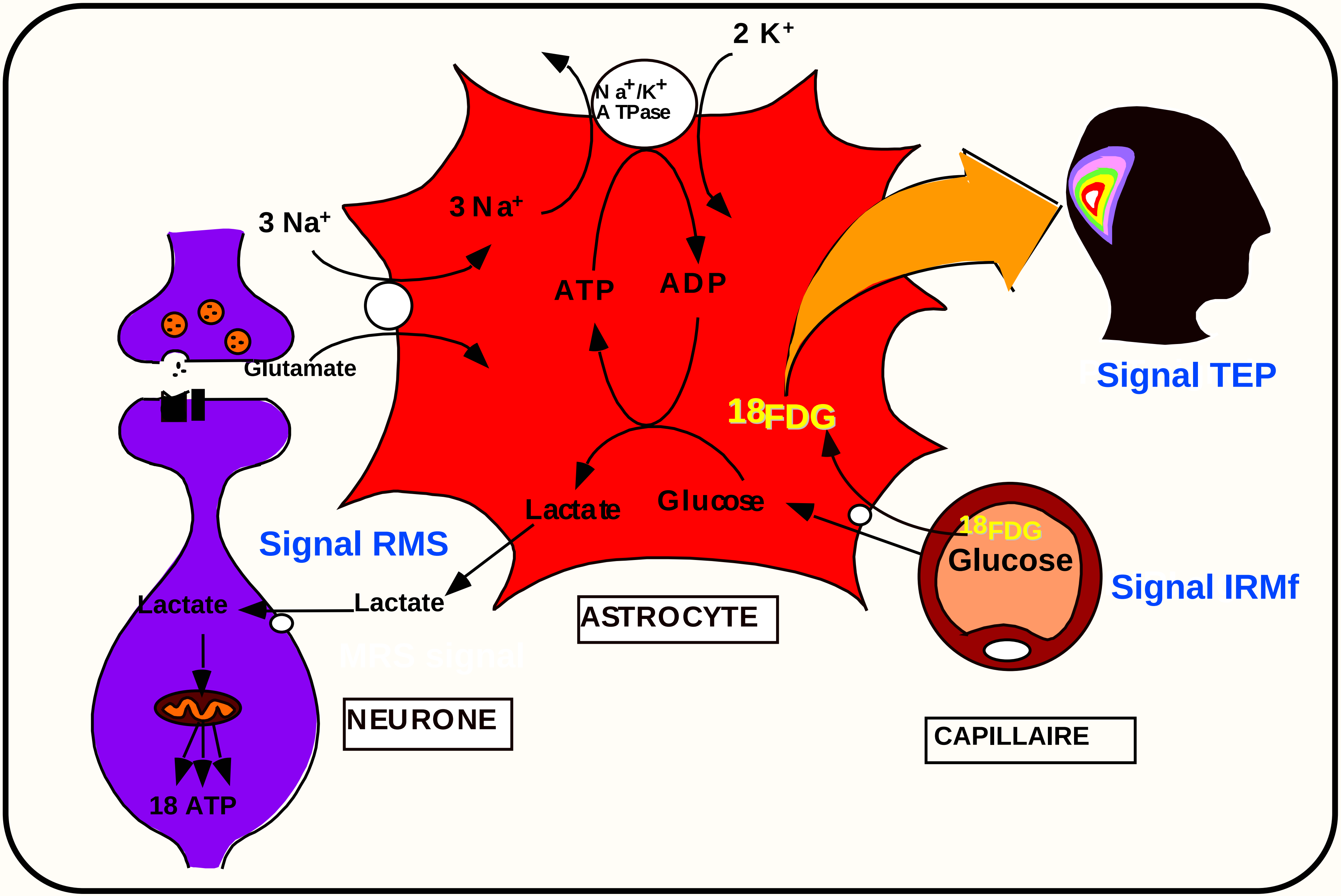
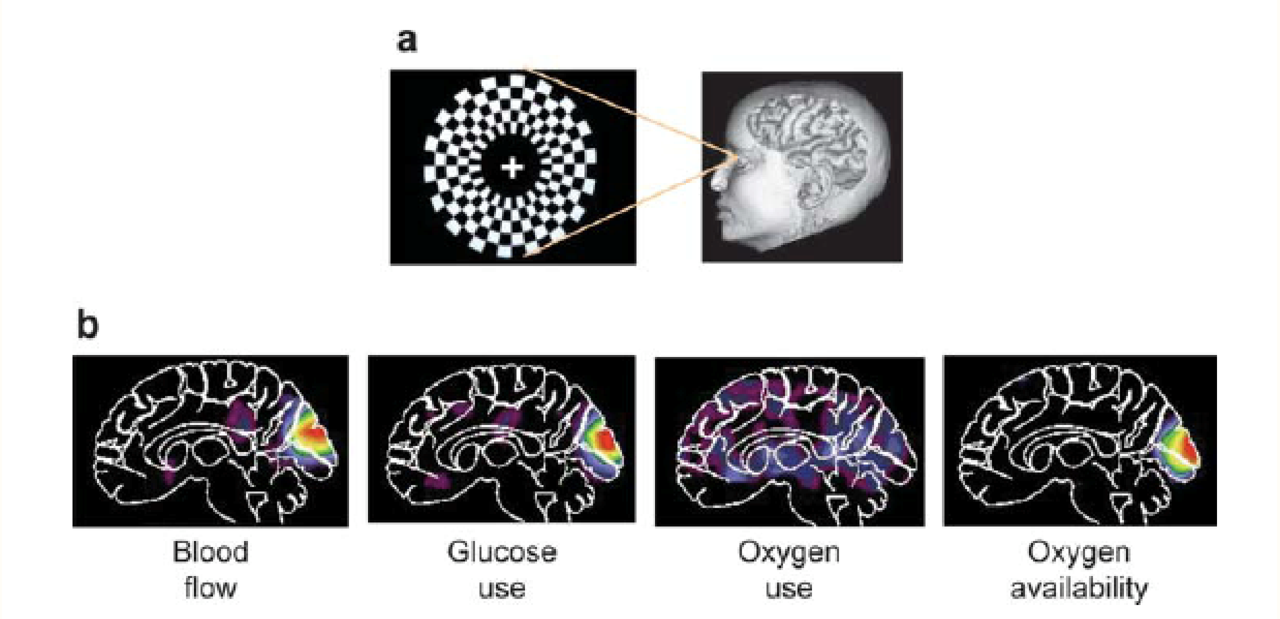
Rôle des astrocytes dans la production des signaux détectés par imagerie fonctionnelle



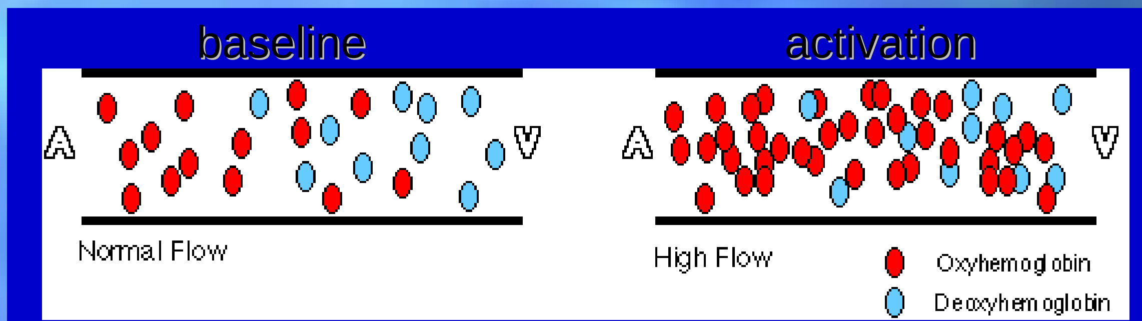
Changement des paramètres neurométaboliques et neurovasculaires durant l'activation



Raichle et Mintun, 2006

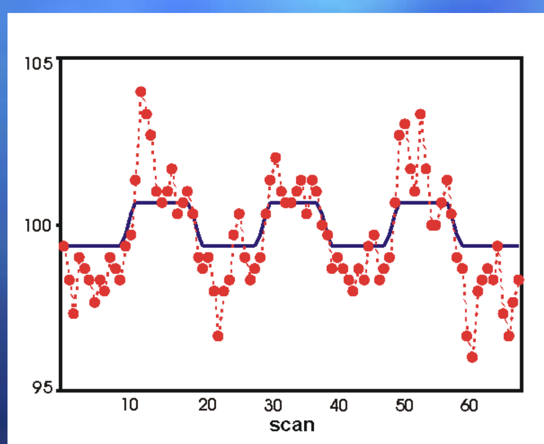
IRMf : principes

Blood **O**xygen **L**evel **D**ependent („BOLD“) Signal



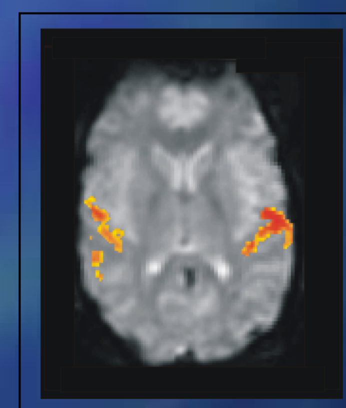
correlates with
local field potentials
and spike frequency

(Logothetis et al., Nature, 2001;
Smith et al., PNAS, 2002)



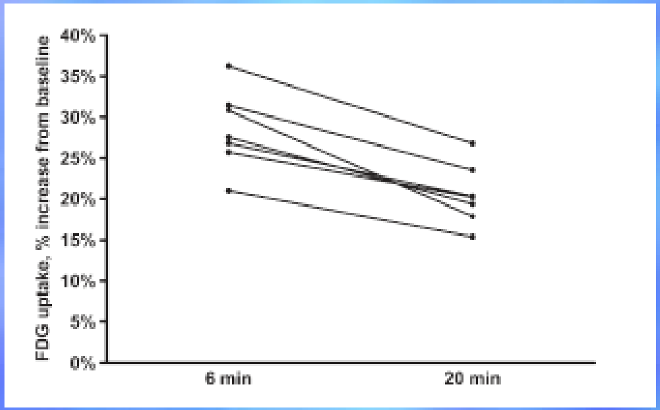
relative BOLD
signal intensity

voxel-wise
cross-correlation

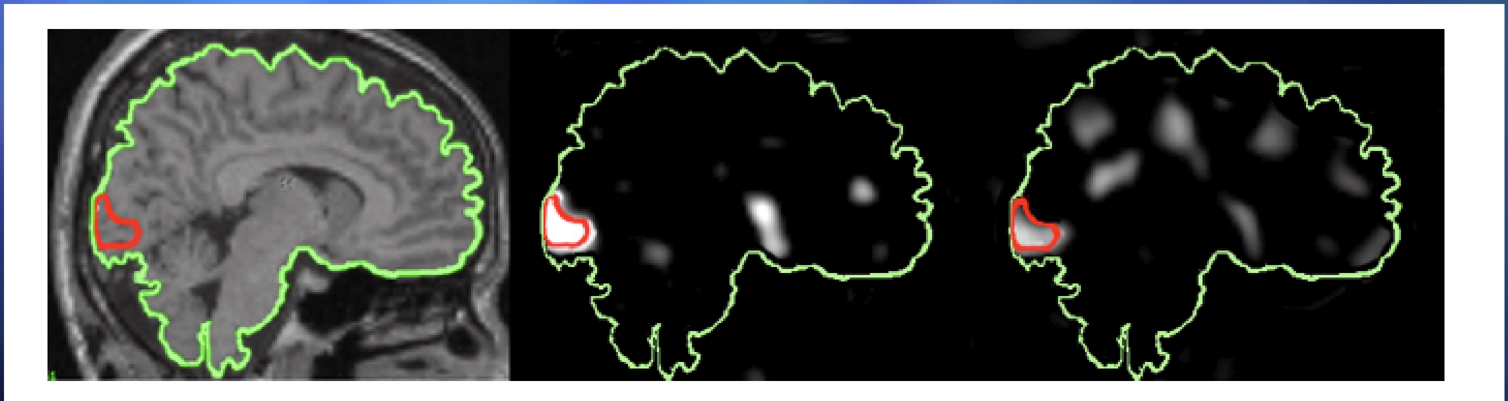


activation map

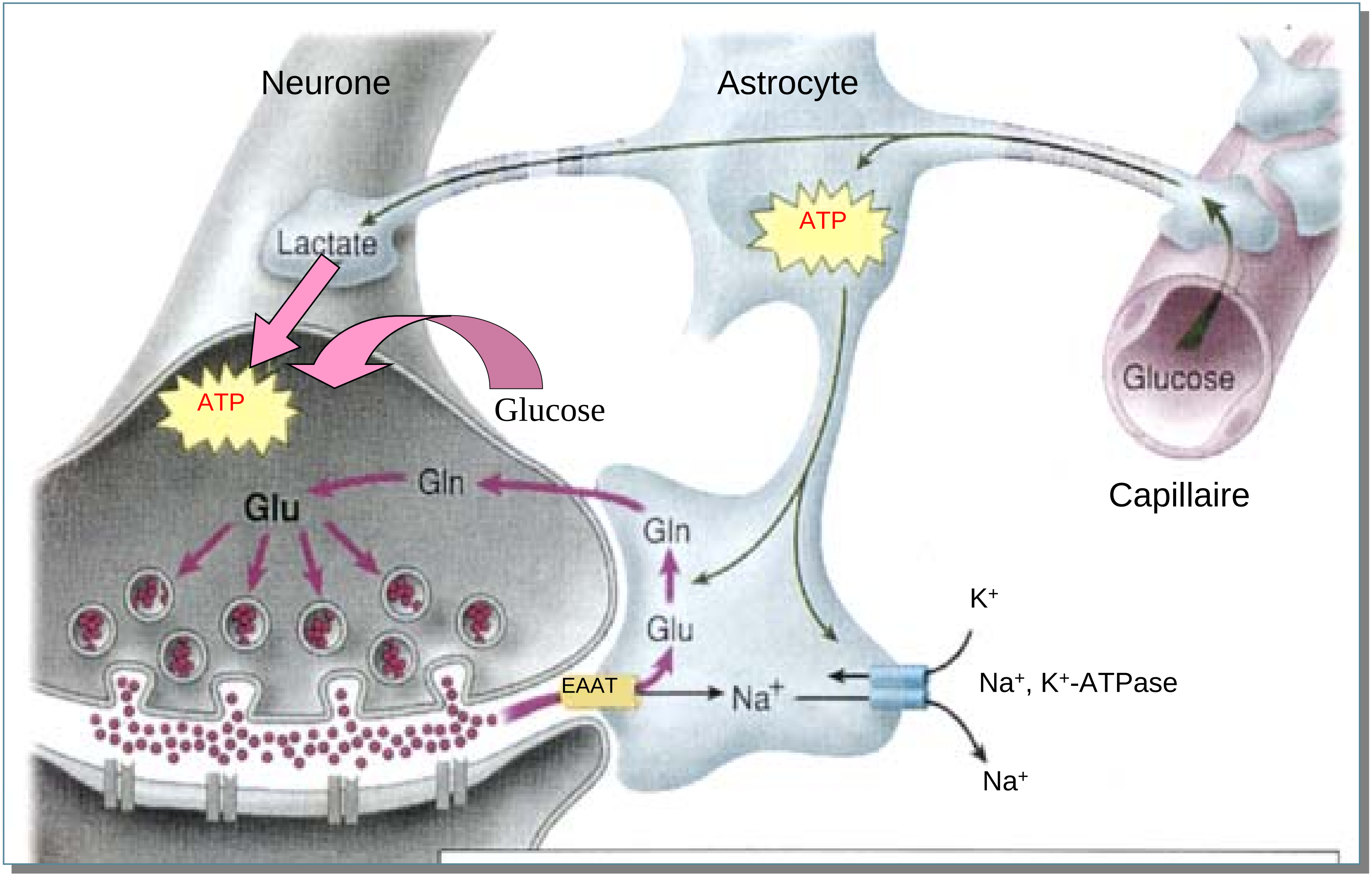
Diminution de la consommation de glucose au cours d’une visuelle prolongée

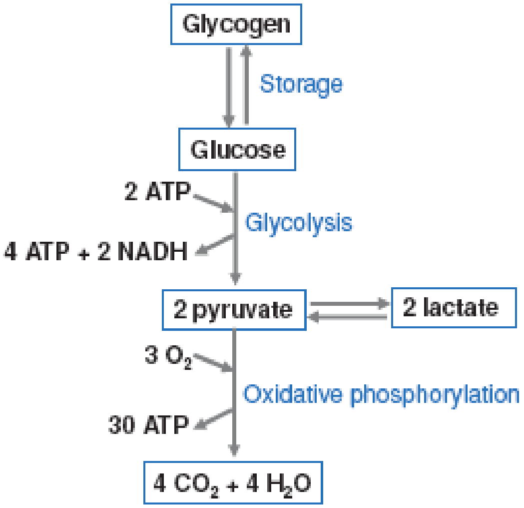


Vlassenko et al 2006



L'unité neuroénergétique

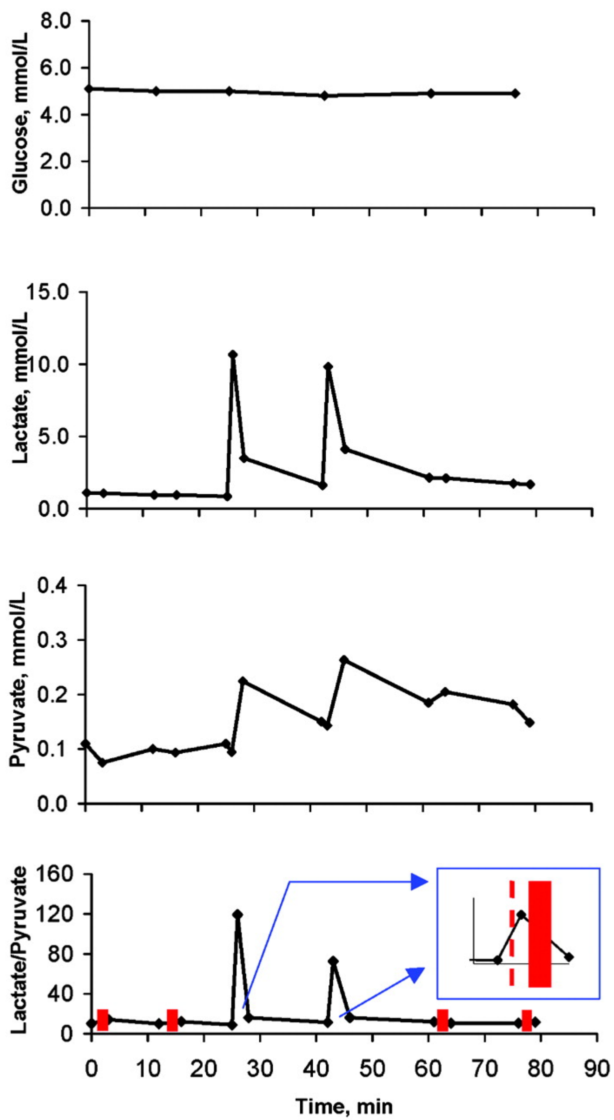



Glycogen
Storage
Glucose
2 ATP
Glycolysis
4 ATP + 2 NADH
2 pyruvate
2 lactate
3 O_2
Oxidative phosphorylation
30 ATP
4 CO_2 + 4 H_2O

Increased lactate/pyruvate ratio augments blood flow in physiologically activated human brain

Mark A. Mintun*, Andrei G. Vlassenko, Melissa M. Rundle, and Marcus E. Raichle

PNAS | January 13, 2004 | vol. 101 | no. 2 | 659–664



PNAS

Journal of Cerebral Blood Flow & Metabolism
23:658–664 © 2003 The International Society for Cerebral Blood Flow and Metabolism
Published by Lippincott Williams & Wilkins, Inc., Baltimore

Lactate: A Preferred Fuel for Human Brain Metabolism *In Vivo*

*Diarmuid Smith, *Andrew Pernet, †William A. Hallett, *Emma Bingham, †Paul K. Marsden, and *Stephanie A. Amiel

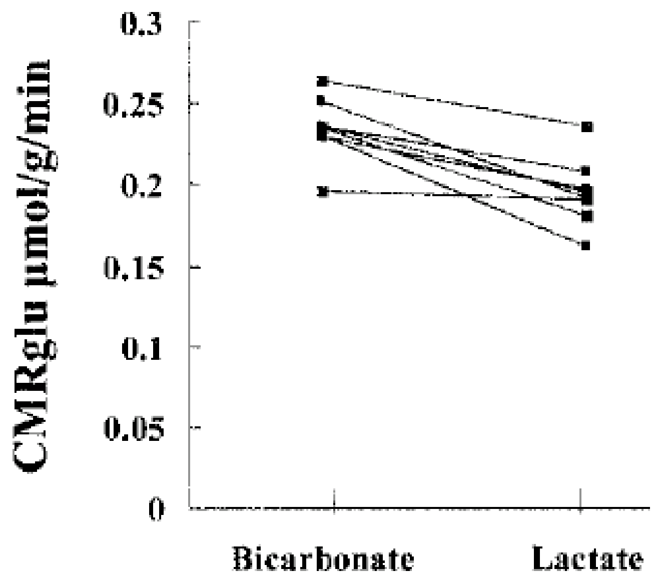
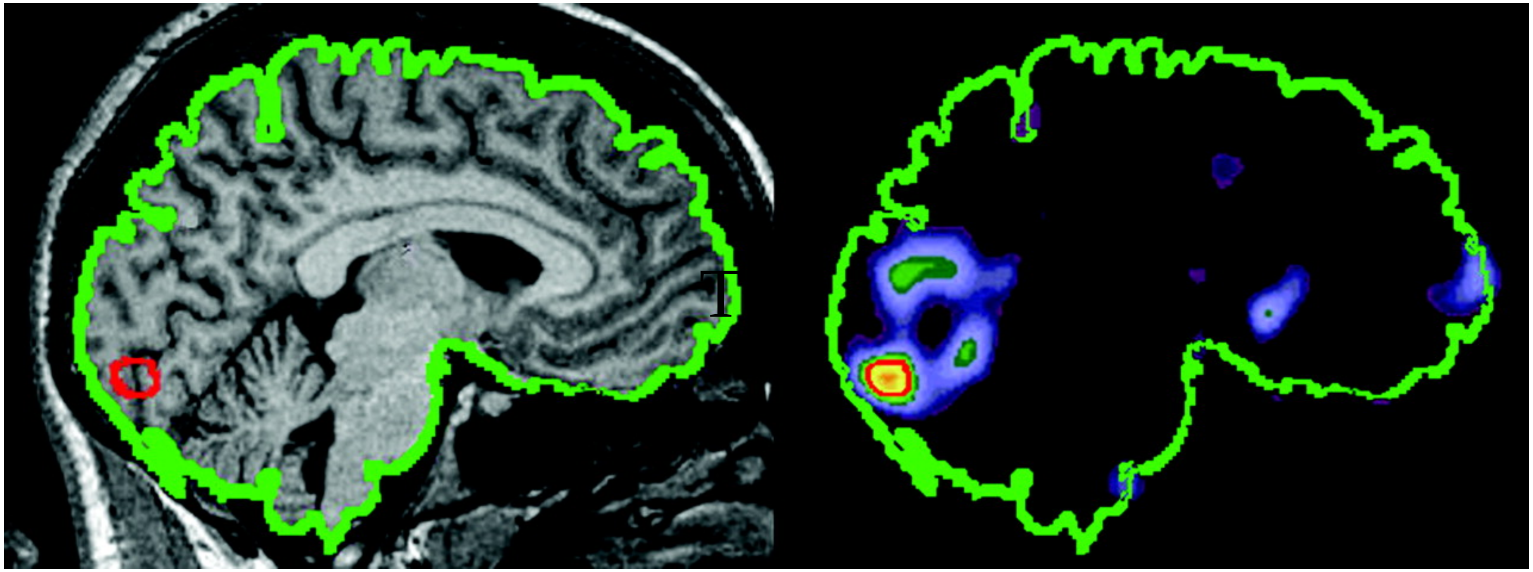
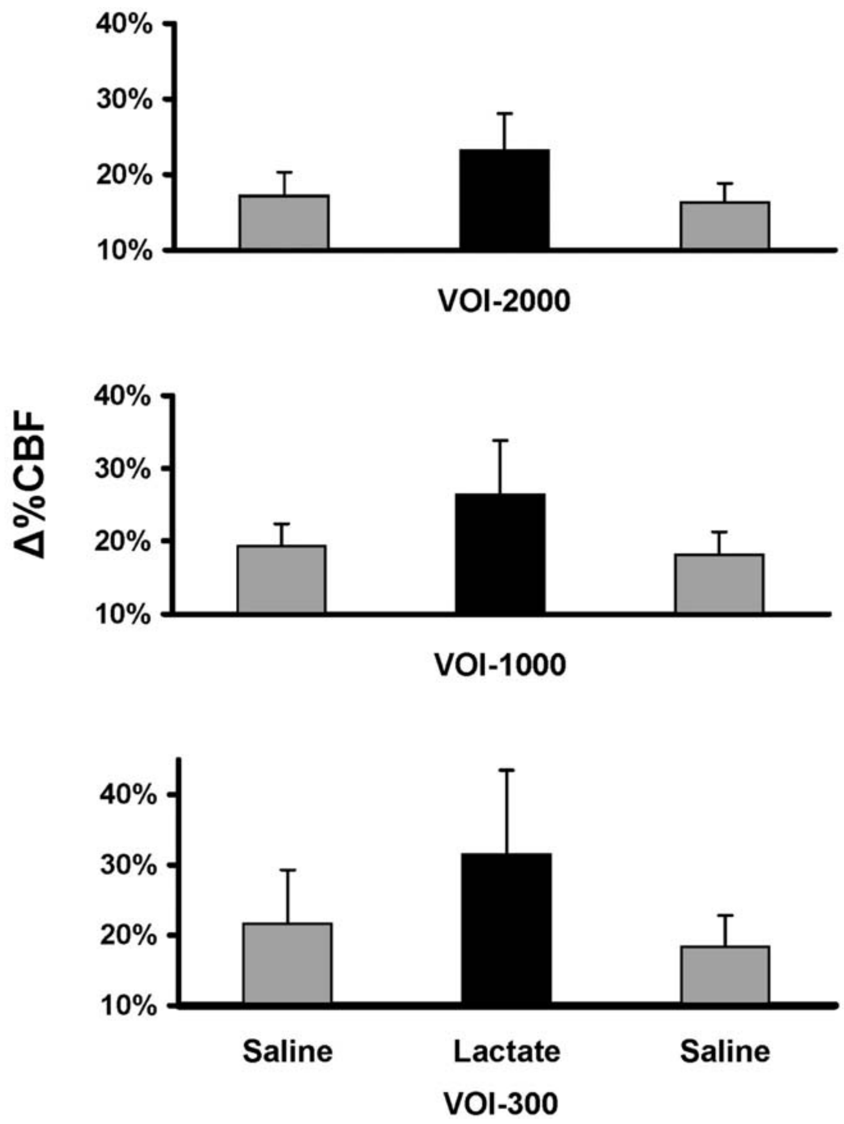


Fig. 2. Coregistered sagittal MRI (left) and PET (right) images from a single subject



Mintun, Mark A. et al. (2004) Proc. Natl. Acad. Sci. USA 101, 659-664

Fig. 3. The percent increase in CBF ({Delta}%CBF) caused by visual stimulation with and without bolus lactate injection for all three sizes of VOIs examined



Mintun, Mark A. et al. (2004) Proc. Natl. Acad. Sci. USA 101, 659-664

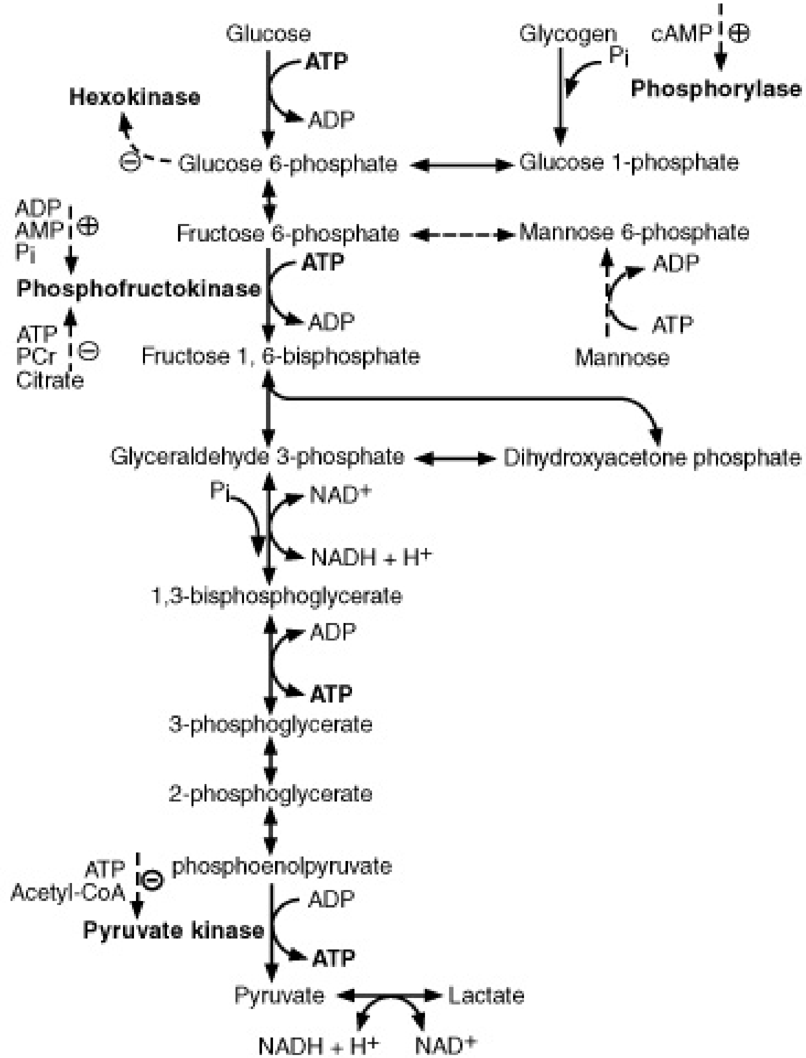


FIGURE 3.1 Glycolysis (Embden–Meyerhof pathway). Glucose phosphorylation is regulated by hexokinase, an enzyme inhibited by glucose 6-phosphate. Glucose must be phosphorylated to glucose 6-phosphate to enter glycolysis or to be stored as glycogen. Two other important steps in the regulation of glycolysis are catalyzed by phosphofructokinase and pyruvate kinase. Their activity is controlled by the levels of high-energy phosphates as well as of citrate and acetyl-CoA. Pyruvate, through lactate dehydrogenase, is in dynamic equilibrium with lactate. This reaction is essential to regenerate NAD^+ residues necessary to sustain glycolysis downstream of glyceraldehyde 3-phosphate. PCr, phosphocreatine.

FROM MOLECULES TO NETWORKS John H. Byrne, James L. Roberts b

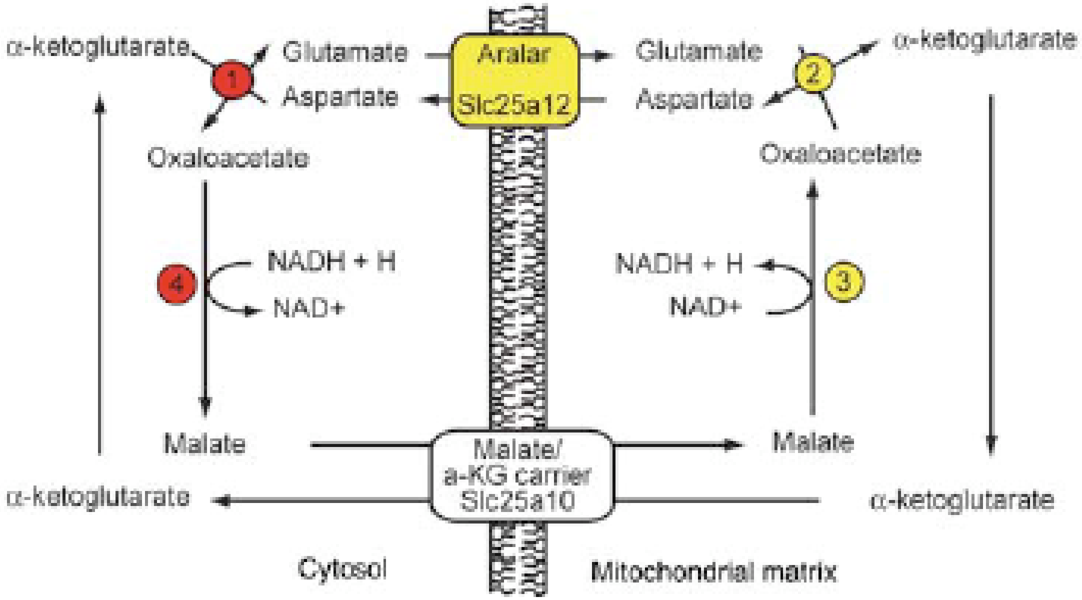
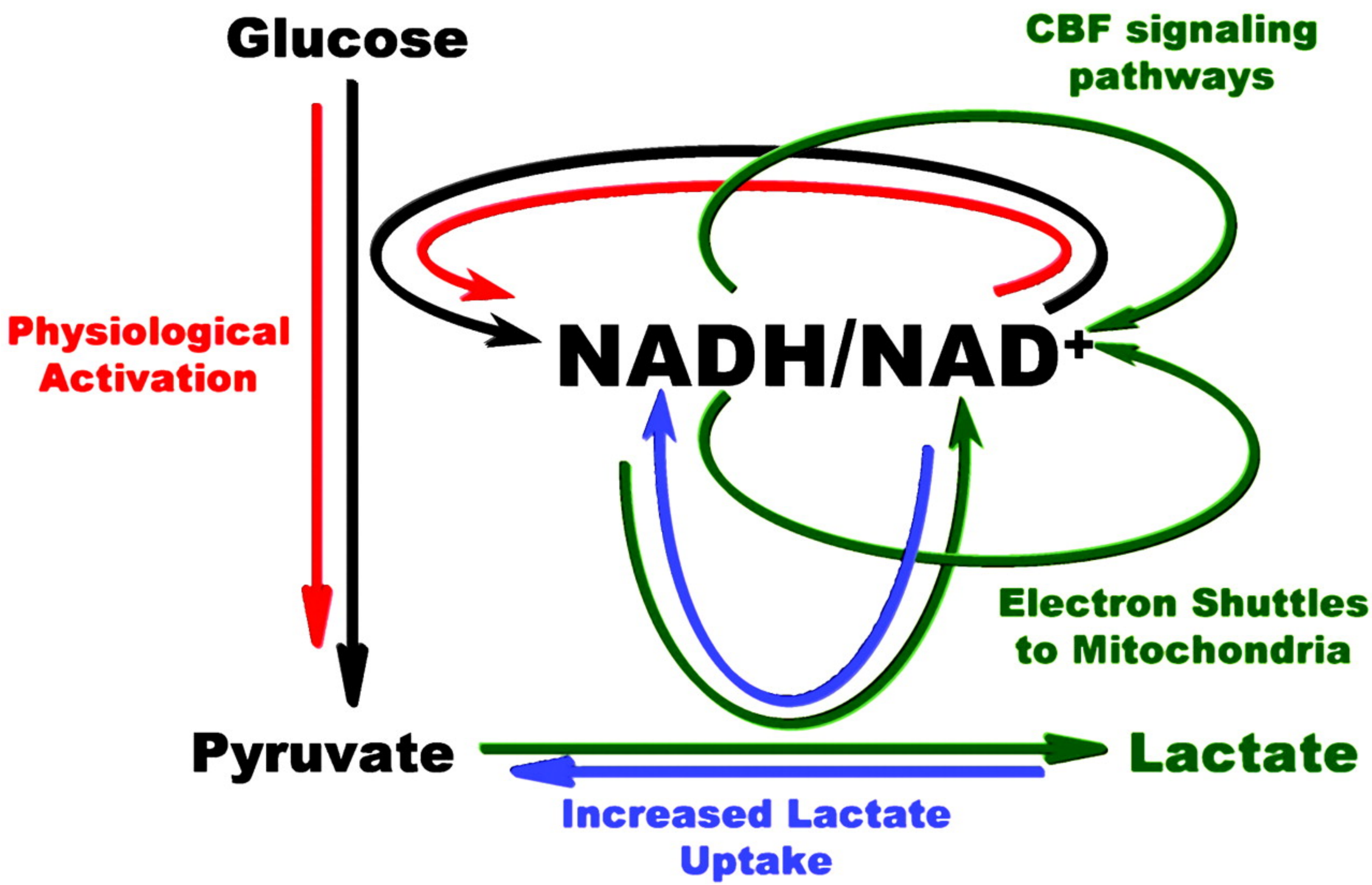

α-ketoglutarate
Glutamate
Aspartate
Oxaloacetate
Aralar
Slc25a12
Glutamate
Aspartate
α-ketoglutarate
Oxaloacetate
NADH + H
NAD+
NADH + H
NAD+
Malate
Malate/
a-KG carrier
Slc25a10
Malate
α-ketoglutarate
α-ketoglutarate
Cytosol
Mitochondrial matrix

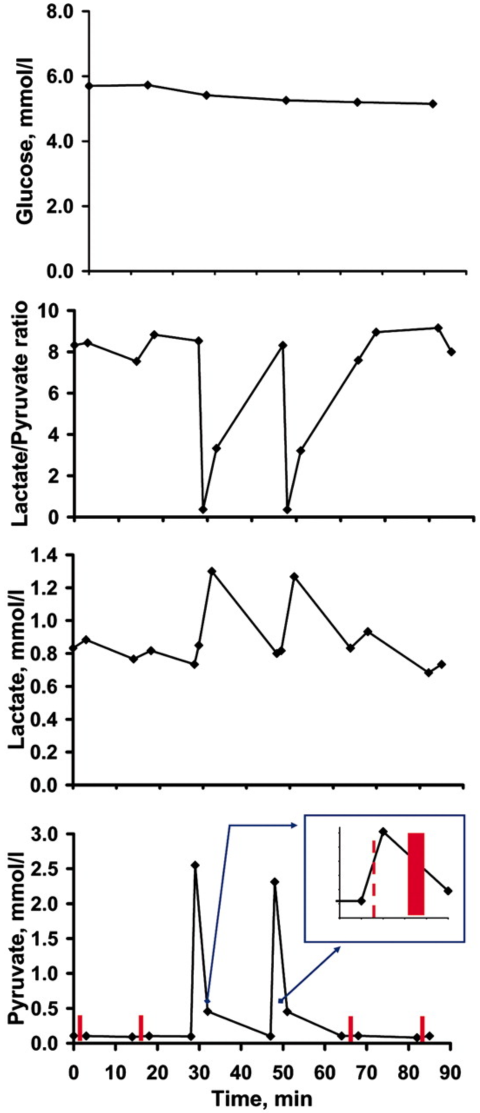
Fig. 5. Mechanisms of increased cytosolic NADH production and regeneration of NAD+



Mintun, Mark A. et al. (2004) Proc. Natl. Acad. Sci. USA 101, 659-664

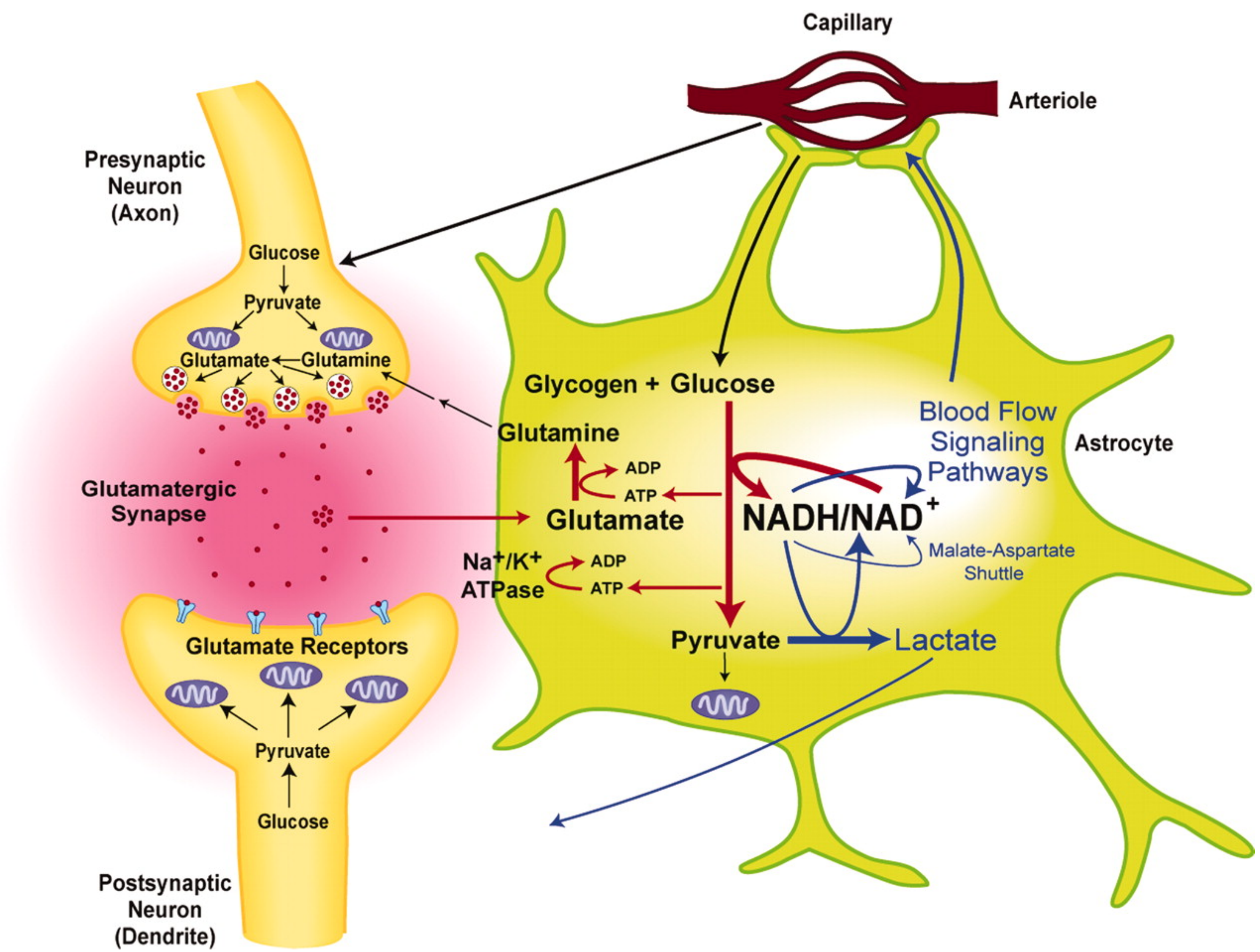
Regulation of blood flow in activated human brain by cytosolic NADH/NAD^{+} ratio

Andrei G. Vlassenko, Melissa M. Rundle, Marcus E. Raichle*, and Mark A. Mintun*



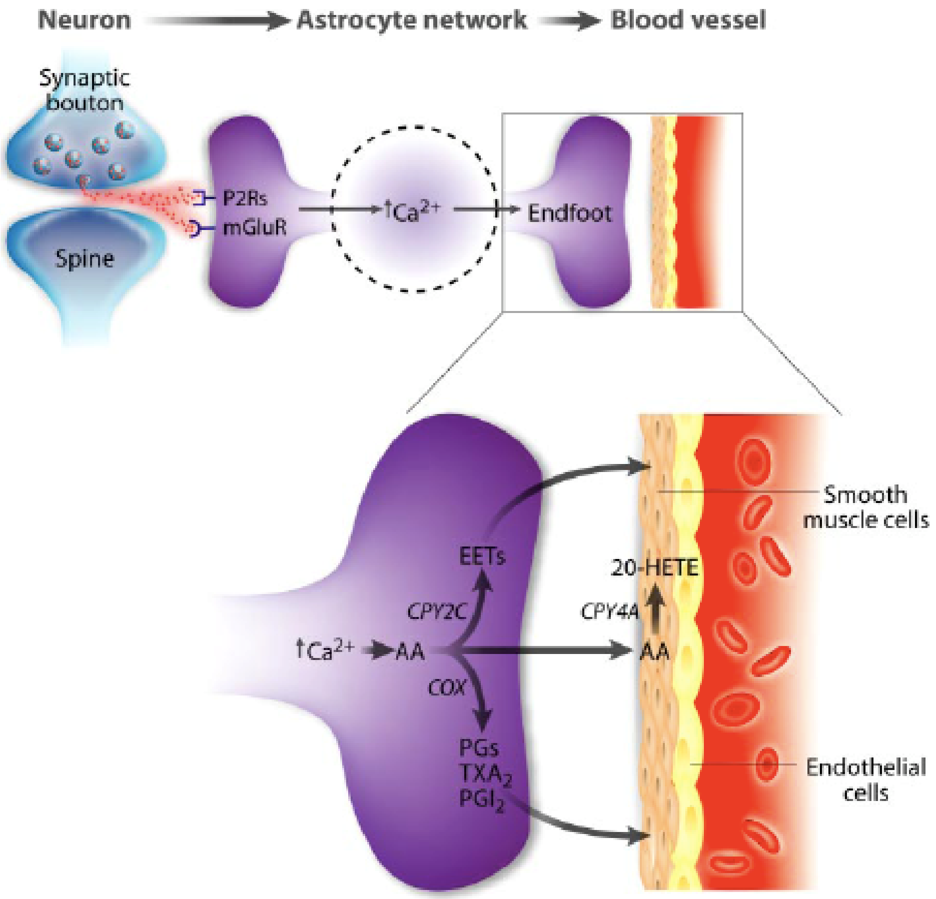
Vlassenko, Andrei G. et al. (2006) Proc. Natl. Acad. Sci. USA 103, 1964-1969

Fig. 3. Proposed model of regulation of blood flow in physiologicallystimulated human brain



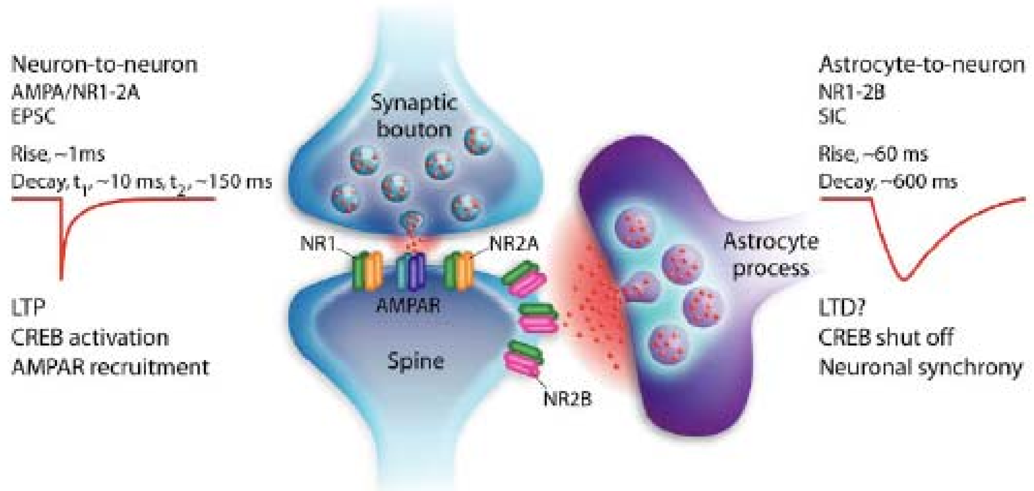
Vlassenko, Andrei G. et al. (2006) Proc. Natl. Acad. Sci. USA 103, 1964-1969

Rôle des astrocytes dans le couplage neuro-vasculaire



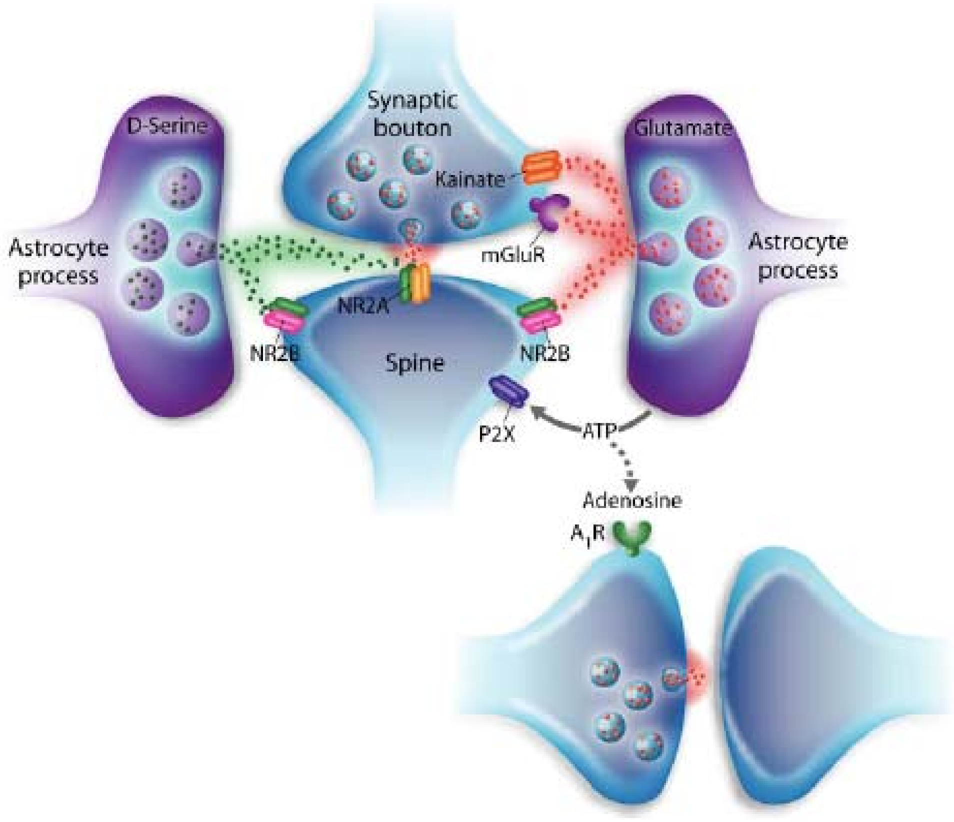
Haydon et Carmignoto, 2006

Action différentielle du glutamate neuronal et astrocytaire sur les récepteurs NMDA



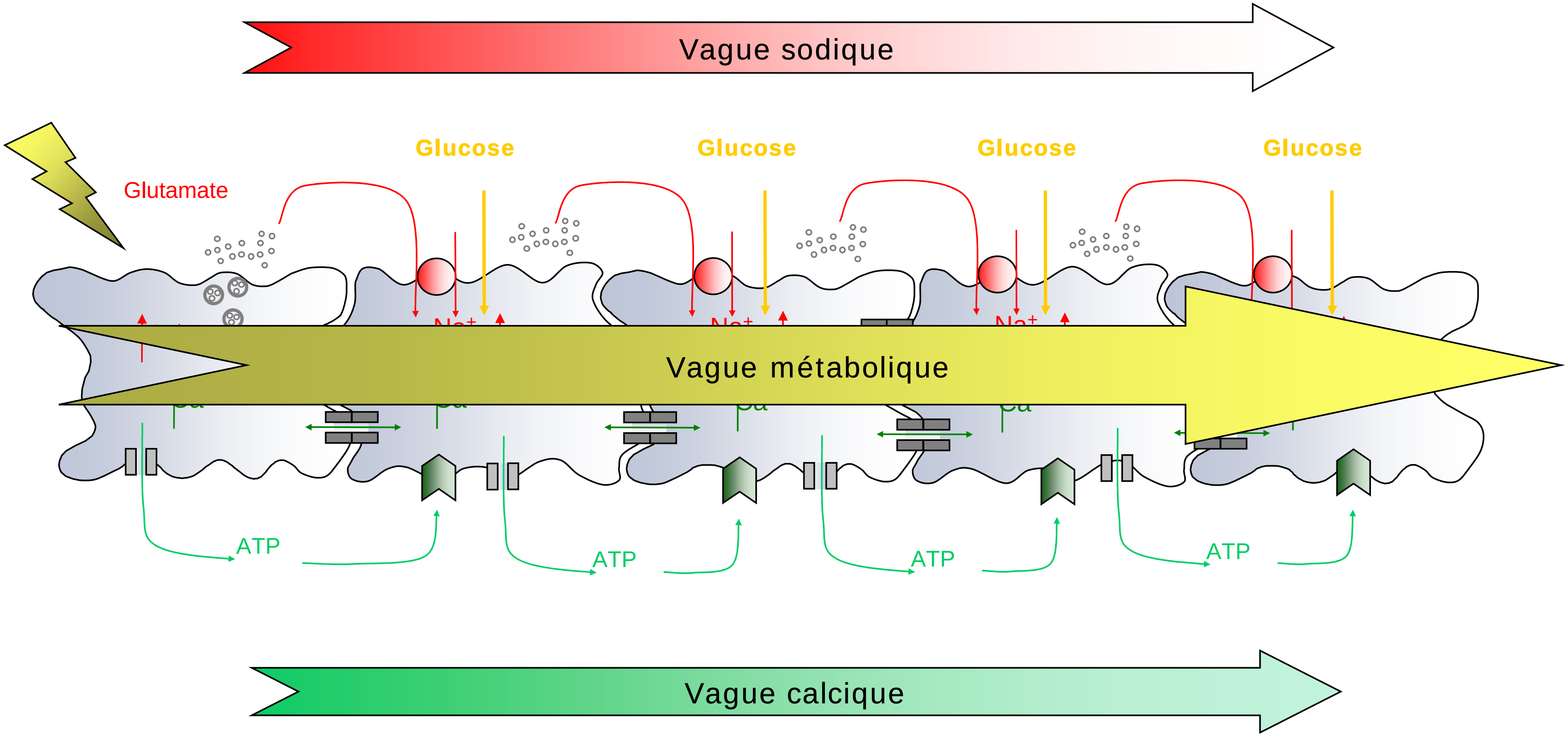
Haydon et Carmignoto, 2006

Modulation de la transmission synaptique par des signaux astrocytaires

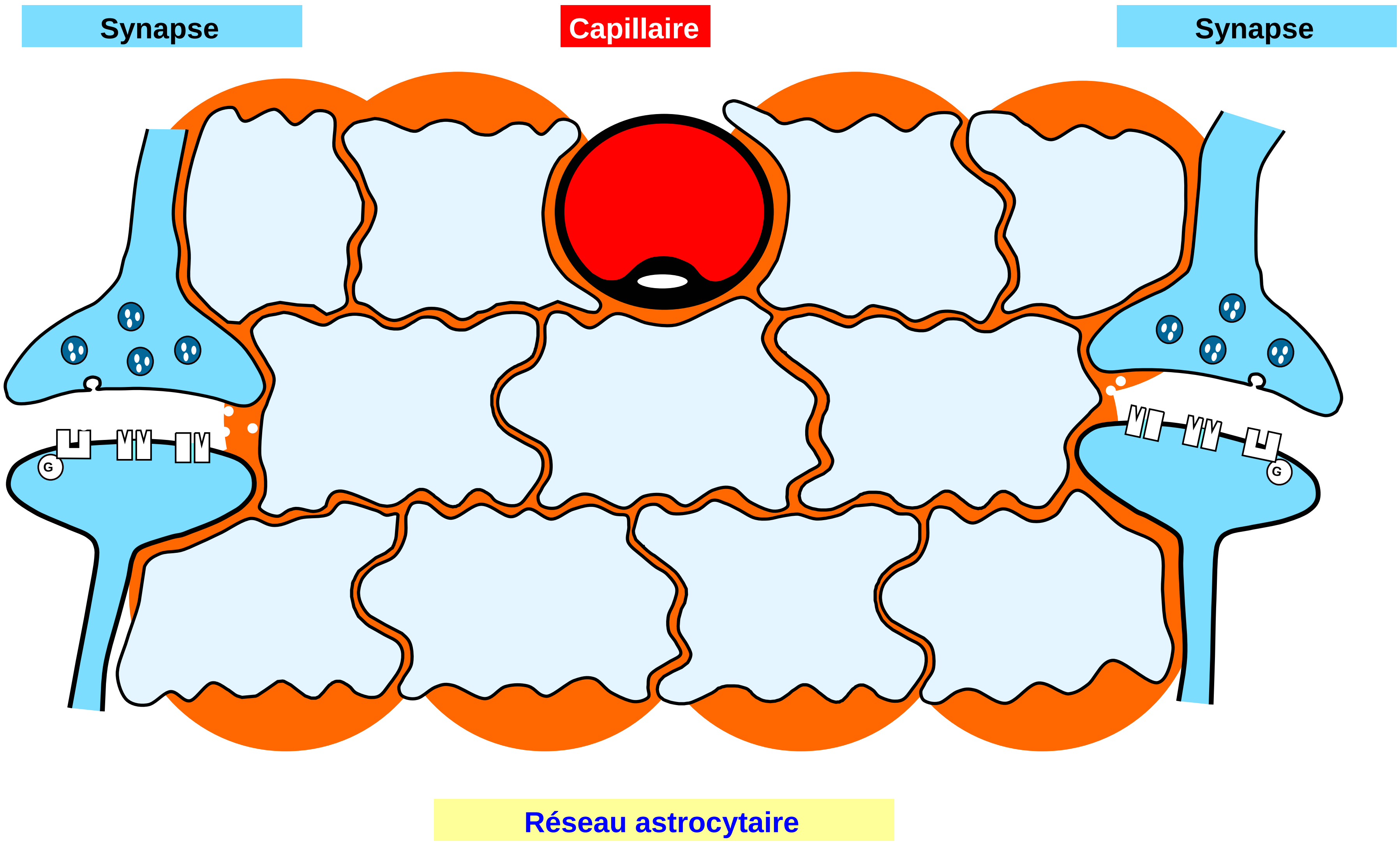


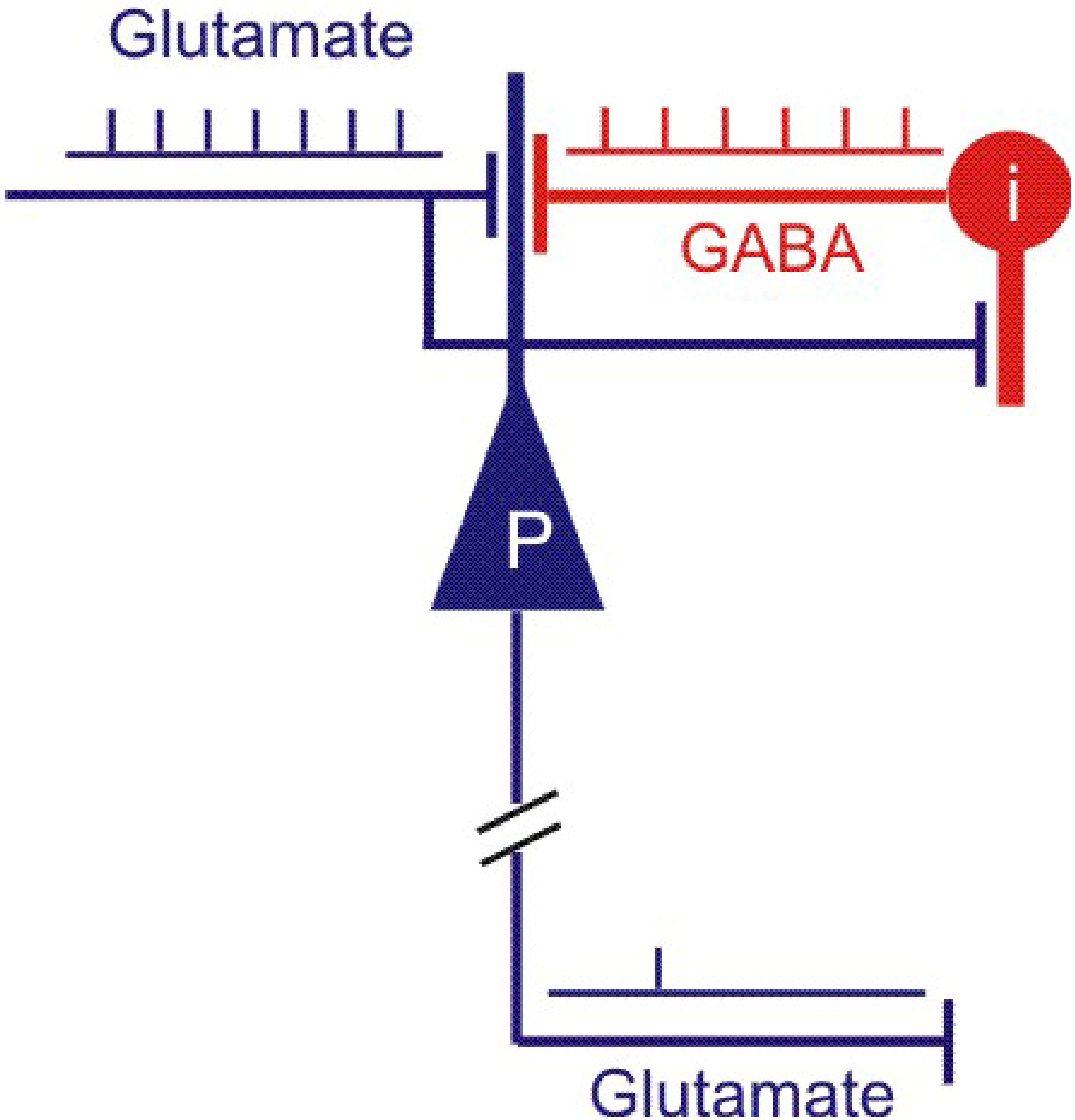
Haydon et Carmignoto, 2006

Vagues intercellulaires calciques, sodiques et métaboliques



Mécanisme d'amplification du couplage neurométabolique





Glutamate
GABA
i
P
Glutamate

Rôle des Astrocytes dans le couplage neurométabolique