The Monmouth College Chemistry/Biochemistry Department wants to thank the Pittsburgh Conference Memorial National College Grants Program for past support. This cycle we request funding ($10,000) to support the acquisition of a portable X-ray fluorescence spectrometer (pXRF). Monmouth College will match this support with $15,000.

Members of our department have hands-on lab experience with the pXRF instrumentation through two NSF cCWCS workshops (Chemistry in the Arts and Medicinal Plants). In our liberal arts environment, we often collaborate with other departments on campus to facilitate interdisciplinary research projects in addition to our own faculty-mentored student research. A pXRF will expand our ability to collaborate and bring science-based measurements to our colleagues in Art and Classics/Archeology departments. The portable nature of this instrument will allow us to expand our scientific reach into our local community (libraries, art centers, history museums) as well as with other local Colleges (ex. Knox College and St. Ambrose University).

Classes and projects which will benefit:

1) ***Inorganic Chemistry*** (Chemistry Dept., ~15 students/yr): A pXRF would be incorporated into an existing lab in which students make superconductors. It would allow students to evaluate their elemental composition rapidly and quantitatively. This course collaborates with physics to use their neutron generator in order to study the behavior of radionuclides. An existing lab activity involving neutron activation would be greatly expanded by the addition of a pXRF. It could also be used to detect color centers in crystals and gemstones to illustrate crystal field theory.

2) ***Instrumental Analysis*** (Chemistry Dept., ~15 students/yr): In addition to the exposure our students receive to the ACS-required analytical instrumentation, the chemistry department tries to familiarize our graduates with unique instrumentation that might be encountered in graduate school, professional schools, or industry. The pXRF will add a nuclear chemistry technique to our other analytical instrumentation that can be used qualitatively and quantitatively.

3) ***Environmental Science*** (Biology Dept., ~20-25 students/yr): The instrument will be used for a lab activity in which students quantify lead in soils surrounding old homes and in soil layers from the 1960s. The lab demonstrates the lasting environmental effects of human activity. The current method limits the number of potential samples because the sample preparation requires a laborious, hazardous, and expensive digestion process to solubilize lead for analysis by atomic absorption. A pXRF would vastly expand the available data for the students to interpret, as well as expand the potential type of sample (e.g. painted surfaces).

4) ***Materials Science*** (Physics and Engineering Dept., ~20 students/yr): Monmouth College is in the process of developing an engineering program. A pXRF will be an invaluable tool for analyzing and identifying alloys and other materials. Giving students in this field experience with XRF will improve their prospects as materials scientists and engineers.

5) ***Archeology Lab/Art History*** (Classics and Art Dept., ~60 students/yr): Monmouth college has an extensive library of artifacts including coins, pottery, tools, and weapons from the classical period and Native American artifacts found locally. A pXRF would allow for validation and analysis of these samples *in-situ* in a way that is non-destructive. This would create an opportunity for archeology and classics majors to collaborate with chemistry majors for their research.

7) ***Ceramics Lab*** (Art Dept., ~15 students/yr): The Chemistry department has an ongoing collaboration with the Art Department. Analyzing the elemental composition of glazes and clay is currently not feasible at the scale we need but a pXRF will make that analysis accessible. Specific projects would involve examining glaze materials, the study of the elemental dependence on the quartz inversion process, and analyzing local clay deposits.

8) ***Advanced Art Research*** (Art Dept., ~8 students): Previous attempts to carry out Xray analysis on Monmouth Special Collection where halted due to the risks involved in transporting artifacts off-campus. The items are too brittle to safely move and the colors have been obscured by quartz inversion. Using the pXRF, the elemental analysis can reveal the original pigmentation and provide clues to the artifacts’ origins.