Idratazione ed attività sportiva

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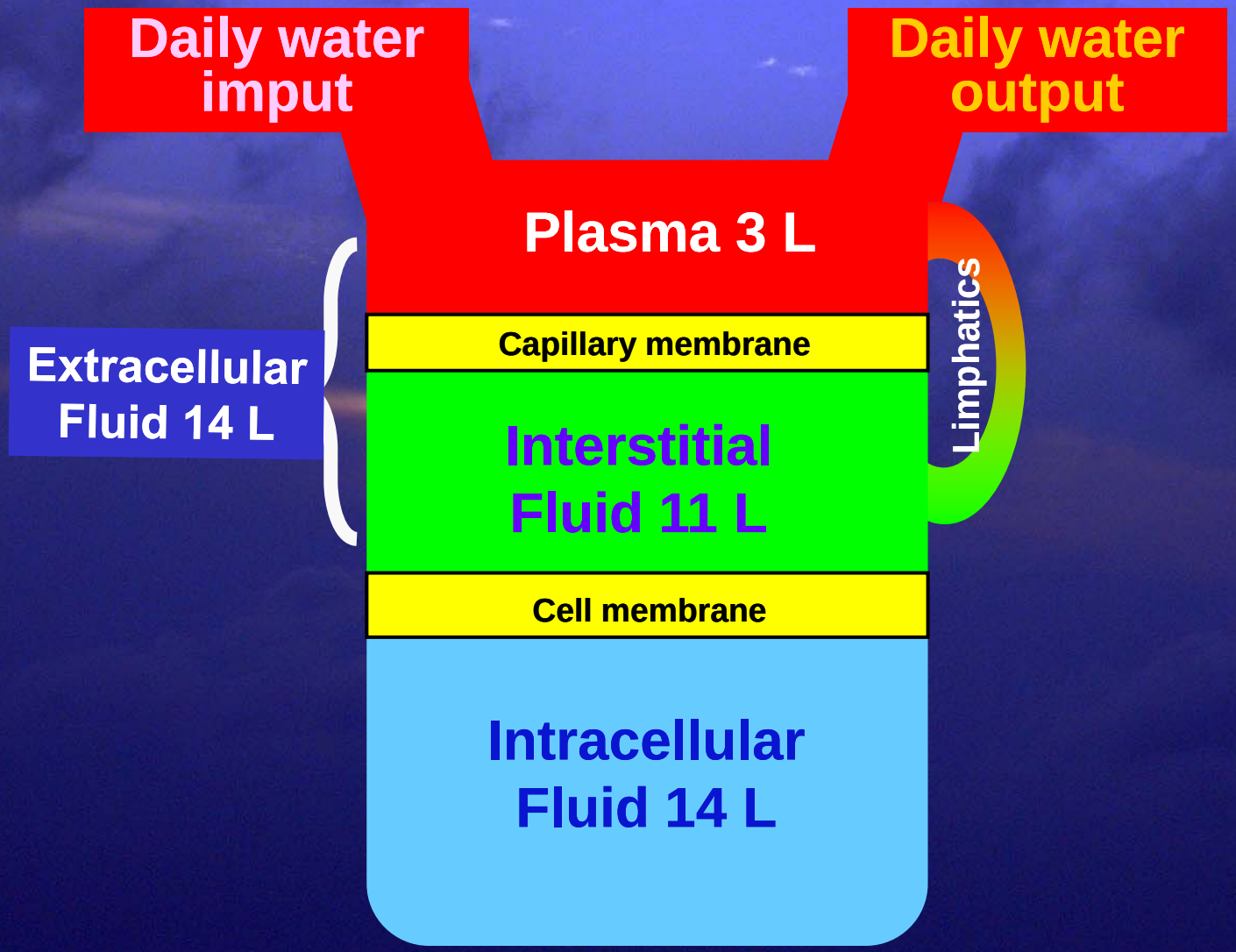
Water
Does not have energetic power.
Has a plastic,hydratant, protective
and bioregular function
0.001 % in the universe
66% of the earth surface
40 - 60 % body weigth
65 - 75 % muscolar mass
90 % cellular weigth

Water is our most important nutrient. We would die much more quickly if deprived of water than than we would if deprived of any other nutrient.
Among its most important functions, water provides:

- Transportation between and delivery to the body different tissues,
- Regulation of body temperature
- Mantainement of blood pressure for proper cardiovascular function.

Fluids Compartements



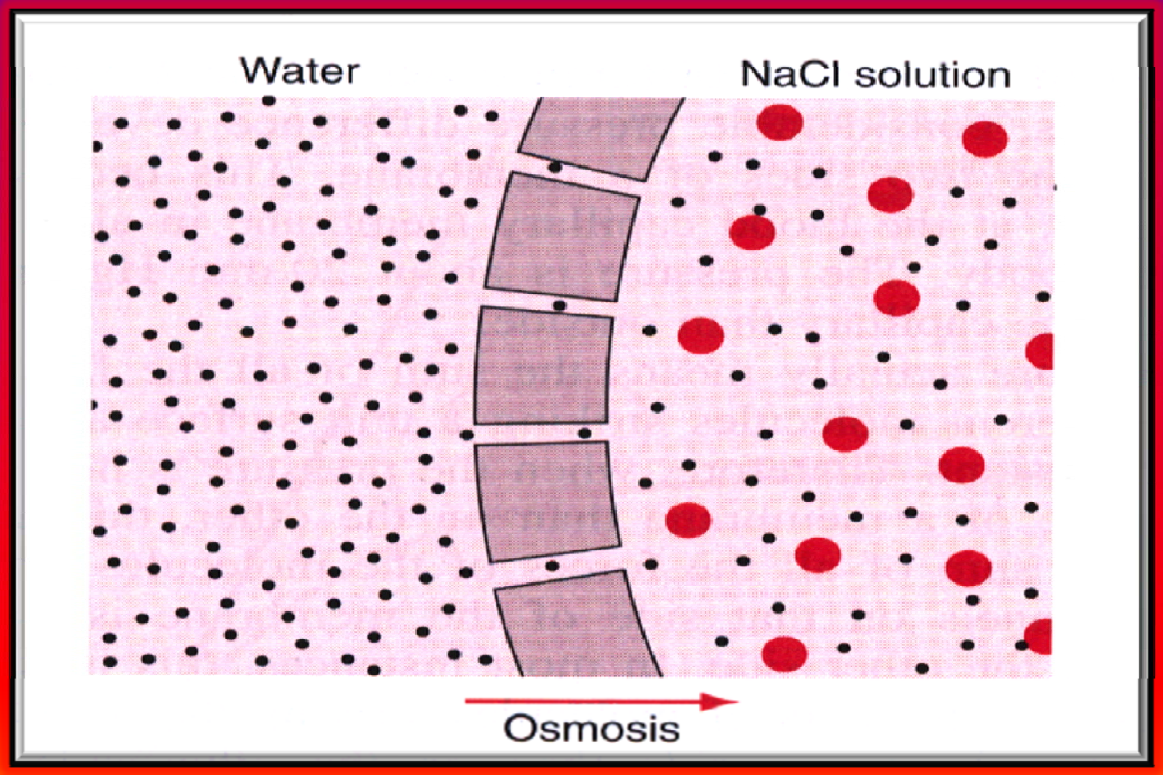
Fluids Compartements

- Body fluids contain many dissolved molecules and minerals.The presence of these particles in variuos body fluid compartement generates an osmotic pressure or attraction to retain water within that compartement
- The amount of osmotic pressure exerted by a body fluid is proportional to the number of molecular particle in solution
- Increasing the osmolarity in one body compartement generally causes water to be drawn away from adjacent compartements that have a lower osmolarity

Osmolarity and Volumes variation effects: Local

Volumes Reduction

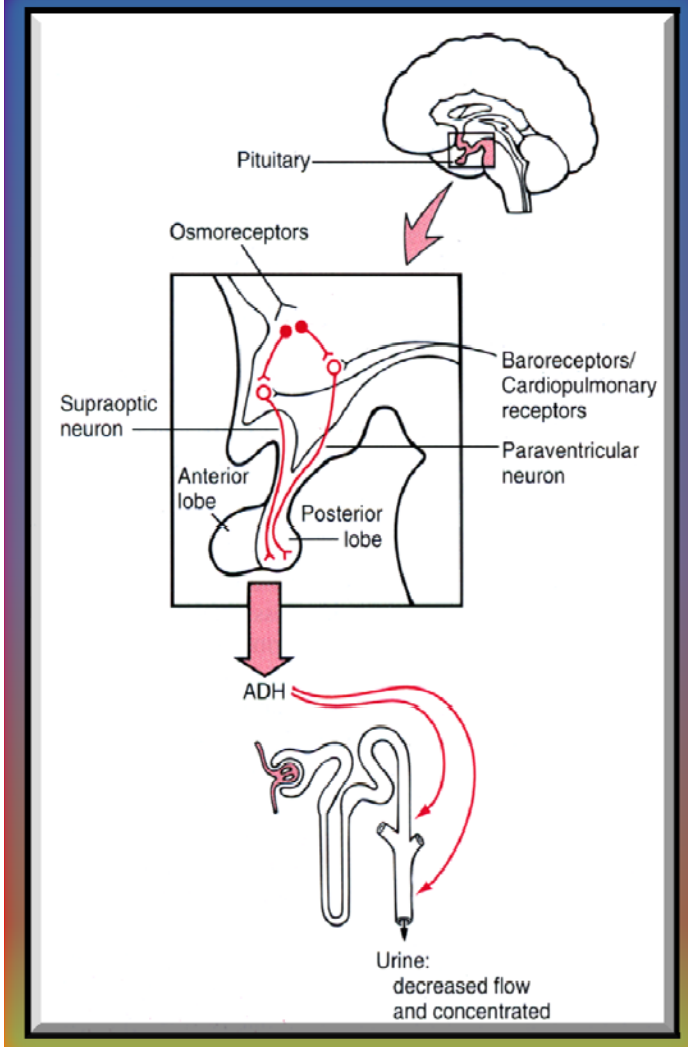
+ Extracellular Na^+ Concentration



Electrolites and Osmolarity following 2 h of exercise

	Electrolite mEq/l				Osmol (mOsm/l)
	Na^+	Cl^-	K^+	$Mg2^+$	
Sweat	40-60	30-50	4-6	1.5-5	80-185
Plasma	140	101	4	1.5	295
Muscle	9	6	162	31	205

Osmolarity and Volumes: Systemic effects



Volumes Reduction

Extracellular Na^+ Concentration

+ Osmolarity extracellular liq

↓

Osmoceptors
Hypotalamus

↓

ADH release

↓

Renal water retention

Osmolarity and Volumes variation effects: *Systemic*

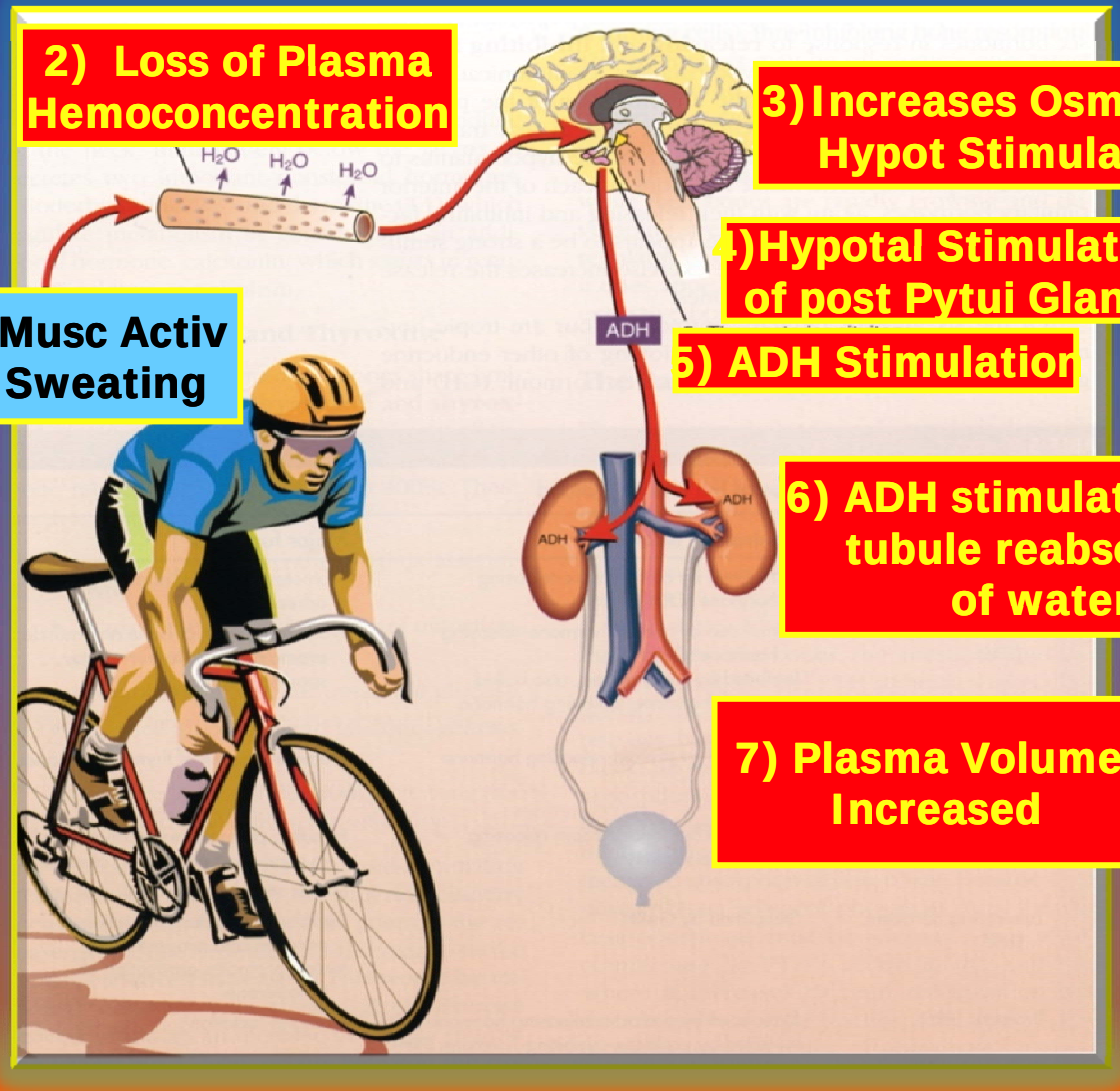
Volumes Reduction

renal flow reduction

Renin-angiotensin Sistem
& Aldosterone

Aldosterone increases
Na^+ H_2O reabsorption

Prolonged Exercise & ADH

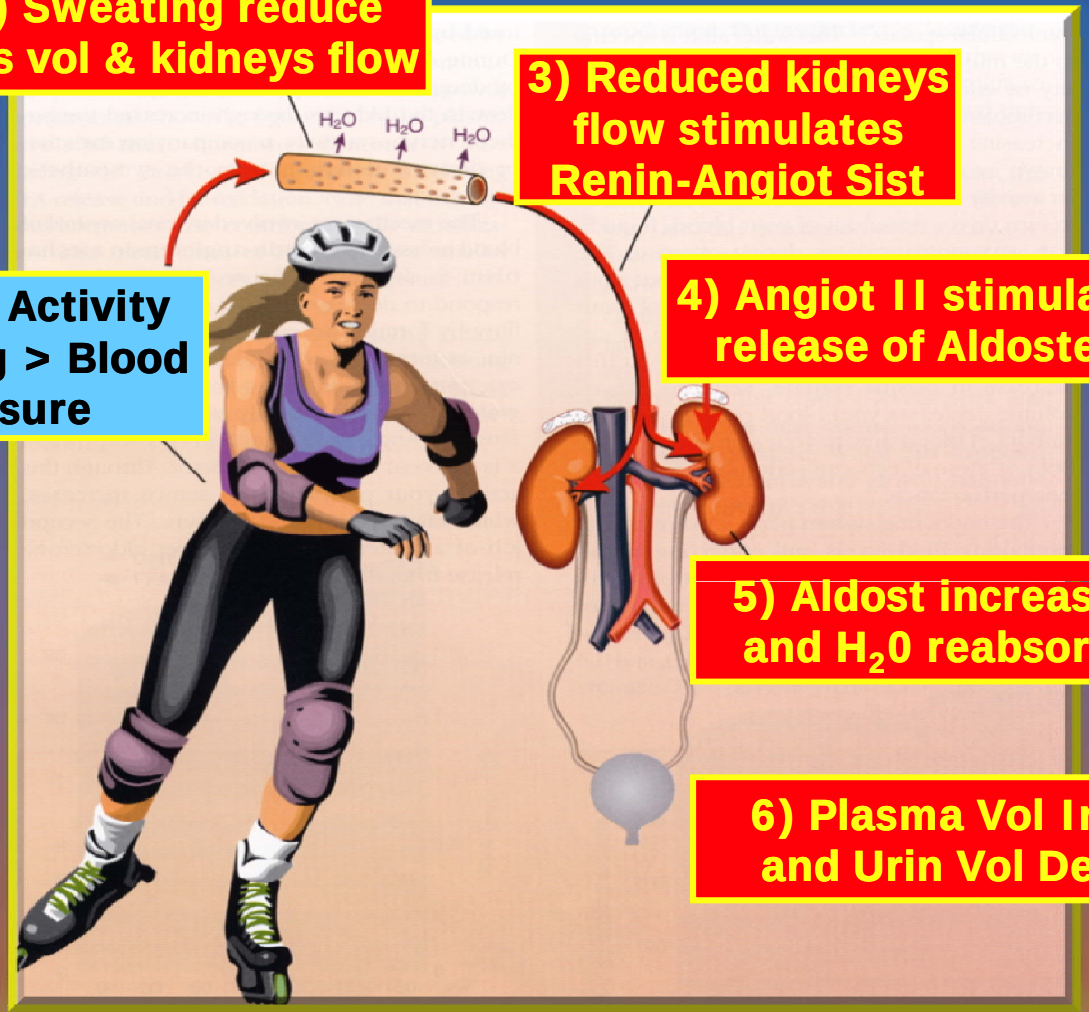


Prolonged Exercise & Aldost

2) Sweating reduce plas vol & kidneys flow

3) Reduced kidneys flow stimulates Renin-Angiot Sist

1) Musc Activity Sweating > Blood Pressure

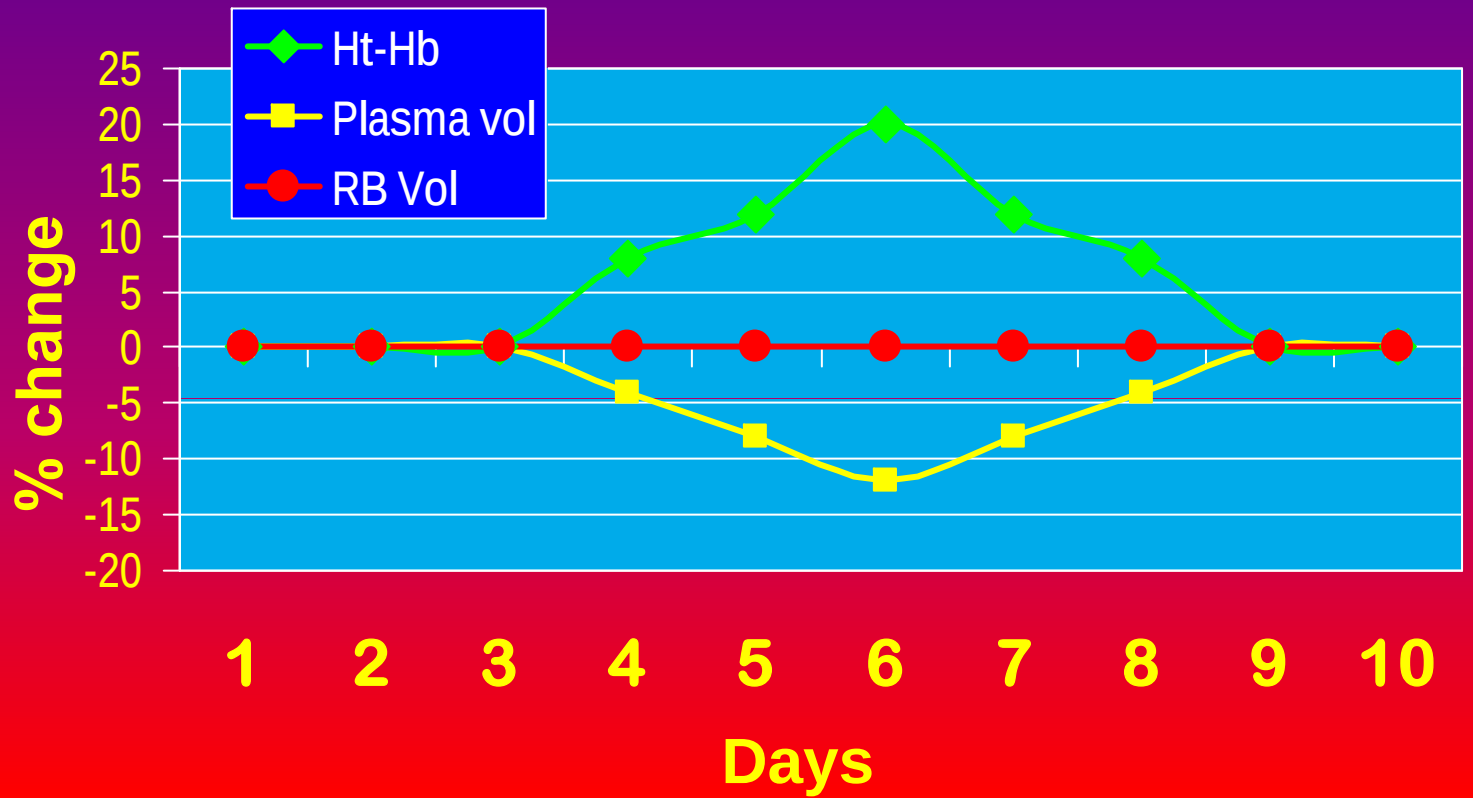


4) Angiot II stimulates release of Aldoster

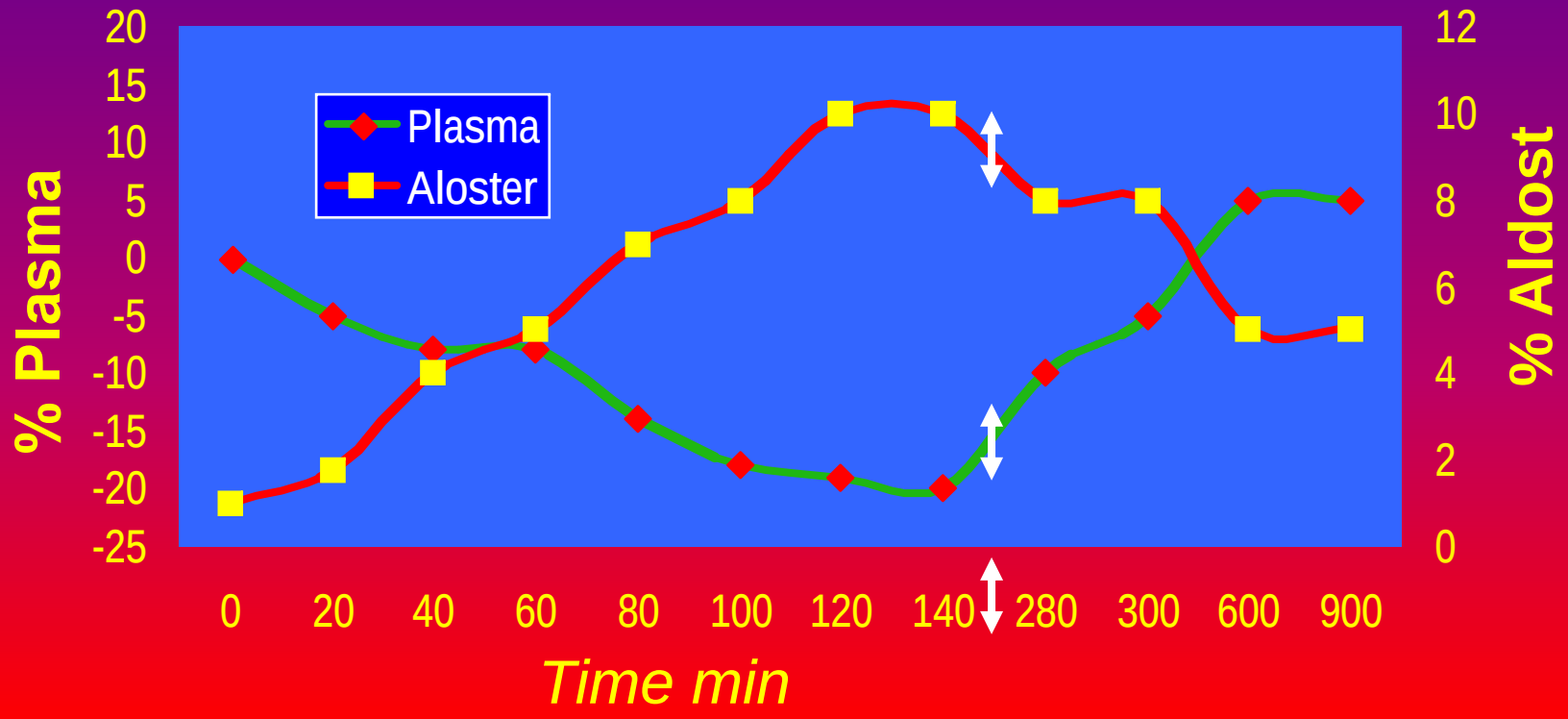
5) Aldost increases Na and H_20 reabsorption

6) Plasma Vol Increases and Urin Vol Decreases

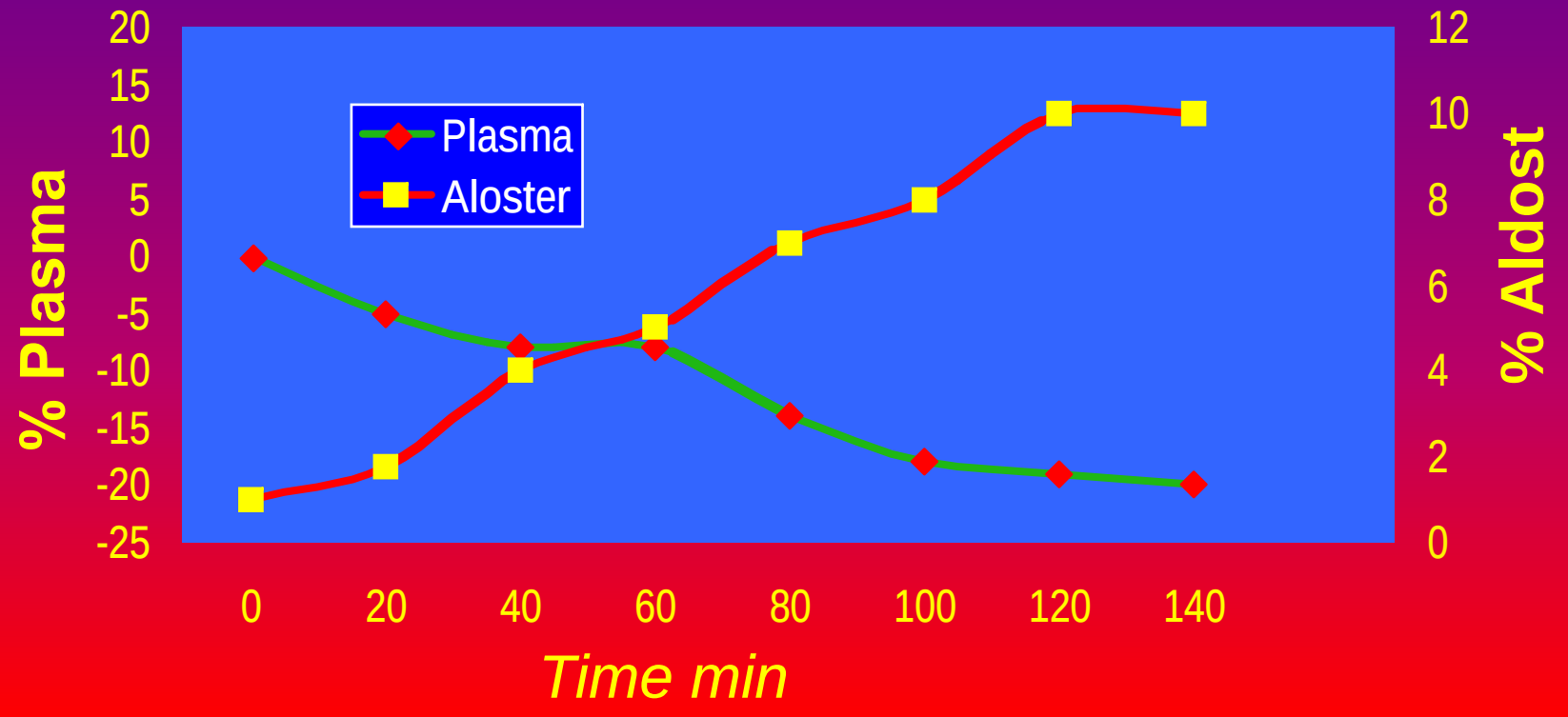
Change in Plasma Vol during 3 days of repeated exercise & dehydration



Change in Plasma Volume & Aldo during & after exercise



Change in Plasma Volume & Aldosterone during exercise



Water Balance at rest

Normal daily water intake of about 2.5 liter is supplied from:

1) **liquid intake (1.2 liter)**
2) **food (1 liter)**
3) **metabolic water produced during energy yelding reactions (0.3 liter).**

Water Balance at rest

Water is lost each day from the body :

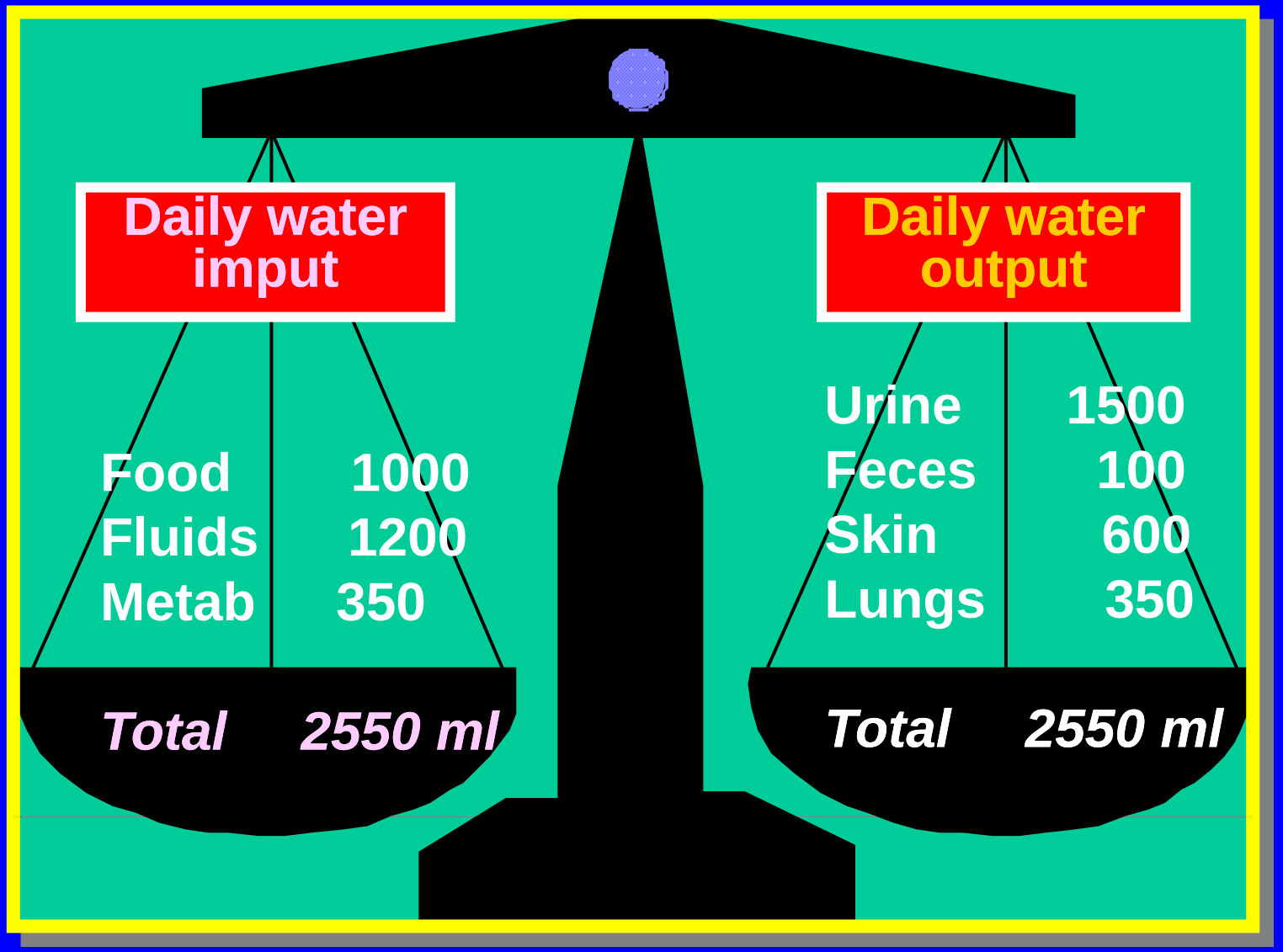
1) in the urine (1-1.5 liters)

2) through the skin as insensibile perspiration (0.5 0.7 liter)

3) as vapor water in expired air (0.25 0.30 liters)

4) in feces as about 70% of fecal matter is water (0.10 liters)

Water Balance at rest



Water loss at rest and during prolonged exercise

Source of loss	Resting		Exercise	
	ml/h	% total	ml/h	% total
Skin	14,6	15	15	1,1
Respir	14,6	15	100	7,5
Sweat	4,2	5	1.200	90,6
Urine	58,3	60	10	0,8
Feces	4,2	5	0	0
Total	95,9 ml/h		1325 ml/h	

⇒ 3.500 ml/h

Barr et al 1991

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Plasma decrease
Htc increase

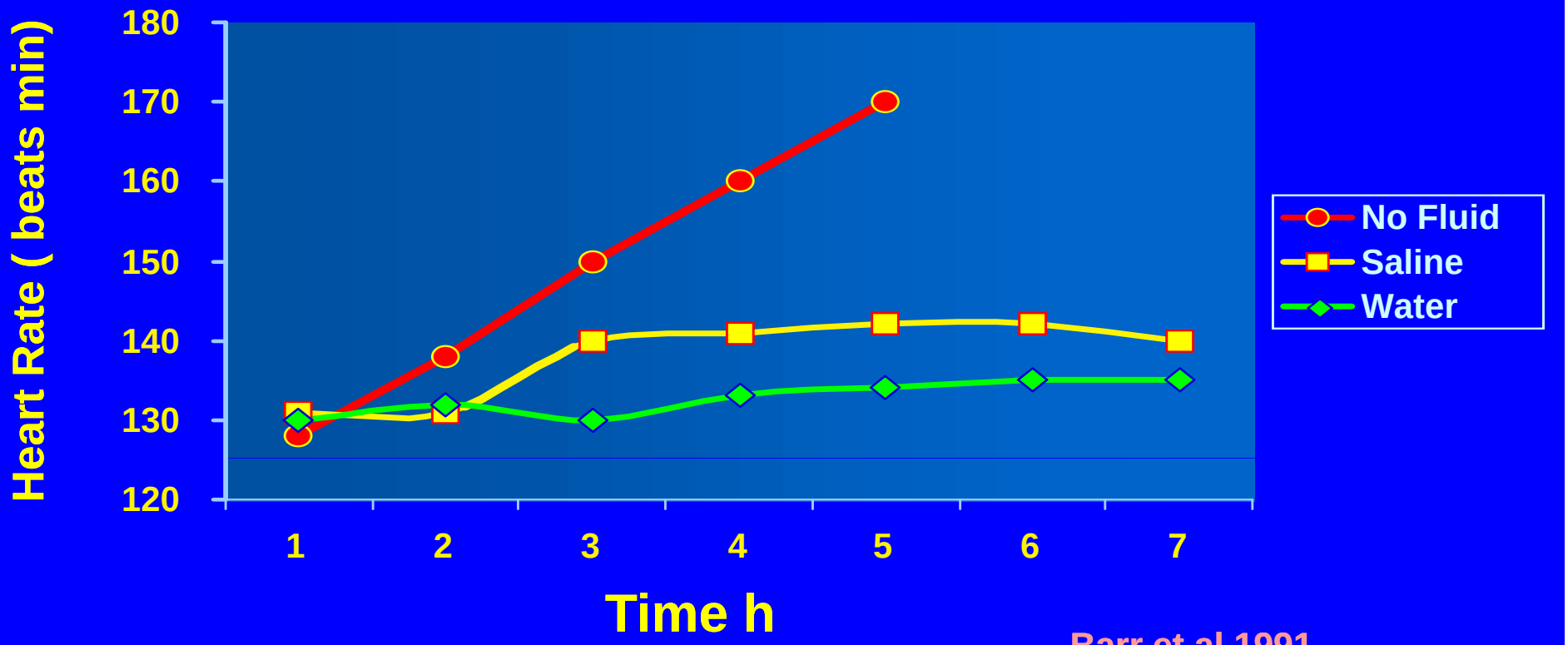
Barr et al 1991

Water Balance

- **Exercise in hot weather greatly increases the body's water requirements.**
- **In extreme conditions the fluid needs can increase five or six times above normal.**

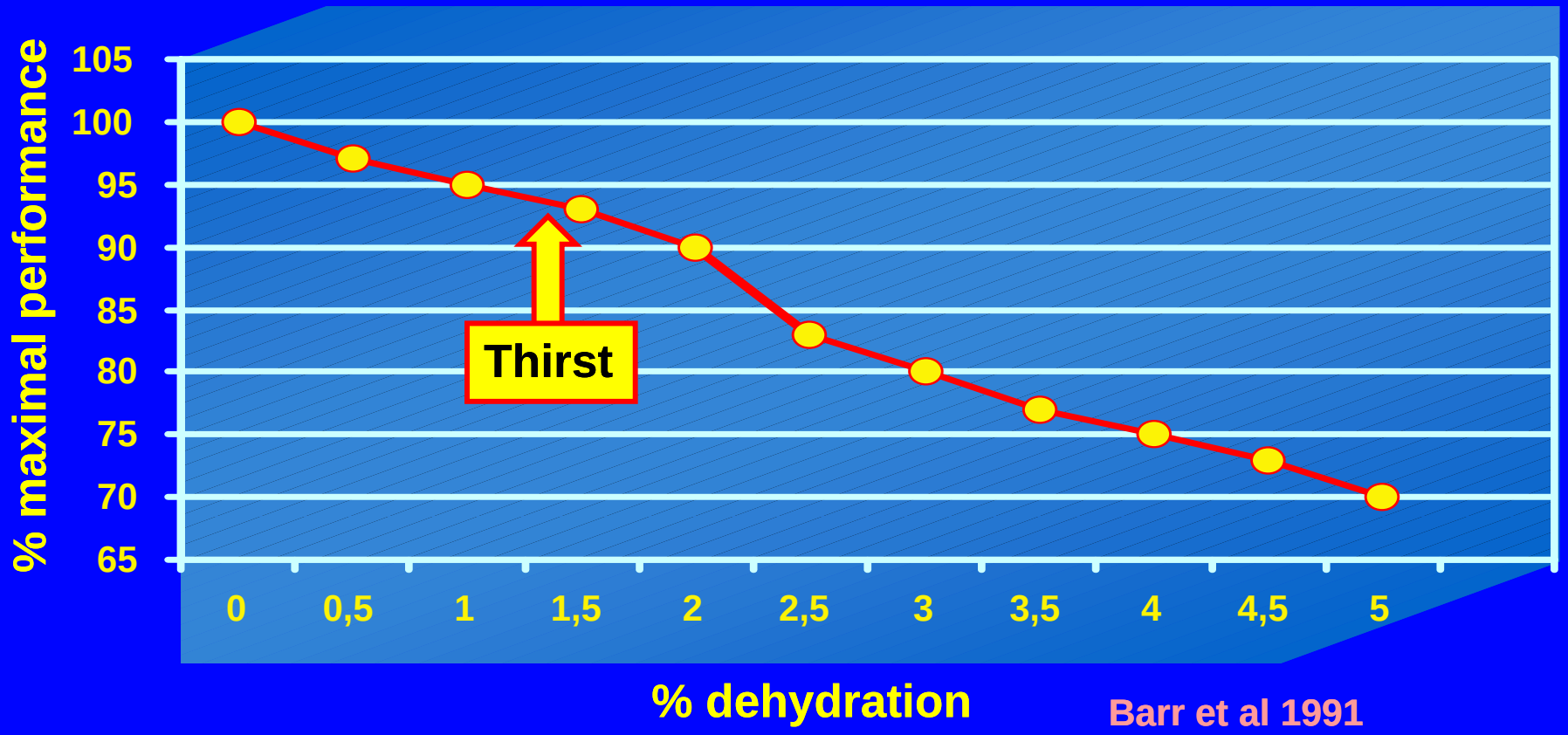
Am.Chem Soc 1986

Fluids Intake and Heart Rate during Prolonged Exercise



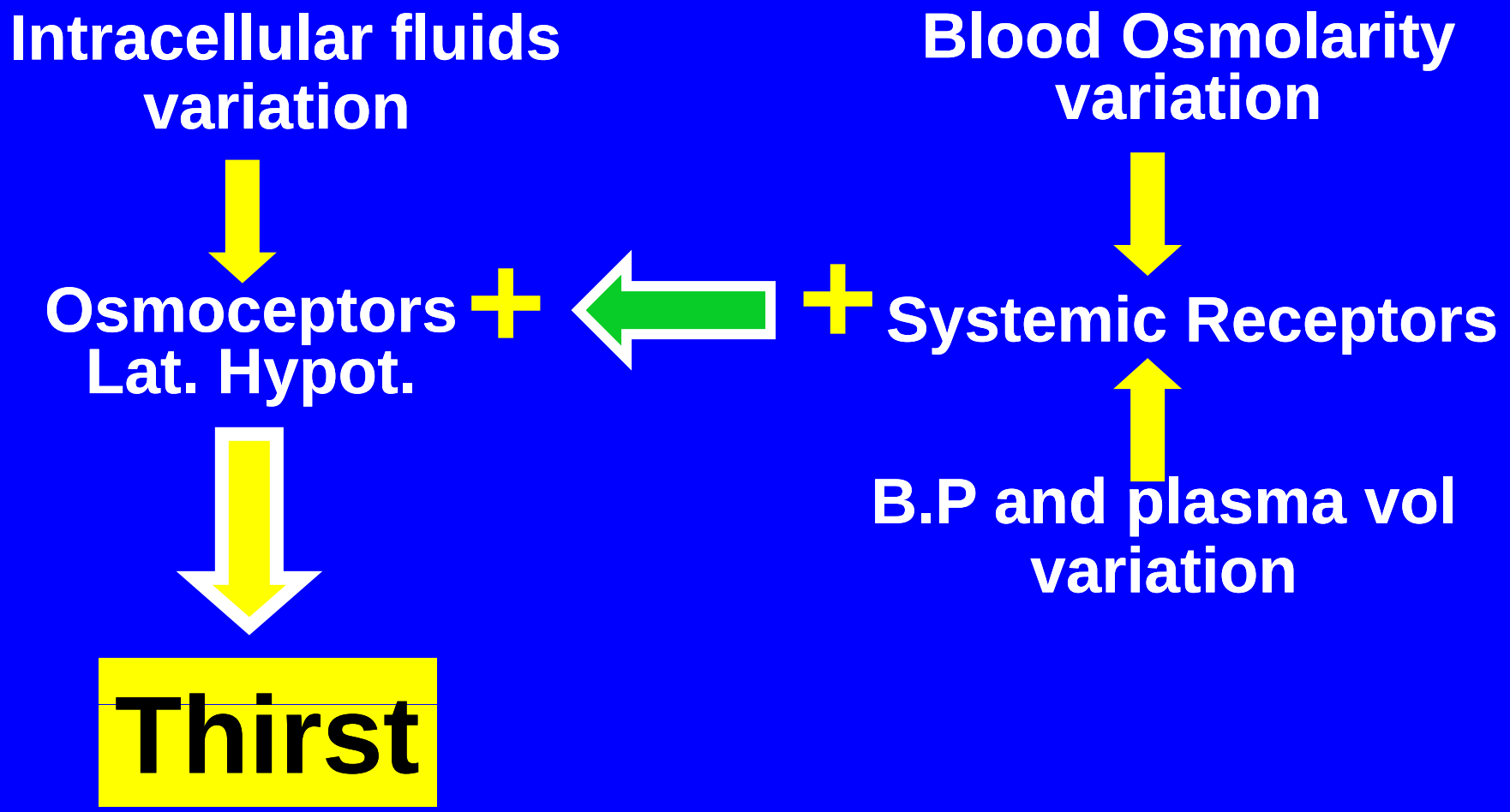
Barr et al 1991

Maximal Performance & Dehydration



Barr et al 1991

Thirst mechanism



Sport & Water Balance

Normohydration represents indeed a key condition for physical practice and muscolar performance. Hypohydration can infact impair exercise capability and finally cause serious disability or even death, particularly in hot and humid enviroments

Am.Chem Soc 1986

Exercise and fluids replacement

- Hydration before
- Hydration between
- Rehydration

Am Coll Sports Med Position Stand 1996

Exercise and fluids replacement

- Hydration before
- Hydration between
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Am Coll Sports Med Position Stand 1996

- Nutritionally balanced diet and drink adequate fluids during 24-hr before an event
- Drink 500 ml of fluid about 2 h before exercise
- During exercise drink early and at regular intervals
- Ingested fluids be cooler than ambient temperature (15-22°C)
- Addition of carbohydrates and/or electolytes for exercise events of duration greater than 1 h

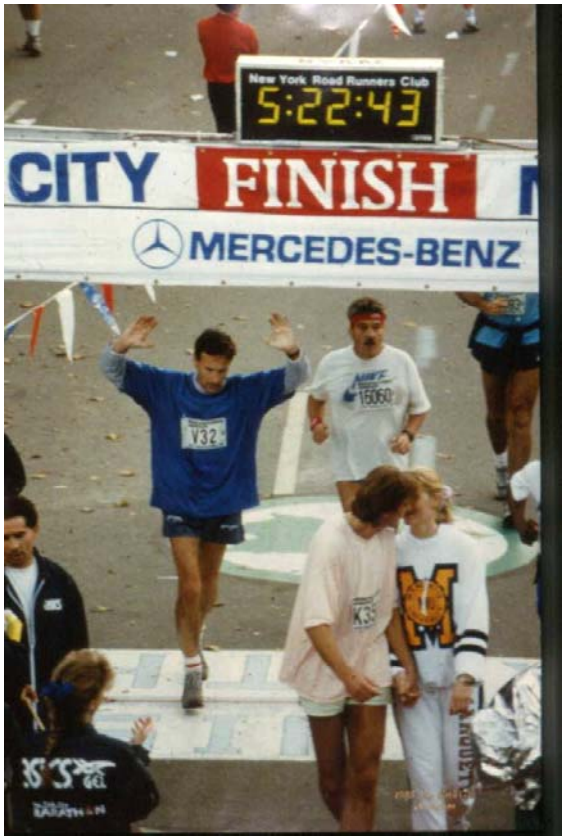
Am Coll Sports Med Position Stand 1996

Bevanda Ideale?

Elementi Caratterizzanti in ioni per mg/lt

• Bicarbonato	650
• Calcio	169
• Cloruro	75
• Fluoro	1,0
• Litio	0,2
• Magnesio	32,8
• Nitrico	6,5
• Potassio	8,1
• Sodio	87
• Solforico	111,4
• Silice	7.3
• CO2	1265

Hyponatriaemia and exercise



CLINICAL SIGNIFICANCE

- Inappropriate antidiuretic hormone secretion exists in patients with exercise-associated hyponatremia.

- Headache, nausea, and vomiting—especially when accompanied by changes in mental status—are warning signs of exercise-associated hyponatremia. Mild cases can be managed by restricting fluids until the onset of urination. Manifestations of hypotonic encephalopathy indicate the need for emergent treatment with hypertonic solutions such as 3% saline or mannitol.

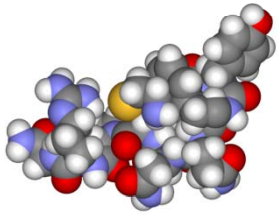
Hyponatraemia and exercise

BJSM ONLINE

Case proven: exercise associated hyponatraemia is due to overdrinking. So why did it take 20 years before the original evidence was accepted?

T D Noakes and D B Speedy

Br. J. Sports Med. 2006;40;567-572
doi:10.1136/bjsm.2005.020354



Exercise-associated hyponatraemia: facts and myths

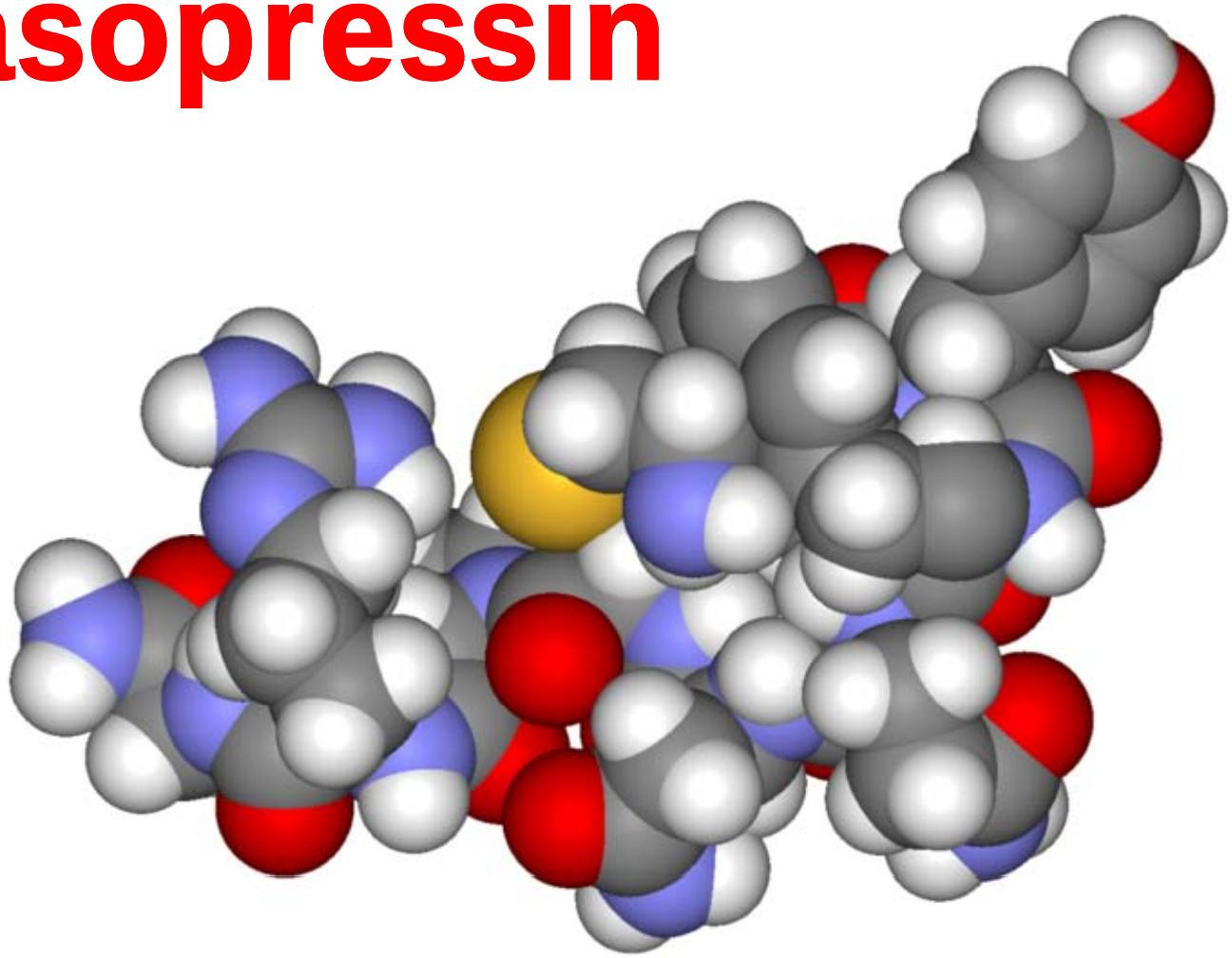
Yoram Epstein and Yoav Cohen-Sivan

Br. J. Sports Med. 2007;41;111-
doi:10.1136/bjsm.2006.031005

- Firstly, sometime around 1990, the US military adopted new drinking guidelines, aimed at reducing the risk of “heat illness” in military personnel.These new guidelines required that US army personnel were hence forth mandated to ingest 1.8 litres of fluid every hour that they were exposed to temperatures in excess of 30°C.
- The immediate result of these new guidelines was that the incidence of EAH increased dramatically in the US. military with 125 cases of EAHE requiring hospital admission between 1989and 1996.In addition, there were at least six recorded deaths.
- Of these 125 cases, 40 occurred at a single training facility, Fort Benning in Georgia. Evaluation of these 40 cases showed that “ all were associatedwith excessive water intake.

- In contrast, in 1996 the American College of Sports Medicine (ACSM), an organisation whose only two “platinum” sponsors are Gatorade and the Gatorade Sports Science Institute (GSSI), produced its modified guidelines, which promoted the concept that subjects should drink “ as much as tolerable” during exercise.
- This was linked to an extensive marketing campaign, directed by the sports drink industry through the GSSI, to promote this novel dogma.

Vasopressin



- Vasopressin is a peptide hormone. It is derived from a preprohormone precursor that is synthesized in the hypothalamus, from which it is liberated during transport to the posterior pituitary. Most of it is stored in the posterior part of the pituitary gland to be released into the blood stream; some of it is also released directly into the brain.
- AVP allows water reabsorption by the introduction of additional water channels in cortical and inner medullary collecting ducts.
- Vasopressin is secreted from the posterior pituitary gland in response to reductions in plasma volume and in response to increases in the plasma osmolality:

The secretion of vasopressin

Reduced plasma volume **is activated by pressure receptors in the veins, atria, and carotids**

Increases in plasma osmotic pressure **is mediated by osmoreceptors in the hypothalamus**

Angiotensin II ***stimulates*** **the secretion of vasopressin.**

Nonosmotic stimulation **of arginine vasopressin secretion may be mediated in part by enhanced release of muscle-derived interleukin-6 during glycogen depletion.**

Ethanol and **caffeine** *reduce* vasopressin secretion. The resulting decrease in water reabsorption by the kidneys leads to a higher urine output.

Coffee is an example of a food product that supresses the body's release of antidiuretic hormones, due to its level of caffeine. This intake of caffeine causes the body to lose more water and may lead to dehydration if consumed excessively.

Volumes Reduction

Extracellular Na+ Concentration
+ Osmolarity extracellular liq

Nonosmotic Angiotensin II

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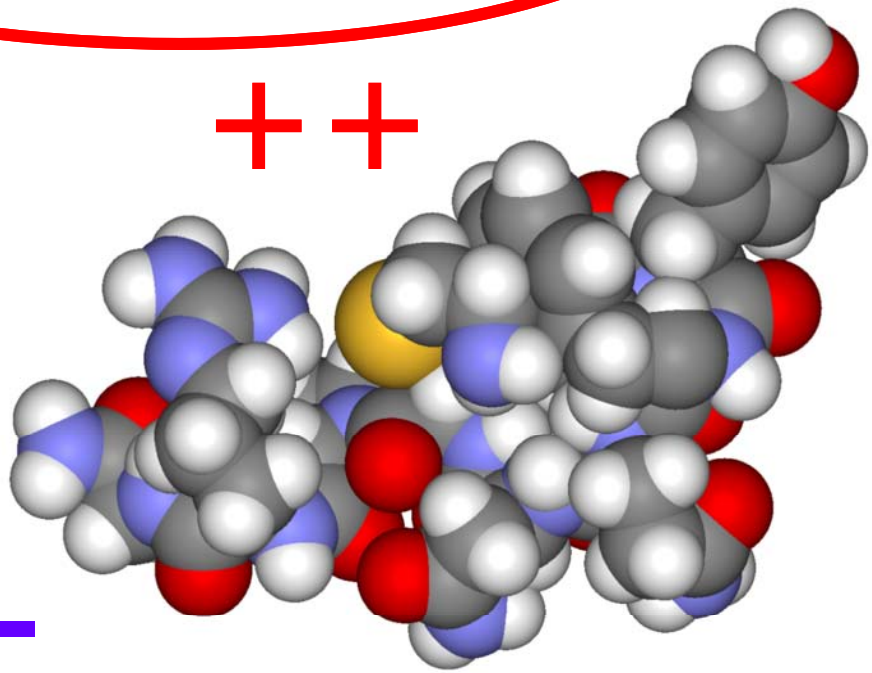

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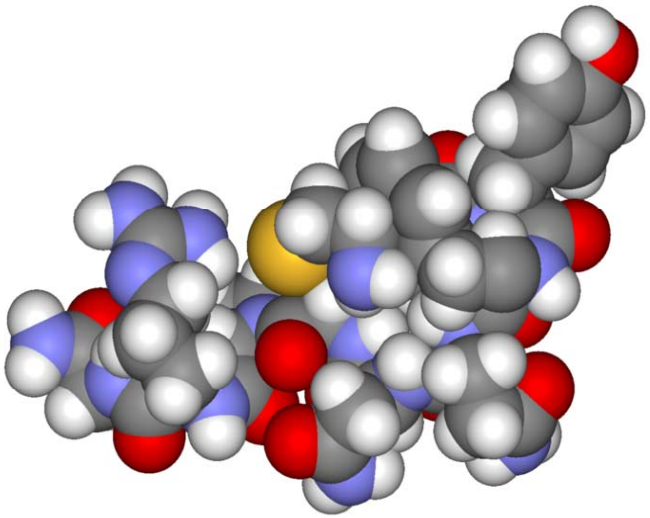
Ethanol and caffeine

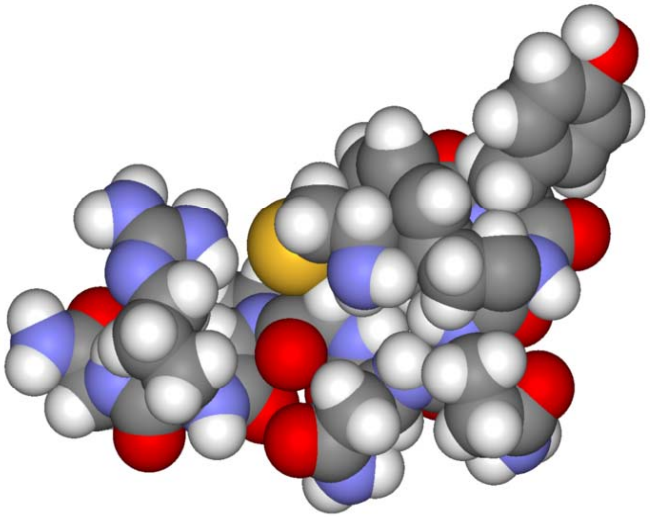
Hyponatriaemia and exercise



In summary, the current hypothesis is that three factors determine the probability that EAH will develop:

- overdrinking owing to biological or psychological factors
- inappropriate antidiuretic hormone secretion, in particular the failure to suppress antidiuretic hormone production in response to an increase in total body water
- failure to mobilise [Na+] from internal osmotically inactive sodium stores or, alternatively, the inappropriate osmotic inactivation of circulating [Na+].

Hyponatriaemia and exercise



In CONCLUSIONS: Cases of EAH fulfill the essential diagnostic criteria for the syndrome of inappropriate antidiuretic hormone secretion (SIADH). Runners with hypotonic encephalopathy at subsequent races were treated with intravenous hypertonic (3%) saline on the basis of this paradigm, which resulted in rapid clinical improvement without adverse effects. Release of muscle-derived interleukin-6 may play a role in the nonosmotic secretion of arginine vasopressin, thereby linkingrhabdomyolysis to the pathogenesis of EAH..

Exercise and fluids replacement

- Hydration before
- Hydration between
- **Rehydration**

Am Coll Sports Med Position Stand 1996

Rehydration can be achieved only if sweat electrolyte losses as well as water are replaced. The speed of rehydration becomes fundamental in intermittent or long lasting exercise and it depends on sodium and potassium concentrations of drinks consumed.

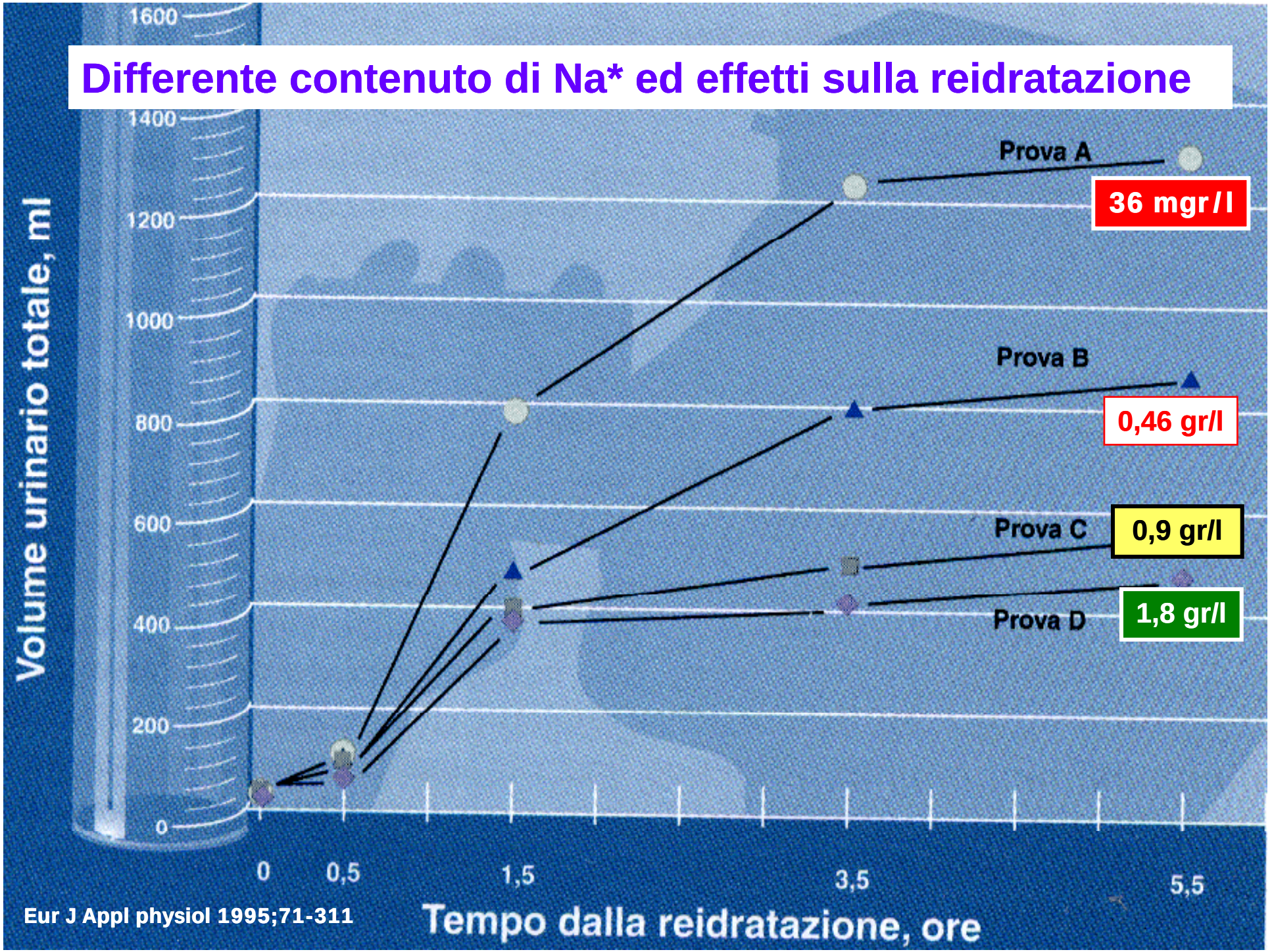
Maughan 1998

Drinks intended specifically for rehydration should have higher electrolyte content than drinks formulated for consumption during exercise.

Drink 50 mmol(900mg) L^{-1} sodium

SM Shirreffs, RJ Maughan. Ex Sport Sc Reviews 2000: 1

Differente contenuto di Na* ed effetti sulla reidratazione



Eur J Appl physiol 1995;71-311

The ideal oral rehydratation beverage

- Tastes good
- Absorbs rapidly
- Causes little or no gastrointestinal distress
- Mantains extracellular fluid volume and osmolarity
- Offfers the potential to enhance exercise performance

Am Coll Sports Med Position Stand 1996

Hydration and Physical Activity
How Can I measure euhydration?


Conosci te stesso

American College of Sports Medicine Roundtable on Hydration and Physical Activity: Consensus Statements

Douglas J. Casa, PhD, ATC, FACSM, Priscilla M. Clarkson, PhD, FACSM,*
and William O. Roberts, MD, FACSM

- **Urine-specific gravity, urine color, and urine osmolality are useful screening measures of hydration status.**
- **A euhydrated athlete will usually have a urine specific gravity of less than 1.020, a pale yellow urine color, and a urine osmolality of less than 700 mOsm/kg.**
- **Level of evidence: A**