

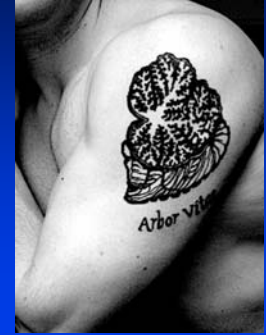
The Cerebellum: Is it Just for Motor Control? AS.080.370(01): Fall 2019

Instructor:
John E. Desmond, Ph.D.

Professor, Department of Neurology,
Cognitive Science, and Neuroscience Program
Johns Hopkins University

Alternative Course Titles

- The cerebellum: It's not just for breakfast anymore
- The cerebellum: WTF?



Courtesy of Dr. Catherine Stoodley

My Background

- PhD: UMASS, Amherst, Psychology
- Stanford University, 1993
 - Assistant Professor, Radiology
 - Functional MRI: New research tool launched new career

The Journal of Neuroscience, December 16, 2009 • 29(50):15816–15824

Lobular Patterns of Cerebellar Activation in Verbal Working-Memory and Finger-Tapping Tasks as Revealed by Functional MRI

John E. Desmond,¹ John D. E. Gabrieli,² Anthony D. Wagner,¹ Bruce L. Good¹ and Gary H. Glover¹

¹Department of Psychology and ²Department of Neurology, Harvard University, Cambridge, Massachusetts 02138, and ³Department of Psychology, Stanford University, Stanford, California 94305

Abstract Working memory (WM) is a core executive function that is essential for human cognition. WM tasks are used to study the neural substrates of executive function, and the cerebellum has been implicated in WM tasks. However, the precise role of the cerebellum in WM is unclear. We used functional MRI (fMRI) to study the neural substrates of verbal WM and finger-tapping tasks. We found that the cerebellum is involved in verbal WM tasks, but not in finger-tapping tasks. This suggests that the cerebellum is involved in verbal WM tasks, but not in motor tasks. This is consistent with the idea that the cerebellum is involved in verbal WM tasks, but not in motor tasks.

Introduction Working memory (WM) is a core executive function that is essential for human cognition. WM tasks are used to study the neural substrates of executive function, and the cerebellum has been implicated in WM tasks. However, the precise role of the cerebellum in WM is unclear. We used functional MRI (fMRI) to study the neural substrates of verbal WM and finger-tapping tasks. We found that the cerebellum is involved in verbal WM tasks, but not in finger-tapping tasks. This suggests that the cerebellum is involved in verbal WM tasks, but not in motor tasks. This is consistent with the idea that the cerebellum is involved in verbal WM tasks, but not in motor tasks.

Methods We used functional MRI (fMRI) to study the neural substrates of verbal WM and finger-tapping tasks. We found that the cerebellum is involved in verbal WM tasks, but not in finger-tapping tasks. This suggests that the cerebellum is involved in verbal WM tasks, but not in motor tasks. This is consistent with the idea that the cerebellum is involved in verbal WM tasks, but not in motor tasks.

Results We found that the cerebellum is involved in verbal WM tasks, but not in finger-tapping tasks. This suggests that the cerebellum is involved in verbal WM tasks, but not in motor tasks. This is consistent with the idea that the cerebellum is involved in verbal WM tasks, but not in motor tasks.

Conclusions We found that the cerebellum is involved in verbal WM tasks, but not in finger-tapping tasks. This suggests that the cerebellum is involved in verbal WM tasks, but not in motor tasks. This is consistent with the idea that the cerebellum is involved in verbal WM tasks, but not in motor tasks.

Key Words cerebellum; working memory; finger-tapping; functional MRI; executive function

Introduction Working memory (WM) is a core executive function that is essential for human cognition. WM tasks are used to study the neural substrates of executive function, and the cerebellum has been implicated in WM tasks. However, the precise role of the cerebellum in WM is unclear. We used functional MRI (fMRI) to study the neural substrates of verbal WM and finger-tapping tasks. We found that the cerebellum is involved in verbal WM tasks, but not in finger-tapping tasks. This suggests that the cerebellum is involved in verbal WM tasks, but not in motor tasks. This is consistent with the idea that the cerebellum is involved in verbal WM tasks, but not in motor tasks.

Methods We used functional MRI (fMRI) to study the neural substrates of verbal WM and finger-tapping tasks. We found that the cerebellum is involved in verbal WM tasks, but not in finger-tapping tasks. This suggests that the cerebellum is involved in verbal WM tasks, but not in motor tasks. This is consistent with the idea that the cerebellum is involved in verbal WM tasks, but not in motor tasks.

Results We found that the cerebellum is involved in verbal WM tasks, but not in finger-tapping tasks. This suggests that the cerebellum is involved in verbal WM tasks, but not in motor tasks. This is consistent with the idea that the cerebellum is involved in verbal WM tasks, but not in motor tasks.

Conclusions We found that the cerebellum is involved in verbal WM tasks, but not in finger-tapping tasks. This suggests that the cerebellum is involved in verbal WM tasks, but not in motor tasks. This is consistent with the idea that the cerebellum is involved in verbal WM tasks, but not in motor tasks.

Key Words cerebellum; working memory; finger-tapping; functional MRI; executive function

Course Organization

- Lectures (from me and a few guest lectures)
- Paper discussions
- Student Presentations
 - Society for Neuroscience-style slide (powerpoint) presentation

Grading

- 20% Participation
- 40% Midterm
- 40% Final (non-cumulative)

Participation 2 Components

- Class Presentation
 - Participation = giving an approx. 10 min Society For Neuroscience style talk on a research paper that you choose
- Paper discussions (7 total, mostly on Tuesdays)
 - Participation = contribution to discussion, voluntarily and/or via instructor

Website: nimlab.johnshopkins.edu -- click on "2019 Course"

The screenshot shows the homepage of the Neuroimaging and Modulation Laboratory (NIMLAB) at Johns Hopkins University. The page features a navigation menu on the left with the following items: Home, Members, Galleries, Newsletters, News, 2019 Course (highlighted with a red circle), and Related Sites. The main content area includes the lab's name, director's name (John E. Desmond, Ph.D.), and a call to action: "Participate in an fMRI or a TMS experiment". Below this, there is a brief description of the lab's research and a list of research topics, including the contributions of the cerebellum, the effects of chronic heavy alcohol consumption, and the effects of aging on neural systems.

The Cerebellum: Is it Just for Motor Control?

AS.080.370: Fall 2019

This website will be used to post lecture notes and papers for discussion.

Messages:

Update: 8/30/2019 2:47 PM

Welcome! This page will be updated periodically with pdf links to lecture notes and papers that will be discussed in class. Also please see links below for syllabus and additional information on grading policy.

Instructor: [Dr. John E. Desmond](#) ← Email link

[Course syllabus is here.](#) ← Syllabus and grading info download

[Additional information on grading is here.](#)

Tue Sep 3 Course Introduction: [Intro Slides](#) (for 1 slide per page click [here](#)). Lecture 01-02. Cerebellar Anatomy, Theory. [Lecture notes](#): for Lectures 1 and 2 with one slide per page, click [here](#).

↑
Today's lecture notes (will try to provide these in advance)

Course Objectives

- Provide overview of cerebellar anatomy and circuitry
- Describe motor aspects of cerebellum, motor symptoms, some theories of cerebellar function
- Survey evidence for cerebellar involvement in functions other than classical motor control

Cerebellum: Party Line View

The screenshot shows a medical reference page from the University of Maryland Medical Center. The page title is "Cerebellum - function". It features an illustration of a person performing a balancing act on a narrow beam, with a diagram of the cerebellum overlaid on their back. A red arrow points from the text "Cerebellum helps provide smooth, coordinated body movement." to the cerebellum in the diagram. A red box highlights the text "Example of a Google search on 'cerebellum'". The page also includes a search bar, social media sharing options, and a "MAGNET" logo.

Non-classical motor topics

- Sensory acquisition
- Timing
- Classical conditioning
- Verbal working memory
- Language
- Executive function
- Neuropsychiatric disorders

Goals

- Give you more knowledge about cerebellum than you had before
- Give you an appreciation that there are many mysteries regarding cerebellar function, and that shedding light on those mysteries is an area of active research
- Develop skills in reading research papers
- Develop skills in conference-style oral presentations

Class Presentation Format

- **Introduction**
 - Background on an issue or problem
- **Purpose**
 - ...of the present study
- **Hypothesis**
 - if there is one
- **Methods**
 - Subject info, procedures, variables measured, how data are analyzed
- **Results**
 - Statistical test results, graphics
- **Discussion**
 - e.g., how does the present study relate to other studies
- **Conclusions**
 - Summary of the take-home message

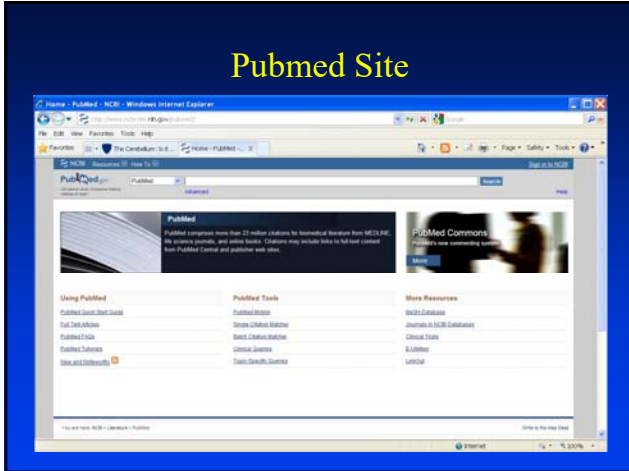
Class Presentations

- Powerpoint preferred
 - If you do not have powerpoint, LibreOffice Impress is OK and it's free
- Email your file to me by deadline
- Ideally, allow a couple of minutes for questions
- It is important to adhere to time constraints

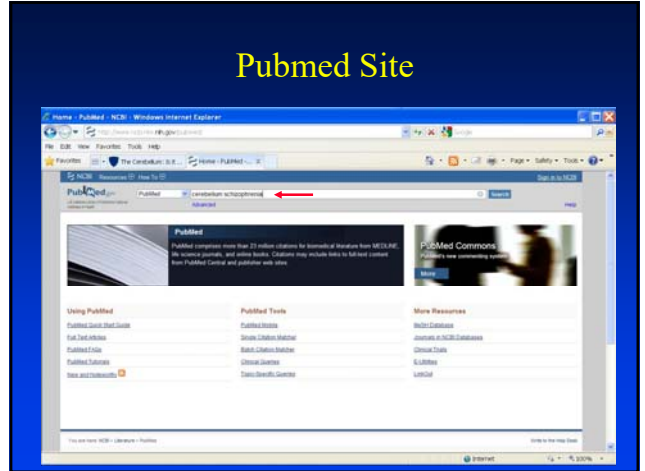
Class Presentations

- Presentation Topic: Anything related to cerebellum that interests you
- Find a paper on Pubmed and present it as if it is your own work
 - A research paper, NOT a review paper
- Pubmed:
<http://www.ncbi.nlm.nih.gov/pubmed/>

Pubmed Site



Pubmed Site



Pubmed



Pubmed



Getting full text of article

- Make sure you are on the Johns Hopkins network
 - ...otherwise journals will not recognize the subscription
- If not directly via pubmed's link, try this:
- <https://findit.library.jhu.edu/>
- Once you have full text pdf, you can copy and paste figures, tables into powerpoint presentation

Getting full text of article



Presentation Schedule

- Oct 22, Oct 31, Nov 5
- Alphabetical order-if you cannot make your scheduled presentation date, email me in advance so we can swap with someone else
- Email the article to me in advance for approval (to avoid duplication)

Presentation Schedule

- Oct 1: Presentation list will be announced
- Oct 8: Notify me if you need a different date
- Email your paper to me for approval 2 weeks in advance of your talk date
- Email your powerpoint presentation to me at least 24 hrs prior to your talk

Paper Discussions

- 7 papers will be discussed
 - Will complement topics presented in lectures (e.g., a verbal working memory paper will come after the verbal working memory lecture)
 - Will involve various cognitive neuroscience techniques (e.g., TMS, fMRI, VBM, neuropsychological approaches)
- Read the article and generate in advance - for the Introduction, Methods, Results, and Discussion – at least 2-3 factual questions that could be answered by another student if he/she read the article:
 - e.g., “How were behavioral responses recorded?”

Paper Discussions

- In addition be prepared to discuss
 - Each figure and table (e.g., be able to describe the axes, if applicable, and what the figure is trying to show)

Routine for Paper Discussion

- First a student’s name is drawn randomly, and then a powerpoint slide will be displayed. That powerpoint slide will say either:
 - Ask a question
 - Describe a figure/table

Routine for Paper Discussion

- If “Ask a Question” a second student’s name will be drawn to answer the question given by the first student
 - The first student will evaluate the second student’s answer

Routine for Paper Discussion

- So, when you read a paper, keep in mind that you will be generating questions for other students, and that you will be answering questions posed by other students (or by me)