V(A). Planned Program (Summary)

Program # 14

1. Name of the Planned Program

Integrated Health Solutions

☐ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

<table>
<thead>
<tr>
<th>KA Code</th>
<th>Knowledge Area</th>
<th>%1862 Extension</th>
<th>%1890 Extension</th>
<th>%1862 Research</th>
<th>%1890 Research</th>
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<tbody>
<tr>
<td>112</td>
<td>Watershed Protection and Management</td>
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<td>8%</td>
<td></td>
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<tr>
<td>133</td>
<td>Pollution Prevention and Mitigation</td>
<td>5%</td>
<td>5%</td>
<td></td>
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<tr>
<td>301</td>
<td>Reproductive Performance of Animals</td>
<td>5%</td>
<td>5%</td>
<td></td>
<td></td>
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<tr>
<td>303</td>
<td>Genetic Improvement of Animals</td>
<td>5%</td>
<td>5%</td>
<td></td>
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<tr>
<td>304</td>
<td>Animal Genome</td>
<td>5%</td>
<td>5%</td>
<td></td>
<td></td>
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<tr>
<td>305</td>
<td>Animal Physiological Processes</td>
<td>5%</td>
<td>5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>307</td>
<td>Animal Management Systems</td>
<td>5%</td>
<td>5%</td>
<td></td>
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</tr>
<tr>
<td>311</td>
<td>Animal Diseases</td>
<td>5%</td>
<td>5%</td>
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<tr>
<td>314</td>
<td>Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals</td>
<td>5%</td>
<td>5%</td>
<td></td>
<td></td>
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<tr>
<td>315</td>
<td>Animal Welfare/Well-Being and Protection</td>
<td>5%</td>
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<tr>
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<td>Quality Maintenance in Storing and Marketing Food Products</td>
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<tr>
<td>711</td>
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<tr>
<td>712</td>
<td>Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins</td>
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<td>721</td>
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<td>722</td>
<td>Zoonotic Diseases and Parasites Affecting Humans</td>
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<td>Hazards to Human Health and Safety</td>
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Total 100% 100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program
V(D). Planned Program (Activity)

1. Brief description of the Activity

Food processing is one of the largest industries in Pennsylvania, and much of the research in this planned program contributes to improved and safer food processing. Research includes study of the effectiveness of high pressure processing on reduction of O157:H7 E. coli in hamburger, the potential to use an extract from avocado seeds as a natural colorant, and gender differences in preference for spicy foods.

Research into one health, toxicology, and immunology in the college includes racial differences in use of health care for diabetes management, interaction of harmless E. coli in our intestines with pathogenic E. coli, suppression of colon tumorigenesis by anthocyanin in purple potatoes, genetic variability in Holstein cattle, efforts to educate about and fight a potential outbreak of highly pathogenic avian influenza, the life cycle of the malaria mosquito, and accumulation of pharmaceuticals and personal care products in and on crops spray irrigated with treated wastewater.

The requirements of the Food Safety Modernization Act are driving much of our extension programming in this planned program. Trainings in Hazard Analysis Critical Control Point (HAACP) and Good Agricultural Practices (GAP) continue. The ServSafe curriculum is frequently presented to meet regulatory requirements for commercial food service operations. We offer specialized food safety trainings for specific industries, such as the wine industry.

Extension work in consumer food safety includes frequent offerings of Cooking for Crowds, for volunteer organizations that prepare and serve food to the public; and workshops by Master Food Preserver volunteers, who teach home food preservation.

We are offering more extension food safety trainings in Spanish to meet the growing need, and we are translating more materials into additional languages as well.
The safe drinking water research and extension team analyzed water samples from private wells in northern Pennsylvania before nearby development of wells for Marcellus shale natural gas extraction. The study provided free water testing and help in interpreting the results and planning action steps as needed.

2. Brief description of the target audience

- Agricultural Producers/Farmers/Landowners
- Agriculture Services/Businesses
- Nonprofit Associations/Organizations
- Business/Industry
- Community Groups
- Education
- General Public
- Government Personnel
- Human Service Providers
- Military
- Non-Governmental Organizations
- Nonprofit Associations/Organizations
- Policy Makers
- Special Populations (at-risk and underserved audiences)
- Students/Youth
- Volunteers/Extension Leaders

3. How was eXtension used?

Penn State Extension supports faculty and staff use of eXtension and promotes communities of practice as a way of broadening sources of information and outreach. Penn State Extension supports the professional development offered through eXtension. Members of most teams answered questions submitted to eXtension's Ask an Expert system.

One extension food safety team member has answered more than 300 questions asked via eXtension's Ask an Expert system and is ranked in the top 20 for responding to food safety questions. Some team members use eXtension as a resource for information and/or articles to use in programs they conduct.

One team member was selected to be a part of eXtension's i-Three Issue Corps with a project for women in agriculture ergonomics.

V(E). Planned Program (Outputs)

1. Standard output measures

<table>
<thead>
<tr>
<th></th>
<th>Direct Contacts Adults</th>
<th>Indirect Contacts Adults</th>
<th>Direct Contacts Youth</th>
<th>Indirect Contacts Youth</th>
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<td>15981</td>
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<tr>
<td>Actual</td>
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</tbody>
</table>

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

Report Date 05/16/2016
Patent Applications Submitted

Year: 2015
Actual: 15

Patents listed
Patent # 2010284428; Serial No. 2010284428; Title: Compositions, Methods, and Kits for Detecting and Treating Abnormal Metabolic and Cardiovascular Diseases

Patent # ZL 201280031659.2; Serial No. 201280031659.2; Title: Compositions, Methods and Kits for Treating Leukemia

Patent # 9,119,862; Serial No. 14/335,020; Title: Compositions, Methods and Kits for Treating Cancer

Serial No. 14/804,933; Filed 7/21/2015; Title: Selected Automated Blossom Thinning

Serial No. PCT/US2015/0413; Filed 7/21/2015; Title: Selected Automated Blossom Thinning

Serial No. 14/810,317; Filed 7/27/2015; Title: Compositions and Methods for Bed Bug Control Using Entomopathogenic Fungi

Serial No. 62/186,026; Filed 6/29/2015; Title: Foaming and Emulsifying Properties of High Pressure Jet Processing Pasteurized Skim Milk

Serial No. 14/850,688; Filed 9/10/2015; Title: Compositions, Methods, and Kits for Detecting and Treating Abnormal Metabolic and Cardiovascular Diseases

Serial No. 2015-151167; Filed 7/30/2015; Title: Compositions, Methods, and Kits for Detecting and Treating Abnormal Metabolic and Cardiovascular Diseases

Serial No. 2015138677; Filed 9/20/2015; Title: Compositions, Methods and Kits for Detecting and Treating Abnormal Metabolic and Cardiovascular Diseases

Serial No. 62/065,931; Filed 10/20/2014; Title: Methods for Treatment of Leukemia

Serial No. 14,735,231; Filed 6/20/2015; Title: Compositions, Methods and Kits for Treating Cancer

Serial No. 62/175,639; Filed 6/15/2015; Title: Methods for Treatment of Leukemia

Serial No. 14/669,663; Filed 3/26/2015; Title: Modulation of CCR10 Signals for Treatment of Skin and Intestinal Inflammatory Diseases and Infection

Serial No. 62/193,876; Filed 7/17/2015; Title: A Size Tunable Enrichment Platform for Capturing Nano Particles in a Fluid

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications
### Output #1

**Output Measure**

- Number of participants in extension education classes and workshops.

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<tr>
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<table>
<thead>
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<th>2015</th>
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<th>Research</th>
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</thead>
<tbody>
<tr>
<td>Actual</td>
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<td>145</td>
<td>0</td>
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</tbody>
</table>
### V(G). State Defined Outcomes

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

<table>
<thead>
<tr>
<th>O. No.</th>
<th>OUTCOME NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Finding that personal care products can be taken up into wheat plants and adhere to plant surfaces when wastewater treatment plant effluent is spray-irrigated</td>
</tr>
<tr>
<td>2</td>
<td>Percentage of participants in Penn State Extension workshops on interpreting results of private drinking water supply testing who had taken action (n=160) on their water supplies within a few months of attending a workshop</td>
</tr>
<tr>
<td>3</td>
<td>Finding that some strains of harmless E. coli in our intestines can interact with pathogenic E. coli in ways that will either increase or decrease how much toxin the pathogen produces</td>
</tr>
<tr>
<td>4</td>
<td>Finding that malaria mosquitoes feed on common caterpillars, suggesting a new mechanism for horizontal transmission of pathogens and other microorganisms between hosts</td>
</tr>
<tr>
<td>5</td>
<td>Finding that Holstein lineages trace back to two bulls from the early 1880s</td>
</tr>
<tr>
<td>6</td>
<td>Assembly of multifaceted, multipartner team to fight highly pathogenic avian influenza and educate all relevant audiences</td>
</tr>
<tr>
<td>7</td>
<td>Number of fruit and vegetable growers trained in Good Agricultural Practices (GAPs)</td>
</tr>
</tbody>
</table>
Outcome #1

1. Outcome Measures

Finding that personal care products can be taken up into wheat plants and adhere to plant surfaces when wastewater treatment plant effluent is spray-irrigated

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>1</td>
</tr>
</tbody>
</table>

3c. Qualitative Outcome or Impact Statement

**Issue (Who cares and Why)**

With rising demands on water supplies necessitating water reuse, as well as a desire to reduce exposure of fish to wastewater constituents, wastewater treatment plant (WWTP) effluent is often used to irrigate agricultural lands. Emerging contaminants, such as pharmaceuticals and personal care products (PPCPs), are frequently found in effluent due to limited removal during WWTP processes. Concern has arisen about the environmental fate of PPCPs, especially regarding plant uptake.

**What has been done**

Penn State researchers conducted a study to analyze uptake of sulfamethoxazole, trimethoprim, ofloxacin, and carbamazepine in wheat plants spray-irrigated with WWTP effluent. Wheat was collected before and during harvest, and plants were divided into grain and straw. Subsamples were rinsed with methanol to remove compounds adhering to surfaces. All plant tissues underwent liquid-solid extraction, solid-phase extraction cleanup, and liquid chromatography-tandem mass spectrometry analysis.

**Results**

Residues of each compound were present on most plant surfaces. Ofloxacin was found throughout the plant, with higher concentrations in the straw (10.2 +/- 7.05 ng/g) and lower concentrations in the grain (2.28 +/- 0.89 ng/g). Trimethoprim was found only on grain or straw surfaces, whereas carbamazepine and sulfamethoxazole were concentrated within the grain (1.88 +/- 2.11 and 0.64 +/- 0.37 ng/g, respectively). These findings demonstrate that PPCPs can be taken up into wheat plants and adhere to plant surfaces when WWTP effluent is spray-irrigated. The presence of PPCPs within and on the surfaces of plants used as food sources raises the question of potential (but apparently very low) health risks for humans and animals consuming...
4. Associated Knowledge Areas

<table>
<thead>
<tr>
<th>KA Code</th>
<th>Knowledge Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>112</td>
<td>Watershed Protection and Management</td>
</tr>
<tr>
<td>133</td>
<td>Pollution Prevention and Mitigation</td>
</tr>
<tr>
<td>314</td>
<td>Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals</td>
</tr>
<tr>
<td>723</td>
<td>Hazards to Human Health and Safety</td>
</tr>
</tbody>
</table>

Outcome #2

1. Outcome Measures

Percentage of participants in Penn State Extension workshops on interpreting results of private drinking water supply testing who had taken action (n=160) on their water supplies within a few months of attending a workshop.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>80</td>
</tr>
</tbody>
</table>

3c. Qualitative Outcome or Impact Statement

**Issue (Who cares and Why)**

In PA, at least 30% of residents in most counties where gas drilling is occurring rely on shallow groundwater sources. Research before gas drilling began found that about 40% of these private supplies fail to meet federal drinking water standards. Because of the gas drilling boom, thousands of homeowners have received predrilling drinking water tests. Homeowners often have difficulty understanding test reports, resulting in low awareness of pre-existing problems.

**What has been done**

Penn State Extension and partners, with leveraged funding from Colcom Foundation, attempted to improve understanding of predrilling water tests. Homeowners in 8 north-central PA counties were provided free water tests. Testing for 21 parameters was completed on 743 homes with a
private water supply. Homeowners received test results and an invitation to a Penn State Extension workshop on interpreting water tests. Homeowners who attended received an online follow-up survey (54% response).

**Results**
Educational workshops with companion publications and websites were used by 79% of all households tested. More than half of the private supplies tested failed at least 1 health-based standard (e.g., coliform bacteria, E. coli, turbidity, or Ba). Many other water supplies failed standards for aesthetic pollutants (e.g., Mn, Fe, pH, total dissolved solids, chloride, or sulfate). Eight percent (n=60) of water supplies contained very hard water, and 14% (n=101) contained measurable concentrations of methane gas before shale gas drilling occurred. Follow-up evaluations found that nearly all homeowners understood the test reports and 80% had taken actions on their water supplies since the workshop, including disinfection, 22% (n=45); improved water supply construction, 17% (n=36); installed water treatment, 10% (n=21); designated wellhead protection area, 9% (n=19); and other responses. The program represents an emerging educational opportunity for extension in shale gas drilling regions.

**4. Associated Knowledge Areas**

<table>
<thead>
<tr>
<th>KA Code</th>
<th>Knowledge Area</th>
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<tbody>
<tr>
<td>112</td>
<td>Watershed Protection and Management</td>
</tr>
<tr>
<td>133</td>
<td>Pollution Prevention and Mitigation</td>
</tr>
<tr>
<td>722</td>
<td>Zoonotic Diseases and Parasites Affecting Humans</td>
</tr>
<tr>
<td>723</td>
<td>Hazards to Human Health and Safety</td>
</tr>
</tbody>
</table>

**Outcome #3**

1. **Outcome Measures**

Finding that some strains of harmless E. coli in our intestines can interact with pathogenic E. coli in ways that will either increase or decrease how much toxin the pathogen produces.

2. **Associated Institution Types**

- 1862 Research

3a. **Outcome Type:**

Change in Knowledge Outcome Measure

3b. **Quantitative Outcome**

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
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</tr>
</tbody>
</table>

3c. **Qualitative Outcome or Impact Statement**
Issue (Who cares and Why)
Scientists wonder why some people get so sick and even die after being infected by the foodborne pathogen E. coli O157:H7, while others experience much milder symptoms and recover relatively quickly.

What has been done
Researchers co-cultured the pathogenic E. coli O157:H7 serotype with a nonpathogenic strain of the bacteria and inoculated mice. These mice got much sicker than mice infected with the pathogenic strain alone. The finding appears to be especially relevant because people normally have multiple strains of E. coli in their intestines.

Results
This research suggests that some strains of harmless E. coli in our intestines can interact with pathogenic E. coli in ways that will either increase or decrease how much toxin the pathogen produces. This may dictate how sick a person gets with an E. coli infection, or even if an infection proves to be fatal. The study may be a significant step toward doctors being able to predict how an E. coli-infected patient will fare by evaluating a stool sample and analyzing the presence or absence of various strains of nonpathogenic E. coli. With further work, we might be able to determine if the patient is going to clear the organisms and have mild symptoms, or if they are likely to have something that is more serious.

4. Associated Knowledge Areas

<table>
<thead>
<tr>
<th>KA Code</th>
<th>Knowledge Area</th>
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<tbody>
<tr>
<td>712</td>
<td>Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins</td>
</tr>
<tr>
<td>722</td>
<td>Zoonotic Diseases and Parasites Affecting Humans</td>
</tr>
<tr>
<td>723</td>
<td>Hazards to Human Health and Safety</td>
</tr>
</tbody>
</table>

Outcome #4

1. Outcome Measures

Finding that malaria mosquitoes feed on common caterpillars, suggesting a new mechanism for horizontal transmission of pathogens and other microorganisms between hosts

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
</tr>
</thead>
</table>
3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Adult female mosquitoes need blood to develop their eggs. Both sexes use nectar and honeydew as carbohydrate resources for flight and survival, and to enhance reproduction. However, there are also a few reports in the literature of mosquitoes feeding on haemolymph of soft-bodied insects such as caterpillars. The frequency and significance of this behavior is not well understood, but is thought to be a vestige of ancestral feeding behavior or an opportunistic behavior that has evolved over time.

What has been done
The research team used y-tube olfactometer assays to investigate the extent to which the malaria mosquito, Anopheles stephensi, is attracted to, and can successfully feed on, larvae of two common moth species, Manduca sexta and Heliothis subflexa.

Results
They found that female A. stephensi readily flew upwind to and landed on the caterpillars of both moth species. The nature of the volatile cues used in host location remains unclear, but respirometer studies suggest a possible role of carbon dioxide. Laboratory cage assays further showed that the female mosquitoes were able to actively feed on moth larvae and gain sufficient nutritional benefit to influence survival. The extent to which such an opportunistic behavior occurs in the field has yet to be explored, but our results suggest that this haemolymph feeding behavior could play a role in malaria mosquito life history and could provide a new mechanism for horizontal transmission of pathogens and other microorganisms between hosts.

4. Associated Knowledge Areas

<table>
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<tr>
<td>721</td>
<td>Insects and Other Pests Affecting Humans</td>
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</table>

Outcome #5

1. Outcome Measures

Finding that Holstein lineages trace back to two bulls from the early 1880s

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure
3b. Quantitative Outcome

<table>
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<th>Year</th>
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</tr>
</thead>
<tbody>
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</tbody>
</table>

3c. Qualitative Outcome or Impact Statement

**Issue (Who cares and Why)**
Holsteins are the most numerous dairy cattle breed in the world and have undergone intensive selection for improving milk production and conformation, which leads to the reduction of the effective population size and a reduced genetic diversity.

**What has been done**
The objective of this study was to investigate effective population size of the Holstein Y chromosome and the effects of the limited Y-chromosome lineages on male reproduction. Paternal pedigrees were analyzed of 62,897 Holstein bulls born between 1950 and 2013 in North America and 220,872 bulls registered in Interbull.

**Results**
The results indicated that the number of Y-chromosome lineages in Holsteins has undergone a dramatic decrease from 1950 to 2013 as a consequence of artificial selection and the application of artificial insemination (AI) technology. All current Holstein AI bulls in North America are the descendants of only two ancestors born in 1880. These two ancestral Y lineages are continued through three dominant pedigrees from the 1960s, namely Pawnee Farm Arlinda Chief, Round Oak Rag Apple Elevation, and Penstate Ivanhoe Star, with contributions of 48.78%, 51.06%, and 0.16% to the population in the 2010s, respectively. This study suggests minimal genetic diversity on the Y chromosome in Holsteins, and provides a basis for investigating the impact of the extremely limited number of Y lineages on male reproduction. Because dairy producers are primarily concerned with the genetic potential of cows, it is not clear that the limited male lineages present any real challenges for Holstein breeders.

4. Associated Knowledge Areas

<table>
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<tr>
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<tbody>
<tr>
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<td>Genetic Improvement of Animals</td>
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<td>304</td>
<td>Animal Genome</td>
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<td>Animal Physiological Processes</td>
</tr>
<tr>
<td>307</td>
<td>Animal Management Systems</td>
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</table>
Outcome #6

1. Outcome Measures

Assembly of multifaceted, multipartner team to fight highly pathogenic avian influenza and educate all relevant audiences

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

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<tbody>
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</table>

3c. Qualitative Outcome or Impact Statement

**Issue (Who cares and Why)**
The highly pathogenic avian influenza (HPAI) that started in the U.S. in December 2014 has affected over 48 million birds in 15 western and midwestern states. This disease causes 75-90% mortality and eventually the depopulation of all birds on site. Pennsylvania’s $1.4-billion egg industry is the fourth largest in the country. If we have a really severe avian flu outbreak, it’s estimated that there could be losses of more than 50,000 jobs and billions of dollars.

**What has been done**
Penn State’s poultry team is a critical part of the PA HPAI task force, along with USDA, PA Department of Agriculture, and others. Team members developed and delivered educational materials and presentations for a wide range of audiences. They would also help with depopulation, disposal, composting, and vaccination in the event of an outbreak. Team members at Penn State’s Animal Diagnostic Laboratory are on the front line of detection and reporting on avian influenza of all types.

**Results**
The result has been widespread education to residents of PA and the region on developing farm plans to deal with biosecurity and depopulation, disposal, and disinfection of their farms. The team widely spread general knowledge of the disease, its etiology, what to do to prevent it, and how to properly report on the disease. Greater skills have been developed, preparedness has improved, resources have been accumulated, and abilities to detect the disease and communicate with our diagnostic labs and diagnosticians have increased. The greatest outcome has been the production of farm plans and the coordination among industry, backyard producers, government, and academia in addressing the problem and preparing for an outbreak of HPAI in
the state.

4. Associated Knowledge Areas

<table>
<thead>
<tr>
<th>KA Code</th>
<th>Knowledge Area</th>
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<tbody>
<tr>
<td>311</td>
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<td>315</td>
<td>Animal Welfare/Well-Being and Protection</td>
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</tbody>
</table>

Outcome #7

1. Outcome Measures

Number of fruit and vegetable growers trained in Good Agricultural Practices (GAPs)

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

<table>
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<tbody>
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</tbody>
</table>

3c. Qualitative Outcome or Impact Statement

**Issue (Who cares and Why)**

Microbial contamination of farm produce is a source of foodborne disease outbreaks that can result in hospitalizations and deaths. In 1998, FDA proposed agricultural production practices to reduce the risk of microbial contamination of fresh produce. These Good Agricultural Practices (GAPs) address farm workers’ health and hygiene; agricultural water quality; the use of domesticated animals; potential contamination by wild animals; sanitation standards; and traceability/recall.

**What has been done**

Since 2009, Penn State Extension has trained approximately 2000 produce growers on GAPs. In 2015, Extension conducted 10 on-farm food safety workshops statewide to train 330 fruit and vegetable growers on GAPs. These workshops were evaluated using pre- and post-tests to assess the impact of the training on participating growers.

**Results**
After-workshop evaluations revealed statistically significant increases in growers' GAP knowledge and identified areas where content delivery must be improved. Practitioners acknowledge the need to conduct delayed follow-up evaluations to gather information on participants' actual steps taken in response to attendance.

Penn State has been a leader in developing research-based food-safety standards for the mushroom industry, known as mushroom GAPS, or MGAPs. Now about 90 percent of the fresh mushrooms consumed in the United States have been grown on a farm that passed an MGAP third-party inspection. As a result of MGAPs, mushroom growers are more prepared than other produce groups to comply with the FDA produce-safety regulation.

4. Associated Knowledge Areas

<table>
<thead>
<tr>
<th>KA Code</th>
<th>Knowledge Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>503</td>
<td>Quality Maintenance in Storing and Marketing Food Products</td>
</tr>
<tr>
<td>711</td>
<td>Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources</td>
</tr>
<tr>
<td>712</td>
<td>Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins</td>
</tr>
<tr>
<td>722</td>
<td>Zoonotic Diseases and Parasites Affecting Humans</td>
</tr>
<tr>
<td>723</td>
<td>Hazards to Human Health and Safety</td>
</tr>
</tbody>
</table>

V(H). Planned Program (External Factors)

**External factors which affected outcomes**
- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)
- Other (Extramural Funding)

**Brief Explanation**

**Natural Disasters**
- Weather extremes (floods and droughts) create numerous questions about effects on private drinking water supplies and management to address these concerns.

**Economy**
- Economic factors drive clients to participate in free or reduced fee water testing programs and also affect what water testing packages are selected by clients.
- The food industry is a major economic driver for the state. Issues that impact a company or an industry will have a ripple effect throughout the state, from the sales to jobs.

**Government Regulations**
- Introduction of water well construction legislation resulted in significant time expenditure.
- Passage of the Food Safety Modernization Act (FSMA) has stimulated interest in offering farm food safety trainings. But FDA has mandated that only one curriculum, developed by
the Produce Safety Alliance (PSA), can satisfy the training requirement. Therefore, we have not been regularly offering our "Keeping Produce Safe Using Good Agricultural Practices" workshop. PSA has not released the new curriculum and has not established a protocol for approving instructors, so we cannot yet teach the curriculum.

- FSMA has changed attitudes in the college and the state legislature as evidenced by funding available for a new GAP extension educator in 2016.
- The Food Safety Modernization Act is having an enormous impact on the food supply chain. Foodborne illness cases and food recalls continue to grab news headlines, which has a dramatic impact on the entire food chain. Food producers and processors need improved practices under increased scrutiny from the public, law makers, and regulators.
- PA has adopted the FDA Food Code, resulting in some changes to regulations governing food service operations. The ServSafe curriculum covers these new regulations. Although FSMA does not affect retail operations as much as other segments of the food system, we can provide information to participants in the program. In large metropolitan areas, more participants have English as a second language, and although the curriculum and test are available in other languages, not all are represented and often the issue of literacy in any language is an issue. Often these individuals must take the exam multiple times before passing.

Public Policy Changes
- Oversight of food and farm businesses at all levels of government affects our program efforts, and we must stay current.

Competing Public Priorities
- Competing public priorities force us to continually align our program priorities with budget realities.
- Retirements may make it more difficult all of our current programs.

Population Changes
- Population changes continue to drive the need to make more extension offerings available in other languages.

Other - Extramural Funding
- Some of our programs are affected by extramural funding, either by adding resources to promote them or by shaping the content of the product.
- Extramural funding has allowed some teams to conduct practical applied research projects that include integrated extension/educational components.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The generation of outcomes from existing programs and the development of new programs require improved evaluation that identifies pre- and post- responses to information and monitoring for long-term behavioral changes that result in improved outcomes. More statewide extension programs are using retrospective evaluation to gather information about the number of participants who actually put into practice lessons learned through extension programs. Measuring costs averted or profit increased can show powerful, tangible benefits of our programming--the type of feedback that keeps people coming back for more information. Customer satisfaction and needs assessment instruments (Salesforce and Atlas) provide feedback on the quality and value of our programs.

Key Items of Evaluation

See highlights of state-defined outcomes in this planned program.