

FY2009 Learning Technologies Grants Proposal
(COVER PAGE)

Project Information

Veterinary Neurology 3D Animated Teaching Model: The Cranial Nerve Examination

Project Title

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Project Director

Small Animal Medicine & Surgery

Requesting Department

\$14,190.80

Amount Requested Year 1 (≤\$15,000)

\$11,792.80

Amount Requested Year 2 (≤\$15,000)

Project Director's Signature

Proposal Endorsement Signatures

Department Head

Dean

Proposal Abstract (100-word maximum)

Teaching clinical neurology is an important component of the veterinary medicine degree. Integration of the basic sciences, neuroanatomy and neurophysiology, with the clinical neurological examination of veterinary patients is essential yet difficult to accomplish. The most complex portion of the neurological examination is cranial nerve evaluation. We propose facilitating the integration of the cranial nerve examination via a 3D animated interactive program available to students on WebCT. Computerized animation will be used to help the transition from the physical evaluation of each cranial nerve, through the underlying responsible neuroanatomy to the neurophysiologic connections essential for a normal response.

Section I. Project Description

Nature of Innovation

We are proposing the development of an interactive web-based neurology teaching program, focusing initially on the cranial nerve examination, using 3D computerized animation technology to enable visual learning. The program would combine computerized neuroanatomy and neurophysiologic pathway animations with video footage of corresponding individual neurological tests on a normal animal. The program will be constructed in an easily accessible and navigated format for veterinary students, available via WebCT and CD-Rom.

The following 12 cranial nerve examinations are to be illustrated and animated to demonstrate the clinical test, the underlying normal neuroanatomic and neurophysiologic pathways: (1) Gross visual test – cotton drop test; (2) Menace response; (3) Pupillary light reflex; (4) Strabismus evaluation; (5) Palpebral reflex; (6) Corneal reflex; (7) Nasal sensation; (8) Ear sensation; (9) Lip stimulation; (10) Jaw tone evaluation; (11) Swallowing and gag reflex; (12) Evaluation of tongue movement. Each cranial nerve will be packaged into 3 defined but integrated units:

1. **CLINICAL TEST** – Animation of the clinical test and subsequent body movements in 2D.
2. **NEUROANATOMY OF TEST** - 2D and 3D animation demonstrating the complete neurological pathway that includes control centers in the central nervous system, the associated cranial nerves, and how they are associated with the skull.
3. **NEUROPHYSIOLOGY** - 3D animation will demonstrate the neurophysiological responses within the brain and brainstem during a specific test and how they are related to the 2D and 3D anatomy.

The resource will provide multiple avenues of access to information and open architecture browsing. It will be an open-ended resource that can be continuously developed; we plan to focus this project on the cranial nerve examination portion of the clinical neurological exam. With the experience gained and with the anticipated success of this project, we plan to add the following specific sections in the future: (1) spinal cord neuroanatomy, neurophysiology and examination; (2) MRI of the normal companion animal nervous system; (3) case-based video footage of specific neurological disease syndromes; and (4) gross and microscopic neuropathology representing the specific neurological disease syndromes. The manner in which this proposed project will be constructed using Adobe® Dreamweaver®, will enable such well defined additions at later dates. The electronic learning resource would serve as a model for other clinical disciplines in the College.

Need/Rationale

It has been repeatedly demonstrated that students increase their achievement when varied, multi-sensory methods are used as a form of instruction. However, at present, veterinary neurology is taught in a very fragmented manner as essential neuroanatomy, neurophysiology and clinical neurology are taught in separate courses. A multi-discipline approach to teaching neurology is necessary and the gap between the pre-clinical sciences and the senior clinical rotations in neurology needs to be bridged.

Our aim is the establishment of a web-based interactive veterinary neurology teaching model, combining clinical neurology, neuroanatomy and neurophysiology. The model will be used in lecture courses and be freely available via either WebCT or CD-Rom for constant student access and ultimately for veterinarians in the state for continuing education.

Veterinary students currently have access to anatomical specimens and text-books. Unfortunately, 1) it takes several anatomic specimens to provide the students with a complete

'picture'; 2) access to anatomic specimens is limited to the anatomy laboratory; 3) specimen preparations is expensive; 4) text books are limited to 2D images for descriptive purposes; and 5) access to normal animals to practice the neurological examination is limited to the opportunity of examining their own pet at home without the reinforcement that their performance is right or wrong. Overall, from our experience with students entering their senior year and our interactions with veterinarians around the state, we believe that the present system of teaching neurology and the limited time available for this teaching could be enhanced by an on-line interactive program. A course enhanced with multimedia will allow the student to experience a detailed view of functional neuroanatomy in order to help with localization of diseases which will subsequently assist with treatment of the responsible diseases. This will also be a more attractive continuing education facility than textbooks for the practicing veterinarian.

Relevance of the project to unit and University priorities

Teaching students to develop clinical problem solving abilities is an essential part of our Department and College's mission. Development of such an interactive web-based freely accessible program will enable students to learn at a pace and level that suits them and utilizes the latest in web-based and digitally animated teaching facilities which would fit in with some of the university's core priorities.

Specific courses and numbers of students benefiting from the project

Neurology SAMS/LAMS 5305 – core course (20 contact hours)

Small Animal Clinical Neurology SAMS 5326 – elective course (20 contact hours)

Clinical neurology is a core 20 lecture course for junior veterinary students given in the Spring of each year. The course enrolls approximately 96 students per year. It aims to teach veterinary clinical neurology, two years after they have been taught veterinary neuroanatomy and neurophysiology, and several months before they enter the clinics to rotate through the clinical services. The course starts with lectures covering the theory of the neurological examination, and progresses through teaching how the abnormalities discovered can help localize where a disease exists in the nervous system. The lectures demonstrate how diseases of the nervous system are manifested in dogs and cats using Microsoft® Powerpoint® presentations and video footage. The presentation, neurological examination, diagnosis and treatment of specific clinical neurological disease in dogs and cats is taught as SAMS 5326, a 20 lecture course using the same teaching tools and is more problem orientated than the first course. This enrolls approximately 74 students each year.

In addition, the following pre-clinical courses have neurological sections and will also benefit from access to this learning tool:

Physical diagnosis LAMS/SAMS 5150 – taught to 96 students as a freshman core course.

Veterinary Neuroanatomy / Neurophysiology VARB/VPHY 5190 - taught to 96 students in the freshman year as a core course.

Small Animal Neurology SAMS 5465 – taught to 70 students as elective clinical senior rotation.

It is difficult to estimate how many post-graduate or professional veterinarians may benefit from this learning tool but it would seem to be an essential and easily accessible method to attain required continuing education.

Section II. Budget

Technology resources, facilities, resources requested

All of the technology and facilities are available to us at the College of Veterinary Medicine, primarily through collaboration with the Department of Educational Resources (DER). One small portion of the project has already been developed in order that (i) we could better understand the manner in which this entire project needs to be constructed; (ii) we could more accurately define the time and financial support necessary for the completion of the entire project; and (iii) we could submit this work as preliminary data for the funding agency to better understand the scope and quality of the work which is being proposed. Representations of this 2D and 3D work can be viewed at <http://thel.myweb.uga.edu/grant/index.html>.

| ITEM | Quantity | Total Cost \$ | Requested from LTG \$ |
|--------------------------------|-----------|---------------|-----------------------|
| Fiscal Year 1 | | | |
| Story board and sketches | 240 hours | 897.60 | 897.60 |
| 2D anatomical illustrations | 480 hours | 1795.20 | 1795.20 |
| 3D modeling of animations | 240 hours | 1560.00 | 1560.00 |
| Production of animations | 960 hours | 6240.00 | 6240.00 |
| Instructional design interface | 200 hours | 1300.00 | 1300.00 |
| Mac Mini | 1 | 899.00 | 899.00 |
| Mac Book | 1 | 1499.00 | 1499.00 |
| Year 1 Total | | 14190.80 | 14190.80 |
| Fiscal Year 2 | | | |
| Story board and sketches | 240 hours | 897.60 | 897.60 |
| 2D anatomical illustrations | 480 hours | 1795.20 | 1795.20 |
| 3D modeling of animations | 240 hours | 1560.00 | 1560.00 |
| Production of animations | 960 hours | 6240.00 | 6240.00 |
| Instructional design interface | 200 hours | 1300.00 | 1300.00 |
| Year 2 Total | | 11792.80 | 11792.80 |
| Grant Total | | 25983.60 | 25983.60 |

Budget Justification

This project will take 2 years to complete and will be the major focus of DER for this period of time. The majority of the budget relates to production costs and as such has been classified as non-personnel, miscellaneous one-time-expenses. Personnel involved in the project will not be paid a salary from the grant for this work.

Research, storyboard animation, preliminary sketches

These sections will be performed by the clinicians in conjunction with Kip Carter. Each test (1 through 12) will be written and drawn out as a storyboard with subsequent sketches performed of the 2D anatomy.

2D anatomical illustrations

The 2D sketches will then undergo a process of painting before importing into the animations

3D modeling

Each 3D action sequence will require a model to be built, enabling texture and lighting development for each sequence.

Animation

This section will involve creating appropriately timed sequences from the 3D models to develop the final movie.

Instructional design interface

Each section (2 and 3D view of clinical test / neuroanatomy / neurophysiology) of the cranial nerve tests (1 through 12) will be individually accessible and accessible as an integrated continuum depending on the student's individual needs. For this to be achieved with wide-based access, an interface is necessary which will enable the development of this project within WebCT and as a CD-Rom. The interface will also allow extension of this project in the future as is planned. The interface will be constructed using Adobe® Dreamweaver®.

Computer equipment and software

All the necessary software for this project is in place and extra licenses will be provided as needed by the DER, as they can be used for other projects. The purchase of the Mac Mini (2.0GHz Intel Core Duo/120GB Serial ATA drive/2GB 667MHz DDR2 SDRAM) is required to increase the speed of the production to meet the outlined schedule below. The purchase of the Mac Book (2.4GHz Intel Core Duo /2GB 667 MHz DDR2 SDRAM / 250GB Serial ATA Drive) will enable 'off-site' work to take place outside of routine working hours by members of the project, again necessary to meet the time schedule.

Animation sequences demonstrating preliminary work in this area can be viewed at <http://thel.myweb.uga.edu/grant/index.html>. These sequences outline a portion of the neurological examination and the neuroanatomical basis of the tests. The budget has been estimated based on the time and equipment which was needed to create these sequences, predominantly outlining the physiological movement of the eyes and the vestibular portion of the nervous system (nystagmus reflex). Based on our outline of the overall program, these sequences represent 1/13th of the final product which enabled an accurate cost prediction for this grant.

The College of Veterinary Medicine is demonstrating commitment to this project, subsidizing the grant by charging the faculty in-house rate for DER services. All DER sketches and 2D anatomical illustrations will be charged at \$3.74/hour, whilst 3D modeling and animation as well as the interface design will be charged at \$6.50/hour. The salary request that this would ordinarily represent for the time commitment of the three DER staff members listed on the grant approximates \$140, 000. We are also committing almost twice the hours that are customarily allowed for grant work among the three DER staff members listed. The facilities and equipment of three staff members is included in our commitment, effectively making this a full time commitment from DER toward this project. Software being used toward this project includes Adobe AfterEffect® v6.5, Adobe Photoshop® CS3, Autodesk Maya Unlimited® v8.0 and DreamWeaver®. Hardware being used toward this project includes Canon color printers ip6600dd and replacement ink, in addition to 2 windows based 3D workstations and monitors. The time allotted to this project for the clinicians to develop the story board and oversee the project development and integration on the interface of the various components, is effectively faculty release time. No professional development will be required and there will be no travel expenses.

Timeline for project development - 2 year full time

| Date (mm/yy) | Objective | Persons responsible |
|--------------|---|---------------------------------|
| 03/09 | Story boards completed for tests 1-6 | Neurologists and Kip Carter |
| 09/09 | 2-D illustrations for tests 1-6 | Kip Carter |
| 10/09 | 3D modeling for tests 1-6 | Thel Melton |
| 12/09 | First 24 animated sequences | Thel Melton |
| 12/09 | Interface designed | Neurologists and Brad Gilleland |
| 12/09 | Story boards completed for tests 7-12 | Neurologists and Kip Carter |
| 03/10 | 2-D illustrations for tests 7-12 | Kip Carter |
| 06/10 | 3D modeling for tests 7-12 | Thel Melton |
| 10/10 | Final 24 animated sequences | Thel Melton |
| 12/10 | Insert text, illustrations, animations into interface | Neurologists and Brad Gilleland |

Section III. Learning Outcomes

We plan to integrate an animated computer-based clinical neurology / neuroanatomy / neurophysiology teaching model focusing on the cranial nerves, into neurology core and elective courses. The *objective of this project* is to shorten and enhance the learning experience in this course by developing an accurate, three dimensional computer graphic representation of neuroanatomical and neurophysiologic pathways that are responsible for the normal neurological examination tests. The model will be used in conjunction with conventional lecturing techniques. The animated 'movies' and interactive images will also be available from a web server (WebCT) and on a computer disc so that students can freely refer to them. The server will allow the students to access the 'movies' from any computer connected to the Internet; the compact discs will enable students without internet access or those with slow access. Both methods will allow the students to control their own speed of learning, and to provide them with continued access to these images as they enter the fourth-year of the veterinary curriculum and after graduation. This allows the module to function as a continuing education tool for practicing veterinarians.

It is expected that the students will change from lower order thinking processes (memorizing neuroanatomy of neurologic diseases) to higher order thinking processes (understanding concepts and integrating basic science with clinical syndromes). The three-dimensional computer graphic model is essential to achieve this transition.

Evaluation of Outcome

The impact of the proposed course revision will be evaluated using a traditional method comparing the test group with a control group. The criteria described below will be applied to the current third-year veterinary class (control group) and next year's third year class (test group). Currently students rely on their anatomy knowledge garnered from examination of specimens and text-books in the first year of the curriculum. Next year's class will be taught in the same fashion, except for access to the animated, graphic representation, interactive version of the neurological examination of the cranial nerves. At the end of the course each year, the students' knowledge will be assessed using a set of quantitative (multiple choice) and qualitative (short answer) questions. By comparing the answers from the class taught with the aid of the three-dimensional model, we will evaluate the effectiveness of this approach. If the results are encouraging, in subsequent years the three dimensional module will also be made available to

first-year students studying neuroanatomy and neurophysiology. Anonymous questionnaires will also be used to obtain more descriptive evaluations of the project's impact.

Potential applications in other academic areas

This type of teaching tool will be important as a motivator to faculty wishing to move towards more experiential instruction. It will enable the instructor to move away from the role of a lecturer and grader to a facilitator. Other disciplines within the College may be able to use this project as a model for integrated teaching approaches.

Section IV. Support Plan

Project Leader: Dr Simon Platt BVM&S, MRCVS, Diplomate ACVIM (Neurology), DECVN

I am presently an associate professor of neurology / neurosurgery in the Department of Small Animal medicine at the College of Veterinary Medicine, University of Georgia. I have a 5 month clinic duty in the veterinary teaching hospital, which is shared with my collaborators, Drs. Kent and Schatzberg. We are all responsible for the instruction of senior students rotating through the hospital in the area of neurology. This includes practical instruction of the neurological examination, neurological disease localization, and treatment and care of dogs and cats with nervous system disease. We are all responsible for coordinating the junior core and elective didactic teaching courses in neurology. I will be responsible for the overall planning and coordination of the project.

Collaborators

Drs Kent DVM, DACVIM & Schatzberg DVM, PhD, DACVIM: duties as above. Drs. Kent & Schatzberg are assistant professors of neurology at the College of Veterinary Medicine and will help design the outline for the project and consult on its development. They will be instrumental in finally presenting this course to the juniors and instructing its set-up around the clinic and school after the course.

Kip Carter MS, CMI: Kip Carter is a national award winning illustrator and the chief of Medical Illustration Services at the DER, College of Veterinary Medicine, UGA. He is a certified medical illustrator and specializes in veterinary anatomy. Kip will be responsible for animating the project's 2-dimensional portions, rendering the images in digital color and sequencing the images with software available in the Department of Educational Resources. Examples of Kip's illustrations can be found on www.KipCarter.com.

Thel Melton MS: Thel is a national award winning veterinary 3D animator at the DER, College of Veterinary Medicine, UGA. Thel will be responsible for all of the 3D modeling and animation.

Brad Gilleland MS: Brad is also a national award winning veterinary 3D animator and is a DreamWeaver® instructor at UGA. Brad will be responsible for creating an instructional design interface for CD-Rom and WebCT.

Resources

All of the technical support, academic materials, and computer hardware and software facilities are available at the College of Veterinary Medicine, DER, as stated above in the budget justification. The facilities at the DER where this project will be undertaken will be provided by the College of Veterinary Medicine, including dedicated office space, furniture and artistic materials.