these omissions are not as serious as they are in England, for here one can probably find them discussed in the Sunday editions of the daily papers!

There are some omissions, however. In the chapter on radiation no mention is made of the sensitive instruments for detecting and measuring radiant energy—the thermoelement, the radiometer, the bolometer. In fact, the discussion of radiation is rather inadequate. In the chapter on the interference of light several pages are given to the discussion of Fresnel's mirrors and biprism, but no mention is made of the interferometer, although the latter is as important theoretically as the former and vastly more important in its numerous applications to exact measurement.

In the chapters devoted to heat, however, admirable illustrations of the application of the principles to modern heat engines are given. In electricity, too, the points of contact of the subject with the world of to-day are shown.

In a book where so much material is presented in so few pages the method of approach is abrupt and the style at times uninteresting. The text will not find favor with those teachers who place emphasis on the inductive aspect of the science nor will it be pleasing to those students who look for entertainment in their reading, but it is a very dependable, clear and fairly complete statement of the principles of physics.

G. F. Hull

Dartmouth College

Essentials of Physics for College Students. A Text-book for Undergraduates and a Lecture Course and Reference Work for Teachers and Other Students of Physics. By Daniel W. Hering. The D. Van Nostrand Co. 353 pages, with 166 illustrations.

The author tells us in the preface that the work is the outgrowth of a course of lectures which he has delivered for several years past to undergraduate students, and that it is intended for that class of students preparing to fill the position of educated men and women who are not specialists in science. As the contents of the book are intended to be presented in "sixty lectures of fifty minutes each" some rather important, perhaps essential, parts of the subject have received a very brief description. On the other hand, liberal space is given to some pseudo-philosophic topics. One notes that the author gives only two pages to the presentation and discussion of the mechanical equivalent of heat and the laws of thermodynamics. The connection between the absorbing and reflecting power of surfaces is given in two lines. But notwithstanding this brevity the author devotes the larger part of the first twelve pages to these captions or questions: Physics, is it or is it not a study of matter, ether and motion? Why study physics? Space, time, matter; Energy "a capability of matter." The best feature in this discussion is found in the definitions and statements quoted from Maxwell's "Matter and Motion."

A couple of pages are given to the discussion of *inertia* in which the author decides that one can no more measure the quantity of matter by its inertia than one can measure the size of a dead elephant by its deadness. This adherence to the notion that *inertia* is a property of matter which can not be represented quantitatively is not in accord with the custom of physicists. The terms *inertia* and *moment of inertia* are used quantitatively in physics. Such authors as Crew and Ames set forth in a very clear manner the mode of measuring the quantity of a bit of matter by its inertia or reluctance to change of linear motion. The author does not deal with the large topic of rotational motion, consequently he makes no reference to *moment of inertia*.

In dealing with the units involved in force and work the author brings in the engineer's system (footnote, p. 32): "If force be measured in pounds then the mass will be in pounds $\div 32$ and work will be in foot-pounds." Had the equation of force been written $F = kma$ instead of $F = ma$ there would have been no necessity for this statement and the confusion it brings to students would have been avoided.

Apart from these criticisms the text is to

be commended for the clearness with which physical principles are stated, and for the numerous workable and practical problems. That part of the text dealing with lenses and with problems concerning the eye is especially to be commended.

One feature of the text which distinguishes it from others is the grouping together of descriptions of demonstration experiments at the end of each chapter. This is a matter of considerable convenience to an instructor and should prove interesting to a student. Another commendable feature is the large number of references to, or quotations from, other texts or original articles.

The author apparently has not attempted to condense as great a number of facts and principles as possible into the text, but has attempted to present in an interesting form what appears to him to be of most importance, and he has succeeded. As a piece of bookmaking the text is excellent.

G. F. HULL

DARTMOUTH COLLEGE

SPECIAL ARTICLES

THE NUTRITIVE VALUE OF THE PROTEINS OF MAIZE[1]

THE state of knowledge at present prevailing concerning the nutritive value of cornmeal when fed to domestic animals is clearly presented in a letter which I recently received from Professor Willard, of the Kansas Agricultural College, who has had a wide experience with practical feeding experiments made on a large scale on domestic animals. He says:

> It is a matter of common experience extending over many years, that corn appears to be deficient in some particular in nutritive value. Some have thought to account for this on the basis of low protein content; others have attributed the result to its small percentage of ash; still others have taken into account not only the small percentage of ash, but its unbalanced character, being deficient in calcium and possessing a large percentage of magnesium; still more recently there has appeared the possibility that the defect may find an explanation in limitations in the amino-acid components present in the corn protein.

From this quotation it is evident that further study is needed in respect to the relative nutritive value of the constituents of this seed. Professor Mendel and I have recently obtained preliminary results from feeding maize proteins to white rats under conditions similar to those which I described at our fall meeting last year.

The proteins of maize have not received the attention that their great economic importance demands, for these, the most valuable constituents of this seed, form from eight to ten per cent. of a crop which in this country alone is annually worth one and a half billion dollars. This is the more remarkable as those chemical investigations which have been made show that at least one half of the protein of this seed consists of a type possessing such unique chemical and physical characters as to make it probable that its nutritive properties differ to a marked extent from those of the proteins in other foods of either vegetable or animal origin.

In addition to this protein, known as zein, the maize kernel contains small quantities of globulins, albumins and proteoses and also protein substance insoluble in neutral solvents which can be extracted from this seed only by dilute alkalies. This latter protein has been named maize glutelin. According to such data as are at present available, zein forms about 58 per cent. of the proteins of corn, the globulins, albumins, and proteoses together about 6 per cent., and the remaining 36 per cent. is supposed to be maize glutelin.

The few recorded attempts to determine the nutritive value of maize proteins, in the isolated state, have been made only with zein. The conditions under which these have been conducted have been such as to render the results of uncertain value, although in every instance zein, when supplied as the only protein, proved ineffective for maintaining adult animals or promoting the growth of the young.

Zein presents striking differences in its amino-acid make-up when compared with the other proteins commonly present in foods. The greatest interest has centered about the

[1] Read before the National Academy, November 13, 1912.