

# Pourquoi le sommeil est-il utile ?

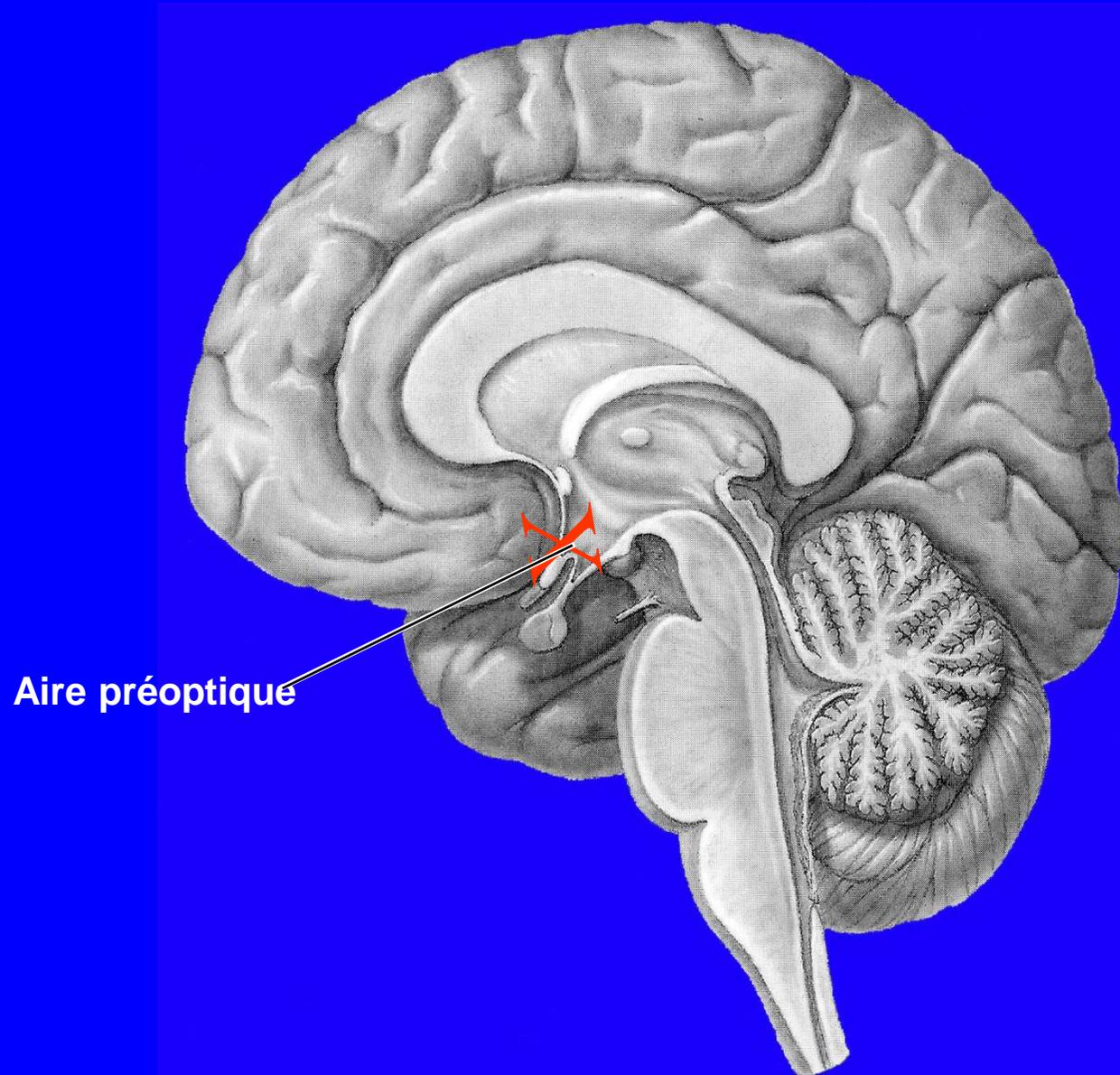
Patrick Lévy

Laboratoire HP2 UJF  
INSERM 1042, Grenoble

# Contenu

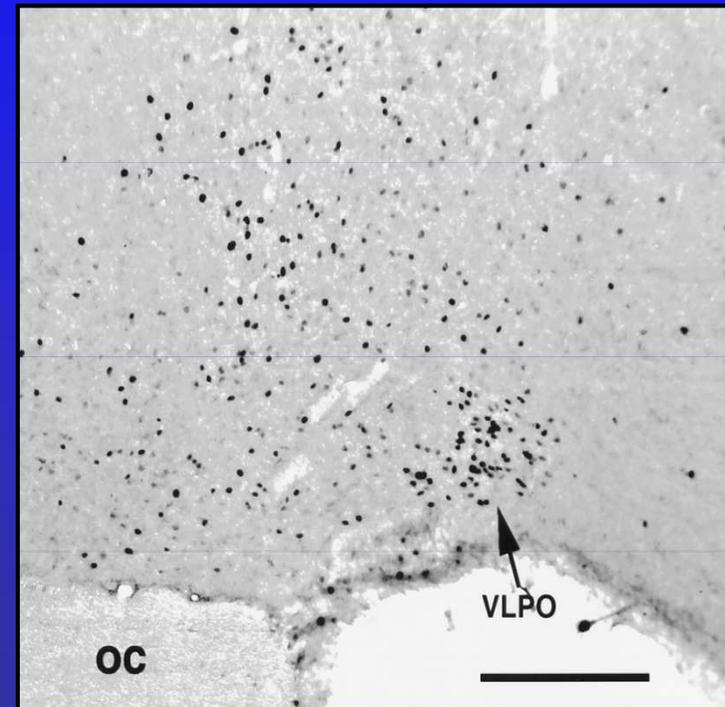
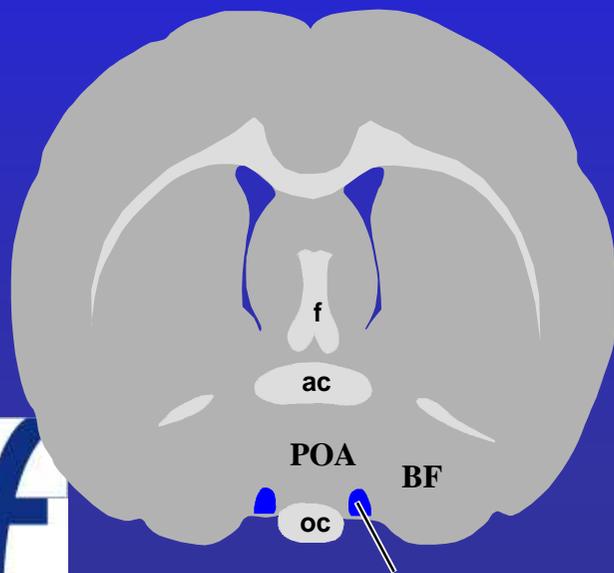
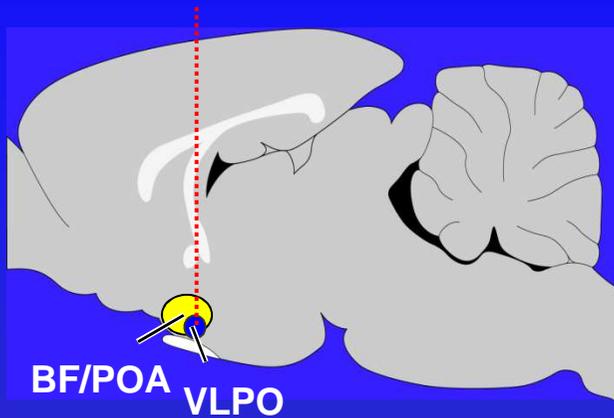
- **A quoi sert le sommeil?**
- **Durée de sommeil et hypertension**
- **Durée de sommeil et syndrome métabolique**
- **Mécanismes induits par la réduction du temps de sommeil**
- **Effets de la sieste**
- **Pathologies du sommeil**

# Comment survient le sommeil?

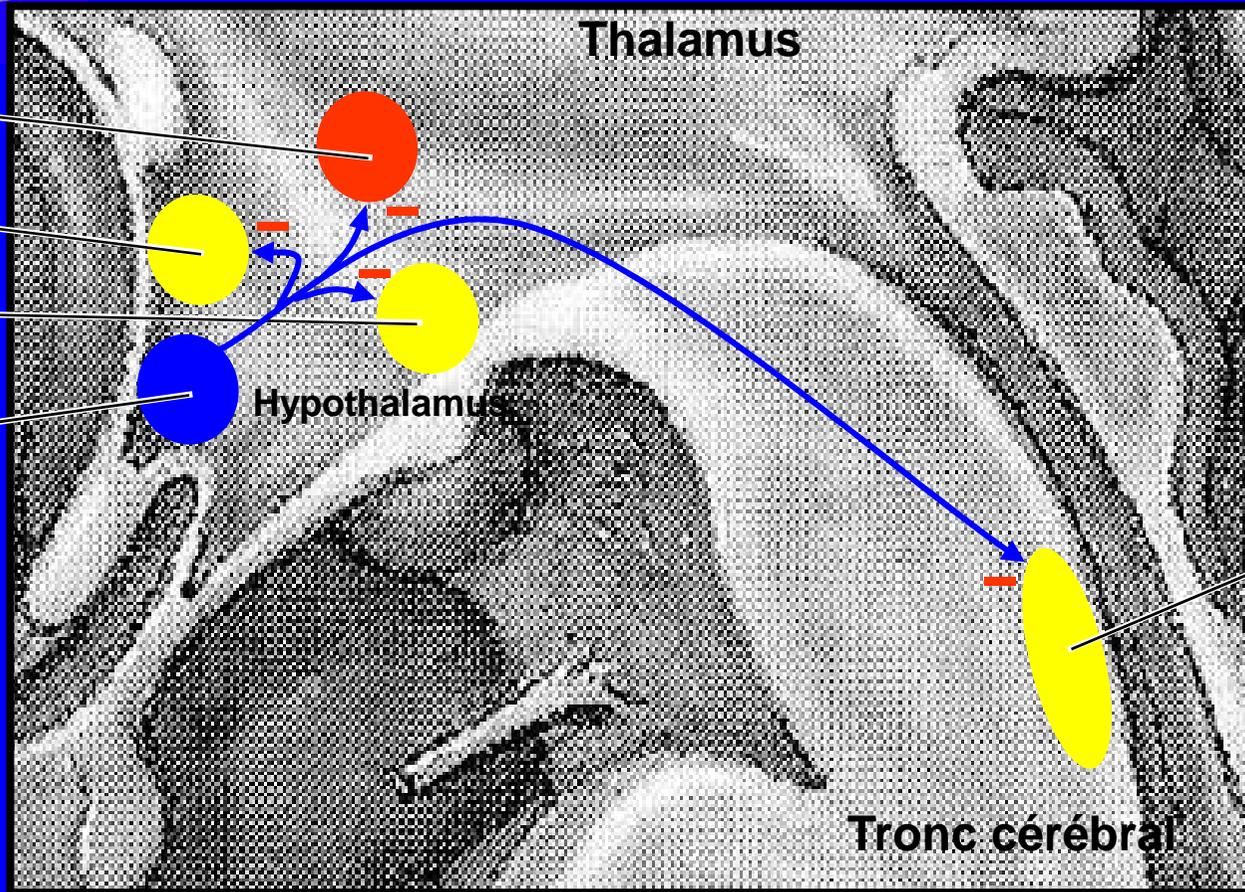
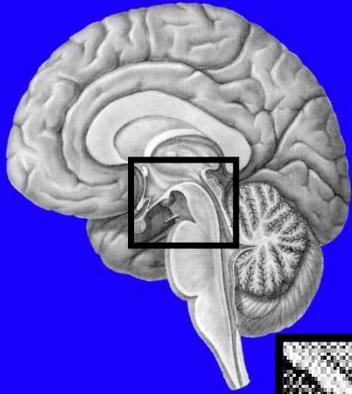


Aire préoptique

# Des neurones séléctivement actifs durant le sommeil sont localisés dans l'aire préoptique ventro-laterale



Sherin et al. 1998 J. Neurosci., 1998, 18, 4705-4721



Orexin

Acetylcholine

Histamine

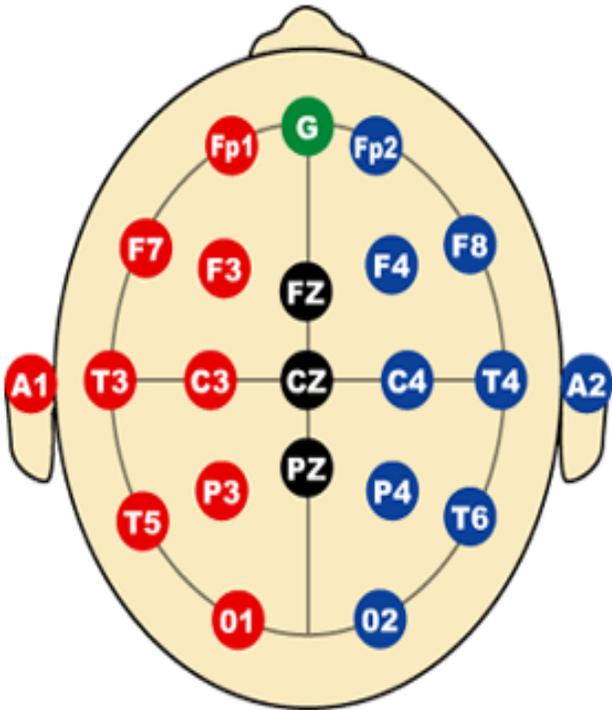
GABA

Transmetteurs  
hypothalamiques

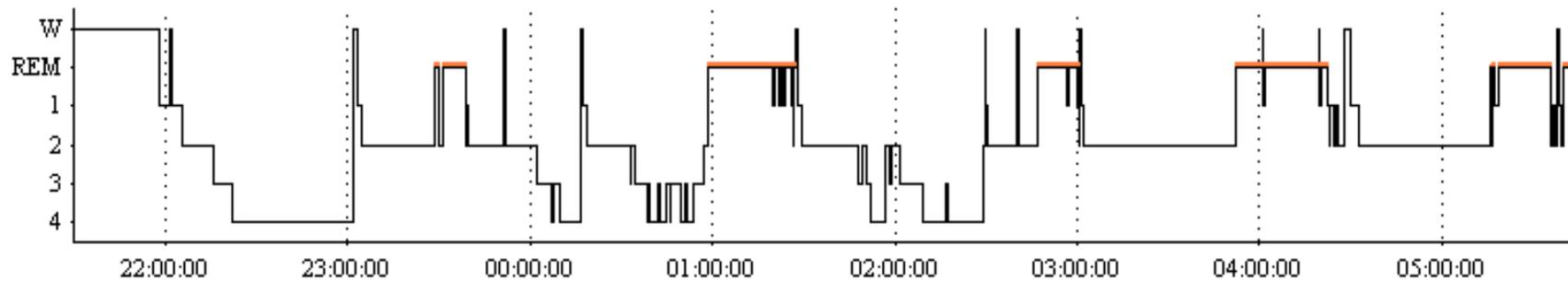
Acetylcholine  
Noradrenaline  
Serotonine

Transmetteurs  
Du tronc cérébral

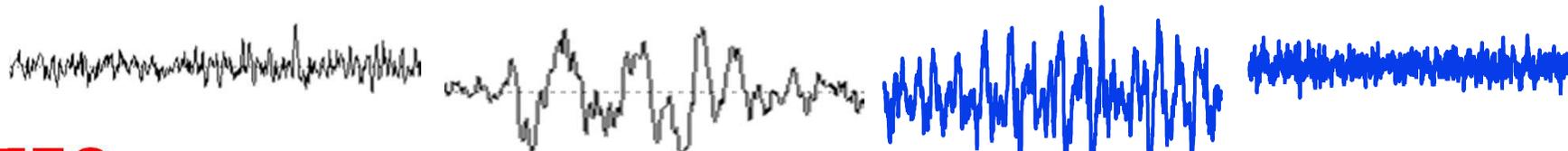
# Polysomnograph



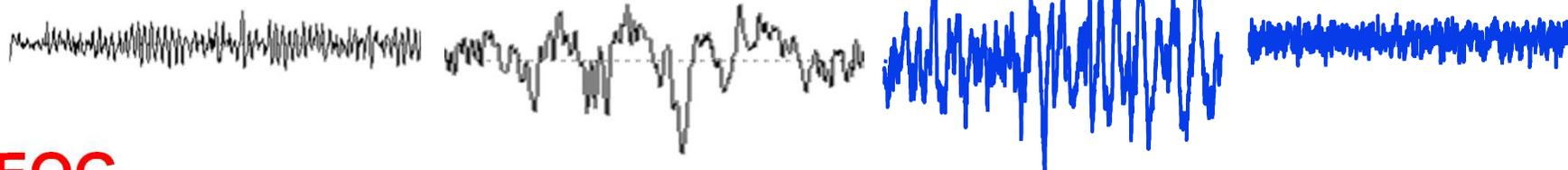
# Polysomnographie



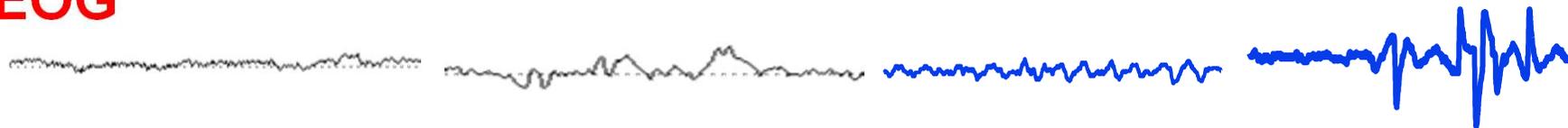
EEG



EOG

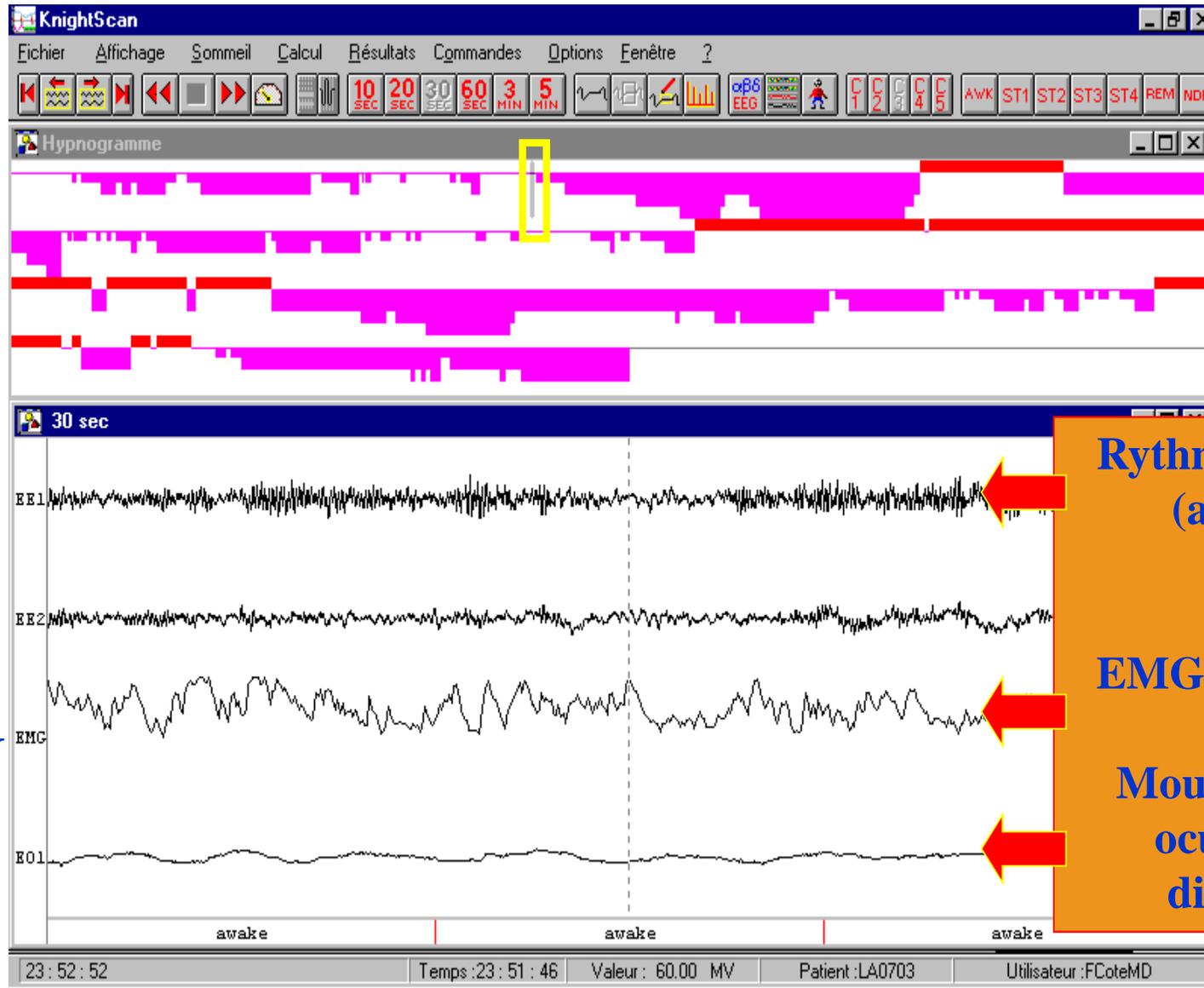


EMG



Veille Sommeil léger Sommeil profond S. paradoxal

# Eveil



EEG

EEG

EMG

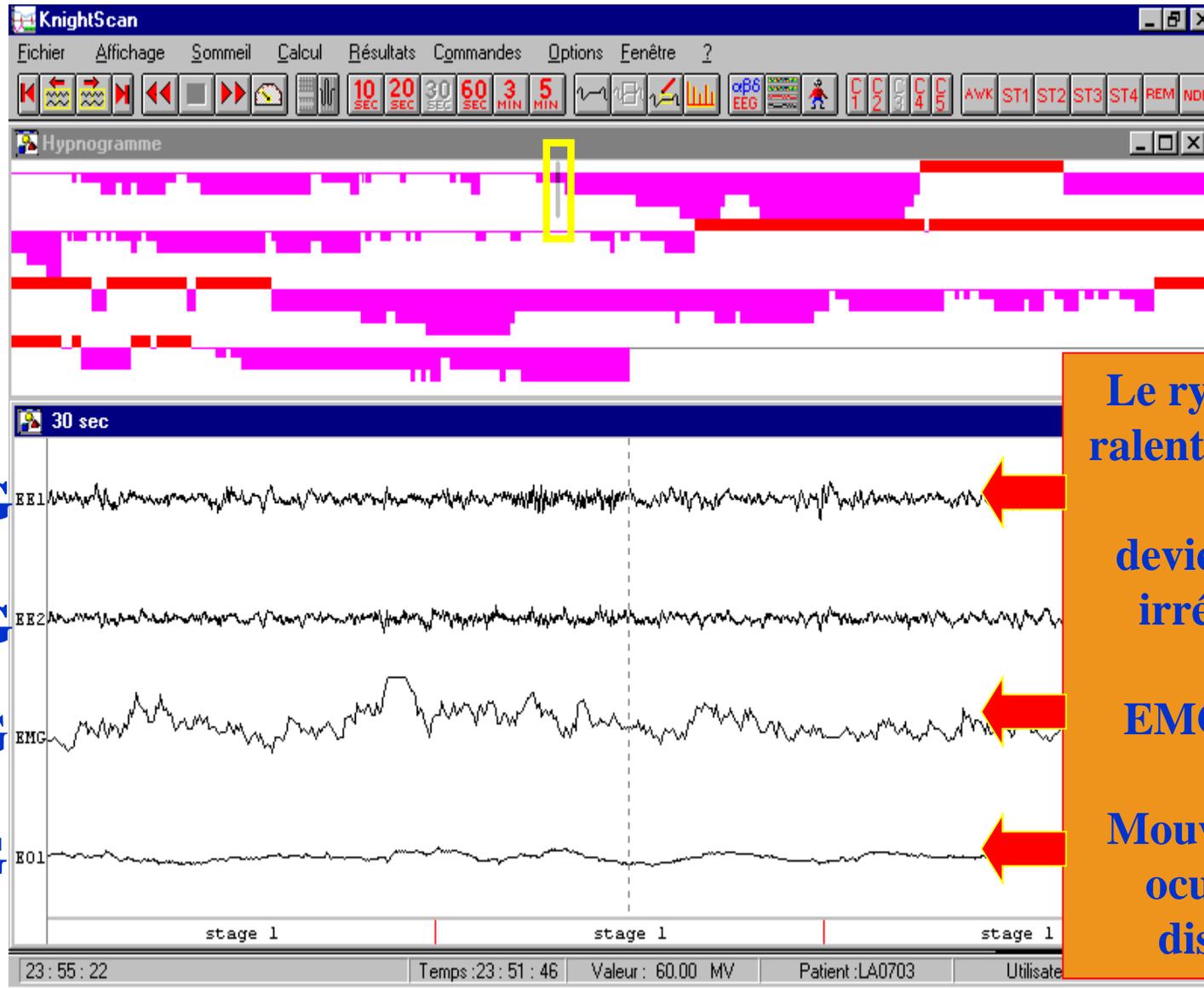
EOG

Rythme rapide  
(alpha)

EMG très actif

Mouvements  
oculaires  
discrets

# Stade 1

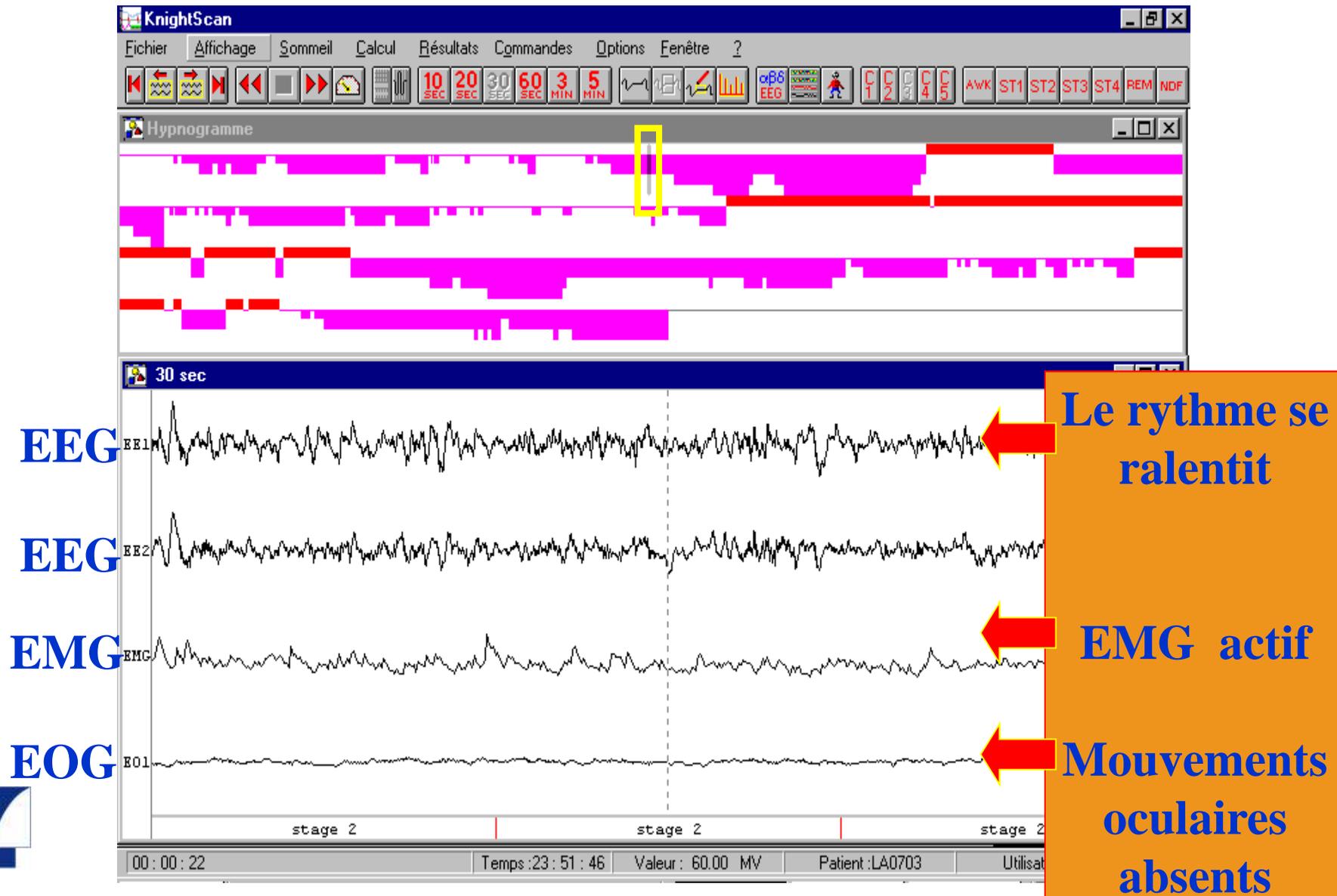


**Le rythme se ralentit un peu et devient plus irrégulier**

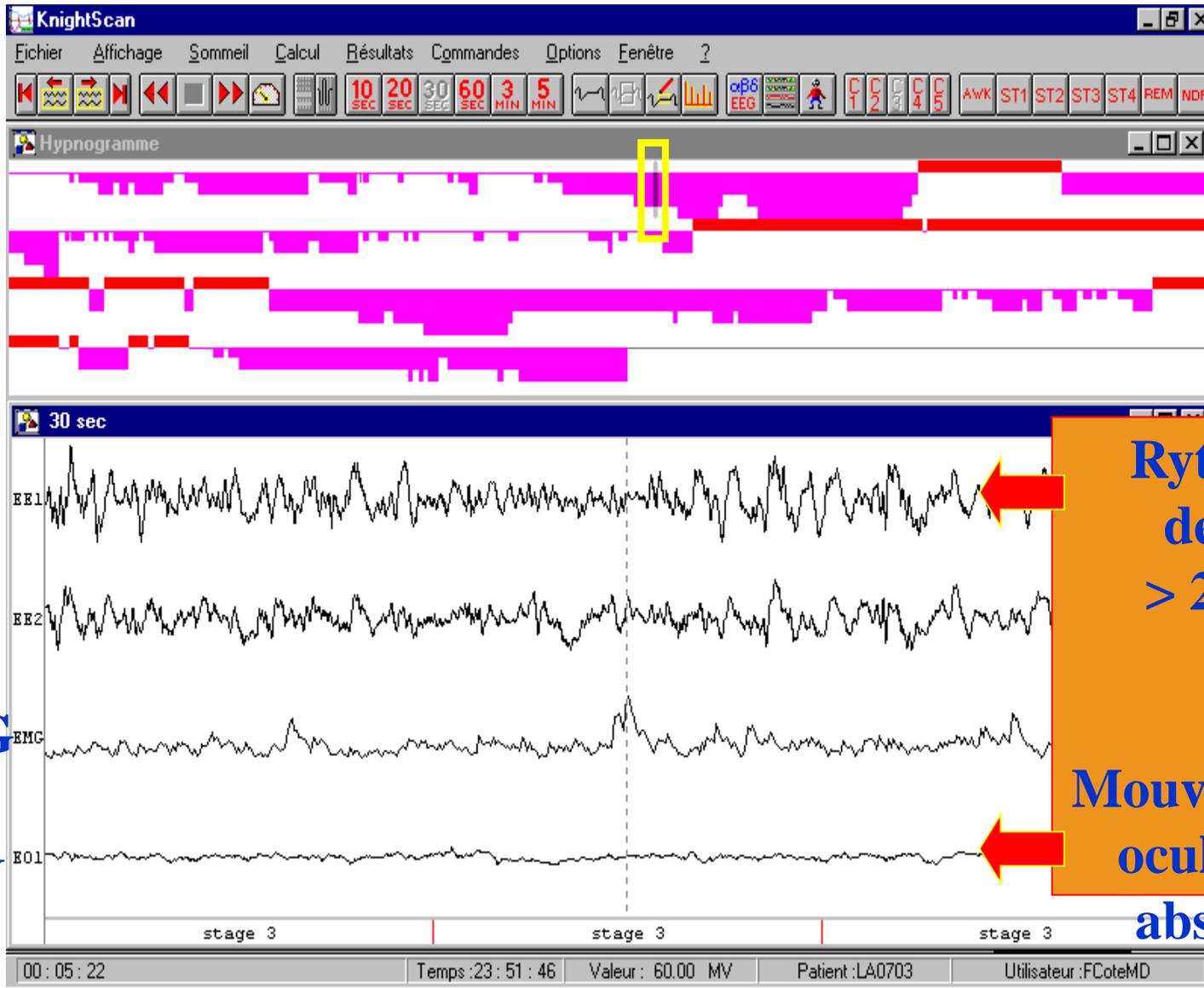
**EMG actif**

**Mouvements oculaires discrets**

## Stade 2



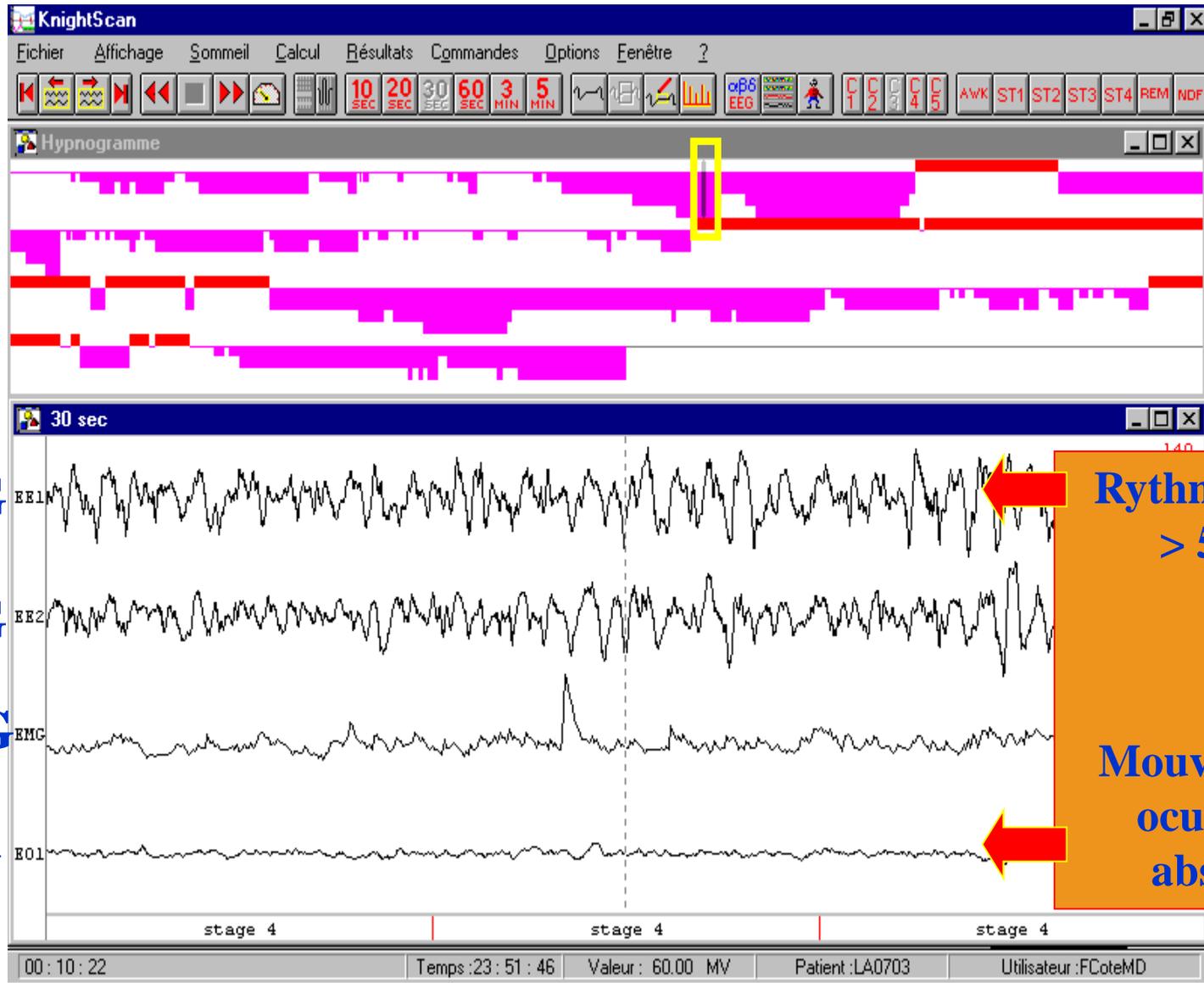
# Stade 3



**Rythme  
delta  
> 20%**

**Mouvements  
oculaires  
absents**

# Stade 3



EEG

EEG

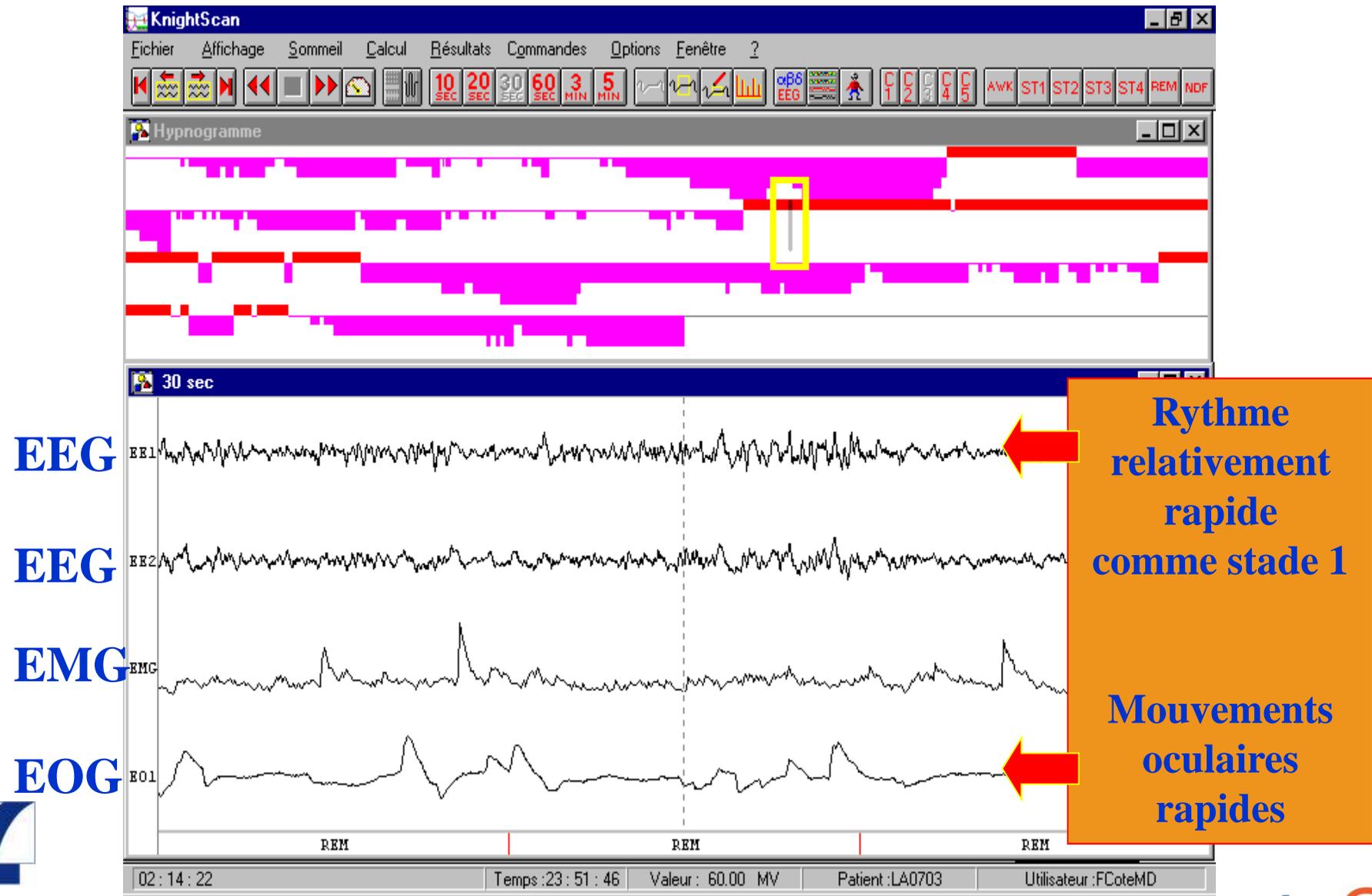
EMG

EOG

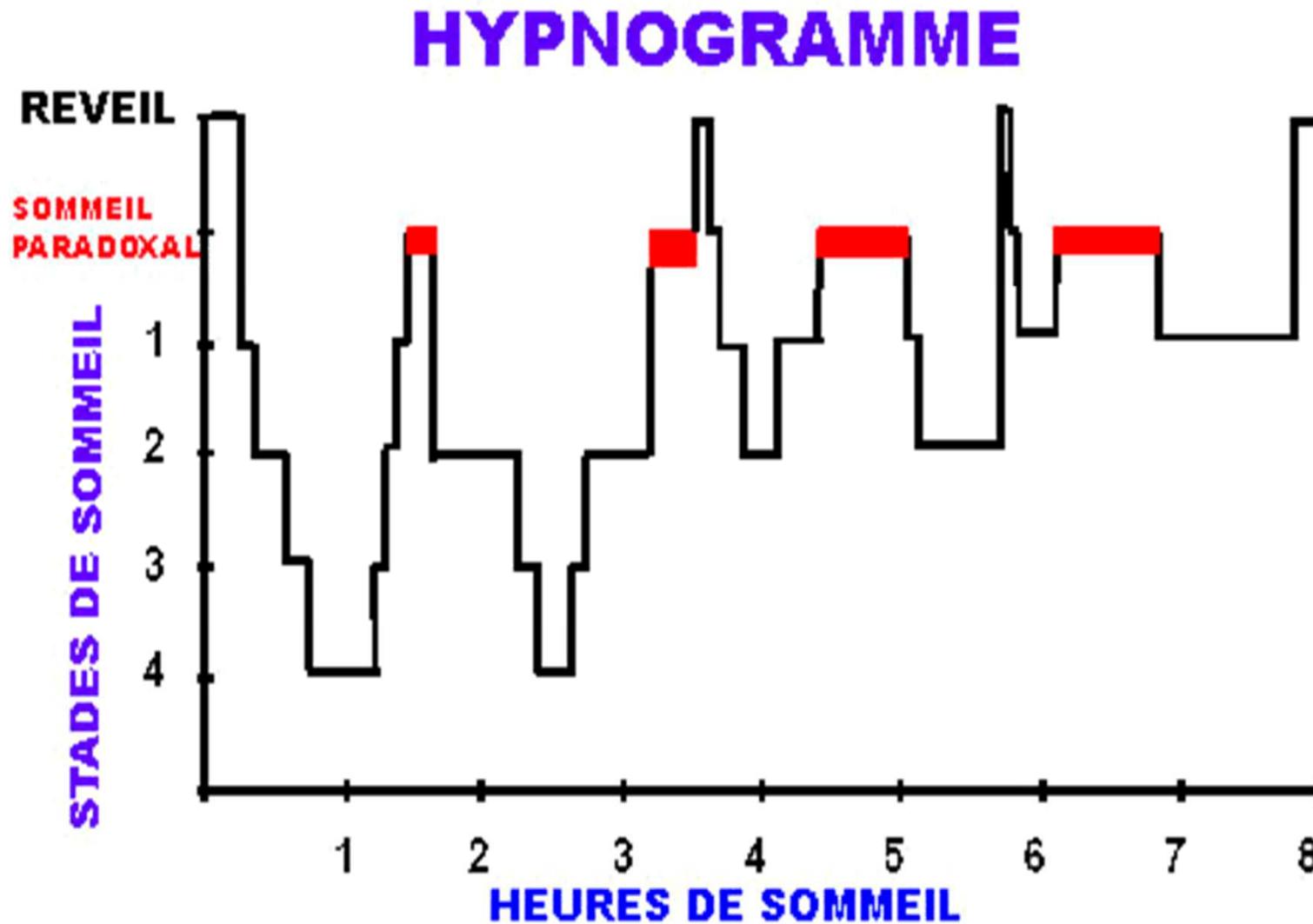
Rythme delta  
> 50%

Mouvements  
oculaires  
absents

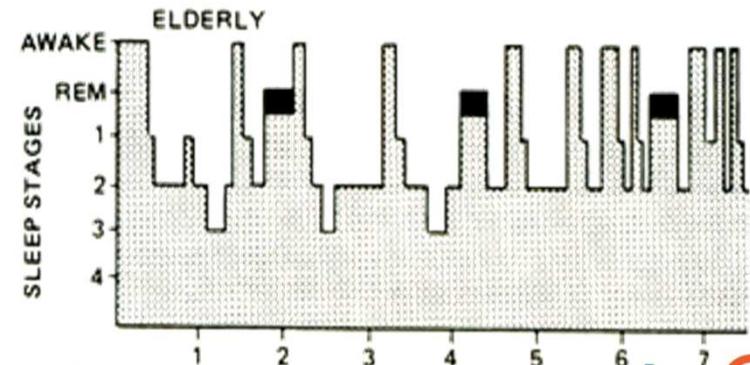
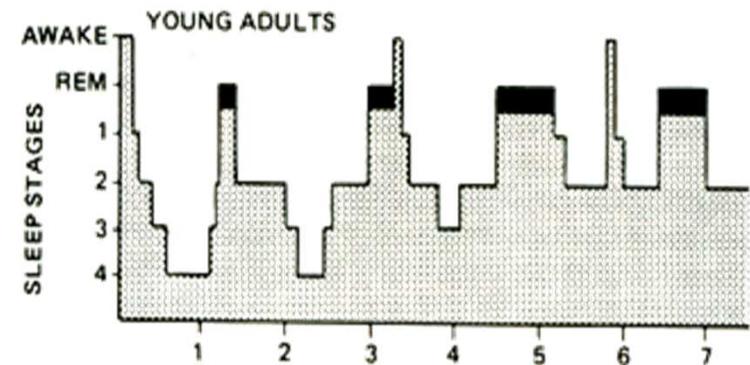
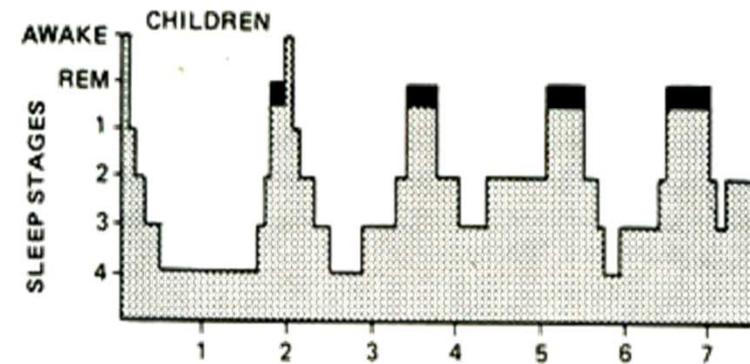
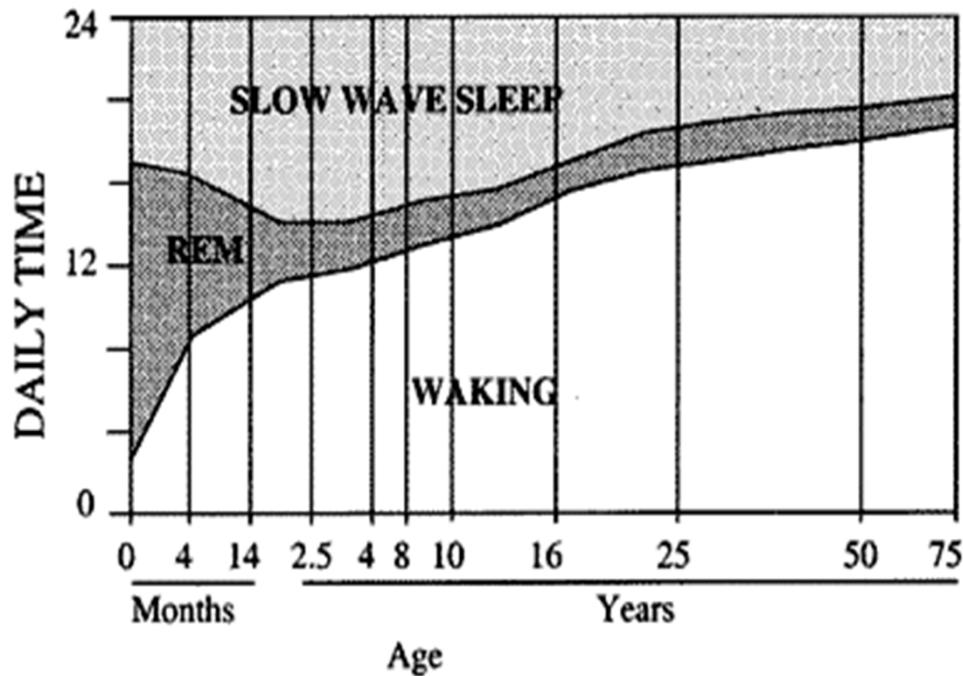
# Sommeil Paradoxal



# L'architecture du sommeil

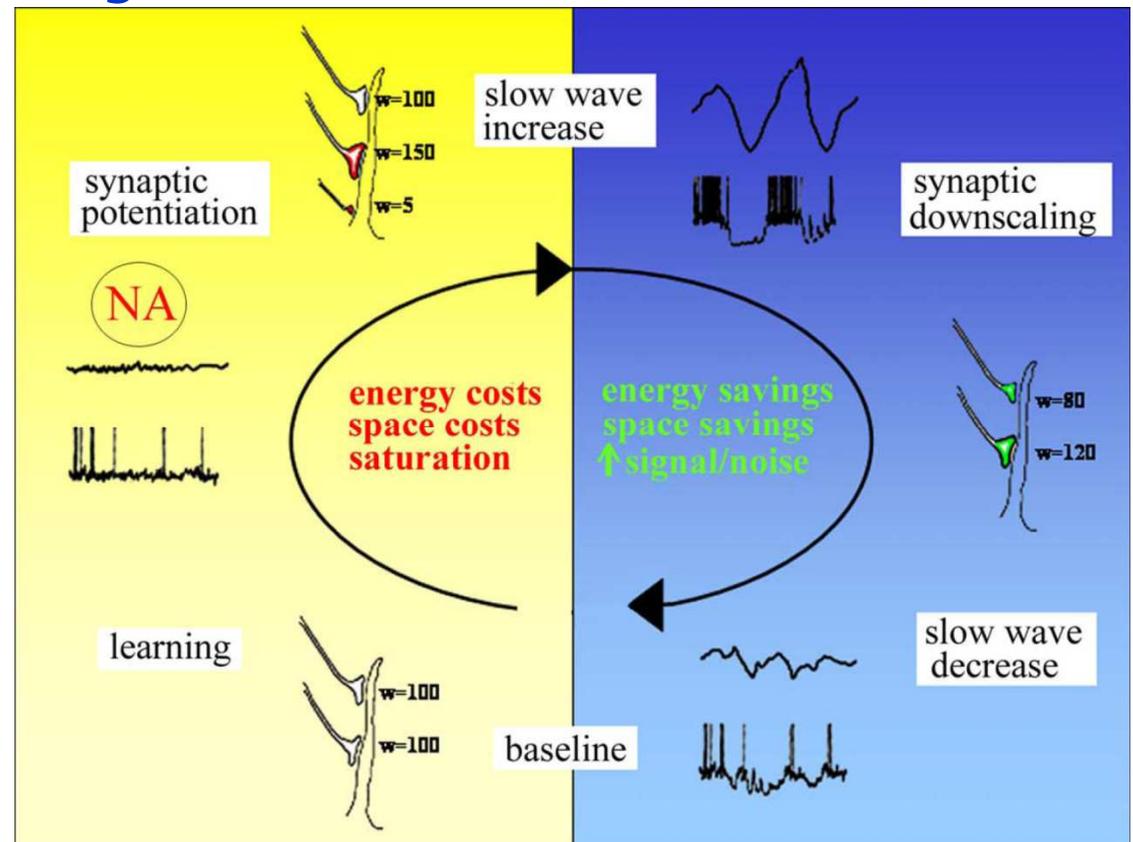
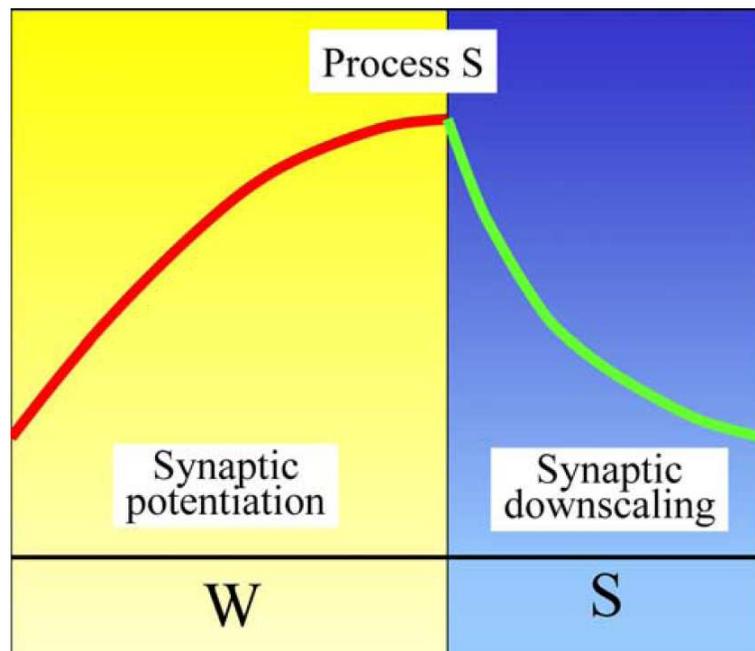


# Evolution du sommeil avec l'âge



# Fonctions du sommeil

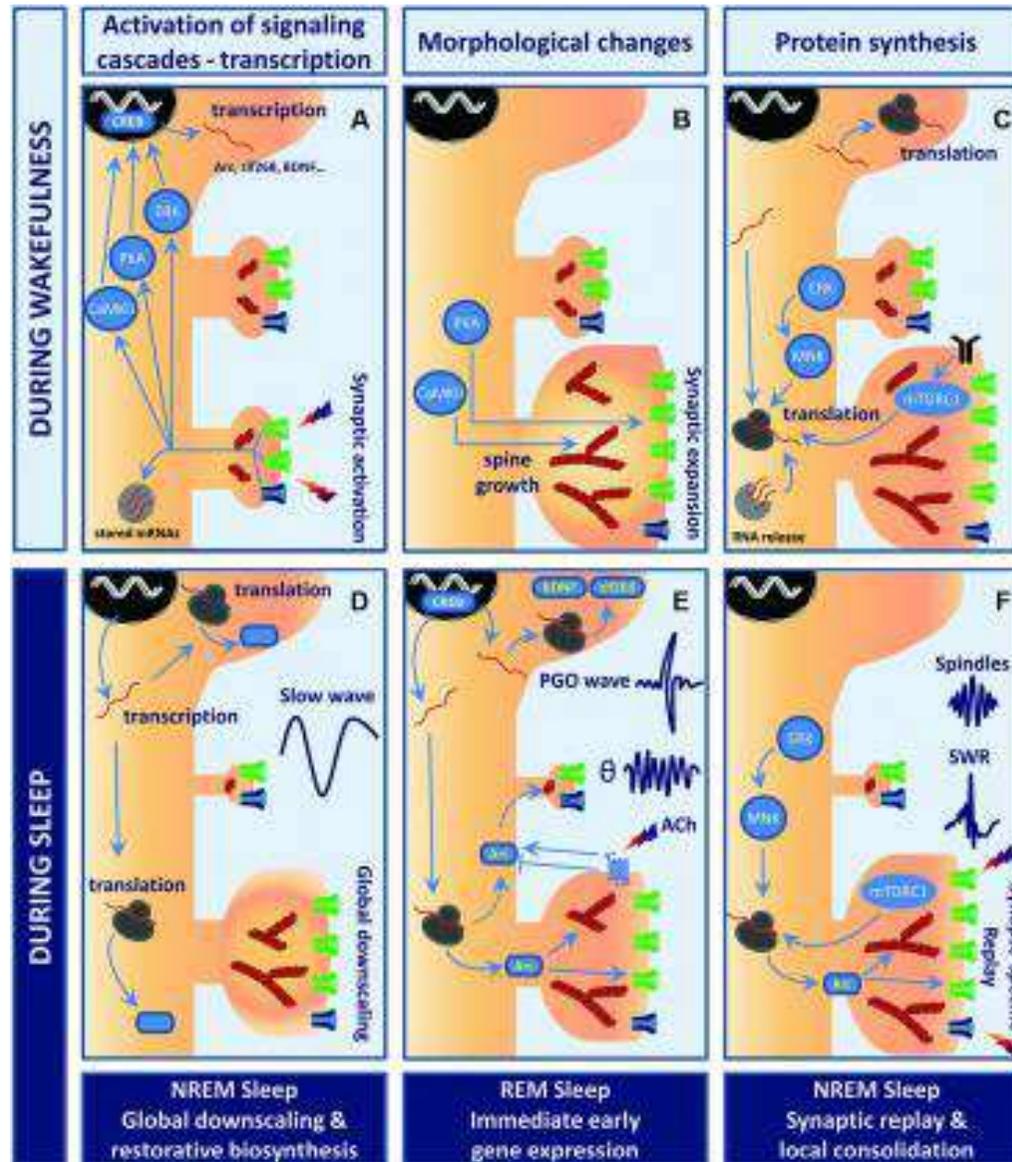
- Maintenance de l'activité cérébrale
  - Objectifs : maintenir un équilibre énergétique cérébral
  - Permettre l'apprentissage et la mémorisation



# Fonctions du sommeil

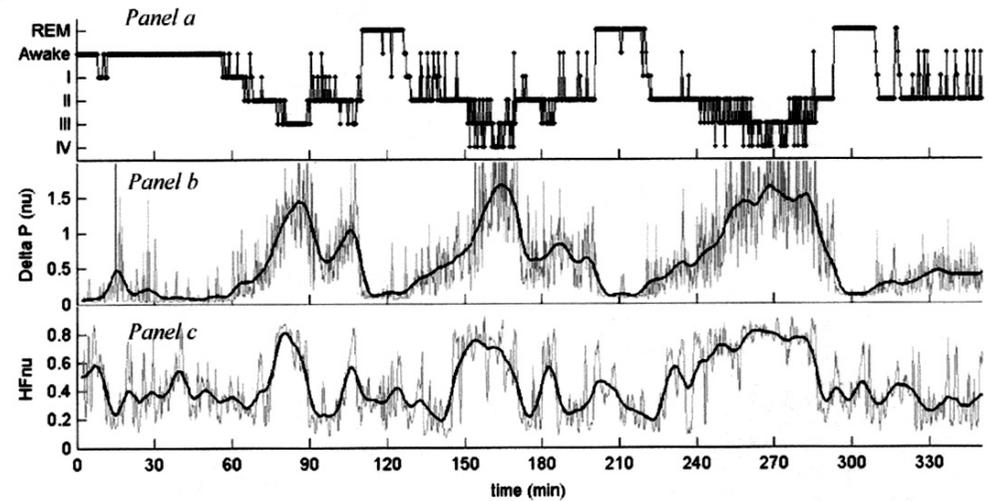
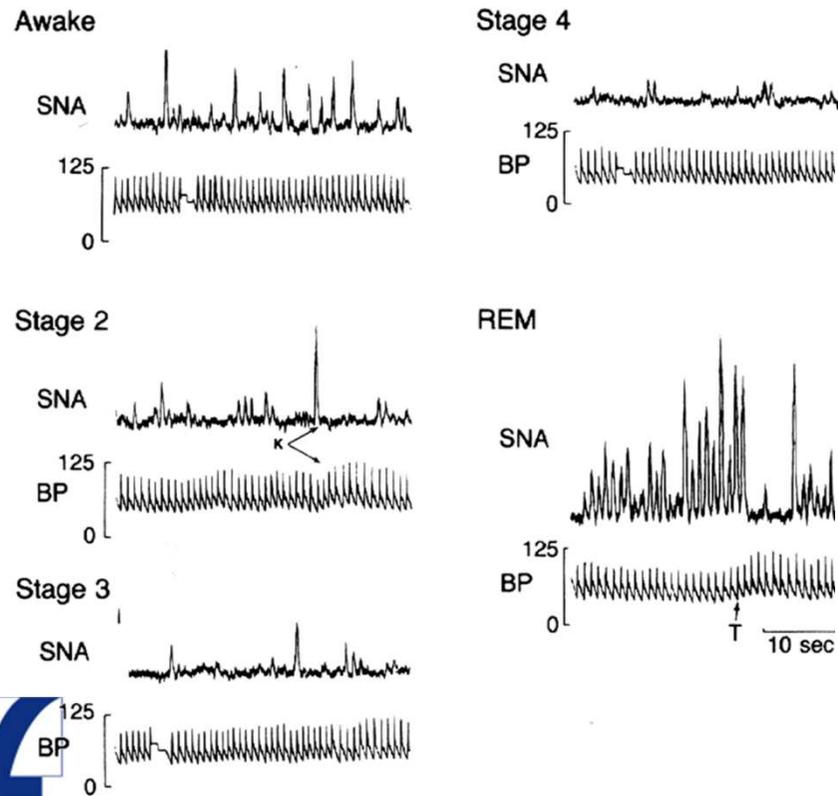
Maintenance de l'activité cérébrale.

Grønli J, Soulé J, Bramham CR  
 Sleep and protein synthesis-  
 dependent synaptic plasticity  
 Front Behav Neurosci. 2014 Jan  
 21;7:224.



# Fonctions du sommeil

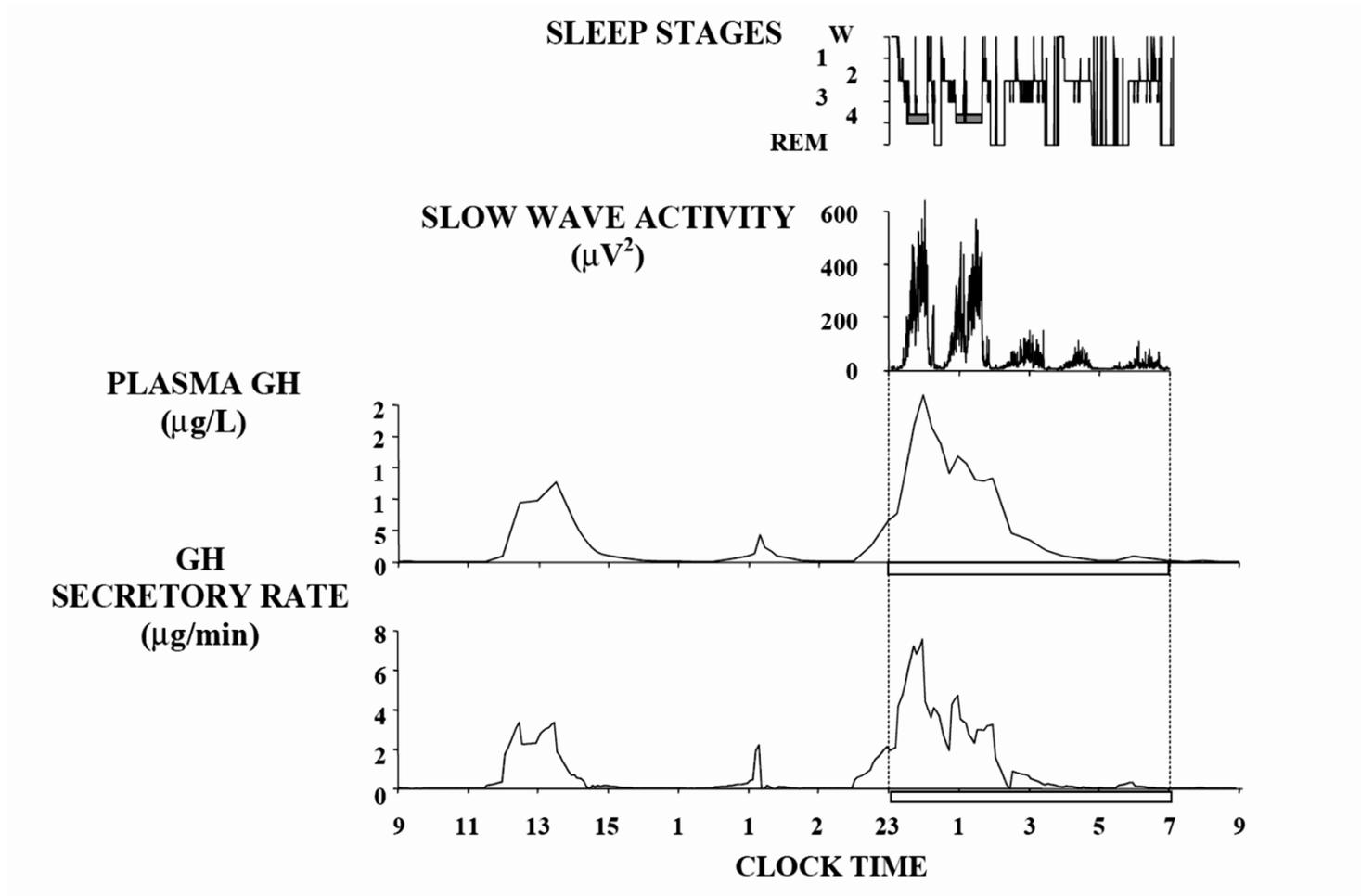
- Mise au repos du système cardiovasculaire
  - Baisse de la pression artérielle et de la fréquence cardiaque
  - Baisse de l'activité sympathique et augmentation de l'activité parasympathique



Jurysta et al. *Clin Neurophysiol*  
2003;114:2146-2155

# Fonctions du sommeil

- Fonctions endocriniennes spécifiques



# Effets de la réduction du temps de sommeil

# Qu'est ce que le temps de sommeil réduit?

Working lexicon of Short Sleep terms.

Term	Working definition
Sleep Opportunity <sup>124</sup> ; Sleep Time <sup>125</sup> /Sleep Duration <sup>126,127</sup> ; Insomnia <sup>128</sup> ;	Amount of time in which sleep is possible; including time in bed awake. Amount of time spent sleeping. A clinical diagnosis with specific diagnostic criteria that describe a condition associated with pathologically long sleep latency, large amounts of wake time after sleep onset, and/or early morning awakenings associated with distress or impairment in functioning.
Partial Sleep Deprivation <sup>129</sup> ; Self-Reported Short Sleep <sup>86</sup>	Sleep deprivation in the laboratory setting, up to 5 h sleep time; some sleep is achieved. Subjective, retrospective estimate of habitual sleep time, or mean sleep time from prospective sleep measures (e.g., sleep diaries).
Short Sleep <sup>130</sup> ; Sleep Attainment <sup>131</sup> ; Sleep Curtailment <sup>122</sup> ; Sleep Deprivation <sup>4</sup> ; Sleep Disturbance <sup>132,133</sup> ;	Habitual sleep time of 6 h or less. Habitual sleep quantity of sufficient quality. The deliberate shortening of sleep opportunity. Acute sleep curtailment in the laboratory setting. Any problems associated with sleep, usually attributed to symptoms of diagnosable sleep disorders, such as insomnia, sleep apnea, narcolepsy, sleep-related movement disorders, and other sleep disorders; may apply to other clinical conditions, including affective disorder, anxiety disorder, or pain.
Sleep Restriction <sup>134</sup> ;	Sleep deprivation (in or out of the laboratory), >5 h sleep time but less than habitual sleep time. May in other contexts refer to a treatment for insomnia. <sup>135</sup>
Sleep Insufficiency <sup>136</sup> ; Sleep Loss <sup>137</sup> ;	Reduction in sleep time of a magnitude associated with negative outcomes. Decrease in sleep time relative to previous sleep time.
Total Sleep Deprivation <sup>138</sup> ; Verified Short Sleep <sup>64</sup> ;	Complete elimination of sleep for 24 h or more. Verification of self-reported habitual sleep duration using polysomnography or actigraphy.

# La restriction volontaire de sommeil : un comportement très fréquent

**Etats-Unis: au cours de la seconde moitié du 20ème siècle:**

**durée du sommeil a diminué de 2h environ  
proportion d'adultes dormant moins de 7h/nuit de 16% à 37%.**

*Kripke DF, et al. Arch Gen Psychiatry. 1979;36(1):103-16.*

*National Sleep Foundation. "Sleep in America" Poll. 2000, 2001 and 2002.*

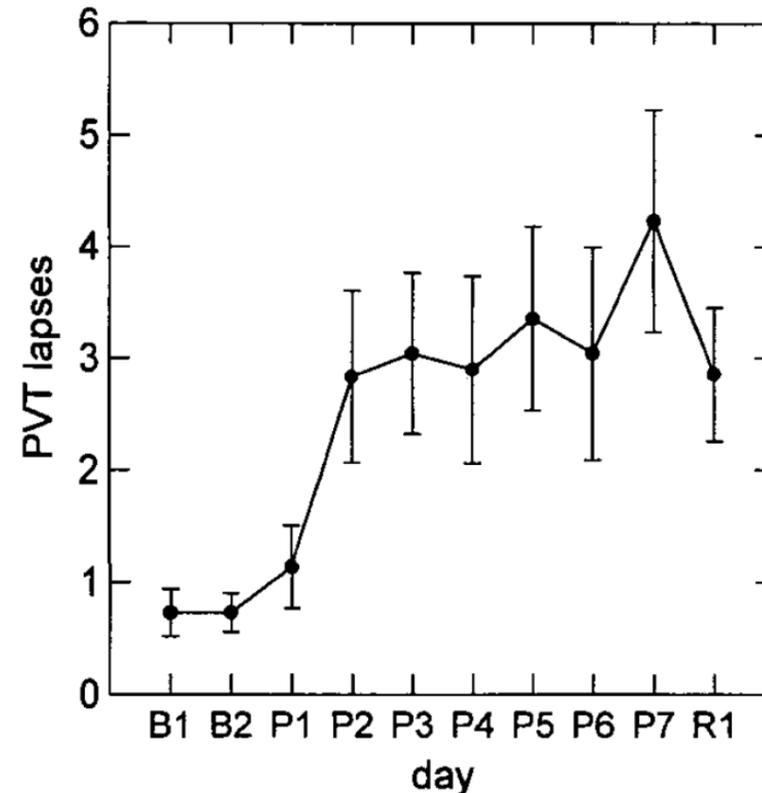
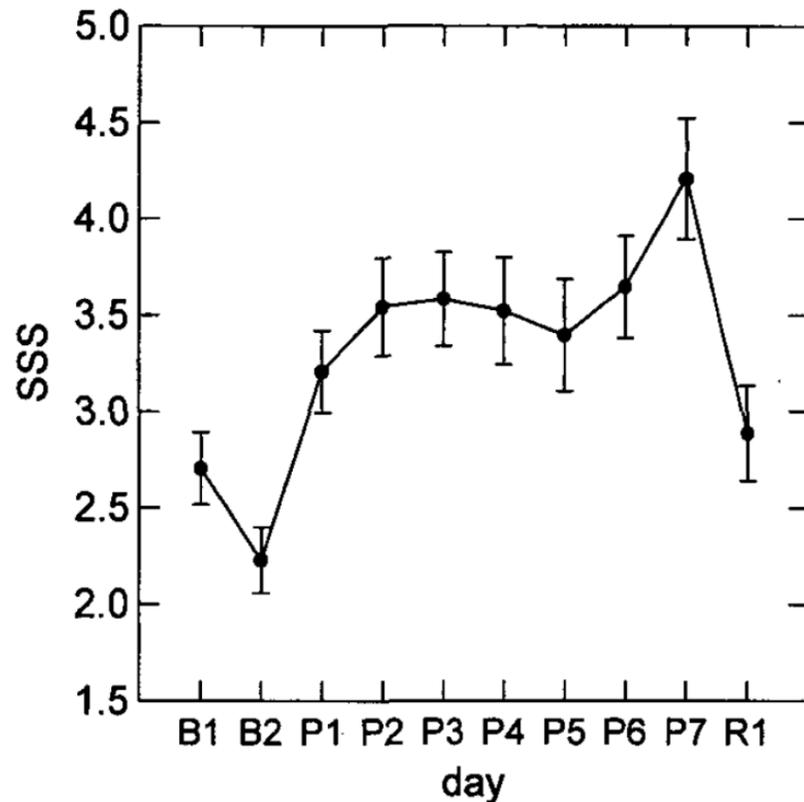
**France: 1004 adultes de 25 à 45 ans:**

**45% considèrent ne pas dormir assez**

**17% accumulent une dette importante de sommeil**

*Institut National de Prévention et d'Education pour la Santé (INPES), mars 2008*

# Effets cognitifs de la privation de sommeil



# Durée de sommeil et hypertension

# Dette de sommeil chronique et prolongée : Effets métaboliques et cardio-vasculaires

## Privation de sommeil et risque cardiovasculaire : Hypertension

### Short Sleep Duration as a Risk Factor for Hypertension Analyses of the First National Health and Nutrition Examination Survey

Hours of Sleep	Model 1*	Model 2†	Model 3‡	Model 4§
<b>Ages 32 to 86 y</b>				
≤5 h	1.76 (1.37 to 2.56)	1.51 (1.17 to 1.95)	1.44 (1.11 to 1.85)	1.32 (1.02 to 1.71)
6 h	1.11 (0.91 to 1.35)	1.07 (0.88 to 1.31)	1.06 (0.87 to 1.29)	1.01 (0.82 to 1.23)
7 to 8 h	1.00	1.00	1.00	1.00
≥9 h	1.32 (0.99 to 1.75)	1.18 (0.88 to 1.57)	1.13 (0.85 to 1.51)	1.12 (0.84 to 1.50)
<b>Ages 32 to 59 y</b>				
≤5 h	2.10 (1.58 to 2.79)	1.84 (1.38 to 2.46)	1.74 (1.30 to 2.32)	1.60 (1.19 to 2.14)
6 h	1.18 (0.94 to 1.48)	1.14 (0.91 to 1.43)	1.13 (0.90 to 1.41)	1.05 (0.83 to 1.31)
7 to 8 h	1.00	1.00	1.00	1.00
≥9 h	0.98 (0.64 to 1.50)	0.91 (0.59 to 1.39)	0.91 (0.59 to 1.40)	0.92 (0.60 to 1.41)
<b>Ages 60 to 86 y</b>				
≤5 h	1.05 (0.63 to 1.75)	0.86 (0.51 to 1.46)	0.86 (0.51 to 1.47)	0.85 (0.50 to 1.45)
6 h	0.90 (0.58 to 1.38)	0.88 (0.57 to 1.36)	0.85 (0.55 to 1.32)	0.86 (0.56 to 1.33)
7 to 8 h	1.00	1.00	1.00	1.00
≥9 h	1.54 (1.03 to 2.30)	1.36 (0.90 to 2.06)	1.32 (0.87 to 2.01)	1.31 (0.86 to 1.99)

N = 4810

647 HTA incidentes  
Entre 1982 et 1992

# Dette de sommeil chronique et prolongée : Effets métaboliques et cardio-vasculaires

## Privation de sommeil et risque cardiovasculaire : Hypertension

### 10 308 fonctionnaires Britanniques âgés de 35 à 55 ans à l'inclusion (1985-8)

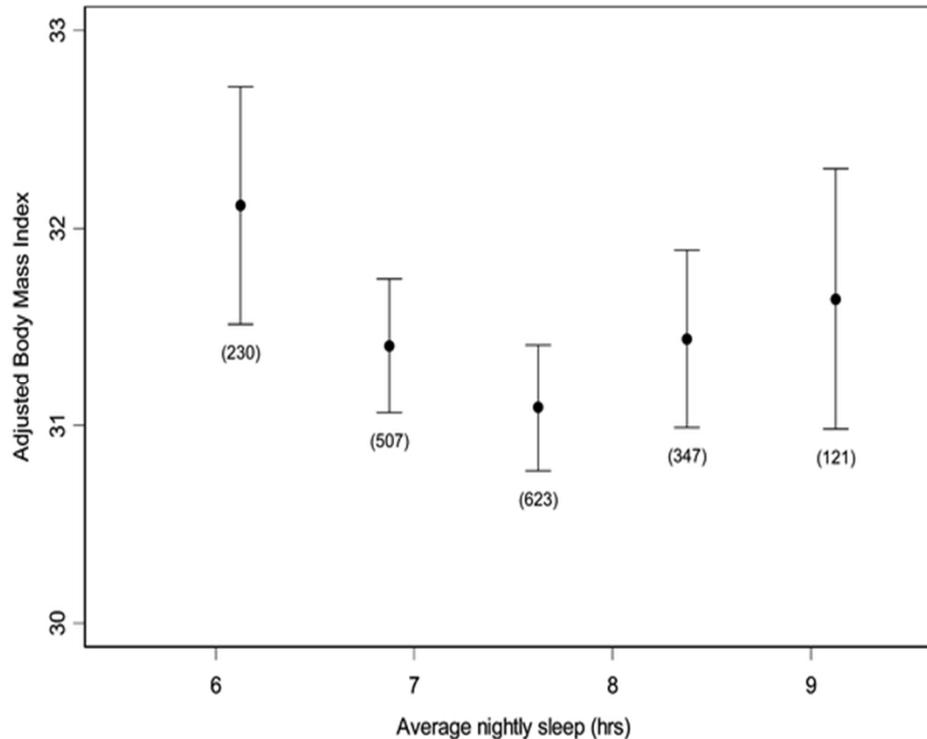
**Table 3. OR (95% CI) of Incident Hypertension at Phase 7 (2002–2003) Across Categories of Sleep Duration at Phase 5 (1997–1999): The Whitehall II Study (n=3691)**

Sample Models	Sleep Duration											<i>p</i> *			
	≤5 h		6 h		7 h		8 h		≥9 h			Linear	Nonlinear		
<b>Men (n=2686)</b>															
No.	160		900		1224		372		30						
Cases, n	29		179		243		85		3						
Model 1‡	0.89	0.58	1.37	1.00	0.81	1.24	1	1.20	0.90	1.58	0.45	0.13	1.49	0.60	0.53
Model 2§	0.96	0.62	1.48	1.07	0.86	1.34	1	1.07	0.80	1.42	0.36	0.11	1.19	0.51	0.42
Model 3¶	0.89	0.55	1.43	1.02	0.80	1.31	1	1.11	0.80	1.53	0.13†	0.02	0.98	0.55	0.18
<b>Women (n=1005)</b>															
No.	75		330		394		186		20						
Cases, n	20		77		64		37		3						
Model 1‡	1.88†	1.05	3.34	1.56†	1.08	2.27	1	1.28	0.82	2.01	0.91	0.26	3.20	0.029†	0.38
Model 2§	1.94†	1.08	3.50	1.56†	1.07	2.27	1	1.17	0.74	1.86	0.92	0.26	3.27	0.015†	0.42
Model 3¶	1.31	0.65	2.63	1.42	0.93	2.16	1	0.99	0.59	1.69	1.07	0.29	3.94	0.12	0.61

# Durée de sommeil et syndrome métabolique

# Dettes de sommeil chronique et prolongée : Effets métaboliques et cardio-vasculaires

## La réduction de la durée de sommeil dans la population générale est significativement associée à l'obésité



December 2004 | Volume 1 | Issue 3 | e62

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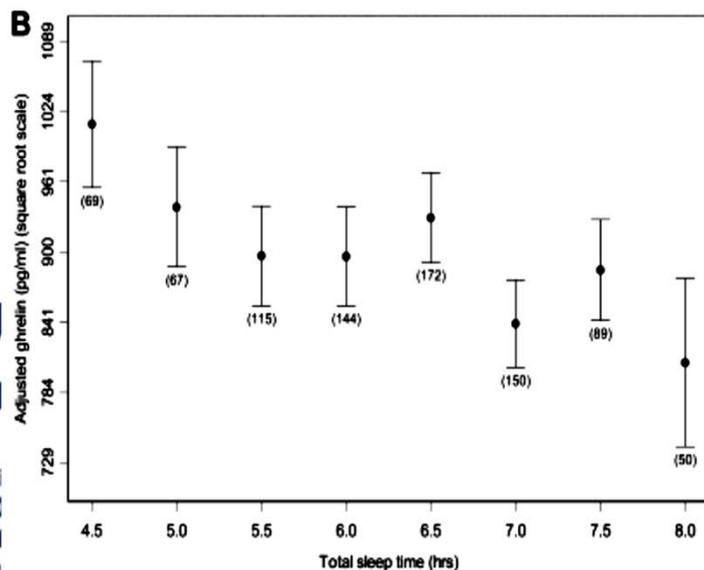
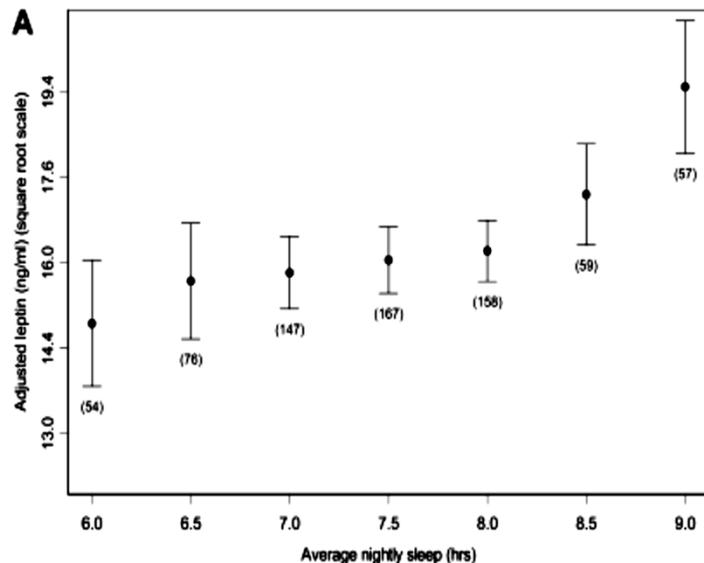
### Short Sleep Duration Is Associated with Reduced Leptin, Elevated Ghrelin, and Increased Body Mass Index

Shahrad Taheri<sup>1</sup>, Ling Lin<sup>1</sup>, Diane Austin<sup>2</sup>, Terry Young<sup>2</sup>, Emmanuel Mignot<sup>1\*</sup>

<sup>1</sup> Howard Hughes Medical Institute, Stanford University, Palo Alto, California, United States of America, <sup>2</sup> Department of Population Health Sciences, University of Wisconsin, Madison, Wisconsin, United States of America

# Dette de sommeil chronique et prolongée

## La réduction de la durée de sommeil dans la population générale est significativement associée à l'obésité



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<sup>1</sup> Howard Hughes Medical Institute, Stanford University, Palo Alto, California, United States of America, <sup>2</sup> Department of Population Health Sciences, University of Wisconsin, Madison, Wisconsin, United States of America

# Dette de sommeil chronique et prolongée

## Privation de sommeil : résistance à l'insuline - diabète

### High Incidence of Diabetes in Men With Sleep Complaints or Short Sleep Duration

A 12-year follow-up study of a middle-aged population

Reported variable or symptom in 1983	Age-adjusted model*	Multivariate model including DIS and DMS†	Multivariate model including sleep duration $\leq 5$ h and sleep duration $\geq 9$ h†
Not married	0.5 (0.1–2.0)	0.3 (0.06–1.8)	0.3 (0.06–1.5)
Living alone	3.0 (1.4–6.2)‡	3.4 (1.4–8.4)‡	2.9 (1.2–6.8)‡
Hypertension	0.6 (0.2–1.7)	0.5 (0.1–1.9)	0.6 (0.2–1.9)
Obesity (BMI $\geq 30$ )	8.6 (3.9–18.9)‡	6.6 (2.6–16.9)‡	6.7 (2.7–16.4)‡
Smoking	1.0 (0.5–2.1)	0.9 (0.4–2.2)	1.0 (0.4–2.5)
Alcohol use	1.0 (0.6–1.8)	1.0 (0.5–2.0)	0.9 (0.5–1.8)
Snoring	2.7 (1.5–5.1)‡	1.6 (0.8–3.5)	1.9 (0.9–3.8)
Depression	2.5 (1.1–6.0)‡	0.6 (0.2–2.0)	1.3 (0.4–3.6)
Sleep duration $\leq 5$ h	3.1 (1.3–7.2)‡		2.8 (1.1–7.3)‡
Sleep duration $\geq 9$ h	NA		NA
DIS	7.0 (2.7–17.7)‡	2.4 (0.7–8.6)	
DMS	6.2 (3.0–12.9)‡	4.8 (1.9–12.5)‡	

# Dette de sommeil chronique et prolongée : Effets métaboliques et cardio-vasculaires

## Privation de sommeil : Hypertension

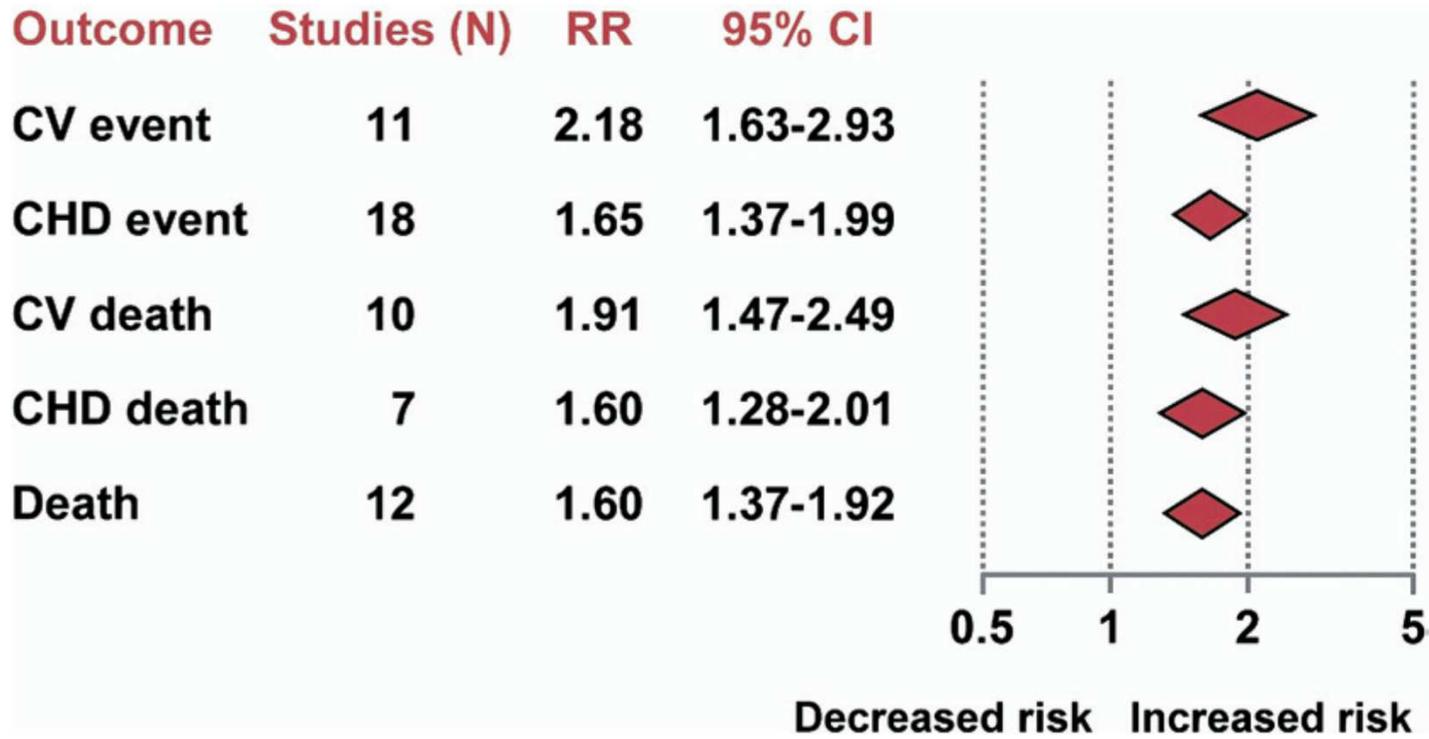
Short Sleep Duration as a Risk Factor for Hypertension  
Analyses of the First National Health and Nutrition Examination Survey

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6 h	0.90 (0.58 to 1.38)	0.88 (0.57 to 1.36)	0.85 (0.55 to 1.32)	0.86 (0.56 to 1.33)
7 to 8 h	1.00	1.00	1.00	1.00
≥9 h	1.54 (1.03 to 2.30)	1.36 (0.90 to 2.06)	1.32 (0.87 to 2.01)	1.31 (0.86 to 1.99)

*Gangwisch*

*Hypertension 2006;47:833–839.*

**Dette de sommeil chronique et prolongée :  
Effets métaboliques et cardio-vasculaires**  
**Syndrome métabolique : risque cardiovasculaire associé**



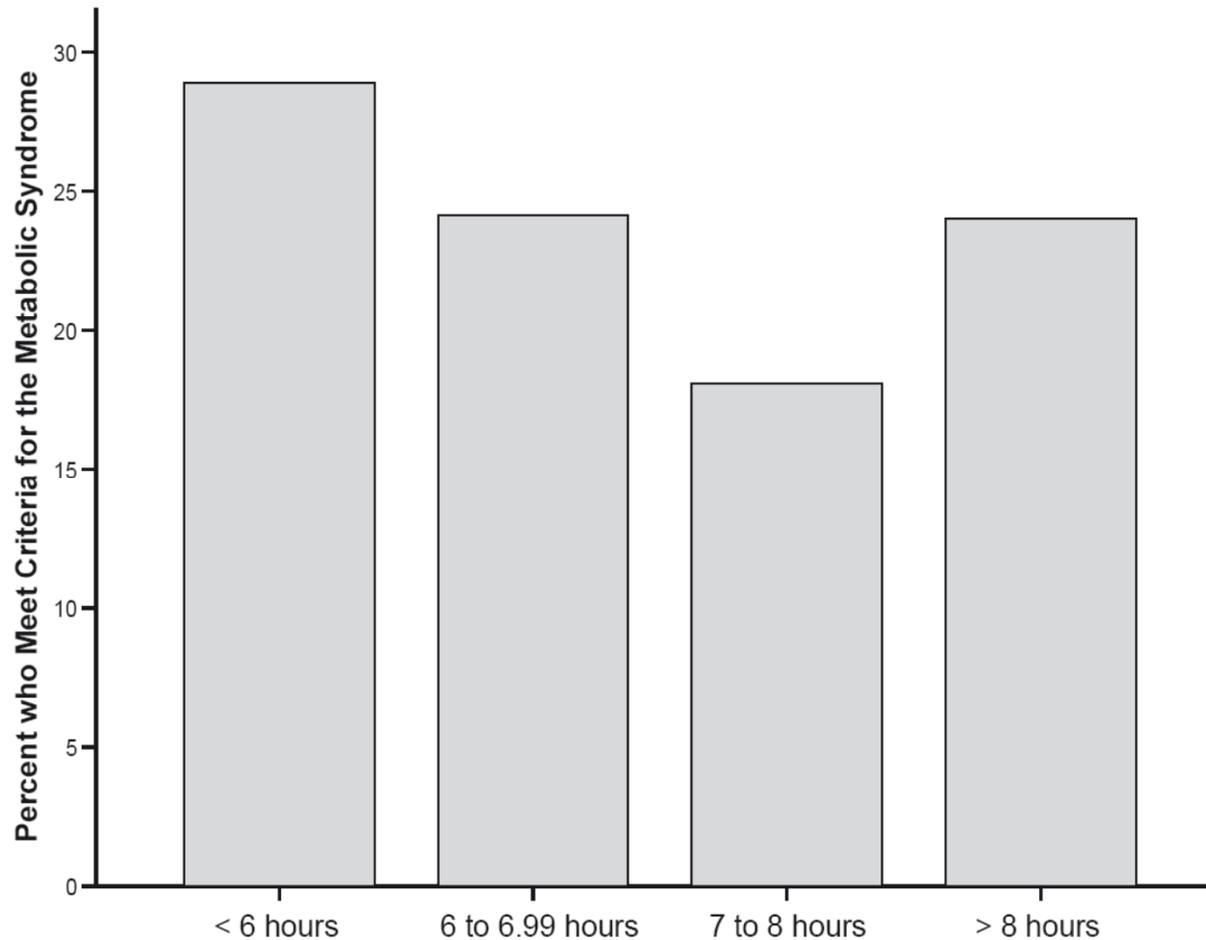
**Association plus forte femmes que hommes : 2.63 Vs 1.98**

**Gami et al. JACC 2007;49:403-14**

# **Dette de sommeil chronique et prolongée : Effets métaboliques et cardio-vasculaires**

**La réduction de la durée de sommeil chez l'adulte est significativement associée au syndrome métabolique**

**N= 1214, 30 à 54 ans**



# Dette de sommeil chronique et prolongée : Effets métaboliques et cardio-vasculaires

La réduction de la durée de sommeil chez l'adulte est significativement associée au syndrome métabolique

N= 1214, 30 à 54 ans

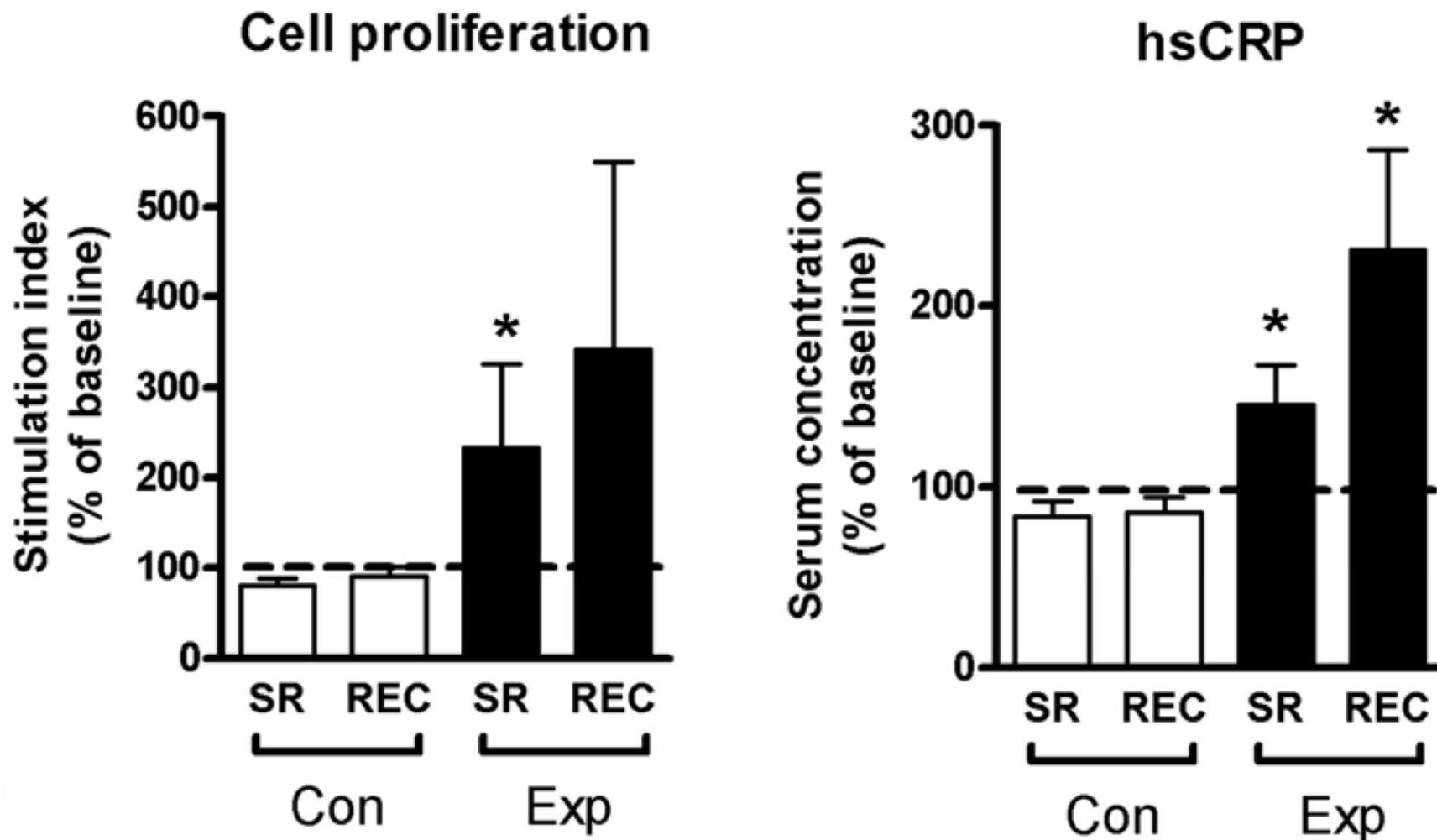
Sleep Duration and Covariates	Individual components of the metabolic syndrome					
	Metabolic syndrome OR (95% CI)	Central adiposity criterion OR (95% CI)	Glucose criterion OR (95% CI)	Blood pressure criterion OR (95% CI)	Triglycerides criterion OR (95% CI)	HDL criterion OR (95% CI)
Reported sleep duration, h <sup>d</sup>						
< 6	1.83 (1.19-2.80)	1.73 (1.21-2.57)	1.74 (1.18-2.55)	1.10 (0.75-1.63)	1.32 (0.85-2.05)	1.34 (0.91-1.99)
6-< 7	1.48 (1.05-2.10)	1.64 (1.22-2.20)	1.11 (0.82-1.52)	0.97 (0.72-1.32)	1.53 (1.10-2.14)	1.24 (0.91-1.69)
7- 8	Ref	Ref	Ref	Ref	Ref	Ref
> 8	1.81 (1.04-3.15)	1.47 (0.91-2.40)	1.70 (1.04-2.80)	1.00 (0.59-1.69)	0.93 (0.50-1.73)	1.54 (0.95-2.50)
Biologic and sociodemographics <sup>a</sup>						
Age	1.05 (1.02-1.07)	1.02 (1.00-1.04)	1.04 (1.02-1.06)	1.07 (1.05-1.10)	1.03 (1.01-1.05)	0.98 (0.96-1.00)
Sex	2.60 (1.90-3.55)	1.01 (0.78-1.32)	2.44 (1.85-3.21)	3.09 (2.33-4.08)	3.20 (2.34-4.38)	1.16 (0.88-1.52)
Race	0.99 (0.65-1.49)	1.79 (1.26-2.52)	1.17 (0.81-1.70)	2.10 (1.46-3.02)	0.31 (0.19-0.53)	0.79 (0.54-1.14)
Educational						
attainment	0.68 (0.50-0.93)	0.78 (0.60-1.02)	0.94 (0.71-1.24)	0.66 (0.50-0.87)	0.74 (0.54-1.01)	0.59 (0.44-0.77)
Health behaviors <sup>b</sup>						
Smoker	1.03 (0.71-1.50)	0.78 (0.56-1.09)	1.27 (0.91-1.77)	0.86 (0.61-1.22)	0.98 (0.67-1.43)	1.15 (0.82-1.61)
Physical activity	0.61 (0.51-0.73)	0.68 (0.58-0.80)	0.82 (0.69-0.96)	0.79 (0.67-0.93)	0.65 (0.54-0.78)	0.67 (0.57-0.79)
Indices of health <sup>c</sup>						
LDL cholesterol	1.01 (1.00-1.01)	1.01 (1.01-1.01)	1.01 (1.00-1.01)	1.00 (1.00-1.01)	1.01 (1.00-1.01)	1.00 (1.00-1.00)
Symptoms of depression	1.03 (0.88-1.21)	1.08 (0.94-1.23)	0.96 (0.83-1.10)	0.93 (0.81-1.07)	1.05 (0.90-1.23)	0.93 (0.81-1.07)

# Mécanismes associés à la privation expérimentale de sommeil

# Dette de sommeil chronique et effets cardio-vasculaires

Augmentation des réponses pro-inflammatoires

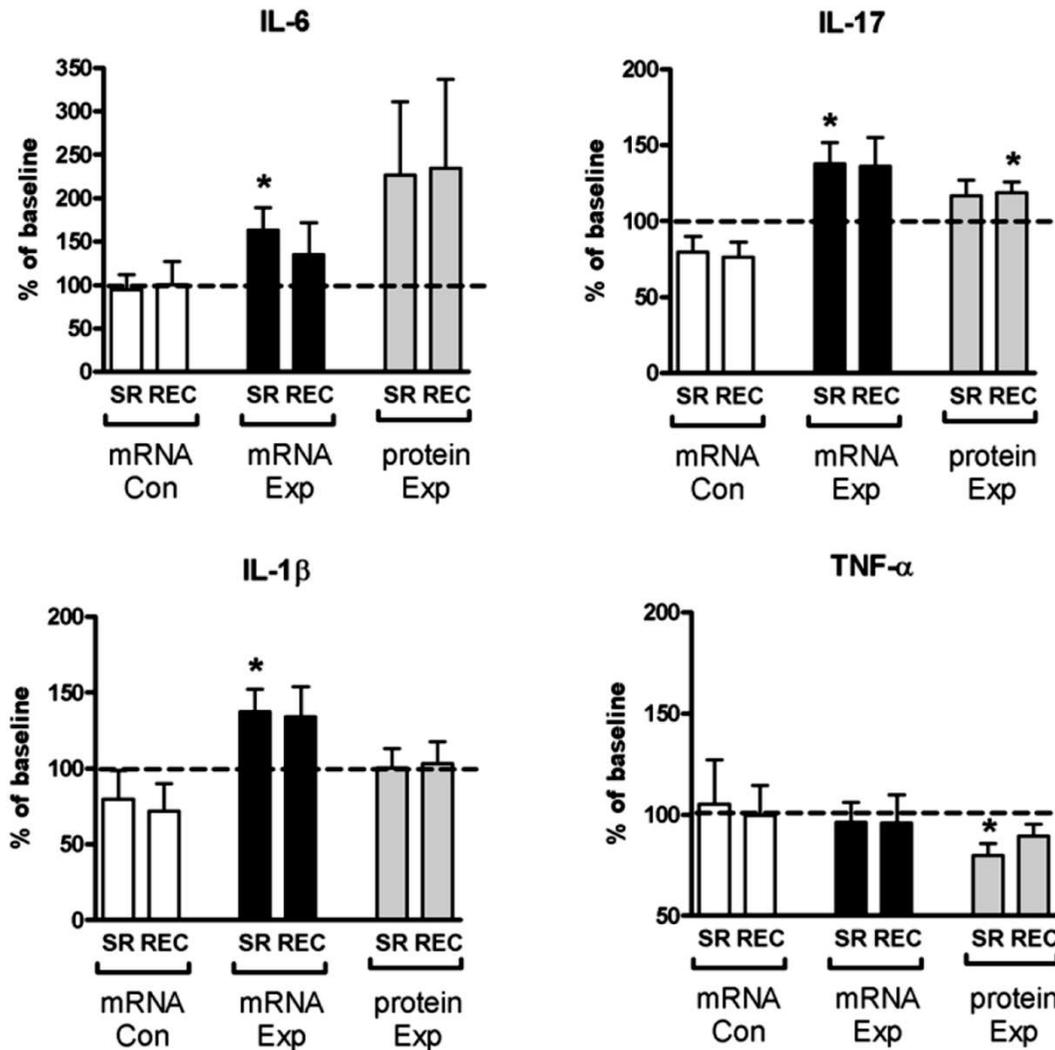
13 sujets sains soumis à 5 jours de temps de sommeil réduit (4 heures)



# Dette de sommeil chronique et effets cardio-vasculaires

## Augmentation des réponses pro-inflammatoires

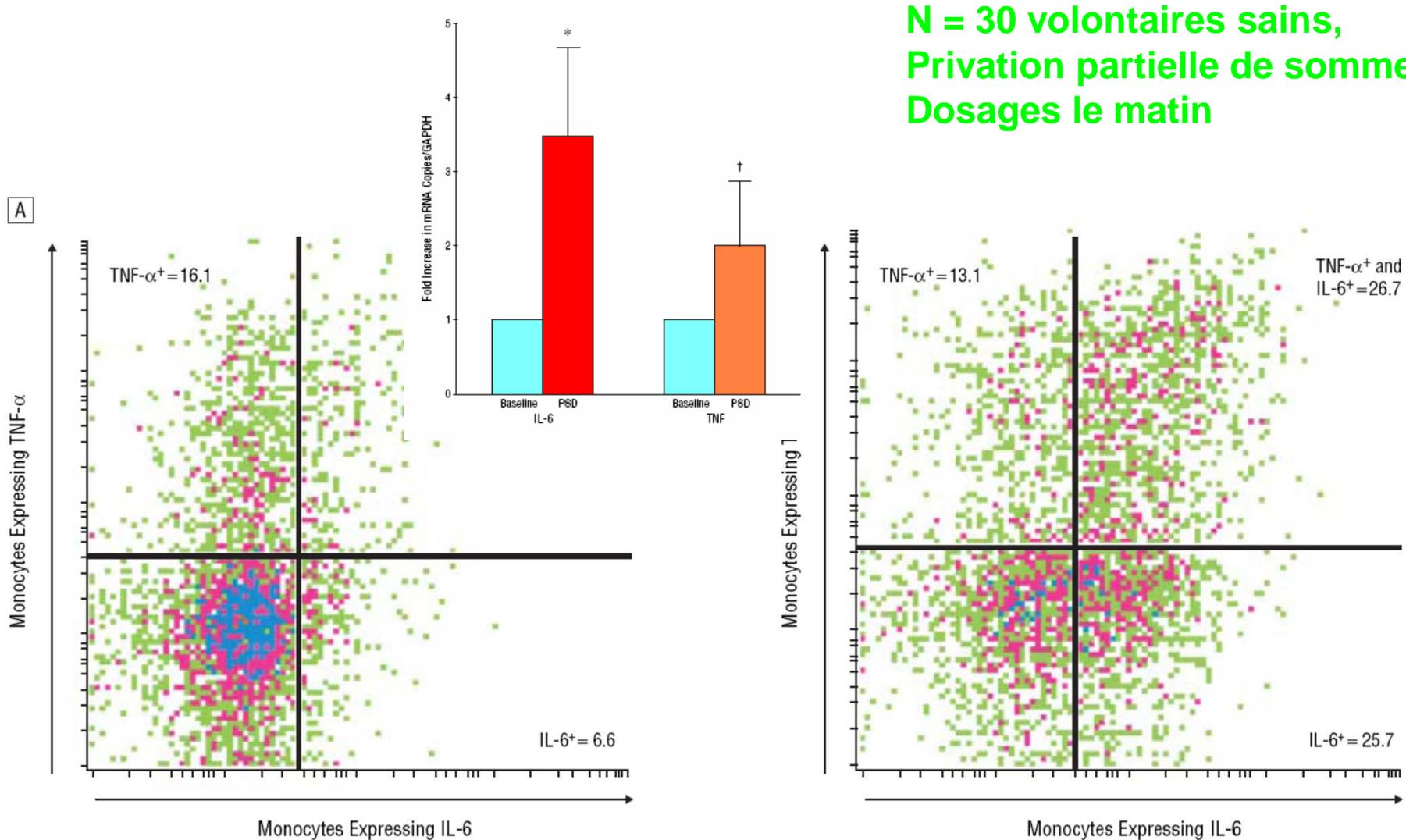
13 sujets sains soumis à 5 jours de temps de sommeil réduit (4 heures)



# Dette de sommeil : Effets cardio-vasculaires

## Privation de sommeil et activation de marqueurs cellulaires et génomiques de l'inflammation

N = 30 volontaires sains,  
Privation partielle de sommeil  
Dosages le matin



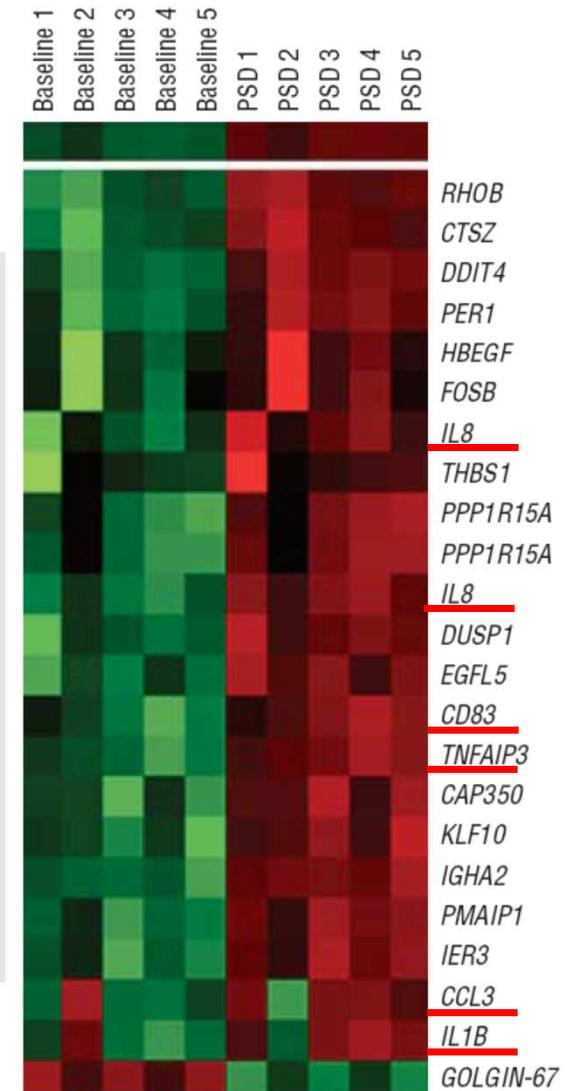
# Dette de sommeil : Effets cardio-vasculaires

## Privation de sommeil et activation de marqueurs cellulaires et génomiques de l' inflammation

N = 30 volontaires sains,  
 Privation partielle de sommeil  
 Dosages le matin

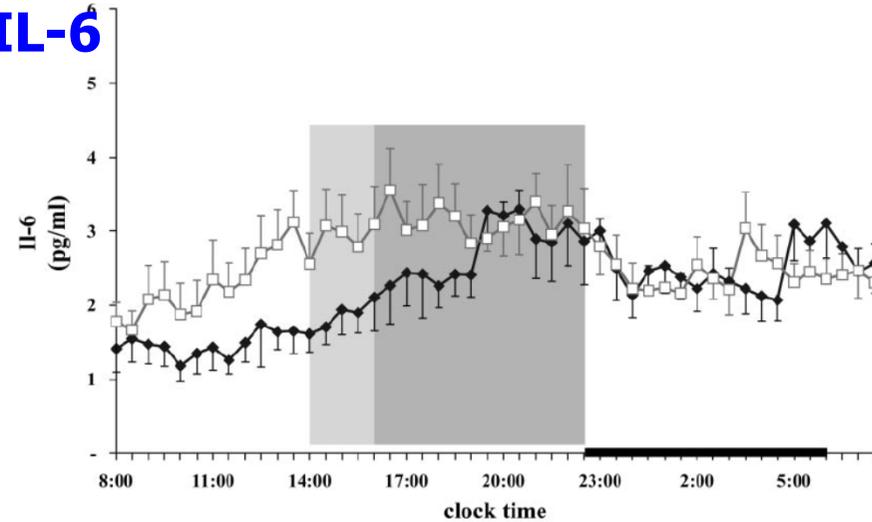
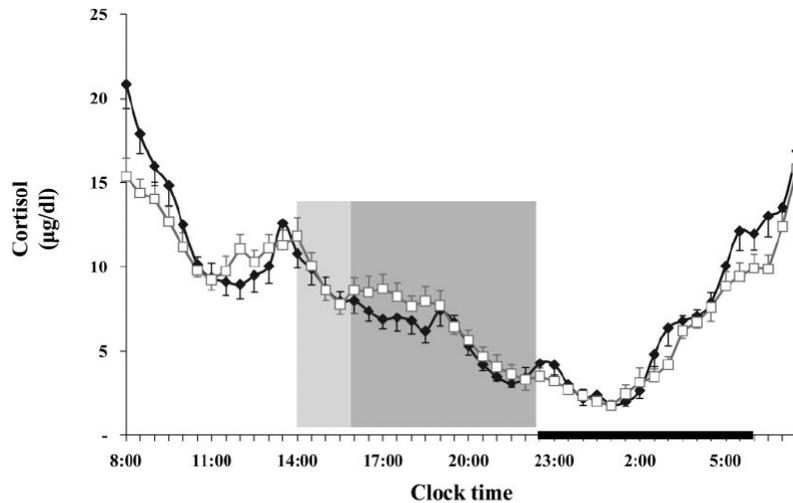
Table. Gene Transcripts Induced by Sleep Deprivation

Probe Name	Gene Symbol*	Common Gene Name
202644_s_at	<u>TNFAIP3</u>	TNF- $\alpha$ -induced protein 3 $\ddagger$
205067_at	<u>IL1B</u>	IL-1 $\beta$ $\ddagger$
202014_at	PPP1R15A	Protein phosphatase 1, regulatory (inhibitor) subunit 15A $\ddagger$
210042_s_at	CTSZ	Cathepsin Z $\ddagger$
204373_s_at	CAP350	Centrosome-associated protein 350 $\ddagger$
217022_s_at	IGHA2 /// MGC27165	Immunoglobulin heavy constant $\alpha$ 2 (A2m marker) /// hypothetical protein MGC27165 $\ddagger$
37028_at	PPP1R15A	Protein phosphatase 1, regulatory (inhibitor) subunit 15A $\ddagger$
204440_at	<u>CD83</u>	CD83 antigen (activated B lymphocytes, immunoglobulin superfamily) $\ddagger$
204285_s_at	PMAIP1	Phorbol-12-myristate-13-acetate-induced protein 1 $\ddagger$
201110_s_at	THBS1	Thrombospondin 1 $\ddagger$
205114_s_at	<u>CCL3 /// CCL3L1 /// MGC12815</u>	Chemokine (C-C motif) ligand 3 /// chemokine (C-C motif) ligand 3-like 1 /// chemokine (C-C motif) ligand 3-like, centromeric $\ddagger$
202393_s_at	KLF10	Kruppel-like factor 10 $\ddagger$
201631_s_at	IER3	Immediate early response 3 $\ddagger$
202859_x_at	<u>IL8</u>	IL-8 $\ddagger$
202887_s_at	<u>DDIT4</u>	DNA damage-inducible transcript 4 $\ddagger$
212099_at	RHOB	<i>ras</i> Homologue gene family, member B $\ddagger$
202768_at	FOSB	FBJ murine osteosarcoma viral oncogene homologue B $\ddagger$
212830_at	EGFL5	EGF-like domain, multiple 5 $\ddagger$
38037_at	HBEGF	Heparin-binding EGF-like growth factor $\ddagger$
211506_s_at	<u>IL8</u>	IL-8 $\ddagger$
201044_x_at	<u>DUSP1</u>	Dual-specificity phosphatase 1 $\ddagger$
202861_at	PER1	Period homologue 1 ( <i>Drosophila</i> ) $\ddagger$

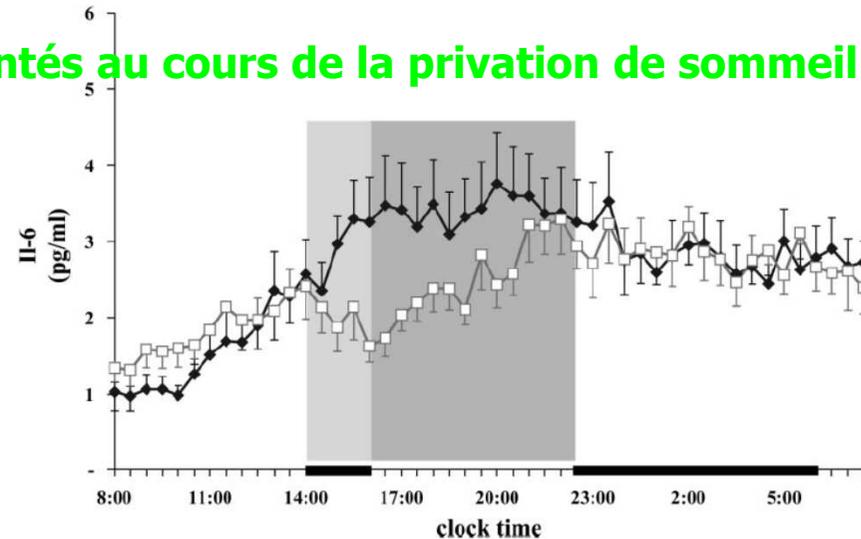
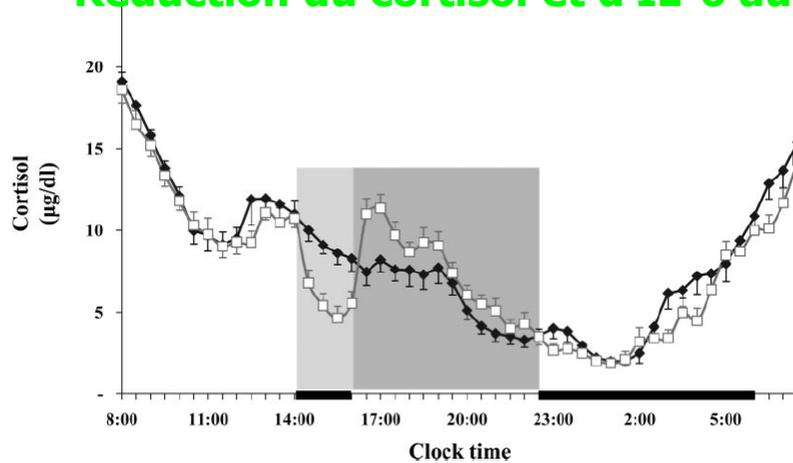


# Dette de sommeil chronique et prolongée : Effets métaboliques et cardio-vasculaires

## Effets de la sieste sur cortisol et IL-6



## Réduction du cortisol et d'IL-6 augmentés au cours de la privation de sommeil



# Données cliniques

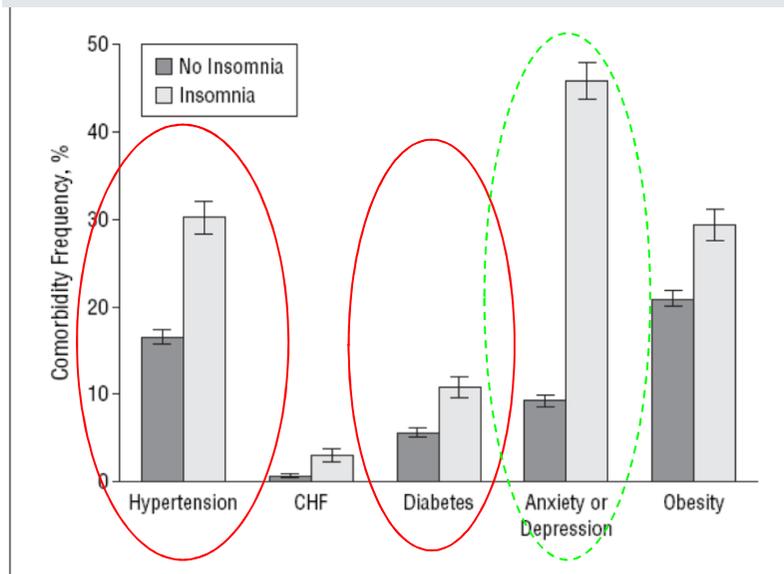
# Réduction du temps de sommeil : Effets métaboliques et cardio-vasculaires

## Insomnie

Pearson et al. Arch intern Med 2006;166:1775-1782.

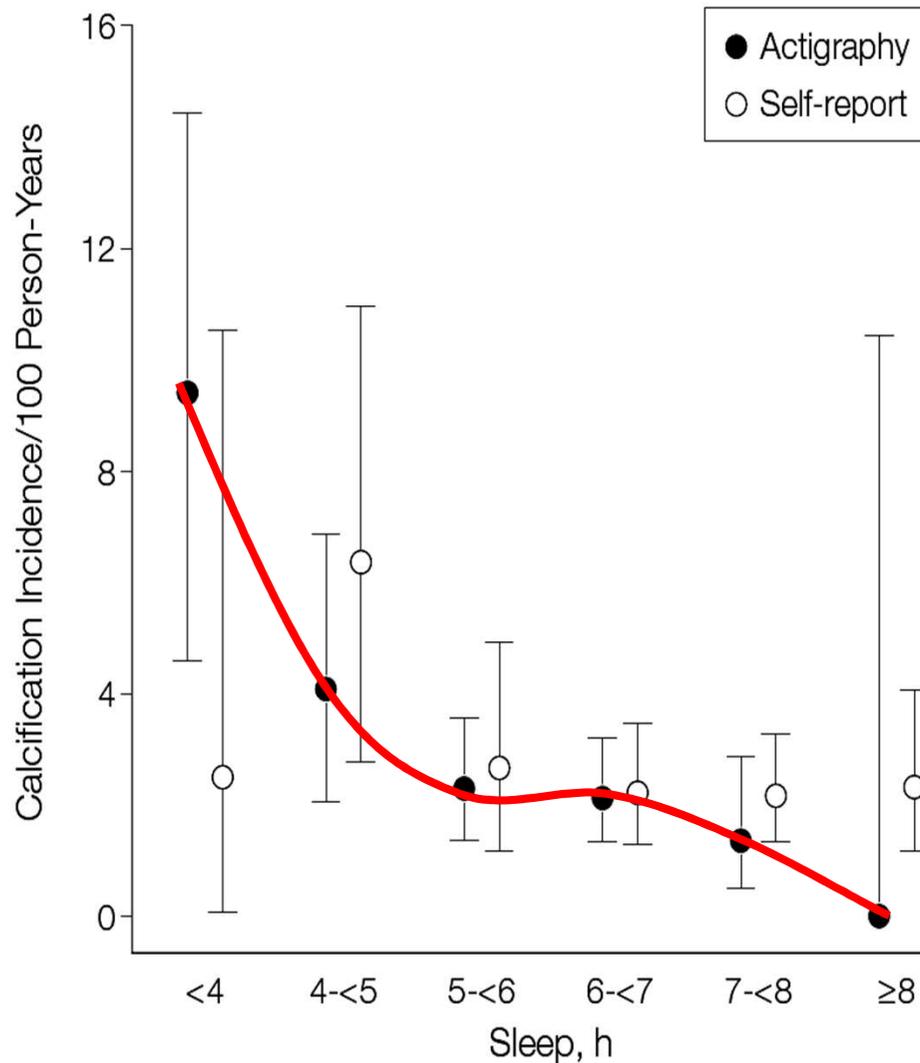
Table 2. Logistic Regression Analysis of Insomnia or Trouble Sleeping in the US Population

Independent Variable	Unadjusted OR (99% CI)	P Value	Adjusted* OR (99% CI)	P Value
<b>Comorbidities (vs not)</b>				
Hypertension	2.19 (1.99-2.42)	<.001	1.32 (1.16-1.51)	<.001
CHF	4.30 (3.15-5.89)	<.001	2.24 (1.60-3.14)	<.001
Diabetes	2.04 (1.76-2.36)	<.001	1.17 (0.98-1.38)	.02
Anxiety or depression	8.25 (7.46-9.11)	<.001	5.64 (5.07-6.29)	<.001
None (vs at least 1)‡	0.10 (0.08-0.12)	<.001	0.20 (0.16-0.26)	<.001
<b>BMI</b>				
Underweight	1.04 (1.03-1.05)	<.001†	1.01 (1.00-1.02)	<.001†
Healthy	1.00		1.00	
Overweight	1.07 (0.96-1.19)	.13	0.98 (0.87-1.10)	.61
Obese	1.63 (1.46-1.82)	<.001	1.15 (1.01-1.31)	.005
Unknown	0.99 (0.79-1.24)	.89	0.86 (0.68-1.09)	.10



# Dette de sommeil chronique et prolongée : Effets métaboliques et cardio-vasculaires

« Privation » de sommeil : calcifications des artères coronaires



Cohorte de 500 sujets adultes d'âge 35-47 ans au moment de l'inclusion. Scanner à la recherche de calcifications coronaires en 2000-1 et 2005-6.

Christopher Ryan King, et al  
**Short Sleep Duration and Incident Coronary Artery Calcification**  
**JAMA. 2008;300(24):2859-2866**

# Effets de la sieste sur la mortalité coronaire

23681 sujets normaux, suivis pendant 6,32 années, classification selon la réalisation d'une sieste (siestes de 30 minutes, > ou < 3 fois/semaine)

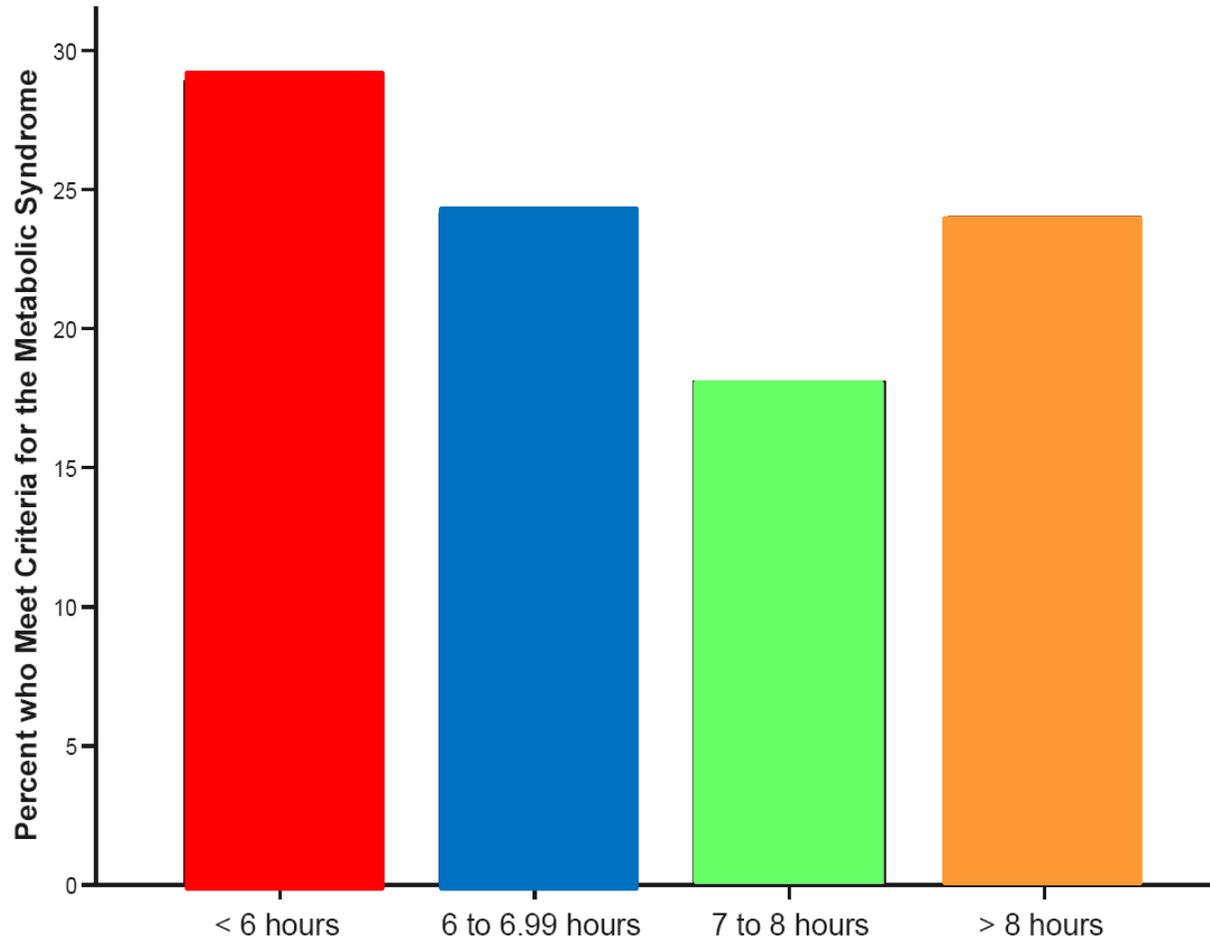
Table 1. Coronary Mortality Ratios (MRs) by Important Covariates in the Greek EPIC Cohort\*

Variable†	Men				Women			
	No.	Person-Years	Deaths	MR (95% CI)	No.	Person-Years	Deaths	MR (95% CI)
Age	9569	58 992	85	1.57 (1.41-1.76)	14 112	90 774	48	2.22 (1.81-2.72)
Smoking status	9569	58 992	85	1.26 (1.08-1.47)	14 112	90 774	48	1.72 (1.11-2.66)
Education	9569	58 992	85	0.81 (0.62-1.06)	14 112	90 774	48	0.69 (0.45-1.07)
Employment status								
Currently working	7301	45 111	28	1.00	5895	38 364	6	1.00
Currently not working	2268	13 881	57	2.23 (1.21-4.11)	8217	52 410	42	0.99 (0.39-2.48)
Body mass index	9569	58 992	85	0.99 (0.94-1.04)	14 112	90 774	48	1.08 (1.02-1.13)
Waist-hip ratio	9569	58 992	85	1.17 (0.89-1.54)	14 112	90 774	48	1.58 (0.98-2.54)
Physical activity	9569	58 992	85	0.87 (0.74-1.03)	14 112	90 774	48	0.75 (0.57-0.97)
Mediterranean diet score								
0-3	2854	16 883	36	1.00	4858	30 038	25	1.00
4-5	4073	25 213	34	0.71 (0.44-1.13)	6081	39 415	17	0.60 (0.32-1.11)
6-9	2642	16 895	15	0.49 (0.26-0.89)	3173	21 322	6	0.48 (0.20-1.18)
Taking midday naps‡								
No	2052	12 550	23	1.00	4844	30 868	16	1.00
Occasionally	1436	8732	8	0.57 (0.25-1.28)	1949	12 882	7	1.50 (0.61-3.65)
Systematically	6081	37 709	54	0.53 (0.32-0.86)	7319	47 024	25	0.90 (0.48-1.68)
Yes	7517	46 442	62	0.53 (0.33-0.86)	9268	59 907	32	0.98 (0.54-1.79)

# **Dette de sommeil chronique et prolongée : Effets métaboliques et cardio-vasculaires**

**La réduction de la durée de sommeil chez l'adulte est significativement associée au syndrome métabolique**

**N= 1214, 30 à 54 ans**



# Dette de sommeil chronique et prolongée : Effets métaboliques et cardio-vasculaires

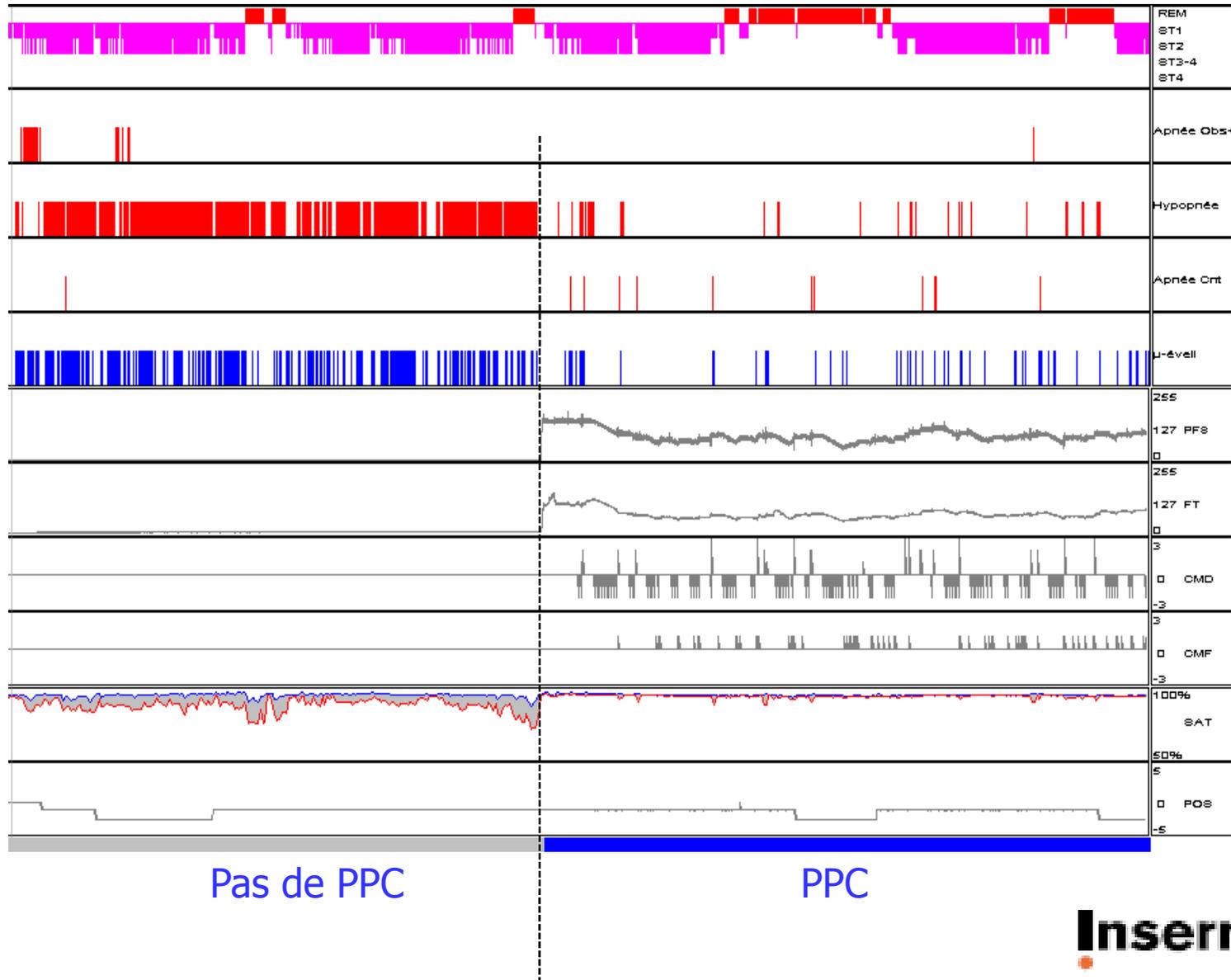
La réduction et l'allongement de la durée de sommeil chez l'adulte sont  
significativement associés au syndrome métabolique

N= 1214, 30 à 54 ans

Sleep Duration and Covariates	Individual components of the metabolic syndrome					
	Metabolic syndrome OR (95% CI)	Central adiposity criterion OR (95% CI)	Glucose criterion OR (95% CI)	Blood pressure criterion OR (95% CI)	Triglycerides criterion OR (95% CI)	HDL criterion OR (95% CI)
Reported sleep duration, h <sup>d</sup>						
< 6	1.83 (1.19-2.80)	1.73 (1.21-2.57)	1.74 (1.18-2.55)	1.10 (0.75-1.63)	1.32 (0.85-2.05)	1.34 (0.91-1.99)
6-< 7	1.48 (1.05-2.10)	1.64 (1.22-2.20)	1.11 (0.82-1.52)	0.97 (0.72-1.32)	1.53 (1.10-2.14)	1.24 (0.91-1.69)
7- 8	Ref	Ref	Ref	Ref	Ref	Ref
> 8	1.81 (1.04-3.15)	1.47 (0.91-2.40)	1.70 (1.04-2.80)	1.00 (0.59-1.69)	0.93 (0.50-1.73)	1.54 (0.95-2.50)
Biologic and sociodemographics <sup>a</sup>						
Age	1.05 (1.02-1.07)	1.02 (1.00-1.04)	1.04 (1.02-1.06)	1.07 (1.05-1.10)	1.03 (1.01-1.05)	0.98 (0.96-1.00)
Sex	2.60 (1.90-3.55)	1.01 (0.78-1.32)	2.44 (1.85-3.21)	3.09 (2.33-4.08)	3.20 (2.34-4.38)	1.16 (0.88-1.52)
Race	0.99 (0.65-1.49)	1.79 (1.26-2.52)	1.17 (0.81-1.70)	2.10 (1.46-3.02)	0.31 (0.19-0.53)	0.79 (0.54-1.14)
Educational						
attainment	0.68 (0.50-0.93)	0.78 (0.60-1.02)	0.94 (0.71-1.24)	0.66 (0.50-0.87)	0.74 (0.54-1.01)	0.59 (0.44-0.77)
Health behaviors <sup>b</sup>						
Smoker	1.03 (0.71-1.50)	0.78 (0.56-1.09)	1.27 (0.91-1.77)	0.86 (0.61-1.22)	0.98 (0.67-1.43)	1.15 (0.82-1.61)
Physical activity	0.61 (0.51-0.73)	0.68 (0.58-0.80)	0.82 (0.69-0.96)	0.79 (0.67-0.93)	0.65 (0.54-0.78)	0.67 (0.57-0.79)
Indices of health <sup>c</sup>						
LDL cholesterol	1.01 (1.00-1.01)	1.01 (1.01-1.01)	1.01 (1.00-1.01)	1.00 (1.00-1.01)	1.01 (1.00-1.01)	1.00 (1.00-1.00)
Symptoms of depression	1.03 (0.88-1.21)	1.08 (0.94-1.23)	0.96 (0.83-1.10)	0.93 (0.81-1.07)	1.05 (0.90-1.23)	0.93 (0.81-1.07)

# Pathologies du sommeil

# Réversibilité des conséquences aiguës



# Somnolence Diurne Excessive et signes associés

- Somnolence diurne excessive (90% des patients)
  - **Altérations de la conduite automobile**
  - **Perturbations intellectuelles**
  - **Modifications de la personnalité**
  - **Troubles de l'humeur**
  - **Diminution de la libido, impuissance**
  - **Perturbations sociales et familiales**
  - **Détérioration de la qualité de vie**
- (+/- Fatigue)



- *Rôle de la somnolence diurne, atteinte neuronale spécifique ?*

# Apnées du sommeil et accidents

Association entre apnées et risque d'accidents

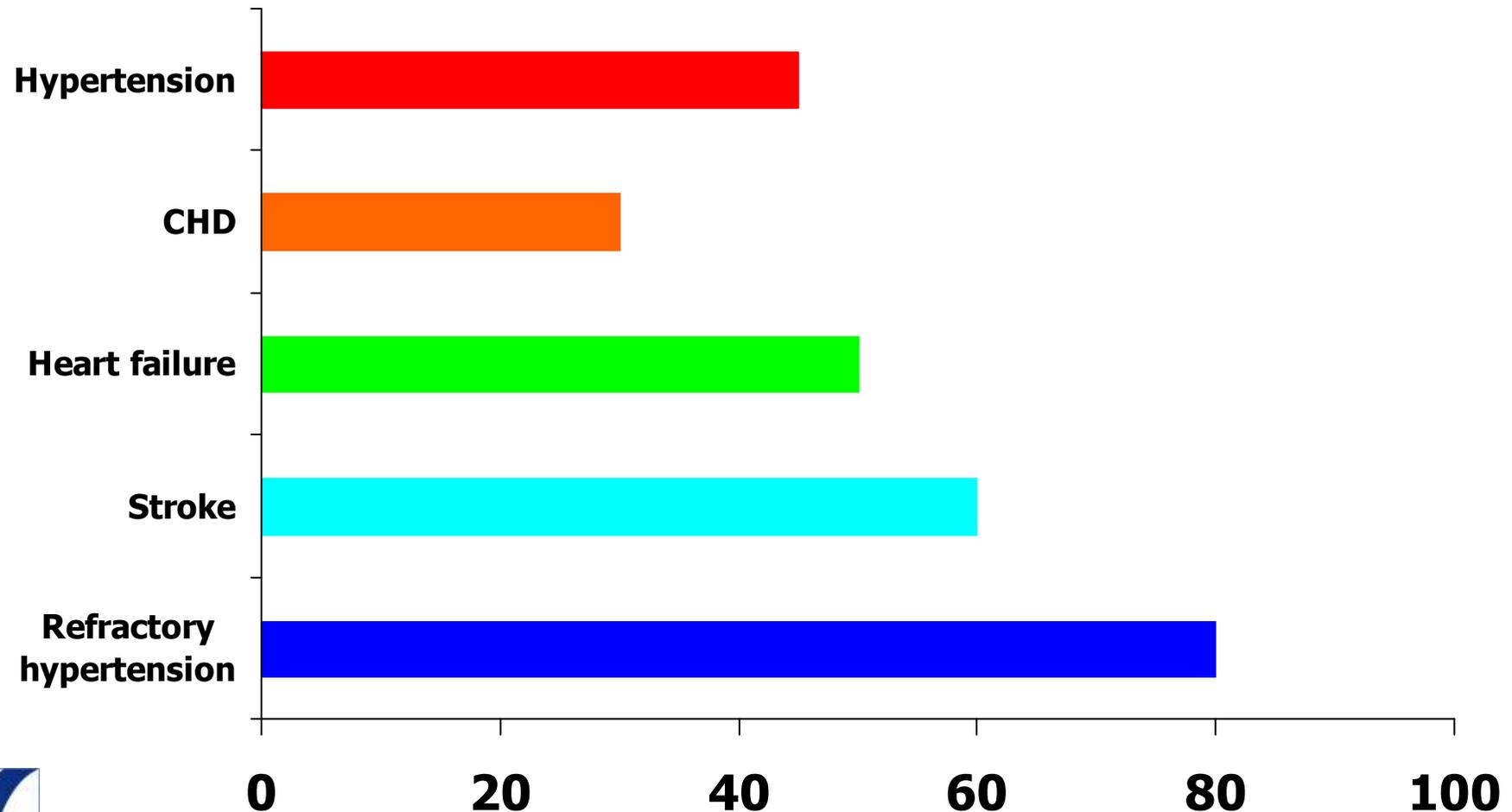
*Cas-contrôle: 102 conducteurs admis après un accident/152 contrôles*

*choisis au hasard dans des services de soins appariés en sexe, âge, origine géographique. Polygraphie à domicile + PSG au laboratoire âge moyen : 44 ans; 77% d'hommes*

*Risque d'accident: x 6,3 (OR 95% CI: 2,4 – 16,2)*

*IAH < 10 vs. IAH > 10*

# Prévalence du SAS au cours des maladies cardiovasculaires



# Morbidité cardiovasculaire

Long-term cardiovascular outcomes in men with obstructive sleep apnoea-hypopnoea with or without treatment with continuous positive airway pressure: an observational study

	Healthy men (n=264)	Simple snorers (n=377)	Untreated mild- moderate OSAH (n=403)	Untreated severe OSAH (n=235)	OSAH treated with CPAP (n=372)
<b>Non-fatal cardiovascular events</b>					
Number of events	12	22	36	50	24
Events per 100 person years	0.45	0.58	0.89	2.13*	0.64
<b>Cardiovascular death</b>					
Number of events	8	13	22	25	13
Events per 100 person years	0.3	0.34	0.55	1.06†	0.35

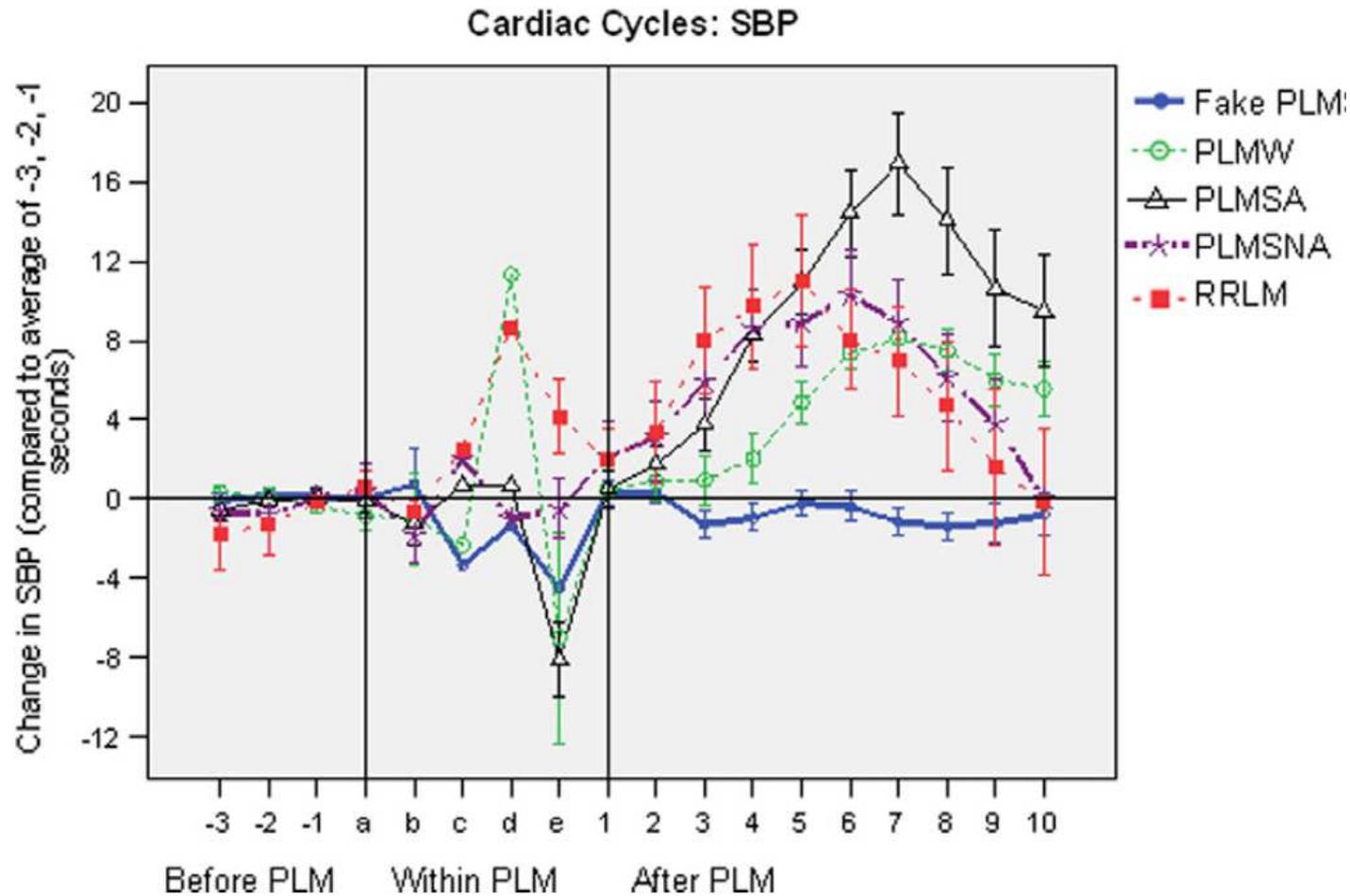
OSAH=obstructive sleep apnoea-hypopnoea syndrome; CPAP=continuous positive airway pressure. \*p<0.0001 versus healthy men; †p=0.0012.

**Table 2:** Incidence of cardiovascular events during the 10-year follow-up in healthy men, snorers, and patients untreated and treated for OSAH

# MPJ, SJSR : Effets cardio-vasculaires

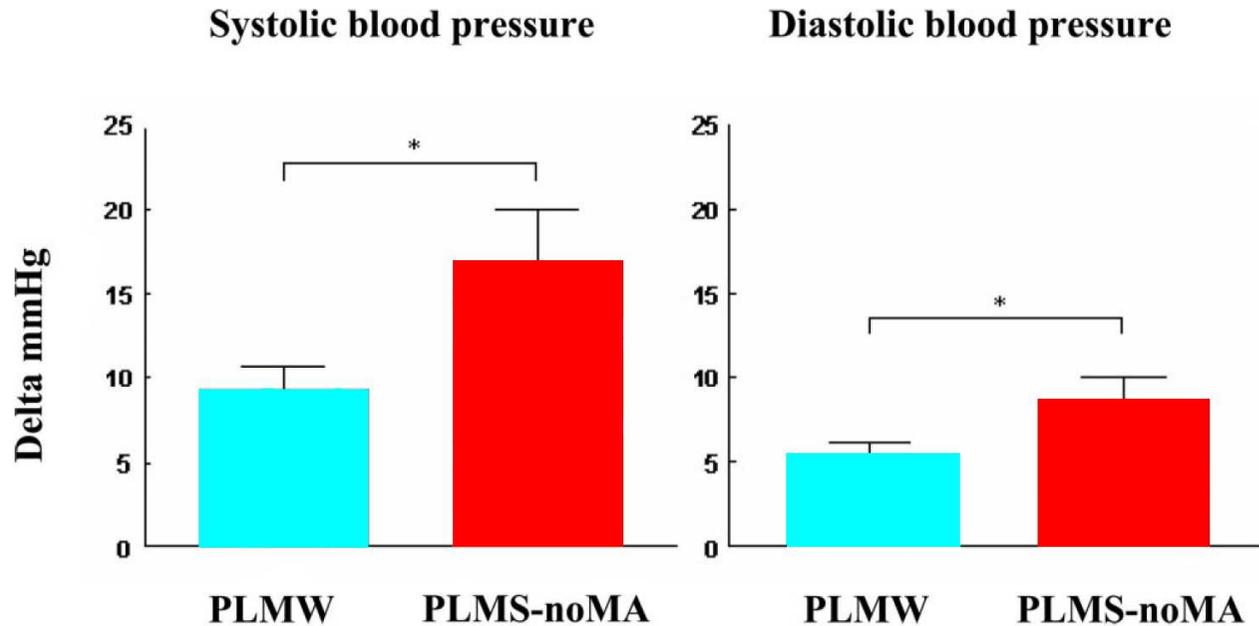
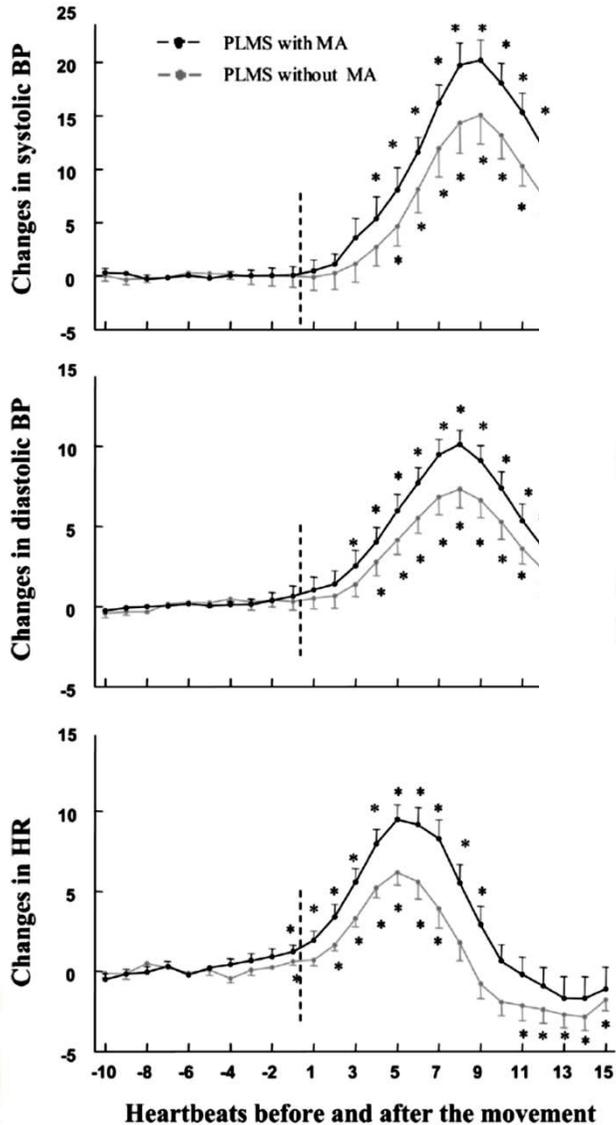
MPJ associés à une réponse cardiovasculaire au cours du sommeil et à l'éveil

N=8 patients SJSR explorés lors de mouvements simulés ou à l'éveil, au cours du sommeil (avec ou sans micro-éveil), lors d'un éveil respiratoire



# MPJ, SJSR : Effets cardio-vasculaires

## Réponse cardiovasculaire au cours du sommeil et à l'éveil



N = 10 patients SJSR, analyse de 10 PLM avec et sans micro-éveil

# MPJ, SJSR : Effets cardio-vasculaires

## Réponse cardiovasculaire au cours du sommeil et à l'éveil

**Table 2** Correlations between cardiovascular increments and subjects and movement characteristics

	Delta SBP	Delta DBP	Delta HR
Age, y	$r = 0.76; p = 0.02$	$r = 0.65; p = 0.06$	$r = -0.34; NS$
Duration of the disease, y	$r = 0.76; p = 0.02$	$r = 0.77; p = 0.02$	$r = -0.07; NS$
PLMS index	$r = -0.16; NS$	$r = -0.12; NS$	$r = 0.04; NS$
Duration of PLMS, sec	$r = 0.43; NS$	$r = 0.35; NS$	$r = 0.22; NS$
Duration of MA, sec*	$r = 0.87; p = 0.002$	$r = 0.90; p = 0.001$	$r = 0.17; NS$

\* Only movements with microarousals (MA) were considered for this correlation.

SBP = systolic blood pressure; DBP = diastolic blood pressure; HR = heart rate; PLMS = periodic leg movements during sleep.

**N = 10 patients SJSR, analyse de 10 PLM avec et sans micro-éveil**

# MPJ, SJSR : Effets cardio-vasculaires

## MPJ et SJSR sont associés à une morbidité cardiovasculaire

N= 2821 participants de la Wisconsin Sleep Cohort.  
Prévalence SJSR quotidien 10%

Adjusted logistic regression models for RLS symptoms and outcomes ( $n = 2821$ )

Odds ratio (95% confidence interval)	No RLS		RLS symptoms	
	No RLS	Leg complaints without RLS	Frequent (1–6/week)	Daily (7/week)
Fair or poor general health	Reference	2.00 (1.42, 2.81)	2.80 (1.64, 4.79)	4.20 (2.51, 7.03)
Epworth > 10	Reference	1.74 (1.43, 2.12)	2.48 (1.75, 3.53)	3.22 (2.20, 4.71)
Excessive daytime sleepiness, at least five times per month	Reference	1.87 (1.48, 2.36)	2.53 (1.70, 3.78)	3.28 (2.15, 5.00)
Not feel rested, regardless of amount of sleep, at least five times per month	Reference	1.92 (1.57, 2.37)	3.44 (2.41, 4.93)	3.59 (2.42, 5.31)
Cardiovascular disease	Reference	1.57 (1.08, 2.28)	1.61 (0.82, 3.13)	2.58 (1.38, 4.84)
Hypertension	Reference	1.05 (0.86, 1.29)	0.98 (0.66, 1.45)	1.27 (0.85, 1.91)

All models were adjusted for age, sex, body mass index, current smoking, sleep-disordered breathing treatment, diabetes, and snoring.

# MPJ, SJSR : Effets cardio-vasculaires

1559 hommes, 1874 femmes (âge moyen 67,9 ans) Sleep Heart Health Study  
 SJSR 6,8% femmes et 3,3% hommes

<b>Table 2</b> Association of restless legs syndrome (RLS) with prevalent coronary artery disease (CAD)				
	No. of subjects (Model 1)	Model 1: Age, sex, race, BMI, DM, SBP, antihypertensive medication use, total:LDL cholesterol ratio, and smoking history	No. of subjects (Model 2)	Model 2: Model 1 + AHI
<b>Main analysis</b>				
No RLS	3,254	Referent	2,467	Referent
RLS	179	2.05 (1.38-3.04)	134	2.22 (1.40-3.53)
<b>RLS frequency</b>				
No RLS	3,254	Referent	2,467	Referent
5-15/mo	53	1.34 (0.62-2.92)	38	0.97 (0.35-2.66)
16-23/mo	50	2.83 (1.40-5.71)	41	3.18 (1.48-6.85)
24+/mo	76	2.14 (1.19-3.86)	55	2.71 (1.37-5.39)
<b>RLS bothersomeness</b>				
No RLS	3,254	Referent	2,467	Referent
Moderate	100	1.98 (1.17-3.37)	70	2.14 (1.13-4.03)
Severe*	79	2.12 (1.20-3.75)	64	2.32 (1.22-4.39)

# MPJ, SJSR : Effets cardio-vasculaires

1559 hommes, 1874 femmes (âge moyen 67,9 ans) Sleep Heart Health Study  
 SJSR 6,8% femmes et 3,3% hommes

**Table 3** Association of restless legs syndrome (RLS) with prevalent cardiovascular disease (CVD)

	No. of subjects (Model 1)	Model 1: Age, sex, race, BMI, DM, SBP, antihypertensive medication use, total:LDL cholesterol ratio, and smoking history	No. of subjects (Model 2)	Model 2: Model 1 + AHI
Main analysis				
No RLS	3,254	Referent	2,467	Referent
RLS	179	2.07 (1.43-3.00)	134	2.38 (1.55-3.65)
RLS frequency				
No RLS	3,254	Referent	2,467	Referent
5-15/mo	53	1.53 (0.76-3.07)	38	1.40 (0.60-3.28)
16-23/mo	50	3.53 (1.85-6.76)	41	3.92 (1.92-8.03)
24+/mo	76	1.75 (0.99-3.09)	55	2.26 (1.17-4.37)
RLS bothersomeness				
No RLS	3,254	Referent	2,467	Referent
Moderate	100	1.88 (1.14-3.09)	70	2.27 (1.26-4.09)
Severe*	79	2.33 (1.37-3.97)	64	2.50 (1.38-4.54)

# Durée et qualité du sommeil risque de diabète

Sommeil normal / < 5 h

Mauvais sommeil / < 5 h

Insomnie / 5-6 h

Insomnie / < 5 h

