THE British Minister of Agriculture on April 7 laid the foundation stone of a new building for the department of agriculture of Leeds University, which is to be built at the cost of £60,000.

AT a public meeting at Kingston organized by university men it was agreed that all sections of the people should be asked to support an appeal to the Secretary of State in favor of founding a West Indian University at Jamaica. It was proposed, further, to solicit imperial assistance for the scheme, which provides for the setting up of an examining body in the West Indies at Codrington College, Barbados, and at the Agricultural College of Trinidad, which would be branches of the university.

PROFESSOR CHRISTIAN A. RUCKMICK, associate professor of psychology in Wellesley College, has been elected professor of psychology in the State University of Iowa.

PROFESSOR A. E. JOLLIFFE has been appointed to the university chair of mathematics tenable at King's College, London. Since 1920 he has been university professor of mathematics at Royal Holloway College.

DISCUSSION AND CORRESPONDENCE

CONCERNING THE VARIATIONS OF ATMOSPHERIC ELECTRICITY AND VERTICAL CURRENTS

I AM sure that Dr. Sanford will concede that my criticism[1] of his theory[2] of the annual variation of the potential gradient of atmospheric electricity was a courteous one. Instead of entering into a discussion of the ideas advanced by him, I confined my remarks to calling attention to data, apparently not accessible to him, which did not support his theory. In the last sentence of the first paragraph of his recent article,[3] he gives an incomplete interpretation of a statement of mine by failing to give it in its entirety. Dr. Sanford's theory had implied that generally over the earth the annual variation at a given place should primarily vary according to the sine of the sun's zenith distance at apparent noon, and I attempted to show that this theory did not fit the facts as we *now* know them, for widely-separated regions. No blame was attached to him for not being in possession of the latest literature; however, as he knows, from my correspondence with him, the Department of Terrestrial Magnetism is at all times ready to keep him informed of latest developments, if he desires such assistance. Were it necessary other facts, not in accord with Dr. Sanford's theory, could be cited. Moreover, it is found that wherever there are available simultaneous observations of the potential gradient and of the electric conductivity, the product of the two quantities, or the vertical current density, follows about the same course during the year as does the potential gradient itself.

Dr. Sanford has also some rather fixed ideas regarding the cause of the diurnal variation of atmospheric electricity, and it would seem as though he has taken an unreceptive attitude towards modern developments that are not in accord with his theories. He cites[2] in support of his ideas, theories and conclusions reached by eminent investigators, 50 years and more ago, when the science of atmospheric electricity was in its infant state, and many of the noted advances of the past two decades were unknown. In the September, 1923, issue of *Terrestrial Magnetism and Atmospheric Electricity* will be found a general summary by my colleague, Dr. S. J. Mauchly, of the principal facts regarding the diurnal variation of the potential gradient of atmospheric electricity, as derived from the available observations on the oceans and at land stations.

Respecting the question as to the existence of vertical electric currents as disclosed by line integrals of the magnetic force, or by analyses of the earth's permanent and transient magnetic fields, Dr. Sanford goes back to results of investigations made 20 years and more ago, before the extensive data accumulated on our ocean cruises, by our land expeditions and by cooperating institutions, were available. The manner of carrying out our computations of line integrals and the interpretation of the signs of the resulting values are in accord with those adopted by eminent physicists.

Any one looking carefully over my various statements, especially those in recent papers, will see that I have not failed to recognize the physical difficulties and that I have diligently pointed out the quantitative discrepancy between the current densities as obtained from the magnetic line integrals and the observations in atmospheric electricity. Furthermore, the endeavor has been made to find some other physical interpretation of the results than that of vertical electric currents, and it may be that when the exhaustive analysis of the earth's magnetic field, in progress at the Department of Terrestrial Magnetism, has been completed, some other physical explanation, as, for example, a relativity effect, will be found sufficient to account for the outstanding "non-potential system." When the analysis has been completed, we shall then be able also to map out this non-potential system, or the geographical distribution of equivalent vertical-current effects, which will supersede the 1920 results quoted by Dr. Sanford, for which the avail-

[1] SCIENCE, July 27, 1923, pp. 67–68.
[2] SCIENCE, May 25, 1923, pp. 616–618.
[3] SCIENCE, February 22, 1924, pp. 194–196.

able observational data, largely because of delays caused by the late war, were still not as extensive as they are now. The 1920 results had been distinctly designated as *preliminary* ones, which fact Dr. Sanford has apparently overlooked. However, the results of the computations to date, though differing somewhat in detail from those for 1920, support the general conclusions previously drawn: The non-potential system besides being unsymmetrical about the axis of rotation is also found to be unsymmetrical about the equator, hence we must not expect, as did Dr. Sanford, that the computations of magnetic line-integrals along corresponding parallels of latitude on opposite sides of the equator should give identical results. The combination of results for corresponding parallels, north and south, was made with the view of obtaining approximately the system symmetrical about the equator. The difficulties encountered in finding an adequate physical explanation of non-potential effects are minor as compared with those which arise when attempting to explain the origin of the earth's magnetic field in the manner Dr. Sanford has attempted.

LOUIS A. BAUER

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CAVERNS IN THE GUADALUPE MOUNTAIN RANGE

IT is evident from the note on the "Carlsbad Cavern in New Mexico" in SCIENCE for December 14, 1923, that Dr. Lee and Mr. Holley are not well acquainted with the early history of that cavern.

The writer met at Carsbad, New Mexico, in the autumn of 1914, a Mr. Borden, then superintendent for the Los Angeles fertilizer concern then working the guano deposits of the Carlsbad cavern. Mr. Borden described to the writer an exploring trip which he had made in the cave which occupied the time from early one Saturday until the afternoon of the following Monday, the work of exploration being continuous during that interval of time except for the intervals necessary for sleeping and eating.

In the summer of 1918, Dr. N. F. Drake, then state geologist of Arkansas and professor of geology, University of Arkansas, and the writer explored the cavern for a distance of about three fourths of a mile from its main entrance. At that time they were informed that the then superintendent in charge of the guano extraction had succeeded in reaching a distance estimated to be ten miles from the mouth of the cavern, but had not found its end.

There are other notable cavern in this same Guadalupe mountain range. One is found in Slaughter Canyon about two miles from its mouth and was visited by us. In its vicinity there were formerly other great caverns later filled in by travertine deposits. At the time of our examination of the region two wells were being drilled on the eastern flanks of the Guadalupe Mountains. One of them encountered a cavern from which a continuous current of cold air issued. The other well was six miles distant from the first. The driller had his hat sucked down the hole when the drill broke into a cavern in this well. Another large cavern was reported to have been found near where the Carlsbad-Queen road crosses the summit of the Guadalupe Mountains.

Other notable caverns occur in the San Andreas limestone of the Sacramento Mountains, the next range north of the Guadalupe. Three days after the summer rains of 1918 began on the summit of the Sacramento Mountains in the vicinity of Cloudcroft wells in the vicinity of Roswell, some 70 miles distant, which previously it had been necessary to pump, began to flow out at the surface. It is likely that the water derived from the rainfall in the mountain summits reached the wells 70 miles away in three days and travelled a considerable part of the distance through underground caverns.

CHARLES LAWRENCE BAKER

THE FLASHING OF FIREFLIES

THE articles in SCIENCE on "The synchronous flashing of fireflies"[1] might lead one to infer that knowledge of this peculiar phenomenon is a recent contribution to science. I have in my possession a textbook studied by my grandfather. This book, called "An Easy Grammar of Geography," was published in Philadelphia in the year 1810. The author is Reverend J. Goldsmith. May I quote paragraph 187 on Siam?

> The elephants of Siam are distinguished for sagacity and beauty. The trees on the banks of the Meinam River are finely illuminated with swarms of fire-flies, which *emit and conceal their light as uniformly as if it proceeded from a machine of the most exact contrivance.*

The italics are mine.

HESTER L. VAN VLECK

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JOSEPH LEIDY

DR. OSBORN, in his address at the Leidy Centenary (SCIENCE, Feb. 22, 1924), referred to Dr. Leidy's breadth of knowledge. This was shown in his ready comments upon the varied papers read before the Academy of Natural Science in Philadelphia. I recall one evening in the early eighties one of the members read an elaborately prepared paper upon the origin of the name of the arbor vitae, taking the accounts of the early Canadian pioneers, and their use of the arbor vitae branches for their beds, and of the

[1] SCIENCE, Vol. LIII, p. 485 (1921); LIX, 163 (1924).