

the whole passage. Again, on p. 200, even after carefully considering the meaning of "purchaser," "consumer," the author arrives at the conclusion that "the consumer is simply the purchaser or customer," whereas the consumer is the purchaser who does not intend to sell again. If an architect builds a palace (to take Mr. Macleod's first example) to carry out some grand idea of his own which he feels sure will attract him a royal customer for it, but lack of funds compels him to sell it unfinished to a commercial company who have a similar faith in his design, they are not consumers, because they intend to sell it again. But if a monarch retired from business buys it of them for his residence, he is the consumer, because, although the palace may stand for centuries, he does not intend to sell it again. To take a much more familiar case, going on under our own eyes: a builder erects a row of villas as a speculation of his own; as long as he has them on his hands they are stock in the market, but as one purchaser is found who elects to inhabit one, and another to inhabit another, those houses are, as far as economics is concerned, "consumed," and the builder is encouraged to produce more.

Far more careful printing is required in such a book. On p. 309, Vol. II., line 1 is quite unintelligible through the misplacing of two commas. On p. 156, no doubt the "division of labour" should be the "division of employment" with combination of labour. For the sake of clearness (we suppose) qualifications have been sacrificed in many places, with, we feel sure, mischievous effect to any student inquiring into the "elements" of so intricate a science.

OUR BOOK SHELF.

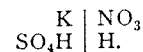
Outlines of Lectures on Physiology. By T. Wesley Mills. (Montreal: Drysdale and Co., 1886.)

THIS little work of scarcely 200 pages gives at a glance very precise information as to the kind of instruction provided in the Physiological Department of the McGill University.

The teaching appears to be both scientific and practical in its character, and of a standard certainly equal to that of the teaching in many of our English schools. Prof. Mills most properly insists on the importance of comparative physiology and biology, the only keys to many of the most complicated problems in human physiology itself. It is, however, unfortunate that he is obliged to incorporate so much elementary biology in his lectures, suggesting, as it does, that this important subject is, in Canada as well as in England, often relegated to the teachers of physiology, who should be in a position to begin with students already acquainted with the fundamental facts of this science. Pathology, or the application of physiology to disease, is hardly touched upon in this book. It is a most unfortunate omission, unless both pathology and therapeutics are taught in other departments of the University far more systematically than with us. From the fact that it is so sketchy it is difficult to understand how Dr. Mills' work can be of any value to the general reader who is not at the same time interested in the progress of medical education, or to the ordinary student of physiology. Under "Saliva" (page 86), which may be taken as an example, we find the following headings without any explanatory text. "Mixed saliva found in the mouth. Secretion of *serous* and mucous glands compared. Morphological elements of saliva. Chemical constitution," &c. The work professes, however, to be only an outline, and such it is.

Chemistry for Beginners. By R. L. Taylor. (London: Sampson Low and Co., 1887.)

THIS little book is valuable as being the outcome of practical experience in the teaching of the first principles of chemistry, and, from its small size and simple statement, is likely to be much used in the sphere for which it is intended. It appears eminently suited for the use of pupils in our higher grade Board schools, where the author has gained most of his experience, and may with advantage be used as an elementary class-book, especially as it contains a graduated series of original problems. We are glad to notice the introduction of an undoubtedly beneficial method of representing chemical reactions, which, especially in more complex cases, expresses what really happens in a very clear light. An example extracted from Mr. Taylor's book is as follows:—



Of course, the equation written in the ordinary form is given, as is proper, side by side with the above.

Although it is unfortunate that the illustrations are of so primitive a character, the book is very readable and likely to interest beginners, and the author may be congratulated upon the absence of all appearance of cram, which has such a paralyzing influence upon the thinking powers of those from amongst whom our future chemists are to be derived.

A. E. T.

LÉTTERS 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.]

Thought without Words.

THE recent work of Prof. Max Müller contains theories on the descent of man which are entirely based on the assertion that not even the most rudimentary processes of true thought can be carried on without words. From this he argues that as man is the only truly speaking animal the constitution of his mind is separated from that of brutes by a wide gulf, which no process of evolution that advanced by small steps could possibly stride over. Now, if a single instance can be substantiated of a man thinking without words, all this anthropological theory, which includes the more ambitious part of his work, will necessarily collapse.

I maintain that such instances exist, and the first that I shall mention, and which I will describe at length, is my own. Let me say that I am accustomed to introspection, and have practised it seriously, and that what I state now is not random talk but the result of frequent observation. It happens that I take pleasure in mechanical contrivances; the simpler of these are thought out by me absolutely without the use of any mental words. Suppose something does not fit; I examine it, go to my tools, pick out the right ones, and set to work and repair the defect, often without a single word crossing my mind. I can easily go through such a process in imagination, and inhibit any mental word from presenting itself. It is well known at billiards that some persons play much more "with their heads" than others. I am but an indifferent player; still, when I do play, I think out the best stroke as well as I can, but not in words. I hold the cue with nascent and anticipatory gesture, and follow the probable course of the ball from cushion to cushion with my eye before I make the stroke, but I say nothing whatever to myself. At chess, which I also play indifferently, I usually calculate my moves, but not more than one or two stages ahead, by eye alone.

Formerly I practised fencing, in which, as in billiards, the "head" counts for much. Though I do not fence now, I can mentally place myself in a fencing position, and then I am irritable and mentally mute. I do not see how I could have used mental

words, because they take me as long to form as it does to speak or to hear them, and much longer than it takes to read them by eye (which I never do in imagination). There is no time in fencing for such a process. Again, I have many recollections of scrambles in wild places, one of which is still vivid, of crossing a broad torrent from stone to stone, over some of which the angry-looking water was washing. I was intellectually wearied when I got to the other side, from the constant care and intentness with which it had been necessary to exercise the judgment. During the crossing, I am sure, for similar reasons to those already given, that I was mentally mute. It may be objected that no true thought is exercised in the act of picking one's way, as a goat could do that, and much better than a man. I grant this as regards the goat, but deny the inference, because picking the way under difficult conditions does, I am convinced, greatly strain the attention and judgment. In simple algebra, I never use mental words. Lately, for example, I had some common arithmetic series to sum, and worked them out, not by the use of the formula, but by the process through which the formula is calculated, and that without the necessity of any mental word. Let us suppose the question was, how many strokes were struck by a clock in twelve hours (not counting the half-hours), then I should have written 1, 2 . . . ; and below it, 12, 11, . . . ; then 2 . . . 13 × 12, then 13 × 6 = 78. Addition, as De Morgan somewhere insisted, is far more swiftly done by the eye alone: the tendency to use mental words should be withstood. In simple geometry I always work with actual or mental lines; in fact, I fail to arrive at the full conviction that a problem is fairly taken in by me, unless I have contrived somehow to disembarass it of words.

Prof. Max Müller says that no one can think of a dog without mentally using the word dog, or its equivalent in some other language, and he offers this as a crucial test of the truth of his theory. It utterly fails with me. On thinking of a dog, the name at once disappears, and I find myself mentally in that same expectant attitude in which I should be if I were told that a dog was in an obscure part of the room or just coming round the corner. I have no clear visual image of a dog, but the sense of an ill-defined spot that might shape itself into any specified form of dog, and that might jump, fawn, snarl, bark, or do anything else that a dog might do, but nothing else. I address myself in preparation for any act of the sort, just as when standing before an antagonist in fencing I am ready to meet any thrust or feint, but exclude from my anticipation every movement that falls without the province of fair fencing.

He gives another test of a more advanced mental process, namely, that of thinking of the phrase "cogito ergo sum" without words. I addressed myself to the task at a time when I was not in a mood for introspection, and was bungling over it when I insensibly lapsed into thinking, not for the first time, whether the statement was true. After a little, I surprised myself hard at thought in my usual way—that is, without a word passing through my mind. I was alternately placing myself mentally in the attitude of thinking, and then in that of being, and of watching how much was common to the two processes.

It is a serious drawback to me in writing, and still more in explaining myself, that I do not so easily think in words as otherwise. It often happens that after being hard at work, and having arrived at results that are perfectly clear and satisfactory to myself, when I try to express them in language I feel that I must begin by putting myself upon quite another intellectual plane. I have to translate my thoughts into a language that does not run very evenly with them. I therefore waste a vast deal of time in seeking for appropriate words and phrases, and am conscious, when required to speak on a sudden, of being often very obscure through mere verbal maladroitness, and not through want of clearness of perception. This is one of the small annoyances of my life. I may add that often while engaged in thinking out something I catch an accompaniment of nonsense words, just as the notes of a song might accompany thought. Also, that after I have made a mental step, the appropriate word frequently follows as an echo; as a rule, it does not accompany it.

Lastly, I frequently employ nonsense words as temporary symbols, as the logical x and y of ordinary thought, which is a practice that, as may well be conceived, does not conduce to clearness of exposition. So much for my own experiences, which I hold to be fatal to that claim of an invariable dependence between thoughts and words which Prof. Max Müller postulates as the ground of his anthropological theories.

As regards the habits of others, at the time when I was inquiring into the statistics of mental imagery, I obtained some answers to the following effect: "I depend so much upon mental pictures that I think if I were to lose the power of seeing them I should not be able to think at all." There is an admirable little book published last year or the year before by Binet, "Sur le Raisonnement," which is clear and solid, and deserves careful reading two or three times over. It contains pathological cases in which the very contingency of losing the power of seeing mental pictures just alluded to has taken place. The book shows the important part played by visual and motile as well as audile imaginations in the act of reasoning. This and much recent literature on the subject seems wholly unknown to Prof. Max Müller, who has fallen into the common error of writers not long since, but which I hoped had now become obsolete, of believing that the minds of everyone else are like one's own. His aptitudes and linguistic pursuits are likely to render him peculiarly dependent on words, and the other literary philosophers whom he quotes in partial confirmation of his extreme views are likely for the same cause, but in a less degree, to have been similarly dependent. Before a just knowledge can be attained concerning any faculty of the human race we must inquire into its distribution among all sorts and conditions of men, and on a large scale, and not among those persons alone who belong to a highly specialized literary class.

I have inquired myself so far as opportunities admitted, and arrived at a result that contradicts the fundamental proposition in the book before us, having ascertained, to my own satisfaction at least, that in a relatively small number of persons true thought is habitually carried on without the use of mental or spoken words.

FRANCIS GALTON.

Tabasheer mentioned in Older Botanical Works.

In recent issues of NATURE (pp. 396 and 488) Mr. Thiselton Dyer and Mr. Judd have made two interesting contributions to the knowledge of "tabasheer," and Mr. Tokutaro Ito, and others, have supplied remarkable additional notes (pp. 462, 437, &c.). But no one has told us what is to be found about so interesting a substance in the older botanical works. In numerous botanical works of the pre-Linnean period, "tabaxir," as it was called by all authors of that time, is mentioned, and some of them give us very good information about it.

The first who wrote on tabasheer seems to have been Al-Hussain Abu-Ali Ebn Sina, or Avicenna, as he is generally called by Eastern literary men, a celebrated physician and minister of the Persian Empire, who lived from 980 till 1037, and whose works, written in Arabic, obtained as early as the twelfth century a very great reputation. Avicenna introduced the Persian word tabaxir, *طبخا شير*, into the Arabian language; it signifies "condensed milk-sap," or as Ray (Raius) translates it (1688) in his "Historia Plantarum," *lac lapidescens*. Avicenna was not well instructed about the origin of tabasheer, for in lib. ii. cap. 609, he says that it is got "ex radicibus arundinum crematis," and by these words he created an erroneous opinion, which lasted several centuries. For Gerardus of Cremona, who in the twelfth century translated the work of Avicenna into Latin, was induced by this suggestion to identify the Indian tabasheer with the *σποδός* of the Greeks or the Arabian "tutia," because this remedy was also got by burning the roots of a certain plant, which was probably a Lawsonia.¹

This error was corrected by Garcia de Orta, the physician of a viceroy of India, who wrote a book "De Plantis et Aromatibus," in Portuguese, which was translated into Latin by De l'Ecuse (Clu-ius) in his "Exoticarum Libri Decem," and whose information is the best I have found in writers of that time. He says:—"Vocatur autem ab indigenis 'Sacar Mambu,' quasi dicas Saccharum de Mambu, quoniam Indi arundines, sive ramos arboris illud proferentes Mambu vocant. Attamen nunc etiam Tabaxir vocare coeperunt, quoniam eo nomine petitur ab Arabibus, Persis, et Turcis, qui id mercimonii causa ex India in suas regiones exportant. Magno emitur hoc medicamentum pro preventus eius ratione. *Eius tamen commune pretium in Arabia est, ut pari argenti pondere ematur.* Arbor in qua gignitur interdum magna est et instar Populi procera: Inter singula internodia liquor quidam dulcis generatur, crassus veluti

¹ Afterwards, the signification of the word "spodium," or "spodos," must have totally changed, for Matthioli and others make it a mixture of metals, probably containing zinc.