Did Sirius change colour?

SIR — Schlosser and Bergmann[1] claim that Babylonian and early mediaeval authors saw Sirius as red, which if true would represent an anomaly in current evolutionary theories of white dwarfs. But van Gent[2] and I[3] independently suggested that it might be a case of mistaken identity, and that, on evidence from Chinese sources, the brightest star in our sky has been white all along. The 'Rubeola' (which means reddish) of Gregory in the sixth century should really be Arcturus rather than Sirius, as justified by McCluskey[4] and van Gent[5]; although Schlosser and Bergmann[6] were unconvinced, and provided equally detailed counter-arguments. Also, Bruhweiler, Kondo and Sion[7] speculated that Sirius B underwent a thermonuclear runaway event, to explain its purported redness in antiquity. Gry and Bonnet-Bidaud invoked[8] the star's transit behind a cold interstellar cloud as the cause of a supposed increase and then decrease in the degree of reddening. I suggest that there is no ground for believing in any colour change, sudden or gradual.

Support for a gradual variation in Sirius's colour[8] comes from a Chinese work of the first century BC. The text appears in an earlier part of the chapter that contains the same passage cited by me[3] to affirm the whiteness of Sirius. Column *b* of the figure literally states that:

> Wolf changes colour/Thieves and robbers abound

where Wolf is the Chinese name for Sirius. Read in context, however, it really means that if you perceive Sirius in a different colour (from white), then you can make the astrological prediction that follows.

In attempting any modern interpretation of ancient scientific writings, we must interpret their statements in the context of the dominant models of that time for that culture. In this case, the model is for inferring world events from astronomical observations, a consequence of the philosophical conception that the cosmos, the human society and individual human bodies respond to one another in turn. Thus, unlike Hellenism, Chinese tradition viewed the celestial sphere as full of secular variations in display, and indeed wanted it that way. A colour modification in a star could therefore be a subjective assessment — if you recited the right chant then you would recognize it — or some meteorological phenomenon. An interesting parallel is the discussion, attributed to an Egyptian source of 2 BC, of omens revealed by the apparent colour of Sirius at its heliacal rising[2].

To be convinced of the hypothetical nature of the colour change in the Chinese writing in question, we need look no further than its preceding passage (*a* in the figure), which says:

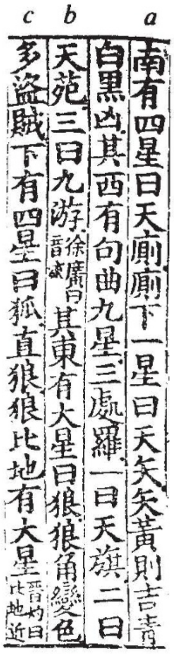
> South of [Betelgeuse] are four stars called the Celestial Commode/Below the Commode is one star call the Celestial Stool/Stool is yellow, everything fine/Green, white or black, it spells danger/To the west . . .

The Stool is the Orion Nebula, but surely any historical colour changes could only be imaginary.

One last cautionary note on text-based archaeoastronomical research: namely the danger of relying on a single excerpt from one extant work. It may have been incorrectly written, or errors introduced during repeated copying or reprinting. An example is provided by the passage that follows immediately (*c* in the figure):

> Beneath are four stars called the Bow/[With an Arrow] pointing at the Wolf.

The number is wrong. The *History of Jing Dynasty* mentions nine stars instead, and indeed it would be stretching the analogy a bit too far to make a bow and arrow out of merely four points. I maintain[3] that the fact that Sirius looked white was not contradicted in any of the other dynastic histories compiled at later times.



Excerpt from a Chinese book of the Western Han dynasty (Northern Sung edition). *a*–*c*, Passages referred to in the text.

TONG B. TANG

Department of Physics,
Hong Kong Baptist College,
Kowloon, Hong Kong

1. Schlosser, W. & Bergmann, W. *Nature* **318**, 45 (1985).
2. van Gent, R. H. *Nature* **312**, 302 (1984).
3. Tang, T. B. *Nature* **319**, 532 (1986).
4. McCluskey, S. C. *Nature* **325**, 87 (1987).
5. van Gent, R. H. *Nature* **325**, 87 (1987).
6. Schlosser, W. & Bergmann, W. *Nature* **325**, 89 (1987).
7. Bruhweiler, F. C., Kondo, Y. & Sion, E. M. *Nature* **324**, 235 (1986).
8. Gry, C. & Bonnet-Bidaud, J. M. *Nature* **347**, 625 (1990).

Bacteria mating preferences

SIR — Although the parasexual processes of bacteria are very different from the sexual systems of higher eukaryotes, there are often surprising parallels. In particular, the preferential uptake of homologous transforming DNA by competent bacteria closely resembles the mating preferences exhibited by many animals (see ref. 1 for a recent review).

When naturally transformable bacteria become competent, they can efficiently take up large DNA fragments which can recombine with and replace homologous segments of the genome. Competent gram-negative bacteria preferentially take up DNA fragments containing specific 9–11-base-pair sequences (AAGTGCGGTca in *Haemophilus influenzae*[2]; GCCGTCTGAA in *Neisseria gonorrhoeae*[3]). Because their genomes contain many dispersed repeats of the preferred sequences, DNA from the same species is taken up much more rapidly than foreign DNA.

The correspondence between uptake preference and sequence abundance must result from selection. There are about 100 times more copies of the uptake sequences than expected in the absence of selection, and their presence in a fragment increases its uptake at least several fold. Transformation thus provides an example of an evolved mating-preference system. In the framework of sexual mating systems, competent cells can be viewed as females discriminating between potential mating partners (DNA fragments), with noncompetent cells being the asexual precursors of both females and free DNA.

The evolution of DNA uptake specificity in transformable bacteria has not yet been subject to the theoretical and experimental analysis applied to sexual mating preferences. One simple model might assume that the DNA receptor initially had a minor unselected sequence bias. DNA fragments containing newly arisen copies of the preferred sequence would then be more efficiently taken up, and could physically replace the resident wild-type sequence by recombination. By its selection of fragments the receptor would thus exert a recombination pressure that gradually increased the frequency of the preferred sequence in the genome. The increased number of copies would then confer a selective advantage on cells whose receptors had a higher affinity for the sequence, and the increased receptor specificity would further increase the recombination of new copies into the genome, until the feedback was limited by other factors such as coding requirements.

The driving force in this model is the high affinity of sequence-specific DNA binding, a direct advantage to the competent cell. This benefit is independent of whether the primary function of transformation is sexual (production of genetically recombinant progeny) or physiological (provision of nucleo-