modification which takes into account the effect of the desire of the experimenter to obtain a random set of throws. We argue that the experimenter tries in his throws to obtain initial distances between the ends of the string (by initial we mean the distance just before the string begins to fall) which follow a uniform distribution. We contend that in this case the distribution of distances between the ends of the string just before it hits the ground is a mixture of equal proportions of a uniform distribution and the distribution proposed by Bass and Bracken[1]. If this argument is true the density function for λ, the ratio of the distance between the ends of the string at the end of each experiment to its total length, is

$$\omega(\lambda) = \tfrac{3}{4}[\tfrac{8}{3}\arccos\lambda - \lambda(1-\lambda^2)^{\frac{1}{2}}]$$

This gives $E(\lambda) \simeq 0.343$ and $E(\lambda^2) \simeq 0.178$ in striking agreement with the data. Bass and Bracken suggested that a proportion of the throws were conducted close to the table surface and if this were so, their model would give a better agreement with the data. It is easy to show that 38.5% of the throws are required to be near the table surface in order to give a good agreement with the experimental results.

We feel that our assumption is more realistic. However, the controversy on this problem will only be resolved when new experimental results are obtained and all the details of the experiment become available.

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BASS AND BRACKEN REPLY—Synge[1] has noted and rejected in passing the unfounded hypothesis that all possible end-to-end distances D of the string of length L lying on the table are equally probable (leading to $\bar{D}/L = \frac{1}{2}$). A modified version of that hypothesis would be that all possible end-to-end distances of the string in space (before impact with the table) are also equally probable. Taking into account the projections of the string on to the plane table[2], the probability density function for the ratio $\lambda = \bar{D}/L$ is then $\arccos\lambda$ (leading to $\bar{D}/L = \pi/8 \approx 0.39$). The implausibility of the hypothesis leading to this distribution is apparent from the consideration that the number of configurations of the string consistent with an end-to-end distance x is much greater when x is near 0 then when x is near L.

If a fraction, p, of the throws conformed to our model[2], and $1-p$ to the hypothesis of equiprobability of end-to-end distances (in space), the resulting probability density of λ would be the combination

$$\frac{3p}{2}[\arccos\lambda - \lambda(1-\lambda^2)^{\frac{1}{2}}] + (1-p)\arccos\lambda;$$

and if p could be treated as an adjustable parameter, agreement with observations could obviously be improved[3]. We have not been able to find any rational basis for such a combination with $p \neq 1$. In particular, we cannot see that the choice $p = \frac{1}{2}$ would arise from the circumstance that "the experimenter tries in his throws to obtain initial distances between the ends of the string ... which follow a uniform distribution"[3].

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Is lymphocytic chalone activity restricted to a spermine–protein complex?

THE nature of lymphocytic chalones which are supposed to be tissue-specific but not species-specific inhibitors of cell proliferation, as defined by Bullough[1], remains a matter of controversy. They were characterised as 50–30,000-dalton factors[2,3] but detected also in the lower molecular weight range[4,5]. Recently Allen *et al.*[6] have proposed spermine as one candidate for an *in vitro* chalone activity. Spermine, present in a porcine thymus extracts as a protein complex, inhibited *in vitro* lymphocyte mitogenic response only when fetal calf serum (FCS) was added to the culture medium. FCS seems to act through polyamine oxidation, and its requirement for the inhibitory activity of spermine as well as spermidine was confirmed by Byrd *et al.*[7]. On the other hand, Rijke and Ballieux[8] have found a chalone-like non-dialysable factor in calf thymus extract differing from spermine complex in that its *in vitro* activity was FCS independent.

We have studied a non-dialysable fraction extracted from bovine spleen characterised previously as a lymphocytic chalone[3]. We demonstrated that most of the activity could be dissociated from high molecular weight carriers and recovered in a low molecular weight fraction[5,9] exhibiting chalone activity[10]. After chromatography, this fraction gave a purified spleen extract (PSE) whose effect was then compared with those of spermine and spermidine in mice. PSE (2×25 μg) was injected intraperitoneally. Twenty-four hours later, spleen, testis, kidney and liver cells were incubated with ^{3}H-thymidine. The radioactivity incorporated into DNA of cells was significantly reduced for spleen (39%, $P < 0.005$) but not in liver, testis and kidney cells. PSE treatment depressed both the number of plaque-forming cells of sheep red blood cell-sensitised mice to 80% ($P < 0.001$), as well as cellular immunity to dinitrofluorobenzene up to 51% ($P < 0.01$), as measured by ear thickness in sensitised mice. Conversely, as judged from the same tests, no significant difference was observed between polyamine-treated mice. These results demonstrate that various factors different from spermine exhibit chalone activity.

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ALLEN REPLIES—I believe that inhibitors of lymphocyte mitosis are not restricted to spermine–protein complexes. In our article[1] we described how the activity of lymphocyte chalone preparations of the type originally used by Garcia-Giralt *et al.*[2] and Lenfant *et al.*[3] could be almost entirely attributed to the presence of spermine. We felt that 'these results emphasise the difficulties associated with the isolation of a lymphocyte chalone, but by no means rule out its existence'[1]. Several groups, having heeded our warning and having now eliminated polyamines from their extracts, are finding that inhibitory activity persists. Dr Lenfant's material is interesting in that it seems to be inhibitory both to the proliferation and function of lymphocytes.

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