Let's Excel Together

CANADIAN ACADEMY OF SPORTS NUTRITION

Lecture 27:

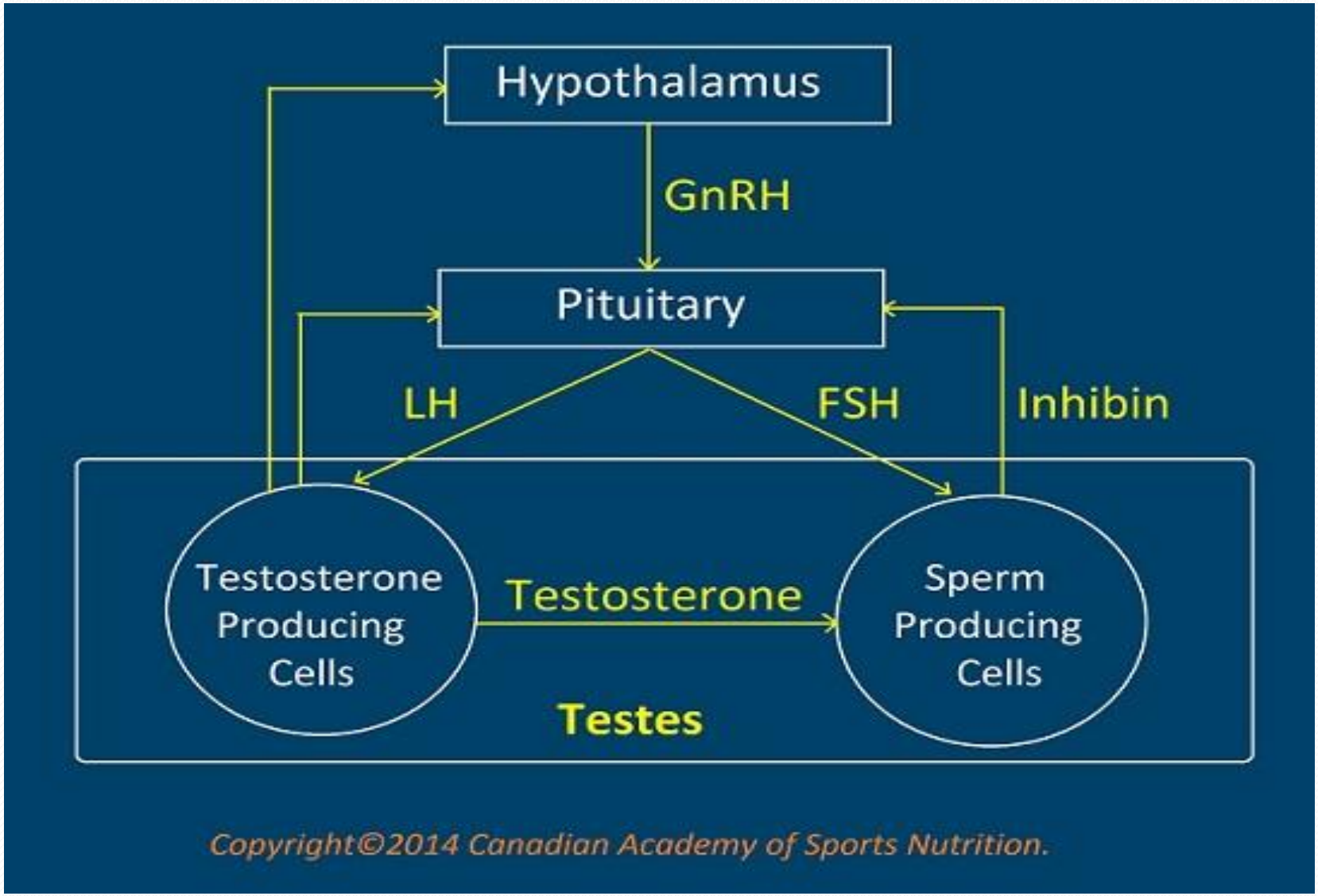
Testosterone and Why Athletes Use It

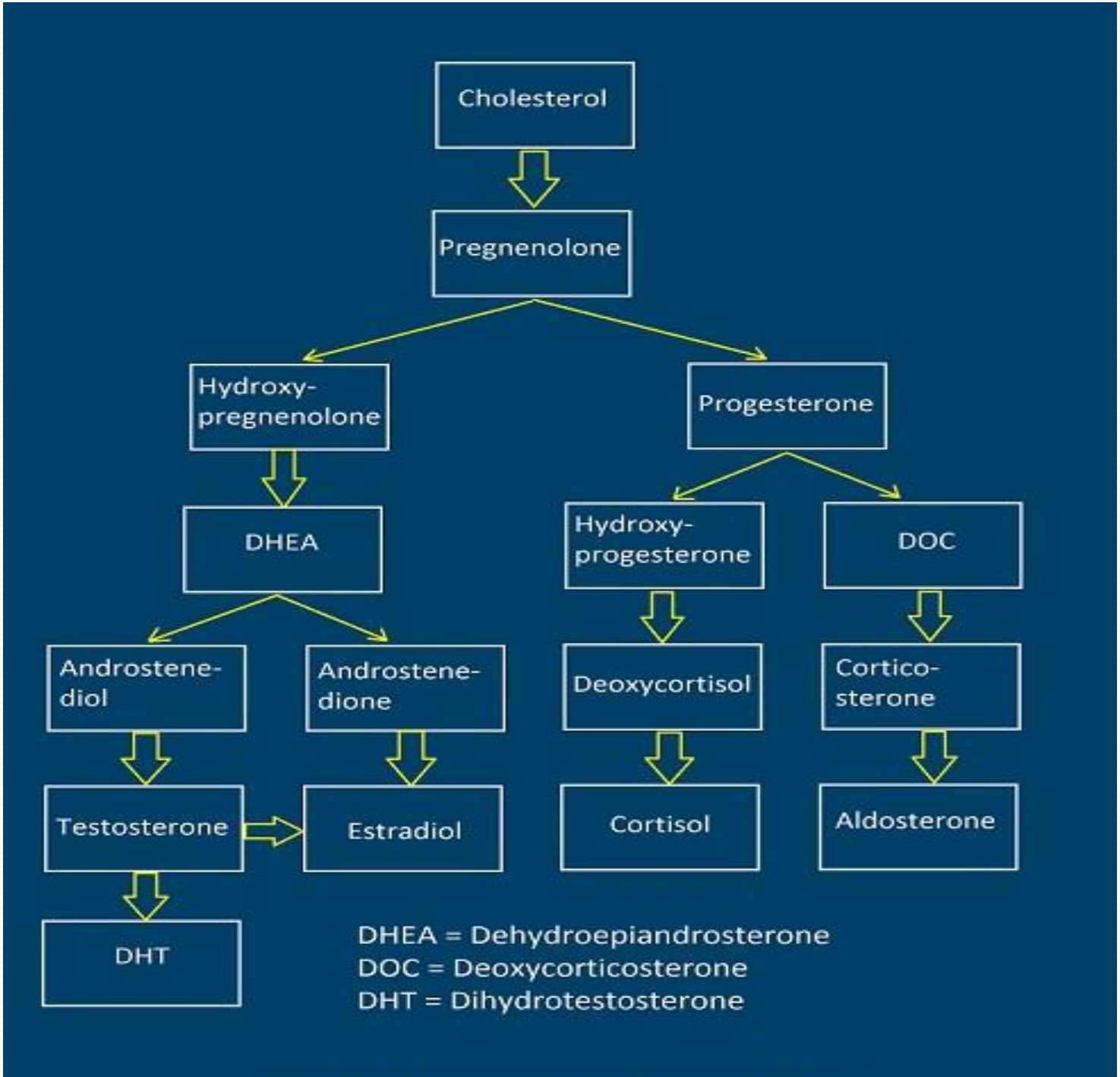
Copyright Protection:

- **Testosterone is the body`s main androgenic hormone, and is secreted from the testicles, ovaries, and adrenal glands.**

- **In men, about 95% of testosterone is produced in the testicles and 5% by the adrenal glands, whereas it is synthesized by the adrenal glands and ovaries in women.**

Testosterone Secretion:




Cholesterol
Pregnenolone
Hydroxy-pregnenolone
Progesterone
DHEA
Hydroxy-progesterone
DOC
Androstene-diol
Androstene-dione
Deoxycortisol
Cortico-sterone
Testosterone
Estradiol
Cortisol
Aldosterone
DHT
DHEA = Dehydroepiandrosterone
DOC = Deoxycorticosterone
DHT = Dihydrotestosterone

Normal Secretion of Testosterone:

Men:

- **7 mg a day, which is approximately 20 to 30 times more than that in women.**
- **Mainly produced by the testicles.**
- **Blood level: 250 to 1000 nanograms /deciliter.**

Women:

- **0.25 mg a day, of which half is due to conversion of androstendione to testosterone in other body`s tissues**
- **Mainly by the adrenal glands and ovaries.**
- **Blood level: 15 to 65 nanograms /deciliter.**

Testosterone level is relatively high during three periods of the male life cycle:

- **Fetal period.**
- **Infancy.**
- **Adulthood.**

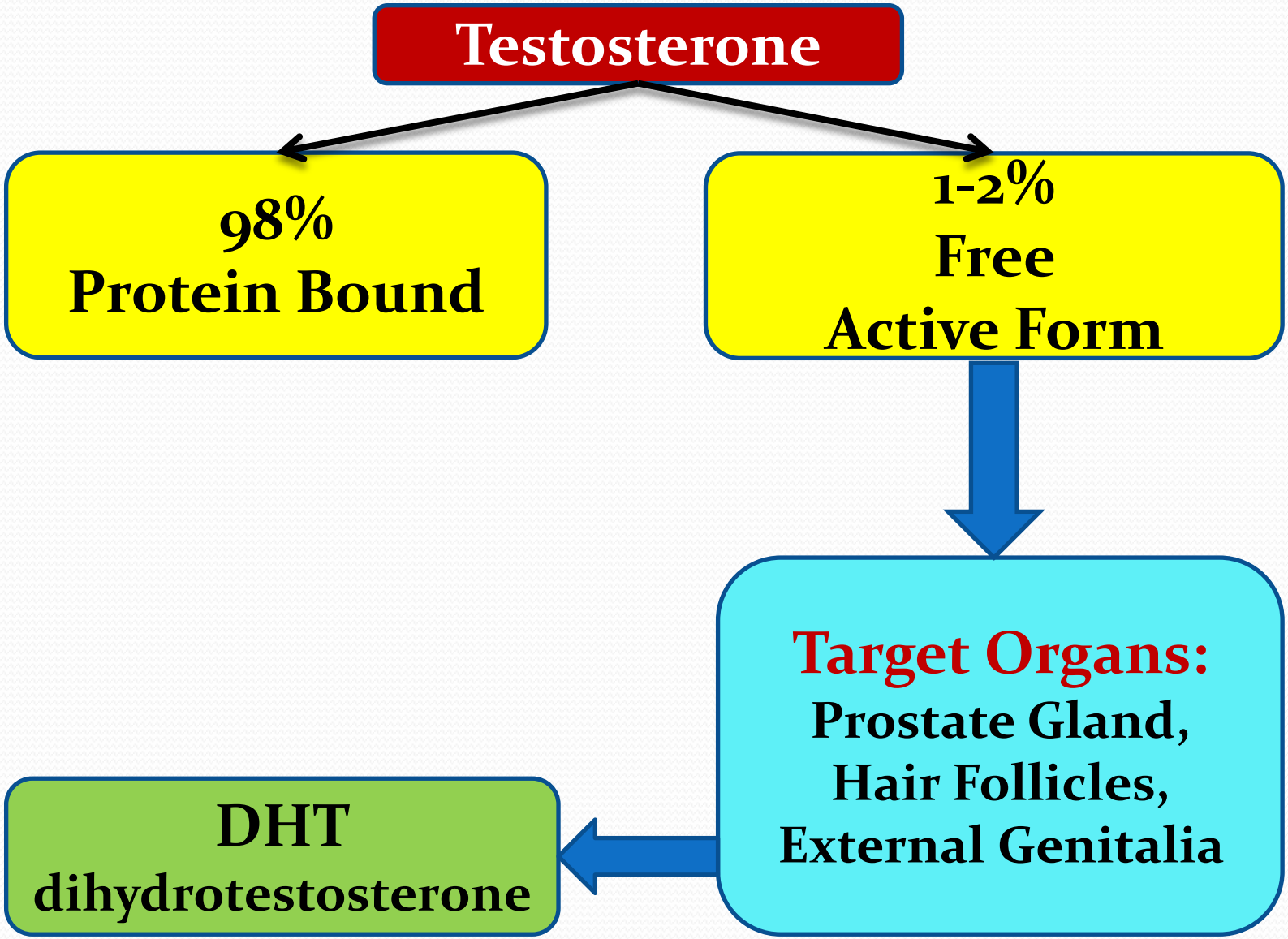
- **The level of testosterone begins to increase in the males after the eighth week of pregnancy and diminishes before birth.**

- **Afterward, its level increases again and reduces after being in a high level for several months.**

- **Testosterone level is low during prepubescent period (it is about 20 nanograms), and then increases sharply during adulthood.**

- **There is a normal decline in both males and females in testosterone secretion with aging.**

Mechanism of Action:



DHT (dihydrotestosterone):

- 80% from conversion of testosterone.
- 20% produced by the adrenal glands.

The half-life of testosterone is approximately 90 minutes.

Effects of Testosterone:

- Controls sexual differentiation in the fetus.
- Influences on the production of sperm.
- Develops secondary male sex characteristics.
- Is essential for the development of the internal and external genital systems and for their optimal functions.
- Is necessary for the development of pubic and axillary hair in both males and females.

- **Increases the size of the larynx and deepens the voice.**
- **Affects sexual behavior.**
- **Increases muscle mass and strength by elevating protein synthesis.**
- **Accelerates growth spurts, directly by influencing on the end plates of the long bones, and indirectly by stimulating growth hormone secretion and IGF-I production.**

- **Promotes protein anabolism and growth and enhances linear bone growth and muscular development.**

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- **Elevates the production of red blood cells, which carry oxygen and nutrients within the body.**

- **Can increase sebaceous gland activity, which may result in acne.**

Indications for Use:

Some medical reasons for using testosterone are as follows:

- **Replacement therapy for low function of the testes and pituitary gland.**
- **Accelerates growth and promotes anabolism.**
- **Stimulates the production of red blood cells in resistant anemia.**

- **Palliative therapy in breast cancer that has spread to distant sites.**
- **Adjuvant therapy in patients with short stature.**
- **Treatment of hereditary angioedema.**
- **Stimulation of maturity in cases of delayed puberty.**
- **Treatment of osteoporosis.**

Contraindications For The Use Of Testosterone:

- **Advanced breast cancer that has not spread to distant sites.**
- **Prostate cancer.**
- **Liver diseases.**
- **High blood levels of calcium.**

Side Effects and Toxicity:

The most common adverse reactions of testosterone are:

- **Edema**
- **Jaundice**
- **local irritation**
- **Urinary obstruction**
- **Steroid fever (Test Fever).**

- In women who use testosterone, the most important side effect is masculinization—the development of male characteristics such as:
- deepened voice
- growth of facial hair

- The most significant side effect of too much testosterone in men is gynecomastia (breast enlargement).

Other adverse effects in men include:

- prostate enlargement.
- priapism (painful erection of the penis).
- reduction in the number of sperm and infertility in advanced cases.
- low and high sexual drive.

Toxic effects of testosterone in both sexes are:

- **Edema and water retention.**
- **Early closure of growth plates in children and consequently, short stature.**
- **Increased levels of blood calcium.**
- **Alteration in the blood levels of cholesterol.**
- **Liver dysfunction.**

Andropause:

- **Testosterone Declines with Aging.**
- **Testosterone loss starts in the late forties.**

- **Reduction of testosterone levels produce a series of symptoms:**

1) changes in sexual function: loss of libido

2) difficulty with erection and maintaining it.

3) Sexual dissatisfaction.

4) Low stamina.

5) Fatigue.

6) Depression.

7) Depressed moods.

8) Joint stiffness.

9) Irritability.

10) Decreased immune system function.

Why Athletes Use Testosterone:

- **Muscle-building property of testosterone drives athletes to abuse it.**
- **Athletes are always looking for the best way to increase their performance.**
- **The diverse effects of testosterone on the body tempt everybody to use it and athletes are not an exception.**
- **The main mission of the CAASN is to promote "clean sports" via advanced sports nutrition.**

The popularity of testosterone among athletes is due to the following reasons:

- 1) **Increases strength:**
- **Testosterone`s ability to build muscle results in increased muscle mass, which increases strength and improves physical appearance.**

- **This is the main reason that athletes use testosterone.**

- **2) Increases aggressiveness:**
- **Testosterone increases aggression and athletes believe that it is one of the keys to winning.**

- **Although elevated fierceness may be desirable on the playing field, it is not usually in social and personal relationships.**

- **"Roid rage" is the name given to the aggressive behavior following the use of testosterone and its derivatives that may become destructive and sometimes criminal.**

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- 3) **Increases tissue oxygenation:**
- **Testosterone`s ability to increase the production of red blood cells, oxygen carriers, is another reason it is abused.**

- **The more oxygen the tissues receive, the better they work.**

- **Not only may increased red blood cells not be beneficial for athletes, but it may also harm users by increasing blood viscosity.**

- 4) **Improves stamina:**
- **One of the key factors in athletes` winning is positive psyche— the mental or psychological state of the athlete.**

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- **Testosterone restores muscle tone, elevates mood, increases mental alertness, and improves stamina.**

- **Apparently, the higher the stamina, the better the psyche, and the greater the chance of winning.**

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- **5) Improves cognition:**
- **Studies show that testosterone has a significant effect on the nervous system.**
- **The human brain produces an enzyme named aromatase, which converts testosterone to estrogen.**
- **It is believed that this hormonal conversion improves cognition, memory, and concentration—the factors may aid in athletes to perform properly and win the game.**

Control of Abuse:

- **Among many banned drugs in sports, anabolic steroids such as testosterone are the most widely used drugs.**

- **Though the International Olympic Committee (IOC) and other sports bodies have taken drastic measures to control them, abuse of anabolic hormones still continues.**

- **Measurement of epitestosterone and the ratio of testosterone (T) to epitestosterone (E) in the urine are used for test for testosterone abuse.**

- **If the level of epitestosterone was more than 200 nanograms per milliliter in an athlete`s urine sample, he or she will be accused of doping.**

- **The presence of a testosterone (T) to epitestosterone (E) in ratio greater than 6 to1 constitutes an offence unless there is evidence that this is due to a physiologic or pathological condition.**

- **These include low epitestosterone excretion, androgen-producing tumors, and enzyme deficiencies.**

- **In the case of T/E greater than 6, it is mandatory that the relevant medical authority conducts an investigation before the sample is declared positive.**

- **A full report will be written and will include a review of the tests, subsequent tests, and any results of endocrine investigations.**

- **The "big question" is: Can we eradicate abuse of testosterone by athletes?**

- **In our opinion, the answer is unfortunately "No".**

- ***Education*** **and providing alternatives are the BEST options to reduce the possibility of testosterone abuse.**

Homework:

- 1) Describe as to why athletes abuse testosterone.
- 2) Describe the general effects of testosterone.