
THE
GOOD
THE
BAD
THE
UGLY

Unit of Reproductive Endocrinology
First Department of Obstetrics and Gynecology
Medical School
Aristotle University of Thessaloniki

Hormones and performance-enhancing drugs

Dimitrios G. Goulis
Associate Professor of Reproductive Endocrinology
Aristotle University of Thessaloniki, Greece
Secretary General, European Academy of Andrology

Christos P. Tsametis
Endocrinologist, Clinical Andrologist (EAA certified)
Aristotle University of Thessaloniki, Greece

Conflict of Interest

- We have received payments for research projects, lectures, ad hoc consultancy work and related expenses from manufacturers of pharmaceutical products.

Aims

- Discussion on the efficacy and safety of hormones as performance-enhancing drugs

- Identification of men and women that use anabolic steroids and complain of other clinical problems

Structure

- Introduction
- Epidemiology
- Types
- Efficacy
- Safety
- Conclusions

Structure

- Introduction
- Epidemiology
- Types
- Efficacy
- Safety
- Conclusions

Questions

- **Efficacy:** Does the use of anabolic steroids increase athletic performance?
- **Safety:** Is the use of anabolic steroids dangerous?

Identical approaches

- **Pharmaceutical industry:** Efficacy and safety
- **Physician:** Efficacy and safety
- **Patient:** Efficacy and safety

Different approaches

- **Trainer and athlete:** Increase of athletic performance
- **Physician:** Safety of athlete - patient
- **Public:** Information on use and potential harm
- **Press:** Presentation of doping cases

Baseline characteristics

- **Providers:** Legitimate pharmaceutical company, strict legislation
- **Co-administration:** Other substances, characterized as drugs
- **Use:** Controlled use (route, dosage, amount)
- **Physician:** Sufficient knowledge of drug effect and safety, evidence from trials

Special characteristics

- **Providers:** Not health professionals - fellow athlete, trainer, sport magazine, Internet
- **Co-administration:** Human chorionic gonadotropin (hCG), aromatase inhibitor, estrogen-receptor antagonist, masking agents
- **Use:** Intermittent use
- **Physician:** No information of use, insufficient knowledge of drug effect and safety, lack of trials

Structure

- Introduction
- Epidemiology
- Types
- Efficacy
- Safety
- Conclusions

Structure

- Introduction
- Epidemiology
- Types
- Efficacy
- Safety
- Conclusions

Prevalence: elite athletes

- United States Anti-Doping Agency (USADA): 12756 screening tests in Olympics Games: 137 possible cases - **prevalence: 1%.**

https://www.usada.org/about/annual-report/2016_annual_report.pdf

- From 26 member of US Weight-Lifting National Team, 10 admitted use of anabolic steroids, and 5 declared that they were able to by-pass the screening procedure of International Olympic Committee - **prevalence: 38%**

Curry LA, et al. Percept Mot Skills 88:224, 1999

Opinions

- When it comes to doping in international competition, it is very likely that almost “everyone's doing it”

Walsh LA. Ballantine Books, 2007

- We should stop trying to catch the cheats, and allow athletes to use whatever substances they like, as they are only harming themselves

Wood RI, et al. Horm Behav 61:147;2012

Prevalence: adolescence

- Study the Center of Disease Control (CDC) on adolescent students using anabolic steroid, over-the-counter - **prevalence: 4%**

Eaton DK, et al. MMWR Surveill Summ 55:1, 2006

Prevalence: overall

- The global lifetime prevalence of anabolic steroid abuse is **6.4% for males** and **1.6% for women**

Nieschlag E, et al. Eur J Endocrinol 173:R47–R58, 2015

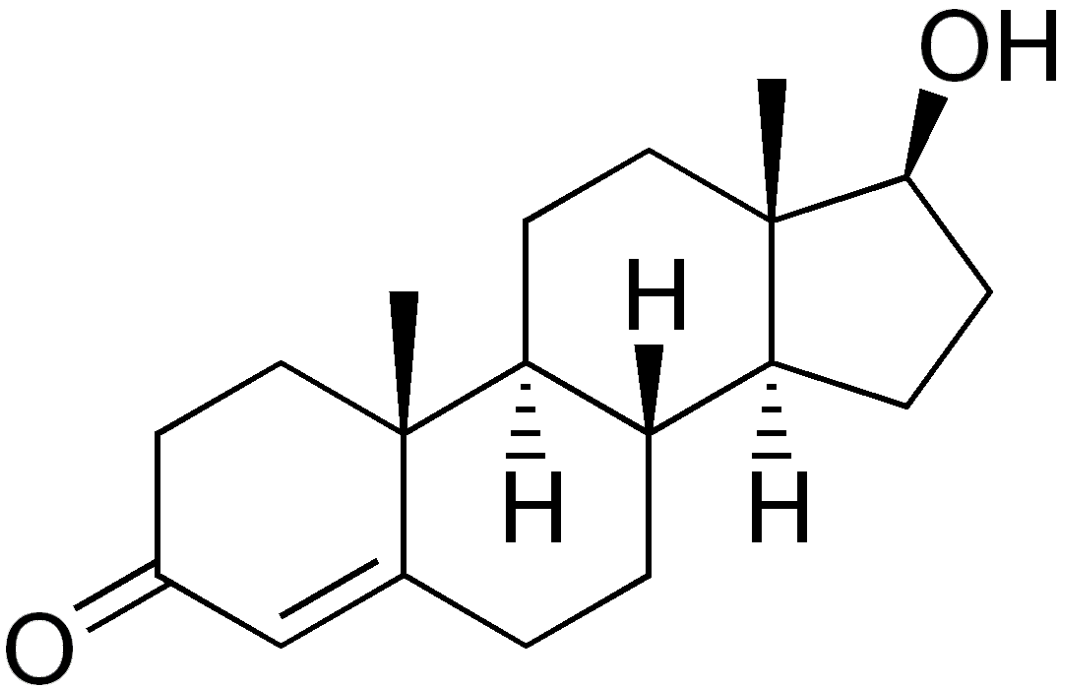
Structure

- Introduction
- Epidemiology
- Types
- Efficacy
- Safety
- Conclusions

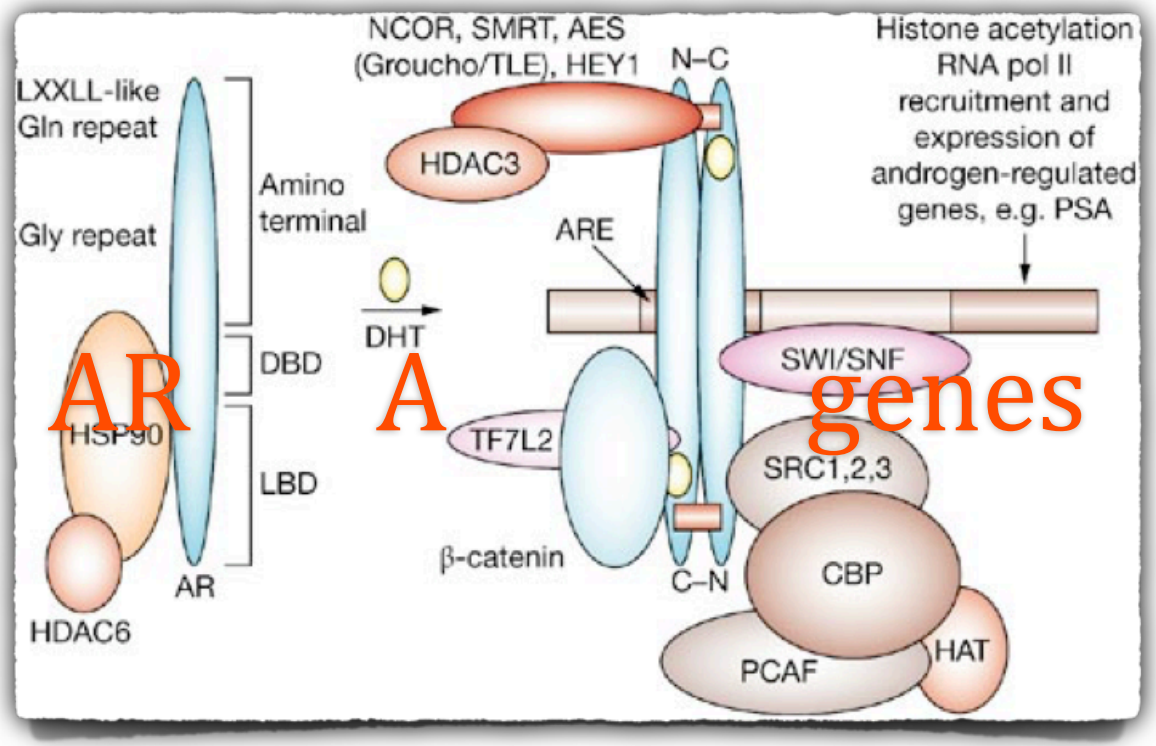
Structure

- Introduction
- Epidemiology
- Types
- Efficacy
- Safety
- Conclusions

Testosterone



Androgen receptor



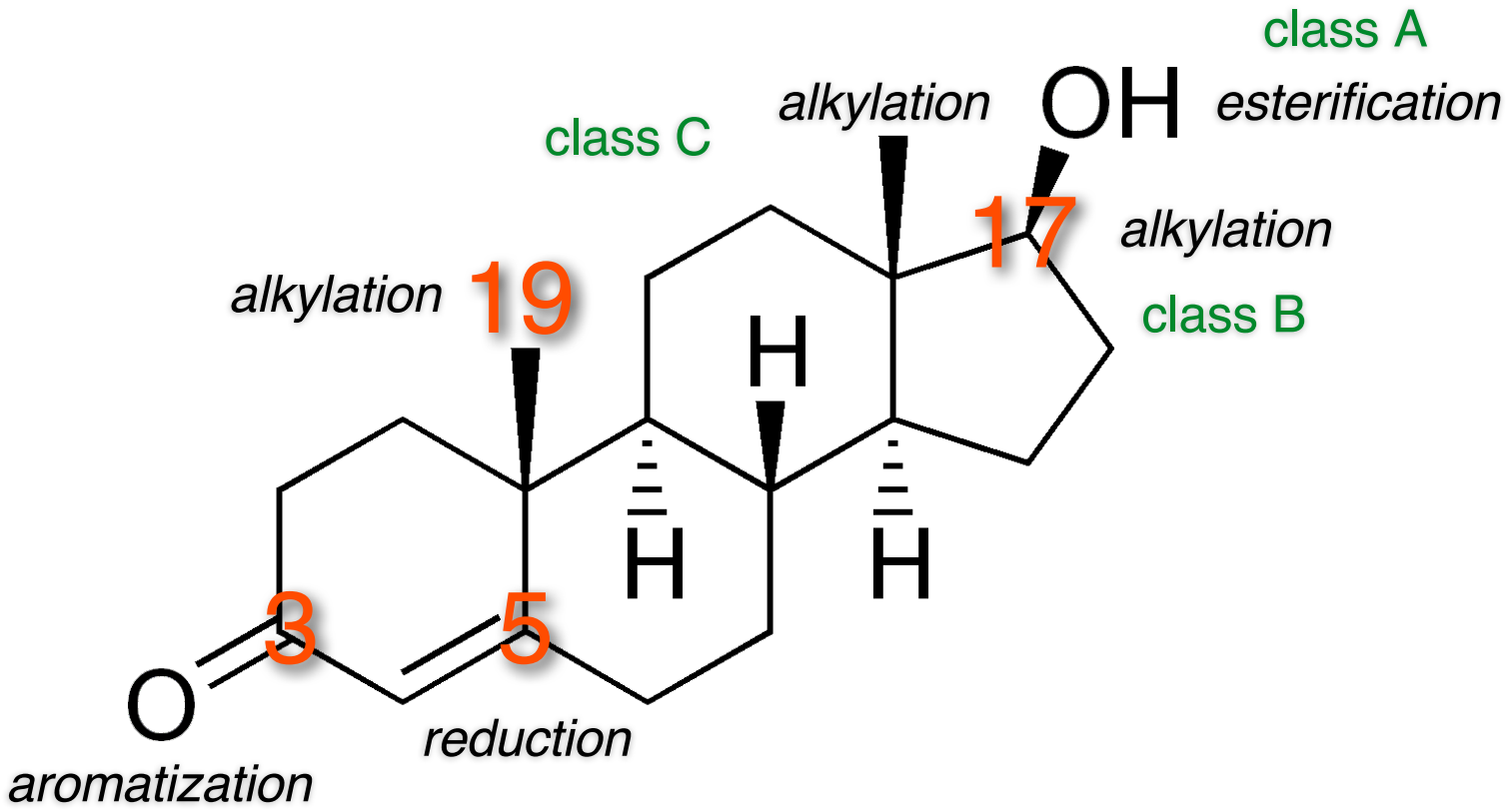
Taplin M-E. Nat Clin Pract Oncol 4:236, 2007

Anabolic steroids

anabolic effect > androgenic effect

Hershberger LG, et al. Proc Soc Exp Biol Med, 83:175, 1953

Testosterone

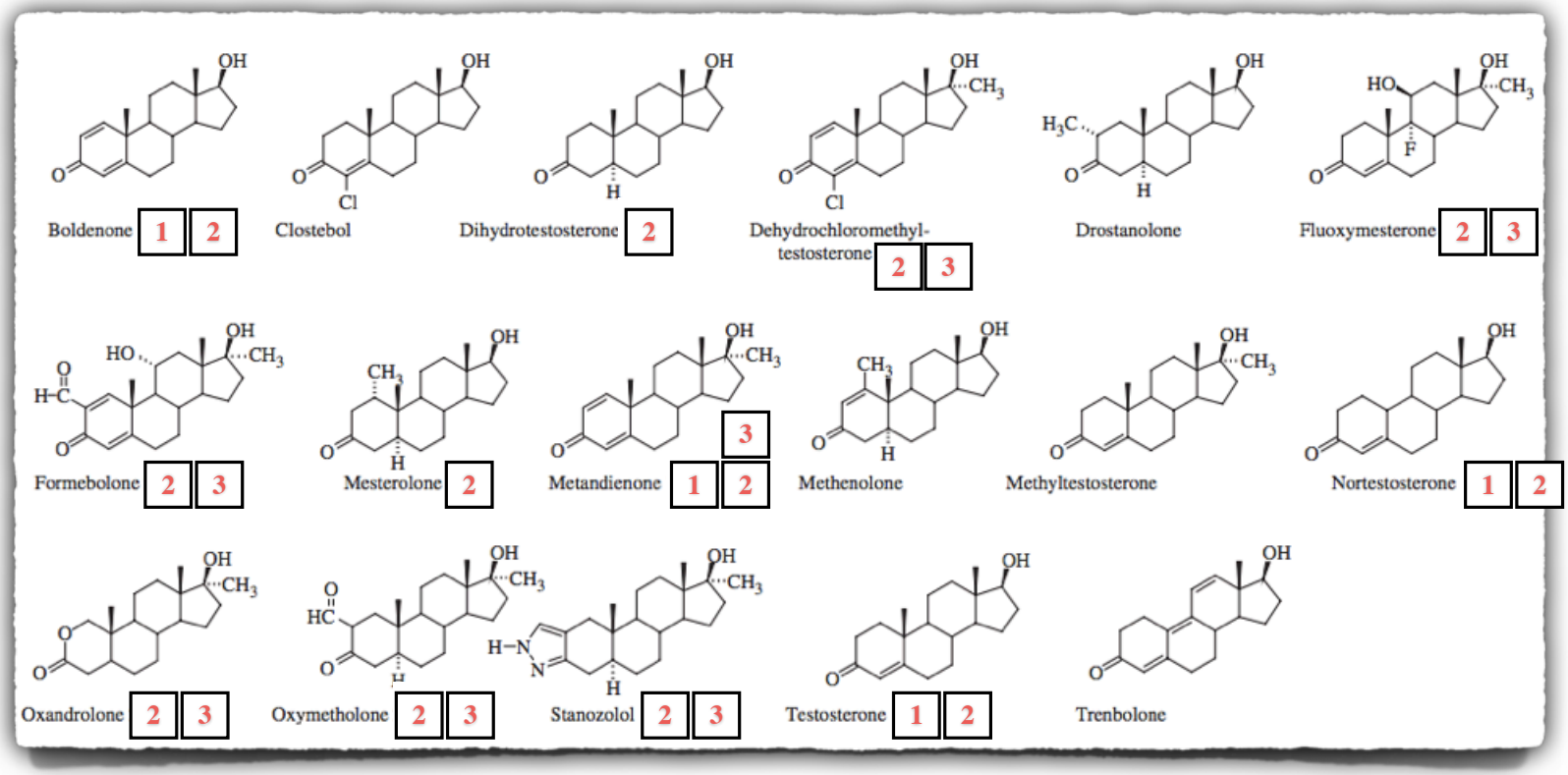


Types of androgens

- **Testosterone esters**
  - enanthate
  - cypionate
- **Synthetic androgens**
  - stanozolol
  - nandrolone
- **Pro-hormones**
  - Δ_4-androstenedione
  - dehydroepiandrosterone

Quiz 1

Anabolic steroids metabolism



1: Can be aromatised, **2:** Are or can be 5α-reduced, **3:** Liver-toxic 17α-alkylation

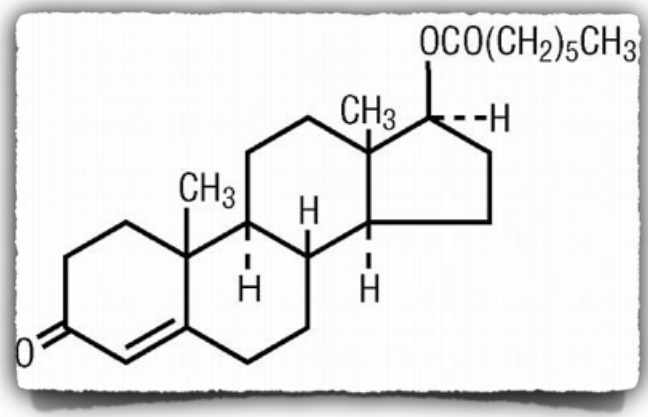
Testosterone esters

Characteristics

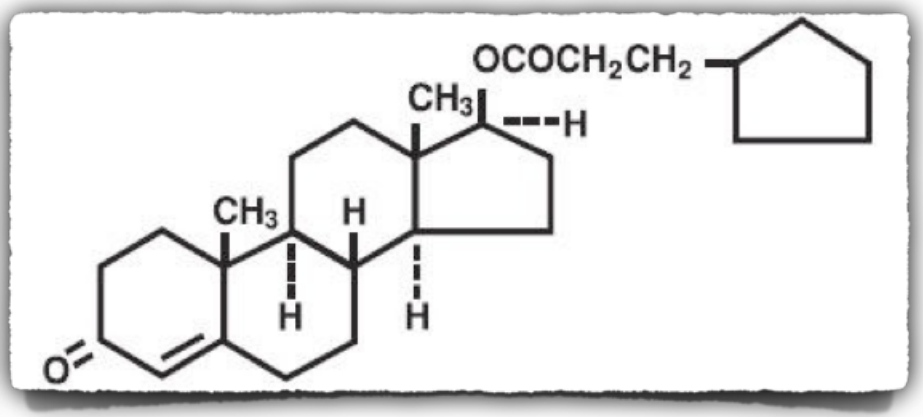
injectable

long half-life

no hepatotoxicity

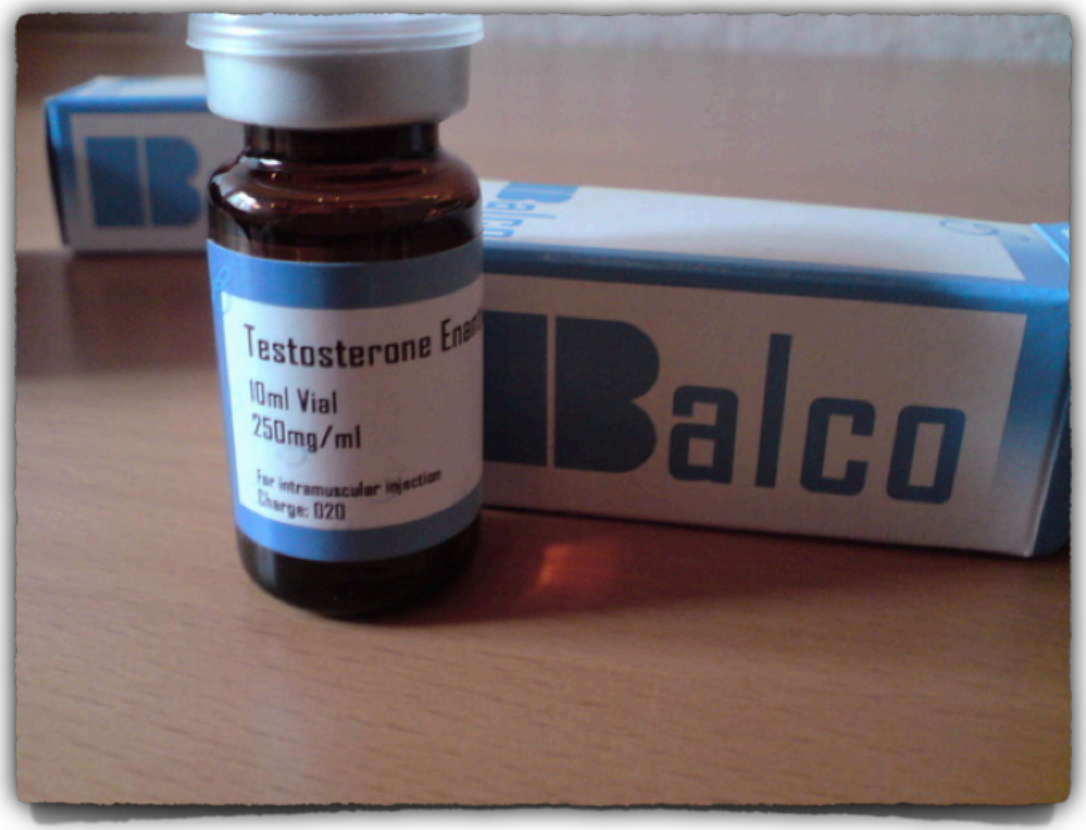


Testosterone enanthate



Testosterone cypionate

Testosterone esters



Alkylated derivatives

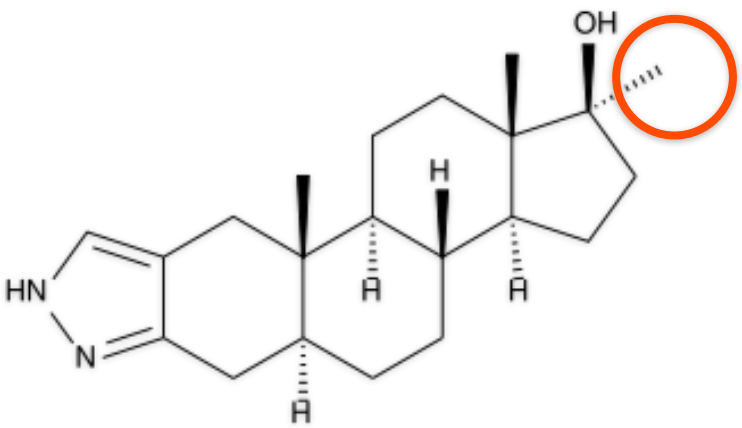
Characteristics

per os

short half-life

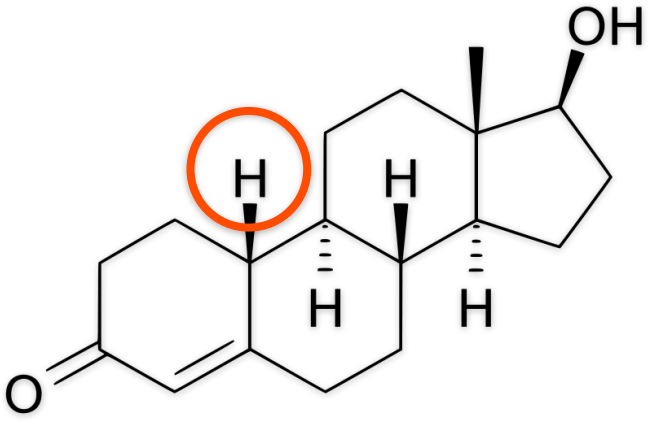
hepatotoxicity

17α-alkylation



Stanozolol

19-derivative



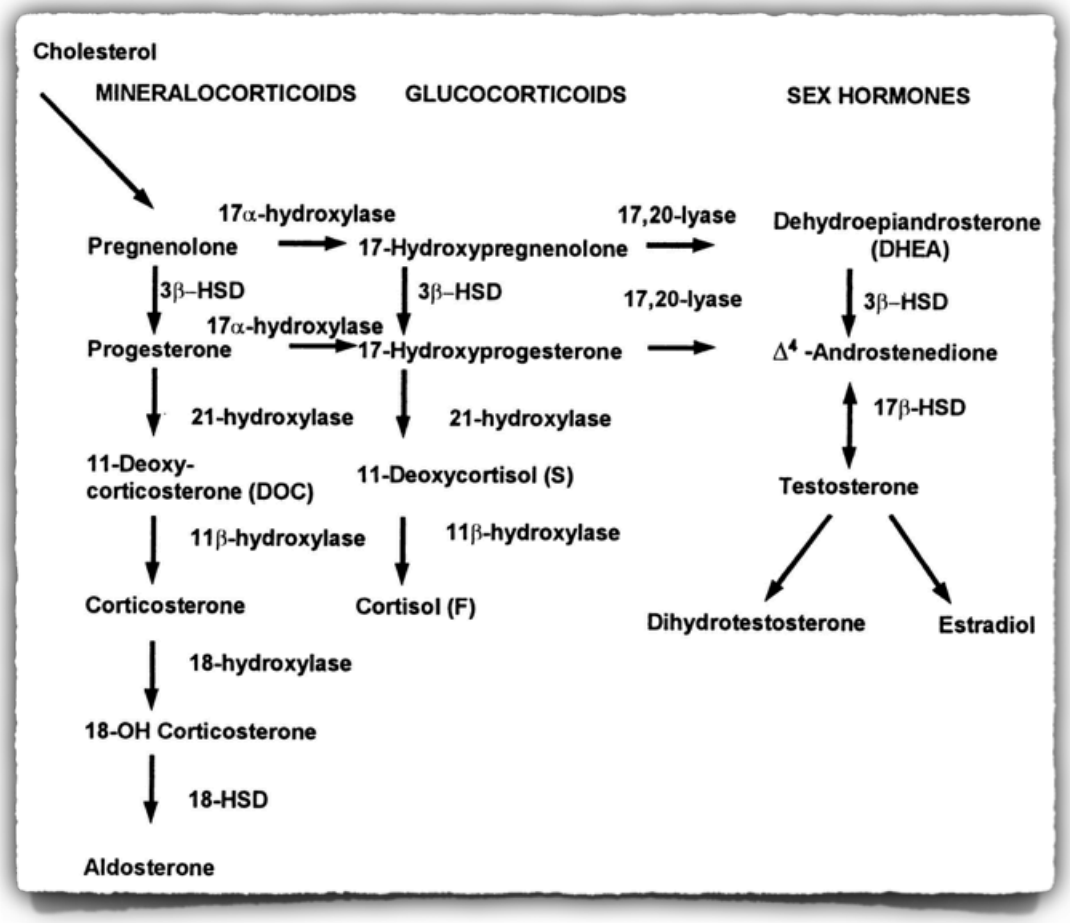
Nandrolone

Alkylated derivatives

Stanozolol

Nandrolone

Corticosteroid biosynthesis

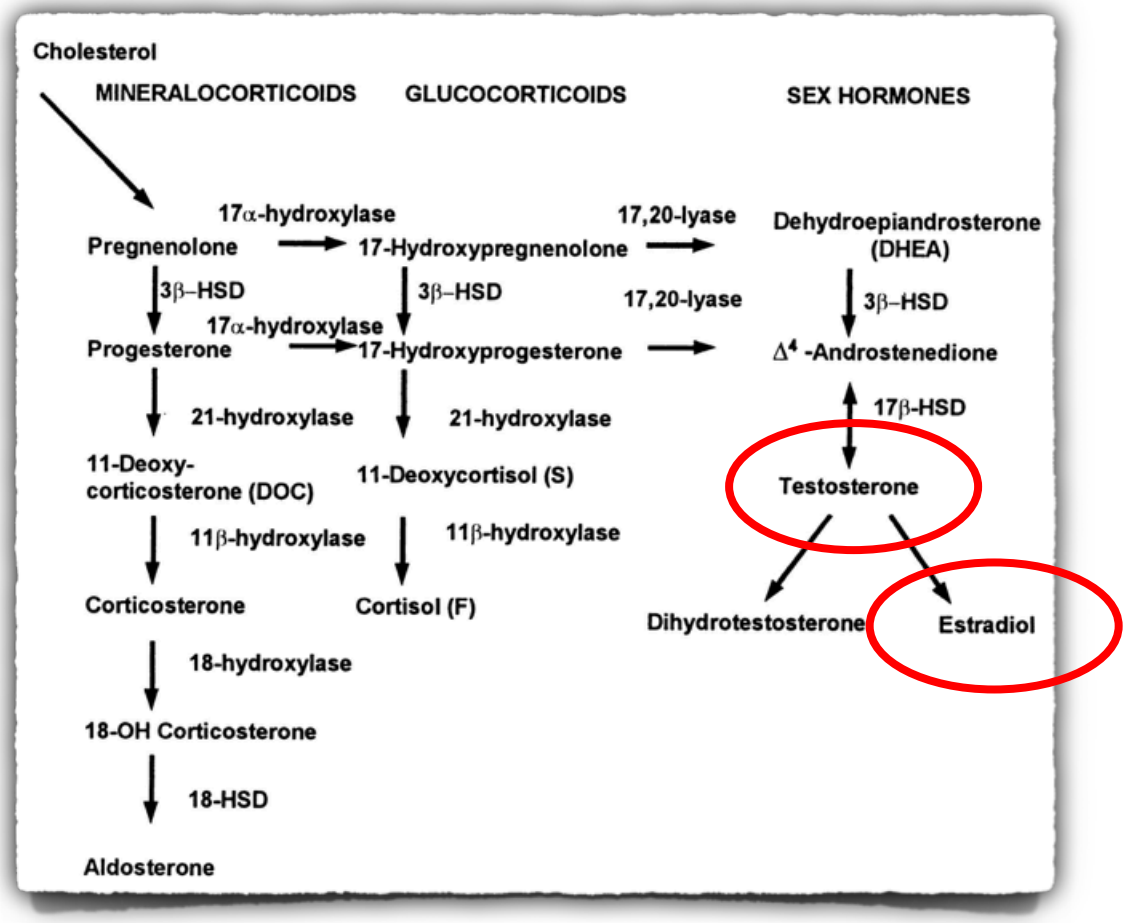


Androstenedione

- Randomized, placebo-controlled trial
- Androstenedione 100 mg tds or placebo for 4 weeks
- No increase in testosterone
- Increase in estradiol

Brown GA, et al. J Clin Endocrinol Metab 85:4074, 2000

Corticosteroid biosynthesis

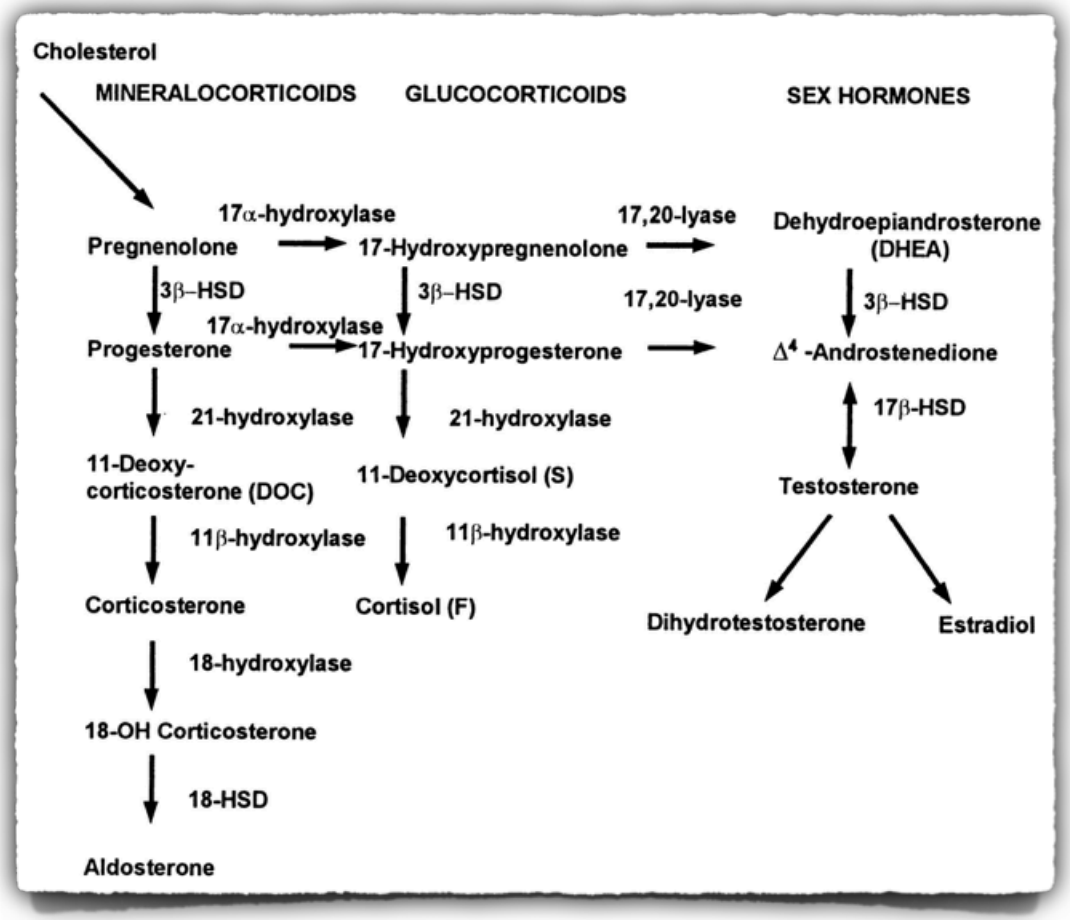


Dehydroepiandrosterone

- Randomized, placebo-controlled trial
- Androstenedione 100 mg od or dehydroepiandrosterone 100 mg od or placebo
- No difference on muscle mass or strength

Wallace MB, et al. Med Sci Sports Exerc 31:1788, 1999

Corticosteroid biosynthesis



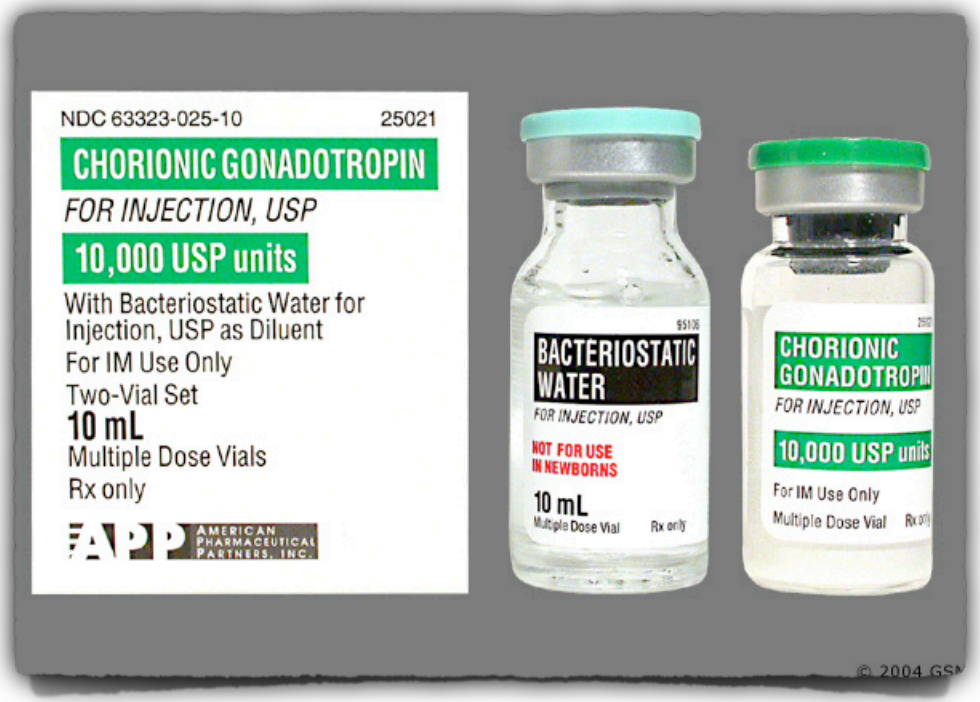
10

20

100

90 - 250

Chorionic gonadotropin

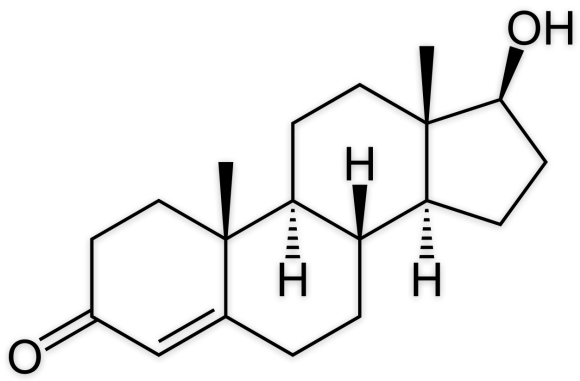


- Production of natural testosterone
- Normal ratio of testosterone : epitestosterone

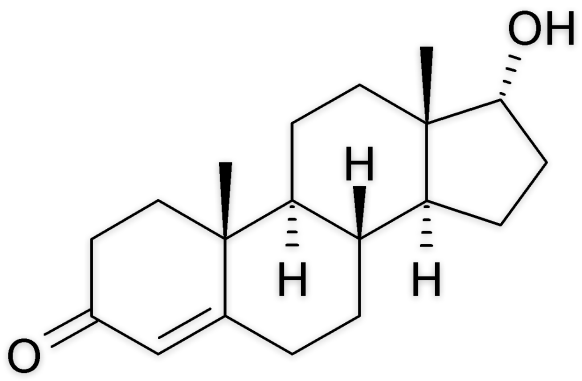
Testosterone epimers

normal ratio 1:1

upper limit 4:1



Testosterone



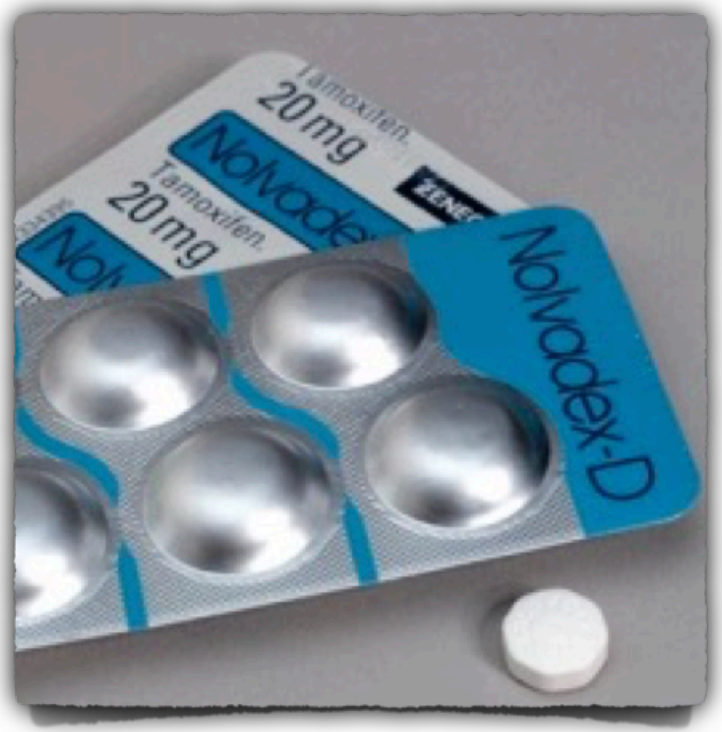
Epitestosterone

Changes in endogenous testosterone

- Testosterone concentrations through menstrual cycle
- Cardiovascular exercise and resistance training transiently increase testosterone concentrations in men and women
- Pre-competition: the “challenge hypothesis”
- Post-competition: in men, testosterone commonly increases following victory and decreases following loss
- Testosterone concentrations can change up to 100% post-competition

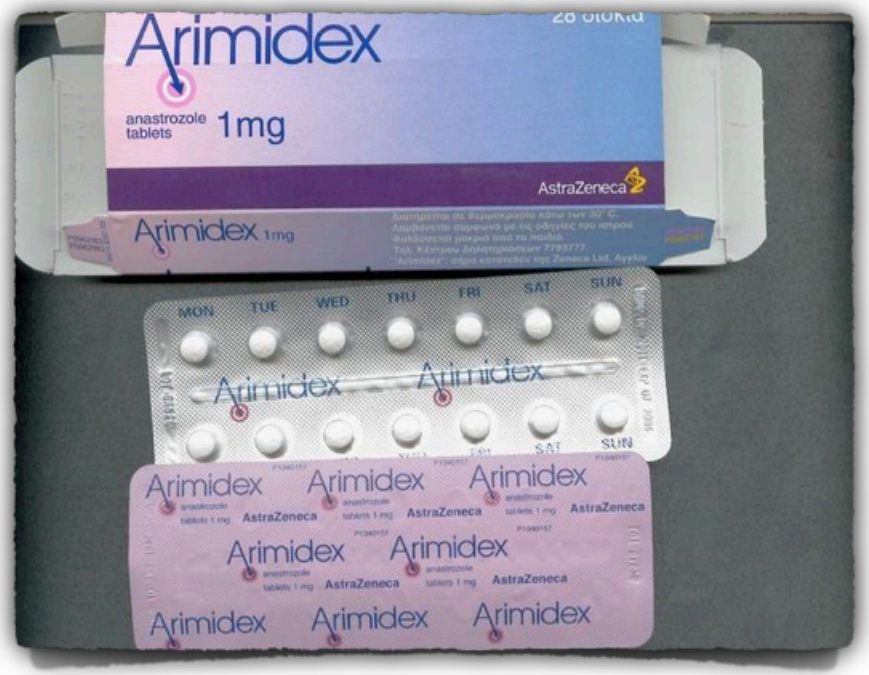
Wood RI, et al. Horm Behav 61:147;2012

Tamoxifen



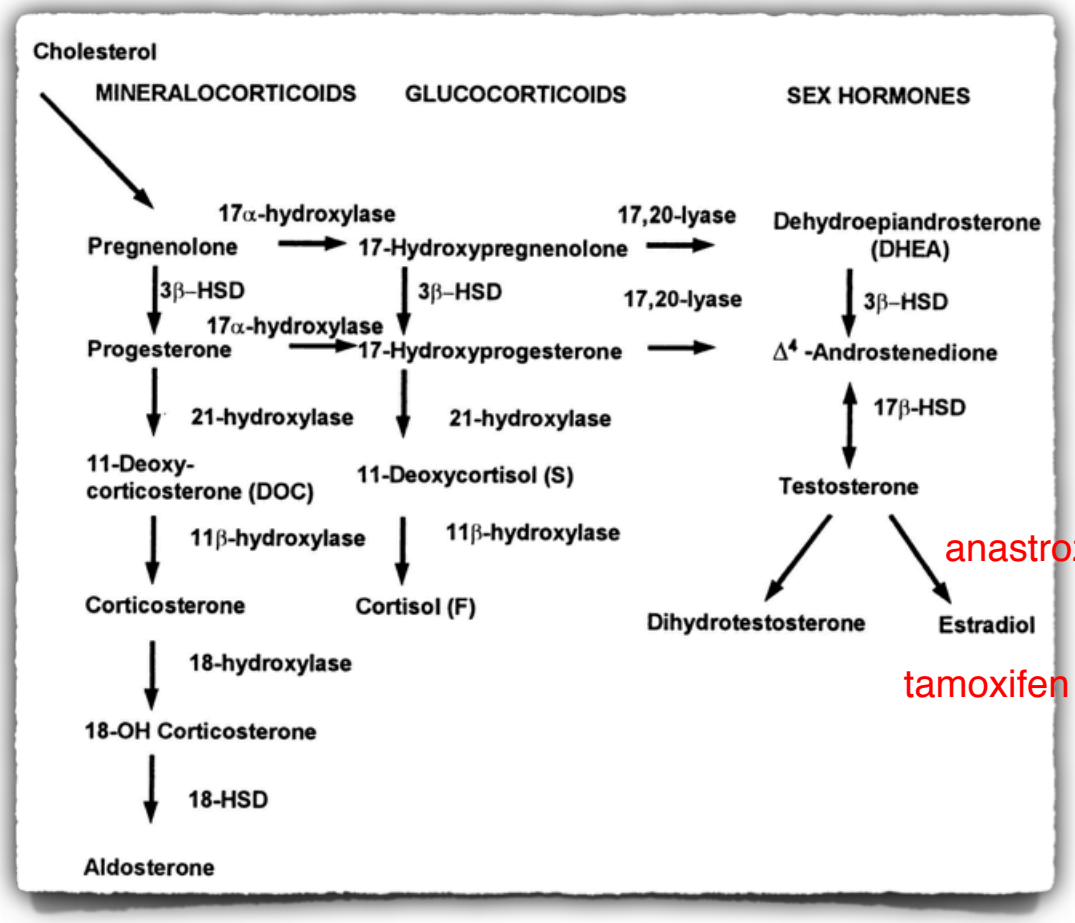
- Anti-estrogen
- Block estrogen effects

Anastrozole



- Aromatase inhibitor
- Increase in testosterone
- Decrease in estrogens

Corticosteroid biosynthesis



Quiz 2

WADA 2018

THE WORLD ANTI-DOPING CODE

INTERNATIONAL STANDARD

PROHIBITED LIST

JANUARY 2018

WORLD ANTI-DOPING AGENCY

play true

The official text of the *Prohibited List* shall be maintained by *WADA* and shall be published in English and French. In the event of any conflict between the English and French versions, the English version shall prevail.

This List shall come into effect on 1 January 2018

SUBSTANCES & METHODS
PROHIBITED AT ALL TIMES
(IN- AND OUT-OF-COMPETITION)

IN ACCORDANCE WITH ARTICLE 4.2.2 OF THE WORLD ANTI-DOPING CODE, ALL *PROHIBITED SUBSTANCES* SHALL BE CONSIDERED AS *"SPECIFIED SUBSTANCES"* EXCEPT SUBSTANCES IN CLASSES S1, S2, S4.4, S4.5, S6.A, AND *PROHIBITED METHODS* M1, M2 AND M3.

PROHIBITED SUBSTANCES

S0 NON-APPROVED SUBSTANCES

Any pharmacological substance which is not addressed by any of the subsequent sections of the *List* and with no current approval by any governmental regulatory health authority for human therapeutic use (e.g. drugs under pre-clinical or clinical development or discontinued, designer drugs, substances approved only for veterinary use) is prohibited at all times.

S1 ANABOLIC AGENTS

Anabolic agents are prohibited.

1. ANABOLIC ANDROGENIC STEROIDS (AAS)

a. Exogenous* AAS, including:

1-Androstenediol (5α-androst-1-ene-3β,17β-diol);
1-Androstenedione (5α-androst-1-ene-3,17-dione);
1-Androsterone (3α-hydroxy-5α-androst-1-ene-17-one);
1-Testosterone (17β-hydroxy-5α-androst-1-en-3-one);
4-Hydroxytestosterone (4,17β-dihydroxyandrost-4-en-3-one);
Bolandiol (estr-4-ene-3β,17β-diol);
Bolasterone;
Calusterone;
Clostebol;
Danazol ([1,2]oxazolo[4',5':2,3]pregna-4-en-20-yn-17α-ol);
Dehydrochlormethyltestosterone (4-chloro-17β-hydroxy-17α-methylandrosta-1,4-dien-3-one);
Desoxymethyltestosterone (17α-methyl-5α-androst-2-en-17β-ol);
Drostanolone;
Ethylestrenol (19-norpregna-4-en-17α-ol);
Fluoxymesterone;
Formebolone;
Furazabol (17α-methyl-[1,2,5]oxadiazolo[3',4':2,3]-5α-androstan-17β-ol);
Gestrinone;
Mestanolone;
Mesterolone;
Metandienone (17β-hydroxy-17α-methylandrosta-1,4-dien-3-one);
Metenolone;
Methandriol;
Methasterone (17β-hydroxy-2α,17α-dimethyl-5α-androstan-3-one);
Methyldienolone (17β-hydroxy-17α-methylestra-4,9-dien-3-one);
Methyl-1-testosterone (17β-hydroxy-17α-methyl-5α-androst-1-en-3-one);
Methylnortestosterone (17β-hydroxy-17α-methylestr-4-en-3-one);
Methyltestosterone;
Metribolone (methyltrienolone, 17β-hydroxy-17α-methylestra-4,9,11-trien-3-one);
Mibolerone;
Norboletone;
Norclostebol;
Norethandrolone;
Oxabolone;
Oxandrolone;
Oxymesterone;
Oxymetholone;
Prostanozol (17β-[(tetrahydropyran-2-yl)oxy]-1'H-pyrazolo[3,4:2,3]-5α-androstane);
Quinbolone;
Stanozolol;
Stenbolone;
Tetrahydrogestrinone (17-hydroxy-18a-homo-19-nor-17α-pregna-4,9,11-trien-3-one);
Trenbolone (17β-hydroxyestr-4,9,11-trien-3-one);

and other substances with a similar chemical structure or similar biological effect(s).

b. Endogenous AAS when administered exogenously:**

19-Norandrostenediol (estr-4-ene-3,17-diol);
19-Norandrostenedione (estr-4-ene-3,17-dione);
Androstanolone (5α-dihydrotestosterone, 17β-hydroxy-5α-androstan-3-one);
Androstenediol (androst-5-ene-3β,17β-diol);
Androstenedione (androst-4-ene-3,17-dione);
Boldenone;
Boldione (androsta-1,4-diene-3,17-dione);
Nandrolone (19-nortestosterone);
Prasterone (dehydroepiandrosterone, DHEA, 3β-hydroxyandrost-5-en-17-one);
Testosterone;

and their metabolites and isomers, including but not limited to:

3β-Hydroxy-5α-androstan-17-one;
5α-Androst-2-ene-17-one;
5α-Androstane-3α,17α-diol;
5α-Androstane-3α,17β-diol;
5α-Androstane-3β,17α-diol;
5α-Androstane-3β,17β-diol;
5β-Androstane-3α,17β-diol;
7α-Hydroxy-DHEA;
7β-Hydroxy-DHEA;
4-Androstenediol (androst-4-ene-3β, 17β-diol);
5-Androstenedione (androst-5-ene-3,17-dione);
7-Keto-DHEA;
19-Norandrosterone;
19-Noretiocholanolone;
Androst-4-ene-3α,17α-diol;
Androst-4-ene-3α,17β-diol;
Androst-4-ene-3β,17α-diol;
Androst-5-ene-3α,17α-diol;
Androst-5-ene-3α,17β-diol;
Androst-5-ene-3β,17α-diol;
Androsterone;
Epi-dihydrotestosterone;
Epitestosterone;
Etiocholanolone.

2. OTHER ANABOLIC AGENTS

Including, but not limited to:
Clenbuterol, selective androgen receptor modulators (SARMs, e.g. andarine, LGD-4033, ostarine and RAD140), tibolone, zeranol and zilpaterol.

For purposes of this section:
* "exogenous" refers to a substance which is not ordinarily produced by the body naturally.
** "endogenous" refers to a substance which is ordinarily produced by the body naturally.

S2 PEPTIDE HORMONES, GROWTH FACTORS, RELATED SUBSTANCES, AND MIMETICS

The following substances, and other substances with similar chemical structure or similar biological effect(s), are prohibited:

1. Erythropoietins (EPO) and agents affecting erythropoiesis, including, but not limited to:

1.1 Erythropoietin-Receptor Agonists, e.g.
Darbepoetins (dEPO);
Erythropoietins (EPO);
EPO based constructs (EPO-Fc, methoxy polyethylene glycol-epoetin beta (CERA));
EPO-mimetic agents and their constructs (e.g. CNTO-530, peginesatide).

1.2 Hypoxia-inducible factor (HIF) activating agents, e.g.
Argon;
Cobalt;
Molidustat;
Roxadustat (FG-4592);
Xenon.

1.3 GATA inhibitors, e.g.
K-11706.

1.4 TGF-beta (TGF-β) inhibitors, e.g.
Luspatercept;
Sotatercept.

1.5 Innate repair receptor agonists, e.g.
Asialo EPO;
Carbamylated EPO (CEPO).

2. Peptide Hormones and Hormone Modulators,
2.1 Chorionic Gonadotrophin (CG) and Luteinizing Hormone (LH) and their releasing factors, e.g. Buserelin, deslorelin, gonadorelin, goserelin, leuprorelin, nafarelin and triptorelin, in males;

2.2 Corticotrophins and their releasing factors, e.g. Corticorelin;

2.3 Growth Hormone (GH), its fragments and releasing factors, including, but not limited to:
Growth Hormone fragments, e.g.
AOD-9604 and hGH 176-191;
Growth Hormone Releasing Hormone (GHRH) and its analogues, e.g.
CJC-1293, CJC-1295, sermorelin and tesamorelin;
Growth Hormone Secretagogues (GHS), e.g.
ghrelin and ghrelin mimetics, e.g.
anamorelin, ipamorelin and tabimorelin;
GH-Releasing Peptides (GHRPs), e.g.
alexamorelin, GHRP-1, GHRP-2 (pralmorelin), GHRP-3, GHRP-4, GHRP-5, GHRP-6, and hexarelin.

3. Growth Factors and Growth Factor Modulators, including, but not limited to:
Fibroblast Growth Factors (FGFs);
Hepatocyte Growth Factor (HGF);
Insulin-like Growth Factor-1 (IGF-1) and its analogues;
Mechano Growth Factors (MGFs);
Platelet-Derived Growth Factor (PDGF);
Thymosin-β4 and its derivatives e.g. TB-500;
Vascular-Endothelial Growth Factor (VEGF).

Additional growth factors or growth factor modulators affecting muscle, tendon or ligament protein synthesis/degradation, vascularisation, energy utilization, regenerative capacity or fibre type switching.

S3 BETA-2 AGONISTS

All selective and non-selective beta-2 agonists, including all optical isomers, are prohibited.

Fenoterol;
Formoterol;
Higenamine;
Indacaterol;
Olodaterol;
Procaterol;
Reproterol;
Salbutamol;
Salmeterol;
Terbutaline;
Tulobuterol;
Vilanterol.

Except:
- Inhaled salbutamol: maximum 1600 micrograms over 24 hours in divided doses not to exceed 800 micrograms over 12 hours starting from any dose;
- Inhaled formoterol: maximum delivered dose of 54 micrograms over 24 hours;
- Inhaled salmeterol: maximum 200 micrograms over 24 hours.

The presence in urine of salbutamol in excess of 1000 ng/mL or formoterol in excess of 40 ng/mL is not consistent with therapeutic use of the substance and will be considered as an *Adverse Analytical Finding (AAF)* unless the *Athlete* proves, through a controlled pharmacokinetic study, that the abnormal result was the consequence of a therapeutic dose (by inhalation) up to the maximum dose indicated above.

S4 HORMONE AND METABOLIC MODULATORS

The following hormone and metabolic modulators are prohibited.

1. Aromatase inhibitors including, but not limited to:
4-Androstene-3,6,17 trione (6-oxo);
Aminoglutethimide;
Anastrozole;
Androsta-1,4,6-triene-3,17-dione (androstatrienedione);
Androsta-3,5-diene-7,17-dione (arimistane);
Exemestane;
Formestane;
Letrozole;
Testolactone.

2. Selective estrogen receptor modulators (SERMs) including, but not limited to:
Raloxifene;
Tamoxifen;
Toremifene.

3. Other anti-estrogenic substances including, but not limited to:
Clomifene;
Cyclofenil;
Fulvestrant.

4. Agents modifying myostatin function(s) including, but not limited, to: myostatin inhibitors.

5. Metabolic modulators:
5.1 Activators of the AMP-activated protein kinase (AMPK), e.g. AICAR, SR9009; and Peroxisome Proliferator Activated Receptor δ (PPARδ) agonists, e.g. 2-[2-methyl-4-[[4-methyl-2-[4-(trifluoromethyl) phenyl]thiazol-5-yl]methylthio]phenoxy] acetic acid (GW1516, GW501516);
5.2 Insulins and insulin-mimetics;
5.3 Meldonium;
5.4 Trimetazidine.

S5 DIURETICS AND MASKING AGENTS

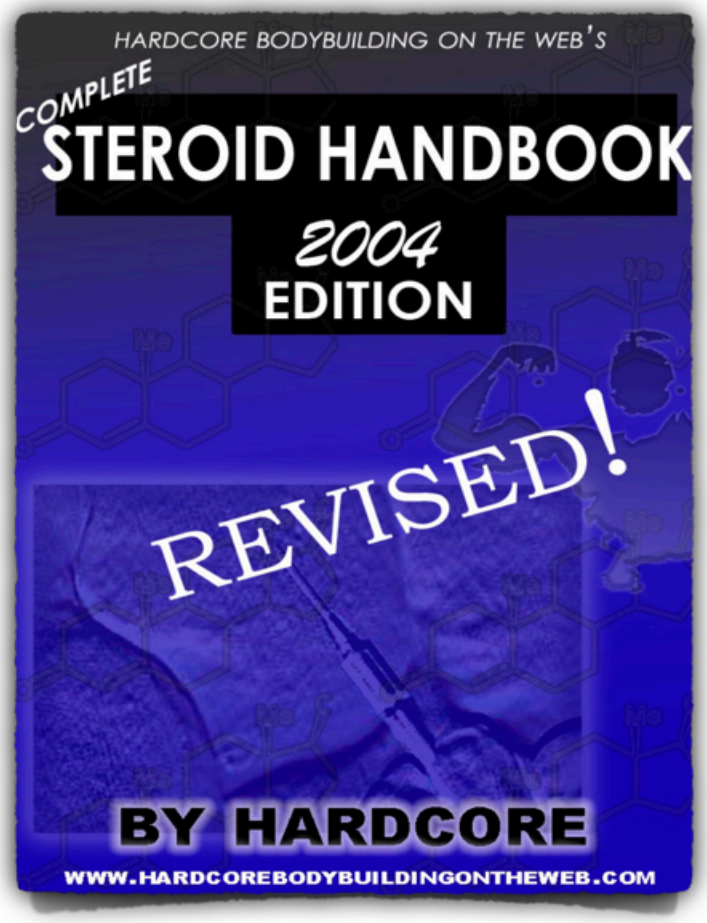
The following diuretics and masking agents are prohibited, as are other substances with a similar chemical

Including, but not limited to:
- Desmopressin; probenecid; plasma expanders, e.g. intravenous administration of albumin, dextran, hydroxyethyl starch and mannitol.
- Acetazolamide; amiloride; bumetanide; canrenone; chlortalidone; etacrynic acid; furosemide; indapamide; metolazone; spironolactone; thiazides, e.g. bendroflumethiazide, chlorothiazide and hydrochlorothiazide; triamterene and vaptans, e.g. tolvaptan.

Except:
- Drospirenone; pamabrom; and ophthalmic use of carbonic anhydrase inhibitors (e.g. dorzolamide, brinzolamide);
- Local administration of felypressin in dental anaesthesia.

The detection in an *Athlete's Sample* at all times or *In-Competition*, as applicable, of any quantity of the following substances subject to threshold limits: formoterol, salbutamol, cathine, ephedrine, methylephedrine and pseudoephedrine, in conjunction with a diuretic or masking agent, will be considered as an *Adverse Analytical Finding (AAF)* unless the *Athlete* has an approved *Therapeutic Use Exemption (TUE)* for that substance in addition to the one granted for the diuretic or masking agent.

Effect ranking



Effect ranking

Drug	Strength Gains	Mass & Weight Gain	Fat Burning	Test Stimulation	Contest Prep	Appetite Suppression	Use as an Anti-Estrogen	Side Effects	Cost	Keep Gains?
Aldactone	-	-	-	-	9	-	-	8	4	-
Anadrol	10	10	-	-	5	-	-	9	5	1
Anavar	7	4	-	-	6	2	-	1	9	9
Andriol	2	2	-	-	-	-	-	1	7	8
Arimidex	-	-	-	-	9	-	10	3	9	-
Catapres	2	2	-	-	-	-	-	8	6	-
Cheque Drops	2	-	-	-	-	-	-	10	8	-
Clenbuterol	1	1	5	-	9	8	-	3	2	1
Clomid	1	-	-	8	8	-	7	3	6	1
Cyclofenil	1	1	-	7	5	-	6	2	3	1

PROHIBITED METHODS

M1 MANIPULATION OF BLOOD AND BLOOD COMPONENTS

The following are prohibited:

1. The *Administration* or reintroduction of any quantity of autologous, allogenic (homologous) or heterologous blood, or red blood cell products of any origin into the circulatory system.

2. Artificially enhancing the uptake, transport or delivery of oxygen.
Including, but not limited to:
Perfluorochemicals; efaproxiral (RSR13) and modified haemoglobin products, e.g. haemoglobin-based blood substitutes and microencapsulated haemoglobin products, excluding supplemental oxygen by inhalation.

3. Any form of intravascular manipulation of the blood or blood components by physical or chemical means.

M2 CHEMICAL AND PHYSICAL MANIPULATION

The following are prohibited:

1. *Tampering*, or *Attempting to Tamper*, to alter the integrity and validity of *Samples* collected during *Doping Control*.
Including, but not limited to:
Urine substitution and/or adulteration, e.g. proteases.

2. Intravenous infusions and/or injections of more than a total of 100 mL per 12 hour period except for those legitimately received in the course of hospital treatments, surgical procedures or clinical diagnostic investigations.

M3 GENE DOPING

The following, with the potential to enhance sport performance, are prohibited:

1. The use of polymers of nucleic acids or nucleic acid analogues.

2. The use of gene editing agents designed to alter genome sequences and/or the transcriptional or epigenetic regulation of gene expression.

3. The use of normal or genetically modified cells.

SUBSTANCES & METHODS PROHIBITED *IN-COMPETITION*

IN ADDITION TO THE CATEGORIES S0 TO S5 AND M1 TO M3 DEFINED ABOVE, THE FOLLOWING CATEGORIES ARE PROHIBITED *IN-COMPETITION*:

PROHIBITED SUBSTANCES

S6 STIMULANTS

All stimulants, including all optical isomers, e.g. *d*- and *l*- where relevant, are prohibited.

Stimulants include:

a: Non-Specified Stimulants:

Adrafinil;
Amfepramone;
Amfetamine;
Amfetaminil;
Amiphenazole;
Benfluorex;
Benzylpiperazine;
Bromantan;
Clobenzorex;
Cocaine;
Cropropamide;
Crotetamide;
Fencamine;
Fenetylline;
Fenfluramine;
Fenproporex;
Fonturacetam [4-phenylpiracetam (carphedon)];
Furfenorex;
Lisdexamfetamine;
Mefenorex;
Mephentermine;
Mesocarb;
Metamfetamine(*d*-);
p-methylamphetamine;
Modafinil;
Norfenfluramine;
Phendimetrazine;
Phentermine;
Prenylamine;
Prolintane.

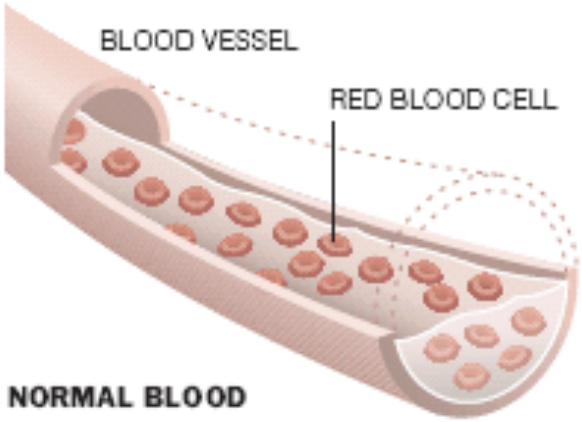
A stimulant not expressly listed in this section is a *Specified Substance*.

b: Specified Stimulants.
Including, but not limited to:

1,3-Dimethylbutylamine;
4-Methylhexan-2-amine (methylhexaneamine);
Benzfetamine;
Cathine**;
Cathinone and its analogues, e.g. mephedrone, methedrone, and α - pyrrolidinovalerophenone;
Dimethylamphetamine;
Ephedrine***;
Epinephrine**** (adrenaline);
Etamivan;
Etilamfetamine;
Etilefrine;
Famprofazone;
Fenbutrazate;
Fencamfamin;
Heptaminol;
Hydroxyamfetamine (parahydroxyamphetamine);
Isometheptene;
Levmetamfetamine;
Meclofenoxate;
Methylenedioxymethamphetamine;
Methylephedrine***;
Methylphenidate;
Nikethamide;
Norfenefrine;
Octopamine;
Oxilofrine (methylsynephrine);
Pemoline;
Pentetrazol;
Phenethylamine and its derivatives;
Phenmetrazine;
Phenpromethamine;
Propylhexedrine;
Pseudoephedrine*****;

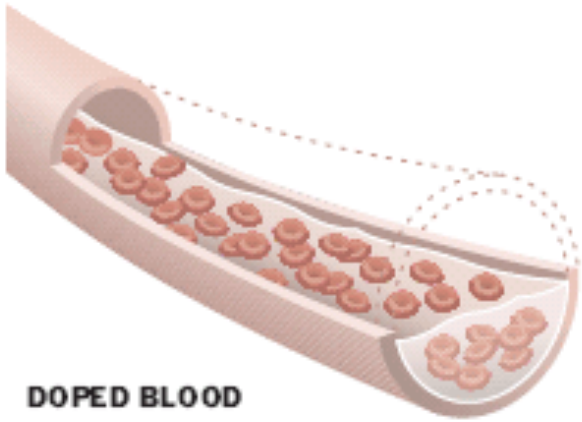
How Blood Doping Works

Elevated levels of red blood cells found in an athlete's bloodstream can be a sign of blood doping.



NORMAL BLOOD

The blood of a typical adult male is made up of 40 to 50 percent red blood cells, which carry oxygen to tissues. Typical levels for women are 35 to 45 percent.



DOPED BLOOD

Red blood cells (from a donor or previously removed from the athlete) or the hormone erythropoietin (EPO) are injected. The increase in red cells allows muscles to work longer and harder without cramping.

Sources: Harrison's Principles of Internal Medicine; Quest Diagnostic Laboratories

PROHIBITED METHODS

M1 MANIPULATION OF BLOOD AND BLOOD COMPONENTS

The following are prohibited:

1. The *Administration* or reintroduction of any quantity of autologous, allogenic (homologous) or heterologous blood, or red blood cell products of any origin into the circulatory system.

2. Artificially enhancing the uptake, transport or delivery of oxygen.
Including, but not limited to:
Perfluorochemicals; efaproxiral (RSR13) and modified haemoglobin products, e.g. haemoglobin-based blood substitutes and microencapsulated haemoglobin products, excluding supplemental oxygen by inhalation.

3. Any form of intravascular manipulation of the blood or blood components by physical or chemical means.

M2 CHEMICAL AND PHYSICAL MANIPULATION

The following are prohibited:

integrity and validity of *Samples* collected during *Doping Control*.
Including, but not limited to:
Urine substitution and/or adulteration, e.g. proteases.

2. Intravenous infusions and/or injections of more than a total of 100 mL per 12 hour period except for those legitimately received in the course of hospital treatments, surgical procedures or clinical diagnostic investigations.

M3 GENE DOPING

The following, with the potential to enhance sport performance, are prohibited:

1. The use of polymers of nucleic acids or nucleic acid analogues.

2. The use of gene editing agents designed to alter genome sequences and/or the transcriptional or epigenetic regulation of gene expression.

3. The use of normal or genetically modified cells.

SUBSTANCES & METHODS PROHIBITED *IN-COMPETITION*

IN ADDITION TO THE CATEGORIES S0 TO S5 AND M1 TO M3 DEFINED ABOVE, THE FOLLOWING CATEGORIES ARE PROHIBITED *IN-COMPETITION*:

PROHIBITED SUBSTANCES

S6 STIMULANTS

All stimulants, including all optical isomers, e.g. *d*- and *l*- where relevant, are prohibited.

Stimulants include:

a: Non-Specified Stimulants:

Adrafinil;
Amfepramone;
Amfetamine;
Amfetaminil;
Amiphenazole;
Benfluorex;
Benzylpiperazine;
Bromantan;
Clobenzorex;
Cocaine;
Cropropamide;
Crotetamide;
Fencamine;
Fenetylline;
Fenfluramine;
Fenproporex;
Fonturacetam [4-phenylpiracetam (carphedon)];
Furfenorex;
Lisdexamfetamine;
Mefenorex;
Mephentermine;
Mesocarb;
Metamfetamine(*d*-);
p-methylamphetamine;
Modafinil;
Norfenfluramine;
Phendimetrazine;
Phentermine;
Prenylamine;
Prolintane.

A stimulant not expressly listed in this section is a *Specified Substance*.

b: Specified Stimulants.
Including, but not limited to:

1,3-Dimethylbutylamine;
4-Methylhexan-2-amine (methylhexaneamine);
Benzfetamine;
Cathine**;
Cathinone and its analogues, e.g. mephedrone, methedrone, and α - pyrrolidinovalerophenone;
Dimethylamphetamine;
Ephedrine***;
Epinephrine**** (adrenaline);
Etamivan;
Etilamfetamine;
Etilefrine;
Famprofazone;
Fenbutrazate;
Fencamfamin;
Heptaminol;
Hydroxyamfetamine (parahydroxyamphetamine);
Isometheptene;
Levmetamfetamine;
Meclofenoxate;
Methylenedioxymethamphetamine;
Methylephedrine***;
Methylphenidate;
Nikethamide;
Norfenefrine;
Octopamine;
Oxilofrine (methylsynephrine);
Pemoline;
Pentetrazol;
Phenethylamine and its derivatives;
Phenmetrazine;
Phenpromethamine;
Propylhexedrine;
Pseudoephedrine*****;


TestClear
Powdered Human
Urine
Powdered Urine
Air Activated
Heater
*Not Synthetic, Real Human Urine

PROHIBITED METHODS

M1 MANIPULATION OF BLOOD AND BLOOD COMPONENTS

The following are prohibited:

1. The *Administration* or reintroduction of any quantity of autologous, allogenic (homologous) or heterologous blood, or red blood cell products of any origin into the circulatory system.

2. Artificially enhancing the uptake, transport or delivery of oxygen.
   Including, but not limited to:
   Perfluorochemicals; efaproxiral (RSR13) and modified haemoglobin products, e.g. haemoglobin-based blood substitutes and microencapsulated haemoglobin products, excluding supplemental oxygen by inhalation.

3. Any form of intravascular manipulation of the blood or blood components by physical or chemical means.

M2 CHEMICAL AND PHYSICAL MANIPULATION

The following are prohibited:

1. *Tampering*, or *Attempting to Tamper*, to alter the integrity and validity of *Samples* collected during *Doping Control*.
   Including, but not limited to:
   Urine substitution and/or adulteration, e.g. proteases.

2. Intravenous infusions and/or injections of more than a total of 100 mL per 12 hour period except for those legitimately received in the course of hospital treatments, surgical procedures or clinical diagnostic investigations.

M3 GENE DOPING

The following, with the potential to enhance sport performance, are prohibited:

1. The use of polymers of nucleic acids or nucleic acid analogues.

2. The use of gene editing agents designed to alter genome sequences and/or the transcriptional or epigenetic regulation of gene expression.

3. The use of normal or genetically modified cells.

SUBSTANCES & METHODS PROHIBITED *IN-COMPETITION*

IN ADDITION TO THE CATEGORIES S0 TO S5 AND M1 TO M3 DEFINED ABOVE, THE FOLLOWING CATEGORIES ARE PROHIBITED *IN-COMPETITION*:

PROHIBITED SUBSTANCES

S6 STIMULANTS

All stimulants, including all optical isomers, e.g. *d*- and *l*- where relevant, are prohibited.

Stimulants include:

a: Non-Specified Stimulants:

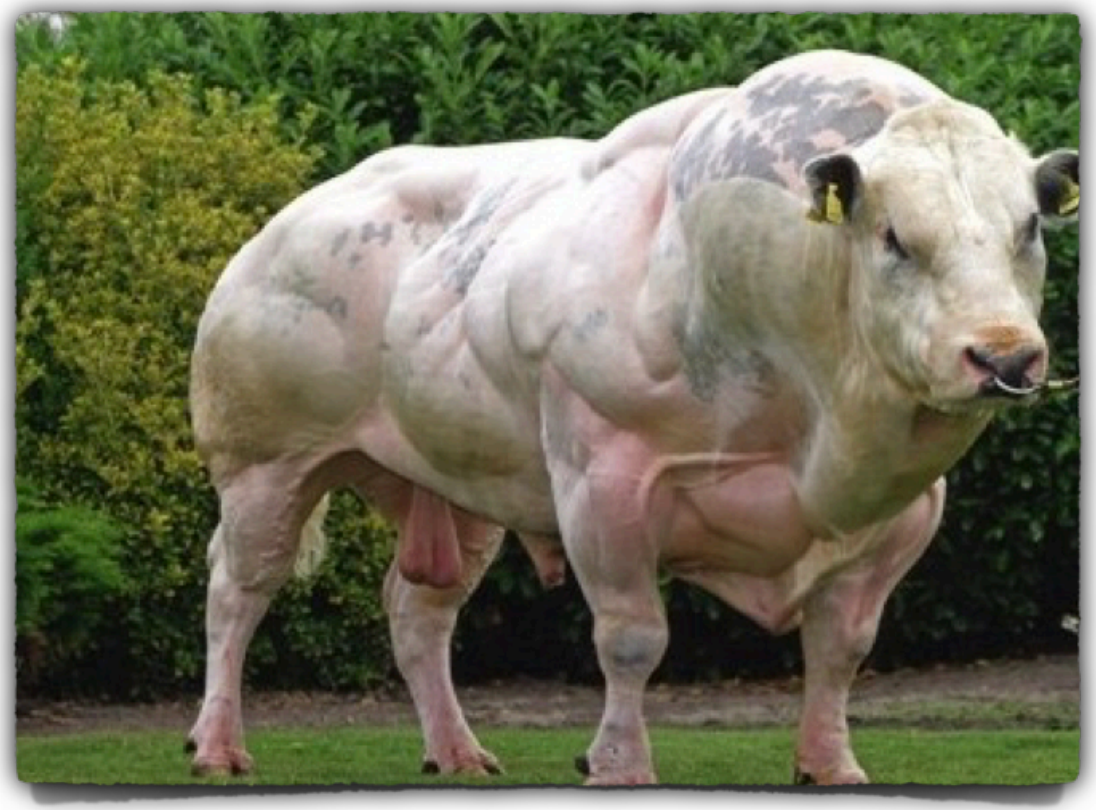
Adrafinil;
Amfepramone;
Amfetamine;
Amfetaminil;
Amiphenazole;
Benfluorex;
Benzylpiperazine;
Bromantan;
Clobenzorex;
Cocaine;
Cropropamide;
Crotetamide;
Fencamine;
Fenetylline;
Fenfluramine;
Fenproporex;
Fonturacetam [4-phenylpiracetam (carphedon)];
Furfenorex;
Lisdexamfetamine;
Mefenorex;
Mephentermine;
Mesocarb;
Metamfetamine(*d*-);
p-methylamphetamine;
Modafinil;
Norfenfluramine;
Phendimetrazine;
Phentermine;
Prenylamine;
Prolintane.

A stimulant not expressly listed in this section is a *Specified Substance*.

b: Specified Stimulants.
Including, but not limited to:

1,3-Dimethylbutylamine;
4-Methylhexan-2-amine (methylhexaneamine);
Benzfetamine;
Cathine**;
Cathinone and its analogues, e.g. mephedrone, methedrone, and α - pyrrolidinovalerophenone;
Dimethylamphetamine;
Ephedrine***;
Epinephrine**** (adrenaline);
Etamivan;
Etilamfetamine;
Etilefrine;
Famprofazone;
Fenbutrazate;
Fencamfamin;
Heptaminol;
Hydroxyamfetamine (parahydroxyamphetamine);
Isometheptene;
Levmetamfetamine;
Meclofenoxate;
Methylenedioxymethamphetamine;
Methylephedrine***;
Methylphenidate;
Nikethamide;
Norfenefrine;
Octopamine;
Oxilofrine (methylsynephrine);
Pemoline;
Pentetrazol;
Phenethylamine and its derivatives;
Phenmetrazine;
Phenpromethamine;
Propylhexedrine;
Pseudoephedrine*****;

Belgian Bull



PROHIBITED METHODS

M1 MANIPULATION OF BLOOD AND BLOOD COMPONENTS

The following are prohibited:

1. The *Administration* or reintroduction of any quantity of autologous, allogenic (homologous) or heterologous blood, or red blood cell products of any origin into the circulatory system.

2. Artificially enhancing the uptake, transport or delivery of oxygen.
   Including, but not limited to:
   Perfluorochemicals; efaproxiral (RSR13) and modified haemoglobin products, e.g. haemoglobin-based blood substitutes and microencapsulated haemoglobin products, excluding supplemental oxygen by inhalation.

3. Any form of intravascular manipulation of the blood or blood components by physical or chemical means.

M2 CHEMICAL AND PHYSICAL MANIPULATION

The following are prohibited:

1. *Tampering*, or *Attempting to Tamper*, to alter the integrity and validity of *Samples* collected during *Doping Control*.
   Including, but not limited to:
   Urine substitution and/or adulteration, e.g. proteases.

2. Intravenous infusions and/or injections of more than a total of 100 mL per 12 hour period except for those legitimately received in the course of hospital treatments, surgical procedures or clinical diagnostic investigations.

M3 GENE DOPING

The following, with the potential to enhance sport performance, are prohibited:

1. The use of polymers of nucleic acids or nucleic acid analogues.

2. The use of gene editing agents designed to alter genome sequences and/or the transcriptional or epigenetic regulation of gene expression.

3. The use of normal or genetically modified cells.

SUBSTANCES & METHODS PROHIBITED *IN-COMPETITION*

IN ADDITION TO THE CATEGORIES S0 TO S5 AND M1 TO M3 DEFINED ABOVE, THE FOLLOWING CATEGORIES ARE PROHIBITED *IN-COMPETITION*:

PROHIBITED SUBSTANCES

S6 STIMULANTS

All stimulants, including all optical isomers, e.g. d- and l- where relevant, are prohibited.

Stimulants include:

a: Non-Specified Stimulants:

Adrafinil;
Amfepramone;
Amfetamine;
Amfetaminil;
Amiphenazole;
Benfluorex;
Benzylpiperazine;
Bromantan;
Clobenzorex;
Cocaine;
Cropropamide;
Crotetamide;
Fencamine;
Fenetylline;
Fenfluramine;
Fenproporex;
Fonturacetam [4-phenylpiracetam (carphedon)];
Furfenorex;
Lisdexamfetamine;
Mefenorex;
Mephentermine;
Mesocarb;
Metamfetamine(*d*-);
p-methylamphetamine;
Modafinil;
Norfenfluramine;
Phendimetrazine;
Phentermine;
Prenylamine;
Prolintane.

A stimulant not expressly listed in this section is a *Specified Substance*.

b: Specified Stimulants.
Including, but not limited to:

1,3-Dimethylbutylamine;
4-Methylhexan-2-amine (methylhexaneamine);
Benzfetamine;
Cathine**;
Cathinone and its analogues, e.g. mephedrone, methedrone, and α - pyrrolidinovalerophenone;
Dimethylamphetamine;
Ephedrine***;
Epinephrine**** (adrenaline);
Etamivan;
Etilamfetamine;
Etilefrine;
Famprofazone;
Fenbutrazate;
Fencamfamin;
Heptaminol;
Hydroxyamfetamine (parahydroxyamphetamine);
Isometheptene;
Levmetamfetamine;
Meclofenoxate;
Methylenedioxymethamphetamine;
Methylephedrine***;
Methylphenidate;
Nikethamide;
Norfenefrine;
Octopamine;
Oxilofrine (methylsynephrine);
Pemoline;
Pentetrazol;
Phenethylamine and its derivatives;
Phenmetrazine;
Phenpromethamine;
Propylhexedrine;
Pseudoephedrine*****;

Selegiline;
Sibutramine;
Strychnine;
Tenamfetamine (methylenedioxyamphetamine);
Tuaminoheptane;

and other substances with a similar chemical structure or similar biological effect(s).

Except:

- Clonidine;
- Imidazole derivatives for topical/ophthalmic use and those stimulants included in the 2018 Monitoring Program*.

* Bupropion, caffeine, nicotine, phenylephrine, phenylpropanolamine, pipradrol, and synephrine: These substances are included in the 2018 Monitoring Program, and are not considered *Prohibited Substances*.
** Cathine: Prohibited when its concentration in urine is greater than 5 micrograms per milliliter.
*** Ephedrine and methylephedrine: Prohibited when the concentration of either in urine is greater than 10 micrograms per milliliter.
**** Epinephrine (adrenaline): Not prohibited in local administration, e.g. nasal, ophthalmologic, or co-administration with local anaesthetic agents.
***** Pseudoephedrine: Prohibited when its concentration in urine is greater than 150 micrograms per milliliter.

S7 NARCOTICS

The following narcotics are prohibited:

Buprenorphine;
Dextromoramide;
Diamorphine (heroin);
Fentanyl and its derivatives;
Hydromorphone;
Methadone;
Morphine;
Nicomorphine;
Oxycodone;
Oxymorphone;
Pentazocine;
Pethidine.

S8 CANNABINOIDS

The following cannabinoids are prohibited:

- Natural cannabinoids, e.g. cannabis, hashish and marijuana,
- Synthetic cannabinoids e.g. Δ9-tetrahydrocannabinol (THC) and other cannabimimetics.

Except:

- Cannabidiol.

S9 GLUCOCORTICOIDS

All glucocorticoids are prohibited when administered by oral, intravenous, intramuscular or rectal routes.

Including but not limited to:

Betamethasone;
Budesonide;
Cortisone;
Deflazacort;
Dexamethasone;
Fluticasone;
Hydrocortisone;
Methylprednisolone;
Prednisolone;
Prednisone;
Triamcinolone.

SUBSTANCES PROHIBITED IN PARTICULAR SPORTS

P1 BETA-BLOCKERS

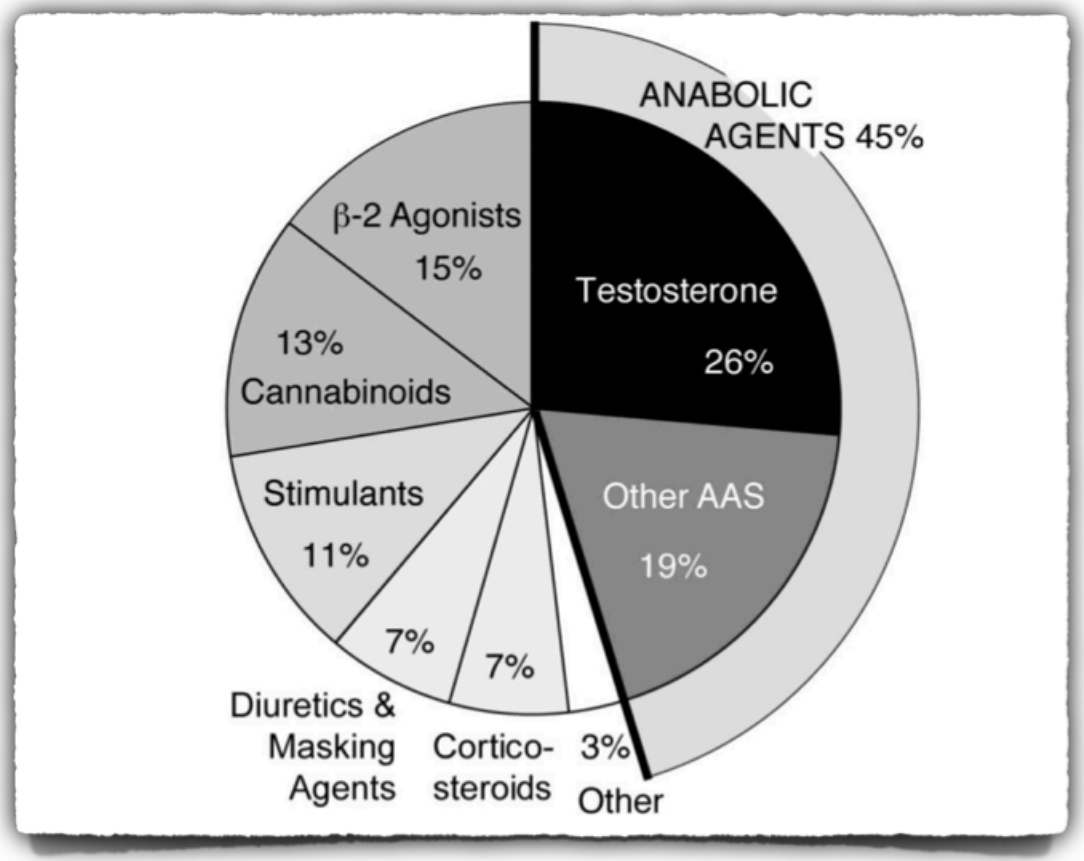
Beta-blockers are prohibited *In-Competition* only, in [redacted] where indicated.

- Archery (WA)*
- Automobile (FIA)
- Billiards (all disciplines) (WCBS)
- Darts (WDF)
- Golf (IGF)
- Shooting (ISSF, IPC)*
- Skiing/Snowboarding (FIS) in ski jumping, freestyle aerials/halfpipe and snowboard halfpipe/big air
- Underwater sports (CMAS) in constant-weight apnoea with or without fins, dynamic apnoea with and without fins, free immersion apnoea, Jump Blue apnoea, spearfishing, static apnoea, target shooting, and variable [redacted]

[redacted]

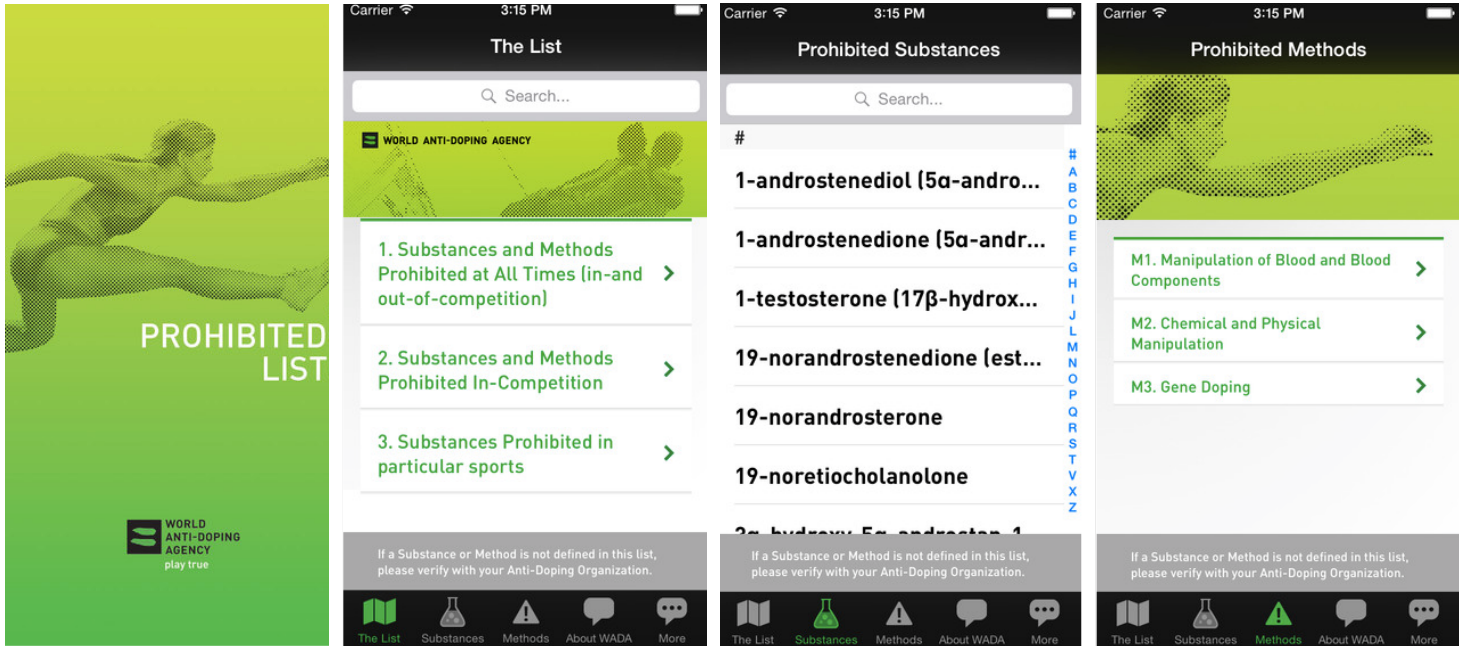
Acebutolol;
Alprenolol;
Atenolol;
Betaxolol;
Bisoprolol;
Bunolol;
Carteolol;
Carvedilol;
Celiprolol;
Esmolol;
Labetalol;
Levobunolol;
Metipranolol;
Metoprolol;
Nadolol;
Oxprenolol;
Pindolol;
Propranolol;
Sotalol;
Timolol.

WADA 2016 positive tests



WADA, 2016

WADA application 2018



WADA application

Quiz 3

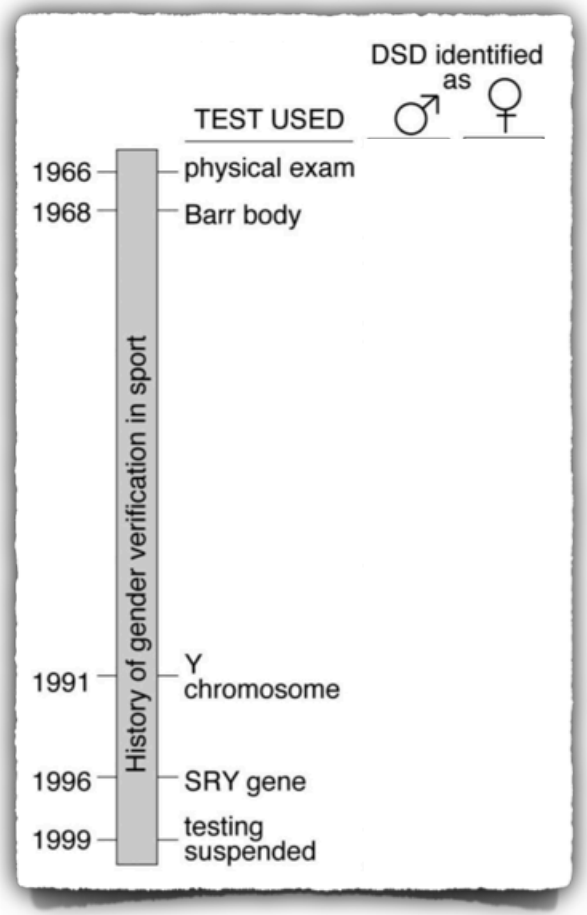
Disorders of Sexual Development

Disorder

- Turner syndrome
- Klinefelter syndrome
- True hermaphrodite
- Mixed gonadal dysgenesis
- Congenital Adrenal Hyperplasia
- Complete AIS
- Partial AIS
- 5α-reductase inhibition
- Transexual

Quiz 4

Time-line of gender verification testing



AIS: androgen insensitivity syndrome

CAH: congenital adrenal hyperplasia

XXY: Klinefelter's syndrome

Structure

- Introduction
- Epidemiology
- Types
- Efficacy
- Safety
- Conclusions

Structure

- Introduction
- Epidemiology
- Types
- Efficacy
- Safety
- Conclusions

The New England
Journal of Medicine

VOLUME 335 JULY 4, 1996 NUMBER 1

THE EFFECTS OF SUPRAPHYSIOLOGIC DOSES OF TESTOSTERONE ON MUSCLE SIZE AND STRENGTH IN NORMAL MEN

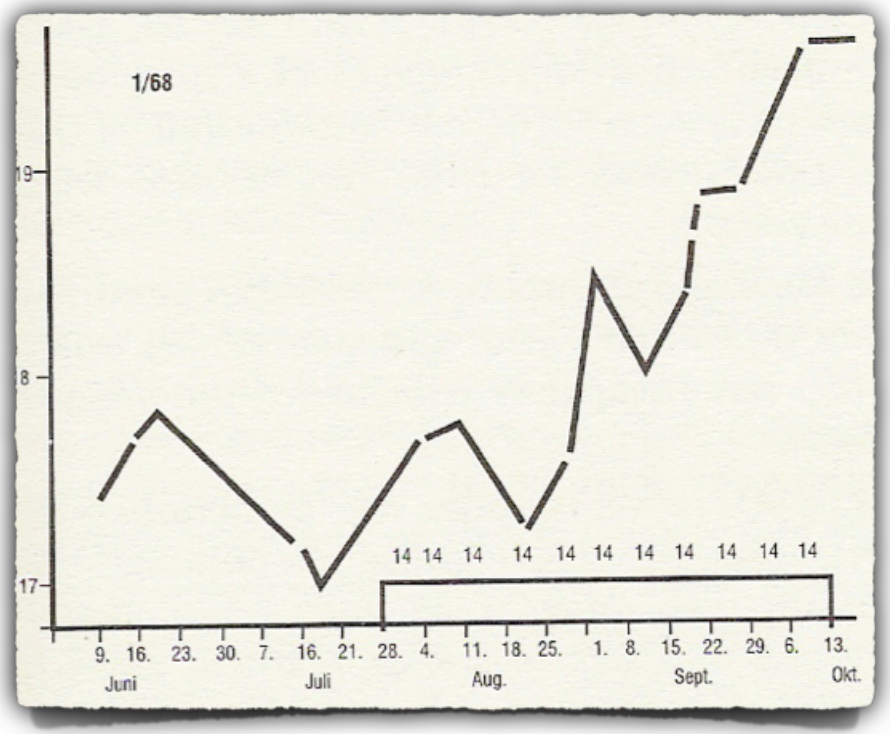
SHALENDER BHASIN, M.D., THOMAS W. STORER, PH.D., NANCY BERMAN, PH.D., CARLOS CALLEGARI, M.D., BRENDA CLEVENGER, B.A., JEFFREY PHILLIPS, M.D., THOMAS J. BUNNELL, B.A., RAY TRICKER, PH.D., AIDA SHIRAZI, R.PH., AND RICHARD CASABURI, PH.D., M.D.

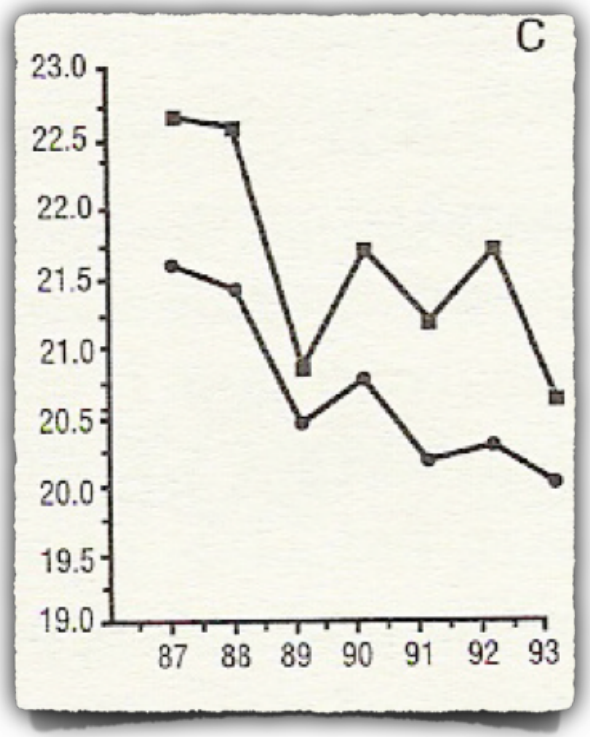
Efficacy study

- **Double-blind, placebo-controlled trial**
- Four groups of men (n = 43):
  - physical exercise & testosterone 600 mg / w
  - physical exercise & placebo
  - no physical exercise & testosterone 600 mg / w
  - no physical exercise & placebo
- Increase in mass muscle and strength with the use of testosterone, especially in combination with physical exercise

Bhasin S, et al. N Eng J Med 335:1, 1996

Efficacy





Franke WW, et al. Clin Chem 43:1262, 1997

Doping Victims' Association

- **Doping-Opfer-Hilfe e.V.**
- **700 of the about 10,000 former GDR high-performance athletes involved in the systematic governmental doping programme based on the anabolic steroid oral turinabol (dehydro-chlormethyl-testosterone) in the 1970s and 1980s.**

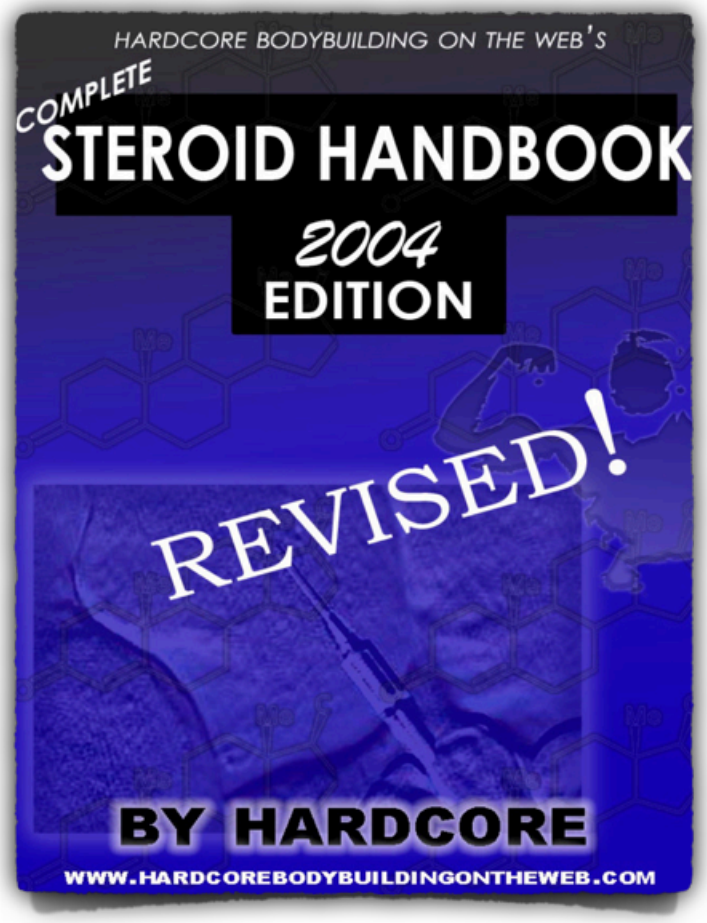
Nieschlag E, et al. Rev Endocr Metab Disord 2015)

Ways of administration

- **Stacking**
  - **Taking two or more anabolic steroids together, mixing oral and/or intramuscular routes**
- **Pyramiding**
  - **At the beginning of a cycle low doses of the stacked substances are administered and the dose is gradually increased for 6 - 12 weeks**
  - **In the second half of the cycle, the doses are slowly decreased to zero**

van Amsterdam J, et al. Regul Toxicol Pharmacol 57:117, 2010

Effect ranking



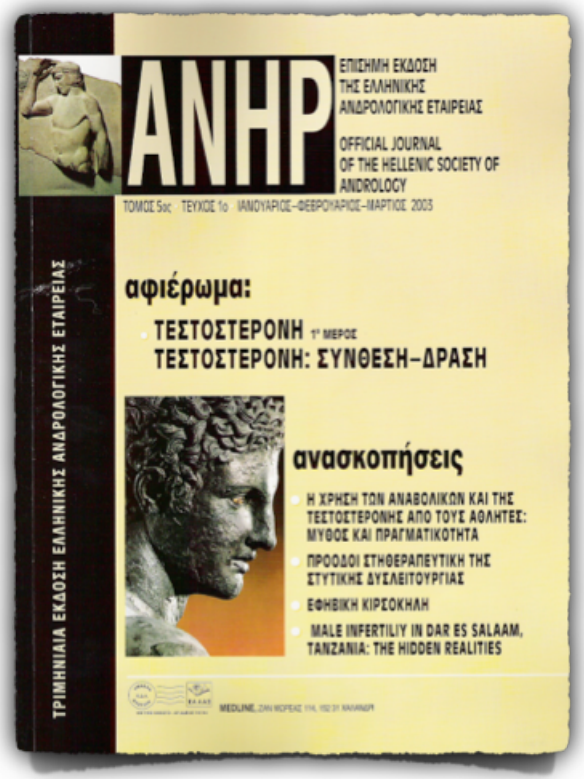
Effect ranking

Drug	Strength Gains	Mass & Weight Gain	Fat Burning	Test Stimulation	Contest Prep	Appetite Suppression	Use as an Anti-Estrogen	Side Effects	Cost	Keep Gains?
Aldactone	-	-	-	-	9	-	-	8	4	-
Anadrol	10	10	-	-	5	-	-	9	5	1
Anavar	7	4	-	-	6	2	-	1	9	9
Andriol	2	2	-	-	-	-	-	1	7	8
Arimidex	-	-	-	-	9	-	10	3	9	-
Catapres	2	2	-	-	-	-	-	8	6	-
Cheque Drops	2	-	-	-	-	-	-	10	8	-
Clenbuterol	1	1	5	-	9	8	-	3	2	1
Clomid	1	-	-	8	8	-	7	3	6	1
Cyclofenil	1	1	-	7	5	-	6	2	3	1

Detection times

18 months	Nandrolone Decanoate (Deca Durabolin)
12 months	Nandrolone Phenylpropionate
5 months	Boldenone Undecyclate (Equipoise) Methenolone Enanthate (Primobolan) Trenbolone (Finaject) Trenbolone Acetate Injectable Methandienone (Dianabol)
3 months	Testosterone-mix (Sustanon & Omnadren) Testosterone Enanthate Testosterone Cypionate
2 months	Oxymetholone (Anadrol & Anapolan) Fluoxymesterone (Halotestin) Indictable Stanozolol (Winstrol) Formebolone Drostanolone Propionate (Masteron)
5 weeks	Methandienone (Dianabol) Mesterolone (Proviron) Ethylestrenole Noretadrolone (Nilevar)
3 weeks	Oxandrolone (Anavar) Oral Stanozolol (Winstrol)
2 weeks	Testosterone Propionate
1 weeks	Testosterone Undecanoate (Andriol)
4 days	Clenbuterol Ephedrine Hydrochloride

Hellenic Society of Andrology



www.hel-soc-andro.org

Structure

- Introduction
- Epidemiology
- Types
- Efficacy
- Safety
- Conclusions

Structure

- Introduction
- Epidemiology
- Types
- Efficacy
- Safety
- Conclusions

Adverse effects

- **Non-specific**
  - common in all androgens
- **Specific**
  - androgen-specific
  - metabolite-specific / derivate-specific
  - sex-specific

Anabolic steroids adverse effects

- Haematopoiesis and coagulation
  - Erythrocytes
  - Haemoglobin
  - Haematocrit
  - Polycythaemia
  - Hypercoagulability
  - Venous thromboembolism
  - Arterial thromboembolism
  - Stroke / Apoplexy
- Musculo-skeletal system
  - Premature epiphyseal closure (in adolescents)
  - Rhabdomyolysis
  - Tendon ruptures (?)
  - Ligamentous injuries
  - Disc herniation
- Cardiovascular system
  - HDL ↓ LDL ↑, ApoA1 ↓
  - Coronary heart disease
  - Myocardial infarction
  - Hypertension (?)
  - Abnormal ECG (QRS>114 ms)
  - Arrhythmia
  - Left ventricular hypertrophy
  - Hypertrophic cardiomyopathy
  - Dilative cardiomyopathy
  - Heart failure
  - Sudden cardiac death

- Liver
  - Cholestasis /Hyperbilirubinaemia
  - Steatosis
  - Peliosis
  - Adenomas
  - Hepatocellular carcinoma
  - Liver coma
- Kidney
  - Creatinine ↑, cystatin c ↑
  - Glomerulosclerosis
  - Cholemic nephrosis
  - Renal failure
- Psyche and behavior
  - Irritability
  - Nervousness, unrest
  - Aggressiveness
  - Reckless behavior
  - Self-aggressiveness
  - AAS dependence
  - AAS withdrawal syndrome
  - Depression
  - Suicide thoughts

- Skin[a]
  - Acne
  - Striae distensae
  - Profuse sweating
  - Alopecia
  - Hirsutism
- Male reproductive functions[a]
  - Decreased testis volume
  - Suppressed spermatogenesis
  - Infertility
  - Loss of libido
  - Erectile dysfunction
  - Gynaecomastia
  - Anabolic steroid induced Hypogonadism (ASIH)
- Female reproductive functions[a]
  - Anovulation
  - Amenorrhoea
  - Dysmenorrhoea
  - Infertility
  - Breast atrophy
  - Dysphonia
  - Deepening of voice

Adverse effects

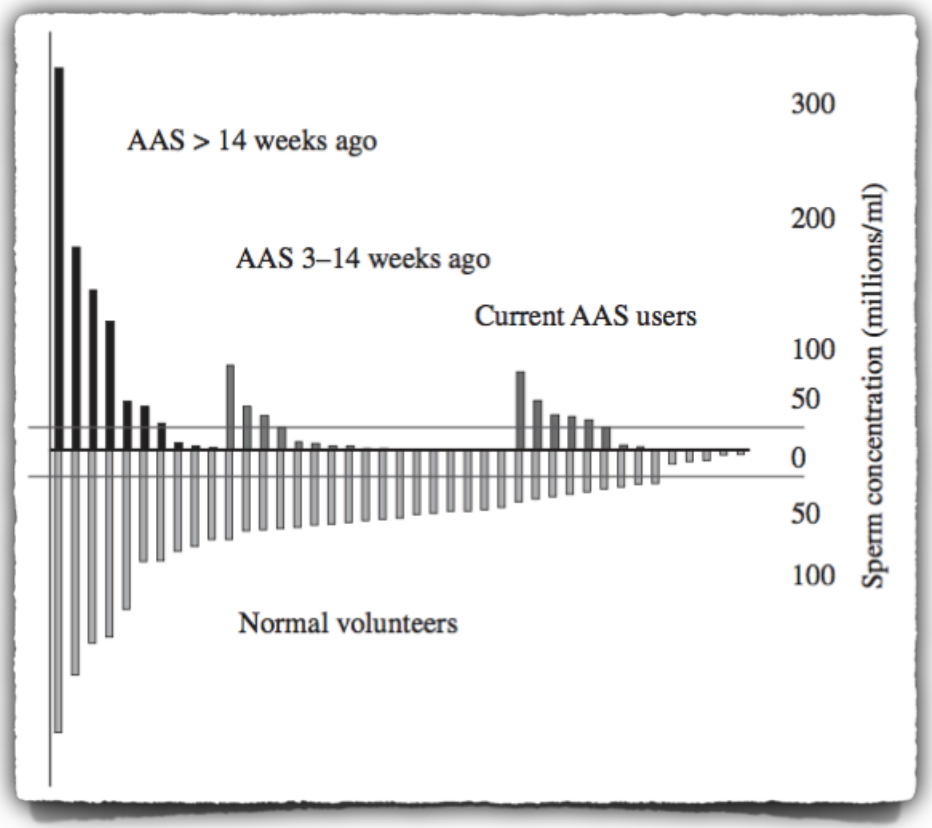
- Inhibition of testicular function
- Gynecomastia
- Polycythemia
- Hepatotoxicity
- Mood disturbances
- Disturbances of cardiac function
- Dyslipidemia
- Activation of coagulation cascade
- Virilization
- Inhibition of linear growth
- Infections

Inhibition of testicular function

- Suppression of gonadotropin secretion
  - suppression of endogenous testosterone secretion
  - suppression of spermatogenesis
  - decrease in testicular size
- Reversible effect in 3-4 months

Knuth UA, et al. Fertil Steril 52:1041, 1989

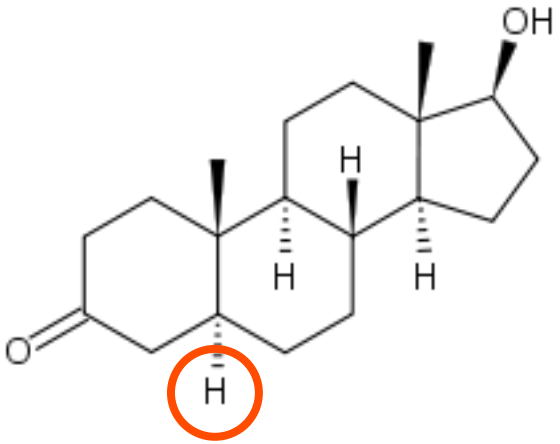
Anabolic steroids on sperm



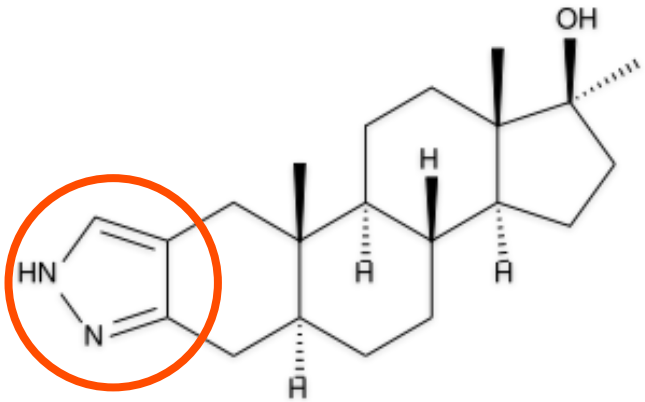
Knuth UA, et al. Fertil Steril 52:1041, 1989

Gynecomastia

- Conversion of testosterone to estradiol



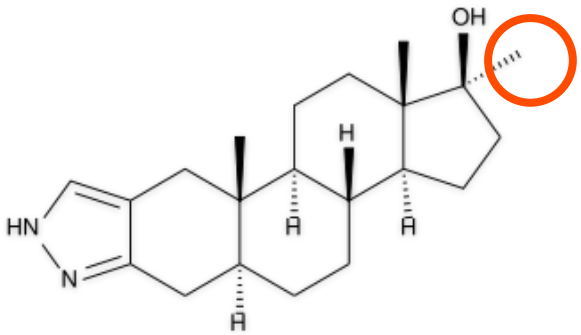
Dihydrotestosterone



Stanozolol

Hepatotoxicity

- Increase in liver enzymes
- Cholestatic jaundice
- Hepatic peliosis
- Hepatoma



Stanozolol

Cabasso A, et al. Med Sci Sports Exerc 26:2, 1994

Mood disturbances

- Questionnaire in men, users and non-users of anabolic steroids (n = 160)
- Users had increased incidence of:
  - depression
  - aggressive behavior
- Symptoms were more severe during the periods of androgen intake

Pope HG, et al. Arch Gen Psychiatry 51:375, 1994

Disturbances of cardiac function

- Sudden death
  - cardiac hypertrophy, myocarditis

Hausmann R, et al. Int J Legal Med 111:261, 1998

- **Randomized, placebo-controlled trial**
- Body-building athletes (n = 8)
- Nandrolone or or placebo for 8 weeks
- No differences on ultrasonographic parameters

Hartgens F, et al. Int J Sports Med 24:344, 2003

Anabolic steroids adverse effects

Table 2. Common cardiovascular complications caused by the most frequently used doping substances.

	AMI	CAD	Cardiomyopathy	Arrhythmias	Hypertension	SCD
AAS	√	√	√	√	√	√
Other anabolic agents (clenbuterol)	√	√	√	√	√	√
hGH			√	√	√	√
EPO	√		√	√	√	√
Beta-2 agonists	√		√	√		√
Diuretics				√		
Amphetamines	√	√	√	√	√	√
Ephedrine	√	√	√	√	√	√
Cocaine	√	√	√	√	√	√
Narcotics				√		√
Cannabinoids	√	√		√	√	√

√ indicates an effect. AMI – acute myocardial infarction; CAD – coronary artery disease; SCD – sudden cardiac death; AAS – anabolic androgenic steroids; hGH – growth hormone; EPO – erythropoietin.

Deligiannis, AP et al. Hellenic J Cardiol 53:447, 2012

Dyslipidemia

- **Effect of 17α-alcyliated derivatives**
  - decrease in HDL-cholesterol
  - increase LDL-cholesterol

Thompson PD, et al. JAMA 261:1165, 1989

Activation of coagulation cascade

- **Weight-lifting athletes, users to non-users of anabolic steroids (n = 49)**
- **In users as compared to non-users:**
  - increase in thrombin-antithrombin complex
  - increase in plasma prothrombin concentrations
  - increase in antithrombin III concentrations
  - increase in protein S concentrations
  - decrease in tPA and PAI-1 concentrations

Ferenchick GS, et al. Am J Hematol 49:282, 1995

Inhibition of linear growth

- Early epiphyseal closure
- Trial of adolescent player of american football (n = 873)
  - anabolic drug users: 6%
    - use before the age of 15 years: 50%
    - use before the age of 10 years: 15%

Stilger VG, et al. J Community Health 24:131, 1999

Structure

- Introduction
- Epidemiology
- Types
- Efficacy
- Safety
- Conclusions

Structure

- Introduction
- Epidemiology
- Types
- Efficacy
- Safety
- Conclusions

Aims

- Discussion on the efficacy and safety of hormones as performance-enhancing drugs

- Identification of men and women that use anabolic steroids and complain of other clinical problems

Anabolic steroids

- Special characteristics
- Epidemiology
- Types
- Efficacy
- Safety

Suspicion of use

Man

- Competitive sport
- Small testes
- Azoospermia
- High hematocrit
- Low SHBG

Woman

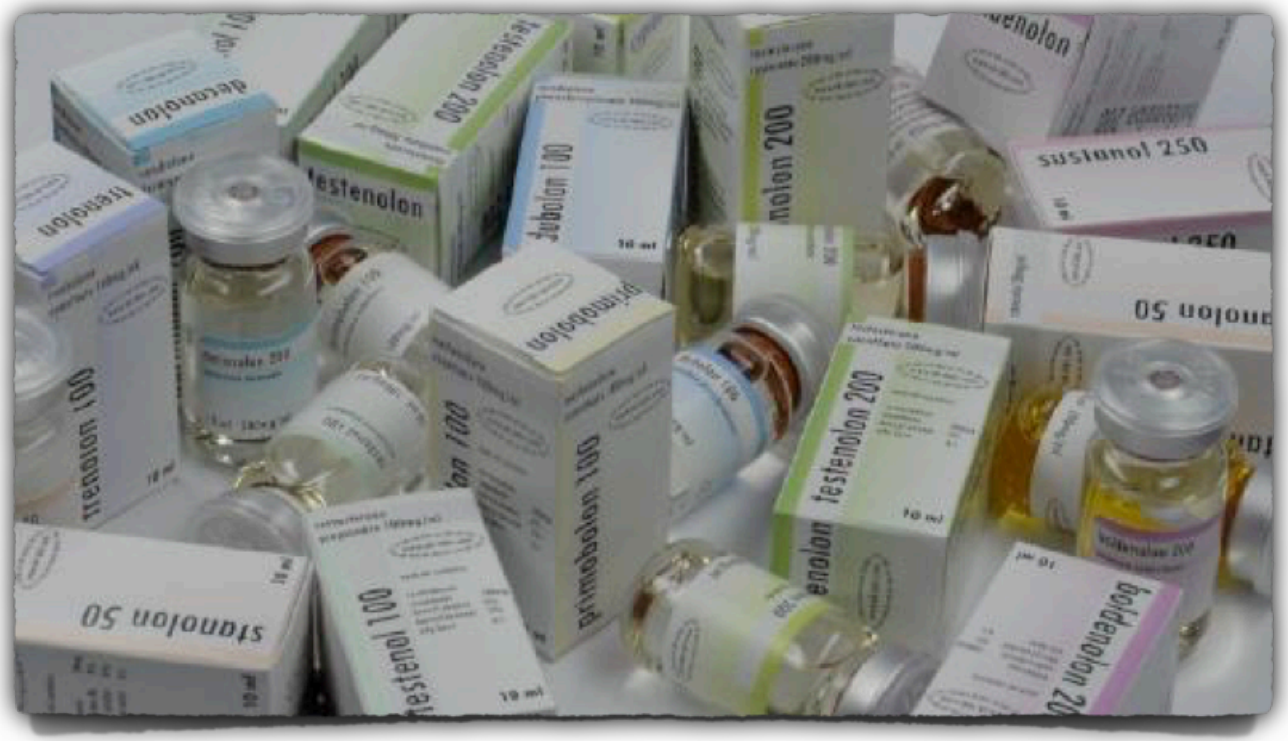
- Competitive sport
- Hirsutism
- Acne
- Androgenic alopecia

Gym program

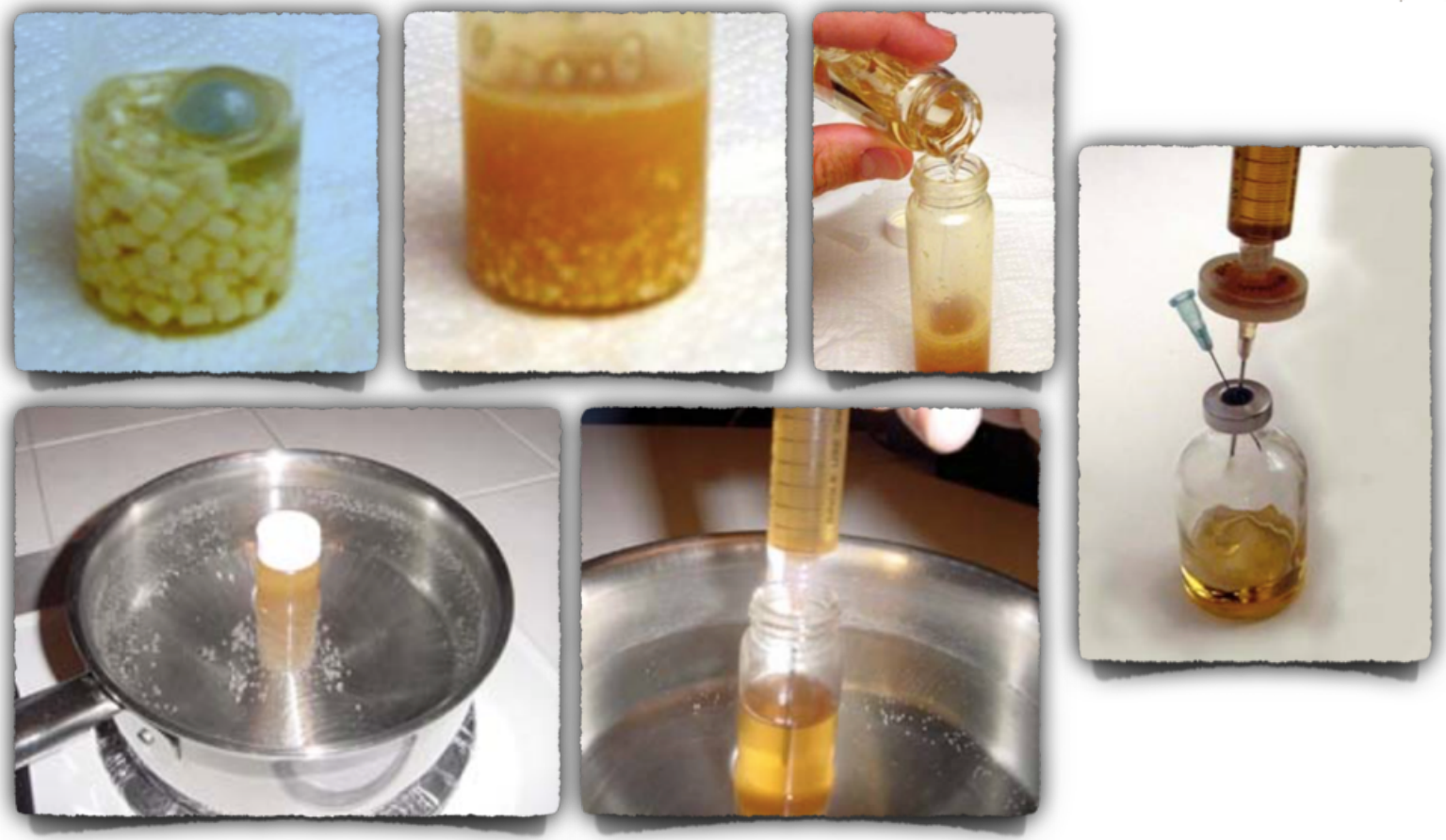
metandienone T esters nandrolone tamoxifen

	anabol	testoviron	deca	nolvadex	LIVE 52
1η εβδομαδα	2	100	200		
2η εβδομαδα	4	250	400		
3η εβδομαδα	6	250	400		
4η εβδομαδα	8	250	400		
5η εβδομαδα	8	250	400	1	
6η εβδομαδα	6	250	400	1	
7η εβδομαδα	4	250	400	1	
8η εβδομαδα	2	100	200	1	
	280χαπια	1700mg	2800mg	28χαπια	
βιταμινες:	EVIOL E	5 τη μερα			
	NEUROBION 5 τη μερα				
	B SIX 4 τη μερα				
	CEBION 3 τη μερα				

Anabolic steroids



The dark side



The bright side

- Steroid biochemistry
- Andrology - testosterone and sperm
- Adolescent Medicine
- Disorders of Sexual Development
- Cardiovascular system
- SERMs, aromatase inhibitors
- Beta-agonists and Beta-blockers
- Belgian bulls

First Department of Obstetrics and Gynecology
Aristotle University of Thessaloniki
Professor G.F. Grimbizis

Unit of Reproductive Endocrinology
Associate professor D.G. Goulis
Professor emeritus J. Papadimas

School of Physical Education
Aristotle and Decocritian University
Professor S. Tokmakidis
Assistant professor K. Dipla
Associate professor A. Zafeiridis

Staff, Post-doc and PhD candidates

Ch. Tsametis (endocrinologist)
P. Poulakos (endocrinologist)
P.K. Iliadou (endocrinologist)
Ch. Dimopoulou (endocrinologist)
J. Litsas (endocrinologist)
S. Karras (endocrinologist)
P. Anagnostis (endocrinologist)
E. Kintiraki (endocrinologist)
A.-G. Kouthouris (urologist)
I. Koutsogiannis (urologist)
A. Mousiolis (endocrinologist)
G. Mintziori (endocrinologist)
E. Tsirou (endocrinologist - dietician)
N. Athanasiadis (dietician)
V. Harizopoulou (midwife)
E. Taousani (midwife)
D. Savvaki (ergophysiologist)