

History of the North Dakota State University Electron Microscopy Center, 1963 to 2018

In 1960, North Dakota Agricultural College became North Dakota State University. Just three years later in 1963, electron microscopy was introduced at the new university with the purchase of a used 1957-model RCA EMU-3C transmission electron microscope from the University of Chicago for \$13,050 (over \$107,000 today). The Experiment Station was the primary contributor, but also providing funding were the College of Agriculture, the College of Arts and Science, the College of Chemistry and Physics, the Graduate School (through National Defense Education Act Fellowship Funds), and an Institutional Grant for Science. In October 1963, Dr. F. M. Salama attended a special school at the RCA plant in Philadelphia to learn about the hot and cold stages and double condenser lens, and how to service the microscope. Under the supervision of the Department of Agricultural Biochemistry, the microscope was installed (for an additional \$500) in 1964 on the fourth floor of the new Chemistry building, Ladd Hall, where a "special air conditioned room costing \$5,511" was prepared to house it. Under "favorable conditions," the 3C was capable of "direct magnifications up to 80,000 diameters."



The annual service contract for the RCA EMU-3C TEM ran \$1476, payable \$123 per month. The service contract proved to be a bargain when Dr. Salama cleaned the microscope chamber with ether, producing an explosion when the beam current was applied, and necessitating extensive repairs. Total annual operating costs for the 1965-1966 fiscal year were estimated at \$7000-8000, including \$5700 salary for technician Miss Esther Blasl to operate and maintain the microscope as well as train new users.

Ford Motor Company Engineering and Research donated a second TEM in the 1960's, a 1956 RCA EMU-2D, but it was never operational, possibly because of improper packing that resulted in breakage of critical parts as it was shipped from Dearborn, Michigan, and the inability to have electron microscope parts tested "north of Minneapolis." Dr. H. J. Klosterman, Chairman of the Department of Agricultural Biochemistry, urged as early as March 1965 that, because the electron microscope served the whole campus, it should be directly and permanently supported by general University funds.

Ford Motor Company

The microscopy facility struggled with personnel changes, funding, and dispersion of equipment across campus rather than in a single centralized location. Little or

no electron microscopy was being performed in 1968, when the Botany Department hired Thomas Freeman, a new PhD graduate of Arizona State University as an assistant professor. Dr. Freeman, who had taken a single one-hour electron microscopy class in graduate school, was informed upon his arrival that, in addition to a full teaching load of seven courses in basic botany, plant anatomy, and plant morphology, he would also be in charge of overseeing the electron microscope and its operation.

In March 1969, Dr. Klosterman, Dr. R. L. Kiesling, and Dr. Freeman formed an ad hoc committee for microscope operation. Deans Hazen, Sugihara, and Callenbach along with representatives of the departments of Plant Pathology, Biochemistry, Veterinary Science, Natural Sciences, Bacteriology, and Agronomy also were involved in planning. The committee suggested that President Loftsgard establish a trust to guarantee technician salary and travel expenses as well as the service contract. The proposed charge for use of the microscope at that time was \$20 per hour.

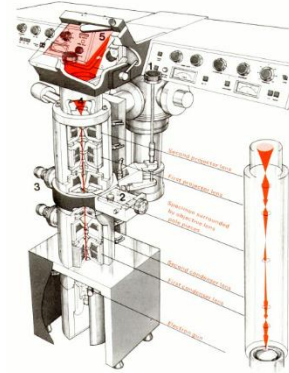
The electron microscope proved to be a burden for the biochemistry department in terms of space and money considering their limited use of the instrument. Miss Blasl resigned May 31, 1969, and no technician was sought to replace her. The RCA TEM went unused from May 1969 until January 1970, when interest in electron microscopy revived; the instrument was moved from Ladd Hall to a former storage room in the basement of Stevens Hall, which had been completed and dedicated in October 1968 to house the Division of Natural Sciences.

Dr. Freeman continued to pitch the concept of a microscopy service facility to the University administration, and the "Electron Microscope Center, a university resource, with campus-wide availability," was established. A technician position was converted to a supporting faculty position: Dr. Thomas Borg, an entomology graduate of the University of Wisconsin-Madison, was hired in August 1970 as an assistant professor, to be head of the EM Center, responsible to Vice President D. G. Worden, and to teach electron microscopy and subcellular cytology courses. Half of Dr. Borg's salary was funded by the Themis project, a large research grant sponsored by the Air Force to stimulate university research on subjects of interest to the Air Force and headed by Dr. M. S. Quraishi. Mosquito eradication was the intended focus of Themis at NDSU. Dr. Klosterman resigned as Chairman of the EM Committee in October 1970, and Dr. Worden named Dr. Borg as temporary Chairman. Despite wide acceptance of the *concept* of an electron microscopy center, no definitive funding arrangement was made.

Laboratory use and support increased as electron microscopy was recognized as a valuable research and teaching tool. In 1972, nine researchers had cooperative EM projects, and teaching for five classes utilized the TEM. Excellent working relationships

had been established with the University of North Dakota Medical School and the USDA Metabolism and Radiation Laboratory. By 1973, seven courses included use of the microscope.

In March 1973, the RCA 3C TEM was traded in towards purchase of a new AEI Corinth 275 for \$39,800 (\$225,524 in 2018 dollars.) At just over half the cost of similar instruments, the 60 kV AEI, along with its vacuum system and power source, was packed into a wood-finished console desk and boasted the largest viewing screen of any electron microscope and a resolution of 7 Å. Four specimens at a time could be loaded through the airlock. The most significant difference between the Corinth and other TEMs, however, was the position of the microscope column: it was upside down, mounted at floor level and rising to a viewing height of 1.02 m. The seven steel rings forming the column had to be aligned manually.



From the beginning, however, problems beset NDSU's AEI instrument, necessitating five days of on-site service in May 1973 alone. Replacement of the anti-contaminator, damaged before installation, took eight frustrating months. Obtaining micrographs on the 70-mm roll-film camera was inconsistent because of static discharge and scratched negatives. A prototype glass-plate photographic system installed in January 1974 did not alleviate the static problem completely, and jamming was common. The cathode assembly had to be replaced in October 1974, and there were vacuum and electronic problems as well. Finally, in 1975, AEI agreed to supply from its factory in England a new tested set of vacuum electronics, lens/high-voltage regulator electronics, and polyester-roll-film camera with a new type of cassette. With those changes completed by early 1976, microscope operation was much improved.

Dr. D. G. Davis, research physiologist at the USDA Metabolism and Radiation Research Laboratory, urged the USDA in 1973 to purchase a scanning electron microscope for its electron microscopy facility to support research efforts including cooperation with NDSU scientists. The cost estimate was \$43,000 to \$73,000. The USDA did have both a Phillips 100 TEM and an SEM, which never worked properly at higher magnifications, possibly because of vibrations inherent in the Red River Valley geology. Usage of the USDA electron microscopy lab declined after the departure of Dr. George Gastner, who had headed the lab, and it closed late in the 1980s. Since that time, USDA scientists have been frequent users and collaborators of the NDSU facility.

Dr. Borg left NDSU for a faculty position as Assistant Dean at the University of South Carolina College of Medicine effective June 1975. Dr. L. J. Littlefield was elected Chairman of the EM Committee and directed to request permission from Dean Sugihara of the Graduate School to initiate a search for Dr. Borg's replacement. Dr. Freeman became director of the laboratory again in spring 1975. A request from the EM Center to the NDSU Special Equipment Advisory Equipment Committee for \$20,000, about half the purchase price of a scanning electron microscope, was not approved. Dr. Freeman hired part-time student technician Keith Kosse, a veteran, with the assistance of Governor Arthur Link. Ultimately, through cooperation across campus



(Experiment Station, College of Agriculture, College of Science and Mathematics, and numerous departments and individual researchers), the first SEM, a JEOL JSM-35, was purchased in the spring of 1976 for \$57,150--about \$252,695 in 2018. It was installed on the second floor of Stevens Hall in room 229, renovated for \$3600, as the basement space was too cramped to hold another instrument. That instrument more than doubled utilization of the facility. As more faculty and students began to incorporate ultrastructure into their research, the electron microscopy laboratory became a true university-wide resource. Service work, mostly performed by Dr. Freeman, was offered to all NDSU colleges and departments in December 1976. Service charges at that time are outlined in Table 1.

Table 1. Electron Microscopy Charges in 1976

Service	Charge
Microscope usage	\$5.00/hour
Technician's services, if used	\$6.00/hour
SEM stubs	\$0.60 each
Metallic coating	\$1.00/sample
Fixation for SEM	\$1.50/sample
Critical point drying	\$1.00/sample
Polaroid film	\$1.10/sheet
TEM sample preparation	\$5.00/sample
TEM micrographs, including 8x10" print	\$0.75 each

Annelee Donnelly was hired for technical support in 1977. She served in that position until her family moved to Colorado in 1979. A struggle to obtain a full-time technician for the EM Center continued through the late 1970s. Salary funding had been rejected by the College of Agriculture and Experiment Station in 1977 on the basis that the microscope facility should generate enough income from service charges to

support itself and a technician, despite the fact that the primary users at that time were scientists from the Agricultural Experiment Station. Student interest had increased to the point that fully half the qualified students had to be turned away from the formal EM courses. On May 16, 1978, administrative responsibility for the supervision of the EM laboratory was transferred from the Graduate School to the Dean's Office of the College of Science and Mathematics because laboratory operations, particularly instruction, were tied closely to activities of Science and Mathematics. According to an August 1978 letter from Associate Director (later dean and Director) Roald Lund of the Agricultural Experiment Station, the State Board of Higher Education approved hiring a laboratory technician for the EM laboratory, and the Department of Botany was to develop a Hatch-level station project to cover the lab's activities. Norman Olson, who had worked in the laboratory on an hourly basis while completing his MS degree in Botany, replaced Mrs. Donnelly as full-time technician in 1979, supported by the Agricultural Experiment Station.

Growing demand for greater magnification and resolution as well as user capacity necessitated new instrumentation. The AEI Corinth alone no longer was adequate to meet educational, research, and diagnostic demands. January 1980 saw the acquisition of a new research-quality TEM (JEOL JEM-100CX) for \$139,000 (\$424,405 today), and the entire microscopy laboratory was relocated to remodeled space on the third floor of Stevens Hall.

By 1981, it was clear that the AEI Corinth electron microscope would have to be replaced. The service contract price increased by 25%, while service days were limited to ten per year. Kratos (AEI) had not manufactured electron microscopes for several years, so parts and supplies were difficult to obtain. In November 1981, a second JEOL TEM, the JEM-100S, did replace the AEI Corinth, which had been out of service a dozen times in the previous year, necessitating emergency service calls and at least 60 days downtime. The 100S cost \$94,170 (\$260,640 in 2018). In addition to several university administrative units, the North Dakota Beef Commission contributed \$10,000 toward the purchase price because of the need for a diagnostic instrument in the NDSU Calf Scour Project. Veterinarian Dr. Allan Peterson had been assigned to the laboratory to help handle the increased workload, but he was reassigned to other aspects of the project, prompting a request for an additional full-time technician to relieve the four- to six-month backlog in electron microscopy work.

A second technician, Mrs. Kathy Iverson, joined the EM Center as a half-time Laboratory Technician III in 1981, funded by the EM Lab trust fund. Mr. Olson resigned in 1982 to accept a full-time biology teaching position at Concordia College. Technical

positions in the laboratory were upgraded to Research Specialists. Although Ms. Iverson was promoted to a Lab Tech IV late in 1982, she apparently received no salary adjustment for her increased responsibility until at least January 1984. Over 1000 samples were examined in 1984.

During 1985, the EM laboratory examined over 1200 samples, representing research efforts by 42 scientists and 35 graduate students from 13 university departments in four colleges, plus the USDA metabolism and radiation laboratory, and the local medical community. Workshops, seminars, laboratory experiences, and demonstrations were presented in addition to formal courses in both scanning and transmission electron microscopy. Mrs. Donnelly returned to the laboratory as a Research Specialist, but resigned again in 1986 for a position in the Graduate School.

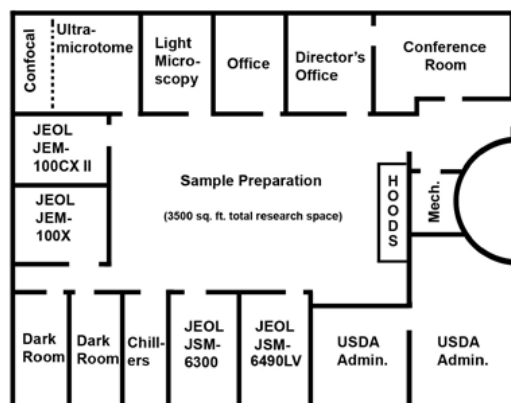
Budget problems in the Agricultural Experiment Station in 1986 stimulated discussions on alternate funding for the Electron Microscopy Laboratory. One proposal required all technical support and maintenance-contract costs to be borne by EM users, and would have necessitated a tenfold increase in service charges. Apprised of this potential change, many users wrote to Dean Lund and Dean Schnell to relate the importance of EM to their research and the adverse effects that the rate increase would have on their programs. The EM facility was reorganized through appointment of a committee of EM users and university administrators (Deans Fischer, Lund, and Schnell) to advise on policy development and user fees. The facility and its operational budget remained under the Office of Graduate Studies and Research, and the Agricultural Experiment Station continued to provide 50% salary support for Dr. Freeman and funding for one technician (reduced from 1.5 in March 1986.)

Agriculture administration in 1986 was encouraging allocation of new and existing resources to basic science, with a goal of increasing general-fund dollars dedicated to non-applied research from 27% to 40% over the next four years. The Experiment Station also lobbied for federal support for a state university biological sciences building. North Dakota Senator Quentin Burdick was instrumental in redirecting that focus toward establishing a *federal* biological research building on the NDSU campus. The USDA-ARS did agree, however, to house NDSU Electron Microscopy within the proposed USDA building, and several other NDSU scientific laboratories also were located there until Loftsgard Hall was completed.

Mrs. Iverson resigned from the university in 1986 to spend more time with her young children. In 1987, Mr. Jay Bjerke was hired as a Research Specialist, and a cryogenic unit, emScope SP2000A, was added for the scanning electron microscope. The Agricultural Experiment Station helped support both actions financially.

March 1988 saw the final relocation of the Electron Microscopy Laboratory to the newly built Northern Crop Science Laboratory of the USDA Agricultural Research Service. Dr. Freeman designed the facility specifically for electron microscopy, a luxury after spending years in retrofitted and limited space. The laboratory took shape only after 2 years of planning and another 1.5 years of construction. The EM suite was the first one occupied in the new building, and in fact, the *sole* occupant for two months, sharing space with only construction workers until other USDA research units arrived in May. The laboratory recommenced service after the move on April 4, and operated near capacity for the next eight months (assisting 44 research scientists from 13 departments) in addition to hosting 41 formal tours and over 1300 visitors. The new facility was the subject of an article in *Microscope Technology & News* in May 1989.

The EM Center occupies 3500 square feet near the main entrance of the architecturally distinctive NCSL on the western edge of the NDSU campus. A dozen rooms, including offices, instrument rooms, darkrooms, and a conference room also used for teaching, surround the high-ceilinged central specimen preparation area, which is flooded with natural light from large windows 35 feet overhead. Concrete isolation slabs in the poured-epoxy floors float free on sand to minimize vibration in the rooms housing electron microscopes; because of increased vibration issues as Fargo has grown, the electron microscopes also have integral or add-on active vibration-isolation systems. The microscope rooms have their own mechanically isolated electrical wiring, chilled water, and nitrogen systems. Baseboard heat in the ultramicrotomy laboratory minimizes interfering air currents. The preparation area has three powerful stainless-steel fume hoods, capacious cabinetry, and bench space for a range of ancillary equipment. A unique exhaust system vents air directly to the outside, and slight negative pressure assures that no fumes enter the rest of the USDA facility.



On June 6, 1989, Deans Fischer, Lund, and Schnell agreed to transfer administration of the Electron Microscopy Laboratory from the College of Science and Mathematics, the Agricultural Experiment Station, and the Graduate School/Research Administration to the NDSU Biotechnology Institute, effective July 1, 1989. The Biotechnology Institute, directed by Dr. Ross Wilkinson, reported through its Executive Committee to the Office of the President and was to comprise the Electron Microscopy Center, a DNA

laboratory, and a monoclonal antibody laboratory. The Electron Microscopy Center cooperated with the Biotechnology Institute but remained a separate entity.

Mrs. Iverson returned to NDSU in 1991 on a half-time appointment as a Research Specialist II supported by the EM lab trust fund without appropriated salary. Mr. Bjerke left the University for a position with Cargill in 1992.

Dr. Freeman's appointment moved from the Department of Botany/Biology to the Department of Plant Pathology in the spring of 1993. The Department of Botany no longer exists: it merged with the Department of Zoology to form the Department of Biological Sciences in 2000. In 1994, EM laboratory personnel were reduced from two full-time technicians to one 3/4-time technician.

Acquisition and updating of microscopes and a full complement of sample-preparation equipment continued. A successful 1992 National Science Foundation grant with University match provided \$261,945 to purchase a replacement SEM, the JEOL JSM-6300, in 1993. The trade-in value for the JEOL JSM-35 SEM was \$63,450--not bad for an instrument that had cost some \$6000 less when it was new in 1975. In 1994, a Noran Voyager X-ray microanalysis system was added to the JSM-6300, which underwent several generations of upgrades and was in service until 2009. The JSM-6300 produced digital image files, initially saved on optical disks.

Through support from the Agricultural Experiment Station as well as the Department of Plant Pathology, Mrs. Iverson's position increased from 1/2 to 3/4 time. Dr. Freeman's academic appointment in Plant Pathology became 95% research and 5% teaching, while his responsibility to the EM laboratory was unaltered. The cooperative administration and financial support of the laboratory by the Graduate School, College of Science and Mathematics, and Agricultural Experiment Station grew uncertain.

Personnel changes and the hunt for equipment persisted. Mr. Scott Payne came to the Electron Microscopy Center in April 1995 as a half-time Research Specialist II, with his salary at that time completely dependent on EM laboratory operations income. Ms. LaRae Ewert joined the staff as a part-time hourly employee in 1996. In 1998, a Codonics NP-1660 photographic network printer was purchased. That signaled a decrease in darkroom printing of SEM micrographs, and the EM staff began to produce posters for meetings and other presentations using computer graphics and large-scale plotter printouts, rather than paste-up of darkroom prints by hand onto card stock. The photographic darkrooms continued to be well used, however, because output of both JEOL TEMs was 3-1/4 x 4-inch black-and-white negative film. Mrs. Iverson was

promoted to Research Specialist III in 1998, then left NDSU in 2000 to work for Eli Lilly and Company in pharmaceutical sales. Beginning in 2000, micrographs from the JSM-6300 SEM were archived as “read only” files on a high-speed NDSU server system. Mr. Payne became Assistant Director of the Laboratory in 2002. In January 2003, Dr. Jayma Moore, a veterinarian, came to the EM Center as a 3/4-time research specialist, funded entirely by the trust; she was named laboratory manager in 2007.

Table 2. Technical Staff of the NDSU Electron Microscopy Center

Name	Tenure	Funding Source up to 2008
Keith Kosse	1975-1977	Graduate Office
Annelee Donnelly	1977-79, 1985-86	Trust
Norman Olson	1979-1982	Experiment Station
Kathy Iverson	1981-1986	College of Science and Mathematics
Jay Bjerke	1987-1992	Experiment Station
Kathy Iverson	1991-2000	Trust (1/2 time 1991-1993); Experiment Station (3/4 time 1992-2003)
Scott Payne	1995-present	Experiment Station (<60%) + Trust (>40%)
LaRae Ewert	1996-2013	Trust (part-time)
Jayma Moore	2003-present	Trust (3/4 time)
Kelly Benson	2004-2005	Trust

The first JEOL JEM-100CX TEM developed an instability in the high-voltage lens tank in 2002, and required more than eight weeks of continuous service. Parts for the 25-year-old instrument were hard to find, and it was retired in 2003. With the assistance of JEOL, the 100CX was replaced by a JEM-100CX II that had been at the University of Chicago, the same institution that had provided NDSU’s first TEM forty years previously. Crating, storing, shipping, and installing the 100CX II cost \$10,337.

The Infrastructure Improvement Program of the North Dakota Experimental Program to Stimulate Competitive Research (EPSCoR) in 2003 provided just under \$100,000 for a CARV (spinning disk) confocal imaging system with Nikon light microscope. In an ongoing search for new major-instrument funding, the Electron Microscopy Center staff prepared unsuccessful Major Research Instrumentation (MRI) grant proposals for the National Science Foundation (NSF) in 2003, 2004, and 2005.

An NSF-MRI proposal for \$287,690 finally succeeded in 2006, enabling purchase of the JEOL JSM6490LV variable-pressure SEM with Thermo energy-dispersive X-ray analysis system and remote-operation capability. Because of the design of the instrument, it required addition of an active vibration-isolation system, prolonging installation

by months until summer 2007. A Nikon SMZ AZ100 stereo light microscope was obtained in 2007 as well. Also in 2007, Drs. Dean Webster and Bret Chisholm of the Department of Coatings and Polymeric Materials and the now-defunct Center for Nanoscale Science and Engineering purchased an RMC Powertome XL + CRX cryoultramicrotome for ultrathin sectioning of materials like polymers that cannot be embedded traditionally. The cryoultramicrotome resides in the Electron Microscopy Center, where the EM staff does the sectioning.

The late 1990s and early 2000s saw a marked increase in imaging and x-ray analysis for materials and engineering. However, veterinary diagnostic microbiology (pathogenic virus identification) continued to be the primary use for the 100S TEM, with calf scours still a problem today as in 1981. Long-term commitments to cooperative projects increased as a way to secure reliable funding for personnel, and principal research areas included ultrastructural studies of the glassy-winged sharpshooter (*Homalodisca coagulata*); greenhouse, giant, and silverleaf whiteflies (*Bemisia* and *Aleurodicus* spp.) and their parasites; and damage to wheat caused by the Hessian fly (*Mayetiola destructor*). From 1993 to 2008, through a creative mix of funding options, Dr. Freeman obtained nearly \$1.75 million for equipment, supplies, and salaries to support the NDSU Electron Microscopy Center: cooperative agreements with USDA-ARS personnel comprised \$469,170; NSF funding amounted to \$418,326; EPSCoR provided \$99,532; and other competitive grants accounted for \$758,540. Total purchase price for equipment acquisition to that date exceeded \$1.5 million.

Unlike most service facilities, with significant hard-money budgets, the EM Center received minimal appropriated dollars through the Agricultural Experiment Station, covering only a portion of the salaries of the director and assistant director. The rest, along with essential supplies, were unsupported by the state, and depended entirely on income from operations. Funding and administrative oversight of the center continued to be issues of concern. Ongoing university support through service contracts has been essential to survival, as well as cost-effective: the annual cost of the service contracts always has been much less than the hourly cost of repair service and parts received.

Dr. Freeman marked his fortieth year as director of NDSU's electron microscopy capability in 2008, retiring in the fall. No new director was named, leaving operations in the hands of the assistant director, Scott Payne, aided by laboratory manager Jayma Moore and LaRae Ewert, who primarily provided bookkeeping support. Despite their markedly increased workload, no additional funding was applied to bolster salaries or operations.

In 2008, Payne and Moore recruited a multidisciplinary team of NDSU researchers led by University Distinguished Professor Dr. Kalpana Katti of the Department of Civil Engineering. They wrote a successful multi-project proposal to NSF-MRI for acquisition of a high-resolution transmission electron microscope. The JEOL 100S was traded in during purchase of the JEOL 2100 LaB₆ TEM. Purchase price for the 2100 TEM was \$969,520.00, with 30% required as matching funds from NDSU and 70% provided by NSF. Not limited to imaging, the 2100 also included EDS elemental analysis and electron energy-loss spectroscopy (EELS), providing elemental information on the nanometer scale. Because of the new instrument's larger size, it was a cramped fit for the existing electron-microscope rooms, so the former film and print darkrooms were combined and refitted to house it. The new TEM arrived in October 2009, and installation was completed in February 2010.

Encouraged by that success, Moore and Payne again identified projects and users on campus who needed improved instrumentation. They assembled another diverse team of scientists whose research aims clearly indicated the widespread value of a field-emission scanning electron microscope at NDSU. The NSF-MRI program funded their 2009 proposal for purchase of the JEOL JSM-7600F, a field-emission scanning electron microscope (FESEM) for imaging and elemental analysis of nanoscale-sized objects with a range of detectors. Purchase price was \$809,996.00 with 70% from NSF and a 30% NDSU match provided by the office of the Provost. Included was a JEOL IB-09010CP argon-beam cross-section polisher to prepare clean cross sections of multilayered materials for FESEM imaging and analysis, and a Hysitron Picoindenter for materials analysis. Installation took place in fall 2010.

In August 2012, discussions began about the nature, organization, and budgeting of centralized facilities or Core Labs at NDSU, and an advisory group of faculty members and administrators formed. A Core Labs page on the NDSU website launched in July 2013 included Electron Microscopy, the Advanced Imaging and Microscopy Laboratory from the Department of Animal Sciences, and the Core Synthesis Facility and Core Biology Facility in the COBRE-funded Center for Protease Research.

A third NSF-MRI proposal by Payne and Moore in 2012 took a different direction: they tapped PI Kendra Greenlee of Biological Sciences and assembled a group of researchers in support of micro computed tomography (microCT) for nondestructive inspection. With a total of \$689,724.00 at the customary 70% NSF/30% NDSU split, this grant funded acquisition of the GE Inspection Technologies v|tome|x s 240kV microfocus X-ray computed tomography system with additional 180kV HPNF submicron X-ray tube (nanoCT) and high-contrast digital flat panel detector. Its complex installation, requiring a crane, house movers, and opening/reconstruction of an exterior and an

interior wall in the NCSL, concluded in July 2013. Included in that grant was a Formlabs Form 2 stereolithography 3D printer, the first of its type on campus.

The era of film use ended at last in June 2013 with acquisition of a Gatan Erlangshen CCD camera and supporting software (\$28,132) for the 100CX II TEM through funding provided by the Provost. By that time, the cost of black-and-white negative plate film and darkroom chemicals had risen to the point that imaging costs far exceeded instrument-use costs, despite the fact that negatives had been digitized on a flatbed scanner for some years rather than darkroom printed. LaRae Ewert left the Electron Microscopy Center in November 2013.

Starting around 2014, some new state-appropriated funds were obtained in support of the cores concept, including the salary of the Electron Microscopy assistant director. Through an administrative oversight, only part of the salary of the laboratory manager was included, with the remainder continuing to come from facility revenue. The chair of the Core Labs Advisory Group resigned in March 2016. At the beginning of fiscal year 2017, Electron Microscopy came under the auspices of the Vice President for Research and Creative Activity and no longer was affiliated with any individual department nor college, reflecting the broad applicability of services provided.

Through the years, the Electron Microscopy Center has adapted to meet current and changing needs of the research community, while attempting to provide stability and continuity of service. Challenges (equipment, personnel, funding) are essentially unchanged since the facility's origin 55 years ago; relocation to an appropriate central division with supportive leadership and solidification of some funding through appropriated dollars has done much to reduce the stress of uncertainty.