

# Vision Science Research Center Core Modules



Dr. Kent Keyser - VSRC Director

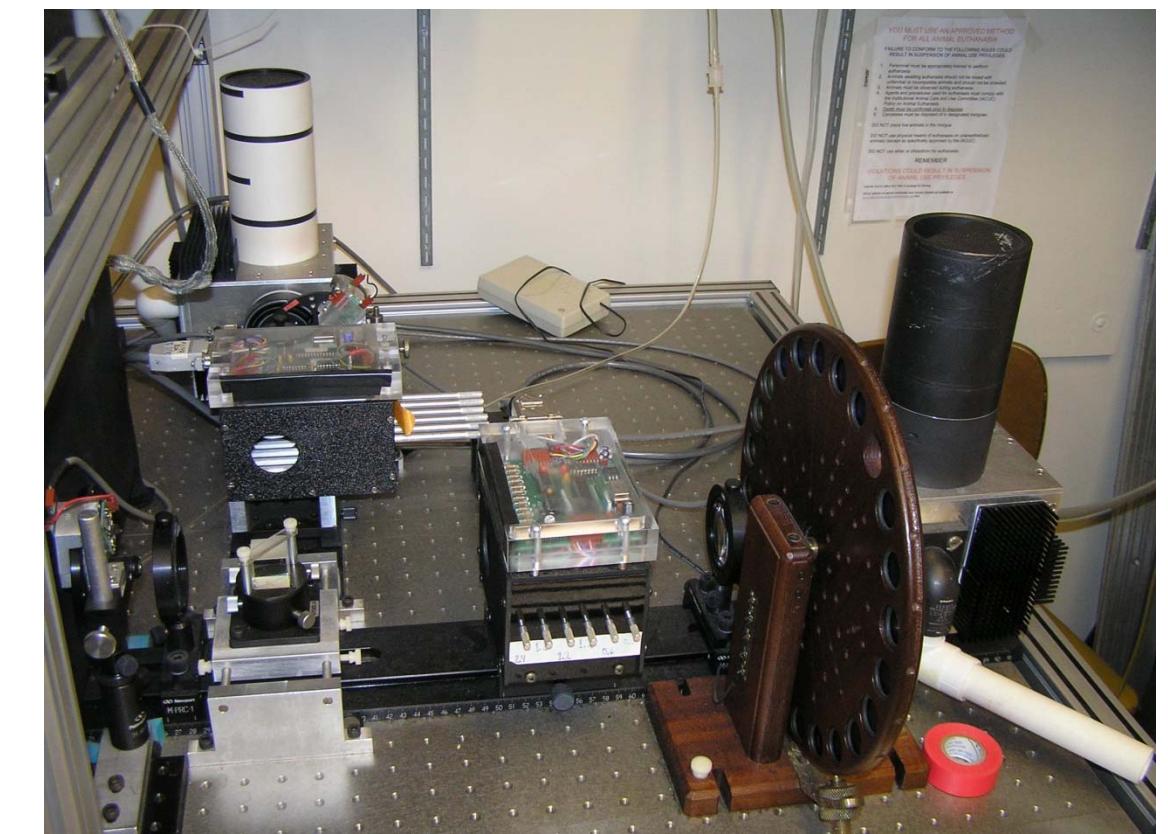
Dr. Steven Pittler - VSRC Core Grant PI

Dr. Christine Curcio - VSRC Core Grant co-PI

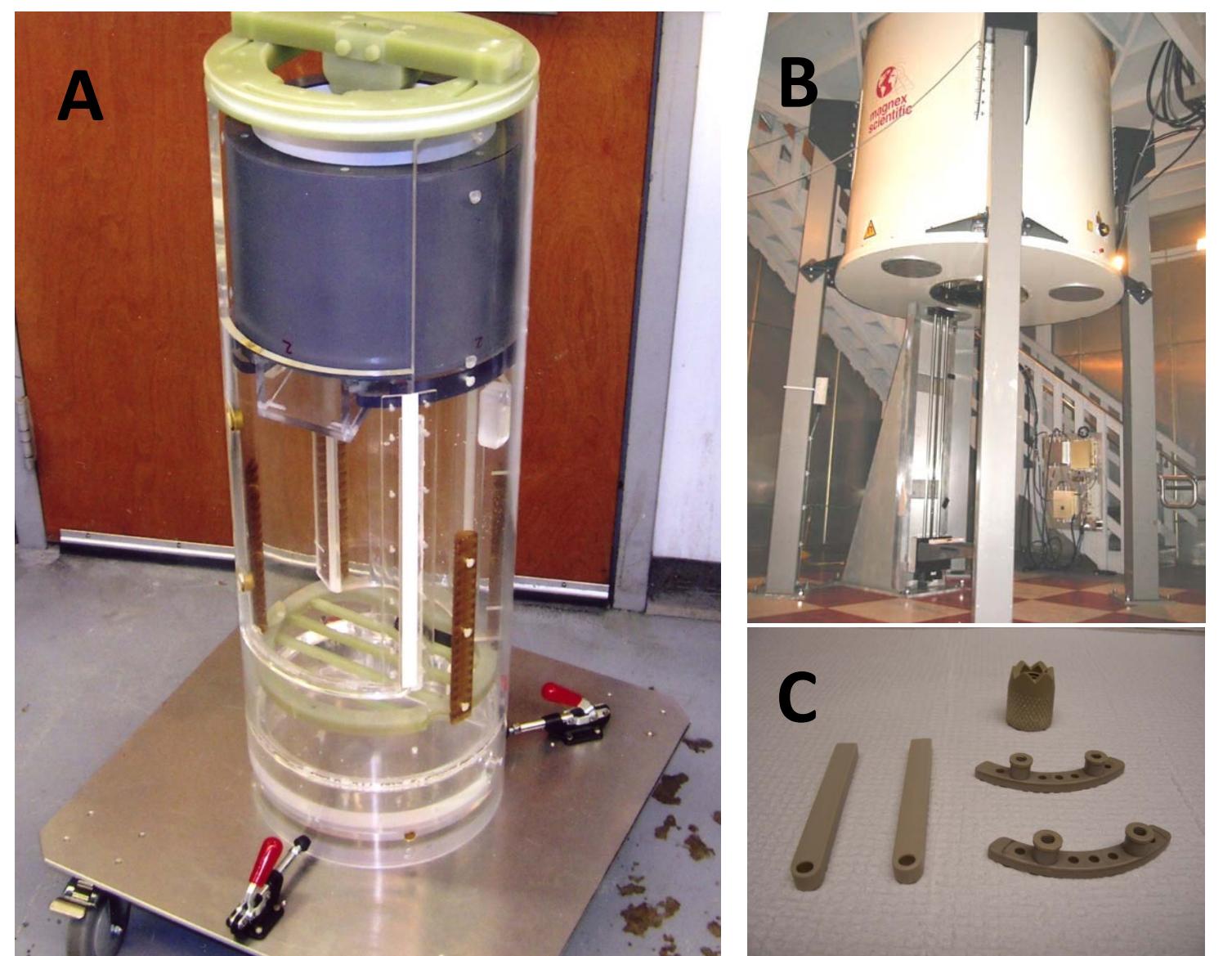
## VSRC Machine Shop Module

Dr. Paul Gamlin – Director

Jerry Millican – Module Manager ([jmillican@uab.edu](mailto:jmillican@uab.edu))



Instrumentation developed for a computer-controlled ultra-rapid change of the spectrum characteristics of a beam of light delivered to in-vitro rabbit retinas during patch-clamp recordings. This is achieved by a fast, servo-controlled filter wheel. A LED-based coding of the wheel position – observe the LED array on the wheel support and the small holes on the wheel – provides a feedback to the computer of the filter presented at that moment.



The VSRC machine shop plays a critical role in the development and fabrication of equipment and parts for vision and oculomotor research on trained behaving non-human primates (NHP). Panel A shows a NHP chair, including the head holder and the RF head coil, used in the 4.7 Tesla NHP MRI/fMRI system of the Center for the Development of Functional Imaging (panel B). The shop can also fabricate high-precision small parts, like the NHP head holder parts shown in panel C, recording chambers, chamber caps, etc. Many of these parts are made from blocks of extra-hard thermoplastic PEEK, which can then be precisely shaped using heat during the surgery. They are also fully MRI compatible when used with bone-compatible ceramic screws.

### VSRC Machine Shop Module

The VSRC Machine Shop Module is a fully-equipped shop which includes a milling machine, a lathe, horizontal and vertical band saws, a drill press, a planer, a belt sander, and a variety of hand tools.

### Services include:

- design and fabrication of new research instruments, in collaboration with the Electronics and the Computer Modules
- repair, modification, retooling, and replacement of parts of existing equipment
- technical assistance for any kind of machine shop and mechanical needs
- assistance in the selection and purchasing of tools, parts, and other mechanical equipment

## VSRC Computer Module

Dr. Claudio Busettini – Director

Alex Zotov – Module Manager ([azotov@uab.edu](mailto:azotov@uab.edu))

The **VSRC Computer Module** provides VSRC members with design and development of custom software systems, technical support and assistance with computer hardware and software. The Computer Module administers VSRC network and developed and maintains VSRC web site and online scheduling services. The Computer Module works closely with investigators and collaborates with other Modules to design and develop custom commercially unavailable systems required to manage experimental equipment and to process experiment data.

**ZStim** is the fully-integrated software system that was developed for whole-cell patch-clamp recordings experiments performed on rabbit retina in vitro. The software, developed in LabVIEW and Matlab, provides an efficient graphical user interface and allows to simultaneously display static or dynamic visual stimuli and to acquire cell responses from a microelectrode or a microelectrode array.

Zstim also provides control of external devices as a picoinjector, light sources and other. Some of the electronic interfaces were developed by the VSRC Electronic Module and some of the mechanical servo-mechanisms by the VSRC Machine Shop. Similar projects were developed or are in development for other VSRC laboratories.

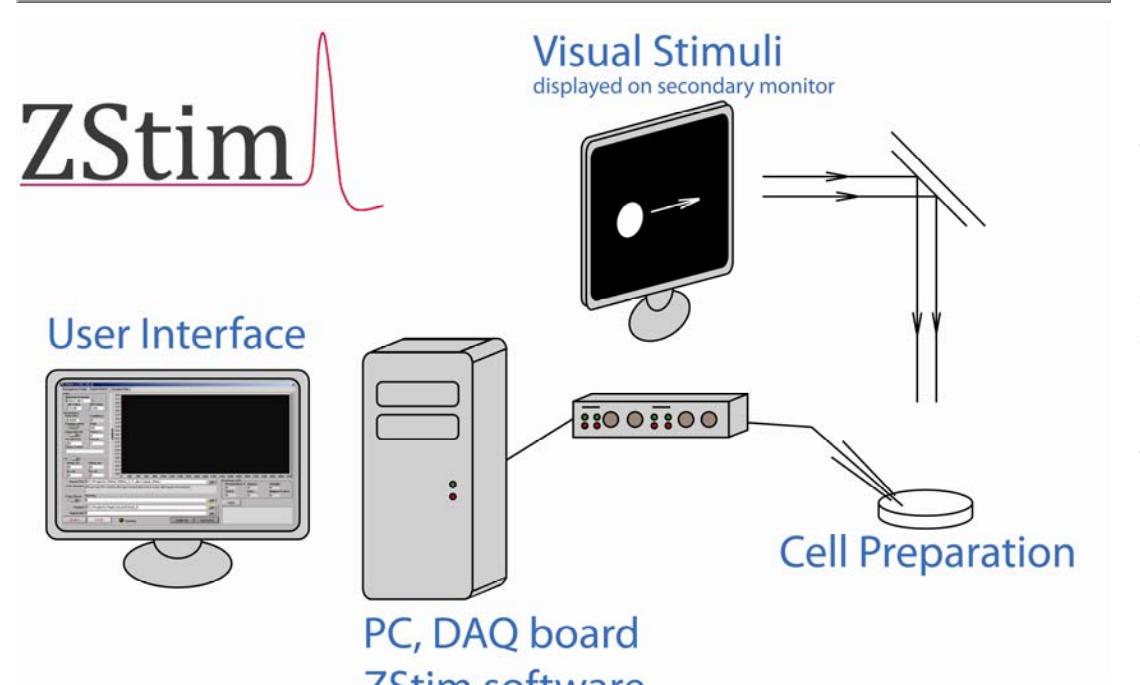
**A:** The customized graphical user interface allows the investigator to specify parameters of experiment execution, data acquisition and recording. All parameters of the static and dynamic visual stimuli that are displayed during the experiment can be preselected using input files. The frequency and timing of the digital outputs controlling a picoinjector and other devices can be specified through the user interface as well.

**B:** The sample setup includes the main computer equipped with dual monitor, data acquisition board and full version of ZStim software. Visual stimuli presented on the extension display are projected to the cell preparation. An electrode or an electrode array detects cell responses that are digitized and stored for off-line analysis.

ZStim Lite version is available and was designed to create, test and view visual stimuli on single monitor computers with no data acquisition. Zstim Matlab version is also available and it allows to view and analyze visual stimuli on computers with no LabVIEW installed.

### Services include:

- development of specialized real-time and off-line laboratory software
- development of customized hardware/software interfaces
- computer assistance, maintenance and upgrades
- website authoring, hosting and development of web applications
- network administration for the Worrell building
- development and maintenance of online scheduling services for shared instrumentation
- scientific poster printing and poster design



## VSRC Electronic Module

Dr. Yuhua Zhang – Director

Abidin Yildirim, PhD – Module Manager ([yildirim@uab.edu](mailto:yildirim@uab.edu))

### Programming Languages and Programming Environments

LabVIEW

Matlab and Phytotoolbox

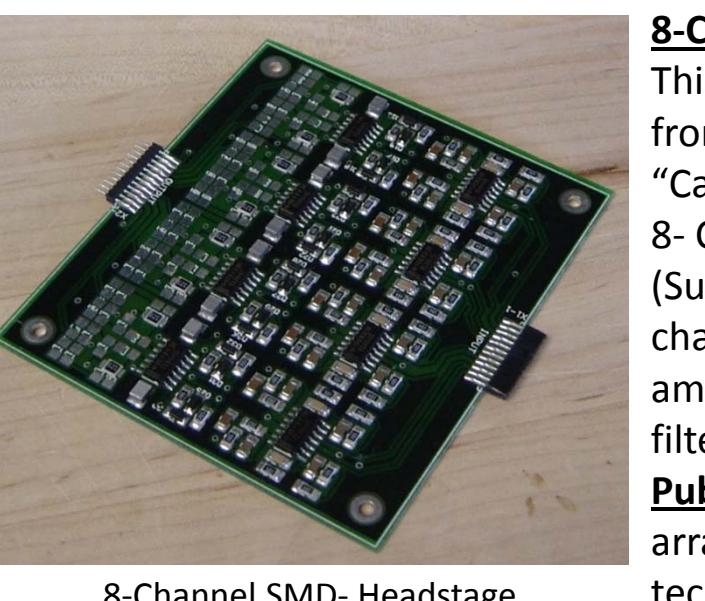
PHP , JavaScript

C/C++, Java

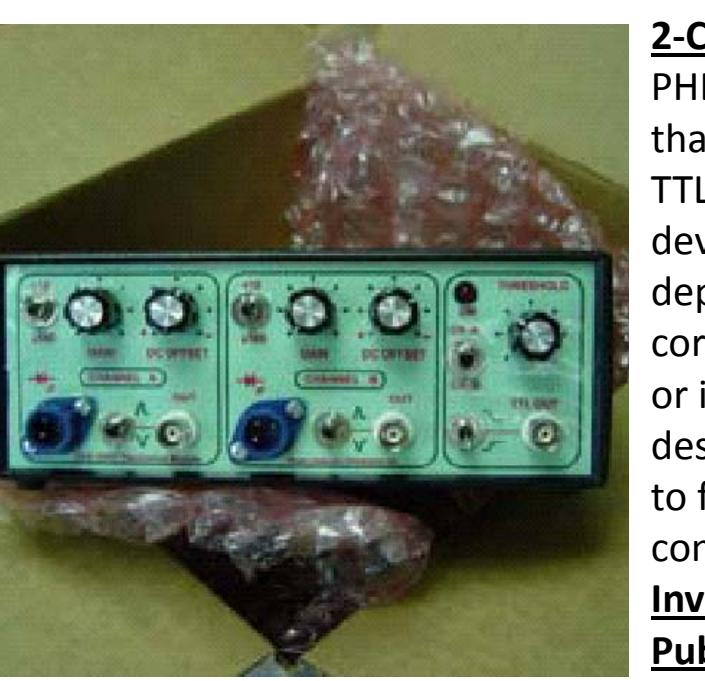
Java 3D, Adobe Flash

Joomla! , SQL

### Custom Research Devices



8-Channel SMD- Headstage



**8-Channel Headstage and Amplifier**  
This 8-Channel amplifier system is designed to record from retinal ganglion cells with a custom in-house "Carbon Fiber Micro-electrode array". To the left is an 8-Channel sub-unit circuitry PCB with SMT (Surfacemount Technology) assembly. Each electrode channel has a pre-amplifier (Gain 20) and end-amplifier (total gain of 5000x) a LPF with 60 Hz notch filter. **Investigator:** Frank Amthor, Ph.D.  
**Publications:** "A new transparent multi-unit recording array system fabricated by in-house laboratory technology", F. Amthor, J. Tootle, A.Yildirim.

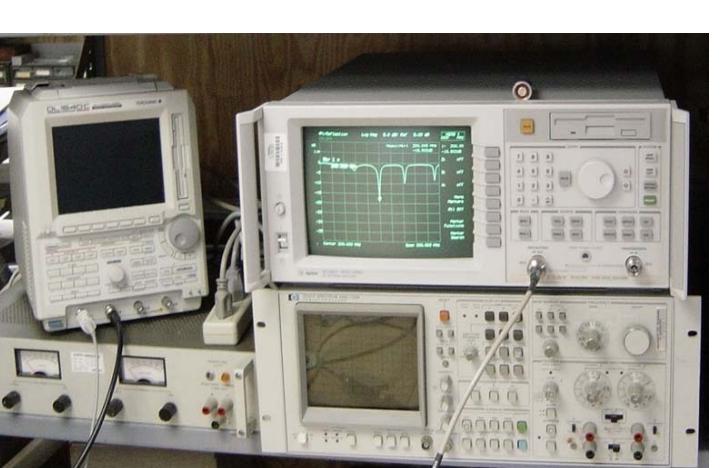
**2-Channel Photo Detector**  
PHD 0202 is a custom universal photo detector unit that provides an adjustable gain, DC offset control, and TTL-synchronizing capability to trigger an external device. It has 2 photo detector channels that can be deployed together for detecting correlation of 2 signals resulting from a single stimulus or independently. A unique, suction type of detector design (optional) enables attachment of the detector to flat surfaces such as a PC monitor or TV screen for convenient detection of optic stimuli.  
**Investigator:** Tim Kraft, Ph.D.  
**Publications:** "A new transparent multi-unit recording array system fabricated by in-house laboratory technology", F. Amthor, J. Tootle, A.Yildirim.

VSRC's core Electronics Module shop is staffed by a full time electrical/electronics engineer who is available to VSRC members for system consultation, circuit design and equipment manufacturing, and computer interfacing tasks. From original idea to completion of each project, the module engineer designs and fabricates various types of research equipment that are used in our vision research labs as well as in the classrooms. Additionally, shop engineer can modify and customize commercially obtained research equipment according to the research requirements. One other major benefit of the Electronics Module is convenient on-site repair services for lab equipment and tools to save researchers time and money.

VSRC support services are generally available for grant holders; however, services for collaborative projects with VSRC members are also available. Many materials required for fabrication and repair are stocked by the Module. Materials and parts not in stock and specific to a project, as well as the cost of manufacturing bare electronics PCB's, will need to be covered by the investigator funds.

### Selected Module Instrumentation

- LeCroy and YOKOGAWA digital oscilloscopes
- General purpose pulse/ function generator(YOKOGAWA)
- LabView 8.6 Full Development System with A/D and D/A
- CadSoft EDA –Electronics Circuit Design and Layout
- Various Multimeters (METEX, FLUKE)
- HP-Spectrum analyzers
- Data Loggers (FLUKE)
- Variety of power supplies
- SMD assembly tools and microscope

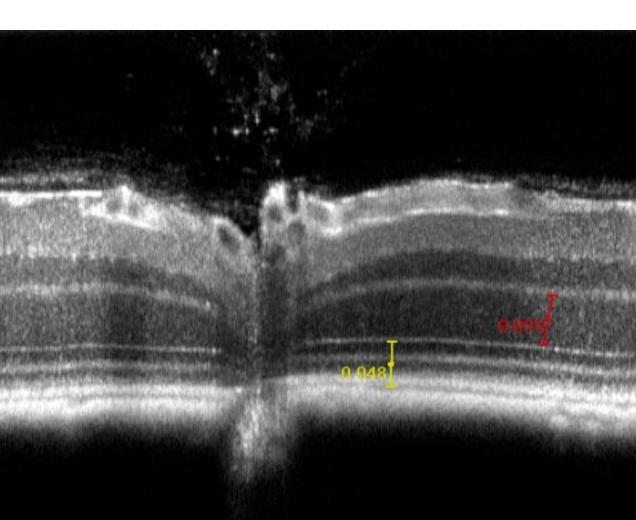


Selected E-Module measurement tools

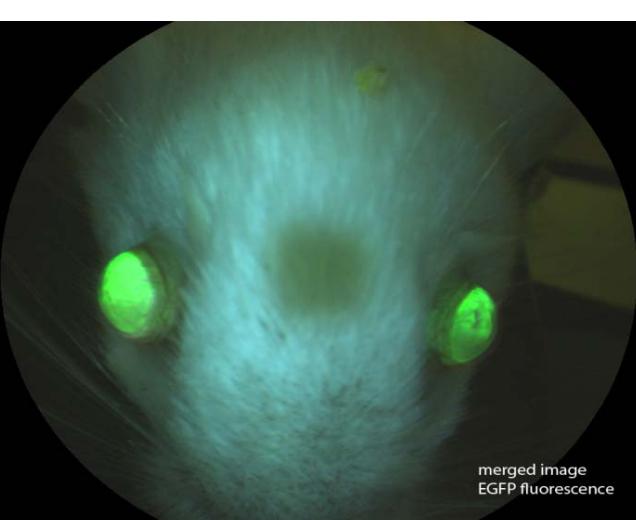
## VSRC Molecular and Cellular Analysis Module

Dr. Steven Pittler – Director, Dr. Shu-Zhen Wang Co-Director

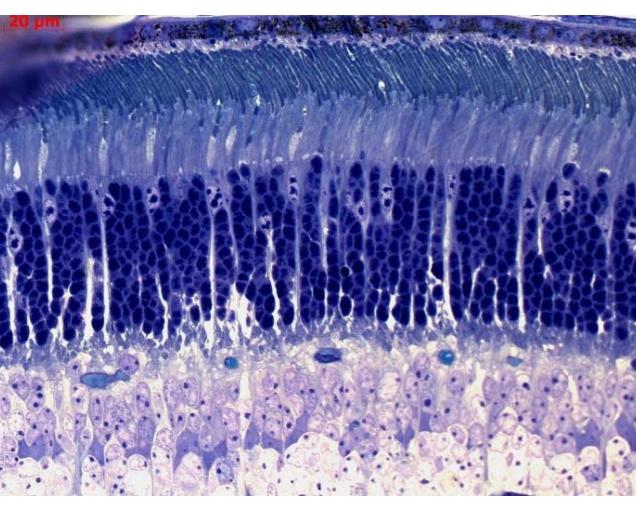
Vincenzo Guarcello – Module Manager ([vguarcello@gmail.com](mailto:vguarcello@gmail.com))



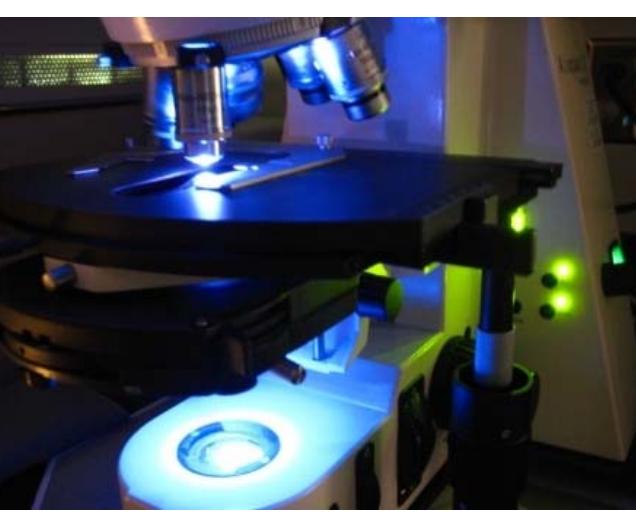
Mouse retina image obtained by Optical Coherence Tomography. Our Bioptigen 840 nm SDOCT allows for non-invasive high resolution imaging of the cornea and retina or any wave penetrable tissue. S. Pittler, H. Fortinberry, S. Sarfare, J. Messinger.



rho-EGFP expression in an albino rat eye imaging using a Phoenix Laboratories Micron III digital fundus microscope with fluorescence capabilities. This instrument is used to obtain semi-invasive high resolution fundus images and movies from mice and rats. T. Wensel, J. Wilson, S. Pittler, A. Gross.



Microscope image of retinal slices of GARP2 Tg mice obtained on our Zeiss AxioPlan2 Microscope. The mouse retina was embedded in Epon, sections were cut at 0.5 mm and stained with toluidine blue, for visualization of cell layers within the retina. S. Sarfare, J. Messinger, S. Pittler



Zeiss AxioPlan2 Microscope with broad range fluorescence capabilities including DAPI, TRITC, FITC and Cy5 filters. This scope has Z-stack capabilities. The objectives are 10X, 20X, 40X, 63X and 100X. The 63X and 100X are oil immersion lenses. H. Fortinberry

**The Molecular and Cellular Analysis Module** offers equipment usage and consulting for molecular biology and histology experiments, as well as, non-invasive imaging of the eye in a variety of animal models. Our goal is to facilitate the research efforts of investigators throughout UAB with primary emphasis on support for UAB vision scientists. Below is a list of some of the equipment available for use:

Bio-Rad iQ5 thermo cycler for real-time quantitative PCR  
Zeiss Axio-Plan2 microscope for fluorescence and light microscopy  
Leica Cryostat for cutting frozen tissue sections for histologic analysis  
Beckman and Eppendorf Centrifuges: micro, swinging bucket and ultra high speed  
Bioptigen 840 nm SDOCT ultra high resolution Optical Coherence Tomography  
Micron III digital fundus microscope with fluorescence capabilities

More information can be obtained by visiting our website at [www.vsrc.uab.edu](http://www.vsrc.uab.edu). In addition to the website; specific details on what is available in this core and other Core Modules can be obtained by contacting the Module Manager at the e-mail addresses listed above.