Description of Course
This course will introduce students to the modern neuroimaging techniques from theoretical and practical perspectives. We will begin with review of neuroanatomy and terms that are necessary to understand neuroimaging results and literature. Next, we will discuss functional and structural neuroimaging approaches. The first portion of the class will focus on MRI and fMRI. In the second part we will discuss applications of electrophysiology (EEG/ERPs) and magnetoencephalography (MEG) to language research. Students will have an opportunity to acquire practical skills with some most commonly used neuroimaging data analysis and visualization softwares (e.g., SPM12, MRICron, xjview, EEGlab). This is an introductory course and it will not be appropriate for advanced or expert users of neuroimaging tools.

Basic knowledge of neuroanatomy and brain function is recommended. The final project will be research proposal and in-class presentation.

Graduate-level requirements include more extensive independent reading, reflection and mastery of scientific writing.

Textbooks:
There will be selected chapters from these textbooks posted on D2L

Instructor and Contact Information
Instructor: Aneta Kielar, Ph.D.
Office: SLHS 332
Telephone: 520-621-5105
Email: akielar@email.arizona.edu
Office Hours: Wednesday 1-3 p.m. by appointment

Course Format and Teaching Methods
Lectures, hands-on in class activities, homework assignments, independent reading, literature review, in-class discussion, presentations, written assignments and papers. This is a graduate level course. Students should display mature behavior. Students are responsible for reading the assigned materials before each class meeting, prepare questions, and participate in class activities. Students are responsible for materials and announcements posted on D2L.
Course Objectives and Expected Learning Outcomes
1) Students will become familiar with basic neuroanatomy and function relevant to the neuroimaging methodology
2) Students will become familiar with terminology required to understand neuroimaging literature and data
3) Students will become familiar with the neuroimaging data preprocessing, analysis, and image visualization
4) Students will gain skills in designing neuroimaging experiments and writing research proposal

Absence and Class Participation Policy
The UA’s policy concerning Class Attendance, Participation, and Administrative Drops is available at http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable: http://policy.arizona.edu/human-resources/religious-accommodation-policy.

Absences preapproved by the UA Dean of Students (or dean’s designee) will be honored. See http://policy.arizona.edu/employmenthuman-resources/attendance.

Participating in the course and attending lectures and other course events are vital to the learning process. As such, attendance is required at all lectures and discussion section meetings. Students who miss class or assignments due to illness or emergency are required to bring documentation from their health-care provider or other relevant, professional third parties. Failure to submit third-party documentation will result in unexcused absences. Lecture notes, book chapters, journal articles, and other reading materials will be made available on the D2L website or other websites. In addition, the D2L website may also be used for messages and announcements related to the course.

Required Texts or Readings
Students will be responsible for the materials on the reading list posted on D2L. The required readings must be completed before each class.

Assignments and Examinations: Schedule/Due Dates

<table>
<thead>
<tr>
<th></th>
<th>Points</th>
<th>Description</th>
<th>Due Dates</th>
</tr>
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<tbody>
<tr>
<td>Test 1</td>
<td>40</td>
<td>Take home problem sets, short answer, multiple choice</td>
<td>Feb 15&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Test 2</td>
<td>40</td>
<td>Take home problem sets, short answer, multiple choice</td>
<td>April 12th</td>
</tr>
<tr>
<td>Homework Assignments</td>
<td>50</td>
<td>In-class activities or/and take home problem sets</td>
<td>Feb 8th, March 1&lt;sup&gt;st&lt;/sup&gt;, March 29th</td>
</tr>
<tr>
<td>Research Proposal</td>
<td>60</td>
<td>This will involve in-class presentations of your research idea</td>
<td>Thu April 19 April 26th</td>
</tr>
<tr>
<td>Thought</td>
<td>20</td>
<td>This is a short reflection</td>
<td>Jan 25&lt;sup&gt;th&lt;/sup&gt;, March 15th</td>
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Papers/article summaries | on the topics discussed in class or summary of the assigned research papers. 1-2 pages.  
Research Proposal Outline | 30 | Prepare outline of your research proposal. Details posted on D2L | Feb 22nd  
Final: Research Proposal | 60 | Original research proposal that applies one of the neuroimaging techniques discussed in class. Topic must be approved by the instructor. (5 pages max) Details posted on D2L | April 19  

**Final Examination or Project**  
The date and time of the final exam or project, along with links to the Final Exam Regulations, [https://www.registrar.arizona.edu/courses/final-examination-regulations-and-information?audience=students&cat1=10&cat2=31](https://www.registrar.arizona.edu/courses/final-examination-regulations-and-information?audience=students&cat1=10&cat2=31), and Final Exam Schedule, [http://www.registrar.arizona.edu/schedules/finals.htm](http://www.registrar.arizona.edu/schedules/finals.htm)  

**Grading Scale and Policies**  
Course grades will be based on the sum of two exams, homework assignments, article summaries, class presentation, and the final paper (max 300)  

- Two midterm tests: 40 points each = 80  
- Thought papers/article summaries = 20  
- Homework Assignments = 50  
- Research Proposal outline = 30  
- Research Proposal Presentation = 60  
- Final Research Proposal = 60  

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>90% or better</td>
</tr>
<tr>
<td>B</td>
<td>80%-89.99%</td>
</tr>
<tr>
<td>C</td>
<td>70%-79.99%</td>
</tr>
<tr>
<td>D</td>
<td>60%-69.99%</td>
</tr>
<tr>
<td>F</td>
<td>50%-59.99%</td>
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University policy regarding grades and grading systems is available at [http://catalog.arizona.edu/policy/grades-and-grading-system](http://catalog.arizona.edu/policy/grades-and-grading-system)  

**Requests for incomplete (I) or withdrawal (W)** must be made in accordance with University policies, which are available at [http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete](http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete) and [http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal](http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal) respectively.  

**Dispute of Grade Policy** If you wish to question the grading of any test or paper, the request must be made in writing (e.g., via email) to the instructor within 1 week of the date
that the test or paper was returned to the class (whether or not you attended that class). The assignment will be entirely re-graded, which may result in a higher or lower final grade. After a test or paper has been re-graded, the final grade is non-negotiable. The only exception to the regarding policy is mathematical errors.

**Scheduled Topics/Activities**

<table>
<thead>
<tr>
<th>Class</th>
<th>Date</th>
<th>Topic</th>
<th>Assignments</th>
<th>Readings</th>
</tr>
</thead>
</table>
| 1     | Thu, Jan 11| Introduction and Overview  
Terminology                                                            |             | D2L: Chouinard et al (2016)                   |
|       |            | **Section 1**  
**Brain Anatomy and Function**                                        |             |                                               |
| 2     | Thu, Jan 18| Basic Brain orientation  
terms/general anatomy  
Organizing principles of the brain                                      |             | D2L: Ward:  
Chapter 1                                      |
| 3     | Thu Jan 25 | Review of main structures  
and organization of the brain  
Brodmann's areas                                                          | Thought paper 1 due | D2L: Ward:  
Chapter 2                                      |
|       |            | **Section 2**  
**Study Design and Data Analysis**                                      |             |                                               |
| 4     | Thu Feb 1  | Introduction to basics of MRI and fMRI  
MRI Safety issues                                                        |             | Ward: Chapter 4  
Recommended: Huettel:  
chapters 3 and 5  
fMRI safety  |
| 5     | Thu Feb 8  | Study design and analysis  
Assignment 1 Due                                                           |             | D2L: Poldrack et al. (2008)  
Recommended: Huettel:  
chapter 6 and 7                                      |
| 6     | Thu Feb 15 | Intro: fMRI/MRI data preprocessing in SPM 12  
Take home Test 1 due                                                      |             | Materials on D2L  
and sections from SPM12 manual  
Recommended: Huettel:  
chapter 11                                      |
| 7     | Thu Feb 22 | Statistical Model Specification                                        | Research Proposal Outline Due | Materials on D2L |

**Section 3**  
**Data Modeling and Visualization**
<table>
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<tr>
<th>8</th>
<th>Thu March 1</th>
<th>Data Analysis: t-test and ANOVA Visualizing results</th>
<th>Assignment 2 due</th>
<th>Poldrack (2008) Manuals and Materials on D2L</th>
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<tbody>
<tr>
<td>9</td>
<td>Thu March 8</td>
<td>Spring Break</td>
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<tr>
<td>10</td>
<td>Thu March 15</td>
<td>Visit to the scanner and MRI image acquisition* (TBA)</td>
<td>Thought paper 2 due</td>
<td>Materials on D2L</td>
</tr>
<tr>
<td>11</td>
<td>Thu March 22</td>
<td>Exploring statistical maps in MRIcon and xjview</td>
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<td>Manuals and Materials on D2L</td>
</tr>
</tbody>
</table>

### Section 4  
**Electrophysiology**

| 12| Thu March 29 | What is EEG and Event-related potentials | Assignment 3 due | D2L: Ward: Chapter 3  
Luck ch 1, 2, 3 |
|---|-------------|----------------------------------------|------------------|---------------------|
| 13| Thu April 5 | Exploring EEG signal and physiological artifacts |                  | Luck ch 5, 6  
Kutas et al. 2007 |
| 14| Thu April 12| Magnetoencephalography and language research | Take home Test 2 due | D2L: Ward: Chapter 3 |

### Section 5  
**Special Topics**

| 15| Thu April 19| Special cases Imaging in clinical populations  
Lesion analysis and challenges | Final Research Proposal Due | D2L: Ward: Chapter 5  
D2L: Rorden (2018)  
Crinion 2007 |
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<tbody>
<tr>
<td>16</td>
<td>Thu April 26</td>
<td>Last Class: Student Research Proposal Presentations</td>
<td>Presentation Handout due</td>
<td></td>
</tr>
</tbody>
</table>

**Bibliography**

Class readings are posted on D2L. Textbooks are linked from the library catalogue and available on D2L.

**Classroom Behavior Policy**

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

Students are asked to refrain from disruptive conversations with people sitting around them during lecture. Students observed engaging in disruptive activity will be asked to cease this behavior. Those who continue to disrupt the class will be asked to leave lecture or discussion and may be reported to the Dean of Students.
Threatening Behavior Policy
The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students.

Accessibility and Accommodations
Our goal in this classroom is that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, please let me know immediately so that we can discuss options. You are also welcome to contact the Disability Resource Center (520-621-3268) to establish reasonable accommodations. For additional information on the Disability Resource Center and reasonable accommodations, please visit http://drc.arizona.edu.

If you have reasonable accommodations, please plan to meet with me by appointment or during office hours to discuss accommodations and how my course requirements and activities may impact your ability to fully participate.

Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.

Code of Academic Integrity
Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity.

The University Libraries have some excellent tips for avoiding plagiarism, available at http://www.library.arizona.edu/help/tutorials/plagiarism/index.html.

Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor’s express written consent.

Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement.

Late Assignments, Make-up Exams
Because tests and assignments are in the take-home format late submissions will not be accepted. In the case of an unexpected emergency or severe illness (e.g. vomiting, fever, highly contagious illness) that prevents you from handing in an assignment on time or taking an exam, you must inform instructor by
email within 24 hours or sooner. Late papers/assignments will lose 1 letter grade (10%) per day that they are late. **Make-up exams will only be given under extremely extenuating circumstances. Make-up exams will be given during the final exam period and may be given in oral form.** Official documentation (e.g., doctor’s note, police report) is required.

**UA Nondiscrimination and Anti-harassment Policy**

The University is committed to creating and maintaining an environment free of discrimination; see [http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy](http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy). Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

**Additional Resources for Student**

UA Academic policies and procedures are available at [http://catalog.arizona.edu/policies](http://catalog.arizona.edu/policies).

Student Assistance and Advocacy information is available at [http://deanofstudents.arizona.edu/student-assistance/students/student-assistance](http://deanofstudents.arizona.edu/student-assistance/students/student-assistance)

**Confidentiality of Student Records**

[http://www.registrar.arizona.edu/ferpa/default.htm](http://www.registrar.arizona.edu/ferpa/default.htm)

**Subject to Change Statement**

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.