Maud Menten

Canadian medical researcher Maud Menten (1879-1960) has been called the "grandmother of biochemistry," a "radical feminist 1920s flapper," and a "petite dynamo." Not only was she an author of Michaelis-Menten equation for enzyme kinetics (like the plot in indigo in my portrait), she invented the azo-dye coupling for alkaline phosphatase, the first example of enzyme histochemistry, still used in histochemistry imaging of tissues today (which inspired the histology background of the portrait), and she also performed the first electrophoretic separation of blood haemoglobin in 1944!

Born in Port Lambton, Ontario, she studied at the University of Toronto, earning her bachelor's in 1904, and then graduated from medical school (M.B., bachelor's of medicine) in 1907. She published her first paper with Archibald Macallum, the Professor of Physiology at U of T (who went on to set up the National Research Council of Canada), on the distribution of chloride ions in nerve cells in 1906. She worked a year at the Rockefeller Institute in New York, where along with Simon Flexner, first director of the Institute, she co-authored a book on radium bromide and cancer, the first publication produced by the Institute - barely 10 years after Marie Curie had discovered radium. She completed the first of two fellowships at Western Reserve University (now Case Western Reserve University), then she earned a doctorate in medical research in 1911 at U of T. She was one of the first Canadian women to earn such an advanced medical degree.

She then moved to Berlin (travelling by boat, unfazed by the recent sinking of the Titanic) to work with Leonor Michaelis. Together they looked at enzyme-catalyzed reactions, found they occurred at a rate proportional to the amount of the enzyme-substrate complex, and developed their famous equation for rate as a function of substrate. This work was critical to understanding how enzymes work, and helped scientists develop means of blocking enzyme reactions (such as drugs like statins which inhibit enzymes which make cholesterol).

She returned to North America and studied cancer from 1913 to 1914 in laboratory of the great surgeon George W. Crile at Western Reserve University (now Case Western Reserve University), in Cleveland. She completed a second doctorate in biochemistry at the University of Chicago in 1916. She was unable to find any good research opportunities for women in Canada at the time, so in 1923 she joined the faculty of the University of Pittsburgh as a demonstrator in pathology, and also served as a clinical pathologist at Children’s Hospital in

Pittsburgh. She held three positions at the Children's Hospital: surgical pathologist, post-mortem pathologist, and haematologist. Despite holding these multiple demanding jobs, she authored more than 100 papers. She discovered the utility of immunization of animals against infectious diseases. In 1944 she was the first to use electric fields to separate different proteins in a mixture based on size - a method called electrophoresis - to separate blood haemoglobin. Her wartime paper received far less attention than later work by Linus Pauling, to the point that this discovery is commonly misattributed to Pauling. Here is yet another example of the Matilda effect, where accomplishments of women in science are often forgotten and attributed to more famous men. This method remains a mainstay of lab techniques for biological systems.

She characterised bacterial toxins from *B. paratyphosus, Streptococcus scarlatina* and *Salmonella ssp.,* then successfully used in an immunisation program against scarlet fever in Pittsburgh during the 30's and 40's. Her research focused on pathology, nucleic acids, tumour cells, scarlet fever, bacterial toxins, and pneumonia. She was known as an outstanding hospital pathologist and teacher, who insisted on excellence in research and who had great compassion for the sick. In due course she was promoted to assistant professor (1923), and associate professor (1925), but did not reach the rank of full professor until 1949 when she was 70, one year prior to retirement. She had retained her Canadian citizenship throughout her time abroad and on retirement promptly moved home to Canada, joined the British Columbia Medical Research Institute and worked three more years, as long as her health would allow. Arthritis forced her second retirement at 75 and she died at 81 in Leamington, Ontario, a 100 km from her birthplace.

Menten never married or had a family, as mothers were usually prohibited from research, but when not revolutionizing biochemistry and medicine she lead a very full life. She was notorious for driving her Model T Ford badly through the University of Pittsburgh campus from 1918 to 1950. She played the clarinet. She mastered six languages including Russian, French, German, Italian, and Halkomelem of the indigenous Coast Salish, which she learned from school friends during her teens in Harrison Mills, British Columbia, where her father was a ferry boat captain. She was a mountain climber and once went on an Arctic expedition. She was an avid amateur astronomer. I am most charmed that she is yet another example of a scientist who was also an artist. She was a talented oil painter, painting colourful and detailed landscapes, still-life works, and florals, and she exhibited her paintings.

The University of Pittsburgh, so slow to promote her to full professor, now has a yearly lecture and professorship named in her honour. In 1998 she was inducted into the Canadian Medical Hall of Fame and has been honoured by a memorial plaque at the University of Toronto. Her obituary in *Nature*, by Aaron H. Stock and Anna-Mary Carpenter states, "Menten was untiring in her efforts on behalf of sick children. She was an inspiring teacher who stimulated medical students, resident physicians, and research associates to their best efforts. She will long be remembered by her associates for her keen mind, for a certain dignity of manner, for unobtrusive modesty, for her wit, and above all for her enthusiasm for research." It is astonishing that she is not a household name as her tremendous accomplishments are still central to research today.