Physiology of Sport and Exercise

Endocrine System in Sport and Exercise

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Learning Objectives

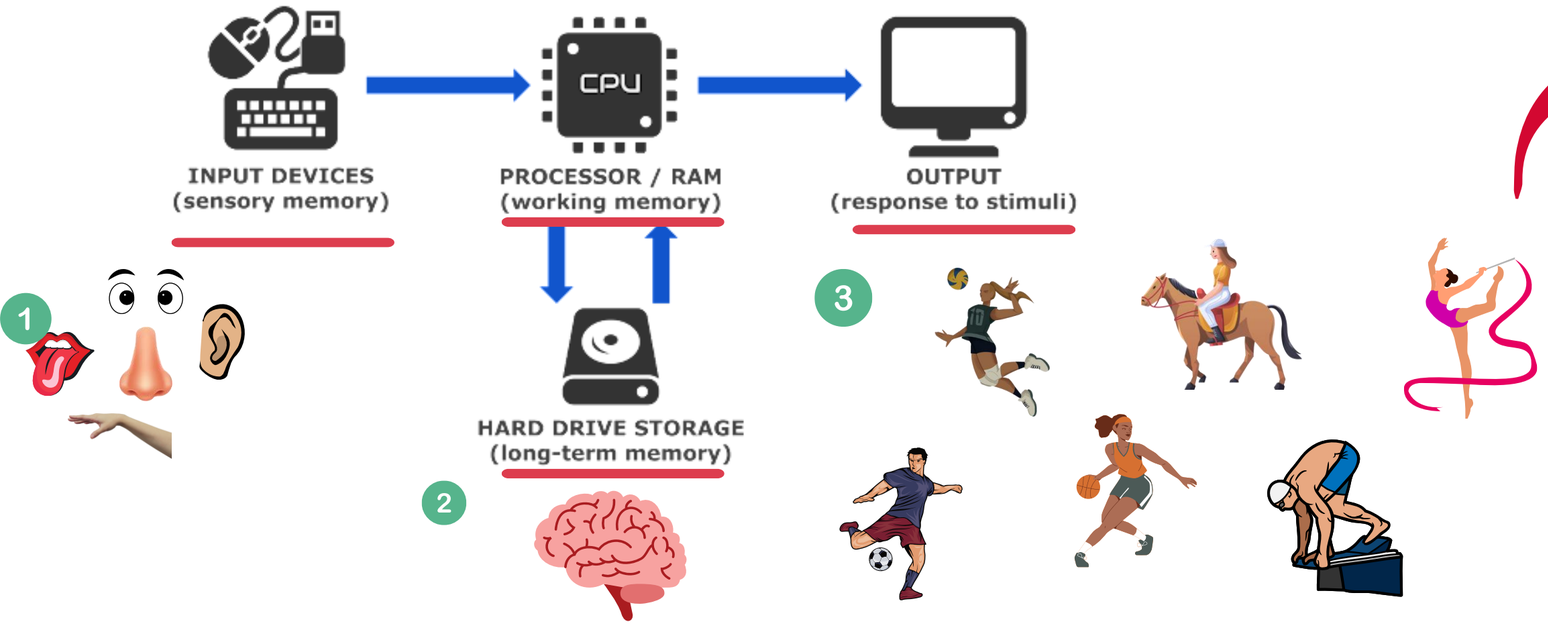
The basic structures of the endocrine system

How endocrine system works during the exercise

Hormones and behavior

Last class???

Today

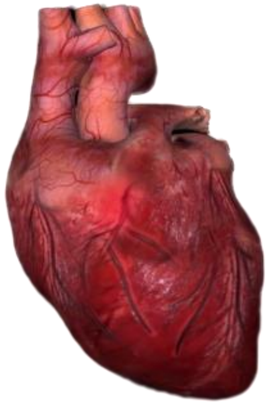


What happen during the exercise??

Stress System

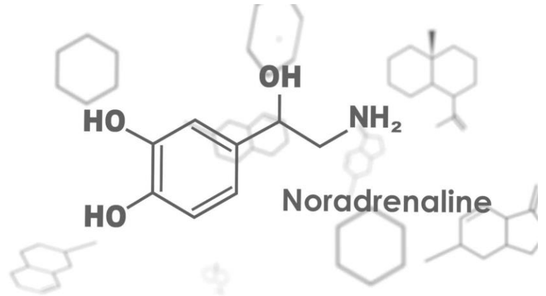
Switch on

Cardiac System



Motor activity

Emotional response



Endocrine System

Endocrine System

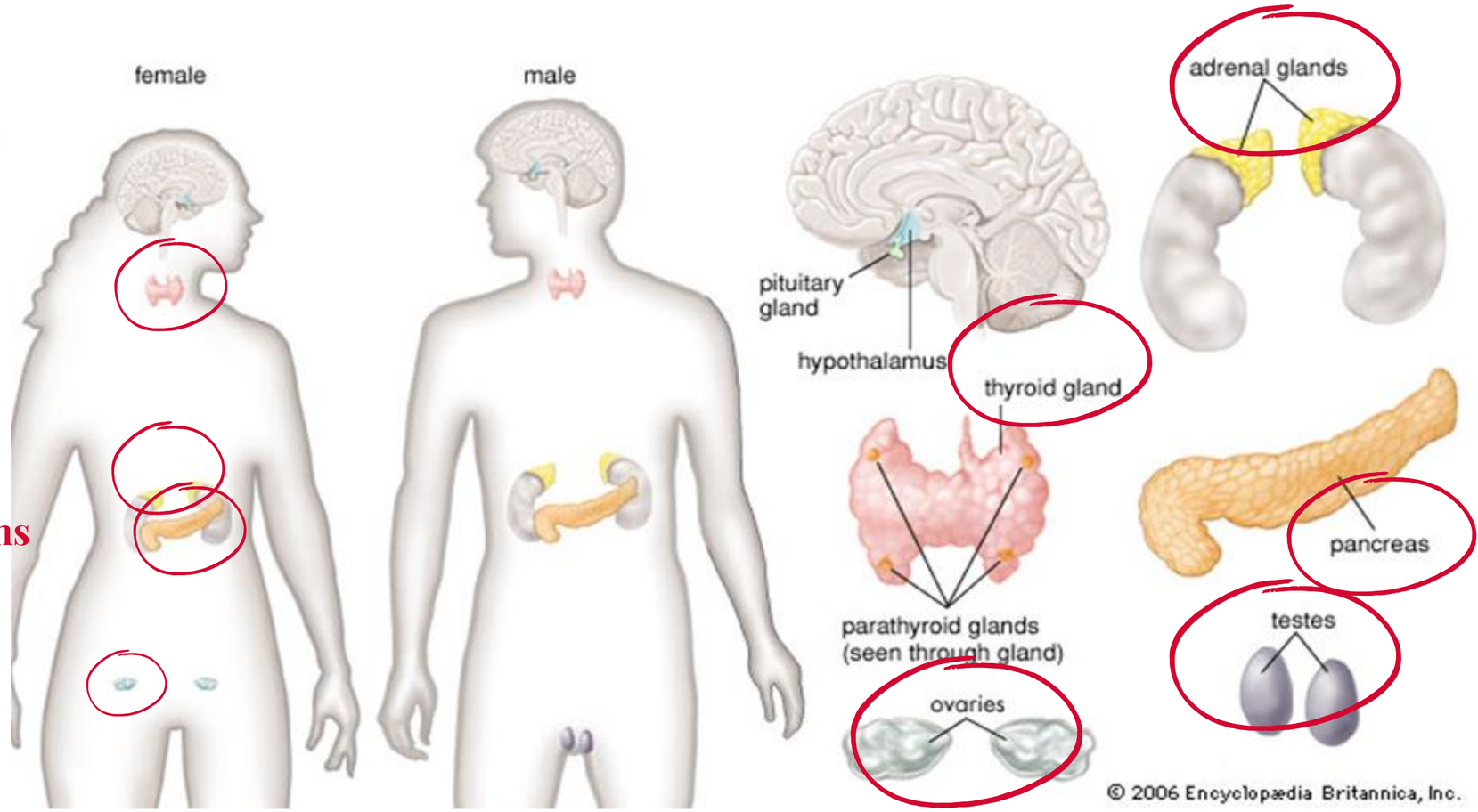
Endocrine Glands (production and secretion)

release hormones into the blood

Hormones (specifics)

travel into the blood to specific target organs

Transmitters (chemicals)



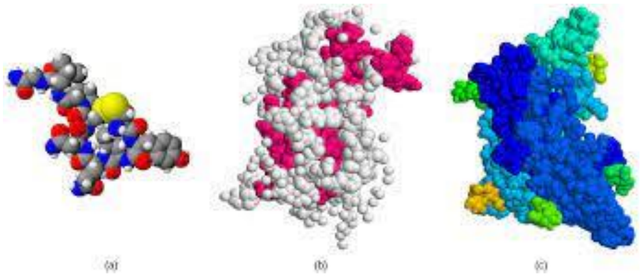
The molecules transmit specific information (in a slow way)

Hormone

Difference among the hormones

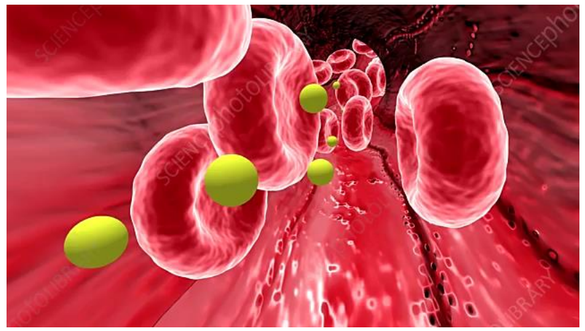
Molecule chemical structure

Type	Examples	Derived From
Steroids	Aldosterone, cortisol, estrogen, testosterone	Cholesterol
Amines	Epinephrine, norepinephrine	Amino acids
Glycoproteins	FSH, LH, TSH	Carbohydrates and proteins
Peptides	ADH, oxytocin, thyrotropin-releasing hormone	Amino acids
Proteins	GH, PTH, PRL	Amino acids



fast

Very slow



	Neurotransmitters	Hormones
DEFINITION	Neurotransmitters are chemical messengers produced by the nervous system.	Hormones are the chemical messengers produced by the endocrine system.
ORGAN SYSTEM	Nervous system	Endocrine system
TRANSFERENCE	Through synaptic cleft.	Through the circulatory system.
SPEED OF THE ACTION	Fast	Very slow
EXAMPLES	Acetylcholine, dopamine, glutamate, glycine, serotonin, histamine and noradrenaline.	Estradiol, testosterone, melatonin, vasopressin, insulin and growth hormone, luteinizing hormone, follicle-stimulating hormone, thyroid-stimulating hormone, etc.
FUNCTION	Facilitate the signal transmission through neurons by passing action potential from axon of one neuron to dendrite of the next neuron.	They affect many processes in our body including growth and development, mood, metabolism, sexual function, reproduction, etc.

Hormone release axis

Steroid Hormones - Brain in charge

Hypothalamus

releasing and
inhibiting hormones

Pituitary

Adrenal

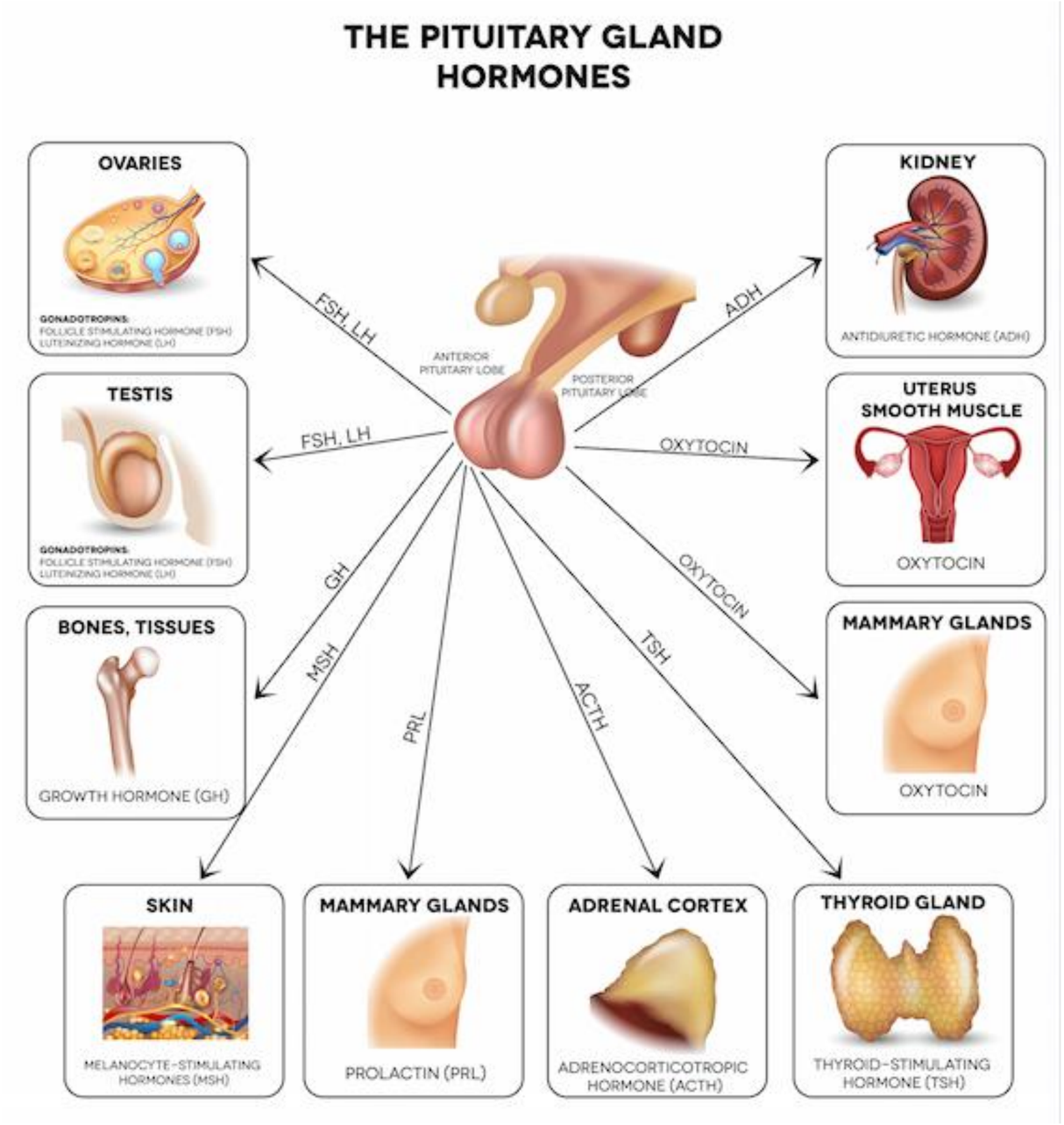
Gonodal

HPA axis

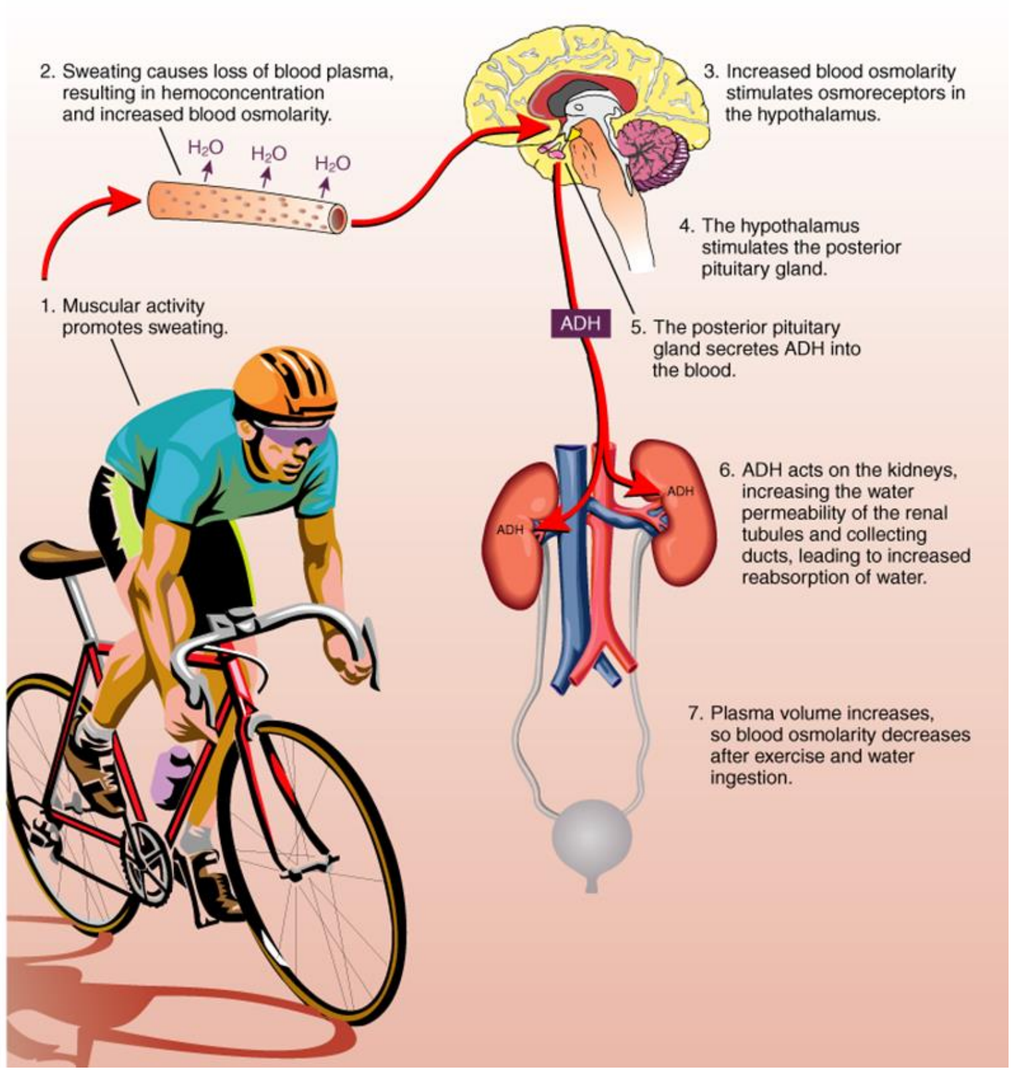
HPG axis

The pituitary

Different part of the pituitary is responsible for the secretion of specific hormones



Hormonal response to exercise



↑ Insulin contrarregulatory hormones

Acute responses to exercises → ↑ GH, ↑ Catecholamines, ↑ Cortisol, ↑ Glucagon

Chronic responses to exercises → ↑ Testosterone

All other hormonal responses to exercise showed inconclusive findings

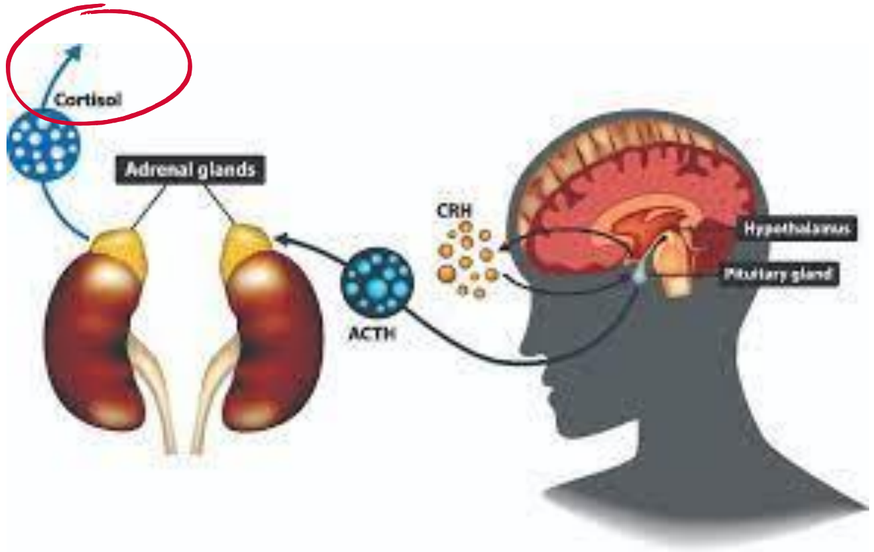
Hormonal response to exercise

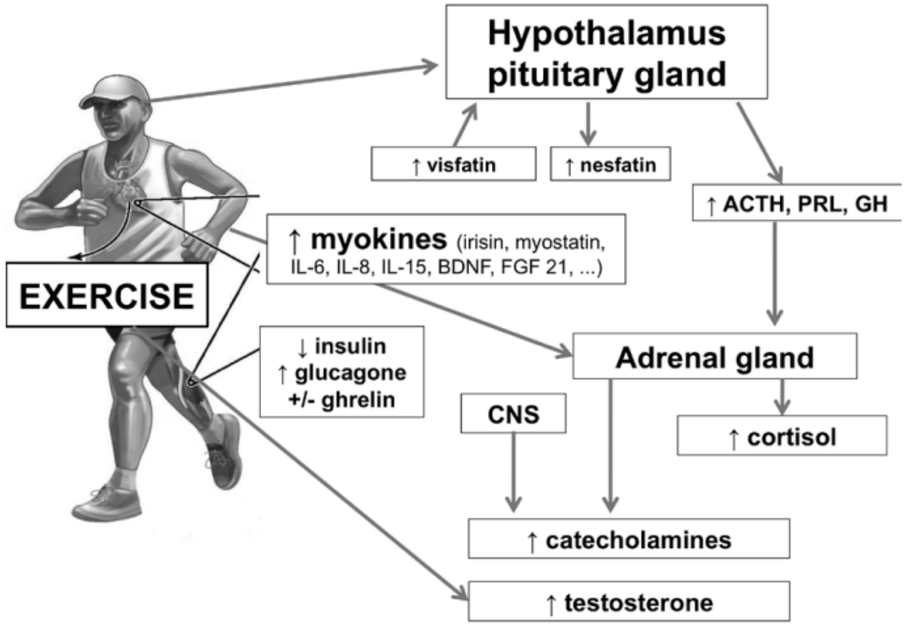
Sympathetic Nervous System

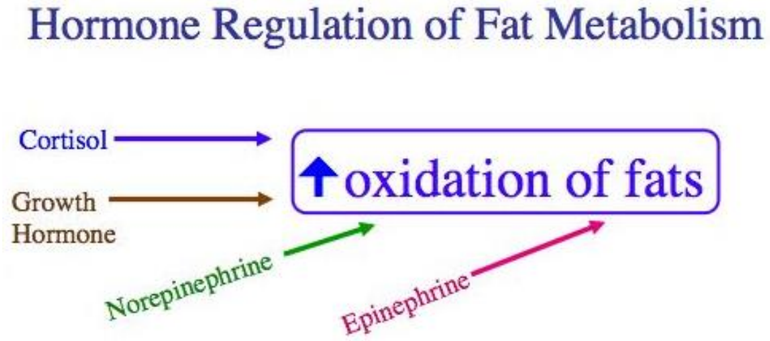
Catecholamines:

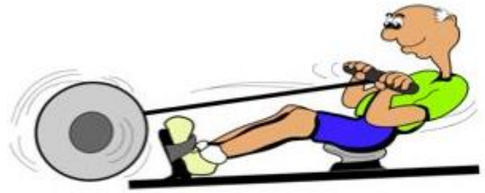
Epinefrine
Norepinephrine

Increase of blood flow, bpm, breathing









Hormonal response to exercise

' Hormone release adapts to meet the demands of the exercise'

Growth Hormone (GH)

Tissue growth and metabolism (muscle cells activated during the exercise - importance of training specificity).

Testosterone

Aerobic and resistance exercise.
Role: increase the activation of muscle fibers. Increase protein synthesis - hypertrophy. Recovery and muscle repair.

Cortisol

Energy production - generate energy. to ensure your muscles get the energy they need.

Insulin-Like Growth Factors (IGF)

Training adaptations in repair and remodeling bone and skeletal muscle

BDNF- brain-derived neurotrophic factor

improvements in cognitive function

Menstrual cycle and hormone concentration

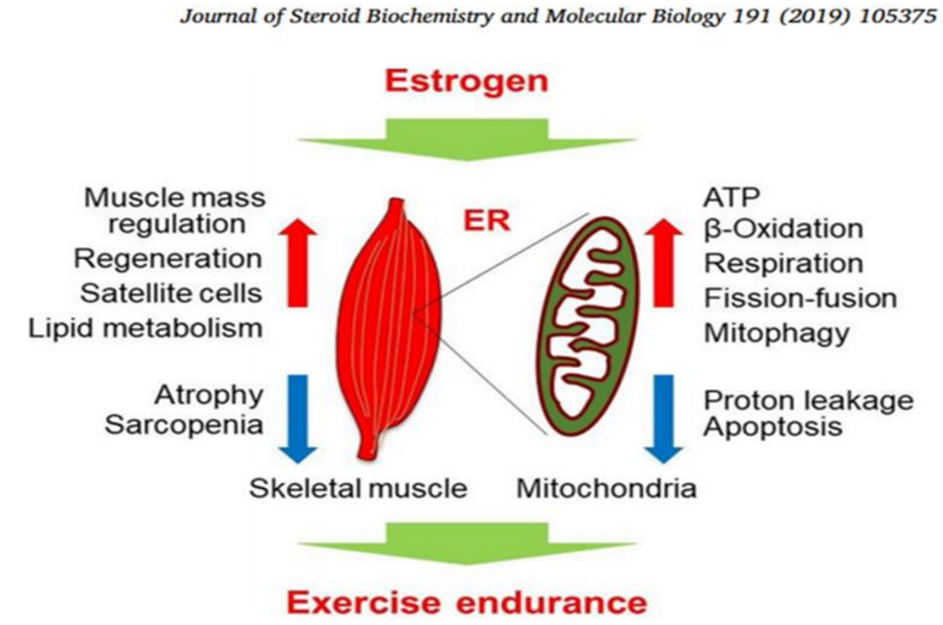
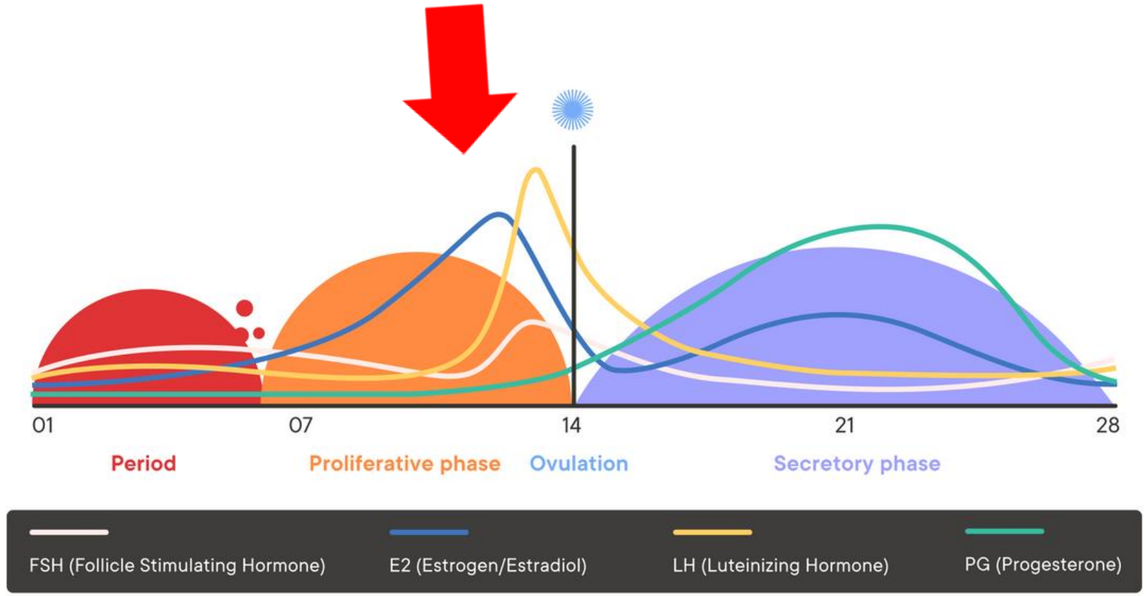


Fig. 1. Model of estrogen functions in exercise endurance, focusing on skeletal muscle and mitochondrial regulation.



No consensus about performance and menstrual cycle phase

Recovery and Sleep

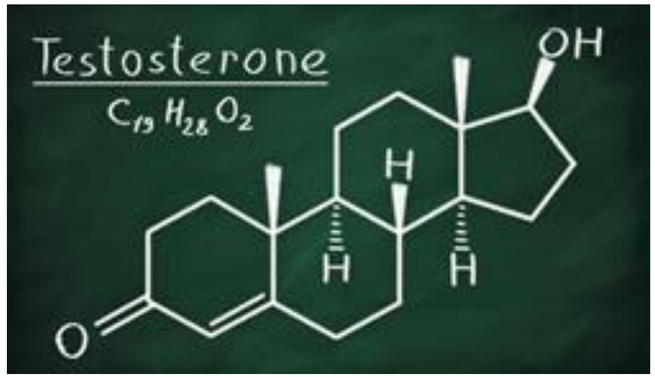
Increase production, receptors and muscle growth

Overtraining **- an imbalance of training dose-responses**

Hypoactivity of HPG axis

Testosterone Concentration

Hormone and Behavioral Reponses



During Exercise

muscle hypertrophy, power , strenght

T concentrations related to better performance

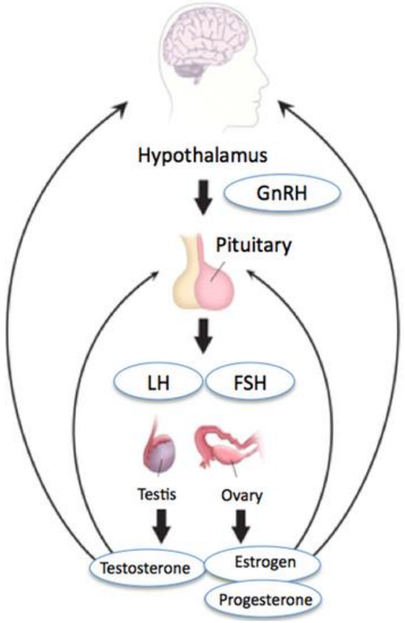
Behaviors

Agressive

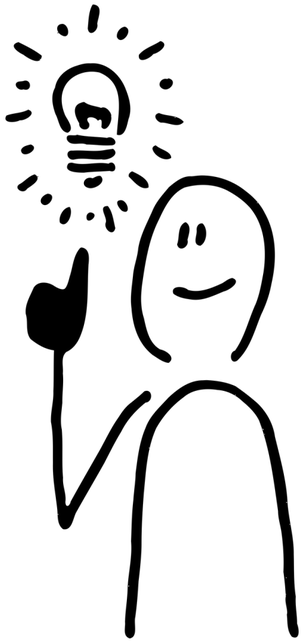
Vigor

Angry

Dominante



Some behaviors can increase T concentration; a major concentration of T during a game/exercise can improve performance



Hormone and Behavioral Reponses

Pre-competition hormonal and psychological levels of elite hockey players: Relationship to the 'home advantage'

Justin Carré [a], Cameron Muir [a,b], Joey Belanger [c], Susan K. Putnam *

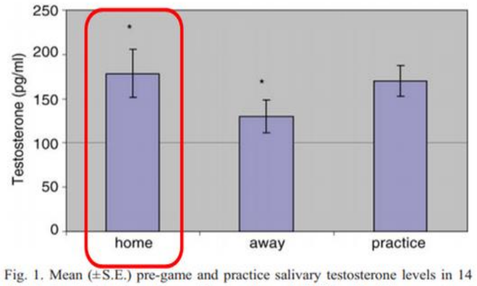


Fig. 1. Mean (±S.E.) pre-game and practice salivary testosterone levels in 14 elite Junior 'A' hockey players. Players showed significantly higher pre-game salivary testosterone levels when playing in their home arena as compared to their opponents' arena (paired *t*-tests, two-tailed). *$p = 0.04$.

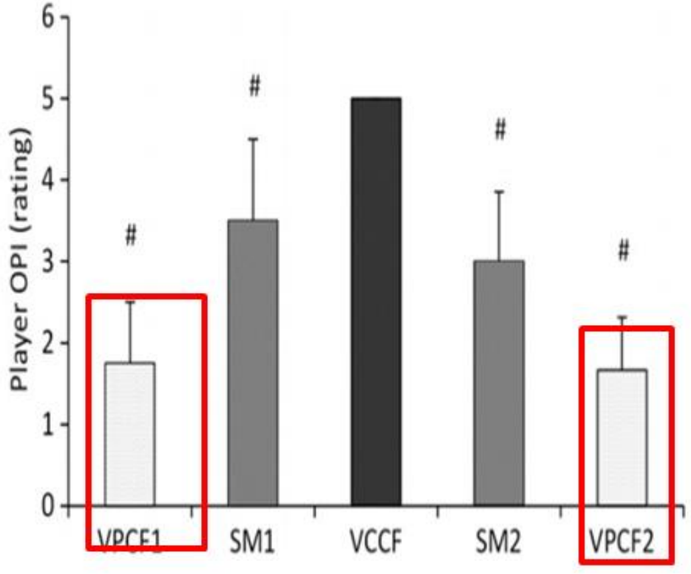
Changes in salivary testosterone concentrations and subsequent voluntary squat performance following the presentation of short video clips

Christian J. Cook [a,b,c], Blair T. Crewther [b,*]

[a] United Kingdom Sport Council, London, UK
[b] Hamlyn Centre, Imperial College, London, UK
[c] Sport, Health and Exercise Science, Department for Health, University of Bath, Bath, UK

The effects of different pre-game motivational interventions on athlete free hormonal state and subsequent performance in professional rugby union matches

Christian J. Cook [a,b,c,d], Blair T. Crewther [b,d,*]



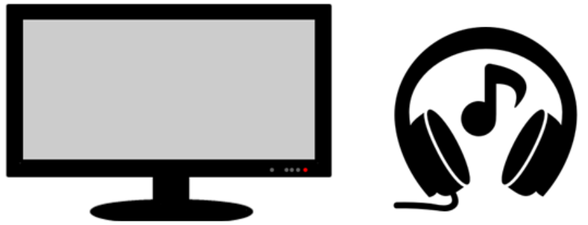


Table 1
Salivary testosterone concentrations in response to the pre-game motivational interventions (mean ± SD).

Testosterone		VPCF1	SM1	VCCF	SM2	VPCF2
Pre-intervention (pg/ml)	M	140.5	152.6	147.4	144.1	147.2
	SD	19.4	30.1	34.6	25.6	19.2
Pre-game (pg/ml)	M	157.5	160.3	146.3	151.0	164.0
	SD	18.5	29.2	35.4	25.1	17.6
% change	M	12.5$^{*,\alpha}$	5.4$^{*,\#}$	−0.7	5.0$^{*,\#}$	11.8$^{*,\alpha}$
	SD	5.9	3.7	4.7	2.4	4.8

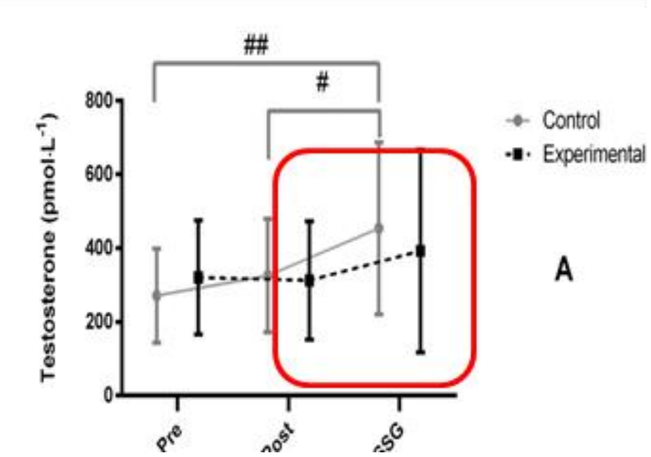
VPCF = video with positive coach feedback, SM = self-motivate, VCCF = video with cautionary coach feedback.

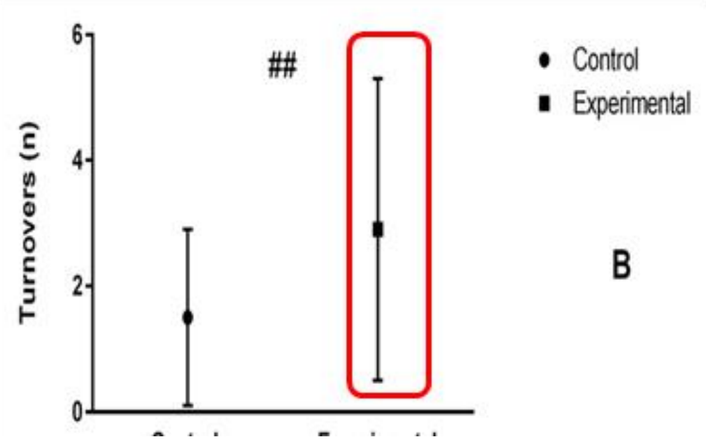
Mental Fatigue and testosterone concentration

Mental fatigue before game??

Mental fatigue impairs technical performance and alters neuroendocrine and autonomic responses in elite young basketball players

Alexandre Moreira[a,*], Marcelo Saldanha Aoki[b], Emerson Franchini[a], Daniel Gomes da Silva Machado[c], Ana Carolina Paludo[a], Alexandre Hideki Okano[d]

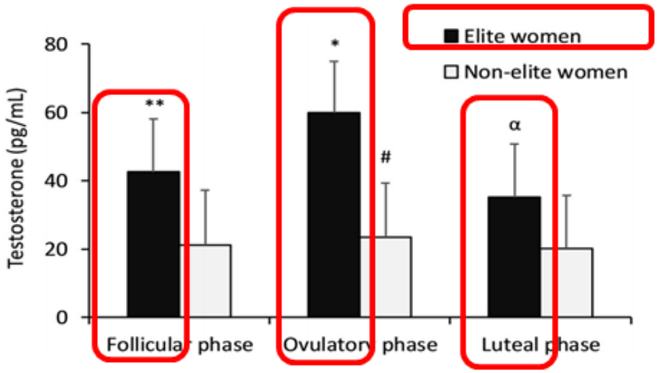


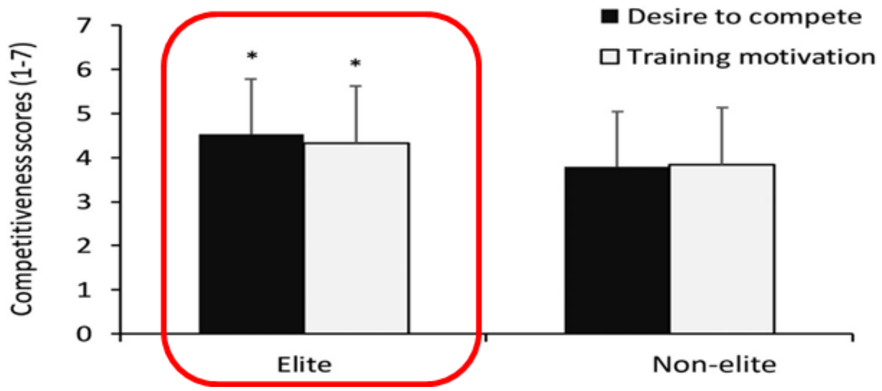


Menstrual Cycle and Testosterone Concentration

A longitudinal analysis of salivary testosterone concentrations and competitiveness in elite and non-elite women athletes

Blair T. Crewther[a,b,*], Christian J. Cook[b,c,d]





Menstrual Cycle and behavioural responses

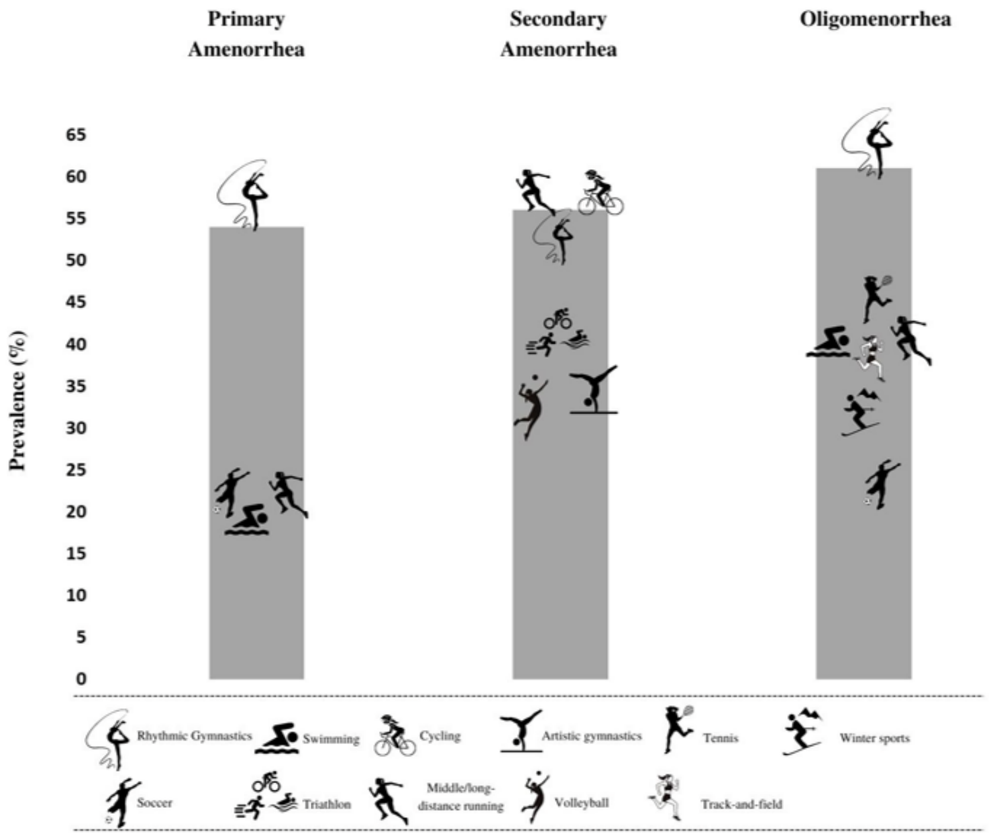


Figure 2. Sports disciplines with the highest prevalence of primary, secondary amenorrhea and oligomenorrhea.

International Journal of *Environmental Research and Public Health*

MDPI

Review

The Prevalence of Menstrual Cycle Disorders in Female Athletes from Different Sports Disciplines: A Rapid Review

Marta Gimunová [1,*], Alexandra Paulínyová [1], Martina Bernaciková [1] and Ana Carolina Paludo [2]

The Effect of Menstrual Cycle on Perceptual Responses in Athletes: A Systematic Review With Meta-Analysis

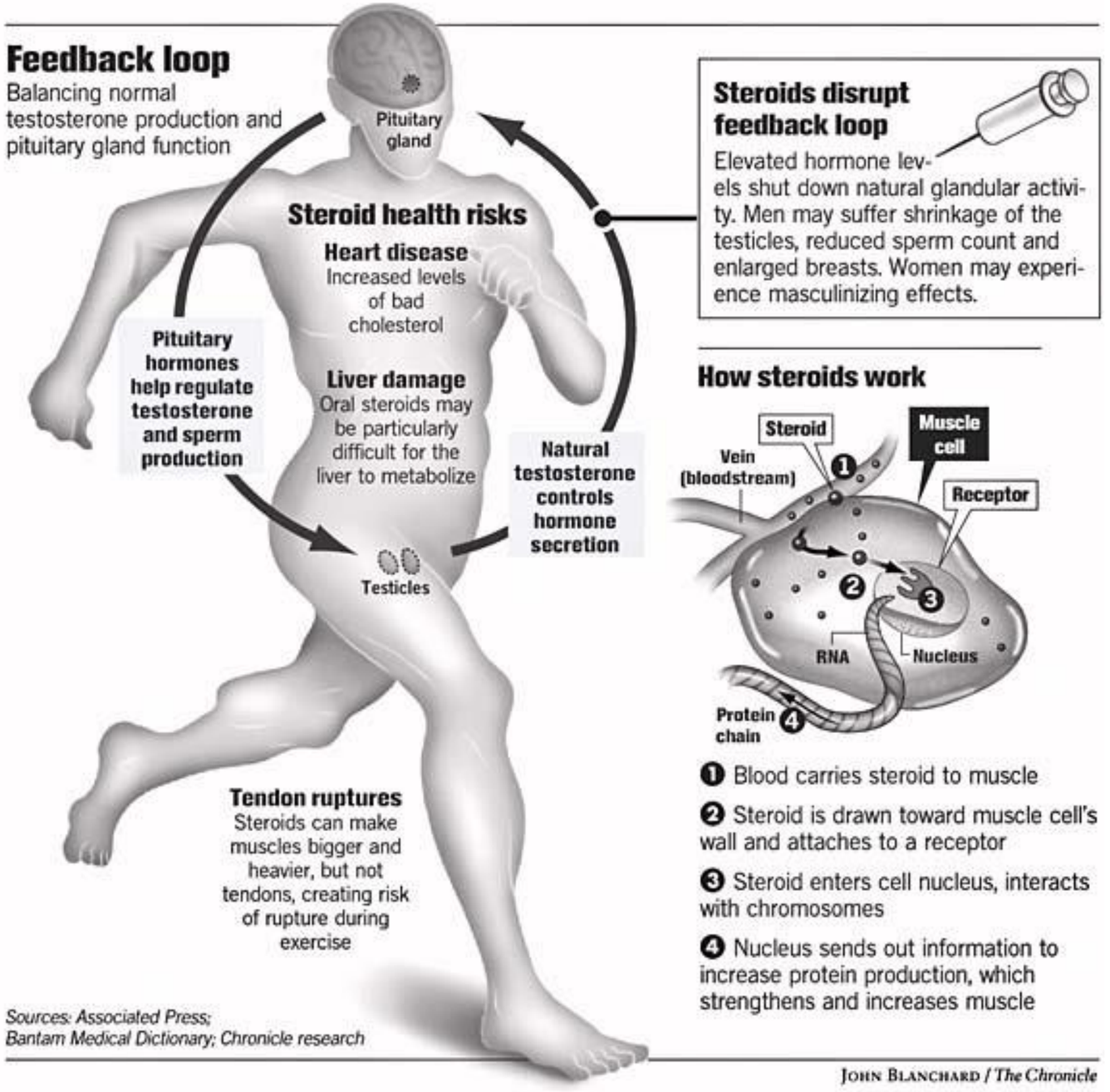
Ana Carolina Paludo [1], Armin Paravlic [1,2,3], Kristýna Dvořáková [4] and Marta Gimunová [5*]*

Hormonal Doping

Anabolic-Androgenic Steroids (AAS)

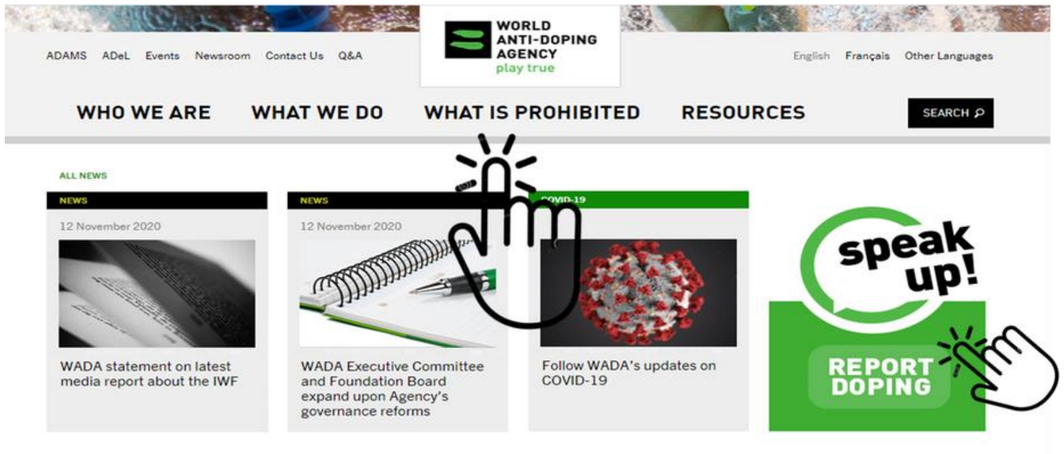
Synthetics derivatives of testosterone

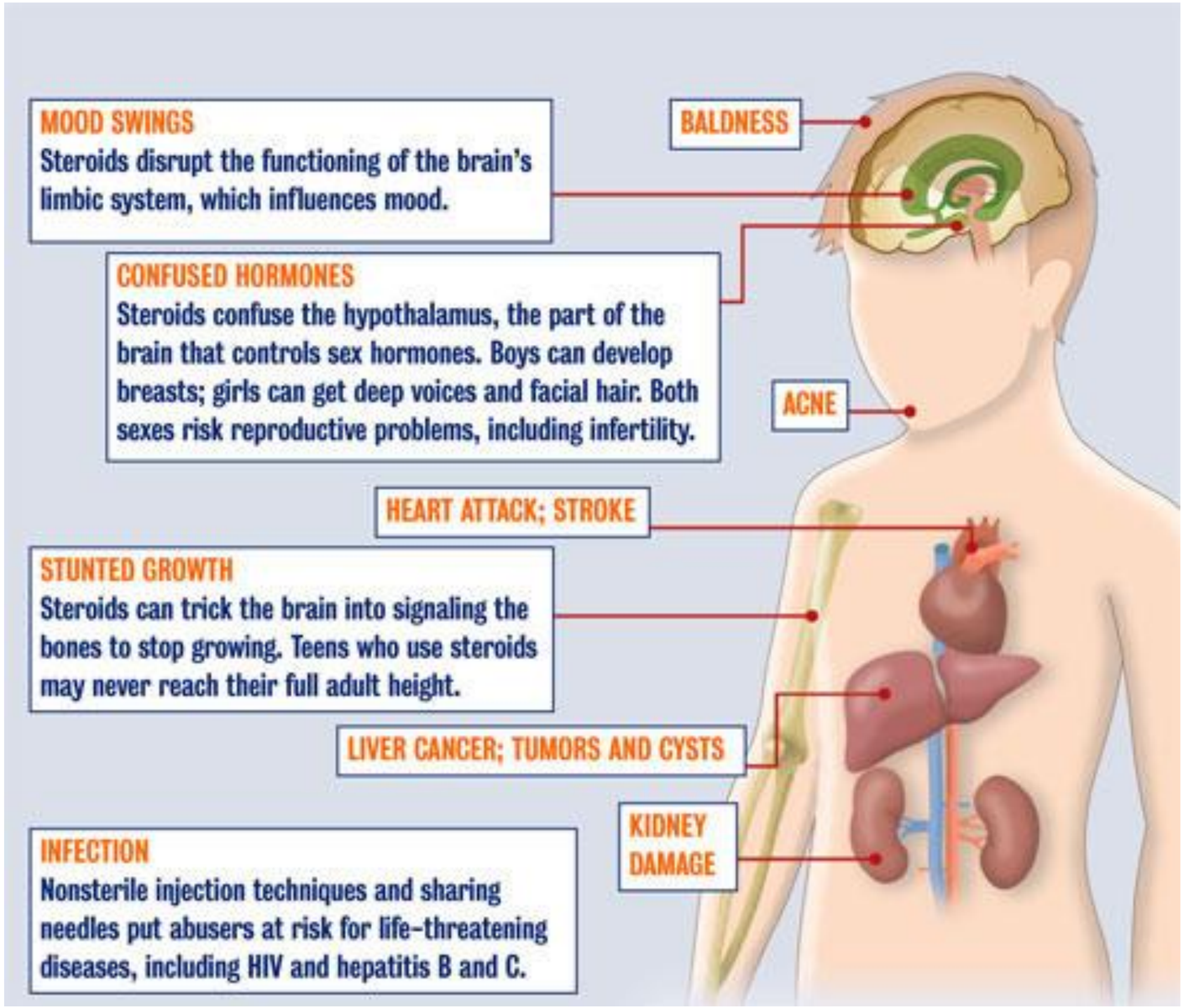
Anabolic: muscle growth, major recovery, pain tolerance, aggression.
Androgenic: secondary sexual characteristics



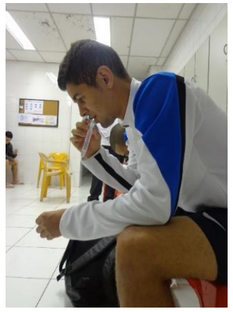
Hormonal Doping

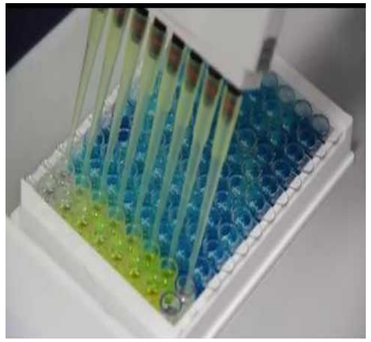
Side effect of AAS use

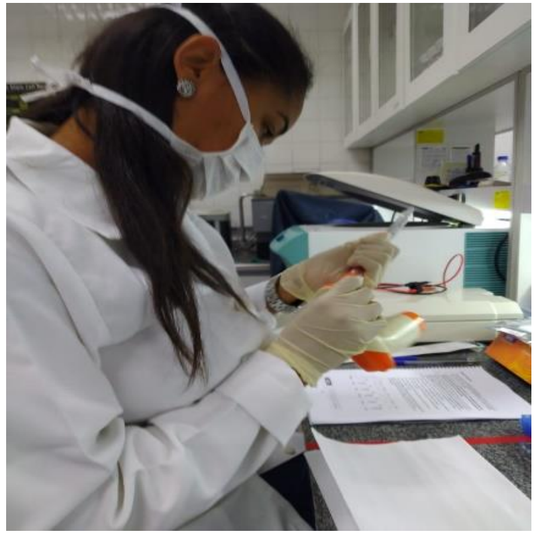




Hormonal Evaluation

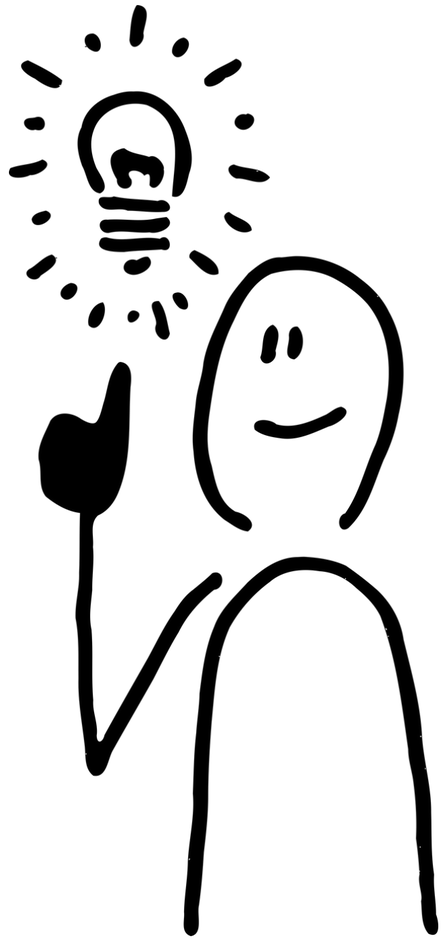






Practical Application

Task: search for an article about hormone and the sport modality



Obrigada

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Complementary material:

Exercise associated hormonal signals as powerful determinants of an effective fat mass loss. https://pubmed.ncbi.nlm.nih.gov/26238498/

Enhancement of hypothalamic-pituitary activity in male athletes: evidence of a novel hormonal mechanism of physical conditioning. https://bmcendocrdisord.biomedcentral.com/articles/10.1186/s12902-019-0443-7.

https://www.youtube.com/watch?v=C0EcMJ7CZfY