## Equipment

### Life Science**[[1]](#footnote-1)**

**Mass Spectrometry**

1. GC/MSMS - Thermo Scientific TSQ 8000 Evo Triple Quadrupole GC-MS/MS, equipped with automatic liquid sampler and EI and CI (methane) sources.
2. MARKES Thermal desorption Unity-xr with Ultra-xr (100 sorbent tubes) autosampler. Interfaced to Thermo TSQ 8000 Evo GC triple quadrupole mass spectrometer.
3. GC/MS - Agilent 5973N Mass Selective Detector interfaced to a 6890 gas chromatograph which is equipped with a 7683 automatic liquid sampler with EI source.
4. GC/MS – Thermo Scientific ISQ QD single quadrupole GC-MS with Trace 1310 GC and Triplus RSH autosampler.
5. Equipped with a Phenomenex 30 m x 0.25 mm x 0.25 um ZB-FAME GC column.
6. Thermo-Finnigan LTQ LC/MSMS linear Ion-trap mass spectrometer with ESI source.
7. Bruker maXis Plus ultra high resolution quadrupole time of flight (QTOF) mass spectrometer with Waters Acquity H-class UPLC. Equipped with Bruker ESI and APCI sources, and an IonSense Direct Analysis in Real Time (DART) ambient ionization source.
8. LC/TOF-MS (accurate mass) Agilent 6224 walk-up time-of-flight mass spectrometer (WTOF) interfaced to an Agilent 1200 HPLC with electrospray and multi-mode (ESI/APCI) sources.
9. LC/TOF-MS (accurate mass) Agilent 6230 Agilent time-of-flight mass spectrometer (BTOF) interfaced to an Agilent 1290 Infinity UHPLC with electrospray and multi-mode (ESI/APCI) sources.
10. LC/QTOF-MSMS (accurate mass) Agilent 6510 quadrupole time-of-flight mass spectrometer (QTOF) interfaced to an Agilent 1200 HPLC with electrospray and multi-mode (ESI/APCI) sources
11. Waters Xevo UPLC-MSMS triple quadrupole with Waters Acquity H-class UPLC, with ESI ionization.
12. Waters Acquity UPLC with PDA detector.

**NMR Spectroscopy**

1. Bruker AV4 NEO 400 NMR equipped with SMART probe and extended range VT.
2. Bruker AV4 NEO 400 NMR equipped with SMART probe, Sample Express and extended range VT
3. Bruker AV4 NEO 400 NMR equipped with PRODIGY probe, Sample Express.
4. Agilent (Varian) 400MR equipped with Automated Tuning and a 7620-96 spots Sample Changer.
5. Agilent Inova 500 with three channels, 3-axis gradients and many other accessories including HCN, broadband probes and a NANO (HRMAS) probe.
6. Agilent Inova 600 with four channels, 2H decoupling, 3-axis gradients and many other accessories including HCN and a flow-probe.
7. Spare Parts Store (working): Three Inova Consoles, Two Mercury Plus Consoles, one mothballed narrow bore (NB) self-shielding Magnex US400 magnet and accessories, two de-energized NB 300 oxford magnets, Magnex Charging Kit, Stainless hydraulic solenoid lift kit, Variety of Varian solution probes, one 3.2mm Varian 400 MHz CPMAS probe.

**UV-Vis-IR Spectroscopy**

1. Nicolet iS-50 FT-IR spectrometer with a single pass diamond ATR-ZnSe also a high index of refraction Ge crystal for thin films, powders and liquids; Harrick Grazing Angle Reflectance Accessory for thin films on metal or semiconductor substrates; Gemini Diffuse Reflectance Accessory for non-reflecting powder materials.
2. Agilent (Cary) UV-Vis-NIR equipped with VASRA or Variable Angle Specular Reflectance Accessory that is used with thin films at angles from 20 to 70 degrees; Praying Mantis diffuse reflection analysis of solids and powders.
3. Malvern Zetasizer Nano ZS with 633nm ‘red’ laser for size measurement of particles and molecules (e.g. proteins) dispersed in a liquid (using dynamic light scattering, DLS); zeta-potential of colloids and nano particles for predicting dispersion stability (using electrophoretic light scattering); and the measurement of microrheology of protein and polymer solutions. The high performance of this instrument also enables the measurement of molecular weight of macromolecules.
4. Horiba Jobin-Yvon FluoroLog-3 Spectrofluorometer with 450W Xenon lamp (230-1800nm), excitation and emission spectrometers- High sensitive, modular spectrofluorometer for fluorescence measurements in the 240 to 850nm emission spectral range.
5. Fluorescence microscope.

### Materials and Surface Science**[[2]](#footnote-2)**

**EM and Surface Analysis**

1. JEOL JSM-6500F field emission scanning electron microscope (FESEM) with EDAX an Oxford SDD EDS detector and EDAX EBSD cameras, a Nabity e-beam Lithography and JEOL STEM-in-SEM holder.
2. JEOL JEM-2100F transmission electron microscope (TEM) with UHR pole piece, with STEM capability and Gatan CCD camera equipped with an Oxford SDD EDS detector.
3. PE-5800 X-ray Photoelectron Spectroscopy (XPS), also known as Electron Spectroscopy for Chemical Analysis (ESCA) with Scanning Auger Microscopy, sputter depth profiling and Ultraviolet photoelectron Spectroscopy (UPS).
4. Bruker DektakXT Contact Profilometer
5. Nanoscience Easyscan-2 AFM
6. Woolam VASE or Variable Angle Spectroscopic Ellipsometer, with 250-1700nm spectral range- used to measure the thickness, refractive index and other optical properties of thin films and multi-layer films.
7. Kruss DSA10 Drop Shape Analyzer Contact Angle Goniometer (CAG)

**Magnetic Properties**

1. Quantum Design PPMS – 9T, DC Resistivity, Electrical Transport, Vibrating Sample Magnetometer (VSM), Thermal Transport, Heat Capacity, Horizontal Rotator, Multi-Function Probe, VT from 1.8 K to 1000 K
2. Quantum Design MPMSXL – 5T supercon with SQUID AC susceptibility, Reciprocating Sample Option (RSO) for DC field measurements, VT from 1.8 K to 400 K
3. Quantum Design Dilution Refrigerator Probe, VT to 50mK (Kate Ross, Physics)
4. Quantum Design ATP-30 and ATL-160 – 20 liter per day liquid helium direct recovery system
5. Agilent Inova 400 equipped with 3mm XH CP-MAS, 12kHz rotors
6. Bruker ELEXSYS E500 X‐Band CW EPR Spectrometer System with low temperature accessory.

**Thermal Analysis**

1. TA Modulated DSC 2500 with sub-ambient accessory and multi-position sample holder.
2. TA TGA Q500 Thermogravimetric analyzer measures thermal stability from ambient up to 900ºC.

**X-ray Science**

1. PE-5800 X-ray Photoelectron Spectroscopy (XPS), also known as Electron Spectroscopy for Chemical Analysis (ESCA) with Scanning Auger Microscopy, sputter depth profiling and Ultraviolet photoelectron Spectroscopy (UPS).
2. Bruker D-8 Discover Diffractometer with Parabolic Göbel mirror for parallel and monochromatic beam, ¼-circle Eulerian cradle, Equipped with 4-Bounce monochromator capable of HRXRD, XRR and GAXRD.
3. Bruker D-8 Discover – DAVINCI with Flip-Stick sample stage, Lynx-Eye Detector, Diffrac-EVA, TOPAS and other software for powder XRD, adaptable for thin film measurements
4. Bruker D-8 Discover – theta-theta mode, Göbel mirror, Cu radiation, Lynx-Eye detector upgrade
5. Bruker APEXII single-crystal diffraction system.
6. Rigaku Wide Angle X-ray Scattering (WAXS)/Small Angle X-ray Scattering (SAXS).
7. Bruker D8 Quest Single Crystal XRD with fixed CHI, Photon 50, sealed Mo tube, Triumph monochromator and motorized track.

## Staffing

**Electronics Shop** – fully equipped and engineer-staffed with full accreditation and expertise in digital, analog and RF design and troubleshooting

**Staff Scientists** – six full-time PhD scientists cover all major instruments, chemistry, engineering and life science disciplines, provide expertise for student training and full collaborations as may be needed or desired.

**Post-Doctoral Research Associates** – one temporary post-doc assignment at fifty percent level to the CIF is desirable where need is demonstrated and funding becomes available.

**Graduate Research Assistants** – two or three graduate student teaching assistants are assigned to Life, Materials and Surface Science laboratories via collaborative opportunities provided by Chemistry and SAMD. These students receive advanced training in the instrument arts, are involved in all aspects of the CIF laboratory including teaching, training, assisting with class room labs and demonstrations, instrument maintenance and method development

**Student Interns** – three to five undergraduate student hourly employees that receive training and experience in laboratory operations. Many of these students become very proficient in sample preparation, instrument operation and basic maintenance.

**Business and Office Management** – the CIF is aided by the equivalent of one full-time-equivalent business and office manager, including business and cost-accounting technical expertise.

## Facilities Assigned to CIF

***Approximately 13,100 square feet of space is assigned to the CIF***

**Chemistry Main Basement Laboratory**: 6800 square feet of newly renovated space includes staff office space, break area (1200 sq ft of total) and investigator collaborative area, C1; laboratory equipment floor space C2B, C3, C4 and C5; 400 square foot NMR Lab, C3E; 700 square feet of additional space for project staging, C2; a brand new 100 square foot gender neutral bathroom, C2A.

Equipment found here includes mass spectrometers, NMRs, XRD, XPS, Magnetic Properties, Spectroscopic tools and Thermal Analysis instruments. Except for the other equipment areas noted below, most of the CIF instrumentation is found in this basement laboratory.

**Chemistry High Field Basement NMR Laboratory** is a 400 square foot lab with a 14 Tesla narrow bore, unshielded NMR magnet and console, B2.

**Chemistry Electronics Shop** is a 600 square foot laboratory with equipment and materials to design, construct, troubleshoot and repair almost any electronics equipped apparatus on campus.

**Chemistry B115 XRD Laboratory** is a 600 square foot laboratory in the 1st floor B-wing with office space. Instruments found here include a powder XRD, a single crystal XRD and a SAXS.

**Yates Hall Y101 Surface Science Laboratory** is a 900 square foot laboratory with vibrationally isolated floor, stray field compensation, precision temperature control, backup UPS, emergency natural gas generator that holds the TEM, the SEM, the AFM and the profilometer as well as surface preparation equipment.

**Chemistry Research Building CRB-109** is 350 square feet of new laboratory space plus office with vibrationally isolated floor that holds two 400 MHz NMRs, a routine electrospray mass spectrometer and new single crystal XRD.

1. Life, Material and Surface Science groups apecialties help to characterize the major focus of instruments in their respective groups. There are obvious and substantial overlaps of instruments among the groups. [↑](#footnote-ref-1)
2. Life, Material and Surface Science groups specialists help to characterize the major focus of instruments in their respective groups. There are obvious and substantial overlaps of instruments among the groups. [↑](#footnote-ref-2)