H. W. Daudt, M.S. (Harvard), assistant in chemistry, and Miss Florence Balch, M.A. (Columbia), instructor in mathematics.

The following appointments have been made in the School of Mining, Kingston, Ont.: M. B. Baker, B.A., B.Sc., advanced from lecturer to professor of geology; Leo F. Guttmann, Ph.D., assistant professor of chemistry; R. J. Manning, M.A., lecturer on chemistry; W. D. Bonner, M.A., lecturer on chemistry; J. Robertson, M.A., lecturer on physics; G. H. Herriot, B.Sc., lecturer on mathematics; S. N. Graham, B.A., B.Sc., lecturer on mineralogy; J. A. McCrae, M.A., M. L. Hersey fellow in chemistry; B. Rose, B.Sc., assistant in mineralogy; B. E. Norrish, B.Sc., assistant in drawing.

The council of King's College, London, have appointed Dr. David Waterston as professor of anatomy, in succession to Professor Peter Thompson, appointed professor of anatomy in Birmingham University. Dr. Waterston was lecturer in anatomy in the University of Edinburgh. Dr. George C. Low has been elected lecturer in parasitology and medical entomology.

Mr. W. S. Abell, instructor in naval architecture at the Royal Naval College, Greenwich, has been appointed to the chair of naval architecture in Liverpool University, endowed by Mr. Alexander Elder.

Dr. E. von Tschermak has been appointed professor at the Hochschüle für Bodenkultur, Vienna.

DISCUSSION AND CORRESPONDENCE

THE EFFECTS OF RAPID AND PROLONGED DEEP BREATHING

The following results of simple experiments may be of sufficient general interest to warrant publication in the columns of Science. They are in no sense new, but are described by way of emphasizing important facts which have been generally neglected and not with any pretense to originality.

The experimental results to which I refer show the effect of enforced deep breathing over a period of several minutes on various functions of the human body. These effects are of several kinds and a few of the simpler ones may be summed up as follows: (1) material increase in the length of time the system can do without respiration; (2) effective mental stimulant; (3) material increase in physical endurance for a short time; (4) rise in the frequency of pulse beat.

1. It has been noticed by others that deep violent breathing for several minutes so changes the system as to make respiration unnecessary for perhaps as much as five minutes after this preparatory breathing is over. In my own case I have found that four minutes' enforced breathing makes it possible to hold the breath for three minutes and a half, whereas without this preparation 56 seconds was my limit. The time during which it is possible to do without respiration increases, of course, with the length of time during which the preparatory breathing is carried on. The increase does not go on indefinitely, but reaches a definite limit, beyond which further length of time given to preparatory breathing does not increase the time during which the breath may be held. Below is a table taken from a curve which represents experiments on myself. The limit (3 minutes 34 seconds)

(*a*) Length of time in minutes devoted to deep breathing.

(*b*) Time in minutes and seconds during which the breath may be held after preliminary breathing is stopped.

(*a*)	0	¼	½	¾	1	2	3	4
(*b*)	0.56	1.24	1.39	1.54	2.12	3.00	3.26	3.34

which is indicated in this table would doubtless differ with different people. It should be noticed that the preparatory breathing is effective long after the "washing out" of the lungs must have been completed. The change produced in the system is certainly, therefore, more fundamental than a lung change, and would appear to a layman to indicate a temporary change in blood constitution.

2. The effect as a mental stimulant is very pronounced. I have noticed in my own case that mental fatigue may be postponed, far beyond the usual point, by two minutes of

rapid deep breathing at half-hour intervals. A feeling of sluggishness or sleepiness may be almost completely dispelled. I have never noticed any reaction as in the case of most stimulants and altogether it seems to me very satisfactory.

3. The effect on muscular fatigue is also striking. A difficult arm exercise with heavy weights which I could not repeat under ordinary circumstances more than twenty times, I found after four minutes of this preparatory breathing that I could do twenty-seven times, *i. e.*, about thirty per cent. more. This increase I found to exist at all stages of fatigue, as might be expected.

4. The pulse beat goes up very rapidly while the breathing is continued, in my own case from about 65 to 106 after four minutes' breathing.

Another curious effect which perhaps is worth mentioning is the apparent rapid lapse of time during the latter half of a hard breathing period. This change in the time-sense is very noticeable.

I might add, in conection with paragraph one, that a friend of mine has found a five-minute limit to the time during which he is able to hold his breath after the preliminary breathing.

I should not have ventured to describe phenomena which are so easily in the reach of every one, had I not found in people at large, and even among scientific men, a surprising ignorance as to their existence. I have seen some very amusing betting on how long it was possible to hold the breath, and have seen the cock-sure bettor laid low by not knowing of this possible resource of his adversary.

As a mental stimulant, and as a means to increase the time during which the system can do without respiration, violent breathing might find considerable useful application, and daring rescues from suffocation are common enough to make a knowledge of this possible threefold endurance without air of no little value.

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MASSACHUSETTS INSTITUTE OF TECHNOLOGY,
November 3, 1909

ESPERANTO

MR. J. D. HAILMAN'S interesting letter on the use of Esperanto by scientific men[1] is, I venture to think, somewhat misleading. He says (p. 561):

> This solution is the world-wide adoption of an *international* language—a second language which all will learn in addition to their natural tongue. . . .

The chemist, in order to be moderately well equipped, requires a good reading knowledge of English, French and German. Suppose we take a somewhat extreme case and assume that after January 1, 1910, under penalty of instant death, all chemical communications must be made in Esperanto, what would be the effect? Apart from the possible creation of a few desirable vacancies, the only result of such a law would be that chemists would have to know at least *four* or *five* languages, including Esperanto, instead of *three* or *four,* as at present. The reason for this is, of course, that the greater portion of the facts and theories which constitute chemistry has been contributed, hitherto, in English, French or German and, in many cases, it is absolutely necessary to have an author's original words.

The same conditions doubtless apply, *mutatis mutandis,* to other branches of knowledge.

I have no desire to obtrude an opinion regarding the merits and defects of Esperanto, nor to say anything as to the desirability or otherwise of an international language. I believe, however, that it is timely to point out that the adoption of Esperanto will involve an increase to the weight of languages which the scientific worker has to carry and that it will not be an alleviation of his burden. It is only fair to call upon the enthusiastic propagandists of Esperanto to state this fact clearly during their missionary labors.

J. BISHOP TINGLE

MCMASTER UNIVERSITY,
TORONTO, CANADA,
October 28, 1909

SCIENTIFIC BOOKS

Descendenz und Pathologie. Vergleichend-biologische Studien und Gedanken. By

[1] SCIENCE, October 22, 1909.