initiation of translation is isomorphous with my treatment of elongation (3) in which I had:

$$\rho = \theta/(\theta + \tau) \qquad (3)$$

where θ (like K_1) characterises the strength of the association and τ (analogous to the R^* term) is the parameter that changes nonspecifically. A more sophisticated model has been considered recently[5].

Substituting $(L-1)$ with L in the denominator of the right-hand expression of Lodish's equation (5) one gets my equation (2).

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DR LODISH REPLIES—Ninio's[1] equation (1) is incorrect on several grounds. First, it yields not the average time for an mRNA to produce a complete protein, but rather the average time it takes an mRNA to produce a polypeptide L amino acids long (L being the number of codons covered by a single ribosome). Secondly, it neglects, by his own admission, the case in which progress of one ribosome is hindered by the presence of another distal to it along the mRNA. As is clear from Fig. 1 of my paper[2], this parameter is considerable for usual densities of ribosomes along an mRNA such as occur in (uninhibited) reticulocytes. The fact that Ninio can transform his equation into one, his equation (3), which resembles my equation (5), does not prove that his equation is correct.

I did point out in my paper the several simplifying assumptions that were made in my derivations. In particular, I pointed out that the equations were valid only for cases in which the overall rate of chain initiation is the same or less than that which obtains in a normal cell. Thus, Ninio's comments about cases in which initiatable ribosomes are in large excess ($K_1 R^*/K_c > 1$) are irrelevant.

All my assumptions, although valid for reticulocytes, might not be for other types of cells. To remove these assumptions necessitates a much more complex statistical analysis of ribosome movement. These are in progress in my laboratory. But I am afraid Ninio's equations are incorrect and do not really help matters.

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Normal redshifts in Markaryan galaxies

TEERIKORPI claims to have found evidence for anomalous redshifts in Markaryan galaxies. His method was to take a sample consisting of the 394 measured redshifts of galaxies in Markaryan's first five lists. He then divided the redshifts into bins of $\Delta z = 0.001$, and, according to him, a peak in the resulting distribution at $z = 0.015$–0.016 is too large to be a chance effect.

Teerikorpi estimates the significance of this peak by calculating the probability that 30 or more redshifts would occur in an interval of $\Delta z = 0.002$, assuming that the distribution of redshifts between $z = 0.003$ and $z = 0.030$ is rectangular, and assuming that Poisson statistics hold. Teerikorpi estimates this probability as 0.05. This is incorrect. There are 269 galaxies in 27 bins of $\Delta z = 0.001$, or approximately 20 galaxies for each bin of $\Delta z = 0.002$. The probability, with these assumptions concerning the distribution, is 0.02 that 30 galaxies will be found in a given interval; however, there are 26 such bins, making the true probability 0.44 that this is just a chance distribution. Things are no better if one considers intervals of $\Delta z = 0.001$. The probability of 17 or more in a given bin is 0.03; for 27 bins it is 0.52. Including the peak at $z = 0.006$, which Teerikorpi does not mention as significant, the probability that the observed distribution results by chance is 0.28.

Teerikorpi argues that 0.015 is an integral fraction of the peaks at $z = 0.03$ and $z = 0.06$ found by Burbidge[2] and by Burbidge and O'Dell[3,4]. No peak is found at 0.030 in Teerikorpi's sample, although it extends past that point, and no peak at 0.015 was found in the sample of galaxy redshifts used by Burbidge and O'Dell[3] even though more than 40% of their sample were Markaryan galaxies.

The assumptions about the gross distribution of redshifts are poor. It is not rectangular, but is a curve peaked near $z = 0.020$. This is exactly as expected with the observed counting statistics as a function of limiting magnitude if one assumes that the distribution of Markaryan galaxies in space and brightness is similar to normal galaxies. Also, as pointed out by Huchra and Sargent[5], Markaryan's survey does not yet cover a large enough area of the sky to remove adequately the small scale effects of clustering. Both of these effects will tend to decrease the significance of any clumps or peaks in the redshift distribution. Finally, because of the small number of samples (27 bins), and the interdependence of the samples, (a peak in one bin will cause a dip in others, with a fixed number of galaxies), it is not clear that Poisson statistics should be used. If a distribution with a larger half width is used, then the

significance of the peaks is decreased still further.

In the light of these arguments, I find nothing to support the claim for anomalous redshifts or non-cosmological components for Markaryan galaxies.

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DR TEERIKORPI REPLIES—My incorrect value resulted from an unfortunate elementary error in my calculations[1], and went unnoticed till now. I am grateful to Huchra for drawing my attention to it.

The low statistical significance of the peak does not, however, invalidate altogether my other arguments, which were the main reasons for suggesting anomalous redshifts. The peak as such was only marginally significant.

It is still interesting that this peak, which at the first sight is a natural candidate for a possible indicator of anomalous redshifts, is consistent with simple ideas concerning intrinsic redshifts: they tend to occur in compact objects, they should be more easily detected in the direction of near, dense galaxy populations, and they possibly prefer certain values connected with simple relationships. One cannot compare the results of Burbidge and O'Dell[2,3] with my analysis. I did not divide the objects according to their radio or emission-line properties, only according to the ultraviolet classification of Markaryan. My sample also contained at least four times as many Markaryan objects as theirs did. Their first analysis of emission-line objects did not include any Markaryan galaxies in the relevant interval: 0.01–0.02.

It is harder to detect relatively small anomalous redshifts than large ones (such as in QSOs, if real) because in addition to the smearing factors I mentioned (random motions, cosmological recession) there are in this case many normal Dopplerian redshifts as 'noise' in redshift distributions. So in order to find out those properties which indicate intrinsic redshifts in objects one must work with a lower statistical significance level and use additional consistency tests. Otherwise possible anomalous redshift 'signals' may well go unnoticed.

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