Signature Program/Landmark

Research Programs

for the College of Veterinary Medicine

and Biomedical Sciences

November 20, 2008

SIGNATURE PROGRAM PROPOSAL: CARDIOVASCULAR SCIENCES/DEBAKEY INSTITUTE

Introduction/Significance

Cardiovascular disease is the number one killer of both men and women in the United States. Texas A&M University has a long-standing history of excellence in cardiovascular science in several collaborating colleges, including a unique ability to perform translational research on client owned animals with naturally occurring heart disease (e.g., Doberman pinschers with dilated cardiomyopathy) referred to the Veterinary Teaching Hospital. This relationship is schematically represented in Figure 1 to identify the participants in the cardiovascular science program and the central role of the Michael E. DeBakey Institute that was created in 1999 to formalize programmatic relationship between units. The Colleges of Veterinary Medicine and Engineering have shared faculty and teaching responsibilities for more than 30 years, while the Colleges of Education and Medicine have become an integral part of the cardiovascular science program during the past 20 years. Basic science studies have progressed to the point where clinical implementation requires a strong relationship with both the human and veterinary clinical units. The veterinary clinical cardiovascular program is considered to be one of the top 2 programs in the US, and its faculty have developed preeminent programs for training veterinary cardiology residents, performing veterinary clinical trials to determine safety and efficacy of new cardiac therapeutics, and for performing interventional cardiac studies (e.g., coronary stents, pacemakers). The importance of using animals with naturally occurring disease is only recently begun to be recognized as a very powerful tool in the development and testing of new cardiovascular agents and TAMU is well positioned to become a world leader in this area.

The Texas Institute for Preclinical Services (TIPS) will enable TAMU to more successfully compete for interdisciplinary biomedical research dollars. TIPS will house state-of-the-art core imaging equipment located in a facility with access to numerous animal models. The clinical cardiovascular group, currently comprised of 3 cardiologists and a cardiac surgeon and in dire need of expansion, has a strong relationship with the biomedical engineering group and has collaborated on numerous cardiovascular related projects totaling in excess of 10 M dollars in NIH and AHA funding in the past 6 years. Additionally, TIPS, the CV clinical program, and BMEN collaborated to hire a new BMEN faculty member using ETF funds which has added great strength to our interventional cardiovascular program.

The basic science cardiovascular science program has been extremely successful in attracting extramural funding to support its mission (approximately $60,000,000 over 8 years). The program is in the process of transitioning from an individual investigator-based program to one in which programmatic proposals (Program Project, Center Grant and Training Grant) provide overarching funding for new core facilities and additional graduate students. Additional faculty are needed to expand both the breadth and depth of faculty to fully qualify for program level funding. The cardiovascular sciences program has a proven track record which portends an excellent “return on investment” associated

with the addition of new faculty positions. This return, coupled with the reduction of death and disability from cardiovascular disease, provides the foundation of this request.

Rationale

The interdisciplinary approach to problem solving within cardiovascular research at the Michael DeBakey Institute has positioned us well to continue expanding our impact on cardiovascular medicine and surgery. This impact has resulted in significant program recognition via extramural funding and publications. Departments within the cardiovascular program have advanced to a point of being in the "top ten" or rapidly approaching this designation based on extramural grant support and publication productivity (approximately 600 publications over 8 years) or clinical expertise. Funding for additional high quality scientists within the cardiovascular program should place participating departments solidly within the top ten. The Clinical Veterinary Cardiovascular Sciences program has been identified as a premier program in the Department of Small Animal Clinical Sciences and cardiovascular science has been identified by the Department of Veterinary Physiology and Pharmacology as one of its premier research foci. The Department of Biomedical Engineering has also identified cardiovascular science as a major research emphasis. **The interdisciplinary nature of our research coupled with an ability to translate basic cardiovascular research from the bench into clinical studies using naturally occurring disease is unequaled anywhere in the US.** The teaching, research, and service elements associated with both basic and clinical programs in cardiovascular science have profound impact on all twelve of the Vision 20/20 goals. Whether it is enhancement of faculty or graduate and undergraduate academic experiences, our program has a significant impact on Texas A&M University; enriching our campus by connecting us to the citizens of Texas and the global community via improved circulatory health and quality of life. Faculty members from the associated colleges and departments have participated in formulation of this plan to add faculty and carry the cardiovascular sciences program to the next level of national and international recognition.

Indices of Excellence

Excellence in research can be measured in several ways. Extramurally reviewed grants and publications are the most commonly used indices, along with clinical successes in areas related to medicine. Members of the DeBakey Institute have received numerous grants from the National Institutes of Health including standard investigator initiated R01 grants as well as individual training grants including K08s (Clinical Investigator Awards), K25s (Quantitative Investigator Awards), and K29s (Career Development Awards). These federal grants have been supplemented by individual grants from the American Heart Association and American Lung Association. In recent years, the cardiovascular science program at Texas A&M University has advanced to a more programmatic level. This transition is identifiable when a group of investigators from various departments and colleges seek and obtain funding based on their collaborative interactions. Examples of such programmatic funding include the development of the Texas A&M Institute for Preclinical Studies, which was originally

developed to perform GLP (Good Laboratory Practice) studies in cardiovascular disease. Approximately 65M has been invested by the state, university, and local economic development groups for infrastructure costs for TIPS. Since inception just over two years ago, TIPS has collaborated on numerous projects with total funding that exceeds 25 million dollars. Examples of such funding include over 2 million in NIH funding with BMEN and the TAMU spin-out CorInnova to develop a direct cardiac compression device, 1.2 million to develop a new coronary stent and 846,455 to develop shape polymers for treatment of cerebral aneurysms. Additionally, TIPS has received over 2 million in funding from DARPA for development and testing of a hemorrhagic shock model in the pig. We are currently collaborating with Siemens to develop a deep tissue coagulation device, a project that has been funded by DARPA at over 10 million dollars, and are working to develop fracture putty which has been awarded over 8 million dollars by DARPA for Phase I studies. Discussions are underway between UTHSC and TAMU to jointly spin-out a company to commercialize veterinary and human applications for fracture putty.

Further examples of such funding include the Michael E. DeBakey Initiative funded at $500,000 to $800,000 per year (2002 – 2005) through the Centers for Disease Control and Department of Defense. Another example is the Whitaker Foundation grant which combined the Colleges of Engineering, Veterinary Medicine, and Medicine for funding of 2 million dollars to enhance our teaching and research interactions. Recently, members of the DeBakey Institute were asked to head one of the projects on the University of Texas Medical School's (Houston) P50 Center Grant in trauma. This opportunity to apply the basic science "lessons learned in the laboratory" at Texas A&M University to patients at various hospitals is an indication of how collaborative interactions can lead to clinically important discoveries. In the training grant arena, members of the DeBakey Institute have applied for a National Science Foundation training grant. Of some 500 applications, 100 preproposals were selected for full proposal submission including the proposal from Texas A&M University. An NIH T32 Training Grant will be submitted utilizing the same database organized for the National Science Foundation proposal. As our program has grown in stature and reputation, we have been fortunate to obtain several endowments including two - $1 million endowed chairs in cardiothoracic surgery and cardiology. Our interactions with the Cardiothoracic Surgery Clinic in Cologne, Germany emphasize our global collaborations and have resulted in a significant grant from the German government (Deutsche Forschungsgemeinschaft) supporting our cardiovascular program. An endowment from the Sid Richardson Foundation has been obtained to specifically support cardiothoracic surgery in our veterinary patient population. The cardiovascular science program at Texas A&M University is clearly establishing itself as one of the premier programs in the country and has approximately 600 peer-reviewed manuscripts since creation of the DeBakey Institute.

Interdisciplinary Impact

The Michael E. DeBakey Institute is an Interdisciplinary Cardiovascular Research Program composed of elements from four colleges and multiple departments. The

Cardiovascular Research Program would have been unable to attain its national and international reputation without contributions from each of these units. As we make the next step to greater national and international exposure, it is critical that we maintain our interdisciplinary approach and will be adding members from additional colleges to our research teams.

Assessment/Expectations

Each new faculty position will be aggressively monitored by both the faculty member's department head and the director of the DeBakey Institute. Publications in appropriate journals and acquisition of individual funding from appropriate federal agencies (NIH, NSF, DARPA) will be required. Evaluating program success will be linked directly to standard programmatic bench marks including participation in program project grants, center grants, and training grants. Programmatic success can also be evaluated when a group of superior investigators begin to receive recognition as part of an overarching programmatic imperative such as the Michael E. DeBakey Institute. The cardiovascular sciences program has had excellent success in recruiting both faculty and graduate students from under represented groups. This has been most evident in our recruiting of female and Hispanic faculty and students. The presence of a diverse faculty and student base acts to promote recruiting for additional under-represented faculty and students particularly when the success of our under represented members is appropriately rewarded. Both graduate and undergraduate instructional programs are profoundly impacted by the presence of teaching faculty who bring new discoveries from the laboratory to the classroom in a timely fashion. The excitement and role model exhibited by these faculty members can also help guide undergraduate students to the possibilities of academic employment and career opportunities.

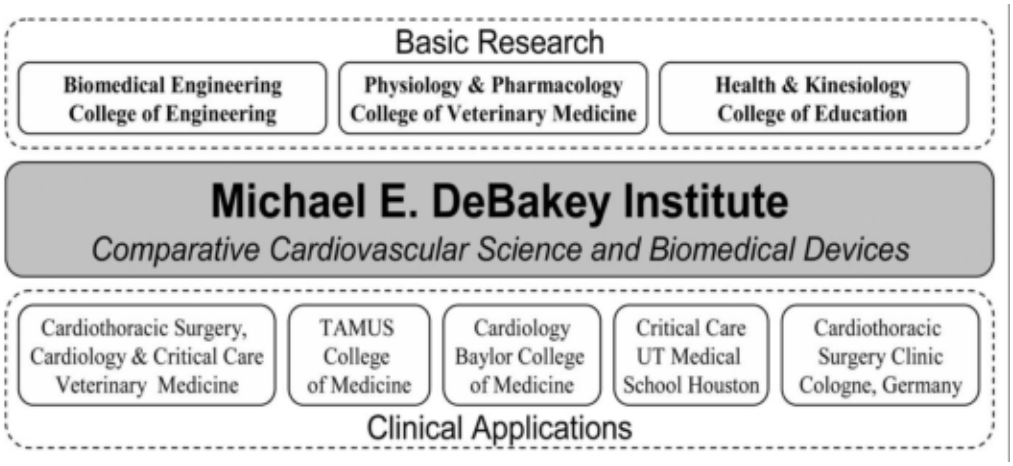


Figure 1

College of Veterinary Medicine and Biomedical Sciences
Participating Faculty

H. Richard Adams, DVM, PhD
Circulatory shock; myocardial and vascular dysfunction in endotoxemia; role of nitric oxide in vasoregulation.

Fred J. Clubb, Jr., DVM., PhD
Electron microscopic evaluation of myocardial and renal biopsies; qualitative and quantitative evaluation of implantable cardiovascular devices for nonGLP and GLP\preclinical trials

Timothy A. Cudd, DVM, PhD
Reflex control of cardiovascular and endocrine systems in the adult and the fetus

Theresa W. Fossum, DVM, PhD
Cardiovascular surger; animal models of cardiovascular disease; chylothorax; lymphatic system; evaluation of artificial heart performance.

Alonso Guedes, DVM, PhD
Clinical Anesthesiology; hormonal and cytokine regulation of intracellular calcium homeostasis in smooth muscle

Sonya G. Gordon, DVM
Canine chronic degenerative valve disease; cardiovascular imaging; interventional cardiology

Cristine L. Heaps, PhD
Cellular and functional adaptations in the coronary circulation in response to coronary artery disease and exercise training; specifically the adaptive responses of both smooth muscle ion channels and endothelial nitric oxide regulation in the regulation of coronary artery function with disease and exercise training.

Glen A. Laine, PhD
Microvascular, interstitial and lymphatic interactions in regulating myocardial fluid balance; myocardial edema and fibrosis; left ventricular mechanics.

Matthew M. Miller, DVM
Cardiomyopathies; color Doppler ultrasonography

Christopher M. Quick, PhD
Quantitative cardiovascular physiology; cardiovascular remodeling and simulation; arterial hemodynamics and pulse wave phenomena

Friedhelm Schroeder, PhD
Research Interests: Intracellular lipid transfer proteins; lipid metabolism; multipohoton imaging of intracellular lipid transport and targeting in living cells and tissues of gene targeted animals

John N. Stallone, PhD
Humoral interactions between vascular smooth muscle and endothelium; genomic and non-genomic effects of gonadal steroid hormones on vascular function.

Randolph Stewart, DVM, PhD
Lymphatic function; microvascular and interstitial fluid dynamics; synovial fluid balance; cardiac function.

George Stoica, DVM, PhD
Cancer biology; growth factors; tumor angiogenesis; immunohistochemical analysis of peripheral arteries after balloon angioplasty.

Yanan Tian, PhD
Transcriptional control of the Ah receptor-regulated genes. Mutual modulation between Ah receptor and NF-kB signal transduction pathway. The effects of Ah receptor ligands on the cholesterol biosynthesis.

LANDMARK AREA OF EXCELLENCE: BIOMEDICAL GENOMICS

Introduction

Genomics is a key and rapidly expanding research discipline that is adding new dimensions to the changing structure of modern biomedicine. Animal genomics has witnessed astonishing expansion and diversification during the past decade. The completion of the human and mouse genome sequences sparked enormous interest in annotation of these genomes through comparative analysis. As a result, genome sequences are now available for nearly all major mammalian companion and livestock species, including cattle, pig, dog, horse and cat, as well as biomedical models such as the rat, rabbit, and opossum genomes. Rapid technical and methodological advancements afforded by genome sequence data are providing the means for new areas of research that could barely be imagined just a few years ago. The study and analysis of animal genomes provides new technologies to better understand phenotypes of biomedical and economic importance in these species, while at the same time informing human biology.

Significance

For more than 25 years, Texas A&M University has played a leading role in the analysis of the genomes of livestock species. The current livestock and companion animal genomics program at Texas A&M University comprises nine faculty at the College of Veterinary Medicine and two faculty at the College of Agriculture & Life Sciences. This program is indisputably one of the most robust animal genomics programs in the world. The nationally and internationally acclaimed faculty (National Academy Science member, President/member of international organizations, international awards recipient, Chair/members of national organizations) specializes in cattle, horse, dog, cat, and marsupial genomics. At no other institution are so many diverse species being simultaneously analyzed. Additionally, expertise exists in wildlife genomics (bison, deer, wild cats, etc.), phylogenomics, traditional & molecular cytogenetics, immunogenetics, and bioinformatics. This broad competence is enabling us to maximally exploit emerging genomic technologies for application in all areas of animal health and disease, while at the same time contributing novel information concerning genome structure and function that promotes greater understanding of human genetic conditions that predispose to, or directly cause, disease and developmental anomalies.

The faculty in Animal Genomics forms the backbone of a number of teaching, research and training programs within and outside the University. These include the Biomedical Sciences undergraduate education program (BIMS)), The Professional Program in Biotechnology, The Center for Animal Genomics and Biomedical Research, and The Interdisciplinary Faculty of Genetics. These programs are the pillars of undergraduate/graduate education and research in basic biology and biomedicine at A&M. In addition, the faculty has significant interaction with a number of national and international groups/institutes in many pivotal areas of animal genomics. It is essential to incorporate emerging areas now, target new faculty enrollment, and establish new programs that will propel our program through the next decade and beyond as a benchmark in genomics education and research.

Rationale

The Animal Genomics Program is one of the research showcases of Texas A&M University. Importantly, the impact of this research is not restricted to agricultural and companion animal models. Knowledge gained from research with animal models of many kinds, including agricultural, companion, and wildlife species, has provided and will continue to provide critically important insights into molecular mechanisms of human development, physiology, and disease conditions that simply cannot be studied by experimental means directly in human subjects. This is especially significant in light of growing realization that rodents are not ideal models for many human genetic conditions. With faculty distributed not only within the CVM but also at the College of Agriculture and Life Sciences, the program dynamically interacts within the Interdisciplinary Genetics Program and with departments/institutes within and outside the University System.

Despite the overall excellence and eminence of this program, to maintain the world class reputation of our genomics program will require diligence and a serous commitment to remain among the most prestigious, well-funded and sought-after genomics education and research programs in the world. This can only be achieved by keeping pace with the latest developments in the field and by investing in faculty recruitment and infrastructure that could provide the basis for ground-breaking research and advanced educational initiatives. Such an investment will be critical for:

- maintaining current national leadership and international prominence in animal genomics
- promoting high quality education in this field for students, and an informative/interactive platform for commodity groups
- preserving and expanding longstanding Texas A&M values to conduct cutting-edge research

Interdisciplinary Impact

There is growing emphasis worldwide to understand the molecular underpinnings of individual diseases, study the proximal and global molecular mechanism(s) of disease and disease-susceptibility, and devise improved ways for prevention and treatment. Understanding these fundamental processes and mechanisms requires the acquisition and implementation of a diverse set of skills, technologies and resources that enable investigators and their students to:

- assimilate and utilize available and new sequence data from various livestock & companion animal species,
- perform functional analysis of genomes to focus on improved production, reproduction, disease resistance and overall health; and
- transition research from genomics studies to devise new diagnostic and preventative treatment approaches.

The current depth and breadth of expertise in animal genomics weaves extremely well with the internationally recognized clinics and departments of Small and Large Animal Medicine Clinical Sciences, the Veterinary Medical Teaching Hospital and the Texas Veternary Medical Diagnostics Laboratory. The synergy arising from the combined strengths of these two programs puts CVM in a unique position to embark on a leadership role in developing bridges between genomics and translational veterinary medical research, as well as with systems biology initiatives planned across

campus and within the new Interdisciplinary Life Sciences Building. Fostering links between these areas will pave the way for the CVM to conduct cutting-edge research that will attract resources from a broader assemblage of state and federal research funding agencies as well as private agencies with interests in livestock and companion animal medicine.

The advancement of the Animal Genomics program will be critical in the philosophical merger of disciplines across campus. It will:

- facilitate increased cooperation through collection and archiving of genetic materials and clinical information as a resource for research
- foster important bonds between the current research, teaching and training programs at the University, bringing together the CVM, COALS, and other colleges and institutes,
- provide a vital interface of genomics research with clinical applications by transferring knowledge gained through laboratory research in genomics to clinics, farms, and animal breeders/owners, barns and stables
- attract new funding from private, state, and federal agencies,
- generate additional interest among diverse student groups for education and training.

Indices of Excellence

Stimulated by the support of the Vision 2020 program, the College of Veterinary Medicine & Biomedical Sciences has added six new genomics faculty positions with expertise in diverse research areas and model organisms, including comparative genomics, molecular cytogenetics, clinical and diagnostic genomics, marsupial genomics, immunogenetics, and most recently, epigenetics. Together with existing strengths in bovine, equine and wildlife genomics, this group of nine core investigators, and their lab units, are among the most productive, collaborative, and internationally visible units on campus. These investigators interact with programs in nearly every College on campus, in addition to scientists at greater than 40 U.S. institutions, and over 30 international institutions. As testament to the strength and international visibility of the CVM Genomics program, the current nine faculty members and their labs have:

- been active participants and leaders in various national & international research endeavors, including four genome projects.
- a consistent record of publications in top-tier peer reviewed international journals (>300 during the past 5 years), including *Science*, *Nature*, *Proceedings of the National Academy of Sciences*, *PLoS Genetics* and *Genome Research*.
- obtained over $13,000,000 in extramural funding as PI/Co-PI's during the past decade. The bulk of these funds come from the major federal funding agencies; NIH, NSF, USDA, DOE, Dept. Interior, supplemented by numerous private foundations.
- trained 48 graduate students and 20 post-doctoral fellows during the past decade, many of whom hold prestigious positions within and outside the USA. In addition, genomics faculty members train approximately 600 undergraduate students annually. At present, there are more than 50 undergraduate students, graduate students and post-docs training in the laboratories of the A&M genomics faculty.

Assessment/Expectations

Based on the past and present success of the Genomics Signature Program, it should continue to be a strong research and educational component of the CVM. Despite our international strength in genomics, collaborative interactions among programs and Colleges, and strong presence among the Genetics Interdisciplinary Program, two areas of expertise/infrastructure must be acquired to remain a competitive force for extramural funding and to maintain our stature as a leading animal genomics program.

First, the departure of two genomics faculty members, Dr. Christine Elsik and Dr. David Adelson, produced a major gap in local access to bioinformatics expertise for the analysis of animal genomic datasets, as well as educational resources for our undergraduate, graduate and post-graduate training programs. Because of this deficit, we must prioritize a programmatic expansion in computational genomics, particularly genomic sequence, microarray and (single-nucleotide polymorphism) SNP analysis. This expansion requires establishing a group with one senior and two junior faculty members (one with a biostatistics background). The recent drop in cost of next-generation sequencing technologies will soon allow individual laboratories or centers to have genome-center-scale sequencing capacity and datasets relevant to disease and phenotypes of biomedical significance. To capitalize on these emerging technologies will require computational genomics expertise and capabilities that are currently not represented at this university.

Second, as genomic moves from assembling and annotating livestock and companion animal genomes, to population and comparative sequencing and SNP analysis, new research efforts will require access to state-of–the art Next Generation DNA sequencing technologies and SNP genotyping platforms present in a local core facility housed in the CVM. In addition, the cutting-edge bioinformatics infrastructure and facilities will be necessary to deal with ever expanding data sets that are needed to understand today's complex scientific questions related to susceptibility to genetic and infectious diseases, as well as basic research in many areas including systems biology initiatives. With the Veterinary Medical Research Building expansion underway, and two and one half floors of non-dedicated space, an opportunity exists to create a state-of-the-art integrated bioinformatics and genomics core facility to support CVM and University Initiatives in biomedical research. This plan should include teaching laboratory/computer infrastructure. A technical director and staff will be needed to oversee the facility.

APPENDIX: PARTICIPANTS

Name	*Position*	*Department*	*Specialty Area in Genomics*
Bhanu Chowdhary	Professor	VIBS	Equine Genomics, Cytogenetics
Gus Cothran	Clinical Professor	VIBS	Equine Genomics, DNA Diagnostics
Michael Criscitiello	Assistant Professor	VTPB	Vertebrate Immunogenetics
James Derr	Professor	VTPB	Wildlife/Conservation Genomics
Scott Dindot*	Assistant Professor	VTPB	Mammalian Epigenetics/Disease Genomics
William Murphy	Associate Professor	VIBS	Feline/Mammalian Comparative Genomics
Terje Raudsepp	Assistant Professor	VIBS	Equine Reproductive Genomics, Cytogenetics
Paul Samollow	Professor	VIBS	Marsupial Genomics, Recombination
Loren Skow	Professor	VIBS	Bovine Genomics, Immunogenetics
James Womack	Professor	VTPB	Bovine/Mammalian Comparative Genomics

* New hire: Start date January 2009

VIBS=Veterinary Integrative Biosciences
VTPB=Veterinary Pathobiology

Landmark Program Title: ***Veterinary Clinical Research at Texas A&M University***

Introduction: The Veterinary Medical Teaching Hospital (VMTH) and the Departments of Large Animal Clinical Sciences and Small Animal Clinical Sciences at Texas A&M University's College of Veterinary Medicine and Biomedical Sciences (CVMBS) provide expertise and facilities for veterinary patient care that are integral to service and teaching missions of the College. The CVMBS is the only veterinary college in the state of Texas, and is ranked fifth among U.S. colleges by the most recent rankings by U.S. News & World Report. During 2007, there were 14,464 patient visits to the VMTH's small animal hospital and 5,961 admissions to the VMTH's large animal hospital. This large number of cases of spontaneous disease managed by the clinical faculty affiliated with the VMTH represents an invaluable resource for clinical research. By clinical research, we refer to research that involves the study of spontaneous disease among client-owned animals, or research in experimental animals that can be directly applied to patients with spontaneous disease (e.g., methods for enhancing fertility in research mares can be directly applied to infertile mares examined at the VMTH). Patients seen by VMTH faculty create opportunities for veterinary and comparative medical research.

Rationale: Clinical research involving animals owned by clients of the VMTH is important for a number of reasons. First, patients seen by faculty at the VMTH can be studied using either clinical trial or observational study designs to evaluate diagnostic, therapeutic, and preventive interventions, or to establish prognosis. Such research directly impacts the health and welfare of companion animals and livestock. Companion animals are of societal importance through the salutary effects of the psychosocial bonds between animals and people and their assistance to those with physical or other handicaps, as well as for their roles in assisting police, rescue, and customs services. Livestock are of immense societal importance as sources of food and fiber. Second, spontaneous diseases in animals can be models of corresponding diseases in humans, such as various types of cancer, diabetes mellitus, and heart disease. Increasingly, there is evidence that experimental models of disease in mice and other laboratory animals do not adequately mimic disease in humans. Moreover, experimentally created disease in any species of animal is often a poor replication of spontaneous disease. Thus, animals with spontaneous disease seen at the VMTH are useful models for evaluating diagnostic, therapeutic, and preventive strategies for the benefit of improving human as well as animal health. Evidence exists that projects involving spontaneous disease in veterinary patients can attract substantial funding from private industry and federal resources. Third, there are public health research

opportunities represented by the client-owned animal populations studied. The large majority (viz., 75%) of emerging infectious diseases of human beings are zoonotic. Changes in methods of food production, trade policies, and a long international border with Mexico pose challenges for biosecurity among food animals and provide opportunities for transmission of food-animal-borne illnesses. Client-owned livestock populations provide a research resource for pre-harvest food safety and biosecurity. Fourth, there are important opportunities for translation of research findings by basic science faculty to patients. Although the VMTH is the public face of the College, a cadre of outstanding research faculty at the school conduct biomedical research that will ultimately have application to veterinary and human patients. Each of the College's landmark research programs (Cardiovascular Diseases; Genetics/Genomics, Infectious Diseases and Biodefense; Neurosciences; Oncology and Toxicology; and Reproduction) include clinical applications and faculty members with VMTH appointments. Thus, there is considerable justification to bolster the unique clinical research program made possible by the VMTH patients and the expertise of the clinical faculty.

Interdisciplinary Impact: The interdisciplinary impact of clinical research involving client-owned animals is strong. Within the CVMBS, each of the Signature Programs includes translation of basic science to clinical practice, including the study of spontaneous disease. The interdisciplinary impact of this program extends beyond the CVMBS. Animal Scientists in the College of Agriculture and Life Sciences collaborate with clinical researchers at the CVMBS to study problems of mutual interest, including cancer, animal reproduction, and nutrition. Investigators from the Texas A&M Health Science Center (including the College of Medicine) collaborate with investigators at the CVMBS in pre-clinical studies using spontaneous disease in animals that are mimics of human disease. Initiatives with the Baylor College of Medicine and the University of Texas's M.D. Anderson Cancer Center to study spontaneous disease in animals at the CVMBS for furthering our understanding of corresponding cardiovascular diseases and cancers have been established. Areas of special strength in clinical research within the CVMBS include bovine mycobacterial disease, cardiovascular disease, environmental disease, equine infectious disease, equine reproduction, gastroenterology, lipid nutrition, nephrology/urology, neurology, oncology, and small ruminant research. Each of these programs has comparative medical aspects and interdisciplinary collaborations, with considerable opportunity for expanded interactions with investigators within and external to Texas A&M University.

Assessment/Expectations: Clinical research is fundamental to the translational aspects of all of the College's landmark research programs, and strong multidisciplinary and intercollegiate clinical research collaborations exist. Moreover, there exist other successful clinical research programs such as gastroenterology, renal disease, and infectious diseases. Thus, the success of the clinical research program will be evaluated on the basis of the extent to which clinical faculty and the patients they treat are incorporated into landmark programs, as well as the extent to which programs outside of the landmark program attract and maintain extramural funding and a laudable record of peer-reviewed publication. Ideally, clinical programs will be incorporated into program project grants, center grants, and training grants. The program will also be assessed by the extent to which it contributes to generating training opportunities for students and veterinarians interested in clinical research careers.

Although there is a Clinical Research Review Committee to monitor the appropriate use of client-owned animals in research activities at the CVMBS, other infrastructure to support clinical research is lacking. Specifically, a centralized program (including faculty and staff) to facilitate efforts by clinical faculty members for planning and designing, conducting, and analyzing research projects involving client-owned animals is lacking. Such a program would provide guidance and resources to enhance the clinical research productivity and clinical research training experiences at the CVMBS. To accomplish this, an epidemiologist with experience in clinical trials research, a statistician, and a programmer should be recruited to the College to develop a Center for Clinical Research.

Indices of Excellence: The expertise of the clinical faculty is manifested by their proficiency in patient care, and their contributions to the scholarship of discovery and the scholarship of integration (such as presentations at continuing education seminars, book chapters, review articles, etc.). Indices of success for individual clinical research programs can also be described by the status of current external/extra-mural funding and the number of peer-reviewed publications during the last 3 years. These data are provided below for a number of existing clinical research programs.

In addition to these research programs, there are clinical services that inter-digitate with all clinical research programs, such as anesthesia, clinical pharmacology, diagnostic imaging, and clinical pathology. Without these services, clinical research could not be conducted.

Current Funding and Recent Publications from Clinical Research Programs in the College of Veterinary Medicine & Biomedical Sciences (November, 2008)

Program Name	Currently Funded Projects	Publications (last 3 years)
Antimicrobial Resistance	$939,999	8 peer-reviewed reports
Cardiology/Cardiovascular	$196,172	15 peer-reviewed reports
Comparative Gastro-enterology	GI Lab Service: $2,698,657 Grants: $118,076	35 peer-reviewed reports
Environmental Disease Modeling	$295,000	18 peer-reviewed reports
Equine Infectious Disease Epidemiology	$736,909	19 peer-reviewed reports
Equine Musculoskeletal Disorders	$35,000	17 peer-reviewed reports
Equine Reproduction	$356,884	20 peer-reviewed reports
Johne's Disease	$300,000	9 peer-reviewed reports
Lipid Nutrition of Companion Animals	$262,867	23 peer-reviewed reports
Nephrology/Urology	$484,044	11 peer-reviewed reports
Neurology	$168,912	34 peer-reviewed reports
Oncology	$106,000	5 peer-reviewed reports
Small Ruminant Research	$68,000	11 peer-reviewed reports
TOTAL	***$4,067,863 plus $2,698,657 service***	**225 peer-reviewed reports**

Participants from CVMBS (Appendix)

Cardiovascular Disease: Dr. Theresa Fossum (Professor), Dr. Sonya Gordon (Assistant Professor), Dr. Matthew Miller (Professor), Dr. Ashley Saunders (Assistant Professor).

Comparative Gastroenterology: Dr. Jörg Steiner (Associate Professor and Director), Dr. Jan Suchodolski (Research Assistant Professor and Associate Director);

Affiliated members: Dr. Michael Willard (Professor); Dr. Debra Zoran (Associate Professor); Dr. Audrey Cook (Clinical Associate Professor); Dr. Allen Roussel (Professor); Dr. Noah Cohen (Professor)

Environmental Disease Modeling: Dr. James Thompson (Professor and Director); Dr. Wesley Bissett (Assistant Professor)

Equine Infectious Diseases and Epidemiology: Dr. Noah Cohen (Professor and Director); Dr. M. Keith Chaffin (Professor);

Affiliated members: Dr. Bhanu Chowdhary (Professor); Dr. James Derr (Professor); Dr. Virginia Fajt (Clinical Assistant Professor); Dr. Thomas Ficht (Professor); Dr. Natalie Halbert (Research Assistant Professor); Dr. Sara Lawhon (Assistant Professor); Dr. Melissa Libal (Clinical Associate Professor)

Equine Musculoskeletal Disorders: Dr. Kent Carter (Professor), Dr. Keith Chaffin (Professor), Dr. Robin Dabareiner (Associate Professor), Dr. Clifford Honnas (Professor), Dr. Jeffrey Watkins (Professor)

Equine Reproduction: Dr. Dickson Varner (Professor and Director); Dr. Terry Blanchard (Professor); Dr. Steven Brinsko (Associate Professor); Dr. Y. Choi (Research Scientist); Dr. Katrin Hinrichs (Professor); Dr. Charles Love (Associate Professor)

Johne's Disease: Dr. Allen Roussel (Professor and Director)

Affiliated members: Dr. James Derr (Professor); Dr. Geoffrey Fosgate (Associate Professor); Dr. Sangeeta Khare (Research Assistant Professor); Dr. Bo Norby (Associate Professor); Dr. Noah Cohen (Professor)

Lipid Nutrition Program: Dr. John Bauer (Professor and Director)

Affiliated members: Dr. Jill Heatley (Clinical Associate Professor); Dr. Sharman Hoppes (Clinical Assistant Professor); Dr. Ian Tizard (Professor); Dr. Deb Zoran (Associate Professor)

Nephrology/Urology Program: Dr. George Lees (Professor and Director);

Affiliated members: Dr. Brian Berridge (Adjunct Associate Professor); Dr. Fred Clubb, Jr. (Professor); Dr. Mary Nabity (Clinical Assistant Professor)

Neurology Program: Dr. Jonathan Levine (Assistant Professor and Director); Dr. Daniel Hicks (Clinical Assistant Professor)

Affiliated members: Dr. Virgina Fajt (Clinical Assistant Professor); Dr. Sharon Kerwin (Professor); Dr. Karen Russell (Associate Professor); Dr. Ashley Saunders (Assistant Professor); Dr. Jörg Steiner (Associate Professor); Dr. Jan Suchodolski (Research Assistant Professor); Dr. George Stoica (Professor); Dr. Ben Young (Assistant Professor); Dr. Noah Cohen (Professor)

Oncology: Dr. Claudia Barton (Professor); Dr. Theresa Fossum (Professor); Dr. Kenita Rogers (Professor and Associate Dean); Dr. Heather Wilson (Assistant Professor and Director)

Small Ruminant Program: Dr. Kevin Washburn (Associate Professor and Director); Dr. Wesley Bissett (Assistant Professor); Dr. Virgina Fajt (Clinical Assistant Professor); Dr. Jeffrey Musser (Associate Professor);

SIGNATURE PROGRAM: INFECTIOUS DISEASE S AND BIODEFENSE

Introduction and Significance

A collaborative and innovative research community in infectious diseases flourishes at Texas A&M University. In the College of Veterinary Medicine and Biomedical Sciences, current and past scholarly accomplishments, along with substantial ongoing funding opportunities, make continued support and expansion of a *Signature Program in Infectious Diseases and Biodefense* a priority of the College. A variety of interrelated research endeavors address a critical public and animal health imperative: *Protection of people and animals against current and future threats from infectious diseases.* At Texas A&M University we are in a unique position to tackle infectious disease threats to both humans and animals, with active research programs in the major areas of microbiology, parasitology, virology and immunology. This broad range of expertise brings together basic scientists, clinicians, epidemiologists, pathologists and cutting edge diagnostic capabilities to respond to both extant and future infectious disease threats to health and food safety. In addition to active research programs, infectious diseases researchers participate extensively in teaching and outreach, activities that are critical to achieving and maintaining biosecurity for humans and animals.

Infectious Diseases and Biodefense necessarily spans multiple disciplines including: 1) the basic and molecular biology of hosts and pathogens; 2) host-pathogen interactions; 3) the genetic basis of susceptibility or resistance to infectious agents; 4) the detection of environmental pathogens, infected hosts and contaminated food supplies; 5) development of vaccines, therapeutics and preventative programs. Research in these areas is being conducted in multiple departments of the College of Veterinary Medicine and Biomedical Sciences and much of the effort involves collaborations with faculty and researchers in the College of Agriculture and Life Sciences (COALS), Texas Agrilife, the Institute for Countermeasures against Agricultural Bioterrorism (ICAB), the Integrative Center for Homeland Security (ICHS), and the National Center for Foreign Animal and Zoonotic Disease Defense (FAZD). These combined efforts address critical current and future infectious disease threats arising from population growth and movement, industrialized livestock production, international movement of food and animals, global warming, and human conflict.

The State of Texas enjoys an actively growing population and serves as a hub of international trade and travel. Texas also has national preeminence in agriculture and food production. For these reasons, natural or introduced infectious agents that pose a threat to public health or agriculture would disproportionately affect our state's economy. Our ability to respond quickly and decisively to outbreaks of infectious disease is key to our sense of well-being, just as the ability to assure the protection of agriculture and the food supply is important in maintaining consumer confidence. The *Signature Program in Infectious Diseases and Biodefense* includes elements of infectious disease research that range from basic and mechanistic studies of microorganisms and disease, to field research, to vaccine development, to detection, diagnosis, and surveillance systems.

Rationale

A 2005 National Research Council report titled **"Critical Needs for Research in Veterinary Science"** identified *infectious disease and biodefense research* as a critical future need. Specific research areas delineated in the report include:

- Rapid, sensitive, and accurate assays for detecting foodborne pathogens
- Identification of previously unrecognized foodborne pathogens of animal origin
- Improved ability to detect and identify disease and pathogens in animal populations
- Improved understanding of interactions between pathogens and hosts so that effective preventive measures and countermeasures can be developed
- Rational development of cost-effective countermeasures, both vaccines and nonspecific therapeutic agents
- Development of capacity and implementation of broad programs in comparative medicine to understand, rapidly detect, and control zoonotic and nonzoonotic diseases in food-producing animals
- Monitoring and assessment of trans-species disease transmission, epidemiology, and the delineation of resistance, susceptibility, and virulence factors across animals and pathogenic organisms

This national report provides significant rationale for continued support of the *Infectious Diseases and Biodefense Signature Program* within the College of Veterinary Medicine and Biosciences. Areas of particular strength in infectious disease research can be defined and should be considered for future investment. These include: 1) development of vaccines, diagnostics, and therapeutics; 2) the host-pathogen interface; 3) intracellular microbial pathogens; 4) virulence mechanisms; and 5) the genetic basis of host resistance. Continued College and University support are instrumental to maintaining excellence in *Infectious Diseases and Biodefense*.

Maintenance of current activities and enhancement of future growth and excellence in the *Infectious Diseases and Biodefense* Signature Program require not only a cadre of dedicated faculty, but significant shared infrastructure. The overall need for biocontainment laboratories for Veterinary Research was also addressed in the 2005 National Research Council's report "Critical Needs for Research in Veterinary Science". Design, development, and testing of innovative vaccines and diagnostics require safe and effective facilities. The costs of building and maintaining appropriate infrastructure are significant, but are well-justified when considering the dual major threats of natural infection and bioterrorism. Several agents currently under investigation at TAMU have been recognized by the Centers for Disease Control (CDC) and the United States Department of Agriculture (USDA) as potential threats to national security, increasing the demand for research and resources to enhance detection, to improve protective immunity and to develop new drugs to prevent or cure infection. The ability to sustain excellence and for CVM faculty to grow new national and international collaborations requires the appropriate infrastructure. *We currently have a critical need for additional BSL3 laboratories and BSL3Ag facilities for large animals, poultry and fish.* The lack of such facilities is having a

negative impact on the ability of CVM faculty to grow their research and to remain competitive for new funding. Ongoing investment to maintain and update *BSL2 and BSL2Ag* facilities is also of great importance. The protection of health and agriculture from the threat of infectious agents is an imperative that is clearly recognized by funding agencies. Federal funding for research in *Infectious Diseases and Biodefense* is available through the U.S. Department of Homeland Security, U.S. Department of Agriculture, U.S. Department of Defense, National Institutes of Health and the National Science Foundation. Therefore continued support by the CVM and the University will leverage significant future research funding.

The *Signature Program in Infectious Diseases and Biodefense* is also central to the mission of the College of Veterinary Medicine (curing and preventing animal disease), the Agrilife 'Scientific Roadmap' (improve agricultural production and efficiency through advances in animal and plant breeding and health, use risk analysis to minimize the impacts of foodborne hazards and biosecurity threat agents, prevent transmission of human disease agents through insect/pest vector control) and Texas A&M University (discovery, development, communication, and application of knowledge).

Interdisciplinary Impact

Interdisciplinary activities are key to the *Infectious Diseases and Biodefense* initiative as illustrated by the following examples: (1) **Development of novel vaccines and therapeutics** and/or **production of genetically resistant animals** require collaboration between microbiologists, geneticists, cell biologists, immunologists, pathologists and clinicians. Understanding the infectious disease process increasingly focuses on the host, host response, and host genetics. (2) **Design and implementation of disease surveillance and pathogen detection systems** are facilitated by the combined expertise of microbiologists, biomedical engineers, epidemiologists, public health experts, and wild-life biologists among others. (3) Population dynamics and food distribution systems must be understood in order to **model the economic impact of naturally occurring or introduced human, animal, or plant pathogens**.

Infectious diseases researchers at the College of Veterinary Medicine and Biosciences are actively engaged in cross-college collaborations as indicated by their membership in the university-wide intercollegiate faculties of Genetics, Virology, and Toxicology. Within the Texas A&M System, significant collaborative efforts involve Agrilife Research and the Health Science Center. An example of one such notable collaboration is the NRSA Institutional Training Grant (T32) titled 'Mechanistic Studies at the Host Pathogen Interface'. This training grant (submitted for renewal September 2008) includes nine faculty affiliated with CVM/TAMU and ten faculty from the College of Medicine and the Institute of Biosciences and Technology. At the national level, several *Signature Program in Infectious Diseases and Biodefense* affiliated faculty are affiliated with the National Center for Foreign Animal and Zoonotic Diseases Defense. FADZ develops products to protect U.S. public health and the national economy from the introduction of high-consequence foreign animal and zoonotic diseases – with an emphasis on prevention, surveillance, intervention and recovery. The Center leverages the resources of six major universities, five national laboratories, two state agencies, two fellow DHS Centers of Excellence and an expanding number of Minority Serving and tribal institutions.

Indices of Excellence

Productivity and success of over 30 CVM faculty with interests in *Infectious Diseases and Biodefense* can be measured through publications and research support. Faculty members have published over 220 peer-reviewed research articles from 2003 through 2008. The areas of strength of the group (molecular biology of hosts and pathogens, host-pathogen interactions and immunity, the genetic basis of susceptibility, pathogen detection and vaccine development) as well as diverse expertise in viruses, bacteria and parasites, is demonstrated by the breadth of high quality journals in which the faculty publish. These include, among others: Emerging Infectious Diseases, Journal of the American Medical Association, Cellular Microbiology, Molecular Microbiology, Journal of Virology, Virology, International Journal for Parasitology, Parasitology, Vaccine, Immunogenetics, Infection and Immunity, Neuroimmunology, Journal of Neuroimmunology, Journal of Biochemistry and the Journal of Molecular Biology.

Grant support from 2003 through 2008 totals over $28 million. National funding agencies include: USDA APHIS, NIH (National Institute of Allergy and Infectious Diseases, National Cancer Institute, National Institute of Aging, National Institute of Neurological Disorders and Stroke), DHS, and DOD.

Assessment/Expectations

The impact of College and Univeristy support of the Signature Program in Infectious Diseases and Biodefense will be monitored by quantitative metrics of productivity including: 1) extramural funding levels, 2)scholarly publication records, 3)successful graduate training programs, 4) international collaborations and 5) the production and/or implementation of technologies and programs to benefit our constituents. External review and recognition will be used where appropriate to evaluate progress.

APPENDIX

Participants

Adams, L.G. Host-pathogen interaction in immunity and disease; intracellular pathogens; host:pathogen genomics.

Ball, J.M. Viral pathogenesis and mechanisms of disease.

Berghman, L. Immuno-neuro-endocrine network in the chicken model; development of immunobiotechnological tools.

Budke, C.M. Parasitology; ecology of infectious diseases.

Caldwell, D. Gastrointestinal immunity and disease resistance in poultry; immunopotentiation of disease resistance in poultry.

Cohen, N.D. Infectious diseases of equines.

Craig, T.M. Epidemiology and control of internal parasites of grazing animals.

Criscitiello, M. Mechanisms of adaptive immunity.

Cyr, T. Medical and veterinary entomology.

Davis, D.S. Infectious and parasitic diseases of wildlife; brucellosis, tuberculosis, anthrax, hemaprotozoon, trematodes, and nematodes.

deFigueiredo, P. Molecular mechanisms mediating plant and animal diseases.

Edwards, J. Diagnostic pathology, infectious diseases of domestic livestock.

Ficht, A.R. Microencapsulation and vaccine delivery vehicles; innate immunity and host gene expression in response to paratuberculosis infection.

Ficht, T. Mechanisms of invasion and survival of intracellular bacteria within host cells; development and application of biosignatures.

Holman, P. Interactions between *Babesia spp.* and their hosts; potential vaccine or drug targets for *babesiosis*; development of DNA-based diagnostic tests for hemoprotozoan parasitic infections.

Lawhon, S.D. Interactions between the intestinal pathogens and mammalian hosts.

Leibowitz, J.L. Replication and pathogenesis of Coronaviruses.

Libal, M. Epidemiology of infectious disease; antimicrobic sensitivity testing; antimicrobic resistance.

Lupiani, B. Development of immunoassays for detection and rapid subtyping of Avian Influenza viruses; molecular mechanisms of pathogenesis of avian influenza viruses.

Norby, B. Ecology and transmission dynamics of food safety and infectious disease organisms and antimicrobial resistance; surveillance, control and eradication of zoonoses and infectious disease in animals.

Musser, J. Dairy production medicine, mastitis prevention and control, and quality milk production; vaccine development.

Mwangi, W. Improvement of vaccine efficacy in livestock and humans; optimizing in vivo antigen presentation by dendritic cells; evaluation of strategies for induction and maintenance of memory cellular immune responses in outbred species.

Payne, S.L. Molecular aspects of retroviral replication, pathogenesis, and evolution.

Reddy, S.M. Molecular basis of pathogenesis of poultry viruses.

Russell, K.E. Platelet pathophysiology and the interaction of platelets with infectious agents.

Scanlan, C. Competitive exclusion cultures for the control of salmonellae in poultry; investigation of anti-salmonellae mechanisms with emphasis on short-chain fatty acids.

Snowden, K.F. Parasites of public health importance; development of animal models for the study of parasitologic diseases and treatments, and development of molecular and immunologic methods for parasitologic diagnosis.

Stoica, G. Mechanisms of retroviral-induced neurodegeneration.

Tizard, I. Comparative avian and mammalian immunology; evolution of the immune system; avian diseases.

Wagner, G. Molecular basis of virulence of protozoal parasites; identification of antigens for serodiagnosis and immunization; host-parasite interrelationships.

Welsh, C.J.R. Viral causes of autoimmune diseases; Theiler's virus-induced demyelination as a model of multiple sclerosis.

Welsh, T. Regulation of genes that control metabolic, reproductive and immune functions; stress-related hormones impacting virally-induced neuropathogenesis in a mouse model of multiple sclerosis.

Zhu, G. Molecular biology, biochemistry and pathogenesis of parasitic protests; molecular interactions between parasites and host cells; discovery of molecular targets for the drug development.

CVM LANDMARK PROGRAM IN NEUROSCIENCE

Introduction and Significance

Neuroscience, which is the study of the nervous system and behavior, is the most rapidly developing field of intellectual inquiry today. The Society for Neuroscience, which is one of over 200 organizations devoted to study of the nervous system, is the world's largest society of scientists and physicians (38,000 + members) devoted to advancing understanding of the nervous system. The National Institutes of Health (NIH) devotes a large proportion of its intramural and extramural funding to study of the nervous system. This is particularly evident in the National Institute of Mental Health, National Institute on Drug Abuse, National Institute of Neurological Disorders & Stroke, National Eye Institute and National Institute on Aging. Other institutes also have emphasis on the role of the nervous system in disease processes, including the National Institute on Alcohol Abuse & Alcoholism and National Institute of Child Health & Human Development. The USDA has an important focus on investigation of behavior of domestic farm animals with emphasis on the quality of life for livestock.

The nervous system, including the brain, spinal cord and the peripheral nervous system, is by far the most complex of all biological systems and, therefore, represents the greatest challenge to biological scientific inquiry. Everything we learn about the nervous system brings us closer to preventing and/or curing a multitude of diseases and disorders such as Parkinson's disease, Alzheimer's disease, multiple sclerosis and mental illness. The cost of caring for the over 5 million Americans suffering from Alzheimer's disease alone exceeds $100 billion annually. Neuroscience research also will help to eliminate or diminish the devastating effects of alcoholism, drug abuse and traumatic brain and spinal cord injuries. Translational medicine, which has at its core the goal to use basic research to provide fundamental discoveries that can be used to develop novel and improved therapies, is currently the center of focus for the NIH. Through its research roadmap, the NIH intends to accelerate fundamental discovery and translation of knowledge from the "bench to the bedside".

Texas A&M University has a rapidly growing neuroscience research and teaching program, which was officially recognized as the TAMU Interdisciplinary Faculty of Neuroscience (IFN) in 2001. The IFN is currently developing a PhD training program in neuroscience and the Texas Higher Education Coordinating Board site visit for this program was held on October 13, 2008. It is anticipated that the PhD degree program in neuroscience will begin in the fall of 2009, which will be a combined program between TAMU and TAMUS-HSC. CVM neuroscientists play an integral role in neuroscience research, graduate teaching and the TAMU undergraduate minor in neuroscience.

One of the unique opportunities made available to neuroscience through veterinary medicine is our ability to diagnose and treat neurological disorders in domestic and companion animals. Natural disease in animals often mimics human disease more closely than animal models, in which disease is induced through genetic or experimental manipulations. For example, rodent glial tumor xenografts do not exhibit the necrosis and vascularity that human glial tumors can have, but naturally occurring glial tumors in dogs often do. In addition, veterinary patients have diverse genetic backgrounds, which is an advantage when trying to understand disease genetics or response to treatment. Also, the size of veterinary patients allows for drug pharmacokinetics to be performed and adverse effects to be monitored, which is

sometimes challenging in mice and even rats. Thus, "natural models" can greatly enhance understanding of disease, which results in the development of better care for both human and veterinary patients. **Only two of the top 25 universities ranked by NIH dollar amount have a college of veterinary medicine, therefore Texas A&M University is uniquely positioned to take advantage of the study of spontaneous animal disease.**

Rationale

The goal of Vision 2020 is to elevate Texas A&M University into the ranks of the top ten U.S. public research universities by the year 2020. This will not be achieved without enhancing the existing research programs on this campus, including neuroscience. Neuroscience programs are all well established and highly visible at the current top ten research universities in the United States. The IFN and especially the CVM neuroscientists form a cohesive working group of basic scientists and clinicians. This strong base forms an excellent starting point to build a nationally recognized research and training program in neuroscience. The CVM neuroscientists are in an excellent position to enhance the teaching program at TAMU through close interactions between clinical and basic science faculty.

Interdisciplinary Impact

Neuroscience by its very nature is a highly interdisciplinary area of research. This is abundantly demonstrated by the number of on-going collaborative research relationships in which CVM neuroscientists are involved. CVM neuroscientists are collaborating with faculty across the TAMU system, including faculty in the TAMUS-HSC College of Medicine (departments of Neuroscience and Experimental Therapeutics, Molecular and Cellular Medicine and Systems Biology and Translational Medicine), the College of Engineering (departments of Computer Science, Biomedical Engineering, Electrical Engineering, Mechanical Engineering), the College of Agriculture and Life Sciences (departments of Biochemistry and Biophysics and Animal Science), the College of Liberal Arts (Psychology department) and the College of Science (departments of Biology and Chemistry). Many collaborations also extend beyond the University and Health Science Center to outside institutions, including the University of Maryland, Cornell University, UCSF Medical School and M.D. Anderson.

An additional strength at TAMU is collaboration with the Texas Institute of Genomic Medicine (TIGM), which maintains the world's largest C57BL/6N gene trap library, a knockout mouse embryonic stem (ES) cell resource that contains over 350,000 cell lines representing more than 10,000 unique genes. The NIH has obtained rights to a subset of these lines, allowing TIGM to make them available for distribution to the academic research community on a subsidized basis.

CVM faculty also participate in the Texas Brain and Spine Institute, which is a center of excellence in clinical and academic neurosciences. The Institute is a multidisciplinary collaboration between clinicians, scientists, and supporting institutions with the purpose of furthering superior clinical and academic missions.

Assessment /Expectations

The interdisciplinary nature of neuroscience provides a natural synergism to research conducted across this campus and with the Health Science Center. The strong collaborations that exist through the Interdisciplinary Faculty of Neuroscience are expected to be maintained and strengthened in the future. To enhance the stature of the interdisciplinary neuroscience program in the college and the university and to continue to be competitive for individual NIH, NSF and private foundation grants, program project grants and training grants, additional senior level faculty are needed. We propose to add a senior level neuroscientist who is using animal models to study basic mechanisms of neurological disease that would complement current strengths in the College of Veterinary Medicine. Ideally, this neuroscientist would be a senior level researcher who is using nonrodent animal models in their research program, such as dogs, pigs, goats or sheep. Using animals in preclinical trials for human diseases and combining expertise and experience of veterinarians and basic scientists is an extremely fruitful and highly underutilized avenue of scientific endeavor. As an example, one CVM neuroscientist currently uses the sheep to study the basic mechanisms by which prenatal alcohol exposure damages the developing brain. The focus of this research is on basic mechanisms of the action of alcohol, developing prevention and identifying better ways to identify affected individuals. Fetal Alcohol Syndrome (FAS) is the leading cause of mental retardation in the western world and has a $6 billion annual cost in the US. FAS is estimated to occur at a rate of 1 per 1000 live births, and when the more minimal effects are included, the rate jumps to 1 per 100 live births.

In general assessment will include funding received from federal (e.g., from NIH, NSF, DOD, USDA) and private foundations. Total publications and the ranking of the journals also will be included. In addition, teaching responsibilities as well as how many graduates students (MS, PhD, DVM-PhD), undergraduate students and postdoctoral fellows trained will be included in the assessment.

Indices of Excellence in the CVM Neuroscience Program

The College of Veterinary Medicine and Biomedical Sciences at Texas A&M University is one of the top veterinary programs in the United States. The Texas Veterinary Medical Center's clinical neurology program is rapidly growing and sees over 750 neurology cases/year. The clinical neurology program also has an established track record with respect to translational medicine projects. CVM neurology clinicians have initiated the first NIH-funded clinical veterinary trial through the CAPTR program, which focuses on spinal cord injury treatments. Both clinicians and basic scientists in the CVM are working on a multi-institutional (involving UT-Houston Medical School and M.D. Anderson) glioma collaboration, which will study naturally occurring disease in dogs. Pet owners are increasingly more willing to invest in treatments for medical and surgical neurological diseases. Moreover, there are many neurodegenerative disorders in dogs, cats and other domestic animal species that serve as animal models for similar human neurological disorders. Study of spontaneous disease in animals provides invaluable information that can be used to develop new therapeutic strategies for both animals and humans. Therefore, neuroscience is extremely important to both humans and animals, and neuroscience research is an ever-increasing component of Texas A&M University's research, teaching and engagement missions.

The CVM faculty currently has 19 faculty members who are clinical and/or basic research neuroscientists. CVM neuroscientists are conducting cutting edge integrative research into mechanisms by which environmental factors interact with the genetic background to induce pathology and dysfunction in neurological diseases. Research areas range from whole animal behavior to the cellular and molecular level. The unique combination of strong research, teaching, presence of clinical neurology in the teaching hospital and the multiple core research laboratories, allow this group to be uniquely placed to advance our knowledge base in mechanisms of neurological disease. Diseases under investigation include: Alzheimer's disease, ataxia telengiectasia, autism, epilepsy, hereditary rat neuronal system degeneration, meningoencephalomyelitis, multiple sclerosis, macular degeneration, neurofibromatosis, neuromuscular diseases, Parkinson's disease, Fetal Alcohol Syndrome, tumors of the nervous system and spinal cord injury. Individual faculty within the group study a number of different cell types within the nervous system, including: oligodendrocytes, astrocytes, neurons and endothelial cells that form the blood-brain barrier. Environmental factors that are currently being studied include: toxicants, viruses and psychological stress. The impact of environmental toxins on neural development and the onset of puberty and toxicants under current investigation include: lead, mercury, cadmium, manganese and organophosphorous compounds. Infectious diseases of the nervous system induced by retroviruses and picornaviruses are under investigation. The effect of psychological stress on the development of multiple sclerosis is also a topic of investigation. A growing emphasis in CVM neuroscience research is translational neuroscience involving both clinical and basic neuroscientists.

Publications by these 19 people for the past five years number over 225. These publications are highly collaborative among the current CVM neuroscience faculty and between the CVM neuroscience faculty and other non-neuroscience faculty members across the TAMU campus such as the interdisciplinary toxicology, genetics, and reproductive biology programs, as well as Colleges of Science and Engineering. For example, over 40 different publications in the past five years have been co-authored by two or more of the 18 CVM neuroscience faculty. Many of these joint publications include both clinical and basic science CVM faculty. In the past five years grant dollars for the CVM neuroscience faculty totals $11.8 million in funding from federal funding agencies including NIH, USDA and NSF or from private foundations such as the National Multiple Sclerosis Foundation. An additional $6.9 million has been acquired for science education. Funding also has been made available through the TAMU NIEHS Center for Environmental and Rural health (CERH) for neuroscience-related research that is carried out mainly in the area of neurotoxicology. The funded proposals demonstrate the highly integrative and collaborative nature of the neuroscience research being conducted at the College of Veterinary Medicine. 40% of the funded grants involve collaborations with faculty in other TAMU Colleges or other universities.

There is significant interdependence between clinical and basic scientists with respect to teaching in the college. We have developed an excellent system of combining clinical and basic science expertise in our first year veterinary professional program with an introduction to neurology course. In addition, several undergraduate and graduate courses in neuroscience topics are taught, including six new courses and a clinical neurology elective that were developed in the past year. It is anticipated that the teaching hospital will start training neurology residents in 2009.

APPENDIX

Abbott, Louise C.	developmental neurotoxicology and the role of heavy metals in autism and neurodegenerative disease.
Bratton, Gerald	toxic metal effects on the neuroendocine system and behavior; trace metals analysis.
Cudd, Timothy	how prenatal alcohol exposure causes neurodevelopmental defects, how defects might be prevented or mitigated and identifying better screening tools in order to identify affected children earlier as early intervention has the best opportunity for mitigating damage.
Dees, W. Les	investigation of endogenous and exogenous substances that control or alter female pubertal development.
Dziezyc, Joan	ophthalmology; ophthalmic surgery; ocular ultrasonography, ocular inflammation.
Hicks, Daniel	biomechanics of the spine, specifically, the effect of implant stabilization in the cervical spine and lumbosacral joint in dogs; canine cervical spondelomyelopathy (wobblers); lumbsosacral disease; and surgical neuro-oncology.
Hong, Don	genetic basis of retinal degeneration; molecular and cellular basis of pathogenesis caused by mutations in retinal degenerative disease genes; new gene therapy through the genetic and cellular understanding of retinal biology and disease pathogenesis.
Kerwin, Sharon	advancing diagnosis and treatment of spontaneously occurring neurologic diseases in the dog and cat, including discospondylitis, intervertebral disk disease and meningomyelitis; advances in surgical stabilization of the spine.
Klemm, William	ganglioside structure and function, action potential interval analysis, alcohol, narcotics, animal hypnosis, vomeronasal function, brainstem arousal, hippocampal theta rhythm, and veterinary neurology; current interests include educational neuroscience and memory.
Ko, Gladys	cellular mechanisms underlying the circadian regulation of retina physiology and function; risk factors leading to photoreceptor degeneration.
Levine, Jonathan	spinal cord injury; epidemiology of neurologic diseases; intra-cranial neoplasia; translational research.

Li, Jianrong	axon-glia interactions, oligodendrocyte development, white matter injury, and CNS myelination, demyelination and myelin repair.
Milichamp, Nick	ophthalmology; inherited retinal diseases; ocular inflammation; equine cataract surgery; ophthalmic telemedicine.
Pine, Michelle	effect of in utero and peripubertal exposure to type II pyrethroid pesticides on timing of female puberty using the Sprague Dawley rat as a model; effects of in utero exposure to these pesticides on neurodevelopment.
Porter, Brian	comparative neuropathology; diseases of special interest include necrotizing meningoencephalitis of pug dogs and GM2-gangliosidosis of Jacob sheep; the study of S100 protein inhibitors for the treatment of Alzheimer disease.
Stoica, George	mechanism(s) of retroviral-induced neurodegeneration; pathogenesis of brain and bone metastases of mammary gland tumors; application of flow cytometry in the study of tumors; lectin and immunohistochemistry; chemical carcinogenesis; animal models for retrovirus-induced neoplasia.
Tiffany-Castigioni, Evelyn	glial cell biology; cellular neurotoxicity of environmental contaminants.
Welsh, C. Jane	investigation of the underlying mechanisms by which viruses cause autoimmune disease in the central nervous system using Theiler's murine encephalomyelitis virus-induced demyelination (TVID) as a model for multiple sclerosis (MS); evaluating therapies for MS and the role of the blood-brain barrier.
Zimmer, Danna	mammalian calcium signal transduction pathways, their role in the pathobiology of neurological disorders/cancers, and the discovery/development of therapeutic agents that target these pathways; development and characterization of genetically modified mouse models for human/veterinary diseases.

LANDMARK AREA OF EXCELLENCE: REPRODUCTIVE BIOLOGY

Introduction and Significance

The study of Reproductive Biology addresses basic aspects of reproduction as well as factors affecting animal and human clinical reproductive health, by examining physiological, cellular, molecular and genetic mechanisms regulating reproductive function. Reproductive biologists within the College of Veterinary Medicine and Biomedical Sciences (CVMBS) investigate gametogenesis, gamete preservation, fertilization, early embryonic development, ovarian and uterine biology, and fetal growth and placental development, and also address the effects of the environment -- such as behavior, circadian rhythms, nutrition, and toxins -- on reproduction.

Reproductive disorders affect society in diverse ways, from reducing the efficiency of food production to impacting survival of endangered species. A major limitation to improved reproductive efficiency in mammals species is embryonic mortality, which is estimated to be 25% to 60%, depending on the species. In the United States, high rates of unexplained infertility and peri-implantation embryonic loss occur in both humans and domestic animals. The 1995 National Survey of Family Growth indicated that 15% of women of reproductive age have infertility-associated health-care visits, and the Centers for Disease Control reported 16% of couples in the U.S. experience infertility. Many pregnancy losses in both humans and domestic animals are attributed to asynchrony in signaling between the conceptus (fetus and placenta) and uterus or to endometrial dysfunction, resulting in defective pregnancy recognition, implantation, and/or placentation. In addition, intrauterine growth restriction, a major human health problem in the United States and worldwide, causes significant perinatal complications and may contribute to adult-onset diseases due to involvement of multiple genetic and environmental factors.

From a male perspective, population-based retrospective studies suggest a global decline in semen quality of men and wildlife, influenced by geographical location. The incidence of testicular cancer and congenital reproductive tract abnormalities such as cryptorchidism and hypospadias has increased in men in several study populations. Man-made endocrine-disrupting chemicals, ranging from plastics to pesticides, are thought to play a causal role in these disturbances. Some of these toxins may disrupt sensitive genes in the developing fetal gonad; others affect the post-pubertal male.

Rationale

Research in reproduction in the CVMBS is both applied -- related to assuring an ongoing and plentiful food supply, efficient production of livestock for specific industries, and production of animals for biomedical research -- and translational, in its exploration of the physiology of normal fertilization and pregnancy and of mechanisms underlying male and female infertility. Basic research is transferred from the laboratory to the classroom and clinics (human and veterinary), to the field (animal agriculture), and to the community (education and information). *In vitro* fertilization, stem cell biology, animal cloning, and other assisted reproductive technologies have been developed to address infertility and disease in both animals and humans, and to help preserve valuable genetics in domestic animals, wildlife and endangered species.

Mammalian reproductive biology has been an area of emphasis at Texas A&M University (TAMU) since 1956, with the establishment of the Physiology of Reproduction degree program. Current research in reproductive biology at TAMU is both intercollegiate and interdisciplinary. The College of Veterinary Medicine and Biomedical Sciences is a major contributor in this area, being one of the two main participants (with the College of Agriculture and Life Sciences, COALS) in the Interdisciplinary Faculty of Reproductive Biology (IFRB; http://repro.tamu.edu). Twenty-one faculty members holding full or joint appointments in the CVMBS perform research in three main areas of reproductive biology: uterine biology and pregnancy, gamete biology and biotechnology, and equine reproductive biology. Texas A&M is regarded as a world leader in all of these fields.

Work in the area of **uterine biology and pregnancy** is strongly intercollegial, with faculty in the CVMBS and in COALS collaborating to conduct basic research in uterine and placental biology using an integrated approach involving physiology and genomics. The aim of this research is to understand the hormonal, cellular, and molecular mechanisms regulating uterine development and function in the non-pregnant female, as well as the interactions between the uterus and conceptus (embryo/fetus and associated membranes) during pregnancy. The goal of this program is the development of management and clinical therapies to diagnose, prevent and treat infertility and fetal growth retardation in humans and domestic animals.

The mammalian **gamete biology and biotechnology** program at the CVMBS has pioneered work in embryo transfer, in vitro fertilization and nuclear transfer in the domestic species. Because of the strong ties between basic and clinical science faculty in this area, the CVMBS has successfully cloned more species of animals than any other institution in the world, including the first cloned cat and white-tailed deer, and the first cloned horse in North America. The research focus of the gamete biology and biotechnology program involves the application of assisted reproductive technologies and animal biotechnology in livestock and domestic species. Current research activities range from basic studies on mechanisms of oocyte activation at the time of fertilization, assessment of embryonic health through preimplantation genetic diagnosis, and characterizing the epigenetic control of early normal and abnormal embryonic gene expression, to the production of genetically engineered livestock with improved production traits or modifications that make them useful as models for biomedical research. The goal of this research program is to develop reproductive biotechnologies for translational and biomedical use, and to decrease the incidence of embryonic and fetal defects in both humans and domestic species.

As befits a Texas institution, the **equine reproductive biology** program at Texas A&M University is regarded as one of the most successful in the world. This program has a strong history of research that addresses basic equine reproductive physiology while also having direct clinical application. With nine CVMBS faculty participating in this area, including five Diplomates of the American College of Theriogenologists, Texas A&M University has pioneered research in causes and treatment of stallion subfertility/infertility; in assisted reproduction techniques such as intracytoplasmic sperm injection, oocyte transfer, in vitro fertilization, gamete preservation, and low dose insemination; and in nuclear transfer (cloning) in the horse. The goal of the equine reproductive biology research program is to increase reproductive efficiency in horses with valuable genetics, and to explore the comparative reproductive physiology of this species.

Interdisciplinary impact

In addition to the strong collaborative interactions among the CVMBS, COALS and Texas AgriLife Research and Extension faculty, reproductive research in the CVMBS has synergy with other TAMU programs as they relate to embryonic, fetal and maternal health. Of particular note are strong interactions with Toxicology, Genetics, Nutrition, Neuroscience and Biotechnology, with the Texas A&M Health Science Center, and also with interdisciplinary initiatives in women's health with the Colleges of Education and Liberal Arts through the TAMU Women's Studies Program. Emerging areas of interaction include those with Engineering and Chemistry.

Assessment / Expectations

Reproductive Biology represents a Landmark Area of Excellence in the College of Veterinary Medicine & Biomedical Science. Strong multidisciplinary and intercollegiate collaborations exist through the Interdisciplinary Faculty of Reproductive Biology, and these should continue to strengthen in the future, as exploration of physiology proceeds to deeper molecular and genomic levels. The CVMBS supports recognition of Reproductive Biology as a Landmark Area of Excellence at Texas A&M University.

Additional faculty and facilities are critical to maintaining TAMU's reputation as an international leader in reproductive biology research. Enhanced faculty retention programs and continued investment in new faculty and new facilities will strengthen our competitiveness for NIH and USDA center and Training grants. The programmatic goal of the IFRB, supported by faculty of the CVMBS, is to obtain an NIH Program Project grant to sustain high levels of activity in integrated, multi-project research, and to further foster collaboration among investigators in reproductive biology at TAMU. To provide the resources required to further these goals, as a Landmark Area of Excellence at Texas A&M University the IFRB will recruit two to three senior faculty members with active NIH-funded programs in molecular, epigenomic or translational reproductive biology. These faculty members will integrate with and strengthen current research in all areas of focus in the IFRB, and provide the depth necessary for TAMU to acquire a federally-funded Program Project Grant in the area of Reproductive Biology.

Indices of Excellence

Over the last 5 years, research performed by CVMBS reproductive biology faculty has resulted in over 300 original publications in top peer-reviewed journals, including the Proceedings of the National Academy of Sciences, Biology of Reproduction, Endocrinology, Reproduction, the American Journal of Physiology, Journal of Biological Chemistry, FASEB Journal, Cancer Research, Journal of Nutrition, and Pediatric Research. Reproductive biology faculty in the CVMBS have participated as Principal or Co-Investigator in 16 grants from the National Institutes of Health in the last 5 years, including two Center grants, totaling over $20 million in funding. Additional funding since 2003 includes:

- USDA: 15 grants totaling over $4 million
- Other external granting agencies, including the American Quarter Horse Foundation, the Texas Heart Institute, the Juvenile Diabetes Research Foundation, and the Grayson-Jockey Club Foundation: over $1.8 million

- Funding from private foundations, individuals and corporations: over $1.3 million
- Intramural funding, including the Link Equine Research Endowment: $1.8 million

Reproductive faculty in the CVMBS are highly respected in their fields, serving as editors or editorial board members on journals such as Biology of Reproduction, Tissues, Cells, and Organs, Journal of Applied Toxicology, Domestic Animal Endocrinology, Theriogenology and Animal Reproduction, on grant review committees and study sections for the NSF, NIH, USDA, National Cancer Institute, Veterans Health Administration, and March of Dimes, and as officers in the governance of their professional and scientific associations. Faculty at the CVMBS serve as advisors on public policy on reproduction and biotechnology at the State and National levels. Leadership in international scientific and professional societies, invited presentations at international meetings, and international collaborations with colleagues around the world demonstrate the global impact of this program. CVMBS reproductive biology faculty include Regents, University, and Texas AgriLIFE Research Faculty Fellows, and three endowed chairs. Awards garnered by the faculty include honorary doctorates, the Pioneer Award from the International Embryo Transfer Society, honorary diplomate status in the American College of Theriogenologists, three faculty awarded Theriogenologist of the Year from the American College of Theriogenologists – more than any other institution -- the Society for Research and Fertility Distinguished Research Award, Vice Chancellor's Award in Excellence for Team Research, and the Society for the Study of Reproduction Carl Hartman and New Investigator Awards, among many others.

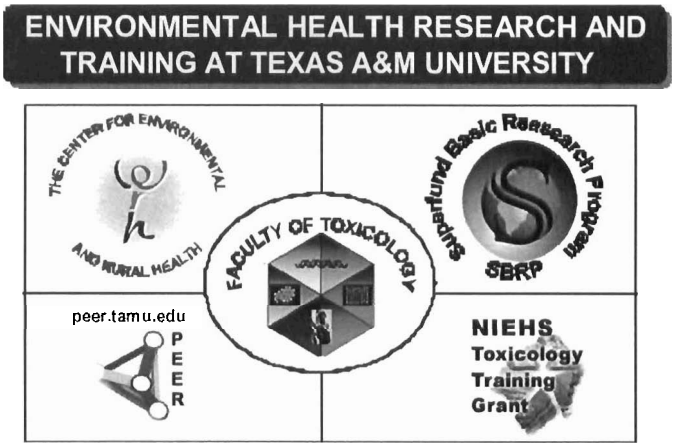
PARTICIPANTS

Name	CVMBS Department	Major Areas of Interest
Arosh, Joe	VIBS	Uterine Biology and Pregnancy
Bazer, Fuller	VIBS/VTPP	Uterine Biology and Pregnancy
Blanchard, Terry	VLCS	Equine Reproductive Biology
Brinsko, Steve	VLCS	Equine Reproductive Biology
Burghardt, Bob	VIBS	Uterine Biology and Pregnancy
Cudd, Tim	VTPP	Uterine Biology and Pregnancy
Forrest, David	VIBS	Equine Reproductive Biology
Hinrichs, Katrin	VTPP	Reproductive Biotechnology Equine Reproductive Biology
Ing, Nancy	VIBS	Equine Reproductive Biology
Jaeger, Laurie	VIBS	Uterine Biology and Pregnancy
Johnson, Greg	VIBS	Uterine Biology and Pregnancy
Johnson, Larry	VIBS	Equine Reproductive Biology
Kraemer, Duane	VTPP	Reproductive Biotechnology
Long, Chuck	VTPP	Reproductive Biotechnology
Love, Charles	VLCS	Equine Reproductive Biology
Romano, Juan	VLCS	Reproductive Biotechnology
Spencer, Tom	VIBS	Uterine Biology and Pregnancy
Varner, Dickson	VLCS	Equine Reproductive Biology
Welsh, Tom	VIBS	Equine Reproductive Biology
Westhusin, Mark	VTPP	Reproductive Biotechnology
Wu, Guoyao	VIBS	Uterine Biology and Pregnancy

LANDMARK AREA OF EXCELLENCE: TOXICOLOGY, ONCOLOGY AND ENVIRONMENTAL HEALTH SCIENCES

Introduction and Significance

Toxicology research and training at Texas A&M University (TAMU) was initiated in 1970 and extensively reorganized in the late 1980s to reflect the interdisciplinary nature of the Toxicology Program on this campus. In 1989, faculty from 6 Colleges and 17 Departments within the University, the USDA Food and Animal Protection Laboratory, and Texas A&M University-Galveston formed the Interdisciplinary Faculty of Toxicology (IFT). The graduate degree was changed from Veterinary Toxicology to Toxicology, and responsibility for management of the graduate program was transferred from the Department of Veterinary Physiology and Pharmacology to the IFT. These changes were approved by the University and the State Coordinating Board. The new IFT represented a unique model for developing a graduate program that encompasses students and faculty from different administrative units (Appendix I). The IFT has since served as a successful graduate program with over 71 Ph.D. and 10 MS degrees awarded (64 of which were awarded in the College of Veterinary Medicine & Biomedical Sciences [CVM]) over the last 10 years. The IFT has had two external Academic Program Reviews, one in 1998 and the last in 2007, both of which rated the Toxicology Program as "outstanding." The major scientific themes of the IFT include cellular and molecular toxicology, reproductive and neurotoxicology, environmental health and food safety, oncology, and nanotoxicology research. All of these areas play an integral role in the other key ongoing environmental health sciences programs at this University. Currently, over 25 graduate students and 10 postdoctoral fellows participate in the Toxicology program, and operating funds for the program are now coordinated through the Office of the Vice-President for Research in collaboration with the Council of Participating Deans. Based on measures of external funding and the number of graduates, TAMU is now recognized as one of the national leaders in Environmental Health Science research and training.



Rationale

Research and graduate training in Toxicology and Environmental Health has been a priority of the CVM and was identified as a Signature Program in the previous Strategic Plan put forward in 2003. The goal of Vision 2020 is to elevate TAMU into the ranks of the top ten public universities in the nation by the year 2020. The IFT has fostered many of the Imperatives outlined in Vision 2020 and is contributing to the achievement of the culture of excellence. By organizing interdisciplinary groups and securing interdisciplinary center, program project, training and individual investigator grants, the IFT has elevated the faculty, their teaching, research and scholarship (Imperative 1) as well as strengthened graduate programs (Imperative 2). The IFT has been instrumental in expanding the breadth of research and interdisciplinary collaborations that incorporated a broad range of new initiatives ranging from community-based translational programs in Texas (Imperatives 9 & 12) to global environmental health focusing on unique environmental health problems in Africa, Azerbaijan, and China (Imperative 6). These programs have provided considerable funding to build new and expand upon existing research infrastructure along with biostatistics and computational tools and resources (Imperative 8). Several CVM toxicology faculty have left the university in recent years and have yet to be replaced. There are expanding opportunities and initiatives in oncology and nanotoxicology that should also be addressed. In

order to for this Signature Program to maintain preeminence in a highly competitive, multidisciplinary area, it is essential that outstanding new faculty be recruited to build upon strengths of the program.

Interdisciplinary Impact

The IFT as an interdisciplinary research and training program has directly contributed to the success of faculty in competing for major National Institutes of Health (NIH)-funded grants in the Environmental Health Sciences. In 1992, TAMU was awarded a training grant from the National Institute of Environmental Health Sciences (NIEHS) and this grant was successfully renewed in 1997 and 2002. The NIEHS Toxicology Training Grant application is currently in revision and seeking more interactions with clinical investigators and their trainees. This was one of the first NIH-training grants awarded to faculty at TAMU and has served as a model for the development of other training grants in the Life Sciences.

The Superfund Basic Research Program (SBRP) was initially funded by NIEHS in 1989 and has since been successfully renewed three times and is currently funded from 2000-2008. A renewal proposal is currently pending. The program has combined faculty from the Texas A&M Health Sciences Center (College of Medicine and Institute of Biosciences and Technology), and Texas A&M University Colleges of Science, Veterinary Medicine, Engineering, and Agricultural and Life Sciences. Research projects are directed at characterizing contaminant-sensitive genotypes, molecular mechanisms of endocrine disruption and birth defects, and genotoxic and non-genotoxic endpoints associated with diverse classes of chemicals occurring in Superfund sites along with two chemical intervention projects for groundwater purification and for biodegradation and detoxification of halogenated aromatic hydrocarbons and heavy metal mixtures.

The Center for Environmental and Rural Health (CERH) was funded by NIEHS from 1998 to 2007 and promoted applied science programs focusing on the impact of environmental factors on human health and disease in rural communities. Two research cores focused on the Environment and Reproduction and the Environment and Cancer were supported by centralized core facilities that advanced the scientific discovery process, enhanced the quality of research programs, and attracted young faculty into the field of environmental health sciences. This has been the only Center grant on the TAMU campus and there is a pressing need to recruit new leadership to expand clinical/translational capabilities of the Center to restore funding for this important program.

Environmental Health Science research at this University is now one of the preeminent programs in the United States. In order to maintain this position of preeminence in a highly competitive field, several new faculty positions and new opportunities to enhance interdisciplinary interactions in several key areas will be needed over the next several years for the Toxicology, Oncology and Environmental Health to reach its full potential. In particular, cancer biology and chemical carcinogenesis has emerged as a major research strength of the CERH and IFT and Faculty have received substantial funding from the NIH, Department of Defense, Komen Foundation and private sources for their research activities. At the same time, the Clinical Oncology service at the CVM has established relationships with MD Anderson's Comprehensive Cancer Center in Houston aimed at forming comparative oncology collaborations between the two institutions. The clinical oncology group is also an active member of the Comparative Oncology Trials Consortium funded by the NIH Comparative Oncology group and is actively participating in multi-institutional clinical trials. The NIH together with a private non-profit group is interested in running a series of clinical trials specifically through the clinical oncology group at the CVM over the next 5 years because of the resources, MD Anderson collaborations and potential that this hospital has to offer. The clinical significance of the client owned veterinary patients as models for cancer research is substantial. The NIH estimates that over 1 million pet dogs per year are diagnosed and managed with cancer in the United States alone. Examination of the recently published canine genome has revealed many significant similarities between dogs and humans, especial in association with gene

families involved in tumorigenesis and tumor progression. These similarities are significantly greater than those seen between the human and the mouse. Clinically, the 'One Medicine' approach to cancer research combines the study of naturally occurring disease in companion animal species and the study of human cancer biology, diagnosis, and therapy. Genetic and molecular cancer research has flourished in recent years, however, relevant *in vivo* preclinical models have been lacking thus far.

Assessment/Expectations

The value of Toxicology, Oncology and Environmental Health as a Landmark Area of Excellence can be appreciated in the context of grant funding highlights of the program, which are listed below. The CVM provides substantial leadership for this program, however, faculty have established extensive collaborations with other departments, colleges, and system units. One purpose of this program is to nurture and expand these partnerships to solve complex problems and to create greater funding and independence. The basic and translational accomplishments that have resulted from the interdisciplinary initiatives in this previously identified signature program have been substantial and we expect to create an unprecedented opportunity for faculty and trainees to achieve new breakthroughs.

Therefore, research and graduate training in Toxicology, Oncology, and Environmental Health should be maintained as a Landmark Area of Excellence as a program in the CVM. In order to maintain its standing as a national leader in Environmental Health Science research and training, and to ensure that the prestigious NIH-funded Center, Training and Program Project grants are successfully renewed, new faculty resources to replace faculty who have left the College and to provide expertise in emerging areas are needed to complement the commitment of the IFT to build upon existing strengths. Expectations of the IFT with support from the College of Veterinary Medicine & Biomedical Science follow:

A. The IFT will collaborate with the CVM to restore the Texas A&M CERH. This will involve recruitment of a senior faculty member who will promote interdisciplinary clinical interactions and translational medicine.

B. The IFT will collaborate with the CVM to recruit clinical (MD and DVM) training faculty and target expanded translational research initiatives in preparation to resubmit the NIEHS Toxicology Training Grant.

C. CVM faculty leadership in the SBRP Program Project Grant will ensure that this grant be maintained.

D. The IFT will collaborate with the CVM to promote interactions and recruiting to enhance interdisciplinary interactions in the area of Oncology as part of the Toxicology, Oncology, and Environmental Health Landmark Area of Excellence with the goal of establishing an Institute for Cancer Research with research space in the new Life Sciences Building. This is part of a strategic initiative the enhance competitiveness for funding from the Texas Cancer Initiative which will provide annual competitive funding of $300 million/year for 10 consecutive years.

E. Recruitment

1. CERH director who will provide leadership to promote interdisciplinary clinical interactions and translational medicine and restore the Texas A&M CERH. New CERH research leadership recruitment should be combined with one of Dr. Murano's hiring of up to 20 "research stars."
2. Recruitment of up to 3 new oncology researchers committed to interdisciplinary research and translational medicine.
3. Recruitment of up to 2 new faculty members in the areas of nanotoxicology and nanomedicine.
4. Recruitment of up to 2 new faculty in the areas of toxicogenomics and other "omics" disciplines.
5. Development partnerships with other colleges and System components for recruitment in this Landmark Area of Excellence

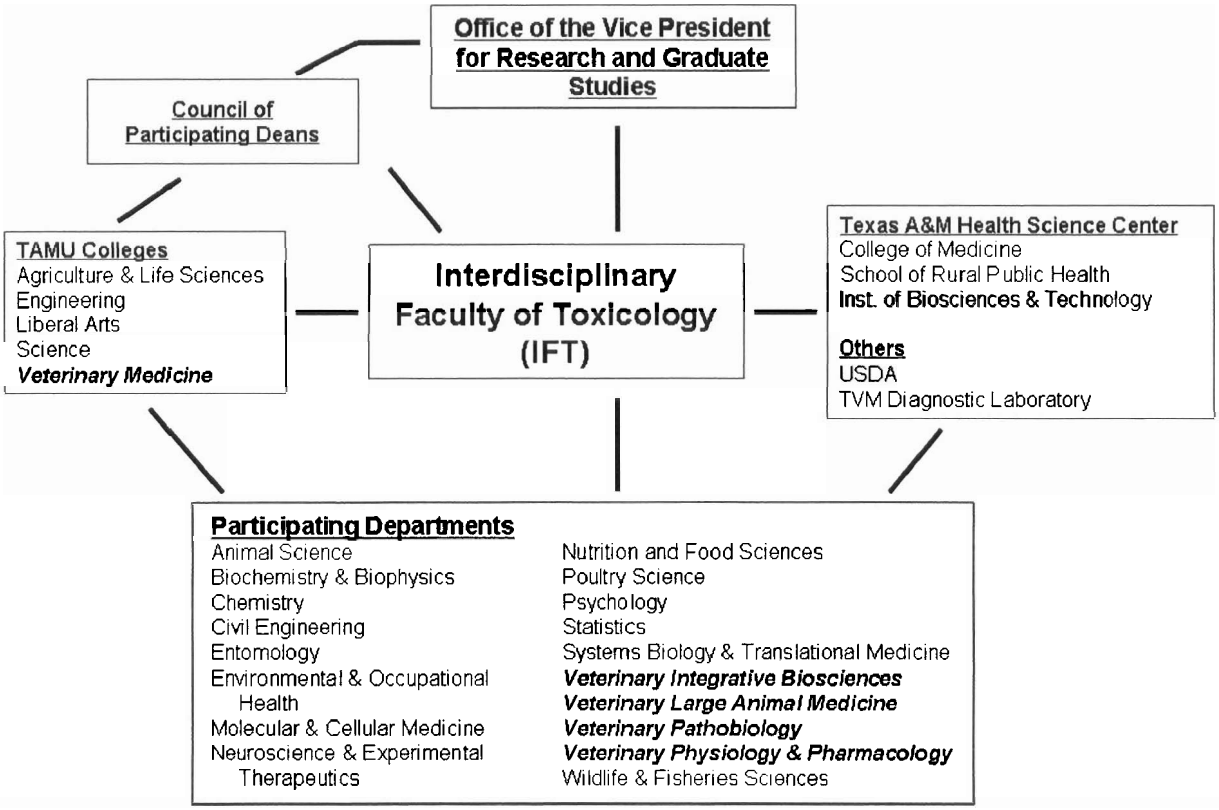
Indices of Excellence

A) The CERH was funded by NIEHS from 1998 to 2007, for approximately $7,500,000. Fifty-one investigators in Environment and Cancer and Environment and Reproduction Research Cores (about 20% from the CVM) were supported by 3 Facility Cores which facilitated interdisciplinary and

multidisciplinary collaborations among collaborations among toxicologists, reproductive biologists, biochemists, engineers, epidemiologists and biostatisticians within the CERH, the Texas A&M System, other state institutions, national and international research agencies. During the period from 2002-2006, CERH investigators published over 740 peer-reviewed research reports and secured over $71.8 million in research funding. The CERH is the only center grant that has been funded at Texas A&M University.
B) The SBRP Program Project has been funded by NIEHS from 1989-present, for approximately $12,000,000. Thirteen investigators (7 from the CVM) are responsible for seven projects and four research support cores involving interdisciplinary collaborations among toxicologists, engineers, epidemiologists and biostatisticians as well as collaborators in the State of Texas and interactions with international collaborators in Azerbaijan, China and the Czech Republic. From 2004-2008 these investigators published 94 research reports.
C) The Toxicology Training Grant was funded by NIEHS from 1992-2007, for approximately $3,000,000. This grant provided funding for six graduate and two postdoctoral stipends annually, and has supported a total of 28 graduate students and 13 postdoctoral fellows during the duration of the program. All trainees in the program participate in annual research symposia, a weekly Toxicology Seminar series, regional and national Society of Toxicology meetings and other local, regional and national scientific conferences. In addition to development of a modern curriculum involving coursework housed primarily in CVM departments, this program also developed a Scientific Ethics course (VMID 686, formerly VAPH/VIBS 689) which is a requirement for all Toxicology trainees, and has become a valued course for other majors throughout the System as well.
D) Outreach/Engagement Activities are core components of the CERH and SBRP grants that provide environmental health information to the public and health care professionals, and facilitate interactions with communities in which the research studies are conducted. These grants facilitated other outreach grants including an NIEHS funded the TAMU Partnership for Environmental Education and Rural Health (PEER) which focused on integrating environmental health science into grades 6 through 8 in rural schools in Texas. This program has been greatly expanded in recent years with science and math emphasis in rural middle schools with funding from NIH and NSF.
E) Cancer biology and chemical carcinogenesis has emerged as a major research strength of the CERH; IFT members have received substantial funding from the NIH, Department of Defense, Komen Foundation and private sources for their research activities. At the same time, the CVM Clinical Oncology group has emerged as a major force in the area of clinical translational research. CERH/IFT members are leading the TAMUS response to the Texas Cancer Initiative and have organized Cancer Workshops to facilitate interchange and collaboration among faculty. In addition, there are plans for establishing a focused cancer research groups in the new Life Sciences building and it is anticipated that newly recruited CVM basic science faculty in cancer biology and carcinogenesis and clinical oncologists will serve as "anchor" research investigators in this unit.
F) The building of a new Cancer Therapy and Advanced Imaging Center at the CVM will upgrade the MRI and radiation therapy unit to cutting-edge tomotherapy. This will provide unparalleled targeting ability and normal tissue sparing to permit treatment of brain and spinal tumors, perform whole body radiation, and treat multiple lesions at once. TAMU would be only the second veterinary school in the world to possess such technology.
G) The Texas A&M Institute for Preclinical Studies (TIPS) was formally established by the Board of Regents as a TAMU institute to serve the preclinical needs of academic researchers and industry. TIPS will develop research activities and provide core services in the areas of device development and combination products, preclinical studies under Good Laboratory Practices (GLP) and biomedical imaging. This is an important step in developing leadership in translational research. The new 112,000 square-foot TIPS facility will open in Summer 2009 and will include long-term large animal housing for approximately 240 animals, state-of-the-art surgical and imaging suites, a clinical diagnostic lab, incubator space for startup companies, and a large auditorium for meetings/training. TIPS imaging center is slated to have the latest in advanced imaging technology. Phase I will include a 3T MRI with XMR, 3-D Echo, and a fixed Cardiac Catheterization Lab; phase 2 plans include a 7T MRI and a 64 slice PET/CT.

APPENDIX I: SUMMARY OF DEPARTMENTS, COLLEGES AND PROGRAMS INVOLVED IN THE IFT

- **VTPP is the Administrative Home Department**
  - **CVM Dean is the Lead Dean for the IFT on the Council of Participating Deans**



APPENDIX II: IFT Faculty Members

Faculty

Name	Dept.	College	Role in IFT
Abbott, Louise C.	VIBS	CVM	Member
Allred, Clinton D.	NUTR	Agrilife	Member
Autenrieth, Robin l.	CVEN	Engineering	Member
Ball, Judith M.	VTPB	CVM	Member
Banu, Sakhila K.	VIBS	CVM	Member
Barr, A. Catherine	TVMDL	CVM	Adjunct Member
Bernstein, Lori R.	MCM	Medicine	Member
Bratton, Gerald R.	VIBS	CVM	Member
Burghardt, Robert C.	VIBS	CVM	Member, Chair, EC
Busbee, David L.	VIBS	CVM	Member
Calvin, James A.	AVPR/STAT	Admin. / Science	Member
Carroll, Raymond J.	STAT	Science	Member
Chapkin, Robert S.	ANSC	COALS	Member
Chu, Kung-Hui "Bella"	CVEN	Engineering	Member
Dees, W. Les	VIBS	CVM	Member
Donnelly, K.C.	EOHS	SRPH	Member
Fackler, John P.	CHEM	Science	Member
Finnell, Richard H.	IBT / VIBS	IBT / CVM	Member
Harvey, Roger B.	USDA/VIBS	CVM	Associate Member
Jayaraman, Arul	CHEN	Engineering	Member
Johnson, Larry	VIBS	CVM	Member
Kier, Ann B.	VTPB	CVM	Member
Ko, Gladys Y.-P.	VIBS	CVM	Member
Miranda, Rajesh C.	NEXT	Medicine	Member
Mirkes, Philip E.	VTPP	CVM	Member
Mora, Miguel	WFSC	COALS	Member
Nation, Jack R.	PSYC	Liberal Arts	Member
Parrish, Alan R.	SBTM	Medicine	Member
Phillips, Timothy D.	VIBS	CVM	Member, Vice Chair, EC
Pietrantonio, Patricia V.	ENTO	COALS	Member
Pillai, Suresh	POSC	COALS	Member
Pine, Michelle D.	VIBS	CVM	Member
Porter, Weston W.	VIBS	CVM	Member, EC
Ramaiah, Shashi K.	VTPB	CVM	Member, EC
Raushel, Frank M.	CHEM	Science	Member
Reagor, John C.	TVMDL	CVM	Member
Russell, Leon H.	VIBS	CVM	Member
Safe, Stephen H.	VTPP/IBT	CVM / IBT	Member, Past Chair, EC
Sayes, Christie M.	VTPP	CVM	Member
Schroeder, Friedhelm	VTPP	CVM	Member
Senseman, Scott A.	SCSC	COALS	Member
Sherman, Michael	STAT	Science	Member
Simanek, Eric	CHEM	Science	Member
Spencer, Thomas E.	ANSC	COALS	Member
Spiegelman, Cliff	STAT	Science	Member
Stallone, John N.	VTPP	CVM	Member

Stoica, Gheorghe	VTPB	CVM	Member
Talcott, Susanne M.	NUTR/VTPP	Agrilife/CVM	Member
Thompson, James A.	VLAM	CVM	Member
Tian, Yanan	VTPP	CVM	Member, EC
Tiffany-Castiglioni, Evelyn	VIBS	CVM	Member
Turner, Nancy D.	ANSC	COALS	Member
Villalobos, Alice R.A.	NUTR	Agrilife	Member
Walker, Cheryl L.	VTPP-Adjunct	CVM	Adjunct Member
Wang, Naisyin	STAT	Science	Member
Wild, James R.	BCBP	COALS	Member
Wilson, Cody L.	EOHS-Adjunct	SRPH	Adjunct Member
Wilson, Emily	SBTM	Medicine	Member
Wood, Thomas K.	CHEM	Engineering	Member

EC = Executive Committee