## LETTERS TO THE EDITOR

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### A Bee's Movements in a Room.

THE following was communicated to me by a friend of mine, Mr. E. W. Winstanley, of Trinity College, Cambridge, and, as it may have some value respecting the relations of insects to flowers, I think it worth putting on record. The observations were written down on the day after the occurrence, when he related to me the facts, and I reproduce them here in his own words:—

"Sitting reading in my room (15 Jesus Lane) by the open window, about noon, October 21—a sunny day—I became conscious of a buzzing sound, and, on looking up, found it due to the entrance of a bee. Noticing that certain objects seemed to arrest the insect's attention, I paid special heed to its movements. It first went across to the pictures on the opposite wall, following them round the room, and hovering a short time close to each of the coloured ones, then passing out of the door, which was wide open; returning, after a few seconds, it flew straight to the gas-shades, which, two in number, are situated one on each side of the mantelpiece; it lingered over the top of one, and then passed on to the other, and repeated this movement. It now took a second tour of the pictures, and after stopping a moment or two near one of the brass knobs of the curtain-pole, came again to the gas-shades and made a closer investigation of them, both by hovering over the top and by entering at the bottom around the gas-burners. It then visited in succession four ornaments on the mantel-mirror, drew near once more to the large central coloured picture, made a second exit by the door, coming back almost immediately, and, after dwelling near the two small coloured pictures for the third time, flew straight out of the window.

"It never actually alighted anywhere, remaining near the objects by the rapid quiver of its wings. The whole visit the bee paid me occupied probably five minutes or less. Although I did not examine it closely, I considered it to be a hive and not a humble bee."

The special features to notice in the above are the systematic way the bee flew about, and the nature of the objects which attracted its attention.

Any one on surveying the room would admit, I think, that the gas-shades and the pictures are the most brightly coloured things in it.

The gas-shades are semi-opaque, lily-shaped, and tinted from yellow to bright pink upwards; in fact, they resemble very large gamopetalous flowers (corollas).

The pictures in the room numbered seven, consisting of a large frame enclosing five photochrome views, of two small photochromes, and four photogravures. My friend says it was distinctly the coloured ones that attracted the bee, giving the other ones a mere glance, as it were. The photochromes are vividly coloured, blue predominating.

The remaining objects visited, the ornaments, are not striking or large, but have flowers painted on them on a white ground, mostly resembling blue forget-me-nots. My friend was somewhat astonished at the bee regarding these, as he was not aware, till he looked, that the vases were decorated thus. He is not a botanical student, and has no bias towards any theory of the flower; it was the methodical way the bee went about the room that arrested his attention. It is mainly owing to this fact that I thought it worth while to make his observations known. Recently some observers have put forward reasons for considering that the colour of the flower exerts little attraction towards insects, and that it is chiefly the odour. The above piece of information favours decidedly colour attraction. There was no perception of odour, or any flowers or plants present in the room at the time.

To my mind it seems rational to assume that colour and odour may play somewhat equal attractions, the scent serving to bring bees from a distance, and the colour helping to guide them directly to the honey. A bee becoming accustomed to associate nectar with conspicuously coloured objects, might thus learn to visit flowers wholly from colour-sensation, and, not having sufficient discriminating power, visit other brightly-coloured things as well.

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Trinity College, Cambridge, October 23.

### A Test for Divisibility.

MAY I venture to supply a long-felt want amongst arithmeticians, viz. a general test of divisibility?

Let N be any integral number, and $\delta$ any divisor, then

$$\begin{aligned} N &= a + 10b + 10^2c + \&c. \\ &= a + b(\delta q + r) + c(\delta q + r)^2 + \&c. \\ &= \delta Q + a + br + cr^2 + \&c. \\ &= \delta Q + a + b(\delta q_1 + r_1) + c(\delta q_2 + r_2) + \&c. \\ &= \delta Q + \delta Q_1 + N_1 \\ &= \delta(Q + Q_1) + N_1. \end{aligned}$$

Here $N_1$ is the least general substitute for N, and is of the form

$$a + br_1 + cr_2 + dr_3 + \&c.$$

where the number of values of $r_1$, $r_2$ &c. cannot exceed $\delta - 1$, but may be much fewer, and constitute a recurring series found from

$$\frac{10^n}{\delta}, \text{ where } n = 1, 2, 3, 4 \text{ \&c.}$$

$$\begin{aligned} \text{Let } \delta &= 2, 5, \text{ then } N_1 = a \\ &= 4, \qquad = a + 2b \\ &= 8, \qquad = a + 2b + 4c \\ &= 16, \qquad = a + 10b + 4c + 8d \\ &= 3, 9, \qquad = a + b + c + \&c. \\ &= 7, \qquad = \left.\begin{array}{l} a + 3b + 2c + 6d + 4e + 5f \\ + g + 3h + 2i + 6j + 4k + \&c. \end{array}\right\} \\ &= 37, \qquad = \left.\begin{array}{l} a + 10b + 26c \\ + d + 10e + 26f + \&c. \end{array}\right\} \\ &= 11, \qquad = a + 10b + c \div 10d + \&c. \end{aligned}$$

and so on.

The practical importance of this general test must primarily depend on the brevity of the recurring period of $r_n$, but in special cases this objection may be removed.

Thus when $\delta = 11$, if $N_1 \div \delta = 11q$ we have

$$\begin{aligned} N_1 &= (a + c + \&c.) + 10(b + d + \&c.) \\ &= S \times 10S_1 = 11q. \end{aligned}$$

But $S - q = 10(q - S_1)$
where $(S - q) \div 10 = q - S = q_1$ suppose;
also $S_1 = (11q - S) \div 10$;

$$\therefore S - S_1 = 11\left(\frac{S - q}{10}\right) = 11q_1.$$

That is, the difference of the sums of the alternate series of digits is divisible by 11 if N or $N_1$ be so divisible. This result may be applied thus: Let $a_3$, $b_3$, $c_3$ &c. denote triple periods, and $\delta = 1001$, then

$$\begin{aligned} N_1 &= a_3 + 10^3b_3 + c_3 + 10^3d_3 + \&c. \\ &= (a_3 + c_3 + \&c.) + 10^3(b_3 + d_3 + \&c.) \\ &= S + 10^3S_1 \text{ which may be changed to} \\ &\quad S - S_1. \end{aligned}$$

Thus $S - S_1$ is a test for divisibility by 7, 11, 13, 77, 91, 143, 1001.

Again, if $a_4$, $b_4$, $c_4$ &c. denote quadruple periods and $\delta = 10{,}001$, then

$$N_1 = a_4 + 10^4b_4 + c_4 + \&c. = S - S_1$$

and is a test for $\delta = 73, 137, 10001$.

Again, if $a_6$, $b_6$, $c_6$ &c. denote sextuple periods and $\delta = 1{,}000{,}001$, then

$N_1 = a_6 + 10^6b_6 + c_6 + \&c. = S - S_1$ and is a test for $\delta = 101$; 9901.

As examples take

(1) $N = 807{,}929{,}122$; $\delta = 7, 11, 13, 143, 77, 91$;
$S - S_1 = 122 + 807 - 929 = 0$.
$\therefore$ the proposed number is divisible by $\delta$.
(2) $N = 67, 3558, 3491$; $\delta = 73, 137$.
$S - S_1 = 3491 + 67 - 3558 = 0$.
(3) $N = 360, 4536, 7388$; $\delta = 73$.
$S - S_1 = 7748 - 4536 = 3212 = 73 \times 44$.
(4) $N = 390, 9569$; $\delta = 137$.
$S - S_1 = 9179 = 137 \times 67$.
(5) $N = 585622, 677027$; $\delta = 101$.
$S - S_1 = 91405 = 905 \times 101$.
(6) $N = 954221, 304387$; $\delta = 101$.
$S - S_1 = 649834 = 6434 \times 101$.