Some Notable Women of Science.

By Eng. Capt. EDGAR C. SMITH, O.B.E., R.N.

A CENTURY ago, on June 27, 1831, the eminent French woman mathematician, Sophie Germain, died in Paris at the age of fifty-five years, and a few days later was buried in the Père Lachaise cemetery. Her great women contemporaries were Mary Somerville (1780–1872) and Caroline Herschel (1750–1848), to whose names might be added, perhaps, that of Mrs. Marcet (1769–1858), whose “Conversations on Chemistry” was the means of awaking the interest of Faraday in science. Of the careers of Caroline Herschel, the devoted assistant of Sir William Herschel, and of Mrs. Somerville, whose “Mechanism of the Heavens” and “The Connexion of the Physical Sciences” gave her a world-wide reputation, everyone has heard, but Sophie Germain’s story is little known. Yet she and Mrs. Somerville had much in common, and their minds were cast in the same mould. When Mary Somerville, amidst the duties of her London home, was finding time to study the works of Lacroix, Biot, Euler, and Laplace, Sophie Germain was corresponding with Lagrange and Gauss, investigating the motion of the sand on Chladni’s vibrating plates, and writing memoirs which gained for her the respect and admiration of both mathematicians and physicists. Her place in history is that of the foremost of all French women of science.

Mary Somerville, Caroline Herschel, and Sophie Germain were not, however, the first women in modern times to devote themselves to scientific studies. Even in the seventeenth century, and amidst the disasters and miseries of the Thirty Years’ War, we hear of the German astronomer Maria Cunitz, with the assistance of her husband, compiling new astronomical tables, which, after much delay, were published at Frankfort in 1654. Maria Cunitz died in 1664. To the seventeenth century also belongs the work of Jeanne Dumée, the French authoress of an unpublished memoir on the views of Copernicus, and of Elizabeth Koopmann, the wife of Hevelius, the celebrated astronomer of Dantzic. Hevelius died in 1687, but for ten years his wife had been his ablest assistant, and after his death she published the two works, “Prodomus astronomiæ” and “Uranographia, seu firmamentum Sobescianum”. Another German astronomer of the seventeenth century, George Eimmart, found in his daughter, Marie Claire, a valuable co-worker, and for him she made some hundreds of drawings of sunspots, comets, and eclipses.

Among the women of science of the eighteenth century, one name, that of the Italian mathematician, Maria Gaetana Agnesi (1718–1799), stands out clearly. When only eleven years of age she knew eight languages, and in her twentieth year she published a collection of ninety-one theses she had previously defended. Her “*Istituzioni Analitiche*”, published in 1748, long continued a valued text-book on the calculus, and is regarded as the first important mathematical work by a

woman. This work had been preceded in 1740 by the “*Institutions de physique*” of the remarkable Frenchwoman, Gabrielle-Émilie Châtelet (1706–1749), the friend of Voltaire, and to her we also owe a translation into French of the “*Principia*” of Newton. This was not published until after her death. While the names of these two distinguished women belong to the history of mathematics, those of Margarete Winckelmann (1670–1720), the wife of Gottfried Kirch, and of Nicole-Reine Étable de la Brière (1723–1788), the wife of Jean André Lepaute, belong to astronomy. Madame Kirch, the wife of one astronomer and the mother of another, while at Berlin discovered a comet and made observations on the Aurora Borealis, and, after she became a widow, she published in 1712 a paper on the approaching conjunction of Jupiter and Saturn. Madame Lepaute from an early age had displayed a taste for science, and when at the age of twenty-five years she married the celebrated horologist she at once became his collaborator. She was also the friend of Clairaut and Lalande, and assisted them in the calculations on Halley’s comet. Her own observations are contained in the “*Connaissance des temps*”, 1759–1774. The last years of her life were devoted to her husband, who was struck down with sickness, and she died at Saint Cloud a few months before him. Another woman of science of the eighteenth century was Dorothea Erxleben (1715–1762), who in 1742 published a work on the cultivation of science by women, and in 1754 was made a doctor by the University of Halle.

Though to-day women are found working at every branch of science, it has been mainly in the realm of astronomy they have hitherto done their most notable work. Following in the footsteps of Mary Somerville and Caroline Herschel, during the nineteenth century a succession of women made their mark either as observers or as writers on astronomy. Maria Mitchell (1818–1889) was long the professor of astronomy and director of the observatory at Vassar College in the United States. She was provided by the women of America with a large equatorial, and the observatory at Nantucket, now under the direction of Miss Margaret Harwood, was erected in her honour. Two other American women, Anna Winlock, who died in 1904, and Mrs. Williamina Fleming (1857–1911), were connected with Harvard University. Especially important were the writings of Miss Agnes Mary Clerke, who was born in County Cork in 1842 and died in London in 1907. Her sound judgment and her wide acquaintance with astronomical literature made her “*History of Astronomy during the 19th Century*” a most valuable book of reference. This work first appeared in 1885, and was followed by her “*System of the Stars*”, 1890, and “*Problems in Astrophysics*”, 1903. Her most eminent woman contemporary in England was Margaret Murray, who in 1875 married Sir William

Huggins. Like Caroline Herschel, Mary Somerville, Anne Sheepshanks, Miss Clerke, and Mrs. Fleming, Lady Huggins enjoyed the distinction of being elected an honorary member of the Royal Astronomical Society.

In other branches of science, mention may be made of the Russian mathematician, Sophie Kovalevsky (1850–1891), who studied under Weierstrass at Berlin, and in 1884 was made professor of higher mathematics in the University of Stockholm; Mrs. Ayrton, the first woman member of the Institution of Electrical Engineers, and who was proposed for admission into the Royal Society; Marie Sklodowska, better known as Madame Curie,

famous for all time as the discoverer of radium; and Dorothea Klumpke, who in 1893 was the first woman to obtain the doctor's degree in the mathematical sciences at the Sorbonne. Her thesis was a study of the rings of Saturn. It was when granting her the degree that M. Darboux said that her work gave her a place beside Maria Agnesi, Sophie Kovalevsky, and Sophie Germain. To this short sketch of some women of science other names might be added, but from what has been said it will be seen that France, England, Switzerland, Russia, Italy, Germany, and America are all represented, showing that the women of science, like science itself, have been confined to no one country or age.

Diet and the Teeth.*

AS a result of numerous experiments, Mrs. Mellanby has shown that there is an intimate relationship between the structure of the teeth in dogs and the composition of the diet, more especially its vitamin D content (see *NATURE*, vol. 125, p. 604; 1930). In further work she has now demonstrated a relation between diet and the structure of the teeth in rabbits and rats, as well as one between diet and certain forms of dental disease in dogs and other animals.

Defects of structure similar to those observed in the teeth of imperfectly fed dogs are common in other animals and have been found in horses, monkeys, rabbits, and ferrets. A common defect is the presence of interglobular spaces in the dentine: in fact, these spaces are so common that it is only their absence from teeth with smooth white enamel and their presence in large numbers in obviously imperfectly calcified teeth that has enabled one to say that they are abnormal structures and that their presence in a tooth otherwise well calcified indicates a certain degree of imperfect development or hypoplasia.

The dentition of rabbits and rats differs considerably from that of the dog: in the former, the permanent dentition shows continuous growth throughout life; in the latter, there is no temporary dentition, and the incisors grow from persistent pulps as in the rabbit, but the molars cease growing after eruption, as in dogs. Young rabbits, about eight weeks old, were used for the experiments: they were placed on a diet containing four parts of oats to one part of bran with 1.5 per cent calcium carbonate; 6 c.c. decitrated lemon juice were also given daily. Without the latter, the animals developed scurvy, and without the calcium carbonate, good growth and health were not maintained. The condition of the teeth on this basal diet was worse than when the calcium carbonate was omitted, since growth was better. Except when vegetables were included, it was necessary to supply water also.

The defects produced by this diet were as follows:

* Medical Research Council. Special Report Series, No. 153: Diet and the Teeth: an Experimental Study. Part 2: A. Diet and Dental Disease; B. Diet and Dental Structure in Mammals other than the Dog. By May Mellanby. Pp. 94+28 plates. (London: H.M. Stationery Office, 1931.) 2s. 6d. net.

the enamel was thin and irregular and stained deeply with carmine; the dentine was thin and easily stained and contained many interglobular spaces; the odontogenetic zone was wide and irregular: the jawbone was poorly calcified, consisting largely of osteoid tissue or osteoporotic bone.

The addition to the diet of materials rich in vitamin D, such as cod liver oil, egg yolk, and irradiated ergosterol, induced good calcification of the teeth: the two former, however, were not well-borne, death following after 7-8 weeks. Smaller doses of cod liver oil, for example, 0.5 c.c. instead of 1-2 c.c. daily, with a supplement of 20 gm. or more of cabbage, markedly improved general health and growth, and calcification was excellent. Vegetables alone exerted only a small calcifying effect, although improving general health: dandelion and clover were fairly effective, cabbage had little influence unless fed in large quantities, the allowance of oats and bran being at the same time reduced: summer but not winter grass, was comparable to cabbage. Swede-turnip, carrot, potato, and white turnip had little or no calcifying power. As might be expected, irradiation of the animals with the mercury vapour lamp also improved the structure of the teeth.

The amount of calcium and phosphorus in the diet and the calcium/phosphorus ratio are only of importance when the vitamin D intake is low. In the basal diet, the ratio is 1:0.81 and the actual percentages of these elements relatively high. It is of interest to note that rats fed on similar quantities of calcium and phosphorus have normally calcified bones. When the calcium carbonate was replaced by phosphate the rabbits grew as well, but the calcification was much improved.

The experiments on rats indicated that the defects of structure caused by a deficient intake of vitamin D were very similar to those found in rabbits, and that supplying this factor in the diet resulted in the development of perfect teeth.

Although it has not been found possible to produce caries satisfactorily in the teeth of experimental animals, it has been shown that the development of the periodontal tissues in dogs and their subsequent liability to disease can be controlled by the diet. On a perfect diet the gingival region of the jaw is comparatively thin: the subgingival epithelium is