Research Equipment in the UCA Chemistry Department

Varian 220 Atomic Absorption Spectrometer

Atomic Absorption spectroscopy is used to measure the amount of a metal ion present in a solution. It is particularly valuable in studying etal pollution in natural waters.

Varian Saturn 2200 GC-MS

GC-MS combines the power of gas chromatography in separating the components of a mixture of volatile compounds with the power of mass spectrometry to identify each of the individual components. One major use is its use in verifying the composition of substances suspected of containing illegal drugs. The purchase of this instrument was funded by an NSF grant authored by Dr. Donald Perry.

Waters Acquity LC-TQMS

Similar to the GC-MS in that liquid chromatography is used to separate compounds in a mixture and the triple quad mass spectrometer is used to identify them. This instrument can be used with nonvolatile samples such as those typically found in biological samples. The triple quad detector provides a number of detector options. This work has greatly enhanced the joint research conducted by Dr. Melissa Kelley and Dr. Lance Bridges.

Micromass MALDI – TOF Mass Spectrometer

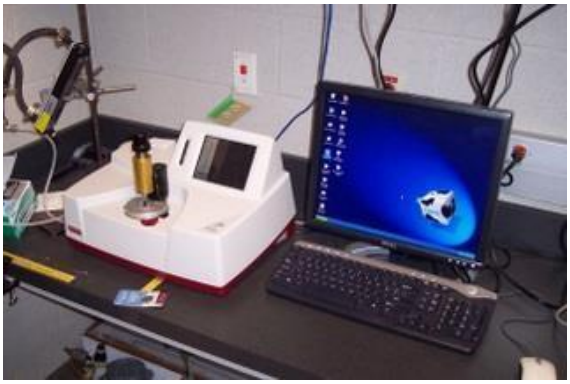
This instrument uses Matrix Assisted Laser Desorption/ionization to generate ions that are then analyzed by Time-Of-Flight mass spectrometry. Maldi produces low energy ions which remain intact which are then are characterized using the time-of-flight spectrometer. It is especially valuable for use with large molecular weight molecules that are unstable when analyzed by more conventional techniques. Both this instrument and the LC-TQMS through an NSF grant written by Dr. Cameron Dorey.

Nicolet 560 FT-IR

Infrared spectroscopy measures the absorption of infrared light resulting from the internal motion of molecules. It is an important technique in the identification of compounds. Dr. Don Perry makes extensive use of this instrument in his research in surface enhanced IR spectroscopy.

Nicolet IR 100 FT-IR with ATR attachment

This general purpose IR instrument includes an attenuated total reflectance attachment. This attachment greatly simplifies the acquisition of spectra for solid samples. The use of computers to perform Fourier Transform analysis on complex wave patternsha s revolutionized this and many other areas of spectroscopy in recent years.



Joel ECX-300 NMR Spectrometer

Nuclear magnetic resonance spectrometry is among the most powerful techniques for the determination of the structures of molecules. Using the magnetic signals generated by spinning atomic nuclei, the same physical phenomenon used for medical MRI imaging, the instrument provides a wide variety of structural information particularly the proximity of different parts of a molecule to one another. Our JOEL 300 MHz instrument allows spectra to be determined for a wide variety of different atomic nuclei and is capable of performing essentially all of the many modern NMR experiments developed over the past 25 years including COSY, HMQC, and NOSY. The instrument was funded by an NSF grant written by Dr. Jerry Manion.

Resonance Instruments Model 8400 EPR

Electron paramagnetic resonance is used to characterize molecular species containing unpaired electrons. Its purchase was funded by an NSF grant written by Dr. Patrick Desorchers who uses the instrument in his work with nickel complexes.

Johnson Matthey Magnetic Susceptibilty Balance

This instrument is used to measure the paramagnetic properties of substances that result from unpaired electrons they contain.

Unilab glovebox

Samples that are sensitive to air require special handling techniques that include this glove box which contains a dry, inert gas.

Perkin-Elmer LS 45 Luminescence Spectrometer

Some molecules emit light (fluoresce) when activated by higher energy radiation. Measurement of this fluorescence provides a means for quantitative analysis.

Gow-Mac Series 400 Gas Chromatograph

This basic GC instrument is used for routine analysis in the instructional organic labs and is also used by various research groups. Like most modern instrumentation it is equipped with a digital data acquisition system that allow the results to be processed by a computer.

Cyclic Voltometry

Cyclic Voltammetry is an electroanalytical technique that provides information about electrochemical reactions such as reduction potentials, numbers of electrons involved , and whether the reaction is reversible.

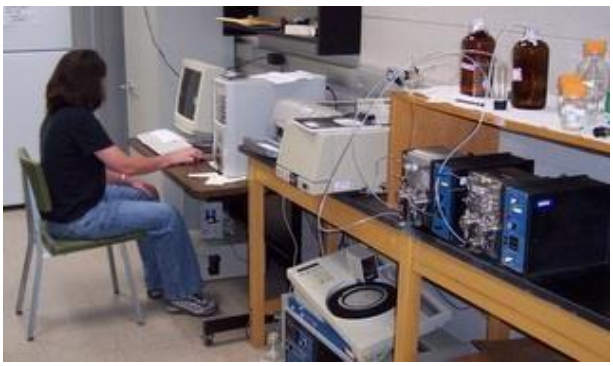
Vacuum deposition

This is a home built vacuum-deposition apparatus used in Dr. Perry's research lab to grow thin films composed of silver or gold nanostructures.

Gas Phase Ion-Molecule Reaction Apparatus

This instrument is used in Dr. Bill Taylor's lab to study fundamental chemical processes occurring between metal ions and neutral molecules. In this device, metal ions are formed in a distribution of electronic states using a sputtering glow discharge (similar to a neon light) and subsequently injected into a drift cell containing a mixture of He and a small amount of the neutral reactant. Products of these reactions are then analyzed using a quadrupole mass filter. The drift cell can also be used to determine the relative amounts of excited and ground state metal ions using a technique called electronic state chromotography, which distinguishes the different states on the basis of their mobilities in He. If carried out in the presence of the reactive neutral, a variation on this technique can be used to determine state-specific products and reaction kinetics.

HPLC with Photodiode Array Detector



HPLC is ideally suited for separation and isolation of a number of biologically active compounds including lipids, steroids, plant pigments, and many pharmaceuticals. Since many of these compounds are conjugated, the PDA detector is very useful since it allows for range of wavelengths to be detected simultaneously. This is a key instrument in use in the Dr. Melissa's Kelley laboratory where they focus on separation, isolation and identification of natural and synthetic derivatives of vitamin A.

Plazma Oxidation Apparatus

Dr. Karen Steelman and her students oxidize archaeological artifacts using a custom-built plasma oxidation apparatus in her laboratory. A capacitively-coupled glow discharge is produced with a radio frequency generator. Ultra-high vacuum is maintained using a turbomolecular pump. Product carbon dioxide is frozen with liquid nitrogen into a glass tube, which is flame-sealed. Subsequent reduction of the carbon dioxide to graphite is followed by accelerator mass spectrometry radiocarbon measurement. In the photo, Dr. Steelman is supervising student, Derek Watts, as he checks a pressure measurement.

Microwave Reactor

The use of microwaves in place of increased temperature to facilitate synthesis has become increasingly common in recent years. Not has Dr. Rick Tarkka introduced this technique into his research program, but has also developed synthetic procedures for use in the introductory laboratory in organic chemistry.

Super Critical Fluid Extraction

Dr. Steelman hopes to use this apparatus for extraction of organic materials from samples obtained from archeological sites. Radiocarbon dating will then be used on these extracts to determine the age of the of the sample.