powder exploded. The cars were blown to bits, rails were broken and warped and the pieces were hurled to great distances; houses in the vicinity were wrecked; and the force of the explosion was felt throughout the city. The seismographs recorded the surface movement as a cross tracing, distinct but susceptible of measurement only with the aid of a lens.

J. E. Talmage

MASS AND ENERGY

The following is an outline of some interesting theoretical results, a full account of which will shortly appear elsewhere.

If a piece of matter be considered as an electrical system, possessing any structure or internal motions, but having on the whole a kind of average symmetry, then it may be shown that the electromagnetic mass of such a system for ordinary velocities is given by

$$\text{Mass} = \frac{4}{3}\frac{1}{V^2}E$$

where V is the velocity of light and E is the total electromagnetic energy of the system. Thus the mass of the system is determined solely by its energy content, and the idea is suggested that mass and energy may have something in common. This result has several interesting implications.

Any reaction which is caused by the action of electric forces will involve a change in the electromagnetic energy content of the system, and hence according to the above view will be accompanied by a change of mass. This change will, of course, in general be a decrease. In the case of ordinary chemical reactions calculation shows that this change would be too small to be detected, but in the case of radioactivity, where the energy lost is relatively much greater, a sensible change is to be expected. Thus on this view the atomic weight of the various products of radium can not be accurately calculated from the number of α-particles lost, for there is this further decrease in mass due to the loss of energy.

The evolutionary theory of the elements has always met an almost insuperable difficulty in the fact that there appears to be no *exact* regularity of any kind throughout the list of atomic weights.

Some years ago Rydberg came to the conclusion that it was necessary to consider the atomic weights, up to that of iron, as made up of two distinct parts $N + D$, where D is a very small difference, a slight deviation in fact from (N). Exact harmonious relations exist between the various N's and Rydberg seems to consider the D's as representing real physical deviations and not merely mathematical remainders.

From the point of view of loss of mass accompanying energy dissipation, it is evident that these small irregularities are just what is to be expected.

Finally it is to be noticed that if for all matter the ratio of mass to weight is sensibly the same, the above mentioned proportionality between mass and included energy can only imply that the gravitation of a body is always proportional to its total energy content, and this constant proportionality seems to point toward the conclusion that it is confined energy which gravitates and not mass in any other sense.

It is perhaps well to point out that the conclusion respecting gravitation involves the assumption that all the mass of matter is electromagnetic, while the conclusion respecting loss of mass and atomic weight irregularities requires only that the forces causing the energy change be electric or magnetic, *i. e.*, requires only that *part* of the total mass be of electromagnetic origin.

Daniel F. Comstock
Mass. Institute of Technology,
September 9, 1907

NOTES ON ENTOMOLOGY

Another heavy installment of Wytsman's "Genera Insectorum," has made its appearance. Fascicle 46[c] by Otto Schwarz completes the Elateridæ or click beetles; it comprises pages 225 to 370, and six colored plates. The types of the genera are not indicated, and the references are incomplete. In the case of new genera there is nothing to show

in what genera the component species were formerly placed, and an author's interpretation of a genus is placed under another genus as a synonym without hinting that that author was not the original describer of the genus. A new genus—*Parallelostethus*—includes *P. attenuatus* Say, the *Ludius attenuatus* of the Henshaw list.

Fascicle 50 is on the Plastoceridæ, a small group near Elateridæ; it is by Otto Schwarz; 9 pages, 1 plate. Many species of this group are from California.

Fascicle 51 is on the Dicronychidæ, a small group of African beetles near to the Elateridæ; it is also by Otto Schwarz, 5 pages, 1 plate.

Fascicle 52 is by H. Schouteden on the subfamily Asopinæ of the Pentatomidæ; 82 pages and 5 colored plates. He restricts *Perillus* to *P. confluens,* and for our other species makes a new genus, *Perilloides.* For *Podisus* he uses the same *Apateticus* Dallas, and most of our species fall in a new subgenus—*Eupodisus.* This fascicle is easily above the average of the "Genera."

Fascicle 53 is on the Lampyridæ or fireflies, by E. Olivier; 74 pages and 3 colored plates. His idea of the family is much narrower than that of Leconte; the Lycini, Phengodini and Teleophorini are omitted. He uses *Lecontea* for *Pyractomena* of our lists, and *Ellychnia* and *Pyropyga* fall as synonyms of *Lucidota.* Over 1,000 species are catalogued, but unfortunately many are briefly described in foot-notes.

Fascicle 54 is by J. J. Kieffer on the Dryinidæ; 33 pages, 2 plates. This includes about 300 species. There is no mention of the family Proctotrypidæ, under which family these tiny Hymenoptera are known to most entomologists. The genera are extremely numerous for a small family.

Fascicle 55, by R. Shelford, on the subfamily Ectobinæ of the Blattidæ, or cockroaches; 13 pages, 1 plate. It includes a table of the subfamilies of cockroaches.

Fascicle 56 is by V. L. Kellogg on the fragile flies of the family Blepharoceridæ; 15 pages, 2 plates, one of the plates with figures of larvæ. It is much less valuable than his paper on the American forms.

THE late Baron Edmond de Selys Longchamps made provision for the publication of a descriptive catalogue of his collections, now in the Belgian National Museum. His collection was largely in Neuroptera, and in the Odonata, or dragon-flies, it was the largest and most important in the world. Two parts of this descriptive catalogue are now issued. Fascicle XVII. on the Cordulines, a group of dragon-flies, is by René Martin; 94 pages, 3 colored plates, and 94 text figures. This part includes all the described species, and a description is given of each form, many of them new. The references are often incomplete, and there seems to be a general lack of systematic treatment. The second part to appear is fascicle VI. on the Trichoptera, or caddice-flies; it is by Georg Ulmer, 102 pages, 4 colored plates and 132 text figures. It includes only species in the Selys collection, which was not large in this group. The new species are mostly from Japan; new descriptions are given of several American species. Unfortunately the author has been careless in the use of the word "type."

PROFESSOR C. FRIONNET has treated systematically the caterpillars of France.[1] He gives a general account of caterpillars and chrysalides, and a synoptic table to the caterpillars of the 213 species of butterflies known to occur in France. Under each species there is a description of the caterpillar, the date of feeding, name of food plants, eggs, distribution in France, habits, and the known parasites. There are lists of parasites and hosts, and of plants and caterpillars feeding on each. An extensive bibliography of the subject is given in the early part of the book. A work on the caterpillars of the Eastern States, on the same plan, would be of great value.

[1] "Les premiers états des Lepidoptères français: Rhopalocera," *Mém. Soc. Lett. Sci. Arts Agric. Ind. St.-Dizier;* 322 pp., 3 pls., 1906.

Dr. F. V. Theobald has issued another volume of his monograph of the mosquitoes.[2] This is the second supplementary volume, and we are told in the preface that another volume is in active preparation. This volume contains the descriptions of 160 species described since the publication of Volume III. and the descriptions of seventy-three new species, none of the latter being from our country. There is a review of the classifications that have been proposed since Volume III., and he clings to his former methods, with the addition of some characters derived from the papers of Lutz. Most of the plates represent portions of wings showing the nature of the scales; others show genitalia and larvæ. There is no bibliography included in this volume.

Dr. Otto Schmeideknecht has published a work[3] of great usefulness, not only to Europeans, but to Hymenopterists throughout the world. Many of the European genera occur in our country, and their careful tabulation will assist us in recognizing them. The book contains 800 pages and 120 text figures; more of the latter would materially strengthen the work. Synoptic tables are given to the species in all groups except the three large families of micro-Hymenoptera, the saw-flies, certain Ichneumonidæ, and some genera of bees, as *Colletes* and *Sphecodes*.

The tiny blood-sucking flies of the genus *Phlebotomus,* as little known as the mosquitoes were twenty years ago, now come into prominence through a paper by Professor B. Grassi.[4] He has obtained an Italian species, worked out its life history, studied its anatomy both external and internal, and presented the results on four beautiful double plates. The previous record of a larva of this genus was for an African form found in cesspools, but the Italian species lives in moist soil. This larva has four long terminal bristles, and differs greatly from the larva of *Psychoda,* and would seem to warrant a still greater separation of this genus from the true Psychodidæ. Grassi gives a long account of the previous writings on the genus.

Mr. E. E. Austen's recent work on the blood-sucking flies is chiefly remarkable for the beauty and accuracy of the plates;[5] these are comparable only to the plates issued by the same author on the tsetse flies. Thirty-five species are figured, and several others are referred to in the text; eight of these are mosquitoes, and seventeen are Tabanidæ. He states that our "horn-fly" known to us as *Hæmatobia serrata* should be called *Lyperosia irritans* Linn.

Mr. E. R. Burdon has given us an interesting historical account of the origin of two generic names.[6] He shows that as "Kermes" the dye-insect of the oak was well known in Southern Europe, and so used by Linnæus in the second edition of his "Systema Naturæ." Later, in the seventh edition he put this insect in *Coccus,* and used *Chermes* for other Hemiptera. Geoffroy used *Chermes* for *Coccus* or the original *Kermes* of Linnæus. Then Boitard went back to the original spelling, using *Kermes,* while Hartig retained *Chermes* for the aphid genus.

One of the largest general works on ants has recently been published, but entirely in the Russian language.[7] It includes an extensive bibliography of 915 numbers, an introduction in which he discusses the structure and classification of ants, and a systematic treatment of the Russian forms. Tables to the genera are followed by the characters, habits and distribution of each genus in detail. Then the species are described, with keys

[2] "A Monograph of the Culicidæ of the World," Brit. Mus. Nat. Hist., 1907, pp. 639; 16 plates, 297 figures in text.

[3] "Die Hymenopteren Mitteleuropas, nach ihren Gattungen und zum grossen Teil auch nach ihren Arten analytisch bearbeitet," Jena, 1907.

[4] "Ricerche sui Flebotomi," *Mem. Soc. ital. Scienze* (3), Vol. XIV., pp. 353–390, 1907, 4 pls.

[5] "British Blood-sucking Flies, with Notes," Brit. Mus. Nat. Hist., 1906, 74 pp., 34 plates.

[6] "Note on the Origin of the Name Chermes or Kermes," *Jour. Linn. Soc. Lond., Zool.,* XXX., pp. 5–9, 1907.

[7] "Formicariæ Imperii Rossici," Kasan, 1906, 800 pp., 176 figs., by M. Rusky.

under each genus. Altogether there are 258 forms, of which 161 are species or subspecies, the others being classed as varieties. Many varieties and several subspecies are new, but described only in Russian. The habits and distribution in Russia of each species is given often in much detail. The Caucasus region appears to be the richest in species. The author recognizes but four subfamilies: Camponotinæ, Dolichoderinæ, Myrmecinæ and Ponerinæ.

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DIET AND ENDURANCE AT BRUSSELS

MLLE. DR. J. IOTEYKO, head of the laboratory at the University of Brussels, and Mlle. Varia Kipiani, student in science, have published a monograph of seventy-seven pages: "Enquête Scientifique sur les Végétariens de Bruxelles."[1] In this monograph the question of vegetarianism is studied by several methods. The authors have become convinced that the vegetarian régime is for the most part a more rational one than the highly nitrogenous diet ordinarily prevailing in Western Europe and America.

In the brief introduction, general considerations in regard to diet are mentioned and special emphasis given to the subject of toxins. The authors quote, in behalf of their conclusions, the eminent French dietitian, Armand Gautier, "who, without himself being a vegetarian, praises the good effects of the vegetarian régime." The authors quote Gautier as follows:

> The vegetarian régime, modified by the addition of milk, of fat, of butter, of eggs, has great advantages. It adds to the alkalinity of the blood, accelerates oxidation, diminishes organic wastes and toxins; it exposes one much less than the ordinary régime to skin maladies, to arthritis, to congestions of internal organs. This régime tends to make us pacific beings and not aggressive and violent. It is practical and rational.

The authors, while apparently classifying themselves as advocates of vegetarianism, admit that in certain cases it is necessary to prescribe meat as a "medicament"—"just as one prescribes sometimes alcohol and other poisons." The authors also observe that the transition to a vegetarian diet should be gradual.

The personal history is traced of forty-three vegetarians of Brussels. Among other interesting observations is the following:

> For the most part the vegetarians appear younger than their age; notably the ladies are distinguished by their clear and fresh complexion.

The experiments conducted by Mlles. Ioteyko and Kipiani are restricted to vegetarians who have been such for several years. The experiments were, for the most part, comparisons of strength and endurance. So far as strength is concerned, very little difference was discovered between vegetarians and "carnivores." In endurance, on the other hand, a very remarkable difference was found, the vegetarians surpassing the carnivores from 50 to 200 per cent., according to the method of measurement.

This result agrees with the experiment on nine Yale students described in SCIENCE.[2] These subjects, by dint of thorough mastication, gradually lost their taste for flesh foods. At the end of five months, while not becoming vegetarians, they had reduced their consumption of flesh foods to one sixth of the amount to which they had originally been accustomed. Their strength remained practically stationary, but their endurance, according to the gymnasium tests, was increased on an average by over 90 per cent.

The method of measuring endurance used by the Belgian investigators was by means of the Mosso ergograph. One of the fingers is used to raise a weight as far as possible. As the experiment proceeds and fatigue sets in, the height to which the weight can be raised is gradually reduced until no further contractions are possible. If a curve be constructed representing the height of the successive contractions, it is called a "curve of fatigue," and it is found that this curve is "different for different individuals, but is constant for the same individual from one day to another and even after an interval of several years, if the

[1] Brussels, Henry Lamertin.

[2] N. S., Vol. XXIV., No. 620, Nov. 16, 1906.