

## BIBB 060: Music and the Brain

Tuesday, 1:30-4:30 Room 117 Lynch

Lead vocals: Mike Kaplan

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Every human culture that has ever been described makes some form of music. The musics of different cultures cover a wide range of styles, but also display fascinating similarities, and a number of features are shared by even the most disparate musical traditions. Within our own culture, music is inescapable- there are very few individuals who do not listen to some form of music every day, and far more who listen to music virtually all day long. Appreciation of music comes very early- newborns prefer music to normal speech, and parents all over the world sing to their babies, and what's more, they do so in a fundamentally similar way. And yet, despite this striking ubiquity, the real origin and purpose of music remains unknown. Music is obviously related to language, but how? Why do so many cultures make music in such similar ways? What goes into the formation of musical "taste" and preferences? What is the nature of musical ability, and how do musicians differ from non-musicians? Does music have survival value, either for the individual or for the group, or is it merely "auditory cheesecake", a superfluous byproduct of evolution?

In this course, we will look for answers by looking at the brain. Almost 200 years of scientific research into brain mechanisms underlying the production and appreciation of music is increasingly shedding light on these and other questions. Although the sciences and the arts are often seen as entirely separate or even in opposition, studying the brain is actually telling us a lot about music, and studying music is telling us just as much about the brain.

Class meets weekly, Tuesdays from 1:30-4:30 in room 117, Lynch Laboratories (and sometimes, Leidy 12). Most classes will be divided into two parts, separated by a short break (\*\*). There will be weekly readings from classic texts but also from the primary literature, and short assignments from time to time to help guide you through the reading. Final grades will be based on these assignments (25 points), a midterm exam (25 points), and a presentation and short paper on a topic of your choice (50 points).

CLASS	DATE	TOPIC
1	Sept 2	<b>Overture</b>
		<i>What is "music"? Instead of a definition, we will compile a list of features common to most musics.</i>
		Introduction to biomusicology, ethnomusicology and the study of musical universals.
		* * *
		Overview of topics and techniques

CLASS	DATE	TOPIC
2	Sept 9	<b>Musical universals (and near-universals) II</b> <i>Peretz introduces some of the major issues we'll be considering this term, starting with the question of to what extent music relies on domain specific vs. domain general mechanisms. We will also revisit the subject of musical universals, by listening to some deliberately exotic and at times obtuse examples.</i> <i>Reading: (<a href="#">Peretz, 2006</a>) Optional readings: (<a href="#">Nettl, 2000</a>), (<a href="#">Brown and Jordania, 2011</a>)</i>

Musical universals, part II: *listening* for musical universals

3	Sept 16	<b>Developmental neuromusicology:</b> <i>What do the musical abilities, preferences and predispositions of infants tell us about brain mechanisms of music and their origins? Also covered: how to read a review article.</i> <i>Reading: (<a href="#">Trehub, 2003</a>)</i>
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The musical predispositions of infants  
*Discussion: predispositions, or early learning?*

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*Guest speaker:* Melanie Cedrone, Biomedical library specialist  
Using Pubmed, Psychinfo, and Scopus

4	Sept 23	<b>From sound to brain</b> <i>What is sound? How do we describe and quantify it? How does the ear detect and analyze it? The cochlea as a frequency analyzer and A/D converter, and spikes as a sort of digital code</i> <i>Reading: Chapters 2 and 3 (<a href="#">Pierce, 1992</a>)</i>
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Sound, strings and standing waves  
The ear (and especially, the cochlea)

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*Lab: Intro to sound apps*  
Intro to neurons, part 3: the action potential

5	Sept 30	<b>Pitch</b> <i>Some sounds have it, some sounds don't. What is pitch, where in the brain is it analyzed, and why does the brain take such an</i>
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*interest in it? Pitch is a measure of periodicity, a quality of harmonically structured sounds, which are important not just for music but for audition in general and speech in particular.*

*Reading: ([McDermott and Oxenham, 2008](#)); optional reading: ([Bendor and Wang, 2006](#)).*

*Lab exercise: analysis of sounds with and without pitch*

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### **Pitch, part II: Absolute (“perfect”) pitch**

*Making and listening to music is mainly a function of relative pitch: of the distances between notes rather than their absolute values. But a small number of individuals (maybe 1 in 10,000) are able to remember and instantly identify individual pitches in isolation. We now know a good deal about the neuroanatomical basis of this genetically linked ability. Reading: ([Loui et al., 2010](#)). Optional reading: ([Zatorre, 2003](#)),*

6 Oct 7

### **Consonance and dissonance**

*From the time of Pythagoras and probably long before that, people all over the world distinguish between consonant and dissonant pairs of notes. What is the basis of this difference? Until recently, dissonance was attributed to “sensory roughness”. Here we look at the neurophysiological correlates of roughness.*

Historical perspective: Pythagoras, Galileo and Newton  
Helmholtz, beating and “roughness”;

*Reading:* Continue reading McDermott and Oxenham, 2008, skipping ahead to section on consonance. Also check out Chapter 5 and 6 in ([Pierce, 1992](#));

\* \* \*

Search for and research topics for final projects

7 Oct 14

### **Consonance and dissonance 2: consonance = harmonicity?**

*Despite evidence of beating in the auditory nerve and neurons that detect roughness in the inferior colliculus, several lines of evidence suggest that roughness is at most part of the explanation. Here we examine another possibility: the resemblance of the spectrum of a consonant interval to that of a single harmonic tone.*

*Reading:* Chapter 6 in ([Pierce, 1992](#)); ([McDermott et al., 2010](#)); will also discuss ([Tramo et al., 2001](#)) and ([Cousineau et al., 2012](#))

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*Lab: sound spectra part II- intervals  
Discuss final projects*

- 8 Oct 21      **Scales (or, Pythagoras n' me):**  
*Virtually all musical cultures divide the octave by 5-7 unequal steps, or scales. A surprising number of cultures use the same or similar scales, especially the pentatonic scale and the major scale and its modes. The notes of these scales are all contained among the harmonics of the root tone- this is not a coincidence, but no one tunes that way any more. What, if anything, does it all mean?*  
*Reading:* Chapter 4 in ([Pierce, 1992](#)); Chapter 10 (Deutsch, 1999)
- 9 Oct 28      **Comparative approaches: the music (?) of animals**  
*Many species of animals make sounds that resemble music on a superficial level, but when if even should those sounds be considered "music" (as opposed to merely musical, or music-ish?) Even if the answer is "never!" can studying the music-ish utterances of animals tell us anything about our own music?*  
  
Song learning and performance in zebra finches  
Special guest vocalist: Dr. Marc Schmidt, Department of Biology  
*Readings:* TBA  
  
\* \* \*  
Comparative approaches: do animals make music?  
*Readings:* Chapters 4 and 5, excerpts ([Brown et al., 2000](#)); ([McDermott and Hauser, 2007](#))
- 10 Nov 4      **Music, language, and laterality:**  
Music is obviously related to language, but how? And which came first? How does musical grammar relate to grammar in language? What is the basis of the seeming right brain dominance for most musical tasks?  
*Reading:* ([Patel, 2003](#)) ([Koelsch, 2005](#))
- 11 Nov 11      **Music and emotion**  
Music plays an integral part in all of our lives and in every culture because of its ability to evoke strong emotions. How does music evoke emotion, and what does this tell us about the origin and purpose of music?  
*Readings:* ([Blood et al., 1999](#)) ([Menon and Levitin, 2005](#)) ([Salimpoor et al., 2011](#))
- 12 Nov 18      *Student presentations*
- 13 Dec 2      *Student presentations*

14 Dec 9 *Student presentations*

**Finale: recap of major themes**

Evolution and origin of music

*Reading:* ([Brown, 2003](#))

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