**PAL INSTRUMENTATION (11-09-22)**

**Molecular Characterization**

* **THF-GPC-MALS** 
  + FLO-M Vacuum degasser
  + Agilent 1100 Pump
  + Agilent 1100 autosampler
  + Wyatt Dawn-EOS LS Detector
  + Waters 410 DRI Detector
* **Aqueous-GPC-MALS**
  + FLO-M Vacuum degasser
  + Isco Syringe Pumps (500mL)
  + Manual Injector
  + Wyatt Dawn-DSP LS Detector
  + Waters 410 DRI Detector
* **Toluene-GPC-MALS**
  + FLO-M Vacuum degasser
  + 2 Isco Syringe Pumps (500mL)
  + Manual Injector
  + Wyatt Dawn-EOS LS Detector
  + Hitachi DRI detector
* **Tosoh EcoSEC Elite HLC-8420GPC with Lens3 Light Scattering Detector**
  + Vacuum degasser
  + Pump
  + Autosampler
  + Lens3 LS Detector
  + DRI detector
* **Viscotek TDA-302 Triple detector**
* **Mixed GPC (aqueous or Organic)**
  + FLO-M Vacuum degasser
  + Agilent 1100 Pump
  + Agilent 1100 autosampler
  + Wyatt Heleos LS detector with DLS Capability and Temp. Control (0 to 60C)
  + Agilent 1200 DRI detector

**Thermal Analysis**

* **TA Discovery DSC250 Modulated Differential Scanning Calorimeter (DSC)** with Refrigerated System Cooling (RSC-90) -90C to 550C
* **TA Q100 Modulated Differential Scanning Calorimeter (DSC**) with Refrigerated System Cooling (RSC-40) -40C to 400C, or Liquid Nitrogen Cooling
* **TA Discovery TGA550** Modulated High Sensitivity Thermogravimetric Analyzer (TGA) with Modulated TGA mode
* **TA Q800 Dynamic Mechanical Analyzer (DMA) with:**
  + NPC (Nitrogen Purge Cooling)
  + ACS-2 Air Chiller System (-55oC)
  + Compression clamp
  + Submersion compression clamp
  + Dual surface film clamp
  + Single/dual Cantilever Clamp
* **TA Discovery HR 20 Advanced Hybrid Rheometer**
  + Environmental Testing Chamber (ETC) (-55oC to 600oC)
  + Upper and Lower Peltier Plates (-40oC to 200oC)
  + UV Curing Accessory
* **TA Ares Advanced Rheometer AR200 with ETC (Environmental Testing Chamber), Tension and Asphalt Geometries**

**Scattering**

* **Malvern Zetasizer Nano ZS with Titrator**
  + One angle Backscattering (173)
  + Zeta Potential
  + Titrator
* **Multiangle Dynamic/Static Light Scattering System**
  + Crystal Laser CL-2000 Diode Pumped Laser (532nm, 500mW)
  + Melles Griot He-Ne Laser (632.8nm, 15mW)
  + Coherent Innova 90 Ion Laser (488, 514.5, 657 nm, 500mW)
  + Oriel 77341 PMT
  + EMI 9863 PMT
  + Pacific Industries AD-126 Amplifier Discriminator and 126 Lab Photometer
  + ALV Correlator
  + Neslab RTE 111 Circulating Bath
* **Thorn EMI Photon Counting System** *( Not in Use***)**
* **Beckman Coulter LS-200 Laser Diffraction Particle Size Analyze**r
  + Micro Cell Accessory
  + Dry Powder sampler
  + Standard Flow sampler

**Microscopy**

* **Olympus BH Polarized Optical Microscope (POM).**
  + AmScope MD1900 Digital Camera
* **Olympus BX50 Microscope** 
  + Mettler FP82 Hot Stage
  + Mettler FP80 Central Processing unit
  + Mettler Photodetector

**Balances**

* **Sartorius A 120 S Analytical Balance (4 decimal)**
* **Cahn C-31 Microbalance (6 decimal)**

**Other Instruments/ Capabilities**

* **Barnstead Nanopure Water System**
  + With Ultrafilter (0.005µm)
* **Perkin Elmer LS50B Luminescence Spectrometer**
  + Temperature Control (VWR 1167 Circulating Bath)
* **Agilent 8453 DAD Spectrophotometer**
  + 7 Multicell Accessory
  + Temperature Control (VWR 1167 Circulating Bath)
* **Thermo Orion 420 pH Meter**
* **Beckman Microfuge E Micro Centrifuge**
* **IEC Clinical centrifuge**
* **American Scientific BT-23 Thermostated Shaking Bath**
* **Fisher Isotemp Oven (up to ~ 200C)**
* **National Appliance Company 5831 Vacuum Oven (up to ~ 200C)**
  + Welch Duo-Seal Vacuum pump, Trap
* **VWR Vacuum Oven (up to ~ 200C) (Not in Use)**
* **Sonic VibraCell VC-750 Sonicator**
  + Several Probes
  + Sound Proof Cabinet
* **Branson 2210 Sonicator**
* **Solvent Filtering Station**
  + 1L Organic Flask
  + 1L Aqueous Flask
  + GAST Diaphragm Pump
* **Buchi RE-121 Rotovap**
  + Buchi B-480 Water Bath
  + Neslab RTE-110 Cooling Circulator
* **NIMA Langmuir Blodgett trough ((Not in use)**

**Other Instruments (NOT PAL)**

* **Bruker EMX 10/2.7 Electron Paramagnetic Resonance (EPR) spectrometer**
  + 10” magnet
  + 2.7 kV power supply
  + Microwave X band solid state bridge
  + microwave frequency counter
  + ER 4119HS high sensitivity Resonator
  + ER 4105DR double resonator
  + Aquax aqueous solution cell accessory
  + Liquid nitrogen Cryostat (Not in use)
* **OLIS-RSM-1000 RSM Stopped Flow**
  + Temperature Control (VWR 1167 Circulating Bath)