the air, the total pressure of the wind must be very great and its tendency is always to drive the wire and kites to a lower altitude. Wind pressures of 30 to 50 kilograms per square meter of surface exposed normally to the wind are not uncommon, and it appears that the line presenting the smallest surface, relative to weight, is the one best to employ. Considering the wire alone, there is an advantage in using the largest size of wire, but there appears to be a practical limit to the number of kites that may be efficiently employed on one line. At Blue Hill, at present, the average number of kites employed at one time is six—three large and three small—having a total lifting surface of less than 30 square meters. Since it is not desirable to increase the size of the kites, the increased power required to lift a larger wire must be derived from a number of the largest kites now used; and since more than eight kites can seldom be used to advantage, it appears that a No. 25 or a No. 26 wire will give the best results, until there can be obtained better kites capable of lifting a larger wire. It is also probable that a line made up of several different sizes of wire may be more efficient than one of uniform size.

The present maximum height (4,850 meters) in all probability is not the highest attainable with No. 17 wire, and while it is unsafe to predict the result of future experiment, it now seems likely that, with a stronger line and kites of greatest efficiency, heights exceeding 6,000 meters are within reach. Moreover, flights to elevations of 4,000 meters or higher could be made more quickly and easily than at present.

S. P. FERGUSSON.

BLUE HILL OBSERVATORY,
September 12, 1900.

SCIENTIFIC BOOKS.

THE PUBLICATIONS OF THE VOLTA BUREAU.

WHILE the Volta Bureau was founded, by Alexander Graham Bell, 'for the increase and diffusion of knowledge relating to the deaf,' with a philanthropic desire to promote their welfare, the publications of the bureau will interest students in many departments of science, and the purpose of this review is to call attention to some of the general bearings of two of these publications.

I. *The Helen Keller Souvenir* (2) Commemorating the Harvard Final Examination for Radcliffe College, June, 1899. By A. GRAHAM BELL, ANNIE M. SULLIVAN, and others.

It is less remarkable that Helen Keller, who was born blind as well as deaf, has passed the examinations for admission to Harvard University, '*with credit in advanced Latin*': than that she has become so familiar with the use of language that she finds no more difficulty in the work of the college class-room than any other bright student.

The way in which this result has been reached, in the face of such difficulties, should be studied by all teachers, not only for their encouragement, but because they will find in it an illustration of the requisites which are essential for all successful instruction.

Her first teacher, Miss Sullivan, speaking of her at the age of twelve, or thereabouts, says that while her accomplishments seem marvelous to many, they "consist *only* in her being able to speak and write the language of her country with greater ease and fluency than the average seeing and hearing child of her age." Miss Sullivan asks whether we may not hope for similar results with children who are so fortunate as to have eyes and ears with which to see and hear, and all who are familiar with the lamentable failure of a common school education to give command of the English language must feel an interest in the answer.

Helen Keller was not *taught* the use of language. She was put into the way to discover its meaning, and was left to make the discovery for herself, as every normal child does, and as we find out everything else that is worth knowing. But while normal children make this discovery at too early an age to be able to tell us about it, Helen did not make it until she had enough maturity of mind to reflect upon it, and enough natural knowledge to know her need of it, and to understand its value.

All students of psychology will be interested in her account of the discovery that things have names and that one name may stand for several things of a kind. She had been taken to the pump-house to feel the water as it gushed from the pump, and as she was enjoying the pleasant sensation, I (Miss Sullivan) spelled the word *water* in her hand, and instantly the secret of language was revealed to her. Helen says: "That word, meaning water, startled my soul, and it awoke full of the spirit of the morning, full of joyous, exultant song. Until that day my mind had been like a darkened chamber, waiting for words to enter, and light the lamp, which is thought."

The guiding principle of her early education was this aphoristic precept by Professor Bell: "I would have a deaf child read books in order to learn the language, instead of learning the language in order to read books." It is by imitation that language is acquired, and it may be that it was Helen's good fortune that she was not able to copy from the feeble and ill-considered efforts to talk English, which make up ordinary conversation.

"The great principle that Miss Sullivan seems to have had in mind," says Professor Bell, "in the instruction of Helen, is one that appears obvious enough when it is once formulated, and one with which we are all familiar as the principle involved in the acquisition of language by ordinary hearing and speaking children. I talked to her almost incessantly in her waking hours"; says Miss Sullivan, "spelled into her hand a description of what was transpiring around us, what I saw, was doing, what others were doing—anything, everything. Of course, in doing this, I used multitudes of words she did not understand at the time, and the exact definition of which I did not stop to explain. I gave her books printed in raised letters long before she could read them, and she would amuse herself for hours each day in carefully passing her fingers over the words searching for such as she knew, and she would scream with delight whenever she found one. Helen's remarkable command of language is due to the fact that books printed in raised letters were placed in her hands as soon as she knew the formation of the letters. It is not necessary that a child should understand every word in a book before he can read it with pleasure and profit. Helen drank in language which she at first could not understand, and it remained in her mind until needed, when it fitted itself naturally and easily into her conversation and compositions. Thus she drew her vocabulary from the best sources, standard literature, and when the occasion came she was able to use it without effort. She has had the best and purest models presented to her, and her conversation and her writings are unconscious reproductions of what she has read."

So well had Miss Sullivan done her work that the instructor who prepared Helen for college says: "I read Shakespeare with her, and she showed the greatest pleasure in the light and amusing touches in 'As You Like It,' as well as in the serious passages of 'King Henry V.' We took up Burke's celebrated speech on Conciliation with the Colonies, and every point made an impression. The political bearing of the arguments, the justice or injustice of this or that, the history of the times, the characters of the actors, the meaning of the words and the peculiarities of style, all came under review, whether I wished it or not, by the force of Helen's interest." In the list of words which she understood without explanation are policy, impunity, immunity, dragooning, illation, inquisition, acquiesces, mediately, congruity, etc.

II. *Marriages of the Deaf in America;* an Inquiry concerning the Results of Marriages of the Deaf in America. By Edward Allen Fay.

Few books on the inheritance of human faculties are more important than this volume which Professor Fay has prepared as the result of researches which have been carried on under the auspices and through the aid of the Volta Bureau. It is by far the most conclusive proof which has ever been obtained that there is no inheritance of acquired characters, so far at least as the inheritance of deafness is in question, for while Professsr Fay proves that the marriage of deaf persons without deaf relatives is no more likely to result in deaf children than any marriage in the community at large, the intermarriage of hearing persons who have deaf

relatives is just as likely to result in deaf children as a marriage of the deaf.

The report will be welcomed by all students of inheritance from the scientific standpoint; although it was undertaken and has been carried on, we are told, "in the hope that it might be of service to the deaf, and to society by settling definitely the question whether or not the deaf are more liable than hearing persons to have deaf children; and if it should appear that, notwithstanding the numerous instances to the contrary, they are more liable to this result, by ascertaining whether or not the liability is increased by the marriage of the deaf with one another; also whether certain classes of the deaf, however married, are more liable than others to have deaf children; and, if this should prove to be the case, by determining how these classes are respectively composed, so that as a result of the conclusions reached, in many instances deaf persons might be advised to follow the choice of their own hearts in marriage, with no restrictions whatever, except such as should influence all right-minded persons in this important matter; while in cases where the deafness of the parent was unquestionably more liable than in others to reappear in the offspring, the persons interested might be effectively warned in time of the danger incurred."

The tables of facts regarding the deaf which make up most of the report are accompanied by a thorough and exhaustive analysis, which shows that this practical philanthropic purpose has been accomplished, and that Professor Fay is now able to give to those deaf persons who contemplate marriage advice which has the value of scientific demonstration.

Professor Bell has shown that marriages of the deaf are more common in America than in Europe, that they have increased at a higher rate of progression during the present century, that the probability of deaf children is much greater among the deaf than in the community at large, and that deafness—not mere hardness of hearing, but what is called 'deaf dumbness'—is also increasing among us, and that we are threatened with a deaf variety of the human race. At the same time, it is clear that the probability of deaf children is not equally great among all deaf persons who marry and have children. A person who has lost hearing by accident or disease, at however early an age, may possibly be in no more danger of transmitting the peculiarity than one who has lost an eye or an arm. It is therefore highly important, in the interest of the deaf as well as in the interest of the community, to determine the conditions which are favorable and those which are unfavorable to the hereditary transmission of deafness.

This report contains more than three hundred and fifty pages of statistical information, giving, for some 8,000 deaf persons who have married, data regarding the origin of their deafness, the hearing or deafness of the partner in marriage, the date of marriage, the number of children, the number of deaf children, a record as to the hearing or deafness of brothers and sisters, and information as to the existence of other deaf relatives. These tables, which contain a record of the marriages of the deaf far larger than all previous records put together, are of great interest to all students of inheritance, but their motive is philanthropic rather than scientific.

While deaf persons are much more likely to have hearing children than to have deaf children, they are much more likely than ordinary normal-hearing persons to have deaf children. Less than one-tenth of one per cent. of all the children of normal parents are deaf, but if one or both parents are deaf, nearly nine per cent. of all the children are deaf. In other words, a normal-hearing pair have no reason to fear that a deaf child will be born to them unless they have more than a thousand children; while if one parent or both are deaf, and they have eleven children, they may, on the average, expect to have one deaf child.

The probability of deaf children is not, however, equally great for all deaf persons, since it depends upon the character of the parental deafness. Marriages of the congenitally deaf, that is, of persons who have never, at any time in their lives, shown evidence of hearing, are far more likely to result in deaf offspring than marriages of the adventitiously deaf, that is, of those who have once heard and have subsequently lost their hearing. Of 526 marriages between a congenitally deaf person and a con-

genitally deaf or a hearing partner, 111, or 21 per cent. resulted in deaf offspring; and 20 per cent. of the children, or one in each five, were deaf; while of 1,155 marriages where one partner was adventitiously deaf and the other adventitiously deaf or hearing, only 40, or 3½ per cent., resulted in deaf offspring; and only 2 per cent. of the children, or one in each fifty, were deaf.

If it were possible to draw this line with rigorous accuracy, and to divide all the deaf into these two classes, all deaf persons with a marked probability of deaf children would be found in the first class, while the members of the second class, the adventitiously deaf, would have little reason to fear the transmission of their deafness to posterity; but, as a practical matter, it is not possible to draw this line with scientific exactness. Deafness is not usually discovered until the child has reached the age when children usually begin to talk; and it is difficult to determine whether the hearing has been destroyed during this period or has been deficient from the first. If the child has suffered from some disease which is known to frequently result in deafness, the case is regarded as adventitious, although it may possibly be congenital. If, on the other hand, no such disease has been observed, the case is likely to be regarded as congenital; but it is, perhaps, just as likely that hearing has been lost in consequence of some unnoticed inflammation of some part of the auditory apparatus, occurring at some time before the deafness was discovered. In fact, one who, having heard, afterwards becomes deaf as the effect of disease, may be an example of congenital deafness. When deafness is said to be inherited, it is not actual deafness, but some constitutional weakness or susceptibility to disease that is transmitted, and a child who has heard and has afterwards lost its hearing may, while regarded as a case of adventitious deafness, have the same significance in inheritance as one born deaf.

The term 'congenitally deaf' usually means 'supposed to be congenitally deaf,' and 'adventitiously deaf' often means 'supposed to be adventitiously deaf.' Some more accurate method of classifying the deaf must be employed before we can clearly express the probability of deaf children in any given marriage of the deaf.

It is well known that deafness often prevails in families; that deaf persons often have deaf relatives; and the arrangement of the deaf-married persons, according to the existence or non-existence of deaf relatives gives results which are most instructive.

In 437 marriages of deaf persons where both partners in marriage had deaf relatives, more than 25 per cent., or one in four, resulted in deaf offspring; and more than 20 per cent., or one child in each five, were deaf. In 471 marriages where neither partner had deaf relatives, only 2½ per cent. resulted in deaf children, and only one child in each hundred was born deaf (1¼ per cent.). When we consider how few persons especially in America, where changes of residence are frequent, are acquainted with the condition of all their relatives, it is not improbable that there were unknown or unreported deaf relatives in some of these marriages and that marriages of this class are even less likely to result in deaf offspring than the tables indicate.

Indeed, Professor Fay is led to the conclusion that even when deafness is congenital, it should not be regarded as a bar to marriage if neither of the partners in marriage has deaf relatives since the tendency to transmit deafness if it exists at all, is very slight. On the other hand, the marriage of a deaf person to a hearing person with deaf relatives is much more hazardous than the intermarriage of deaf persons without deaf relatives. In fact, careful study of the tables indicates that the marriage of two hearing persons who have deaf relatives is just as likely to result in deaf offspring as the intermarriage of two deaf persons who have deaf relatives. Taking all the marriages of a year's standing or longer of which the results have been reported, where both the parents had deaf relatives, more than 25 per cent. of the marriages resulted in deaf offspring, and the proportion of deaf children born to them is 20.9 per cent.; where one of the parents has deaf relatives while the other has not, the proportion of marriages resulting in deaf offspring is 6.6 per cent.; where neither of them had deaf relatives only 2.3 per cent. of the marriages

resulted in deaf offspring; and the proportion of deaf children born therefrom is 1.2 per cent. The actual percentage of marriages resulting in deaf offspring, and the number of deaf children born therefrom, when neither of the parents has deaf relatives, may be even smaller than these figures indicate; for in some cases the statement that neither parent had deaf relatives is not well authenticated, and in all of them there is the possibility that there may have been deaf relatives who were unknown to the person who filled out the record-blanks. Professor Fay is led to believe, from the study of the records, that the probability of deaf children, where neither parent had deaf relatives, is very slight, perhaps no greater than in ordinary marriages.

The marriages of the deaf most liable to result in deaf offspring are those in which the partners are related by consanguinity. Thirty-one such marriages are reported in the marriage records, and of these 14, or 45.1 per cent., resulted in deaf offspring. One hundred children were born from these thirty-one marriages, and of these 30, or 30 per cent., were deaf. It is, therefore, exceedingly dangerous for a deaf person to marry a blood relative, no matter what the character or degree of the relationship may be, and no matter whether the relative is deaf or hearing, nor whether the deafness of either or both or neither of the parents is congenital, nor whether either or both or neither of them have other deaf relatives.

The student of inheritance will, no doubt, be disposed to state this conclusion in more general terms, and to assert that the consanguineous marriage of one who has *any* constitutional infirmity or defect is imprudent and inadmissible, and that since no one can be sure that both parties to a contemplated marriage are constitutionally sound in all respects, no consanguineous marriage is permissible.

The writer of this review prepared, by request, some twelve years ago, an essay on the conditions which are necessary for the production of a deaf variety of the human race, which was printed in the Report of the Royal Commission on the Blind, the Deaf and Dumb, etc. London, 1889.

In this essay he gave reasons for holding the only necessary condition to be that successive generations of persons—either deaf or hearing—*with deaf relatives* should marry and have children.

This opinion was so much opposed to the views on inheritance which were current at that day that none of the eminent men of science—seven in number—who prepared essays upon the same subject, gave it any support, or even took it into consideration. Most of them, indeed, held that a deaf variety of the human race may be expected to result from the intermarriage of successive generations of deaf persons.

Professor Fay's thoughtful and exhaustive analysis of the da taafforded by the records of some 4,500 records of marriages of the deaf shows that the view of the matter which was reached by the writer twelve years ago, on theoretical grounds, turns out to be a fact so soon as it is submitted to a practical test.

W. K. BROOKS.

Exploitation technique des forêts. Exploitation commerciale des forêts. Two Volumes. By M. H. VANUTBERGHE, Ingénieur agronome Garde général des Forêts. 8vo. Paris, Gauthier-Villars.

With the establishment of professional schools of forestry at Cornell and Yale Universities and the promise of others to follow, technical forestry literature will naturally receive more attention in this country than hitherto. Foreign literature, however, except the few standard text-books and the best journals, will hardly attract much attention, unless it is essentially new in matter or manner. The two volumes under review bring nothing new in matter to the professional man, but some portions are treated in an unorthodox, independent manner which will appeal to the thinking student and practitioner, even though he may not agree always with the author's views. To find these volumes published as a part of an *Encyclopédie scientifique des aide-memoire* is rather surprising, for they are by no means, as one would expect, reference books or brief reviews, but in large part rather argumentative and free in style, attempting to impress the author's radical views unbiased by the orthodox tenets

upon the reader, while the other parts are without interest to those to whom the argument might appeal. It is difficult to imagine what class of readers the author intended to serve. Like most books written from the Continental point of view—*i. e.*, starting out with established conditions of forestry practice—much is unpalatable and of little import to the American reader. The title, division and treatment of the subject also are novel with the author, and not always fortunate. The term 'exploitation' does not, as in English, mean the mere rough utilization, but the very opposite, a regulated management. Under *exploitation technique* he discusses not only the methods of regulating the management of a forest for continuous revenue, but also silvi-cultural operations—*i. e.*, the methods of securing the wood-crop—while under *exploitation commerciale* the methods of harvesting the crop are discussed, and the commercial considerations that enter into it either with or without reference to the future conditions of the property. From this little is to be learned for our practice. Yet it is interesting to note that evidently good forestry practice is not as general among private forest-owners in France as is usually supposed, for the author declares silvi-culture 'a new art,' primitive in its development, deficient in scientific basis and 'official'—*i. e.*, practiced mainly by the government officials in government forests. We agree with the author that forestry as a business commends itself mainly to rich people, to eternal persons like the state, and not to people who have the natural desire to increase their property by their labor. Forestry is, as the Germans term it, *kapital-intensiv*, and *arbeits-extensiv*—business, *i. e.*, relying to a large extent on capital, with small chance of increasing the earnings by intensive application of labor. Especially for timber purposes it requires large areas in one hand, a persistent system of management and a 'wholesale' organization. Small space and little light are given on the difficult and complex question of rotation (*principe de l'exploitabilité ou eqoque de la récolte*)—*i. e.*, the length of time to which it is desirable to allow the crop to grow—when to cut the crop. This problem is *sui generis* in forestry, unknown to other industries, and as the author very wisely points out, requires a different solution according to whether the state, with its long existence and providential functions, or a private owner is concerned. Since to a certain point 'the value of a tree grows at least as the cube of the diameter,' from the standpoint of the financier the harvest time would have arrived when this value is at a maximum, if other calculations, namely, interest on investment, cost of production, etc., to be charged with compound interest, did not vitiate this simple device. The author concludes that 'every harvest of old timber is economically or financially a bad operation' which contemplation leads to short rotations, hence the production of heavy timber is not for private enterprise, which thesis the author supports by examples. Most space is given to the consideration of the 'felling budget' (*offre raisonné*) in a sustained-yield management which the author calls with a new term '*possibilité en fertilité*'—*i. e.*, a management which only reaps the amount annually accumulating (*revenue*) if the soil is properly stocked with a wood capital (*valeur génératrice*).

We learn here to distinguish financially between two distinct values, which may attach to one and the same forest property, namely, the realizable (sale) value (*valeur de réalization*) based upon what can be realized at once by a crude exploitation of the standing timber, and the investment value (*valeur de placement*) based upon what can be continuously realized from the property by a forest management, a distinction which will only gradually vanish, the author expects, when the old natural woods have vanished or the State has hold of them. The same expectations are in place in the United States, notwithstanding the sanguine assertions of enthusiasts.

B. E. Fernow.

Technic of Mechanical Drafting. By C. W. Reinhardt. (Pub. by Engineering News Co.)

Mechanical draftsmen and teachers of graphics may well add to their working libraries this volume, in which the chief draftsman of the *Engineering News* gives to the profession the 'wrinkles,' 'short cuts' and methods in

general which have approved themselves to him during his long experience. As the author frankly admits, this is not a complete work for beginners, as all theory of construction is omitted; but as an adjunct to existing text-books it must prove of great service, being especially rich in examples of conventional representation and of line shading. Incidentally it shows also the remarkable adaptability of the author's system of lettering to reduction by photo-processes.

F. N. WILLSON.

PRINCETON UNIVERSITY.

BOOKS RECEIVED.

Elements of Mineralogy, Crystallography and Blowpipe Analysis. ALFRED J. MOSES and C. L. PARSONS. New York, D. Van Nostrand Company. 1900. Pp. vii + 409.

Elements of Physics for Use in High Schools. HENRY CREW. New York, The Macmillan Company. 1900. Second Edition Revised. Pp. xvi + 353. $1.10.

Ethnology. MICHAEL HABERLANDT. Translated by J. H. LOEW, London, Dent. Pp. viii + 169.

SCIENTIFIC JOURNALS AND ARTICLES.

THE *American Journal of Physiology* for October contains a very interesting and suggestive article by D. J. Lingle on 'The Action of certain Ions on Ventricular Muscle.' Particular attention is paid to the rhythmic activity of heart tissue as an ion effect. Strips from the ventricle of the turtle's heart were placed in solutions of non-conductors, in solutions of sodium, of calcium, and of potassium, and in solutions of these salts combined. Lingle found that the non-conductors he used (cane sugar, dextrose, glycerine) did not occasion rhythmic beats in the heart strips. In the solution of sodium salts, however, the strips always beat rhythmically. If a strip is kept in the solution the beats reach a maximum and then gradually decline to a complete standstill. The stopping is apparently due to poisonous action of the sodium salt alone, for the rhythm is prolonged by diluting the solution in which the strip remains or by exposing the strip for a shorter interval to the action of the strong solution. When transferred to solutions of sodium salts, strips which have been quiescent in non-conductors begin to beat as suddenly as if started by an electric shock. The application of calcium salts and the treatment of the tissue so that an excess of calcium salts remains in the tissue both fail to start rhythmic beats. Potassium salts are likewise ineffective. Moreover calcium and potassium in combination do not start beats, while sodium chloride always succeeds. These results have a remarkable similarity to the results obtained by Loeb on rhythmic contractions in striped muscle and the tissue of the swimming bell. According to Lingle, sodium and not calcium is the stimulus for rhythmic contraction in the heart; calcium and possibly potassium salts improve the rhythm by neutralizing the injurious action of pure sodium salt solutions. W. T. Porter and H. G. Beyer in a paper on 'The Relation of the Depressor Nerve to the Vasomotor Center' raise the question, Does the bulbar vasomotor center act as a physiological unit to lower or raise the general blood-pressure, or has it parts regulating the regional distribution of blood? This question they have endeavored to answer by investigating the depressor nerve, an afferent nerve regarded by Cyon and Ludwig as stimulating the bulbar vasomotor center to cause especial dilatation of abdominal blood vessels. First the depressor nerve was stimulated when the splanchnic nerves were prepared for experimentation but still intact. This caused a fall in blood-pressure usually from 35 to 40 per cent. Next the abdominal vessels were removed from vasomotor influence by cutting the splanchnic nerves. The blood-pressure which falls on cutting these nerves was restored to the normal level either by stimulating the peripheral ends of the cut nerves, or by intravenous injection of normal salt solution. Now, with the abdominal vessels free from vasomotor influence and the blood-pressure normal, the depressor nerves were again stimulated. The blood-pressure fell usually as much as it had previously fallen when the abdominal vessels were still connected with the bulb. From their results the investigators conclude that the depressor nerve has no special connection with cells controlling vasomotor fibers of the splanchnic nerves, and they express the opin-