Reduces Ab Fat. *Muscular Development*, 42 (6), 152.

Testosterone Boosts Muscle in Old Men

Menopause causes physical and emotional changes in women that include irritability, weight gain, depression, and decreased sex drive, mood swings, bone and muscle loss and hot flashes. Men don't experience menopause, but they do have hormone changes called andropause that cause many of the same symptoms. Men lose 20 percent of their muscle mass between ages 40-60—a condition called sarcopenia. By age 70, most men can no longer lift 10 pounds overhead. Low testosterone levels make them feel depressed and unmotivated, and they lose interest in sex. Bhasin and colleagues from Drew Medical University in Los Angeles found that testosterone supplements reverse many of the symptoms of andropause. Critics worry that testosterone injections may promote prostate cancer or have other serious side effects. Researchers from the Emory University School of Medicine found that giving men testosterone (200 milligrams testosterone enanthate every two weeks) and finasteride (a drug that blocks the formation of DHT) for 36 months caused fat loss and increased muscle mass, strength and quality of life. The effects of both drugs were the same as those produced by testosterone alone. DHT promotes prostate enlargement and hair loss, so blocking its production is important when supplementing testosterone. Control subjects who didn't receive any testosterone declined markedly in physical performance and body composition during the experiment, which shows the importance of supplementing testosterone supplements without increasing their risk of prostate cancer or hair loss. (Journal of Clinical Endocrinology Metabolism, 90:1502-1510, 2005).

Blechman, S., & Fahey, T. (2005). Testosterone Boosts Muscle Mass in Old Men. *Muscular Development*, 42 (6), 152.

Growth Hormone Improves Body Composition and Metabolic Health in Women

Growth hormone is extremely popular with body builders and aging adults because it decreases body fat and increases muscle mass. Low growth hormone levels are linked to abdominal obesity, increased fat around the internal organs, poor blood sugar regulation, and abnormal blood fats and blood clotting. Growth hormone deficiency is also linked to hardening of the arteries, which promotes heart attack and stroke. Many studies have examined the effects of growth hormone supplementation in men. A Harvard University study on women found that moderate doses of growth hormone (.67mg per day for six months) decreased markers of poor metabolic health, including C-reactive protein (marker of inflammation), tissue plasminogen activator (blood clotting marker), total cholesterol, abdominal obesity, and increased HDL level (the good cholesterol). Positive changes in metabolic health were directly related to changes in blood levels of IGF-1 (growth hormone works by increasing the secretion of IGF-1 in the liver). Growth hormone reduced total body fat and abdominal fat and improved measures of cardiovascular health in adult women, but did not interfere with blood sugar metabolism. (Journal of Clinical Endocrinology and Metabolism, 93:2063-2071, 2008)

Blechman, S., & Fahey, T. (2008). Growth Hormone Improves Body Composition and Metabolic Health in Women. *Muscular Development*, 45 (11), 90.

Testosterone Supplements Increase Muscle and Bone Mass in Older Men

Testosterone decreases with age, particularly the biologically active free testosterone. Low levels of the hormone contribute to heart disease and diabetes, decreased muscle and bone mass, loss of strength and power, depression, impaired sexual performance, fatigue and reduced quality of life. Scientists and physicians disagree on the risks and benefits of testosterone supplements in aging men. A study from the University Hospital of North Norway found that older men (age 60-80) with the lowest testosterone levels showed a higher incidence of metabolic abnormalities (higher blood levels of sugar, insulin and fats), more abdominal fat and reduced bone and muscle mass. After one year of testosterone supplementation, the men showed increased muscle and bone mass and decreased total fat and abdominal fat, but no change in metabolic measures. The supplement program only increased blood testosterone levels to low normal values, so this study was not a good test of the treatment. Increasing blood levels of testosterone

even slightly increased muscle and bone mass and decreased fat in older men. (International Journal of Impotence Research, 20:378-387, 2008)

Blechman, S., & Fahey, T. (2008). Testosterone Supplements Increased muscle and Bone Mass in Older Men. *Muscular Development* , 45 (11), 128.

Low Dose GH and Testosterone Therapy Increase Muscle Protein Synthesis in Older Men

Aging alters muscle protein turnover, which results in greater protein loss and reduced protein synthesis. This causes a progressive decrease in muscle mass and strength that eventually leads to decreased physical performance and quality of life. Testosterone and growth hormone supplements might stop the slide. Manthos Giannoulis and colleagues from King's College in London found that low doses of growth hormone or growth hormone plus testosterone increased protein synthesis but did not affect protein breakdown. Testosterone by itself did not influence protein turnover. However, testosterone plus growth hormone increased androgen receptor density, which increases the capacity for muscle growth. Neither growth hormone nor testosterone (alone or in combination) influenced gene activity associated with protein synthesis or breakdown. This was a very sophisticated study that involved isotopic tracers and muscle biopsies. IT showed that while anabolic hormones by themselves influenced protein synthesis, they do not match the changes reported in other studies stimulated by weight training and hormone supplementation. In other words, while anabolic drugs promote muscle growth, they are no substitute for hard work in the gym. (Journal of Clinical Endocrinology and Metabolism, 93: 3066-3074, 2008)

Blechman, S., & Fahey, T. (2008). Low-Dose GH and Testosterone Therpay Increase Muscle Protein Synthesis in Older Men. *Muscular Development* , 45 (11), 130.

Growth Hormone Prevents Muscle Loss After Weight-Loss Surgery

More than 30 percent of Americans are obese, and the numbers keep rising every year. Diet and exercise do not work fro most obese people, so many resort to bariatric surgery to help them lose weight. Bariatric surgery refers to medical procedures that restrict nutrient intake. Depending on the type of surgery, weight loss ranges from 70 to 120 pounds. Unfortunately, people lose muscle mass as well as fat. A study led by Silvia Savastano from the University Federico II in Naples, Italy found that growth hormone supplements preserved lean mass following weight loss surgery. Six months after surgery, patients taking growth hormone lost less lean body mass and bone mass, showed improved blood fat profiles, and normal blood sugar regulation compared to patients who didn't take the supplements. Growth hormone supplementation is an effective way to boost the success rate of weight-loss surgery. (Journal Clinical Endocrinology and Metabolism, 94:817-826, 2009)

Blechman, S., & Fahey, T. (2009). Growth Hormone Prevents Muscle Loss After Weight-Loss Surgery. *Muscular Development* , 46 (6), 94.

Testosterone Supplements Do Not Increase Prostate Cancer Risk

Supplementing testosterone to prevent the effect of aging is highly controversial, in part because the hormone might promote prostate cancer. In fact, suppressing testosterone with drugs is a common treatment fro men with prostate enlargement or cancer. Do testosterone supplements promote prostate cancer? Researchers from the College of Physicians and Surgeons of Columbia University, in a review of literature, concluded that testosterone therapy did not increase the risk of prostate cancer or levels of prostate-specific antigen (PSA, a test to detect prostate enlargement and cancer). They evaluated 197 studies and made their recommendations based on 44 well controlled experiments. Testosterone supplements do not increase the risk of prostate cancer. In fact, low testosterone levels are linked to an increased risk of the disease. (International Journal of Impotence Research, 21: 9-23, 2009).

Blechman, S., & Fahey, T. (2009). Testosterone Supplements Do Not Increase Prostate Cancer Risk. *Muscular Development* , 46 (6), 136-138.

Growth Hormone Supplements Effective in 10-Year Study

Growth Hormone (GH) supplements are popular with middle-aged and older adults because they build muscle and cut fat. Physicians are reluctant to prescribe GH because few long-term studies demonstrate its safety or effectiveness. Swedish researchers found that 109 patients (61 men and 48 women average age 44) given daily injections of GH for 10 years (.47 to .98

mg per day) increased muscle mass and strength for five years. During years six through 10 of the study, subjects were also protected against the normal age-related decrease in strength. Typically, older adults gain fat and lose muscle mass as they age. GH reversed this trend. Men benefited from GH treatment more than women. This study did not include a control group (subjects who took a placebo, or 'fake' growth hormone), but the results look promising. Older adults gain substantial benefits from long term growth hormone supplementation, with minimal side effects. (*Journal of Clinical Endocrinology and Metabolism*, 94:809-816, 2009)

Blechman, S., & Fahey, T. (2009). Growth Hormone Supplements Effective in 10-Year Study. *Muscular Development*, 46 (6), 138.

Testosterone Therapy Boosts Sex Drive In Postmenopausal Women

Sex drive typically decreases after menopause and in women with surgically removed ovaries. Since 1938, many physicians have used supplemental testosterone or combinations of testosterone and estrogen to boost libido in these women. The Food and Drug Administration never approved these treatments because of fears of an increased risk of breast and endometrial cancers. A review of literature by Claudia Panzer and Andre Guay from the Rose Medical Center in Denver concluded that the benefits of androgen therapy for postmenopausal women outweigh the side effects. Testosterone supplements can boost sex drive without increased risk of cancer. Androgen therapy has become increasingly popular for postmenopausal women who want to continue a zesty sex life. (*Journal of Sexual Medicine*, 6:8-18, 2009)

Blechman, S., & Fahey, T. (2009). Testosterone Therapy Boosts Sex Drive in Postmenopausal Women. *Muscular Development*, 46 (6), 138.

Testosterone Supplements Recommended After Prostate Surgery

Physicians often suppress blood testosterone levels with drugs after prostate surgery because high testosterone levels have been associated with prostate cancer cell growth. This often leads to erectile dysfunctions and loss of sex drive. Harvard researchers, led by Dr. Abraham Morgenthaler, found no relationship between blood levels of testosterone and prostate cancer or enlarged prostate glands. Mohit Khara from the Department of Urology at the Naylor College of Medicine, in a review of literature, concluded that testosterone plays an important role in normal erectile function and that supplements could benefit sexual performance in men following prostate surgery. Testosterone is important for blood vessel health and critical for normal erections. (*Journal of Sexual Medicine*, 6 (Supplement 3): 234-238, 2009)

Blechman, S., & Fahey, T. (2009). Testosterone Supplements Recommended After Prostate Surgery. *Muscular Development*, 46 (6), 146.

Erectile Dysfunction Common in Obese Men with Low Testosterone Levels

Erectile dysfunction (ED) is an early warning sign of coronary artery disease and heart attack. At least 50 percent of men with ED have heart disease. Obesity and low testosterone levels contribute to blood vessel abnormalities and ED. Fat cells release dangerous chemicals called cytokines that disrupt the inner lining of the blood vessel and promote hardening of the arteries. Adequate testosterone levels are also important for maintaining blood vessel health. Researchers from the Harbor-UCLA Medical Center concluded that erectile dysfunction, obesity, and low testosterone levels are important markers of poor metabolic health and each is a predictor of diabetes and coronary artery disease. (*International Journal of Impotence Research*, 21: 89-98, 2009)

Blechman, S., & Fahey, T. (2009). Erectile Dysfunction Common in Obese Men with Low Testosterone Levels. *Muscular Development*, 46 (6), 146.

Low Testosterone Linked to Diabetes and Metabolic Syndrome

Testosterone is critical for building large, strong muscles and making you feel like a man. It is also important for metabolic health. Men with low testosterone levels have an increased risk of type 2 diabetes and Metabolic Syndrome. Type 2 diabetes is a disease characterized by poor blood sugar regulation. Metabolic Syndrome is a group of symptoms linked to poor metabolic health that include high blood pressure, abdominal obesity, abnormal blood fats, inflammation, insulin resistance, type 2 diabetes and blood clotting abnormalities. Both health problems can zap your energy levels, cause heart attack and ruin your sex life. Low testosterone might cause these problems by altering body composition, decreasing androgen receptor sensitivity, impairing glucose (sugar)

transport into cells and reducing the cells' ability to fight free radicals that cause cell destruction. Testosterone supplements can help men with low testosterone levels improve blood sugar control and reduce abdominal fat. (Current Opinion Endocrinology Diabetes & Obesity, 14: 226-234, 2007)

Blechman, S., & Fahey, T. (2009). Low Testosterone Linked to Diabetes And Metabolic Syndrome. *Muscular Development* , 46 (1), 114.

Growth Hormone Prevents Hardening of the Arteries and Insulin Resistance

Some bodybuilders take growth hormone because it builds muscle and cuts fat. Many older adults call it a modern Fountain of Youth because of its effects on quality of life, skin texture, body composition, sexual performance and strength. Low growth hormone levels in older adults are linked to heart disease, muscle and bone loss, depression and premature death. The Food and Drug Administration has not approved growth hormone as an anti-aging drug. Many physicians fear its possible long term side effects and want to see the results of large, well controlled studies before they prescribe it to their patients. A 120 year long Swedish study of low dose growth hormone supplementation in older adults showed positive effects on body composition, bone mass and metabolic measurements (Journal of Clinical Endocrinology and Metabolism, 92: 1442-1445, 2007) A five year long Italian study showed that growth hormone replacement therapy (4-5 micrograms per kilogram body weight per day) prevented atherosclerosis (hardening of the arteries) and insulin resistance. This study was difficult to interpret because of the patients were taking a variety of other drugs, including testosterone and thyroid hormone. However, we are beginning to see promising long term evidence that growth hormone supplementation is beneficial in older adults. (Journal of Clinical Endocrinology and Metabolism, 93:3416-3424, 2008)

Blechman, S., & Fahey, T. (2008). Growth Hormone Prevents Hardening of the Arteries and Insulin Resistance. *Muscular Development* , 45 (12), 130.

Testosterone Supplements Decreased PSA in a Prostate Cancer Patient

Testosterone therapy is extremely popular in middle-aged and older men. Many physicians are reluctant to prescribe testosterone, because they fear an increased risk of prostate cancer. Recent studies from Harvard found no relationship between blood testosterone levels and the risk or progression of prostate cancer. Abraham Morgentaler from Harvard is a leading proponent of testosterone therapy for aging men with low levels of the hormone. He found a decrease in prostate specific antigen (PSA) in an 84 year old man with prostate cancer who was given supplemental testosterone. PSA is a measure of prostate growth. The patient refused treatment from prostate cancer, but requested testosterone therapy to improve his quality of life. Testosterone supplements not only improved his vigor and physical capacity, but also improved his prostate cancer symptoms. (Journal of Sexual Medicine, 6: 574-577, 2009)

Blechman, S., & Fahey, T. (2009). Testosterone Supplements Decreased PSA in a Prostate Cancer Patient. *Muscular Development* , 46 (5), 96.

Growth Hormone Prevents Muscle Loss After Weight Loss Surgery

Obesity rates in the United States topped 31 percent in 2008, with no end in sight. While most obese people want to lose weight, few are successful. Consequently, weight loss surgery, such as gastric bypass and banding are more popular than ever. Following the surgery, many people lose 50 to 100 pounds or more. Unfortunately, they also lose muscle mass, which makes them look sickly and saggy rather than fit and trim. Italian researchers found that growth hormone supplements helped patients maintain muscle mass after weight loss surgery. Weight loss surgery patients given growth hormone lost more fat and preserved lean body mass and muscle mass better than women advised to follow a diet and exercise program. Growth hormone supplements improve the outcome of weight loss surgery. (Journal of Clinical Endocrinology and Metabolism, in press; published online January 2009)

Blechman, S., & Fahey, T. (2009). Growth Hormone Prevents Muscle Loss After Weight Loss Surgery. *Muscular Development* , 46 (5), 124.

Testosterone Deficiency Syndrome Undertreated

Testosterone and the biologically active free testosterone decrease with age. By age 50, about 25 percent of men have low testosterone levels that are linked with premature death, loss of muscle and bone mass, heart disease and diabetes, depression, decreased sexual performance, and declining mental function. Malcolm Carruthers from the Center for Men's Health in London called for an international effort to treat testosterone deficiency. Worldwide, less than 2 percent of men receive treatment. Unfortunately, the general population and many physicians equate testosterone supplementation with doping practices in athletics. This has resulted in draconian drug laws and attitudes that make it difficult to treat men with low testosterone levels. This is a significant health issue that has become more urgent with the increased number of older adults, obesity that depresses testosterone, and chemicals in the environment that interfere with testosterone metabolism. (The Aging Male, 12: 21-28, 2009)

Blechman, S., & Fahey, T. (2009). Testosterone Deficiency Syndrome Undertreated. *Muscular Development*, 46 (7), 104.

Strength Linked to Longer Life

Get strong if you want to live longer. Most exercise recommendations mention muscle strength as an afterthought. Aerobic exercise strengthens the cardiovascular system, protects the heart and blood vessels from disease, and reduces the risk of heart attack and heart related sudden death. A 19 year long study of 8762 men aged 20 to 80 conducted at the Aerobics Institute in Dallas found that men with the highest levels of strength were less likely to die each year from heart disease, cancer, or any other cause. The men received medical exams and physical fitness tests during the 1980s and their status was re-evaluated nearly 20 years later. Greater strength reduced the risk of death from all causes by 32 percent, 50 percent from heart attack, and 32 percent from cancer, compared to the 'weakest' one third of men. Increasing strength might make you live longer and increase your quality of life. Weight training should not be a substitute for aerobic exercise—you should do both. (British Medical Journal, 337: a439 2008)

Blechman, S., & Fahey, T. (2009). Testosterone Deficiency Syndrome Undertreated. *Muscular Development*, 46 (7), 104.

Testosterone plus Growth Hormone Increases Muscle Mass and Physical Performance

Muscle mass decreases 20 percent between ages 40 and 60, and things go downhill from there. Many aging men take testosterone and growth hormone supplements to preserve muscle and bone mass and to improve the quality of life. Fred Sattler from the Department of Medicine at the University of Southern California and colleagues found that testosterone and growth hormone supplements increased lean mass, upper and lower body strength, and endurance in a study involving 122 older men (average age 71 years). The treatment increased blood pressure slightly, but other side effects were minor and reversible. This study presents more evidence of the beneficial effects of hormone replacement therapy in aging adults. These supplements prevent many of the negative effects of aging and improve the quality of life. (Journal of Clinical Endocrinology and Metabolism, 94: 1991-2001, 2009)

Blechman, S., & Fahey, T. (2009). Testosterone plus Growth Hormone Increases Muscle Mass and Physical Performance. *Muscular Development*, 46 (10), 122.

Low Testosterone linked to Alzheimer's Disease

Low testosterone levels contribute to many symptoms of aging including loss of muscle and bone mass, depression, coronary artery disease, and decreased sexual performance. Eleanor Drummond and colleagues from the University of Western Australia found a link between low levels of testosterone and an increased risk of Alzheimer's disease in aging men. Low testosterone levels were associated with increased levels of 'beta-amyloid' and 'hyperphosphorylated tau,' brain chemicals associated with Alzheimer's. They also linked low testosterone with decreased mental performance, particularly those linked to memory. This study presented more evidence on the importance of maintaining testosterone levels for normal brain function during aging. (Current Opinion Endocrinology, Diabetes and Obesity, 16:254-259, 2009)

Blechman, S., & Fahey, T. (2009). Low Testosterone Linked to Alzheimer's Disease. *Muscular Development*, 46 (9), 96.

Growth Hormone Therapy Enhances effects of statins on Blood Fats

Physicians prescribe statin drugs, such as Lipitor, to reduce LDL cholesterol (the bad cholesterol) and prevent coronary artery disease. Likewise, many older adults and body builders take growth hormone to reduce body fat. British researchers found that cholesterol and LDL cholesterol decreased in response to statin or growth hormone therapy and the effects were greater when the drugs were taken together. Neither statins nor growth hormone had any effect on HDL cholesterol (the good cholesterol) or triglycerides (blood fats). A German study found that growth hormone therapy did not change LDL size—an important factor influencing its effect on heart disease. The researchers concluded that growth hormone therapy provides additional benefits to people taking statin drugs for preventing heart disease. (Clinical Endocrinology, 67:623-628, 2007; Growth Hormone IGF Research, 18:264-266, 2008).

Blechman, S., & Fahey, T. (2008). Growth Hormone Therapy Enhances Effects of Statins on Blood Fats. *Muscular Development*, 45 (9), 96.

Low Testosterone Disturbs Sleep

Sleep disturbances cause daytime sleepiness, accidents, constant fatigue, depression, heart rhythm disturbances and irritability. A study from the Department of Medicine at the University of California, San Diego showed that older men with low testosterone levels had lower sleep efficiency, woke up more often at night, spend less time in deep sleep and had lower blood oxygen levels at night than men with normal testosterone levels. Many physicians are reluctant to prescribe testosterone to aging men because they fear it will lead to sleep disturbances and other side effects. Scientists from Southern Illinois University, in a review of literature, concluded that little evidence links testosterone therapy to sleep apnea (a serious sleep disorder). The link between the two was first presented in 1978 and based on observations in a few patients. Millions of men have been treated successfully with testosterone therapy and have not suffered an increased incidence of sleep apnea. They concluded that while sleep apnea is commonly listed as a side effect of supplemental testosterone, the link between the two is weak and inconsistent. Low testosterone levels can lead to poor sleep quality, but the problem might be remedied with testosterone supplements. (*Journal of Clinical Endocrinology and Metabolism*, 93: 2602-2609, 2008; *Journal of Sexual Medicine*, 4: 1241-1246, 2007)

Blechman, S., & Fahey, T. (2008). Low Testosterone Disturbs Sleep. *Muscular Development*, 45 (10), 102.

Growth Hormone Increase Muscle Mass and Decreases Fat in Middle Aged Adults

Growth Hormone is extremely popular with older adults trying to slow down the aging process, and with young adults, bodybuilders and power athletes who want to build muscle and lose fat. GH is expensive and mainstream medicine has discouraged people from using it. We are beginning to see long term studies of GH use in nonathletic adult populations, Japanese researchers from the Kobe University Graduate School of medicine found that GH improved body composition in middle aged adults with few side effects. Low doses of GH (.3mg per day; dose varied according to IGF-1 levels) increased lean mass (mainly muscle) by about 5% in men and women and decreased fat by 2.4% in women and 8.9% in men. A study published in 2007 by Swedish researchers found that middle aged men and women given daily injections of GH for 10 years (.47 to .98mg per day) increased muscle mass, maintained body fat and improved blood markers of general health (cholesterol, HDL, and hemoglobin A1c). Both studies concluded that GH therapy caused positive changes in body composition with minimal side effects. (*Growth hormone & IGF Research*, 18:307-317, 2008; *Journal of Clinical Endocrinology Metabolism*, 92:1442-1445, 2007).

Blechman, S., & Fahey, T. (2008). Growth Hormone Increased Muscle Mass and Decreases Fat in Middle-Aged Adults. *Muscular Development*, 45 (10), 132.

Low Testosterone and Estrogen levels Linked to Premature Death in Men

Testosterone levels decline gradually after age 30, which causes decreased muscle mass and strength, psychological depression, impaired mental function, and lack of energy. Low testosterone levels in aging men increase the risk of fractures, falls, obesity, diabetes, and cardiovascular disease. Testosterone is converted to estrogen in the fat cells. Low levels of testosterone reduce estrogen production, which could impair bone and cardiovascular health in older men. A study from Sahlgrenska University Hospital in Goteborg, Sweden, showed low testosterone and estrogen levels increased the risk of premature death. Death rates were more than 50 percent higher in men with the lowest levels of both hormones. In another study, death rates were higher in men with heart failure, who had the lowest levels of estrogen (estradiol). Reproductive hormone levels have a significant impact on the health, well-being, and survival of aging men. (*Journal of Clinical Endocrinology and Metabolism*, in press; published online April 28, 2009; *Journal of the American Medical Association*, 301: 1892-1901, 2009)

Blechman, S., & Fahey, T. (2009). Low Testosterone and Estrogen Linked to Premature Death in Men. *Muscular Development*, 46 (8), 90.

Testosterone Supplements Decrease Arterial Stiffness in Aging Men

Blood vessels are highly elastic in young men, which helps propel blood throughout the circulation, while minimizing the load on the heart. Blood vessels get thicker with age, which increases heart stress and blood pressure. An Israeli study showed that men with low levels of testosterone had stiffer arteries than normal. Three months of testosterone supplementation reduced blood vessel stiffness, but did not eliminate it. Low levels of testosterone are linked to an increased risk of cardiovascular disease,

impaired blood sugar regulation, and premature death. This study provided direct evidence that testosterone supplements improved cardiovascular health in aging men. (*European Journal of Endocrinology*, 160: 839-846, 2009)

Blechman, S., & Fahey, T. (2009). Testosterone Supplements Decrease Arterial Stiffness in Aging Men. *Muscular Development*, 46 (8), 90.

Growth Hormone Cuts Abdominal Fat Better in Men Than Women

Many Athletes and older adults take growth hormone supplements because they are potent fat burners that also increase muscle mass and strength. Growth hormone supplementas appear to reduce body fat more in men than women. Swedish researchers compared the effect of low doses (.5 milligrams daily) supplementation of growth hormone in men and women with abdominal obesity. After one year of treatment, abdominal fat levels were 18 percent lower in men but only 5 percent lower in women. Men experienced a greater increase in muscle mass and a decrease in diastolic blood pressure. On the other hand, only women showed decreases in LDL (bad cholesterol) and increase in blood insulin levels. The researchers could not explain the sex differences in response to growth hormone therapy. (*Growth Hormone IGF Research*, 19: 112-120, 2009)

Blechman, S., & Fahey, T. (2009). Growth Hormone Cuts Abdominal Fat Better in Men Than Women. *Muscular Development*, 46 (7), 130.

Low Testosterone Levels Linked to Poor Metabolic Health

Testosterone and the biologically available free testosterone decrease gradually after age 30. Low levels of these hormones are linked to muscle and bone loss, erectile dysfunction, decreased sex drive, psychological depression and reduced self esteem. A review of literature by researchers from Boston University School of Medicine concluded that low testosterone contributed to the metabolic syndrome—a group of symptoms that include high blood pressure, abdominal fat deposition, insulin resistance, type 2 diabetes, blood clotting abnormalities and inflammation. The metabolic syndrome increased the risk of heart attack, stroke, obesity, erectile dysfunction, poor energy levels and some types of cancer. The measurement of blood testosterone levels should be routine part of medical examinations in aging men. (*Journal of Andrology*, 30:10-22; 23-32, 2009)

Blechman, S., & Fahey, T. (2009). Low Testosterone Levels Linked to Poor Metabolic Health. *Muscular Development*, 46 (3), 128-130.

Testosterone Supplements Decrease Inflammation

C-reactive protein is a marker of whole body inflammation, which increases the risk of coronary artery disease, heart attack and stroke. Low testosterone levels are also linked to vascular disease and inflammation. Dutch researchers showed that 91 men who took supplemental testosterone for six months showed decreases in C-reactive protein and improvements in symptoms associated with aging in males, such as decreased libido, erection problems, loss of muscle mass and depression. Inflammation might be a cause of some of the negative effects associated with low testosterone levels in men. (*Andrologia*, 40: 398-400, 2009)

Blechman, S., & Fahey, T. (2009). Testosterone Supplements Decrease Inflammation. *Muscular Development*, 46 (3), 130.

Hormone treatment and muscle anabolism during aging: Androgens.

Aging is associated with a gradual decline in circulating testosterone concentrations and decreased musculature in men. While testosterone administration is often considered when symptoms of hypogonadism are presented, the long-term effects of androgen use on muscle physiology are not yet fully understood. The definition of hypogonadism in men remains obscure but is generally indicated by total testosterone concentrations less than a threshold value of 300-500 ng/dL. Androgen replacement therapy is generally safe in men and women with low endogenous testosterone concentrations. The development of selective androgen receptor modulators (SARMs) may provide additional options in treatment of hypogonadism while lowering the potential of side effects often associated with long-term androgen use. Androgen administration, either alone or in combination with other treatments, can be successful in improving muscle mass by increasing protein anabolism and reducing protein catabolism in men and women. Further research is necessary to optimize the anabolic and anticatabolic properties of androgens for treatment and prevention of muscle loss in men and women. Copyright © 2010 Elsevier Ltd and European Society for Clinical Nutrition and Metabolism.

Dillon, E. L., Durham, W. J., Urban, R. J., & Sheffield-Moore, M. (2010, May 6). Hormone treatment and muscle anabolism during aging: Androgens. *Clinical Nutrition*.

Testosterone and the aging male: to treat or not to treat?

Abstract

It is well-established that total testosterone (TT) in men decreases with age and that bioavailable testosterone (bio-T) falls to an even greater extent. The clinical relevance of declining androgens in the aging male and use of testosterone replacement therapy (TRT) in this situation is controversial. Most studies have been short term and there are no large randomized placebo-controlled trials. Testosterone has many physiological actions in: muscles, bones, hematopoietic system, brain, reproductive and sexual organs, adipose tissue. Within these areas it stimulates: muscle growth and maintenance, bone development while inhibiting bone resorption, the production of red blood cells to increase hemoglobin, libido, enhanced mood and cognition, erectile function and lipolysis. Anabolic deficits in aging men can induce: frailty, sarcopenia, poor muscle quality, muscle weakness, hypertrophy of adipose tissue and impaired neurotransmission. The aging male with reduced testosterone availability may present with a wide variety of symptoms which in addition to frailty and weakness include: fatigue, decreased energy, decreased motivation, cognitive impairment, decreased self-confidence, depression, irritability, osteoporotic pain and the lethargy of anemia. In addition, testosterone deficiency is also associated with type-2 diabetes, the metabolic syndrome, coronary artery disease, stroke and transient ischemic attacks, and cardiovascular disease in general. Furthermore, there are early studies to suggest that TRT in men with low testosterone levels may improve metabolic status by: lowering blood sugar and HbA1C in men with type-2 diabetes, reducing abdominal girth, ameliorating features of the metabolic syndrome, all of which may be protective of the cardiovascular system. The major safety issue is prostate cancer but there is no evidence that supports the idea that testosterone causes the development of a de novo cancer. So on balance in a man with symptoms of hypogonadism and low or lowish levels of testosterone with no evidence of prostate cancer such as a normal PSA a therapeutic (4-6 months) trial of TRT is justified. Treatment and monitoring of this duration will determine whether the patient is responsive. Copyright 2010 Elsevier Ireland Ltd. All rights reserved.

Bain, J. (2010). Testosterone and the aging male: to treat or not to treat? *Maturitas*, 66 (1), 16-22.

Effect of testosterone replacement therapy on prostate tissue in men with late-onset hypogonadism: a randomized controlled trial.

Abstract

CONTEXT: Prostate safety is a primary concern when aging men receive testosterone replacement therapy (TRT), but little information is available regarding the effects of TRT on prostate tissue in men. **OBJECTIVE:** To determine the effects of TRT on prostate tissue of aging men with low serum testosterone levels. **DESIGN, SETTING, AND PARTICIPANTS:** Randomized, double-blind, placebo-controlled trial of 44 men, aged 44 to 78 years, with screening serum testosterone levels lower than 300 ng/dL (<10.4 nmol/L) and related symptoms, conducted at a US community-based research center between February 2003 and November 2004. **INTERVENTION:** Participants were randomly assigned to receive 150 mg of testosterone enanthate or matching placebo intramuscularly every 2 weeks for 6 months. **MAIN OUTCOME MEASURES:** The primary outcome measure was the 6-month change in prostate tissue androgen levels (testosterone and dihydrotestosterone). Secondary outcome measures included 6-month changes in prostate-related clinical features, histology, biomarkers, and epithelial cell gene expression. **RESULTS:** Of the 44 men randomized, 40 had prostate biopsies performed both at baseline and at 6 months and qualified for per-protocol analysis (TRT, n = 21; placebo, n = 19). Testosterone replacement therapy increased serum testosterone levels to the mid-normal range (median at baseline, 282 ng/dL [9.8 nmol/L]; median at 6 months, 640 ng/dL [22.2 nmol/L]) with no significant change in serum testosterone levels in matched, placebo-treated men. However, median prostate tissue levels of testosterone (0.91 ng/g) and dihydrotestosterone (6.79 ng/g) did not change significantly in the TRT group. No treatment-related change was observed in prostate histology, tissue biomarkers (androgen receptor, Ki-67, CD34), gene expression (including AR, PSA, PAP2A, VEGF, NXX3, CLU [Clusterin]), or cancer incidence or severity. Treatment-related changes in prostate volume, serum prostate-specific antigen, voiding symptoms, and urinary flow were minor. **CONCLUSIONS:** These preliminary data suggest that in aging men with late-onset hypogonadism, 6 months of TRT normalizes serum androgen levels but appears to have little effect on prostate tissue androgen levels and cellular functions. Establishment of prostate safety for large populations of older men undergoing longer duration of TRT requires further study. Trial Registration clinicaltrials.gov Identifier: NCT00161304

Marks, L., Mazer, N., Mostaghel, E., Hess, D., Dorey, F., Epstein, J., et al. (2006). Effect of testosterone replacement therapy on prostate tissue in men with late-onset hypogonadism: a randomized controlled trial. *JAMA*, 296 (19), 2351-2361.

Abstract

Aging is associated with a decline in several important health factors in men, including libido. Serum testosterone concentrations also decrease with age, and many age-related clinical features are closely associated with androgen deficiency, including erectile function (ED). Approximately 70% of ED is of organic origin, with the major risk factors being diabetes mellitus, hypercholesterolemia, smoking and chronic medical illnesses. These are also established risk factors for atherosclerosis, which is the predominant predisposing factor of vasculogenic ED. The introduction of phosphodiesterase-5 (PDE-5) inhibitors for the treatment of ED made a significant impact both in terms of clinical efficacy, and increasing the awareness of the condition. In spite of this, some patients fail to respond to PDE-5 inhibitors alone. Both animal and clinical studies indicate that testosterone therapy improves both erectile function and the response to PDE-5 inhibitors in patients with ED and hypogonadism. Indeed, interventional studies demonstrate that testosterone replacement therapy improves erectile function in hypogonadal men who have previously failed to respond to PDE-5 inhibitors alone. Furthermore, it has been demonstrated that the full therapeutic potential of PDE5 inhibitors will only become manifest in a eugonadal state. Recent studies have demonstrated a close relationship between testosterone and ED and suggest that testosterone therapy may be a valuable option for an increasing number of affected men. European guidelines recommend that all men presenting with ED should have their testosterone concentrations measured.

Yassin, A., & Saad, F. (2008). Testosterone and erectile dysfunction. *Journal of Andrology*, 29 (6), 593-604.

Abstract

Androgen deficiency in older men can be related to age associated changes of neuro-endocrine mechanisms controlling the hormones secreted by the testis and adrenal cortex. We listed the clinical consequences of androgen deficiency at three different levels in three areas: somatic (body composition, glucidic and lipid metabolism, erythropoiesis), sexual and psychological (cognition and affectivity). Observational studies and randomized placebo controlled trials have been reviewed from medical literature. Testosterone, now preferentially administered as transdermal gel, and dehydroepiandrosterone represent two possible treatments. New compounds designed to target androgen receptors in specific tissues are promising options as anabolic agents.

Valenti, G., Ceresini, G., & Maggio, M. (2007). Androgen deficiency in older men. *Minerva Ginecologica*, 59 (1), 43-49.

Abstract

In adults, GH replacement therapy will often be maintained for decades. Owing to the long duration of GH replacement in many adults, it is essential to establish the long-term safety aspects of the treatment. In this review, studies that have investigated the safety profile of long-term GH replacement will be reviewed with an emphasis on studies based on data from the Pfizer International Metabolic Database (KIMS). These studies show that long-term GH replacement in adults is safe and that long-term GH replacement may even improve cardiovascular mortality and morbidity in GH-deficient adults.

Svensson, J., & Bengtsson, B. (2009). Safety aspects of GH replacement. *European Journal of Endocrinology*, 161 (1), S65-74.

Abstract

CONTEXT: GH replacement for 1-5 yr improves, but does not fully normalize, muscle strength. OBJECTIVE, DESIGN, AND PATIENTS: In this single-center, open-labeled, prospective study, the effects of 10 yr of GH replacement on muscle strength and neuromuscular function were followed in 109 consecutive adults (61 men; mean age 50.0 yr; range 22-74 yr) with adult-onset GH deficiency. RESULTS: The mean initial GH dose of 0.88 mg/d was gradually lowered to 0.47 mg/d. The mean IGF-I sd score increased from -1.54 at baseline to 1.12 at study end. GH replacement induced a sustained increase in lean mass and isometric knee flexor strength (60 degrees). In most other measures of upper leg and handgrip strength, there were transient increases during the first half of the study (0-5 yr), whereas during the second half (5-10 yr), the absolute values of muscle strength decreased and returned to or even below the baseline values. However, after correction for age and gender using observed/predicted value ratios, there were sustained and, until 7 yr, even progressive increases in the measures of muscle strength. At study end, knee flexor strength had increased to 104-110% of predicted, knee extensor strength to 93-108%, and handgrip strength to 88-93%. Measurements of neuromuscular function showed reduced voluntary motor unit activation after 10 yr. CONCLUSIONS: Ten years of GH replacement therapy increased muscle strength during the first half of the study and thereafter partly protected against the normal age-related decline in muscle strength and neuromuscular function, resulting in approximately normalized muscle strength after 10 yr.

Gotherstrom, G., Elbornsson, M., Stibrant-Sunnerhagen, K., Bengtsson, B., Johannsson, G., & Svensson, J. (2009). Ten years of growth hormone (GH) replacement normalizes muscle strength in GH-deficient adults. *Journal of Clinical Endocrinology and Metabolism*, 94 (3), 809-816.

Testosterone plus Growth Hormone Increases Muscle Mass and Physical Performance

Muscle mass decreases 20 percent between ages 40 and 60, and things go downhill from there. Many aging men take testosterone and growth hormone supplements to preserve muscle and bone mass and to improve the quality of life. Fred Sattler from the Department of Medicine at the University of Southern California and colleagues found that testosterone and growth hormone supplements increased lean mass, upper and lower body strength, and endurance in a study involving 122 older men (average age 71 years). The treatment increased blood pressure slightly, but other side effects were minor and reversible. This study presents more evidence of the beneficial effects of hormone replacement therapy in aging adults. These supplements prevent many of the negative effects of aging and improve the quality of life. (*Journal of Clinical Endocrinology and Metabolism*, 94: 1991-2001, 2009)

Blechman, S., & Fahey, T. (2009). Testosterone plus Growth Hormone Increases Muscle Mass and Physical Performance. *Muscular Development*, 46 (10), 122.

Growth Hormone Stimulates Fat Breakdown

Many bodybuilders and older adults take growth hormone supplements to decrease body fat and increase muscle mass. Most of the evidence for growth hormone's effects are indirect: people take the hormones and see a decrease in body fat or increase in muscle mass. Louise Moller from Aarhus University Hospital in Biborg, Denmark and college demonstrated that growth hormone affected fat metabolism by blocking growth hormone receptors in the cells. Receptor blockade caused a 20 percent decrease in blood fats (free fatty acids), a 50 percent decrease in ketone bodies (a measure of fat metabolism), and a 20 percent decrease in muscle fatty acid uptake. The study showed that growth hormone has a marked effect on fat metabolism. (*Journal of Clinical Endocrinology and Metabolism*, 94: 4524-4532, 2009).

Blechman, S., & Fahey, T. (2010). Growth Hormone Stimulates Fat Breakdown. *Muscular Development*, 47 (2), 114.

Long-Term Growth Hormone Therapy Safe for Older Adults

Growth Hormone supplements are extremely popular with many older adults because they promote fat loss, increase muscle mass, and strengthen connective tissue, which improves the appearance of the skin. However, GH is extremely anabolic and could possibly accelerate the growth of cancer cells. Consequently, many physicians are reluctant to prescribe it to their patients for long term use. A review of literature by Swedish researchers from Sahlgrenska University Hospital in Goteborg, Sweden concluded that long term growth hormone supplementation in adults is safe and reduces the risk of heart related deaths (mortality) and non fatal heart problems (morbidity). They found no evidence that growth hormone therapy increase the risk of cancer. (*European Journal of Endocrinology*, 161: s65-s74, 2009).

Blechman, S., & Fahey, T. (2010). Long Term Growth Hormone Therapy Safe for Older Adults. *Muscular Development*, 47 (2), 114.

Growth Hormone Levels Do Not Affect Lifespan

Millions of older adults take growth hormone supplements to live longer and improve the quality of life. Research led by Roberto Salvatori from the Johns Hopkins University School of Medicine showed that people with low GH, due to a genetic mutation, lived as long as the general population. They studied a population of dwarves living in rural Brazil.

Other studies found that damage to the pituitary gland (produces GH) shortened lifespan by increasing the risk of heart disease. Growth hormone supplements increase muscle mass and decrease fat in older adults, which could improve the quality of life. We don't know if they make people live longer. (Journal of Clinical Endocrinology and Metabolism, 95:714-721, 2010).

Blechman, S., & Fahey, T. (2010). Growth Hormone Levels Do Not Affect Lifespan. *Muscular Development*, 47 (5), 124.

Long Term Risks of Growth Hormone Therapy

Growth hormone (GH) supplements are popular with older adults who want to increase muscle mass, decrease fat, improve skin texture, enhance physical vitality, and live longer. Many physicians worry about the long term safety of GH. An editorial by David Allen summarized the safety of GH supplements in children treated for retarded growth due to GH deficiency. GH causes rapid growth in children that can disrupt bone growth centers (not important in adults). It increase blood sugar and might trigger type 2 diabetes. This can be a problem in some adults, but it is less significant in physically active people. GH increases the risk of sudden death in children, but probably not in adults. GH does not increase the risk of cancer in those without risk factors but may speed the progress of existing cancer. GH has a remarkable safety record in children, but it is not known if these results apply to aging adults. (Journal of Clinical Endocrinology and Metabolism, 95: 52-55, 2010).

Blechman, S., & Fahey, T. (2010). Long Term Risks of Growth Hormone Therapy. *Muscular Development*, 47 (5), 124.

Testosterone Helps Fight Frailty in Older Adults

Most bodybuilders know that testosterone and other anabolic steroids increase muscle mass and improve physical performance. Are these drugs useful in older adults for preventing physical wasting and improving the quality of life? Shalender Bhasin from Boston University concluded that testosterone supplements increase muscle mass, strength, and physical vitality in frail older men. Testosterone works best when combined with an exercise program. The benefits of testosterone therapy increase with dose but so do the side effects. Physicians must balance the benefits of the drugs with their side effects to boost the quality of life, while minimizing risks. (Journal of Clinical Endocrinology and Metabolism, 95: 509-511, 2010).

Blechman, S., & Fahey, T. (2010). Testosterone Helps Fight Frailty in Older Adults. *Muscular Development*, 47 (5), 124.

Testosterone's Bad Rep

Most people--particularly women--link high testosterone levels with antisocial, egotistical, and aggressive behavior. A study from the University of Zurich in Switzerland showed that testosterone promoted cooperative behavior. They gave women either testosterone or a placebo that the women thought was testosterone and measured fair bargaining behavior. A single dose of testosterone in women increased fair bargaining behavior, reduced bargaining conflicts, and smoothed social interactions. Women who took the placebo, but thought they were getting testosterone, behaved more unfairly and stubbornly. Testosterone promotes socialization; its bad boy reputation is an urban legend. (Nature, 463: published online January 21, 2010).

Blechman, S., & Fahey, T. (2010). Testosterone's Bad Rep. *Muscular Development*, 47 (5), 126.

Growth Hormone Promotes Carb, Fat, and Protein Metabolism

Many bodybuilders, power athletes, and older adults take growth hormone supplements to build muscle and cut fat. Researchers from the Mount Sinai School of Medicine in New York City, in a review of literature, concluded that growth hormone has significant effects on carbohydrate, fat, and protein metabolism. GH promotes protein

synthesis, mainly by increasing the production of the powerful growth factor IGF-1 in the liver and other tissues. IGF-1 helps stabilize blood sugar, stimulates blood sugar uptake in various tissues, and suppresses sugar release in the liver. GH stimulates fat breakdown, particularly in fat cells surrounding the organs. It also prevents sugar uptake in fat cells, which helps reduce fat accumulation. In muscle, GH promotes protein synthesis and prevents protein breakdown. It reduces muscle tissue loss (sarcopenia), particularly in fast-twitch muscle fibers, that occurs with age, which accounts for the popularity of GH in older adults. We need more studies on the long term effects of GH in athletes and older adults to determine its effects on muscle tissue, fat, health, and longevity. (Growth Hormone & IGF Research, 20: 1-7, 2010).

Blechman, S., & Fahey, T. (2010). Growth Hormone Promotes Carb, Fat, and Protein Metabolism. *Muscular Development*, 47 (5), 126.

Testosterone Improves Metabolic Health

Low testosterone is linked to The Metabolic Syndrome---a group of symptoms that include high blood pressure, abdominal fat gain, poor blood sugar regulation, and abnormal blood fats. A review of literature by Martin Miner concluded that testosterone, combined with exercise, weight loss, and improved diet was a powerful therapy for people with type 2 diabetes, congestive heart failure, and The Metabolic Syndrome. This treatment improved insulin resistance, blood sugar control, and prevented premature death. Although controversial, many physicians are using testosterone supplements as routine treatment for aging men with poor metabolic health and low testosterone levels. (Journal of Sexual Medicine, 7: 635-639, 2010).

Blechman, S., & Fahey, T. (2010). Testosterone Improves Metabolic Function. *Muscular Development*, 47 (6), 112.

Testosterone Supplements Improve Metabolic Health

Low testosterone is linked to premature death, heart disease, high blood pressure, abdominal fat deposition, and poor blood sugar regulation. Men with low testosterone levels might benefit from hormone supplements. A review of literature by Martin Miner concluded that testosterone supplements combined with exercise, weight loss, and improved diet was powerful therapy for people with type 2 diabetes, congestive heart failure, and The Metabolic Syndrome. This treatment improved insulin resistance, blood sugar control, and prevented premature death. Although controversial, many physicians are using testosterone supplements as routine treatment for aging men with poor metabolic health and low testosterone levels. (Journal of Sexual Medicine, 7: 635-639, 2010).

Blechman, S., & Fahey, T. (2010). Testosterone Supplements Improve Metabolic Health. *Muscular Development*, 47 (8), 100.

Testosterone Therapy is Safe

Between 20 and 50 percent of middle aged and older men have testosterone deficiency. Many of these men get testosterone replacement therapy, but is it safe? Researchers from the Mayo Clinic, in a meta-analysis that combined the results of 51 studies, concluded that testosterone supplements increase hematocrit and hemoglobin, which thickens the blood. It also decreases HDL cholesterol (the good cholesterol). Testosterone therapy did not result in premature death, prostate disease, urological problems, heart attack, stroke, or increase risk factors of cardiovascular disease. Men might reduce the risk of thick blood by using testosterone creams or gels. Injections cause spikes in testosterone that can stimulate the production of red blood cells. Testosterone therapy can benefit many aging men. (Journal of Clinical Endocrinology and Metabolism, 95: 2560-2575, 2010).

Blechman, S., & Fahey, T. (2010). Testosterone Therapy is Safe. *Muscular Development* , 47 (9), 104.

Testosterone Supplements Improve Cardiovascular Disease Symptoms in Older Adults

Testosterone therapy reduced blood levels of cholesterol and triglycerides in the incidence of chest pain and low heart blood flow in older adults with heart disease----according to an Italian study led by Alessandra Cornoldi. Testosterone deficiency is linked to problems with insulin and blood sugar control, nitric oxide release (controls blood flow), and coronary artery disease. The study showed that testosterone supplements benefited people with heart disease and improved blood vessel health. Until recently, physicians were often reluctant to prescribe testosterone supplements because they feared an increased risk of heart attack, stroke, and prostate disease. Many older adults can safely benefit from hormone replacement therapy. (International Journal of Cardiology, 142: 50-55, 2010)

Blechman, S., & Fahey, T. (2010). Testosterone Supplements Improve Cardiovascular Disease Symptoms in Older Adults. *Muscular Development* , 47 (9), 106.