FOR ADMINISTRATIVE USE **Minnesota Wheat Research and Promotion Council**
Program Area Code Proposal Code

RESEARCH PROPOSAL GRANT APPLICATION

1. NAME AND ADDRESS OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE

Name: Regents of the University of Minnesota
Address: Sponsored Projects Administration
454 McNamara Alumni Center, 200 Oak Street SE
Minneapolis, MN 55455-2070

2.TITLE OF PROPOSAL

Processed Wheat Bran As a Food That Decreases Food Intake

3. PRINCIPAL INVESTIGATOR(S)	**4. PI #1 BUSINESS ADDRESS**
Daniel D. Gallaher, Ph.D. PI# 2 Name: _____ PI# 3 Name: _____	169 FScN 1334 Eckles Ave St Paul, MN 55108

5. PROPOSED PROJECT DATES (calendar years)	**6. TOTAL PROJECT COST**	**7. PI #1 PHONE NO.**
January 1, 2011 to December 31, 2011 Note: Research Reports are Due November 15th of Each Year	$11,495	612-624-0746

8. RESEARCH OBJECTIVES: (List objectives to be accomplished by research grant)

The objective of this proposal is to measure satiety-related hormone concentrations in the plasma of rats that have been fed a wheat bran processed to release phenolic compounds from the bran that are normally bound and not available for intestinal absorption. Plasma has been collected from these rats in both the fasted state and at two hours after a meal containing wheat bran, either unprocessed or processed. We will measure these hormones in both the fasting state, to indicate the degree of hunger the animals may have felt, and two hours after a meal, to indicate their sense of fullness after eating a meal.

The specific hormones to be measured are amylin, CCK, ghrelin, PYY (total), PYY (3-36 form), and insulin. Correlations between the plasma concentration of these hormones and food intake,body weight, and body fat will be calculated. It is expected that hormone concentrations will change in a manner that would account for the changes in food intake, body weight, and body fat that we have already found.

Attach a 2-page detailed discussion of importance of the proposal to wheat profitability; how study complements previous research in area; procedures to be used; and competency of the research group in achieving research objectives. (Please keep the proposal concise, only 2 pages will be provided reviewers).

Signature Of Principal Investigator	**Date**	**Phone Number** **612-624-0746**
Signature Of Authorized Representative	**Title**	**Date**
Address Of Authorized Representative Kevin McKoskey, Branch Mgr., McNamara Bldg. Suite 450, 200 Oak StMinneapolisMN55455-2070		**Phone Number**

Minnesota Wheat Research and Promotion Council
RESEARCH PROJECT PROPOSAL
(2-pages maximum)

Project Title: Processed Wheat Bran as a Food That Decreases Food Intake

Importance:

The high prevalence of obesity in our society is a major public health problem. Pharmacological attempts to reduce obesity have been almost completely unsuccessful, in spite of many hundreds of millions of dollars spent on research and testing. Further, almost all drugs introduced to reduce obesity have been withdrawn due to safety concerns. Thus, there is clearly a huge unmet need for an approach to reducing body fat that is safe and effective.

Our results to date suggest that processed wheat bran may be useful in combatting obesity. However, to be convincing, we feel more information is necessary about how processed wheat bran is functioning to reduce body fat. Showing that processed wheat bran alters satiety-related hormones in a way consistent with decreased food intake could make the processed wheat bran a highly desirable product for the food industry. This would result in a low value product – wheat bran – becoming a high value product, one that is rather easy to incorporate into foods and is completely safe to consume.

Background:

The overall prevalence of obesity in the United States is now estimated at 26.7% of the population and is still increasing(1). This high level of obesity is leading to skyrocketing levels of type 2 diabetes and other obesity-related diseases. Ways to reduce this high prevalence of obesity are desperately needed. Reducing food intake is one obvious approach to help reduce obesity, although this is clearly difficult. However, consumption of foods that provide greater satiety may help reduce food intake by leading to a greater sense of fullness and thereby causing an earlier end to a meal or by reducing food consumption between meals(2).

Wheat bran is a rich source of phenolic compounds that, if absorbed, are thought to have highly beneficial effects. Unfortunately, these phenolic compounds are normally bound in such a way that they remain almost entirely unavailable for absorption. As part of a currently funded USDA grant, we have conducted a study in obese, diabetic rats in which we fed wheat bran that was chemically treated and subjected to high pressure homogenization to release the phenolic compounds, thereby making the phenolic compounds present in the wheat bran available for intestinal absorption. The wheat bran processed in this way is food grade and completely safe to eat.

Our results to date have been extremely successful. The diabetic, obese rats fed the processed wheat bran were found to have lower plasma insulin levels and improved insulin sensitivity, indicating that they were less diabetic as a result of consuming the processed wheat bran, compared to normal (unprocessed) wheat bran. Rats consuming the processed wheat bran tended to weigh less and tended to consume less diet that rats consuming normal wheat bran. Most importantly, the rats consuming the processed wheat bran diet clearly had less body fat, indicating that the processed wheat bran was in some way reducing the accumulation of body fat.

Control of eating is clearly a very complex phenomenon. However, a number of hormones have been identified that play important roles in both the desire to begin eating and the signal to stop eating. These are referred to as satiety-related hormones. We believe that consumption of the processed wheat bran may have changed the concentration of these satiety-related hormones in such a way as to decrease food intake in our animals compared to rats eating normal, unprocessed wheat bran. The purpose of this project is to confirm that hypothesis.

Relationship To Past Projects:

Several types of studies have suggested that consumption of whole grains may lower body weight. A number of epidemiology studies have found that whole grain intake was inversely associated with BMI, fasting insulin, and waist-to-hip ratio (3-5). Experimentally, subjects consuming either 3 or 4 whole grain servings per day as part of a hypocaloric diet lost significantly more weight than those in the control group(6). It has also been demonstrated that over 12 weeks, obese adults with metabolic syndrome consuming whole grains on a hypocaloric diet significantly decreased their percent body fat in the abdominal region compared to subjects on a hypocaloric refined grain diet (7). Although these studies strongly suggest that whole grain consumption may lead to a decreased body weight or body fat, they have not provided any biochemical understanding of how whole grains may influence body weight. For

example, in none of the studies have satiety-related hormones been measured. Further, from the above studies, the type of whole grain (e.g. wheat, oats) or the form of the whole grain that has the effect on body weight is uncertain. Our proposal offers a unique opportunity, in that we propose to study a defined whole grain component, wheat bran, by examining hormones known to influence feeding behavior. Further, we will examine it after it has been processed in a manner that releases the known bioactive components present in wheat bran, components are not absorbable because they exist in a bound form. We hypothesize that this processed wheat bran will be dramatically more effective at reducing body weight or body fat compared to unprocessed bran.

Procedures:

In our experiment, obese, diabetic rats (Zucker Diabetic Fatty, ZDF) were fed one of the following diets for three weeks: Control (no wheat bran), Wheat Bran, Optimized Wheat Bran (processed), Soluble Fraction of Optimized Wheat Bran, or Insoluble Fraction of Optimized Wheat Bran. The diets were fed for three weeks. Blood was drawn from the rats in both the fasted state and at two hours after a meal. For each wheat bran-containing diet we have determined the amount of free and bound phenolics in the wheat bran or wheat bran fraction, which will allow us to correlate the satiety hormone concentration to the amount of free phenolics in the diet. Body weight, food intake, and body fat have already been measured in these animals.

The specific hormones to be measured are amylin, CCK, ghrelin, PYY (total), PYY (3-36 form), and insulin. All the assays for hormones will be radioimmunoassays, and will be purchased as commercial kits.

Research Group:

My research group has been conducting nutrition-related animal studies for >30 years. We have considerable experience in conducting radioimmunoassays. Further, we recently completed a study examining the effect of different types of dietary fiber on satiety-related hormones, similar to the study being proposed here. Thus, the assays being proposed are routine for us.

Regional Linkages To Other Research Activities:

The USDA-funded grant that supported the animal trial is a multi-investigator project. Other investigators are located at Kansas State University (Dr. Jon Fabion), University of Manitoba (Dr. Gary Fulcher), and Cornell University (Dr. Rui Hai Liu).

Additional Sources of Funding:

The proposed project is a side project to a $750,000 USDA-funded multi-investigator project examining the health benefits of wheat bran processed to improve its health benefits. However, our allocation of funds from this project has been spent, and there are no funds from it or elsewhere to support this project.

References:

1. Prevention CfDCa. U.S. Obesity Trends. 2009 [cited October 19, 2009]; Available from: http://www.cdc.gov/obesity/data/trends.html
2. Gerstein DE, Woodward-Lopez G, Evans AE, Kelsey K, Drewnowski A. Clarifying concepts about macronutrients' effects on satiation and satiety. J Am Diet Assoc 2004;104:1151-3.
3. Harland JI, Garton LE. Whole-grain intake as a marker of healthy body weight and adiposity. Public Health Nutr 2008;11:554-63.
4. Jacobs DR, Jr., Marquart L, Slavin J, Kushi LH. Whole-grain intake and cancer: an expanded review and meta-analysis. Nutrition and cancer 1998;30:85-96.
5. McKeown NM, Meigs JB, Liu S, Wilson PW, Jacques PF. Whole-grain intake is favorably associated with metabolic risk factors for type 2 diabetes and cardiovascular disease in the Framingham Offspring Study. Am J Clin Nutr 2002;76:390-8.
6. Azadbakht L, Mirmiran P, Esmaillzadeh A, Azizi T, Azizi F. Beneficial effects of a Dietary Approaches to Stop Hypertension eating plan on features of the metabolic syndrome. Diabetes Care 2005;28:2823-31.
7. Katcher HI, Legro RS, Kunselman AR, Gillies PJ, Demers LM, Bagshaw DM, Kris-Etherton PM. The effects of a whole grain-enriched hypocaloric diet on cardiovascular disease risk factors in men and women with metabolic syndrome. Am J Clin Nutr 2008;87:79-90.

Minnesota Wheat Research and Promotion Council

RESEARCH PROJECT PROPOSAL BUDGET

ORGANIZATION AND ADDRESS

Name: Regents of the University of Minnesota
Address: Sponsored Projects Administration
450 McNamara Alumni Center, 200 Oak Street SE
Minneapolis, MN55455-2070

Principal Investigator(s) / Project Directors(s) Daniel D. Gallaher	Funds Requested For Year 1 (2011)	Year 2 (2012)	Year 3 (2013)
A. Salaries and Wages	$	$	$
1. Co-principal Investigator(s)			
2. Senior Associates			
3. Research Associates - Post Doctorate			
4. Other Professionals			
5. Graduate Students	711		
6. Prebaccalaureate Students			
7. Secretarial - Clerical			
8. Technical, Shop and Other			
B. Fringe Benefits	334		
C. Nonexpendable Equipment (Planting and harvesting equipment use)			
D. Materials and Supplies	10,100		
E. Travel	350		
F. Publication Costs			
G. Computer Costs			
H. All Other Direct Costs (Attach supporting data) See Attached			
I. **TOTAL AMOUNT OF THIS REQUEST (per year)**	**$ 11,495**	**$**	**$**

Budget Justifications:

Graduate Students	$ 711.00
Fringe Benefits	$ 334.00
Materials & Supplies	$ 10,100.00
Amylin RIA kit - $1,900	
CCK RIA kit - $1,850	
Ghrelin RIA kit - $1,450	
PPY total RIA kit - $1,750	
PYY 3-36 RIA kit - $1,750	
Insulin RIA kit - $400	
Miscellaneous supplies - $1,000	
Travel	$ 350.00
Airfare for graduate student from California to do the assays.	