

Le lactate: substrat énergétique ?

Pr Eric Fontaine

Clinique de Nutrition Artificielle - CHU de Grenoble
INSERM U 884 - Université Joseph Fourier - Grenoble

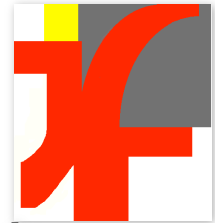


**Direction Scientifique
Nutrition Humaine
et Sécurité des Aliments**

Inserm

**Institut national
de la santé et de la recherche médicale**

CHU de GRENOBLE



Université J. Fourier

U884 Bioénergétique Fondamentale et Appliquée



Lactate as Substrate

Xavier Leverve

ESPEN 2010, Nice - Acropolis

Agression et œdème

Injury

Trauma, Sepsis, Ischemia, Hypoxia, Cardiogenic

↗ capillary leakage
↗ cell volume (swelling effect)
Interstitial edema

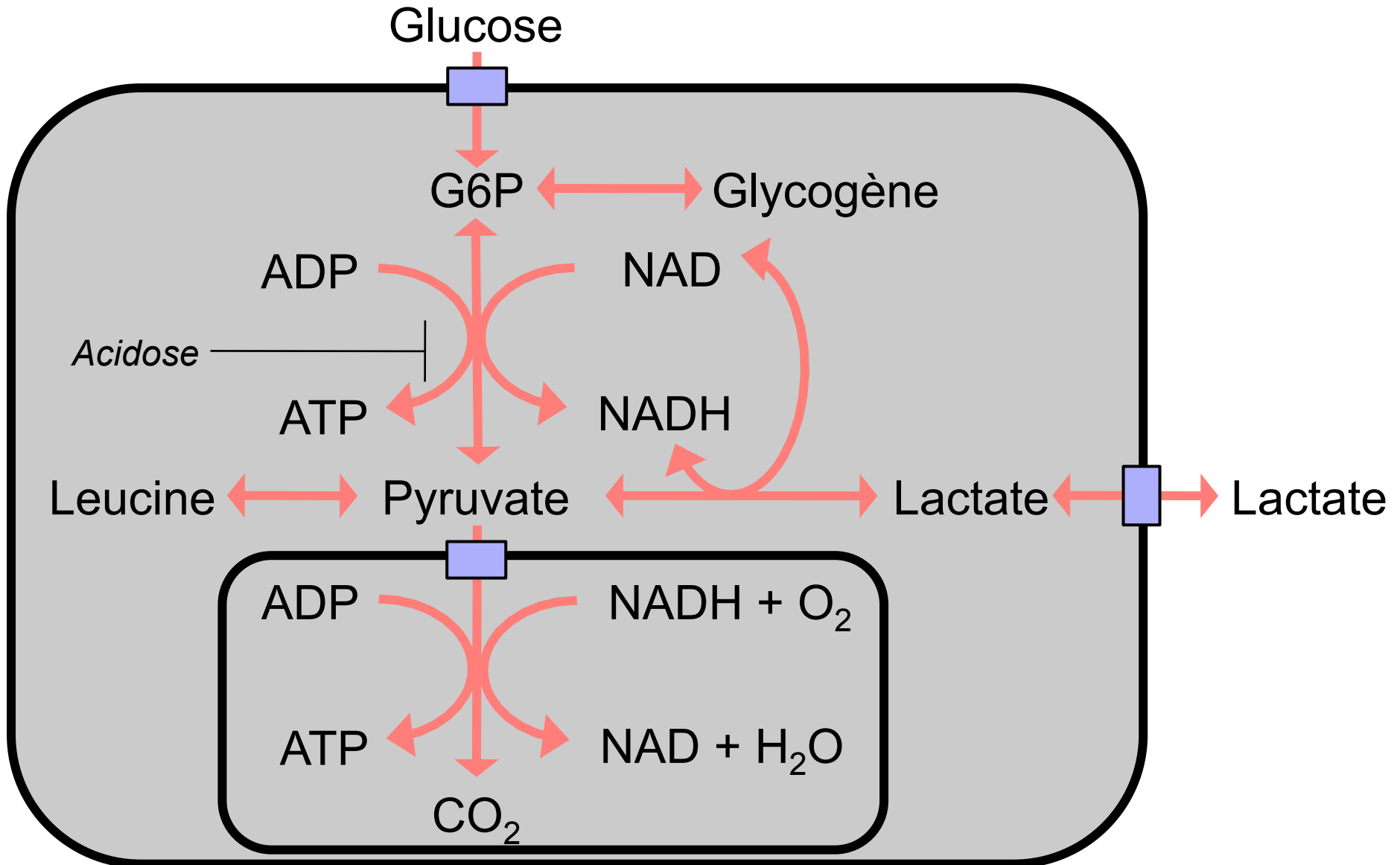
Fluid administration
Crystalloids, Colloids,
Blood, Plasma or Albumin

↘ Intravascular volume
↘ Tissue perfusion

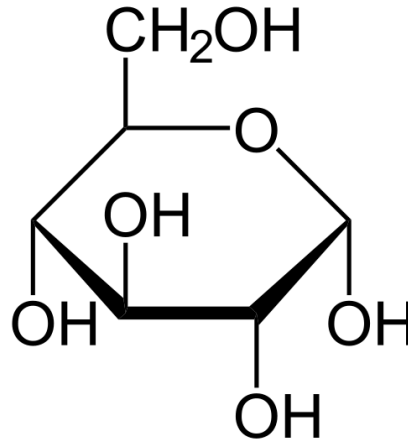
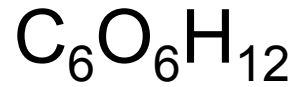
Le malade de réanimation

- Métabolique
 - Insulinorésistance
 - Hyperglycémie = glucotoxicité
 - Insulinothérapie = hypoglycémie
 - Acidose
- Perfusion tissulaire
 - Bas débits (\pm ischémie reperfusion)
 - Œdèmes
 - Extratissulaire
 - Intratissulaire

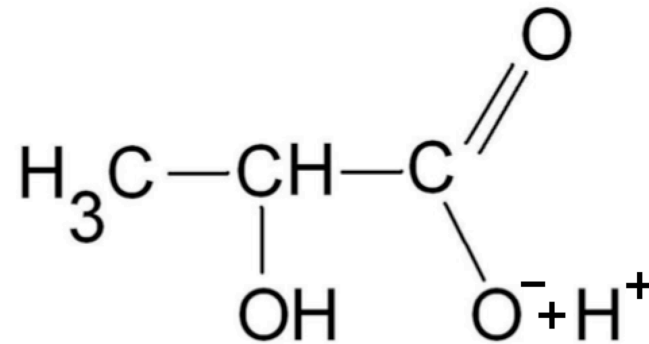
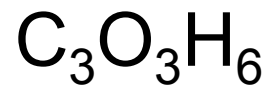
Le lactate: un glucide



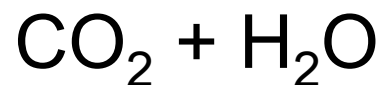
Acide lactique ou Lactate ?



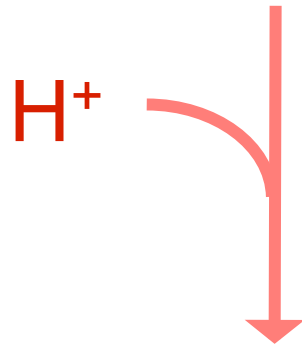
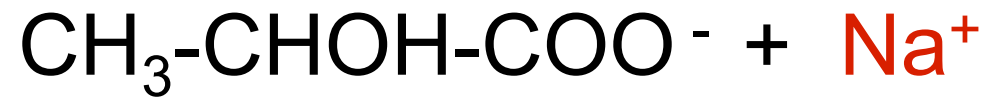
Acidification



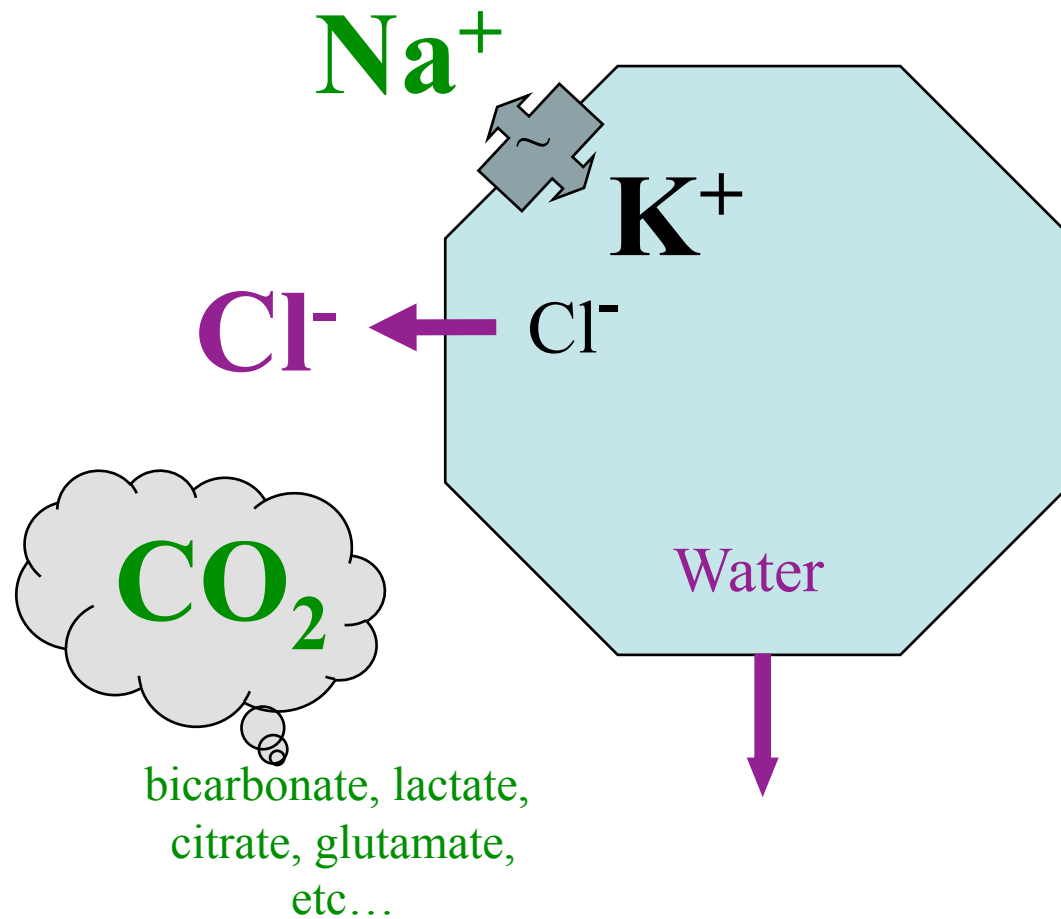
Alcalinisation



Lactate de Sodium

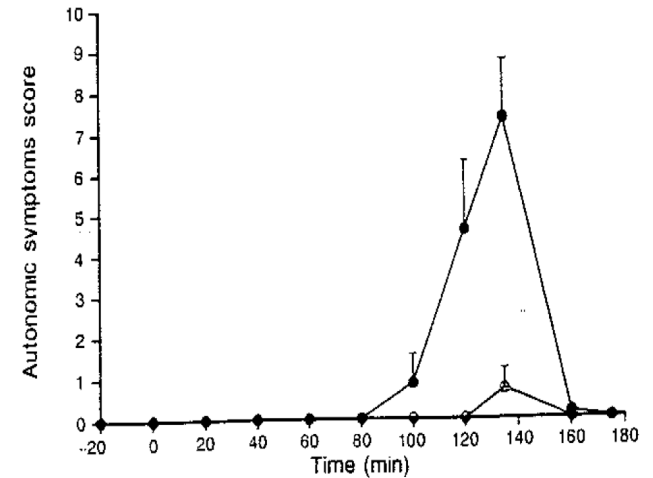
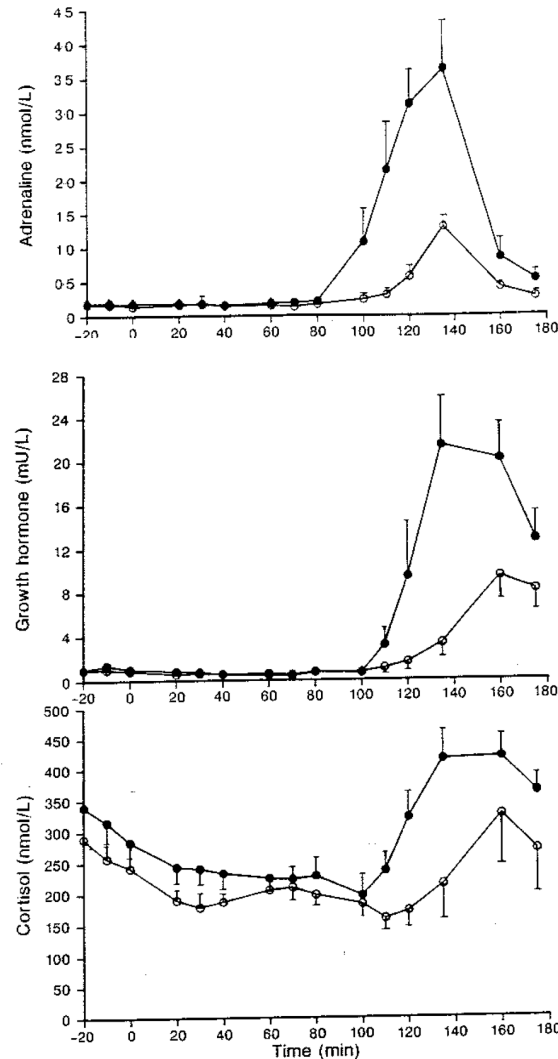
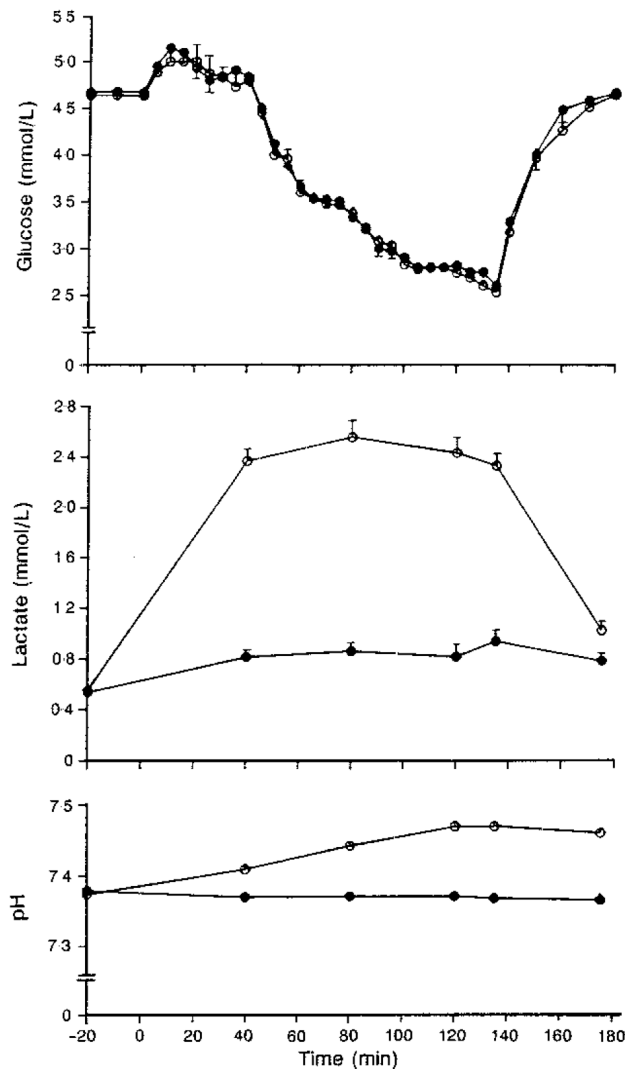


Que faire du Sodium ?



Du lactate à la place du glucose ?

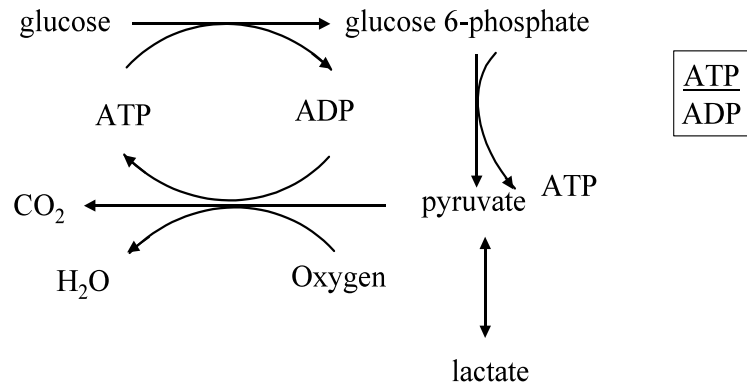
7 volontaires sains, perfusion d'insuline ± lactate



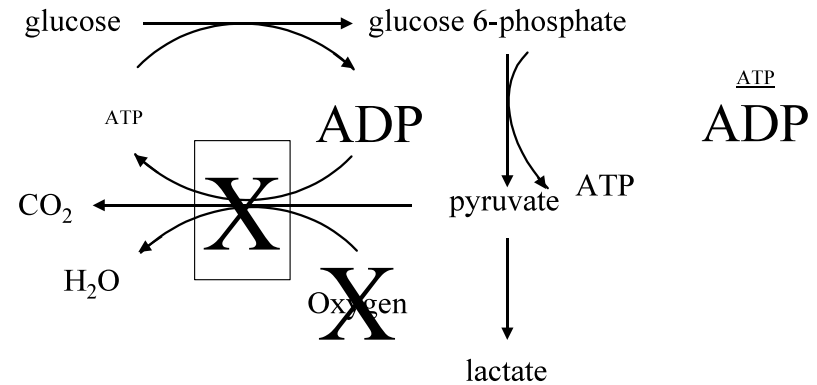
Maran, 1994, Lancet

Mieux en ischémie reperfusion ?

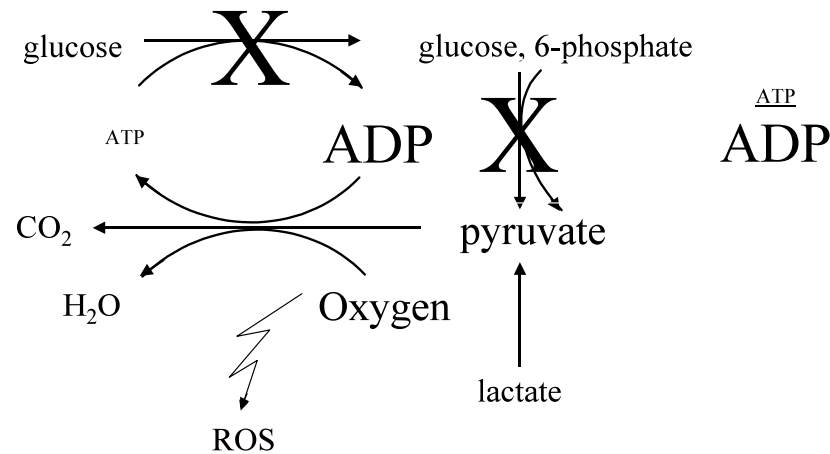
Condition normale



Ischémie



Reperfusion



Le lactate des astrocytes ...

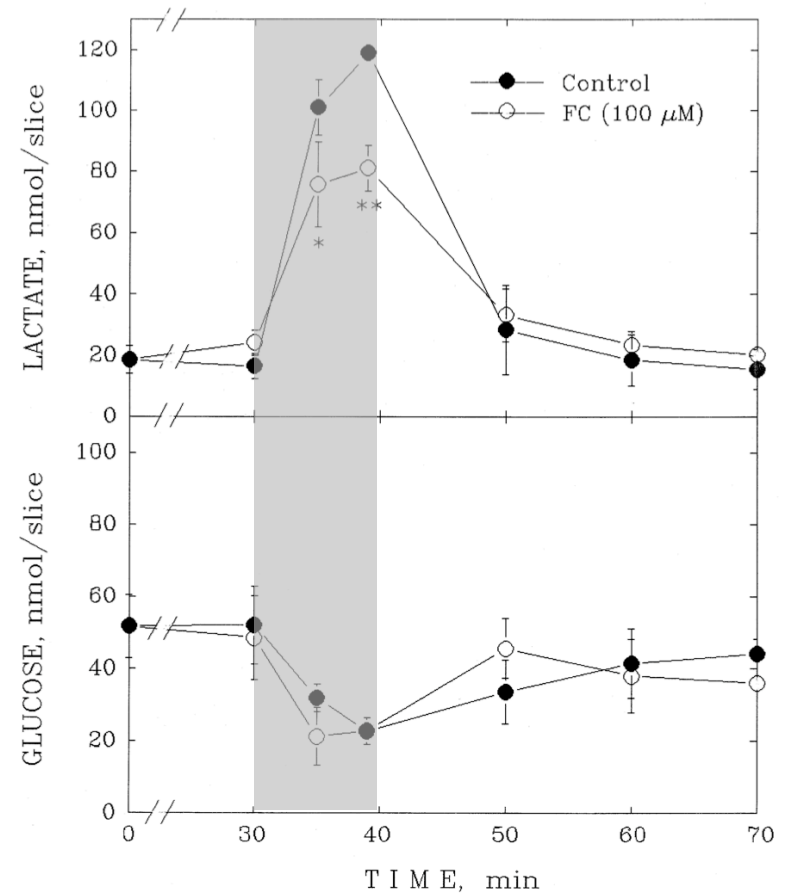
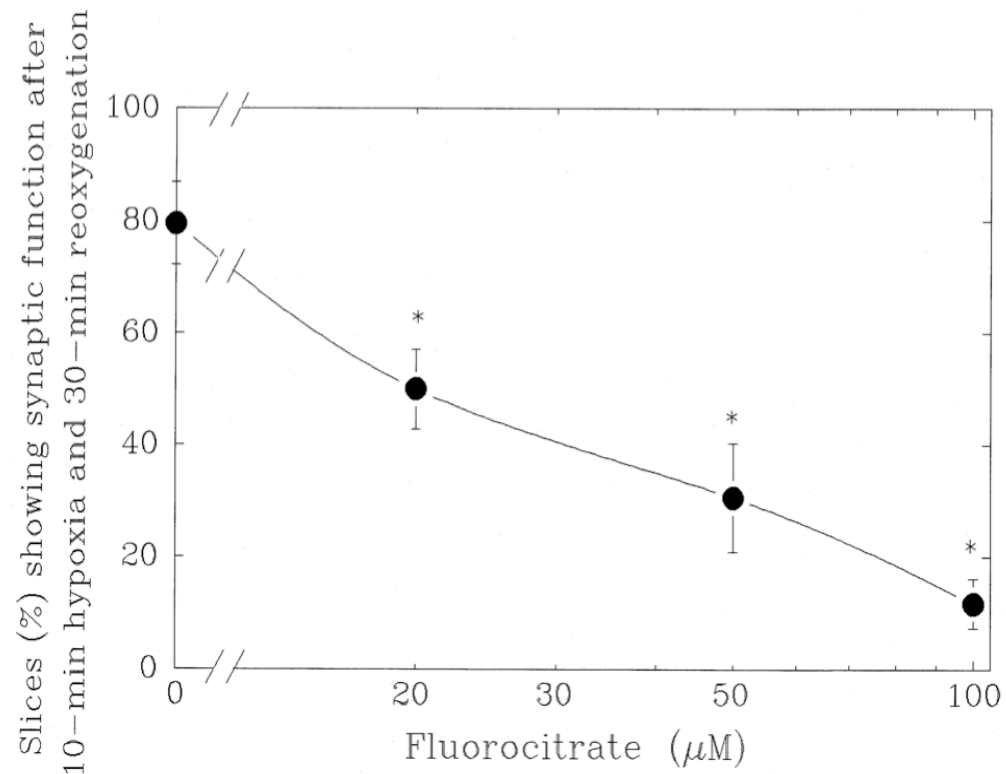
Tranches de cerveau de rat

10 mM Glucose

10 min hypoxie et 30 min reperfusion

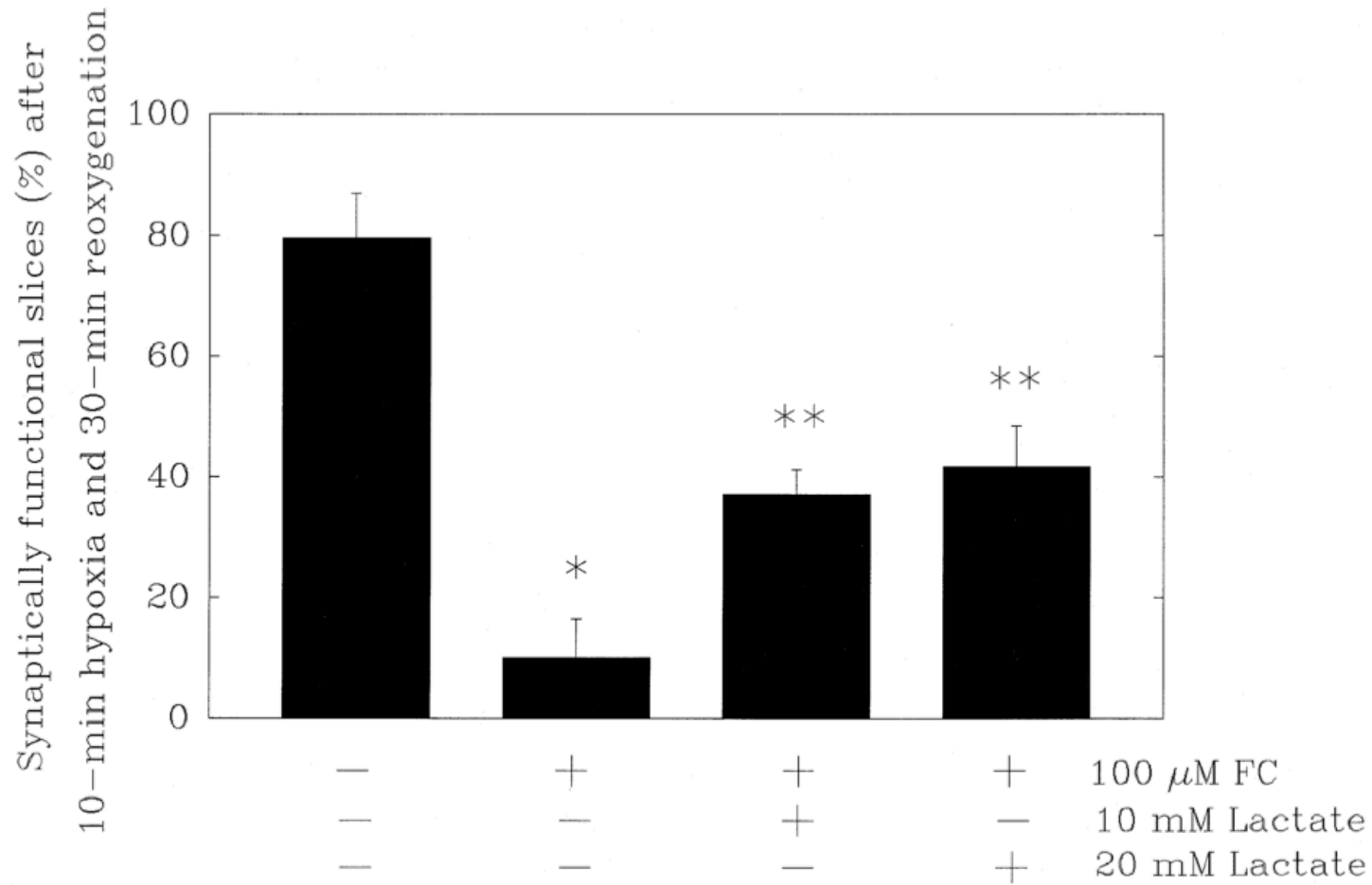
± inhibiteur des astrocytes

Mesure de la fonction synaptique



Schurr, 1997, Brain Res

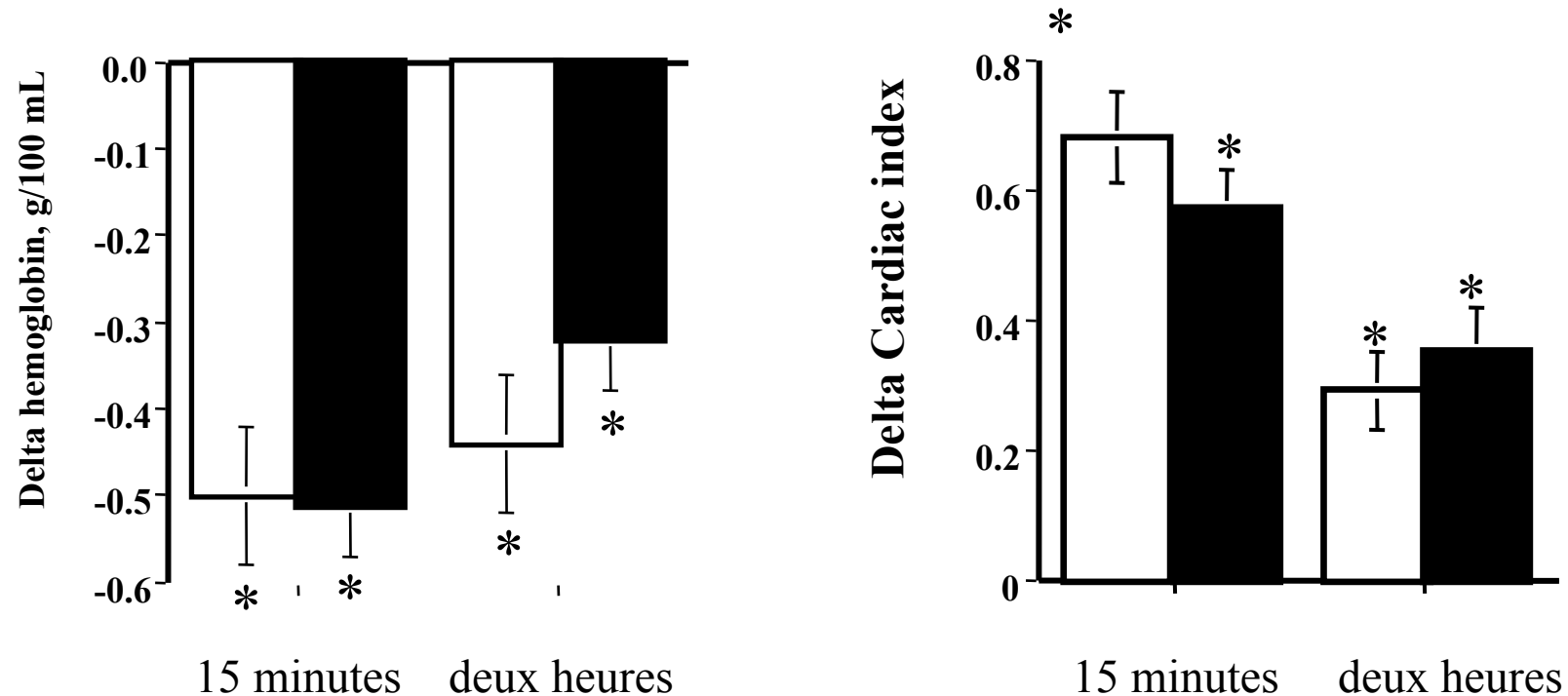
... pour les neurones !



Lactate et « remplissage »

Patients de chirurgie cardiaque

Effet expanseur et tonicardiaque



□ Na-lactate, n = 40
■ Na-chloride, n = 40

Lactate et diurèse

208 patients post chirurgie cardiaque en ICU

Fig. 1 Effect of RL versus HL on mean arterial pressure and cardiac index. *Open symbols:* RL, *closed symbols:* HL. **a** Mean arterial pressure (MAP), mm Hg. **b** Cardiac index (CI), $L \cdot min^{-1} \cdot m^{-2}$. Results are expressed as mean \pm sem; statistical comparisons with ANOVA for repeated measures: MAP = NS; CI $P = 0.0242$ (unpaired student's post hoc analysis: 2 h $P = 0.004$; 3 h $P = 0.016$; 12 h $P = 0.037$)

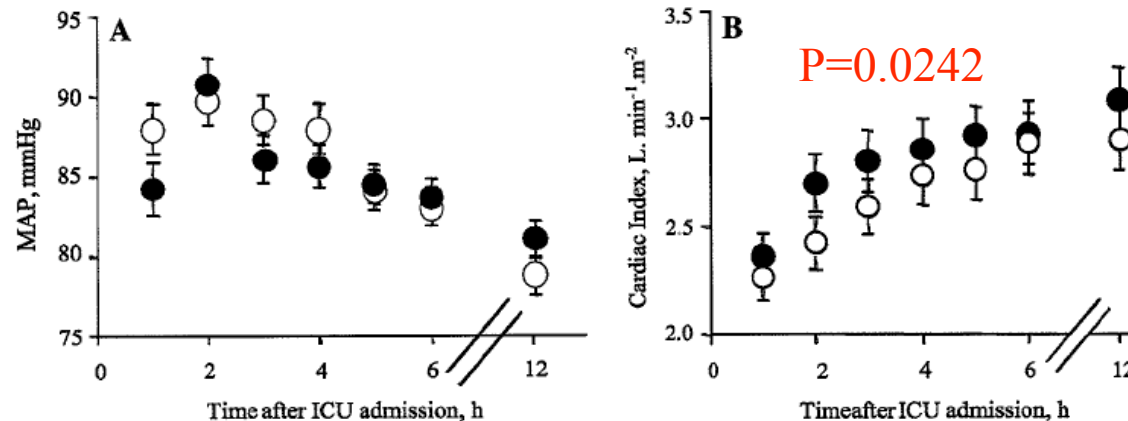
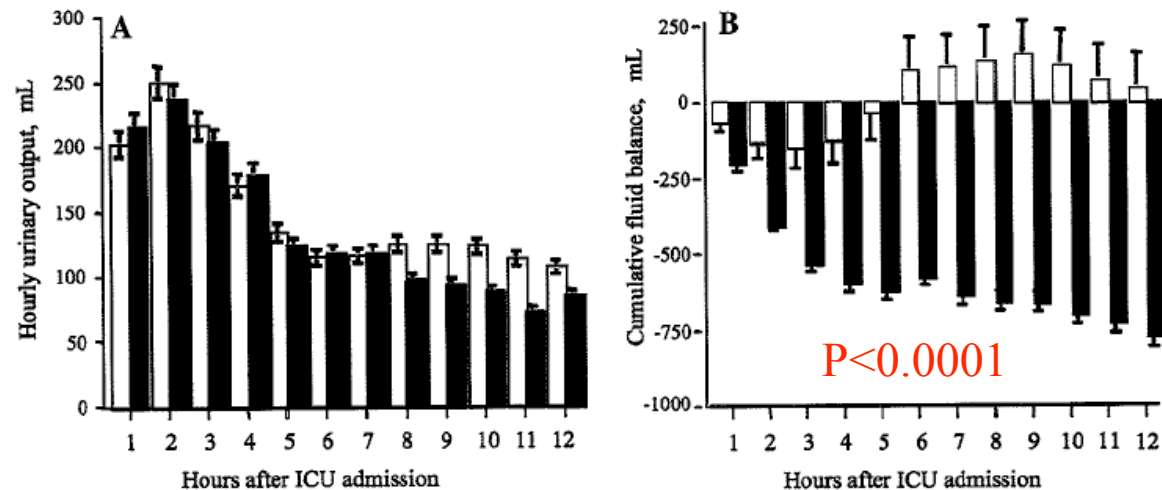


Fig. 2 Urinary output and body fluid balance in post-CABG patients treated with RL or HL. *White columns* patients treated with RL, *black columns* patients treated with HL. **a** hourly urinary output, mL. **b** cumulative body fluid balance, mL. Results are expressed as means \pm sem, statistical comparisons between RL and HL with ANOVA for repeated measures: non-significant for urine output; $P < 0.0001$ for cumulative body fluid balance



Hyperosmolar sodium-lactate infusion during cardiac surgery

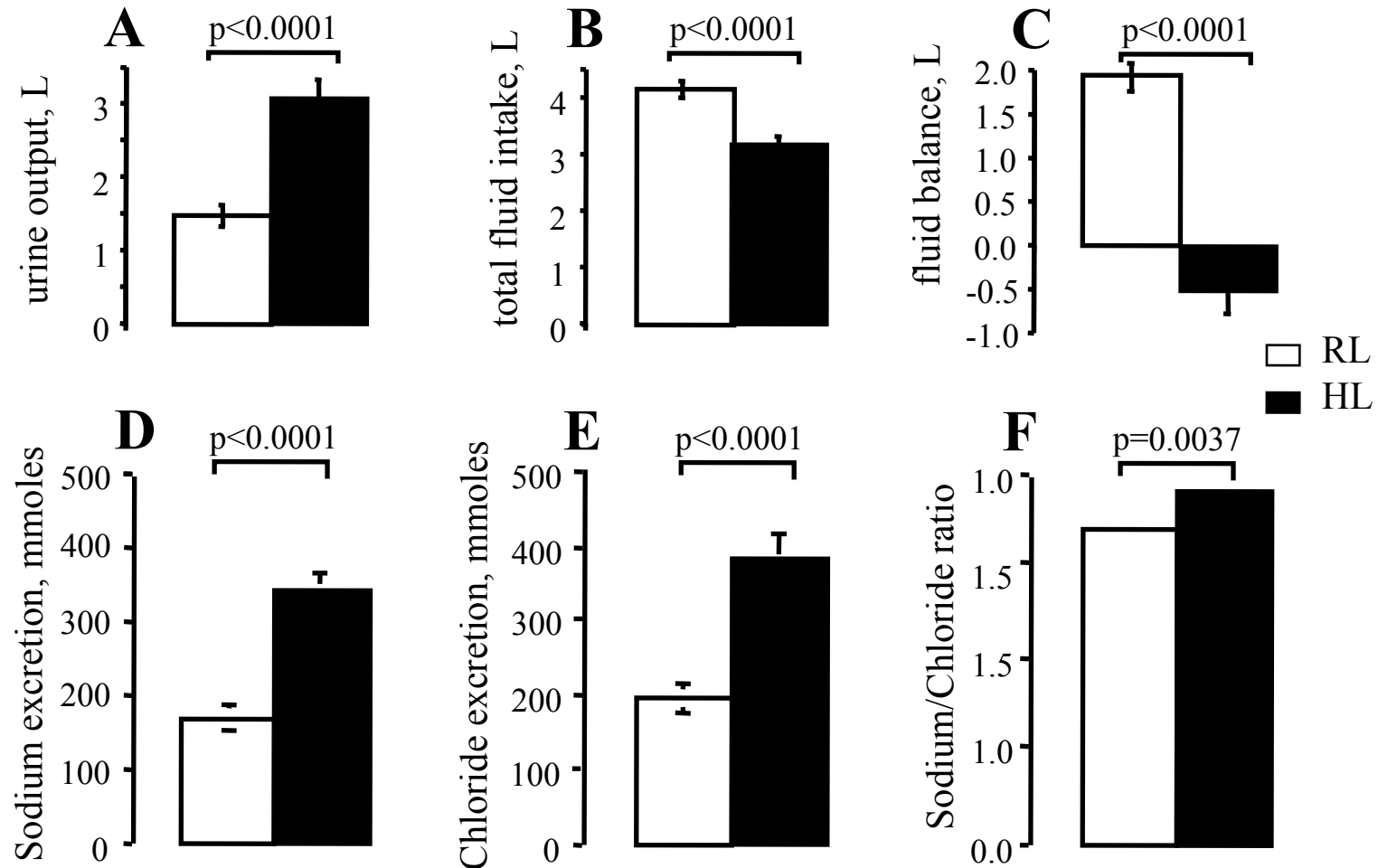
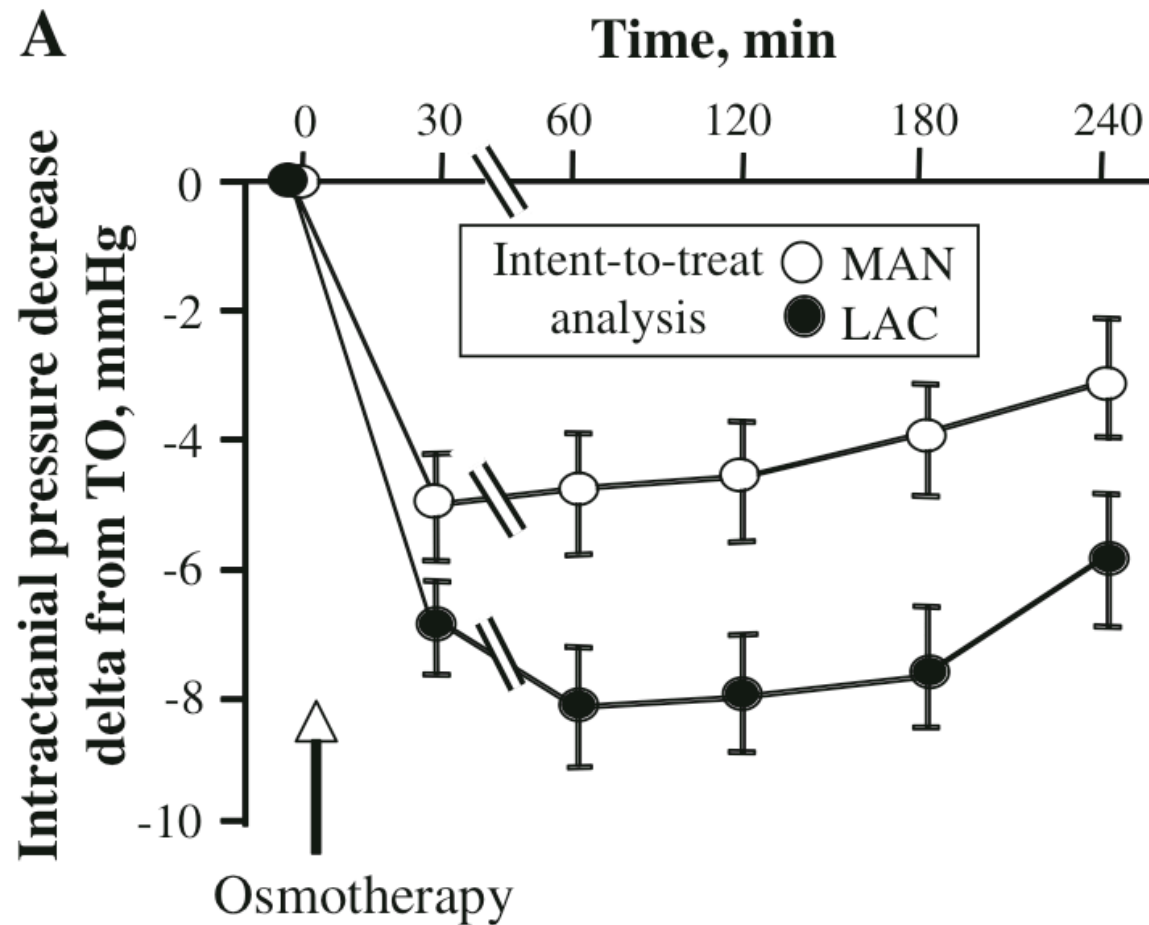


Figure 2. *Intra-operative changes in body fluids, sodium and potassium excretion in patients treated with RL or HL.* White columns: patients treated with RL; black columns: patients treated with HL. Panel A: urinary output (L); Panel B: cumulative fluid intakes (L); Panel C: body fluid balance (L); Panel D: sodium excretion output (mmol); Panel E: chloride excretion (mmol); E: sodium/chloride ratio. Results are expressed as means±sem, statistical comparisons between RL and HL by unpaired student's t test for: urine output ($p<0.0001$); cumulative fluid intakes ($p<0.0001$); body fluid balance ($p<0.0001$), sodium excretion ($p<0.0001$) and chloride excretion ($p<0.0001$). Sodium/chloride ratio was expressed as median, comparisons between HL and RL by the non-parametric test of Man & Withney ($p=0.0037$).

Lactate et œdème cérébral

34 patients trauma crânien avec HIC



Ichai, 2008, Intensive Care Med

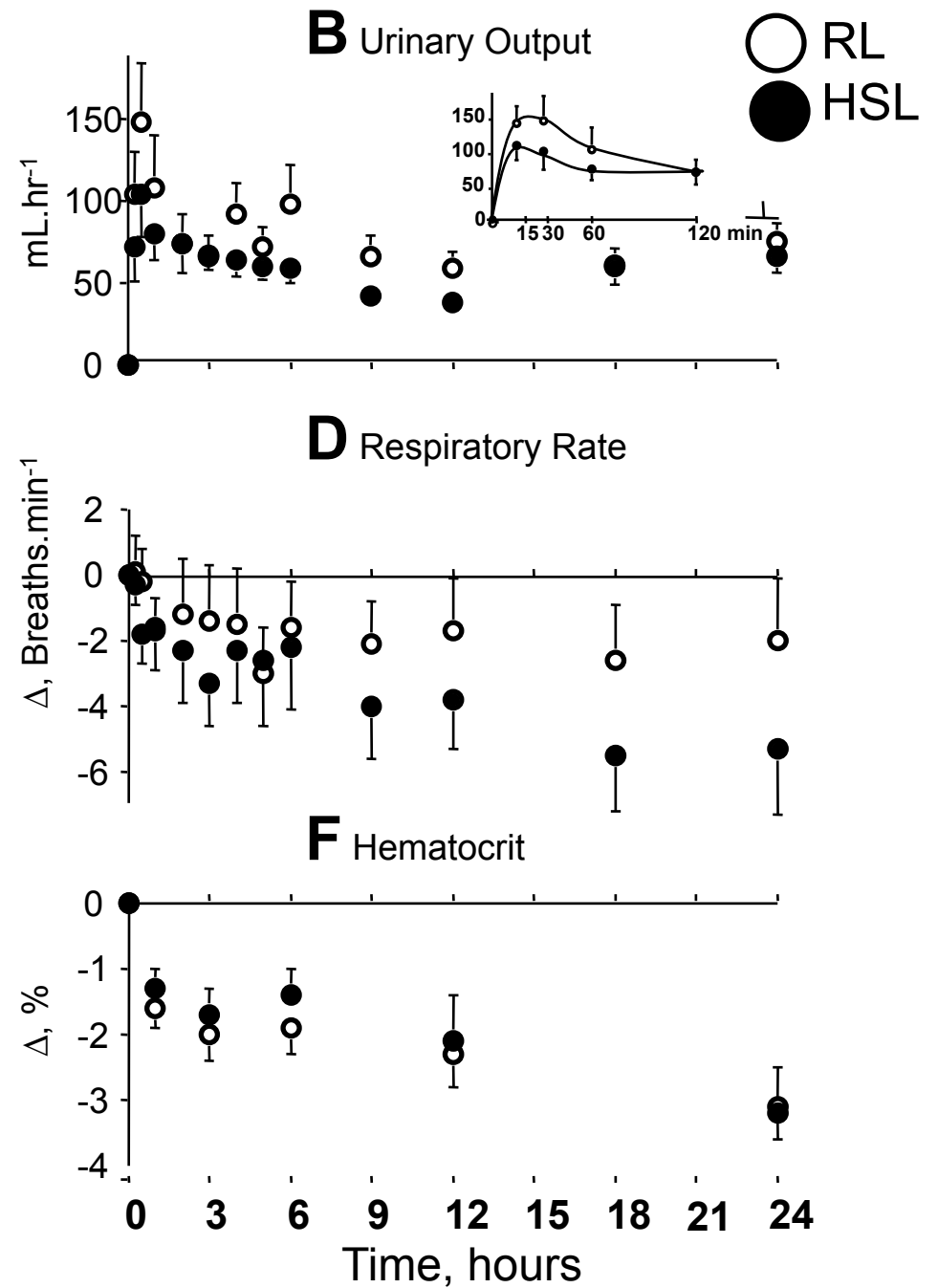
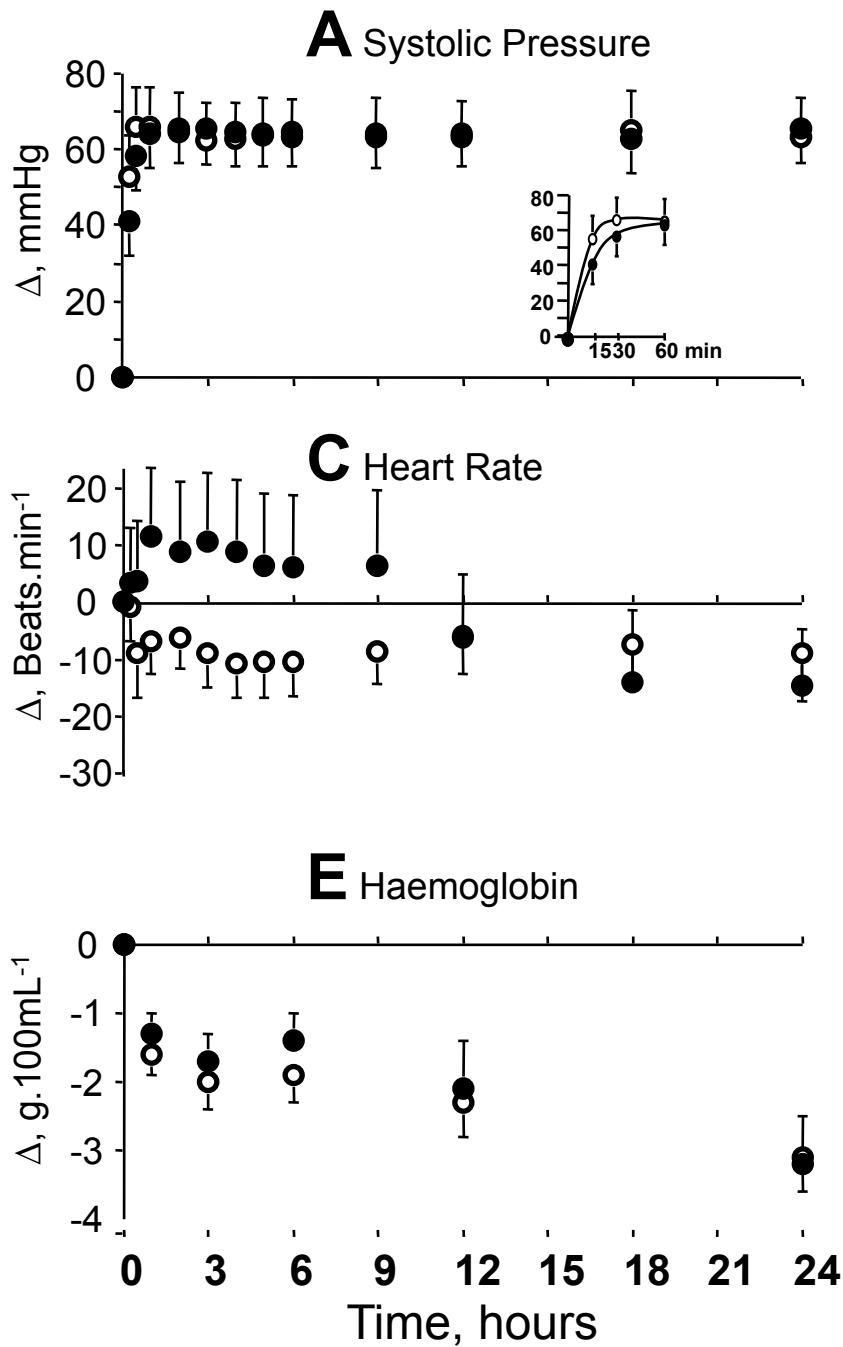
A NEW CRYSTALLOID SOLUTION BASED ON HYPEROSMOLAR SODIUM-LACTATE (HSL) IN THE TREATMENT OF DENGUE SHOCK SYNDROME (DSS) IN CHILDREN.

Dadang H Somasetia¹, Tatty E Setiati², Azhali MS¹, Ponpon S. Idjradinata¹, Djatnika Setiabudi¹ and Xavier M Leverve³.

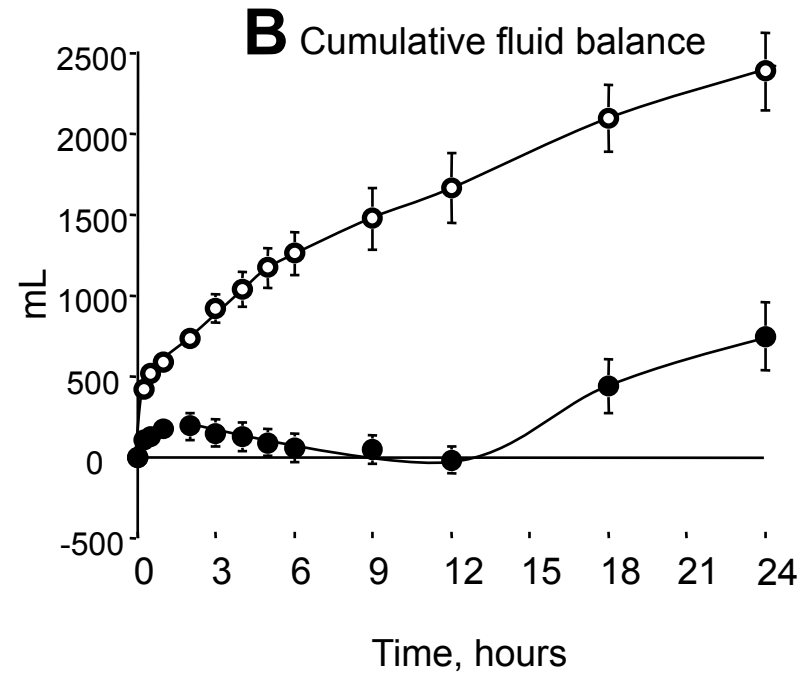
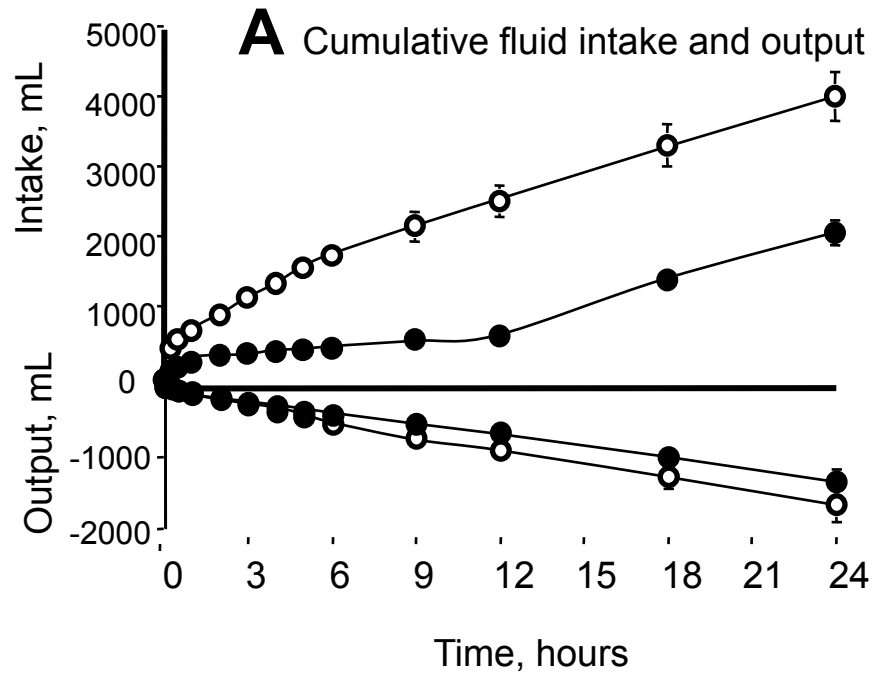
¹Department of Pediatric, Padjadjaran University, Bandung, Indonesia; ²Department of Pediatric, Diponegoro University, Indonesia, ³ Joseph-Fourier university, INSERM U884, Grenoble, France.

Aims: DSS fluid resuscitation remains critical because the need of avoiding both insufficient fluid infusion and secondary fluid-overload. This study aims comparing the efficacy of HSL *versus* Ringer Lactate (RL) on hemodynamic recovery, plasma expansion and fluid balance since beneficial hemodynamic properties of HSL have been reported¹.

Method: RCT including 46 DSS children (8.2±0.5years; 24.9±1.9Kg; m±sem) resuscitated with HSL (n=24, 5ml/Kg bolus followed by 1mL/Kg/h for 12h) or RL (n=22, WHO's guideline).

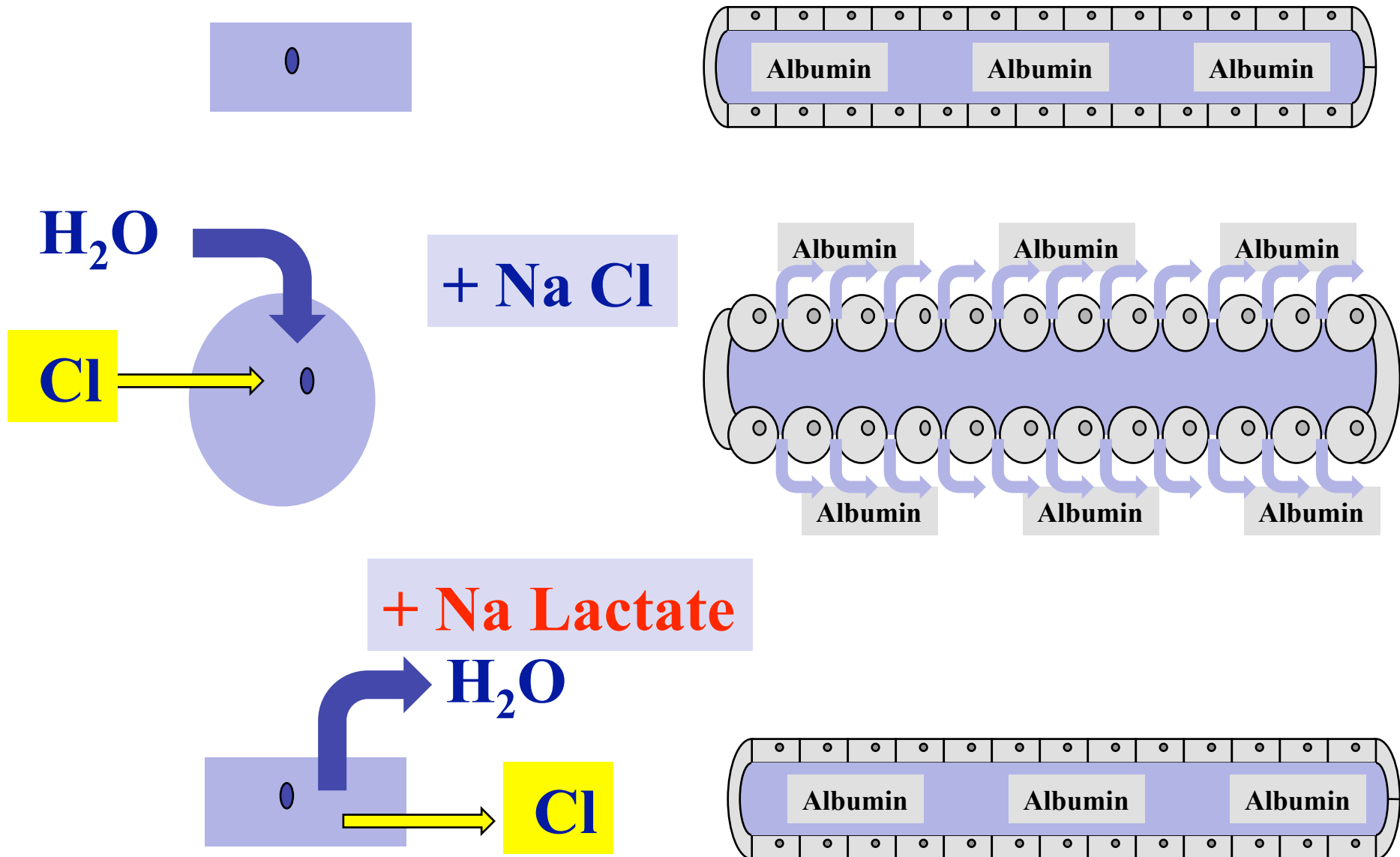


○ RL
● HSL



Effect on intravascular/interstitial volume

Cell swelling and capillary leakage



Les lenteurs de la science

Dietary Chloride as a Determinant of “Sodium-Dependent” Hypertension

Abstract. The uninephrectomized rat given desoxycorticosterone (DOC) provides a classic model of “sodium-dependent” hypertension. In such rats, the extent to which a given dietary intake of sodium induced an increase in blood pressure depended on whether or not the anionic component of the sodium salt was chloride. With normal and high dietary intakes of sodium, sodium chloride induced increases in blood pressure much greater than that induced by approximately equimolar amounts of sodium bicarbonate, sodium ascorbate, or a combination of sodium bicarbonate and sodium ascorbate. A normal amount of dietary sodium chloride induced hypertension, whereas an equimolar amount of sodium bicarbonate did not increase blood pressure. This difference could not be attributed to differences in sodium or potassium balances, weight gain, or caloric intake. The DOC model of “sodium-dependent” hypertension might better be considered sodium chloride-dependent.

Kurtz, 1983, Science

Conclusion

- Le lactate
 - Glucide
 - Indépendant de l'insuline
 - Sans danger
- Le lactate de sodium
 - Est un « extracteur » de chlore intracellulaire
 - Augmente le volume intravasculaire
 - Est un alcalinisant

Merci

