question in relation to comets, would indicate that it may be equally unobjectionable in the case of the bright line stars.

But there was more evidence behind with regard to the other carbon flutings.

The spectrum of carbon does not consist of the blue band alone, so that some account must be rendered of the other parts of the carbon spectrum, more especially of two groups of flutings in the green. We should not expect the green flutings to be so easily visible as the blue in stars, for the reason that they fall in the brightest part of the continuous spectrum; while in comets where there is little continuous spectrum, they are the most conspicuous bands.

In the star BD + 36° 3956, for example, Vogel's observations gave indications of the two green bands which are seen in the spectra of carbon compounds, and are the chief characteristics of the spectra of comets at mean distances from the sun.

It was in 1890 that Dr. and Mrs. Huggins formulated objections, based on some new measures, to my view as to the probable carbon origin of the blue band in the bright line stars.

Thus, in two cases they found, as Vogel had found before them, that the brightest band was still more refrangible than the brightest part of the modified carbon band; but in each of these cases they found, also, a band about the position of 4685.

As a result of their work, they made the following statement:¹ "Our observations appear to us, however, to be conclusive on the main object of our inquiry, namely, that the bright blue band in the three Wolf-Rayet stars in Cygnus, and in DM + 37° 3821, is not coincident with THE BLUE BAND OF THE BUNSEN FLAME."

The capitals are mine. It will have been seen how carefully Vogel in the case of comets, and myself in the case of stars, had pointed out that it was not a question of the Bunsen flame!

Dr. and Mrs. Huggins do not admit that the observed variations of the band in the carbon spectrum are sufficient to explain the position and appearance of the band at 4685 in the stars, basing their objections on experimental evidence afforded by Hasselberg.

Vogel's researches, as well as my own, on the carbon spectrum, however, indicate a much greater concentration of luminosity of the band about 4685 than appears to have been observed by Hasselberg. But this is not to be wondered at, since every change in the experimental conditions may have an effect on the spectrum.

I am not aware of any other objection to my view than the above, and it will be remarked that Dr. Huggins is silent altogether in regard to the existence of the band in comets.

Very fortunately for science, a great mass of new work on this part of the subject has been brought together since the Meteoritic Hypothesis was published, chief among the workers being Prof. Campbell.

Let us turn to this new work, therefore, and see in what direction it tends.

We may take the case of one of the brightest stars of this class in Argo, the spectrum of a star which my friend Respighi and myself were the first to see on a very hot night in Madras in 1871, a beautiful spectrum with many bright lines. Prof. Campbell, in 1893, included the study of this bright line star in his work at Lick. What is his result with regard to the band at 4685? He finds a band at 4688.² In my first discussion I took the position of the brightest band as 4682, depending upon measurements made by Ellery, at Melbourne, in 1879. In a more general examination of all the Wolf-Rayet stars in 1894,³ he finds a band at 4688 to be the most constant feature, and in some stars it appears almost alone! This in itself would be almost sufficient to prove carbon.

Prof. Campbell does not discuss the origins of the lines and bands which he has measured, but it will be seen that for such a diffuse band as that in question, his wave-length 4688 does not differ materially from that already given for the modified carbon band.

There is now, therefore, in the light of the newest and best work, no question about the fact that in the bright line stars there is a band at 468, the wave-length of the modified carbon band; and this was my original contention.

The new measures obtained by Dr. and Mrs. Huggins, therefore, do not affect my views as to the origin of the blue band of the bright line stars recorded at places varying between λ 468 and λ 469.

With regard to this band, then, the first conclusion is now firmer than ever, strengthened as it is by Campbell's new work.

Dr. and Mrs. Huggins object to another point.

It has already been remarked that Vogel's observations suggested the presence of the green flutings in one of the stars.

On this point Dr. and Mrs. Huggins remark that, when observing the bright line stars with small dispersion, "it might easily be supposed that the spectrum is brighter at the position of the green carbon band"; with high dispersion, however, they can see "no sensible brightening" in that part of the spectrum. In the case of another line distinctly seen with small dispersion, they remark that with high dispersion it was so indistinct that they could not determine whether it was D or D₃;¹ so that their observations do not demonstrate the absence of the green fluting of carbon.

Observations made at Kensington strengthen the idea that the green flutings are present in the spectra of bright line stars. When high dispersion is employed, flutings are weakened in much greater proportion than lines; so that comparatively small dispersion must alone be employed in observations of this kind.

Campbell shows that while the average position of the brightest blue band in one group of stars is 4688, in another group it is 4652. These two bands are frequently associated in the same spectrum, but occasionally each occurs by itself.

As to those stars in which a band appears about λ 465, it is quite possible that we may still have to deal with carbon. At present I am not aware of any experimental evidence; but the possibility of a band at this wave-length, under a certain still untried condition is suggested by the fact that a band about this position was observed in Brorsen's comet in 1868 and 1879.

But the existence of a band at 465 surely does not negative the existence of a band at 4685!

The present position of the question of carbon, then, is this. The new work of Campbell justifies us in associating, not only in comets, as first suggested by Vogel, but in bright line stars, as suggested by myself, the blue bands at 468 with carbon; and a study of the spectra of comets suggests, but does not demonstrate, that the other band at 465 has the same origin. The feeble appearance of the green bands is no doubt due to their superposition upon the brightest part of the continuous spectrum.

Hence the idea of the chemical and physical kinship of comets, nebulae, and bright-line stars is strengthened.

J. NORMAN LOCKYER.

THE SAVING OF VANISHING KNOWLEDGE.

IT is well from time to time to take stock of our knowledge and of our methods of inquiry, to see whether we are working on sound lines. As the business man finds it necessary to periodically go over his stock and balance his books, so, too, the scientific man, especially the biologist, should perform an analogous operation, lest perchance he find out too late that he has been entering on a comparatively unprofitable line of work, or has been neglecting valuable opportunities. While it is impossible to say what scientific work is ultimately unprofitable, it may not be difficult to suggest that particular subjects for investigation are of more immediate importance than others.

Let us for the moment divest ourselves of all preconceived ideas and pet fancies, so as to discover what is at the present time the most urgent need of science. In order not to complicate the question, we will dismiss the practical applications of science by admitting that they are of immediate importance. This leaves the field clear for scientific subjects which are studied solely for their own sakes.

We can, perhaps, gain a clearer view of the question by looking at it from the standpoint of our successors—What will be the opinion of the naturalist of a hundred, or of a thousand, years hence? What is the scientific work that he would wish us to have undertaken? This question is an easy one to answer.

He would not consider it very necessary for us to elucidate the structure, development or physiology of every common animal; these matters can be done at any time. The investigation of the life in the oceans—whether on the surface, in shallow water, or in abysmal depths—can be done by him as well as by us. We may safely leave for the present the problems of the Ant-

¹ Roy. Soc. Proc., vol. xlix. p. 46.

² Astronomy and Astrophysics, 1893, p. 555. ³ Ibid., 1894, p. 448.

arctic polar basin ; if this generation does not learn the secrets of the palæocrystal ice, another can and will do so.

Our future naturalist will certainly and most justly complain if we busy ourselves with problems that can wait, that he can solve as well as we, and at the same time neglect to do that work which we alone can do. Our first and immediate duty is to save for science vanishing knowledge ; this should be the watchword of the present day.

Those students of botany, zoology, and anthropology who have at all considered the matter, are impressed with the fact that the present is a very critical time for the native flora and fauna of many parts of the world. Owing to the spread of commerce, the effects of colonisation, and the intentional or accidental importation of plants and animals, a very rapid change is affecting the character of the indigenous life of numerous districts. This is notably the case in oceanic islands, the area of which is often extremely limited, and as a consequence the native forms are the more likely to be swamped by the immigrants ; but it is just those spots which are of especial interest to the naturalist, on account of their isolation from the great land areas. Thus the flora and fauna of many of the districts most interesting to the field-naturalist are in our day becoming largely exterminated before they have been adequately recorded. The investigation of disappearing animals and plants can, in many cases, be undertaken by us alone—and even now much has disappeared and more is fast passing away. It is, perhaps, scarcely necessary to point out that this investigation is not a matter of interest to the systematist only, but it is of great importance in connection with the problems of the geographical distribution of animals and plants which open up such fascinating vistas of the extension of continents in former ages, and of their partial submergence ; not to speak of the bearing of specific and individual varieties on the intricate questions of the origin of species ; or the adaptation of those peculiar forms to their particular localities, and those wonderful inter-relations between plants and plants, plants and animals, or between animals and animals, and between all and their environment.

Some years ago a Committee was appointed to investigate the zoology of the Sandwich Islands, and they sent out Mr. R. C. L. Perkins, who has done most excellent work. His researches in the Hawaiian group prove that quite a noticeable decrease in the indigenous fauna is taking place each season. The district around Honolulu was perhaps originally the richest in endemic forms, but now introduced forms are in vast preponderance ; the distinctive fauna of the plains, if there was one, has quite disappeared. Captain Cook found certain birds, for example, near the shore ; of these, some are extinct, and others are to be found only in the mountains. In a letter recently received, by Dr. D. Sharp, dated from Lihue, Kauai, he states : " This place has been a dead failure. The country where I camped here was a low-lying, densely-covered forest bog-land, at first sight a paradise for Carabide (ground beetles), and differing from any other place known to me. Its fauna is entirely lost for ever. I turned during my stay thousands of logs, any one of which at 4000 feet would have yielded Carabide ; of all these there was not a single one under which *Pheidole megacephala* had not a nest, and I never beat a tree without this ant coming down in scores." This is an introduced ant which is overrunning the islands, and which exterminates the native insect fauna. Mr. Perkins finds that earwigs alone can withstand this ant, and his only chance of collecting endemic insects is to get ahead of the ant. The area of the whole group is somewhat larger than Yorkshire. If the diminution of the fauna is so marked in such a comparatively large group as the Hawaiian Islands, how much greater must it be in the small islands.

Mr. Knight, in his entertaining book "The Cruise of the *Falcon*," describes the prostrate forests of the island of Trinidad in the South Atlantic. We never can know what was the nature and extent of this vanished flora and fauna.

What is taking place in the small islands holds good to a somewhat less extent for the larger ones. In New Zealand the Government is taking steps to preserve certain well-known vestiges of its ancient fauna which are in imminent danger of extermination ; but it does not interest itself in the inconspicuous forms, which are subject to the same danger, nor does the New Zealand Government systematically investigate the existing fauna of the group.

It is necessary that such investigations should be undertaken by competent naturalists. They should not only be good collectors, but keen observers, in fact, naturalists in the true

sense of the term ; for unless the work is well done, it had almost be better left undone. There are many examples of collecting being so imperfectly done as to lead to very erroneous conclusions. It takes time for a naturalist to become acquainted with the local types. The endemics do not show themselves, as usually the conditions of life are such that insects, for example, live retired lives and are not seen, while those that manifest themselves are often foreigners.

The extermination of animal life is more rapid and striking than that of plants, but what has been stated for animals must be applied to plants as well.

Not less important than the foregoing is the study of the anthropology of these districts. The Tasmanians have entirely disappeared, and we know extremely little about this interesting people. In many islands the natives are fast dying out, and in more they have become so modified by contact with the white man and by crossings due to deportation by Europeans, that immediate steps are necessary to record the anthropological data that remain. Only those who have a personal acquaintance with Oceania, or those who have carefully followed the recent literature of the subject, can have an idea of the pressing need there is for prompt action. No one can deny that it is our bounden duty to record the physical characteristics, the handicrafts, the psychology, ceremonial observances and religious beliefs of vanishing peoples ; this also is a work which in many cases can alone be accomplished by the present generation.

The late Prof. H. N. Moseley was so impressed with this fact during his voyage on H.M.S. *Challenger*, that he concluded his "Notes by a Naturalist on the *Challenger*" by pointing out that the physical conditions and fauna of the sea can be investigated at leisure at any future time. "On the surface of the earth, however, animals and plants and races of men are perishing rapidly day by day, and will soon be, like the Dodo, things of the past. The history of these things once gone can never be recovered, but must remain for ever a gap in the knowledge of mankind. The loss will be most deeply felt in the province of Anthropology, a science which is of higher importance to us than any other as treating of the developmental history of our own species. The languages of Polynesia are being rapidly destroyed or mutilated, and the opportunity of obtaining accurate information concerning these and the native habits of culture will soon have passed away. The urgent necessity of the present day is a scientific circumnavigating expedition which shall visit the least-known inhabited islands of the Pacific, and at the same time explore the islands which yet remain almost or entirely unknown as regards their botany and zoology ; these promise to yield results of the highest interest if only the matter be taken in hand in time."

There is no difficulty in finding men willing and competent to undertake such investigations if the funds were forthcoming ; experience has shown that an annual sum of at least 400*l.* is necessary to equip and maintain one naturalist.

Here, then, is a great opportunity for the millionaire. No one doubts that the work is worth doing ; it is essential that it should be done at once ; capable men are ready to undertake it—only the means are lacking.

The British Association has appointed a Committee to report on this matter, of which Sir William Flower, Director of the Natural History Museum, South Kensington, is the Chairman, and the present writer the Secretary ; so there exists a machinery ready to be put in action when funds are available. Will not one wealthy man, or a syndicate of rich men, contribute to do this work for the world ? The opportunity if neglected is lost for ever.

A. C. HADDON.

SIR MARTIN CONWAY'S CROSSING OF SPITZBERGEN.

SIR MARTIN CONWAY read a paper on the first crossing of Spitzbergen at the meeting of the Royal Geographical Society on January 25, illustrating his description by a series of fine lantern slides of Spitzbergen scenery. He landed at Advent bay, accompanied by Dr. J. W. Gregory, Mr. E. S. Garwood, Mr. A. Trevor-Batty, and Mr. H. E. Conway, two Norwegian sailors, and two ponies. The descriptions of previous travellers had led him to expect a series of boggy coast valleys leading up to an interior plateau covered with snow or ice, on which sledging would be practicable. The actual conditions were very different. The northern and southern parts of Spitzbergen are, in the main, covered with great accumulations of