

# **Scopolamine Reduces Persistent Activity Related to Long-Term Encoding in the Parahippocampal Gyrus during Delayed Matching in Humans**

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**BY: COLLEEN LAW**

# Introduction

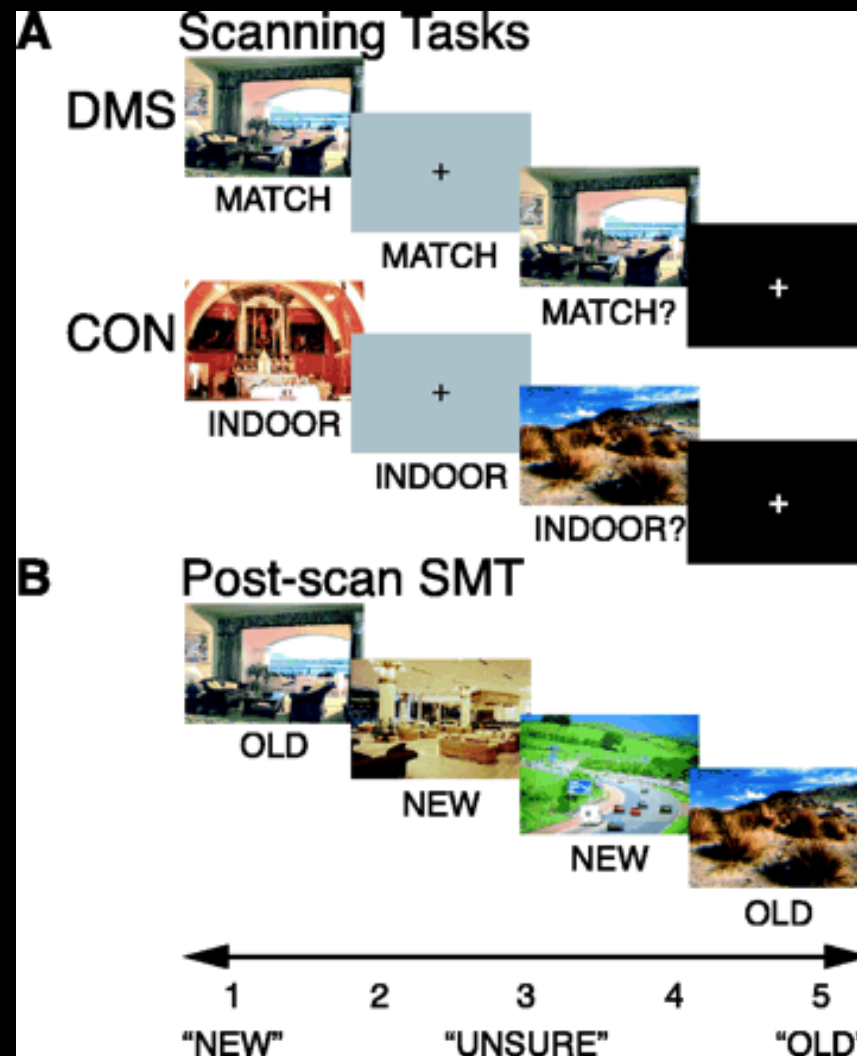
- ❖ Long-term encoding may depend on sustained spiking during memory delays in Parahippocampal neurons
- ❖ Persistent spiking activity is modulated by effects of acetylcholine at muscarinic receptors
- ❖ Methods:
  - ❖ Brain Imaging- Functional Magnetic Resonance Imaging (fMRI)
  - ❖ Pharmacology (Scopolamine)
- ❖ Scopolamine- Ach Antagonist
- ❖ Focus is on brain activity during delay period  
Layout: Stimulus, Delay, Test

# Subject Information

- ❖ 31 healthy subjects from Boston University
- ❖ 15 given Scopolamine before encoding task (SCOP)
  - ❖ .4 mg of Scopolamine
  - ❖ Side effects: transient dryness of the mouth, mildly altered subjective perception, nine felt mildly to moderately tired, five felt mildly lightheaded for a short time
  - ❖ Monitored
- ❖ 16 Control Group (NO DRUG)
  - ❖ Matched for age
  - ❖ 1ml of saline

# Procedure: Tasks

- ❖ A: DMS TASK: Match to Sample
  - ❖ 2 sec of stimulus
  - ❖ 6,10, 14 sec delay
  - ❖ MATCH? y/n
  - ❖ 6 trials
- ❖ CON TASK: Indoor
  - ❖ y/n, 6 trials
- ❖ B: POST SCAN (SMT):
  - ❖ 20 min later, surprise, self paced,
  - ❖ Viewed all stimuli in DMS and CON plus equal number of new stimuli
  - ❖ Rate 1 to 5
    - 1, high confidence new;
    - 2, low confidence new;
    - 3, unsure;
    - 4, low confidence old;
    - 5, high confidence old)

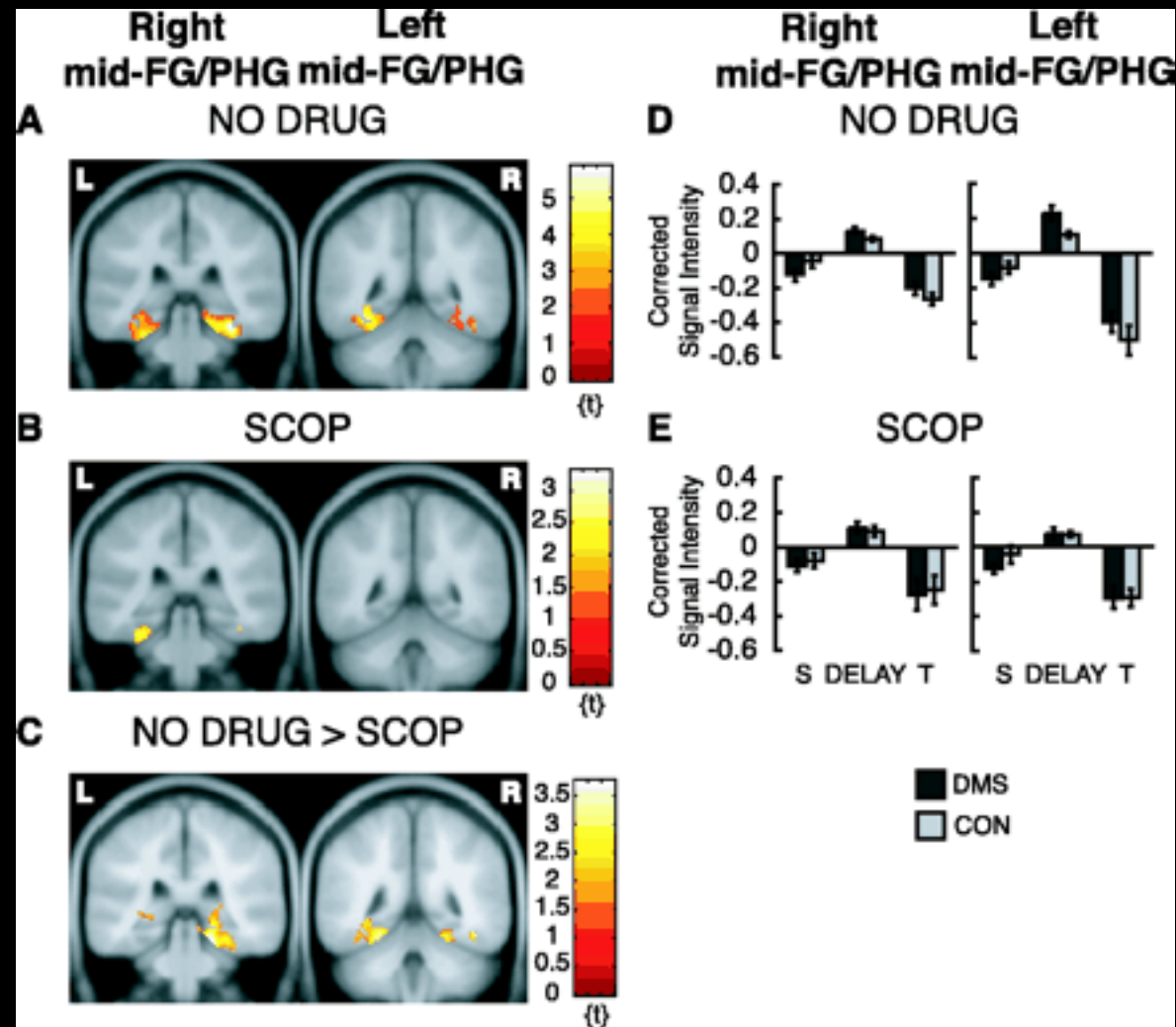


# Results/Conclusion

- ❖ Delay period activity in the anterior parahippocampal gyrus predicted memory in NO DRUG group
  - ❖ (high activation => correct responses)
- ❖ Effect reduced in SCOP group
- ❖ SCOP groups showed reduced brain activity
- ❖ But did not affect behavioral performance
- ❖ Reduced number of high confidence report

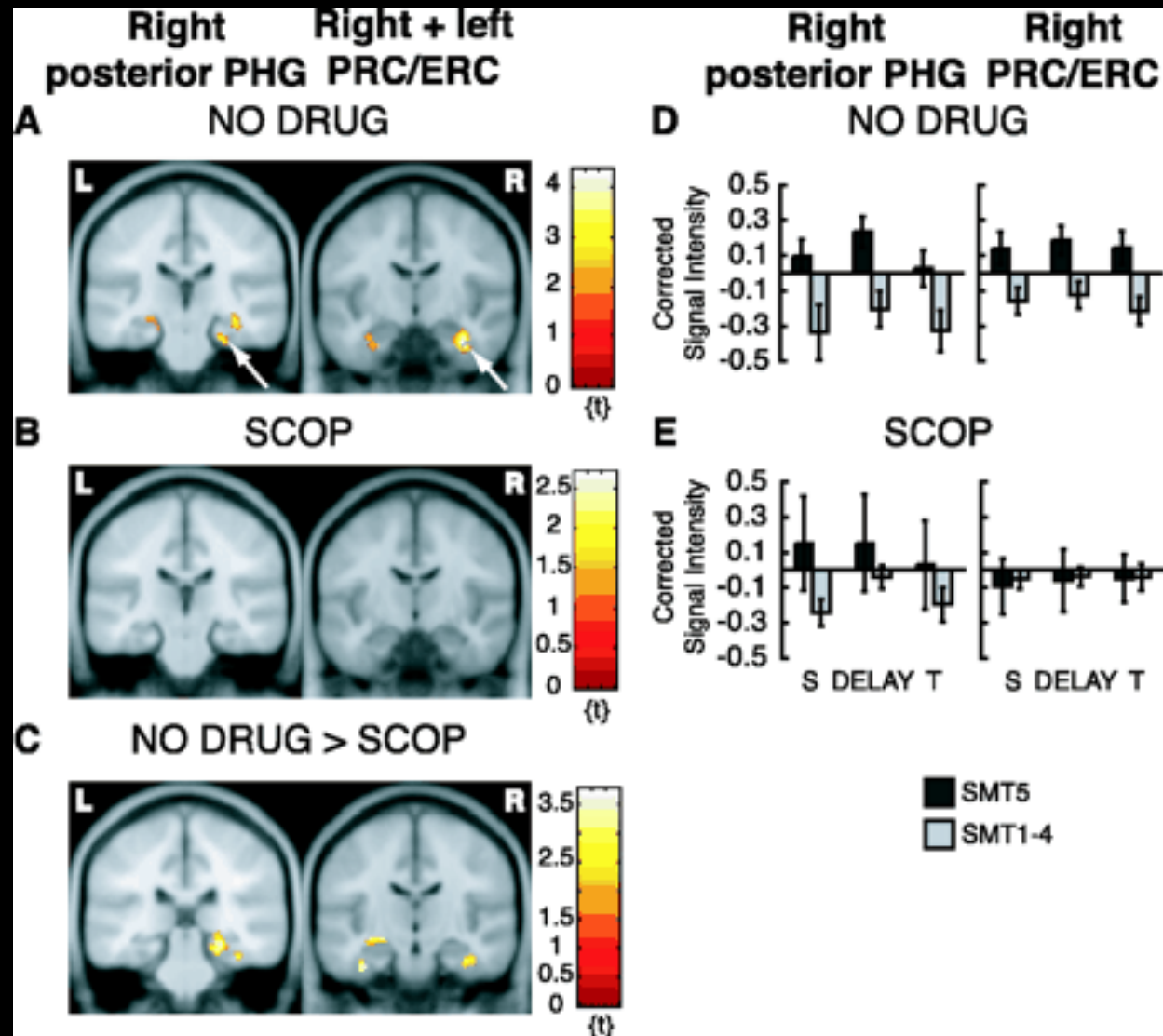
# Results/Data

- ❖ Delay Match To Sample
  - ❖ Active Maintenance
- ❖ Parahippocampal Gyrus/Fusiform Gyrus
- ❖ Difference in Activation



# Results/Data

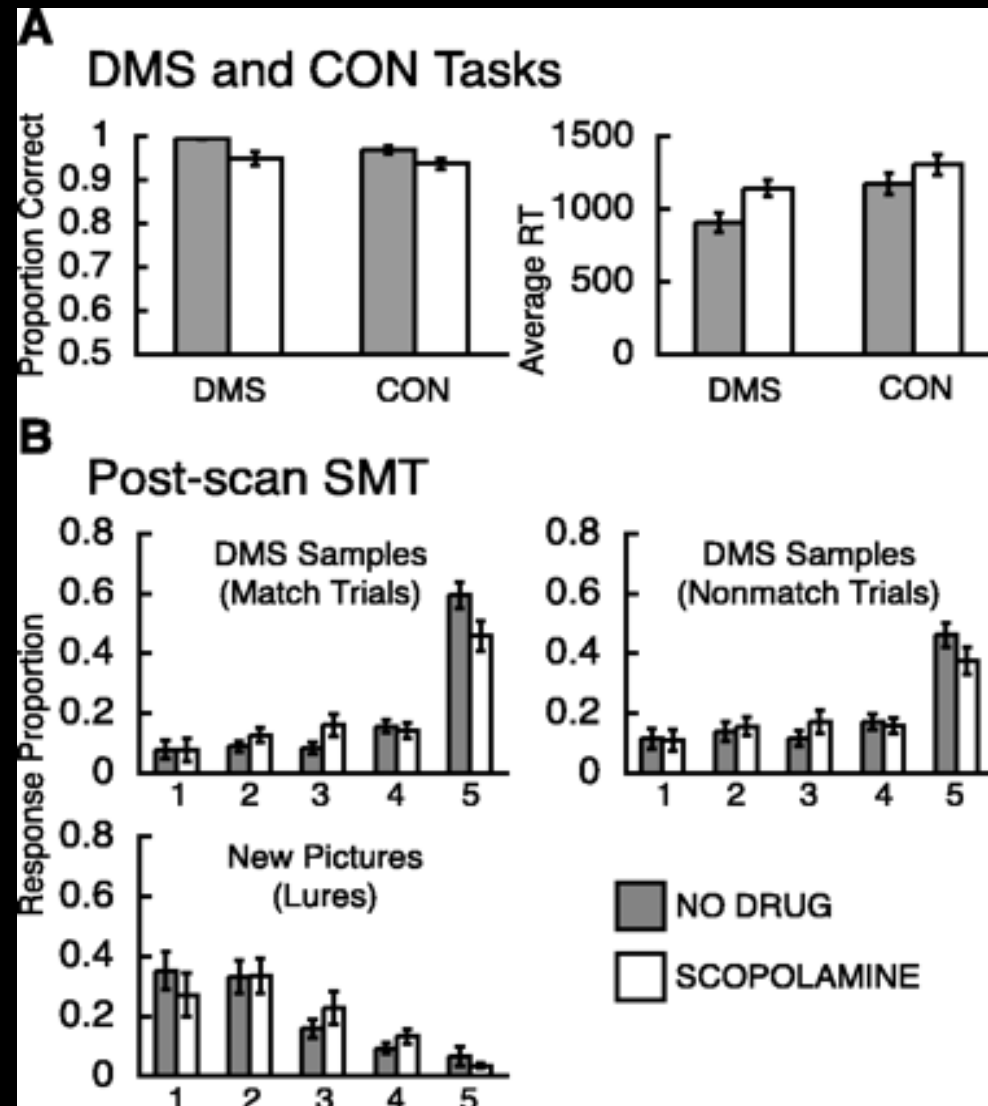
- ❖ POST SCAN (SMT)
  - ❖ Long term encoding
- ❖ Parahippocampal Gyrus/ Perirhinal and Entorhinal cortex (PRC/ERC)
- ❖ Difference in Activation



# Results/Data

❖ SCOP: affected performance a little, not enough to be significant

❖ Reduced number of high confidence report





# Results/Conclusion

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# DEVIL'S BREATH

- ❖ 7 MG (vs .4 mg, 17.5x more potent)
- ❖ Anterograde memory
- ❖ Used for criminal purposes, not recreational
  - ❖ Rape, Robbery
  - ❖ Victims are compliant, normal
  - ❖ Most hallucinogens 5-ht, DB Ach
- ❖ CIA used for interrogation
  - ❖ Side Effects too harmful (hallucinations)



*Datura stramonium var tatula*  
Photo by Josh Ledington, © 2003 Erowid.org



<http://documentary.net/worlds-scariest-drug-scopolamine-the-devils-breath/>

# Why This is Important

- ❖ Study memory and how it works
  - ❖ Long Term Encoding of Memory
  - ❖ Ach as a key player and how it affects memory encoding
  - ❖ Confirms that long-term encoding depend on sustained spiking during brief memory delays in parahippocampal neurons
- ❖ Helps combat criminal use of Scopolamine
- ❖ fMRI is sensitive to Ach modulation
  - ❖ Biomarker for Alzheimer