pages, and contains merely a few illustrations of the capacity inherent in music of modulating the pleasant sensation it produces in the mind of man in a number of various ways. An appendix treats of the pleasure man derives from the aspect of colours, certain forms, and the beauty of the human body.

LETTERS 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 ensure the appearance even of communications containing interesting and novel facts.*]

On the Spectrum of Brorsen's Comet

THE observations of Prof. Young on the present appearance of the spectrum of Brorsen's comet are of great interest, from the circumstance to which he refers in his letter in NATURE, vol. xix. p. 559, namely, that in 1868 I found the positions of the three bright bands of this comet not to agree with those of other comets which I showed to be coincident with the bright bands in the spectrum of flames containing carbon.

The care I bestowed upon the determination of the apparently anomalous character of the spectrum of Brorsen's comet in 1868 gives me great confidence in its approximate accuracy. I wish now to call attention to the fact that a spectrum apparently essentially similar to the peculiar one exhibited by Brorsen's comet in 1868, was observed at Dunecht by Lord Lindsay in the case of Comet C 1877 (Borelly's). It is remarkable that another comet, Comet B (Winnecke's) 1877, observed by Lord Lindsay on the same evening (May 6) presented the ordinary cometary spectrum.

Lord Lindsay's diagram in the *Monthly Notices* R.A.S. (vol. xxxvii. p. 431) of these two spectra agrees as nearly as can be expected in such observations with my diagram in the *Phil. Trans.*, 1868 (Pl. xxxiii.), contrasting the spectrum of Comet B, 1868, with that of Brorsen's comet.

It may be accepted, therefore, as beyond doubt that the unusual form of spectrum of Brorsen's comet in 1868 is occasionally presented by comets. The great interest of Prof. Young's observation lies in the information which it gives us that the *same comet* may present on one occasion one spectrum, and on another the other spectrum.

I regret that the special arrangement of my telescope for photographic work does not permit me to observe the spectrum of Brorsen's comet at its present appearance.

Upper Tulse Hill WILLIAM HUGGINS

The Migration of Birds

IN NATURE, vol. xix. p. 433, there is a notice of my paper "Ueber das Wandern der Vögel," to which I have somewhat to reply.

However agreeable it is to me that my views should be communicated to your readers, and however little I object to their being submitted to rigorous criticism, I must still also desire that this criticism be fair.

I believe it is due to differences of national customs that your reviewer has not quite satisfied this desire. We make, perhaps, in Germany a sharper distinction between a *scientific* treatise and a *popular* work than in England. Of the latter we do not require that it bring forth what is *new*, but only that it should give what it has to give in a clear and easily intelligible manner. Nor do we require completeness of such a work, or even a criticism of the scientific works on which it is based; indeed, it is generally left to the author how far to cite his sources of information and how far not. In the *scientific* treatise it is quite otherwise; here only that is of value which is new; the theme must be treated *exhaustively;* the sources must always be named and dealt with critically, &c.

Now my publication is a lecture, which was delivered *before a company of educated ladies and gentlemen, and so before mere laics*, and a year and a half afterwards was printed in Virchow and Holtzendorff's Collection of Popular Lectures. *It thus belongs unquestionably to the category of popular writings.*

For this reason your severe critic had no occasion to point out that in my lecture there is much that had been long known, that sources are named but rarely, and that no scientific criticism is exercised. That is quite a matter of course in a popular work, at least in Germany. Mr. Newton would have had much better right to feel surprised *that even any new ideas were contained in it.*

My original aim in this lecture was merely to make my hearers acquainted with the new facts and views on the migration of birds, as they have been established by Wallace, Middendorff, and especially by Palmén. As I followed the new facts theoretically to their consequences, there arose perhaps some new ideas, which I should be glad to find verified in the future.

It is further a matter of course that, notwithstanding the *popular* form of my work, I stand by all that I have said; but I must protest against being made responsible *for what I have not said!*

Thus, *e.g.*, I have nowhere said that I hold Palmén's routes of flight for "absolute truths." I am rather quite of Mr. Newton's opinion, that these routes are merely *inferred*, not *directly* observed, and therefore that they are to a certain extent "conjectural." In this sense, however, the routes of birds must ever remain comparatively "conjectural," unless one were to follow the birds in a balloon. But while "conjectural," Palmén's routes are yet inferred by a purely scientific method, and I doubt not that most of them will in the main be confirmed by further observations. Precisely in the application of this method lies Palmén's great merit, and it is only to be hoped that ornithologists will follow further in his footsteps, and correct his mistakes by accumulation of new facts. That Palmén's routes contain some errors I do not doubt; I should rather wonder if it were not so.

Little, however, comes of this with reference to the questions which are treated with special fulness in my lecture, *the origination of the instinct of migration, and the powers by which the bird reaches its distant goal.*

I have, further, nowhere said that birds fly over the sea at a height of 20,000 feet, but have merely cited the fact that birds have been seen at such height; with reference, of course, to explanation of their flight over the sea. I believe that birds, in flight over the sea, do not close their eyes, but exercise their keen eyesight as far as possible. Therewith, however, it is not said (as Mr. Newton imputes to me) that in *all* flights over the sea they always keep the land in sight.

I desist from adducing further misunderstandings by Mr. Newton, and come to what *I have actually said* and am minded to maintain.

In agreement with Palmén, I have expressed the opinion, *that migratory birds have no special sixth sense*, as Middendorff has assumed, but that *they find their way only with the help of their ordinary five senses.*

Mr. Newton seems to be of a different opinion. He does not say, indeed, whether he agrees with Middendorff, but he brings forward observations which appear incapable of harmony with my view.

First, there appear in New Zealand two species of cuckoo (*Chrysococcyx lucidus* and *Eudynamis taitensis*) which regularly fly some 1,000 miles' distance over the ocean. I believe with Mr. Newton that the birds cannot fly so high as to see at once New Zealand and the Norfolk or Kermadec Islands, though on the former is a hill of 1,000 feet. Likewise I will accept the case of *Charadrius pluvialis* as a regular guest of the Bermuda Islands, and a doubtful *Charadrius* species as regular guest of the Sandwich Islands. *All these observations are, indeed, still very imperfect*, inasmuch as it is not known whence the birds come nor whither they go; but so much seems certain, that they do *regularly* fly over large stretches of ocean in which are almost no islands or rocks, and which are so great that they must of course also fly by night.

What then? Are we therefore compelled to make the assumption, with Middendorff, of a sixth sense, which informs the bird which direction is north? Is there no simpler explanation of the fact? Obviously, we should only be warranted in accepting such a purely hypothetical sense, if it were clearly proved, that we could never get to understand the facts without it.

The question had already occupied me, before I knew of Mr. Newton's examples. I omitted it in my lecture, because it seemed to lead me further into the region of hypotheses than I considered I could answer for before my audience.