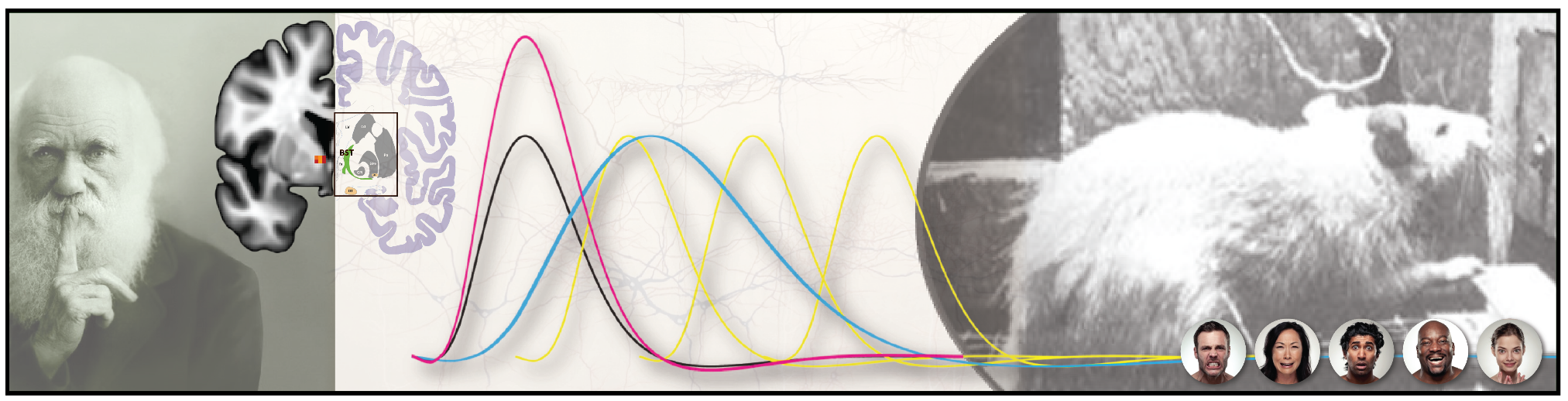
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**PSYCHOLOGY/NACS 614**

**Emotion:**

***From Biological Foundations to Contemporary Debates in the Psychological Sciences***

***\*\*\* COVID-19 EDITION \*\*\****

**professor alex shackman, uNIVERSITY OF MARYLAND*,* fall 2020**

**readings & MODULE OVERVIEWS[[1]](#footnote-2)**

* All the reading assignments can be found on ELMS under the “Pages” tab (“Readings” sub-directory).

**Module 01: Introductions, course mechanics, and fundamental questions roundtable**

Required

* The Syllabus! The syllabus can be found on ELMS under the “Syllabus” tab

Optional (But Short & Strongly Encouraged)

* NoE – Dedication (*immediately following the copyright page; this captures the spirit of the entire course*)
* NoE – Introduction (*provides a guide to how the NoE is organized*)

**SECTION I: THE PSYCHOLOGICAL NATURE OF THE EMOTIONAL MIND**

**Module 2. What is an Emotion? *Western* *Folk Psychology and Contemporary Scientific Perspectives***

*Emotions are a central feature of human existence and a hallmark of many mental illnesses. How do practicing affective scientists think about emotions, and how do scientific models differ from folk psychology? Is there consensus among researchers about how to define emotion? In other areas of science, everyday understandings of nature slowly evolved into precise, universally recognized definitions and formal quantitative models (e.g. “force” is now defined as a specific relationship between mass and acceleration) that clearly spell out what something is and what it is not. This facilitates generative science and practical applications (e.g. choosing safe and appropriate materials for construction). How close are we to achieving this for emotion? How “loose” are current definitions? This module will highlight seminal work by Charles Darwin, William James, Walter Cannon, and Paul Ekman, as well as recent research from Lisa Feldman Barrett, Alan Fridlund, Jim Russell, Ralph Adolphs, Seth Pollak, Dachner Keltner, Alan Cowen, David Anderson, Joe LeDoux, and many others.*

Required

* H NoE - Chapter 1. What is an emotion?
* Ekman & Cordaro *Emotion Rev* 2011 (pp. 364-365)

Optional

H Keltner et al. *Understanding Emotions* (4th ed.) (Chapter 1: *an easy-to-read* *general overview*)

* The Great Emotion Debate
  + Adolphs, Mlodinow & Barrett *Curr Biol* 2019 *(mini-roundtable discussion)*
  + H Barrett & Satpute *Neurosci Lett* 2019 (*history and philosophy of affective science*)
  + H Gendron & Barrett *Emotion Rev* 2009 (*history and philosophy of affective science*)
  + Adolphs *Soc Cog and Affective Neurosci* 2017 (*contemporary scientific perspectives on emotion; functionalist rebuttal of Barrett’s framework*)
  + H Ekman & Cordaro *Emo Rev* 2011 (*Paul* *Ekman’s perspective on emotion evolved substantially over the course of his long career; this paper summarizes his view as it stood toward the end*)
  + H Cordaro, Fridlund, Keltner & Russell Emo Res (ISRE Newsletter) 2015 (*lively, unflinching scholarly* *debate between prominent supporters and critics of basic emotion theory*)
  + H Crivelli & Fridlund *J Nonverb Behav* 2019 (*scathing critique of basic emotions theory (BET); even if you love BET, there’s a great deal to learn from this well-written and unflinching attack by a former student of Ekman*)
  + H Keltner et al. *J Nonverb Behav 2019 (stirring defense of BET and rebuttal of Crivelli and Fridlund)*
  + Berridge *Frontiers in Psychol* 2018 (*rebuttal of LeDoux’s claims that emotions are synonymous with feelings*)
  + LeDoux *Neuron* 2012 *(argues that emotions are synonymous with feelings and should be reserved for humans)*
  + LeDoux *PNAS* 2014 *(argues that emotions are synonymous with feelings and should be reserved for humans)*
  + Ekman Persp Psychol Sci 2016 *(data-driven assessment of conceptual consensus among affective scientists; published just as LeDoux and Barrett’s critiques were starting to gain traction)*
  + Shackman & Wager *Neurosci Lett* 2019b (pdf pp. 1-4)
* Specific Emotions
  + Fox & Shackman *Neurosci Lett* 2019 (*fear “vs.” anxiety*)
  + Mobbs, Adolphs, Fanselow, Barrett, LeDoux, Ressler & Tye *Nature Neurosci* 2019 *(roundtable discussion of fear)*
  + Harmon-Jones & Harmon-Jones *Handbook of Emotions* (4th ed.) 2016 (Chapter 44: *anger*)
  + Lewis *Handbook of Emotions* (4th ed.) 2016 (Chapter 45: *embarrassment, pride, shame, and guilt*)
  + Rozin et al. *Handbook of Emotions* (4th ed.) 2016 (Chapter 46: *disgust*)

**Module 3. How Are Emotions Expressed and Perceived?**

*Scholars have long conceptualized emotions as the driving force behind coordinated suites of adaptive responses to evolutionarily ancient challenges. If danger is imminent, you become fearful. If a goal is blocked or thwarted, you become angry. Emotions like fear and anger, in turn, are thought to drive stereotyped changes in arousal, physiology, and behavior: clenching your fists, increased blood flow to the extremities, scowling, and so on.* ***Expression.*** *In the first part of this module, we will explore the growing scientific consensus that many of these widely believed claims simply are not true, and touch on new work suggesting that emotion is embodied in a wider array of bodily systems—from the microstructure of our neurons to the flora of our gut—than previously appreciated.* ***Perception.*** *Popular movies like ‘Inside Out’ and TV shows like ‘Lie to Me’ imply the existence of a small number of universal emotional expressions (anger, disgust, fear, happiness, and sadness) that transparently belie our innermost motivations, like the “tells” of a gambler. And, it’s not just Hollywood, in fact, techniques derived from this model have been used by security agencies, judges, and physicians around the world. In the second part of this module, we will examine the scientific credibility of this perspective, and explore the broader consequences of emotion for interpersonal synchrony and social function. This module will highlight seminal work by Charles Darwin and Paul Ekman, as well as recent research from Lisa Feldman Barrett, Ralph Adolphs, Dachner Keltner, Alan Cowen, Bridget Waller, and many others.*

Required

* H NoE Chapter 10. How and why are emotions communicated?
* H NoE Chapter 11. How are emotions physically embodied?

Optional

* H Barrett et al. *Psychol Sci in the Public Interest* 2019 (*focus on the main take-home points; highly recommended!*)
* H Cowen et al. *Psychol Sci in the Public Interest* 2019 (*focus on the main take-home points*)
* Ekman *Perspectives on Psychol Sci* 2016 (*in 2016, Paul Ekman reported the results of a survey of scientists, using the results to argue that there is scientific consensus on the universality of facial expressions of emotion; in just a few short years, it appears that the tide is turning against the strong version of this claim*)
* H Ekman’s Afterword to Darwin’s *The Expression of the Emotions in Man and Animals* 1998 (*Paul Ekman’s personal account of his longstanding interest in Darwin, how he came to study the expression of emotion, and some of the tribulations he faced as an early-career researcher*)
* H NoE Chapter 9. How are emotions embodied in the social world?
* ~~Spunt & Adolphs~~ *~~Neurosci Lett~~* ~~2019 (~~*~~mini-review of emotion perception~~*~~)~~
* Siegel et al. & Barrett *Psychol Bull* 2018 *(meta-analysis of psychophysiological ‘fingerprints’ of emotions)*
* Susskind et al. & Anderson *Nature Neurosci 2008* *(empirical investigation of the sensory benefits of emotional expressions)*
* Aviezer et al. *Science* 2012 *(decoding of faces vs. bodies “in the wild”)*
* Kret et al. Neurosci & Biobehavioral Rev 2020 *(emotional expressions in chimpanzees and other nonhuman primates)*

**Module 4. How Are Emotions Regulated?**

*Emotions are typically unbidden; they feel automatic and reflexive. This raises the question: Can we control our emotions? Beginning with the pioneering work of Richard Lazarus in the 1960s, there is now compelling scientific evidence that we can. We will discuss recent work by James Gross, Kateri McRae, and others to understand the nature and some of the mechanisms by which emotions can be controlled.*

Required

* NoE Chapter 7. How are emotions regulated by context and cognition?

Optional

* McRae & Gross *Emotion* 2020 *(mini-review)*
* Gross *Psychol Inquiry* 2015
* Neuro-Computational Perspectives on Emotion Regulation
  + Buhle … & Ochsner *Cerebral Cortex* 2014
  + Etkin, Büchel & Gross *Nature Rev Neurosci* 2015
  + ~~Langner … & Eickhoff~~ *~~Neurosci Biobehav Rev~~* ~~2018~~
  + ~~Morawetz … & Heekeren~~ *~~Neurosci Biobehav Rev~~* ~~2017~~
  + ~~Picó-Pérez … & Fullana, M. A.~~ *~~Neurosci Biobehav Rev~~* ~~2019~~
  + Morawetz … & Kohn *Neurosci Biobehav Rev* 2020
* Robustly Eliciting and Reliably Assessing Emotion in the Laboratory
  + Rottenberg et al. *Handbook of Emo Elicitation & Assessment* 2007 (*films*)
  + Bradley & Lang *Handbook of Emo Elicitation & Assessment* 2007 (*photographs*)
  + Shackman et al. *Emotion* 2006 (*methodological desiderata*)
  + NoE Epilogue (*methodological desiderata*)

**Module 5. Emotional Traits**

*Children and adults differ in their propensity to experience positive and negative emotions. How do scientists conceptualize emotional traits? Are individual differences in emotional traits practically important? How culturally invariant are they? How do emotional traits unfold across the lifespan—are childhood temperament and adult personality fundamentally different? Are emotional traits fixed and immutable across the lifespan or plastic and malleable? Should we be hopeful or pessimistic about the possibility of positive change and growth? This module will be illustrated using classic and recent work by Rebecca Shiner, Brent Roberts, Avshalom Caspi, Ken Kendler, Paul Costa, Robert McRae, and David Matsumoto. From a methodological perspective, this module will also afford opportunities to discuss the value of meta-analysis and the stability of correlations across samples of varying sizes.*

Required

* NoE - Question 2. How are emotions, mood, and temperament related?
* H NoE - Chapter 3. What are the dimensions and bases for lasting individual differences in emotion?
* H Caspi et al. *Ann Rev Psychol* 2005 (pp. 453-460; *seminal overview of childhood temperament and adult personality*)

Optional

* Zentner & Shiner 2012 (p. 677; *contemporary perspective with a focus on development; highly recommended!*)
* Wikiwand “Big 5” 2018
* H Goldsmith et al. *Child Dev* 1987 (*seminal roundtable discussion of childhood emotional traits*)
* H Shiner et al. *Child Dev* 2012 (*updated roundtable discussion of childhood emotional traits*)
* H Clark & Watson 2008 (*classic perspective on adult emotional traits*)
* Soto & John J Personality & Social Psychol 2016 *(updated Big 5 Inventory)*
* H Block Psychol Bull 1995a *(critical review of the history and discovery of the Big 5/OCEAN)*
* Mottus et al. European J Personality 2020 *(expert workgroup critique of standard Big 5 approaches and models)*

**Module 6. How are Emotional Traits and States Related? What Do Emotional Traits Do? (Part 1)**

*Western philosophers have long distinguished emotional traits from states. What do emotional traits “do?” Are they reducible to average of moment-by-moment emotional states? Can emotional traits influence emotional states in the absence of trait-relevant challenges (at “rest”)? In this module, we will explore contemporary scientific models of the trait-state relationship. This module will feature work by Lee Anna Clark, David Watson, Jerry Suls, Brent Roberts, James Gross, Will Fleeson, Matthias Mehl, Gordon Allport, Charles Spielberger, and Alex Shackman.*

Required

* Shackman et al. *Psychol Bull* 2016 *(‘Trait–State Links Inferred from Self-Report and Behavior;’ pp. 1280-1283)*
* Gross, Sutton & Ketelaar *Personality & Social Psychol Bull* 1998 *(using a controlled lab mood induction to understand T&P; focus on the key take-homes, not the finer methodological details)*

Optional

* Fleeson *JPSP* 2001
* Fleeson *JPSP* 2009
* Matz & Harari *JPSP* 2020 *(using experience sampling to understand T&P)*
* Tackman et al. *Euro J Personality* 2020 *(using EAR technology to understand T&P)*
* Gladstone et al. *Psychol Sci* 2019 *(using digital breadcrumbs to understand T&P)*
* Bolger *JPSP* 1990 *(using daily diaries to understand differential reactions to the MCAT)*
* Thake & Zelenski *Personality & Individual Diffs* 2013 *(using a controlled lab mood induction to understand T&P)*

**Module 7. How are Emotional Traits and States Related? What Do Emotional Traits Do? (Part 2)**

*We will continue to explore what emotional traits “do,” focusing on tonic consequences of emotional traits, and their potential role in actively shaping approach and avoidance behaviors. This integrative (psychology + neurobiology) module will synthesize work by Lee Anna Clark, David Watson, Alex Shackman, Toni Kaczkurkin, Richie Davidson, Ned Kalin, and Andrew Fox.*

Required

* Shackman et al. Psychol Bull 2016 *(‘Trait–State Links Inferred from Self-Report and Behavior;’ pp. 1280-1283)*
* Bolger & Schilling J Personality 1991 *(do not worry about the technical aspects of the analytic approach, just the aims, key results, and significance!)*

Optional

* Watson & Clark *Psychol Bull* 1984
* Suls & Martin *J Personality* 2005
* Fox … & Kalin *PlosOne* 2008 *(please do not worry about the technical details)*
* Kaczkurkin et al. *Biol Psychiatry* 2016 *(please do not worry about the technical details; you are welcome to skip the material focused on developmental and sex differences)*
* Schuyler … & Davidson *Soc Cogn Affect Neurosci* 2012 *(please do not worry about the technical details)*

**Module 8. How are Emotional Traits and States Related? What Do Emotional Traits Do? (Part 3)**

*In what ways might individuals differ in their reactivity to emotional challenges? How do emotional traits influence daily experience? Are emotional traits entirely passive, or can they motivate specific approach and avoidance behaviors? We will explore laboratory and field research by Niall Bolger, Richie Davidson, Kristin Buss, and Jenni Blackford.*

Required

* Davidson *Cog and Emo* 1998 *(please read Sections I and II only)*
* Bolger & Schilling *J Personality* 1991 *(please do not worry about the technical aspects of the analytic approach!)*

Optional

* Shackman et al. *Psychol Bull* 2016

**Module 9. The Interplay of Emotion and Cognition: *Focus on Anxiety, Hypervigilance, and Safety Learning***

*For thousands of years, Western philosophers, scholars, and lay people have conceptualized emotion and cognition as distinct, often warring mental faculties (*“I can’t think straight—I’m too stressed out!”*). But contemporary research suggests an intimate connection between the two, consistent with Darwin’s argument that emotions evolved to enhance long-term reproductive fitness—even if they sometimes thwart momentary function. A major focus of this module will be on recent work to understand the consequences of fear and anxiety for attention (‘hypervigilance’) and Pavlovian safety learning. We will explore recent work by Colin MacLeod, Shmuel Lissek, Danny Pine, Christian Grillon, Michelle Craske, and other investigators.*

Required

* NoE Chapter 8. How do emotion and cognition interact?

Optional

* Hur … & Shackman *Prog in Brain Research* 2019 (Sections 3.0-3.6; *highly recommended!)*
* Grupe & Nitschke *Nature Rev Neurosci* 2013 *(splitting anxiety into its constituent processes; highly recommended!)*
* MacLeod et al. *Ann Rev Clin Psychol* 2019 *(attentional biases)*
* Sep et al. *Neurosci & Biobehavioral Rev* 2019 *(meta-analysis of overgeneralization)*
* Duits et al. *Dep and Anx* 2015 *(meta-analysis of overgeneralization/deficient safety learning)*
* Stout et al. *Sci Reports* 2017 *(impact of threat cues on working memory)*
* Moran *Psychol Bull* 2016 *(impact of stress and anxiety on working memory)*
* ~~Shackman et al.~~ *~~Emotion~~* ~~2006~~

**SECTION II: NEGATIVE AFFECT**

**Module 10. Neuroticism/Negative Emotionality (N/NE)**

*What role does negative affect play in the development of anxiety disorders and depression (often collectively dubbed the ‘emotional disorders’ or ‘internalizing spectrum’)? In this wide-ranging module, we will explore the epidemiology of the emotional disorders (with a special focus on university student populations), briefly review diagnostic criteria, and drill into prospective-longitudinal evidence. A major portion of the module will be devoted to David Barlow’s integrative model of N/NE and the emotional disorders, which has important implications for understanding the etiology and the nosology of mood and anxiety disorders, and serves to reinforce recent efforts focused on transdiagnostic phenomena, including the National Institute of Mental Health’s Research Domain Criteria (RDoC) initiative and the Hierarchical Taxonomy of Psychopathology (HiTOP) framework. We will touch on work by Roman Kotov, Lee Anna Clark, David Watson, Hans Ormel, Bertus Jeronimus, Randy Auerbach, the Global Burden of Disease consortium, and many others.*

Required

* Hur … Shackman *Prog Brain Res* 2019 (Sections 2.1-2.3)
* Barlow et al. *Clin Psychol Sci* 2013

Optional

* *Mood and Anxiety Disorders: Primers and Large-Scale Surveys*
  + Craske et al. *Nature Disease Primers* 2017 (*easy-to-digest primer on anxiety disorders*)
  + Otte et al. *Nature Disease Primers* 2016 (*easy-to-digest primer on depression*)
  + GBD 2019 *The Lancet* 2020 *(WHO global burden of disease; online visualizations at* [*http://ghdx.healthdata.org/gbd-results-tool*](http://ghdx.healthdata.org/gbd-results-tool)*)*
  + Substance Abuse and Mental Health Services Administration 2019 *(large-scale survey of mental illness and addiction among US young adults and youth)*
  + CDC Suicide Update 2018 (*epidemiology of suicide in the US*)
  + Baranne & Fallssard *Child Adolesc Psychiatry Ment Health* 2018 (*clear description of the strengths and limitations of different measures of mortality and morbidity)*
* Conway et al. *Perspectives on Psychol Sci* 2019 (*HiTOP: hierarchical dimensional approaches to mental illness*)
* Clark et al. *Psychol Sci in the Public Interest* 2017 (*comprehensive review of historical and contemporary perspectives on classifying and diagnosing mental illness, with substantial implications for research, clinical practice, public policy, and patient experience; highlights the truth and consequences of different iterations of DSM and RDoC, including the ‘smoke-filled back room’ decisions that led to DSM-5; this is not for the fainthearted, but should be rewarding for those willing to invest the time*)
* *Student Mental Health*
  + ACHA-NCHA 2019 Graduate Students *(national survey of student mental and physical health)*
  + ACHA-NCHA 2019 Undergraduate Students *(national survey of student mental and physical health)*
  + Evans et al. *Nature Biotech* 2018 (*mental health crisis among graduate students*)
  + Woolston *Nature* 2017 (*interviews with graduate students who have battled depression and anxiety*)
  + Sohn *Nature* 2018 (*stories of academics surviving and thriving with depression*)

**Module 11. Childhood Behavioral Inhibition (BI)**

*Some children show elevated levels of ‘behavioral inhibition’ (BI)—shyness, distress, anxiety, and avoidance—in the face of novelty and potential danger. In this module, we will explore the nature of BI, its relationship with other emotional traits, its genetic underpinnings, and its relevance to social anxiety disorder. I will also highlight a prominent nonhuman primate model of early-life anxiety and BI. We will explore the social-learning pathways by which BI in early childhood can evolve into frank psychopathology in adolescence. We will touch on work by Jerry Kagan, Steve Resnick, Jennifer Blackford, Nathan Fox, Danny Pine, Koraly Perez-Edgar, Andrea Chronis-Tuscano, Andrew Fox, Alex Shackman, and Ned Kalin.*

Required

* H Fox et al. *Ann Rev Psychol* 2005 (*seminal review of contemporary perspectives on BI*)

Optional

* Heng *NY Times Magazine* 2009 (*popular science perspective on BI; highly recommended!*)
* NoE Chapter 14. What develops in emotional development? (*broader perspectives on the development of emotional states and traits across the human lifespan; the Goldsmith essay is particularly valuable*)
* Oler, Fox, Shackman, & Kalin 2016 (*mechanistic studies in monkeys and their relevance to understanding BI and social anxiety disorder*)
* Fox & Walker 2015 (*for those hungry to learn more about recent BI research*)
* Kagan et al. *Science* 1988 (*seminal BI study*)
* H Schwartz et al. *Science* 2003 (*seminal BI study*)
* Clauss & Blackford *J Amer Acad Child & Adol Psychiatry* 2013 (*seminal meta-analysis linking BI to social anxiety disorder*)
* Tang et al *PNAS* 2020 *(childhood BI predicts adult personality and internalizing symptoms)*

**SECTION III: THE BRAIN**

**Module 12. The Brain: *Foundations in Neuroscience (Part 1)***

*Welcome to your brain! Across modules 12 and 13, we will explore the structure and function of the central nervous system (CNS) at the molecular, cellular, and systems levels. We will cover the cellular building blocks of the CNS (neurons and glia), basic aspects of neuronal communication (synaptic transmission and neurotransmitter systems), sensory and motor systems, and fundamental principles of CNS organization (maps and distributed/bi-directional circuits). Throughout these modules, we will discuss classic, as well as contemporary perspectives.*

Required

* None

Optional

* Kandel et al. *Principles of Neural Science* (5th edition) (Chapter 16; *written by David Amaral*, *provides a high-level summary of the organizing principles of perception and action*)
* Purves et al. *Neuroscience* (6th edition) (Chapters 5, 6, 9, 12)
* Kandel et al. *Principles of Neural Science* (5th edition) (Chapters 2, 4, 7, 15, and 46)
* Mai, Majtanik & Paxinos 2015 (*human brain atlas*; see also <https://scalablebrainatlas.incf.org>, <https://tinyurl.com/abiHumanAtlas>, & <http://braininfo.rprc.washington.edu/aboutBrainInfo.aspx>)
* ten Donkelaar, Tzourio-Mazoyer & Mai *Frontiers in Neuroanat* 2018 (*consensus anatomical terms*)

**Module 13. The Brain: *Foundations in Neuroscience (Part 2)***

Required

* None

Optional

* Kandel et al. *Principles of Neural Science* (5th edition) (Chapter 16; *written by David Amaral*, *provides a high-level summary of the organizing principles of perception and action*)
* Purves et al. *Neuroscience* (6th edition) (Chapters 5, 6, 9, 12)
* Kandel et al. *Principles of Neural Science* (5th edition) (Chapters 2, 4, 7, 15, and 46)
* Mai, Majtanik & Paxinos 2015 (*human brain atlas*; see also <https://scalablebrainatlas.incf.org>, <https://tinyurl.com/abiHumanAtlas>, & <http://braininfo.rprc.washington.edu/aboutBrainInfo.aspx>)
* ten Donkelaar, Tzourio-Mazoyer & Mai *Frontiers in Neuroanat* 2018 (*consensus anatomical terms*)

**SECTION IV: GENETICS: *FOUNDATIONS AND APPLICATIONS TO EMOTION***

**Module 14. Part 1: *Heritability and Behavioral Genetics***

*Family and twin studies provide overwhelming evidence that emotional traits are heritable. Parents who are prone to negative affect are more likely to have children with similar emotional biases. Likewise, identical twins tend to be more similar in their emotions than fraternal twins. But what are the implications of this familial association? Does it imply genetic determinism? Parents and caregivers, teachers and coaches strive to cultivate healthy emotional development in children. Is this a futile exercise? Are our emotional fates sealed at conception? In this module, we will explore common mis-conceptions about the scientific and practical significance of heritability, key differences between “heritability” and “genes,” and the challenges of dissecting nature from nurture, all with a focus on emotional traits. A major focus of this module will be on foundational knowledge in behavioral genetics. We will then apply this to understanding the nature and nurture of emotional traits. This module incorporates foundational work by Ned Block and Peter Visscher.*

Required

* Wikiwand “Genetics” 2018 *('nuts-and-bolts' summary of heritability and genetics)*
* Fisher Twitter 2018 *(heritability in 5 easy tweets)*
* H Harden *Annual Review of Psychol* 2021 (*accessible overview*)

Optional

* H Visscher et al. *Nature Rev Genetics* 2008 *(seminal review of foundations in heritability)*
* Kendler *Molec Psychiatry 2013* *(entertaining essay on genetics, free will, chance, and mental illness)*
* Plomin et al. *Perspectives on Psychol Sci* 2016
* Sauce & Matzel *Psychol Bull* 2018 *(very readable review focused on the paradox of high malleability in the face of high heritability in the context of IQ; highly recommended)*

**Module 15. Part 2: *Molecular Genetics and GWAS***

*What mechanisms underlie stable individual differences in emotion? In this module, I will provide a broad overview of molecular genetics and genome-wide association studies (GWAS), with a focus on the strengths and limitations of this approach for understanding the molecular pathways associated with emotional traits. We will also discuss several recently published large-scale GWAS of emotional traits. The central focus of this module will be foundational knowledge in molecular genetics. In the final section of this module, I will highlight seminal work by Terrie Moffit and Avshalom Caspi suggesting that specific genetic variants, so-called “candidate genes,” interact with experience (G\*E) to jointly determine emotional traits and emotional disorders.*

Required

* H Harden *Annual Review of Psychol* 2021 (*accessible overview*)
  + *You may find these Glossaries useful*
    - Briley et al *Euro J Personality* 2018
    - NCBI Genetics Glossary 2018
* Resnick *Vox* 2018 *(popular science story on the strengths, weaknesses, and potential applications of GWAS to medicine and drug discovery)*

Optional

* Tam et al. *Nature Rev Genetics* 2019 (*GWAS foundations: basic principles, strengths, and limitations; do not worry about the technical details!*)
* Murray et al. *JAMA Psychiatry* 2020 *(digestible primer on the application of polygenic risk scores to mental illness)*
* Wray et al. *JAMA Psychiatry* 2020 *(digestible primer on the application of polygenic risk scores to medicine)*
* Duncan et al. *Neuropsychopharm* 2019 (*highly digestible summary of evidence that candidate gene studies are obsolete*)
* Reimers … & Kendler *Behav Genet* 2019 (*thoughtful take on the prospects for GWAS*)
* HSullivan et al. *Amer J Psychiatry* 2018 *(moderately technical summary of psychiatric genetics, from its historical origins in mid-20th C twin studies of schizophrenia to contemporary GWAS consortia, and onward with a description of the most fruitful avenues for future research; do not worry about the technical details, just the overall gist and most important take-home points)*
* Sullivan et al. *Biol Psychiatry* 2017 (*short, entertaining commentary on the demise of candidate gene studies*)
* *Personal Stories and Real-World Impact*
  + Richards *The Atlantic* 2018 (*genetic counselors are left scrambling by the rapidly rising popularity of direct-to-consumer genetic tests*)
  + Pinker *NY Times Magazine* 2009 *(science writer’s personal story about getting genetic testing)*
  + Mukherjee *New Yorker* 2016b *(science writer’s story about his family and psychiatric genetics)*
  + Couzin-Frankel *Science* 2014 *(science writer’s personal story about getting genetic testing for familial breast cancer)*

**Module 16. Part 3: *Neurogenetics and Epigenetics***

*We will continue our discussion of Moffitt and Caspi’s early work to understand gene-environment interactions, but with a focus on more recent data questioning their conclusions. We will explore efforts by Ahmad Hariri and his students to promote ‘neurogenetic’’ approaches—which combine brain imaging with candidate gene assays—from the vantage of recent research. More broadly, we will collectively tackle several fundamental questions: Can genetics research provide insights into the molecular mechanisms that underpin stable individual differences in brain structure and function? Can it explain why my amygdala is more reactive than yours? How malleable are emotional traits? How do persistent changes in emotional traits get under the skin and alter brain function? In this module, we will explore several high-profile meta-analyses of the literature, as well as work by Ned Kalin, Michael Meaney, and Kerry Ressler. In short, we will explore foundational knowledge in neuro- and epigenetics, and apply that to understanding the intergenerational transmission of emotional traits.*

Required

* Border et al *American J Psychiatry* 2019 *(large-scale failure to detect significant candidate gene-environment interactions in depression; do not worry about the approach, just focus on the aims, key results, and significance)*
* Meaney *Ann Rev Neurosci* 2001 *(seminal review; do not worry about the technical details)*
  + ***You may find the Glossaries useful***
    - Briley et al. *Euro J Personality* 2018
    - NCBI Genetics Glossary 2018
* Hughes *Nature* 2014 *(brief non-technical commentary on Dias & Ressler ‘14)*

Optional

* Jawaid, Jehle & Mansuy *Trends in Genetics* 2020 (*accessible* *introduction to* *recent human studies of intergenerational transmission of acquired epigenetic programming*)
* Jawaid & Mansuy *Curr Opinion Behav Sci* 2019 (*accessible* *introduction to* *recent animal studies of intergenerational transmission of acquired epigenetic programming*)
* Bošković & Rando *Ann Rev of Genetics* 2018 (*technical and more skeptical review of non-genomic inheritance*)
* Chan, Nugent & Bale *Biol Psychiatry* 2018 (*technical review of non-genomic inheritance*)
* Dias & Ressler *Nature Neurosci* 2014 *(do not worry about the technical details)*
* Grabitz et al. *J Cog Neurosci* 2017 (*conceptual and methodological issues affecting human neurogenetic studies*)
* Mitchell *Euro J Neurosci* 2018 *(short, very readable introduction to neurogenetics with a focus on challenges, opportunities, and methodological recommendations)*
* Mukherjee *New Yorker* 2016b *(science writer’s story about his family, twins, and epigenetics)*

**SECTION V: THE EMOTIONAL BRAIN**—***BASIC AND CLINICAL AFFECTIVE NEUROSCIENCE***

**Module 17. The Human Brain and Emotion: *Significance and* *Methodological Foundations***

*~~What is the ‘added value’ of studying the brain for understanding the nature of emotion? Is neuroscientific research a necessary step to understanding the nature of emotion?~~ What are the key strengths and limitations of widely used fMRI and EEG/ERP techniques?* *What can and can’t we do using these approaches?* *What’s lurking inside a single “voxel” of imaging data, and how should we think about that in light of recent research in animals?*

Required

* ~~NoE Chapter 4. What is the added value of studying the brain for understanding emotion?~~
* Norris, Coan & Johnstone *Handbook of Emo Elicitation & Assessment* 2007 (*imaging emotion*)
* Shackman & Fox *Trends in the Cog Sci* 2018 (*desiderata for the neuroscientific study of emotional traits and disorders*) (*you only need to read Box 1*)

Optional

* Hur et al. *Behavioral and Brain Sci* 2019 (*value of neuroscience for understanding emotional disorders*)
* *Neuroimaging/fMRI*
  + Logothetis *Nature* 2008 (*seminal overview of the conceptual limitations of* *fMRI*)
  + Slides available at <http://www.fmri4newbies.com>
  + <https://miykael.github.io/nipype-beginner-s-guide/neuroimaging.html>
* *Building Better Brain-Based Markers of Emotion*
  + Woo … & Wager *Nature Neurosci* 2017 (*building better brain-based biomarkers of psychopathology*)
  + Kragel … & Wager *Neuron* 2018 (*building better brain-based measures of emotion*)

**Module 18. The Neurobiology of Negative Affect: *Focus on the Amygdala***

*The neural systems underlying fear and anxiety are complex and distributed across a number of brain regions. In this module, we will explore work to understand the most intensively scrutinized of these regions, the amygdala. The major focus of this module will be on basic science perspectives, including pioneering work in rats by Joe LeDoux, Mike Davis, and the Blanchards; recent perturbation and imaging studies in rodents and monkeys; as well as imaging, lesion, and microstimulation research in humans. A major focus of the module will be on the fascinating case of Patient S.M., a woman with selective damage to the amygdala. In the final section of this module, we will briefly explore the most important implications of this body of research for understanding emotional disorders. We will touch on work by Alex Shackman, Andrew Fox, Ned Kalin, Justin Feinstein, Ralph Adolphs, Dan Tranel, Antoine Bechara, the Damasios, Cory Inman, Kate McLaughlin, ~~Amit Etkin, Tor Wager, Kate McLaughlin,~~ Johnna Swartz, Ahmad Hariri, Martin Paulus, and Murray Stein.*

Required

* Hur et al. Prog Brain Res 2019 (Sections 2.4-2.7)
* Feinstein et al. *Curr Biol* 2011 *(Patient SM)*

Optional

* Adolphs *Annals NY Acad Sci* 2010
* Fox & Shackman *Neurosci Lett* 2019 (mini-*review of the extended amygdala’s contributions to fear and anxiety, including recent work in humans, monkeys, rodents*)
* Feinstein et al. 2016 (*a more detailed description of Patient SM, including her real-world trials and tribulations*)
* H Davis et al. *Neuropsychopharm* 2010 (*seminal review*)
* H Davis & Whalen *Molec Psychiatry* 2001 (*seminal review*)
* Rodgers Encyclopedia of Behavioral Neuroscience 2010 *(very readable, thoughtful critique of widely used animal models of fear and anxiety)*

**Module 19. The Neurobiology of Positive Affect and Reward (Part 1): *Wanting, Liking, and Depression***

*The popular media suggests that the neurotransmitter dopamine underlies pleasure, euphoria, and even sensations of yumminess. But affective neuroscience reveals a more complex and nuanced story about the neural underpinnings of positive affect and reward. The major focus of this module is on the basic neuroscience of wanting and liking, beginning with James Olds’ pioneering work on self-stimulation in the 1950s and continuing to recent work by Kent Berridge, Terry Robinson, Brian Knutson, Argyris Stringaris, and many others. In addition to invasive manipulations in animal models, we will explore work leveraging neurofeedback and pharmaco-imaging ~~(drug challenge + fMRI)~~approaches in humans. In the final section, we will briefly discuss the implications of this body of basic research for understanding anhedonia, a cardinal symptom of major depression that features prominently in a number of other psychiatric disorders, including schizophrenia. We will touch on assays developed by Michael Treadway, David Zald, and Diego Pizzagalli, recent meta-analyses, and Big-N imaging research—including prospective-longitudinal work. Time permitting, we will also touch on work leveraging acute drug manipulations (e.g. ketamine) and deep brain stimulation.*

Required

* Berridge & Kringelbach *Neuron* 2015 (*seminal recent review*)

Optional

* Fleming *Intell Life Magazine* 2015 (*journalist hangs out with Kent Berridge for a week; discusses mindfulness, HH the Dalai Lama, scientific progress, and more!*)
* H Berridge & Robinson *Brain Res Rev* 1998 (*seminal early review*)
* H Berridge & Robinson *Amer Psychol* 2016 (*updated mini-review*)
* Zald & Treadway *Ann Review Clin Psychol* 2017 (*comprehensive recent review, with a focus on human depression research*)
* Husain & Roiser *Nature Rev Neurosci* 2018 (*comprehensive recent review, with a focus on animal models of anhedonia*)
* Rizvi et al. *Neurosci & Biobehav Rev* 2016 *(comprehensive review of paper-and-pencil and behavioral measures of anhedonia)*
* Khazanov & Ruscio *Psychol Bull* 2016 *(meta-analysis of E/PE and depression)*
* Halahakoon et al. *JAMA Psychiatry* 2020 *(meta-analysis of reward tasks and depression)*
* Oldham et al. *Hum Brain Mapp* 2018 *(meta-analysis of imaging studies of reward tasks)*
* Nielsen … & Stringaris *Biol Psychiatry* 2020 *(VS/NAcc and depression)*

**Module 20. The Neurobiology of Positive Affect and Reward (Part 2): *Temptation, Craving, and Addiction***

*Temptation and craving are common. Why is it often so hard to resist immediate gratification? Here, we will continue to explore the neurobiology of reward and positive affect, focusing on the interplay between ventral striatal/accumbens circuits involved in craving and approach (“*mmmm, doughnuts!”) *and prefrontal circuits involved in self-control* (“arrrggh, diet!”). *Like the prior module, the major focus will on basic science, not clinical implications.* *We will explore innovative research from Todd Heatherton and colleagues that integrates fMRI measures of brain function with experience-sampling (“EMA/ESM”) and other measures of motivated behavior collected in the midst of daily life. We will discuss the florid impulse control problems (e.g. hyper-sexuality) that afflict some patients with Parkinson’s Disorder, and what has been learned about the underlying neurochemistry using positron emission tomography (PET).* *We will discuss a range of work—including neuroimaging research by Todd Hare and Colin Camerer and classic studies of Phineas Gage and Damasio’s Patient EVR/Elliot—suggesting that the orbitofrontal cortex plays a key role in adjudicating conflicts between the devil on one shoulder (temptation) and the angel on the other (self-control). In the final section, we will briefly explore the implications of this body of basic research for understanding substance abuse and other impulse control disorders. Using the tragic story of actor Philip Seymour Hoffman as a touchstone, we will discuss Berridge and Robinson’s Incentive Sensitization Theory, which attempts to address why users remain vulnerable to relapse years after quitting, long after the symptoms of acute withdrawal have subsided.*

Required

* Berridge & Robinson *American Psychol* 2016 *(very readable mini-review)*

Optional

* Lopez et al. *Psychol Sci* 2014 *(please do not worry about the technical aspects of fMRI or experience sampling)*
* Hare et al. Sci 2009 *(please do not worry about any of the more technical aspects of this complex neuroeconomics study)*
* Substance Abuse and Mental Health Services Administration 2019 *(large-scale survey of mental illness and addiction among US young adults and youth)*
* Yong *The Atlantic* 2016 *(brief popular press piece on the neurobiology of impulsivity and risk aversion)*

**Module 21. The Brain and Emotion: *Key* *Conceptual Lessons and Future Challenges***

*Here, we will set aside specific areas of research and reflect more broadly on how emotions (and other psychological constructs) are organized in the brain. Is the amygdala really a “fear center?” Is the nucleus accumbens a reward center? Does it make sense to talk about the “limbic system” or the “emotional brain” or is all of the brain involved in processing and responding to emotional challenges? What is the ‘added value’ of studying the brain for understanding the nature of emotion? Is neuroscientific research a necessary or useful step to understanding emotion? We will explore contemporary scientific perspectives, illustrated by case examples from the recent literature, including rodent and human research linking the amygdala to craving, approach, and positive affect, and the accumbens to desire and dread; evidence that the amygdala is not necessary for experiencing terror; and work harnessing machine learning techniques to identify the brain regions most closely associated with subjective feelings of negative affect (Spoiler: it ain’t just the amygdala!). We will touch on work by Justin Feinstein, Ralph Adolphs, the Damasios, Kent Berridge, Tor Wager, Luke Chang, Luiz Pessoa, Joe LeDoux, Bob Levenson, Tom Johnstone, Lisa Feldman Barrett, and others.*

Required

* NoE Chapter 4. What is the added value of studying the brain for understanding emotion?
* NoE Chapter 5. How are emotions organized in the brain?

Optional

* NoE Epilogue (pp. 403-411 only; *highly recommended*)
* Berridge *Nature Rev Neurosci* 2019
* Feinstein et al. *Nature Neurosci* 2013
* Chang … & Wager *PlosOne* 2015
* Headley … & Pare *Neuron* 2019
* Pessoa & Adolphs *Nature Rev Neurosci* 2010

1. ‘H’ superscript indicates reading assignments relevant to the APA ‘History & Systems’ requirements. [↑](#footnote-ref-2)