

HUMAN GROWTH HORMONE (hGH)

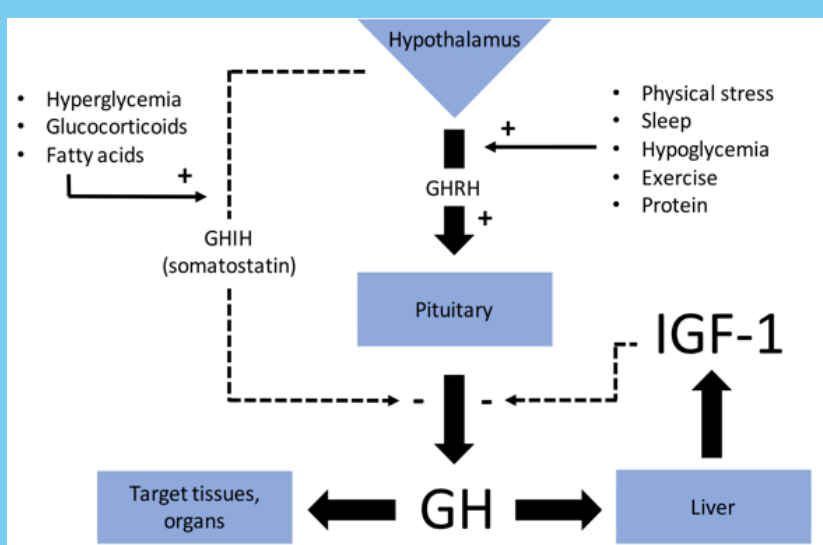
WHAT IS HGH?

Anabolic, amino-acid protein that stimulates growth, cell reproduction and cell regeneration

Drives physiological processes:

- Skeletal and organ growth
- Calcium homeostasis
- Lipolysis
- Regulation of lean body mass

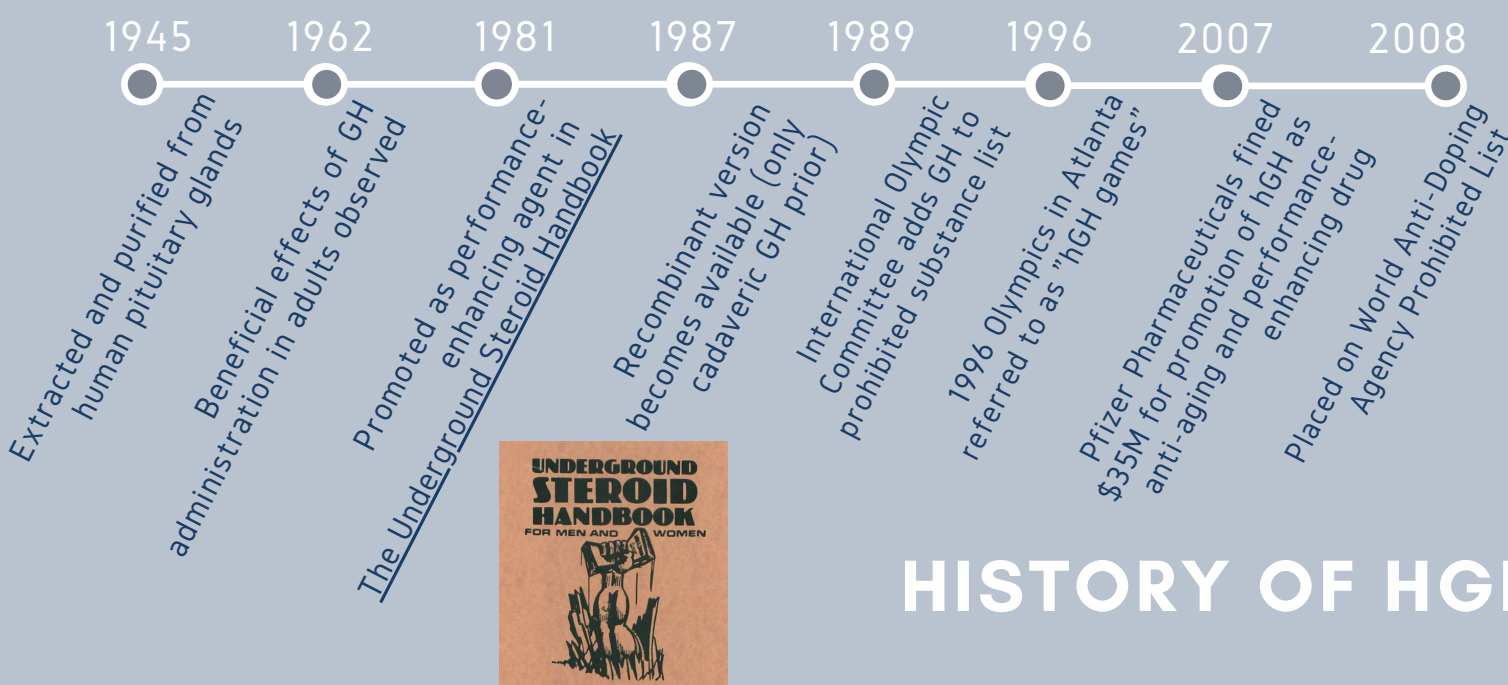
GROWTH HORMONE, INSULIN-LIKE GROWTH FACTOR-1 AXIS



GH: growth hormone, GHRH: growth hormone-releasing hormone, GHIH: growth hormone-inhibiting hormone; IGF-1: insulin-like growth factor-1

HUMAN GROWTH HORMONE USES

- Exogenous GH replacement is used to treat deficient patients
- Theorized effects on muscular and other systems have made it a target of abuse in sports world (often called “sports doping”)
- In U.S., hGH is illegal to possess or distribute for any purposes other than those approved by FDA or prescribed by a physician



HISTORY OF HGH

WHAT'S THE HYPE?

GH deficiency results in:

- Reduction of lean body mass
- Muscle atrophy
- Increase in fat mass and central abdominal obesity
- Impaired aerobic exercise (respiratory muscle weakness, reduced cardiac function, reduced oxygen delivery)

In GH-deficient population, GH reverses muscle atrophy and reduces central and total body fat mass

- Adults with long-term GH replacement showed reduced fat mass up to 20% and increase in lean body mass by 3 - 7 %
- Improves some aspects of exercise capacity, but no further increase in muscle mass or strength beyond expected for healthy adults of same age and gender

EFFECTS ON ATHLETIC PERFORMANCE

- In healthy athletes, GH administration increased lean body mass by average of 1.8 kg, but strength was not increased
- Increased lipolysis - leads to increased body fat utilization
- Aerobic exercise capacity may actually worsen and adverse events (edema and fatigue) were more common with use of GH
- Improved anaerobic exercise capacity in ethically supervised studies

Research Limitations:

- Few studies evaluated athletic performance
- Growth hormone protocols in available studies may not reflect real-world doses and regimens (doses used in doping and cocktails with other substances is unknown, along with combined effects)

CONSEQUENCES & SIDE EFFECTS

Table 2. Punishments for positive growth hormone tests by league

League	Punishment (First Positive Test)	Second Positive Test	Third Positive Test
NFL ⁴⁵	4-game suspension	8-game suspension	2 season suspension; must apply for reinstatement
MLB ³⁵	80-game suspension	162-game suspension	Lifetime ban; may apply for reinstatement after 2 years
NBA ⁴¹	20-game suspension	45-game suspension	Lifetime ban; may apply for reinstatement after 2 years
NHL ⁴⁶	20-game suspension	60-game suspension	Lifetime ban; may apply for reinstatement after 2 years
NCAA ⁴³	1 year suspension, 1 year loss of eligibility	Lifetime suspension, loss of remaining eligibility	—

MLB, Major League Baseball; NBA, National Basketball Association; NCAA, National Collegiate Athletic Association; NFL, National Football League; NHL, National Hockey League.

- High-dosing in athletes may promote development of diabetes, hepatitis and acute renal failure
- Dysregulated growth of cartilage (arthralgia)
- Carpel tunnel syndrome
- Fluid retention, edema
- Insulin resistance
- Cardiac complications
- Creutzfeldt-Jakob disease (degenerative, fatal brain disorder)

THE BOTTOM LINE

For healthy, fit people, ethically supervised dosing of growth hormone does not affect muscle strength or aerobic capacity but may improve anaerobic capacity. The side effects and consequences of doping seem to outweigh the minimal, proven benefits.

References

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