V(A). Planned Program (Summary)

Program # 15

1. Name of the Planned Program

Structure and Function of Macromolecules

☑ 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
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		5%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		5%	
206	Basic Plant Biology	0%		20%	
211	Insects, Mites, and Other Arthropods Affecting Plants	0%		5%	
212	Pathogens and Nematodes Affecting Plants	0%		5%	
304	Animal Genome	0%		5%	
305	Animal Physiological Processes	0%		45%	
311	Animal Diseases	0%		5%	
312	External Parasites and Pests of Animals	0%		5%	
	Total	0%		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	8.0	0.0
Actual Paid Professional	0.0	0.0	5.7	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	252150	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	252150	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	1434310	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

-Basic research will be conducted that will make fundamental discoveries which will enhance our understanding of molecular mechanisms involved in the regulation of physiological processes in plant and animal systems.

- New faculty and staff will be recruited to build, foster and maintain a cohesive critical mass of research faculty with a diverse set of expertise that focuses on the study of structural biology.

-Grant proposals will be written to acquire and maintain state of the art equipment to enhance the research capabilities relating to protein structure/ function/ interactions on the OSU campus.

- Funds will be solicited from national, state and university sources to acquire, and maintain support for "Core" facilities that are critical to the research mission of DASNR and Oklahoma State University.

- Design and conduct basic research to fill critical gaps in scientific knowledge that will address needs, issues and problems that ultimately can be translated into an improvement in plant and animal health.

- Develop new research methods and procedures.

- Train undergraduate and graduate students, and postdoctoral associates.

- Publish scientific articles.

- Write and submit grant proposals.

- Attend and present scientific findings at professional conferences.

- File patents for protection of intellectual property and negotiate licensing agreements for technology transfer.

- Interact with other researchers both on and off the OSU campus.

2. Brief description of the target audience

- Departments and department heads
- OSU administrators
- Other faculty and other scientific researchers in DASNR, at OSU & the scientific community
- Students and post-docs
- Federal, state, and private funding agencies
- Scientific journal editors, readers & the scientific community
- Candidates for open faculty and staff positions.
- Patent officers
- Agricultural, environmental, life, and human science industries
- General public and elected officials

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	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	25	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of graduate students graduated and post doctoral scientists moving on to full

employment.

Year	Actual
2013	8

Output #2

Output Measure

- Numbers of manuscripts submitted from research efforts

Year	Actual
2013	27

Output #3

Output Measure

- Numbers of patent agreements (requests for protection of intellectual property with IP office) filed.

Year	Actual
2013	1

Output #4

Output Measure

- Numbers of graduate students, and postdoctoral associates being trained in structural biology.

Year	Actual
2013	35

Output #5

Output Measure

- Numbers of extramural grants submitted with preliminary data gathered from research efforts.

Year	Actual
2013	34

Output #6

Output Measure

- Numbers of instrumentation proposals submitted to obtain new instrumentation to support research efforts

Year	Actual
2013	7

Output #7

Output Measure

- Numbers of presentations given at local, state, national and international meetings to disseminate research results and publicize ongoing research efforts in structural biology at OSU.

Year	Actual
2013	90

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Research development knowledge taken to patent or license stage.
2	Detecting biological contamination of foods and on surfaces used for food processing
3	Increased number of graduate students and post doctoral associates will be recruited into and trained in molecular biology.
4	Increased competitiveness of team members for extramural funding.
5	Increased competitiveness of equipment proposals submitted by team members due to investments made in research infrastructure.
6	Faculty at OSU will become known nationally and internationally for their expertise and research in their particular area of structural biology.
7	Development of new and better therapeutics for the treatment and prevention of inflammatory and autoimmune diseases

Outcome #1

1. **Outcome Measures**

Research development knowledge taken to patent or license stage.

Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

Detecting biological contamination of foods and on surfaces used for food processing

2. **Associated Institution Types**

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	25

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
While the need for a method that can detect biological contamination of foods and on surfaces used for food processing and its importance for food safety is well-understood, currently there is no rapid method available for such detection.

What has been done
Researchers demonstrated that laser-induced breakdown spectroscopy (LIBS) can be used to differentiate bacterial pathogens and antimicrobial-resistant bacterial pathogens from isogenic antimicrobial-susceptible strains, and to detect food pathogens on foods and food-processing surfaces. The type (E. coli or S. enterica) of bacteria could also be differentiated in all cases studied along with the metabolic state (viable or heat killed). The main advantages of LIBS-based technology are the speed of analysis, minimal sample preparation, use of few consumables, and the ability to detect pathogens on all types of surfaces.

Results
The rapid detection of biological contaminants, such as Escherichia coli O157:H7 and Salmonella enterica, on foods and food-processing surfaces is important to ensure food safety and streamline the food-monitoring process. LIBS is an ideal candidate technology for this application because

sample preparation is minimal and results are available rapidly (seconds to minutes). This study provides data showing the potential of LIBS for the rapid identification of biological contaminants using spectra collected directly from foods and surfaces, and its future application in the food processing industry with a predicted outcome of a significant reduction in the instances of outbreaks of food-borne diseases.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology
304	Animal Genome
305	Animal Physiological Processes

Outcome #3

1. Outcome Measures

Increased number of graduate students and post doctoral associates will be recruited into and trained in molecular biology.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	8

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants

206	Basic Plant Biology
304	Animal Genome
305	Animal Physiological Processes

Outcome #4

1. Outcome Measures

Increased competitiveness of team members for extramural funding.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	11

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology
304	Animal Genome
305	Animal Physiological Processes

Outcome #5

1. Outcome Measures

Increased competitiveness of equipment proposals submitted by team members due to investments made in research infrastructure.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	4

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology
304	Animal Genome
305	Animal Physiological Processes

Outcome #6

1. Outcome Measures

Faculty at OSU will become known nationally and internationally for their expertise and research in their particular area of structural biology.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	13

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The cell walls of plants play a critical role in their growth and vitality. Knowledge on plants cell wall synthesis and structure is critical for advancing our understanding of disease resistance and approaches for increasing the productivity of plants.

What has been done
Dr. Andrew has an international reputation in cell wall research. Dr. Mort was invited to the 13th Annual International Cell Wall Meeting in Nantes, France to give a presentation on "Half of the xyloglucan in cell walls of tissue cultures is linked to pectin via a highly branched arabinan."

Results
Dr. Mort's research is advancing the scientific community's understanding of the structure and functions of plants cell walls. In the future, this knowledge should facilitate the development of more productive and disease resistant plants. Dr. Mort's invitation to present his laboratory's research results at an international symposium acknowledges the important contributions that are being made by researchers in the Division of Agricultural Sciences and Natural Resources at OSU to the scientific community at large, and the international prominence of its faculty.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology
304	Animal Genome
305	Animal Physiological Processes

Outcome #7

1. Outcome Measures

Development of new and better therapeutics for the treatment and prevention of inflammatory and autoimmune diseases

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)
IL-17 cytokines play a crucial role in the development of a variety of autoimmune and inflammatory diseases that affect both humans and livestock. IL-17 E signals through a receptor complex composed of IL-17RA and IL17RB chains. Components of the IL-17 receptor (IL-17R) contain SEFIR domains that mediate protein-protein interactions critical for IL-17R signaling. Considering the significance of SEFIR mediated interactions in IL-17 signaling, a better mechanistic understanding of these interactions is vital for the development of novel and improved therapies for the treatment of IL-17-mediated inflammatory diseases.

What has been done
The first crystal structure of SEFIR domain from IL-17RB has been published. Distinct structural elements in SEFIR domain were identified that are key to their ability to mediate protein-protein interactions, and suggest a dual ligand-binding mode for SEFIR domains. Functional analysis of the protein further identified specific regions of the SEFIR domain and Act1 that modulate their interaction. Act1 (activator of NFkappaB, a transcription factor central to the inflammatory response) is an essential component of IL-17 signaling.

Results
The structural and functional analyses of the SEFIR domain of IL-17RB suggest a unique model on how signaling that is mediated by SEFIR?SEFIR interactions take place. The structural insights provided by these analyzes into the molecular mechanisms of IL-17 cytokine signaling will help facilitate the development of new and better therapeutics for the treatment and prevention of inflammatory and autoimmune diseases.

4. Associated Knowledge Areas

KA Code	Knowledge Area

305 Animal Physiological Processes

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities

Brief Explanation

Appropriations for support of research have been shrinking at both the state and federal levels for all of the reasons listed above. As a result there are fewer grant dollars available, and competition for funding is strong. While increased grant dollars were generated by the team this year, they for the most part represent short term seed money to gather preliminary data for submission of competitive grants.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Despite shrinking appropriations and increased competition for research funding, team members have in the short term increases their newly acquired funding from 2012 levels. However, overall funding in comparison to grant funding acquired prior to 2012 is down reflecting the external factors discussed above. The result of this is that fewer graduate students can be supported, and fewer postdoctoral fellows can be hired. In addition, the number of faculty members on the Structure and Function of Macromolecules Team has decreased and the current funding environment has not allowed for their replacement. The impact of this situation on the current evaluations is that the number of manuscripts published has decreased, as has the number of graduate students receiving degrees.

Key Items of Evaluation

Compare percent change in output measures with output measures from 2012.