nouns this is extremely arbitrary; and, moreover, in all inflected languages, words very often undergo transformation in gender during course of time. Le Péloponnèse, for instance, has a feminine termination, but is of the masculine gender; and Galilée may be of either gender. Val, feminine in the Latin *vallem,* and still feminine in French proper nouns, has become masculine by common usage, taking the plural *vaux* by analogy with *mal, cheval,* etc. Some words, like *sang,* are masculine in certain combinations, and feminine in others. Finally it can hardly be claimed that the form 'Mont Pelée' does violence to a language which authorizes us to place the feminine article before *bon-bec,* and the masculine before a variety of words like *rouge-gorge, rouge-queue, cent-garde, grand' croix, patte-pelu,* etc.

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THE METRIC FALLACY.

TO THE EDITOR OF SCIENCE: In a recent article in SCIENCE on the discussion of the metric question in the House of Lords, Dr. Seaman repeats with approval the claim as to the great saving of time that would be accomplished in school by the use of the metric system. This claim has been one of the chief supports of the metric cause for generations, and has remained practically unchallenged except by a general denial. The forms in which is was presented in the House of Lords last February and in the report of our House Committee on Coinage, Weights and Measures in 1902, are so typical of this claim that both are given here:

Lord Belhaven, in House of Lords, February 23: "There is a great waste of time in the education of children, through the learning of the arithmetical tables and their application. Out of 221 school-masters consulted, 212 replied. One hundred and ninety-seven stated that there would be a considerable saving of time if the metric system were introduced; of these, 161 estimated the saving at one year; 30 estimated it at two years; and six went so far as to estimate it at three years."

Report of the Committee on Coinage, Weights and Measures to the House of Representatives, April 21, 1902: "Estimates made by the Department of Education and others show that the work of at least two thirds of a year in the life of every child would be saved by the adoption of the metric arithmetic. * * * Teachers and pupils alike unanimously testify as to the ease with which the system is taught and learned and the facility with which it is applied to the problems which in ordinary arithmetic are complex and difficult to solve. When we consider that there are over 15,000,000 school children in the United States being educated at a public cost of not less than $200,000,000 per year, the enormity of the waste will be appreciated. In the lifetime of a single generation nearly $1,000,000,000 and 40,000,000 school years are consumed in teaching a system which is in harmony with that of no other nation of the world."

This argument has been reiterated with so much emphasis and with such a show of authority that it has unquestionably carried conviction to the minds of thousands. The opinions of experts regarding their own trade are ordinarily accepted by others. If educators say the metric system would effect a saving of one to three years in the school life of a child, why should it not be accepted as true?

Within a few weeks Frederick A. Halsey has applied the scientific method to the school children argument, and, in view of its general acceptance, with startling results. It is to him that I am indebted for the data on this point. In the report of the course of study for elementary schools, dated May 27, 1903, the board of education of New York city gave a time schedule for each study for the eight years. This schedule is based on 1,500 minutes per week, and the time allotted for all branches of mathematics amounts to $34\frac{1}{8}$ weeks for the eight years. No reliable data is available as to the proportion of this time occupied in the study of weights and measures; 20 per cent. of the text-book on arithmetic, however, is occupied by the chapters on compound numbers, weights and measures. In order to be liberal to the metric cause we will apply this rate, 20 per cent., to the whole time, including that occupied with algebra and geometry. The total time devoted to the study of compound numbers, weights and measures during the eight years

of school life by this liberal estimate amounts to 6.8 weeks, from which the introduction of the metric system is to save from one to three years.

It would seem as if absurdity in advocating the metric system could go no farther. The exposure of this metric fallacy is not an occasion for ridicule, directed at Lord Belhaven, the House Committee on Coinage, or others who have accepted it in good faith. It is rather a cause of humiliation that such an absurd pretence regarding education should have been spread broadcast, not only without dissent from the schools, but with their enthusiastic approval. Have our educators become so accustomed to receiving and imparting information by mere authority that they have lost the power of analysis?

Dr. Seaman refers to the English system as 'the complex, irregular and barbarous system now in vogue.' Again, Professor J. H. Gore, of the Society for the Promotion of the Metric System, is thus quoted in *School Science:*

> We send consular representatives to every quarter of the globe for the express purpose of making possible an extension of our foreign commerce, and then busy ourselves in an attempt to make such commerce impossible, and retain a system of weights and measures which adds to our own difficulties and makes us mere barbarians to the more progressive nations.

The metric advocates, while accepting the wild and extravagant claims for the metric system, treat our own system with contempt. Nevertheless, the scientific method that exposes the hollowness of their claims also proves that the English system is intrinsically the best and, as far as uniformity is desirable, the most uniform system on earth. It is the standard of the richest portion of the earth's surface; of the two most enlightened, populous and powerful nations on earth; and of the only nations that control vast unsettled regions to accommodate the increase of their population. It is the standard of the past and present, and the world trend points to it as the standard of the future.

Dr. Seaman states that:

> Any one who will take pains to inquire of any of the thousands of immigrants that come among us, will convince himself that the metric system is the principal system in actual use in trade and commerce in European countries.

For two years I have been taking pains to do this very thing, and have been convinced by it that the European immigrants know very little about the metric system. A few typical examples: An Italian from Naples was acquainted with the 'kil,' but knew nothing about the meter, his ideas of length being based on the *can,* which he informed me was something less than eight feet. A Swede said that while the metric system was used in the stores in his country, the *tunland* and *hemend* were used for measuring land. An Austrian was ignorant of metric measures, but was familiar with the *pfund* and *zoll.* An educated German informed me that the metric system was the only one used in Germany, but added: "Aber das Volk braucht die alten Masse." A Greek had heard that the 'kil' was used in Italy, but did not know what the metric system was. His standard of weight was the *oka.* Greek land, he said, was measured by the *stremma.* When asked how cloth was measured in Greece, his wife replied: "By the *pik.*"

With all it was the same story, ignorance of metric units, familiarity with their old standards. None expressed any ideas of measure to conform with those of any other nationality until I talked with a Russian. Scratch a Russian and you will find an Englishman—in measures. His standards of linear measurement are either the same as or commensurable with the English inch. His *duim* is our inch; his *archin* is 28 inches; his *verschock* is $1\frac{3}{4}$ inches; his *sagen* is 7 English feet; and his *verst* is 3,500 English feet. Two hundred years ago, Peter the Great, while in Holland, was impressed by the superiority of the English vessels that visited the Dutch ports. This led him to visit England, where he worked as an ordinary carpenter in the English shipyards. When he returned to Russia he took back with him four mast makers, four boat builders, two sail makers, and about twenty other workmen to teach their trade to his people. Thus without coercive laws, but peacefully and naturally, the English system was introduced into Russia, and to-day is the

basis for all linear measurements throughout that vast empire. The inch carried by the English settlers to Jamestown in 1607, and that taken by the English carpenters to St. Petersburg in 1698 were the same; and the Russian emigrant, landing in America in 1905, finds the linear measurements of his new home commensurable with those of the land he has left.

Compare this uniformity of popular usage with the chaos of incommensurable standards wherever the metric system has been forced by law into conflict with the old standards of the people. One is the result of English evolution; the other, of French revolution.

SAMUEL S. DALE.

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SPECIAL ARTICLES.

DETERMINATE MUTATION.

AMONG the significant results obtained by Professor de Vries in his breeding of *Œnothera lamarckiana,* and by Dr. MacDougal breeding the same species in the New York Botanical Garden, there is one feature which seems to have attracted less attention than it may deserve. Most of the seven mutants observed by de Vries, and of the thirteen seen by MacDougal, have appeared more frequently than would be natural were the mutations wholly fortuitous and indeterminate.

In the Amsterdam garden the mutant *albida* appeared in four different generations from *lamarckiana* parents, previous to 1902, 15 *albida* appearing in one generation, 25 in another, 11 in another and 5 in another. *Nanella* appeared 5 times in one generation, and in other generations, respectively, 3, 60, 49, 9, 11 and 21 times. *Lata, oblonga rubrinervis* and *scintillans* appeared frequently.

In the fourth generation along with 14,000 *lamarckiana* plants there appeared 41 *gigas,* 15 *albida,* 176 *oblonga,* 8 *rubrinervis,* 60 *nanella,* 63 *lata* and 1 *scintillans,* all bred from *lamarckiana* seed. In the fifth generation, similarly bred from pure *lamarckiana* seed, among 8,000 *lamarckiana* plants were found 25 *albida,* 135 *oblonga,* 20 *rubrinervis,* 49 *nanella,* 142 *lata* and 6 *scintillans.* In the fourth generation one plant in 80 was *oblonga.* In the fifth generation one plant in 60 was *oblonga.* De Vries himself says: "A species, therefore, is not born only a single time, but repeatedly, in a large number of individuals and during a series of consecutive years."

De Vries writes of *Œnothera oblonga:*

Meist etwa sechsten Blatte sind die jungen Pflänzchen dieser Art mit Sicherheit zu erkennen, also etwas später als *O. lata* und *O. nanella,* und wesentlich früher als *O. rubrinervis* und *O. scintillans.* Die Blätter sind schmal, lang gestielt, ziemlich scharf vom Stiele abgesetzt, mit breiten, blassen, auf der Unterseite oft röthlichen Nerven. In Aussaaten sind die *O. oblonga* nur bei sehr weitem Stande früh und gleichzeitig zu erkennen, aber wenn man in den Versuchen von Zeit zu Zeit die unzweifelhaften *oblonga*-Exemplare auszieht, so zeigen sich die Merkmale bald in weiteren und weiteren Individuen, ohne dass diese dazu viel Raum brauchten.

In den ausgepflanzten Rosetten erhält sich die angegebene typische Blattform. Einige Exemplare treiben Stengel, andere werden zweijährig. In beiden Fällen bleiben die Pflanzen niedrig, erreichen kaum 1 m Höhe und sind auffallend kleiner, als die in derselben Weise cultivirten Exemplare von *O. Lamarckiana.* Die einjährigen verzweigen sich wenig. Die Zweige bleiben meist kurz, Die Aehren sind dicht mit Blüthen und Knospen besetzt; die Blüthen kleiner als bei *O. Lamarckiana,* sehr arm an Blüthenstaub und nur ganz winzige Früchtchen mit wenigen Samen aussetzend. Die zweijährigen verzweigen sich kräftiger und sind mit Pollen reichlich versehen; sie bilden zwar kurze, aber dicke Früchte, welche eine reiche Samenernte geben.

Bei fortschreitender Blüthe erkennt man die *oblonga*-Exemplare schon von Weitem an den dichtgedrängten, aber kleinen unreifen Früchten.

This mutant, therefore, differs from the parent species, *lamarckiana,* not in a single feature, but in an elaborate complex of characters. The other mutants likewise are distinguished from *lamarckiana* by a complex of characters rather than by a single feature. Speaking of the contrast between reversions and progressive mutations, de Vries says: