

Final Progress Report for Research Projects Funded by Health Research Grants

Instructions: Please complete all of the items as instructed. Do not delete instructions. Do not leave any items blank; responses must be provided for all items. If your response to an item is “None”, please specify “None” as your response. “Not applicable” is not an acceptable response for any of the items. There is no limit to the length of your response to any question. Responses should be single-spaced, no smaller than 12-point type. The report **must be completed using MS Word**. Submitted reports must be Word documents; they should not be converted to pdf format. Questions? Contact Health Research Program staff at 717-783-2548.

- 1. Grantee Institution:** The Pennsylvania State University
- 2. Reporting Period (start and end date of grant award period):** 1/1/2010 - 12/31/2013
- 3. Grant Contact Person (First Name, M.I., Last Name, Degrees):** John Anthony, MPA
- 4. Grant Contact Person’s Telephone Number:** 814 935 1081
- 5. Grant SAP Number:** 4100050904
- 6. Project Number and Title of Research Project:** 30. Role of Olfactory Cues in Addictive Behavior
- 7. Start and End Date of Research Project:** 9/1/2010 - to 6/30/2012
- 8. Name of Principal Investigator for the Research Project:** Susan K. Lemieux, PhD
- 9. Research Project Expenses.**

9(A) Please provide the amount of health research grant funds spent on this project for the entire duration of the grant, including any interest earned that was spent:

\$ 36,496 _____

9(B) Provide the last names (include first initial if multiple individuals with the same last name are listed) of **all** persons who worked on this research project and were supported with health research funds. Include position titles (Principal Investigator, Graduate Assistant, Post-doctoral Fellow, etc.), percent of effort on project and total health research funds expended for the position. For multiple year projects, if percent of effort varied from year to year, report in the % of Effort column the effort by year 1, 2, 3, etc. of the project (x% Yr 1; z% Yr 2-3).

Last Name	Position Title	% of Effort on Project	Cost
None			

9(C) Provide the names of **all** persons who worked on this research project, but who *were not* supported with health research funds. Include position titles (Research Assistant, Administrative Assistant, etc.) and percent of effort on project. For multiple year projects, if percent of effort varied from year to year, report in the % of Effort column the effort by year 1, 2, 3, etc. of the project (x% Yr 1; z% Yr 2-3).

Last Name	Position Title	% of Effort on Project
Lemieux	Sr. Research Associate	25%
Corwin	Professor	1%
Wilson	Assist. Prof.	10%
Keller	Assist. Prof.	1%
Hayes	Assist. Prof.	5%
Engels	SLEIC Assoc. Director	5%
Gearhart	MRI Technologist	1%
Stitt	Sr. Research Associate	1%
Vesek	MRI Technologist	1%
Yang	Professor and MR Core Director	10%
Wang	Assist. Prof.	10%

9(D) Provide a list of **all** scientific equipment purchased as part of this research grant, a short description of the value (benefit) derived by the institution from this equipment, and the cost of the equipment.

Type of Scientific Equipment	Value Derived	Cost
Olfactometer	Olfactory fMRI stimuli for University Park MRI laboratory. Can be used by all investigators using the lab.	\$20,000

10. Co-funding of Research Project during Health Research Grant Award Period. Did this research project receive funding from any other source during the project period when it was supported by the health research grant?

Yes X No _____

If yes, please indicate the source and amount of other funds:

Penn State Social Science Research Institute supplied \$20,000.

11. Leveraging of Additional Funds

11(A) As a result of the health research funds provided for this research project, were you able to apply for and/or obtain funding from other sources to continue or expand the research?

Yes _____ No X _____

If yes, please list the applications submitted (column A), the funding agency (National Institutes of Health—NIH, or other source in column B), the month and year when the application was submitted (column C), and the amount of funds requested (column D). If you have received a notice that the grant will be funded, please indicate the amount of funds to be awarded (column E). If the grant was not funded, insert “not funded” in column E.

Do not include funding from your own institution or from CURE (tobacco settlement funds). Do not include grants submitted prior to the start date of the grant as shown in Question 2. If you list grants submitted within 1-6 months of the start date of this grant, add a statement below the table indicating how the data/results from this project were used to secure that grant.

A. Title of research project on grant application	B. Funding agency (check those that apply)	C. Month and Year Submitted	D. Amount of funds requested:	E. Amount of funds to be awarded:
None	<input type="checkbox"/> NIH <input type="checkbox"/> Other federal (specify: _____) <input type="checkbox"/> Nonfederal source (specify: __)		\$	\$

11(B) Are you planning to apply for additional funding in the future to continue or expand the research?

Yes X _____ No _____

If yes, please describe your plans:

The data collected in this pilot study were instrumental in laying the foundation for several proposal submissions in preparation now. Kathleen Keller, Ph.D. (Nutrition and Food Science) will be combining these results with additional data she is currently collecting looking at children's response to visual food cues (IRB #39505 "A pilot study to test for differences in how children's brains respond to food brands") and fat taste cues (IRB #39599 "Developing palatable milks for children by screening for polymorphisms that are associated with fat preferences and brain imaging") for the submission of an R01 NIH/NICHD entitled "Neural mechanisms of food-cue responsiveness in children." Study PI Lemieux, and co-Is Stephen Wilson and John Hayes will be collaborators on this project. In addition, the development and validity testing of the olfactometer was instrumental in establishing the

Social, Life and Engineering Sciences Imaging Center (SLEIC), as a leading facility for understanding the neural mechanisms of eating behavior. This instrument will greatly enhance Dr. Keller's research program and will allow for a more integrated, real-world study of the neural controls of eating behavior in children.

12. Future of Research Project. What are the future plans for this research project?

During the fall of 2012 the data analysis for all of the participants including all of the stimuli will be completed. The questionnaire responses will also be analyzed and statistically tested with the imaging data. After the analysis is complete, a manuscript will be written comparing the two groups we studied, 10 participants who were not fed lunch and 10 participants who were fed lunch. This will be submitted to the Journal of Chemosensory Perception. The next steps will depend on the success of funding proposals.

13. New Investigator Training and Development. Did students participate in project supported internships or graduate or post-graduate training for at least one semester or one summer?

Yes X No _____

If yes, how many students? Please specify in the tables below:

	Undergraduate	Masters	Pre-doc	Post-doc
Male				
Female	3		1	
Unknown				
Total	3		1	

	Undergraduate	Masters	Pre-doc	Post-doc
Hispanic				
Non-Hispanic				
Unknown	3		1	
Total	3		1	

	Undergraduate	Masters	Pre-doc	Post-doc
White				
Black				
Asian				
Other				
Unknown	3		1	
Total	3		1	

14. Recruitment of Out-of-State Researchers. Did you bring researchers into Pennsylvania to carry out this research project?

Yes _____ No X _____

If yes, please list the name and degree of each researcher and his/her previous affiliation:

15. Impact on Research Capacity and Quality. Did the health research project enhance the quality and/or capacity of research at your institution?

Yes X _____ No _____

If yes, describe how improvements in infrastructure, the addition of new investigators, and other resources have led to more and better research.

Both of the laboratories that do functional MRI research at Penn State, the SLEIC at University Park and the Core NMR facility at Hershey have almost identical capabilities to study olfactory and visual cues as a result of this project. Dr Kathleen L. Keller was recruited to Penn State-University Park particularly because she saw this project in action. Since her arrival, there is now gustatory stimuli equipment at both facilities.

16. Collaboration, business and community involvement.

16(A) Did the health research funds lead to collaboration with research partners outside of your institution (e.g., entire university, entire hospital system)?

Yes _____ No X _____

If yes, please describe the collaborations:

16(B) Did the research project result in commercial development of any research products?

Yes _____ No X _____

If yes, please describe commercial development activities that resulted from the research project:

16(C) Did the research lead to new involvement with the community?

Yes _____ No X _____

If yes, please describe involvement with community groups that resulted from the

research project:

17. Progress in Achieving Research Goals, Objectives and Aims.

List the project goals, objectives and specific aims (as contained in the grant application's strategic plan). Summarize the progress made in achieving these goals, objectives and aims for the entire grant award period. Indicate whether or not each goal/objective/aim was achieved; if something was not achieved, note the reasons why. Describe the methods used. If changes were made to the research goals/objectives/aims, methods, design or timeline since the original grant application was submitted, please describe the changes. Provide detailed results of the project. Include evidence of the data that was generated and analyzed, and provide tables, graphs, and figures of the data. List published abstracts, poster presentations and scientific meeting presentations at the end of the summary of progress; peer-reviewed publications should be listed under item 20.

This response should be a DETAILED report of the methods and findings. It is not sufficient to state that the work was completed. Insufficient information may result in an unfavorable performance review, which may jeopardize future funding. If research findings are pending publication you must still include enough detail for the expert peer reviewers to evaluate the progress during the course of the project.

Health research grants funded under the Tobacco Settlement Act will be evaluated via a performance review by an expert panel of researchers and clinicians who will assess project work using this Final Progress Report, all project Annual Reports and the project's strategic plan. After the final performance review of each project is complete, approximately 12-16 months after the end of the grant, this Final Progress Report, as well as the Final Performance Review Report containing the comments of the expert review panel, and the grantee's written response to the Final Performance Review Report, will be posted on the CURE Web site.

There is no limit to the length of your response. Responses must be single-spaced below, no smaller than 12-point type. If you cut and paste text from a publication, be sure symbols print properly, e.g., the Greek symbol for alpha (α) and beta (β) should not print as boxes (\square) and include the appropriate citation(s). DO NOT DELETE THESE INSTRUCTIONS.

Research Project Overview:

Studies of the neural pathways active in eating indicate that the reward circuitry contributes to consumption patterns. To increase the power of the stimuli, we used both visual and olfactory stimuli to study non-smoker participant responses to smoking and eating cues.

The specific aims of this project are to:

- 1) Evaluate the saliency of multisensory cues (visual/odorant) delivered separately or simultaneously
- 2) Examine the construct of binge-eating as an addiction by comparing and contrasting cue-related brain activation in groups who binge-eat, smoke, or do both.

This project required the use of an MRI-compatible odorant-delivery system (an olfactometer) and functional MRI (fMRI). The proposal planned to examine brain activation in four groups: healthy controls (HC), persons who binge-eat (BE), smokers (SM), and smokers who binge-eat (SB). We predicted that brain activation would be strongest to cues that combine olfactory and visual stimulation. We also expected that each group will show the strongest responses to their respective substance, and that the comorbid group will show a superadditive effect, exhibiting activation greater than the sum of responses to each individual cue.

For the first time, the twin 3T Siemens scanners installed in the Social, Life, and Engineering Sciences Imaging Center (SLEIC) at University Park (UP) and the Center for NMR Research (CNMRR) at Penn State Hershey College of Medicine were used conjointly in a cross-campus collaboration. These technical developments will foster research across the UP/Hershey campuses by equipping both 3T MRI scanners to deliver olfactory stimuli in addition to standard audio/visual stimuli. The long-term objectives include facilitating multi-site collaboration between UP and Hershey campuses and building critical mass in the sensory neuroscience of addiction. In addition, a deeper understanding the neural pathways affecting eating and smoking addictions may help to design effective treatment and prevention programs.

Aims Met: One important goal of this project was to expand the capabilities of the SLEIC 3T MRI Laboratory at Penn State University Park to provide olfactory stimulation to parallel the capabilities at the Penn State Hershey MR Core Facility 3T Laboratory. This aim was accomplished during the first year (9/2010-6/2011) of funded activities. This technical development can now be used to foster research across the UP/Hershey campuses.

The long-term objectives for this pilot application included facilitating multi-site collaboration between UP and Hershey campuses and building critical mass in the sensory neuroscience of addiction. To that end a multi-disciplinary team of co-investigators has been formed including faculty from the departments of Nutrition, Food Science, Psychology and Radiology and staff from the two core MR facilities, located at the Penn State University Park and Hershey campuses. These investigators have been working together across the campuses for two years now.

Twenty data sets were collected across the campuses for healthy non-smoking, non-binge-eating participants using odorant stimuli presented by the new olfactometer funded by this grant. The preliminary analysis of these data was presented at the Association of the Chemoreceptive Sciences (ACHEMS) meeting in April 2012. The title of our presentation was *Food Craving Studied by Combined Visual and Olfactory Stimulation*. The final analysis of these results was completed by the PI in Fall of 2013 and accepted for presentation at the ACHEMS conference in April 2014, entitled *Functional MRI of the Reward System Using Multisensory Cues*. The authorship on this abstract and our article submission confirms the ongoing cross-campus collaboration between these departments at University Park: *Psychology, Nutritional Sciences, Food Science, Bioengineering* and at Hershey: the *Core Facility for Magnetic Resonance and Radiology*. The full analysis has also been prepared for submission to the journal, *Human Brain Mapping* as an article entitled, *High-calorie Food Preference versus Tobacco Aversion Demonstrated by Functional MRI Using Visual and Olfactory Cues*.

Aims Unmet: The initial application proposed a study that would have included 15 smoking, 15 binge-eating, and 15 smoking and binge-eating participants. Only 3 possible participants who met these criteria responded to the posted recruitment advertisements. Of these 3, one was too large to scan, the other two failed to schedule appointments. During the second year of the funded period, we made two major changes to the recruitment to improve the response rate. 1) We altered the advertisements to make them more appealing. The changes were approved by the IRB in March but the altered advertisements did not generate more responses. 2) We then increased the participant payment from \$40 to \$75; that change was approved quickly by the IRB and yet we had no volunteers all summer. This was surprising and disappointing. Because of this failure to recruit, we are closing this arm of the study and not requesting a no-cost extension.

Research Outcomes:

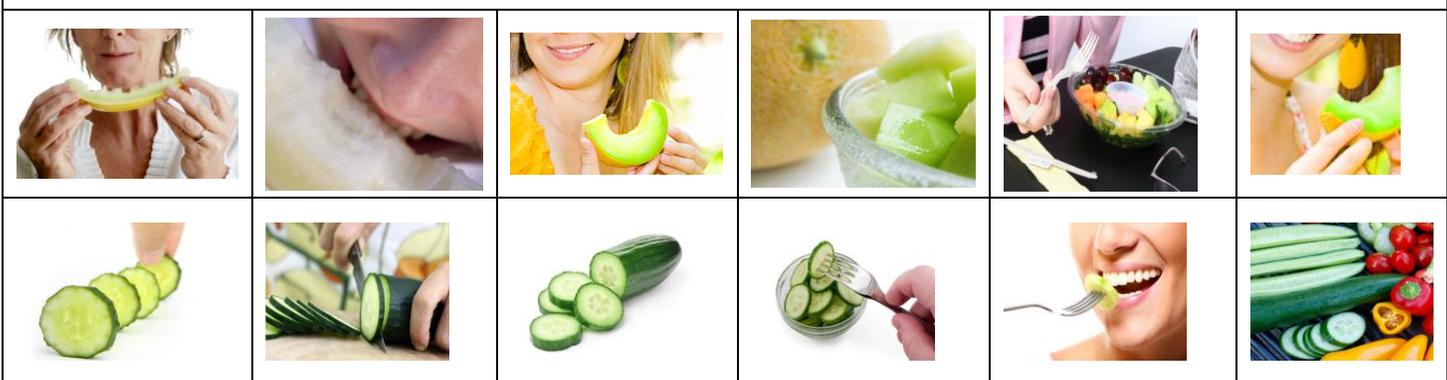
Participants Enrolled:

The first round of scanning (N=5 participants at both facilities, total 10 scans) was to test the capabilities for running the same protocol at University Park's SLEIC scanner (UP-MRI) and at the Hershey College of Medicine Core MRI Facility scanner (COM-MRI). The second round of scanning (N=14 participants, 9 eligible for scanning) implemented the full protocol including lunch, questionnaires, and scanning. Figure 1 shows the pictures used for visual stimuli and Figure 2 shows the protocol for stimuli presentation.

High Calorie Foods: Odorants were Givaudan Chocolate and Cinnamon Rolls



Low Calorie Foods: Odorants were Givaudan Honeydew Melon and Cucumber



Smoking: Odorant was tobacco from cigarettes (unburnt)



Figure 1: All pictures used presented by category.

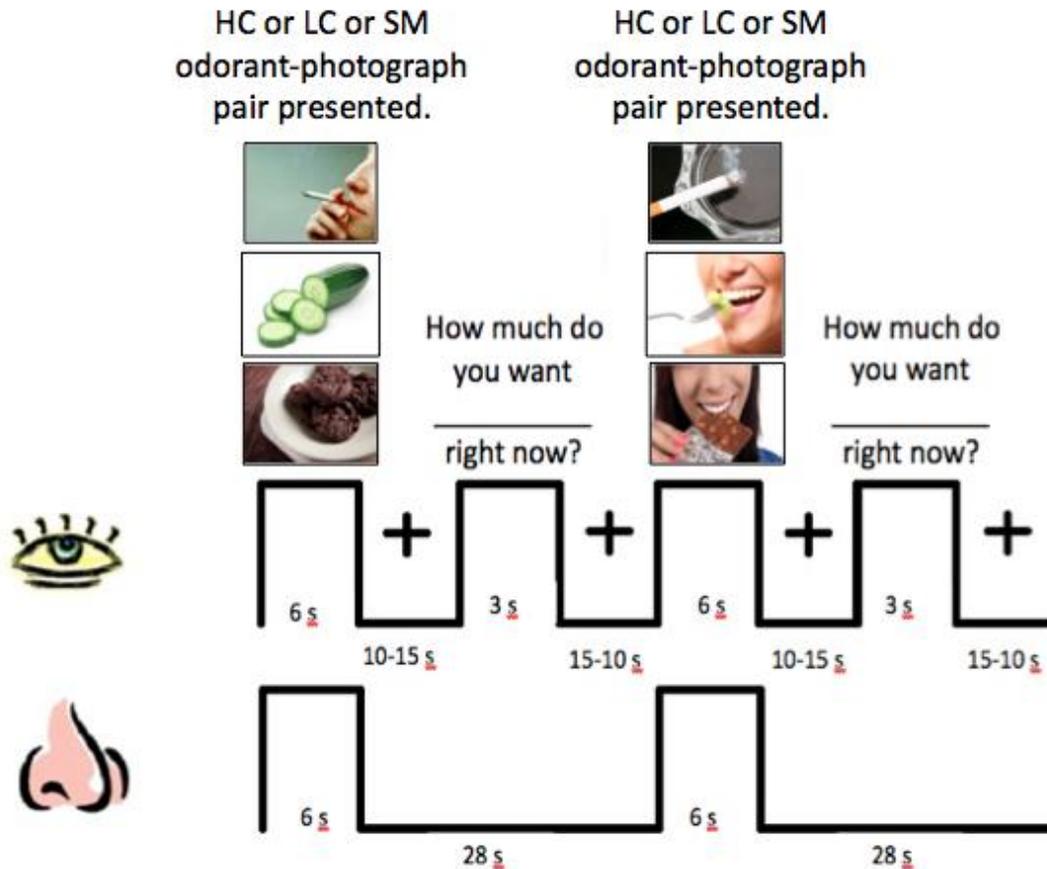


Figure 2. Functional MRI stimulus presentation protocol.

MRI Scanning and Analysis:

Functional magnetic resonance imaging (fMRI) methods were used to study the blood oxygen level dependent (BOLD) signal change in the reward system. In brief, a T_1 MPRAGE pulse sequence was used to collect the anatomical scans and a BOLD-EPI pulse sequence was used to acquire the functional data at UP-MRI. During the scan, all participants rated how much they wanted to eat that particular food or smoke after each stimuli presentation (rating scale 1-5, 1 = not wanted at all, 5 = wanted very much). The presentation during the scan consisted of randomized congruent visual-olfactory cues. All participants completed two scans. The two scans differed in the order of stimuli presentation and timing of the rating after the stimuli. The first round of fMRI scans were collected using the visual-olfactory stimuli alone.

Data from the second round of fMRI scans were collected after the participants ate a calorically standardized lunch provided as part of the study and filled out the following questionnaires: Binge Eating Scale (BES), Barrat's Impulsivity Scale (BIS), Brief Substance Use Questionnaire (BSUQ), Center for Epidemiologic Studies Depression Scale (CESD), Food Craving Inventory (FCI), Mood and Anxiety Symptom Questionnaire (MASQ), Penn State Worry Questionnaire

(PSWQ), Questionnaire on Eating and Weight Patterns (QEWP). These questionnaires provide information that can be used to determine if there are significant variations in behavior or mood in the groups of people studied. Standard questionnaires for smoking behavior were also administered.

For all imaging, a standard analysis pipeline in SPM8 including registration into standard brain space, motion correction, frequency filtering and smoothing were used to analyze the fMRI data.

Results

The stimuli ratings (desirability/craving) from these healthy non-smoking, non-binge-eating participants were averaged across all stimuli and all participants. The mean and standard deviations demonstrated that craving levels were consistently very low following the smoking stimuli (1.05 +/- 0.09) overall ratings for all subjects, “1 = I do not want to smoke at all”. For the foods shown, the standard deviations were quite large across all participants. Only one food rated higher than neutral (3=neutral) that was chocolate at 3.26 +/- 1.35 across all participants. The cinnamon rolls and melon desirability were rated at 3.02 +/- 1.24 and 2.63 +/- 1.46 respectively while cucumbers were rated at 2.38 +/-1.26.

It was not unexpected that a large standard deviation would be present in the mean averages across the participant’s responses to different foods. Different people prefer different foods. Analysis of the questionnaire responses may provide insight into the high degree of standard deviation across the food stimuli, particularly the food craving inventory (FCI). The most statistically significant result from the mean ratings was the self-reported lack of any desire to smoke in these non-smokers. To these young non-smoking adults, smoking was not neutral or mildly disagreeable, rather it was rated as not desirable at all.

Group level one-sample t-tests comparing contrasts between all visual-olfactory pairs contrasted with the ratings (VO-ratings), high calorie (HC) foods contrasted with smoking (HC-SM) and high-calorie foods contrasted with low calorie foods (HC-LC) are shown in Figures 3, 4, and 5.

The visual-olfactory events compared by 2nd level analysis student’s t-test to the rating events demonstrate activation across the visual and supplementary visual cortex, multisensory integration areas (lingual cortex), and olfactory areas including orbital frontal cortex, amygdala, hippocampus and parahippocampal gyrus.

The 2nd level analysis student’s t-test to comparison of HC to SM category responses shown in Figure 4 revealed lingual multisensory integration, insular and putamen olfactory-reward responses. Difference in left pre-frontal and left medial frontal areas are associated with complex working memory tasks. The 2nd level analysis student’s t-test to comparison of HC to LC category responses were much less significant in this group of normal non-smokers showing smaller differences, Figure 5, between responses to high calorie or low calorie foods. This is consistent with the ratings results that showed much lower differences between HC or LC foods compared to smoking ratings. Activation was observed in left dorsal lateral frontal in response to the food cues, right mid-temporal, and supplementary motor, pre-motor, frontal operculum associated with taste and multi-sensory cortex, and lingual cortex processing of multisensory integration.

Covariance analysis of the functional MRI covariance data for individual rating by category (Figure 6) revealed significant positive covariance in the reward network, the putamen, caudate, insula, orbitofrontal cortex, dorsolateral prefrontal cortex, and anterior cingulate, $p < 0.001$, (Figure 6).

For the functional MRI data analysis, the ratings used were from each individual rather than mean values. The ratings from each individual were correlated with the functional MRI activation data in a second level multiple regression SPM analysis. This analysis was conducted to determine if there was a relationship between the desire for a particular food and the intensity of fMRI activation localized to the reward regions of the brain.

For the analysis, data for 14 participants that had all eaten during the hour before scanning were analyzed. After careful consideration, the investigators decided that this was the only acceptable analysis procedure since there was no documentation of food intake for the first 5 participants that participated in the test-retest arm of the study.

The analysis performed that correlated each individual's ratings to the activation, revealed significant positive correlation in the reward network, the putamen, caudate, insula, orbitofrontal cortex, dorsolateral prefrontal cortex, and anterior cingulate, ($p < 0.005$). A two-sample t-test ($p < 0.005$) across all 14 participants revealed significantly stronger activation for the High Calorie (chocolate and cinnamon bun) compared to Smoking (cigarette, tobacco odorant) stimuli in the reward areas.

There were a number of changes to the final methods used from the proposed methods. The initial proposal included a plan to use picture/odorant pairs selected based on the participant's preferences. This proved to be impractical as the odorants provided by Givaudan were not as pleasant when delivered using the olfactometer. The hot food odorants were very strong and not pleasant (even after dilution to strengths lower than recommended) when delivered by the olfactometer. Also, the use of commercial pictures from iStockphoto became necessary to create picture-odorant congruent pairs.

We did not need to use the pulse sequence with gradient correction as the EPI-BOLD sequence on the Siemens 3T scanners did not create significant signal drop out in the regions of interest with the carefully chosen parameters we used. In addition, because all of the participants were normal volunteers not under a physician's care, who did not smoke or binge-eat, the behavioral and psychological questionnaires provided no helpful additional data for the study. We have all the questionnaire data stored in our database for the study so that we can use these 14 participants as a control group.

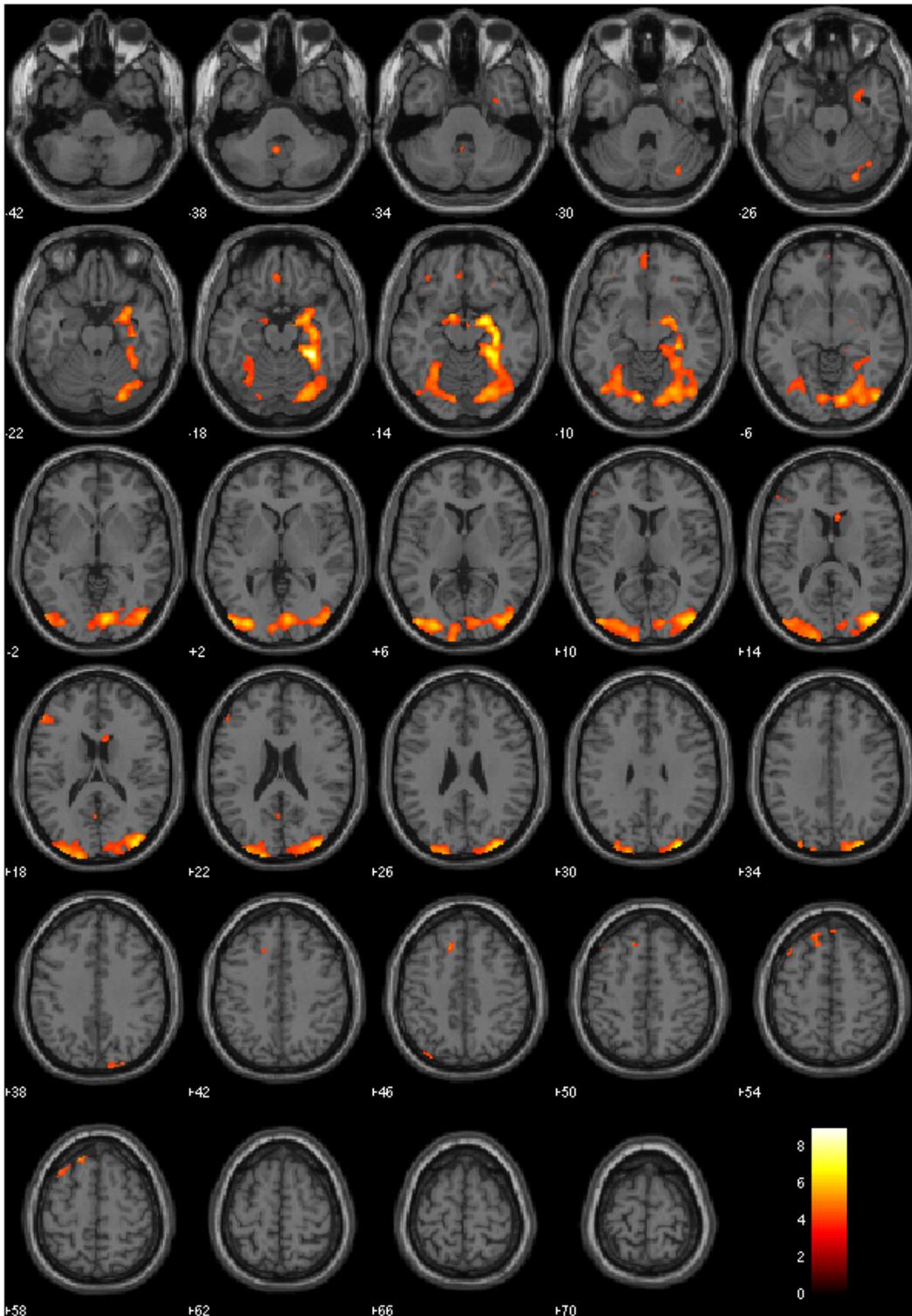


Figure 3. Contrast shown here is VO-ratings – visual processing of picture content in occipetal cortex (-2 to +30), olfactory and multiple mode cue processing in lingual gyrus, parahippocampal gyrus, right amygdala, right hippocampus, right orbital frontal cortex (-22 to -10). Olfactory processing in cerebellar cortex in levels -38 to -18.

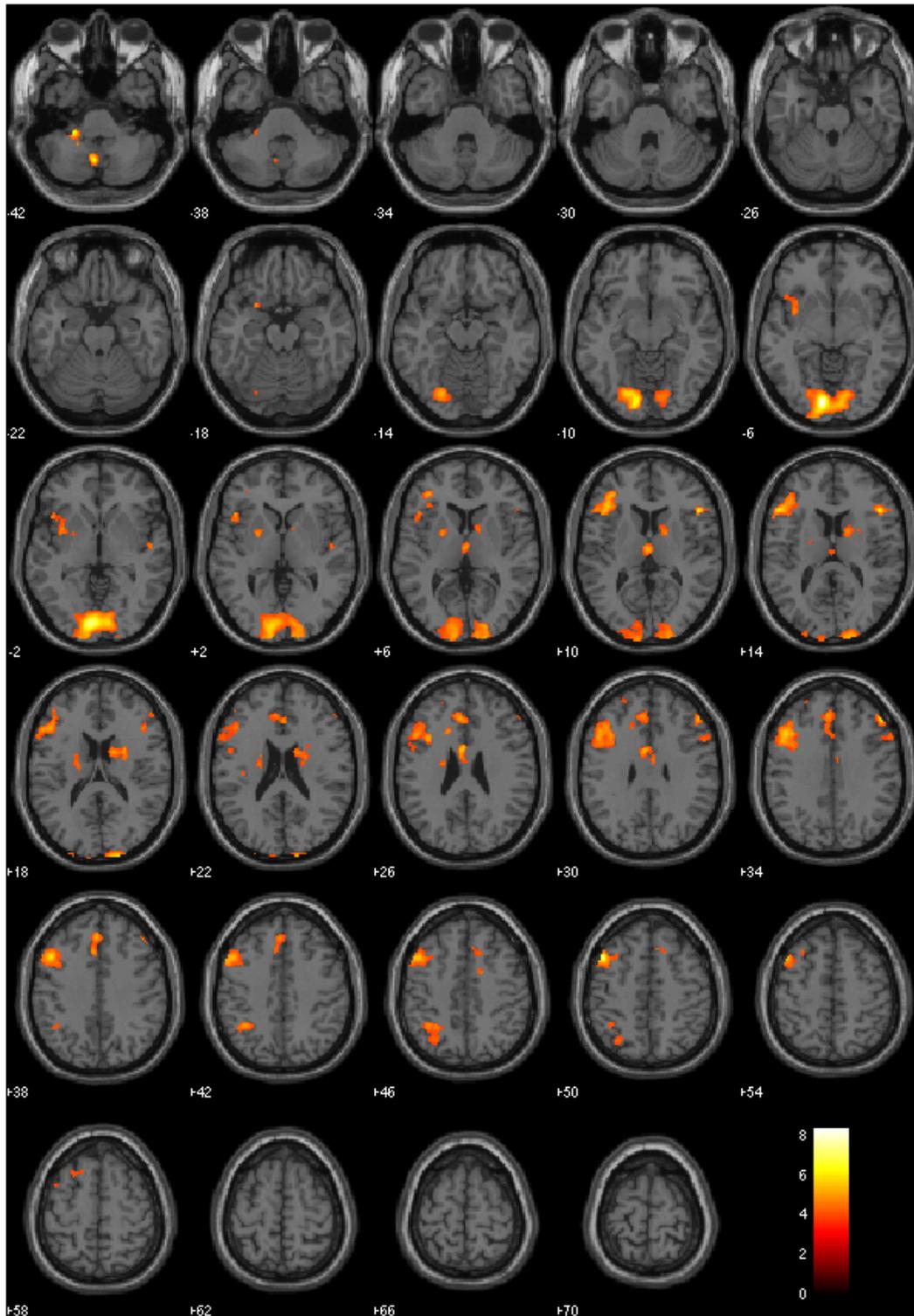


Figure 4. HC-SM: Lingual multisensory integration, insular, caudate, and putamen olfactory-reward. Strong DLPFC, Left pre-frontal and left medial frontal areas are associated with working memory tasks. VMPFC is associated with impulse control.

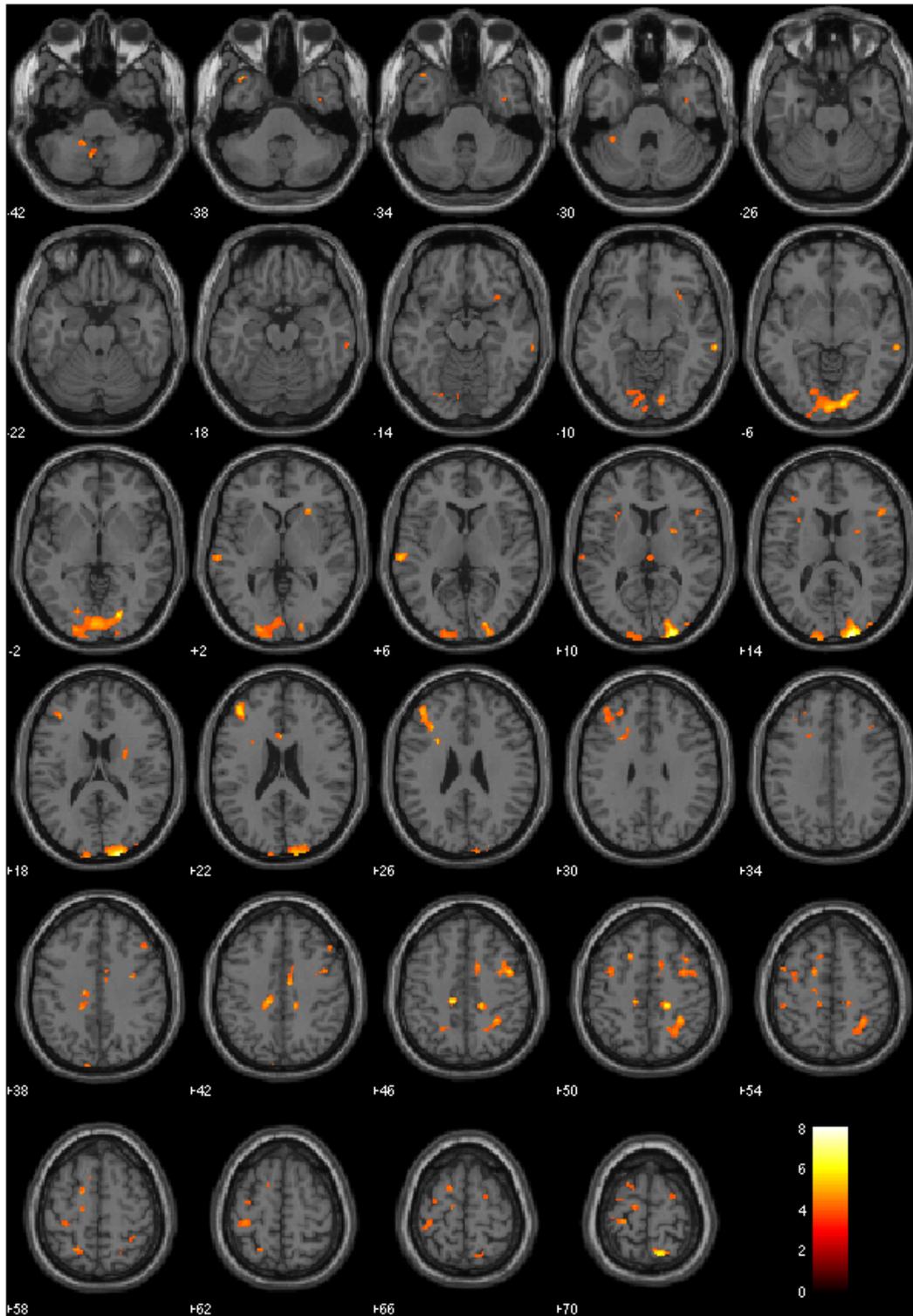


Figure 5. Contrast is High Calorie (HC) – Low Calorie (LC) : Left dorsal lateral frontal (food cues), right mid-temporal, and supplementary motor, pre-motor, frontal operculum (taste, multi-sensory cortex), lingual cortex processing of multisensory integration.

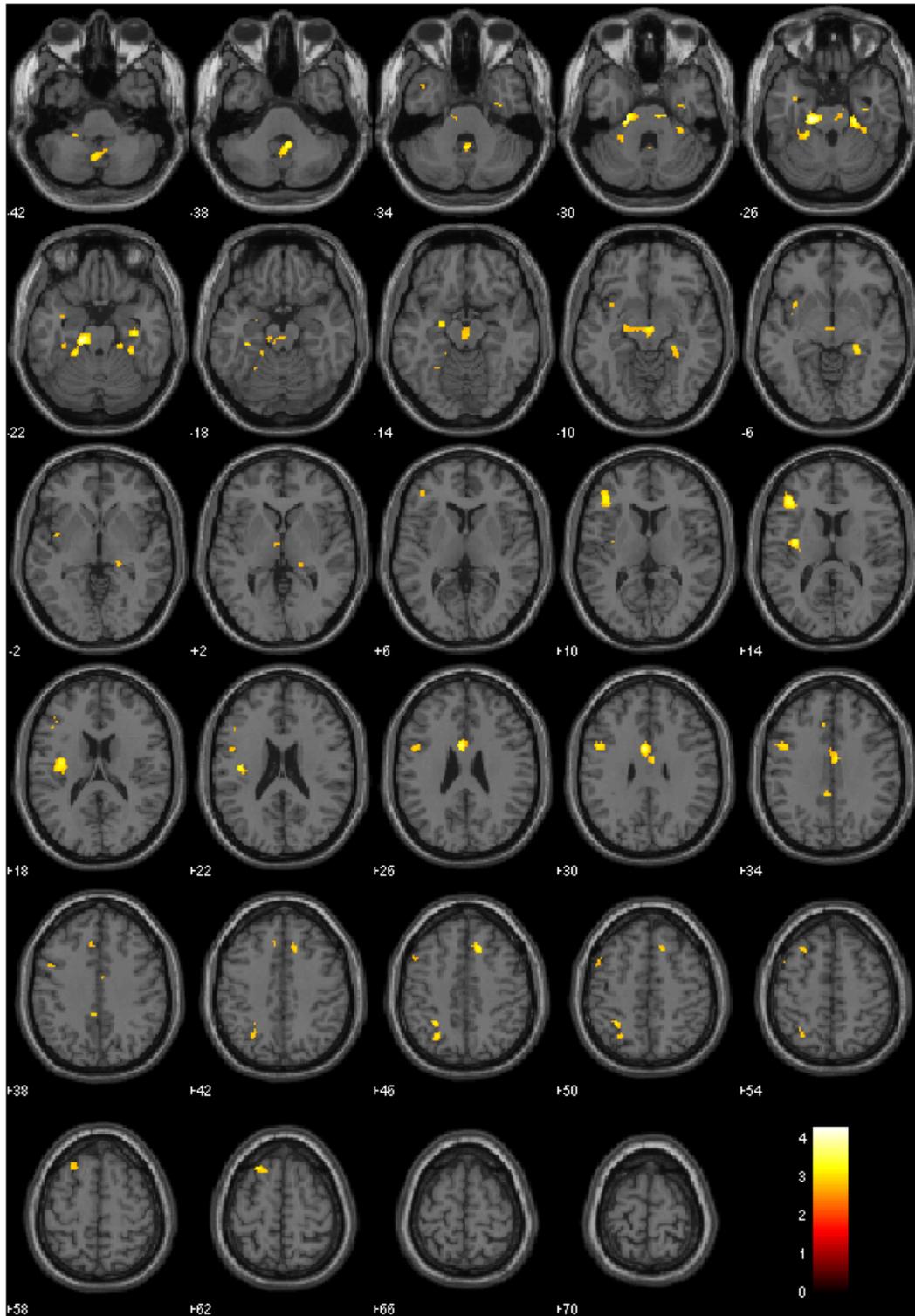


Figure 6. Results for covariance of functional activation versus individual ratings by category.

External Proposal Submissions

The data collected in this pilot study were instrumental in laying the foundation for several proposal submissions that are in preparation. Kathleen Keller, Ph.D. (Nutrition and Food Science) will be combining these results with additional data she is currently collecting looking at children's response to visual food cues (IRB #39505 "A pilot study to test for differences in how children's brains respond to food brands") and fat taste cues (IRB #39599 "Developing palatable milks for children by screening for polymorphisms that are associated with fat preferences and brain imaging") for the submission of an R01 NIH/NICHHD entitled "Neural mechanisms of food-cue responsiveness in children." Study PI Lemieux, and co-Is Stephen Wilson and John Hayes will be collaborators on this project. In addition, the development and validity testing of the olfactometer was instrumental in establishing SLEIC as leading facility for understanding the neural mechanisms of eating behavior. This instrument will greatly enhance Dr. Keller's research program and will allow for a more integrated, real-world study of the neural controls of eating behavior in children.

Publications/Citations

Association of the Chemoreceptive Sciences Meeting April 2012: #P68 POSTER SESSION II: TRIGEMINAL SYSTEM; TASTE CNS; NEUROIMAGING; OLFACTION CNS

Food craving studied by combined visual and olfactory stimulation

Megha M Patel¹, Susan K Lemieux², Stephen J Wilson³, Rebecca L Corwin⁴, John E Hayes⁵, Joseph Stitt², Anna S Engels^{2,3}, Jianli Wang¹, Jeff Vesek¹, Qing X Yang^{1,6}

¹Dept. of Radiology Hershey, PA, USA, ²Social, Life, & Engineering Sciences Imaging Center State College, PA, USA, ³Dept. of Psychology State College, PA, USA, ⁴Dept. of Nutritional Sciences State College, PA, USA, ⁵Dept. of Food Science State College, PA, USA, ⁶Dept. of Neurosurgery Hershey, PA, USA

Association of Chemoreception Sciences 2012 Annual Meeting, Huntington Beach, California USA, April 2012, 2012 Abstract Book, pg 50.

Accepted for presentation to the Association of the Chemoreceptive Sciences Meeting April 2014: Poster Session VI ODORANT RECEPTORS; AVERSIVE TASTE; SOCIAL OLFACTION; RETRONASAL OLFACTION; MULTIMODAL SENSATION; EXTRAORAL/EXTRANASAL CHEMORECEPTION; AMINO ACID TASTE. Functional MRI of the Reward System Using Multisensory Cues, Susan K Lemieux, Jianli Wang, Megha M Vasavada, Stephen J Wilson, Kathleen L Keller, John E Hayes, Qing X Yang. ¹Penn State Harrisburg / Elec. Eng., Middletown, PA, United States; ²Penn State Hershey/Radiology, Hershey, PA, United States; ³Penn State / Psychology, University Park, PA, United States; ⁴Penn State / Nutritional Sciences, University Park, PA, United States; ⁵Penn State / Food Science, University Park, PA, United States; ⁶Penn State / Bioengineering, University Park, PA, United States.

18. Extent of Clinical Activities Initiated and Completed. Items 18(A) and 18(B) should be completed for all research projects. If the project was restricted to secondary analysis of clinical data or data analysis of clinical research, then responses to 18(A) and 18(B) should be "No."

18(A) Did you initiate a study that involved the testing of treatment, prevention or diagnostic procedures on human subjects?

Yes
 No

18(B) Did you complete a study that involved the testing of treatment, prevention or diagnostic procedures on human subjects?

Yes
 No

If “Yes” to either 18(A) or 18(B), items 18(C) – (F) must also be completed. (Do NOT complete 18(C-F) if 18(A) and 18(B) are both “No.”)

18(C) How many hospital and health care professionals were involved in the research project?

_____ Number of hospital and health care professionals involved in the research project

18(D) How many subjects were included in the study compared to targeted goals?

_____ Number of subjects originally targeted to be included in the study
_____ Number of subjects enrolled in the study

Note: Studies that fall dramatically short on recruitment are encouraged to provide the details of their recruitment efforts in Item 17, Progress in Achieving Research Goals, Objectives and Aims. For example, the number of eligible subjects approached, the number that refused to participate and the reasons for refusal. Without this information it is difficult to discern whether eligibility criteria were too restrictive or the study simply did not appeal to subjects.

18(E) How many subjects were enrolled in the study by gender, ethnicity and race?

Gender:

_____ Males
_____ Females
_____ Unknown

Ethnicity:

_____ Latinos or Hispanics
_____ Not Latinos or Hispanics
_____ Unknown

Race:

_____ American Indian or Alaska Native
_____ Asian
_____ Blacks or African American

- Native Hawaiian or Other Pacific Islander
- White
- Other, specify: _____
- Unknown

18(F) Where was the research study conducted? (List the county where the research study was conducted. If the treatment, prevention and diagnostic tests were offered in more than one county, list all of the counties where the research study was conducted.)

19. Human Embryonic Stem Cell Research. Item 19(A) should be completed for all research projects. If the research project involved human embryonic stem cells, items 19(B) and 19(C) must also be completed.

19(A) Did this project involve, in any capacity, human embryonic stem cells?

- Yes
- No

19(B) Were these stem cell lines NIH-approved lines that were derived outside of Pennsylvania?

- Yes
- No

19(C) Please describe how this project involved human embryonic stem cells:

20. Articles Submitted to Peer-Reviewed Publications.

20(A) Identify all publications that resulted from the research performed during the funding period and that have been submitted to peer-reviewed publications. Do not list journal abstracts or presentations at professional meetings; abstract and meeting presentations should be listed at the end of item 17. **Include only those publications that acknowledge the Pennsylvania Department of Health as a funding source** (as required in the grant agreement). List the title of the journal article, the authors, the name of the peer-reviewed publication, the month and year when it was submitted, and the status of publication (submitted for publication, accepted for publication or published.). Submit an electronic copy of each publication, listed in the table, in a PDF version 5.0.5 format, 1,200 dpi. Filenames for each publication should include the number of the research project, the last name of the PI, the number of the publication and an abbreviated research project title. For example, if you submit two publications for PI Smith for the “Cognition and MRI in Older Adults” research project (Project 1), and two publications for PI Zhang for the “Lung Cancer” research project (Project 3), the filenames should be:

- Project 1 – Smith – Publication 1 – Cognition and MRI
- Project 1 – Smith – Publication 2 – Cognition and MRI
- Project 3 – Zhang – Publication 1 – Lung Cancer

Project 3 – Zhang – Publication 2 – Lung Cancer
 If the publication is not available electronically, provide 5 paper copies of the publication.

Note: The grant agreement requires that recipients acknowledge the Pennsylvania Department of Health funding in all publications. Please ensure that all publications listed acknowledge the Department of Health funding. If a publication does not acknowledge the funding from the Commonwealth, do not list the publication.

Title of Journal Article:	Authors:	Name of Peer-reviewed Publication:	Month and Year Submitted:	Publication Status (check appropriate box below):
1. Affective responses to visual and olfactory cues for high-calorie food and tobacco demonstrated by functional MRI	Susan K. Lemieux, Steven J. Wilson, Kathleen L Keller Megha Patel, Britland Vergnetti, Sarah Tonkin, Jianli Wang, Amanda R. Gearhart, Jeffrey Vesek, John Hayes, Qing X. Yang	Human Brain Mapping	May 2014	<input checked="" type="checkbox"/> Submitted <input type="checkbox"/> Accepted <input type="checkbox"/> Published

20(B) Based on this project, are you planning to submit articles to peer-reviewed publications in the future?

Yes X No _____

If yes, please describe your plans:

Data analysis has been completed using the standard SPM analysis pathway and the second analysis using functional connectivity approaches is underway. We anticipate another publication will be submitted for review by the end of summer 2014.

21. Changes in Outcome, Impact and Effectiveness Attributable to the Research Project.

Describe the outcome, impact, and effectiveness of the research project by summarizing its impact on the incidence of disease, death from disease, stage of disease at time of diagnosis, or other relevant measures of outcome, impact or effectiveness of the research project. If there were no changes, insert “None”; do not use “Not applicable.” Responses must be single-spaced below, and no smaller than 12-point type. DO NOT DELETE THESE INSTRUCTIONS. There is no limit to the length of your response.

None.

22. Major Discoveries, New Drugs, and New Approaches for Prevention Diagnosis and Treatment. Describe major discoveries, new drugs, and new approaches for prevention,

diagnosis and treatment that are attributable to the completed research project. If there were no major discoveries, drugs or approaches, insert "None"; do not use "Not applicable." Responses must be single-spaced below, and no smaller than 12-point type. DO NOT DELETE THESE INSTRUCTIONS. There is no limit to the length of your response.

None.

23. Inventions, Patents and Commercial Development Opportunities.

23(A) Were any inventions, which may be patentable or otherwise protectable under Title 35 of the United States Code, conceived or first actually reduced to practice in the performance of work under this health research grant? Yes _____ No X

If "Yes" to 23(A), complete items a – g below for each invention. (Do NOT complete items a - g if 23(A) is "No.")

- a. Title of Invention:
- b. Name of Inventor(s):
- c. Technical Description of Invention (describe nature, purpose, operation and physical, chemical, biological or electrical characteristics of the invention):
- d. Was a patent filed for the invention conceived or first actually reduced to practice in the performance of work under this health research grant?
Yes _____ No _____

If yes, indicate date patent was filed:

- e. Was a patent issued for the invention conceived or first actually reduced to practice in the performance of work under this health research grant?
Yes _____ No _____
If yes, indicate number of patent, title and date issued:
Patent number:
Title of patent:
Date issued:
- f. Were any licenses granted for the patent obtained as a result of work performed under this health research grant? Yes _____ No _____
If yes, how many licenses were granted? _____
- g. Were any commercial development activities taken to develop the invention into a commercial product or service for manufacture or sale? Yes _____ No _____

If yes, describe the commercial development activities:

23(B) Based on the results of this project, are you planning to file for any licenses or patents, or undertake any commercial development opportunities in the future?

Yes_____ No__X_____

If yes, please describe your plans:

24. Key Investigator Qualifications. Briefly describe the education, research interests and experience and professional commitments of the Principal Investigator and all other key investigators. In place of narrative you may insert the NIH biosketch form here; however, please limit each biosketch to 1-2 pages.

Biographical Sketch

Susan K. Lemieux, Ph.D. Senior Research Associate
102 Chandlee Laboratory, The Pennsylvania State University,
University Park, State College PA 16801
814-863-1074, sklemieux@psu.edu

A. PROFESSIONAL PREPARATION

<u>College/University</u>	<u>Major</u>	<u>Degree & Year</u>
Brescia College	Computer Science	A.S. 1982
University of Kentucky	Physics	B.S. 1984
University of Kentucky	Physics	M.S. 1986
University of North Carolina	Physics	Ph.D. 1993
Stanford University	Magnetic Resonance	1993-1995

B. ACADEMIC/PROFESSIONAL APPOINTMENTS

<u>University/Company</u>	<u>Position</u>	<u>Years</u>
The Pennsylvania State University	Senior Research Associate	2008 - Present
West Virginia University	Assist. Prof. Radiology	2000-2008
Temple University School of Medicine	Assist. Prof., Radiology,	1995-2000
Siemens Medical Systems	Sr. Cyclotron Training Specialist	1992-1993

C. PUBLICATIONS

Publications Most Closely Related to Proposal

1. Julie Brefczynski-Lewis, Svenja Lowitzsch, Michael Parsons, Susan Lemieux and Aina Puce. Brain Topography 21:193-206 (2009).
2. J.D. Mendola, I. P. Conner, S. Sharma, S.K. Lemieux. J Cogn. Neurosci. 18:363-375 (2006).
3. M.W. Parsons, M.W. Haut, S.K. Lemieux, M.T. Moran, S.G. Leach. Brain Cogn 60: 253-261 (2006).
4. L. Shuster, S.K. Lemieux. Brain and Language 93:20-21 (2004).
5. Conner, S. Sharma, S.K.Lemieux, J.D. Mendola. Journal of Vision 4: 509-523.

Other Significant Publications

1. Abraham, J., Haut, M. W., Moran, M. T., Filburn, S., Lemieux, S., & Kuwabara, H. (2008) Clinical Breast Cancer, 8, 88-91.
2. Takaharu Shonai, MD, PhD, Jeffrey S. Carpenter, MD, Susan K. Lemieux, PhD, Kuniaki Harada, RT, PhD, Kazumi Omori, MD, Nobuaki Kaneko, MD, and Takanori Fukushima, MD, DMSc. J. Magn.Res.Imag. (2007).
3. L.D.Sparks, S.K.Lemieux, M.W. Haut, L.C. Baxter, S.C. Johnson, J.E. Lopez, M.N. Sabbagh, D.J.Conner DJ. Cleveland Clinic Journal of Medicine, Mar. 2008 75: S87.

4. R. R. Raylman, S. Majewski, **S. K. Lemieux**, S. Sendhil Velan, B. Kross, V. Popov, M. F. Smith, A. G. Weisenberger and C. Zorn. (2006). J Magn Reson. 2007 Jun;186(2):305-10. Epub 2007 Mar 24.21.
5. S. Sendhil Velan, **Susan K. Lemieux**, Raymond R. Raylman, Warren Boling, Gerald R. Hobbs, Rajagopalan Sridhar, Periannan Kuppasamy, M. Albert Thomas. J Magn. Res. Imag. 2007 Aug;26(2):405-9.
6. R. R. Raylman, S. Majewski, **S. K. Lemieux**, S. Sendhil Velan, B. Kross, V. Popov, M. F. Smith, A. G. Weisenberger and C. Zorn. Phys Med Biol 51:6371-6379 (2006).
7. M.W. Parsons, M.W. Haut, **S.K. Lemieux**, M.T. Moran, S.G. Leach. Brain Cogn 60: 253-261 (2006).
8. D.S. Woodruff-Pak, R. W. Vogel III, M. Ewers, J. Coffey, O. B. Boyko, S.K. Lemieux. Neurobiol Learn Mem 76(3): 342-57 2001.
9. A.A. Patel, E. T. Gawlinski, S. K. Lemieux, R. A. Gatenby. J. Theor. Biol. Sept.2001, 213:315-331.
10. G. Boden, B. Lebed, M. Schatz, C. Homko, S. Lemieux, Diabetes July 2001 50: 1612-1617.
11. S.K. Lemieux and G.H. Glover, JMRI 1996 6:561-564.
12. G.H. Glover, S.K. Lemieux, and M. Drangova, "Decomposition of Inflow and BOLD Effects with Dual-echo Spiral GRE fMRI, Mag.Res.Med. 1996, 35:299-308.
13. S.K. Lemieux, T.B. Clegg, H.J. Karwowski, W.J. Thompson, and E.R. Crosson, Nucl. Instr. & Meth. in Physics Research, Section A (Accelerators, Spectrometers, Detectors and Associated Equipment, Sept. 1993 vol.333, no.2-3, p. 434-42.
14. E.R. Crosson, S.K. Lemieux, E.J. Ludwig, W.J. Thompson, M. Bisenberger, G. Graw,
15. R. Hertenberger, D. Hofer, H. Kader, P. Schiemenz, A.M. Eiro, and F.D. Santos, Phys. Rev. C, (Nuclear Physics), June 1993 vol.47, no.6, p. 2690-8.
16. E.R. Crosson, T.B. Clegg, H.J. Karwowski, S.K. Lemieux. Nucl. Instr.Meth., vol. A310, 703-705, 1991.

D. SYNERGISTIC ACTIVITIES

1. MRI Safety Officer creating/supervising MRI safety procedures and training of faculty, staff, and student MRI researchers at WVU.
2. Developed and taught three physics courses for residents: Basic Radiological Physics, Board Review Course for Radiological Physics, Nuclear Medicine Physics at Temple University and WVU.
3. Directed high school student research in the Temple Minority Access to Research Careers program.
4. Worked with radiologists, neuroscientists, neurosurgeons, and neuropsychologists to start MRI research programs at Temple University and West Virginia University. Activities included MRI pulse sequence design, protocol/parameter optimization, design, development, and testing of MRI compatible devices.
5. Information Technology activities: instrumental in the design and installation of Temple University wide-area network PACS system for Radiology (1996) enabling electronic image transfer. Completely redesigned WVU Radiology website (2006) to promote Center for Advanced Imaging including creation of a web-compatible video with the WVU mascot visiting the Center to participate in a research study.

COLLABORATORS AND OTHER AFFILIATIONS

Collaborators Over The Last 48 Months:

Bernard Schreurs, Ph.D., Blanchette Rockefeller Neuroscience Institute, West Virginia University – MRI of Rabbit Model of Alzheimer’s Disease. Funded by NIH

James Lewis, Ph.D. West Virginia University, Motion Reduction in MRI Scans, unfunded.

Raymond Raylman, Ph.D., West Virginia University, Animal MRI/PET scanner development.

Graduate and Postdoctoral Advisors

Thomas B. Clegg, University of North Carolina at Chapel Hill, Department of Physics and Astronomy

Gary H. Glover, Stanford University, Richard Lucas Center for MRI/S

Thesis Advisor and Postgraduate Scholar Sponsors over the Last Five Years:

Graduate Students: Nitya Krishnan – Massachusetts General Hospital, Ashwin Tanagula - QualCom, Rajesh Garugu – University of Miami.

Total Number of Graduate Students advised: 3

Total Number of Postdoctoral Scholars Sponsored: None.

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME Rebecca L. Corwin	POSITION TITLE Associate Professor of Nutritional Neuroscience		
eRA COMMONS USER NAME RCORWIN			
EDUCATION/TRAINING <i>(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)</i>			
INSTITUTION AND LOCATION	DEGREE <i>(if applicable)</i>	YEAR(s)	FIELD OF STUDY
University of Florida	B.A	1972	Education
Texas Woman's University	B.S.	1978	Clinical Dietetics
University of Houston-Clear Lake	M.A.	1983	Biopsychology
The University of Chicago	Ph.D.	1989	Biopsychology
Bourne Behavioral Research Laboratory, New York Hospital-Cornell Medical Center	Post-doc	1989-1991	Food intake regulation
National Institute of Mental Health	Resrch Assoc	1991-1994	Neuropsychopharmacol

A. POSITIONS AND HONORS

Positions and Employment

- 1979-1980 Clinical dietitian, The Institute for Rehabilitation and Research, Houston, TX
- 1982-1983 Behaviorist, Institute for Health Maintenance weight loss program, Houston, TX
- 1983-1984 Research Assistant, The University of Chicago, Chicago, IL
- 1986-1988 Research Assistant, The University of Chicago, Chicago, IL
- 1994-2000 Assistant Professor, Nutritional Sciences Department, The Pennsylvania State University
- 2000-present Associate Professor, Nutritional Sciences Department, The Pennsylvania State University

Other Experience and Professional Memberships

- Member The American Dietetic Association (ADA), American Society for Nutritional Sciences (ASNS), American Society for Clinical Nutrition (ASCN), Society for the Study of Ingestive Behavior (SSIB), The Society for Neuroscience
- 2003-present Editorial Board: Journal of Nutrition
- 2004 Invited participant: Workshop on Dysfunctional Appetitive Behavior: Developing Interdisciplinary Approaches to Understanding Substance Abuse and Eating Disorders. National Institutes of Health (NIMH, NIAAA, NIDA)
- 2005-2007 Ad hoc member: NIH Neurobiology of Motivated Behavior (NMB) study section

Honors

- 1988 Joseph Kelly Memorial Award for Research Merit, Committee on Biopsychology, The University of Chicago
- 1997 Dorothy Jones Barnes Teaching Award, College of HHD, Penn State University
- 1997 Named Outstanding Alumna in Behavioral Sciences, Graduate Program in Human Sciences and Humanities, University of Houston-Clear Lake, Texas

B. PEER-REVIEWED PUBLICATIONS

- Corwin, R.L.**, Woolverton, W.L., Schuster, C.R., and Johanson, C.E. (1987) Anorectics: Effects on food intake and self-administration in rhesus monkeys. *Alcohol and Drug Research* 7:351-361.
- Chait, L.D., **Corwin, R.L.**, and Johanson, C.E. (1988) A cumulative dosing procedure for administering marijuana smoke to humans. *Pharmacol. Biochem. Behav.* 29:553-557.
- Corwin, R.L.**, Woolverton, W.L., and Schuster, C.R. (1990) Effects of cholecystokinin, *d*-amphetamine, and fenfluramine in rats trained to discriminate 3-hours from 22-hours of food deprivation. *J. Pharmacol. Exp. Ther.* 253:720-728.
- Corwin, R.L.**, Gibbs, J., and Smith, G.P. (1991) Increased food intake after Type A but not Type B cholecystokinin receptor blockade. *Physiol. Behav.* 50:255-258.
- Corwin, R.L.**, Corp, E.S., Gibbs, J., and Smith, G.P. (1992) Decreased behavioral effects of daily intracerebroventricular bombesin. *Peptides* 13:1215-1218.
- Corwin, R.L.** and Schuster, C.R. (1993) Anorectic specificity as measured in a choice paradigm in rhesus monkeys. *Pharmacol. Biochem. Behav.* 45:131-141.
- Corwin, R.L.** and Smith, G.P. (1993) Different effects of CCK antagonists on gastric acid response to CCK and pentagastrin. *Peptides* 14:253-257.
- Crawley, J.N., **Corwin, R.L.**, Robinson, J.K., Felder, C.C., Devane, W.D., and Axelrod, J. (1993) Anandamide, an endogenous ligand of the cannabinoid receptor, induces hypomotility and hypothermia *in vivo* in rodents. *Pharmacol. Biochem. Behav.* 46:967-972.
- Corwin, R.L.**, Robinson, J.K., and Crawley, J.N. (1993) Galanin antagonists block galanin-induced feeding in the hypothalamus and amygdala of the rat. *Eur. J. Neurosci.* 5:1528-1533.
- Bartfai, T.; Langel, Ü; Bedecs, K.; Andell, S.; Land, T.; Gregersen, S.; Ahrén, B.; Girotti, P.; Consolo, S.; **Corwin, R.**; Crawley, J.; Xu, X; Wiesenfeld-Hallen, Z.; and Hökfelt, T. (1993) Galanin receptor ligand M40 peptide distinguishes between putative galanin-receptor subtypes. *Proc. Nat'l. Acad. Sci.* 90:11287-11291.
- Corwin, R.L.**, Jörn A., Hardy, M., and Crawley, J.N. (1995) The CCK-B antagonist CI-988 increases dopamine levels in microdialysate from the rat nucleus accumbens via a tetrodotoxin- and calcium-independent mechanism. *J. Neurochem.* 65:208-217.
- Corwin, R.L.**, Rowe, P.M., and Crawley, J.N. (1995) Galanin and the galanin antagonist M40 do not change fat intake in a fat-chow choice paradigm in rats. *Am. J. Physiol.* 269 (*Regulatory Integrative and Comp. Physiol.* 38) R511-R518.
- Rice, H.B. and **Corwin, R.L.** (1996) Intracerebroventricular enterostatin stimulates food intake in non-food deprived rats. *Peptides* 17:885-888.
- Rice, H.B. and **Corwin, R.L.** (1998) Effects of enterostatin on consumption of optional foods in non-food deprived rats. *Obes. Res.* 6(1):54-61.
- Corwin, R.L.** and Rice, H.B. (1998) Effects of enterostatin on optional oil or sucrose consumption in non-food deprived rats. *Physiol. and Behav.* 65:1-10.
- Corwin, R.L.**, Wojnicki, F.H.E., Fisher, J.O., Dimitriou, S.G., Rice, H.B., and Young, M.A. (1998) Limited access to a dietary fat option affects ingestive behavior but not body composition in male rats. *Physiol. and Behav.* 65:545-553.
- Corwin, R.L.** (2000) Biological and behavioral consequences of food restriction. *Appetite* 34: 112.
- Rice, H.B., Greenberg, D. and **Corwin, R.L.** (2000) Different preferences for oils with similar fatty acid profiles. *Physiol. Behav.* 68:755-759.
- Dimitriou, S.G., Rice, H.B., and **Corwin, R.L.** (2000) Effects of limited access to a fat option on food intake and body composition in female rats. *International Journal of Eating Disorders.* 28:436-445.

- Rice, H.B and **Corwin, R.L.** (2002) Food intake in rats is unaffected by the profile of dietary unsaturated fatty acids. *Physiol. Behav.*75: 611-619.
- Thomas, M.A., Rice, H.B., Weinstock, D. and **Corwin, R.L.** (2002) Effects of aging on food intake and body composition in rats. *Physiol. Behav.*76: 487-500.
- Rice, H.B. and **Corwin, R.L.** (2002) mCPP-induced hypophagia in rats is unaffected by the profile of dietary unsaturated fatty acids. *Pharmacol Biochem Behav* 73: 545-550.
- Corwin, R.L. (2004) Binge-type eating induced by limited access in rats does not require energy restriction on the previous day. *Appetite* 42: 139-142.
- Buda-Levin, A., Wojnicki, F.H.E., **Corwin, R.L.** (2005) Baclofen reduces fat intake under binge-type conditions *Physiol. Behav* 86: 176-184.
- Corwin, R.L.** and Hajnal, A. (2005) Too much of a good thing: Neurobiology of non-homeostatic eating and drug abuse. *Physiol. Behav* 86: 5-8.
- Corwin, R.L.**, Hartman, T.J. Maczuga, S.A., Graubard, B.I. (2006) Dietary saturated fat intake is inversely associated with bone density in humans: analysis of NHANES III *J. Nutr*136: 159-165
- Wojnicki, F.H.E., Roberts, D.C.S., **Corwin, R.L.W** (2006) Effects of baclofen on operant performance for food pellets and vegetable shortening after a history of binge-type behavior in non-food-deprived rats. *Pharmacol Biochem Beh* 84:197-206.
- Corwin, R.L.** (2006) Bingeing rats: a model of intermittent excessive behavior? *Appetite* 46: 11-15.
- Griel, A. E., Kris-Etherton, P. M., Hilpert, K. F., Zhao, G., West, S.G., **Corwin, R.L.** (2007) An Increase in Dietary n-3 Fatty Acids Decreases a Marker of Bone Resorption in Humans *Nutrition J.* 6:2.
- Wojnicki, F.H.E, Stine, J.G., **Corwin, R.L.W** (2007) Liquid sucrose bingeing in rats depends on the access schedule, concentration and delivery system. *Physiol Behav* 92(4):566-74
- Broft, AI, Spanos, A, **Corwin, R.**, Mayer, L, Steinglass, J, Devlin, MJ, Attia, E, Walsh, T (2007) Baclofen as a novel treatment for binge eating: an open-label pilot study. *International Journal of Eating Disorders* 40: 687-91.
- Rao RE, Wojnicki FHE, Coupland J, Ghosh S, Corwin RLW (2008) Baclofen, raclopride and naltrexone differentially reduce solid fat emulsion intake under limited access conditions. *Pharmacol Biochem Behav* 89(4):581-90.
- Wojnicki, F.H.E., Charny, G., and Corwin, R.L.W. (2008) Binge-type behavior in rats consuming trans-fat-free shortening *Physiol Behav* 94(4):627-9.
- Yu, Z, Geary, N, Corwin, RL (2008) Ovarian hormones inhibit fat intake under binge-type conditions in ovariectomized rats *Physiol Behav* 95:501-7.
- Wojnicki, F.H.E., Johnson, D.S., **Corwin, R.L.W.** (2008) Access conditions affect binge-type shortening consumption in rats. *Physiol Behav* 95: 649-657.
- Corwin, RL, Grigson, PS (2009) Symposium Overview. Food Addiction: Fact or Fiction? *Journal of Nutrition* Jan 28 [Epub ahead of print]
- Wong KJ, Wojnicki, FHW, Corwin, RLW (2009) Baclofen, raclopride, and naltrexone differentially affect intake of fat/sucrose mixtures under limited access conditions. *Pharmacol Biochem Behav* 92(3):528-36.
- Corwin, RL, Wojnicki, FHE Baclofen, raclopride, and naltrexone differentially affect intake of fat and sucrose under limited access conditions. (2009). *Behav Pharmacol.* 20(5-6):537-48.

Invited Reviews

- Crawley, J.N. and **Corwin, R.L.** (1994) Biological actions of cholecystokinin. *Peptides* 15:731-755. LISTED BY ISI AS A CITATION CLASSIC
- Corwin, R.L.** (2003) Effects of dietary fats on bone health in advanced age. *Prostaglandins Leukot Essent Fatty Acids* 68 (6):379-386.

Corwin, R.L. and Buda-Levin, A. (2004) Behavioral models of binge-type eating *Physiol Behav* 82: 123-130.

Book Chapter

Corwin, R.L. and Wojnicki, F.H.E (2006) Binge eating in rats with limited access to vegetable shortening. 9.23B1-9.23B11 *Protocols in Neuroscience* John Wiley & Sons, Inc.

C. RESEARCH SUPPORT (PAST THREE YEARS)

Ongoing Research Support

2-R01-MH67943-05 Corwin (PI) 7/25/09-5/31/14

NIH/NIMH

Neurobiology of Binge-type Behavior

This grant continues to focus on the neurological underpinnings of binge-type behavior, with an emphasis on reward-related neurocircuitry.

Role: PI

No number assigned Corwin (PI) 7/07-6/10

Penn State Diabetes and Obesity institute

Effects of the GABA-B Receptor Agonist Baclofen on Binge Eating

This seed grant is funding a double-blind, placebo-controlled pilot clinical trial of the use of baclofen in the treatment of binge eating in human subjects.

Role: PI

Completed Research Support

No number assigned Coupland (PI) 5/08-6/09

College of Agricultural Sciences Seed Grant Program

Solid Lipid Nanoparticles in the Diet

The effects of different lipid formulations on intake and excretion will be assessed.

Role: Co-investigator

No number assigned Coupland (PI) 5/06-12/08

Johnson & Johnson, and the Pennsylvania State University

What makes fatty food 'irresistible?': Relating food structure and eating behavior

In this project the chemical composition of different fats are being manipulated in order to determine which components of fat contribute to their rewarding effects and their ability to promote intake.

Role: Co-investigator

02-173 Jones, Norgren (PIs) 6/03-5/06

PA Tobacco Settlement Fund

Consortium on Nutritional Neuroscience

This award funded a group of investigators at Penn State to collect pilot data for research and training grants.

Role: Co-Investigator

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME Stephen J. Wilson, Ph.D.	POSITION TITLE Assistant Professor		
eRA COMMONS USER NAME SJWILSON			
EDUCATION/TRAINING <i>(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)</i>			
INSTITUTION AND LOCATION	DEGREE <i>(if applicable)</i>	YEAR(s)	FIELD OF STUDY
Univ. of Pittsburgh-Johnstown, Johnstown, PA	B.S.	1999	Psychology
Univ. of Pittsburgh, Pittsburgh, PA	M.S.	2004	Clinical Psychology
Univ. of Pittsburgh, Pittsburgh, PA	Ph.D.	2008	Clinical Psychology

A. Positions and Honors

Positions

1998-1999	Research Assistant, Dept. of Psychology, U. Pittsburgh-Johnstown, Johnstown, PA
2000-2001	Research Assistant, Dept. of Psychology, U. of Pittsburgh, Pittsburgh, PA
2001-2008	Graduate Student Researcher, Dept. of Psychology, U. of Pittsburgh, Pittsburgh, PA
2007-2008	Clinical Psychology Intern, VA Pittsburgh Healthcare System, Pittsburgh, PA
2008-2009	Research Associate, Dept. of Psychology, Penn State U., University Park, PA
2009-	Assistant Professor, Dept. of Psychology, Penn State U.

Honors

1995	Senior Thesis Excellence Award, U. of Pittsburgh-Johnstown
1995-1996	Rhea Louise Smith Scholarship, U. of Pittsburgh-Johnstown
2000	Natural Sciences Division Travel Grant, U. of Pittsburgh-Johnstown
2000	College Scholar Award in Psychology, U. of Pittsburgh-Johnstown
2000	Outstanding Student Award in Psychology, U. of Pittsburgh-Johnstown
2001	Honorable Mention, American Psychological Association Minority Fellowship Program
2001	Ford Foundation Predoctoral Fellowship for Minorities
2002	K. Leroy Irvis Fellowship, U. of Pittsburgh
2002-2003	African American Summer Graduate Research Award, U. of Pittsburgh
2004	National Institute on Drug Abuse Frontiers in Addiction Research Travel Award
2004-2007	Bassell Student Publication Award, U. of Pittsburgh
2007	Bassell Award for Excellence in the Clinical Psychology Program, U. of Pittsburgh

B. Selected peer-reviewed publications (in chronological order)

Stern, S.E., Mullennix, J.W., Dyson, C., & Wilson, S.J. (1999). The persuasiveness of synthetic speech versus human speech. *Human Factors*, 41, 588-595.

Stern, S.E., Mullennix, J.W., & Wilson, S.J. (2002). Effects of perceived disability on persuasiveness of computer synthesized speech. *Journal of Applied Psychology*, 87, 411-417.

Mullennix, J.W., Stern, S.E., Wilson, S.J., & Dyson, C. (2003). Social perception of male and female computer synthesized speech. *Computers in Human Behavior*, 19, 407-424.

Wilson, S.J., Sayette, M.A., & Fiez, J.A. (2004). Prefrontal responses to drug cues: A neurocognitive analysis. *Nature Neuroscience*, 7, 211-214. PMID: 15001989.

Wilson, S.J., Sayette, M.A., Delgado, M.R., & Fiez, J.A. (2005). Instructed smoking expectancy modulates cue-elicited neural activity: A preliminary study. *Nicotine & Tobacco Research*, 7, 637-645. PMID: 16085533.

Wilson, S.J., Sayette, M.A., Fiez, J.A., & Brough, E. (2007). Carry-over effects of smoking cue exposure on working memory performance. *Nicotine & Tobacco Research*, 9, 613-619. PMID: 17454718.

Wilson, S.J., Sayette, M.A., Fiez, J.A., & Delgado, M.R. (2008). Effects of smoking opportunity on responses to monetary gain and loss in the caudate nucleus. *Journal of Abnormal Psychology*, 117, 428-434. PMID: 18489219.

C. Research Support

Previous Research Support

“Somatosensory Stimulation for the Alleviation of Craving to Smoke: A Pilot Study.”

Social Science Research Institute, The Pennsylvania State University

Role: Principal Investigator

Type: Seed Grant

Period: 2009-2010

The goal of this work was to investigate a novel procedure for alleviating craving to smoke in tobacco dependent individuals. Specifically, the study examined the utility of somatosensory stimulation as an intervention for preventing/reducing craving in cigarette smokers.

BIOGRAPHICAL SKETCH

NAME	POSITION TITLE		
Hayes, John Edward	Assistant Professor of Food Science		
INSTITUTION AND LOCATION	DEGREE (if applicable)	YEAR(s)	FIELD OF STUDY
Cornell University, Ithaca NY	BS	1998	Food Science
Cornell University, Ithaca NY	MS	2000	Food Science
University of Connecticut, Storrs CT (8/24/2007)	PhD	2007	Nutrition
University of Connecticut, Storrs CT	Certificate	2007	Quantitative Research
Brown University, Providence RI	Postdoc	2007-09	Alcohol / Addiction

A. Positions and Service.

Positions and Employment

1998-2000	Graduate Research Assistant, Cornell University
2001-2003	Research Assistant, JB Pierce Foundation (a Yale University affiliated laboratory)
2004,2005	Instructor, University of Connecticut
2003-2007	Graduate Research Assistant, University of Connecticut
2007-2009	NIH NIAAA T32 Postdoctoral Fellow, Brown University
2009-Present	Assistant Professor of Food Science, The Pennsylvania State University

Other Professional Activities

Member (Past or Present):

Association for Chemoreception Sciences
 Research Society on Alcoholism
 American Psychological Association
 Institute of Food Technologists
 Society for the Study of Ingestive Behaviors

Invited Reviewer:

Chemosensory Perception (Editorial Board Member: 2009 – Present)
 Chemical Senses
 Physiology and Behavior
 Psychology of Addictive Behaviors
 Journal of Studies on Alcohol and Drugs
 British Journal of Nutrition
 Australian Journal of Grape and Wine Research

Honors

2005 Institute of Food Technologists – Nutmeg (Connecticut) Chapter Scholarship
 2005 Association for Chemoreception Sciences Student Travel Award
 2006 Rose Marie Pangborn Sensory Science Scholarship (Pre-doctoral Fellowship)
 2007 Pangborn Sensory Science Symposium Travel Award
 2008 International Symposium on Olfaction and Taste (ISOT) Junior Scientist Travel Award
 2009 National Institute of Alcohol and Alcohol Abuse (NIAAA) T32 Trainee Travel Award

B. Peer-reviewed publications (in reverse chronological order).

12. **Hayes JE.** 2009. "Response to 'Lack of Relation Between Bitter Taste Receptor TAS2R38 and BMI in Adults'." *Obesity*. In press. doi:10.1038/oby.2009.351
11. Duffy VB, **Hayes JE**, Sullivan BS, Faghri P. 2009. "Surveying Food/Beverage Liking: A Tool for Epidemiological Studies to Connect Chemosensation with Health Outcomes." *Ann NY Acad Sci*. 1170:558-568. doi: 10.1111/j.1749-6632.2009.04593.x

10. **Hayes JE**, Duffy VB. 2008. "Oral sensory phenotype identifies level of sugar and fat required for maximal liking." *Physiol Behav* **95(1-2)**: 77-87. Epub 2008 May 2, doi:10.1016/j.physbeh.2008.04.023
9. **Hayes JE**, Bartoshuk LM, Kidd JK, Duffy VB. 2008. "Supertasting and PROP bitterness depends on more than the *TAS2R38* gene." *Chem Senses* **33(3)**: 255-265. Epub 2008 Jan 21, doi:10.1093/chemse/bjm084
8. **Hayes JE**. 2008. "Transdisciplinary perspectives on Sweetness." *Chemosensory Perception* **1(1)**:48-57. Epub 2007 December 11, doi:10.1007/s12078-007-9003
7. **Hayes JE**, Duffy VB. 2007. "Revisiting sugar-fat mixtures: sweetness and creaminess vary with phenotypic markers of oral sensation." *Chem Senses* **32(3)**: 225-236. Epub 2007 Jan 4, doi:10.1093/chemse/bjl050
6. Bartoshuk LM, Duffy VB, **Hayes JE**, Snyder DJ. 2006. "Psychophysics of sweet and fat perception in obesity: problems, solutions and new perspectives." *Philos Trans R Soc Lond B Biol Sci* **361(1471)**: 1137-48.
5. Dinehart ME, **Hayes JE**, Bartoshuk LM, Lanier SL, Duffy VB. 2005. "Bitter taste markers explain variability in vegetable sweetness, bitterness, and intake." *Physiol Behav* **87(2)**: 304- 13.
4. Lanier SA, **Hayes JE**, Duffy VB. 2005. "Sweet and bitter tastes of alcoholic beverages mediate alcohol intake in of-age undergraduates." *Physiol Behav* **83(5)**: 821-831.
3. Green BG, **Hayes JE**. 2004. "Individual Differences in Perception of Bitterness from Capsaicin, Piperine and Zingerone." *Chem Senses* **29(1)**: 53-60.
2. Green BG, **Hayes JE**. 2003. "Capsaicin as a probe of the relationship between bitter taste and chemesthesis." *Physiol Behav* **79(4-5)**: 811-821.
1. Horne J, **Hayes J**, Lawless HT. 2002. "Turbidity as a measure of salivary protein reactions with astringent substances." *Chem Senses* **27(7)**: 653-9.

C. Book Chapters

3. Duffy VB, **Hayes JE**, Bartoshuk LM, Snyder DJ. "Taste: vertebrate psychophysics." In: *Encyclopedia of Neuroscience*. 2009. Squire L (ed in chief). Academic Press. Oxford. p. 881- 885. doi:10.1016/B978-008045046-9.01674-0.
2. Snyder DJ, Duffy VB, **Hayes JE**, Bartoshuk LM. Propylthiouracil (PROP) taste. In: *The Senses: A Comprehensive Reference*. 2008. Basbaum et al (eds). Academic Press. New York. Vol 4, p. 391-399. doi: 10.1016/B978-012370880-9.00093-1.
1. Duffy VB, **Hayes JE**, Dinehart ME. "Genetic differences in sweet taste perception." In: *Optimising sweet taste in foods*. 2006. Spillane WJ (ed). Woodhead Publishing Ltd. Cambridge.

CURRICULUM VITAE

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Education

- Ph.D.** May 2009
University of Illinois at Urbana-Champaign
Major: Clinical-Community Psychology
Minor: Brain & Cognition
Dissertation title: *Additive and Interactive Effects of Comorbidity during Emotion Processing*
- M.A.** August 2006
University of Illinois at Urbana-Champaign
Major: Clinical-Community Psychology
Thesis title: *Specificity of Regional Brain Activity in Anxiety Types during Emotion Processing*
Thesis Committee: Wendy Heller, Ph.D.; Gregory A. Miller, Ph. D.
- B.A.** May 2002, with Honors
University of Kansas, Lawrence, KS
Major: Psychology
GPA: 4.0
Honors thesis title: *Age Differences in Distractibility Between Twelve- and Eighteen-month-olds.*
Thesis Advisor: John Colombo, Ph.D.

Professional Experience

- 2008 – Present Pennsylvania State University, University Park, PA
Assistant Director, Social, Life, & Engineering Sciences Imaging Center (SLEIC)
Research Associate, Department of Psychology
- 2002 – 2008 University of Illinois, Urbana-Champaign, IL
Predoctoral Research Assistant
Advisors: Gregory A. Miller, Ph.D. & Wendy Heller, Ph.D.
- 2000 – 2002 University of Kansas, Lawrence, KS
Undergraduate Research Assistant, Department of Psychology
Advisor: Ruthann Atchley, Ph.D.

Honors & Awards

- 2008 Society for Psychophysiological Research Poster Award
2007 Clinical/Community Division Ed Scheiderer Award, University of

	Illinois. Recognizes “outstanding research or scholarship by a Clinical/Community graduate student”
2004 – 2006	Predoctoral traineeship, NIMH Cognitive Psychophysiology Training Grant, University of Illinois
2001 – 2002	Harley Nelson Scholarship, University of Kansas Psychology Department
1998 – 2002	National Merit Finalist Scholarship, University of Kansas
1998 – 2002	Harold Otto National Merit Scholarship, University of Kansas
1998 – 2002	Honors Program, University of Kansas
2001 – 2002	Mortar Board Honor Society, University of Kansas
2001 – 2002	Psi Chi Honor Society, University of Kansas
2000 – 2002	Golden Key National Honor Society, University of Kansas
2000 – 2002	Department of Psychology Honors Program, University of Kansas
2000 – 2001	Gamma Sigma Alpha National Honor Society, Program Director, University of Kansas
2000 – 2001	Owl Leadership Honor Society, University of Kansas
1999	Summer Language Institute Eugenie H. Galloo Scholarship, University of Kansas
1999	University Scholars Finalist (top 40 sophomores), University of Kansas
1998 – 1999	Merit Scholars Development Program, University of Kansas
1998	Watkins-Berger National Merit Scholar, University of Kansas

Publications

Silton, R.L., Heller, W., Towers, D.N., **Engels, A.S.**, Edgar, J.C., Spielberg, J.M., Sass, S.M., Stewart, J.L., Sutton, B.P., Banich, M.T., & Miller, G.A. (under review). Depression and anxiety distinguish frontocingulate cortical activity during top-down attentional control.

Warren, S., Bost, K., Roisman, G., Silton, R. L., Spielberg, J., **Engels, A.**, Choi, E., Sutton, B., Miller, G. A., Heller, W. (under review). Effects of adult attachment and emotional distracters on brain mechanisms of cognitive control.

Engels, A. S., Heller, W., Spielberg, J. M., Warren, S. L., Sutton, B.P., Banich, M. T., & Miller, G. A. (in press). Anxiety comorbidity influences patterns of brain asymmetry in depression. *Cognitive, Affective, and Behavioral Neuroscience*.

Silton, R.L., Miller, G.A., Towers, D.N., **Engels, A.S.**, Edgar, J.C., Spielberg, J.M., Sass, S.M., Stewart, J.L., Sutton, B.P., Banich, M.T., & Heller, W. (in press). The time course of activity in dorsolateral prefrontal cortex and anterior cingulate cortex during top-down attentional control. *NeuroImage*.

Herrington, J. D., Heller, W., Mohanty, A., **Engels, A. S.**, Banich, M. T., Webb, A. G., and Miller, G. A. (in press). Localization of asymmetric brain function in emotion and depression. *Psychophysiology*.

Engels, A. S., Heller, W., Mohanty, A., Herrington, J. D., Banich, M. T., Webb, A. G., & Miller, G. A. (2007). Specificity of regional brain activity in anxiety types during emotion processing. *Psychophysiology*, *44*, 352-363.

Mohanty, A., **Engels, A. S.**, Herrington, J. D., Heller, W., Ho, R. M., Banich, M. T., Webb, A. G., Warren, S. L., & Miller, G. A. (2007). Differential engagement of anterior cingulate cortex subdivisions for cognitive and emotional function. *Psychophysiology*, *44*, 343-351.

Miller, G. A., **Engels, A. S.**, & Herrington, J. D., (2007). The seduction of clinical science: Challenges in psychological and biological convergence. In T. Treat, R. Bootzin, & R. Levenson (Eds.), *Psychological clinical science: Papers in honor of Richard McFall* (pp. 53-74). Mahwah, NJ: Lawrence Erlbaum.

Heller, W., & **Engels, A. S.** (In press). Anxiety section editors for D. Barch (Editor), to appear in the *Cognitive and affective neuroscience of psychopathology*, to be published by Oxford University Press.

Supervised Clinical Training

2007 – 2008	University of Illinois Psychological Services Center Stress and Anxiety Clinic Practicum, student supervisor Supervisor: Howard Berenbaum, Ph.D.
2005 – 2006	University of Illinois Psychological Services Center Stress and Anxiety Clinic Practicum, student therapist Supervisor: Howard Berenbaum, Ph.D.
2004 – 2005	University of Illinois Psychological Services Center Neuropsychological Assessment Practicum, service provider Supervisor: Wendy Heller, Ph.D.
2003 – 2004	Provena Covenant Medical Center, Urbana IL Inpatient Psychiatry Assessment Practicum, service provider Supervisor: Gregory A. Miller, Ph.D.
2000 – 2001	Headquarters Counseling Center, Lawrence Kansas Crisis Line Volunteer Supervisor: Marsha Epstein, LMSW, Headquarters Director