Inserm
La science pour la santé
From science to health

C2VN Marseille
Center for CardioVascular and Nutrition research

Aix*Marseille université
Initiative d'excellence

Boire ou ne pas Boire plus?

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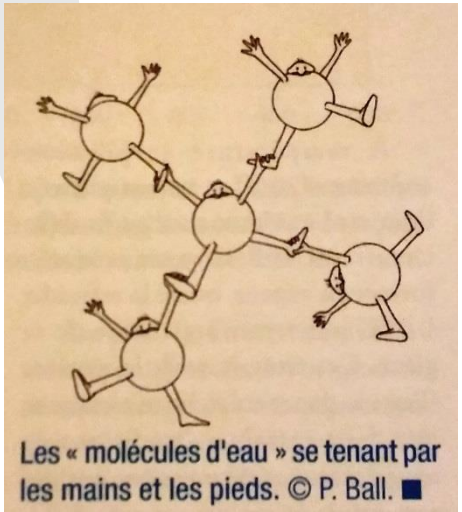
Marseille

Déclaration conflits d'intérêts

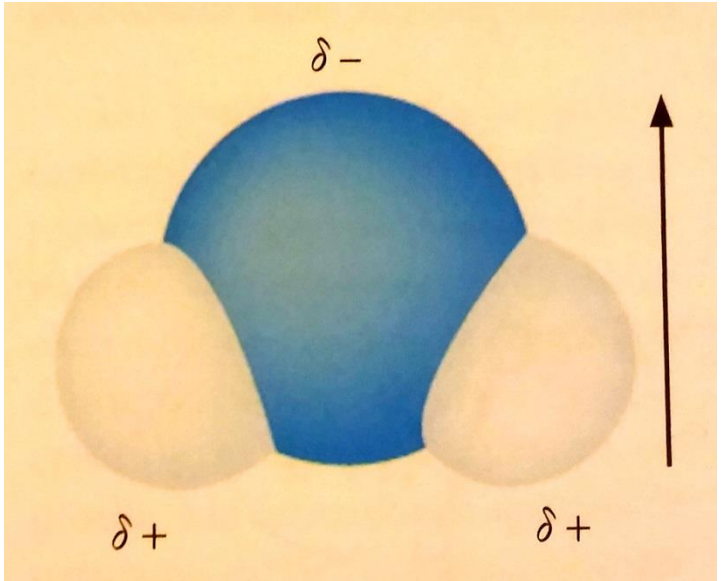
- Alexion
- Amgen
- Genzyme
- Baxter
- Fresenius Kabi
- Sanofi
- Otsuka

L'eau

- La molécule sans laquelle la vie ne serait pas possible
- H_2O: Le solvant de la vie sur terre
  - La molécule la plus simple.
  - Un dipole
  - Des propriétés incroyables essentiellement dues aux liaisons hydrogènes



Les « molécules d'eau » se tenant par les mains et les pieds. © P. Ball. ■



Le mythe du « 8oz*8 » ou « 236ml*8 »

Table 2 Total water intake and beverage consumption among adults in different countries

Country	UK (2000/2001)	UK 2008/2010	UK 2008/2009	France	Germany	Sweden	The Netherlands	USA	USA
Units	Mean g/day	Mean g/day	Mean ml/day	Mean ml/day	Mean (ml/day)	Mean ml/day	Mean ml/day	Mean g/day	Mean ml/day
Total Water (M + F)	2396†	2418*	2494	1984	2039‡	2461‡	2222	3179	
Total Water (M)	2533	2604*	N/A	N/A	2259	2467	2622	3467	2595–3189§
Total Water (F)	2059	2234*	N/A	N/A	1875	2455	2402	2897	2219–2513§
Total beverages (M + F)	1727	1886	1970	1183‡	1500	1903	N/A	2594¶	2793
Total beverages (M)	1918	2052	N/A	1236	1530	1911	1708–2018§	2827¶	N/A
Total beverages (F)	1536	1725	N/A	1130	1469	1895	1762–1941§	2377¶	N/A
Reference	(S Gibson & S Shirreffs unpublished data)	(Bates *et al.* 2011)	(Ng *et al.* 2011)	†(Volatier 2000)	†(Manz and Wentz 2005)	†(Becker and Pearson 2002)	†(TNO 1998) (water); National Institute for Public Health and the Environment, 2011 (beverages)	(Kant *et al.* 2009)	(Popkin 2010)
Data source	NDNS 2000/1 raw	NDNS report Table 5.1	Fig 4; Table A2	INCA (AFFSA)	VERA	Riksmaten 1997–1998	Dutch Food Consumption Survey TNO 1998	NHANES 2005/2006	NHANES 2005/2006

La puissance du mythe

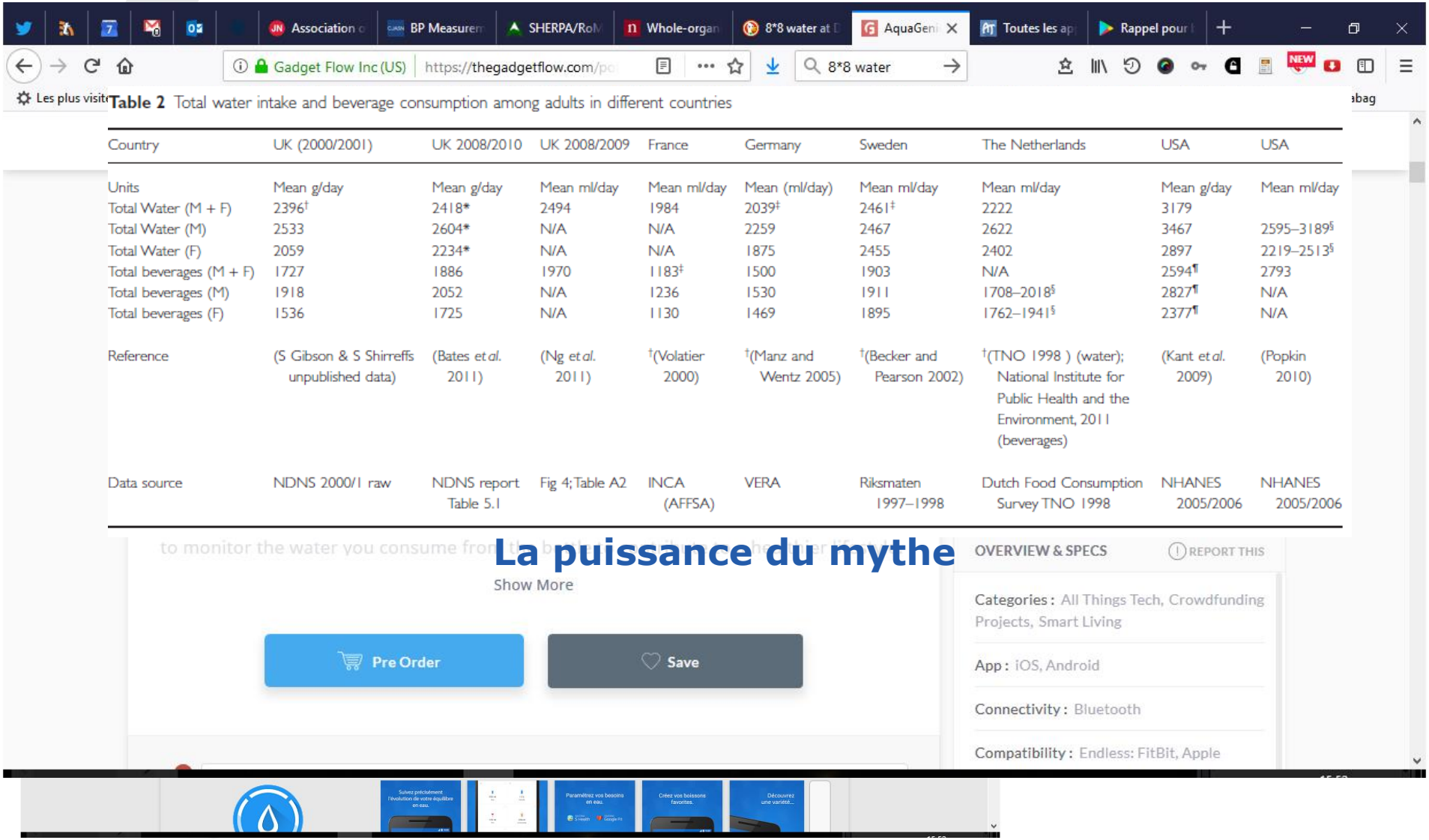
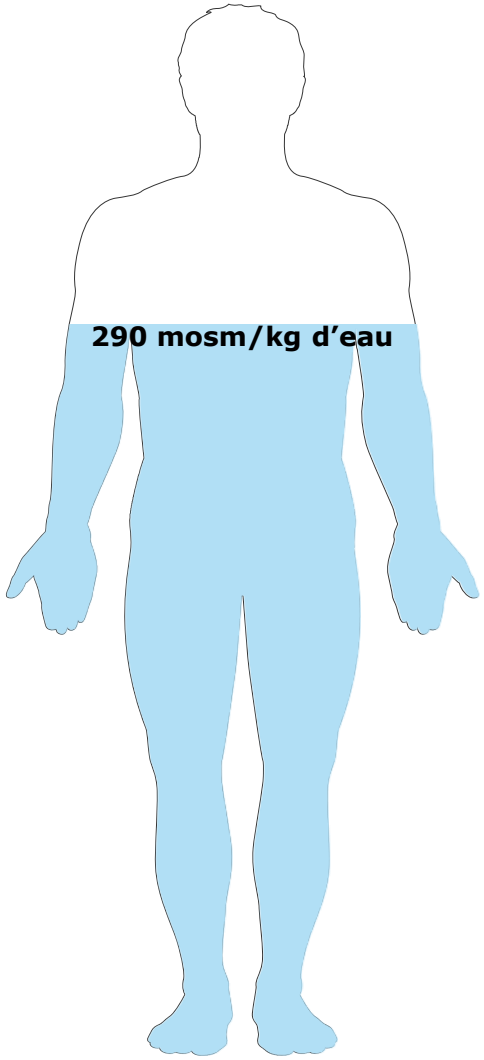


Table 1 Dietary reference intakes (adequate intakes) for total water set by the European Food Safety Authority (EFSA) and the Institute of Medicine (IOM)

	Adequate intake (L/day)			
	EFSA [3]		IOM [24]	
Age	Total water intake	Fluid intake[a]	Total water intake	Fluid (beverage) intake)
0–6 months	0.68[b]	0.68[b]	0.70	0.70
6–12 months (IOM 7–12 months)	0.80–1.00	0.64–0.80	0.80	0.80
1–2 years	1.10–1.20	0.88–0.90		
2–3 years	1.30	1.00		
1–3 years			1.30	0.90
4–8 years	1.60	1.20	1.70	1.20
9–13 years				
Boys	2.10	1.60	2.40	1.80
Girls	1.90	1.50	2.10	1.60
>14 years as adults				
Boys	2.50	2.00	3.30	2.60
Girls	2.00	1.60	2.30	1.80
Adults				
Men	2.50	2.00	3.30	2.60
Women	2.00	1.60	2.30	1.80
Pregnant women	+0.30		+0.30	0.10
Lactation women	+0.60 to 0.70		+1.10	0.90
Elderly	As adults	As adults	As adults	As adults

Un peu de physiologie



Métabolisme: 200 ml

Alimentation

Poumon:250 ml

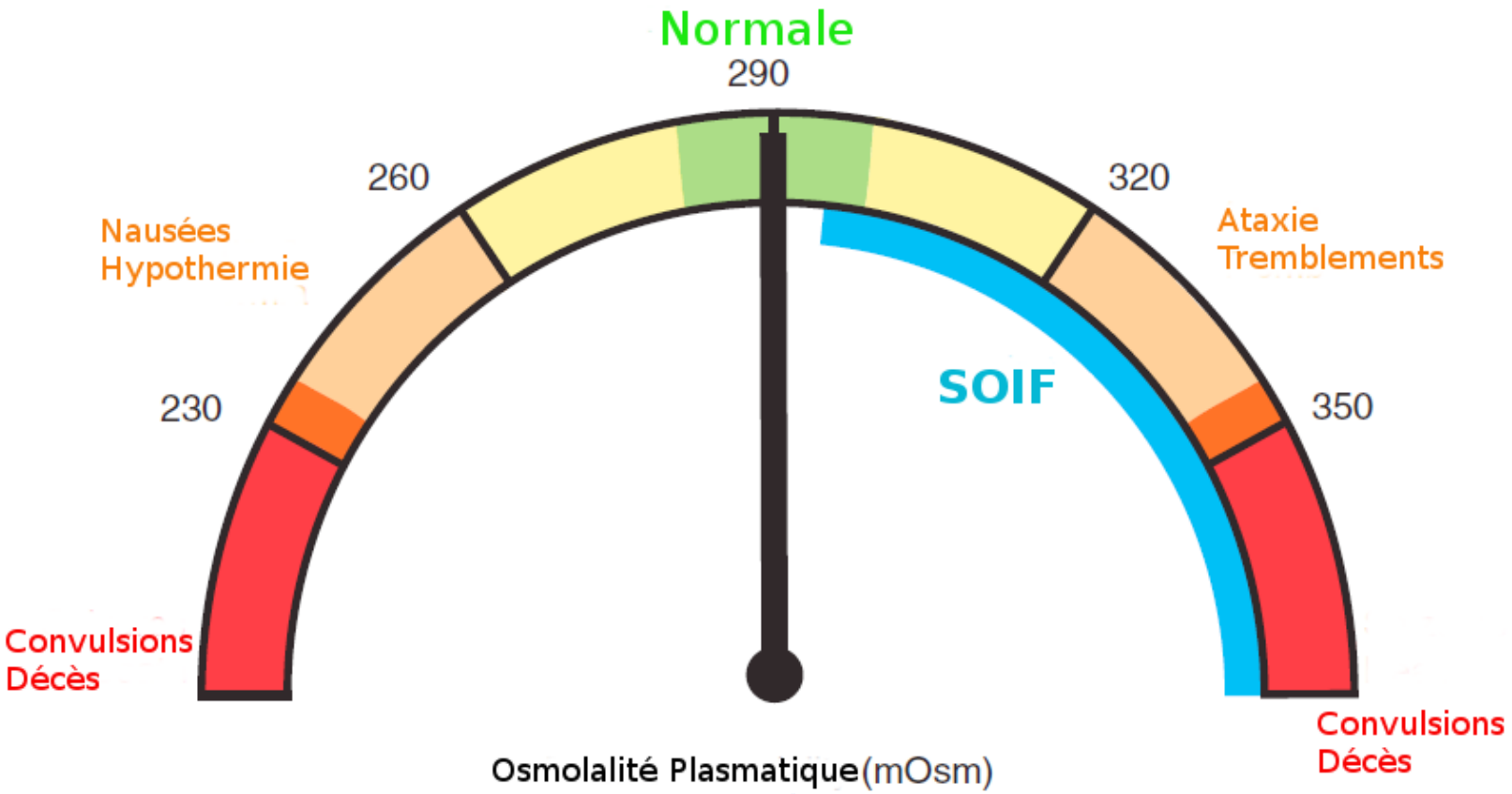
Peau 450 ml

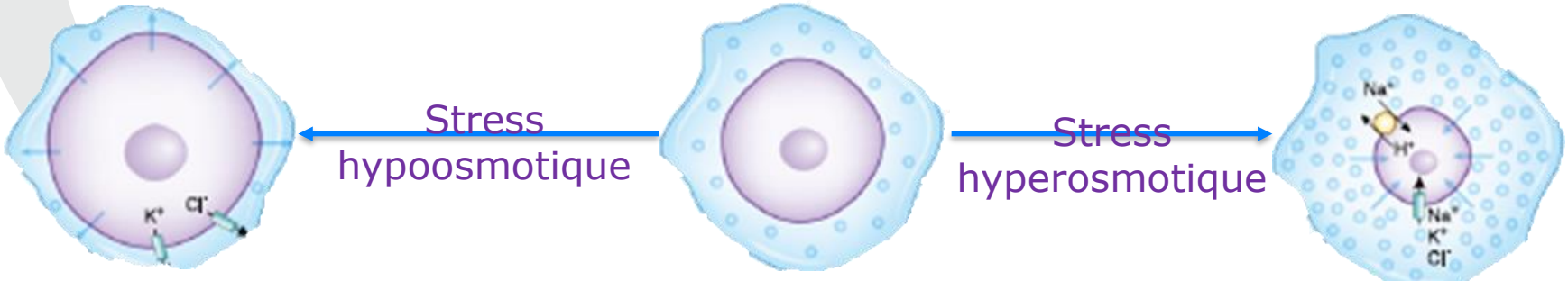
Urine

TD: 200 ml

Eau Totale: 60% du poids du corps

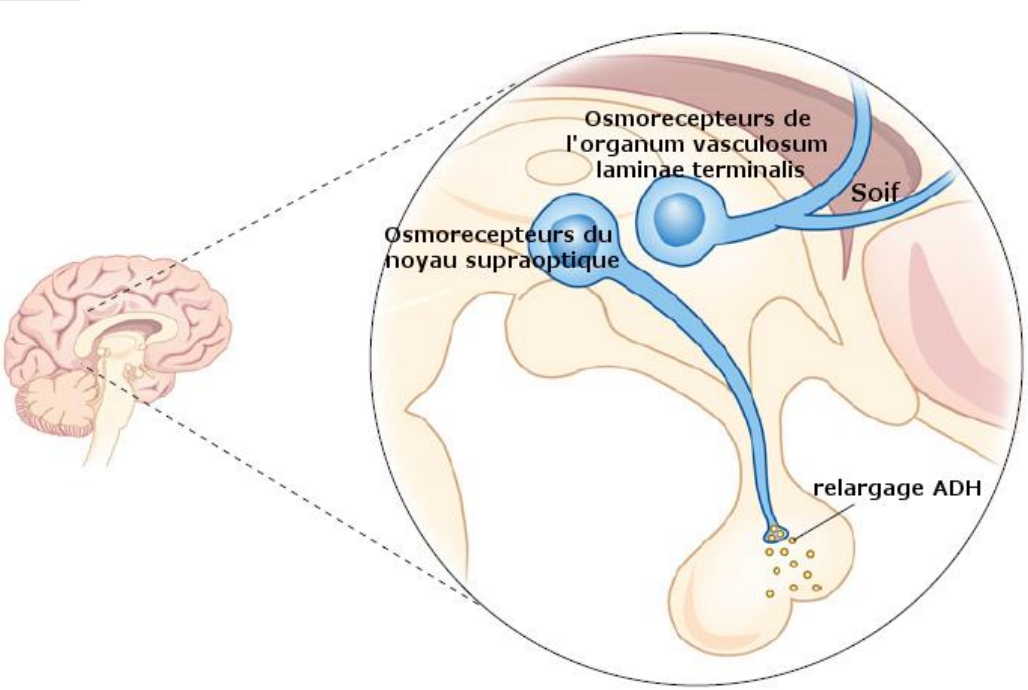
Osmostat

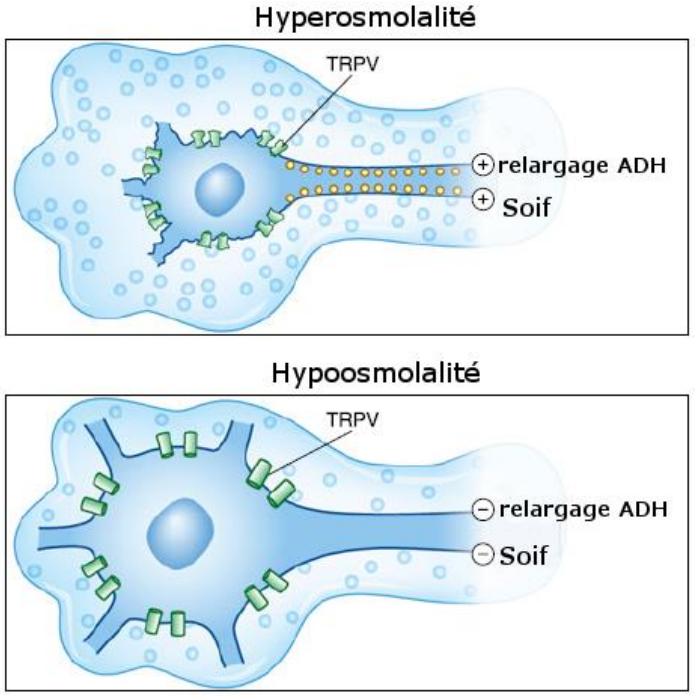

Normale
290
260
320
Nausées
Hypothermie
Ataxie
Tremblements
230
SOIF
350
Convulsions
Décès
Convulsions
Décès
Osmolalité Plasmatique (mOsm)


Stress
hypoosmotique
Stress
hyperosmotique
K+
Cl-
Na+
H+
Na+
K+
Cl-

Pour prévenir le stress osmotique

- Coordination entrée et sortie
  - La soif
  - Le rein





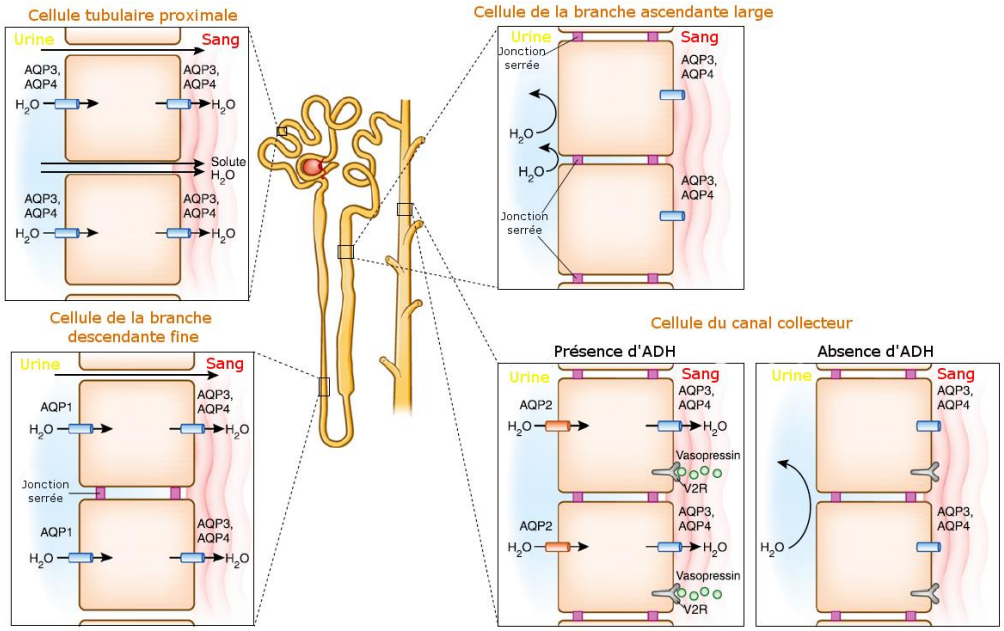
La soif

- La soif
  - Les hormones qui donnent soif
    - Angiotensine II
    - Insuline, Amyline, Histamines, GLP-1
    - Relaxine
  - L'hormone qui bloque la soif
    - ANP
  - Anticipation de la soif lors de l'alimentation
  - Anticipation de la soif avant de dormir
  - Un stimulus puissant qui se déclenche avant même que l'osmolalité soit pathologique.

Current Biology *26*, R1247–R1271, December 19, 2016

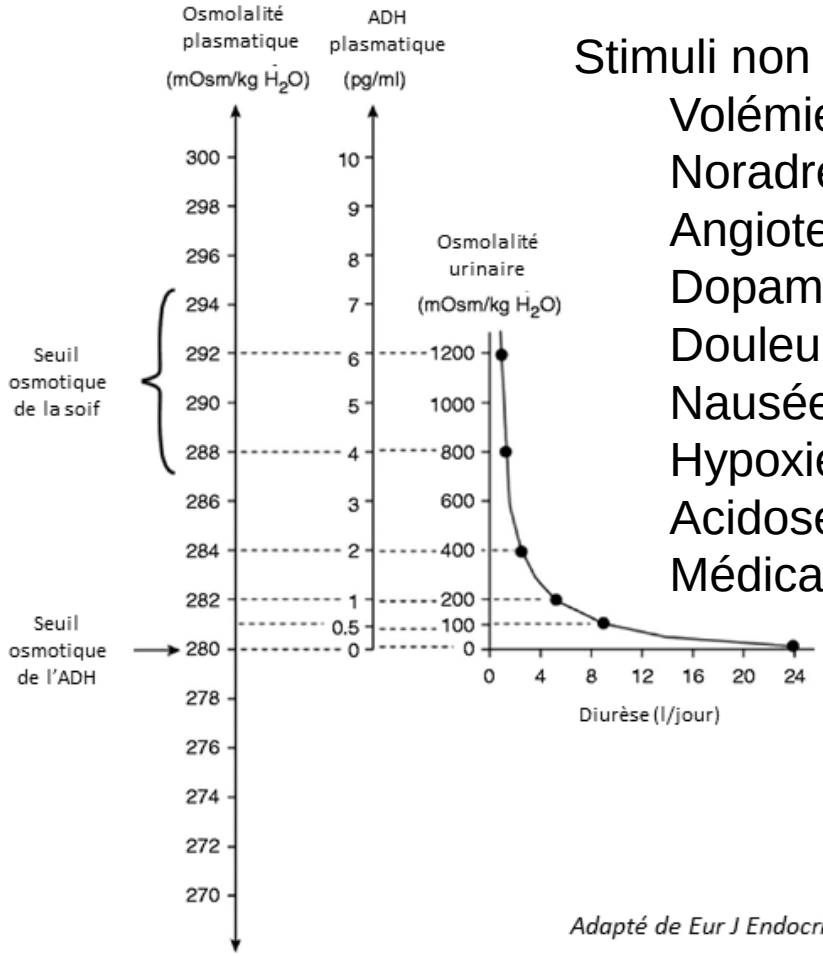
Le rein

- Du cerveau au rein: une hormone
  - L'hormone antidiurétique: ADH
- Le rein: des capacités d'adaptation étonnantes
  - Diurèse de 500 ml à 20 l pour une charge osmotique de 1000 mosm.



Nous n'avons pas besoin de réfléchir à notre apport hydrique.

L'OSMOLALITÉ



Stimuli non osmotiques:

- Volémie
- Noradrénaline et adrénaline
- Angiotensine II
- Dopamine
- Douleurs
- Nausées
- Hypoxie
- Acidose
- Médicaments: trop pour tous les citer.

Adapté de Eur J Endocrinol March 1, 2014 170 G1-G47

Est-ce que se forcer à boire c'est bon?

The medicinal use of water in renal disease

Connie J. Wang[1], Jared J. Grantham[1] and James B. Wetmore[1]

Kidney International (2013) **84,** 45–53

Hydration and Chronic Kidney Disease Progression: A Critical Review of the Evidence

William F. Clark[a] Jessica M. Sontrop[b] Shi-Han Huang[a] Louise Moist[a, b]
Nadine Bouby[c, d] Lise Bankir[c, d]

Am J Nephrol 2016;43:281–292

Shifting Focus: From Hydration for Performance to Hydration for Health

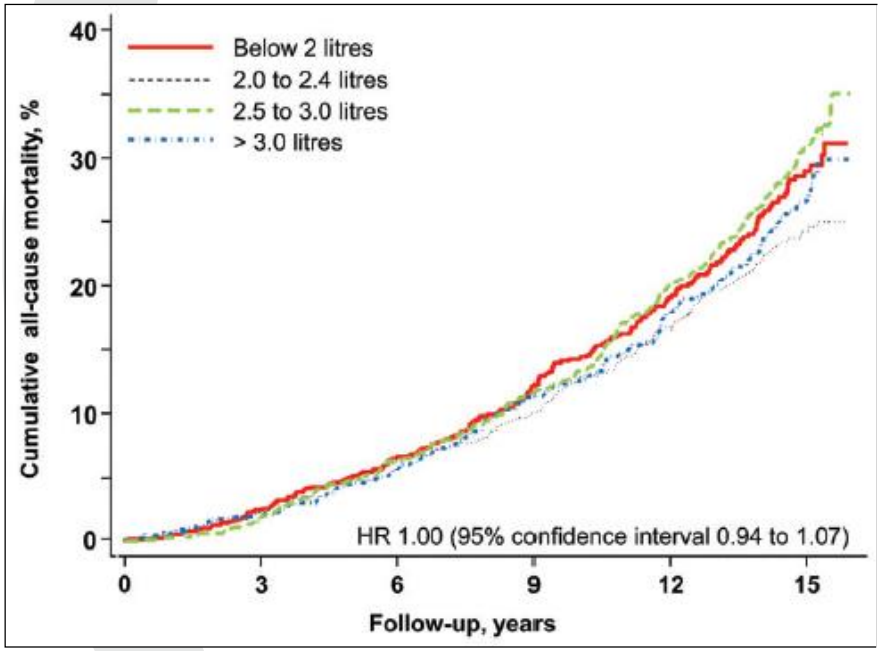
Erica T. Perrier

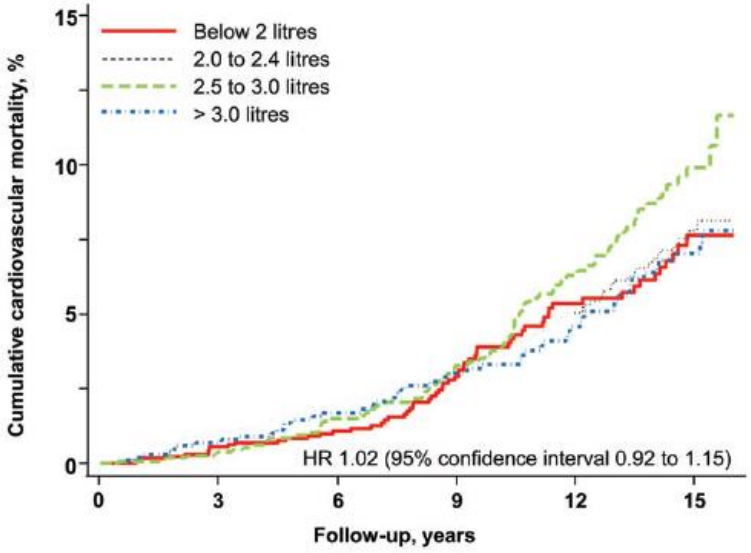
Danone Research, Hydration and Health Department, Palaiseau, France

Ann Nutr Metab 2017;70(suppl 1):4–12

Regardons les données

- La meilleure série observationnelle (3858 personnes de plus de 49 ans pendant 13 ans)





Number at risk						
Less than 2.0 litres	578	549	507	463	416	210
2.0 to 2.4 litres	665	635	587	550	497	232
2.5 to 3.0 litres	584	563	517	477	425	211
>3.0 litres	520	504	475	440	402	206

Nephrol Dial Transplant (2014) 0: 1–8
doi: 10.1093/ndt/gft507

Regardons les données

- La médecine basée sur les preuves
  - Lithiase
  - Récidive d'AVC
  - Pour le reste, ceci tient de la croyance

Table 1. The association between fluid intake and various medical conditions.

Condition	Level of evidence	Results
Overactive Bladder	1	Increased fluid intake is associated with an exacerbation of urinary frequency.
Urolithiasis	1	Increased fluid intake associated with a reduced risk of urolithiasis recurrence and primary urolithiasis.
Exercise tolerance	2	Dehydration does not decrease performance in many types of exercise in temperate climates; dehydration in hot, humid environments decreases exercise performance.
Orthostatic hypotension	2	Water drinking can improve orthostatic tolerance in both healthy patients and patients with autonomic dysfunction.
Cerebral infarct	2	Fluid intake greater than 2L per day may prevent stroke recurrence; no evidence to support increased fluid intake for preventing primary stroke.
Cardiovascular disease	2	Water intake is associated with a decreased risk of fatal coronary heart disease, no evidence to support increased fluid intake in lowering short-term CVD risk.
Constipation	2	Decreased fluid intake may exacerbate constipation in subjects with chronic constipation; no evidence that hyperhydration has a beneficial effect on constipation.
Headache	2	Increased water intake is linked to reduced headache intensity and length; no evidence of increased fluid intake in lowering headache frequency; hyperhydration has no effect on post-LP headache.
Venous thromboembolism	3	Dehydration is associated with the development of venous thromboembolism after acute ischemic stroke; some patients endorse dehydration prior to thrombosis.
Cognitive function	2	Increased water intake in children improves memory and attention; inconclusive evidence on the role of dehydration and rehydration in adult and elderly subjects' cognition.
Bladder cancer	2	Conflicting evidence on whether high fluid intake is associated with lower risk for primary bladder cancer; no evidence that high fluid intake prevents bladder cancer recurrence.

The Journal of Urology® (2018), doi: 10.1016/j.juro.2018.02.3089.

Encore des données

- Dans le diabète: rien de probant car les essais sont de mauvaise qualité

Prevention and Therapy of Type 2 Diabetes—What Is the Potential of Daily Water Intake and Its Mineral Nutrients?

Nutrients **2017**, *9*, 914; doi:10.3390/nu9080914

- Réduire son apport en calories? NHANES 18311

Table 2 Estimated hanges in daily diet associated with one percentage point increase in the proportion of daily plain water in total dietary water consumption among US adults

Sample	Total energy (kcal)	Energy from SSBs (kcal)	Energy from discretionary foods (kcal)	Total fat (g)	Saturated fat (g)	Sugar (g)	Sodium (mg)	Cholesterol (mg)	HEI-2010 (score)
All (n = 18 311)	−8.58*** (−9.29, −7.87)	−1.43*** (−1.59, −1.27)	−0.88*** (−1.32, −0.44)	−0.21*** (−0.25, −0.17)	−0.07*** (−0.09, −0.06)	−0.74*** (−0.82, −0.67)	−9.80*** (−11.39, −8.20)	−0.88*** (−1.13, −0.64)	−0.01 (−0.02, 0.00)

An R. & McCaffrey J. (2016) Plain water consumption in relation to energy intake and diet quality among US adults, 2005–2012. *J Hum Nutr Diet*.

- Il s'agit d'une association…

Encore un peu

- L'hydratation de la peau.

Does dietary fluid intake affect skin hydration in healthy humans? A systematic literature review

M. Akdeniz | T. Tomova-Simitchieva | G. Dobos | U. Blume-Peytavi | J. Kottner

TABLE 2 Risk of bias of included intervention studies

	Mac-Mary et al. (2006)	Williams et al. (2007)	Palma et al. (2012)	Palma et al. (2015a)	Palma et al. (2015b)
Random sequence generation (selection bias)	High risk	Unclear risk	High risk	High risk	High risk
Allocation concealment (selection bias)	Unclear risk	Unclear risk	High risk	High risk	High risk
Blinding of participants and personnel (performance bias)	Unclear risk	Unclear risk	Unclear risk	Unclear risk	Unclear risk
Blinding of outcome assessment (detection bias)	Unclear risk	Unclear risk	Unclear risk	Unclear risk	Unclear risk
Incomplete outcome data addressed (attrition bias)	Low risk	Low risk	Low risk	Unclear risk	Low risk
Selective reporting (reporting bias)	Low risk	Low risk	Low risk	Low risk	Low risk

Skin Res Technol. 2018;1–7.

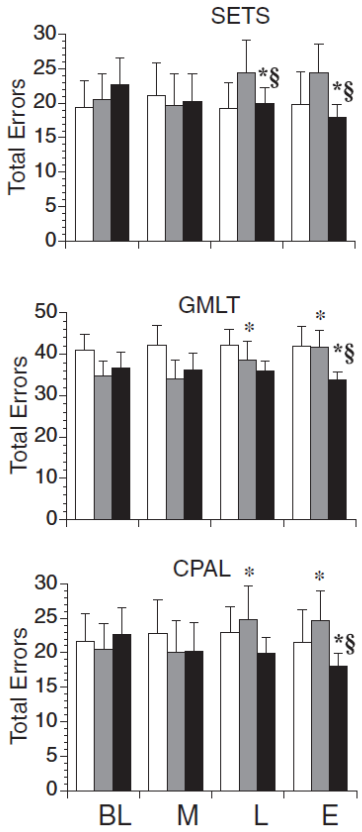
Conclusions: Additional dietary water intake may increase stratum corneum hydration. The underlying biological mechanism for this possible relationship is unknown. Whether this association also exists in aged subjects is unclear. Research is needed to answer the question whether increased fluid intake decreases signs of dry skin.

Pour finir

- Fonction cognitive

Water intake reverses dehydration associated impaired executive function in healthy young women☆

Physiology & Behavior 185 (2018) 103–111



Thirsty	56.8 ± 28.3	50.1 ± 28.4	26.4 ± 28.5	26.6 ± 28.8
Dry mouth	40.7 ± 37.3	39.2 ± 35.7	16.5 ± 17.8	17.3 ± 21.4
Thirsty	40.1 ± 36.6	66.7 ± 22.8	75.5 ± 24.4	80.9 ± 30.4
Dry mouth	30.0 ± 29.3	62.5 ± 33.0	61.0 ± 32.2	66.1 ± 35.3
Thirsty	37.5 ± 31.6	41.1 ± 27.8	22.9 ± 24.3	23.0 ± 22.4
Dry mouth	25.4 ± 19.4	36.1 ± 36.1	15.2 ± 18.8	22.5 ± 28.1

La déshydratation n'est pas bonne pour le cerveau.
Anticiper la soif n'apporte pas un bénéfice majeur.
Ces études ont toujours le même défaut ne pas s'intéresser à la réponse en fonction de la soif.

L'avenir

- Des essais randomisés de bonne qualité pour répondre à la question
  - Est-ce que suivre sa soif est suffisant pour prévenir ce que vous voulez?
  - Est-ce qu'augmenter son apport hydrique au-delà de sa sensation de soif est utile?

The Chronic Kidney Disease Water Intake Trial: Protocol of a Randomized Controlled Trial

William F. Clark[1], Shih-Han Huang[1], Amit X. Garg[1], Kerri Gallo[1], Andrew A. House[2], Louise Moist[1], Matthew A. Weir[2], and Jessica M. Sontrop[1]

Canadian Journal of Kidney Health and Disease
Volume 4: 1–11

DOI: 10.1177/2054358117725106
journals.sagepub.com/home/cjk
SAGE

BMJ Open **Randomised controlled trial to determine the efficacy and safety of prescribed water intake to prevent kidney failure due to autosomal dominant polycystic kidney disease (PREVENT-ADPKD)**

Annette T Y Wong,[1,2] Carly Mannix,[1,2] Jared J Grantham,[3]

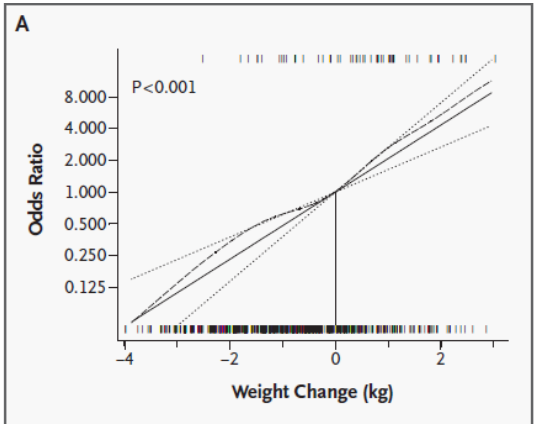
Est-ce que trop boire pourrait être dangereux?

Hyponatremia among Runners in the Boston Marathon

N Engl J Med 2005;352:1550-6.

Table 2. Univariate and Multivariate Predictors of Hyponatremia.*

Variable	Univariate Predictors			Multivariate Predictors	
	Hyponatremia (N=62)	No Hyponatremia (N=426)	P Value†	Odds Ratio (95% CI)	P Value†
Demographic characteristics					
Age (yr)	38.1±9.5	39.0±9.4	0.52	—	—
Nonwhite race (%)‡	8	8	1.00	—	—
Female sex (%)	60	30	<0.001	—	—
Body-mass index	22.8±3.7	23.0±2.5	0.68	—	—
Category of body-mass index			0.01		
<20 (%)	25	8	—	2.5 (1.1–5.8)	0.03
20–25 (%)	54	73	—	1.0§	—
>25 (%)	21	19	—	1.0 (0.4–2.0)	0.90
Training and performance					
Previous marathons (no.)	3	5	0.008	—	—
Training pace (min:sec/mi)	8:52±1:11	8:02±1:01	<0.001	—	—
Race duration (hr:min)	4:12±0:47	3:42±0:42	<0.001	—	—
Category of race duration (hr:min)			<0.001		
<3:30 (%)	13	44	—	1.0§	—
3:30–4:00 (%)	35	31	—	3.6 (1.4–11.5)	0.01
>4:00 (%)	52	25	—	7.4 (2.9–23.1)	<0.001
Fluids and electrolytes					
Self-reported fluid intake					
Frequency (%)			<0.001		
Every mile	75	54	—	—	—
Every other mile	25	36	—	—	—
Every third mile or less often	0	9	—	—	—
Volume, >3 liters (%)	42	26	0.01	—	—
Composition, 100% water (%)	8	11	0.66	—	—
Self-reported water loading (%)¶	82	73	0.16	—	—
Self-reported frequency of voiding during race (%)			0.047		
None	51	63	—	—	—
Once	27	25	—	—	—
Twice	8	8	—	—	—
Three times or more	14	5	—	—	—
Postrace weight > prerace weight (%)	71	29	<0.001	4.2 (2.2–8.2)	<0.001
Self-reported use of NSAIDs (%)‖	61	53	0.34	—	—



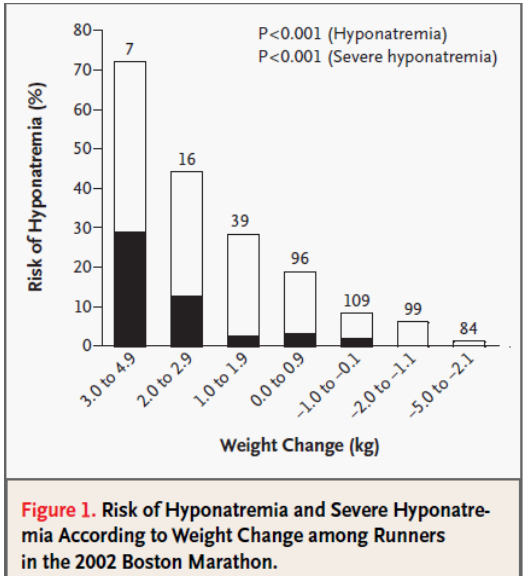


Figure 1. Risk of Hyponatremia and Severe Hyponatremia According to Weight Change among Runners in the 2002 Boston Marathon.

Conclusion

- La physiologie nous permet de prévenir la déshydratation.
- Le bénéfice de prévenir sa soif ne repose sur aucun rationnel scientifique fort sauf dans la lithiase rénale
- Actuellement, la recommandation doit être:

Boire à **sa soif**


KEEP
CALM
AND
FOLLOW
your
HYPOTHALAMUS