future chemistry or "ultra-pure" substances must arise: not only the physical condition but also the reactions of these "ultra-pure" substances must be investigated. How do these substances react on one another and also in great dilution when present only in traces? Is it not peculiar that matter in the "ultra-pure" state behaves very much like the so-called "unsaturated compounds" as is shown in the behavior of ultra-pure water, the Baker extremely dry bodies, etc.?

And this brings us to the end of our discussion. Can we and should we learn something from the old chemistry, from its masters, its methodology and its aims? I think the answer is "Yes." An individualistic rhythm controls the development of chemistry. People and times change, yet certain ideas and ideals persist forever. True enough they undergo a change in form and value with the course of time, but they live on from generation to generation and act as guides for chemical reasoning and research.

Pascal's words will ever remain true:—"La suite des hommes pendant le cours de tant des siècles doit être considéré comme un même homme qui subsiste toujours et qui apprend continuellement." (The succession of men during the course of many centuries should be considered as one and the same man who exists always and learns continuously.)

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SARAH FRANCES WHITING

AFTER a life characterized by devotion to high ideals and filled with unusual activities, Sarah Frances Whiting, professor emeritus of physics and astronomy at Wellesley College, died on September 12, 1927, at her home in Wilbraham, Massachusetts. She retired in 1916 after forty years of service at Wellesley.

She was born at Wyoming, New York, in 1846. Through her paternal grandmother she was a direct descendant in the ninth generation from Elder Brewster of the *Mayflower*. Her father, the principal of a series of academies which preceded the New York public schools, was not only an excellent classical scholar, but was also well versed in the science of his day. After graduating from Ingham University in Le Roy, New York, Miss Whiting was a teacher there and in Brooklyn for about ten years.

In 1875, when Wellesley College opened its doors to students, Edward C. Pickering, then professor of physics at the Massachusetts Institute of Technology, had established the first students' physical laboratory in America. Mr. Durant, the brilliant founder of Wellesley College, ever alert for new methods of teaching, was greatly attracted by the reports of the students' experiments. He conceived the idea of duplicating the method at his college, but was seriously handicapped because his faculty was to be composed entirely of women. No woman trained in physical experiments could be found, and in no college was such training offered.

Mr. Durant then inquired of Professor Pickering whether it would be possible for him to allow such an appointee to sit as a guest in his classes, since women were not then admitted as regular students. With his wonted courtesy, Professor Pickering agreed and offered to assist in any way towards establishing such a department at Wellesley.

Mr. Durant's quest for the holder of his chair of physics ended when he found Miss Whiting at the Brooklyn Heights Seminary, where, although teaching mathematics and the classics, she had already become fascinated, as she said, with physics and the revelations of the spectroscope.

She went to Wellesley in 1876 to plan and equip the new department of physics. Four times a week in that busy year she sat as a guest in Professor Pickering's classes, and learned from him of his "physical manipulation." Not only did she have to acquire facility in using the instruments, but it rested with her to decide upon those to be purchased for Wellesley, a perplexing problem in those days when all such instruments were made abroad by firms who did not issue catalogues.

She was therefore obliged to visit the physical laboratories of various colleges and institutes, such as Harvard, Yale, Amherst, Bowdoin, Pennsylvania, and see the instruments before ordering. She was always courteously received, although in those early days when the whole idea of a woman's college was so new, there must have been among the staid professors many a "doubting Thomas" who pondered over the question later asked of her by Sir William Crookes in England, "If all the ladies should know so much about spectroscopes, who would attend to the buttons and the breakfasts?"

Her work was varied and onerous during these early years—deciding upon the instruments and putting them together when they came from Germany carefully packed in many detached pieces; lecturing before large classes, for physics was required of all candidates for a degree until 1893; demonstrating and making the experiments go off successfully without assistants until 1885.

But the very novelty of the whole undertaking was most exhilarating. Something was continually being done for the first time.

In the early eighties, Wellesley's good friend, Professor Horsford, of Harvard, offered to install incandescent electric lights in the college library. Alarm was felt among the trustees lest such lights might be

injurious to the students' eyes. Miss Whiting had already visited the Edison works in New York, and realized how different the incandescent lights were from the glaring, flickering arc lamps then in some public use, and how much better than the lights from the smoky gas manufactured by the college. She therefore obtained some Edison bulbs and offered an exhibition, for which she had to do all the work of preparation, such as setting up a battery of forty nitric cells.

An especially exciting moment came when the Boston morning papers reported the discovery of the Röntgen or X-rays in 1895. The advanced students in physics of those days will always remember the zeal with which Miss Whiting immediately set up an old Crookes' tube and the delight when she actually obtained some of the very first photographs taken in this country of coins within a purse and bones within the flesh.

Her rather frequent visits to Europe always served for widening her knowledge and enlarging her acquaintance with scientific people. As early as 1888, she was received at famous physical laboratories in England, including those of Sir Norman Lockyer, Thompson and Ramsay, Sir Oliver Lodge, Lord Kelvin and Lord Rayleigh. In 1896, there were more opportunities for women and she studied under Tate in Edinburgh. In 1913 she attended the meeting of the International Solar Union in Bonn, Germany.

Miss Whiting's pioneer work in establishing the first experimental physical laboratory in a woman's college did not exhaust her resources, for she also became the founder of the astronomical department of Wellesley College. As early as 1879, she offered a semester of lectures in astronomy. By that time Professor Pickering had become the director of the Harvard College Observatory, and he invited her there to learn of the recent development of the new astronomy along physical lines.

A celestial globe and a portable four-inch Browning telescope comprised Wellesley's total astronomical equipment for twenty years. Meanwhile Miss Whiting was thinking and dreaming of a real working observatory where the telescope and the spectroscope together would tell the whole celestial story to the coming Wellesley girls. At last, in 1898, her dream found a lodging in the brain of one of the trustees, Mrs. John C. Whitin, of Whitinsville, Massachusetts. Mrs. Whitin had always been interested, as she said, in "Other Worlds than Ours," and entered into the plan with girlish enthusiasm, so that within a couple of years a beautiful observatory, of white marble with copper roof, had arisen on one of Wellesley's hills. Once more, Miss Whiting's executive ability was called into action in locating, planning and equipping the new observatory. The main telescope is a Clark 12-inch equatorial. There is also a 6-inch Clark telescope, mounted equatorially, a Bamberg broken transit, with 3-inch telescope, a Browning spectroscope, a Rowland concave grating spectroscope, and two Howard sidereal clocks, besides numerous smaller instruments and very complete apparatus for students' work.

She retired from the department of physics in 1912 and devoted herself solely to astronomy, to which she also applied the laboratory method, attributing to Professor Pickering's inspiration her novel introduction of day-time observing. In her little book "Day-time and Evening Exercises in Astronomy," the result of years of teaching large classes, she includes together with "Study of the Telescope" and "Use of Sidereal Clock" such exercises as classifying spectra and finding the light curves of variable stars from Harvard photographs.

She trained many young women for important positions and always followed their lives with the keenest interest, desiring that their work should not only be scholarly, but that they should inspire their pupils with high ideals and prove in every way that the higher education of women was not a failure.

She was a member of the American Association and the American Astronomical and Physical Societies. In 1905 the honorary degree of Sc.D. was conferred on her by Tufts College in recognition of her pioneer work in physics and astronomy.

Her many years of devotion to science did not by any means deaden the social or womanly side of Miss Whiting's character. She was for years the hostess in College Hall, while many friends and alumnae will always recall with pleasure the delightful hospitality extended by Miss Whiting and her sister at the beautiful Whitin Observatory House.

She had a genius for friendship. The observatory is a memorial to her long years of friendship with its donor, Mrs. Whitin. While in London in 1896, she was a frequent visitor at Tulse Hill Observatory and formed a lasting friendship with Lady Huggins, the gifted colaborer with Sir William in laying the foundations of astrophysics. Because of this friendship Lady Huggins bequeathed to Wellesley College a rare collection of treasures including seven hundred books, fifty pictures, old jewelry and embroideries, and twelve small astronomical instruments.

Always dignified, calm and well-poised, rejoicing in the remarkable development of her chosen sciences and of her beloved college, cheered by life-long friendship with kindred spirits, sustained in every crisis by an unfailing Christian faith, Miss Whiting has left behind her the record not only of an eminently successful, but also of a singularly happy life.

ANNIE J. CANNON

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