Correspondence

Reflections on a Presidential Address

DEAR EDITOR

In *Gazette* no. 421, the truth within Professor Matthews' Presidential Address was well illustrated by the articles which followed. To give credit to him, and to yourself, I think that this should be made more explicit.

It will not surprise some readers if I reward Mr. Gates by referring to his article about playing cards. This contains the apparently "unimportant" Gates' Theorems on periods and cycles in packs. When Mr Gates was younger, he sometimes had nothing better to do than play his own invented game of patience ("It is forbidden not to waste time"). "Restlessness" and the "Modified Banana Model" have been applied.

The unimportance has now become important. There is little doubt that he has benefited personally, and will encourage his students in Gillingham to be "mathematically alive" in a similar way.

Yours sincerely,
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DEAR EDITOR,

It is well known that the four-colour problem was suggested to Augustus De Morgan by one of his pupils and that he did his best to publicise it. In looking through his manuscripts in Trinity College Library lately I came upon a letter to R. L. Ellis, dated June 24, 1854, in which he tentatively suggested a proof. It seems also that he had ideas on summation of non-convergent alternating series; in *Trans. Camb. Phil. Soc.* **8**, 182–203 (1849) there is a long discussion of Divergent Series and on p. 192 he has what he describes as a "glimpse" of a method of dealing with such series as

$$1 - 1 + 1 - 1 + \ldots.$$

This is to take the mean of the first n partial sums and to make $n \to \infty$. He shows this to be the limiting case of

$$1 - a + a^2 - a^3 + \ldots$$

provided that 1 is approached by values of a less than 1. This was some 40 years before Cesàro's paper on Multiplication of Series in *Bull. des Sciences Math.* **14**, 114–120 (1890). In referring to this paper I came across another counter-example to the President's (non-) theorem (October 1978 *Gazette*, p. 146). If

$$u_n = \frac{(-1)^{n+1}}{n}, \quad v_n = \frac{(-1)^{n+1}}{\log(n+1)}$$

then, writing

$$w_n = (-1)^{n+1}\left[\frac{1}{\log(n+1)} + \frac{1}{2\log n} + \ldots + \frac{1}{n\log 2}\right]$$

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we have, since

$$w_n > \frac{1 + \frac{1}{2} + \ldots + \frac{1}{n}}{\log(n+1)},$$

and the expression on the right tends to unity, the result that $\sum w_n$ cannot converge.

Yours faithfully,
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Reviews

Studies in mathematical biology, edited by S. A. Levin. **Part 1. Cellular behaviour and the development of pattern. Part 2. Populations and communities.** Pp xiv, 624, 20 (index). $16 each, $27 for both volumes. 1978. SBN 0 88385 115 6/116 4 (Mathematical Association of America)

It is greatly to the credit of the American Mathematical Association to have commissioned these two books. At present biologists seem divided into 3 groups: the first regards mathematics as an obscurantist device to be avoided like the plague (but fortunately this group is slowly though steadily diminishing in size and prestige); the second will, at the drop of a hat, present a dazzling array of statistics. These books deal with activities of the third group, fortunately growing in numbers, who are painstakingly using mathematical tools, forged originally for the relatively rather easy problems of theoretical physics, on hard and often not yet clearly defined questions in mathematical biology.

As the subtitles imply, the first volume deals with individual organisms, or parts of them; the second with aggregates (population problems). The level of treatment is one which will provide an entry into the field for a mathematician with adequate grounding in ordinary and partial differential equations but little or no training (though some interest!) in biology. The bibliography for each chapter has been very carefully compiled and each chapter itself provides a sound introduction.

In the first chapter John Rinzel discusses neuro-electric signalling, starting from the 1952 Hodgkin and Huxley paper. This shows up at once a characteristic of a number of investigations in the field; the Hodgkin–Huxley equations are cumbersome and intractable. A simpler model with two dependent variables, FitzHugh's, mimics the behaviour by what is essentially a modification of the van der Pol oscillator. Even then, of course, convenient analytic solutions are not available so a further step is McKean's "FitzHugh caricature". The next problem is that of the behaviour of neural nets, to confront, as it were, Hodgkin and Huxley with McCulloch and Pitts' 1943 paper. J. D. Cowan and G. B. Ermentrout choose the same simplifying path noted above, but they back it up with an elegant appeal to catastrophe theory. According to M. A. Arbib, in Chapter 3, this "bottom-up" approach needs to be complemented by a "top-down" approach in which the problem is, rather, to see how an overall function of the brain (or another organism) can be achieved by cooperative computations by various regions. He considers a binary model of such a function as segmentation in binocular vision.

The second section of the book moves into a mathematically more conventional situation in L. A. Segel's chapter on models for cellular behaviour (i.e. for the behaviour of large numbers, e.g. in slime mould amoeba), where the first approximation is the one-dimensional diffusion equation. In the other chapter of this section, N. Kopell follows this by starting