colmea

# Colóquio Interinstitucional

## Modelos Estocásticos e Aplicações

Quarta-feira, 06 de novembro de 2013

# *Sonho, Memória e Loucura*

INSTITUTO DO CÉREBRO

Sidarta Ribeiro
Universidade Federal do Rio Grande do Norte

Ministério da Ciência e Tecnologia

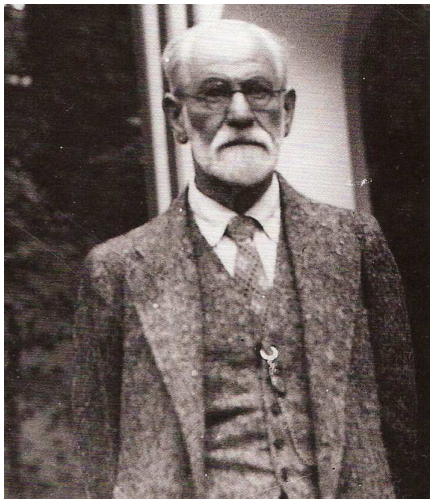
BRASIL UM PAÍS DE TODOS

PEW Latin American FELLOWS PROGRAM in the BIOMEDICAL SCIENCES

FAPERN Fundação de Apoio à Pesquisa do Estado do Rio Grande do Norte

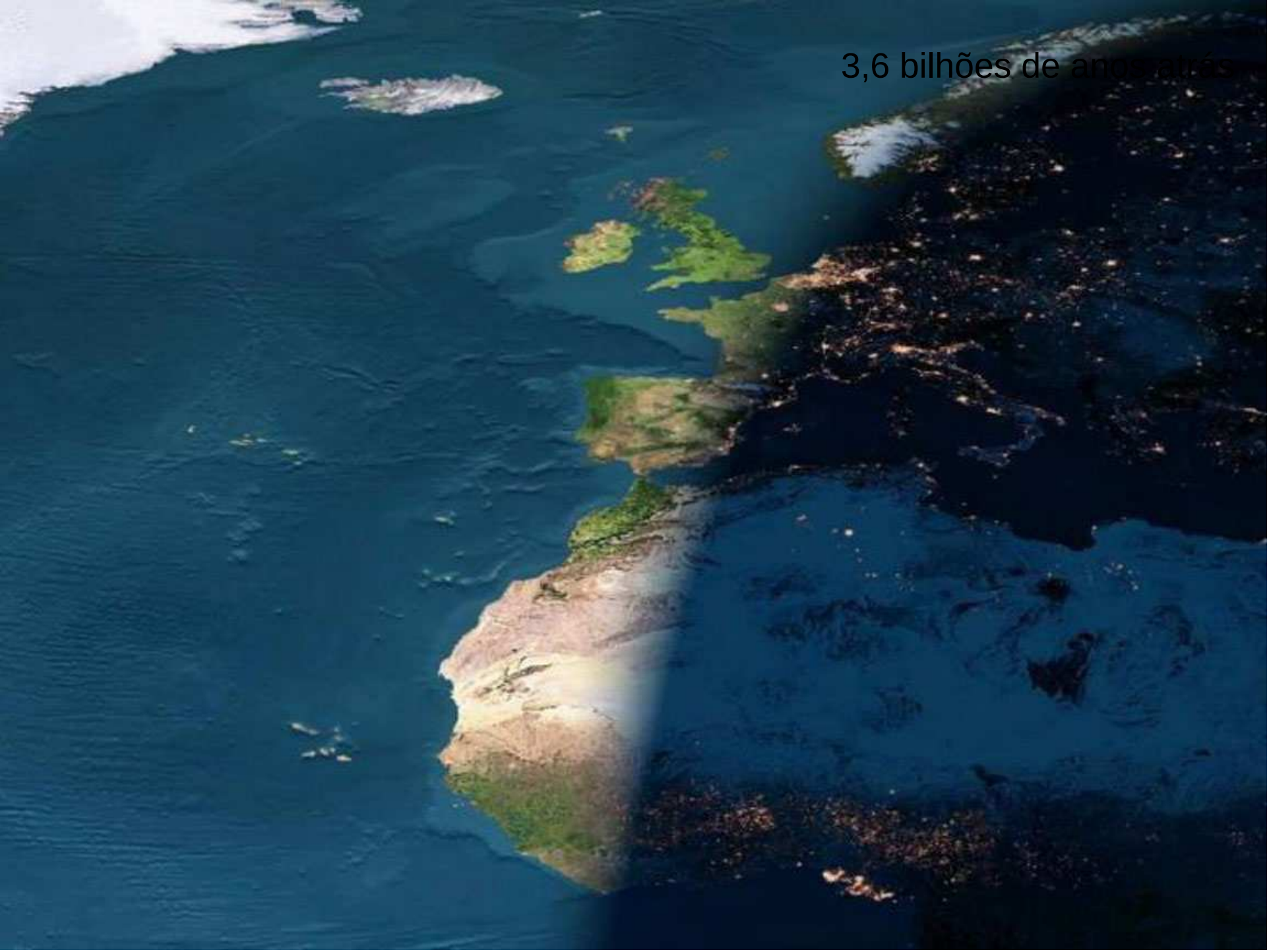
CNPq Conselho Nacional de Desenvolvimento Científico e Tecnológico

CAPES



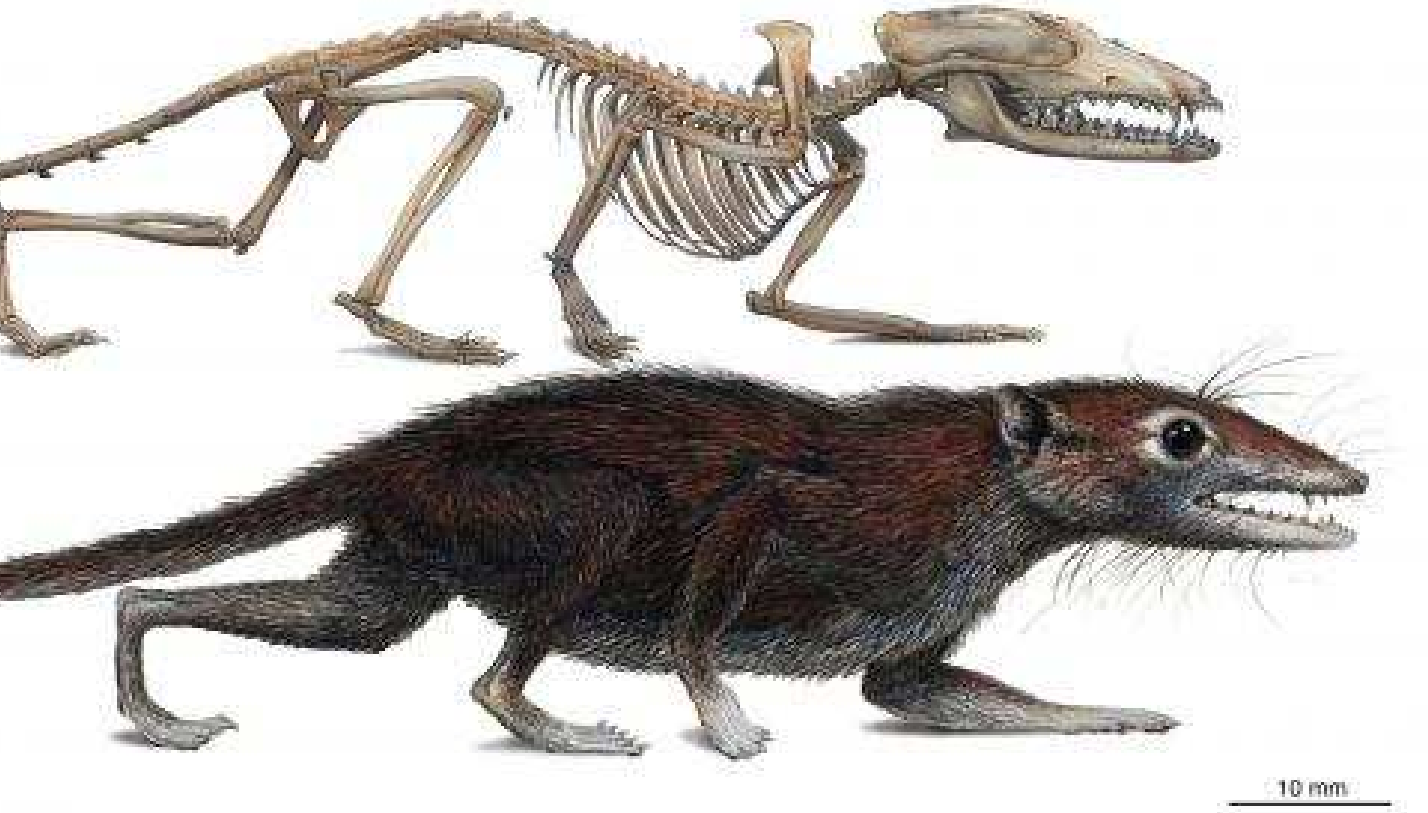
Sigmund Freud

Será o sonho um “cálice sagrado” para compreender a consciência?


3,6 bilhões de anos atrás

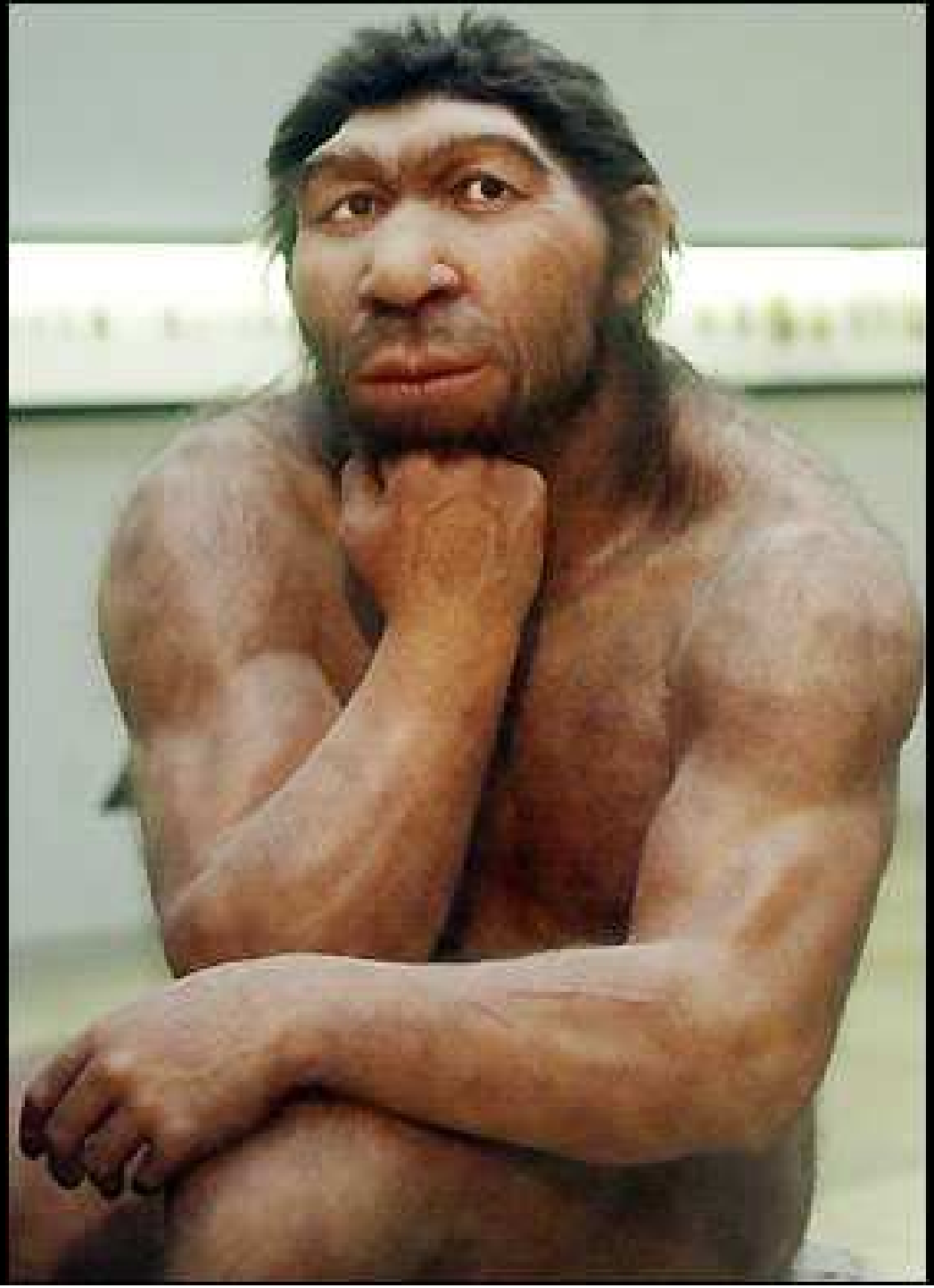

www.MzePhotos.com

160 milhões de anos atrás
Sono REM




Mark A. Klingler / Carnegie Museum of Natural History

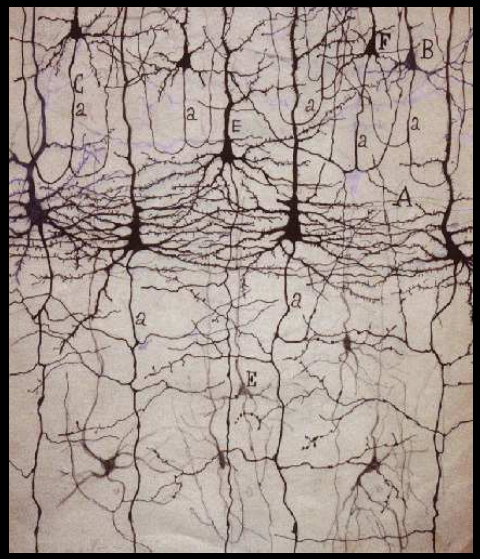

100 mil anos atrás
Ferramentas e arte

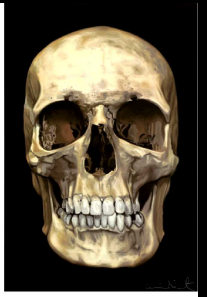


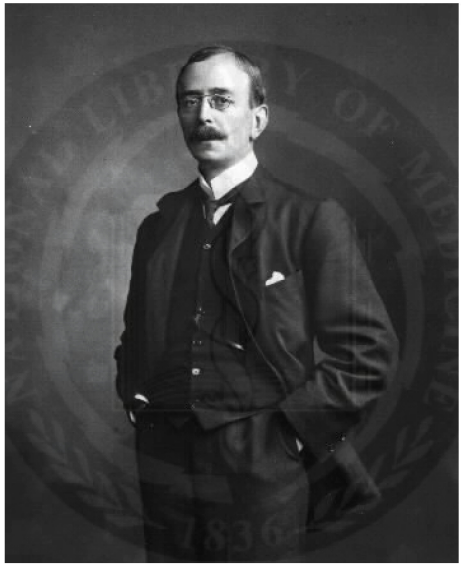

6 mil anos atrás

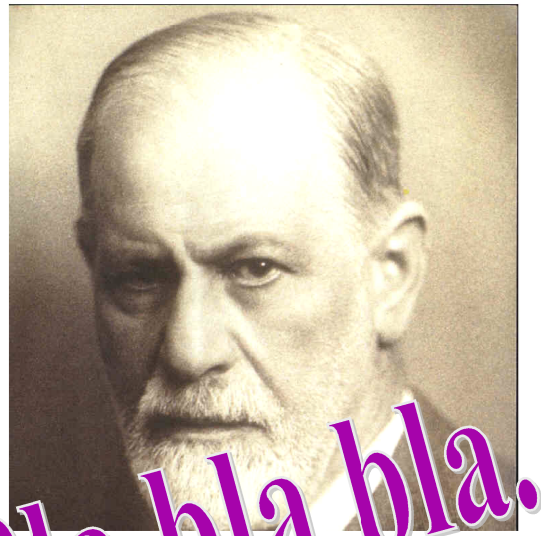
# A neurociência no começo do século 20

Ramón y Cajal

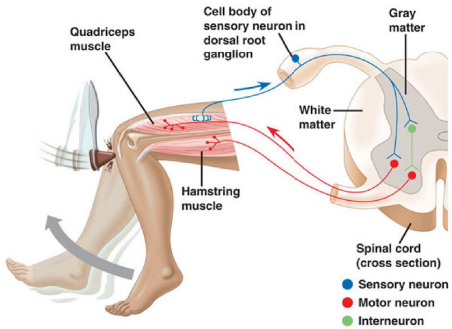


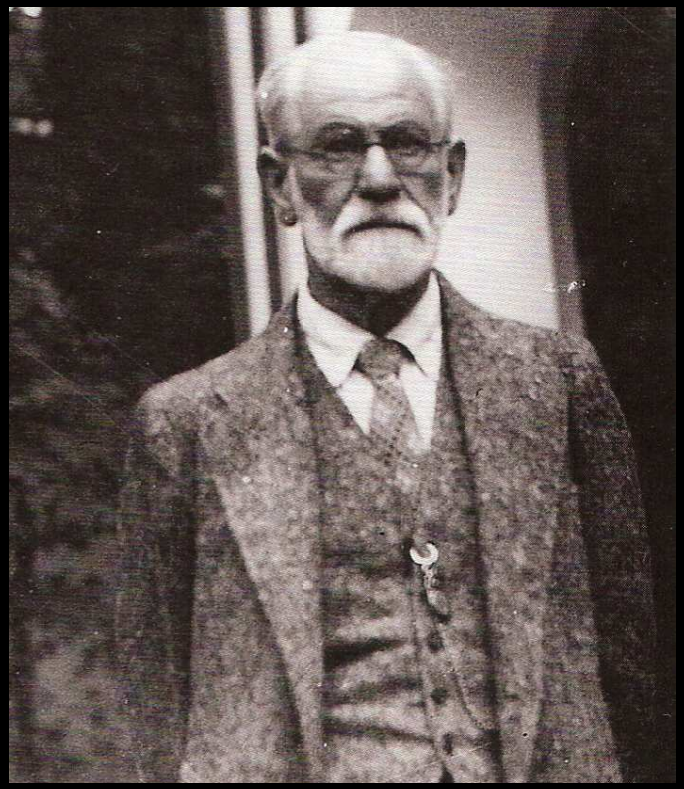




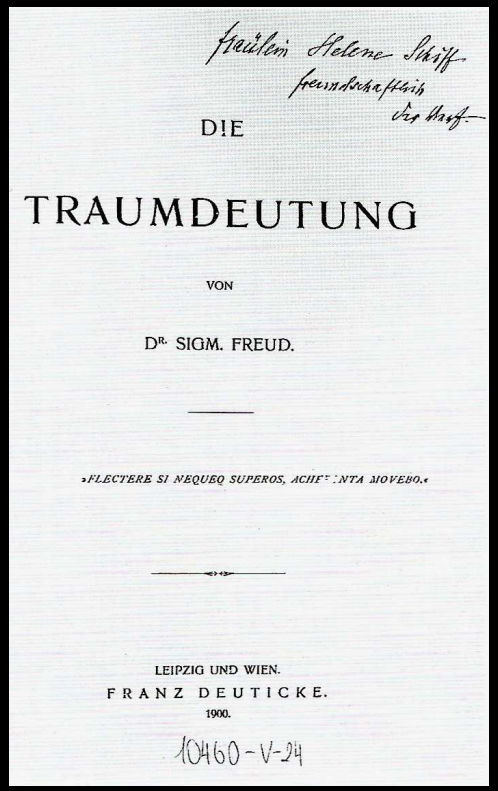


Bla bla bla...





Sigmund Freud




A Interpretação dos Sonhos

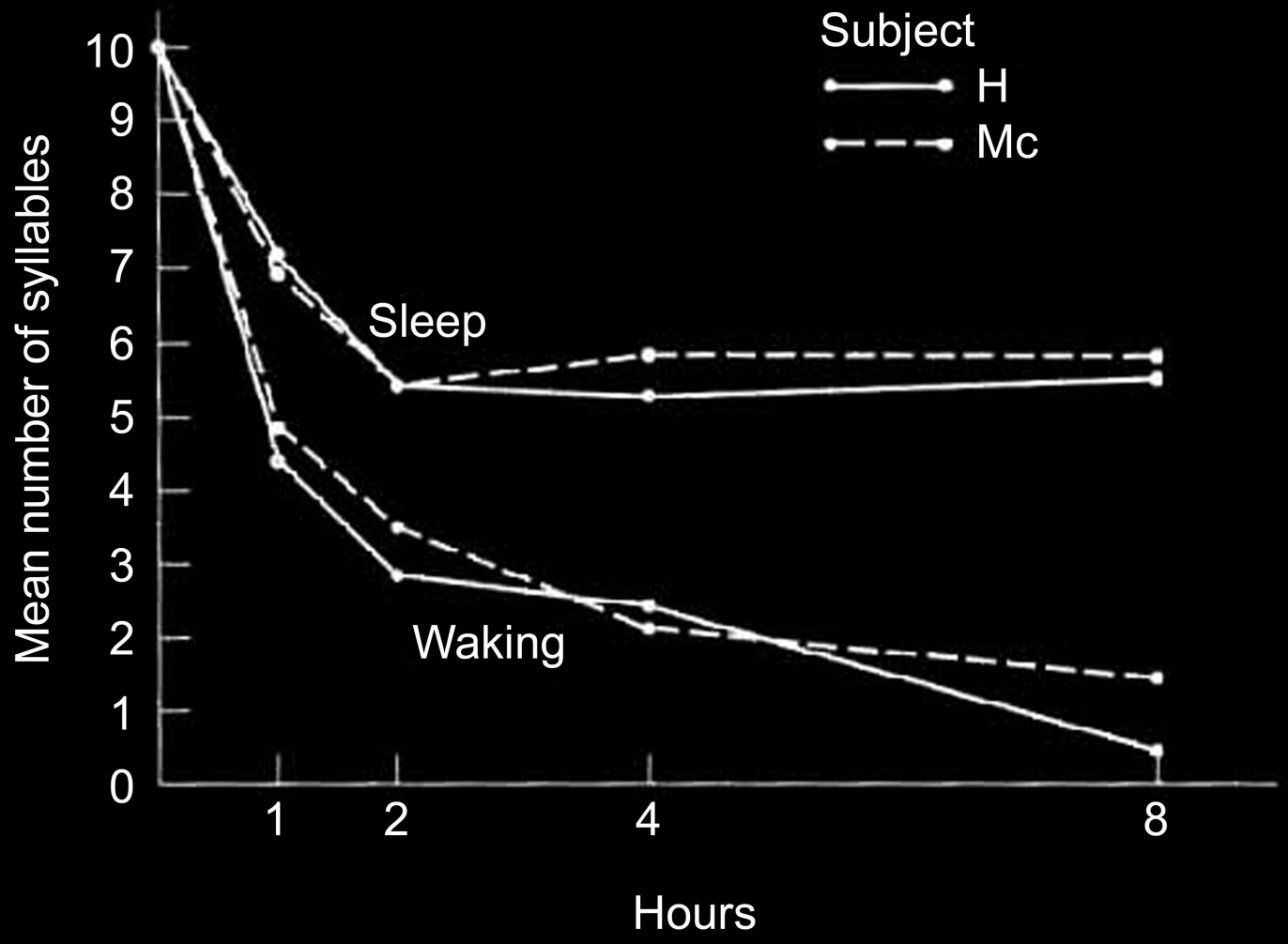
Sonhos contêm restos diurnos

Desejos são o motor dos sonhos

Sonhos são conglomerados de formações psíquicas

Sonhos são o caminho real para o inconsciente

# O sono favorece a consolidação de memórias



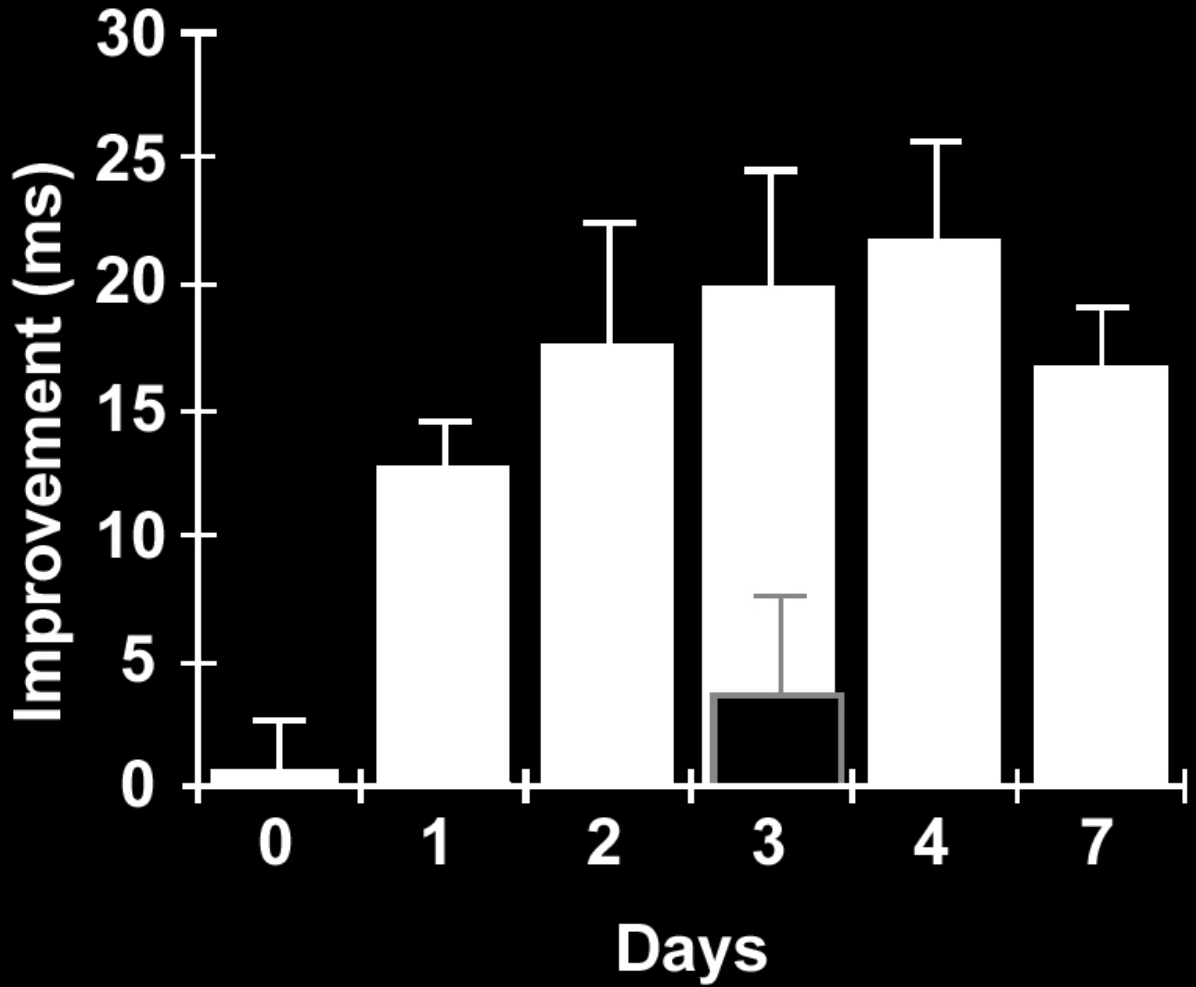

*Jenkins & Dallenbach (1924) Am. J. of Psychol. 35:605-612*

# Em meados da década de 1990…

**Sono e memória são relacionados?**

Controvérsia : Vertes & Siegel versus Carlyle-Smith & Stickgold

Ambas as fases de sono contribuem para o aprendizado

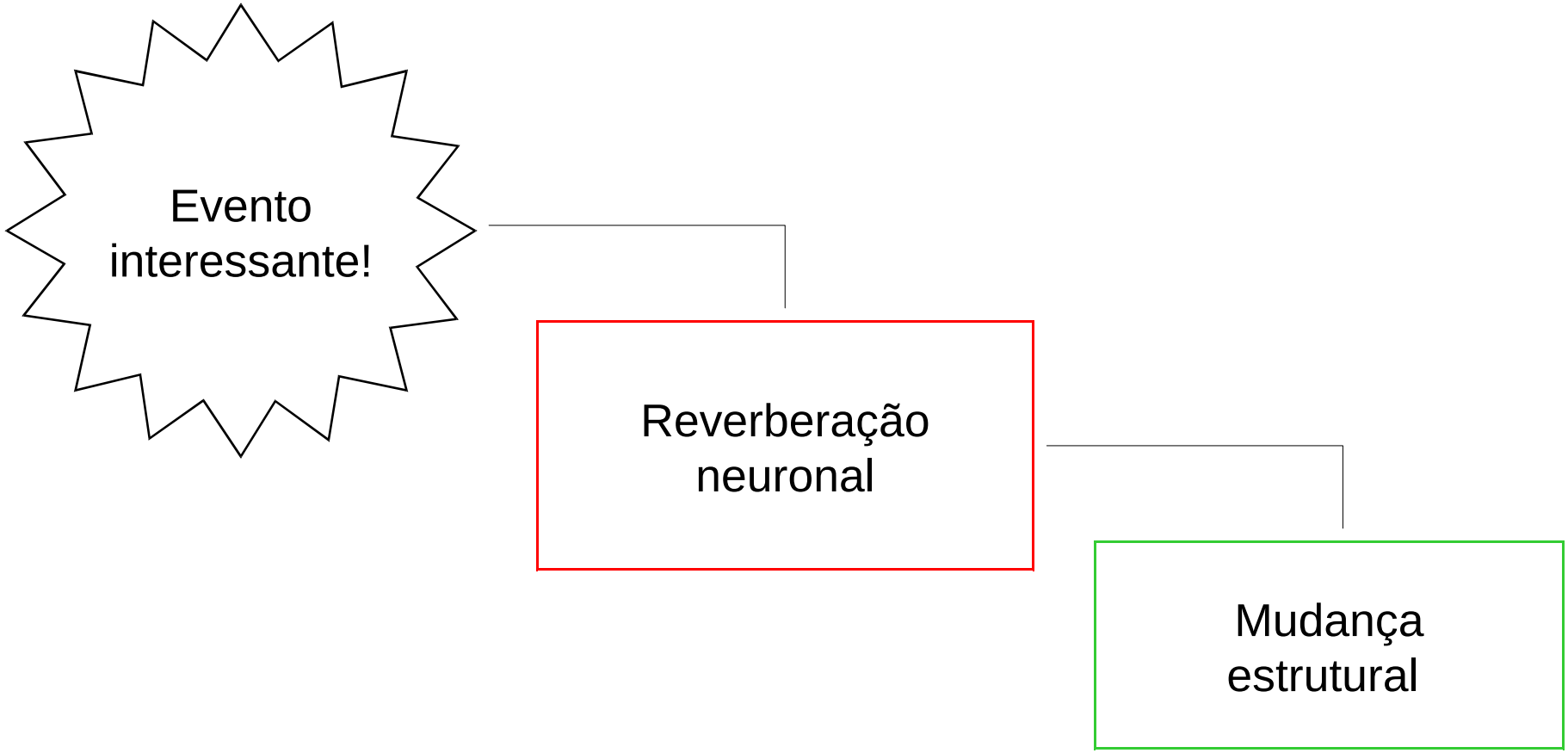


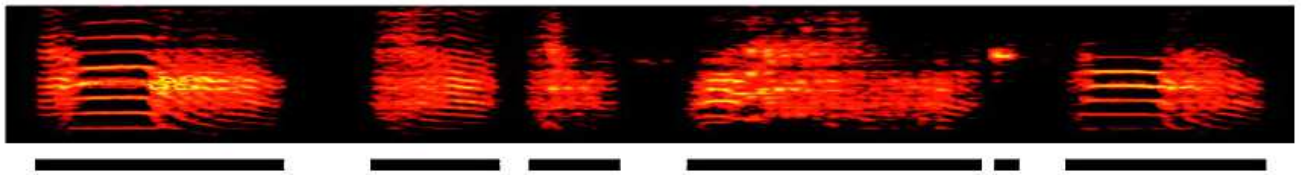

Stickgold et al. (2000)

Quais são os mecanismos?

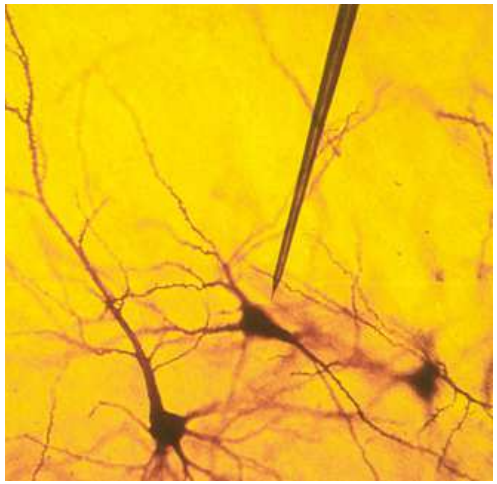
# A teoria do traço dual de memória

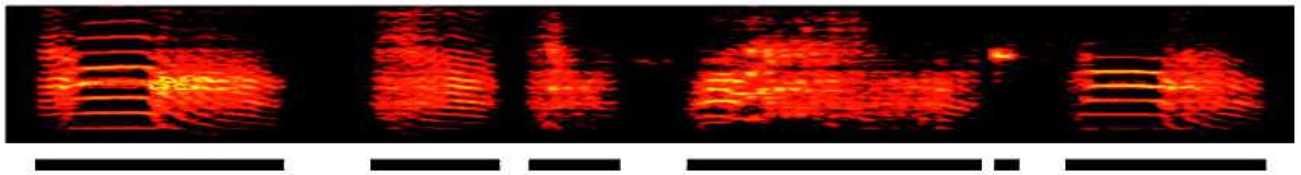
*Donald Hebb (1949) A Organização do Comportamento*



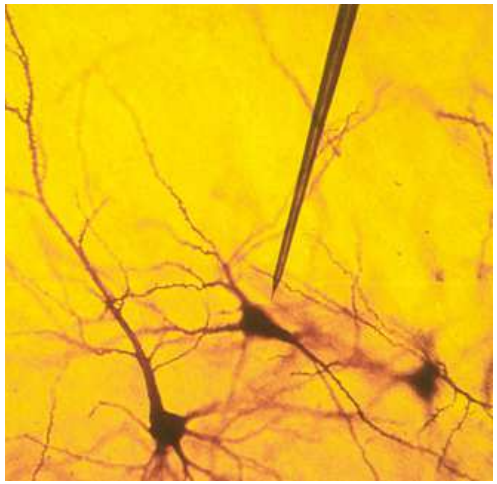


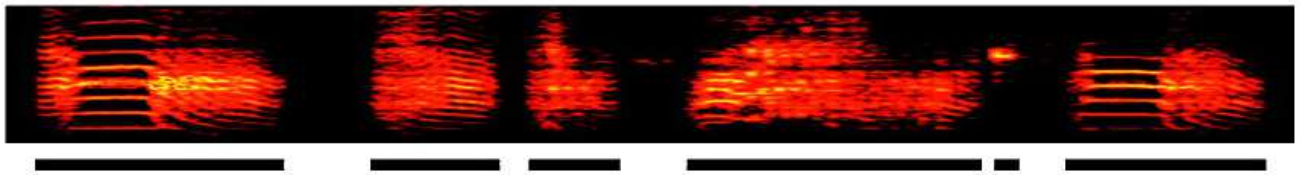
Dave & Margoliash (2000) Science 290:812-





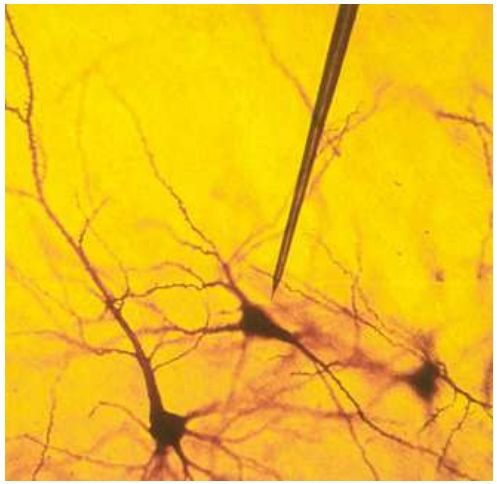
Dave & Margoliash (2000) Science 290:812-

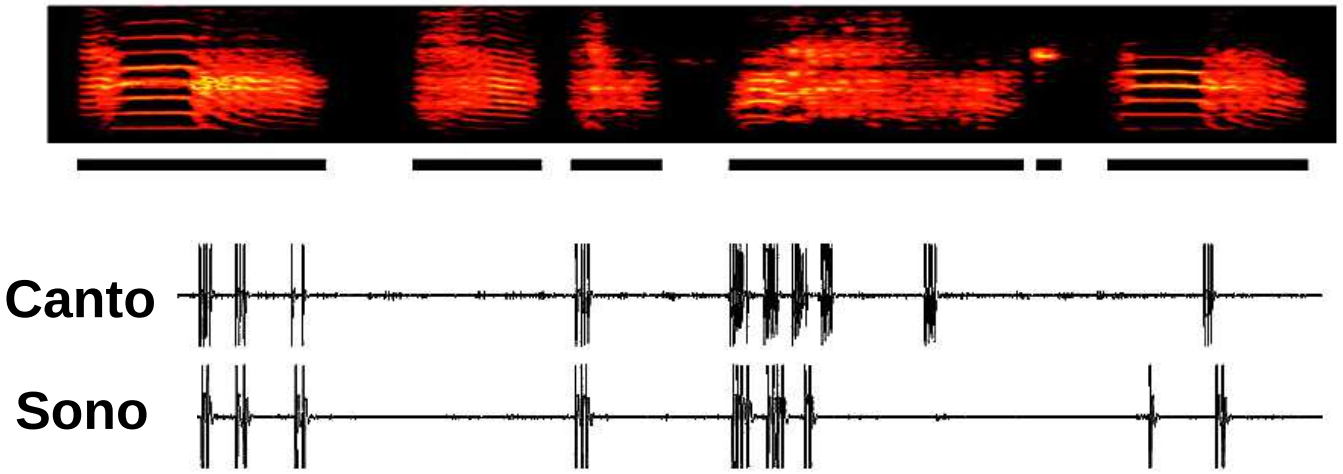




Canto

Dave & Margoliash (2000) Science 290:812-

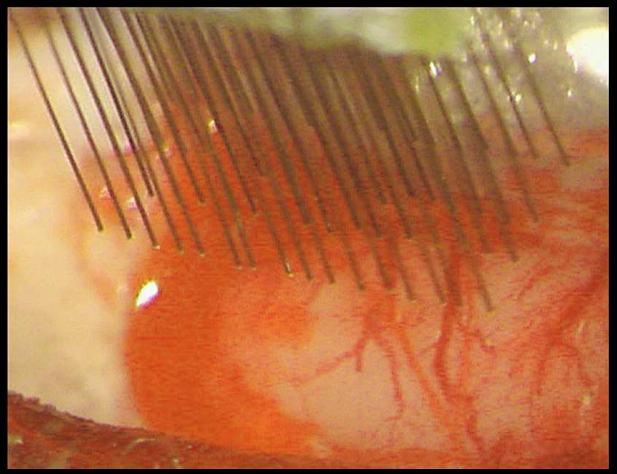


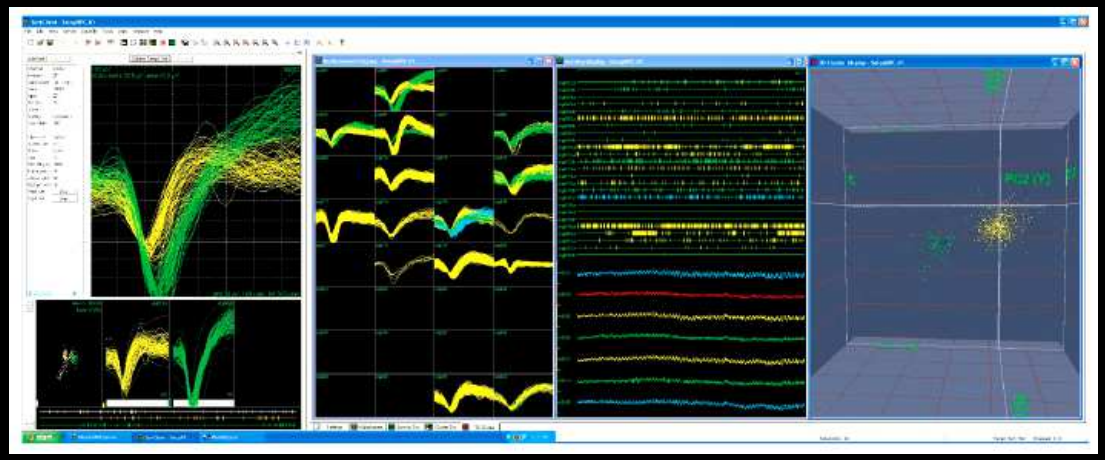


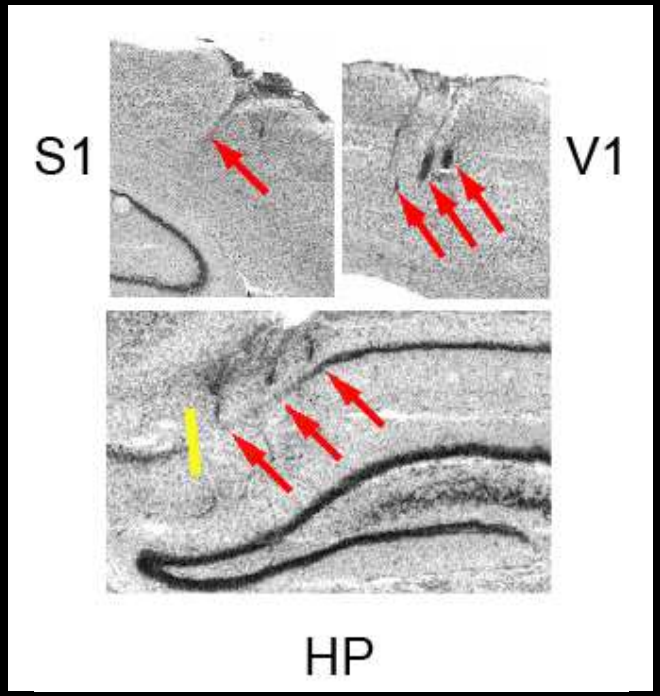

Dave AS, Margoliash D. Song replay during sleep and computational rules for sensorimotor vocal learning. Science 290: 812–816, 2000.

**Dave & Margoliash (2000) Science 290:812-**

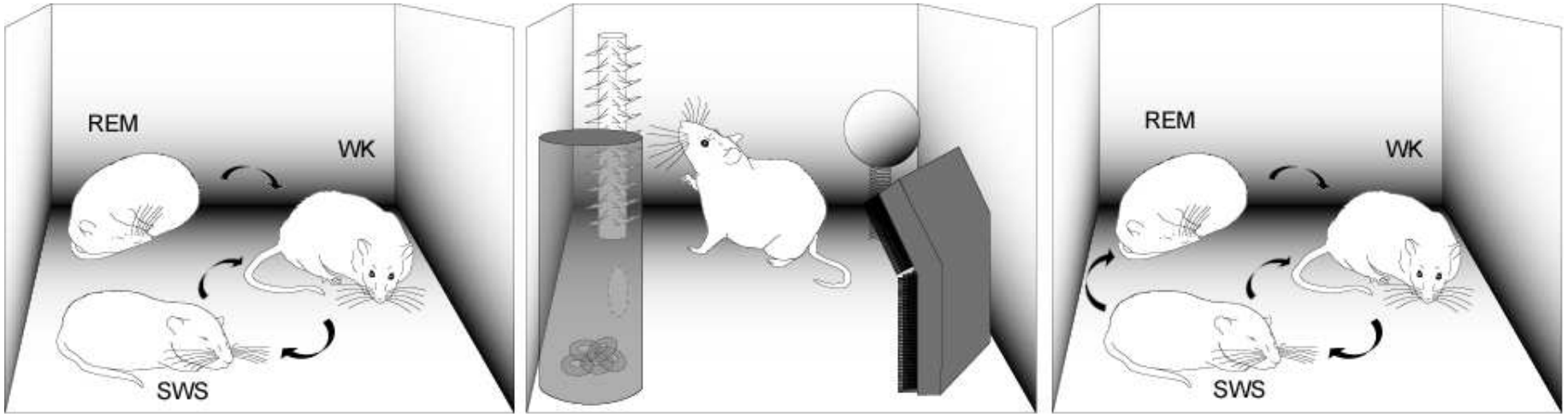
# Registros extracelulares com múltiplos eletrodos

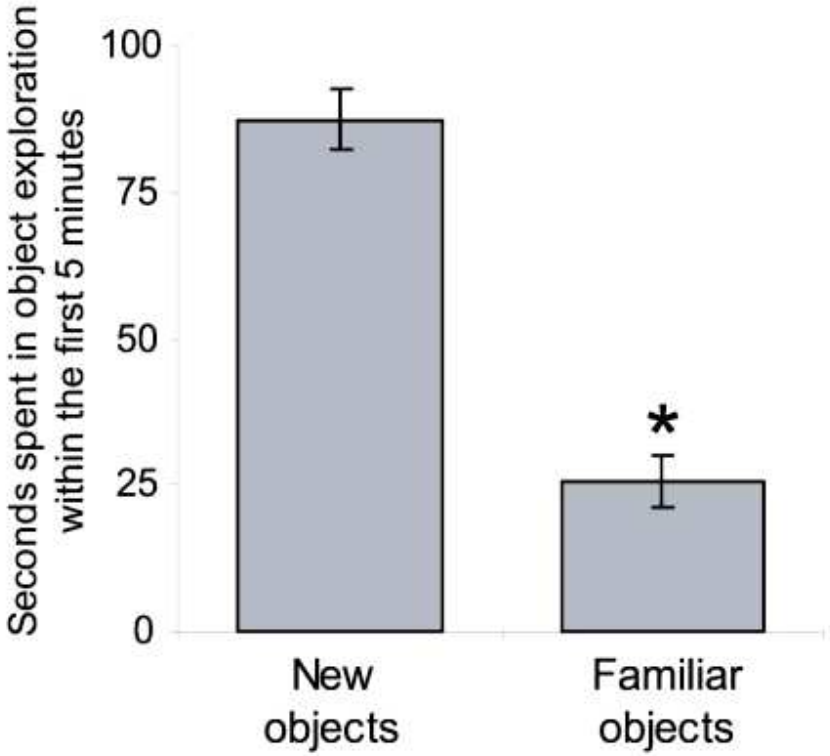


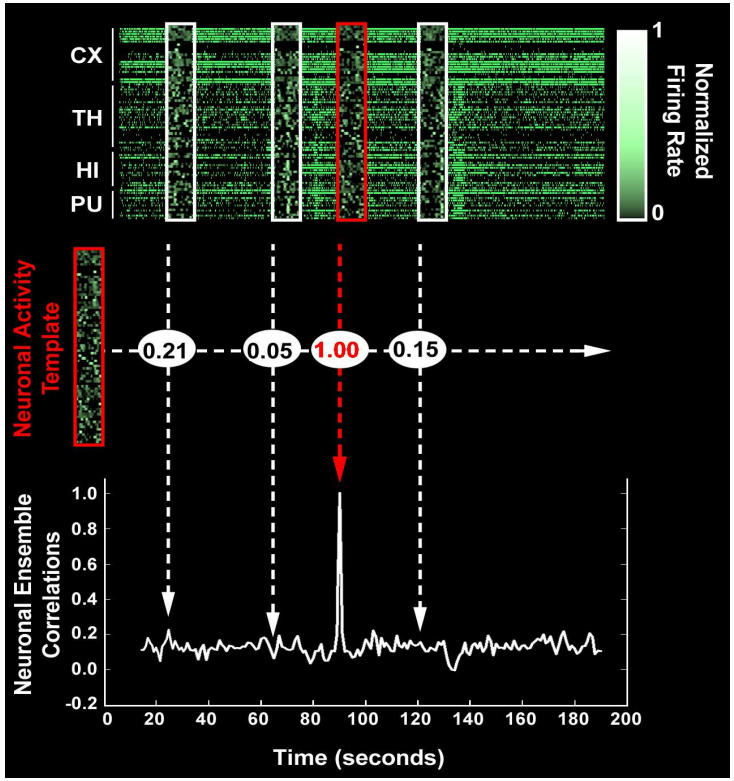




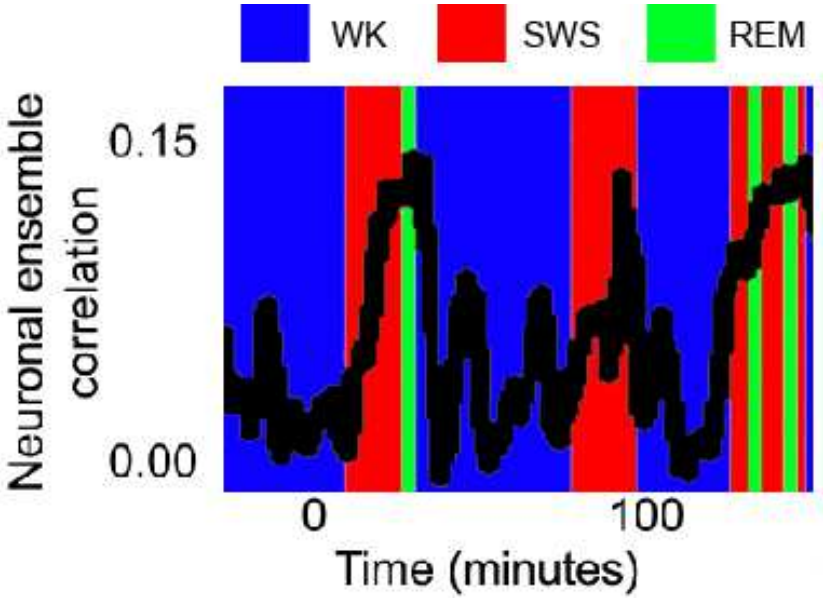
**Pre-Exposição** **Exposição** **Pós-Exposição**



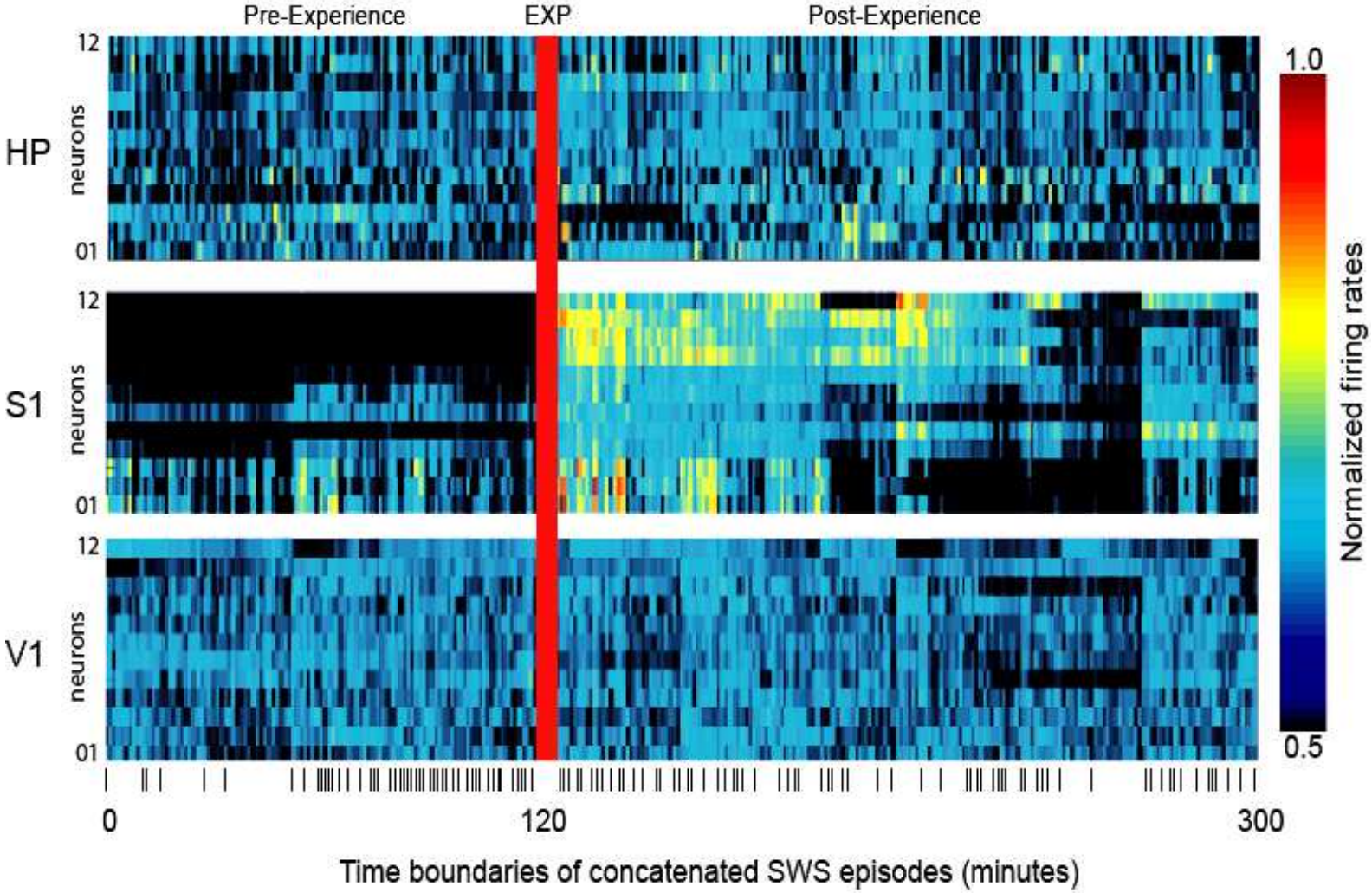



Louie & Wilson (2001) Neuron 29:145-56



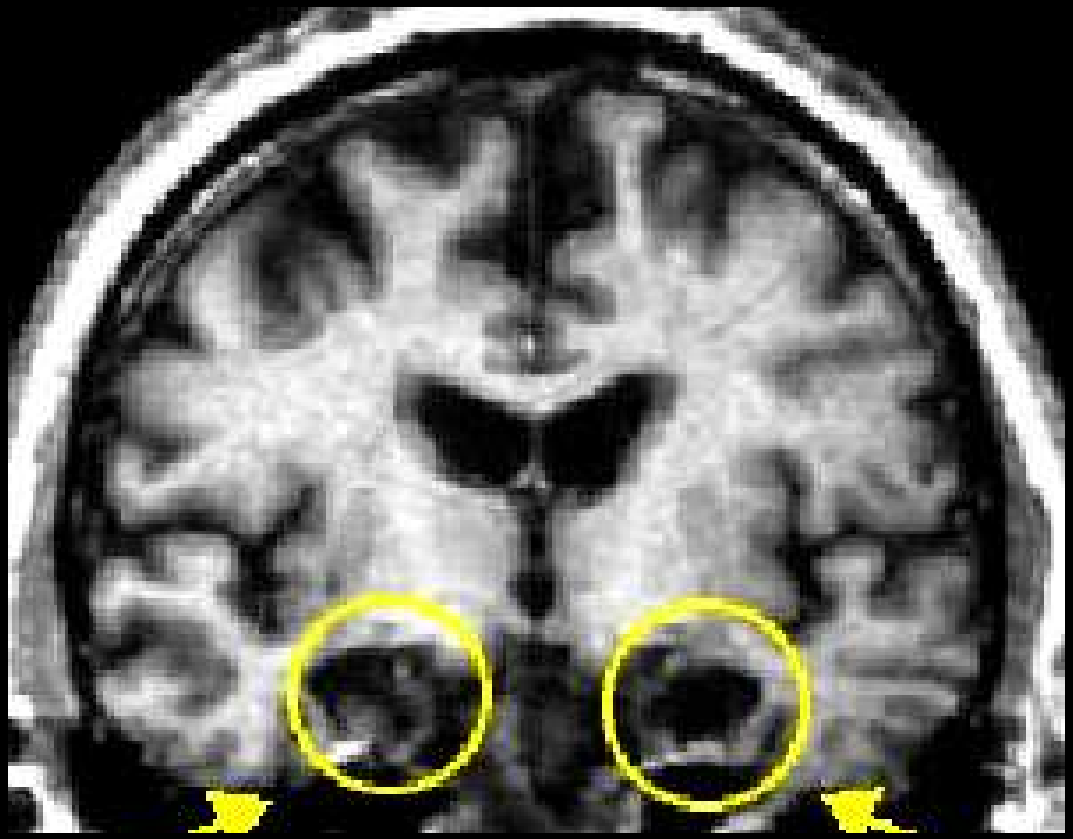

Ribeiro et al. (2004) PLoS Biol. 2: 126-137

$$COR = \frac{\sum_{c=1}^{N}\sum_{m=1}^{M}(x_{cm}-\bar{x})(y_{cm}-\bar{y})}{\sqrt{\sum_{c=1}^{N}\sum_{m=1}^{M}(x_{cm}-\bar{x})^2}\sqrt{\sum_{c=1}^{N}\sum_{m=1}^{M}(y_{cm}-\bar{y})^2}},$$




Ribeiro et al. (2007) Frontiers in Neuroscience 1(1) 43-55

Memórias dependentes do hipocampo se corticalizam com o tempo

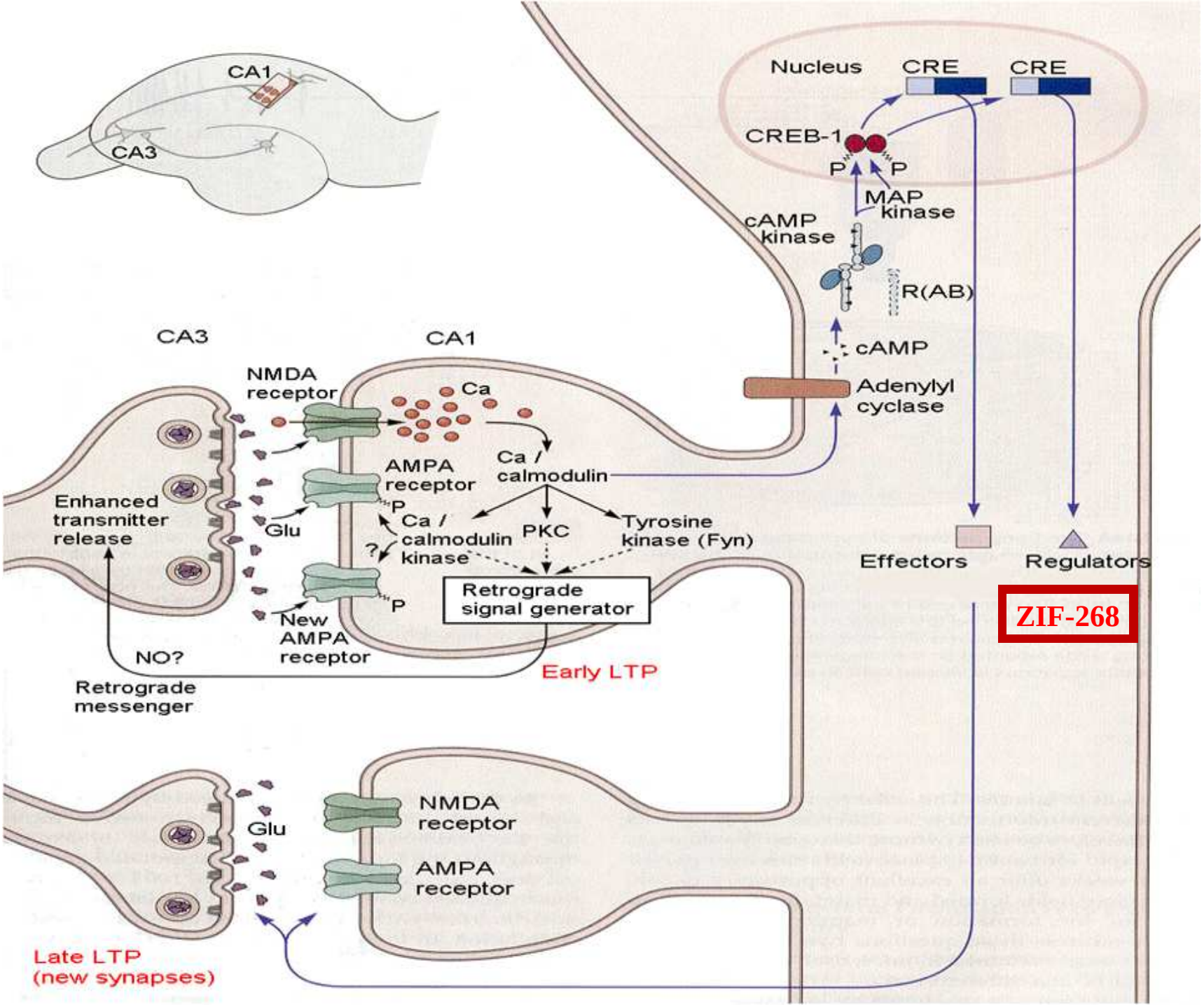


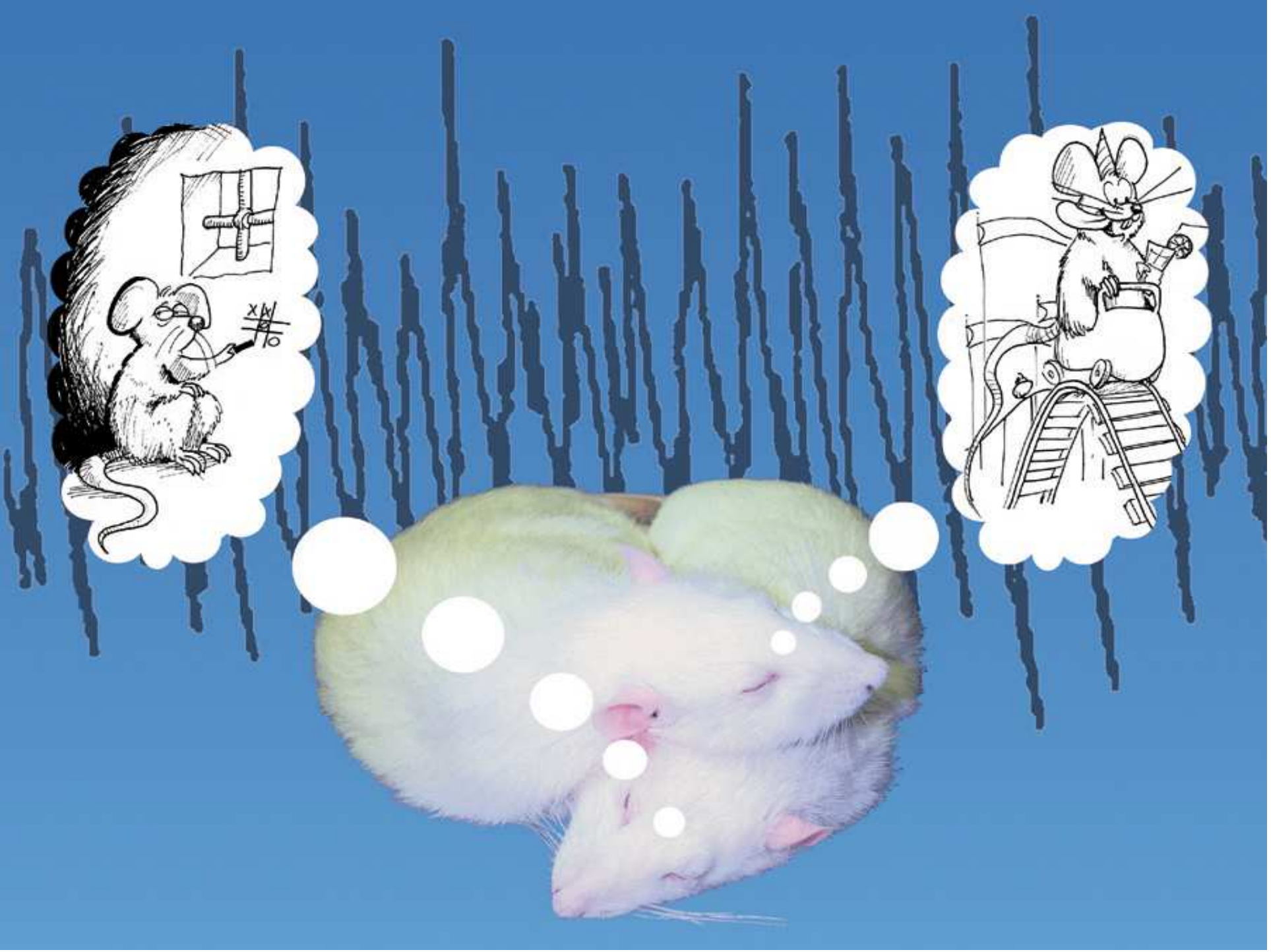
Scoville and Milner (1957) J. Neurol. Neurosurg. Psych. 20: 11-21

# Em meados da década de 1990…

**O sono reduz a expressão cerebral de genes imediatos?**

O sono como estado de renormalização sináptica
Tononi &Cirelli

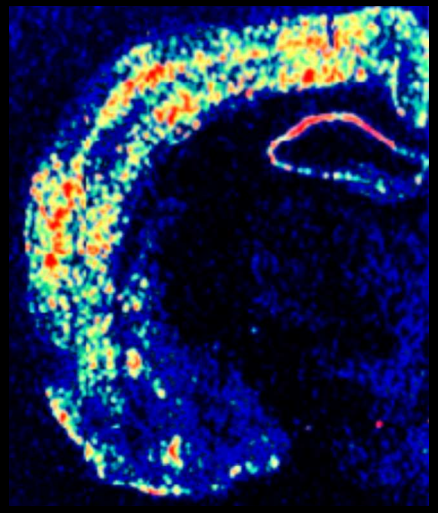

CA1
CA3
Nucleus
CRE
CRE
CREB-1
P
P
MAP kinase
cAMP kinase
R(AB)
cAMP
Adenylyl cyclase
CA3
CA1
NMDA receptor
Ca
Ca / calmodulin
AMPA receptor
P
Enhanced transmitter release
Glu
Ca / calmodulin kinase
?
PKC
Tyrosine kinase (Fyn)
Effectors
Regulators
ZIF-268
Retrograde signal generator
P
New AMPA receptor
NO?
Retrograde messenger
Early LTP
Glu
NMDA receptor
AMPA receptor
Late LTP
(new synapses)

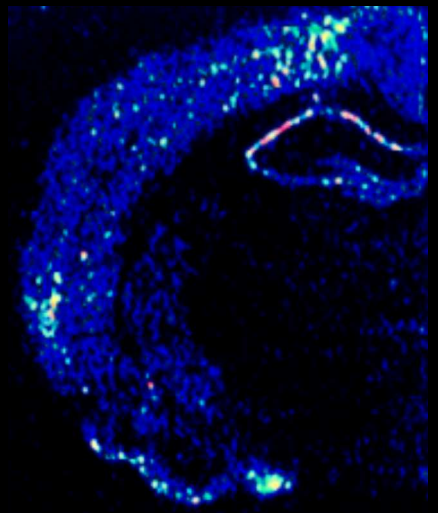


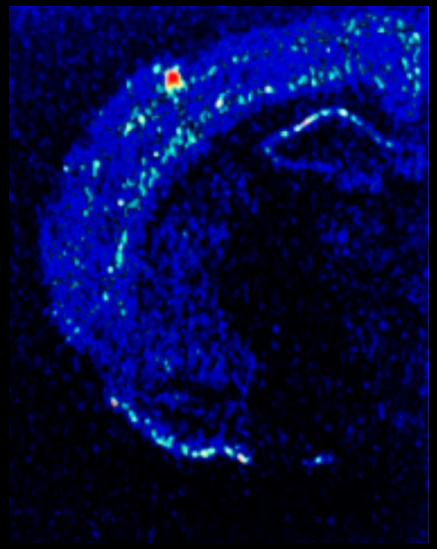
Vigília

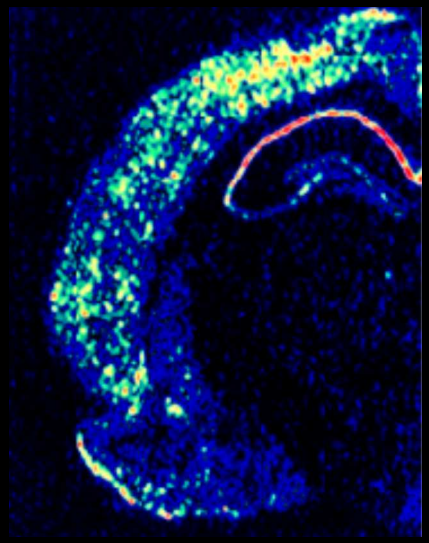
Sono de ondas lentas

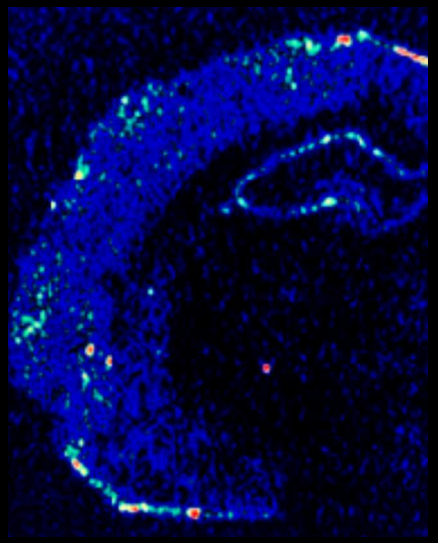
Sono REM

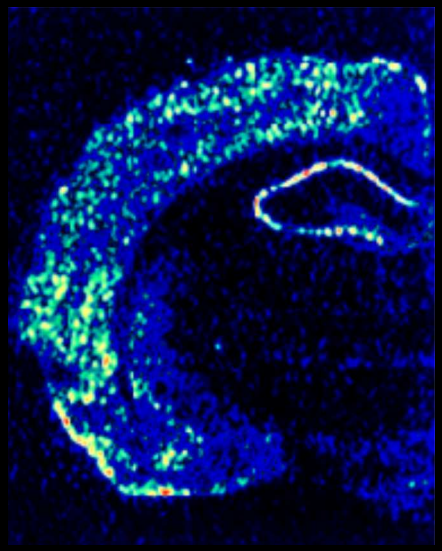




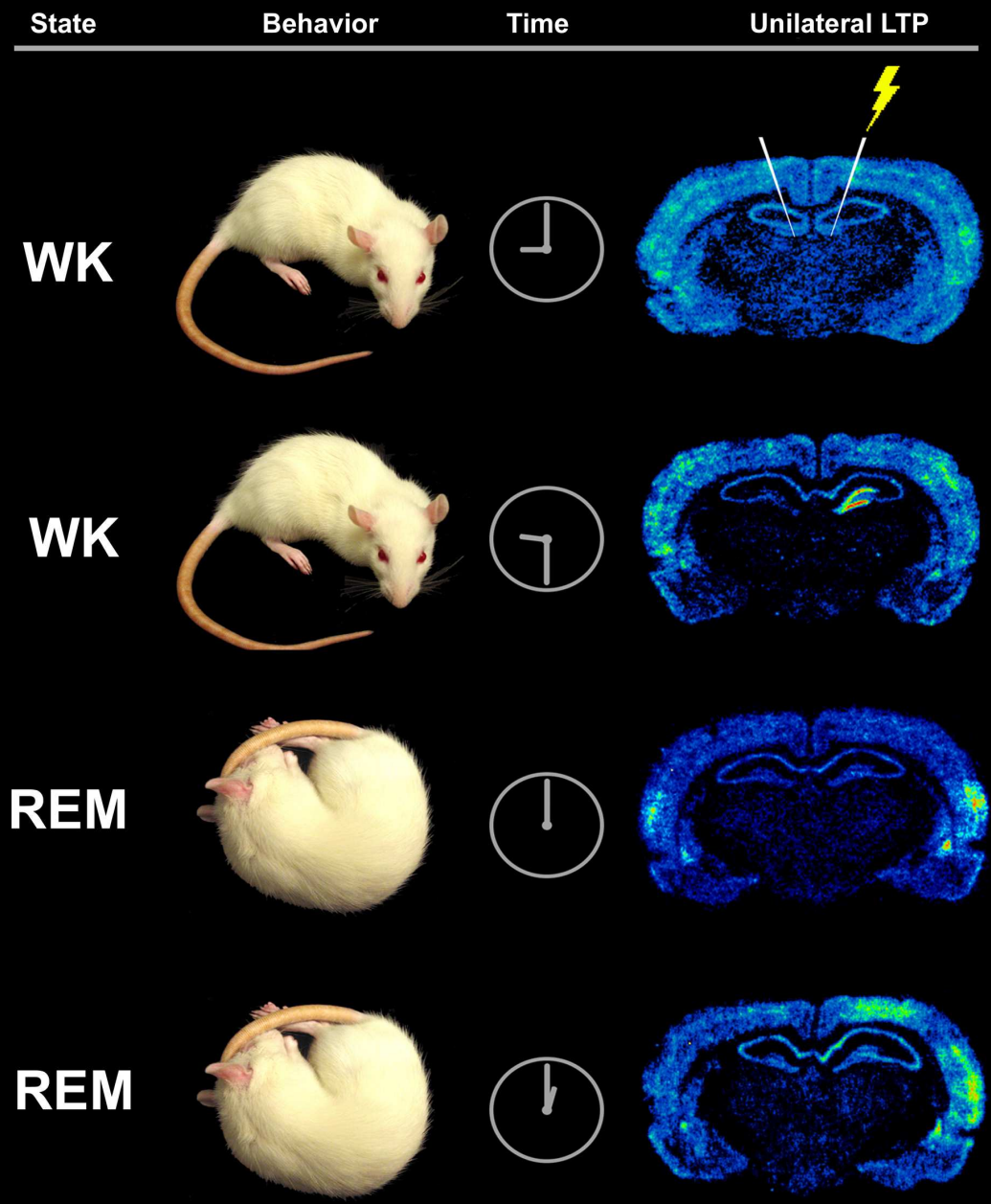






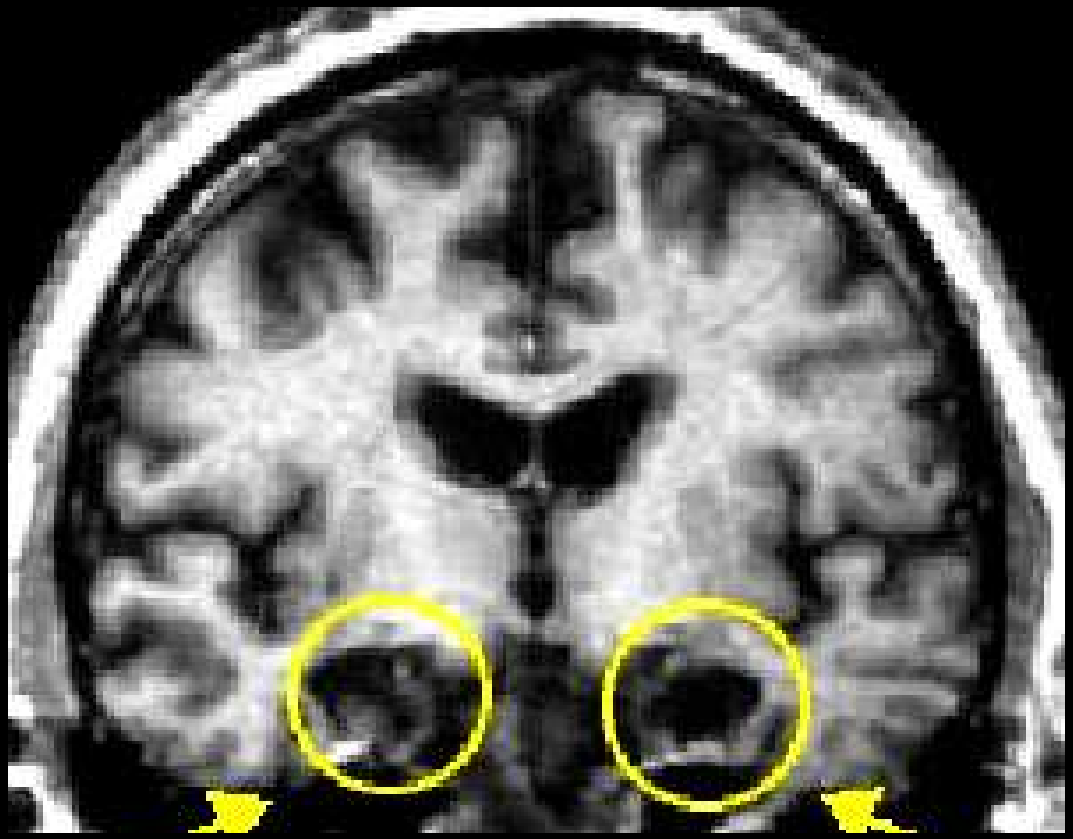


Ribeiro *et al*. (1999) *Learn.Mem*. 6: 500-508




Ribeiro *et al*. (2002) *J. Neurosci.* 22:10914-10923

Memórias dependentes do hipocampo se corticalizam com o tempo



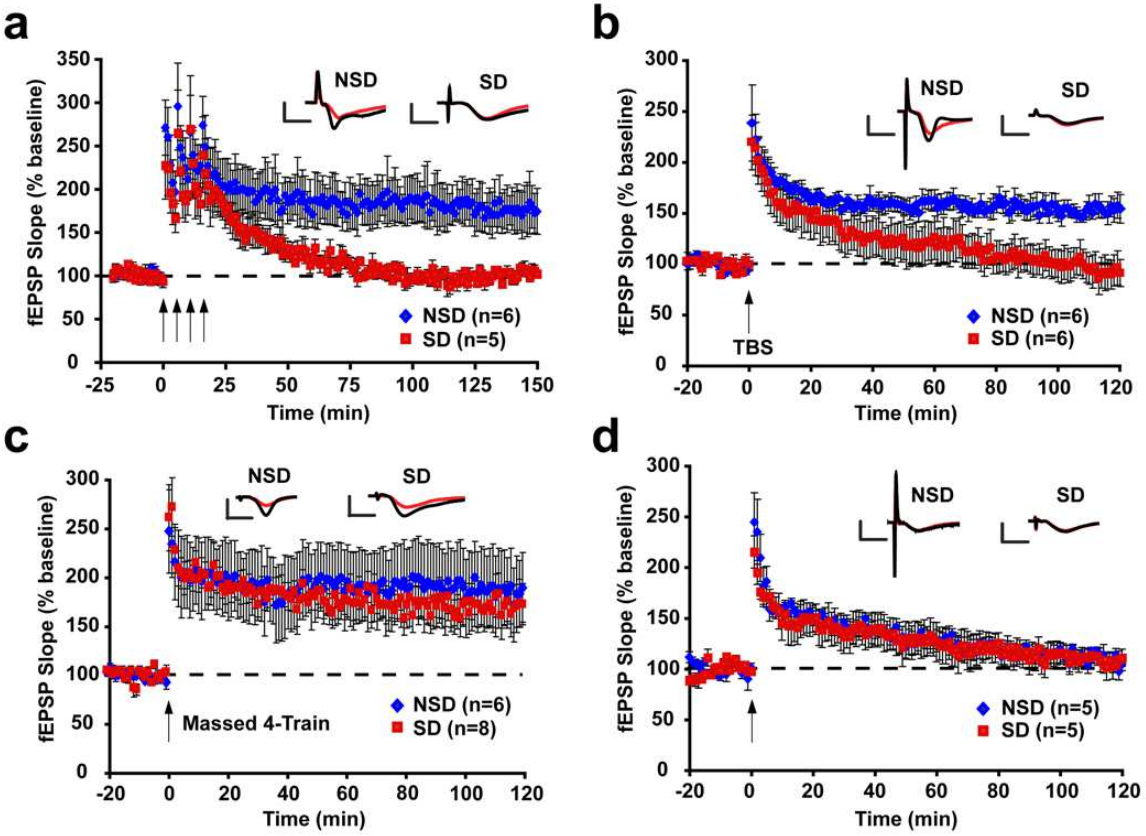
Scoville and Milner (1957) J. Neurol. Neurosurg. Psych. 20: 11-21

nature Vol 461|22 October 2009|doi:10.1038/nature08488

LETTERS

# Sleep deprivation impairs cAMP signalling in the hippocampus

Christopher G. Vecsey[1,2], George S. Baillie[3], Devan Jaganath[2], Robbert Havekes[2], Andrew Daniels[2], Mathieu Wimmer[1,2], Ted Huang[1,2], Kim M. Brown[3], Xiang-Yao Li[4], Giannina Descalzi[4], Susan S. Kim[4], Tao Chen[4], Yu-Ze Shang[4], Min Zhuo[4], Miles D. Houslay[3] & Ted Abel[2]



SLEEP

# The memory function of sleep

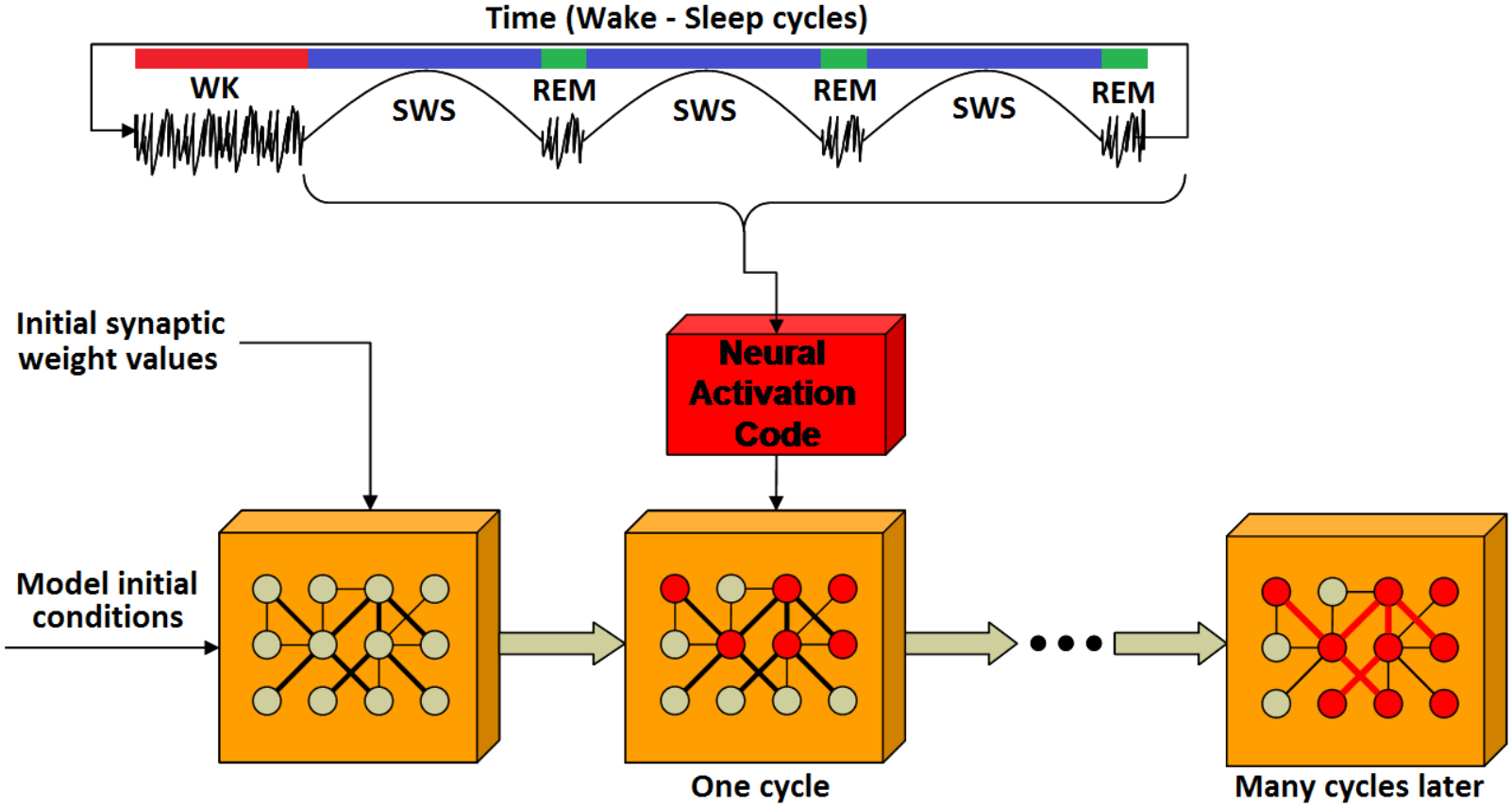
*Susanne Diekelmann and Jan Born*

Abstract | Sleep has been identified as a state that optimizes the consolidation of newly acquired information in memory, depending on the specific conditions of learning and the timing of sleep. Consolidation during sleep promotes both quantitative and qualitative changes of memory representations. Through specific patterns of neuromodulatory activity and electric field potential oscillations, slow-wave sleep (SWS) and rapid eye movement (REM) sleep support system consolidation and synaptic consolidation, respectively. During SWS, slow oscillations, spindles and ripples — at minimum cholinergic activity — coordinate the re-activation and redistribution of hippocampus-dependent memories to neocortical sites, whereas during REM sleep, local increases in plasticity-related immediate-early gene activity — at high cholinergic and theta activity — might favour the subsequent synaptic consolidation of memories in the cortex.

Wilfredo Blanco, Ph.D.
Universidade Estadual
do Rio Grande do Norte (UERN)

# Dinâmica de padrões sinápticos através do ciclo sono-vigília: renormalização versus restruturação numa rede computacional alimentada com potenciais de ação hipocampais.

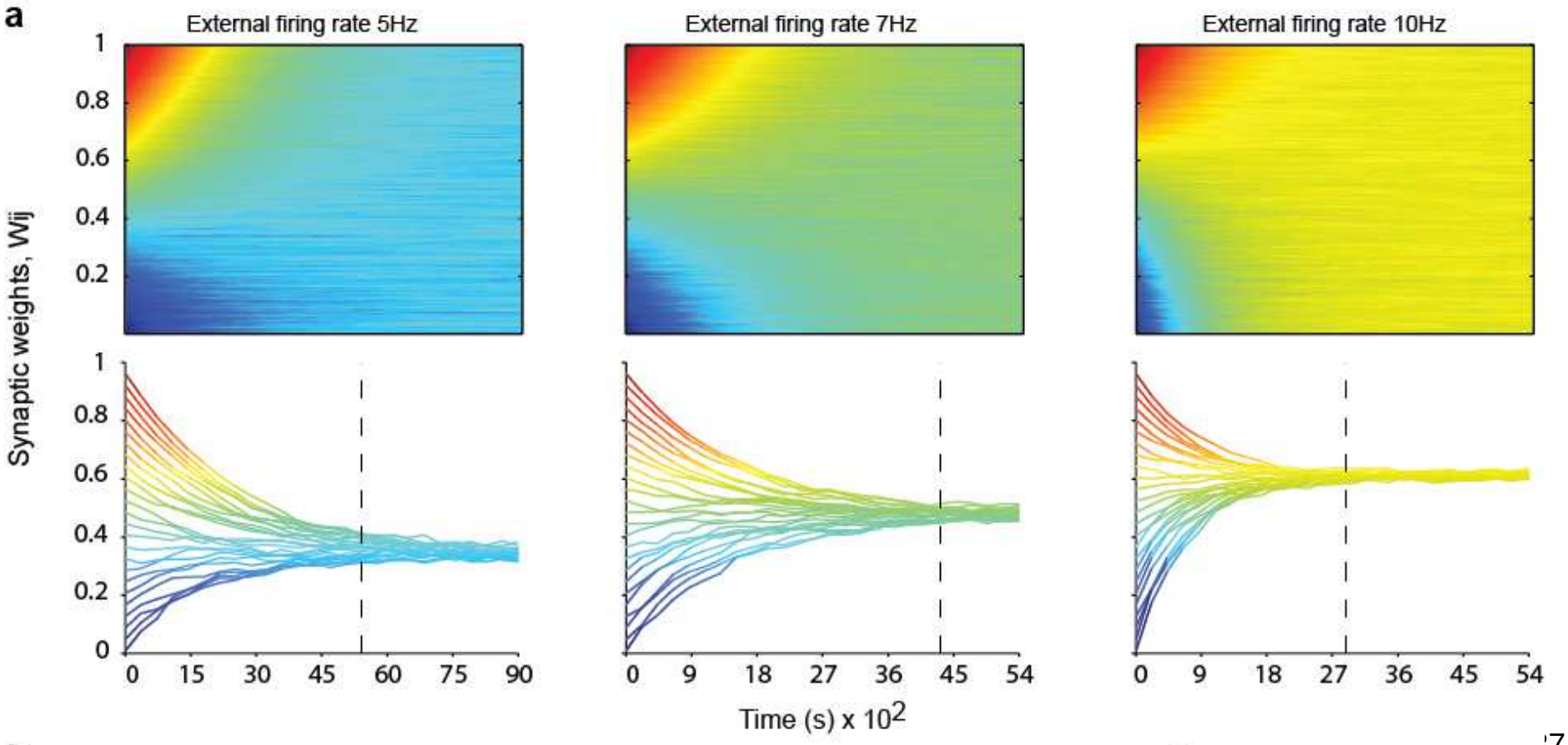
Wilfredo Blanco, Ana M.G. Guerreiro , Adrião D. D. Neto, Sidarta Ribeiro



Dados de entrada na rede artificial:

**Potenciais de ação com distribuição temporal aleatória**

Renormalização proporcional à taxa de disparo



# Dados reais

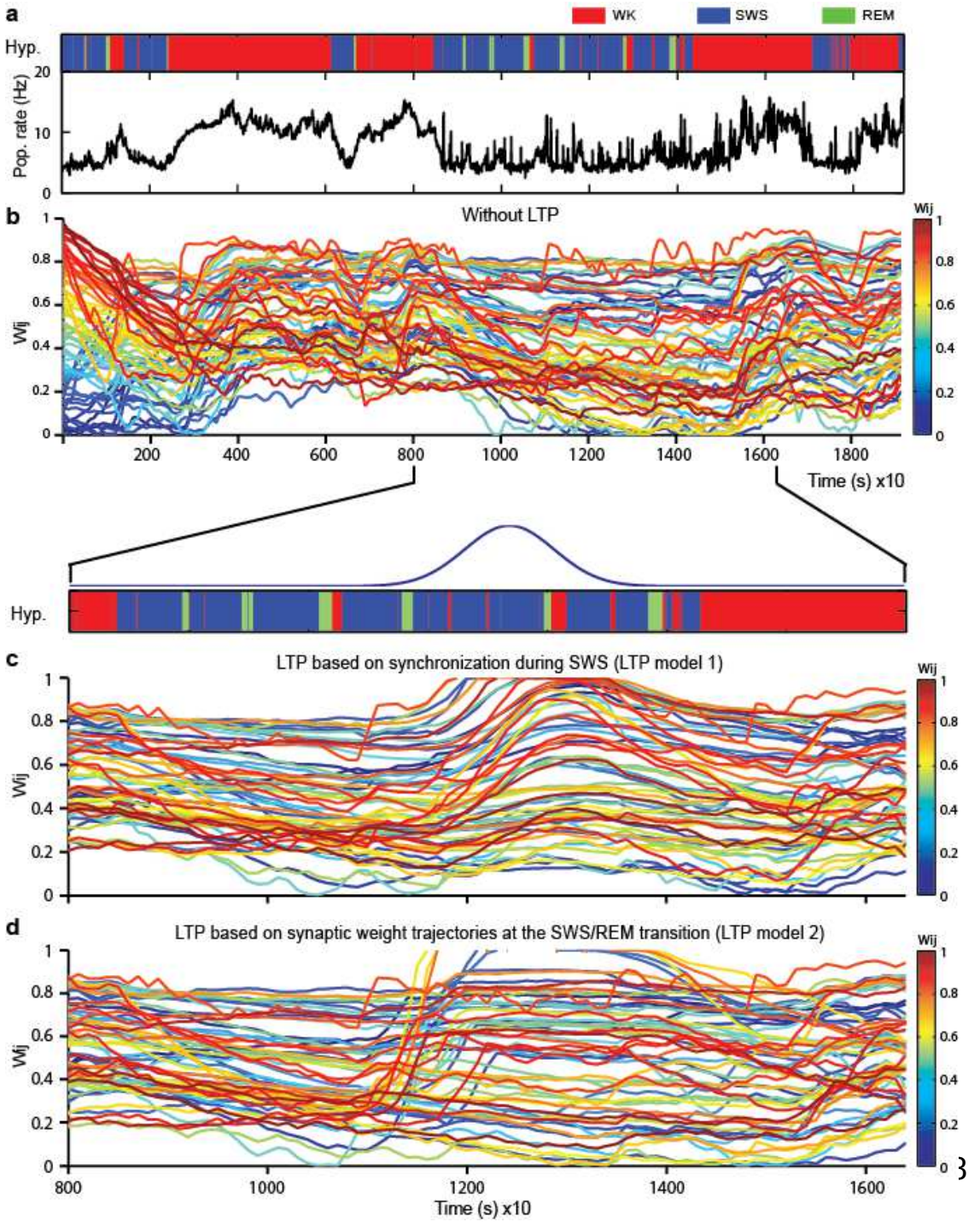
## Sem potenciação (LTP)

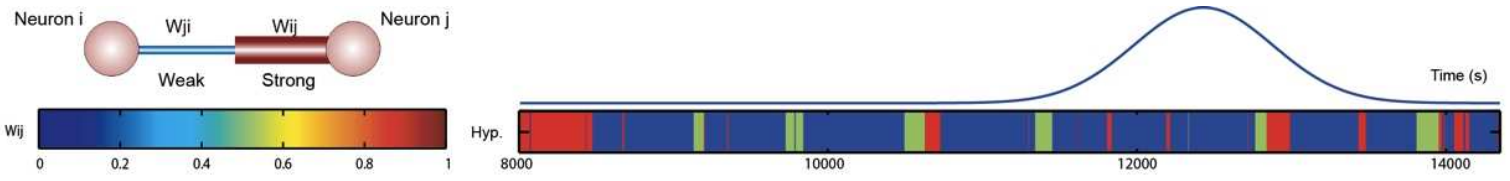
## Com potenciação (LTP)

Sincronia durante o sono de ondas lentas

## Com potenciação (LTP)

Trajetórias sinápticas durante transição entre sono de ondas lentas e sono REM

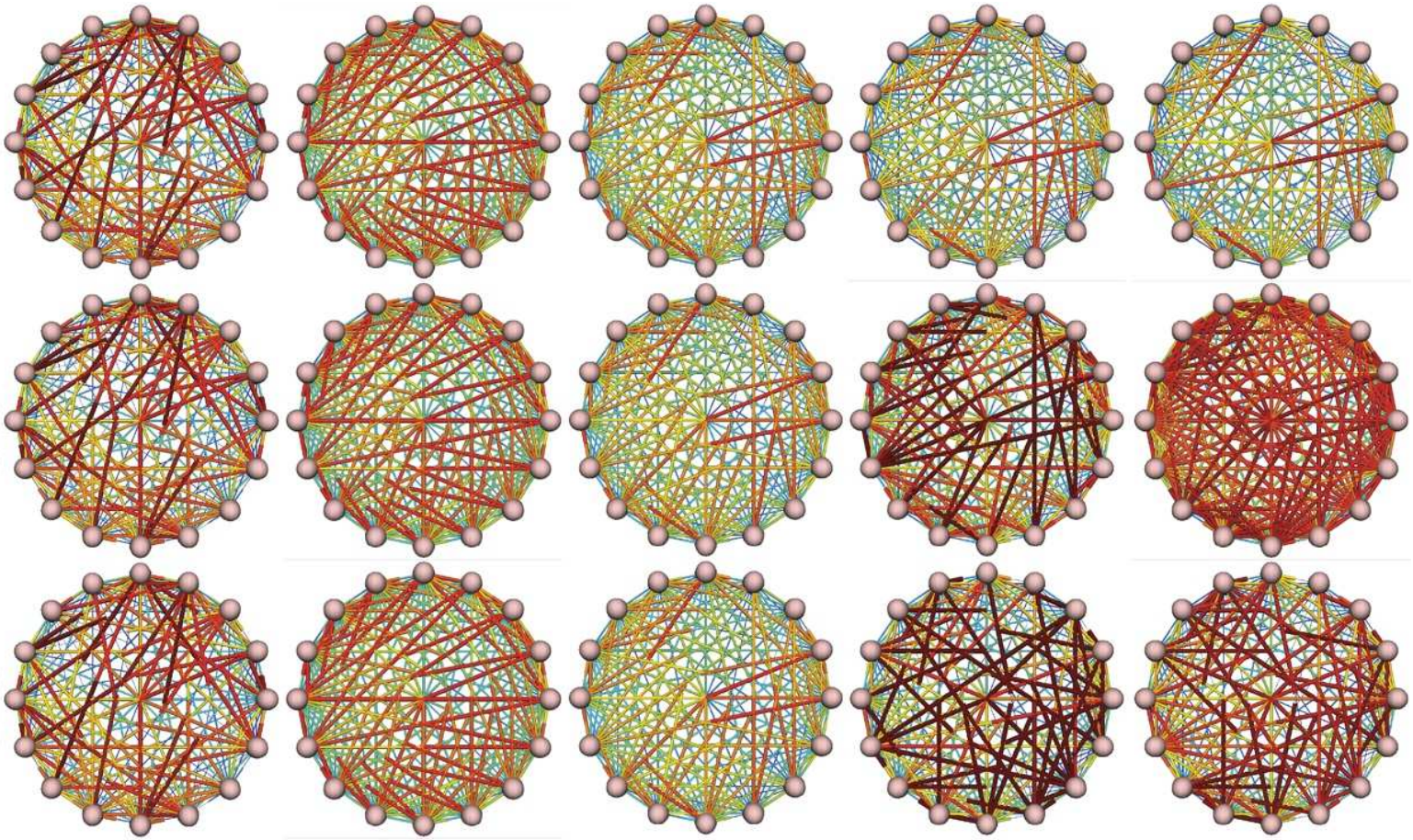




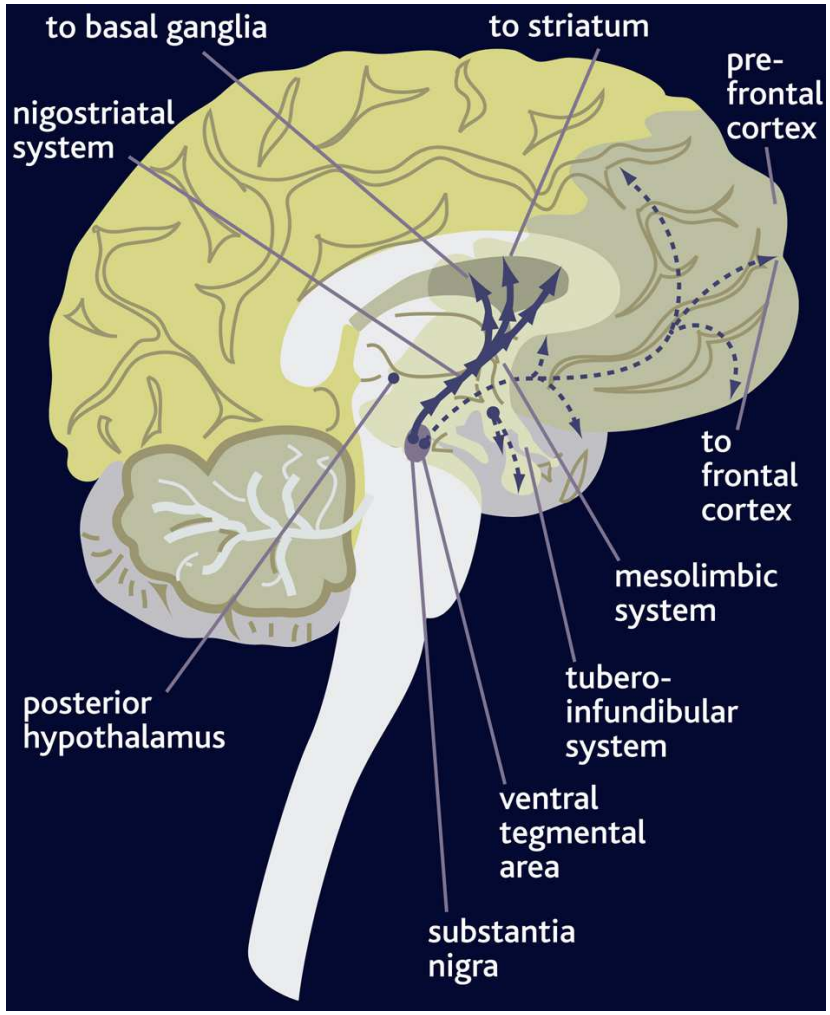

**Sem potenciação**

**Com potenciação**
Sincronia
Sono ondas lentas

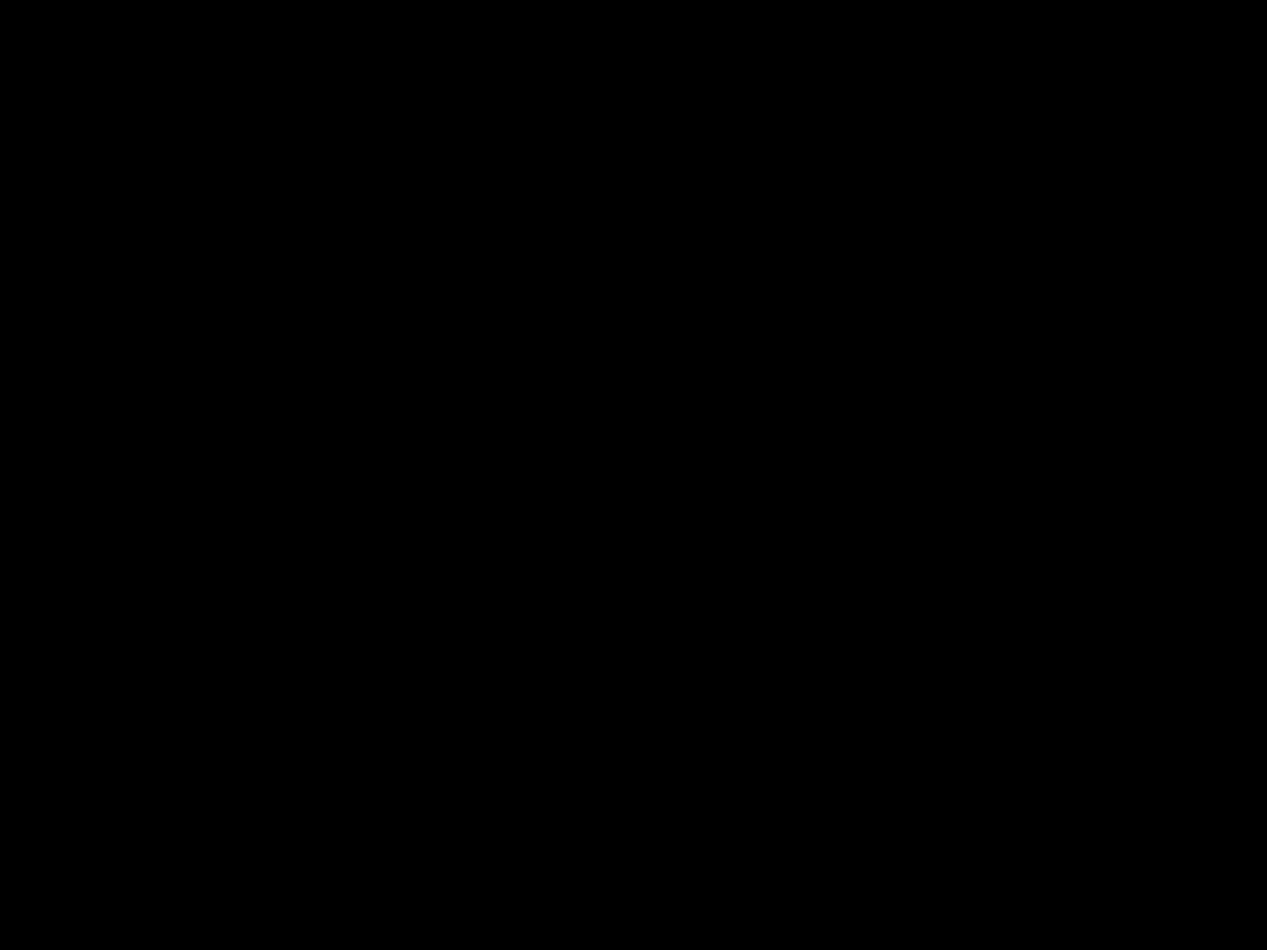
**Com potenciação**
Trajetórias sinápticas
Sono ondas lentas
e REM



# A lesão de circuitos de recompensa dopaminérgicos abole o sonho mas não o sono REM




Solms (2000) Dreaming and REM sleep are controlled by different brain mechanisms
Behavioral and Brain Sciences 23 (6): 843-850

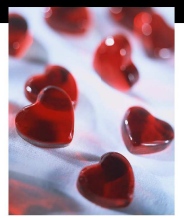


Para quê sonhar?

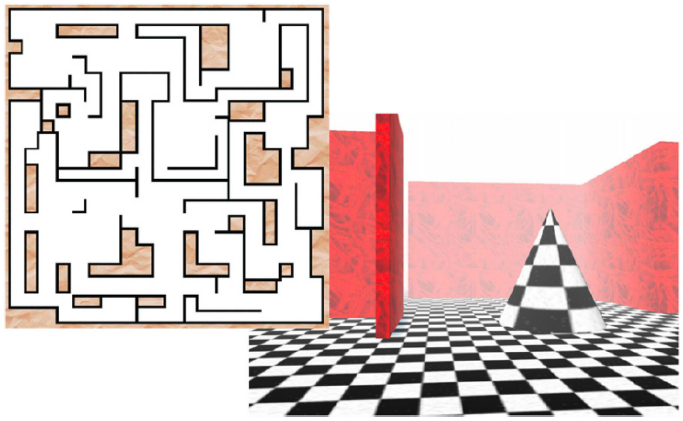
Revonsuo (2000)
The reinterpretation of dreams: an evolutionary hypothesis of the function of dreaming.
*Behavioral and Brain Sciences 23 (6): 877-901*

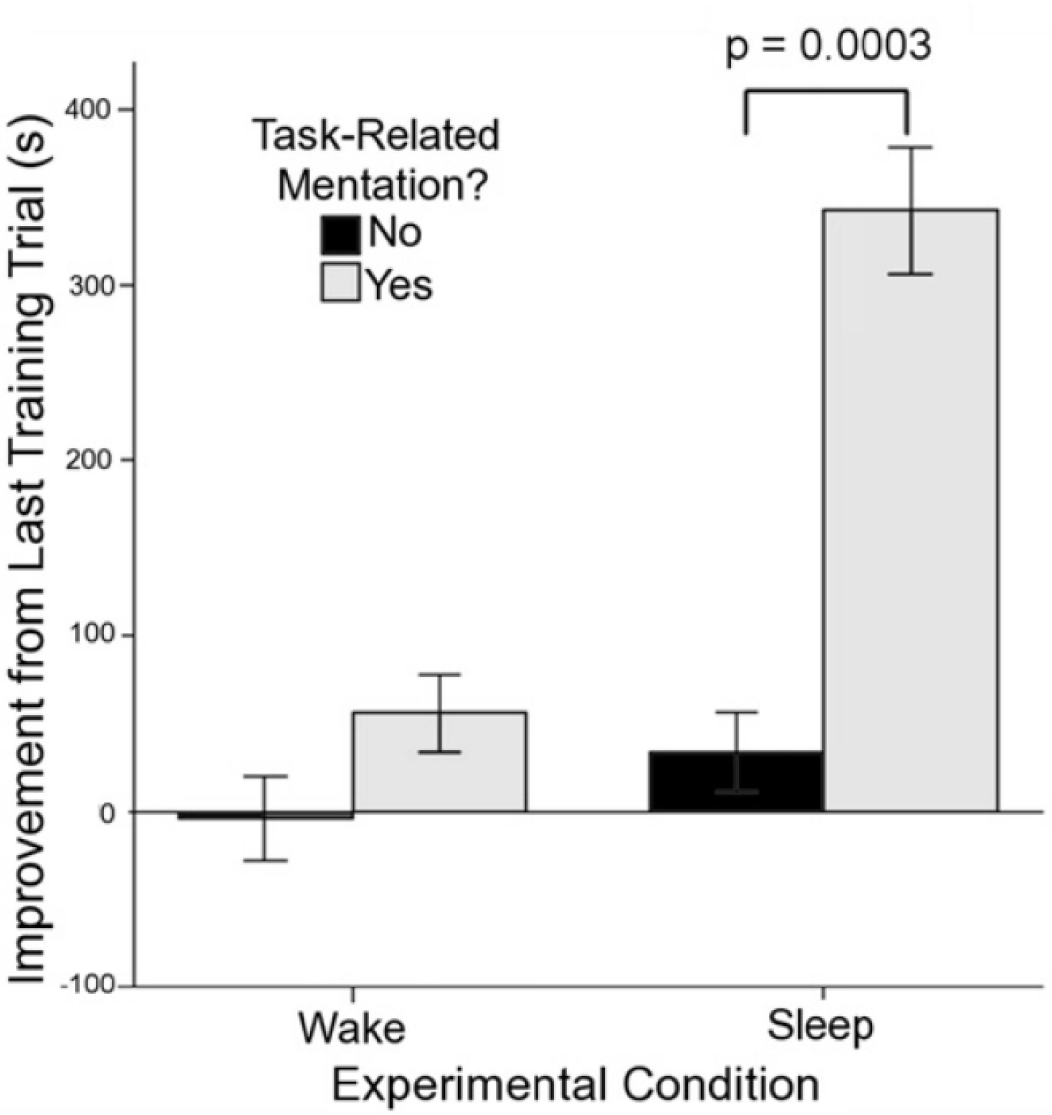
O pesadelo como sonho prototípico, para alertar contra perigos futuros

# Mas  o pesadelo de uns pode ser o sonho prazeroso de outros!




Ribeiro & Nicolelis (2006) *The evolution of neural systems for sleep and dreaming*. Evolution of Nervous Systems. Org. Jon H. Kaas, 1st ed., Elsevier, v.3, pp 451-464






Wamsley et al. (2010) Current Biology 20, 850–855

Sciencexpress Reports

EMBARGOED UNTIL 2:00 PM US ET THURSDAY, 4 APRIL 2013

# Neural Decoding of Visual Imagery During Sleep

**T. Horikawa,[1,2] M. Tamaki,[1]* Y. Miyawaki,[3,1]† Y. Kamitani,[1,2]‡**

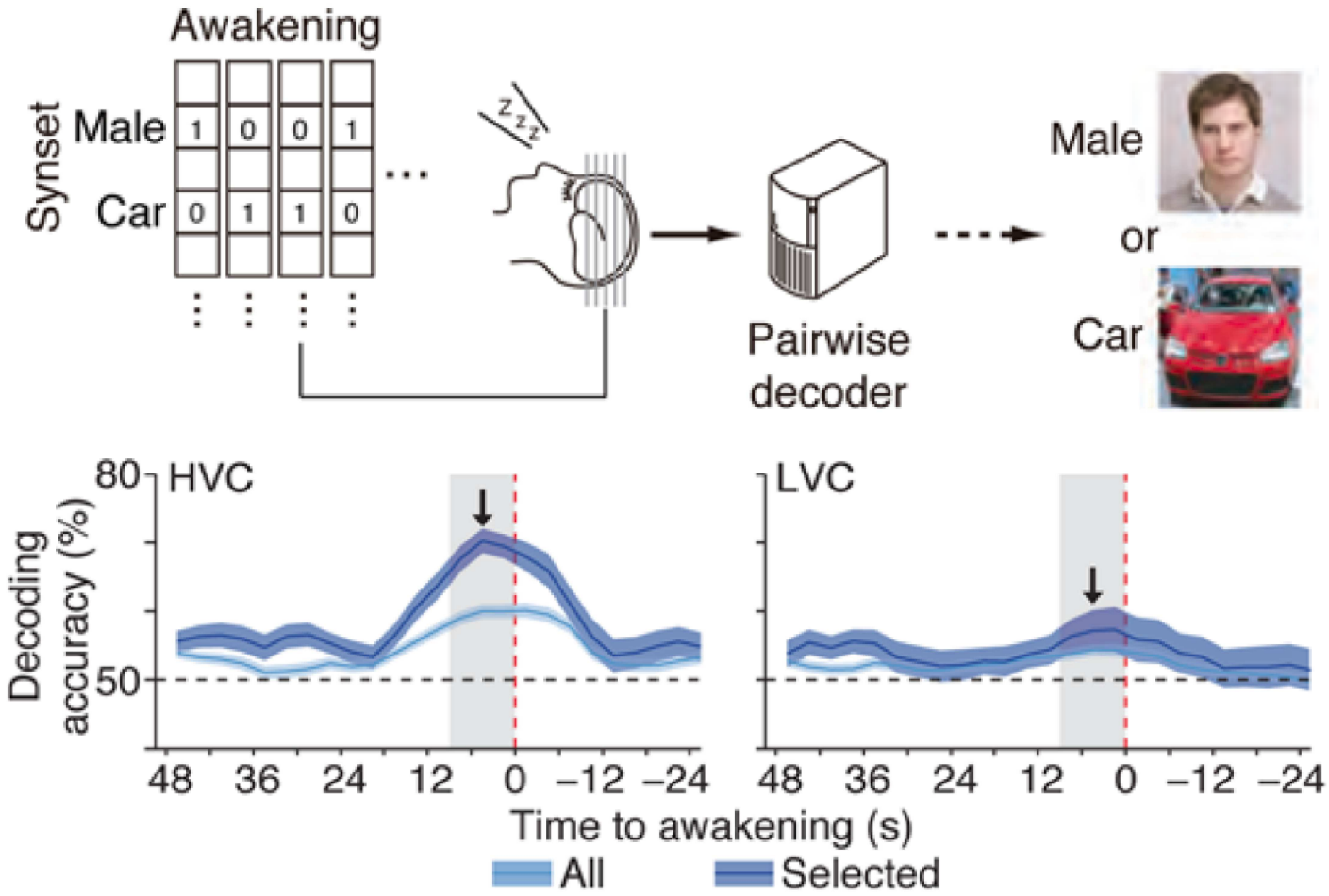
[1]ATR Computational Neuroscience Laboratories, Kyoto 619-0288, Japan. [2]Nara Institute of Science and Technology, Nara 630-0192, Japan. [3]National Institute of Information and Communications Technology, Kyoto 619-0288, Japan.

*Present address: Brown University, 190 Thayer Street, Providence, RI 02912, USA.

†Present address: The University of Electro-Communications, Tokyo 182-8585, Japan.

‡Corresponding author. E-mail: kmtn@atr.jp

From the collected reports, words describing visual objects or scenes were manually extracted and mapped to *WordNet*, a lexical database in which semantically similar words are grouped as *synsets* in a hierarchical structure (*17*, *18*) (Fig. 2A). Using a semantic hierarchy, we grouped extracted visual words into *base synsets* that appeared in at least 10 reports from each subject (26, 18, and 16 synsets for subject 1–3; tables S2 to S4) (*16*). The fMRI data obtained before each awakening were labeled with a *visual content vector*, each element of which indicated the presence/absence of



*Emily Dickinson, Poem 937*

OPEN ACCESS Freely available online

PLoS one

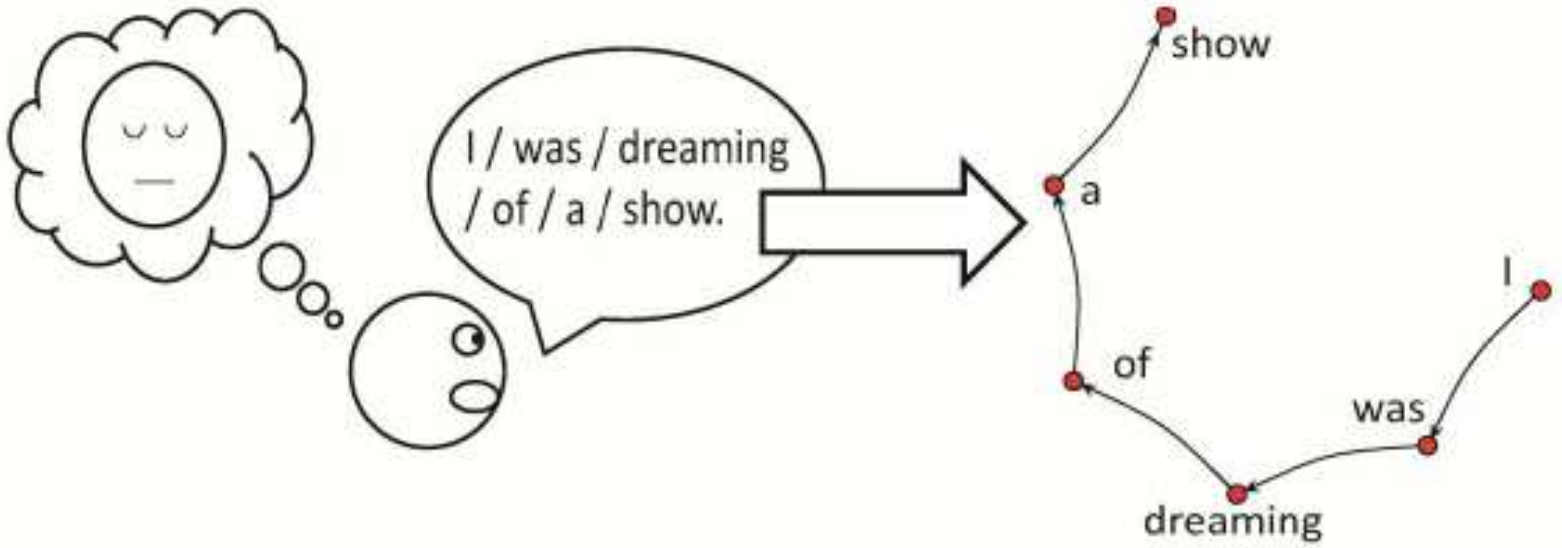
# Speech Graphs Provide a Quantitative Measure of Thought Disorder in Psychosis

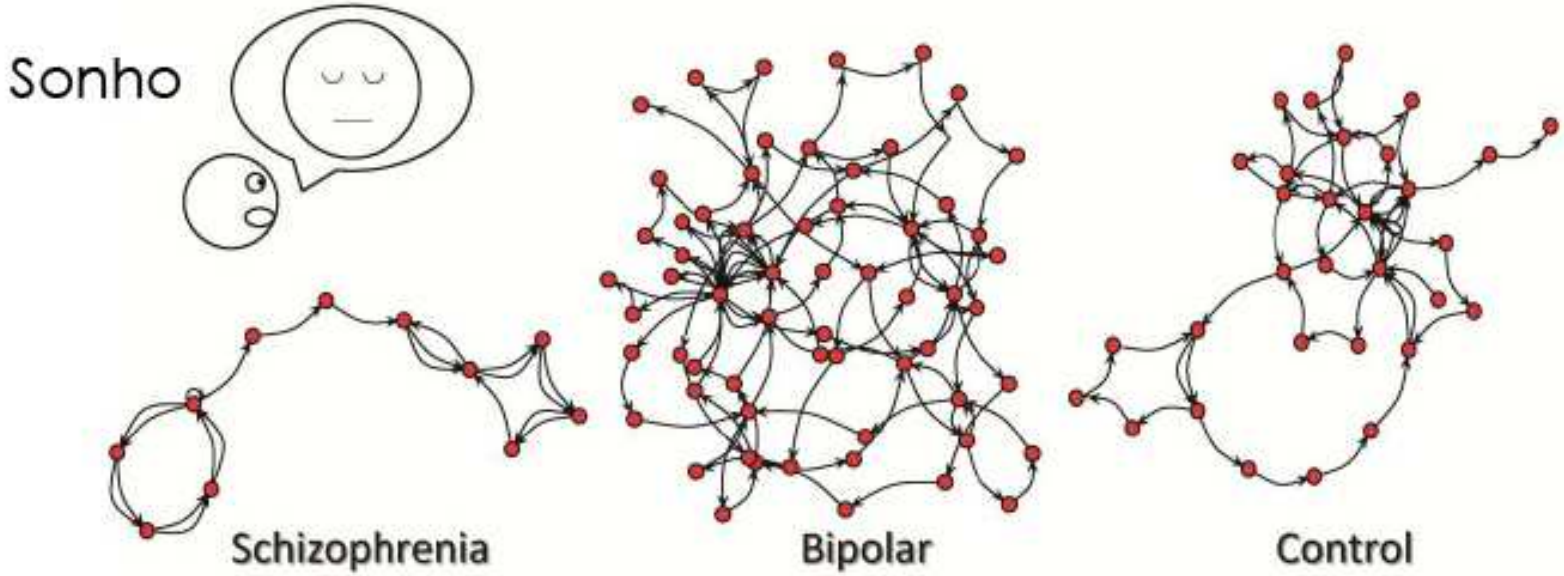
**Natalia B. Mota[1,2,3], Nivaldo A. P. Vasconcelos[1,4,5], Nathalia Lemos[1], Ana C. Pieretti[1], Osame Kinouchi[6], Guillermo A. Cecchi[7], Mauro Copelli[8], Sidarta Ribeiro[1]***

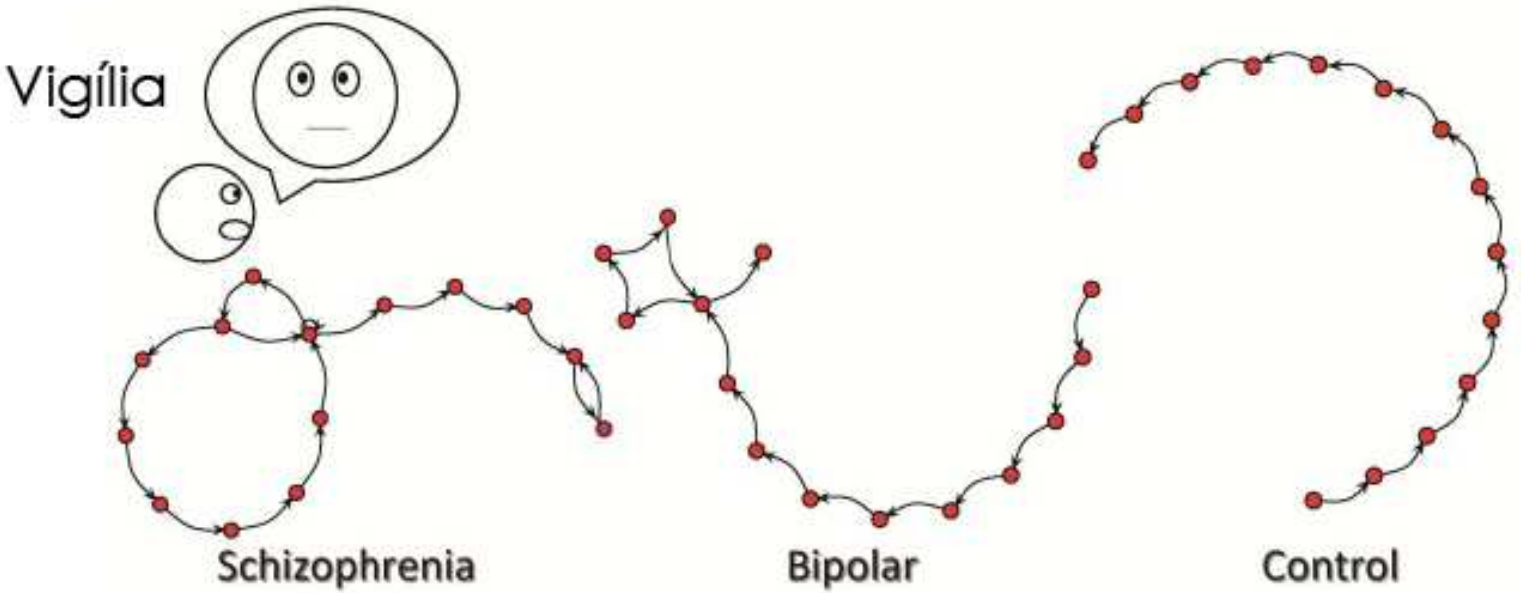
**1** Brain Institute, Federal University of Rio Grande do Norte, Natal, Brazil, **2** Hospital Onofre Lopes, Federal University of Rio Grande do Norte, Natal, Brazil, **3** Edmond and Lily Safra International Institute of Neuroscience of Natal, Natal, Brazil, **4** Faculdade Natalense para o Desenvolvimento do Rio Grande do Norte, Natal, Brazil, **5** Department of Systems and Computation, Federal University of Campina Grande, Campina Grande, Brazil, **6** Department of Physics, Universidade de São Paulo, Ribeirão Preto, Brazil, **7** Biometaphorical Computing, Computational Biology Center, IBM Research Division, IBM T. J. Watson Research Center, Yorktown Heights, New York, United States of America, **8** Department of Physics, Federal University of Pernambuco, Recife, Brazil

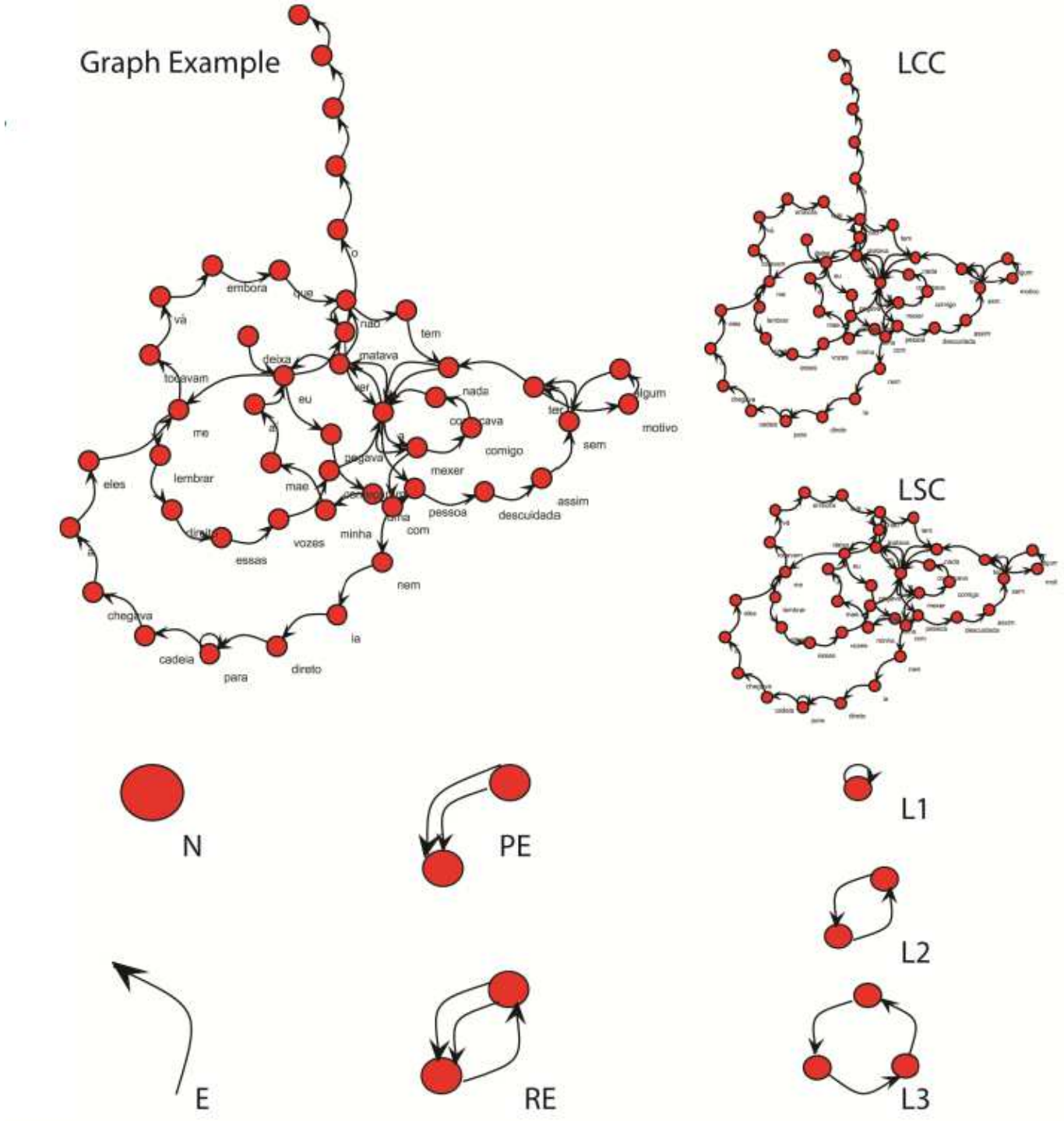
Natalia Mota, M.D.
Ph.D Student
Brain Institute, UFRN

Mauro Copelli, Ph.D.
Associate Professor
Federal University of
Pernambuco (UFPE)


I / was / dreaming
/ of / a / show.
show
a
I
of
was
dreaming


Sonho
Schizophrenia
Bipolar
Control


Vigília
Schizophrenia
Bipolar
Control


Graph Example
o
embora
que
vá
não
tem
deixa
matava
toc avam
eu
nada
algum
motivo
me
sem
comigo
lembrar
mexer
eles
mae
assim
pessoa
descuidada
com
minha
vozes
essas
nem
chegava
ia
cadeia
para
direto


LCC


LSC


N


PE

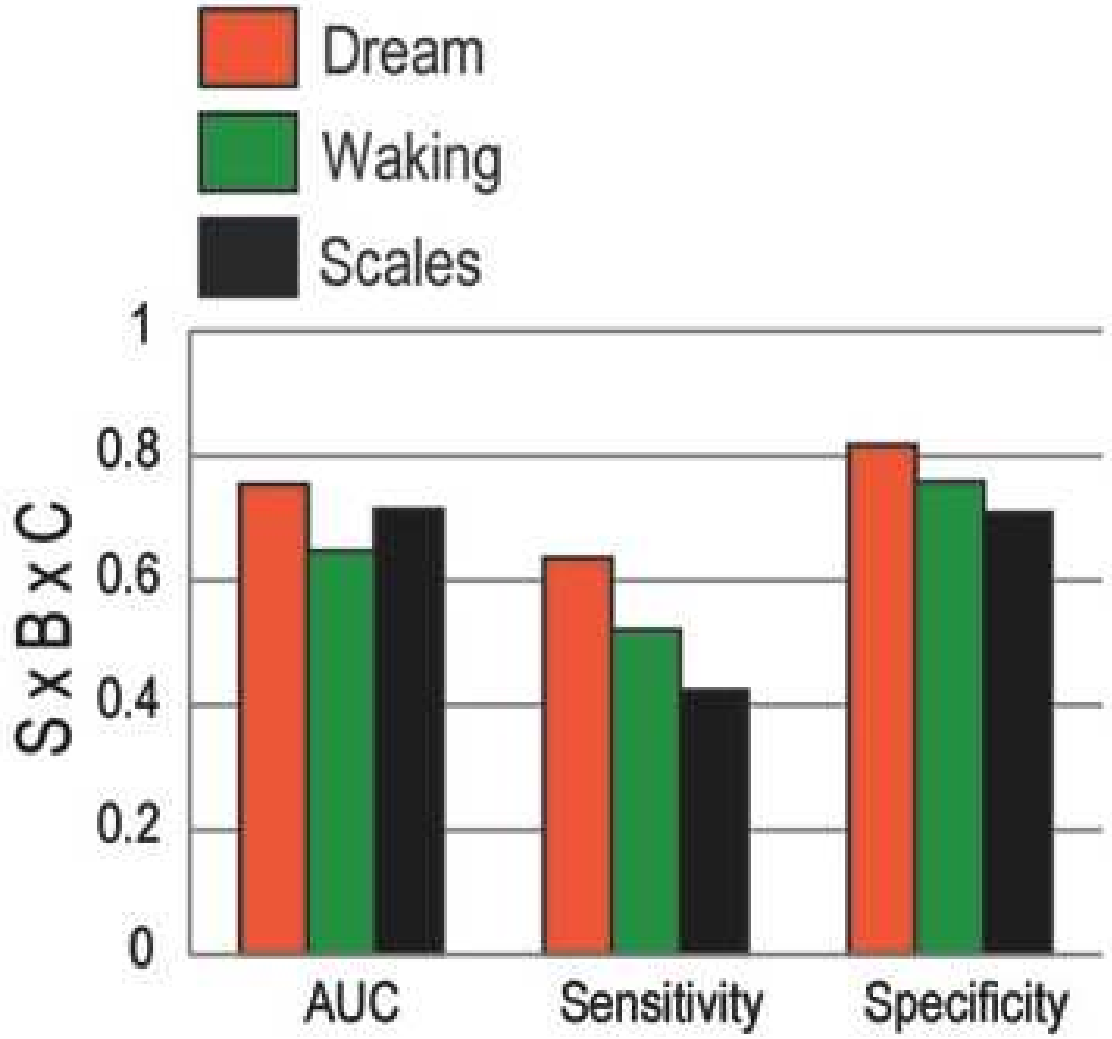

L1

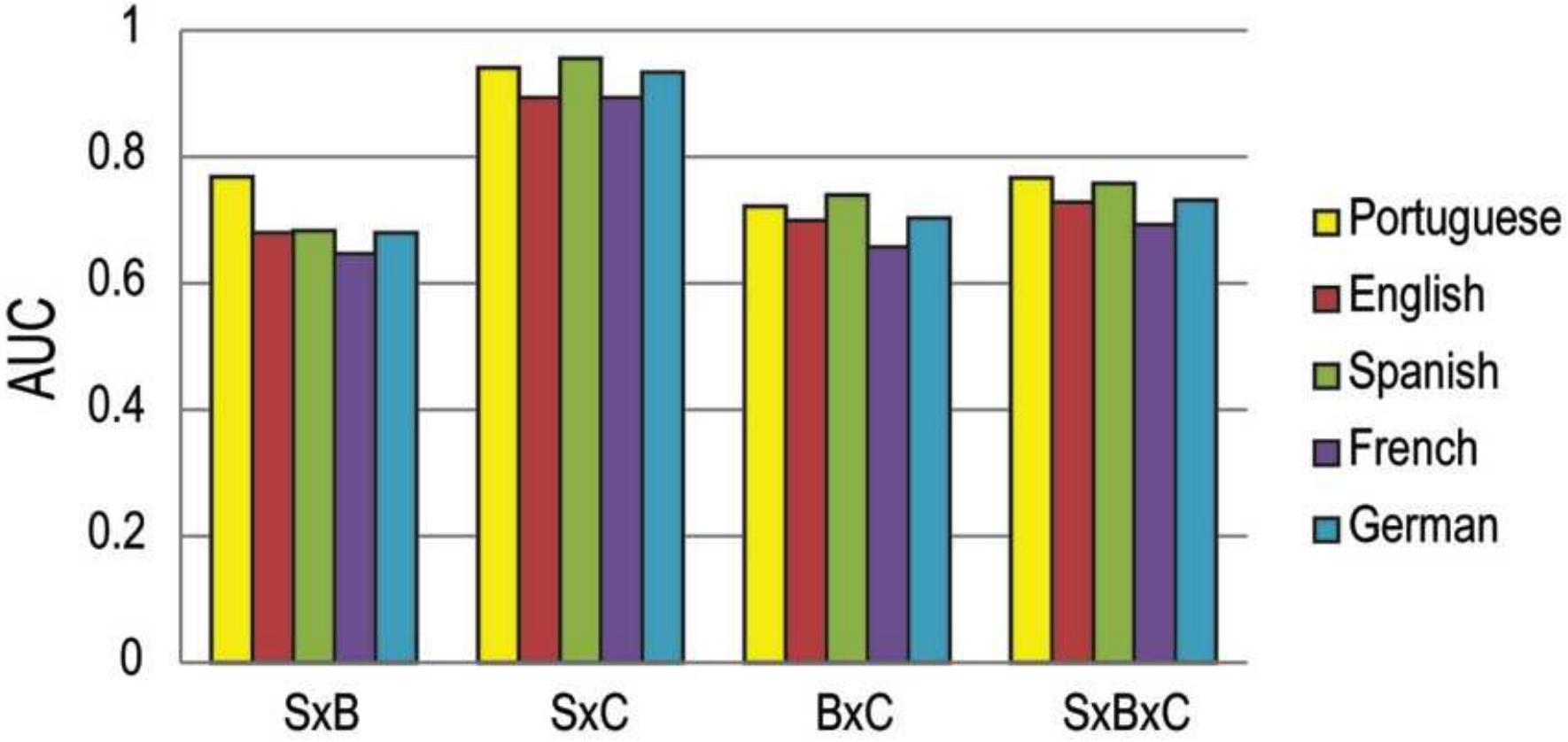

L2

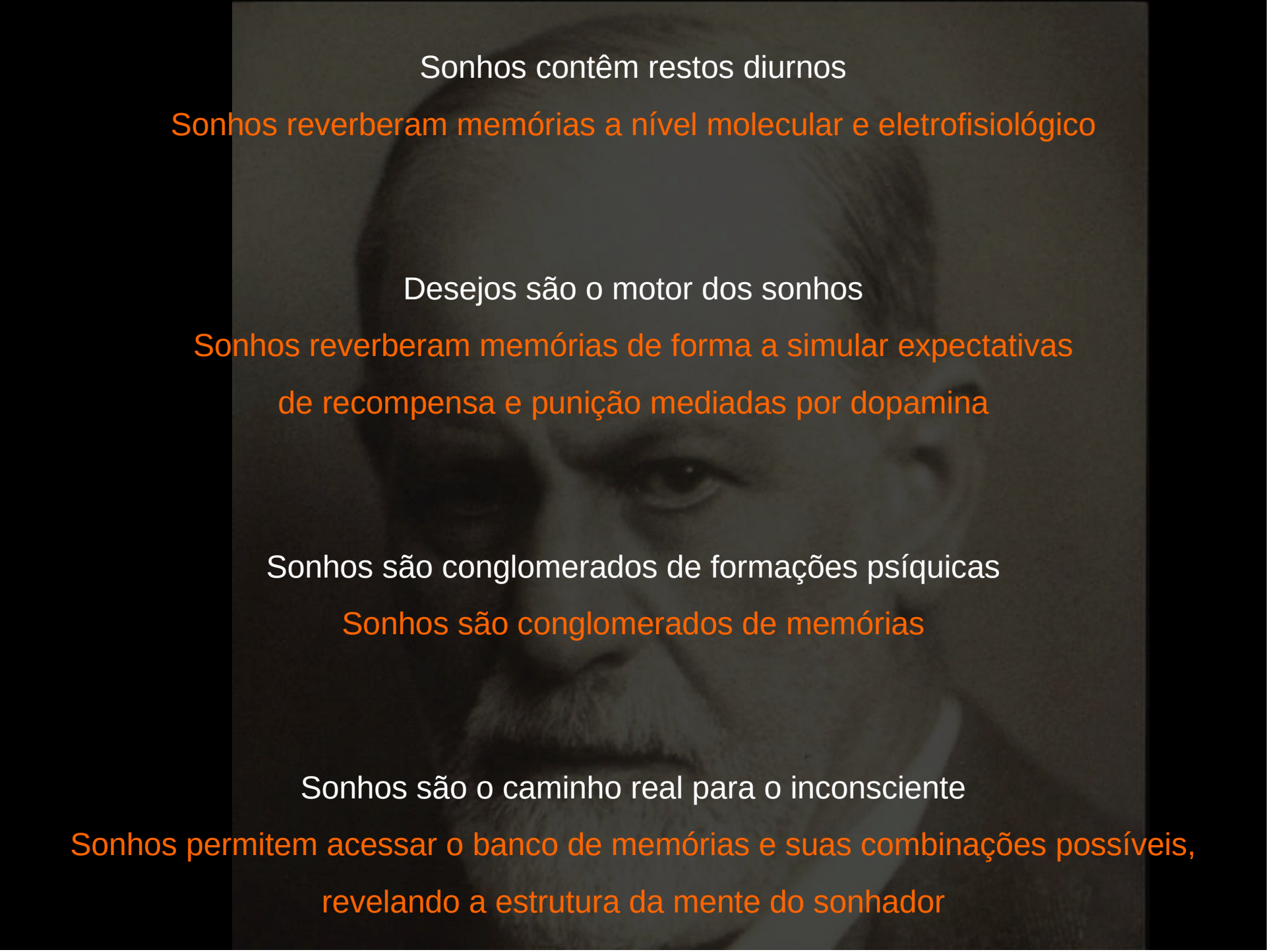

E


RE


L3


Dream
Waking
Scales
1
0.8
0.6
0.4
0.2
0
S x B x C
AUC
Sensitivity
Specificity


AUC
1
0.8
0.6
0.4
0.2
0
SxB
SxC
BxC
SxBxC
Portuguese
English
Spanish
French
German



Sonhos contêm restos diurnos

Sonhos reverberam memórias a nível molecular e eletrofisiológico

Desejos são o motor dos sonhos

Sonhos reverberam memórias de forma a simular expectativas de recompensa e punição mediadas por dopamina

Sonhos são conglomerados de formações psíquicas

Sonhos são conglomerados de memórias

Sonhos são o caminho real para o inconsciente

Sonhos permitem acessar o banco de memórias e suas combinações possíveis, revelando a estrutura da mente do sonhador