"for students of all denominations who can command the means and have the wish to construct for themselves a histological cabinet," and that it has been produced "between the numerous and unavoidable interruptions of a family medical practice." G. B. H.

OUR BOOK SHELF.

Precious Stones in Nature, Art, and Literature. By S. M. Burnham. (Boston: Bradlee Whidden. London: Trübner and Co.)

MR. BURNHAM is the author of a work on limestones and marbles published a few years ago in which he indicated the resources of the United States and other countries in stone for decorative purposes. In the present volume he treats of precious stones in that exhaustive and thorough fashion which we are accustomed to regard as a special characteristic of German writers. He begins by describing, as far as is known, the origin, properties, classification, localities, imitations, and antiquity, of precious stones (antiquity here applies of course to their use as ornaments), and then proceeds to treat of their prices, the trade in them, the sumptuary laws relating to them, those of remarkable size, and notorious jewel robberies. This chapter is followed by a description of various notable collections, and of the Crown jewels of different countries, from which the author passes on to some very interesting chapters on the secular uses of precious stones, the different kinds of ornaments, and their sacred uses. A chapter on precious stones in literature, and their mystical properties, is succeeded by one on the curious art of engraving on precious stones, and then commences a series of chapters on the various stones. First, of course, comes an account of the diamond, its home, and of historical and remarkable diamonds, which is followed by descriptions of all the precious stones at present known, from the sapphire, emerald, and ruby, to coral, amber, jet, cat's-eye, and rock-crystal, to the number of about one hundred. The appendices give the sizes of large and remarkable diamonds, a classification of precious stones according to their principal constituents, the hardness and specific gravity of precious stones, their relative hardness, relative specific gravity, and finally a list of the localities in the United States in which gem-minerals have been found. It will be perceived from this very brief indication of the contents of the book that the work is perfectly encyclopædic in its treatment of its subject; nothing relating to precious stones is strange to or disregarded by Mr. Burnham. Of the value of the book to the gem collector, expert, or mineralogist, it is needless to speak, but we can answer for it that it is highly interesting to the general reader, or at least to all who like to hear about those rare and beautiful products of Nature to which man in all ages and in every country has attached a high value.

Hydrophobia: An Account of M. Pasteur's System. By Renaud Suzor. (London: Chatto and Windus, 1887.)

DR. RENAUD SUZOR is the delegate commissioned by the Government of the colony of Mauritius to come to Europe to study M. Pasteur's treatment of hydrophobia, and this volume is the result of his mission. It is greatly to the credit of Sir John Pope Hennessy, the Governor of that colony, and of the members of the Legislative Council, that they perceived the value to science and humanity of adequately studying M. Pasteur's recent discoveries on the subject of hydrophobia, and that they "unanimously voted" the appointment of a delegate to proceed to Paris to work under the distinguished discoverer. It is to be hoped that other and more prominent colonies may be led to follow this excellent example. This little volume amply justifies the selection of Dr. Suzor as delegate. It opens with an historical account of hydrophobia and its treatment from the earliest times—for this dreadful disease has been known and studied for more than 2000 years—down to the end of 1880. The second and principal part of the volume is occupied by translations of all M. Pasteur's communications on the subject to the Academy of Sciences, beginning with his first note in January 1881, and ending with a lengthy paper presented in November 1886. Finally, there is a description of the technique of M. Pasteur's method. The book is valuable as a clear and comparatively untechnical exposition of the Pasteur method; but it is still more valuable as an example of the manner in which Pasteur's wonderful discovery should be met and treated by Governments and others in authority, who are responsible for the prevention, as far as possible, of disease amongst the populations which they govern. The Governor of Mauritius has taken care that the neglect of this primary duty, in relation at least to hydrophobia, cannot be laid to his charge.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.*]

A Monstrous Foxglove.

A SOLITARY specimen of *Digitalis purpurea* was found last month in a damp wood near Old Colwyn, North Wales, which exhibited the following curious abnormalities in the structure of its flowers. In only one out of the six opened flowers of the raceme was the calyx normal (*i.e.* consisting of four broad and one narrow segment); in all the others it was divided almost to the base into five equal linear segments. The corolla in four out of the six flowers consisted of merely two narrow petals with long claws, placed at opposite points on the receptacle; in one flower these two distinct floral leaves were deeply divided into two and three lobes respectively, thus forming a perfect two-lipped flower, the lips, however, being quite separate from one another. In the only other flower the upper lip was altogether wanting, the three-lobed lower one alone being present, upon which, alternating with its lobes, were inserted one long and one short stamen. This was the only flower which possessed stamens.

The form and number of the styles also was variable and abnormal. In one flower only was the usual single shortly two-cleft style met with; two other flowers possessed each a single style forked below the middle; in two others there were two, and in the remaining flower three styles, all separate and similar.

The same abnormalities were seen in the corolla and styles of two unopened buds.

I should be happy to learn if such monstrous forms are at all usual in the foxglove. F. R. TENNANT.

Longport, Staff.

The Law of Error.

DR. VENN, in a letter published in NATURE, September 1 (p. 411), adduces certain meteorological statistics which do not conform to the typical law of error or probability-curve. To discover the cause of this failure there would be required both a special knowledge of the subject-matter and the general conceptions which the calculus of probabilities supplies. The latter qualification is the only one to which the present writer can make any pretension.

The essential condition of the typical law being fulfilled is that each observation or statistical return should be made up of a great number of independent variable items. A good example is afforded by taking a great number, *e.g.* 100, digits at random from mathematical tables. The sums of that number

of digits will fluctuate about the mean 450 according to a probability-curve whose "probable error" is about 19.

(1) One explanation of the failure of the law is that the requisite plurality of items is wanting. Suppose we had taken sums of *two* (instead of a hundred) digits, the grouping of these sums would be best represented by a right line, or rather two right lines. If we took three digits at a time, the resulting form would be parabolic. A variant of this class of exception is when the larger items are few or unique, while items of an inferior order congregate in great numbers. Suppose each observation to consist *either* of the digits 3 or 6, *plus* ten items taken at random from the series ·1, ·2, ... ·9. There would then be generated a curve like those in Dr. Venn's Fig. 2. If, instead of 3 and 6, we had two digits, 4 and 5, differing by very little from each other, the abnormal uniqueness of the larger items would be disguised. It is upon this principle, doubtless, that the population of a kingdom appears to conform (in respect of height or other attribute) to the law of error, while at the same time each province may present a distinct type. Suppose that the majority of our returns were, as the last-mentioned case, *either* 4 or 5 *plus* an aggregate of smaller items; but that a small proportion of the returns were governed by a widely disparate "large item," *e.g.* 8 or 9; in this case we might have the appearance presented by Dr. Venn's Fig. 1. The body of the curve would seem to be of the probability family; but there would be tacked on a tail appertaining to a different type. Dr. Charles Roberts has adduced some statistics of this species in a paper published in the *Medical Times*, February 7, 1885.

(2) We have hitherto supposed that the constituent items have no bias in one direction. Suppose, however, that instead of the digits 1, 2, ... 8, 9 being each equally eligible, 8 and 9 became inadmissible; and, whenever one of those digits was presented, we had to substitute 6 and 7 respectively. There would thus be two chances in favour of 6 and also of 7. An aggregate of 100 digits each selected according to this unsymmetrical scheme would be grouped about the mean value $10 \times (1 + 2 + 3 + 4 + 5 + 2 \times 6 + 2 \times 7)$, or 410, in a form which as to the body of the curve would be a probability-curve, but which would be unsymmetrical at the extremities. The most familiar example of this case is afforded by games of chance. If black and white balls, in an unequal proportion and immense numbers, are mixed up, then if you take at random batches of 100 (or 1000) balls the percentage of white or black balls will fluctuate in the manner described. It is quite possible that this principle should govern what Dr. Venn calls a "one ended phenomenon," *i.e.* one in which unlimited variation is conceivable in one direction but not in the other. Dr. Venn's Fig. 1 seems fairly well to represent a biased probability-curve.

(3) We have hitherto supposed that the individual observation or return is the *sum* of the variable elements. But it may be a more complicated function. Thus it may be a product. The *logarithm* of the observations may fluctuate according to a probability-curve, while the observations themselves obey a law which has been investigated by Dr. Macalister in the Proceedings of the Philosophical Society (1879); related to the geometrical mean just as the probability curve is to the arithmetic mean. This grouping is to be expected wherever the analogies of *Fechner's law* prevail. This may be the rationale of the fact which I have elsewhere pointed out, that fluctuations of price rise much higher above, than they fall below, the mean. But, where the principle of estimation does not come in, it is not quite clear why the geometrical curve should be more appropriate to a "one-ended phenomenon" than the biased probability-curve which has been described under our heading (2). At any rate, in the case before us, Dr. Venn's Fig. 1, the numerical statistics which he has allowed me to inspect show much too close a correspondence between the body of the figure and the probability-curve to admit of the geometrical explanation. There is also this peculiar difficulty, that the longer limb of the given curve is the lower one.

F. Y. EDGEWORTH.

King's College, London.

A Null Method in Electro-calorimetry.

BY reference to the last number of the *Electrical Review* (vol. xxi. p. 262), wherein is printed a short abstract of our paper on "A Null Method of Electro-calorimetry" read before the British Association on September 1, Mr. Huntly will find that the method of measuring specific heats suggested by him is in principle similar to that described by Mr. Gee and myself. The method has been employed for determining specific heats during the last two years, but we have delayed publication till the best working details of the method have been elaborated.

In certain practical details our method differs from Mr. Huntly's suggestion. The mass of liquid in each calorimeter is *not* the same. It is much preferable to have the masses inversely proportional to the specific heats, so that the thermal capacities of the liquids are equal. In this way it will be readily understood that the correction for radiation can be made to disappear altogether. For since the calorimeters are precisely equal, and their temperatures equal, the loss of heat by radiation must be the same from each; further, since the thermal capacities of the liquids are the same, as well as that of vessels and stirrers, it follows from the equality of the resistances that the same current will produce the same rise in temperature in each case, and conversely, since the heat radiated from each calorimeter is the same, and since the thermal capacities of the calorimeters and stirrers are equal, it follows that, if the same current traversing the equal resistances produces the same rise in temperature in each liquid, the thermal capacities of the two liquids are the same, whence the specific heat can at once be determined by determining the masses of the liquids. Virtually, then, the null method of obtaining the same rise of temperature in each calorimeter is attained by varying the mass of liquid in either or both calorimeters. In practice we approximate as nearly as possible to the condition by adding liquid to that calorimeter which rises in temperature most quickly, and then make a final adjustment by shunting a *very small fraction* of the current by means of the high resistance in the box. This is, we believe, the first time that a method for measuring specific heats has been published in which the correction for radiation and for the thermal capacity of calorimeters and stirrers has been entirely eliminated.

With the first apparatus we had made to embody these ideas, viz. that described in the *Electrical Review* (*loc. cit.*), an accuracy of at least one-tenth per cent. could be obtained from a single experiment, thoroughly confirming Mr. Huntly's anticipations as to the delicacy of the method. We have just introduced some considerable improvements in the apparatus which we hope will enable us to insure much greater accuracy than that hitherto obtained.

A few words are required in reply to some observations of Mr. Huntly. First, he suggests a bolometric method of determining the difference of temperature. We have so far preferred a thermo-electric method, which, without a specially constructed galvanometer, enables us to detect with certainty 1/2000 of a degree; the necessary corresponding variation in the resistance of a Pt wire would only be 1·6 parts in a million; besides some difficulties may arise in procuring two pieces of Pt wire which shall have the same temperature coefficient to 1 part in a million, even if they be cut from the same piece originally. Secondly, the time method described by Mr. Huntly at the end of his paper seems to me to have a fatal objection: it would be quite impossible to keep the current constant for a long time to the 1/2000 part which would be requisite to secure such accuracy as we can get with present arrangements.

WILLIAM STROUD.

Mental Development in Children.

I SHOULD like to hear the opinion of psychologists on the following circumstance:—A female child, quick and intelligent, when about fifteen months old, learned to repeat the alphabet, shortly afterwards the numerals, days of the week, month, &c., and, subsequently, scraps of nursery rhymes, English and German; then to spell words of two and three letters. All this was learned readily, eagerly indeed, and for a time she remembered apparently every word acquired, indelibly. At about two years old further teaching was for a time remitted, as she was observed to be repeating audibly in her sleep what she had learned during the day. Subsequently, tuition was resumed, under a governess, but she had not only forgotten much of what she had previously known perfectly, but learns far less readily than formerly. She is now about three and a half years old, in perfectly good health and spirits, quick, and particularly observant, but the capacity for learning by rote is materially diminished; she is remarkably imitative, but shows no faculty whatever for writing, and as little for music.

I should like to hear of any parallel cases, and what the ultimate development has been; with any opinions upon the cause of their appearances.

M A.

September 18.