them), granted for promise shown in scientific research to students whose work is considered likely to be of benefit to the nation and national industries. The men who have held these scholarships for two or three years form a body highly trained in the best English and Continental universities, with, in most cases, considerable research experience under varied conditions and breadth of view. Yet we see on all hands these men barely able to make a living (unless they go to America). They are in general men of all-round education, with specialised knowledge in science in addition; they are not particularly uncouth, unpractical, or unbalanced, as popular tradition would have men of science to be. It is this addition of specialised knowledge that, under present conditions, is the greatest obstacle to their earning a living; they would probably be better paid if they turned their hand to any employment other than the pursuit of science, or became the worst paid of Government clerks

In case I should be supposed to be taking a sordid view and claiming riches for the man of science, I explain that when I write "earning a living" I mean earning just sufficient to enable a *single* man to live in the most modest way befitting a member of a learned profession, and I state without fear of contradiction that to do so was a matter of grave difficulty for our younger men of science before the war.

There is nothing unique about the treatment of the 1851 Exhibition scholars. Taking scientific research workers in general, the State has nothing to offer them except occasional grants of 5*l.* or 10*l.* towards purchasing apparatus; the modern universities offer them (and the offer is widely accepted) 150*l.* or so a year (see the advertisement columns of NATURE) for lecturing on the higher and lower branches of their science, and for spending all their spare time in research; private enterprise treats them as amiable eccentrics on a par with the pleasant gentlemen who devise in our popular papers and magazines problems dealing with the joint ages of old families, and the division of ridiculouslv shaped fields into absurd areas. Only their love of science keeps them employed on scientific work, and you are not likely to extend the class of men willing to accept scholarships under such conditions and with such prospects, however many scholarships you may offer.

So long as the present attitude towards science and scientific workers obtains it is useless to train fresh men, and by means of scholarships to set keen workers on a path which leads them through the pleasant fields of scientific discovery to the pathless waste of apathy and neglect which lies in the way of all workers in pure science in England, a waste where material life is very scarcely nourished. Once the waste is abolished the path need not be made so smooth. To drop the obscurity of metaphor, once show the young and keen student that he has some hopes of employment for his activities and recognition for his work, that there is some place for him in national life when he is accomplished as a research worker, and he will derive more encouragement from the prospect of some future definite goal than from all the help by the way to nowhere offered by scholarships, exhibitions, and such like. These are of little use until there is good prospect of the attitude of the governing classes towards science being changed, and, in my humble opinion, all energies should be devoted to bringing about this change of opinion. It is conceivable that a refusal by our great men of science to do national work for nothing but scant and grudging thanks would do more to increase the national reputation of science than any sort of begging for scholarships. It would mark a new era, when the man of science will be held worthy of his hire, and not as one rather permitted to exist than encouraged; and who will be found to say that such a new era would be a bad thing?

One further point. All present discussion seems to be concerned only with the direct application of science to industry, and not at all with the advisability of encouraging pure science. Many of us would welcome a definite pronouncement from the leading authorities as to their attitude towards pure science. If only science which can be immediately applied to industrial processes is in future to be considered of national value, let us have a clear announcement to this effect from some responsible body. This will give those of us who have spent their youth working in pure science, and who are now on active service, a fair opportunity to set about cultivating the correct attitude of mind towards science before returning to peace-time pursuits. For an attitude of mind is one of the few things easily cultivated within range of German guns.

E. N. DA C. ANDRADE.

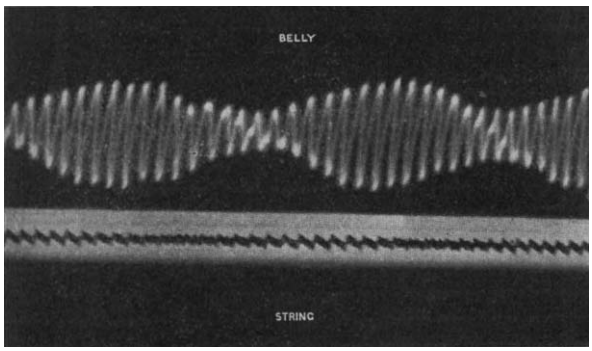
B.E.F., France, June 21.

On the "Wolf-note" of the Violin and 'Cello.

IT has long been known that on all musical instruments of the violin family there is a particular note which is difficult to excite in a satisfactory manner, and that when this "wolf-note," as it is called, is sounded, the whole body of the instrument vibrates in an unusual degree, and it seems to have been also understood that the difficulty of eliciting a smooth note of this particular pitch is due in some way to the sympathetic resonance of the instrument (Guillemin, "The Applications of Physical Forces," 1877). In a recent paper (Proc. Camb. Phil. Soc., June, 1915) G. W. White has published some experimental work confirming this view. The most striking effect noticed is the *cyclical* variation in the intensity of the tone obtained when the instrument is forced to speak at this point. White suggests as an explanation of these fluctuations of intensity that they are due to the beats which accompany the forced vibration imposed on the resonator. The correctness of this suggestion seems open to serious criticism. For the beats which are produced when a periodic force acts on a vibrator are essentially *transitory* in character, whereas in the present case the fluctuations in intensity are *persistent*.

The following explanation of the effect, which is different from that suggested by White, occurred to me some time ago on theoretical grounds, and has since been confirmed by me experimentally. The effect depends on the fact (which is itself a consequence of theory) that when the pressure with which the bow is applied is less than a certain critical value proportionate to the rate of dissipation of energy from the string, the principal mode of vibration of the latter, in which the fundamental is dominant, is incapable of being maintained and passes over into one in which the octave is prominent. When the bow sets the string in vibration the instrument is strongly excited by sympathetic resonance, and the rate of dissipation of energy rapidly increases and continues to increase beyond the limit up to which the bow can maintain the string in the normal mode of vibration. The form of vibration of the string then alters into one in which the fundamental is feeble compared with the octave. Following this, the amplitude of vibration of the belly decreases, but this change lags behind that of the string to a considerable extent. When the rate of dissipation of energy again falls below the critical limit, the string begins to regain its original form of vibration with the dominant fundamental. This is accordingly followed, after an interval, by a fresh increase in the vibration of the belly, and the cycle then repeats itself indefinitely.

The accompanying photograph showing the simultaneous vibration-curves of the belly and string of a 'cello amply confirms the foregoing explanation suggested by theory, and is itself of interest. It will be



seen that the changes in the vibrational form of the string are about a quarter of a cycle in advance of those of the belly, and that in both curves the octave is conspicuous when the amplitude is a minimum.

C. V. RAMAN.

The Indian Association for the Cultivation of Science, Calcutta, May 20.

THE ETHNOGRAPHY OF CENTRAL INDIA.[1]

THE publication of this work recalls the tragical fate of its author, who soon after the final revision of the proof-sheets sailed for India and lost his life in the s.s. *Persia,* sunk by a German submarine in the Mediterranean. The book is the result of a long study of the races of the Province, begun when the author was placed in charge of the census operations in 1901, and since steadily prosecuted, in spite of very indifferent health. He enjoyed opportunities denied to the writers of the volumes on Northern India—Mr. Crooke for the United Provinces and Mr. Rose for the Punjab, who dealt with regions where the all-absorbing Brahmanism and militant Islam had caused much of the more primitive beliefs and usages to disappear. Sir H. Risley, in his account of the tribes of Chota Nagpur, and Mr. Thurston, in those of the Nilgiri Hills, were dealing with people believed to be indigenous, or at least settlers of whose coming no information is now available, and their religion and organisation are of a very primitive type. The people considered by Mr. Russell are perhaps even more interesting—Gonds, Baigas, Korkus, and the like, about whom little has hitherto been known.

The scheme of Mr. Russell's work differs from that of others in the same series, inasmuch as in his Introduction and throughout the caste and tribal articles he has not confined himself to a mere description of the religious and social life. He has taken occasion to discuss questions such as the character and origin of the local totemism and animism, the Corn Spirit, the sanctity attached to opium and alcohol, the pig as a sacred animal, the buffalo as representing the Corn God, the respect paid to the umbrella and to counting, and so on. In the course of these digressions he quotes largely from standard words on anthropology, such as Sir J. G. Frazer's "The Golden Bough," "The Religion of the Semites," by Prof. Robertson Smith, "The History of Human Marriage" and "The Origin and Development of Moral Ideas," by Prof. Westermarck, and other standard authorities. This method possesses some advantages, inasmuch as it tends to popularise the principles of anthropology, and his work is learned and interesting. But it is doubtful if this advantage justifies the space which is occupied by these discussions. They are unnecessary to the trained anthropologist, and it is a question how far this learning is likely to be assimilated by the persons—the officials, European and native, of the Province—who will chiefly use the book. Further, it must be remembered, as appears from

FIG. 1.—Bahrūpia impersonating the Goddess Kāli. Reproduced from "The Tribes and Castes of the Central Provinces of India."

Prof. Ridgeway's latest book, reviewed recently in these columns, many of these principles are still the subject of active controversy.

[1] "The Tribes and Castes of the Central Provinces of India." By R. V. Russell, assisted by Rai Bahadur Hira Lal. Four volumes. Vol. i., pp. xxv+426 Vol. ii., pp. xi+540. Vol. iii., pp. xi+589. Vol. iv., pp. xi+608. (London: Macmillan and Co., Ltd., 1916.) Price 42s. net, four vols.