The Neurobiology of Food Intake and Overeating (PSY 333)

Overview: It is clear that as a species we are experiencing tremendous difficulty in our relationship with food. Food intake can be regulated by precise feeding mechanisms that have evolved allowing for the survival of the human race. However, the environmental conditions our ancestors dealt with differ drastically than those presented in today's society, where obesity and its physical comorbidities (e.g., diabetes, heart disease) continue to place a burden on society in general, and the individual in particular.

Instructional Objectives: This undergraduate course will examine the underlying basis of energy (food) intake, its expenditure; learned and unlearned physiological and neurological mechanisms that drive food intake and overeating, and vulnerabilities to obesity. Information will be presented form a range of disciplines including psychology, neuroscience and medicine. The overall goal of the course is to consolidate our understanding of what drives us to eat and why what we eat, and where we eat it is so important. Please be aware that this course deals with a lot of the **biology** underlying how the brain and body influence eating behaviors. If you don't like biology very much, this may not be the course for you.

Time and Location:

8:30-9:50 AM on Tuesday and Thursday throughout Spring 2021. Instruction requires interaction online at scheduled meeting times. This synchronous class has required attendance and includes deadlines for completion of learning objectives and testing.

Our class will meet via the following zoom link: https://msu.zoom.us/j/96071147055
Meeting ID: 960 7114 7055. **Passcode**: PSY/NEU333

Office hours on Fridays 9:00-10:00 AM: https://msu.zoom.us/j/97759330531**
Meeting ID: 977 5933 0531. **Passcode**: officehour

Top Hat

We will be using Top Hat Pro (www.tophat.com) for class participation and discussion. You will be able to submit answers to in-class questions using Apple or Android smartphones and tablets, laptops, or through text message. For instructions on how to create a Top Hat account and enrol in our Top Hat Pro course, please refer to the invitation sent to your MSU email address or consult Top Hat's Getting Started Guide (https://bit.ly/31TGMlw).

To connect to Top Hat complete the following:

- Go to https://app.tophat.com/register/student
- Click "Search by school" and input the name of our school
- Search for our course with the following join code: **925410**

If a paid subscription is required, it will be listed at checkout when you enrol in Top Hat Pro course. Should you require assistance with Top Hat at any time please contact their Support Team directly by way of email (support@tophat.com), the in-app support button, or by calling 1-888-663-5491. Specific user information may be required by their technical support team when troubleshooting issues.

Instructor and Office Hours

Dr. Alex Johnson
Office: 205 Giltner Hall
Office hours: Friday 9:00-10:00AM (or by appointment)
E-mail: awj@msu.edu

Grading: Grades will be determined from **five** sources:

(i) **Module quizzes** (40%): Three Midterm Exams: (**50 questions/exam**). These exams will cover material dealt with during lecture periods (lectures, movies, discussion, etc) or contained in the readings. They will be multiple-choice tests. Bring your student ID with you to the midterms. **Be on time:** No exam will be given if you are late and a completed exam has already been turned in.

(ii) **Class participation** (10%): During each class, students will receive on average four questions based on the material being discussed. The overall grade for class participation will be split between the student responding to the question and a correct response for that question.

(iii) **In class symposium** (25%): Towards the end of the semester, there will be an in-class symposium which will include video presentations and topical contemporary questions on the study of obesity and its impact on our society. The questions will be based on material being presented and information that will have been previously discussed in class. This will be graded through the students' use of the 'Discussion' function on Top Hat.

(iv) **Final exam** (20%): There will be a final exam that covers material dealt throughout the semester. It will be the same format as the midterms.

(v) **Class attendance** (5%): Attendance will be monitored throughout the semester; many classes will have overlapping themes, which are designed to help with conceptualizing the topics discussed. Students who attend less than 90% (without genuine mitigating circumstances) of the classes will receive a 5% reduction in their overall grade.

Grades will be assigned on the following scale:
90-100% = 4.0 75-79% = 2.5 60-64% = 1.0
85-89% = 3.5 70-74% = 2.0 < 60% = 0
80-84% = 3.0 65-69% = 1.5

Questions and Exam Preparation

If you are having difficulty with the material, have questions or other concerns, you may come to office hours or make an appointment. You are encouraged to ask questions; I am available to help you learn!

Make-up Exams

Make-up exams will **only be given in extreme cases such as**: 1) a documented serious medical or family emergency, or 2) a documented scheduled conflict, such as a religious holiday or required participation in a university-sanctioned event. No makeup exams will be given unless you have a valid, documented excuse (e.g., a note from the dean, a note from your doctor recommending that you not attend class). If you cannot get a note or if your excuse involves something that is personal and that you want to keep private, you must get a note from the Dean. If you cannot take the exam because of a university-scheduled event (e.g., a commitment for a sports team), a religious holiday, or some other acceptable event that you could have been foreseen, you must notify the instructor at least one week before the exam. If you cannot take the exam because of a sudden illness or because of a family emergency, you must notify Dr. Johnson **by the end of the day of the exam.** Absence from an exam for any other reason will result in a grade of 0 for that exam.

There are no make-up exams without a written valid excuse AND permission from the instructor. **Permission must be obtained immediately before or after the missed exam (within 1 day)**.

Academic Honesty

Article 2.3.3 of the Academic Freedom Report states that "The student shares with the faculty the responsibility for maintaining the integrity of scholarship, grades, and professional standards." In addition, the Department of Psychology adheres to the policies on academic honesty as specified in General Student Regulations 1.0, *Protection of Scholarship and Grades;* the all-University Policy on *Integrity of Scholarship and Grades*; and Ordinance 17.00, Examinations. (See *Spartan Life: Student Handbook and Resource Guide* (http://www.vps.msu.edu/SpLife/index.htm) and/or the MSU Web site: http://www.msu.edu.). At MSU, General Student Regulation 1.00 states in part that “no student shall claim or submit the academic work of another as one’s own.” (For the complete regulation, see Protection of Scholarship and Grades.) You are expected to complete all course assignments, including homework, lab work, quizzes, tests and exams, without assistance from any source. You may not assist anyone or be assisted by anyone on an exam, and you may not use the text or any notes during an exam. Your written work must be your own and you are not authorized to use the www.allmsu.com web site to complete any course work in this course. Any student caught cheating, plagiarizing or otherwise violating the MSU academic integrity policy may receive the maximum punishment, including a grade of 0.0 in the course.

Classroom Behavior

Although classes will be taken virtually during this semester, the same expectations apply as regular class settings. This includes: Students are expected to put away all distractions before class begins, and turn off cell phones etc. It is not appropriate to answer phone calls or text message during lecture. If you arrive late or leave early, plan to sit near the back and by an aisle to minimize the disruption to others. Please respect your instructors and fellow students by turning off unnecessary electronic communication devices during class. Distracting activities such as instant messaging, writing e-mail, social networking, or playing games is **strictly prohibited during class time.** These behaviors are disruptive and are not conducive to the learning process.

Accommodations for Disabilities

Students with disabilities should contact the Resource Center for Persons with Disabilities (RCPD) to establish clear and reasonable accommodations. For an appointment with a counselor, call 353-9642 (voice) or 355-1293 (TTY). If you require testing accommodations as specified from RCPD, contact your TA with the appropriate paperwork at least one week prior to the exam date.

Additional information

Reading and other material: Relevant manuscripts, commentaries, opinion articles and reviews will be made available electronically (suggested material can be found below). These readings have been purposely chosen due to their relevance to the material discussed in class. During class you will also be shown carefully selected videos on topics relevant to the study of food intake and overeating.

Suggested reading material

Module 1 Reading: Taste, flavor and experience

Scott, K. K. (2005). Taste recognition: food for thought. Neuron, 48(3), 455–464.

Brunstrom, J. M., & Mitchell, G. L. (2007). Flavor-nutrient learning in restrained and unrestrained eaters. Physiology & Behavior, 90(1), 133–141.

Berridge, K. C., & Kringelbach, M. L. (2015). Pleasure Systems in the Brain. Neuron, 86(3), 646–664.

Teff, K. L., Mattes, R. D., Engelman, K., & Mattern, J. (1993). Cephalic-phase insulin in obese and normal-weight men: relation to postprandial insulin. Metabolism-Clinical and Experimental, 42(12), 1600–1608.

Module 2 Reading: Traditional Feeding centers

Balagura & Davenport (1970). Feeding patterns of normal and ventromedial hypothalamic lesioned male and female rats. Journal of Comparative and Physiological Psychology.

71(3), 357-364.

Mogenson, G. J., & Stevenson, J. A. F. (1966). Drinking and self-stimulation with electrical stimulation of the lateral hypothalamus. Physiology & Behavior, 1(3), 251–IN9.

Module 3 Reading: Orexigenic gut peptide—ghrelin

Ariyasu, H. (2001). Stomach Is a Major Source of Circulating Ghrelin, and Feeding State Determines Plasma Ghrelin-Like Immunoreactivity Levels in Humans. Diabetes, 86(10), 4753–4758.

Cummings, D. E., Purnell, J. Q., Frayo, R. S., Schmidova, K., Wisse, B. E., & Weigle, D. S. (2001). A preprandial rise in plasma ghrelin levels suggests a role in meal initiation in humans. Diabetes, 50(8), 1714-1719.

Module 4 Reading: Anorexigenic gut peptides—insulin and leptin

Le Roux, C. W., Batterham, R. L., Aylwin, S. J. B., Patterson, M., Borg, C. M., Wynne, K. J. & Bloom, S. R. (2006). Attenuated peptide YY release in obese subjects is associated with reduced satiety. Endocrinology, 147(1), 3-8.

Lieverse, R. J., Jansen, J. B., Masclee, A. A., & Lamers, C. B. (1995). Satiety effects of a physiological dose of cholecystokinin in humans. *Gut*, *36*(2), 176-179.

Kahn, S. E., Hull, R. L., & Utzschneider, K. M. (2006). Mechanisms linking obesity to insulin resistance and type 2 diabetes. Nature, 444(7121), 840–846.

Ruhl et al., (2007). Body mass index and serum leptin concentration independently estimate percentage body fat in older adults. The American journal of clinical nutrition, 85(4), 1121-1126.

Module 5: Contemporary feeding mechanisms

Arora, S., Anubhuti. (2006). Role of neuropeptides in appetite regulation and obesity – A review. *Neuropeptides*, *40*(6), 375–401.

Module 6: Brain reward and stress centers

Harbuz, M. S., & Lightman, S. L. (1992). Stress and the hypothalamo-pituitary-adrenal axis: acute, chronic and immunological activation. Journal of Endocrinology, 134(3), 327-339.

Wyvell, C. L., & Berridge, K. C. (2000). Intra-accumbens amphetamine increases the conditioned incentive salience of sucrose reward: enhancement of reward “wanting” without enhanced “liking” or response reinforcement. Journal of Neuroscience, 20(21), 8122-8130.

Module 7: Neuropeptide reward and stress feeding

Malik, S., McGlone, F., Bedrossian, D., & Dagher, A. (2008). Ghrelin Modulates Brain Activity in Areas that Control Appetitive Behavior. Cell Metabolism, 7(5), 400–409.

Abizaid, A., Liu, Z.-W., Andrews, Z. B., Shanabrough, M., Borok, E., Elsworth, J. D., et al. (2006). Ghrelin modulates the activity and synaptic input organization of midbrain dopamine neurons while promoting appetite. *Journal of Clinical Investigation*, *116*(12), 3229–3239.

Johnson, A. W. (2013). Eating beyond metabolic need: how environmental cues influence feeding behavior. Trends in Neurosciences, 36(2), 101-109.

Module 8 Reading: Learning, cognition and obesity

Watson, P., Wiers, R. W., Hommel, B., & De Wit, S. (2014). Working for food you don't desire. Cues interfere with goal-directed food-seeking. *Appetite*, *79*, 139-148.

Siegel, S. (1975). Conditioning insulin effects. Journal of Comparative and Physiological Psychology, 89(3), 189.

Module 9 Reading: Genetics of obesity

Bouchard, C., Tremblay, A., Després, J.-P., Nadeau, A., Lupien, P. J., Thériault, G., et al. (1990). The Response to Long-Term Overfeeding in Identical Twins. The New England Journal of Medicine, 322(21), 1477–1482.

O'Rahilly, S., & Farooqi, I. S. (2006). Genetics of obesity. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, *361*(1471), 1095–1105.

Module 10 Reading: Epigenetics

Heijmans, B. T., Tobi, E. W., Stein, A. D., Putter, H., Blauw, G. J., Susser, E. S., et al. (2008). Persistent epigenetic differences associated with prenatal exposure to famine in humans. Proceedings of the National Academy of Sciences, 105(44), 17046–17049.

Module 11 Reading: Obesogenic environment

M. Ng, T. Fleming, M. Robinson, B. Thomson, N. Graetz, C. Margono, et al., Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013, Lancet 384 (2014) 766–781.

Drewnowski, A. (2004). Obesity and the food environment. American Journal of Preventative Medicine, 27(3), 154–162.

Week beginning	Course topic(s)	Activities
1/11/21	- Reading week for introduction to material	- No online classes, see D2L for reading material
1/18/21	- Introduction to syllabus - Taste cells and receptors - Taste, preferences and aversions	- Module 1 reading material
1/25/21	- Taste, preferences and aversions - Taste hedonics and 'liking'	- Module 1 reading material **- No class 1/28/21**
2/1/21	- Taste hedonics and 'liking' - Taste, brain and gut interactions	- Module 1 reading material
2/8/21	- Traditional feeding centers	- Module 2 reading material - **Exam 1: 2/11/21** - Module 3 reading material
2/15/21	- Ghrelin: The sole feeding signal in body - Leptin and insulin: Food intake inhibitors	- Module 3 reading material - Module 4 reading material
2/22/21	- Leptin and insulin: Food intake inhibitors - Neuropeptide hypothalamic feeding	- Module 4 reading material - Module 5 reading material
3/1/21	- Brain mechanisms of stress and reward - Neuropeptide reward and stress-evoked feeding	- Module 6 reading material - Module 7 reading material **- Guest lecture 3/4/21**
3/8/21	- Learning and its influence on feeding behaviors	**- No class 10/22/19** - Module 8 reading material
3/15/21	- Cognitive disruptions in obesity	**- Exam 2: 3/18/21** - Module 8 reading material
3/22/21	- Evolution and heritability - Why are thin people not fat	- Module 9 reading material - Video
3/29/21	- Genetic polymorphisms and human obesity genes - Epigenetics and obesity	- Module 10 reading material Video
4/5/21	- The obesogenic environment: What we eat and where we eat it - The obesogenic environment: How we eat and why it's a problem	- Module 11 reading material
4/12/21	- How to treat the obesity epidemic	- Module 11 reading material **- Exam 3: 4/15/21**
4/19/21	- The obesity symposium	- Videos, questions and discussion forum

4/26/21	- Final Exam	**- Final Exam: 4/27/21 @ 7:45AM**