Module 1: Visual Function Assessment

Purpose of the module

To fully understand the mammalian visual system requires accurate assessment of its intricate functions. Many of these functions are compromised in diseases of the retina, cornea and lens. This module offers the following technical expertise and instrumentation for *in vivo* visual functional assessment procedures, especially in rodents:

- electroretinography (ERG)
- optokinetic response (OKR)
- *in vivo* ocular imaging including spectral domain-optical coherence tomography (SD-OCT)
- fundoscopy and fluorescein angiography (FA)
- slit-lamp biomicroscopy
- laser induction of vasculopathy
- assessment of intraocular pressure (IOP)

Location and contact information:

Carl Sanders Research and Education building, 2nd floor, Room: CB2908

Phone: 706-721-3449

Director: Dr. Sylvia B. Smith (SBSMITH@augusta.edu)
Co-director: Dr. Amany Tawfik (AMTAWFIK@augusta.edu)

Co-managers: Dr. Barbara Mysona (BMYSONA@augusta.edu) and Dr. Haiyan Xiao (HXIAO@augusta.edu)

Hours of operations: 9:00 a.m. – 5:00 p.m.

Instrumentation available to assess visual function

ASSESSMENT	INSTRUMENTATION	APPLICATION	TECHNICAL SUPPORT
ERG	Highly sophisticated rig custom-designed by Dr. Alan Saul, Department of Ophthal-mology	Assesses scotopic and photopic responses to light flashes as well as "natural" noise stimulus, which is a slowly varying luminance time series with amplitude inversely proportional to temporal frequency. This unit is best suited for interrogation of very low functioning retinas or subtle differences in inner retinal neuronal function.	Investigators are asked to coordinate with Dr. Saul to perform these specialized analyses. His email address is: (ASAUL@augusta.edu)

ERG	Celeris Fully Integrated High Throughput ERG Testing system including a Celeris PERG (pattern ERG) stimulator from Diagnosys LLC USA	This is a fully-integrated ERG system enabling high throughput and reproducible results, best suited for routine ERGs – such as scotopic and photopic ERGs. It is also capable of performing PERG.	Investigators will be trained by Module 1 personnel and will then be able to conduct their own analyses. Support is available throughout the session if there are difficulties.
OKR	Cerebral Mechanics Inc. OptoMotry system	Virtual reality system for rapid quantification of optokinetic threshold response. It utilizes the OptoMotry© software allowing assessment of rodent visual acuity and contrast sensitivity. It is performed in un-anesthetized mice.	Investigators will be trained by Module 1 personnel and will then be able to conduct their own analyses. Support is available throughout the session if there are difficulties.
SD-OCT	Bioptigen Spectral Domain Ophthalmic Imaging System (SDOIS; Bioptigen Envisu-R2200), equipped with probes for rodent retina and cornea.	The system is operated using proprietary Bioptigen software and features the InVivoVue™ Diver 2.4 software for sophisticated measurements. It allows in vivo histologic analysis of cornea tissue or retinal layers. Note: Each PI will need to purchase a special "Porter" –an image storage unit for data that is compatible with the instrument. We can provide the necessary ordering information.	Investigators will be trained by Module 1 personnel to use SD-OCT and the software. They will be able to conduct their own analyses. Support is available throughout the session if there are difficulties.
OCT	Image-guided OCT attached to MICRON IV (Phoenix)	The OCT2 system includes a live, real-time fundus display with superimposed scan line to allow precise positioning of OCT imaging. The system supports 2D capture, and production of 3D volumes, and includes a set of powerful segmentation and visualization tools.	Investigators will be trained by Module 1 personnel for OCT and can then conduct their own analyses. Support is available throughout the session if there are difficulties.
Fundus Imaging & FA	Two MICRON IV *in vivo* high-resolution retinal imaging microscopes (Phoenix Technology)	Retinal Imaging microscope for in vivo retinal imaging of small laboratory animals. This allows capture of images of the fundus (back of the eye) and if used with fluorescein dye permits visualization of vessels (fluorescein angiography).	Investigators will be trained by Module 1 personnel for instru-mentation use as well as fluorescein injection. Investigators will be able to conduct their own analyses. Support is available throughout the session if there are difficulties.
Laser-Induced CNV	Phoenix MICRON Image-Guided Laser System	This device is attached to the MICRON IV system (described above). The laser produces precise, laser photocoagulation to generate retinal choroidal neovascularization (CNV). An OCT imaging system is also available to verify precisely the site of injury.	Investigators will be trained by Module 1 personnel to use the laser and will be able to conduct their own analyses. Support is available throughout the session if there are difficulties.

		Screens are provided to protect against laser-induced injury.	
Slit-Lamp Bio-microscopy	SL-DR slit-lamp (Topcon Medical Systems)	This slit lamp allows examination/high resolution imaging of the anterior segment of the eye (cornea, iris, lens). It can be used to visualize posterior ocular structures as an adjunct to OCT. It features a digital camera and magnification up to 40X.	Investigators will be trained by Module 1 personnel to use the slitlamp and will be able to conduct their own analyses. Support is available throughout the session if there are difficulties.
IOP	Tonolab tonometer (iCARE)	We have two hand-held tonometers available to measure IOP in lightly anesthetized animals. Data are not stored on a computer, rather pressures are recorded by the investigator.	Investigators will be trained by Module 1 personnel to use the tonometer and will be able to acquire pressure data on their own. Guidance is available if needed.

Training

This module affords investigators the opportunity to perform most of the analyses themselves, thus allowing the capacity to assess as many subjects as needed to obtain statistical power. For those who are not experienced in the use of the above-listed instruments, staff members are available for comprehensive training. In addition, they are present in the module throughout the day and are readily accessible should you encounter difficulties at any time during testing. Please coordinate directly with them if training is required. Additionally, please relay any problems to staff members immediately so that they can be addressed/corrected.

Module access and associated costs:

There are no charges associated with the use of equipment in Module 1. Access to the module is provided using a calendar sign-up system. The link for the scheduling mechanism is being established and will be inserted into this site as soon as available. If you need help with scheduling, either of the module managers (Dr. Mysona or Dr. Xiao) will be glad to assist.

Guidance for experimental design for studies of visual function

Investigators who would like to discuss appropriate methods for testing visual function are welcome to contact the module directors (Dr. Smith or Dr. Tawfik) for guidance.

Animal care and use considerations

Each PI must have their own IACUC-approved protocol to conduct specific visual function tests using this module including specification of the appropriate anesthetic for procedures. It is expected that all investigators will adhere strictly to the guidelines for animal care and use set forth by the Association for Research in Vision and Ophthalmology (ARVO).

Responsibilities associated with module use

DATA STORAGE: It is impractical and unwise to store data of a large number of investigators on the hard drives of computers that could fail. Therefore, investigators are expected to utilize a reliable system (BOX) to store data. Note: for the Biopitigen system a specialized "porter" is used for data storage. Module staff can provide the ordering information for the porter.

ANIMAL ANESTHESIA: Investigators must provide their own anesthesia. If any anesthesia includes DEA-controlled substances, it is the sole responsibility of the PI to obtain proper Federal/State DEA licenses and to ensure that proper records are maintained for substance use and disposal. Those records will reside within individual users laboratories (not in Module 1). Module 1 staff members cannot supply or administer any anesthesia to any experimental subjects.

Citation

Please cite the NEI Center Core Grant for Vision Research - **P30EY031631** in your publications if you use the instrumentation offered in this module.