(1) Advancing on the lines laid down by Sir Charles Bell and J. Müller, "that, *however excited*, each nerve of special sense gives rise to its own peculiar sensation" (Bayliss, "Principles of General Physiology," 1915, p. 513), Helmholtz put forward the hypothesis that each fibre of the auditory nerve "hears in its own peculiar pitch" ("Sensations of Tone," 1885, pp. 148 and 151) without regard, as it seems, to the immediate consequences which it must have for his main theory. For, from the rate of damping determined by him, "it follows that the natural pitch of the internal vibrators, which respond sensibly to a given simple sound, ranges over about a whole tone" (Rayleigh, "Theory of Sound," vol. ii., § 389). That means that when a note is sounded a great number of nerve-fibres are stimulated, for the Helmholtz mechanism of the internal ear requires every string of its remarkable pianoforte to be connected "with a nervous fibre in such a way that this fibre would be excited and experience a sensation every time the string vibrated" (p. 129). The number of strings or internal vibrators allotted to the interval of a whole tone varies. In 1870 it was 66½; in 1877 it was 100; but the number, if more than one, is immaterial here. Assuming that 100 strings of the basilar membrane vibrate in unison with the given note, 99 of these will be executing forced vibrations at other than their proper frequencies, and *ex hypothesi* 99 nerve-fibres will call up 99 dissonant sensations of tone, all of different pitch and of intensities diminishing regularly on either side of a maximum, which is due to the 100th fibre, the peculiar pitch of which agrees with the exciting note. As each nerve-fibre, *however excited*, gives rise to the sensation of its own peculiar pitch, it matters not whether the internal vibrators vibrate with their proper frequencies or with that of the imposed tone. Unless, therefore, there is in the central organ some contrivance, which Helmholtz does not provide, for inhibiting the odd 99 nerve-fibres, or a transformer of some kind to standardise their pitch, it follows that when a tuning-fork is made to vibrate, no note can be heard, but only an unimaginable din. Music would then be impossible; we could never hear anything but noise.

On the other hand, if Helmholtz had allowed each nerve-fibre to communicate the actual pitch of the vibrator connected with it, whether executing a free or a forced vibration, then there could never be a clean-cut, staccato ending to a note, but after a bass note has ceased externally to the ear there would ensue for about one-tenth of a second, according to his estimate—to the ear an appreciable period of time—a similar confused noise of many mistuned strings; for, by p. 144, "an elastic body set into sympathetic vibration by any tone vibrates sympathetically in the pitch number of the exciting tone; but as soon as the exciting tone ceases, it goes on sounding in the pitch number of its own proper tone." The cochlea (limaçon, Schnecke) well deserves its name. For, however many fibres its house may hold, the snail certainly has two horns. Sir Thomas Wrightson's theory presents us with no such dilemma as this.

(2) In 1916 I found that if I sing to a bass note such a vowel as *oh* or *oo*, and end the note staccato by closing the glottis (the "Glasgow" substitute in speech for occlusive *t* or *k*) while keeping the shape of the mouth unaltered, I hear that the harmonic of the voice which is reinforced by that excellent resonator, the cavity of the mouth, is still audible for a very brief space after the voice has ceased to be heard. From which I infer that the rate of damping in the internal ear is more rapid than that of the body of air in the mouth shaped for certain vowels. But as I do not expect or desire that this inference should be accepted

as scientific fact merely on my statement, just as little am I disposed to accept Helmholtz's guess-work as an adequate basis for the calculation which was to have such far-reaching and subversive consequences, overthrowing, for example, the belief of Lagrange and Thomas Young that rapid beats may combine into a sensation of tone. Hence my previous letter (NATURE, May 16, 1918) with a kymograph tracing of the word "utter" intoned at pitch 100 and measured by a tuning-fork of the same pitch. In that tracing it is not a question of a note being reduced to one-tenth of its intensity in the time occupied by 9.5 vibrations, but well within that limit a loud note is reduced to silence. There is the proof that the unchecked estimate which is the very keystone of the Helmholtz theory of audition is wide of the mark.

The complete cessation of sound in "utter" is an essential feature of English and of other languages. It is astonishing that Ellis, the phonetician, never thought of this when translating Helmholtz. That which is *common* to the first *p*, *t*, or *k* in "stop, please," "or not to be," "bookcase," by virtue of which these three "sounds" are classed together as voiceless occlusives, is evidently a shock sensation of the sudden cessation of a sound. How the existence of such a sensation is to be reconciled with any resonance theory of audition has long been a puzzle to me. The very term *resonance* seems out of place in the presence of this phenomenon; and when, on May 17, Sir Thomas Wrightson's book came into my hands, the expression "*dead beat*" in his preface appeared to promise an advance towards the solution of a most complicated problem. W. PERRETT.

University College, London, October 23.

The Society of Civil Servants.

APROPOS of the letter which appeared in NATURE of October 24 on the need for scientific workers to organise themselves, I shall be obliged if you will allow me through your columns to direct the attention of scientific workers in the Government service to the recently founded body, the Society of Civil Servants, which is intended to cover the middle and upper grades of the Service—grades which hitherto have been almost wholly unorganised. By its second rule the objects of the society are defined as "to deal with all matters affecting the Civil Service, and to take such action thereon as may be expedient"—a purview of unlimited range. While the society is constituted on the basis of individual membership, members are encouraged to coalesce into whatever sectional associations—called in the rules "grade groups"—may conveniently and naturally come about. It is these "grade groups" that will consider matters such as salaries and scales of promotion which affect their members solely, the society taking up only wide questions affecting the Civil Service generally.

It is an old saying that "Providence helps those who help themselves." Scientific workers have in the past had just cause to complain of the niggardly treatment that they have experienced at the hands of the State. By organising themselves into "grade groups" of the society, according to the various Departments, those in the State employ will have an opportunity of directing attention to their claim for more generous treatment; but should they fail to take advantage of the present opportunity, they will have no one to blame but themselves if in the future they continue to receive the same neglect as in the past. It is no secret that a scheme for the application of the principles of the Whitley report to the

Civil Service has been drawn up by the Ministry of Labour, and is even now being considered by an Inter-Departmental Committee. The recommendations advocated in that report are based on the fundamental hypothesis that both parties to an industry—the employer and the employed—are well organised. If, therefore, men of science desire to have a voice in framing the conditions under which they work for the State, they must organise themselves, and the sooner the better. A beginning has been made, but only a beginning.

G. F. HERBERT SMITH,

Joint Hon. Sec., *pro tem.*, Society of Civil Servants.

2 Old Queen Street, S.W.1, November 5.

Modern Studies in Schools.

I WAS somewhat surprised to read in NATURE of October 3 a vigorous attack upon the Government Committee on Modern Languages on the ground of its having considered nothing but the interests of trade and diplomacy. I trust this will not deter your readers from examining what is generally considered to be a most valuable report. It is certainly a document which has met with the general approval of modern language teachers and others interested in the subject with which it deals. Against the charge made I may point out that of the nine pages of the section entitled "The Value of Modern Studies," nearly three are devoted to the higher aspects of the subject, while the section on the aims of language teaching in schools begins with the sentence, "Language teaching has, and should have, a disciplinary and educative aim," and the treatment of the subject is based on this text.

Most surprising of all is the view expressed in the article that "the opinions of the Committee on educational methods are astonishingly reactionary." If by "educational methods" is meant—as one supposes must be meant, considering the context—"methods of language teaching," the statement is the exact reverse of the truth. The opinions enunciated are the most advanced which have ever appeared in a document issued by a public authority. The Committee recognises the strong position now held by the "direct method," and discusses its merits critically, yet sympathetically. A whole section is devoted to phonetics, and the need for a good phonetic training for teachers is insisted on. Uniformity in grammatical terminology is recommended. Of our own suggestions for examinations, which are usually considered to be of a moderately advanced character, the report says that they are "good so far as they go, but they do not go far enough." An oral test is recommended in all cases, and free composition, it is considered, should either be substituted for or be additional to translation into the foreign tongue. Finally, it is urged that translation in school "should be practised only so far as it is necessary"—a view which probably many teachers will think unsound, but which none will characterise as reactionary.

G. F. BRIDGE,

Hon. Sec., Modern Language Association.

I CORDIALLY agree that teaching for "bread-winning" is the first duty, but "bread-winning" may be "bread-capturing," and it is this spirit, I am afraid, which pervades the report. But manufacturers to-day are more concerned with production and co-operation than with commerce, and they find the need for a wider knowledge of languages for this service, so I am not surprised that the *questionnaire* met with little response.

The aims and methods set forth in the report are

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of the standard classical type, and they insist on the study of one or, at most, of two languages taught to a high state of proficiency; but the needs of the times, and the average capacities of boys, demand a less specialised course. The difference is fundamental, as Mr. Bridge will admit. We expected a new method and a new outlook, but we got the old. In our opinion, schools should give boys the opportunity of reading many languages, not excluding the Eastern languages or the languages of Africa, and boys should use the languages for research and discovery. Whether this work is disciplinary or educative is of minor importance; or whether it cultivates taste or judgment. Of minor importance, too, as we think, are the various methods of teaching which are recounted by Mr. Bridge. It is true that these are the things which trouble the minds of many schoolmasters, but with deeper aims the methods would take care of themselves. We expected the Committee would have shown the way to more fundamental changes in method, but it did not do so.

THE WRITER OF THE ARTICLE.

THE MINISTRY OF HEALTH BILL AND AFTER.

SINCE October 17, when most of the newspapers gave prominence to an announcement that the Ministry of Health Bill had been re-cast and submitted to the War Cabinet, possibly because the body named has had other things to think of, nothing has been heard of this measure. Much, however, has been said and written of the Ministry itself, and a certain amount, none of it good, of the Local Government Board, the reason being the extent and severity of the influenza outbreak. If some of the speakers and writers are to be believed, the Board, because its methods are "wooden," or because of its "Poor Law taint," is mainly to blame for the epidemic: if there had been a Ministry in existence, the suggestion is that there most certainly would have been no outbreak.

The persons who make these statements are, many of them, those who are responsible for trying to convince the public that if only a Ministry of Health were formed there would follow an immediate and marked improvement in public health.

That many have listened to promises of this kind and look for something in the nature of a quick change is pathetically true. Unfortunately it is true also that disappointment awaits them. It has never been quite clear why it should have been necessary to exaggerate so much as to the benefits likely to follow the establishment of a Health Ministry. The case for a separate Ministry to co-ordinate health effort and ensure that all branches of hygiene, scientific, practical, and administrative, should have proper recognition and support was always sound, and no good can come of these exaggerations. On the contrary, a great deal of harm may result unless it is recognised at once and generally that it may be long, very long, before signs of improvement become apparent.

It has taken, and may still take, a long time to get a Ministry of Health Bill. It will take time