

**PSYC G4492 -- Psychobiology of Stress
Fall 2012**

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I. Bulletin description

PSYC G4492 -- Psychobiology of Stress (seminar).

4 pts. Thursdays 2:10 – 4 PM in 200c Schermerhorn Hall

Prerequisites: PSYC W1010 or 2450 or equivalent, plus permission of the instructor. This seminar explores factors that modulate stress reactivity and the impact of stress on the structure and function of the nervous system and behavior. Topics include how developmental stage, sex/gender, time of day, and experience influence how an organism responds to stress at endocrinological, neurobiological, and behavioral levels.

II. Full course description:

Though we all experience stress, not many people appreciate the myriad factors that influence the way we respond to stressors and what this ultimately means to our physiology and behavior. For instance, how old we are, our sex, whether it's morning or evening, and our previous experiences with stressors all interact to affect how we respond to stressors both physiologically and behaviorally. This seminar will examine each of these factors, as well as how stress impacts the structure and function of the nervous system. The course will begin with an in-depth examination of the neuroendocrine axis that mediates the hormonal stress response, and move onto weekly discussions, based on assigned journal articles, that highlight how different parameters modify the ways we respond to stress. The final weeks will be devoted to exploring how stress relates to the emerging fields of psychoneuroimmunology and epigenetics. In addition to these discussions and readings, each student will be required to write a substantive literature review on a topic related to stress and neurobehavioral function.

III. Rationale for giving the course:

PSYC G4492 is an advanced seminar, designed particularly for graduate students, for advanced undergraduates who are majoring in Psychology or in Neuroscience and Behavior, and for students participating in the Psychology Postbac Certificate Program. These students will have priority in registration, followed by junior majors followed by non-majors.

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The seminar will be well suited to students who have completed at least one neuroscience course beyond W1001, such as W1010 (Mind, Brain, and Behavior) or W2450 (Behavioral Neuroscience). It will help ameliorate a serious shortage of advanced seminars giving students opportunities to develop their oral and written presentation skills.

Students who complete this seminar will learn to: 1) demonstrate experimental methods used in psychobiological stress research; 2) demonstrate the impact of stress and stress-related hormones on the structure and function of the nervous system and behavior; 3) critically read and interpret the primary research literature and discuss the strengths and weaknesses of experimental results; 4) conduct literature searches and synthesize these searches into a comprehensive literature review; and 5) write a scientific literature review.

It fulfills the following degree requirements:

- For Psychology Graduate Students, PSYC **G4492** will apply toward the “two seriously graded seminars” requirement of the Master’s degree.
- For the Psychology major or concentration in the College and in G. S., for the Psychology minor in Engineering, and for the Psychology Postbac Certificate, **G4492** meets the Group II (Psychobiology and Neuroscience) distribution requirement.
- For the Neuroscience and Behavior joint major, **G4492** will fulfill the 5th Psychology requirement: “one advanced psychology seminar from a list approved by the Psychology Department advisor to the program.”
- For non-majors in the College and GS, **G4492** – by virtue of its numbering in the 4400's--will count as one term of the natural science requirement, provided that students obtain the necessary permission and have taken the prerequisite psychology courses. Graduate students, and students who are majoring in Psychology or in Neuroscience and Behavior, and postbac certificate students will have priority over students who are taking the course for the science requirement. For this reason, as well as because of the course prerequisites, we anticipate the course will rarely be used for the science requirement.
- For the Psychology Postbac certificate, PSYC **G4492** will fulfill the advanced seminar requirement.
- For the Barnard Psychology major, PSYC **G4492** will fulfill the senior seminar requirement.

IV. Schedule of topics and readings [subject to revision]:

Readings: No text is required, but assigned readings will be made available in pdf format through CourseWorks (<https://courseworks.columbia.edu>). Full citations of assigned readings will be found following the Schedule.

| Schedule: | Topic: | Reading: |
|---|---|---|
| Wk 1 (9/6) | Course Organization, Syllabus, Topics and Expectations | |
| Wk 2 (9/13) Neurosci | Regulation of the Stress Response | Ulrich-Lai and Herman (2009) Nat Rev |
| Wk 3 (9/20) | Journal Articles and Discussion (Examples by Instructor) | Droste <i>et al.</i> (2008) Endo Thomas <i>et al.</i> (2009) Physio Beh Bergman <i>et al.</i> (2007) J Am Acad Child Adolesc Psychiatry |
| Wk 4 (9/27) | Journal Articles and Discussion (Development) Psychiatry | Dent <i>et al.</i> (2000) Endo Sapolsky and Altmann (1991) Biol |
| Wk 5 (10/4) | Journal Articles and Discussion (Sex) | Gallucci <i>et al.</i> (1993) Health Psychol Viau and Meaney (1991) Endo |
| Wk 6 (10/11) | Journal Articles and Discussion (Experience) | Bhatnagar <i>et al.</i> (2002) J Neuroendo Romeo <i>et al.</i> (2006) Endo |
| Wk 7 (10/18) | Journal Articles and Discussion (Rhythmicity) | Windle <i>et al.</i> (1998) Endo Karatsoreos <i>et al.</i> (2010) Endo |
| Wk 8 (10/25) | Journal Articles and Discussion (Brain) | Bloss <i>et al.</i> (2010) J Neurosci Liston <i>et al.</i> (2009) PNAS |
| Wk 9 (11/1) | Journal Articles and Discussion (Modulation) | Furay <i>et al.</i> (2008) Endo Ulrich-Lai <i>et al.</i> (2007) Endo |
| Wk 10 (11/8) | Journal Articles and Discussion (Neuroimmune and Health) | Dhabhar and McEwen (1999) PNAS Cavigelli and McClintock (2003) PNAS |
| DUE: Topic and Citations for Literature Review | | |
| Wk 11 (11/15) | Journal Articles and Discussion (Transgenerational/Epigenetic) | Francis <i>et al.</i> (1999) Science Weaver <i>et al.</i> (2004) Nat Neurosci |
| Wk 12 (11/22) | NO CLASS MEETING (Academic Holiday) | |
| Wk 13 (11/29) | Individual Meetings to Discuss Literature Review | |
| Wk 14 (12/6) | DUE: Literature Review | |

Reading List (pdfs are available via CourseWorks):

- Bergman, K., Sarkar, P., O'Connor, T. G., Modi, N., and Glover, V. (2007). Maternal stress during pregnancy predicts cognitive ability and fearfulness in infancy. *Journal of the American Academy of Child and Adolescent Psychiatry*, 46, 1454-1463.
- Bhatnagar, S., Huber, R., Nowak, N., & Trotter, P. (2002). Lesions of the posterior paraventricular thalamus block habituation of hypothalamic-pituitary-adrenal responses to repeated restraint. *Journal of Neuroendocrinology*, 14, 403-410.
- Bloss, E. B., Janssen, W. G., McEwen, B. S., & Morrison, J. H. (2010). Interactive effects of stress and aging on structural plasticity in the prefrontal cortex. *Journal of Neuroscience*, 30, 6726-6731.
- Cavigelli, S. A., and McClintock, M. K. (2003). Fear of novelty in infant rats predicts adult corticosterone dynamics and an early death. *Proceedings of the National Academy of Science*, 100, 16131-16136.
- Dent, G. W., Smith, M. A., & Levine, S. (2000). Rapid induction of corticotropin-releasing hormone gene transcription in the paraventricular nucleus of the developing rat. *Endocrinology*, 141, 1593-1598.
- Dhabhar, F. S. & McEwen, B. S. (1999). Enhancing versus suppressive effects of stress hormones on skin immune function. *Proceedings of the National Academy of Science*, 96, 1059-1064.
- Droste, S. K., de Groote, L., Atkinson, H. C., Lightman, S. L., Reul, J. M. H. M., & Linthorst, A. C. E. (2008). Corticosterone levels in the brain show a distinct ultradian rhythm but a delayed response to forced swim stress. *Endocrinology*, 149, 3244-3253.
- Francis, D., Diorio, J., Lui, D., & Meaney, M. J. (1999). Nongenomic transmission across generations of maternal behavior and stress response in the rat. *Science*, 286, 1155-1158.
- Furay, A. R., Bruestle, A. E., & Herman, J. P. (2008). The role of the forebrain glucocorticoid receptor in acute and chronic stress. *Endocrinology*, 149, 5482-5490.
- Gallucci, W. T., Baum, A., Laue, L., Rabin, D. S., Chrousos, G. P., Gold, P. W., & Kling, M. A. (1993). Sex differences in sensitivity of the hypothalamic-pituitary-adrenal axis. *Health Psychology*, 12, 420-425.
- Karatsoreos, I. N., Bhagat, S. M., Bowles, N. P., Weil, Z. M., Pfaff, D. W., & McEwen, B. S. (2010). Endocrine and physiological changes in response to chronic corticosterone: a potential model of the metabolic syndrome in mouse. *Endocrinology*, 151, 2117-2127.
- Liston, C., McEwen, B. S., & Casey, B. J. (2009). Psychosocial stress reversibility disrupts prefrontal processing and attentional control. *Proceedings of the National Academy of Science*, 106, 912-917.
- Romeo, R. D., Bellani, R., Karatsoreos, I. N., Chhua, N., Vernov, M., Conrad, C. D., & McEwen, B. S. (2006). Stress history and pubertal development interact to shape hypothalamic-pituitary-adrenal axis plasticity. *Endocrinology*, 147, 1664-1674.
- Sapolsky, R. M. & Altmann, J. (1991). Incidence of hypercortisolism and dexamethasone resistance increases with age among wild baboons. *Biological Psychiatry*, 30, 1008-1016.
- Thomas, M. B., Hu, M., Lee, T. M., Bhatnagar, S., & Becker, J. B. (2009). Sex-specific susceptibility to cocaine in rats with a history of prenatal stress. *Physiology & Behavior*, 97, 270-277.

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- Ulrich-Lai, Y. M., & Herman, J. P. (2009). Neural regulation of endocrine and autonomic stress responses. *Nature Reviews Neuroscience*, 10, 397-409.
- Ulrich-Lai, Y. M., Ostrander, M. M., Thomas, I. M., Packard, B. A., Furay, A. R., Dolgas, C. M., van Hooren, D. C., Figueiredo, H. F., Mueller, N. K., Choi, D. C., & Herman, J. P. (2007). Daily limited access to sweetened drink attenuates hypothalamic-pituitary-adrenocortical axis stress responses. *Endocrinology*, 148, 1823-1834.
- Viau, V., & Meaney, M. J. (1991). Variations in the hypothalamic-pituitary-adrenal response to stress during the estrous cycle in the rat. *Endocrinology*, 129, 2503-2511.
- Weaver, I. C. G., Cervoni, N., Champagne, F. A., D'Alessio, A. C., Sharma, S., Seckl, J. R., Dymov, S., Szyf, M., & Meaney, M. J. (2004). Epigenetic programming by maternal behavior. *Nature Neuroscience*, 7, 847-854.
- Windle, R. J., Wood, S. A., Shanks, N., Lightman, S. L., & Ingram, C. D. (1998). Ultradian rhythm of basal corticosterone release in the female rat: dynamic interaction with the response to acute stress. *Endocrinology*, 139, 443-450.

V. Course requirements and grading [subject to revision]:

Grades:

- 10% Participation in Journal Article Discussions
- 15% Questions for Journal Article Discussions
- 20% Presentation of Journal Article
- 10% Topic and Bibliographic Citations for Literature Review
- 45% Literature Review

Participation in Journal Article Discussions (10%): All students are expected to participate in weekly discussions. As participation in seminar courses is of paramount importance, it is assumed that students will make every effort to attend each seminar meeting. If medical or other emergencies keep a student from attending class, an email (rromeo@barnard.edu) or phone call (4-5903) is required before class to explain the absence.

Questions for Journal Article Discussions (15%): All students (except those presenting) are expected to provide one substantive question for **each** journal article being discussed during that week's class meeting. These questions are to be emailed to the instructor by 5:00pm the day before the class meeting. Also, the students are expected to bring these questions to the appropriate class meeting to begin the discussion for each journal article.

Presentation of Journal Article (20%): Each student will be required to present one assigned journal article on the assigned class meeting. Students are expected to present a "walk through" of the article's Introduction, Methods, Results, and Discussion. During Weeks 2 and 3, students will be provided with examples of how these presentations should be conducted.

Topic and Bibliographic Citations for Literature Review (10%): All students are required to provide a title (i.e., topic) and at least 10 FULL citations for their proposed literature

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review. These will be due and handed in on the class meeting of Thursday November 8th.
No exceptions will be made for this deadline.

Literature Review (45%): All students are required to write a substantive original, independent literature review. Though the topic of the review is chosen by the student, the topic will require approval of the instructor. These literature reviews will be 15-20 pages in length (double-spaced, 1in margins), have at least 15 citations, written in accordance with the APA style guidelines, and submitted on the final day of class, Thursday December 6th. No exceptions will be made for this deadline.