

have been insufficient to wedge the nest securely on the narrow and open framework of the tower, and an artificial material like wire could not lie within the purview of instinctive action?

It is stated that similar wire nests are frequently made by these crows on the transmission towers of the Orange Free State. Electrification of the railway line in that part of the Union is comparatively recent, and owing to the scarcity of trees the crows have taken a great liking to the towers and they have discovered that by using wire they are able to nest on them. However, the birds will have little opportunity to improve on their initial and successful attempt to utilise the towers to their own advantage, since the line-men invariably interfere with the nests.

ERNEST WARREN.

Natal Museum,
Pietermaritzburg.
May 10.

Does History Repeat Itself?

It is sometimes stated¹ that, given a vast but finite number of particles and an infinity of time, history must needs repeat itself, so that all the particles will find themselves reassembled in some previous arrangement possessing the very same relative positions with the identical original velocities, so that cycle after cycle of similar events must necessarily recur, and history in the large is like the repeating pattern of a wall-paper.

If there is an infinite past duration it would then follow that I have written these words before, and the very you have read them, not once, but again and again in the past, by the same light that falls now upon the previously printed paper actually manufactured as before from the same material, woven atom by atom in the same pattern, printed in the same number of NATURE, dated identically day, month, year and entirely indistinguishable from the present number, all the rest of the universe being in the same state as before.

If there is an infinite future before us all these things must happen not once, but over and over again, without limit.

No one believes this, but is it true?

Consider a simple universe consisting only of two infinitesimal particles or points, one swinging to-and-fro along a diameter, the other going round the circumference of a circle. If these points start together on their different paths from the same end of a diameter and move as stated with equal and unvarying speeds, then since the circumference and diameter are incommensurable, and their ratio $\pi = 3.14159 \dots$ never repeats or terminates even in an infinity of figures, it follows that the two points will never meet again at their original starting point. Incommensurables such as the square root of 2, 3, etc., are also common enough in our pattern of Nature so that it is safe to reject the idea of recurrent cycles and to state definitely that history does not and can not repeat itself. So that creation, new things for old, is proceeding to its fullest extent now.

If it is urged that the above argument about two ideal infinitesimal particles racing round a circle and to and fro along a diameter (none of such things existing) is too academic and abstruse, it may be stated that if there is no limit to the smallness of a displacement, then any three bodies may occupy an infinitude of relative positions, which will not

necessarily recur in an infinity of time. If the height of a wave is capable of all values, then the pattern of the waves on a lake or ocean will never repeat. Radiation in the universe, even in infinite time, is certainly yet more unlikely to recapture a previous state, even ignoring the tendency to 'run down' or change from short to longer waves.

Two swinging pendulums of unequal length will not twice achieve the adventure of being at their lowest points together, and my colleague, Dr. L. V. King, has pointed out to me that, even two equal pendulums (were such equality possible) starting together from their lowest points and acquiring unequal amplitudes, would never arrive together again at their lowest points. The same is true of two small round particles oscillating in a spherical bowl; and the reason is that such problems involve transcendental numbers. But enough has been said to demolish what, after all, is only a bogey.

A. S. EVE.

McGill University,
Montreal.
May 20.

¹ NATURE, 131, 529, April 15, 1933, reviewing J. B. S. Haldane's "The Inequality of Man" (pp. 165-170).

Formation of Formaldehyde and Reducing Sugars from Organic Substances in Light

WE have observed that when aqueous solutions of tartaric, citric and lactic acids are exposed to direct sunlight in presence of air, formaldehyde and reducing sugars are produced.

A few observations are recorded below:

Time of exposure	100 c.c. of N/4 tartaric acid		100 c.c. of N/4 citric acid	
	Gm. of formaldehyde per 100 c.c.	Gm. of reducing sugar calculated as glucose	Gm. of formaldehyde per 100 c.c.	Gm. of reducing sugar calculated as glucose
10 hours	0.0001	0.0114	0.0111	nil
20 hours	0.0024	0.0153	0.0125	0.0060
30 hours	0.0008	0.0183	0.0093	0.0093

In the case of lactic acid, a solution containing 2.245 gm. in 100 c.c. when exposed to sunlight gave Schryver's test for formaldehyde after 6 hours' exposure but no reducing sugar could be detected in 20 hours. After 35 hours' exposure, the same solution yielded 0.0081 gm. of reducing sugar calculated as glucose.

It is interesting to note that glycine, malic acid, acetic acid and acetone solutions form formaldehyde very readily on photo-oxidation, but no reducing sugar has been obtained so far. Formaldehyde is also readily obtained when aqueous solutions of colouring matters like methylene blue, methyl violet, acridine orange, crystal violet, malachite green, gentian violet, etc., are exposed to light in presence of air. We are trying to find out if the antiseptic properties of some of these dyes are associated with the ease with which they yield formaldehyde on photo-oxidation.

N. R. DHAR.

L. N. BHARGAVA.

Chemical Laboratory,
University of Allahabad,
India.
April 22.