



4:45 – 5:30 pm

Sleep, Memory and Dreams: A Cognitive Neuroscience Approach

SPEAKER
Robert Stickgold, PhD



Presenter Disclosure Information

The following relationships exist related to this presentation:

- ▶ Robert Stickgold, PhD: No financial relationships to disclose.

Off-Label/Investigational Discussion

- ▶ In accordance with pmiCME policy, faculty have been asked to disclose discussion of unlabeled or unapproved use(s) of drugs or devices during the course of their presentations.

*Sleep, Memory and Dreams:
A Cognitive Neuroscience Approach*

Pri-Med East Conference, Boston MA, Sept 19, 2015

Robert Stickgold

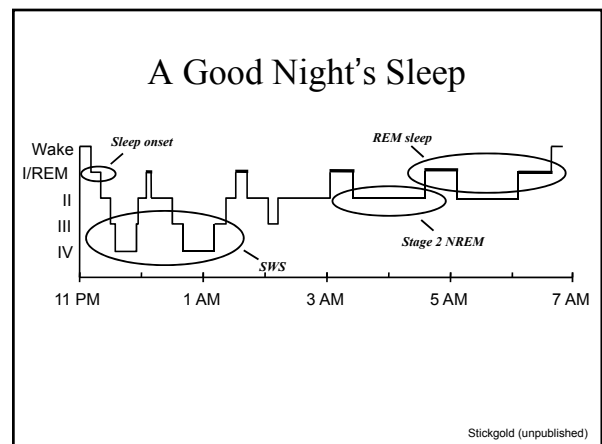
*Harvard Medical School
Beth Israel Deaconess Medical Center
Boston, MA*

Some of the work presented here was sponsored by Sepracor, Inc.

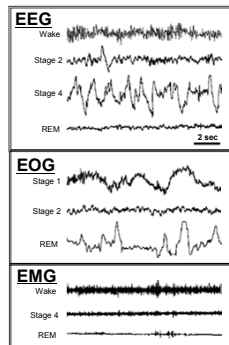
Today's Outline

- 1) The physiology of sleep
- 2) The diversity of memory *evolution*
 - a) Stabilization and enhancement
 - b) Selection, gist, rules and insight
- 3) The future ...

The Physiology and Chemistry of the Brain Change Across the Night



Sleep Physiology



Stickgold (unpublished)

Neuromodulation Varies Across the Wake-Sleep Cycle

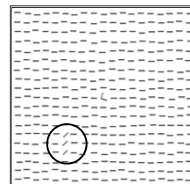
	Active Wake	Quiet Wake	SWS	REM
ACh	++	+	+/-	+++
NE 5-HT	++	+	+	-

Stickgold (unpublished)

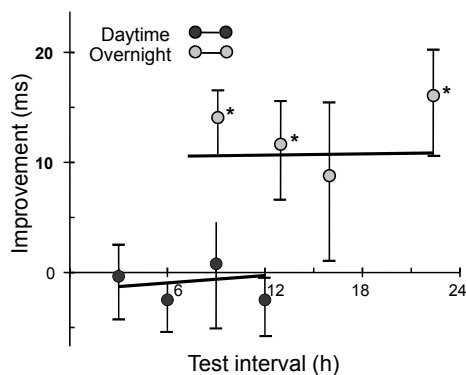
Sleep and Memory Evolution

Stabilization & Enhancement (two examples)

Sleep Enhances Procedural Learning

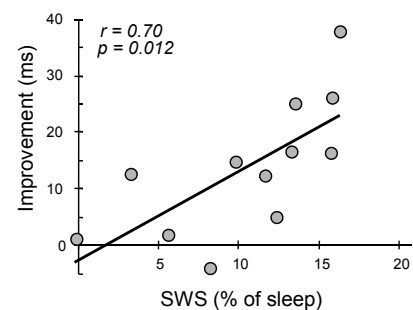


- Vipul Patel
- Beth Schirmer
- Dana Whidbee
- LaTanya James

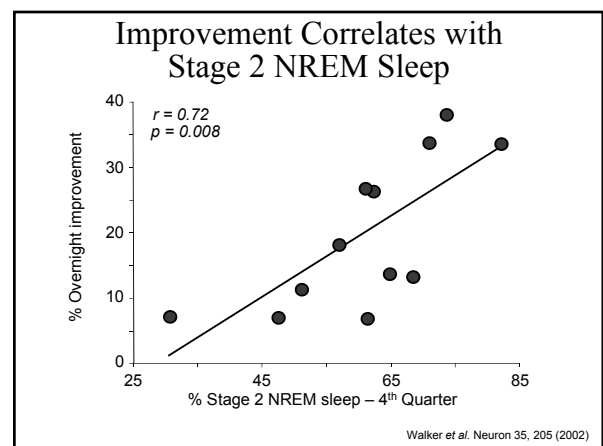
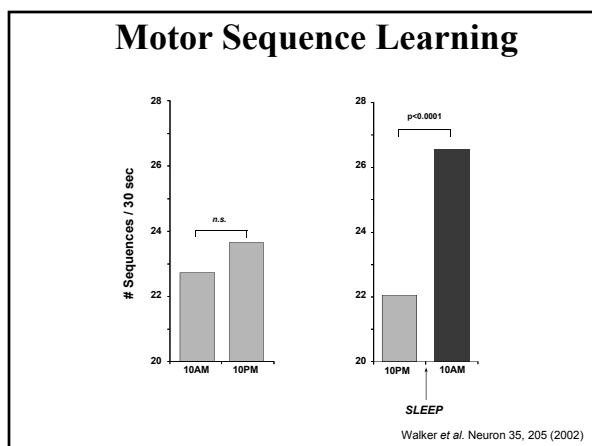
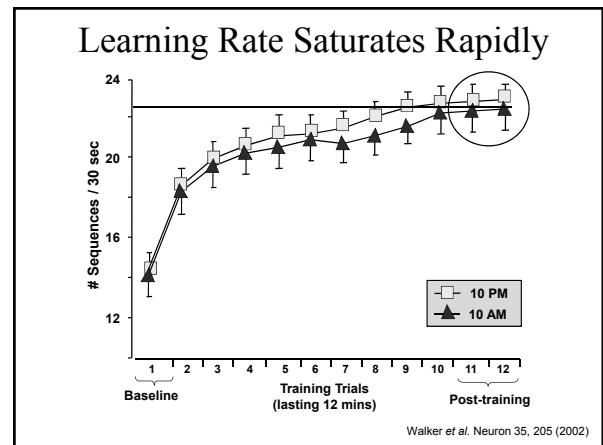
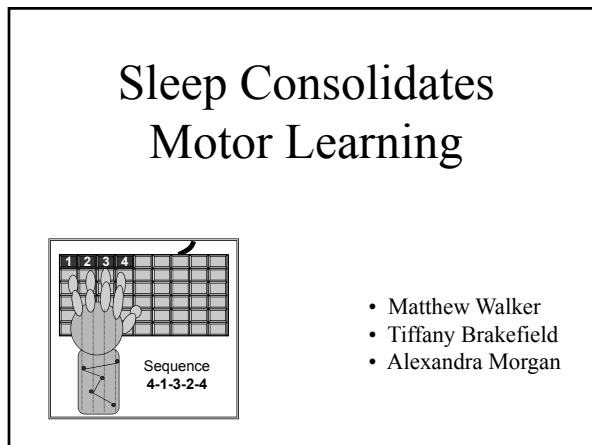
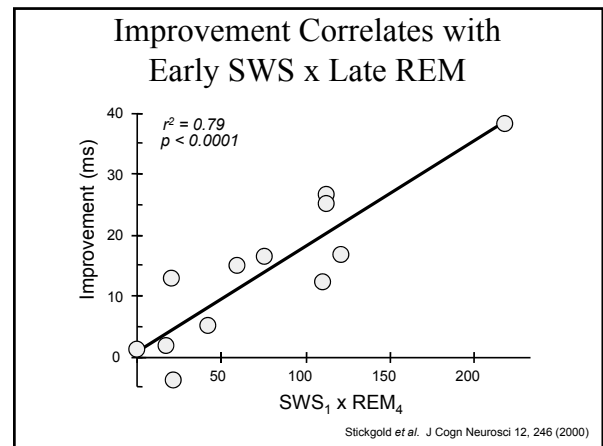
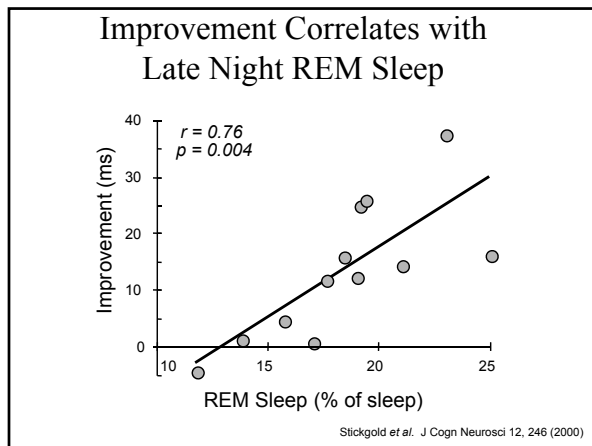


Stickgold et al. J Cogn Neurosci 12, 246 (2000)

Improvement Correlates with Early Night SWS



Stickgold et al. J Cogn Neurosci 12, 246 (2000)



Sleep and Memory Evolution

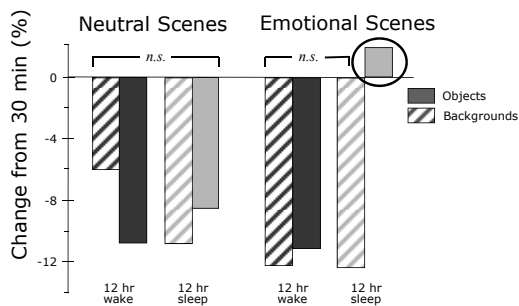
Saliency, Gist, Rules, Insight
(three examples)

Sleep Selects Emotional Memory

Emotional Trade-Off

- Jessica Payne
- Elizabeth Kensinger

Changes Over 12 Hr Wake or Sleep



Payne et al. Psych Sci 19, 781 (2008)

Sleep Consolidates Episodic Declarative Memory

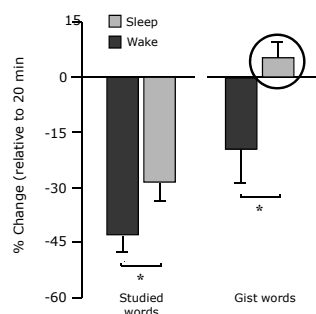
Verbal Memory Task

Word Lists

Door	House	Ledge
Glass	Open	Breeze
Pane	Frame	Curtain
Shade	View	

- Jessica Payne
- Ruth Propper

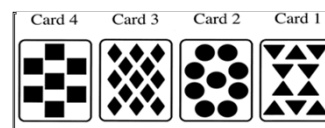
D-R-M: 12-Hour Deterioration



Payne et al., Neurobiol Learn Mem 92, 327 (2009)

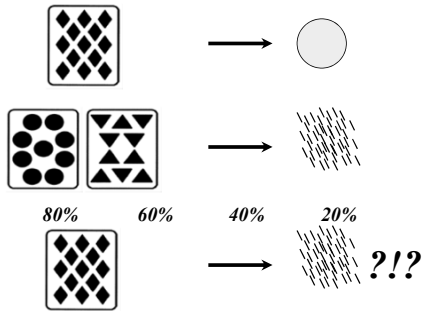
Sleep Enhances Rules

Weather Prediction Task



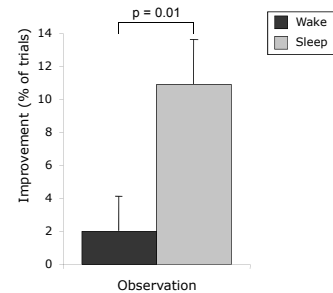
- Ina Djonlagic
- Andy Rosenfeld
- Murray Barsky

Probabilistic Learning



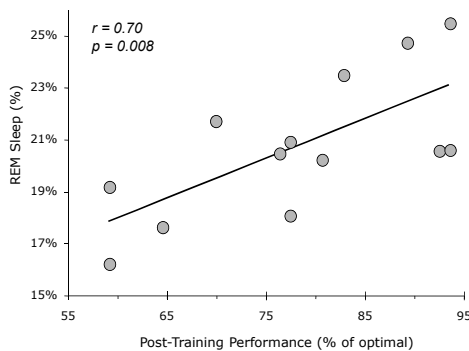
Djoniagic et al., Learn Mem 16, 751 (2009)

Sleep Enhances Performance



Djoniagic et al., Learn Mem 16, 751 (2009)

Learning Correlates with REM Sleep



Djoniagic et al., Learn Mem 16, 751 (2009)

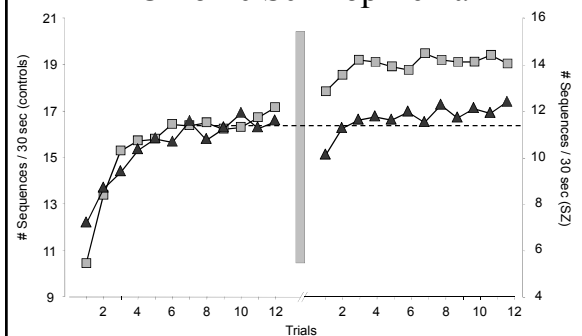
The Future (three directions)

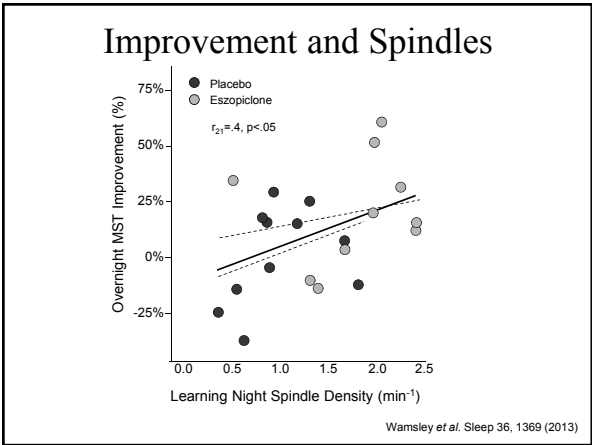
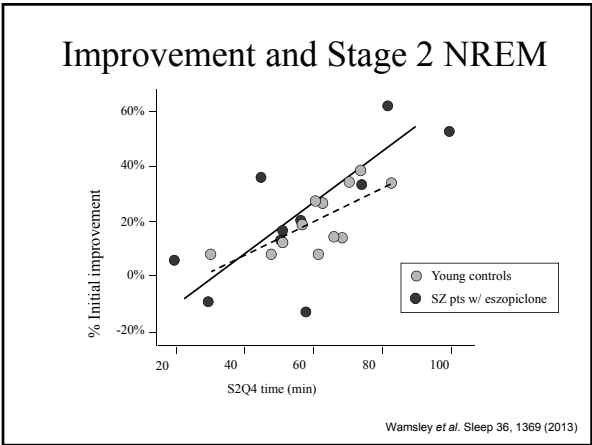
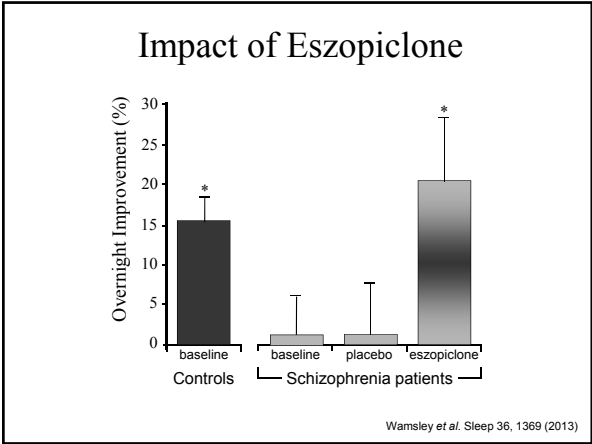
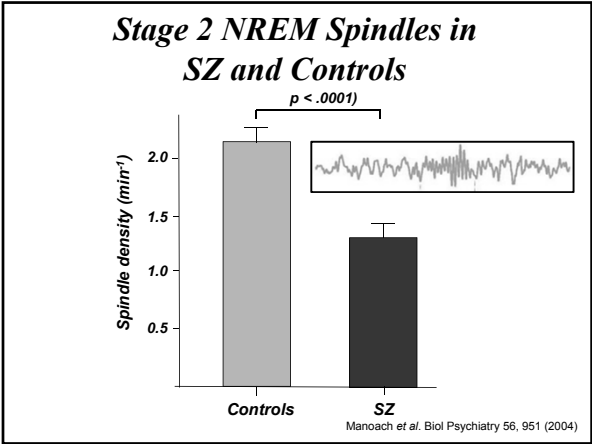
Sleep-Dependent Learning is Impaired in Schizophrenia

(Study funded by Sepracor & Co.)

- Dara Manoach
- Erin Wamsley
- Ann Shinn
- Donald Goff

Motor Skill Learning in Chronic Schizophrenia





Reduced Spindle Activity as an Endophenotype of Schizophrenia

- Dara Manoach
- Erin Wamsley
- Ann Shinn
- Donald Goff

Early Course, Neuroleptic Naïve

Spindle Measures				
	Patients n=26		Controls n=25	p
	SZ n=15	Other n=11		
Spindle Density/min	1.41 ± .47	1.67 ± .30	1.64 ± .32	.049*
Low sigma 12 – 13.5 Hz	0.07 ± 0.05	0.15 ± 0.07	0.13 ± 0.07	.16
				.006*
Characteristics of Individual Spindles				
Amplitude (μV)	16.1 ± 4.1	17.7 ± 3.1	18.0 ± 4.6	.11
	14.4 ± 4.4			.07

Manoach et al. Front Hum Neurosci 8, 762 (2014)

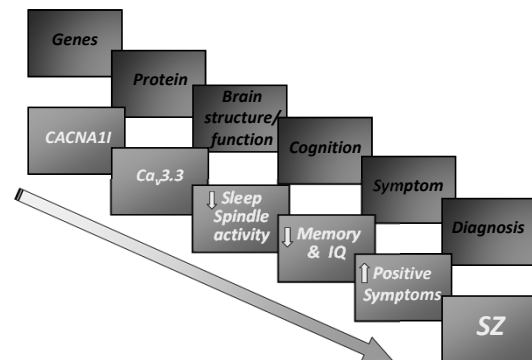
High Risk 1st Degree Relatives

Spindle Measures			
	Relatives n=19	Controls n=12	<i>p</i>
Spindle Density/min	1.52 ± .29	1.72 ± .33	0.09
Low Sigma (μV ² /Hz)	.13 ± .09	.29 ± .24	.01*

Characteristics of Individual Spindles			
Amplitude (μV)	18.2 ± 4.7	24.4 ± 6.8	.005*

Manoach et al. Front Hum Neurosci 8, 762 (2014)

Sleep & Schizophrenia: From Genes to Diagnosis



Reduced Sleep Spindle Activity: An Endophenotype of Schizophrenia

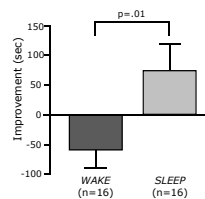
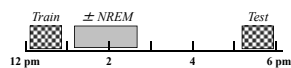
- Predates the onset of schizophrenia
 - Persists throughout the course of the illness
 - Contributes to its cognitive dysfunction
- and*
- Is not a general feature of psychosis
 - Is not an antipsychotic side effect
 - *And may be treatable!*

Dream Content Predicts Sleep-Dependent Consolidation

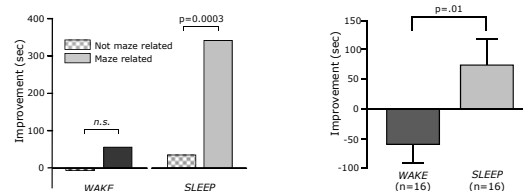
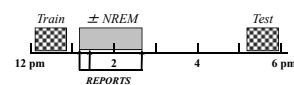
NREM Napping

NYTime.com April 22, 2010

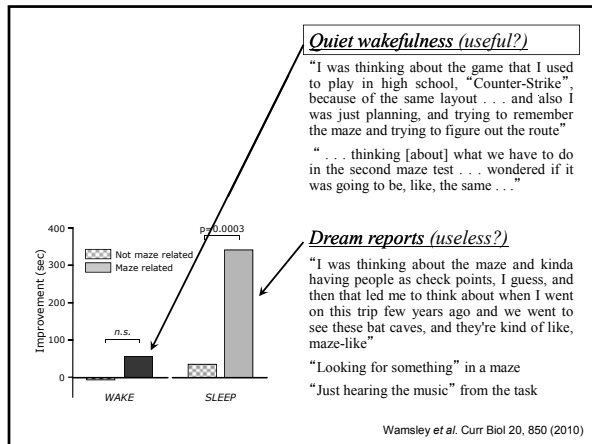
- Erin Wamsley
- Matt Tucker



Wamsley et al. Curr Biol 20, 850 (2010)



Wamsley et al. Curr Biol 20, 850 (2010)



Summary

- Sleep plays a critical role in the *evolution* of memories, stabilizing and strengthening them. It also identifies, analyzes, and maintains our most important memories.
- But this processing is applied *selectively*,
- Disruption of these processes may contribute to both neurologic and psychiatric disorders such as SZ.

More importantly, these systems carry out what may well be the most sophisticated function that the human brain performs – the building of a model of ourselves and our world that provides clues to the course of our future and creates the meaning within our life.