

son with a 'red noise' spectrum. In the frequency range of interest, however, the plotted red noise Markovian curve does not fit the data. He has stated (private communication) that he used a least squares fit to the pre-whitened rainfall spectrum over frequencies up to 0.5 c d^{-1} . Such a fit (which determines ρ) is overwhelmingly weighted by the high frequency power from 0.1 to 0.5 c d^{-1} , not shown in Fig. 1. To be valid, the red noise reference spectrum should fit the data equally well in the frequency interval whose peaks are being questioned and in the rest of the spectrum. For example, in the article by Gilman *et al.*² the Markovian curve used to approximate rainfall data fits all frequency intervals equally well.

El-Sayed (private communication) claims that the pre-whitening he used eliminated the annual peak. Pre-whitening (flattening the average slope of the spectrum) and recolouring should result in a spectrum with peaks (including the annual peak) whose height above the continuum is about the same as in the un-pre-whitened spectrum, but with a reduction of power leakage into the continuum. No sharp band pass filter was used to eliminate the annual peak because it is clearly evident at $1/365 = 0.0027 \text{ c d}^{-1}$ in Fig. 1. The peak-like shape and the very steep slope on its right side, which levels out immediately, indicates that the value plotted at 0.002 c d^{-1} is not part of a continuum. Figure 1 (ref. 1), leads to the spurious conclusion that the annual peak (see Table 2 of ref. 3) is not statistically significant with respect to the red noise test. If some process applied by El-Sayed reduced the height of the annual peak, which otherwise would have been above the Markovian curve, then it may have reduced the height of the ≈ 27 -d peak as well. A good Markovian fit to the 0.0 - 0.1 c d^{-1} interval could have been made by choosing the same number of points to be fit in this interval as in the 0.1 - 0.5 c d^{-1} interval. The one point at the known annual periodicity could have been excluded from this fit. In short, we believe El-Sayed applied the red noise test incorrectly. He also failed to take the cube root of the daily rainfall (before doing a spectrum) which is considered absolutely necessary to obtain a meaningful spectrum⁴ as it reduces the variance associated with anomalously large events.

If a spectral peak is not significant with respect to red noise, the conclusion is that this peak should "be relegated to the category of probable accidents that might not recur in an independent data sample"³. Yet the 27-d peak occurs in each of the 5 spectra shown in Figure 2 of ref. 3. These spectra include the totally time-independent spectra for Los Angeles for 1900-35 and for 1936-71, each with 105 degrees of freedom, and spectra (each with 129 degrees of freedom) for 1927-71 for the cities of Los Angeles,

Matters arising

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Santa Barbara, and San Diego. The latter two cities are 300 km apart. The occurrence of the 27-d spectral peak in long, time-independent intervals is one of the most significant tests of its reality, and supports our criticism of El-Sayed's analysis.

In our study we searched for a possible correlation between rainfall and the new moon or full moon cycle (result negative)

Cysteine and survival of transplanted thymoma

It has been shown¹ that 0.25 M cysteine could completely inhibit the growth of a transplanted thymoma, an effect claimed to be due to the ability of cysteine to inhibit collagenase.

Cysteine is usually purchased as the hydrochloride and 0.25-M solutions are strongly acidic ($\text{pH} \sim 1.0$), and, not surprisingly, cause necrosis at the site of subcutaneous injection. In the paper by Campbell *et al.*¹ it was not made clear whether the cysteine was neutral-

but no other lunar cycle was examined. Using data covering 20 yr, Bryson⁵ found a statistically significant correlation between the latitude of the surface, semi-permanent, East Pacific high pressure cell and the meridional lunar force over the 27.3-d lunar cycle in declination. During this cycle, the moon moves north in declination for 13.65 d and then south for 13.65 d and, as Bryson found, pulls the Pacific high cell along with it. Lamb⁶ examined this result and stated that "the association appeared to be statistically significant". This high pressure cell acts in turn as a classical blocking high, blocking storms from reaching Southern California as in Fig. 1 of our study³.

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¹ El-Sayed, H., *Nature*, **258**, 457 (1975).

² Gilman, D. L., Fuglister, F. J., and Mitchell, J. M., *J. Atmos. Sci.*, **20**, 182-184 (1963).

³ Rosenberg, R. L., and Coleman, P. J., Jr., *Nature*, **250**, 481-484 (1974).

⁴ Stidd, C. K., *Trans. Am. geophys. Un.*, **34**, 31-35 (1953).

⁵ Bryson, R. A., *Trans. Am. geophys. Un.*, **29**, 473-475 (1948).

⁶ Lamb, H. H., *Climate: Present, Past and Future, Vol. 1, Fundamentals and Climate Now*, 219 (Methuen, London, 1972).

effect observed is thus due, almost entirely, to the injection of an acidic solution rather than to any special property of cysteine.

It should also be noted that cysteine hydrochloride given intraperitoneally to mice as an unneutralised solution is between five and ten times more lethal than neutralised cysteine.

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¹ Campbell, N. R., Reade, P. C., and Radden, B. G., *Nature*, **251**, 158 (1974).

Table 1 Effect of cysteine and cysteine hydrochloride on the growth of the transplanted PC6 plasma cell tumour

Treatment	Tumour weight (g)	Inhibition (%)
Controls	9.8, 8.1, 8.4, 9.0, 8.6	
0.25 M Cysteine*	5.6, 5.5, 5.6, 7.7, 5.3	33
0.25 M Cysteine hydrochloride	0.3, 1.6, 0, 0.6, 0	94

*The solution of cysteine was brought to pH 7.5 by titration with normal NaOH.

The plasma cell tumour was transplanted subcutaneously as a tumour fragment by trocar. Treatment commenced 3 d after transplantation. Samples (0.2 ml) of the appropriate solutions were injected subcutaneously as close to the tumour site as possible for five consecutive days. Animals were killed 35 d after tumour transplantation and the weight of the treated tumours compared with controls.

ised before injection and since isotonic saline was used as a control solvent, it is probable that the cysteine was not, in fact, neutralised.

Table 1 shows that a solution of cysteine hydrochloride can readily prevent the growth of a transplanted plasma cell tumour, whereas neutralised cysteine has only a very slight inhibitory action. In the experiment described in Table 1 the antitumour

CAMPBELL ET AL. REPLY—Whereas we did not attempt to buffer our cysteine solutions and acknowledge the possibility raised by Connors and Jones¹, the peak of activity that we consistently obtained at 0.25 M cysteine suggests that a specific effect is also involved.

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¹ Connors, T. A., and Jones, M., *Nature*, **258**, 458 (1975).