



**The pharmaceutical industry in anti-doping:
Possibilities and limitations
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Possibilities and limitations

Possibilities

- Inform about
 - The molecules
 - Secretion and physiology
 - Potential analysis
- To prevent misuse of pharmaceutical products companies can participate/support international projects to develop tests that can detect misuse of the products

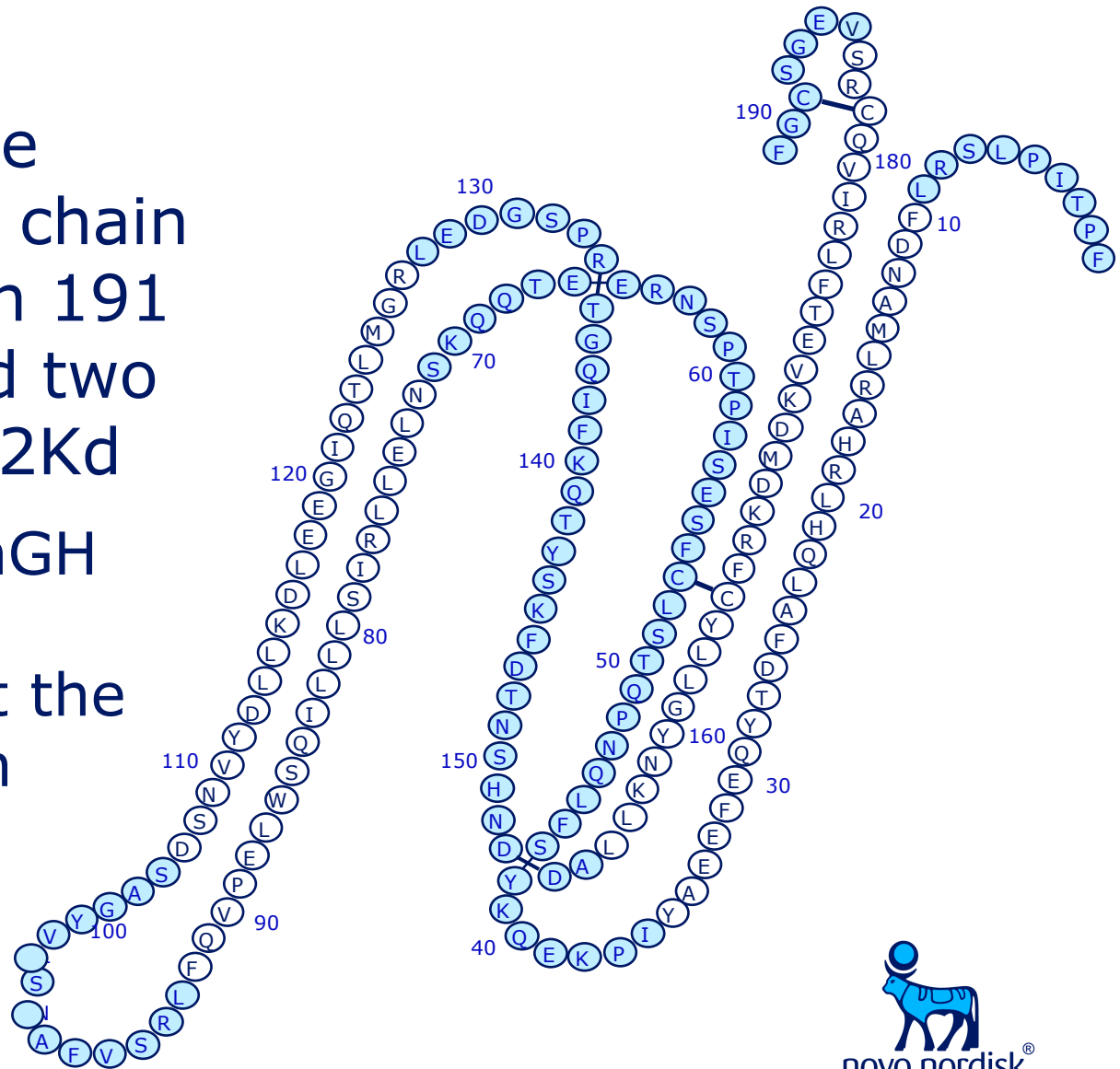
Limitations

- Prescribed medications
- Sponsorships



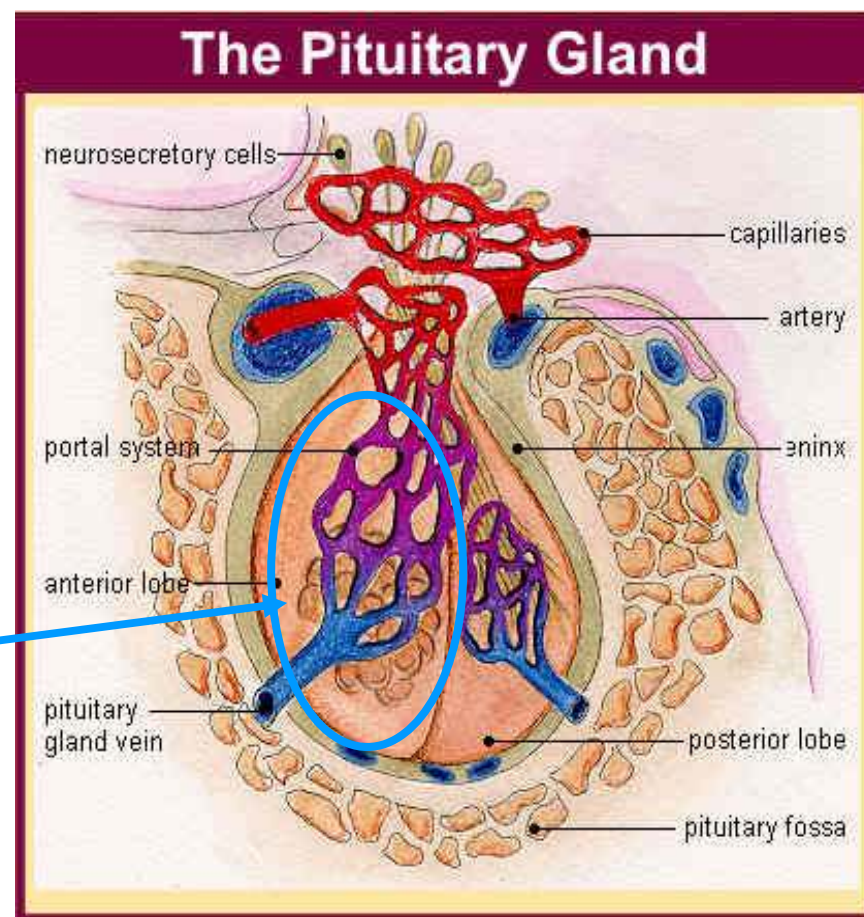
Biosynthetic hGH molecule

- Growth hormone (GH) – is single chain polypeptide with 191 amino acids and two S-S bridges – 22Kd
- Identical to the hGH produced by the pituitary gland at the basis of the brain

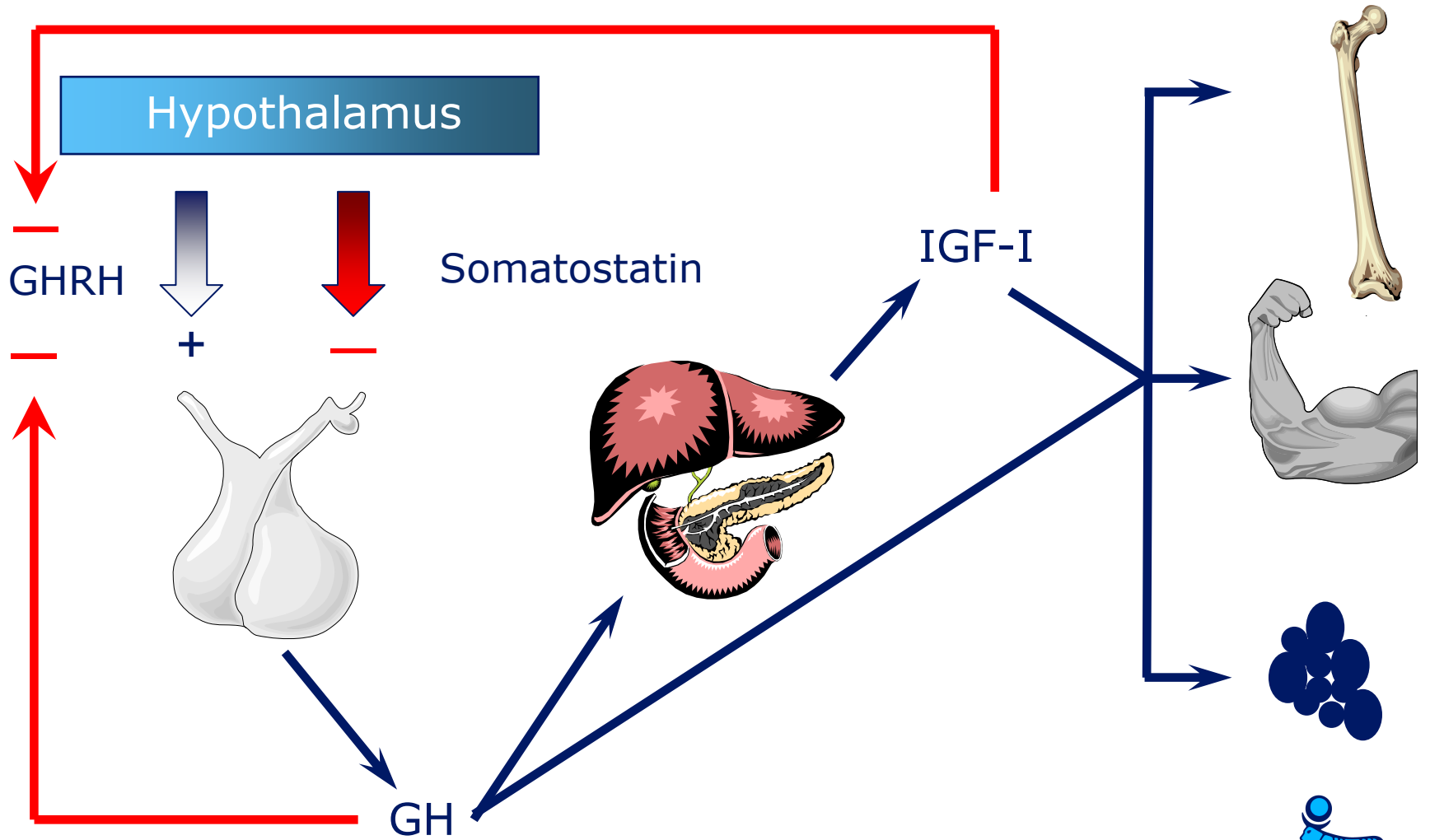


Role of Growth Hormone

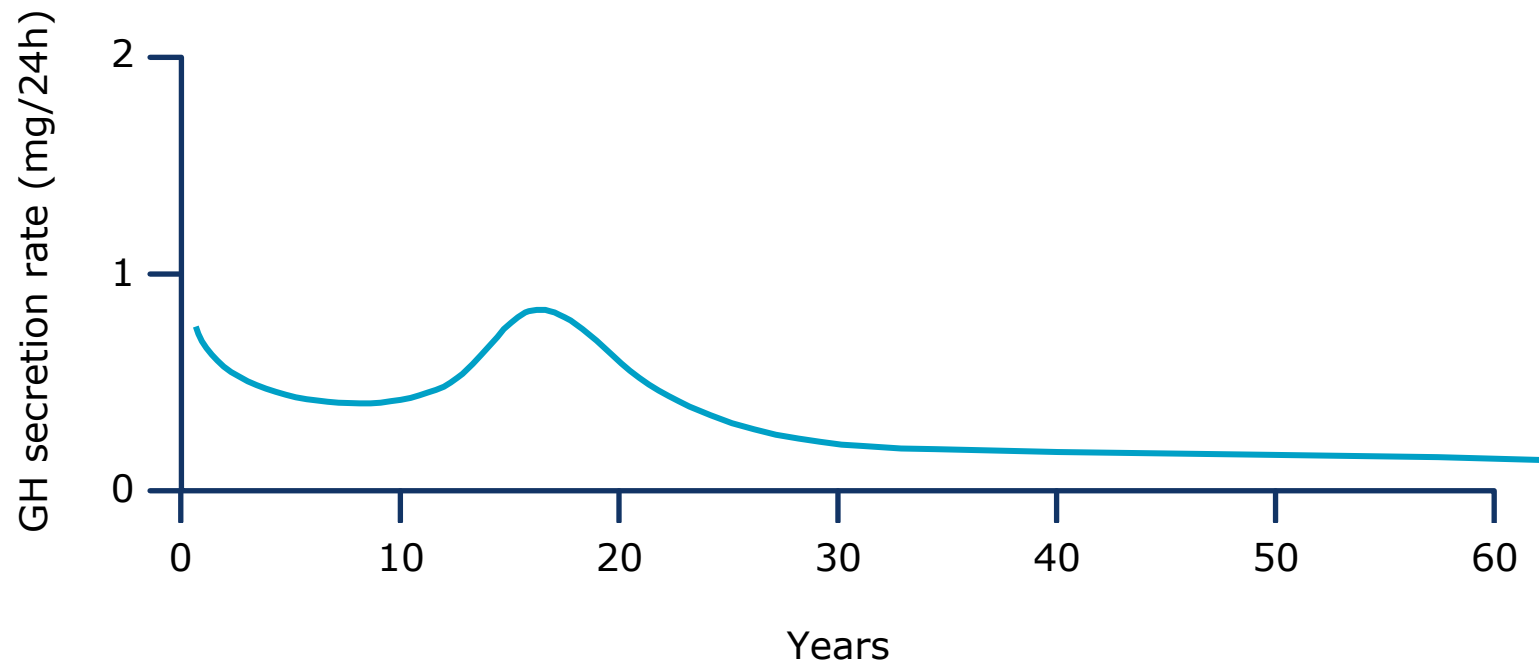
- Regulates growth in children
- Plays significant role in multitude of metabolic functions
 - **GH is more than cm**
- Produced throughout life; necessary after adult height reached
- GH deficiency causes deleterious effects in children and adults



Growth Hormone Physiology



GH secretion is age-dependent



Our aspiration is to improve life for patients where GH will make a clinically relevant difference

- GH should only be used for treatment of diseases for which it is indicated and when prescribed by a medical doctor.
 - Adults with GH deficiency
 - Children with GH deficiency
 - Short children born small for gestational age (SGA)



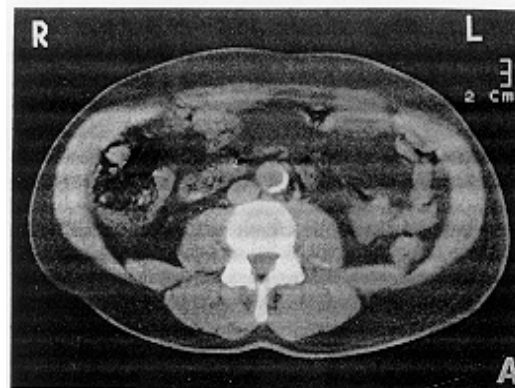
What's adult GH deficiency (AGHD)?

Characteristics of AGHD

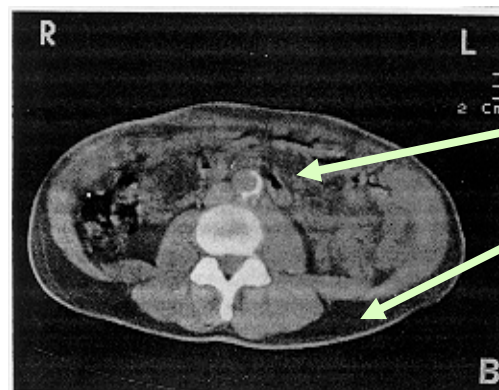
- Abnormal body composition
 - ↑ fat mass, ↓ muscle mass
- Increased risk of CVD
 - ↑ total cholesterol & LDL, ↓ HDL
- Impaired quality of life

AGHD patient

- Before GH treatment



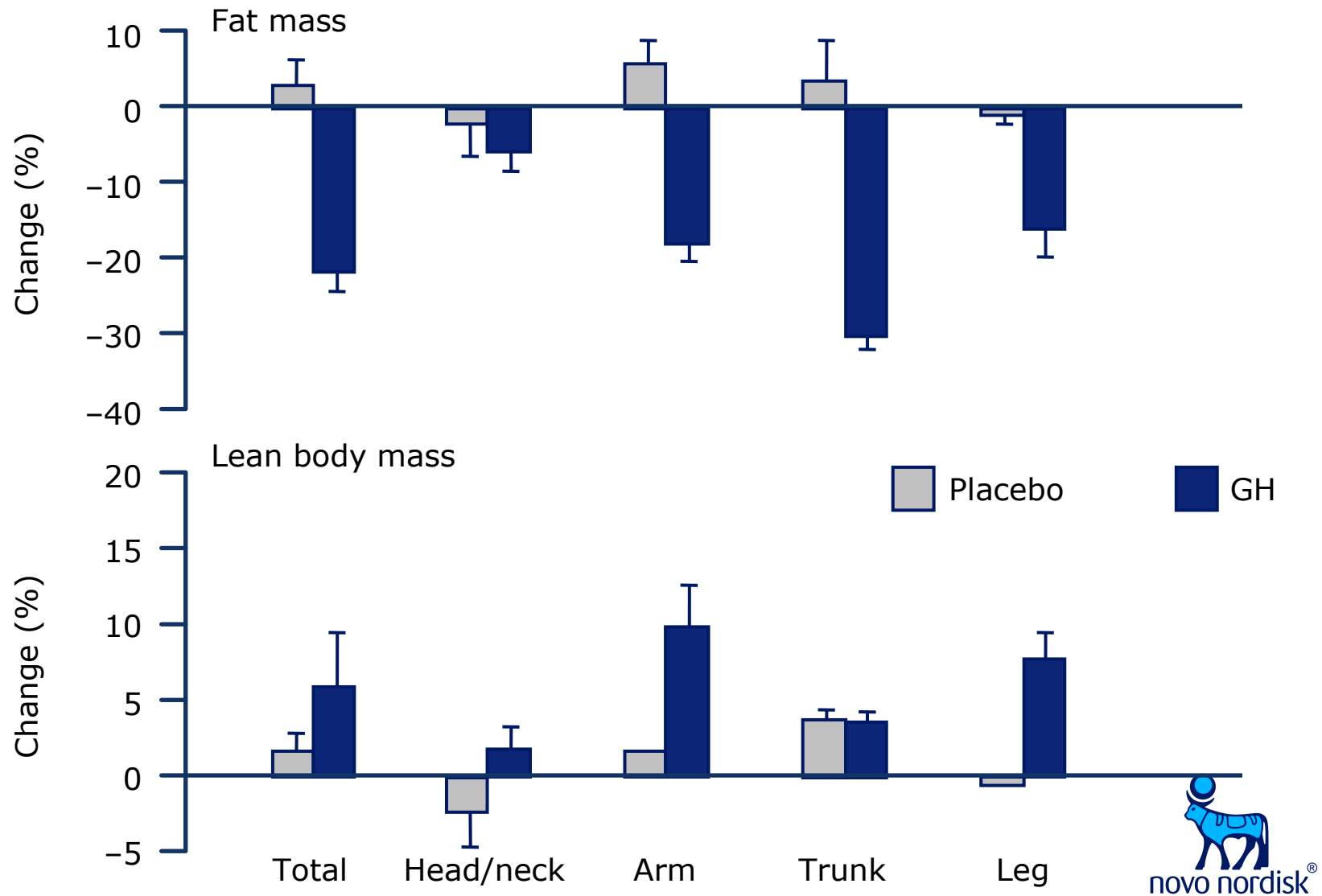
- After 6 months on GH



Reduced visceral
and sc. fat



Effect of GH in AGHD - Body composition



Effect of GH in AGHD

Exercise capacity ↑



What is SGA?

- Small for gestational age (SGA):
 - A baby born shorter and/or lighter than normal for its gestational age.
- Definition:
 - Birth length and/or birth weight < -2 SDS
- Approximately 5% of infants are born SGA
 - Most catch-up and normalise their height before 2 years of age
 - But approx. 10% remain short (height $\text{SDS} < -2$) throughout childhood



Can GH be measured

Yes!
In blood not in urine

Direct method

- 22K/20K ratio method to detect GH abuse during GH administration
 - The window of detection following withdrawal of GH is short, max 36 hours.
 - Pituitary gland produce a mixture of 22Kd and 20Kd & 17Kd, ratio approx 80:20
 - bhGH is 100% 22Kd

Indirect methods

- GH dependent variables
 - IGF-I, IGFBP-3, ALS
 - Bone and soft tissue markers, osteocalcin, PICP, ICTP, P-III-P
- Normative values in athletes in men, women and all races
- Algorithm based IGF-I, IGFBPs and bone parameters

Novo Nordisk collaboration with IOC and EU

- **1996-2001**
 - **GH 2000 – developing a test for GH misuse**
 - Study performed by 4 European Universities in the period 1996 - 2001
 - Key investigators: Peter Sönksen, London, UK - Jens Sandahl Christiansen, Aarhus, Denmark – Bengt-Åke Bengtsson, Gothenburg, Sweden and S Longobardi, Naples, Italy
 - Sponsors: IOC, EU, **Novo Nordisk** & Pfizer
 - Results published in peer reviewed journals in the period 2003-2006



Novo Nordisk collaboration WADA, Australian and Japanese Institutes of Sports Sciences I

- **2003 → on-going to 2008**
 - **Defining interactions between testosterone and GH: developing a robust test for GH doping**
 - Key investigator: Ken Ho, Sydney, Australia
 - Sponsors: Australian & Japanese Anti-doping Agencies and **Novo Nordisk**
 - Published at the Endocrine Society meeting in the US



Novo Nordisk collaboration WADA, Australian and Japanese Institutes of Sports Sciences II

Study to detect misuse of GH & testosterone (T)

- 8-week study in 97 (33F/64M) non-competition athletes, aged 18-40 years – GH 2mg/day, T 250 g/week
 - Women assigned to GH or placebo
 - Men assigned to GH, T, a combination of these, or placebo
 - Samples before, during and 6 weeks after stopping drugs
 - **T has a greater protein and cellular anabolic effect than GH**
 - **GH or T supplementation in the doses used does not significantly improve physical performance, while combined treatment enhance anaerobic work capacity in men**



Novo Nordisk collaboration WADA, Australian and Japanese Institutes of Sports Sciences III

- The **power of the mind** in a double-blind placebo controlled study
 - The athletes in the placebo group who believed they were on GH not only had a perceived improvement on performance but also in measured physical improvement
 - The effect was greater in men
- **Method to detect GH abuse:** The 22K/20K ratio useful method for detecting GH abuse during GH administration
 - The window of detection following withdrawal of GH is short, max 36 hours.



GH prescribed medication

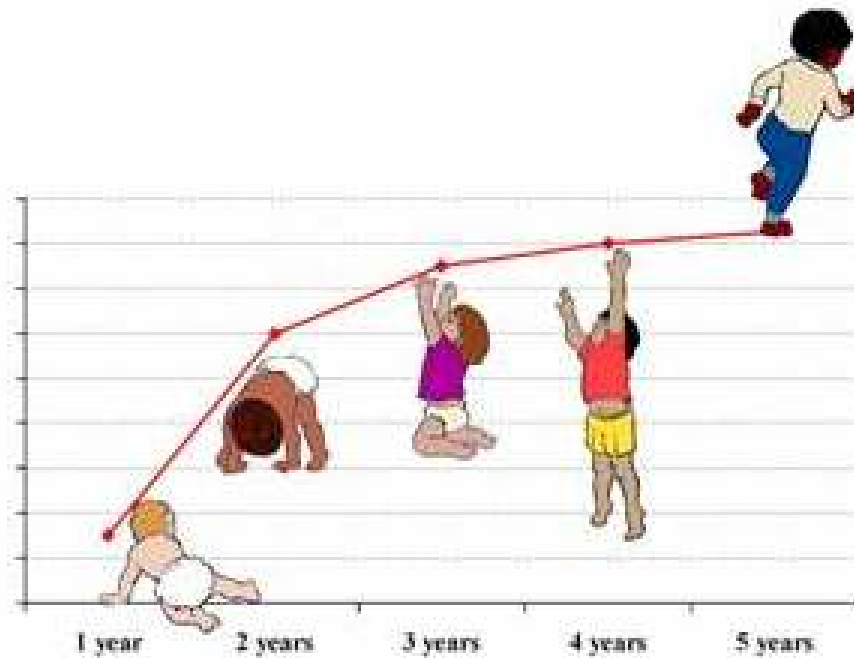
- GH must be prescribed by a physician
- Abuse of GH can have side effects
- It is known that healthy young and elderly people take GH supplementation to boost performance and energy levels
 - The risk and costs outweigh potential benefits
 - The Australian study used high, but safe doses of GH and found that GH had no beneficial effects!

Novo Nordisk position on Norditropin and doping

- Norditropin® should only be used to improve life for patients where GH will make a clinically relevant difference and when prescribed by a medical doctor.
- Novo Nordisk strongly advises against any use of Norditropin as a performance enhancement drug by athletes or bodybuilders: It's effect is questionable and the long term side effects of such use are unknown and could be serious.
- To help prevent misuse of GH, Novo Nordisk participates in international projects to develop tests that can detect misuse of GH.



Thank you very much listening!



Any questions

They grow and grow-up to be happy adults

