

has been fully discussed elsewhere without my knowledge of it. Is the fact that the sting of the worker-bee is an imperfect weapon of defence, a result of its having nothing to do with the propagation of its species, this being left to the stingless queen and drones? Consequently any tendency to develop a more effective sting in one generation of worker-bees has no hereditary effect on succeeding generations, nor apparently have the worker-bees any influence whatever on the worker-bees that succeed them, except by the way in which they feed and educate them, unless, indeed, they can impress their tendencies on the drones or on the future queen before she leaves the hive. If they have no such power, it seems likely that they will always have to lament the use of a weapon which nature might have made as effective as the sting of a wasp. Finally, are there any other insects in the same predicament as worker-bees, *i.e.*, unable to use their weapons of defence without doing themselves more injury than they inflict on their adversary, and unable to help their successors by the transmission of a continually accumulating instinct?

Manningtree, January 22

R. A.

Molecular Vibrations

MR. CHAPPELL is certainly right in stating that "the noises in a belfry are most discordant." He might have said (what no doubt he meant) that the sounds emitted by each single bell are most discordant. Every bell which is at all tolerable, possesses, it is true, one predominating note due to the thick part of the bow, where the clapper strikes, but there are also innumerable other notes, some of which *may* be harmonics, while the majority are not so at all. This is presumably often owing to flaws and other defects in casting, but there is another cause common to every case, which is due to the following fact:—

All bells are cast of a conventional shape, with varying diameters from bow to crown. Now every part of a bell, taken vertically, comes into vibration when struck, and in order to give a true note, each horizontal section ought to have a certain exact thickness of metal proportional to its diameter. This is easily verified to the ear by tapping the bell gently at all parts from the bow upwards. Every inch gives a different rate of vibration, and, consequently, a different pitch.

About the time when the second "Big Ben" was cast, which is a long time ago, I tried experimentally to ascertain what the law was which regulated the thickness of the metal in relation to the diameter of the bell, so that every section might be of identical pitch. This was done by casting a series of bell metal rings of varying diameters, and tuning them, by turning in a lathe, to exact unison. So far as my recollection now serves me, the following was the result:—

Measuring all the rings by their outside diameters, no un-deviating rule was apparent, and the same was the case when the inside diameters were compared. When, however, a circle was taken whose circumference was, as nearly as possible, one-third from the outside of the thickness and two-thirds from the inside, then the law came out distinctly that the thickness of the metal must be proportionate to the square of the diameter of such circle. It occurred at once that this circle must, in fact, constitute the neutral axis of vibration. Working on this principle, it seemed worth while to try whether a bell could not be constructed free from discordant sounds. I may shortly say that this proved to be possible, but only by turning the actual casting with great care and accuracy in a lathe. It became evident that the slightest variation in the true thickness vitiated the unisonal character of the tone. A "miss was as good (or as bad) as a mile," and consequently the process of casting itself was too rough for obtaining the desired end.

It may fairly be gathered from Mr. Chappell's letter that he is not enamoured of a "triple bob major," and that he does not class bells generally as musical instruments. I am much afraid he never will. If the present shape and mode of construction (and let me add, the present mode of change ringing) is adhered to, a peal of bells which will quite satisfy a musical ear may be regarded as a practical impossibility.

R. H.

Missing Nebulæ

IN the note on missing nebulae in NATURE, vol. xix. p. 221, I find the nebulae G. C. 132, 4570, and 5051 mentioned together with the Merope nebula as being diffused objects which are "overlooked in very large telescopes, though obvious in much smaller ones." This alludes, no doubt, to the occurrence of

these objects in the list of nebulae not found with Lord Rosse's 6-foot reflector (*Phil. Trans.*, 1861, p. 745).

With regard to the first object, G. C. 132, it has only been looked for once at Birr Castle, and in the N.P.D. 111° 30' it is possible to account for its non-appearance either by a tilting of the speculum or by the haziness of the sky in this low altitude. G. C. 4570 has been seen three times, and only twice searched for in vain, both times in twilight. G. C. 5051 was set for twice and not found, but 15° north of the zenith the tilting of the speculum almost always changes the index-error of the setting-circle considerably, as expressly stated by the observer on one of the two occasions alluded to. The Merope nebula was last winter seen very distinctly, and roughly sketched with a low power and large field.

J. L. E. DREYER

The Observatory, Dunsink, Co. Dublin, January 13

Time and Longitude

Now that mankind begin to have settlements, even continental, as appears from Mr. Latimer Clarke's account of Sitka, subject to the inconvenience that he and Mr. Layard point out, is it not time that we agreed to make the line dividing "yesterday from to-morrow" avoid all continents, by taking advantage of two very convenient, if not providential, facts, which are certain, though each was *à priori* highly improbable? First, there were great chances against a globe with our existing proportion of land to water, of coast-lines to area, and of large and small lands to each other, having any Behring Strait, admitting one degree of longitude, or thereabouts, to enjoy the above property. But next, there was still greater chance, perhaps, against the exact opposite degree to the strait covering several national observatories; not only more of them, I think, than any equally narrow meridional band, but the only one that, on historical grounds, we can conceive distant civilised nations accepting without jealousy as a common centre. The antimeridians of Copenhagen, Uraniburg, Leipzig, Munich, Padua, Venice, and Florence, seem to avoid both continents; possibly also those of Christiania, Gotha, Verona, and Modena. Those of Berlin, Prague, Naples, and Palermo, seem a very few miles too far east. Europe proper, and its present railways, are very closely bisected by this street of observatories; the local time of the furthest points each way varying but an hour and a half from it. But the chief coincidence is yet unnamed. Would the pride of any existing land, except China, refuse to make a standard meridian of Rome?

The very Chinese must allow Europe a sort of scientific precedence, not as the metropolitan, but the learned continent—earth's university. Europe alone is the adult continent, if there be one; and no other has in a strict sense a metropolis. The history of no other has so turned upon one pivot city as that of Europe has on Rome, nor is likely ever to do so. Some one says that "what a church is to a city, Palestine is (or may some day be) to the world;" but it is less disputable that what the market-place is to a city, Europe is to the world—perhaps permanently. And what the tribunal is to the market-place, Rome has been to Europe, as long as Europe was growing. Observe, too, that in this special connection both our civilised time reckonings, "Old Style" and New, have come from Rome. Might we not also supersede the distinction of E. and W. longitude, by calling Rome 180°, and reckoning all round, from Behring to Behring, leaving the 0° as yet unmarked?

E. L. G.

[E. L. G.'s proposal has been already made by M. de Beaumont. See NATURE, vol. xix. p. 247.—ED.]

Shakespeare's Colour Names

I FEAR you will think that the correspondence on this subject is becoming a mere criticism on Shakespeare's text, and therefore out of place in your columns, but I trust you will afford me space for a short rejoinder to Mr. Ingleby's letter (NATURE, vol. xix. p. 244).

I am obliged to him for pointing out that Sir T. Hanmer had already suggested the substitution of "keen" for "green" in the passage from "Romeo and Juliet," Act iii. Sc. 5. This had escaped me, but I cannot agree with him that the alteration has been *rightly* rejected by subsequent commentators. I have not at present any opportunity of examining the eyes of any living eagles, but in opposition to Mr. Craig-Christie's evidence (NATURE, vol. xix. p. 221) I must point out that all our best