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:** Monell Chemical Senses Center

2. **Reporting Period (start and end date of grant award period):** 01/01/09-12/31/09

3. **Grant Contact Person (First Name, M.I., Last Name, Degrees):** Gary K. Beauchamp, PhD

4. **Grant Contact Person's Telephone Number:** 267-519-4710

5. **Grant ME Number or SAP Number:** SAP# 4100047640

6. **Project Number and Title of Research Project:** 01 -Effect of Genotype on Smoking, Taste and Obesity in Mothers and Children

7. **Start and End Date of Research Project:** 01/01/09 – 12/31/09

8. **Name of Principal Investigator for the Research Project:** Danielle R. Reed, 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:

   $ 217,966

   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
Reed	Member	10%	$11,000
Mennella	Member	5%	$ 6,800
Finkbeiner	Technician	100%	$32,997
Duke	Technician	100%	$27,999
Silva-Garcia	Student Research Apprentice	25%	$5,001

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
Crawford	Student Research Apprentice	25%
Crowley	Student Research Apprentice	25%
Will	Student Research Apprentice	25%
James	Student Research Apprentice	25%

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
None		

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_____ No_____x_____

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

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	☐NIH ☐ Other federal (specify:_____) ☐ 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 during this project and described herein will provide groundwork for an NIH R01 application.

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

We observed differences between current smokers and never-smokers in taste preferences, specifically an elevated liking for sweet and high-fat foods. The next step is to understand the origins of these differences from a biological perspective. This may involve animal models or may involve studying humans at different stages in the development of nicotine dependence.

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	1			
Female	4			
Unknown				
Total	**5**			

	Undergraduate	Masters	Pre-doc	Post-doc
Hispanic	1			
Non-Hispanic	4			
Unknown				
Total	**5**			

	Undergraduate	Masters	Pre-doc	Post-doc
White	5			
Black				
Asian				
Other				
Unknown				
Total	**5**			

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.

    The main improvement to our research is the development of a laboratory-based test for fat preference. The preference for high-fat foods is strongly implicated in the development of human obesity but the reason why people prefer fat (and eat too much when it is available) is unknown. The development of a laboratory-based test of fat preference allows us to understand the molecular, cellular and physiological basis of fat preference, e.g., the role of genotype. Of particular importance was our development of a fat preference test suitable for both children and adults.

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____x_____ No_____

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

The opportunity to participate in this research project was available to all women with children regardless of race or income. As a result, some of our subjects were recruited through the WIC (Women, Infant, Children) programs, homeless shelters, and other programs which serve women and children. The participation in this research program raises awareness about nutrition and taste among women from all strata of education and income and therefore is of benefit to the participants.

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 (ß) should not print as boxes (□) and include the appropriate citation(s). DO NOT DELETE THESE INSTRUCTIONS.

Specific Aims -The overall goal of this research is to determine the interaction of genotype on health-related behaviors with a focus on taste, smoking and the preference for high-fat, high-sugar foods. The specific aims of this project are to determine how alleles in a human bitter receptor gene affect sweet and fat taste perception/preferences as well as smoking behaviors and body weight in a cohort of women and their children.

The data are presented below in the following order: overview of laboratory testing; description of subject population; smoking behavior of mothers by self-report; direct measures of carbon monoxide in breath; subject characteristics by maternal smoking status; additional obesity phenotypes; sweet and fat liking by self-report; direct measures of sweet and fat preference; bitter-taste and other genes by smoking status

Overiew of laboatory testing procedures. Each mother and child were tested separately on two separate days, approximately 1 hour before their next scheduled meal (see Table 1 for the timetable). Testing sessions lasted about 90 to 120 minutes each day and took place in a newly renovated testing facility specifically designed for psychophysical testing of children and their parents.

Description of subject population. We projected that fifty mother-child pairs would be tested on two separate days during the project period (January 1st 2009 to Dec 31st 2009). Mothers were recruited from newspaper advertisements and initial interviews to screen subjects for the inclusion criteria were conducted over the telephone. Mothers were excluded from participation if they had a history of chronic rhinitis or sinusitis, were diabetic, pregnant, lactating or taking any prescription medication, with the exception of birth control pills. Children were excluded if they were less than five or more than ten years of age. Using these criteria, this goal for subject recruitment and testing was met and exceeded. The final total of subjects tested was 76 mothers and 97 children. The number of children tested was larger than the number of mothers because some mothers had more than one eligible child. Specifically, there were 13 sibling pairs and 4 sibling triads.

See Table 2 for a summary of the characteristics of the mothers and Table 3 for those of the children. All children tested were between the ages of 5 and 10 years and their mothers were 21 years or older. On average, the mothers were 35 years old, had an average of 14 years of school (equivalent to two years of college). As outlined in the original strategic research plan, the sample reflected the community of greater Philadelphia and was predominantly African American, with European-American (Caucasian) being the next most common ethnic/racial group. Some mothers were poor and reported an annual family income of less than $15,000 US dollars per year (21%) but the sample was also economically diverse, with 15% reporting an income of over $75,000 per year.

Smoking behavior of mothers by self-report. Based on our previous work, we anticipated that about half of the women will be 'never-smokers' and half would be current smokers. Current smokers are defined as women who are currently smoking at least 5 cigarettes (or the nicotine equivalent, e.g., cigars) a day and have been smoking for more than one year. Never-smokers are women who have never smoked in their lifetimes. (In the results that follow, we use the term 'never-smokers' rather than 'non-smokers' to precisely reflect the past and current smoking behavior of the women studied). As predicted, just over half of the women were never-smokers, about 33% of the women were current smokers and a little over 10% of women were former smokers. Former smokers were a diverse group: some smoked briefly when they were young and had never relapsed while others were heavy smokers who had stopped and started smoking many times but who currently report not smoking. The group of former smokers was small in number (eight mothers out of the 76 studied). Because of the small numbers of former smokers, their lack of uniformity in their smoking patterns and the possibility they might not provide sufficient statistical power for data analysis, they were not considered further in this progress report or ensuing data analysis.

To evaluate nicotine self-administration behavior in smokers, subjects were given the Fagerstrom test of Nicotine dependence and the Michigan Nicotine Reinforcement questionnaire which have been used in previous research to measure the degree of personal dependence on nicotine and its subjective effects. The results are shown in Table 4. For women who reported they were current smokers, there was a wide range of nicotine dependence, with some women scoring 14 on the Fagerstrom scale (indicating extreme dependence) whereas a few women reported relatively low measures of nicotine dependence, with the average rating being 7.3. The average rating corresponds to a high level of dependence, which is consistent with the inclusion criterion, that to be considered smokers, women had to smoke at least five cigarettes a day and had to have smoked for at least a year. Thus women who are not very nicotine dependent, like casual smokers who have an occasional cigarette in social situations, were excluded from this study.

Most women in this study started smoking early in life, the average age of the first cigarette was 14 years, and by 18 years of age, all women had their first cigarette. As expected, the age of the first cigarette was about two years before smoking was established as a habitual behavior: most women started smoking routinely between the ages of 16 to 17. Commensurate with the range of scores of nicotine dependence, there was a range in the number of cigarettes smoked per day, with the maximum number being twenty-five. In general, people vary in how heavily they smoke over time. For instance, in periods or stress, people might smoke more or in response to health concerns (or practical limitations on smoking such as working in a non-smoking

environment), they will smoke less. Therefore subjects were asked to report the number of cigarettes smoked during their period of heaviest smoking and these data suggest that on average, during this period, people smoked about 13 cigarettes a day. As expected from the current average age of the women (35 years old) and the average age which smoking began (16 to 17 years old), most women had been smoking for an average of 16 years, or most of their adult life (although about half the women reported a smoking hiatus during pregnancy). When each mother's smoking history was tabulated, the average pack/years was 171.

Direct measures of carbon monoxide in breath. At the beginning of each test day, the mother and child were asked to breath into Vitalograph (Lenexa, KS) to obtain a measure of carbon monoxide levels. This measure is useful because smokers have a higher concentration of this chemical in their expired lung air than do never-smokers. The results of these studies are presented in Table 5 and confirm that at the time of testing women who stated they were smokers had a higher carbon monoxide concentration in their breath compared to women who report they are never-smokers. Most children had low levels of carbon monoxide in their breath but had slightly higher mean concentrations if they were the children of smokers compared to never-smokers. We examined the breath carbon monoxide measures to ensure that the self-report of smoking behavior was consistent with the amount of breath carbon monoxide and found no instances of inconsistencies.

Subject characteristics by maternal smoking status: age, education, income and obesity. Next we focused on whether there were differences in the characteristics of mothers based on whether they were current or never-smokers. Mothers were stratified by smoking status and compared for age, education, income and obesity. The results of this analysis are shown in Table 6. Mothers who smoked were on average three years younger than mothers who report they were never-smokers but this result did not attain statistical significance (using a $p<0.05$ criterion). There were little or no differences in smoking status by ethnicity/race, with about 62-64% of each smoking group reporting their race as African American. However there were large differences between current smokers and never-smokers in education and income. Current smokers completed fewer years of school compared with women who were never-smokers, with current smokers having fewer years of formal education and earning less money per household than never-smokers.

The prevalence of obesity was also tabulated for women by smoking group. As a proxy measure of obesity, weight and height measurements were obtained for each subject and the body mass index (BMI; the weight in kilograms divided by the square of the height in meters) was computed. For women, BMI was categorized by standards set by the Center for Disease Control (CDC): 18.5 kg/m^2 to 24.9 kg/m^2 (normal weight), 25.0 kg/m^2 to 29.9 kg/m^2 (overweight), and 30.0 kg/m^2 or more (obese). Overall, current smokers were heavier than never-smokers, and almost all were obese by CDC standards. Overall never-smoking women had more years of formal education, higher household incomes and had lower rates of obesity compared with current smokers.

Children were compared for the same characteristics, stratified by maternal smoking (Table 7). The average age of the children did not differ by maternal smoking and both groups were (on average) 8 years old. There were differences in the distribution of boy and girls in the groups:

there were more boys than girls from smoking mothers. However because of the lack of epidemiological evidence for a birth sex-bias and smoking, these differences are probably due to chance. Children did not differ in years of education, which is to be expected because each group was the same approximate age. The ethnicity/race of the children was similar to that of their mothers and did not differ based on maternal smoking status.

For each child, BMI was computed and they were classified into one of four categories (i.e., underweight, healthy weight, overweight or obese) using the Center for Disease Control and Prevention pediatric grow charts. The largest difference between children based maternal smoking was for body weight: 38% of children of current smokers were at a healthy body weight as defined by the CDC whereas 67% of children from non-smoking mothers were within this healthy weight category. The rates of obesity in children and their mothers were similar: women who reported currently smoking were obese and their children were as well.

Additional obesity phenotypes. Obesity is often measured in epidemiological studies by the body mass index because it is a simple and fast measure which requires only height and weight. But it is also a crude measure because it does not take into account the relative proportion of fat and lean weight. For instance, football players and weightlifters are often obese as categorized by BMI but this is not an accurate classification. These athletes are heavier not because they are fatter but because they have more muscle mass.

Therefore more refined measures, in addition to BMI, are needed to assess obesity and body shape. Here we used three additional methods: waist circumference, waist to hip ratio and percent body fat. Abdominal circumference (waist) was measured by having the subject stand comfortably with his or her weight evenly distributed on both feet, and the feet about 25-30 cm apart. The measurement was taken midway between the inferior margin of the last rib and the crest of the ileum, in a horizontal plane. The waist and hip measurement were recorded to the nearest 0.1 cm. We also estimated percent body fat and basal metabolic rate by bioelectrical impedance analysis using the Quantum X instrument (RJL Systems, MI). (While procedures for the measures of bioelectrical impedance are the same for children and adults, special software was purchased so that it could be computed for children). Basal metabolic rate (BMR) was also calculated by mathematical formulas which take into account the amount of lean body mass per person. Skin fold measurements can also be used as an index of obesity were not obtained here due to time constraints.

The results of these three additional obesity measures for mothers and children stratified by the smoking status of the mother are presented in Table 8 and 9. Mothers who smoked were fatter as a percentage of total body weight and burned more calories compared with women who never smoked. Smokers had larger waist sizes and were more ‘apple’ than ‘pear’ shaped. The distribution of body fat is important because people with a larger waist relative to hips have higher rates of diabetes and other metabolic complications. Children of current or never smokers did not differ in waist to hip ratio but they did have larger waist circumferences, consistent with their higher weights. Likewise, children of smokers had higher body fat as a percentage of body weight and a higher basal metabolic rate due to their larger size.

Sweet and fat preferences by self-report. Mothers answered questions about their own preference for sweet and fat (Table 10) and those of their children (Table 11). Mothers who smoke reported higher liking and intake of high-fat foods and an inability to control their intake of sweets but they did not differ in amount of mood elevation experienced when sweet foods were consumed compared with never-smokers. Regarding food craving (the intense desire to eat a particular food), current smokers were more likely to crave high-fat but not sweet or other types of foods compared with never-smokers. Children did not differ in the liking for fat or sweet food by maternal smoking.

Mothers answered questions about the feeding habits and temperment of their children. Children of current or never-smokers did not differ in the amount of time mother's devoted to monitoring of the child's food intake, the amount of pressure placed on the child to eat, or the amount of restriction of the child's food intake. However mothers who smoked were more concerned about the weight of their children than were never-smokers; the most likely explanation is that their children were significantly fatter than children of never-smokers. Regarding temperament, all measures were similar between current and never-smoking groups, e.g., shyness, sociability, and food neophobia. Children of smokers were not more depressed compared with children of nonsmokers. See Table 12 for details.

Direct measures of sweet and fat preferences. The most preferred level of (1) sucrose dissolved in plain water or (2) sucrose or (3) fat mixed in vanilla pudding was assessed by a forced-choice tracking technique developed at the Monell Center. Mothers who smoked had a preference for higher concentrations of sucrose dissolved in water than did never-smoking mothers (Table 13). The same was not true the preference for sucrose or fat preferences when it was contained in a pudding—mothers who smoked did not have significantly higher preferences compared with never-smoking mothers. Children of current smokers or never-smokers mothers had similar sweet preferences when they were tested with sugar-water or different concentrations of sugar or fat in pudding (Table 14).

We next tested whether there were generational differences in sweet preference (mothers versus children). Children had a preference for more concentrated solutions of sugar-water compared to mothers (Figure1). When children and mothers were grouped by whether the mother currently smoked, we found that women who smoked had child-like preferences for sucrose dissolved in water (Figure 2). The results were similar for preferences for sugar in puddings (compare Table 16 and 17). For preference for fat in pudding, we learned that mothers liked puddings with a higher fat content than did children (Figure 3). When children and mothers were grouped by whether the mother currently smoked, mothers who smoked liked a higher-fat pudding then never-smoking women or children (Figure 4).

Fat and sweet preferences apparently change in opposite directions during development: sweet preference decreases and fat preferences increases. The direction of causality is unclear: (1) smoking may prevent the drop in sweet preference and encourage a rise in fat preferences or (2) women who smoke may have inborn sweet and fat preferences that are impervious to developmental effects.

Bitter taste and other genes by smoking status. Cigarettes can have a bitter taste and it is possible that people who are more sensitive to these bitter tastes are less likely to smoke. This hypothesis has recently gained support because bitter receptors, similar to those that sense bitter chemicals on the tongue, are also found in the airways.

To test this hypothesis directly, we obtained samples of genomic DNA (similar to the method used to collect forensic DNA samples, cheek swabs) and genotyped the samples for alleles of the *TAS2R38* gene. The *TAS2R38* gene is a bitter receptor gene involved in taste (hence the gene symbol begins with TAS), and it is a member of the second family of taste receptors (the bitter family is the second gene family and the sweet/savory family is the first family). The gene symbol contains the letter R because it is a receptor (and is found on the surface of taste cells were it binds the bitter chemicals and stimulates the cell to communicate with surrounding cells and finally the brain).

The *TAS2R38* gene is of interest because there are two major forms (alleles/haplotypes). If people have one form, they are insensitive to a particular bitter chemical (called propylthiouracil; PROP) whereas if they have the other form, they are sensitive and find PROP to be very bitter. We use the term taster and nontaster to refer to bitter sensitivity but these terms are used for simplicity; some people who are nontasters can taste slight bitterness at high PROP concentrations.

There are three places in *TAS2R38* gene which differ between people (alleles): an alanine or proline at position +49 in the protein (A49P), a valine or isoleucine at position +262 (V262A) and isoleucine or valine at position +296 (I296V). The alleles are found in two primary configurations. Most people have either the AVI haplotype or the PAV haplotype or both (haplotype is the ordered arrangement of genotypes on a chromosome; people with an A at position +49, a V at position +262 and an I at position +296 would have an AVI haplotype). The AVI haplotype is the non-taster form and the PAV haplotype is the taster form. Other haplotypes are more rare and intermediate in tasting ability, e.g., AAV.

Women were grouped by their smoking status to determine whether smokers were more likely to be insensitive to some bitter compounds (i.e., have the AVI/AVI form of the taste receptor; there are two copies of each gene and thus two haplotypes for each person). The results are provided in Table 15, which indicate no difference in the frequency of the nontaster haplotypes between never-smokers and current smokers.

We also tested a related hypothesis. As mentioned above, there is a gene family of bitter receptor of which *TAS2R38* is an important member. There is also a second family of taste genes, called the TAS1R family. This family contains three members: (*TAS1R1, TAS1R2* and *TAS1R3*). The protein product of these genes combines to form a receptor for umami (*TAS1R1* and *TAS1R3*). Umami is a savory flavor exemplified by monosodium glutamate and is found in tomatoes, mushrooms and certain cheeses. The *TAS1R2* and *TAS1R3* proteins combine to make the sweet receptor. There are alleles of the *TAS1R3* gene which are associated with the increased ability to sense sucrose, and so we tested the hypothesis that alleles of this taste gene might differ in frequency between current and never-smokers. The data are presented in Table 16 and

demonstrate no difference between current and never-smokers in the frequency of the alleles associated with increased sweet perception.

Because current smokers and never-smokers differed in body weight and obesity, we also tested the hypothesis that a recently discovered gene associated with obesity and fat intake (*FTO*) might differ between these two groups. Following the strategy outlined above, we stratified the mothers by current smoker and never-smoker groups and compared them for the frequency of *FTO* alleles. The results of this analysis are presented in Table 17. Women who were smokers were also more obese (on average) than never-smokers but they did not have different frequencies of the *FTO* allele. We also tested genes associated with craving and addiction: the dopamine receptor gene *DRD2* and the opioid receptor gene, *OPRM1* but found no differences between smoking and never smoking groups in allele frequency.

To summarize the gene results, there were no differences in allele frequencies between smoking groups for genes relevant to taste behavior (bitter and sweet perception; *TAS2R38* and *TAS1R3*), obesity (*FTO*), or addiction (*DRD2* and *OPRM1*). We also proposed to test the genotype of the cannabonid receptor in this project but technical problems (poor primer probe matches to the genomic DNA) prevented us from obtaining these results.

Time Frame and Milestones –

Milestone(s) for 1/1/2009-6/30/2009: Ascertain and test 30 mother-child dyads into the research study.

This goal was met. Fifty-three children and 44 mothers were tested before 6/30/2009.

Milestone(s) for 7/1/2009-6/30/2010:

Testing of remaining subjects was completed and the target goals (N=100; 50 mothers and 50 children) was met and exceeded (total of 76 mothers and 96 children). The genotype, data entry and analysis were completed by 12/31/09. Manuscript preparation is ongoing and submission is projected for August 2010.

Table 1. Overview of laboratory testing

Day A	Day B
Carbon monoxide concentration	Carbon monoxide concentration
DNA cheek swab (3 min each)	Anthropometry of child (20 min)
Anthropometry of mother (20 min)	Fat preference in pudding (20 min)
Sweet preferences in pudding (20 min)	Sucrose preference test (15 min each)
Questionnaires (1 hr)	Questionnaires (50 minutes)

The measure of carbon monoxide levels is useful to validate maternal reports of smoking status. On Day A, cheek swab samples were taken to collect cells for DNA analysis. Anthropometry refers to the measure of height, weight, body fat content and body circumference. Sucrose preferences tests on Day B refer to tests using sweet solutions (sugar dissolved in water) whereas the sweet preferences on Day A were conducted by varying the amount of sucrose in vanilla pudding. Likewise on Day B, subjects were tested for fat preference in pudding. Pudding was selected because it is familiar food for most children and the fat content is precisely and easily manipulated. Finally, on Day A and B mothers and children answered questionnaires about health-related behaviors.

Table 2: Characteristics of mothers

Number of mothers	N=68
Age , mean (SD)	34.7 (7.3)
Race %African American %Caucasian %Other %Hispanic	 63.2% 32.4% 1.5% 2.9%
Yrs of school, Mean (SD)	13.7(2.3)
Family yearly income %<15,000 %15,000-35,000 %35,000-75,000 %>75,000	 22.1% 32.4% 30.9% 14.7%
Smoking status Never-smokers Current-smoker	 63.2% 36.8%
BMI, Mean (SD)	29.3(6.8)
Weight category by BMI Underweight Normal-weight Overweight Obese	 1.5% 29.4% 29.4% 39.7%

SD=standard deviation. Yrs=Years. Family yearly income is reported in US dollars ($). Smoking status was determined through questionnaire and confirmed with empirical measures (breath carbon monoxide concentrations). School refers to formal education, high school, community or four-year college. BMI=body mass index, a measure of obesity. BMI=kg/m^2 where kg is weight in kilograms and m is height measured in meters. Categories to classify BMI are from the Center for Disease Control. Former smokers are excluded from analysis here and elsewhere.

Table 3: Characteristics of children

Number of children	N=84
Age , mean (SD)	8.01(1.9)
Sex %Female %Male	 52.4% 47.6%
Yrs of school, Mean (SD)	2.9(1.9)
By smoking status of the mother %Never-smokers %Current-smokers	 65.5% 34.5%
Weight category Underweight Healthy-weight Overweight Obese Missing data	 4.8% 56.0% 19.0% 19.0% 1.2%

See Table 2 caption for list of abbreviations.

Table 4: Nicotine dependence and behavior of current smokers (N=25)

Measures	Mean	Range
Fagerstrom (measure of nicotine dependence) Score: 0-6: low to moderate nicotine dependence 7 and up : high nicotine dependence	7.3 (3.1)	3-14
Age of first cigarette (yrs)	14.4(2.3)	11-18
Age started regular smoking (yrs)	16.7 (2.8)	11-25
# Cigarettes/day (currently smoking)	7.0 (6.2)	5§-25
#Cigarettes/day (when smoking the heaviest)	13.3 (7.8)	6.5§-30
Years smoking	15.9 (7.9)	3-34
Dose (pack/years) Max Dose(pack/years)	170.8 (146.8) 235.4(235.7)	15.0-542.8 16.5-1017.8
Did you smoke during pregnancy?	YES=12 NO=13	

Yrs=years; Mean values are followed by standard deviations, in parenthesis. §Cigar smoker, translated to cigarettes per day.

Table 5: Carbon monoxide levels (ppm) at the time of testing as measured by the Vitalograph monitor

Subjects	N	Mean	SD	range
Mothers, current smokers	25	11.4	8.1	0-35
Mothers, never-smokers	43	0.7	1.4	0-4
Children of current smokers	29	0.2	0.7	0-3
Children of never-smokers	55	0.1	0.4	0-3

SD=standard deviation

Table 6: Demographics of mothers when grouped by smoking status

Measures	Never Smoker	Current Smoker	p-value
N=68	43	25	
Age (Mean±SD)	35.9 (6.8)	32.7 (7.9)	0.08
Race (%)			0.20
African American	62.8%, N=27	64%, N=16	
Caucasian	34.9%, N=15	28%, N=7	
Other	2.3%, N=1	0%, N=0	
Hispanic	0%, N=0	0%, N=2	
Years of school	14.3 (2.3)	12.6 (1.8)	0.003
Yearly income			>0.000
<15,000	9.3%, N=4	44.0%, N=11	
15,000-35,000	23.3%, N=10	48.0%, N=12	
35,000-75,000	44.2%, N=19	8.0%, N=2	
>75,000	23.3%, N=10	0.0%, N=0	
BMI ($kg/m^{2)}$	27.5 (5.8)	32.5 (7.3)	0.003
BMI category			0.07
% Underweight	2.3%, N=1	0.0%, N=0	
% Healthy Weight	34.9%, N=15	20.0%, N=5	
%Overweight	34.9%,N=15	20.0%, N=5	
%Obese	27.9%, N=12	60.0%, N=15	

SD=standard deviation; For quantitative traits, statistics were conducted using an ANOVA with smoking status as the fixed factor and the demographic value as the dependent variable, e.g., years of school. Post-hoc tests were conducted to assign group differences. For categorical data, non-parametric tests like Chi-Square were conducted. Criterion p-value is $p \leq 0.05$.

Table 7: Children grouped by smoking status of the mother

	Smoking status of the mother		
	Never Smoker	Current Smoker	p-value
N=84	55	29	
Age (Mean±SD)	8.0 (1.8)	8.1 (2.0)	0.85
Sex (%)			0.02
Female	61.8%, N=34	34.5%, N=10	
Male	38.2%, N=21	65.5%, N=19	
Years of school	3 (1.9)	2.9 (2.1)	0.97
Race (%)			0.19
African American	54.6%, N=30	55.2%, N=16	
Caucasian	34.6%, N=19	20.7%, N=6	
Other	10.9%, N=6	24.1%, N=7	
BMI category, N=96			0.01
% Underweight	7.4%, N=4	0.0%, N=0	
% Healthy Weight	66.7%, N=36	37.9%, N=11	
%Overweight	14.8%, N=8	27.6%, N=8	
%Obese	11.1%, N=6	34.5%, N=10	

See previous tables for list of abbreviations and other details.

Table 8: Additional obesity measures of mothers grouped by smoking status.

	Never Smoker N=43	Current Smokers N=25	p
Waist-to-hip ratio, Mean (SD)	0.81(0.09)	0.86(0.08)	0.04
Waist circumference (cm)	88(16)	102(16)	0.001
% body fat	36.5	41.2	0.01
BMR (calories)	1478(167)	1640(222)	0.001

Waist-to-hip ratio was calculated by dividing the circumference of the waist by the circumference of the hips. Typically the values range from 0.7 (extreme pear-shape) to over 1.0 (extreme apple shape, waist larger than hips). SD=standard deviation. BMR=basal metabolic rate as measured in calories; this value is calculated based on the amount of lean body mass using mathematical formulas. Larger people with more lean body mass have higher caloric requirements than do smaller people.

Table 9: Additional obesity measures of children grouped by maternal smoking

	Smoking Status of the mother		
	Never Smoker N=55	Current Smokers N=29	p-value
Waist-to-hip ratio	0.83(0.05)	0.83(0.05)	0.86
Waist circumference	60(8)	67(15)	0.01
% fat in body	25.8(8.3)	32(12.3)	0.01
BMR	1104(107)	1210(241)	0.01

Units of measure and abbreviations are found in the caption of Table 8.

Table 10: Questionnaire for fat and sweet liking of mothers grouped by smoking status

	Never Smoker	Smokers	p
N=68	43	25	
Fat preference questionnaire -% of high fat foods reported to taste better.	60.3(16.9)	72.8(10.6)	0.002
-% of high fat foods reported eaten more often.	48(19.6)	61.6(18.5)	0.01
Sweet Questionnaire Q1: Sensitivity to mood altering effects of sweet food	19.5(7.4)	18.2(8.8)	0.49
Q2: Impaired control over eating sweets	8.5(6.8)	4.4(6.9)	0.02
Food Craving Inventory High-fats	2.0(0.7)	2.60(0.8)	0.001
Carbohydrates	2.3(0.8)	2.3(0.7)	0.91
Sweets	2.5(0.8)	2.2(0.8)	0.12
Fast-Food-fats	2.6(0.8)	2.8(0.8)	0.38
Average Total Cravings	2.3(0.6)	2.5 (0.7)	0.41

Table 11: Questionnaire for fat and sweet liking by children; children were grouped according to the smoking status of their mothers

	Smoking Status of the mother		
N=84	Never Smoker	Smokers	p-value
N	55	29	
Children's Fat Liking Score (score 0-11)	6.9 (1.9)	7.4 (2.0)	0.27
Children's Sweet Liking Score (score 0-6)	3.8 (1.3)	3.7 (1.3)	0.52

Table 12: Child temperament and feeding behavior; children were groups according to smoking status of the mothers

	Smoking Status of the Mothers		
	Never Smokers	Current-Smokers	p
Child Feeding Questionnaire (1-5)			
Overall Resp.Feeding the Child	4.4(0.6)	4.5(0.7)	0.65
Monitoring			
Pressure to Eat	4.2(0.7)	4.0(0.9)	0.27
Restriction	2.7(1.0)	2.6(1.1)	0.89
Perceived Parent's Weight	3.4(0.7)	3.1(1.0)	0.17
Perceived Child's Weight	3.7(0.9)	3.8(0.6)	0.71
Weight Concerns for Child	3.0(0.3)	3.2(0.6)	0.02
Pickiness	1.8(1.1)	2.3(1.5)	0.08
Time to Eat Healthy			
	2.3(1.2)	2.1(0.91)	0.34
	1.5(0.7)	1.5(0.6)	0.83
Child Temperament and Eating Behavior			
Shyness			
Emotion	2.3(0.9)	2.4(0.8)	0.71
Sociability	2.5(1.0)	2.7 (1.1)	0.42
Negative Reaction to Food	3.6(0.6)	3.5(0.7)	0.58
Activity	2.8(1.1)	3.0(0.7)	0.52
Food Neophobia	3.8(0.9)	3.7(0.8)	0.55
	2.9(1.1)	2.9(0.9)	0.96
Pictorial Depression Scale			
% depressed, score >9	31	45	0.23

Scores which differ by maternal smoking are underlined for emphasis.

Table 13: Laboratory measures of sweet and fat preference of mothers grouped by smoking status

	Smoking Status of the mother		
	Never Smoker N=43	Current Smokers N=25	p
Taste Test			
Sucrose in water preference (GeoMean)(SD)(SE) Inclusion, steps<4	13.2(8.9)(1.44)	20.5(10.1)(1.87)	**0.003**
Sucrose in pudding preference (GeoMean)(SD)(SE) Inclusion, steps<3	24.5(6.4)(1.0)	26.2(6.5)(1.3)	0.30
Fat in pudding preference (GeoMean)(SD)(SE) Inclusion, steps<3	8.4(3.2)(0.6)	9.2(4.5)(0.8)	0.40

GeoMean=geometric mean; SD=standard deviation; SE=standard error of the mean; Inclusion refers to the criterion used to incorporate specific data into the analysis. Explanation of the term 'step': subjects are offered two concentrations of sucrose and asked to point to the one they prefer. If they prefer the higher concentration of the two solutions, the next choice (step) is taken to ensure it is stable, e.g., repeated with different concentrations to determine if the subject consistently prefers the highest concentration. Low step numbers are associated with stable preferences. Subjects who gave erratic answers (and had correspondingly high step numbers) were eliminated from this analysis.

Table 14: Laboratory measures of sweet and fat preference of children; children were grouped by maternal smoking status

	Smoking Status of the mother		
N=84	Never Smoker	Current Smokers	p-value
N	55	29	
Sucrose in water preference (GeoMean)(SD)(SE) Inclusion: steps<4	20.2 (9.1)(1.4)	19.6 (11.3)(2.0)	0.82
Sucrose in pudding preference (GeoMean)(SD)(SE) Inclusion: steps<3	26.9 (5.2)(0.8)	26.5(4.8)(1.0)	0.78
Fat in pudding preference (GeoMean)(SD) (SE) Inclusion: steps<3	7.4 (2.4)(0.3)	6.9(1.7)(0.4)	0.36

See the caption of Table 13 for abbreviations and other details.

Table 15: Bitter taste gene *TAS2R38* frequency of the mothers by their smoking status.

Taster ability	Haplotype	Never Smoker (N=43)	% NS	Current Smoker (N=25)	%CS
Nontaster	AVI/AVI	10	23	6	24
Intermediate	AVI/AAV	2	5	2	8
Intermediate	AVI/AAI	4	9	3	12
Taster	PAV/AVI	13	30	7	28
Taster	PAV/AAV	3	7	0	0
Taster	PAV/AAI	4	9	1	4
Taster	PAV/PAV	7	16	6	24

NS=never-smoker; CS=current smoker; N=number of subjects. There were no differences in haplotype frequency by smoking group.

Table 16: Sweet taste gene *TAS1R3* -1266 frequency by the smoking status of the mother

Genotype	Non Smokers (N=43)	%NS	Current Smokers (N=25)	%CS
AA	17	40	9	36
AB	16	37	11	44
BB	10	23	5	20

Genotypes are shown as AA (homozygous), AB for heterozygous and BB (homozygous). *TAS1R3* is a sweet receptor gene (TAS=taste, 1=first family of taste genes, R=receptor, 3=third of a family of three genes). The numbers following the gene symbol (-1266) indicate the location of the variant site relative to the start codon of the gene. This genetic variant is in the upstream region of the gene and is probably involved in the regulation of gene expression rather than the amino acid composition of the protein. NS=never-smokers; CS=current smokers. A nearby allele was also typed (*TAS1R3* -1572) with similar results.

Table 17: Obesity gene *FTO* (rs9939609) frequency by the smoking status of the mother

Genotype	Nonsmoker N=42	%NS	Current Smoker N=25	%CS
AA	8	19	3	12
AB	18	43	12	48
BB	16	38	10	40

Abbreviations are described in Table 15 and 16. The rs designation (*rs9939609*) refers to the identifying number associated with a particular allele archived in public databases, e.g., http://www.ncbi.nlm.nih.gov/. A nearby allele was also genotyped (*rs3751812*) with similar results.

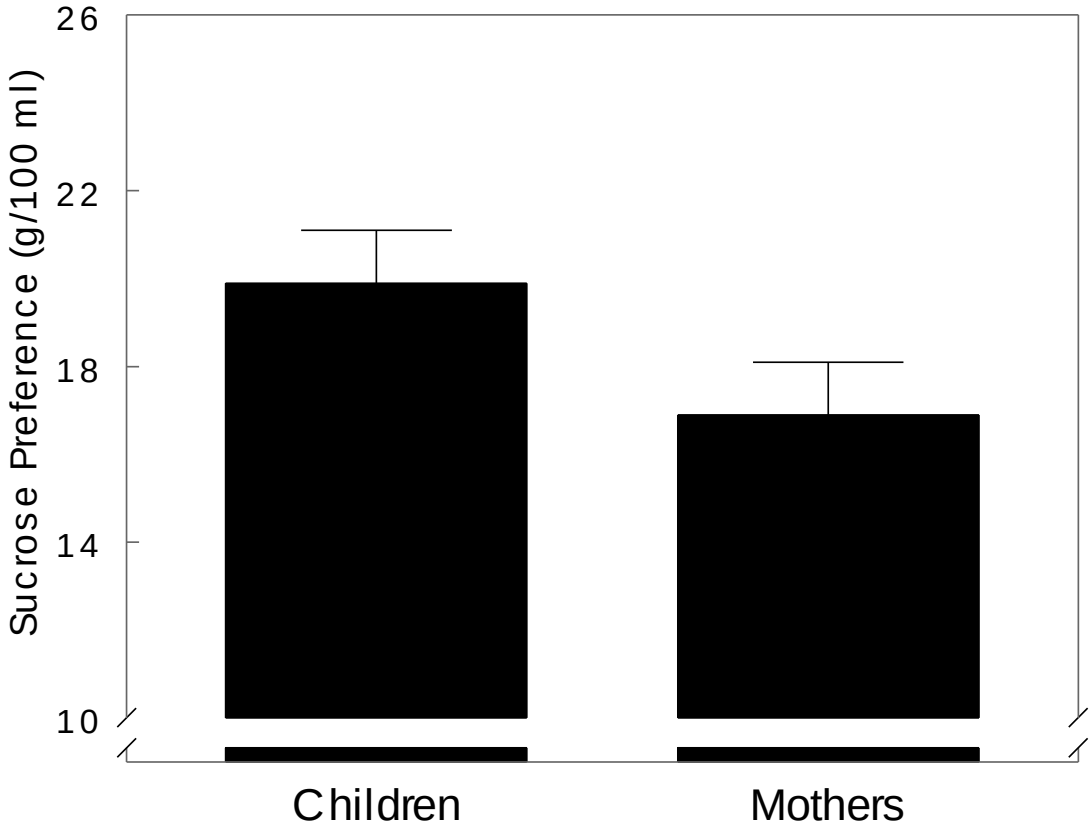

Figure 1: Sucrose preference of mothers and children measured with sugar dissolved in water. Subjects were grouped by generation, children versus mothers, and compared for their preference. Children had higher sweet preferences than did mothers, which is consistent with previous studies of sweet preference using this procedure. Note that the scale is broken between zero and 10 g/100 ml. For comparison with commonly consumed beverages, most commercially-available soft drinks are between 10 to 14 g/100 ml.

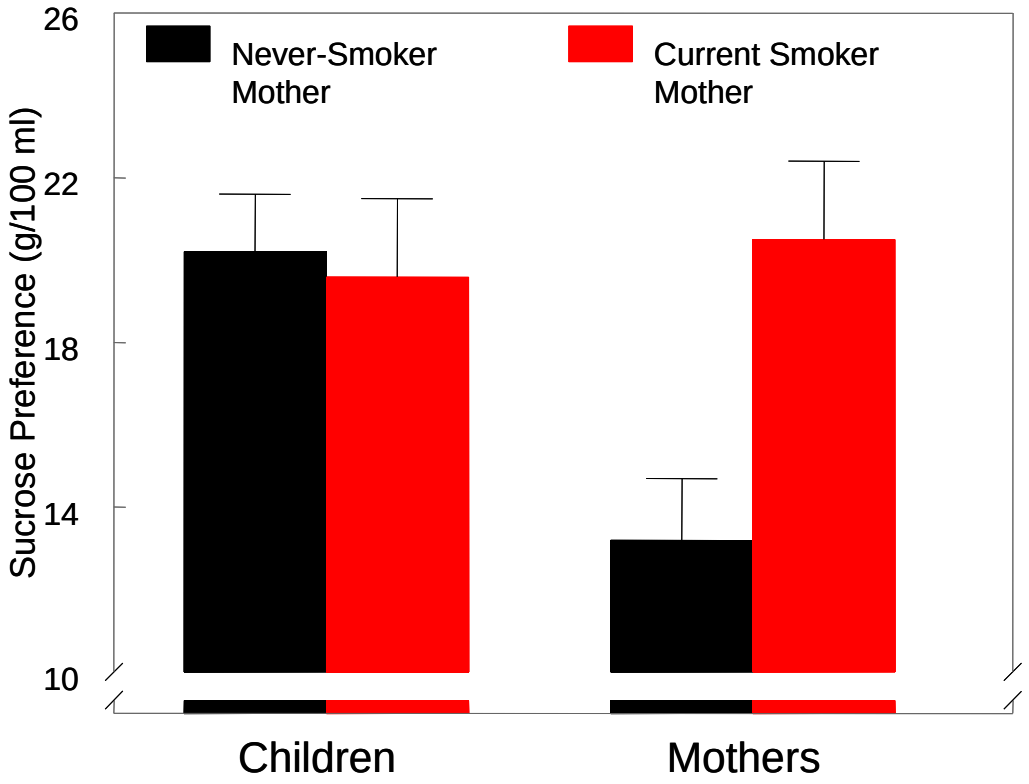

Figure 2: Women who smoke are child-like in their sweet preferences. Children and mothers were grouped by the smoking behavior of the mother and compared for their preference for sucrose dissolved in water. Children of current and never smokers were similar in their sugar preference. Mothers who were currently smoking had sweet preferences which were similar to their children whereas women who never smoked had lower sweet preferences. Other details are similar to those described in the caption of Figure 1.

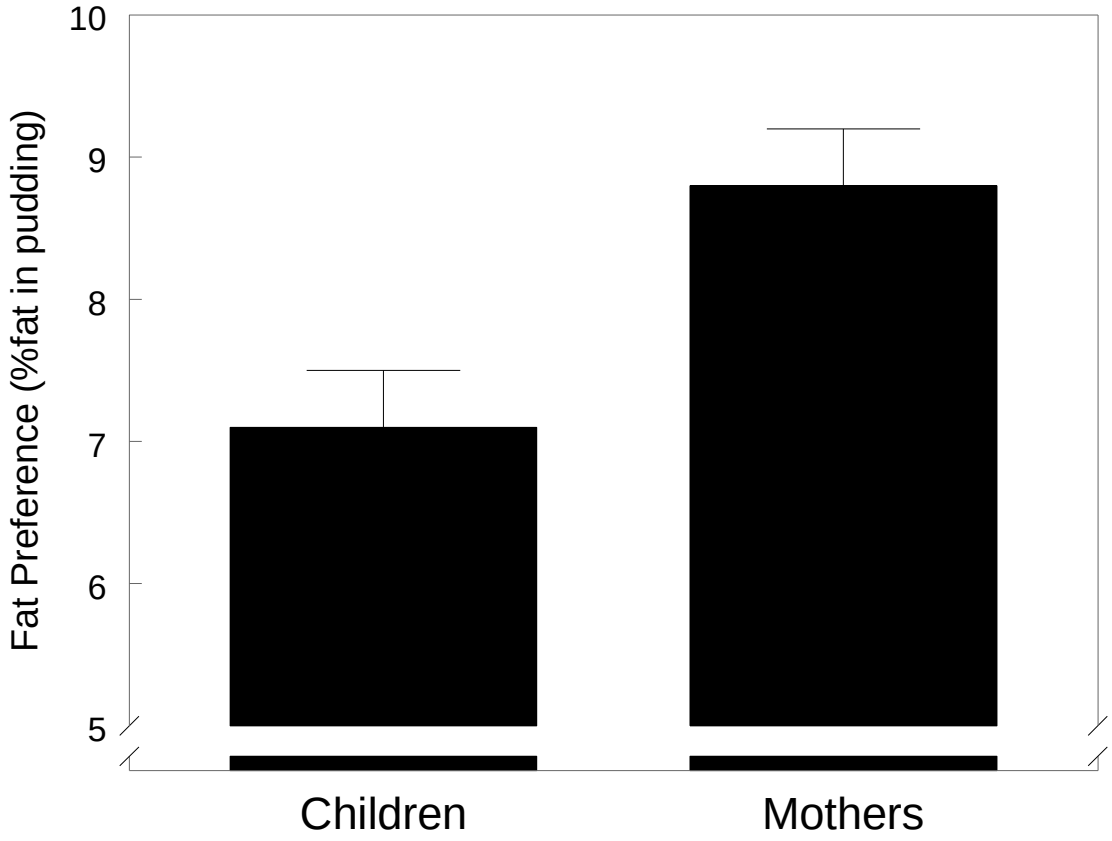

Figure 3. Mothers prefer pudding with higher fat content than do children. Subjects were grouped by generation, children versus mothers, and compared for their preference for different fat concentrations mixed in vanilla pudding. Children had lower fat preferences than did mothers. Note that the scale is broken between zero and 5% fat in pudding. For comparison, most commercially-available puddings are between 0 and 8% fat and vary widely due to the availability of fat-free or low-fat options.

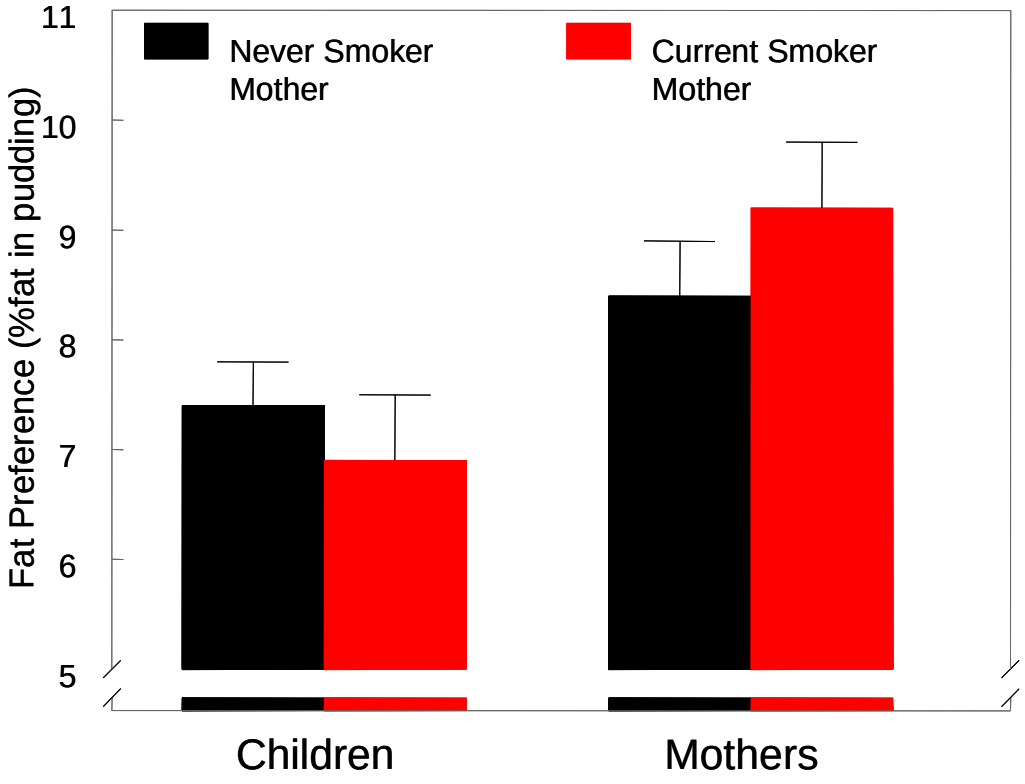

Figure 4: Women who smoke have higher fat preference than both groups of children. Children and mothers were grouped by the smoking behavior of the mother and compared for their fat preference for different amount of fat in pudding. Children of current and never smokers were similar in their fat preference. Mothers who were currently smoking had the highest fat preferences whereas women who never smoked had lower fat preferences. Other details are similar to those described in the caption of Figure 2.

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?

____x__Yes
_____ No

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

___x___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?

___0___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?

100_ Number of subjects originally targeted to be included in the study
173_Number of subjects enrolled in the study

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

Gender:
_43___Males
130___Females
__0___ Unknown

Ethnicity:
__2___ Latinos or Hispanics
171___ Not Latinos or Hispanics
__0___ Unknown

Race:
__0____American Indian or Alaska Native
__0____Asian
102__ Blacks or African American
0____ Native Hawaiian or Other Pacific Islander
54____White
17___ Other, specify:15 multiracial, 2 Hispanic
0_____ 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.)

Philadelphia

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

___x___ 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. None				☐Submitted ☐Accepted ☐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:

We plan to prepare this manuscript for publication in June 2010 for the American Journal of Clinical Nutrition or similar journal.

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.

The outcome of this research is to understand the relationship between smoking, food preferences and obesity. The information gleaned will be helpful for caregivers such as nutritionists, physicians, nurses and psychologists who treat nicotine addiction and craving. The main finding of these results is that women who smoke have elevated sweet preferences relative to non-smoking women and are similar to children in their high liking for and preference for sweet.

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.

The major discovery of this project was that children of smokers do not have different sweet or fat preferences compared to children of never-smokers but that smoking mothers have elevated sweet and fat preferences. This finding raises an interesting further question, which is whether smoking changes preferences for high-fat, high-sugar foods or whether people with food preferences are more likely to start smoking. There is a hypothesis that smoking is one of a constellation of behaviors on an addiction spectrum and that people who have the genetic and biological predisposition to smoke may also have food preferences for less wholesome food, e.g., those which are heavily sweetened and fried.

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. *For Nonformula grants only – include information for only those key investigators whose biosketches were not included in the original grant application.*

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors in the order listed on Form Page 2.
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NAME Danielle Renee Reed	POSITION TITLE Member
eRA COMMONS USER NAME (credential, e.g., agency login) DANIELLEREED	

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	MM/YY	FIELD OF STUDY
University of Washington	B.S.	05/84	Psychology
Yale University	Ph.D.	05/90	Psychology
Monell Chemical Senses Center		05/90	Metabolism
University of Pennsylvania	Postdoc	05/95	Genetics

Positions and Honors

Yale Fellowship	1984-1987
Howard Heinz Endowment Fellowship	1987-1990
NIH-PHS Award # 5-T32-CA09430	1990-1992
NIH-NRSA Award #1-F32-DK08732	1992-1994
University of Penn, Research Assistant Professor	1995-2000
Monell Chemical Senses Center, Assistant Member	2000
Monell Chemical Senses Center, Associate Member	2000
NIH, Metabolism Study Section, Temporary Member	2004
NIH, IPOD Study Section, Temporary Member	2004-2005
NIH, CADO Study Section, Temporary/Member	2004-2005; 2006-2009
Queensland Institute Medical Research, Visiting Scientist	2005
Monell Chemical Senses Center, Member	2007
NIH, SCS Temporary Member	2008
IFF Award for Outstanding Research	2008
NIH, CIDO Study Section, Temporary Member	2009
NIH, Shared Equipment Study Section	2009
Invited Symposium Speaker AChemS	2009

Publications

1. Reed DR, Bartoshuk LM, Duffy V, Marino S, Price RA. Propylthiouracil tasting: determination of underlying threshold distributions using maximum likelihood. Chemical Senses, 1995, 20, 529-533. PMID: 8564427

2. Reed DR, Bartoshuk LM, Price RA. Localization of a gene for bitter-taste perception (PROP) to human chromosome 5p15, American Journal of Human Genetics, 1999, 64, 1478-1480. PMCID: 1377888
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7. Coldwell SE, Oswald TK, Reed DR. A marker for bone growth differs between adolescents with high vs. low sugar preference. Physiology and Behavior, 2009, 96, 574-580. PMCID: 2764307 [available 3/23/2010]
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9. Mennella JA, Pepino, MY, Duke F, Reed DR. Bitter taste and childhood: age modifies the genotype-phenotype for *TAS2R38* heterozygotes. BMC Genetics, in revision.

Research support.

NIH R01 HD037119 (5% effort; Mennella), "Model for sensitive periods in early flavor learning," July 2006 to July 2011.

Commonwealth of Pennsylvania; Department of Health; Tobacco Settlement Fund Heath Research Formula Program (5% effort; Reed and Mennella), "Effect of genotype on smoking, taste and obesity in mothers and children. January 2009 to January 2010.

Commonwealth of Pennsylvania; Department of Health; Tobacco Settlement Fund Heath Research Formula Program (10% Effort; Reed and Mennella), "Relationship between Parental Smoking, Dietary Habits, Salt and Sweet Preferences and Blood Pressure among Children," January 2010 to January 2011.

Sponsored research (5% effort; Reed), June 2009 to March 2010.

NIH R01DK58797 (50% effort; Reed), "Mapping genes for body weight and fatness in mice," March 2000 to June 2014.

NIH R01DK58797 (Supplement, Reed) "Mapping genes for body weight and fatness in mice," October 2009.

NCRR RRS10RR025607 (Shared Equipment grant; Reed), "LABMASTER: Food intake, activity and metabolic rate. 2009

NIH R01 DC000882 (20% effort; Beauchamp), "Genetics of sweet taste perception," August 2002 to August 2011.

NIH R01 AA011028 (10% effort; Bachmanov), "Genetics of alcohol related ingestive behaviors in mice," March 2003 to March 2008.

NIH R01 DK046791 (5% effort; Tordoff), "Physiology of calcium appetite," June 2003 to June 2014.

NIH R01DC010393 (5% effort; Tordoff), "Genetic controls of mineral consumption," Oct 2009 to July 2014.

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors in the order listed on Form Page 2.
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NAME	POSITION TITLE
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eRA COMMONS USER NAME (credential, e.g., agency login)	
JMennella	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	MM/YY	FIELD OF STUDY
Loyola University, Chicago, IL	BS	06/77	Biology
DePaul University, Chicago, IL	MS	02/81	Biology
The University of Chicago, Chicago, IL	PhD	08/88	Biopsychology
Monell Chemical Senses Center, Phila, PA	Postdoc	09/88-06/90	Chemical Senses

Positions and Employment:

1990-1995 Assistant Member, Monell Chemical Senses Center, Philadelphia, PA
1995-1999 Associate Member, Monell Chemical Senses Center, Philadelphia, PA
1999-present Member, Monell Chemical Senses Center, Philadelphia, PA

Selected Honors and Service:

1991-1993 First recipient of the Morley R. Kare Fellowship, Monell Chemical Senses Center
1996 First recipient of the Avanelle Kirksey Lectureship Award for research excellence in maternal nutrition and infant behavior, Purdue University, West Lafayette, Indiana
1997 Association for Chemoreception Sciences (AChemS) Moskowitz-Jacobs Award for research excellence in psychophysics of taste and smell
1999-present Member, Minority and Clinical Travel Fellowship Awards Committee, AChemS
2002-present Consultant for US Agency for International Development (USAID), infant feeding project, Lilongwe, Malawi
2003 Invited Speaker, WHO Global Health Forum, Geneva, Switzerland
2003 Member of the NIAAA Dietary Guidelines (Moderate Drinking) Working Group
2005-present Chair, Taste and Flavor Working Group, Best Pharmaceuticals for Children Act, Pediatric Formulation Initiative Working Group, National Institute of Child Health and Human Development (NICHD)
2007-2009 Member, American Heart Association Writing Group, "Helping Families Implement Nutrition Recommendations"
2007-present Consultant, NIH Toolbox of Neurological and Behavioral Function, Taste and Olfaction Groups
2010 Panel Member, NIH Consensus Development Conference, "Lactose Intolerance and Health"
2010 Bring the Family Address, American Psychological Sciences 22nd annual convention (*forthcoming*)

Peer-reviewed publications or manuscripts in press most relevant to the current applications (Selected from more than 90 peer-reviewed publications)

1. Mennella JA, Jagnow CJ, Beauchamp GK. Pre- and post-natal flavor learning by human infants. *Pediatrics* 107: e88, 2001. PMCID: 1351272.
2. Mennella JA, Pepino MY, Beauchamp GK. Modification of bitter taste by a sodium salt in children. *Developmental Psychobiology* 43:120-27; 2003. PMCID: 2799510.
3. Mennella JA, Pepino MY, Reed DR. Genetic and environmental determinants of bitter perception and sweet preferences in children and adults. *Pediatrics* 115:e216-22, 2005. PMCID: 1397914.
4. Pepino MY, Mennella JA. Effects of cigarette smoking and family history of alcoholism on sweet taste perception and food cravings in women. *Alcohol: Clinical and Experimental Research* 31:1891-99, 2007. PMCID: 226890.
5. Mennella JA, Beauchamp GK. Optimizing oral medications for children. *Clinical Therapeutics*, 30: 2120-32; 2008. PMCID: 2744307.
6. Mennella JA, Forestell CA, Morgan LK, Beauchamp GK. Early milk feeding influences taste acceptance and liking during infancy. Am J Clin Nutr 90: 780-788S, 2009. PMC Journal – In Process.
7. Pepino MY, Finkbeiner S, Beauchamp GK, Mennella JA. Obese women have lower monosodium glutamate taste sensitivity and prefer higher concentrations than normal-weight women. *Obesity*, in press. PMC Journal – In Process.
8. Mennella JA, Pepino MY, Lehmann S, Yourshaw, L. Family history of alcoholism and depressive symptomology are associated with higher bliss points for sweets among children. *Addiction*, in press. PMC Journal – In Process.
9. Mennella JA, Pepino, MY, Duke F, Reed DR. Bitter taste and childhood: age modifies the genotype-phenotype for *TAS2R38* heterozygotes. BMC Genetics, in revision.

Research Support

1. R01 HD37119-08 (50% Effort; Mennella) "A Model System for Sensitive Periods in Early Flavor Learning," 05/01/06-01/31/11
2. Commonwealth of Pennsylvania; Department of Health – Tobacco Settlement Fund Heath Research Formula Program (5% Effort; Mennella, Beauchamp, and Reed, Co-PIs), "The Effect of Genotype on Smoking, Taste and Obesity in Mothers and Children," 01/09-01/10.
3. Ajinomoto Company (30% Effort; Mennella and Beauchamp, Co-PIs), "Taste and Obesity II," 03/01/2009-02/28/2011.
4. Commonwealth of Pennsylvania; Department of Health – Tobacco Settlement Fund Health Research Formula Program (15% Effort; Mennella, Reed, Co-PI), "Relationship between Parental Smoking, Dietary Habits, Salt and Sweet Preferences and Blood Pressure among Children," 01/2010-01/2011