

## **Planned Program 4 (Summary)**

### **1. Name of the Planned Program**

Improving Animal Reproduction and Health

### **2. Brief summary about Planned Program**

This planned program will exploit the overlap in techniques, approaches and knowledge base that are being used to study animal health issues (e.g. understanding zoonotic diseases and developing animal vaccines) and those that are being used to solve problems in animal reproduction. The concepts of gamete biology will be used to develop hormone free contraception, understand nuclear reprogramming and increase nuclear transfer efficiency. We will develop embryonic stem cell lines and investigate the molecular basis of somatic cell nuclear reprogramming in model systems. We will also investigate oocyte-associated reprogramming factors, embryonic stem cell line establishment and propagation, and stem cell differentiation with preferential interest in the development of hematopoietic cell lineages. We will develop novel methods to enhance the efficiency of nuclear transplant cloning both for establishment of embryonic stem cell lines and for the development of healthy, genetically-engineered livestock. We will develop medical countermeasures (vaccines for prophylaxis) and strategic interventions (cytokines to stop rapid threat of unknown infections) in food animal species. We will explore tissue remodeling and the remediation of tissue pathology in diseases such as laminitis.

**3. Program existence :** New (One year or less)

**4. Program duration :** Long-Term (More than five years)

**5. Expending formula funds or state-matching funds :** Yes

**6. Expending other than formula funds or state-matching funds :** Yes

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

### **1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
301	Reproductive Performance of Animals			8%	
303	Genetic Improvement of Animals			42%	
305	Animal Physiological Processes			9%	
306	Environmental Stress in Animals			3%	
311	Animal Diseases			23%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occuring Toxins,			2%	
315	Animal Welfare/Well-Being and Protection			7%	
722	Zoonotic Diseases and Parasites Affecting Humans			6%	
	<b>Total</b>			100%	

## V(C). Planned Program (Situation and Scope)

### 1. Situation and priorities

Infectious diseases are still the leading cause of death worldwide and we face a continual challenge from newly emerging and re-emerging infectious diseases considering this new era of globalization. Many of these threats are zoonotic diseases (West Nile virus, smallpox, avian influenza). Seventy percent of emerging human diseases come from animals. Zoonotic diseases are those that humans acquire from infected animals. In some cases they can then be spread human-to-human (flu) while in others the human is the end-host (brucellosis) with no human-to-human transmission but nevertheless they can cause serious disease, even life-threatening infections. Current threats include: West Nile virus (carried in mosquitoes, reservoir in horses), eastern equine encephalitis (reservoir in horses), avian influenza (adapted through poultry and pigs), foot and mouth disease (spreads rapidly in swine and cattle), brucellosis (reservoir in US in caribou and bison, spreads to cattle). There are also many infectious diseases that pose food safety risks for humans. These include salmonellosis (caused by a bacteria carried chronically in some poultry and transmissible through eggs) and prion disease (mad cow disease). We are entering the post-genomics era since the genomes of many of the food animals are now known or in the process of being completed (cattle-done, chicken-done, swine and horses in process, fish-done) as well as the genomes of many infectious disease-causing viruses and bacteria. The genome of a virus can now be done in days rather than years. This opens the possibility of rapid vaccine development using cutting-edge technology. In order to make the new reproductive technologies practical, it is imperative that the underlying biological/biochemical processes that allow an oocyte to successfully reprogram a somatic cell nucleus be elucidated so that patient-specific stem cells can be easily engineered thus allowing regeneration of damaged nerves, regrowth of limbs, scar-free wound healing, or immune system replenishment. The processes of dedifferentiation and subsequent differentiation of a somatic cell into a therapeutically useful tissue will require a complement of many specialized areas of biology and engineering including expertise in stem cell biology, biochemistry, molecular biology, genomics/proteomics, cellular and tissue engineering, and animal and veterinary science, the

latter providing large animal models for regenerative tissue research as well as expertise in reproductive biology and nuclear transplant cloning of mammals.

## 2. Scope of the Program

- Integrated Research and Extension
- In-State Research
- Multistate Research

## V(D). Planned Program (Assumptions and Goals)

### 1. Assumptions made for the Program

Tackling zoonotic diseases necessitates an interdisciplinary program of research to fully comprehend the complex interactions of humans, pathogens, reservoirs, and arthropod vectors. There is now a resurgence of interest in virus-cell and virus-host interactions, and viral pathogenesis and immunity that can be brought to bear on problems in animal health. At the genetic, immunological and molecular levels there are often strong correspondences between human and animal health issues. The emergence of new infectious diseases and antibiotic resistant strains of bacteria, the re-emergence of previously controlled infectious diseases and the threat of biological terrorism has increased the need for new vaccines as well as development of broad-acting immunopotentiators for agricultural animals as well as for humans. Understanding the biology of fertility can reduce the risk of infertility in valuable animals.

### 2. Ultimate goal(s) of this Program

to produce research that results in increased understanding of disease processes, control of disease, reproduction and development, development of new animal models or animals with new genetic capabilities, and effect of toxins on animal and human health and on control of disease. To promote the use of research to improve animal health and well-being, increase food safety, and prevent the spread of disease between humans and animals, to increase consumer confidence in animal products, while sustaining public health and decreasing economic loss for producers, to improve reproductive efficiency in large domestic animals, to develop vaccines and immunological interventions to protect large domestic animals from disease

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

### 1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2009	0.0	0.0	3.0	0.0
2010	0.0	0.0	3.0	0.0
2011	0.0	0.0	3.0	0.0
2012	0.0	0.0	3.0	0.0
2013	0.0	0.0	3.0	0.0

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

### 1. Activity for the Program

Conduct research and produce refereed publications in the scientific literature.

**2. Type(s) of methods to be used to reach direct and indirect contacts**

Extension	
Direct Methods	Indirect Methods
● {NO DATA ENTERED}	● {NO DATA ENTERED}

**3. Description of targeted audience**

Animal producers, farmers, agri-tourism

**V(G). Planned Program (Outputs)**

**1. Standard output measures**

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2009	0	0	0	0
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0

**2. (Standard Research Target) Number of Patent Applications Submitted**

**Expected Patent Applications**

2009 :0                      2010 :1                      2011 :1                      2012 :0                      2013 :0

**3. Expected Peer Review Publications**

Year	Research Target	Extension Target	Total
2009	35	0	0
2010	35	0	0
2011	35	0	0
2012	35	0	0
2013	35	0	0

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

**1. Output Target**

- # of refereed manuscripts

2009 :15                      2010 :15                      2011 :15                      2012 :15                      2013 :15

## V(I). State Defined Outcome

### 1. Outcome Target

Accurate research on animal reproduction and health made available and shared

### 2. Outcome Type : Change in Knowledge Outcome Measure

2009 :0

2010 : 0

2011 : 0

2012 :0

2013 : 0

### 3. Associated Institute Type(s)

- 1862 Research

### 4. Associated Knowledge Area(s)

- 301 - Reproductive Performance of Animals
- 303 - Genetic Improvement of Animals
- 305 - Animal Physiological Processes
- 311 - Animal Diseases
- 314 - Toxic Chemicals, Poisonous Plants, Naturally Occuring Toxins, and Other Hazards Affecting Animals
- 315 - Animal Welfare/Well-Being and Protection
- 722 - Zoonotic Diseases and Parasites Affecting Humans

## V(J). Planned Program (External Factors)

### 1. External Factors which may affect Outcomes

- Natural Disasters (drought,weather extremes,etc.)

#### Description

New outbreaks of diseases will impact public perception of the safety of the food supply. A deliberate bioterrorist attack will increase the pressure for more research in this area.

## V(K). Planned Program (Evaluation Studies and Data Collection)

### 1. Evaluation Studies Planned

- Other (peer scientific review)

#### Description

Evaluation will be done through the established scientific review process in the open literature and the merit review process.

### 2. Data Collection Methods

- Journals

#### Description

{NO DATA ENTERED}

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

### **1. External Factors which may affect Outcomes**

- Natural Disasters (drought, weather extremes, etc.)

#### **Description**

The management practices that are most appropriate are strongly influenced by extremes of weather.

## **V(K). Planned Program (Evaluation Studies and Data Collection)**

### **1. Evaluation Studies Planned**

- Other (scientific peer review)

#### **Description**

Evaluation will be done through the established scientific review process in the open literature and the merit review process.

### **2. Data Collection Methods**

- Journals

#### **Description**

{NO DATA ENTERED}