# Special Topics- Using EEG in Kinesiology Research

Instructor:Matthew W. Miller, Ph. D.

Email: mwm0024@auburn.edu (I usually respond to email 8 AM – 3 PM on weekdays)

Virtual Office Hours (when I will be in my Zoom Office Hours Meeting):

 Wednesday 1 – 3 PM and by appointment (Meeting ID: 545 460 3288)

Office Location:Kinesiology, Room 164

Course Number: KINE 7970-004

Class Meeting:Monday – Friday, 11:30 AM – 1 PM, Student Activities Center 247

Credit Hours: 3.000

Texts/Resources: Readings are posted on Canvas and links to videos are in this syllabus.

Course Description: Origin of EEG, how to record and preprocess it, and four main ways to analyze and utilize it to study topics of interest to kinesiology researchers.

Learning Outcomes: Students will gain basic knowledge about how to record and preprocess EEG as well as its origins. Students will become familiar with four main ways to analyze and utilize EEG for kinesiology research.

Justification for Graduate Credit: Students will be challenged to comprehend a complex neuroscientific research method through reading high-level textbook excerpts and primary research articles as well as watching high-level videos. They will be further challenged by proposing a kinesiology research study that uses EEG.

## Course Content and Dates (SUBJECT TO CHANGE)

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| Week | Lectures/Discussions |
| 05/13 – 17No Class 05/13– 15 | Introduction to ClassIntroduction to EEG (*read and/or watch videos*)* Cohen (2014), Chapters 2 & 5
* [Origin, Significance, and Interpretation of EEG video](https://youtu.be/Bmt89hHyxuM?si=BmyxI0AKBLS2t-Jv)
* [ERP Basics 1- The EEG video](https://youtu.be/79mPZFwPa9A?si=ldtuPUYLsbsIxZYk)
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| 05/20 – 24No Class 05/24 | Introduction to EEG Data Collection w/ **Lab Demo*** Cohen (2014), Chapter 6
* [Recording and Analysis 2- Recording video](https://youtu.be/sdesLHEgohU?si=VzX6Xk8wujrmt3M7)
* [Recording and Analysis 3- Active, Reference, Ground video](https://youtu.be/-A9jK7mKZbs?si=l2HG5vCAeTfJ4Xey)
* [Recording and Analysis 4- Reference Location video](https://youtu.be/LQydnE54rLU?si=hrc8AMaW75XmB3d3)
* [Recording and Analysis 5- Common Artifacts video](https://youtu.be/QZyjrHTrTwc?si=X21pn6gHIFtWIPyc)

Introduction to EEG Data Preprocessing w/ **Lab Demo*** Cohen (2014), Chapter 7 (*read and/or watch video*)
* [Overview of Possible Preprocessing Steps video (Cohen, 202)](https://youtu.be/JMB9nZNGVyk?si=OXgxbQhcWuFqtzlS)

Event-related potential (ERP) Overview* Luck (2014), Chapter 2 (*read and/or watch next two videos below*)
* [ERP Basics 2- Averaged ERPs video](https://youtu.be/XX4yr5tEv8I?si=GYznSC_o9MVTbs51)
* [ERP Components 1- What is an ERP Component video](https://youtu.be/OlZNMntD68c?si=LD4WIn1xtEKqVIos)
* Cohen (2014), Chapter 9 (*read and/or watch next video below*)
* [Overview of Time-Domain Analyses (ERPs) video](https://youtu.be/iFWrVzLYop0?si=TLC8VLKWlnfR3YD7)

Using ERPs to Study Motor Learning and Performance* Frömer et al. (2016)

Using ERPs to Study Exercise Psychology* [Cheval et al. (2019)](https://auburn.box.com/s/1d89rc9e6niymanjmfsht90yv40wdksx) (*watch and listen to lecture recording*)
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| 05/27 – 05/31No Class 05/27 | Using ERPs to Study Exercise Psychology* Hillman et al. (2014)

Using ERPs to Study Cognitive Workload During a Visuomotor Task* Dyke et al. (2015)

Using ERPs **Lab Demo**Static Frequency Overview* Luck (2014), pp. 219 – 226 (*read and/or watch next video below, and watch second as well as third video below)*
* [Background Issues 1- Fourier Analysis video](https://youtu.be/vKIEKvDJPfw?si=25lyw-o27XM9zVLG)
* [Motivations for Rhythm-Based Analyses video](https://youtu.be/3hk4z3yrMzk?si=no3GTgyAgifve-dn)
* [Time and Frequency Domains video](https://youtu.be/fYtVHhk3xJ0?si=bRQO7qi7crMnDriY)
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| 06/03 – 07  | Static Frequency in Exercise Psychology* Gutmann et al. (2018)

Static Frequency in Motor Learning and Performance* Daou et al. (2018)

Frequency **Lab Demo**Time-Frequency Overview* Cohen (2014), Chapter 3 (*read and/or watch next video below*)
* [Interpreting Time-Frequency Plots video](https://youtu.be/s2MfmIx8wv4?si=5QiuTUYcbiX9kCAR)
* Luck (2014), pp. 274 – 282 (*read and/or watch next video below*)
* [Background Issues 4- Time Frequency Analysis](https://youtu.be/nZi1dZOxxR8?si=_t3nTg5hLexgyCEv)

Time-Frequency in Motor Learning and Performance* Hamel et al. (2018)
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| 06/10 – 14No Class 06/14 | Time-Frequency in Exercise Psychology* Cheval et al. (2021)

Time-Frequency **Lab Demo**Connectivity Overview (*read and/or watch video*)* Cohen (2014), Chapter 25
* [Four Things to Keep in Mind about Connectivity video](https://youtu.be/ardi0hO6lOU?si=dYKvylnZKEg0SS6u)

Connectivity in Motor Learning and PerformanceBellomo et al. (2020)[Connectivity **Lab**](https://auburn.box.com/s/716eqi1qkoaf8hgs9498gj6otyhde889) **Demo (*watch and listen to lecture recording*)** |
| 06/17 – 21No Class 06/17, 06/19, or 06/21 | Student Presentations |

## Assignments:

### Student Presentations (50% grade)

Each student will work in a group to deliver an oral proposal of an original kinesiology research study that uses EEG as a primary outcome measure. Students will state the purpose of the study, describe the study design and EEG measure(s) of interest, declare study hypotheses regarding the EEG measure(s), and indicate potential pitfalls. Students will also be responsible for asking questions and indicating potential pitfalls of other groups’ proposals.

### Attendance and Participation (50% of grade)

Students must attend each class unless they have an excused absence. Additionally, students must assist with lab demonstrations when called upon to do so. Finally, students are expected to ask at least one question each class.

## Grading:

Percentages will be associated with the following letter grades:

 A: 90.0% ≤

 B: 80.0% ≤

 C: 70.0% ≤

 D: 60.0% ≤

 F: 60.0% >

## Class Policies:

Attendance: Attendance is required. Students are expected to attend all classes and will be held responsible for any content covered in the event of an absence, excused or unexcused.

Excused Absences: Students are granted excused absences from class for the following reasons: Illness of the student or serious illness of a member of the student’s immediate family, death of a member of the student’s immediate family, trips for student organizations sponsored by an academic unit, trips for University classes, trips for participation in intercollegiate athletic events, subpoena for a court appearance and religious holidays. Students who wish to have an excused absence from this class for any other reason must contact the instructor in advance of the absence to request permission. The instructor will weigh the merits of the request and render a decision. When feasible, the student must notify the instructor prior to the occurrence of any excused absences, but in no case shall such notification occur more than one week after the absence. Appropriate documentation for all excused absences is required.

Make-Up Policy: Arrangements to make up missed major examination (e.g. hour exams, mid-term exams) due to properly authorized excused absences. Except in unusual circumstances, such as continued absence of the student or the advent of University holidays, a make-up exam will take place within two weeks from the time the student initiates arrangements for it. Except in extraordinary circumstance, no make-up exams will be arranged during the last three days before the final exam period begins. The format of the make-up exam will be (as specific by the instructor).

Academic Honesty Policy: All portions of the Auburn University Student Academic Honesty code (Title XII) found in the [Student Policy eHandbook](http://www.auburn.edu/student_info/student_policies/)will apply to this class. All academic honesty violations or alleged violations of the SGA Code of Laws will be reported to the Office of the Provost, which will then refer the case to the Academic Honesty Committee.

Disability Accommodations: Students who need accommodations are asked to electronically submit their approved accommodations through AU Access and to make an individual appointment with the instructor during the first week of classes – or as soon as possible if accommodations are needed immediately. If you have not established accommodations through the Office of Accessibility, but need accommodations, make an appointment with the Office of Accessibility, 1228 Haley Center, 844-2096 (V/TT).

Class Communication: Communication will occur via Canvas. If you are new to Canvas, please see this link to a 7 minute: [“Getting Started with Canvas” video (and transcript)](https://vimeo.com/74677642). Communication via Canvas will appear in your Auburn email and on Canvas. You are responsible for regularly checking class emails and Canvas.

Emergency Contingency: If normal class and/or lab activities are disrupted due to illness, emergency, or crisis situation, the syllabus and other course plans and assignments may be modified to allow completion of the course. If this occurs, an addendum to your syllabus and/or course assignments will replace the original materials.

Professionalism: The Auburn University Classroom Behavior Policy is strictly followed in the course; please refer to the [Student Policy eHandbook](http://www.auburn.edu/student_info/student_policies/) for details of this policy.

## Mental Health:

If you are experiencing stress that feels unmanageable (personal or academic) during the semester, Auburn University’s Student Counseling & Psychological Services (SCPS) offers a variety of services to support you. The mission of SCPS is to provide comprehensive preventative and clinical mental health services to enhance the psychological well-being of individual students, as well as the broader campus culture. As an instructor, I am available to speak with you regarding stresses related to your work in this course, and I can assist in connecting you with the SCPS network of care. You can schedule an appointment yourself with the SCPS by calling (334)844-5123 or by stopping by their offices on the bottom floor of Haley Center or the second floor of the [Auburn University Medical Clinic.](http://auburn.edu/map/?id=150)

If you or someone you know needs to speak with a professional counselor immediately, the SCPS offers counseling during both summer term as well as the traditional academic year. Students may come directly to the SCPS and be seen by the counselor on call, or you may call 334.844.5123 to speak with someone. Additional information can be found at <http://wp.auburn.edu/scs>.

## Bias:

Auburn University values freedom of expression and the open exchange of ideas. While openness protects the expression of controversial ideas, there are times when actions or expression can negatively affect individuals or groups. A bias-related incident involves conduct (acts, behaviors, or communications) against a person, motivated by the offender’s biases regarding age, disability, ethnicity, gender, gender identity/expression, nation origin/nationality, race, religion, sex, sexual orientation, veteran status or other identity. These acts, behaviors, conduct or communications may produce an unwelcoming environment. A bias incident may involve behavior which does not rise to the level of a violation of Auburn University policy, including legally protected free speech.

The Bias Education and Response Team (BERT) consists of a cross-disciplinary group of staff and faculty who will ensure that students, faculty, and staff have the means to report bias incidents. This group of professionals share information about incidents reported to the BERT, and advocate for prevention and awareness programs. BERT members will also connect those impacted by bias-related incidents with immediate and ongoing support resources. Students can report a bias incident at <https://studentaffairs.auburn.edu/bert/>.