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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

PROFESSOR WILLIAM FERREL.

WILLIAM FERREL was born in Pennsylvania, 1817. In 1856, at the age of thirty-nine, he began a series of studies in meteorology, which, in their more finished form, in later years gave a new aspect to this science, and placed him at the time of his death, Sept. 18, 1891, at the front of American meteorologists. His work was always quietly done, never with any attempt at the conversion of the great public, or almost with indifference to the attitude of the scientific public regarding his beliefs; but with the patient conviction that he was working in the right direction and that his theories would in time receive general acceptance. Towards the close of his life, this happy end was reached, as far as the better informed meteorologists of the world were concerned, and in Europe as well as in this country, Ferrel was regarded as the leader in the methods of mathematical meteorology; not that others who followed in his paths did not exceed him in completeness of demonstrations, but that the methods which he introduced into the science were essentially the same as those by which his successors carried it further. A comprehensive narrative of his life is given in the *American Meteorological Journal* for February, 1888, by Alexander McAdie of the Weather Bureau, and a list of his publications in the same journal for October last; I shall therefore here only touch on what seems to me highly characteristic of his work, and of the revolution that it produced in scientific meteorology.

Unscientific meteorology, such as was current before Ferrel's work reformed it, cannot yet be said to be excluded from popular acceptance. We still find writers who take Maury as their authority, following his antiquated views, quite unaware that they are thirty years behind the times. I do not wish to detract in the least from the deserved reputation gained by Maury for his persevering study of the winds and currents of the ocean; for the great incentive that he gave to ship-masters to become observers and bring home a careful record of their observations. The tabulation of the facts thus gathered formed the basis of wind charts for the several oceans, first produced in this country, and closely followed by the hydrographers of many foreign nations. It is on this collection of facts that Maury's reputation rests secure; and not on his theories, for they were essentially wrong and are now practically laid aside. Unfortunately for his success in this department of science, Maury seems not to have been well equipped with knowledge of physics and mathematics, and in his ignorance of these subjects he was led into serious errors as to the motions of the winds. Those errors have been considered by various writers, but by none earlier or more effectively than by Ferrel, who, in 1856, published an essay in the Nashville *Journal of Medicine*, an essay prompted by the insufficiency of Maury's theories. It is not necessary to enter here into an exposition of Ferrel's theory; those who wish to study it may find its fullest statement in his latest work, a "Popular Treatise on the Winds," published in 1889. Some statement of these theories may be found in *Science*, ix., 1887, 539; and xv., 1890, 142. But it may be briefly said that the difference between Maury's theory and Ferrel's is as the difference between darkness and light.

Maury thought the return current from the poles was in this hemisphere an east-north-east wind: Ferrel showed that it is a west-north-west wind. Maury was not alone in thinking that the polar return current flowed in our latitudes from the north-east. Dove, the leading German meteorologist of the middle decades of this century, had the same idea, and, I think, at an earlier date than Maury. According to Dove, the alternation of north-east and south-west winds that we feel with the passage of our storms centres is simply the contest of the polar and equatorial currents, of which first one and then the other reach the surface of the earth. This view, embodying the idea of the north-east-south-west course of the polar return current, may be said to have held an accepted place in meteorology at the time when Ferrel prepared his first essay on the subject. But for those who have followed Ferrel's work, the north-east return current has no existence. His reasons for giving this return current a north-west source are simple and ample; and for those who do not share this view, there is a large fact in nature which cannot be explained; namely, the low pressure about the North Pole; a similar arrangement prevailing in the Southern Hemisphere, where the return current comes from the south west.

This seems to be a small matter. It is a slight change to make in words, to say that the return polar current comes from the north-west, not from the north-east: and truly, if this were all that could be said, it would not be a great affair. But if the reader will examine the question carefully, and study the development of our knowledge of the winds, he will soon be convinced that the introduction of Ferrel's idea as to the course of the polar return current and the explanation of the low pressure that is bound up with it, marks the introduction of rational physical principles into this department of meteorology. This change came at a time when the physical study of meteorology was a rare thing. Look, for example, at Schmid's "Meteorologie" of 1860, a voluminous treatise, well representing the condition of the science then; compare with it Spring's "Lehrbuch" of 1885, in which the science is presented in the manner introduced by Ferrel. The difference is that between statistical, inductive methods, and fully expanded logical methods that utilize all means of inquiry. The science has become a new thing by this change; would that meteorologists had as greatly changed and were not still so content to read instruments and count up totals and means.