
RRC Reporter

The Newsletter of the Research Resources Center

The following article is the first of a two-part history of the RRC written by Dr. Robert Loizzi prior to his retirement in December 1998. He reviews the Research Resources Center over its 50-year history, first, by noting its modernization during the past three years; second, by recalling his impressions of the RRC in the mid-60s through his familiarity with one facility; and, finally, by reviewing the RRC's origins and development and the forces and people that shaped it.

Thoughts on the RRC While Exiting

R. F. Loizzi

Changes in the late 90's.

During the past three years the Research Resources Center has undergone an extensive revitalization including the following: New, state-of-the-art instrumentation in several areas. Recruitment of scientific personnel with special skills to match that instrumentation. A new 12,000 sq. ft. facility on the east side of the campus primarily serving the physical sciences. Administrative reorganization including creation of a new oversight position, Assoc. V.C. of Research Resources and its first appointment, Dr. B. Taylor Bennett. Expanded ability to design, fabricate and repair custom research equipment. Modernization of its billing and bookkeeping systems. Budgetary changes that permit rational updating and replacement of existing instruments and introducing new technology. Increased opportunities for input from faculty and administration. And a new focus of the campus on the role of core facilities, faculty research needs, and how to maximize the effectiveness of such support units. These changes have brought new research support services to hundreds of UIC faculty, postdoctoral fellows and graduate students. It has also, particularly with the introduction of user fees, meant painful accommodation and adjustment for some as change, even beneficial change, often does. It will be shown that the RRC has undergone many, substantial changes since its founding while its mission of facilitating campus research has remained constant.

1966. Electron Microscopy - A personal impression of the RRC

What is the Research Resources Center? Why do some of us think it plays a critical role in the ongoing development and health of research at UIC? My own introduction to the RRC came in early 1966. During my recruitment and seminar visit

to the dept. of Physiology (*Biophysics* would be added to the title 12 years later), the head of the department, Dr. Arnold Wolf, arranged for a tour of the Electron Microscopy Facility. I was familiar with EM labs on other campuses, some very impressive. One problem, however, was their dependence on a particular investigator's research grant. This usually resulted, first, in very high fees (to fully cover costs of personnel, operations and service contracts). A fee of \$30 per hour or more in 1966 (equivalent to \$157 per hour in 1998 according to CPI changes), was common. Second, the EM lab personnel were really part of the investigator's staff and busy with their own research assignments; teaching others to do EM was not a primary task. Third, obtaining access to another individual's microscope was not always easy and often depended on that person's sense of research camaraderie and workload, as well as the viewpoint of his or her department and college. Finally, because the instrument was so tied to one individual's research endeavor, access to outsiders usually occurred via collaboration with the P.I. This meant that projects were usually restricted to areas of mutual interest with the "owner" and the latter automatically became a coworker on each project - a situation which could be good or bad for the person seeking EM usage.

The EM facility I visited here, however, was a dedicated, multi-user core facility. That is, its main function was to maintain and provide access to instruments by investigators from the entire campus for their research, and the expertise of scientists and technologists to train and assist them in their work rather than that of a single P.I. or single group of collaborators. It was totally subsidized by the university and thus neither the instruments nor the personnel were dependent on one individual's grant. This meant independence for the investigator as well as continuity of function unrelated to external funding. Its equal treatment for all users was ensured by the fact that the RRC reported to the Graduate College (later, the OVCR) and not to a particular departmental or college unit. In 1966 there were no user fees, the facility staff was knowledgeable, enthusiastic, and generous with their time for training and assistance although services such as sample preparation and data acquisition were not available. There was a distinct teaching commitment, primarily to graduate education. Eventually, however, problems developed in this and similarly organized "no fees" facilities nationwide. Obsolescence of equipment and lack of funds for replacement or upgrades marked the end of this utopian arrangement.

1995. A break with the past: User Fees and Services

Almost 30 years would pass before user fees were instituted for RRC facilities, in October, 1995, and they were markedly less than \$30 per hour, even in 1995 dollars. Besides ~~introducing user fees, RRC facilities also started offering~~ services in instrument facilities that had previously been available only for user operation, namely, EM, mass spectrometry, NMR. This change in RRC policy recognized the need for specialized data by a large population of investigators unable to spend months or years learning and perfecting a technique but who were willing to hire this work out to experts who did it routinely, especially if the experts and instrumentation were located a few minutes from their own laboratories. Put another way, when investigators accepted the concept of service, the RRC was forced to overcome its policy of only providing access to instruments for user operation and start providing services as well.

Actually, some RRC facilities had been offering services prior to 1995. The electronic and mechanical shops (BioInstrumentation Facility or BIF, and Instrument Shop Facility or ISF, respectively) had been providing services only since the 1970s (user access to shop equipment was prohibited by liability problems). The Flow Cytometry Laboratory was established in 1986 with about 50:50 service:user operation. The Protein Research Laboratory was first established in 1989 as the Protein Sequencing and Synthesis Laboratory, primarily a service facility with some technique training. The DNA Core Facility, which was established by Hematology and Oncology and 1997 and transferred to the RRC in 1998, is strictly a service facility.

1948. The Aeromedical Laboratory: Beginnings, Context and Roots

Planning began about twenty years before the founding of the U. of I. Circle Campus and forty years before UIC. Aviation had become a major post-war topic of speculation nation wide but particularly in Chicago. Due to its strategic location, many people in Illinois in the mid-forties were predicting Chicago would become an important center for the aviation industry just as it had become an important railroad hub in the 19th century. Chicago's Municipal Airport, later called Midway Airport, was already the busiest in the world. Then, between 1946 and 1949 the Chicago City Council authorized spending \$48.4 million for the purchase of over 8,000 acres of land northwest of the city to build a second airport. The property, which included a military airfield, was called Orchard Place (ORD) and in 1949 was renamed in honor of a young Chicagoan killed during the war, Lieut. Comdr. Edward H. "Butch" O'Hare. In the beginning there would be stiff competition with Midway but, by mid-1962, all scheduled operations at Midway had been transferred to O'Hare, enabling the latter to become known as the busiest airport in the world.

The prospect of mass transportation by air brought concerns about potential medical problems along with commercial opportunities. Assuming that passenger airplanes would soon be flying higher, longer, and faster, ordinary citizens, on a massive scale, might soon be facing some of the same physiologically unfriendly environments recently experienced by soldiers, pilots and sailors in World War II. These included: high altitude with its ambient low pressure and poor oxygen content; icy ocean waters; ocean depths with pressures several times that at sea level; hot and arid deserts; hot and steamy jungles; movement in 3-dimensional space vs. 2-dimensional surface; accelerations, positive, negative and rotational, with several times gravitational force encountered in normal activities. Thus, the combination of commercial opportunities and medical dangers, plus a growing interest in space research, mobilized university and state resources.

A group of faculty in Mechanical Engineering at the Urbana campus began talks with faculty from the College of Medicine at the Chicago campus. A decision was made to form a new research unit, the *Physical Environment Laboratory*, to facilitate research on the effects of environmental stress on the human body. It was agreed that the ideal location for the new facility would be the Chicago campus. UIMC, then known as the Chicago Professional Colleges of the University of Illinois, was located in the first medical district in the U.S which began in the 1870s when Cook County Hospital, Rush Medical School and the College of Physicians and Surgeons (predecessor of the U. of I. College of Medicine) were established. In 1941, following the efforts of a famous Trustee, Park Livingston, and a state representative and future alderman, Vito Marzullo, it had been officially designated the *Illinois Medical District* by an act of the Illinois legislature and would grow into the largest urban medical center in the world. To build and direct the new unit the University recruited Dr. John Marbarger, an environmental Physiologist who had studied these stressors while in the military. He reported for work in July, 1948.

The Aeromedical Laboratory: Nature and Philosophy

From the start this was regarded as an important, major addition to the Chicago campus, one which was expected to stimulate research efforts in its various colleges. The *Physical Environment Laboratory* was organized as a well equipped environmental laboratory where faculty from any field in the university could come to use its equipment which included a variety of chambers such as hypo- and hyperbarometric, and variable humidity and temperature chambers, to do hands-on research in environmental physiology and medicine, and support facilities including a biochemistry lab and a machine shop. The Director reported directly to the Vice President and the latter chaired an advisory committee of 18 research-savvy VIPs, administrators and faculty, including U of I luminaries

such as John Youmans, Granville Bennett, George Wakerlin, William Whitehorn and Warren Cole. A year after its founding the Advisory Committee voted to change the name of the facility to the *Aeromedical and Physical Environment Institute*, and then later to the *Aeromedical and Physical Environment Laboratory*. Two subcommittees, Research and Planning were also formed. A third subcommittee oversaw a Physical Environment Laboratory at the Urbana campus. A Table of Organization was adopted which described the functions of these committees, one of which was to determine priorities for projects submitted in writing by investigators wishing to use the Aeromed Lab. Two rules were that users would perform their own work rather than the Lab personnel doing it for them and, second, users from all colleges would be treated equally. Marbarger would write a monthly report to the President via the V.P. the first few years and later an annual summary report throughout his tenure. Included in the reports was a synopsis of each ongoing research project and a list of all publications of work which had utilized the Lab. The site of operations was the Aeromedical Laboratory building. Constructed especially for this purpose and dedicated in 1948, it was a one story, brick structure with a large lower level to contain the various environmental chambers listed above. In 1964, Aeromed Lab equipment was relocated to space in the lower level of the just completed Phase 1 of Medical Sciences Addition (now MSB). The old, cylindrical hypobarometric chambers were discarded and the current 4-chamber complex was set in place first and the MSA built around it. However, the Aeromedical Laboratory building still stands and, up until 1985, was identified by that name in the UIC Staff Directory, although people walking past it as they cross the inner courtyard between MSB and the Clinics are unaware of its history. A few years ago its name was formally changed to the Magnetic Resonance Center to reflect its current function.

Marbarger relates the story that he almost lost his job during his first few weeks at UIMC. Noting that the new building was not equipped for housing experimental animals, particularly dogs, he realized that biologists had not participated in the planning. However, when he mentioned this to one of the Urbana faculty that started the Aeromed Lab and hired him, there was shock at the idea of doing animal research, as opposed to strictly human research, and opinion of him suddenly turned negative. Marbarger brought his problem to the Vice President, to whom he reported, and was told he was on the right track and to go ahead with the planning for animal research. The vice president's name was Andrew C. Ivy.

During its earliest years the Aeromed Lab operated the following facilities: Constant Temperature Room (-40°F to +160°F); Six-Man Pressure-Temperature-Humidity Room (+20°F to +140°F, 7% to sat., up to 55,000 ft simulated altitude); 20-Man Pressure-Temperature-Humidity Room (+30°F to +140°F, 20% to sat., up to 55,000 ft simulated

altitude); Small Animal Pressure-Temperature Room (+20°F to +160°F, up to 60,000 ft simulated altitude); High Pressure-Temperature Controlled Animal Room (ground level up to 140 psi); Small Animal Pressure Chamber (up to 70,000 ft); Six-Man Positive-Negative Pressure Room (-20 in. Hg to +10 in Hg); Dust-Free Chromatography Room; Suite of Cold Rooms for Biochemistry Research (anteroom +70°F, outer cold room +32°F, inner cold room +15°F); small machine shop (shared with other departments); biochemistry laboratory; and a biophysics laboratory (for development of new instrumentation, especially sensing equipment).

A small group of support personnel were hired by Marbarger to run the Aeromed Lab: Non-academics included Clarence Pestel, Instrument Maker; John Hansen, Sr. Lab. Mechanic; Minnie Hein, Secretary; Henry Benson and Gabrielle Meyer, Lab. Assts.; and Allyn Hansen, Animal Caretaker (part-time). Academics included Victor Guillemin, Biophysicist. The shop maintained, repaired and fabricated new equipment and parts for the Aeromed Lab. In 1950 an Experimental Pathologist, Gordon Vawter, joined the staff. When Benson resigned in 1953, Marbarger hired William Kadetz as "Supervisor of Mechanical, Electrical and Electronic Equipment". Kadetz remained with the Aeromed Lab/RRC for many years until his retirement in 1981. His shop evolved into the RRC's Electronics Shop, formally known as the BioInstrumentation Facility or "BIF" now headed by Bob Kulseth who started as Kadetz' assistant 35 years ago. In 1958 Marbarger hired another familiar name, Eugene Robbins, a lab assistant who did the biochemical analyses and blood collecting from animals at simulated high altitude in the hypobaric chambers.

1952. First step toward an RRC

In November, 1952 an event occurred which would change the nature of the Aeromed Lab. A faculty member in the department of Physiology, Dr. Reed, asked Marbarger to take responsibility for an RCA EMU2 Electron Microscope. After determining there was a need for this technology by faculty, and with V.P. Ivy's approval, Marbarger accepted the instrument, transferred it to the Aeromed Lab, set it up as a new unit, and hired the Lab's first EM Technologist Ms. E. T. Bush. The significance is that up until this time all projects studied in the Aeromed Lab were focused on the environment and its effects on the body, and all the equipment closely reflected that narrow purpose. As of 1952 the primary mission of the Aeromed Lab had enlarged to include technology ~~which could be applied to other research problems not directly~~ related to environmental stress. As Marbarger writes in a letter, "With this acquisition the Aeromedical Laboratory ... was launched on a program with the same philosophy as originally followed but with the central acquisition of large, expensive scientific equipment centrally located, maintained in excellent operating conditions and available to any investigator who truly needs to use it." In 1955 Ms. Irena Kairys was hired

to supervise and build up the EM facility. By 1960 two more RCA EMs had been added to the facility. One of these instruments is now an exhibit in the Museum of Science and Industry, split in two to reveal the insides of the EM column, electromagnetic lenses, etc. In 1962, another EM Tech, Ms. Lucia Vedegys joined the Lab. By 1967 the addition of even more techniques would result in renaming the Aeromedical Laboratory the *Research Resources Center* or RRC.

The Aeromedical Laboratory was also open to researchers from other institutions and soon became the site for sabbatical leaves by faculty from foreign as well as American universities. Ties between UIMC and several foreign, particularly Asian, universities were based on these research experiences as well as exchange visits in both directions. Years later, in the mid-sixties, several of the Aeromedical Laboratory crew joined medical faculty in a combined USAID-UIMC team invited by the Thai government to set up a new medical school in its northern province, Chiangmai.

In 1957 Marbarger hired a young physiologist interested in the neuroendocrinology of stress, Dr. Sabath F. "Sam" Marotta, as a Research Associate in the nine-year old Aeromed Lab. Sam combined high energy, leadership and a talent for administration and proved equally passionate about doing research and creating a facilitating research environment. He was promoted to Assistant Director in 1960 and also Assistant Professor in Physiology. In 1964 Marotta spent two years as part of the team to Chiangmai, Thailand and, upon his return, he transferred full time to the Physiology department. A decade later he would return to the Aeromed Lab renamed RRC.

Research in the Aeromedical Laboratory

During the 1950s and 60s, Marbarger maintained a high research profile studying the effects of environmental stress on the body, as well as the development of instrumentation and equipment for its study, which contributed to the growing reputation of the facility. Under his direction the Aeromedical Laboratory was the site of numerous, ongoing government-funded research grants and contracts as well as joint studies with centers such as the Naval School of Aviation Medicine, Pensacola, Florida, and Wright Patterson Air Force Base. The archives and reports for these studies are still stored in the RRC. Marbarger also served as editor in chief for the journal *Aviation Medicine*, later changed to *Aerospace Medicine*, which meant he was familiar with virtually all research in this area and the papers submitted for review and publication. During the early period of space research from the mid-50's and Sputnik in 1957 through the 60's, the Aeromedical Laboratory/RRC took part in numerous studies with Marbarger personally involved in much of the actual experiments including those connected with space flights.

Early computing at UIMC

It was soon apparent that collecting large amounts of data would require computerization. In July, 1960, Marbarger hired Dr. Norio Shioura, an M.D. with a talent for writing scientific programs, as a Research Associate to begin the application of computer programming to the work of the Aeromed Lab. An IBM 320 mainframe was acquired along with a keypunch machine, a programmer was hired, and scientific data was soon being stored and processed. Upon completion of the Benjamin Goldberg Research Center, Aeromed Lab computing was moved from the MSA into the large space in BGRC currently assigned to the Computer Center. An early version of a UPS (uninterrupted power supply), intended to keep the computers running in a power loss, consisted of rows of batteries, about 50, sharing the same bath which had to be checked and topped off on a daily basis. In this manner the Aeromed Lab introduced computing to the Medical Center campus. In 1967 Minu K. Patel, a Biostatistician at Presbyterian-St. Luke's Hospital, was recruited to the RRC as a Research Associate to help design and analyze results from the myriad of experiments taking place and was later promoted to Assistant Professor of Biometry. The 320 was replaced by an IBM 360 followed by an IBM 1800 and eventually DEC VAXs. Dave Rappaport was hired in 1970 along with other programmers, and this opened a wide variety of computer support services to users of the now Research Resources Center. Although dedicated to scientific purposes, its expertise caused the RRC to be consulted by others at UIMC attempting to apply computers to other academic functions such as test scoring and analysis, and administrative issues.

During this same period, John Hansen left and, in 1968 was replaced by Edward "Eddie" Farrell in the position of Laboratory Operating Engineer. Originally needed for expertise with the large vacuum pumps operating the hypobarometric chambers and refrigeration systems, the LabOpEng soon became the indispensable Jack-of-all-trades, keeping everything in the RRC running properly. This phrase became literally correct when he retired after 25 years and Eddie was replaced by another engineer, Jack Farrell, his son.

Addition of more techniques

Just as it had made electron microscopy available as a centralized facility 16 years earlier, in 1968 the RRC provided access to a second instrumentation technique, Nuclear Magnetic Resonance Spectroscopy. Dr. Terrell C. Myers from Biochemistry obtained funds from a variety of campus sources for a Bruker HFX-90 NMR. Myers and later one of his graduate students, Thomas Glonek, had received training in NMR spectroscopy from a pioneer in phosphorus NMR, John Wazer. In August, 1968, crates arrived containing the instrument for installation in the RRC. Glonek, still a student, was assigned the role of operating it. The five feet high, ten-

ton, cast iron magnet arrived at the old hospital dock and required an entire day to move it through the tunnels to room E12 in MSA and from there into its permanent site, E6D. To do so, however, the concrete block east wall of the lab first had to be torn down, the magnet moved in and the wall rebuilt. The first paper publishing data acquired on the HFX-90 came out in 1969. By 1970 Dr. Glonek was working full time in the RRC with the title Assistant Professor of Biochemistry. Among the many individuals who received NMR spectroscopy training in Myers' lab are two familiar names. Dr. Robert A. Kleps had started as a technician in the lab and later entered graduate school. In 1979, after a U of C postdoc, the RRC hired Kleps to replace Glonek as head of the NMR Laboratory. ~~Marbarger also changed the position's faculty title to the~~ academic professional Senior Spectroscopist to underline the service nature of the RRC. Dr. Richard J. Labotka had joined Myers' lab as a medical student where he did NMR research. Later, he returned to UIMC as Professor of Hematology/Oncology, and continues to use NMR to study red blood cells. In the mid 70's the NMR was used in a series of papers by Drs. Akira Omachi, Physiology, and Thomas Henderson, Biochemistry, and their coworkers culminating in a 1975 PNAS article demonstrating that phosphorus NMR spectroscopy could be used to follow metabolic and chemical changes in living cells. These pioneering studies brought considerable attention and acclaim to UIMC and the RRC. Dr. Michael Barany, Biochemistry, then applied NMR spectroscopy to a wide variety of tissues asking even more biological and biomedical questions which added considerably to the reputation of the university. Further acquisitions over the next few years included a CXP180 MHz NMR (awarded to Dr. Daniel Fiat and assigned to the RRC for management in 1980), and the 200 MHz instrument (jointly acquired by Dr. Michael Johnson and the RRC), and a 360 MHz (from RRC funds) installed in 1983. The wide bore 180 and 200 were often used by Omachi for his experiments on phosphate changes in the heart during contractions using Langendorf (isolated, perfused rat heart) preparations.

In 1978 a third technique, mass spectrometry, was added when a Varian MAT 112 GC-MS was installed. Eugene Robbins, who did the biochemical gas analyses, was retrained to operate and maintain the new MS, and train users which he did until his retirement in 1996. A second MS, a Finnigan MAT 4500, was added in 1987.

1972. Saving the machine shop

Although the Aeromed Lab did include a small machine shop from its beginnings, a large part of the RRC's current mechanical shop was transferred *in toto* as an existing shop from the Physiology department in 1972. Dr. Arnold V. Wolf, head of Physiology from 1958 through 1972, was an expert in water and electrolyte metabolism and the ability of animals to regulate these functions, i.e. maintain homeostasis, in extreme

environments. Hence, Wolf's interests fit in nicely with those of the Aeromedical Laboratory. For many years the department operated its own controlled temperature and humidity chamber for conducting water and electrolyte balance and temperature regulation studies on humans. The room, E211, has served many functions over the years, but its outer and inner chambers and freezer-type doors give away its original purpose. As in most medical schools, the Physiology department also operated an extensive mechanical shop which served the needs of the physiology faculty but also served as a support facility for the entire UIMC. It was headed first by George Leur and then by George Mertz, who was hired by Physiology in 1962, until his retirement in 1992. As with ~~many physiology departments of the fifties and sixties, the~~ shop was used extensively by faculty who required research equipment not commercially available. Although its primary activity was fabricating research equipment, it was often called upon to create equipment for the extensive, multi-quarter teaching laboratories common prior to their decline in the 1970s and '80s. At the time Wolf was appointed Dean of the Graduate College in 1972, the shop was doing more work outside the department than inside. The shop occupied space equivalent to that normally occupied by three faculty members. Hence, there was pressure by the faculty to move or close the shop after Wolf's departure and use the space for faculty laboratories. To save the shop, which was already a valuable campus core facility, Wolf first transferred it to the RRC which reported to the Dean of the Graduate College thus maintaining it under Wolf's authority. Soon after, it was physically relocated to the Benjamin Goldberg Research Center which then also housed the RRC administrative offices and BIF until their respective moves to MSB in 1986 and to CSN in 1994. Mertz supervised the shop, now called the Instrument Shop Facility (ISF), another 20 years within the RRC before retiring in 1992. All of the original instrument makers and machinists are retired as is Ruben Stortzum who managed the ISF for four years after Mertz. It is currently supervised by Eric Schmidt, who was recruited from industry in July, 1995, and has added a computerized milling machine to its array of equipment. Despite having been reduced to a staff of three (supervisor plus two instrument makers) from an original staff of five, the ISF under Schmidt's direction has a very high workload designing and fabricating new equipment with a much reduced turn around time.

Marbarger's legacy

Tall, wavy white hair, formal manner, with a deep, thespian voice, Marbarger was not only the organizer and first Director of the RRC, serving in that position until his retirement in 1980, but a forceful spokesman for research and its support throughout the campus, particularly in the critical quarter century between the end of WWII and the first landing of man on the moon in 1969. Just as basic research in all fields exploded after Sputnik, Marbarger first established

Aeromedical research at UIMC and then broadened his unit's focus to major high tech instrumentation, freely accessible. At the time of his retirement Marbarger tallied the total number of publications of work done in the Aeromed Lab/RRC at 3300. Of these, 92 were published by the RRC staff. He now resides in Florida.

The author, Dr. Robert F. Loizzi, Director, RRC-West, retired in December after 32 years at UIC. Bob writes, first, from the perspective of a user of the RRC for 20 years while a Professor of Physiology and Biophysics, and then as an RRC director for the past 12+ years.

His article will conclude in the Spring 1999 edition of the RRC Reporter.