

The model proposed in 1975 by Meselson and Radding⁸, which was put forward for quite another good reason (the need to reconcile the Holliday model with the increasingly strong evidence for hybrid DNA on one participating chromatid only), provides a very plausible way of uncoupling conversion from crossing-over to any desired extent. According to this model, the first step leading to gene conversion is the unilateral invasion of one participating chromatid (DNA duplex) by a single DNA strand unwound from the other. The reciprocal strand-crossing and the formation of the symmetrical cross-strand structure (Holliday junction), which hypothetically sets up the possibility of crossing over, follows later after a series of manoeuvres that could easily require special conditions (such as may prevail more or less during meiosis) for their efficient performance. An apparently easy alternative is for the initial single bridge to be cut by an endonuclease, the invading single-strand fragment ligated into the recipient chromatid and the gap in the donor chromatid filled by repair synthesis. This could lead to conversion without any possibility of crossing over.

Since crossing over (both in fact and in theory) can be so easily uncoupled from conversion even in regular meiosis, it is no surprise to find it largely avoided during genetic exchange between repetitive sequences at non-homologous loci, when its occurrence would lead to highly deleterious chromosome rearrangements. But perhaps it is not avoided completely. Spontaneous chromosome aberrations do occur at a low frequency, and something like a "0.1 per cent rule" governing interactions between dispersed repeats could account for many of these.

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SIR — Fink and Petes¹ in writing on gene conversion make repeated reference to a so-called 50 per cent rule. According to this, half the intragenic conversion events in fungi are associated with reciprocal recombination. These authors imply that there is compelling evidence for this conclusion. In reality there is much variation in the frequency with which aberrant segregation is associated with reciprocal exchange, with values ranging from 15 per cent to 75 per cent (see ref. 2, p. 321). Only one example seems to be known of a satisfactory fit with 50 per cent, namely, aberrant 4:4 segregation at the *g* spore

colour locus in *Sordaria fimicola*^{3,4} (and see ref. 2, p. 240).

Klar and Strathern⁵ have discovered that conversion involved in yeast mating type switching during the mitotic cycle is not associated with reciprocal exchange and Klein⁶ has made the same discovery for meiotic intrachromosomal conversion between duplicated inverted sequences at the HIS3 locus, also in *Saccharomyces cerevisiae*. Fink and Petes¹, in commenting on these results, overlook the evidence of various kinds from organisms as diverse as *Drosophila melanogaster*^{7,8}, *Secale cereale* (rye)⁹ and several fungi¹⁰⁻¹³, that eukaryote recombination may be a two-step process, with gene conversion events in the first step and reciprocal exchange in the second (see ref. 2, pp. 324, 336, 343). The results obtained by Klar and Strathern⁵ and Klein⁶ could then be accounted for if intergenic recombination differs from the normal process in lacking the second step.

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Snookered by colour differences

SIR — Your correspondent William Hickmott (*Nature* **310** 731-732 1984) reported a hitherto unrecognized property of colour. My own part-time socio-physiologico-behavioural research, carried out over many years, lends further weight (*sic*) to the hypothesis proposed, although my extensive data, collected for a different purpose, reveal a different ordering. My research has been on the influence of the recreational context on the liquid consumption of the adult human male.

From the mass (*sic*) of data which I have accumulated I extracted the small subset relating to a particular recreational activity in which pairs of males use sticks to strike small spheres of identical size on a large green rectangular surface. Naturally, in order to minimize the "Hawthorne" effect I have always observed from a great distance (~10³ cm) and have never enquired as to their purpose. (I opine that they are amateur physicists constantly testing and retesting Newton's laws of motion. Their efforts are, however, constantly frustrated since the experimental surface has a number of

roughly circular defects into which spheres frequently disappear.)

All this brings me to the point of my observations. The spheres are of different colours, presumably to facilitate their differentiation in the heavily polluted atmosphere in which these experiments usually take place. The behaviour of these spheres is most curious and for a long time the reason eluded me, but it can be explained now by your correspondent's hypothesis.

The red spheres behave most oddly of all — when they disappear down a defect in the experimental artefact they are not reused, unlike the other coloured spheres. (This correlates well with your correspondent's observations of the red tomato, and suggests that the effect of this colour is so great that the objects are more easily damaged.) As the red spheres disappear the effect of the other coloured spheres is more easily discernible, although the effects are exceedingly complex.

My computer analysis of the results has led me to the inescapable conclusion that the colours do indeed display action at a distance. The disappearance of the colours, usually temporary, triggers a behavioural response in the males which manifests itself in the physical moving of pointers on a scale displayed on the wall near the experiment. I have no idea of the function of these scales, but they may be of symbolic or ritualistic significance.

From my analysis (Imperial undimensional scaling), I conclude that the order of the colours is: red, yellow, green, brown, blue, pink and black, with white occupying an anomalous position on a dimension normal to this. This seems to be almost completely the opposite of the ordering which your correspondent reported, but this need not cause us to reject his basic hypothesis.

The answer clearly lies in the observations discussed by John Maddox (*Nature* **310**, 723; 1984) — the inverse square law needs to be generalized to an inverse sphere law in the complex situation where more than two bodies are involved. As a corollary, the colour of the spheres in the experiments to measure *G* is probably the reason for the variations observed.

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