LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his Correspondents. No notice is taken of anonymous communications.*]

Red-Necked Grebe

A FINE specimen of the Red-necked Grebe, picked up alive, but wounded, near Bedford, on the 11th of February, has been sent to me dead, and is being stuffed. It is a female, in winter plumage.

Taunton, Feb. 16 W. TUCKWELL

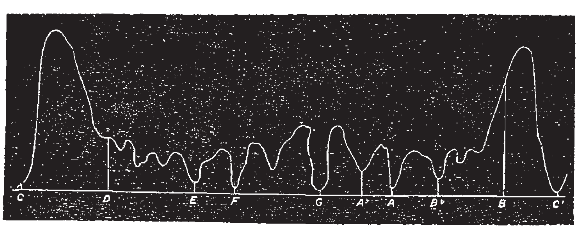
Professor Listing's Amplifier

IN reference to your report of the Boston Natural History Society in NATURE of 27th January, nothing more is requisite to amplify the power of a microscope than to cut off the rims of two or three eye-pieces and insert them in pairs into the ends of a draw tube. Any degree of *amplification* can be obtained whilst the achromatism is preserved. The Huyghenian eye-piece has generally been preferred because the dust accumulating on the inverted eye lens of a positive eye-piece is inconveniently magnified, and obscures the field of view. To those who are desirous of trying Professor Listing's plan, described in your last number, this simple method of mounting may be acceptable.

Lansdowne Crescent, W. ROYSTON PIGOTT

Analogy of Colour and Music

IT appears to me that in the discussion raised by Mr. Barrett's letter in your columns, too little attention has been paid to differences between harmony in music and harmony in colour, which are sufficiently great to show that the coincidences pointed out cannot be regarded as more than *numerical.* Your correspondents have hitherto regarded the subject rather from an optical than a musical point of view. I propose, with your permission, to make a few remarks from the latter stand-point. It is well known that to get a good concord, exact tuning is requisite—*i.e.*, that a slight deviation from the right pitch is sufficient to make a concord into a discord. Moreover, the better the concord, the more intolerable is any appreciable variation of its pitch. Thus unisons, fifths, and octaves are the most sensitive to defective tuning, while the intervals adjacent to them, such as minor seconds, sharp fourths, and sevenths are the harshest discords in the scale. The degree to which this holds will be seen at once by the following diagram, roughly copied from Helmholtz's "Ton-empfindungen." The ordinates of the curve represent the amount of "roughness"—*i.e.*, discordancy corresponding to the intervals marked on the line of abscissæ. The *quality* of tone selected is that of the violin.



A glance at the figure will show that the sounds which produce the most discordant effects with the key-note lie in the immediate neighbourhood of the unison, the octave and the fifth; and further, that a very slight departure from accurate pitch in any concord will provoke a harsh dissonance.

If we now turn to the spectrum, the state of things is widely different. The various colours shade off insensibly one into the other, and in any one colour there is very little, if any, change of tint, except close to its extremities. Thus, then, as far as mere colour goes, any part of any one colour-division produces an equally harmonious effect on the eye, and has an equal claim to be compared to a concord of the gamut.

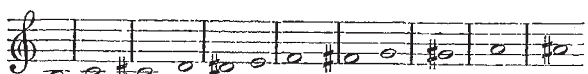
Mr. Barrett, by taking the *central point* of each band of the spectrum as the basis of his comparison, has left this important circumstance out of sight. If we take it into consideration, the result will, I think, be to deprive Mr. Barrett's comparison of any serious importance.

In order to fix our ideas, let us assume that the *mean* red of the spectrum corresponds to *middle C* of the pianoforte with 264 vibrations per second. Taking the limiting and mean wave-lengths as quoted from Prof. Listing by Mr. Barrett, and calculating the number of corresponding sound-vibrations per second, we get the following table:—

	Wave-lengths in 10 millionths of a millimetre.	Number of sound vibrations per second.	Corresponding positions on gamut, with number of vibrations.	
Red	7234	250	247·5	B
	6853	264	264	C
	6472	280–	282–	C♯
Orange	6164	293·5		
	5856	309–	297	D
Yellow	5601·5	323–	317–	D♯
	5347	338+	330	E
Green	5133	352·5	352	F
	4919	368–	376	F♯
Blue	4737	382–		
	4555	397+	396	G
Indigo	4398	411+		
	4241	427–	422	G♯
Violet	4104	441–	440	A
	3967	456+	469+	A♯

(+ or – means that the number of vibrations given is a fraction less than ½ above or below the actual amount. In the last column are given the vibration-numbers of the sounds of the chromatic scale.)

By comparing the last two columns it will be seen that Red covers very nearly the portion of the scale between B natural and C sharp: Orange that from C♯ to half-way between D and D♯, and so on. The whole relation is exhibited in the following figure:—



It will be seen that each colour, on the whole, corresponds to *very discordant* intervals in the scale of pitch, and that only at one point in each (and that by no means always the middle point of each band) can it answer to a concord.

What has been said is probably enough to show how little real "correlation" Mr. Barrett's letter has succeeded in establishing. I will now notice the observations on Newton's rings contained in that signed "W. S. Okely." The diameters of these rings vary in lights of different refrangibility, as the *square root* of the wave-lengths,* and therefore they give a spectrum unfit for the purpose to which Mr. Okely applies them. Indeed this is otherwise obvious from the lengths of these diameters given in his letter from a work by Prof. Zannotti. They are as 1, $\sqrt[3]{\frac{8}{9}}$, $\sqrt[3]{\frac{5}{6}}$, $\sqrt[3]{\frac{3}{4}}$, $\sqrt[3]{\frac{2}{3}}$, $\sqrt[3]{\frac{3}{5}}$, $\sqrt[3]{\frac{9}{16}}$, $\sqrt[3]{\frac{1}{2}}$, and therefore, of course, the intervals between them are not as Mr. Okely makes them, $\frac{9}{8}$, $\frac{16}{15}$, $\frac{10}{9}$, $\frac{9}{8}$, $\frac{10}{9}$, $\frac{16}{15}$, $\frac{9}{8}$, but the *cube roots* of these fractions. The interval from red to red $\sqrt[3]{\frac{1}{2}}$, comes out rather less than 1·26, which lies between a major third and a fourth. Mr. Okely's view, which requires the interval from red to red to correspond to an octave, must therefore fall to the ground at once.

Mr. Deas' conception of "millions" of violinists performing "every conceivable sound within" the octave, with a view to the production of the "purest and most ethereal of sounds," seems to me the wildest delusion. Let us suppose the comparatively modest number of thirty-three at work on the interval from middle C to D, so that the first produces 264 vibrations per second, the second 265, the third 266, and so on up to the last, with 297 vibrations. We should obtain a charming variety of *beats*, one a second, two a second, three a second, &c., up to thirty-three a second, those near the higher limit adapted to produce the very worst barking dissonance attainable. Mr. Deas' million-fiddler-power sound, so far from being "pure" or "ethereal," would not be a musical sound at all, but a mere bewildering chaos of noises, likely to drive the inventor himself,

* See Airy's Tracts or Lloyd's Wave Theory of Light.