appears that the number of complex phonetic shifts, for the most part determined by adjacent sounds, is enormous. These involve the loss of consonants, at times of whole syllables, the transformations of consonants and vowels, the leveling of old vowel-quantities with a redistribution of such quantities, etc. To such an extent have these wrought havoc that words have been transformed almost beyond recognition. Who would suspect that maistō'^{u}—"throat"—comes from *mekuntākani, ma'éx^{a}—"eye"—from *meckēncekwi, ho'íst^{a}—"fire"—from *ickutäwi? Yet it can be rigorously demonstrated. Incidentally the chronology of these shifts must be ever taken into consideration. Thus, the same Cheyenne sound may come from two distinct archetypes which have been merged, and in such cases the phonetic treatment often is determined by the original archetype. Another potent factor must also be reckoned with, namely, analogy. At times the plural of a noun has been influenced by the form of the singular, the reverse of what has happened in a few cases in Cree. The terms for bodily parts combined with possessive pronouns have frequently been rebuilt analogically. The so-called "intervocalic —t—" in verbal forms has been entirely wiped out. Thus it appears that the morphological transformations are due to phonetic shifts and analogy. I do not know a single Cheyenne morphological trait that is due to extraneous influence. The speech-form has remained Algonquian.

I am not in a position to report on Arapaho and Blackfoot, two divergent Algonquian languages, with any degree of confidence, save to say that I have worked out a number of phonetic shifts in both, with the result that the number of demonstrably Algonquian words has decidedly increased in both. This last applies especially to Blackfoot. Very fortunately in Cheyenne, Arapaho and Blackfoot the semantic transformations do not seem to be very radical. In conclusion it may be said that none of the above-mentioned languages contributes much towards the reconstruction of the parent Algonquian language, of which the historical languages are the descendants. An exception must be made in one or two cases where Cheyenne, though aberrant, is clearly archaic.

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IRON TOXICITY FROM LIMING

IT has been found that one of the immediate effects of heavy liming rather acid soils with calcium carbonate is to greatly increase the iron content in the soil solution. Incident to liming the amount of organic matter in solution is greatly enhanced. Owing to the great increase in carbon dioxide in the soil, directly and indirectly the result of liming, the pH of the soil solution is maintained at a lower level until the excess carbon dioxide is largely dissipated. The first reactions in the soil are favorable for the holding of iron in the soil solution. As soon as the limed acid-soil comes to equilibrium the iron level falls back to a desirable amount for crop production. The adjustment period under field conditions would depend upon the weather, varying from several months to a year. This transitory higher level of iron in the soil solution, and perhaps other sesquioxides, apparently accounts for the toxic effects to farm crops from the use of large amounts of lime on some of the acid soils. In a case of the Caddo silt loam the use of a large amount of lime increased the iron content in the soil solution from 0.5 ppm to 50.0 ppm. The original reaction of the soil is pH 4.8.

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SCIENTIFIC BOOKS

Manual of Meteorology, Volume IV, Meteorological Calculus: Pressure and Wind. BY SIR NAPIER SHAW, with the assistance of ELAINE AUSTIN. Pages XX, 359, xii, and 79 illustrations. Cambridge: At the University Press. New York: The Macmillan Co., 1931, $9.50.

THIS last volume of Sir Napier Shaw's great "Manual of Meteorology" is not a book to be read at a single sitting. There are 600 words, or more, to the page and many sections are so full of thought and suggestions as to require reading and rereading with much pondering and meditation. This never is owing to carelessness in expression, for Sir Napier is a master in saying things both clearly and elegantly, but to the inherent difficulty of the subject itself, and the necessity for some sort of limitation to the length of the exposition.

No other treatise on meteorology approaches in magnitude this four-volume manual, and yet apart from the historical and statistical portions, it essentially is restricted to the mechanics and thermodynamics of the atmosphere. It would be a great boon if Sir Napier would give us a supplementary volume or two on the acoustical, electrical and optical phenomena that also pertain to that medium. This further contribution from him we wish, but have not the face to request. The task he already has accomplished was Herculean, and he richly deserves all the holidays he wants. But will he rest? Certainly not, if we may judge the future by the past.

The first chapter of this Volume IV treats of the laws of atmospheric motion, and a lot of things incidental thereto. Indeed, it is an excellent summary of a considerable portion of classical physics—harking back to the era of sanity when he studied under Helmholtz and taught at Cambridge. It is in this chapter that, like Rücker in 1889 (*Phil. Mag.*, Vol. 27, p. 105), he finds for absolute temperature the same dimensions as those of kinetic energy per unit mass. In this connection the reviewer regrets that Sir Napier passed by an excellent opportunity to say another good word for entropy which he has so effectively and abundantly used in his discussions of the atmosphere and its motions. He might have, as did Tolman (*Phys. Rev.*, Vol. 9, p. 247, 1917), regarded entropy as a fundamental quantity and from the expression $T=\frac{dQ}{dS}$ found for absolute temperature the dimensional value $ML^2T^{-2}S^{-1}$, that is, energy divided by entropy. This is very interesting, but no doubt most of us, in practice at least, shall continue using temperature in our equations and calculations as just a number on a scale, wholly without dimensions of any kind.

The second chapter, covering 50 pages, shows ways of applying mathematics to the problem of the movement of a parcel of air over the rotating earth, when subject jointly to the urge of an active push and the restraint of viscosity and turbulence. Here Sir Napier makes some portions delightfully easy, while others he leaves to the reader's own ingenuity and amusement. The rest of the book affords relatively easy and sure going, except, of course, over the many parts where knowledge of the way still is seriously deficient.

The next seven chapters give detailed accounts of the phenomena to which the mathematics of the second chapter apply, with numerous interesting and profitable side excursions. Sir Napier knows too much of his subject to be content to follow a straight and narrow course from premise to conclusion, nor are his readers willing that with such knowledge he should do so.

To the American readers of these chapters, in which a number of striking numerical values are given, a note of warning is in order. Sir Napier always uses the full-weight ton of 2,240 pounds, not our short-weight ton of 2,000 pounds. Again, when he says billion he means a sure-to-goodness British billion of a million million, and not our diminutive billion of only a thousand million.

The last chapter in this, the final volume of Sir Napier's great manual, is an appropriate and excellent retrospect over the whole present field of meteorology, in which he himself has been a most industrious and efficient worker—a retrospect, however, that closes with a stimulating urge to further good work in the future.

And now another warning: Don't think that when the excellent eleven-page index is reached the book is done, for after that, instead of the customary blank leaves, is a two-page postscript worth reading; and even after that, in turn, a convenient summary of the contents of the entire manual.

Now that this great work is available to all it might be supposed that the meteorological millennium at last had come, but it has not come, and it will not have come until the upper personnel, save only the business element, of every considerable meteorological service have fully mastered it and at least the dozen next best treatises on the air and its ways; nor, further, until they themselves, and those in line to follow them, have become creative workers in this same limitless field. All must agree that such a state of affairs is urgently needed. Furthermore, it is entirely possible to effect and, moreover, rapidly coming to pass.

W. J. HUMPHREYS

My Nature Nook. By W. S. BLATCHLEY. Pages 1–302, and 15 half-tone plates. The Nature Publishing Company, Indianapolis, 1931.

IN January, 1913, Dr. Blatchley went to the Gulf Coast of Florida from the rigors of an Indiana winter to find a place where he might spend a few months each year living an outdoor life in pleasant surroundings. He wished a place where he might be surrounded by a fauna and flora yet primitive and undefiled, where he might live in close daily contact with interesting trees and shrubs and the shy live folk that dwell among them. He selected Dunedin-on-the-Gulf, some twenty miles north of St. Petersburg, and has been going there each winter since. A short distance from the little town he found a secluded spot near Clearwater Bay and there he purchased a few square rods of land which he calls "My Nature Nook." He built a comfortable small house in which to live when bad weather makes it necessary to stay indoors. He then began seriously and with enthusiasm to examine the little patch of ground which was the first primitive spot of mother earth which he ever had that he could call his very own. He studied it in great detail, vastly more minutely than did Gilbert White the region which he made famous in that classic, "The Natural History of Selborne." Blatchley selected an old leaning oak tree, in a fork of which he made a comfortable rustic seat where he could sit, observe and think and write. And what he thought is duly set down in this book.