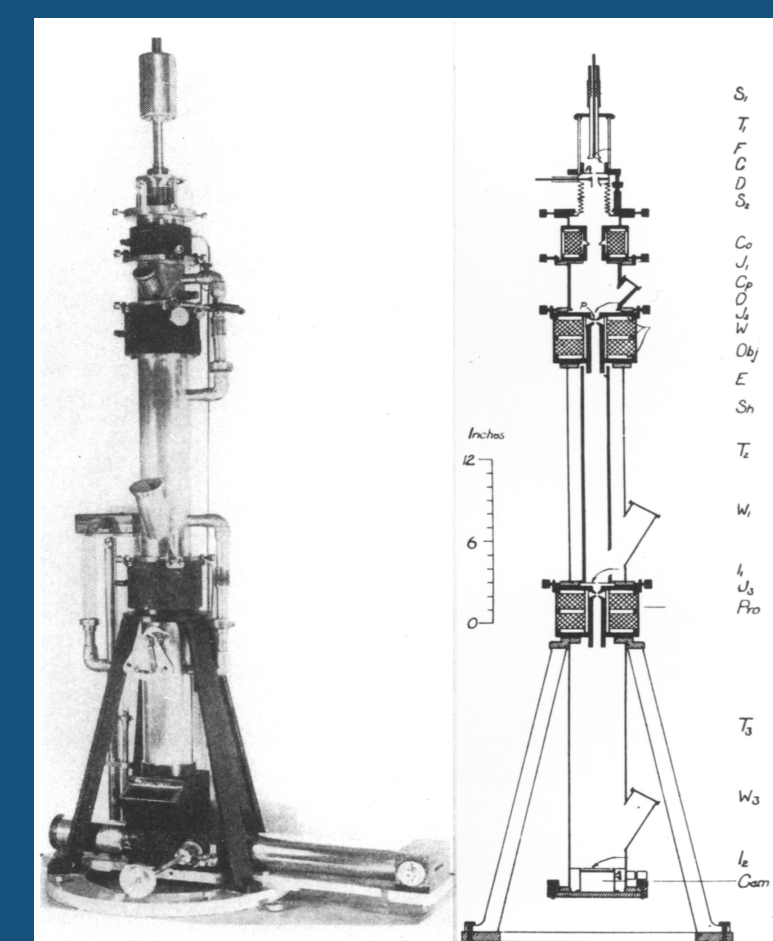
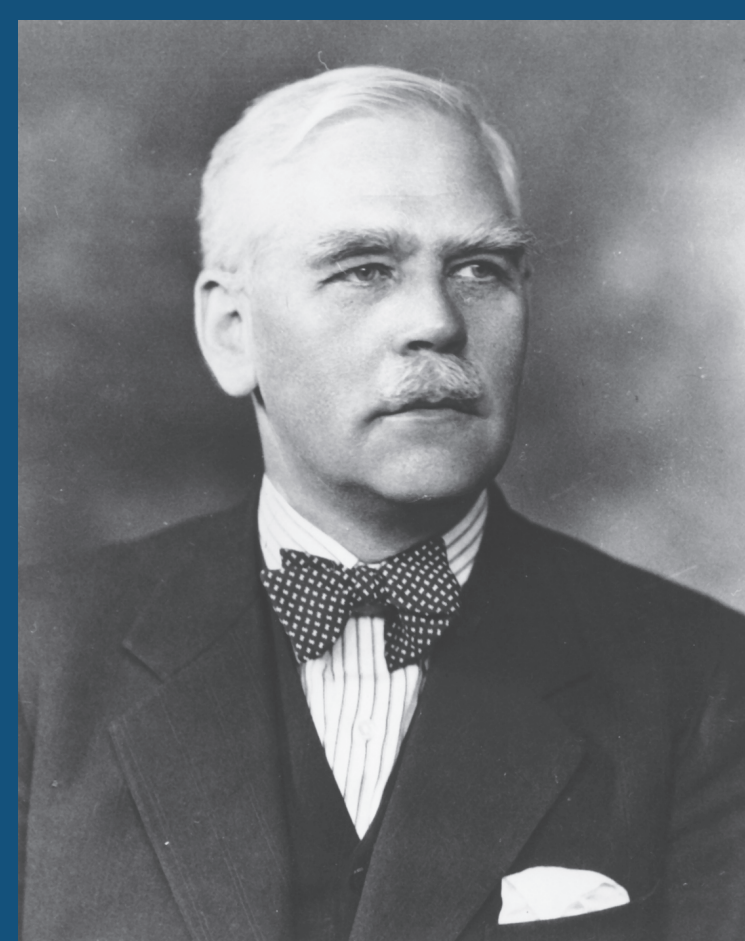


The Beginnings of Electron Microscopy and the Electron Microscope Society in North America



The first successful transmission electron microscope in North America was built in 1938 at the University of Toronto Department of Physics, which was directed by Eli F. Burton. Burton was interested in colloids, and saw the electron microscope as an ideal instrument for their study. Burton was encouraged by the lectures of W. H. Kohl who came to the Department from Dresden in 1930, and built demonstration emission electron microscopes by 1934. Burton visited Berlin in 1935 to see Ruska's microscope, and in the same year he started his own EM program with its first graduate student, Cecil Hall. Hall, born in England and educated in Alberta, built a simple transmission electron microscope as proof of concept, thus helping Burton obtain support for the EM program, although not before lack of funding forced Hall to leave. Hall then built a microscope for Kodak, and ultimately joined the Biology Department at MIT.

The next graduate students were James Hillier, a Toronto native, and Albert Prebus, from Alberta. They continued the work, and completed an advanced electron microscope with resolution considerably higher than that of a light microscope by April, 1938.

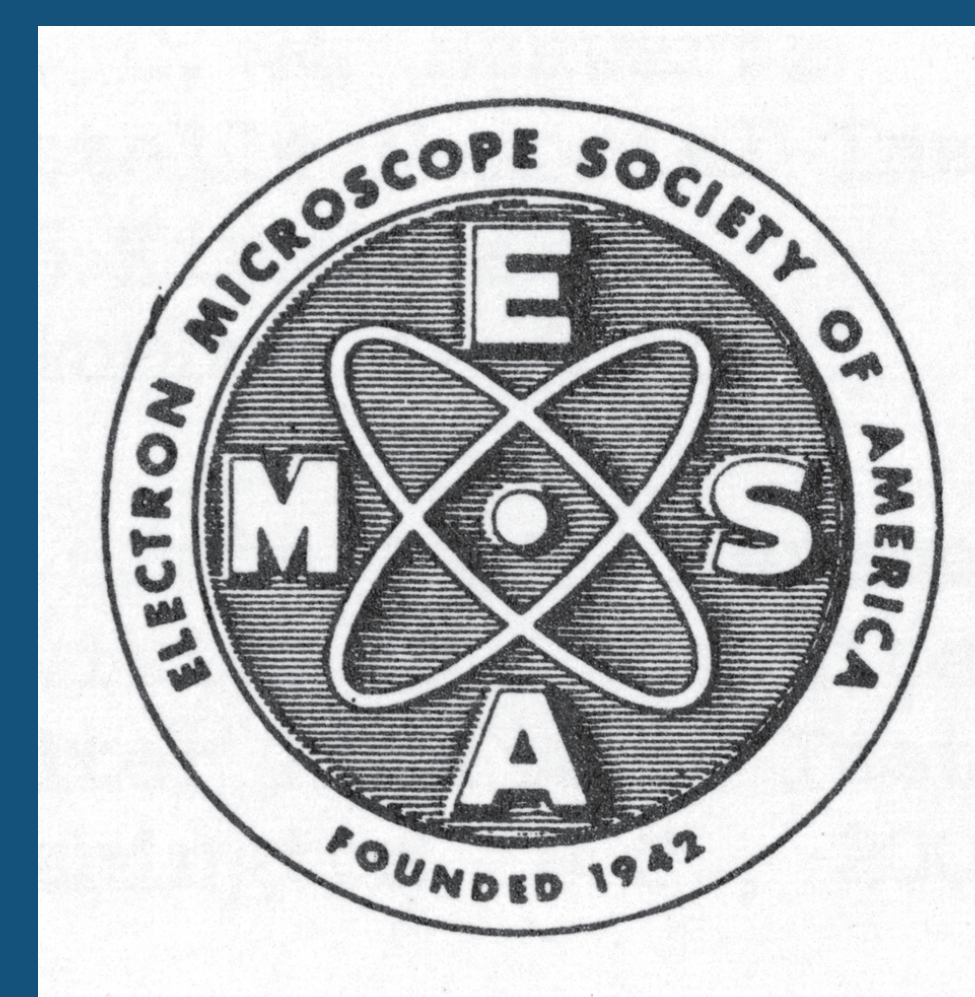
About this time, Sir Frederick Banting of Toronto's Banting and Best Medical Institute, famous for the isolation of insulin for the treatment of diabetes, had all University staff tested for the disease. It turned out that Burton had diabetes. Banting, having been made aware of the electron microscope, saw its potential for medical studies and strongly supported Burton's program. Many of the earliest applications of the Toronto microscope were medically-related.

The Toronto microscope (now displayed at the Ontario Science Center) was built in four months, and by summer 1938 the images were good enough start using it for medical research. Two new graduate students joined the EM program in 1939, William Ladd and John H. L. Watson, both Ontario natives (like Burton, Ladd also was found to have diabetes). Later in the year, the resolution of the microscope reached 10 nm. That level of resolution was reached at about the same time in Germany.

In 1940, James Hillier left for RCA, and Albert Prebus for Ohio State. William Ladd constructed a microscope for the Columbian Carbon Company, and then was hired by that company to operate it. John Watson constructed another improved version of the microscope, and left for the University of British Columbia on finishing his doctorate in 1944, then finally going to the Physics Department at the Ford Institute for Medical Research in Detroit. Burton was proud that his group of Canadians went on to be among the handful of major players in the continued development of the electron microscope.

In 1938 V. K. Zworykin, famed for early work in television, started the EM program at RCA. He brought in L. L. Marton from Belgium. Marton had constructed several advanced electron microscopes, and took the first micrograph of a biological specimen in 1934. However, after building the RCA EMA, it was clear that there were philosophical differences, and in 1940 Hillier was hired to take over the EM program. In less than a year, America's first commercial electron microscope, the EMB, was in production. The EMB, naturally, had an electron optical design very similar to the Toronto microscope, but with much improved electronics and vacuum seals.

At the same time that Hillier and Prebus were working on their first microscope, but without knowledge of that work, electron microscopes were constructed at Washington State University at Pullman, and in St. Louis at Washington University. However, neither of these efforts continued once the rapid advances being made in Toronto and Europe, and then in the US, became known.



Left to right: G. L. Clark (Meeting Chairman), James Hillier, O.S. Duffendack, L. A. Matheson, V. K. Zworykin

Left to right: R.T. Dufford, Perry C. Smith, unidentified, Ernest F. Fullam, W.G. Kinsinger, M. Charles Banca, unidentified

The first meeting of electron microscopists in North America took place on November 27 and 28, 1942, at the Sherman Hotel in Chicago. It was organized by G. L. Clark of the University of Chicago, Chairman of the American Chemical Society's Division of Analytical Chemistry, and took place concurrently with the National Chemical Exposition. All known electron microscopists were invited, and about 60 people attended. RCA set up an operating EMB microscope at the hotel for the meeting. No formal papers were presented. The agenda was heavily weighted towards descriptions and operation of electron microscopes, and methods of specimen preparation. A temporary slate of officers was elected. President: R. Bowling Barnes, American Cyanamid; Vice-president: Albert F. Prebus, Ohio State University; Secretary-Treasurer: M. Charles Banca, RCA; Directors: O. S. Duffendack, University of Michigan, Ann Arbor, and V. K. Zworykin (RCA).

During 1943, the officers met twice and a survey and application form were mailed out. The by-laws were written by A. F. Prebus and O. S. Duffendack. The dues fee for Charter Members was \$5. Via the survey, the membership voted on the name of the Society and approved the affiliations with the American Association for the Advancement of Science and the American Institute of Physics.

The first meeting of the so-named Electron Microscope Society of America was held January 14-15 1944 at Columbia University, New York City. The following officers were elected.

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|--------------------------|------------------------------------|
| President: | R. Bowling Barnes |
| Vice president: | James Hillier |
| Secretary-Treasurer: | M. Charles Banca |
| Directors (three years): | R. D. Heidenreich, T. F. Anderson, |
| Directors (two years): | L. L. Marton, David Harker, |
| Directors (one year): | O. S. Duffendack, V. K. Zworykin |



In 1947, an electron microscopy conference (not the EMSA meeting, which was held in Philadelphia that year) was hosted by E. F. Burton at University of Toronto. Burton passed away not long after this conference.

Front row, left to right: Lorne Newman, Chester Calbick, Cecil Hall, E. F. Burton, James Hillier, William Ladd, and John Watson. Back row: Thomas McLaughlin, Frank Boswell, Beatrice Deacon, Alice Grey, Mary Ferguson, unidentified, R. S. Senett, Glenn Ellis.

The 1948 EMSA meeting, the Burton Memorial Meeting, was held at the University of Toronto.

- (1) Marie Jakus; (2) Mary Schuster Jaffe; (3) G. L. Clark; (4) O. S. Duffendack; (5) Albert Prebus; (6) Daniel Pease; (7) Ernest F. Fullam; (8) Sterling Newberry; (9) Perry C. Smith; (10) R. F. Baker; (11) J. B. Nicols; (12) F. A. Hamm; (13) Charles Banca; (14) John Reisner; (15) F. O. Schmitt; (16) Joseph Comer; (17) Gaston Dupouy; (18) Jeanette Cooper; (19) William Ladd

