

**V(A). Planned Program (Summary)**

**Program # 1**

**1. Name of the Planned Program**

Childhood Obesity

Reporting on this Program

**V(B). Program Knowledge Area(s)**

1. Program Knowledge Areas and Percentage

| KA Code | Knowledge Area   | %1862 Extension | %1890 Extension | %1862 Research | %1890 Research |
|---------|--|-----------------|-----------------|----------------|----------------|
| 305     | Animal Physiological Processes                                   |                 |                 | 16%            |                |
| 701     | Nutrient Composition of Food                                     |                 |                 | 4%             |                |
| 702     | Requirements and Function of Nutrients and Other Food Components |                 |                 | 42%            |                |
| 703     | Nutrition Education and Behavior                                 |                 |                 | 20%            |                |
| 704     | Nutrition and Hunger in the Population                           |                 |                 | 10%            |                |
| 723     | Hazards to Human Health and Safety                               |                 |                 | 8%             |                |
|         | <b>Total</b>   |                 |                 | 100%           |                |

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

| Year: 2013               | Extension |      | Research |      |
|--------------------------|-----------|------|----------|------|
|                          | 1862      | 1890 | 1862     | 1890 |
| Plan                     | 0.0       | 0.0  | 2.1      | 0.0  |
| Actual Paid Professional | 0.0       | 0.0  | 2.4      | 0.0  |
| Actual Volunteer         | 0.0       | 0.0  | 0.0      | 0.0  |

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

| Extension           |                | Research       |                |
|---------------------|----------------|----------------|----------------|
| Smith-Lever 3b & 3c | 1890 Extension | Hatch          | Evans-Allen    |
| 0                   | 0              | 113240         | 0              |
| 1862 Matching       | 1890 Matching  | 1862 Matching  | 1890 Matching  |
| 0                   | 0              | 83564          | 0              |
| 1862 All Other      | 1890 All Other | 1862 All Other | 1890 All Other |
| 0                   | 0              | 452701         | 0              |

## V(D). Planned Program (Activity)

### 1. Brief description of the Activity

Project activities included

- Characterized biochemical impacts in tissues of animals exposed to environmental chemicals which appear to act as obesogens.
- Determined the oxidative stress impact of environmental obesogens on key glucose-metabolizing tissues of animals.
- Examined effects of inflammatory omega six fatty acids and non-inflammatory omega three fatty acids from dairy fats on the development of respiratory allergy in a rat model.
- Enhanced student researchers' skills in participatory research techniques and built and partnerships among researchers, extension and outreach educators, and populations of young adults through the development of cooperative intervention programs to limit weight gain in young adults. This project developed community-based applications that will be refined and evaluated in future projects.
- Developed cutting edge analytical methods to evaluate the hypothesis that metabolic syndrome, a precursor to type II diabetes and heart disease, is associated with specific epigenetic changes in chromatin of differentiating adipocyte (fat cells). This process was studied in a mouse model.

### 2. Brief description of the target audience

These research projects are intended to benefit the health of people across New Hampshire and the region, while making the conduct of scientific research more transparent to community partners, stakeholders, and the public. Several research projects looked at genetic, epigenetic, and/or biochemical mechanisms associated with obesity and how different types of unsaturated fatty acids influence one's susceptibility to allergic responses. Initial outcomes inform scientific communities and human health regulatory agencies.

### 3. How was eXtension used?

eXtension was not used directly by these projects. However, some of the online activity and diet tools developed and evaluated as a part of this planned program could be integrated into eXtension in the future.

## V(E). Planned Program (Outputs)

### 1. Standard output measures

| 2013          | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|---------------|------------------------|--------------------------|-----------------------|-------------------------|
| <b>Actual</b> | 1666                   | 2270                     | 500                   | 0                       |

### 2. Number of Patent Applications Submitted (Standard Research Output) Patent Applications Submitted

Year: 2013  
 Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

| 2013   | Extension | Research | Total |
|--------|-----------|----------|-------|
| Actual | 0         | 7        | 0     |

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number of undergraduate students directly involved in the projects

| Year | Actual |
|------|--------|
| 2013 | 15     |

**Output #2**

**Output Measure**

- Number of university courses in which project results have been incorporated

| Year | Actual |
|------|--------|
| 2013 | 9      |

**Output #3**

**Output Measure**

- Number of presentations at regional, national, or international scientific meetings

| Year | Actual |
|------|--------|
| 2013 | 11     |

**Output #4**

**Output Measure**

- Number of surveys or other means of gathering information and data from participants

| Year | Actual |
|------|--------|
| 2013 | 3      |

**Output #5**

**Output Measure**

- Number of reviewed, bulletin, popular and other publications

| <b>Year</b> | <b>Actual</b> |
|-------------|---------------|
| 2013        | 7             |

**Output #6**

**Output Measure**

- Number of graduate students directly involved in the research.

| <b>Year</b> | <b>Actual</b> |
|-------------|---------------|
| 2013        | 4             |

**Output #7**

**Output Measure**

- Research outcomes disseminated by websites

| <b>Year</b> | <b>Actual</b> |
|-------------|---------------|
| 2013        | 3             |

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

| O. No. | OUTCOME NAME  |
|--------|---|
| 1      | Number of graduate students trained and ready to enter the workforce.   |
| 2      | Number of undergraduate students involved and trained in engagement research.   |
| 3      | Increased knowledge about the role of PBDE flame retardant in obesity related metabolism.   |
| 4      | Availability of methods for participatory research related to obesity.  |
| 5      | Evaluate the hypothesis: Milk fat consumption of pasture-fed cows will have a more protective effect against development of allergy development than milk fat cows fed a total mixed ration diet. |
| 6      | The impact of a whole foods curriculum for older adults will be evaluated.  |

**Outcome #1**

**1. Outcome Measures**

Number of graduate students trained and ready to enter the workforce.

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

| <b>Year</b> | <b>Actual</b> |
|-------------|---------------|
| 2013        | 2             |

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

| <b>KA Code</b> | <b>Knowledge Area</b>            |
|----------------|----------------------------------|
| 305            | Animal Physiological Processes   |
| 701            | Nutrient Composition of Food     |
| 703            | Nutrition Education and Behavior |

**Outcome #2**

**1. Outcome Measures**

Number of undergraduate students involved and trained in engagement research.

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

| <b>Year</b> | <b>Actual</b> |
|-------------|---------------|
| 2013        | 15            |

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

| <b>KA Code</b> | <b>Knowledge Area</b>  |
|----------------|--|
| 305            | Animal Physiological Processes                                   |
| 701            | Nutrient Composition of Food                                     |
| 702            | Requirements and Function of Nutrients and Other Food Components |
| 703            | Nutrition Education and Behavior                                 |
| 723            | Hazards to Human Health and Safety                               |

**Outcome #3**

**1. Outcome Measures**

Increased knowledge about the role of PBDE flame retardant in obesity related metabolism.

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

| <b>Year</b> | <b>Actual</b> |
|-------------|---------------|
|-------------|---------------|

2013

0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Being obese or overweight increases one's risk of many diseases, including type 2 diabetes, coronary heart disease, stroke, and certain cancers. There is increasing of experimental evidence suggesting certain environmental chemicals or obesogens could disrupt the body's metabolism and contribute to the obesity epidemic. This project has examined whether environmental chemicals found in fire retardants may impair glucose metabolism.

#### What has been done

1. The first project tested the hypothesis that one class of brominated flame retardants, polybrominated diphenyl ethers (PBDEs), suppress the activity of phosphoenopyruvate carboxykinase (PEPCK) in adipose tissue. This metabolic response could lead to insulin resistance.
2. The second project validated that liver cytochrome YP3A (CYP3A), a cytochrome P450 drug-metabolizing enzyme responsible for detoxifying PBDEs, is induced by in vivo PBDE treatment.

#### Results

polybrominated diphenyl ethers ( PBDEs), suppress the activity of phosphoenopyruvate carboxykinase (PEPCK) in adipose tissue. This metabolic response could lead to insulin resistance.

2. The second project validated that liver cytochrome YP3A (CYP3A), a cytochrome P450 drug-metabolizing enzyme responsible for detoxifying PBDEs, is induced by in vivo PBDE treatment.

Results: (10-12 lines)

1. NHAES researchers findings from research using a rat model suggest that PBDEs suppress a key enzyme, PEPCK, during glucose and lipid metabolism in adipose tissue as well as in the liver.
2. Twenty-eight days of PBDE treatment caused a 30-fold induction of liver CYP3A activity compared to corn oil treatment. This response may suppress vitamin D3 synthesis.
3. Rats exposed to synthetic flame retardants have perturbations of glucose and lipid metabolism in their fat tissue, which could promote diabetes, and enzyme changes in their liver, which could promote an additional health problem of Vitamin D deficiency. These findings establish the possible health consequences of environmental chemical exposure.

### 4. Associated Knowledge Areas

| KA Code | Knowledge Area                     |
|---------|------------------------------------|
| 305     | Animal Physiological Processes     |
| 723     | Hazards to Human Health and Safety |

## **Outcome #4**

### **1. Outcome Measures**

Availability of methods for participatory research related to obesity.

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Condition Outcome Measure

### **3b. Quantitative Outcome**

| <b>Year</b> | <b>Actual</b> |
|-------------|---------------|
| 2013        | 0             |

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Excessive weight gain is associated with an increased risk of developing cardiovascular disease, hypertension, and type 2 diabetes. Young adults are at a unique risk for weight gain because of rapidly changing social situations that influence exercise and eating behaviors. Research is needed to elucidate the combination of individual and environmental factors associated with unhealthy weight gain among college students. This project will refine and validate instruments to assess the environmental and individual factors associated with health outcomes and define the relationship between environmental and behavioral factors to create a College Health Campus Index.

#### **What has been done**

1. The Young adult Eating and Active for Health (YEAH) project has been established to investigate the effectiveness of a 10-week tailored, Internet-based intervention to prevent excessive weight gain among 18-24 year olds (n=360).
2. Guiding stars (GS), a point of purchase consumer tool, was evaluated to determine whether GS would influence consumers' perceptions and choice of food at two campus eateries. A survey was conducted pre-GS and post-GS at both venues.

#### **Results**

1. The Young adult Eating and Active for Health (YEAH) Internet-based intervention program was found to support metabolic improvement among subjects assigned to the intervention--as compared with control condition--and included lower rates of elevated glucose (4 vs. 13%,  $p < 0.01$ ), lower rates of elevated blood pressure (3 vs. 8%,  $p = 0.06$ ), and lower numbers of metabolic syndrome criteria (0.6 vs. 0.9,  $p < 0.05$ ).
2. Survey results revealed that Guiding Stars significantly increased consumers' perceptions that healthy foods are available.

#### 4. Associated Knowledge Areas

| KA Code | Knowledge Area                   |
|---------|----------------------------------|
| 703     | Nutrition Education and Behavior |

#### Outcome #5

##### 1. Outcome Measures

Evaluate the hypothesis: Milk fat consumption of pasture-fed cows will have a more protective effect against development of allergy development than milk fat cows fed a total mixed ration diet.

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2013 | 0      |

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

Over the last forty years, there has been an upward trend in the incidence of respiratory allergy and asthma in children. One dietary factor that has been suspected to be a causal factor is the imbalance in dietary levels of omega-6 versus omega-3 polyunsaturated fatty acids. The imbalance is believed to be, in part, the result of eating meat products and milk fat from farm animals that have been fed cereal grains?which are in higher omega-6 (inflammatory) fatty acids?rather than pasture-fed animals products, which are higher in omega-3 n (non-inflammatory) fatty acids.

###### **What has been done**

Experiments were designed to test the hypothesis that consumption of milk fat that is high in omega 6 relative to omega 3 fatty acids induces a shift in the chemical function of lung (alveolar) macrophages which stimulate the allergic mediators prostaglandinE2 (PGE2) and interleuken12. Male C57BL/J6 mice were fed the same milk fat-based diet, which was varied in the ratio of omega6/omega3 fatty acids as follows: 1:1, 6:1, 15:1. Half of the animals on each diet were vaccinated (sensitized) with the egg protein, ovalbumin. On week 16, macrophages were collected surgically from the lungs for biochemical testing.

###### **Results**

Prostaglandin E2 is a hormone associated with the regulation of immune responses. Alveolar (lung) macrophages of mice that consumed diets imbalanced in omega 6 and omega 3 fatty acids

(6:1; 15:1), produced significantly more prostaglandin E2 (PGE2) than cells of the animals that consumed the diet balanced (1:1) in fatty acids. These preliminary findings suggest that diets imbalanced in fatty acids can affect the biochemical function of lung macrophage cells, which could promote respiratory allergy in humans.

#### 4. Associated Knowledge Areas

| KA Code | Knowledge Area   |
|---------|--|
| 305     | Animal Physiological Processes                                   |
| 701     | Nutrient Composition of Food                                     |
| 702     | Requirements and Function of Nutrients and Other Food Components |

#### Outcome #6

##### 1. Outcome Measures

The impact of a whole foods curriculum for older adults will be evaluated.

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2013 | 0      |

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

Older adults are at risk for obesity-related disabilities. There is a need for research on interventions to improve diet and exercise in older adults, which may improve their health trajectories.

###### **What has been done**

A whole grains food education program has been developed and is being tested across multiple states.

###### **Results**

Research is providing evidence for recommendations as well as identifying barriers to the consumption of whole grain foods. The consumption of whole grain foods has been shown to reduce the risk factors of age related diseases

#### 4. Associated Knowledge Areas

| <b>KA Code</b> | <b>Knowledge Area</b>  |
|----------------|--|
| 702            | Requirements and Function of Nutrients and Other Food Components |
| 704            | Nutrition and Hunger in the Population                           |

#### **V(H). Planned Program (External Factors)**

##### **External factors which affected outcomes**

- Economy
- Appropriations changes
- Competing Programmatic Challenges
- Other (Two project directors were on medical leave over part of FY13 slowing experimental work)

##### **Brief Explanation**

The NHAES suffered a ~23.9% cut in state funds in the budget that ran through FY13. This has necessitated cuts in investigator support budgets and funding for students/postdocs, which has slowed overall progress.

#### **V(I). Planned Program (Evaluation Studies)**

##### **Evaluation Results**

The success of research projects in this planned program is measured in several ways:

- For new projects, are preliminary results statistically significant and do the results test underlying hypotheses?
  - o Preliminary results support the hypothesis that fat from conventionally raised dairy cows, compared to pasture fed dairy cows, stimulated the production of immune system molecules in a way consistent with enhanced allergic reactions.
  - o UNH researchers have demonstrated that rats exposed to synthetic flame retardants have perturbations of glucose and lipid metabolism in their fat tissue, which could promote diabetes and enzyme changes in their livers that could promote additional health problems with Vitamin D deficiency.
- For mature projects, have results been published in peer reviewed journals? Do project directors participate in national and international conferences?
  - o There were nine peer-reviewed papers over five projects.
  - o There were eight published abstracts from national and international conferences over five projects.
  - o Where appropriate outcomes/protocols, etc. were disseminated to stakeholders and adopted by the broader public.
  - o Results have been broadly disseminated on a local, regional, and international level.
- NHAES believes research conducted under the auspices of this program has been very effective by the measures listed above.

##### **Key Items of Evaluation**

- Of particular significance are the results of the College Health and Nutrition Assessment Survey, which shows that rates of obesity are on the decline.
- The Young adult Eating and Active for Health (YEAH) study findings suggest modest metabolic improvements may be associated with web-based interventions targeting healthy lifestyle behavior change among young adults.
- The Guiding Stars (GS) survey suggests that the presence of nutrition guidance positively influences consumers' perceptions that healthy foods are available.