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)
- Optomotor Response (OMR)
- *In vivo* imaging including spectral domain optical coherence tomography (SD-OCT)
- Fundoscopy and fluorescein angiography (FA)
- Slit-Lamp microscopy
- *In vivo* corneal confocal microscopy (IV-CCM)
- Laser induction of vasculopathy
- Assessment of Intraocular Pressure

Location and Contact Information

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

Phone: 706-721-3449

Hours of Operation: 9:00 AM – 5:00 PM

Contacts:

- P30 Director: Dr. Yutao Liu (yutliu@augusta.edu)
- Core Director: Dr. Jing Wang (jwang1@augsuta.edu)
- Co-Director: Dr. Ming Zhang (mzhang@agusta.edu)
- Core Manager: Dr. Barbara Mysona (bmysona@augusta.edu)
- Core Operations: John Carpenter (jcarpenter@augusta.edu)

Instrumentation available to assess visual function

Assessment	Instrumentation	Application	Technical Support
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.
OMR	Cerebral Mechanics Inc. OptoMotry system	Virtual reality system for rapid quantification of optomotor 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. Two instruments are available for investigators.	The system is operated using proprietary Bioptigen software and features the InVivoVueTM 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 SDOCT and the software. They will be able to conduct their own analyses. Support is available throughout the session if there are difficulties.
Fundus Imaging and 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 instrumentation 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 ImageGuided 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. Screens are provided to protect against laser-induced 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.
Slit Lamp Microscopy	Zeiss SL 800 Slit lamp with 2 Additional available instrument: SL-DR slit-lamp (Topcon Medical Systems)	The Zeiss instrument is a state-of-the-art high resolution slit lamp that allows extensive illumination options and is user friendly. It permits 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 magnifications of 6, 10, 16, 25, and 40X.	Investigators will be trained by Module 1 personnel to use the slit lamp and will be able to conduct their own analyses. Support is available throughout the session if there are difficulties.
IV-CCM	Heidelberg Engineering HRT3 RCM	The HRT3 RCM is a cutting-edge corneal imaging system that uses confocal scanning laser microscopy to provide high quality images of the cornea. It has a 400 x 400 µm field of view and can scan the entirety of the cornea, from the epithelium to the epithelium with stunning quality.	Investigators will be trained by Module 1 personnel to use the IV-CCM 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 hand-held tonometers available to measure IOP in lightly anesthetized animals. Data is 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 core 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 and 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 iLAB, the electronic calendar sign-up system. Details about the resources can be found on the iLAB website: https://augusta.corefacilities.org/sc/5663/visual-function-assessment-core/?tab=equipment. If you need help with scheduling, please reach out to John Carpenter using his email address.

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 director (Dr. Wang) for guidance

Animal care and use considerations

The module is inspected regularly by LAS, however 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 from a large number of investigators on the hard drives of computers that could fail. Therefore, investigators are expected to utilize a reliable system (such as 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 pharmaceutical 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. There are anesthesia chambers associated with certain instruments (slit-lamp, laser system), which are fully available to users.

Citation

Please cite the NEI Center Core Grant for Vision Research - P30EY031631and list our RRID (**SCR_027277**) in your publications if you use the instrumentation offered in this module.

Research Resource Identifiers (#RRID) are ID numbers assigned to help authors identify all key biological resources including core facilities, support the proper citation and authentication of each resource, and enable the FAIR sharing of resource information. RRIDs are part of the MDAR checklist, a pan-publisher rigor and transparency checklist created and endorsed by major publishers. RRIDs are also part of the NISO JATS standard, the journal article tagging suite.