11-25-2013

Purdue Bioscience Imaging Facility

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The Bioscience Imaging Facility provides both the instruments and expertise needed to visualize molecular probes in preparations ranging from single cells to entire animals. The facility provides service to all interested users, including clients not associated with Purdue University. All facility users receive individualized training as well as project specific advice for optimal data acquisition. Consultation on sample preparation, image processing, and data analysis is also available. Collaborations and contract research services are encouraged.

- **Nikon A1R Confocal Microscope.** This system features a Ti-E inverted microscope equipped with high NA objectives, a motorized stage, seven visible lasers at 445nm (Cyan), Argon (457nm, 476nm, 488nm, 514nm), 561nm and 640nm and either five independent detectors or a 32-window spectral detector. It has the transmitted detector for DIC-like confocal imaging. It is equipped with a hybrid scanner (galvanometer and resonant) for multi-mode imaging applications. The resonant scanner and piezo z-drive allow 3D image acquisition at multiple frames per second. A Tokai Hit live imaging chamber is optionally available. The hardware based Perfect Focus System makes maintaining “perfect focus” on the cells or area of interest easy and stable for both short and long term live cell time-lapse experiments. NIS-Elements software encompasses acquisition through analysis, including modules for FRAP and FRET experiments.

- **Nikon N-SIM / N-STORM Super Resolution Microscope.** The system is built around a Ti-E inverted microscope equipped with high NA objectives, a motorized stage, piezo z-drive and perfect focus system. Continuous STORM (or dSTORM) can be performed on dyes that activate with 405 nm, 488 nm, or 561 nm light. A 647 nm laser is available to drive the reporter to the dark state when used with the tandem dyes used in original STORM imaging or to perform cSTORM using AlexaFluor647. SIM can be performed with blue, green or red dyes. The TIRF capability uses the STORM lasers and high-speed, multi-color TIRF (10 ms/channel) is possible using triggered acquisition.

- **Nikon A1R MP Multiphoton Microscope.** This confocal system is built on the Nikon TiE inverted microscope equipped with the tunable Spectra Physics Mai Tai DeepSee Ti:Sapphire laser (690-1040nm) for deep tissue or other unique Multi-Photon imaging. The confocal also has a set of 7 visible lasers at 405nm (DAPI), Argon (457nm, 476nm, 488nm, 514nm), 561nm and 640nm for standard four channel confocal imaging. It has the transmitted detector for DIC-like confocal imaging. It is equipped with the hybrid scanner (galvanometer and resonant) for multi-mode imaging applications.

- **Nikon 90i Epifluorescence Microscope.** This upright, automated microscope is suitable for most forms of wide-field microscopy. Cameras include a DS-Ri1 color camera for standard applications, or alternatively, a Photometrics QuantEM:512SC CCD for imaging extremely weak signals and/or large dynamic ranges at up to 100s of frames per second.

- **Nikon Ti-S Microscope.** This inverted microscope is equipped with phase contrast, brightfield and a Zenon light source for fluorescence imaging. It is also equipped with a ultra-high sensitive Photometrics QuantEM EMCCD camera for both low light and high dynamic temporal imaging applications.
Zeiss LSM 880 Confocal Microscope. This system features Zeiss Axio Examiner.Z1 upright microscope equipped with motorized XYZ movement. The lasers include 405nm, 458nm, 488nm, 514nm, 561nm and 633nm. It is equipped with a 32-channel GaAsP spectral PMT plus 2 MA-PMTs as well the transmitted light PMT. Our selection of objectives includes; Plan APO 5x/0.16, 10x/0.45 and 20x/0.8, 63x/1.4 oil; water dipping objectives that do not require coverslips include Plan APO 20x/1.1 and 40x/1.0; water immersion objectives requiring coverslips are 20x/1.0 and 40x/1.1. Software modules include base Zen plus Experimental Designer, Tiles/Positions, Visualization and Analysis and Deconvolution.

IncuCyte S3. The IncuCyte S3 is a compact dual fluorescent and HD-phase contrast live-cell imaging microscope placed within a standard tissue culture incubator. It has a rotating objective turret with 4x, 10x and 20x objectives that allow concurrent experiments requiring different magnifications. The 2 fluorescent channels have the following bandpass excitation and emission wavelengths: Green: EX - 440nm-480nm, EM - 504nm-544nm and Red; EX 565nm-605nm, EM - 625nm-705nm. This scope enables multiple dish observation (up to 6 multi-well dish format vessels) and quantification of cell behavior over time by automatically gathering and analyzing images around the clock. Data acquired from the time points is used to generate movies and/or graphical data for quantitative measurements of multiple cellular applications. The instrument can measure proliferation, apoptosis, viability, phagocytosis, cell migration, 3D spheroid growth, stem cell colony control and can detect fluorescently labeled proteins, ligands and reporter gene activation.

Spectral Ami Optical Imaging System. The SPECTRAL Ami optical imaging system is an easy to use yet powerful in vivo imaging system. It is designed around SI Imaging’s rigid backbone which serves as a stable spatial configuration. This structural integrity ensures highly accurate and easily reproducible images and calibrations. The door to the Ami units opens vertically for ergonomics, maximizing valuable bench space and providing waste anesthesia gas control. It can perform either Fluorescence or Bioluminescent Imaging with a standard photography overlay. Excitation and Emission spectra include; EX: 430,465,500,535,570,605,640,675,710 and 745nm; EM: 510,650,670,690,710,750,770,790 810 and 830nm. Software includes quantitative analysis features as well as multi-well template guide for measuring intensities on multi-well dishes.

Caliper IVIS Lumina II. The IVIS Lumina II is a robust optical imaging system. The Living Image software enables background subtraction, automated acquisition and quantification, as well as common image processing routines. It can perform either Fluorescence or Bioluminescent Imaging with a standard photography overlay. Excitation and Emission spectra include (these are bandpass filters); EX: 445-490, 500-550, 615-665, 710-760; EM: 515-575, 575-650, 695-770, 810-875. Software includes quantitative analysis features as well as multi-well template guide for measuring intensities on multi-well dishes.

MILabs U-SPECT-II/CT/PET. A combined single photon emission CT / x-ray CT. The unique VECTor, combines true simultaneous SPECT and PET down to sub-mm resolution in mice. The SPECT and PET systems are capable of making 4D movies of pharmaceutical interactions in tissue with a time resolution of seconds. The ultra-high gamma detection yield makes these units suitable for a wide variety of SPECT and PET isotopes. The large number of focused pinholes facilitate the detection of a large number of gamma quanta from the area of interest (e.g. the heart, a tumor, a joint or the brain). Using the same focusing collimator, it is possible to obtain total-body scans of mice at approximately 0.25mm by shifting the bed in x, y and z direction, and to acquire gamma
radiation from an arbitrarily large part of the animal. The VECTor+/CT is fully integrated with a high resolution, low-dose CT scanner (down to 0.08mm resolution) with automatic co-registration of SPECT, PET, and CT images. Two different stage beds for either mice or rats (or other objects similar size and weight) are available to be used for any of the SPECT, PET or CT imaging. A variety of different collimators are available ranging in resolution and sensitivities. Acquisition software allows post hoc sorting of incident photon data for energy thresholding, multi-channel acquisition or temporal binning relative to biological triggers (gating). A MLEM or POS-EM algorithm is available for SPECT reconstruction.

- **Perkin Elmer Quantum CX microCT.** This multispecies imaging system provides high-resolution/high speed images at an X-ray dose low enough to enable true longitudinal imaging capability. It can also be used for non-biologic imaging with a lower resolution down to 4.5 mm. The scanner acquires high-quality slice images which are rendered for 3D visualization. The system is appropriate for preclinical longitudinal studies of small animals. It is equipped with an anesthesia device for in vivo imaging. The imaging system uses a cone beam X-ray source and a flat panel X-ray detector to produce high resolution 3D images of animal bone structure and surrounding soft tissue.

- **Accessories.** A Tokai Hit (INU-TIZ-F1) live imaging chamber and 5%CO2 are available for use with any of the inverted microscopes. A cell culture hood and 5%CO2 incubator are provided for short term culture storage and basic manipulations. NIS-Elements, Zen and Image J are supported and available for image analysis. For whole animal imaging, isofluorane vaporizer units, ECG, respiratory monitor, temperature probe and BioVet software are available for anesthesia and vitals monitoring during imaging sessions.

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Keywords: imaging, confocal, super resolution, multi-photon, epifluorescence, fluorescence, bioluminescence, chemiluminescence, CT, microCT, SPECT, PET, live imaging, whole animal imaging