

## **A Review of Fifty Years of Light and Electron Microscopy at a Two-Year Community College**

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The education of students in electron microscopy at San Joaquin Delta College was conceived 50 years ago. The two-year vocational program utilized an advisory board that was well experienced in various phases of electron microscopy. The original premise was to give engineering transfer students background in the use of the electron microscope. It quickly evolved into a program that would train microscopy technicians that would assist scientists in research, industrial failure analysis or related fields as required in biological sciences and materials engineering. The graduates would assist in sample preparation or microscope image acquisition – whatever was needed to effectively and efficiently utilize the time of primary investigators.

There was no blueprint to follow and no potential students that were even familiar with electron microscopy. Consequently, the EM program had to start out with small steps. The first course offered was a lecture course on what electron microscopy is. The following semester basic sample preparation course covering. The next step involved electron microscope theory and operation, which continued to be developed in later courses. Expensive instrument acquisition, maintenance, and space allocation were ongoing obstacles.

Successful development was contingent on several factors: Who would design the course? How would students be attracted to such a position? What was the outlook of job possibilities? What would be the prerequisites for the program? Where would the equipment be obtained? With the help of an excellent advisory board things began to take shape. Individuals from the University of California, Davis, Lawrence Livermore National Labs, General Electric and individuals from other institutions were very willing to share their expertise.

In the beginning the program started with a both an old Elmiskop TEM and an RCA TEM, a classic Zeiss Ultraphot with carbon arc rods for color photography, a Porter-Blum MT1 ultramicrotome, which was challenging for the best of them, and a variety of miscellaneous lab equipment. Amid all of the challenges, the program started to slowly grow as courses were added and equipment acquired.

Through out all of these years the college supported the development and growth of the program. The staff consisted of one biological instructor, one materials science instructor, and one laboratory technician that had the responsibility of maintaining the laboratory, the equipment, and assisting students as needed.

In general, the courses that are offered result in the students obtaining an associate of science degree in electron microscopy. Courses consist of basics in TEM, SEM, and EDS. Some pieces of equipment have additional software that is utilized for further analysis of stored images and spectra. Related sample preparation techniques are incorporated into projects and assignments. Advance courses include Focused Ion Beam and Atomic Force microscopy. A general maintenance course involves assembly and disassembly of vacuum pump systems, filament changing, and routine trouble shooting of general

laboratory equipment. Common modes of light microscopy are incorporated into several classes including those dealing with metallography, ultramicrotomy, and integrated circuit technology. The program courses are complimented by college general education requirements for an associate in science degree.

Because of ongoing budget limitations, the acquisition of both new and used equipment has been a necessity. In one sense this enhances the ultimate goal of the program: to give students hands on training with equipment that will help them to understand the purpose and function of instrumentation controls. Some of the older pieces of equipment have single function controls that are fully labeled for learning purposes. Cost of equipment acquisition is governed by the demand for those specific skill sets that potential employers are seeking.

Acquisition of equipment has been a result of many types of support. First of all, Delta College has continually supported the viability of the EM program realizing the importance of technological skills required in the modern world. State programs (Strong Work Force) and Federal programs (Career Technical Education) have made some funds available for cutting edge technology jobs that address the need for increasing the probability of success for under represented populations. Contributions by past graduates have been instrumental in the success of this program. They have come back to be guest speakers, sharing the skills required and job responsibilities that are required at their current position. Support has also come from EM related companies directly or from companies that have some of our graduates working for them. Some recent acquisitions have come from companies that have hired our graduates. When a Delta graduate has a positive impact on a company there is a greater inclination that that company may be thinking of Delta when replacing instrumentation. Smaller companies have also been supportive in maintaining the program viability.

We are thankful for all of those individuals and corporations that have made contributions to insure the success of the microscopy program at San Joaquin Delta College. [1], [2]

#### References:

- [1] San Joaquin Delta College, <https://www.deltacollege.edu/program/electron-microscopy> (accessed February 22, 2019).
- [2] The authors would like to give acknowledgment to Mr. Victor Remillard and Dr. Elizabeth Mathews for establishing and developing this program.