

# NYUAD Facilities, Equipment and Resources

## **Major Research Facilities**

### ***Laboratory***

Dedicated 800 square feet of modifiable modular design laboratory space equipped with power supplies and in house laboratory grade water production. Equipped with two-stereo Nikon fluorescent microscopes with LED driven lighting sources, outfitted for optimal imaging and image capture of zebrafish embryos. Includes digital capture dedicated cameras suitable for publication quality images, and image analysis. Refrigerated Centrifuge with digital control, electrophoresis power supplies and gel apparatus, western blot transfer apparatus with fast. Four dedicated -20 and -80 degree storage for chemical and biological samples. Ample laboratory supplies, pipets, carboys, glassware, and separated storage for chemicals and glassware. In house compressed air, vacuum and grounded power supply throughout.

### ***Vivarium***

The NYUAD Vivarium a new facility in which construction was completed in 2014. It is a 58,269 square foot facility located in the basement of the Experimental Research Building (ERB). There are 8 animal holding rooms with a cage capacity of 480 cages per room, which is a total of 3,840 cages. The caging equipment being used are Tecniplast IVC cages. The facility has two surgical procedure rooms, a receiving room and one necropsy room. The Vivarium major equipment consists of a Bulk autoclave, 2 Rack washers, Bedding Dispenser, bottle filling station, RO water system, and downdraft table.

### ***Zebrafish Facility***

Two independent zebrafish research habitat systems with automated control and dosing systems, controlling for pH, temperature and salinity. Includes filtration, UV sterilization, and light control capabilities. These systems are housed separately from the mechanical and filtration components of the system in an adjoining room. There is capacity to house greater than 15,000 adult zebrafish in each system, contained in a 700 square foot habitat room. There is a standalone zebrafish quarantine system with remote monitoring, separate from the two large habitat systems allowing for isolation and observation of zebrafish imported from laboratories and collaborators at other institutions. There is separate laboratory space for microscopy and injection stations for manipulation of zebrafish embryos.

## **Research Environment**

The NYU Abu Dhabi (NYUAD) Institute is a center of advanced research, scholarly and creative activity, and public workshops. Programs of the greatest rigor and creativity incubate and guarantee the formative presence of the research university in NYUAD. The Institute sponsors and coordinates major academic conferences, lecture and film series, research workshops, and exhibitions. It offers outstanding facilities, research funding at a significant level and with

exceptional continuity of support, and a vigorous, cohesive and interactive intellectual environment.

### **High Performance Computing**

Research Computing Services (RCS) at NYUAD is a set of services that supports researchers use of IT as an enabler for their research activities. It provides High Performance Computing (HPC), Research Application Hosting, Professional Services, and Research Lab Support Services.

NYUAD's HPC cluster plays a critical role in supporting the computational requirements of the NYUAD research community. It is also connected to Ankabut, the UAE's national research and education network, supporting high-speed connectivity between educational, research, and non-profit organizations in the country.

The supercomputer is the fastest in the UAE, a state-of-the-art resource was built by Hewlett-Packard and is currently maintained at the Injazat headquarters in Abu Dhabi. It runs at approximately 70 teraflops, and consists of 512 super-dense compute nodes, each of which has a memory capacity of at least 48 gigabytes. Additional memory nodes supply 192 gigabytes of RAM, with an additional terabyte node dedicated for NYUAD's Center for Genomics and Systems Biology. Graphics processing units and visualization nodes included in the system are used for specialized functions, such as the translation of data into images.

### **Core Technology Platforms**

NYU Abu Dhabi has dedicated significant resources to developing one of the premier science and engineering research laboratories in the region. An integral component of the laboratories are the Core Technology Platforms (CTP), which are shared facilities that support research activities across disciplines. Each CTP consists of a suite of research-grade equipment and are defined by the type of research they facilitate. The CTPs will continue to evolve and develop as new technology is added and new areas of research are conducted at NYUAD.

CTPs are overseen by Faculty Directors/Directors who oversee their development and management, and liaise with faculty and researchers about current and future research requirements. Support is provided by a team of highly-qualified specialists who maintain and upgrade the equipment, define standards for operational performance, and provide service across the CTPs.

Relevant CTPs include:

#### ***Analytical and Materials Characterization***

The Analytical and Materials Characterization CTP aids in the investigation of the characteristics, properties, structures, and performance of a variety of materials, from the level of the millimeter, to the micrometer, to the angstrom.

#### Relevant Equipment List:

- Confocal Raman AFM SNOM Combined System: Witec Alpha 300
  - Combined Witec alpha 300 system - the design of this system features a Confocal Raman Microscope, a Near-Field Optical Microscope and an Atomic Force Microscope in a single instrument.
  - The confocal Raman imaging system offers the unique ability to acquire chemical information non-destructively with a resolution down to the optical diffraction limit (~ 200nm). This allows you to observe and analyze the distribution of different phases within a sample in ambient conditions without specialized sample preparation.
  - For scanning near-field optical microscopy, this system uses unique and patented micro-fabricated Cantilever SNOM-sensors that significantly outperform standard fiber optic probes in resolution, transmission, ease of operation and reliability. The cantilever, employing the well established beam deflection principle for distance control, features a hollow pyramid with an aperture at its apex. This allows topography and optical images to be acquired simultaneously. Typical applications for SNOM are found in materials science, life science, and nanophotonics or nanotechnology.
  - The inclusion of a special AFM objective allows simultaneous cantilever and sample observation, which provides precise cantilever positioning and rapid alignment. The user-friendliness and versatility of this composite system can benefit an enormous variety of scientific endeavors.
- Scanning Electron Microscope: FEI Quanta 450FEG (HV/LV/ESEM)
  - The Quanta 450 FEG is a field emission scanning electron microscope capable of generating and collecting images from variety of sample material. It is versatile and high-resolution, operating in high and low-vacuum, with extended low-vacuum capabilities for characterization, prototyping, and in-situ analysis. This FE-SEM is equipped with EDAX elemental analysis, WetSTEM Detector , Beam Deceleration, In-Column Detector, Retractable Annular STEM Detector, Plasma Cleaner, Peltier/Heating Stage, and 1000° C Heating Stage.

#### ***High-Throughput Screening***

The High-Throughput Screening CTP is used by biologists and chemists to automate tests using biological and chemical materials. This technology is used in drug discovery, toxicity studies, and cell biology research, and allows researchers to quickly automate the production of millions of chemical and biological tests.

#### Relevant Equipment List:

- Agilent Bravo Automated Liquid Handling Platform
  - The Agilent Bravo Automated Liquid Handling Platform is both versatile and precise. Pipette heads can be changed in minutes, and numerous platepad

options are available to enable a wide range of assays, the Bravo platform uses proven high-accuracy pipette heads for dispensing from 100nL to 200µL in 96- and 384-well microplates with either disposable or fixed tips for specific applications.

- The workstation is equipped with 96LT disposable tip heads. An EnVision plate reader is integrated to enable the platform to run both fluorescent and luminescent assays. A PlateLoc Sealer, Microplate Labeler, Teleshakes, a Magnetic Bead Plate, Vacuum Filtration station, Heating/Cooling pads, and Trash Chute are included to equip the system.
- The workstation provides an effective solution for automation of laboratory protocols that are needed for high throughput procedures used in modern genomics experiments. Notably, the workstation is configured to carry out: transfer and re-arraying of samples from 96 and 384 well plates; DNA preparation from bacterial cultures; high throughput normalization of DNA, RNA, and protein samples; library preparations for high throughput sequencing for Illumina and Ion platforms; high throughput screening including but not limited to RNAi and chemical library screenings.

### ***Light Microscopy***

The Light Microscopy CTP is equipped with devices that facilitate the viewing and imaging of both the surface and depth of live neurons and other living tissue. Equipment in this CTP can be used to obtain high-resolution images of fluorescent samples at specific depths and can produce scans of moving neurons at up to 428 frames per second.

It is equipped with devices that allow the imaging of transparent samples using different contrast methods including phase contrast, differential interference contrast (DIC), and fluorescence. The microscopy CTP includes standard bright field microscopes and fully automated laser scanning microscopes (upright and inverted) that enable multicolor imaging of surfaces and 3D volumes with diffraction-limited resolution.

Current applications at NYUAD range from neuronal development studies to analysis of photo-induced chemical reactions in crystalline matter and include characterization of cell-penetrating peptides as drug delivery vectors and oncogene regulation and activation studies.

#### Relevant Equipment List:

- Olympus FV1000 Confocal/2-Photon Inverted Microscope
  - The FV1000 inverted microscope is equipped with: three confocal detectors (two spectral, one filter based); four non-confocal/non-descanned; one regular transmitted light detector for DIC; four laser heads featuring six laser lines (from 400-650 nm) controlled by acousto optical tunable filter (AOTF); two IR lasers for multi-photon imaging, stimulation, and manipulation with a tuning range of 690-1040 nm; a SIM scanner for simultaneous laser stimulation and confocal/multi-photon imaging; three objectives 10x, 30x and 60x; a diffusion measurement software module for FCS, FCCS, and RICS.

- Olympus FV1000 Confocal/2-Photon Upright Microscope
  - The Upright Confocal/2-Photon Microscope has the following features: three confocal detectors (two spectral, one filter based); four non-confocal/ non-descanned; one regular transmitted light detector for DIC; four laser heads featuring six laser lines (from 400-650 nm) controlled by acousto optical tunable filter (AOTF); one IR laser for multi-photon imaging, stimulation, and manipulation with a tuning range of 690-1040 nm; three dipping lens objectives 10x, 25x, and 60x
- Leica DMI3000 Fluorescence Inverted Microscope with Micromanipulator and Microinjector
  - The Leica DMI3000 is suitable for: polarized light microscopy; differential interference contrast microscopy DIC; fluorescence microscopy with blue, green, and red channels.
  - The setup includes: time-lapse software module; narishige micromanipulator and Femtojet microinjector.
- Leica DMI6000 DIC/Fluorescence Inverted Microscope
  - The DMI6000 is equipped with: full motorized xy-stage; fluorescence and transmitted light accessories; motorized Z-stage with software autofocus.
- Leica SP8 Confocal Upright Microscope with White Light Laser
  - The Leica TCS SP8 is ideal for confocal microscopy with optimal photon efficiency and high speed. It is equipped with: fully adjustable spectral detector unit with five channels (2 HyDs and 3 PMTs); white-light laser for unlimited combination of excitation colors; 405, 488, 514, 559, and 633 nm Laser lines; Galvo Z-stage for optimal Z-stack imaging; FoV scanner with up to 428 fps.

### ***Molecular and Cell Biology***

The Molecular and Cell Biology Core Technology Platform aids in the following activities: genomics at single-cell resolution, gene cloning and manipulation, protein expression and purification, biophysical and biochemical structural characterization of different macromolecules.

#### Relevant Equipment List:

- Microplate Reader
  - Synergy H1 is a flexible monochromator-based multi-mode microplate reader. The monochromator optics uses a third generation quadruple grating design that allows working at any excitation or emission wavelength with a 1 nm step. This system supports top and bottom fluorescence intensity, UV-visible absorbance and high performance luminescence detection.
- QPCR system
  - Applications include: gene expression analysis; microarray data validation; SNP genotyping; pathogen detection; DNA methylation analysis and chromatin immune-precipitation studies.

### ***Sequencing***

Researchers in genomics and systems biology utilize the Sequencing CTP to investigate the arrangement of nucleotides in DNA. Equipment in this CTP facilitates human genome, RNA, and gene sequencing, and can be used to sequence a whole human genome in a day. NYUAD affiliates make use of genomics, proteomics, imaging and computational technologies to address questions at all levels of biological organization — from cells to ecosystems.

#### Relevant Equipment List:

- Agilent Bioanalyzer 2100 Electrophoresis & Flow Cytometry
  - The Agilent 2100 Bioanalyzer is a microfluidics-based platform for sizing, quantitation and quality control of DNA, RNA, proteins, and cells on a single platform, providing high quality digital data.
- ECO Real-time PCR
  - The Eco Real-time PCR System delivers true 4-color multiplexing and industry-leading well-to-well uniformity to offer a new level of data quality and reproducibility that meets the needs of the most demanding applications.
- HiSeq 2500
  - The HiSeq 2500 system is a member of the revolutionary HiSeq family of sequencers, offering high output and low cost.
  - In high output mode, the HiSeq 2500 enables sequencing of a large number of genomes, exomes, or transcriptomes in a single run, allowing large studies to be completed with the fewest number of runs.
  - In rapid run mode, the HiSeq 2500 is capable of sequencing in a day exome, resequencing or RNA-Seq. The rapid run time includes automated, on-instrument cluster generation, and paired-end sequencing.
  - High output mode: 300Gb per flowcell.
  - Rapid run mode: 60Gb per flowcell in a day.
- MiSeq
  - The MiSeq system offers the first end-to-end sequencing solution, integrating cluster generation, amplification, sequencing, and data analysis into a single instrument. The MiSeq employs Illumina sequencing by synthesis technology (SBS), the most widely used, proven next-generation sequencing chemistry.
  - Enable up to 15Gb of output with 25M sequencing reads and 2x300bp read lengths.
- Ion PGM Sequencer
  - The Ion PGM Sequencer is ideal for sequencing small genomes, sets of genes, or performing gene expression profiling or ChIP-Seq. Using Ion AmpliSeq Custom Solutions, researchers can interrogate targeted genomic regions using up to 1,536 amplicons in a single tube, in a single day. The Ion PGM Sequencer is faster than any other next-generation sequencer, requiring as little as 90 minutes to do an entire sequencing run. Its speed, simplicity, and scalability also make it an ideal platform to extend into diagnostics. Scalable output from 30Mb up to 2Gb.
- Ion Proton Sequencer

- The Ion Proton Sequencer is based on the same next generation of semiconductor sequencing technology as the Ion PGM Sequencer. New high-throughput chips will enable the Ion Proton Sequencer to sequence a human genome with similar run times and single-day workflow, as the Ion PGM Sequencer.
- StepOnePlus Real-Time PCR System