

EDITORIAL

By Wayne Spencer

This issue of the *Skeptical Intelligencer* contains three new features. The first is a special section that contains our first peer-reviewed article, a critique by psychologist Adrian Simpson of the *Daily Mail's* recent claim to have presented cogent evidence of the truth of sun sign astrology. The second is a section we have called *Skeptical Allies*. The purpose of this section is to provide information on organisations and publications that share ASKE's commitment to skeptical enquiry, starting with HealthWatch, a group that promotes the objective evaluation of alternative and orthodox medical claims. The third innovation is a *Comment* section. This will feature observations by readers on material published in the *Skeptical Intelligencer*. We propose to impose minimal editorial control over the contributions to this section, and we hope that in addition to well-defended critiques and reflections, it will also come to contain a wide range of

speculations and expressions of personal opinion. We urge readers to write to us. For example, amongst the pieces in this issue's *Comment* is one that contends that both religion, science and critical thinking rely on faith. This line of argument caused a degree of controversy amongst the editorial team. We should be interested to hear what you think of it.

In this issue we continue our practice of reprinting interesting and informative articles from other publications. Some of these articles first appeared in journals that have adopted the convention of making references to other books, articles etc. by means of footnotes. Rather than revise these articles to bring them into line with the *Skeptical Intelligencer's* conventions, we have left them as they were originally printed. We would ask readers to compare the two types of articles and tell us which they prefer.

NEW PEER-REVIEWED ARTICLE

Astrological Star Signs and Personality

Has the *Daily Mail* found 'Proof'?

by Adrian Simpson

Adrian Simpson lectured in the Department of Psychology of the University of Sheffield before taking early retirement. His research interests were, and still are, in cognitive psychology and applied statistics. He currently teaches statistics on a masters course.

Abstract

This article discusses evidence reported in the *Daily Mail* arising from an investigation, carried out on behalf of the paper by ICM, into the relationship between astrological star sign and personality. The *Daily Mail* article claimed that a strong association between these two factors had been revealed by the investigation, and that this supported the astrological hypothesis that personality is influenced by star sign. It is argued below that a better explanation of the results is that they are due to the process of self-attribution, and that, in any case, many of the results reported in the *Daily Mail* could well be due to chance. Calculation of an index of the strength of the association between the star-sign and personality factors for each star sign shows all the associations to be very weak. In contrast, analysis of the consistency of the groups' choices reveals strong evidence that the 12 star-sign groups were very much in agreement

about which personality profiles they thought most, and which least, applicable to themselves. This result suggests that the social desirability of the profiles was a powerful influence on the participants' choices.

Introduction

Under the headline, *Astrology - is this the proof?* the *Daily Mail* published an article by journalist Natalie Clarke on February 3rd of this year reporting the results of an investigation into the relationship between personality and astrological star sign (Clarke 1998b). The paper had commissioned the opinion-poll organisation ICM to carry out what the article describes as "a unique and extensive survey into Britain's belief in the supernatural." As part of this survey, which involved face-to-face interviews with 1092 participants, a set of 12 different personality profiles was shown to participants, who were asked which of the profiles applied to them. As far as one can tell from the article, they could choose as few or as many as they wished. Each of the profiles was associated, according to astrological lore, with a particular star sign, though the participants were not told that. (The essentials of the 12 profiles, obtained by reducing the original text to lists of personality characteristics, are presented in Table 1.)

According to Natalie Clarke:

"The results were remarkable. A sceptic would expect no correlation between star signs and star-sign characteristics. But interviewees belonging to all 12 signs showed a powerful and unmistakable connection with the personality traits usually attributed to their star sign."

The main results presented in the *Daily Mail* involved a comparison of two percentages, for example:

"[We] examine the percentage of respondents who said their personality matched closely with their star-sign characteristics - compared with the average of all those questioned. The answer is significantly more. So whereas an average of 34% of those questioned said they had Libran characteristics [...] 46% of Librans did."

Similar pairs of percentages for other star-sign groups were also identified in the article. The *Daily Mail* article included a 12x12 table which presented the percentage of those born under each star-sign group who thought each personality profile fitted them, for all 144 combinations of star-sign group and profile. For every one of the 12 profiles, the percentage of members

choosing a given profile was higher in the group with which the profile was associated than it was in the sample as a whole. Moreover, for six of the profiles (those associated with the Taurus, Gemini, Virgo, Libra, Scorpio and Capricorn star signs) the group with which each profile was associated was the group with the highest percentage of members choosing it.

On the previous day, the *Daily Mail* had "revealed" that nearly two-thirds of the population believe in the paranormal (Clarke 1998a). In the article under consideration, it is reported that 40% of the interviewees (53% of women and 26% of men) said they consulted their horoscopes very or quite often, a fact which, Natalie Clarke observes, "confirms Britain's enduring fascination with astrology".

The conclusion drawn in the *Daily Mail* article - that there is "a powerful and unmistakable connection" between star sign and personality - may be challenged on a number of grounds, which I shall discuss below. Before doing so, however, I should make clear that while preparing the present critique, I twice asked the *Daily Mail* to send me a copy of the ICM report but they were unwilling or unable to do so. The present article therefore has to be an evaluation of the evidence and conclusions presented in the *Daily Mail*, the only available public report of the ICM investigation, rather than an evaluation of the report prepared by the investigators themselves.

The role of self-attribution

The most obvious criticism that may be made of the study is that almost everyone is aware of the identity of their star sign, and, at least approximately, of the personality characteristics associated with it. If 40% of people consult their horoscopes "Very or quite often" (according to the *Daily Mail* article), they are likely to have quite an accurate idea of the suggested personality profile, and even those who rarely do so are likely to have a moderately accurate notion of it, because it is hard to avoid this information in a society pervaded by astrological superstition. Given this knowledge, people are likely to believe that they possess the predicted personality characteristics, whether they do or not, and choose profiles accordingly - the process of self-attribution. Indeed, Hamilton (1995)

has concluded that astrological personality characteristics become incorporated into people's "long-term self-concepts" in such a way that neither a belief in astrology, nor an awareness that presented personality profiles are astrologically derived, are necessary for people to choose their star-sign associated profile from a set of alternatives.

Although the ICM study might have simply asked each interviewee which one of the set of 12 profiles best matched their personality, it is clear from the percentages in the *Daily Mail* table that most of the participants selected several profiles. Given the opportunity to choose several, the temptation to include the astrologically 'correct' one amongst the set would have been very strong.

The tendency for people to complete personality tests in accordance with star-sign knowledge has been invoked by Kelly and Saklofske (1986) to explain those few studies where associations between star signs and personality have been found. They describe several investigations in which knowledge of supposed personality characteristics was controlled by the employment of groups either familiar with or unfamiliar with the personality characteristics associated with the star signs. The astrological effect occurred only in the former groups, indicating that it was due to self-attribution. In general, it hardly seems necessary to add that numerous surveys have concluded that no reliable link has been demonstrated between personality and star signs. Kelly (1997) and Spencer (1997) provide lists of review articles in which this conclusion is drawn. An example of a recent investigation is that of Dahlstrom et al (1996) who examined the data provided by the restandardisation of the Minnesota Multiphasic Personality Inventory. The sample consisted of 2600 people; astrological signs accounted for less than 2% of the variance on the 13 personality scales of the MMPI.

In short, one powerful criticism that can be made of the ICM investigation as reported in the *Daily Mail*, is that it is much more likely to be providing evidence of the process of self-attribution than of a link between star sign and personality. Dean (1998), in a letter about the *Daily Mail* article to the journal *Correlation*, makes this point, and carries out a number of statistical analyses in support of it. In fact it is worth examining the percentages presented in the *Daily Mail* article from a statistical point of view not only because such analysis provides support for the assertion that the

effects observed are the result of self-attribution, but also because it is desirable to emphasise that any conclusions one wishes to draw from a survey such as this will rest on a more secure foundation if based upon statistical analysis.

The statistical approach

The sort of non-statistical argument employed in the article (for example that "Whereas an average of 34% of those questioned said they had Libran characteristics - diplomacy and a tendency to self-indulge - 46% of Librans did") can be misleading. Although it is true for the sample interviewed, it may not necessarily be true for the population in general, because the results from samples are subject to random variation. It is therefore possible that the apparently impressive difference in percentages between the two groups mentioned above has occurred by chance, and is not representative of the population as a whole. To draw comparisons between percentages, and to conclude that they reflect the percentages in the population at large, we need to take into account the number of people from which each percentage has been derived. Provided that these sample sizes are known we can employ statistical tests, like the chi-squared test, to answer questions about whether the apparent differences between the samples actually exist in the whole population. (This approach assumes that the investigators have sampled randomly from the population to which they wish to generalise.) In the first statistical analysis below, I look at each of the individual star-sign profiles separately and examine whether the obtained result - that the members of each group in the survey chose their own profile more than others did - can reasonably be extended to the population in general.

Analysis of individual star-sign percentages

As mentioned above, to do any statistical analysis we need to know the sizes of the samples providing the data. Unfortunately, the *Daily Mail* article does not tell us what the sample sizes were under each of the individual star signs, with the result that analyses of the individual star-sign data are imbued with uncertainty. A crude approximation is to take the total sample size (which the article does tell us - it is 1092) and to divide by 12 to obtain a rough estimate of each of the individual sample sizes, which then become 91.

This is obviously very gross, it must be admitted. However, while the limitations of this approximation must be acknowledged, it is worth doing, at least as an indication of the sort of statistical procedure that should be carried out in any serious analysis of these data. We can take each star sign and compare those interviewees who belong to that star sign against those who don't with regard to the percentages who said their personalities closely matched the particular star-sign profile. (This is better than the comparison in the article in which the author chooses "to examine the percentage of respondents who said their personality matched closely with their star-sign characteristics - compared with the average of *all* those questioned.") Doing so we obtain the data given in Table 2.

In Table 2, each of the entries under the heading 'Star-sign's own percentage (given)' is the percentage of people with a particular star sign who thought they fitted their own profile when it was presented. Each entry in the 'Others' percentage (estimated)' column is my estimate (given incomplete information about sample sizes) of the percentage with which all the other people in the sample thought they fitted the profile in question. These percentages are close to the "Averages" given in the *Daily Mail* article; however, because they exclude the star-sign members in each case (who have above average percentages) they tend to be about 1% lower than the percentages in the *Daily Mail*. My percentages act in favour of finding significant differences between the two groups in each case, and, therefore, act against the sceptical view.

Chi-squared 2x2 tests of association were carried out on the numbers corresponding to these percentages. In each case a matrix like that given below in Table 3, which is just one example of 12, was tested to determine whether the 'Star-sign's own percentage (given)' (under the rough assumption of a sample size of 91 members of each star sign) differed significantly from the 'Others' percentage (estimated)' (under the assumption of a sample size of 1001 for this group of varying membership).

The outcomes of the twelve tests conducted are given in the 'chi-squared' and 'p' columns of Table 4. It can be seen that for five of the tests the p values are identified with an asterisk. This is used to indicate the fact that these tests give results that are 'significant' beyond the 0.05 level of significance. In other words, for each of these five profiles we can conclude (subject to

the reservations arising from not knowing the exact sample sizes) that the percentage, in the population as a whole, of members of the star sign who think their personalities fit the given profile is higher than the percentage of members of the other 11 signs who think so. For the other seven profiles the chi-squared tests indicate that the evidence is insufficient for us to be able to conclude that the difference is present in the whole population. In the *Daily Mail's* table of percentages, six star-sign profiles (Taurus, Gemini, Virgo, Libra, Scorpio and Capricorn) are identified as ones where the group with which each profile was associated was the group with the highest percentage of members choosing that profile. (Actually, in the case of Taurus the percentage is equal first with that given by Sagittarius members.) It is of some interest that in two of these cases, Taurus and Capricorn, the percentage is, in fact, not *significantly* greater than that obtained from the other star-sign members. In other words, one cannot conclude that the Capricorn members' percentage of choices of the Capricorn profile, despite its top ranking, differs from the remaining members' percentage of choices of this profile in the population at large; and the same remark applies to the Taurus profile.

These analyses have simply shown whether it is justifiable to generalise from the 12 groups questioned to their respective populations: e.g. from the Aquarius interviewees to all members of the Aquarius star sign in the population. The analyses suggest that only in the case of five of the 12 personality profiles are we justified in doing so. It must be admitted that this conclusion depends partly upon the choice of the conventional but arbitrary "0.05" level of significance, which converts a continuum of probabilities into the dichotomy of "significant" (i.e. generalisable to a wider population than the sample of interviewees) or "not significant" (i.e. not generalisable). However, it is expressed in this fashion here for two reasons: first, in order to counter the implication in the *Daily Mail* article that it is sufficient to examine the percentages calculated from the samples themselves to be able to draw conclusions; and second, to demonstrate that most of these results do not warrant generalisation - in most cases there are no grounds for rejecting the assumption that the apparent differences between the percentages are simply due to chance.

It is also worth considering not the entitlement to generalise but the strength of the association

between the two variables under consideration: 'whether or not the profile fits' and 'membership or non-membership of a given star-sign group', i.e. the column and row variables of which the Aquarius example is shown in Table 3. The strength of the association is given by the statistic phi. It ranges from +1 for perfect agreement, through 0 for no agreement or disagreement, to -1 for perfect disagreement. The phi values for each of the personality profiles are given in Table 4. It can be seen that all of them are very close to 0 and far from 1, indicating that the association between group membership and profile choice is very weak. Reconsidering the significant chi-squared results in the light of these phi values, we can conclude that the former merely provide evidence for some very weak associations existing in the population as a whole. Even a weak association will be revealed if the sample size is large enough, and in the ICM study it was large - over 1000 people were interviewed *in toto*.

However, given the uncertainty about the individual star-sign sample sizes the above analyses are somewhat dubious. If the sample sizes varied to any great extent, the consequence would be an increase in the probability by chance of some of the results and a reduction in that of others, but as to the extent to which any now significant would become non-significant or vice versa we cannot say.

In his letter to the journal *Correlation*, Dean (1998) also calculates these phi values. He obtains slightly lower values than the ones obtained above, partly, perhaps, because of making different assumptions about the unknown sample sizes, and partly because he employs the statistical 'correction for continuity' for 2x2 tables. Actually, it is doubtful whether the latter should be applied to most 2x2 contingency tables. Except in the rare case where all the marginal totals are fixed, and they are not in the present case, the uncorrected statistic is more appropriate. However, choice of the corrected or uncorrected statistic makes little difference. Another relevant factor is the fact that each star-sign sample size is much smaller than the total sample. Dean points out that this tends to lead to an underestimation of the association actually present, but also that the effect is relatively insignificant. The important material in Dean's analysis is that he compares the average, 0.09, of correlations obtained from "all available studies (N=19) of Sun sign self-attribution" to a mean value of phi calculated from the

12 star-sign values. The results were similar, and Dean concludes that self-attribution is a sufficient explanation of the ICM results.

Dean goes on to examine the relationship between the ICM versions of the star-sign profiles and popular tradition. He argues that one would expect phi to decrease as the ICM profiles disagree with tradition. Inconsistencies between, say, the ICM version of the Aries profile and the traditional version of it would impede attempts by members of the Aries group to apply self-attribution to their own profile when shown it in the survey, and this would result in a relatively low value for phi. Dean does indeed claim that, for the three lowest values of phi, the ICM profiles contain several conflicts with popular tradition (established from a number of sources) whereas for the five highest values the presented profiles agree better with tradition. There is, of course, an element of subjectivity in deciding how well two profiles agree. Moreover, as Dean points out, popular tradition and source-book tradition will not necessarily coincide. There is, therefore, some degree of uncertainty in the rationale for this analysis. Furthermore, Dean finds some inconsistencies between the ICM versions and popular tradition even in several of the profiles corresponding to the five highest phi values, but broadly speaking Dean's analysis provides further support for the self-attribution argument.

Analysis of the personality profiles as a set

It can be seen from Table 2 that, for all 12 star signs, the percentage of participants belonging to a particular star sign who thought they fitted their own profile was greater than the percentage of the other participants who thought they fitted the profile. The probability of 12 out of 12 comparisons all giving differences in the same direction simply by chance is very low, at $p = 0.000488$ (derived from raising 0.5 to the power 12, and doubling the result for a non-directional test). Furthermore, the probability of them all being in the direction of 'own' greater than 'other' (the direction predicted by the proponents of astrology) is half the previous probability, at $p = 0.000244$. These probabilities are very low indeed, and lead us to reject the idea that the differences have come about by chance. However, all the arguments above to the effect that self-attribution is a better explanation of the results than the theory that there is a connection between

personality and star sign apply equally to the results of these analyses of the profiles as a set.

Consistencies between star-sign groups in their choice of profiles

The 12x12 table in the *Daily Mail* presents the percentage of each star-sign group who thought each personality profile fitted them. A close scrutiny of this table reveals that some profiles were much more popular than others. In his letter to *Correlation*, Dean (1998) points out that the Aquarius profile was chosen more frequently than any other by all star-sign groups except the Taurus group, who chose the Leo profile most frequently and the Aquarius profile next-most frequently. Dean also observes that the Gemini profile was chosen least frequently or least-but-one by 10 star-sign groups. (Actually, in the case of the Aquarius group the Gemini profile was jointly least-but-one popular with the Scorpio.)

Dean provides a very useful re-organisation of the *Daily Mail's* 12x12 table of percentages, arranging the personality profiles in order of popularity of choice within each of the star-sign groups. From it one can easily see that there are a number of consistent patterns of popular and unpopular choices besides those mentioned above. We shall examine some of these, and calculate their probability of occurrence by chance. Inspection of Dean's table suggests that the following results are worth investigating (each of the following totals is out of a possible maximum of 12): for 11 star-sign groups the Aquarius profile was the most popular (noted by Dean); for 9 groups the Aquarius and Leo profiles (in either order) were more popular than all the others; for 8 groups the Aquarius, Leo and Virgo profiles (in any order) were more popular than all the others; for 9 or 10 groups (depending on how the tie with Scorpio is resolved) the Gemini profile was the least or least-but-one popular (noted by Dean); for 6 groups Gemini was the least popular profile; and for all 12 groups the Gemini or Scorpio profiles (or both) were the least or least-but-one popular.

We can use the binomial distribution to calculate the probabilities of these results, in all examples taking the following precautions to minimise the number of cases favourable to the claim that different star-sign groups are making similar choices. We do not include cases where the astrological hypothesis would predict the result or part of the result actually observed (e.g. the

Aquarius, Leo and Virgo groups might be expected to choose some or all of that particular trio of profiles more often than other profiles and so are excluded from the 'trio' calculation), and we diminish the number of outcomes considered by one because we have not predicted, but only observed, the results. Also, in the case where the Gemini profile is least or least-but-one popular, we resolve the tied result by employing the conservative figure of 9 rather than 10 cases.

The revised totals are shown in Table 5 as the modified numbers of groups satisfying the criterion out of the modified maximum possible. The results of the calculations on these revised totals, i.e. the probabilities of each of these outcomes occurring by chance, are also given in the table. (In all the calculations we sum over all cases more extreme than the one obtained to find the probability of obtaining *at least* that result.) All the probabilities are very low indeed, indicating that these outcomes are very improbable by chance. Clearly the various star-sign groups were very consistent in deciding which profiles they thought most and which least applicable to themselves.

In addition, we can obtain a single measure of the degree to which the 12 star-sign groups were consistent in respect of the rank ordering of the percentages with which they chose *all* the profiles. This measure is provided by Kendall's coefficient of concordance, W , (Siegel and Castellan, 1988, p.262). It can range from 0, representing no agreement between the groups, to 1, for complete agreement. For the percentages as arranged by Dean, $W = 0.782$ (corrected for ties), and the probability of this result by chance is extremely low, at $p < 0.0001$. In other words, there are strong grounds for accepting the hypothesis that the groups are consistent in many of their choices. (Dean comes to essentially the same conclusion by calculating the average of the 66 correlations that could be computed between pairs of star-sign groups. His average Spearman rank correlation coefficient of 0.76 can be shown to be in agreement with the W value of 0.782 given above.) On the basis of his analysis of the consistency of the participants' choices, Dean concludes that "Such strong agreement indicates that Barnum and social desirability effects are dominant." It is certainly hard to avoid the conclusion that a factor such as social desirability was influencing the star-sign groups, leading them in general to make similar choices

across the whole range of profiles, and in particular with regard to the most and least popular profiles.

It was noted above that for all 12 groups the Gemini or Scorpio profiles (or both) were the least or least-but-one popular. Neither the Gemini nor the Scorpio star-sign groups themselves chose their own profile least or least-but-one frequently - the Gemini group chose the Scorpio profile least frequently and vice versa. However, even in these two groups, their own profiles were not frequently chosen. The Gemini group chose five, and the Scorpio group nine, other profiles more frequently than their own. Also, the Sagittarius and Aries groups chose seven and eight profiles, respectively, more frequently than their own. All this points to a strong tendency in several star-sign groups for the profiles associated with other signs to be preferred to their own.

Methodological Comments

Since the *Daily Mail* article is not a scientific paper, almost nothing is said about the methods employed in the "face to face" interviews. It is possible that there were various biases present, and although we assume that ICM would have trained their interviewers to avoid the usual sources of bias present in the face-to-face interview (e.g. Oppenheim, 1992, Ch. 6), biases specific to a star-sign investigation may not have been so easily identified. Possible examples are: (a) Did the interviewers ask the respondents what their birthdates were before asking them to choose from the set of profiles? To do so would have hinted to them that there was an astrological aspect to the interview. (b) Did the interviewers ask about horoscope habits before the choices were made? (They did so at some point.) If so, the criticism given in (a) would apply, but much more strongly. (c) Were the personality profiles presented in a random order to each participant? Any tendency for the order or presentation to have contained consistencies could have been one factor leading to the observed systematic tendencies in the choices. These and other methodological questions cannot be pursued, despite their importance for any conclusions to be drawn from the investigation, in the absence of a rigorous report describing the methods employed.

Conclusions

We are forced to the conclusion that the *Daily Mail* is very far from having found proof of an astrologically-based relationship between star-sign membership and personality. Although for each star-sign profile the percentage of members choosing it was higher in the group with which the profile is supposedly connected than it was in the sample as a whole, statistical analyses of the data demonstrate that these results are not as impressive as they seem at first sight. Instead, the analyses suggest the following conclusions:

1. In few of the 12 profiles are there grounds for claiming that the apparent associations mentioned above can reasonably be generalised to the population at large; in most of them there is little evidence that the differences in the percentages were not due to chance. If the conventional .05 level of statistical significance is adopted as the criterion for deciding whether or not such generalisation is reasonable, it is justified in the case of only five of the profiles. However, it is more useful to look at the strength of the associations, rather than their statistical significance.
2. The associations are all very weak. This is revealed by the fact that all 12 phi indices of association between star-sign membership and personality, calculated from the percentages, are close to zero, the value corresponding to no association. None of the phi correlation coefficients is greater than 0.08, whereas "a powerful and unmistakable connection" (the claim in the *Daily Mail* article) would lead us to expect values fairly close to 1.0.
3. Such effects as are present in the data could possibly be explained by the mysterious process of an astrological association between personality and star sign, but are much more plausibly explained by the empirically-demonstrated process of self-attribution.
4. There was a strong tendency for the different star-sign groups to be consistent in their choices, especially in respect of the three most popular profiles and the two least popular. The patterns of choices revealed are extremely unlikely by chance. Moreover, the consistencies in the star-sign groups' patterns of choices applies across the whole set of profiles. Here we do find a strong effect, in which the coefficient of concordance is 0.78, a value fairly close to the maximum of 1.0. This result, again, is very unlikely by chance. The high value of this coefficient is in sharp contrast to the low values

of the phi coefficients which were the subject of conclusion 2. The consistency effect seems likely to be due to the differing social desirability of the various profiles.

Tables

Table 1

Star Sign	Abbreviated personality profile
Aquarius	Friendly, independent, helpful, honest, loyal, unpredictable, emotionally detached
Pisces	Imaginative, sensitive, compassionate, selfless, idealistic, weak-willed, easily led
Aries	Selfish, impatient, quick-tempered
Taurus	Patient, reliable, placid, determined, self-indulgent, jealous
Gemini	Gifted communicator, versatile, intelligent, superficial, inconsistent
Cancer	Emotional, protective, imaginative, moody, clinging
Leo	Generous, faithful, loving, great organiser, tends to know best
Virgo	Practical, shy, modest, perfectionist, over-critical, prone to worry
Libra	Great diplomat, sees both sides of argument, self-indulgent, indecisive
Scorpio	Exciting, powerful, passionate, energetic, jealous
Sagittarius	Relishes challenge, likes freedom, optimistic, honest, good-humoured, tactless
Capricorn	Potential achiever, pessimistic, unconfident, patient, disciplined, humorous

Table 2

Star Sign associated with Personality profile	Star-sign's own percentage (given)	Others ' percentage (estimated)
Aquarius	62	54.6
Pisces	41	29.4
Aries	24	21.7
Taurus	33	25.9
Gemini	28	16.5
Cancer	32	24.4
Leo	50	45.3
Virgo	51	39.8
Libra	46	32.5
Scorpio	28	18.1
Sagittarius	26	24.8
Capricorn	40	31.4

Table 3

	Aquarius members	Others
Aquarius profile fits	56 (62%)	547 (54.6%)
Aquarius profile doesn't fit	35	454
Totals	91 (assumed)	1001

Table 4

Personality profile	Star-sign % (given)	Others % (estimated)	Chi-squared	Phi	P
Aquarius	62	54.6	1.60	.038	.206
Pisces	41	29.4	5.03	.068	.025 *
Aries	24	21.7	0.30	.017	.581
Taurus	33	25.9	2.16	.044	.142
Gemini	28	16.5	7.01	.080	.008 *
Cancer	32	24.4	2.50	.048	.114
Leo	50	45.3	0.94	.029	.332
Virgo	51	39.8	3.94	.060	.047 *
Libra	46	32.5	6.89	.079	.009 *
Scorpio	28	18.1	5.97	.074	.015 *
Sagittarius	26	24.8	0.11	.010	.736
Capricorn	40	31.4	2.57	.049	.109

* p<.05

Table 5

Outcome	Modified totals	Probability
Aquarius most popular: 11 groups	9 groups out of 10	< 0.000001
Aquarius & Leo most popular pair: 9 groups	7 out of 9	< 0.000001
Aquarius, Leo & Virgo most popular trio: 8 groups	4 out of 8	< 0.000001
Gemini least or least-but-one popular: 9 or 10 groups	8 out of 11	0.0000608
Gemini least popular: 6 groups	5 out of 11	0.00164
Gemini or Scorpio least or least-but-one popular: 12 groups	11 out of 11	0.00000217

Notes

1 The term 'sun sign' is frequently employed and is perhaps more appropriate, but I shall use 'star sign' to be consistent with the terminology used in the *Daily Mail*.

2 For any particular result, this means that, if the result is simply due to chance, it has a very low probability of occurrence, in fact less than 5%. This probability is so low that we reject the assumption that chance caused the result, and conclude instead that the result is due to an alternative factor. This could possibly be the astrological hypothesis that star signs are associated with personality traits, or more probably the psychological claim that systematic biases are present.

References

- Clarke, N. 1998a. The power of the paranormal. *Daily Mail*, 2 February 1998: 18-19.
- Clarke, N. 1998a. Astrology - is this the proof? *Daily Mail*, 2 February 1998: 30-31.
- Dahlstrom, W.G., Hopkins, D., Dahlstrom, L., Jackson, E. and Cumella, E. 1996. MMPI findings on astrological and other

folklore concepts of personality. *Psychological Reports*, 78: 1059-1070.

Dean, G. 1998. Astrology - is this the proof? Letter to *Correlation*, 16 (2): 63-66.

Hamilton, M. M. 1995. Incorporation of astrology-based personality information into long-term self-concept. *Journal of Social Behavior and Personality*, 10 (3): 707-718.

Kelly, I.W. 1997. Modern astrology: A critique. *Psychological Reports*, 81: 1035-1066.

Kelly, I.W. and Saklofske, D.H. 1986. Alternative explanations in science: The extraversion-introversion astrological effect. In K. Frazier (ed). *Science Confronts the ormal*. Buffalo: Prometheus Books.

Oppenheim, A.N. 1992. *Questionnaire Design, Interviewing and Attitude Measurement*. 2nd edition. London: Pinter Publishers.

Siegel, S. and Castellan, N.J. 1988. *Nonparametric Statistics for the Behavioral Sciences*. 2nd edition. New York: McGraw-Hill.

Spencer, W. 1997. Written in the Stars? The history and psychology of western astrology. *The Skeptical Intelligencer*, 2 (2): 3-13.

ARTICLES

Proper Criticism

By Ray Hyman

This article first appeared in Skeptical Briefs (1987; 3: 4-5), the newsletter of the Committee for the Scientific Investigation of Claims of the Paranormal (CSICOP), and is reprinted with kind permission. Ray Hyman is Professor of Psychology at the University of Oregon at Eugene and the Chairman of the CSICOP Parapsychology Subcommittee.

Since the founding of The Committee for the Scientific Investigation of Claims of the Paranormal in 1976, and with the growing numbers of localized skeptical groups, the skeptic finds more ways to state his or her case. The broadcast and print media, along with other forums, provide more opportunities for us to be heard. For some of these occasions, we have the luxury of carefully planning and crafting our response. Most of the time we have to formulate our response on the spot. But, regardless of the circumstance, the critic's task, if it is to be carried out properly, is both challenging and loaded with unanticipated hazards.

Many well-intentioned critics have jumped into the fray without carefully thinking through the various implications of their statements. They have sometimes displayed more emotion than logic, made sweeping charges beyond what they reasonably support, failed adequately to document their assertions, and, in general, have failed to do the homework necessary to make their challenges credible.

Such ill-considered criticism can be counterproductive for the cause of serious skepticism. The author of such criticism may fail to achieve the desired effect, may lose credibility, and may even become vulnerable to lawsuits. But the unfavorable effects have consequences beyond the individual critic, and the entire cause of skepticism suffers as a result. Even when the individual critic takes pains to assert that he or she is expressing his or her own personal opinion, the public associates the assertions with all critics.

During CSICOP's first decade of existence, members of the Executive Council often found themselves devoting most of their available time to

damage control - precipitated by the careless remarks of a fellow skeptic - instead of toward the common cause of explaining the skeptical agenda.

Unfortunately, at this time, there are no courses on the proper way to criticize paranormal claims. So far as I know, no manuals or books of rules are currently available to guide us. Until such courses and guide books come into being, what can we do to ensure that our criticisms are both effective and responsible?

I would be irresponsible if I told you that I had an easy solution. The problem is complicated and there are no quick fixes. But I do believe we all could improve our contributions to responsible criticism by keeping a few principles always in mind.

We can make enormous improvements in our collective and individual efforts by simply trying to adhere to those standards that we profess to admire and that we believe that many peddlers of the paranormal violate. If we envision ourselves as the champions of rationality, science, and objectivity, then we ought to display these very same qualities in our criticism. Just by trying to speak and write in the spirit of precision, science, logic, and rationality - those attributes we supposedly admire - we would raise the quality of our critiques by at least one order of magnitude.

The failure to consistently live up to these standards exposes us to a number of hazards. We can find ourselves going beyond the facts at hand. We may fail to communicate exactly what we intended. We can confuse the public as to what skeptics are trying to achieve. We can unwittingly put the paranormal proponents in the position of the underdogs and create

sympathy for them. And, as I already mentioned, we can make the task much more difficult for the other skeptics.

What, then, can skeptics do to upgrade the quality of their criticism? What follows are just a few suggestions. Hopefully, they will stimulate further thought and discussion.

1. *Be prepared.* Good criticism is a skill that requires practice, work, and level-headedness. Your response to a sudden challenge is much more likely to be appropriate if you have already anticipated similar challenges. Try to prepare in advance effective and short answers to those questions you are most likely to be asked. Be ready to answer why skeptical activity is important, why people should listen to your views, why false beliefs can be harmful, and the many similar questions that invariably are raised. A useful project would be to compile a list of the most frequently occurring questions along with possible answers.

Whenever possible, try your ideas out on friends and "enemies" before offering them in the public arena. An effective exercise is to rehearse your arguments with fellow skeptics. Some of you can take the role of the psychic claimants while others play the role of critics. And, for more general preparation, read books on critical thinking, effective writing, and argumentation.

2. *Clarify your objectives.* Before you try to cope with a paranormal claim, ask yourself what you are trying to accomplish. Are you trying to release pent-up resentment? Are you trying to belittle your opponent? Are you trying to gain publicity for your viewpoint? Do you want to demonstrate that the claim lacks reasonable justification? Do you hope to educate the public about what constitutes adequate evidence? Often our objectives, upon examination, turn out to be mixed. And, especially when we act impulsively, some of our objectives conflict with one another.

The difference between short-term and long-term objectives can be especially important. Most skeptics, I believe, would agree that our long-term goal is to educate the public so that it can more effectively cope with various claims. Sometimes this long-range goal is sacrificed because of the desire to expose or debunk a current claim.

Part of clarifying our objectives is to decide who our audience is. Hard-nosed, strident attacks on paranormal claims rarely change opinions, but they do

stroke the egos of those who are already skeptics. Arguments that may persuade the readers of the *National Enquirer* may offend academics and important opinion-makers.

Try to make it clear that you are attacking the claim and not the claimant. Avoid, at all costs, creating the impression that you are trying to interfere with someone's civil liberties. Do not try to get someone fired from his or her job. Do not try to have courses dropped or otherwise be put in the position of advocating censorship. Being for rationality and reason should not force us into the position of seeming to be against academic freedom and civil liberties.

3. *Do your homework.* Again, this goes hand in hand with the advice about being prepared. Whenever possible, you should not try to counter a specific paranormal claim without getting as many of the relevant facts as possible. Along the way, you should carefully document your sources. Do not depend upon a report in the media either for what is being claimed or for facts relevant to that claim. Try to get the specifics of the claim directly from the claimant.

4. *Do not go beyond your level of competence.* No one, especially in our times, can credibly claim to be an expert on all subjects. Whenever possible, you should consult appropriate experts. We, understandably, are highly critical of paranormal claimants who make assertions that are obviously beyond their competence. We should be just as demanding on ourselves. A critic's worst sin is to go beyond the facts and the available evidence.

In this regard, always ask yourself if you really have something to say. Sometimes it is better to remain silent than to jump into an argument that involves aspects that are beyond your present competence. When it is appropriate, do not be afraid to say, "I don't know."

5. *Let the facts speak for themselves.* If you have done your homework and have collected an adequate supply of facts, the audience rarely will need your help in reaching an appropriate conclusion. Indeed, your case is made much stronger if the audience is allowed to draw its own conclusions from the facts. Say that Madame X claims to have psychically located Mrs. A's missing daughter and you have obtained a statement from the police to the effect that her contributions did not help. Under these circumstances it can be counterproductive to assert that Madame X lied about

her contribution or that her claim was "fraudulent." For one thing, Madame X may sincerely, if mistakenly, believe that her contributions did in fact help. In addition, some listeners may be offended by the tone of the criticism and become sympathetic to Madame X. However, if you simply report what Madame X claimed along with the response of the police, not only are you sticking to the facts, but your listeners will more likely come to the appropriate conclusion.

6. *Be precise.* Good criticism requires precision and care in the use of language. Because, in challenging psychic claims, we are appealing to objectivity and fairness, we have a special obligation to be as honest and accurate in our own statements as possible. We should take special pains to avoid making assertions about paranormal claims that cannot be backed up with hard evidence. We should be especially careful, in this regard, when being interviewed by the media. Every effort should be made to ensure that the media understand precisely what we are and are not saying.

7. *Use the principle of charity.* I know that many of my fellow critics will find this principle to be unpalatable. To some the paranormalists are the "enemy," and it seems inconsistent to lean over backward to give them the benefit of the doubt. But being charitable to paranormal claims is simply the other side of being honest and fair. The principle of charity implies that, whenever there is doubt or ambiguity about a paranormal claim, we should try to

resolve the ambiguity in favor of the claimant until we acquire strong reasons for not doing so. In this respect, we should carefully distinguish between being wrong and being dishonest. We often can challenge the accuracy or the validity of a given paranormal claim. But rarely are we in a position to know if the claimant is deliberately lying or is self-deceived. Furthermore, we often have a choice in how to interpret or represent an opponent's arguments. The principle tells us to convey the opponent's position in a fair, objective, and nonemotional manner.

8. *Avoid loaded words and sensationalism.* All these principles are interrelated. The ones previously stated imply that we should avoid using loaded and prejudicial words in our criticisms. We should also try to avoid sensationalism. If the proponents happen to resort to emotionally laden terms and sensationalism, we should avoid stooping to their level. We should not respond in kind. This is not a matter of simply turning the other cheek. We want to gain credibility for our cause. In the short run, emotional charges and sensationalistic challenges might garner quick publicity. But, most of us see our mission as a long-run effort. We would like to persuade the media and the public that we have a serious and important message to get across. And we would like to earn their trust as a credible and reliable resource. Such a task requires always keeping in mind the scientific principles and standards of rationality and integrity that we would like to make universal.

A Report on the 'Meet the Skeptics' Day

By Gordon Livesey

Gordon Livesey has a degree in Physics and works for a vacuum technology company where he is manager of an Applied Maths Group. His principal areas of expertise are vacuum science and technology and gas flow dynamics. His main sceptical interest is the science versus anti-science conflict. He is a member of ASKE.

Meet the Skeptics was a public event staged by ASKE at the University of Sheffield Department of Psychology on Friday, March 20th. It included a stall with posters, books and periodicals about skepticism

and paranormal claims and an opportunity for the public to meet and talk with skeptics. The main event were talks and demonstrations by Michael Heap and Tony Youens on the theme: *Paranormal or Normal?*

Michael Heap began proceedings by talking about the ways in which the human brain constructs its view of the world and how this can fool us into seeing things which may not be there. To illustrate this, he showed a number of pictures that consisted of only a few blobs and yet were perceived as a face, a dog or a horse and carriage. One of the more amusing examples was the 'plank from Bacup', the grain structure of which appeared to resemble an elongated face that some believe is the face of Jesus. (The grain does look vaguely like a face; but why Jesus? There are no records of what Jesus looked like).

Long before spacecraft visited Mars, Percival Lowell drew remarkable pictures of the planet on the basis of his telescopic observations. Believing he could see lines, Lowell concluded that these were a vast network of canals supposedly built by a civilisation on Mars to transport water from the polar caps. However, images from the Viking and later spacecraft to visit the planet have shown no sign of any such canals, and Lowell's perceptions are examples of what the brain can construct when straining to see detail at the limit of the eye's resolution.

Proponents of the 'aliens are out there' school of thought continue to make claims much like Lowell's. A 1976 photograph of the surface of Mars taken by the orbiting Viking I probe appears to show a geological structure that looks something like a human face (more accurately, half a face). This has been construed by some as a structure built by aliens, in spite of the almost total lack of evidence for even the most primitive life on Mars. (The evidence for bacterial fossils in the Martian meteorite found in Antarctica is debatable at best). Not surprisingly, a new high-resolution image of the region of Mars in which the 'face' is located provided by the Mars Global Surveyor in April 1998 demonstrates beyond doubt that the formation in question bears little real resemblance to a human face and is purely a product of such natural processes as wind erosion and temperature changes.

Michael pointed out that human beings are very good at recognising shapes, so good that chance alignments of relief and shadow in an image often give rise to recognisable shapes, particularly faces. The 'man in the moon' is the most obvious example. So, if we can fool ourselves in what we see, how confident can we be in what others report?

An illustrative example cited was the case of the bear that escaped from a zoo in Holland. The escape was described in the media and subsequently more than 100 people from all over the country reported seeing the bear. A little later the bear was found dead no more than 100 yards from the zoo. So, why the many reports? The people reporting must have been mistaken or hoaxing (unless the bear mysteriously transported itself all round the country before returning to the vicinity of the zoo to be killed by a motor vehicle).

Many claims of paranormal or weird phenomena arise from hoaxes. Human-like beasts are a common theme from around the world like the Yeti and Bigfoot and, closer to home, the 'Beast of Bodmin'. Mistakes? Hoaxes? Real? Alas, these beasts are curiously elusive, and convincing evidence of their existence does not seem to have been forthcoming.

The Cottingley Fairies made headlines in their day. But simple examination of the best known photograph, shown during the talk, reveals an oddity. Long exposures were needed at the time the photographs were taken which would blur the images of anything moving. By contrast, the images of dancing fairies are clear and sharp. A more obvious hoax it is hard to imagine but it was enough to fool Sir Arthur Conan Doyle. For example, the paper cut-out fairies that appeared in the photographs were propped up with pins stuck through the middle of the paper from the back. This gave rise to a small protrusion in the abdomens of the paper fairies. The great man's conclusion after careful examination of the photographs? Fairies had umbilical chords and therefore gave birth!

The stories and illustrations presented by Michael were designed to get across to the audience a key message: don't invent weird explanations for phenomena which can perfectly well be explained in terms of current knowledge.

Of course, stories are one thing but the evidence of one's own eyes is something else. Or is it? Cue Tony Youens and live demonstrations of 'psychic powers'.

A member of the audience chooses a book and a word from the book. The choice is seemingly random: the volunteer opens the book and runs her finger down a page to choose the first word of a line. Tony writes down the word - amazingly, it's the word chosen. Psychic power? Or did the preceding judicious

chat and questioning have something to do with it? Or was there another equally prosaic explanation that we in the audience simply lack the skills to unravel?

In a demonstration of metal-bending, keys and spoons are bent at will, some in the hands of audience volunteers. This demonstration involved a thought-provoking hoax of Tony's own in which he offered for sale a supposedly metal-softening chemical called 'chloridol' which was later revealed to be completely bogus. As Tony pointed out, a spoon is perfectly easy to bend. Neither psychic powers nor strange substances are required.

A paper cone is balanced on a pencil point fixed in a block of wood. The cone is easily made to rotate by blowing over it. Now a glass container is placed over the cone to protect it from any possibility of external influence. Members of the audience are invited to blow over the glass to prove there are no gaps. But, a little psychic concentration and the cone rotates.

A volunteer from the audience has made a drawing and sealed it in an envelope. Tony draws on a flip chart. The envelope is opened. Remarkably, the drawings are almost identical.

Michael Heap puts up a slide showing 4 coloured blocks and invites the audience to make a choice. He writes down his prediction. By this time in the proceedings no-one is surprised that his prediction matches that of the majority of the audience. The explanation is that most

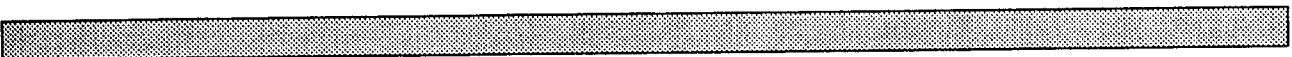
people choose one of the blocks in the middle rather than the ends. The choice here is between red and black and most people choose red. This demonstration of psychic power was once presented in a TV programme by Uri Geller.

The most dramatic demonstration was of psychic surgery. Tony makes his preparations, his hands clearly empty. A young volunteer lies prone on a table awaiting his fate; hands delve into his body and blood spurts everywhere. The young man merely complains that it tickles. His parents are re-assured that the 'blood' doesn't stain clothes!

Michael asks: What harm can this do? What are the consequences if someone needs a real operation, but avoids it in the belief that psychic surgery has effected a cure? In some cases 'psychic surgeons' actually cut the skin. The possibilities for serious injury are very real.

Michael and Tony emphasised once again that explanations for odd phenomena should first be sought in terms of what is already known and understood about the world. Hoaxes, lies and misdirection lie at the root of many psychic claims.

By the end of the talk and demonstrations, around 100 people had been intrigued and entertained, and were, perhaps, a little more sceptical than when they arrived.



Abducted?

By Kevin McClure

*Kevin McClure works as a civil servant in Leeds, and is an ASKE member who has been writing critically about extraordinary beliefs and experiences for more than twenty years. He currently publishes the monthly newsletter *Abduction Watch*, described as "the only publication in the world devoted to dealing sceptically with the abduction mythos, the lies and fantasies that underpin it, and the damage caused by the increasing complexity of the belief system that has developed from it". In the UK, 12 monthly issues cost only £10, and your support, and input, would be much appreciated. Please make payments out to Kevin McClure, and send to 3, Claremont Grove, Leeds, LS3 1AX.*

Scepticism has seldom dealt effectively with the alien abduction mythos. Because encounters with aliens look, at first sight, like a straightforward extension of 'UFO' experiences, it has been natural for scientists to try and adopt explanatory strategies similar to those that have been used for unusual 'lights in the sky'. A variety of talking-head sceptics have apparently assumed that each abduction experienced by each abductee results from a specific internal or external stimulus, a stimulus which, with the benefit of wider scientific knowledge, can be identified and explained.

Consequently, the arsenal of sceptical explanations for reports of abduction experience covers, with a handful of honourable exceptions, only a limited range. At one end there is the misinterpretation of physical objects such as stars, planets, mirages relating to natural phenomena, helicopters, airships and other aerial craft. At the other there is sleep paralysis, temporal lobe epilepsy, the effect of energy released from seismic strains on the operation of the brain, and vague suggestions regarding the operation of abnormal psychological processes in perceiving events which to the more normal or rational mind would supposedly have straightforward explanations. Because most media presentations of the abduction mythos include only one token sceptic at best, and that token sceptic is usually chosen from a very small range of media-friendly 'scientists' who present exactly that range of explanations, both science and scepticism have so far failed miserably to deal with the substantial problems that abduction beliefs presents.

The consequences of this failure are highlighted by the content of the new book *Abducted: The True Story of Alien Abduction in Rural England* (Andrews and Ritchie 1998) and by the publicity it was given on publication. This included an absolutely uncritical four-day presentation in the *Sun*, television and radio programmes in which other self-identified abductees were encouraged to phone in with their experiences, and the availability to the media of the principal 'abductee' himself, 14 year-old Jason Andrews (according to the cogent but sad account by journalist James Dalrymple (1998), Andrews seldom answered for himself on these occasions). Dalrymple suggests that the family has been guaranteed £60,000 for the book and serialisation.

This is the first detailed British account of a family apparently plagued by aliens and abductions to

be put out by a major publisher. The case is impervious to traditional 'scientific' explanations. Firstly, because it is largely grounded in 'internal' experiences, initially of Jason himself, and then, when gradually "remembered", of his mother and brother. And secondly because those involved refuse to answer questions about such supposedly physical, checkable elements as there are in this extraordinary story. There has, to date, been no concerted and effective sceptical response to it

Tony Dodd is at the forefront of proponents of the abduction mythos in the UK. A long-retired policeman, he has recently broken away from the newsstand glossy *UFO Magazine*, and the research organisation Quest International, to carry out research independently. However, he has many followers, and his beliefs have considerable influence. It's worth noting that when Nick Pope - the Ministry of Defence 'UFO desk' civil servant with two books and countless media appearances to his credit - was at the MoD, he used to recommend Dodd to those who approached the MoD for help with UFO enquiries. It's not yet clear whether the MoD realised that this was happening. I suspect they were unaware of Dodd's wholehearted commitment to the use of non-professional hypnotic regression, or his belief that:

"there is without doubt liaison going on between a race of ETs and our own people. There is also substantial information that another race of ET with malevolent intent is visiting us. It would appear that we are being given advanced technology by the friendly ET to enable us to defend against the unfriendly, hence the new generation of triangular aircraft. The weapons in use appear to be highly advanced particle beam weapons which have been used with great success.

This also confirms the reason why so many huge underground facilities have been appearing all over the globe when we are supposed to be living in a peace time environment. Of course the animal and human mutilation situation is part of all this."

Tony Dodd first wrote about this case in *UFO Magazine* for March/April 1996. At that time, as reported in my publication *Promises & Disappointments*, I repeatedly questioned the claims he made in that article. At that time, the child was identified as 'Jason Williams' and although he was but 11 years old, the magazine chose to publish photos of him with only a black strip across his eyes, as well as

photographs of the grounds around the family home - an irresponsible potential breach of confidentiality.

I asked, particularly, whether, as Dodd had claimed, Jason had been "expelled from school for disruptive behaviour"; whether Jason had been "rushed into hospital" on "three separate occasions", when "Disturbingly, on each occasion, Jason's mother noticed a strange red circular mark on his stomach which she described as the size of her hand"; and whether social services had been contacted about the supposedly mysterious injuries and needle marks the child was said to display. Among other issues that seemed to make no sense at all, I also enquired about the supposedly extraordinary behaviour of the Ministry of Agriculture, Fisheries and Food (or some other Government agency), which supposedly stole the carcasses of the family's animals. And, out of concern for Jason's welfare, I passed on details of the allegations of mysterious abuse to the National Society for the Protection of Children and Kent Social Services. I understand that Social Services did investigate the situation: this was explained in a solicitor's letter on behalf of the parents, discouraging me from writing about the case! Maybe that £60,000 had been mentioned.

I am now reviewing Andrew and Ritchie's book for *Fortean Times*. According to this new account of the case, Jason *wasn't* expelled from school, *wasn't* rushed to hospital three times, and when he did go to hospital had different marks from those Dodd described. Dodd said Jason was 8 when the experiences started; the book says he was 4. The story about MAFF has changed drastically, with animals alive in one version, dead in the other; "several" vehicles calling to collect carcasses in one, only two in the other. In both versions, the MAFF story makes no sense at all.

Tony Dodd has not responded to my written request to explain why there are such major discrepancies between his article and the book.

What is clear from both versions is that this family had come to believe that their son's disturbed behaviour - which had taken him previously to a child psychologist and various doctors - resulted from repeated abductions by alien beings, and had no other cause. They apparently decided this when watching a previously 'regressed' abductee on television. They bought UFO books, immersed themselves in the culture, and sought out an investigator; they found Tony

Dodd. It seems that since then all kinds of memories have come flooding back, without the use of hypnotic regression. Ritchie, a national journalist, apparently of some standing, saw fit to write a book around Jason's developing reminiscences and Dodd's views on aliens, alien 'implants' (Jason apparently has two) and the wonders of recovered memory. In line with some of the more oppressive American beliefs about abduction being a generational phenomenon, the mother believes herself to have been abducted, and has found an explanation for a miscarriage in the conviction that the foetus was taken by aliens, and may have been an alien-human hybrid. The elder son also now recounts encounters with aliens and - echoing the techniques used by witness support groups in the USA and elsewhere to keep abductees 'on message' and supportive of the abduction belief - Jason has been taken to meet and mix with other abductees.

While this probably wasn't the authors' intention (and Dodd says that he didn't know what would be in the book until it was published) the book is not only a sadly intriguing account of the development of a belief in alien abductors, but it also sets out Dodd's undoubtedly influential beliefs. The reader can clearly discern the skeleton of a master/pupil relationship which develops along with those beliefs, fuels them and feeds on them in turn.

"Tony Dodd agrees that being abducted should be regarded not just as being a victim, a part of some strange medical monitoring being carried out by aliens, but as the start of a spiritual journey. He has recorded the messages that he 'receives' in his brain from alien intelligences, and the recordings have been used to bring a great deal of spiritual comfort to many people, particularly to patients in hospices who are facing up to the end of their time on Earth.

Tony now feels that his initial experience of the UFO - followed by several more sightings on the moors in the subsequent few years - was a deliberate introduction engineered by the aliens. He himself, he believes, has been regularly abducted for many years . . . His contact with the aliens, he believes, has a definite purpose: he has been chosen to pass on messages promoting world peace, and greater understanding of the cosmos. The messages 'appear' in his brain, and are so unlike any of his own, familiar, down-to-earth thought patterns that he feels sure they are planted there by benevolent aliens . . . Tony does not believe all aliens are benevolent, nor does he think the earth is

simply being buzzed by one particular race of space beings, but by several. He subscribes to the view that world governments are involved in cover-ups, that they know far more about alien activity than they admit to the populace at large."

I have serious concerns about how Dodd apparently saw fit very early in his contact with Jason to confirm a number of the standard elements of the contemporary alien abduction myth. Jason was then only 11 or 12 years old:

"He pulled no punches with Jason, admitting from the beginning that there was no 'cure', no magic potion which would make the abductions stop, but by being frank and open with Jason about his own experiences, he has helped the boy come to terms with what is happening.

'Don't be embarrassed, Jason', he said. 'We are all scared, not just you . . . I'm too afraid to enter a darkened room on my own. They still come for me, and although I know that they mean me no harm - and have accepted it - it still scares the hell out of me . . . Having seen their crafts and the awesome power they possess, I know that we can never stop them. How the hell do you fight something which can not only paralyse you, but can levitate you out of the house through solid walls?'

It was a speech which brought a great deal of comfort to Jason. If a grown man could admit he was scared of the night visitors, he had nothing to be ashamed of, he could accept his own fear as natural."

Dodd is quoted again:

"I wish I could promise Jason that it would stop one day.' says Tony Dodd 'but it is unlikely. Having been selected for multiple abductions, I feel the aliens will follow him for many years to come, probably all his life. But he will come to terms with it. He'll find a way of coping.

I think he may, eventually, prove to be a very important abductee. Some of the experiences he has had make me think he is being groomed as a 'teacher', a human who is entrusted by the aliens with messages for the whole of mankind'."

It appears that Dodd has identified in Jason somebody with very similar experiences - and powers - to his own. As some cult leaders do, perhaps he thinks that he has

found his successor, a young person able to perceive, and pass on, those messages from the aliens.

I have set out a number of these problems to the publishers of the book, who have sent me - probably because a review in *Fortean Times* carries a good deal of clout in terms of potential sales - a holding reply of sorts. In addition to the contradictions already mentioned, my questions to them centred on two passages in the book where major issues of journalistic propriety arise. Firstly, there is the response to one apparent abduction. Jason had gone missing in the night. On previous occasions, such disappearances had ended with Jason returning home physically injured. Moreover, as the authors (Jason's mother and a professional writer) record without apparent concern, Jason's brother had informed the family that:

"the bastards have taken him again. I knew it was happening but I couldn't move, I couldn't stop it"

Notwithstanding this, they appear to have accepted without demur the decision of another abductee with whom they were in contact that the Police should not be informed or asked for assistance in finding him because

"Going to the Police, when they already knew what the explanation for the disappearances was, would only make matters much worse for the boy..."

Secondly, there is the account of a suicide attempt on the part of Jason, which is reported as a reason to believe in the aliens and their power, and not as a cry for the sort of help that a journalist and other abductees are unlikely to be able to provide

"The most dispiriting and depressing moment that I had while researching this book was when I asked Jason what the future held for him. He shrugged his shoulders and said that he did not see it ever getting any better, nor did he see himself ever learning to accept it. Chillingly, he told me how he had seriously contemplated suicide, even going so far as to take a rope into the woods in an attempt to hang himself. He talked about it laconically, with apparent indifference, describing it as though it happened to a third party. Then, suddenly, the reserve broke, and tears came to his eyes as he shouted angrily at 'them', the uninvited strangers who have robbed him of so much of his youth."

In any other context, encouraging, maybe even persuading, a child to hold beliefs which lead not only to the contemplation of suicide but also to his obtaining the means of killing himself and travelling to the intended location of death would be regarded with the utmost seriousness and horror. I hope to hear what view *Headline*, a substantial publisher, takes of the issue; but I'm not optimistic that I'll receive a worthwhile response.

I can think of no reason why the context of a belief in alien abduction should provoke any less concern, indignation, or intervention by individuals or agencies which have a genuine concern or legal responsibility for the welfare and protection of children. Perhaps it is necessary to establish among the caring professions a national position as to whether any child, let alone one who has already required the services of a child psychologist, should be, as the book repeatedly puts it, "counselled" by those who believe themselves to have been abducted by aliens.

The dedication in the book reads:

"This book is for the countless number of families who are presently struggling to cope with similar experiences. Take heart in the hope that we will one day have an answer."

The book's *Acknowledgements* make the same point:

"The authors would like to thank everyone who helped with the research and writing of this book, in particular Jason Andrews. The impetus to write the book came from his commitment to finding the truth of his own experiences, and his strong feeling that by speaking out about his abductions, he would help other people - particularly children and teenagers - who may be struggling to cope with similar phenomena."

I don't know how many copies the book will sell, but I'd be very surprised if more children, and more families, were not drawn into this world of false belief. If they are, they too will believe that alien beings control their lives, take them away, harm them, give them tasks to perform, maybe impregnate them and remove their hybrid foetuses to improve the stock, and prolong the life, of some evil and alien race.

This is why I suggest that science and scepticism have, so far, failed miserably to deal with the substantial problems presented by the abduction mythos. At best, the believers regard those who explain their experiences away by reference to natural

phenomena or quirks of perception as ignorant of the truth; as unable or unwilling to understand. At worst, we are identified as agents of the government or some other dark force, plotting deliberately to cover-up the truth.

I do not wish to suggest that sleep paralysis, temporal lobe epilepsy, and the like do not account for *some* core experiences that underpin the abduction mythos. But sceptics need to realise that this is a fully-fledged belief system, and that it is all too easy to acquire a commitment to that belief, a conviction of its truth. These people just *know* that there are aliens; they *know* they are being abducted; they *know* that there are hybrid babies and nurseries on giant spaceships; they *know* that the parents of hybrid babies are taken, via abduction, on regular visits to nurse their young. Importantly, they also *know* they have a higher purpose in life; that they have tasks to do, duties to perform, responsibilities to fulfil, a message to proclaim. And they want to draw others into sharing those beliefs.

To take a potentially offensive parallel, there are many millions of Christian believers in the world, none of whom saw either the crucifixion or the burial of Christ. Yet they can tell you about it in intricate detail. Only a handful of people ever claimed to have seen the resurrected Christ in their lifetimes. Yet many millions of Christians can tell you the detail of that experience, and willingly live their lives on the premise that it really occurred, and holds both a promise and power for them even now, close on 2,000 years later. These are beliefs without specific, individual stimuli, but they have proved utterly convincing to even the finest of intellects.

None of the material in the Jason case has been 'recovered' through the use of specific techniques for the enhancement of memory. The hothouse context of a presumably vulnerable child surrounded by abduction believers makes the use of such techniques unnecessary. But, as I have suggested, this particular case offers some potential for further, effective investigation because there are clear contradictions between the two published accounts. That will not always be the case, and we need to devise effective ways of dealing with investigators and "experiencers" who not only believe in the personal reality of these extraordinary experiences, but are willing to proselytise those beliefs, whether from a genuine desire to assist others, to make money, or to simply try to make sense of a perceived mystery. Explanations derived from

physical science are not the appropriate means by which to pursue a sceptical understanding of the abduction mythos. But neither that, nor the fact that this myth can look very much like a religion, should deter us from trying to devise ways of dealing with it, and the harm it certainly does.

References

- Andrews, A. and Ritchie, J. 1998. *Abducted: The True Story of Alien Abduction in Rural England*. London: Headline.
- Dalrymple, D. 1998. Abducted by aliens? *Daily Mail*, 21 March 1998: 16-17.

Science Education in America

A Casualty Report from the Evolution Wars

by Mark O'Leary

Mark O'Leary is a molecular biologist turned computer network specialist. He is a member of ASKE.

MESSAGE FROM THE ALABAMA STATE BOARD OF EDUCATION

[to be pasted in all biology textbooks]

This textbook discusses evolution, a controversial theory some scientists present as a scientific explanation for the origin of living things, such as plants, animals and humans.

No one was present when life first appeared on earth. Therefore, any statement about life's origins should be considered as theory, not fact.

The word "evolution" may refer to many types of change. Evolution describes changes that occur within a species. (White moths, for example, may "evolve" into gray moths.) This process is microevolution, which can be observed and described as fact. Evolution may also refer to the change of one living thing to another, such as reptiles into birds. This process, called macroevolution, has never been observed and should be considered a theory. Evolution also refers to the unproven belief that random, undirected forces produced a world of living things.

There are many unanswered questions about the origin of life which are not mentioned in your textbooks, including:

- Why did the major groups of animals suddenly appear in the fossil record (known as the Cambrian Explosion)?
- Why have no new major groups of living things appeared in the fossil record in a long time?
- Why do major groups of plants and animals have no transitional forms in the fossil record?
- How did you and all living things come to possess such a complete and complex set of "instructions" for building a living body?

Study hard and keep an open mind. Someday you may contribute to the theories of how living things appeared on earth.

Introduction

In November 1995, the Alabama State Board of Education amended "The Alabama Course of Study - Science" - the equivalent of the UK's National

Curriculum in science - in a way that it is unlikely would have been even considered in the UK. This amendment required that all state-approved biology textbooks and materials for children aged from kindergarten through

grade 12 carry a so-called 'educational aid' pasted inside their front covers. Written by Board members David Byers and Stephanie Bell, this 'aid' is the infamous 'Alabama Disclaimer'. Its adoption was as a result of the controversial recommendation in its favour made by the 1995 State Textbook Committee. The reasons for the committee's support were subsequently outlined in an article written by Norris Anderson, a committee member.

This controversy has been given fresh relevance in Washington State, where a similar text is currently under consideration. On January 16, 1998, legislation calling for the insertion of an evolution disclaimer identical in wording to the Alabama Insert was introduced in the Washington State Senate, and was subsequently referred to the Education Committee. A hearing was scheduled to debate this "*Message from the Washington State Legislature*" on Thursday, January 22 at 8:00 a.m. However, the hearing was postponed when an invited speaker failed to appear.

In the light of these events, the aims of this article are firstly to provide a critical discussion of the grounds on which the Textbook Committee based their support for the original disclaimer (as laid out in the article mentioned above), and secondly, to introduce the elegant rejoinder by Richard Dawkins which follows.

The "Disclaimer" idea in its various incarnations has become the current rallying banner of the American anti-evolutionists. As we shall see, the arguments advanced in its support are phrased in such a way as to make it appear that it is solely an attempt to promote the thorough and impartial teaching of the sciences.

The Case for the Disclaimer

Following the original Alabama Disclaimer's adoption at the prompting of the 1995 State Textbook Committee, Norris Anderson, a member of that committee, produced an article titled *The Alabama Insert: A Call for Impartial Science* (Anderson, n.d.) in which he put forward and attempted to defend the arguments behind the committee's sponsorship of the 'disclaimer' concept. It is evident from his article that the arguments used to justify the committee's support rest on five key observations or premises.

1) A perceived bias in existing textbooks:

"the current crop of inquiry-deficient science textbooks submitted by mainline publishers [...] read more like a catechism than scientific literature - they give the appearance of trying to indoctrinate rather than educate."

2) A disagreement over the definition of scientific terms:

"the word 'evolution' is used in such an ambiguous manner as to actually be misleading. [...] This linguistic slight of hand confuses rather than instructs students in the proper methods of scientific inquiry."

3) A perceived presentation of philosophical speculation as science:

"The greatest failures of the texts are that philosophical assumptions are not identified, and that such assumptions are treated as 'scientific knowledge'. An unwarranted world view is presented to students under the color of scientific authority and knowledge."

4) A perception of evolutionary theory as anti-theological:

"Statements such as 'evolution works without either plan or purpose' illustrate that Darwinism is a theory with explicitly anti-theistic implications. Clearly, those who promote Darwinianism as fact have a theological ax [sic] to grind [...] To teach this philosophy uncritically in state schools establishes a religion antagonistic to all theistic views."

5) The absence of discussion of perceived weaknesses in evolutionary theory:

"no mention is made of any problems with current theories of origins [...] These texts deprive students of information that would help them evaluate what is being taught [...] Students should be exposed to evidences at variance with the prevailing Darwinian theory"

The Case Against the Disclaimer

I intend to address in turn what I believe to be (from my best attempts to apply the principle of charity) the reasoning behind these creationist arguments and claims. This discussion shall include the possible consequences for the teaching of science were such claims to gain widespread acceptance.

Bias and Fairness.

Attempts to get the teaching of evolutionary theory removed entirely from American school curricula have encountered seemingly insuperable constitutional obstacles. Anti-evolutionists, particularly those of the creationist lobby, thus now demand that science teaching be "fair", meaning that 'creation science' get equal time and emphasis alongside evolutionary science teaching). Any presentation wherein this is not the case is characterised as "unfair" or "biased". But, science is not a democratic process. The fairness inherent in science derives solely from the critical examination of evidence against objective standards, without allowing fashion, personal belief or profit to interfere. Any idea may be advanced (creationism itself was respectable amongst pre-Darwin biologists, who lacked both an alternative model and the body of evidence required to see its flaws), but only those proposed ideas with both explanatory power and the ability to withstand such an examination survive to be accepted and are developed or taught. Those explanations that fall at these hurdles are forgotten or relegated to the status of historical curiosities (unless there is an active pressure group unwilling or unable to accept the verdict). Can it be considered "unfair" that geocentric celestial spheres are not taught equally alongside the standard cosmological model, or that the natural history of unicorns is not taught alongside that of horses? I doubt that those who wish to promote creation science would be willing to accept such logical consequences of their position, and give equal time to 'flat-earth geography', 'phlogiston physics or 'four elements chemistry'. It is this special pleading for creationism alone out of the myriad other (failed) attempts to model the world throughout history that betrays the existence of deeper reasons behind this misplaced desire for an inappropriate conception of fairness.

Another facet of the bias/fairness argument is that the presentation of alternative explanations in teaching encourages students to develop and exercise the skill of critical thinking when attempting to judge the relative merits of those arguments. However, the development of critical thinking skills does not require the presentation of unsupported or ill-founded ideas, particularly in the early stages of science teaching when a student's discriminatory powers and opportunity for research and evaluation outside of the teacher-led

classroom environment are minimal. There are quite enough active areas of research in which competing models share roughly equivalent levels of evidential support at the present time to serve as examples for this kind of exercise. The basic groundwork of scientific learning (and of the concept of evolution, which is inextricably at the heart of all modern biology) must be laid down in as clear a manner as possible to provide a solid foundation upon which more sophisticated critical evaluation can later be built.

Definition and Re-definition of Terms.

We have already seen that applying the everyday meaning of a term such as 'fairness' in an inappropriate context can be exploited as support for an untenable argument. This same tactic has been applied to the concept of the 'theory' (as will be discussed by Richard Dawkins). It is fundamental to science that a single robust observation that does not fit within the current model of a phenomenon is enough to bring it into question in its current state; and this is true even of models so extensively supported that they are commonly taken as indisputable 'scientific facts' or even as 'laws of nature'. In strict usage, scientists refer to such solid 'facts' as theories, and more tentatively supported ideas (or indeed models not yet tested at all) as hypotheses. However, to much of the general public the words 'theory' and 'hypothesis' are both synonyms for 'guess', implying little if any confidence or support. A scientist is not alarmed to work with the 'theory' of evolution at the level of a 'fact' equivalent in certainty to the 'theory' of gravity - both are models of reality that have been exhaustively tested and have vast, testable predictive power. To members of the public, however, the 'theory of evolution' is a phrase that carries overtones of doubt that are lacking in, for example, the 'law of gravity'. Creationist argument plays upon this misapprehension.

Although the difference between everyday and technical definitions of some words is amenable to exploitation in this debate, there are some precisely defined technical terms that are not so flexible - unless explicitly redefined to suit the interpretation the creationist desires. 'Evolution' itself is such a term. In the modern synthetic theory, evolution is precisely defined as "change of allele frequency in a population with time"; no more or less. This is seldom as the creationist camp presents it.

Philosophical Questions

Creationists deny that their stance is an attempt to promote their philosophical model of the world but insist that the emphasis placed on evolution in biology teaching is just such an attempt. That is, they claim that evolution is preferred for reasons beyond that of its explanatory power or evidential support. There seems to be little grounds for holding such an opinion, unless one posits a grand conspiracy theory among the worlds educators:

"There is no law that mandates the teaching of evolution, and there should not be, yet it is practically universally taught in universities and colleges around the world. The theory of evolution is what is taught because it is what best explains the data in a rational manner." (Berra, 1990: 139-140)

Evolution also stands accused as being part of a scientific framework which is accustomed to acknowledging some entities that are materially inconceivable, such as subatomic particles, but is perceived as rejecting the reality of a similarly inconceivable Creator. The fundamental distinction is that 'materially inconceivable' particles have specific qualities from which one can predict their existence and behaviour, whilst a creator can act arbitrarily, and so cannot be modelled in a mathematically rigorous manner. This makes hypotheses involving electrons falsifiable, but hypotheses involving a mysterious "Creator" unfalsifiable (and therefore unscientific).

Creationism itself when phrased in any falsifiable form *has* already been falsified (although I am sure that many die-hard creationists would argue this point), so the creationists apparently choose to keep it in an unfalsifiable, unscientific form by basing their position on a mixture of the assumption of biblical inerrancy as a source of evidence, and the occasionally subtle misrepresentation of such scientific evidence as is found amenable.

They are also quite willing to adopt essentially philosophical arguments in their turn in the belief that they refute evolution. For example, it is often stated that natural processes cannot be a sufficient cause of human qualities like love: the cause of love must be "something loving". In reply, Michael Shermer asks:

"If [the cause of x must be x-like], should not nature then have a natural cause, not a supernatural cause?!" (Shermer, 1997: 146)

Evolutionary theory as anti-theological.

Biological science, in common with science in general, employs *methodological* naturalism: that is, it explains the natural world with reference to only natural causes and forces rather than supernatural ones. There is another sort of naturalism, *philosophical* naturalism, the belief that there can be no 'supernatural' causes beyond the mundane interactions of matter and energy. The former should not be misrepresented as the latter. Nor should the fact that some biologists are also publicly 'philosophical naturalists' make the science they practice intrinsically atheistic. The same distinction can be drawn between *evolution* the scientific theory, and *evolutionism*, the naturalistic ideology. It is true that some evolutionary biologists are also atheists, but equally there are those who are committed followers of any of the world's religions one might name. An atheistic scientist no more proves science itself to be anti-theist than an atheistic writer demonstrates all literature to be opposed to religious views.

Science does contradict a naively literal interpretation of Genesis (there is good reason to believe that Genesis should be read as allegory rather than a factual account) but it is ridiculous to assert that this makes it 'anti-Bible'. As Carl Sagan wrote:

"Modern Roman Catholicism has no quarrel with the Big Bang, with a Universe 15 billion years or so old, with the first living things arising from prebiological molecules, or with humans evolving from apelike ancestors - although it has special opinions on 'ensoulment'. Most mainstream Protestant and Jewish faiths take the same sturdy position." (Sagan 1995)

Weaknesses in Evolutionary Theory.

Creationists have a well rehearsed list of what they believe are weaknesses in the theory of evolution. Addressing this group of misconceptions (and occasional outright falsehoods) offers the informed author the opportunity to fill several volumes - but such an endeavour is beyond the aims of this present article. The perceived weaknesses considered most damning, as selected by the anti-evolutionists themselves, form the core of the Alabama Insert, and are rebutted at length by Richard Dawkins in the article which follows

this introduction. Tempting as it is to address some of the subsidiary points myself, I am happy to leave it to him to knock down the straw men with which we are presented by the disclaimer and wider creationist contention.

Conclusions: Science Teaching and Creationist Ideas

The anti-evolutionists are clearly aware that their arguments make most impression on those who are ill-equipped to question authoritative assertions, and a significant part of their recent activities have been targeted on children and the educational system that shapes their thought. Having failed to have the teaching of evolution itself banned, the battleground has shifted to that of requiring equal time devoted to evolution and its alternative, creationism. Implicit in this demand are the propositions that creationism is an equally valid competing theory of origins, and that Biblical creationism is the *only* such viable alternative to evolution. It is difficult to see how an assertion that cannot be phrased in a falsifiable form can be called a theory, let alone be taught in the context of science. For a conscientious teacher to try and present both these worldviews as products of the same methodological process, namely science, is simply impossible. Either the requirements of scientific rigour would have to be de-emphasised to such an extent that creationism becomes admissible – at which point the student might justifiably wonder what need there is for 'science' at all, since it is indistinguishable from personal belief - or the teacher would be left trying to defend an indefensible creationist position whose weaknesses have been

thrown into sharp relief by the other aspects of the science syllabus.

Finally, why should we be concerned that science is well taught to everyone, not just the few that will go on to scientific careers? Perhaps Derek J. De Solla Price's observation is relevant:

"Using any reasonable definition of a scientist, we can say that 80 to 90 per cent of all the scientists that have ever lived are alive now. Alternatively, any young scientist, starting now and looking back at the end of his career upon a normal life span, will find that 80 to 90 per cent of all scientific work achieved by the end of the period will have taken place before his very eyes, and that only 10 to 20 percent will antedate his experience" (De Solla Price, 1963, quoted by Shemer, 1997)

This exponential growth in scientific activity shows little sign as yet of slowing down, and the ability to evaluate science and interact with resultant technologies is becoming increasingly vital to everyday life. It is to be feared that the superficial re-marketing of a belief in Biblical creationism as 'valid science' promotes confusion and undermines this increasingly vital skill.

References

- Anderson, N. *The Alabama Insert: A Call for Impartial Science*. <<http://www.arn.org/arn/articles/norrisb/norrisb.htm>> Accessed 17 June 1998.
- Berra, T. M. 1990. *Evolution and the Myth of Creationism*. Stanford: Stanford University Press.
- Sagan, C. 1995. *The Demon-Haunted World: Science As a Candle in the Dark*. London: Headline.
- Shermer, M. 1997. *Why People Believe Weird Things: Pseudoscience, Superstition, and Other Confusions of Our Time*. New York: W. H. Freeman.

THE "ALABAMA INSERT": A STUDY IN IGNORANCE AND DISHONESTY

By Richard Dawkins

This article is a transcript of the Franklin Lecture in Science & Humanities delivered at Auburn University 1 April 1996. It first appeared in the Journal of the Alabama Academy of Science (1997; 68(1) and is reprinted with the kind permission of the author. Please note that the original lecture was illustrated with slides, and it is these that are referred to from time to time in this transcript. Richard Dawkins is Charles Simonyi Professor In the Public Understanding of Science at Oxford University and the author of a number of books on evolution.

As a former prime minister of my country, Neville Chamberlain once said: "I have here a piece of paper." It says "A message from the Alabama State Board of Education." This is a flier that is designed to be - ordered to be - stuck into the front of every textbook of Biology used in the public schools. What I thought I would do, with your permission, is to depart from the prepared text I brought with me. Instead I should like to go through every sentence of this document, one by one.

"THIS TEXTBOOK DISCUSSES EVOLUTION, A CONTROVERSIAL THEORY THAT SOME SCIENTISTS PRESENT AS A SCIENTIFIC EXPLANATION FOR THE ORIGIN OF LIVING THINGS SUCH AS PLANTS, ANIMALS, AND HUMANS."

This is dishonest. The use of "some scientists" suggests the existence of a substantial number of respectable scientists who do not accept evolution. In fact, the proportion of qualified scientists who do not accept evolution is tiny. A few so called "creation scientists" are much touted as possessing PhDs, but it does not do to look too carefully where they got their PhDs from nor the subjects they got them in. They are, I think, never in relevant subjects. They are in subjects perfectly respectable in themselves, like marine engineering or chemical engineering, which have nothing to do with the matter at hand.

"NO ONE WAS PRESENT WHEN LIFE FIRST APPEARED ON EARTH"

Well, that is true.

"THEREFORE, ANY STATEMENT ABOUT LIFE'S ORIGINS SHOULD BE CONSIDERED AS THEORY, NOT FACT."

That's also true but the word theory is being used in a misleading way. Philosophers of science use the word theory for pieces of knowledge that anybody else would call fact, as well as for ideas that are little more than a hunch. It is strictly only a theory that the earth goes around the sun. It is a theory but it's a theory supported by all the evidence. A fact is a theory that is supported by all the evidence. What this is playing upon is the ordinary language meaning of theory which implies something really pretty dubious or which at least will need a lot more evidence one way or another.

For example, nobody knows why the dinosaurs went extinct and there are various theories of it which are interesting and for which we hope to get evidence in the future. There's a theory that a meteorite or comet hit the earth and indirectly caused the death of the dinosaurs. There's a theory that the dinosaurs were killed by competition from mammals. There's a theory that they were killed by viruses. There are various other theories and it is a genuinely open question which (at the time of speaking) we need more evidence to decide. That is also true of the origin of life, but it is not the case with the theory of evolution itself. Evolution is as true as the theory that the world goes around the sun.

While talking about the theories of the dinosaurs I want to make a little aside. You will sometimes see maps of the world in which the places where people speak different languages are shaded. So, you'll say, "English is spoken here," "Russian is

spoken there," "French is spoken here, etc." And that's fine; that's exactly what you would expect because people speak the language of their parents.

But imagine how ridiculous it would be if you could construct a similar map for theories of, say, how the dinosaurs went extinct. Over here they all believe in the meteorite theory. Over on that continent they all believe the virus theory, down here they all believe the dinosaurs were driven extinct by the mammals. But if you think about it that's more or less exactly the situation with the world's religions.

We are all brought up with the religion of our parents, grandparents and great-grandparents and by golly that just happens to be the one true religion. Isn't that remarkable! Creation myths themselves are numerous and varied. The creation myth that happens to be being taught to the children of Alabama is the Jewish creation myth which in turn was taken over from Babylonian creation myths and was first written down not very long ago when the Jews were in captivity. There's a tribe in West Africa that believes that the world was created from the excrement of ants. The Hindus, I am told, believe that the world was created in a cosmic butter churn. No doubt every tribe and every valley of New Guinea has its own origin myth. There is absolutely nothing special about the Jewish origin myth, which is the one we happen to have in the Christian world.

Moving on in the "Alabama Insert" as I shall call it.

"THE WORD 'EVOLUTION' MAY REFER TO MANY TYPES OF CHANGES. EVOLUTION DESCRIBES CHANGES THAT OCCUR WITHIN A SPECIES (WHITE MOTHS, FOR EXAMPLE, MAY "EVOLVE" INTO GRAY MOTHS). THIS PROCESS IS CALLED MICROEVOLUTION WHICH CAN BE OBSERVED AND DESCRIBED AS FACT. EVOLUTION MAY ALSO REFER TO CHANGES OF ONE LIVING THING INTO ANOTHER SUCH AS REPTILES CHANGING INTO BIRDS. THIS PROCESS CALLED MACROEVOLUTION HAS NEVER BEEN OBSERVED AND SHOULD BE CONSIDERED A THEORY."

The distinction between microevolution and macroevolution is becoming a favorite one for creationists. Actually, it's no big deal. Macroevolution is

nothing more than microevolution stretched out over a much greater time span.

The moth being referred to, I presume, is the famous peppered moth, *Biston betularia*, studied in England by my late colleague Bernard Kettlewell. It is a famous story about how, in the Industrial Revolution when the trees went black from pollution, the peppered pale colored version of this moth was eaten by birds because it was conspicuous against the black tree trunks. After the Industrial Revolution years, the black moths became by far the majority in industrial areas of England. But if you go into country areas where there is no pollution, the original peppered variety is still in a majority. I presume that's what the document is referring to.

The point about that story is that it's one of the few examples we know of genuine natural selection in action. We are not normally privileged to see natural selection in action because we don't live long enough. The Industrial Revolution, however unfortunate it may have been in other respects, did have the fortunate by-product of changing the environment in such a way that you could study natural selection.

To study other examples of natural selection I recommend the book *The Beak of the Finch* by J. Weiner. He is describing the work of Peter and Rosemary Grant on the Galapagos finches. Those finches, perhaps more than any other animal, inspired Charles Darwin himself. What the Grants have done studying Galapagos Island finches is actually to sample populations from year to year and show that climatic changes have immediate and dramatic effects on the population ratios of various physical structures such as beak sizes.

Darwin was inspired by the example of the Galapagos finches; he was also inspired by the examples of domestication.

These are all domestic dogs (Slide 1) except the top one which is a wolf. The point of it is, as observed by Darwin, how remarkable that we could go by human artificial selection from a wolf ancestor to all these breeds - a Great Dane, a Bulldog, a Whippet, etc. They were all produced by a process analogous to natural selection - artificial selection. Humans did the choosing whereas in natural selection, as you know, it is nature that does the choosing. Nature selects the ones that survive and are good at reproducing, to leave their genes behind. With artificial selection, humans do the

choosing of which dogs should breed and with whom they should mate.

These plants (Slide 2) are all members of the same species. They are all descended quite recently from the wild cabbage *Brassica oleracea* and they are very different: cauliflower, brussels sprouts, kale, broccoli, etc. This great variety of vegetables, which look completely different, has been shaped - they have been sculpted - by the process of artificial selection from the same common ancestor.

That's an example of what can be achieved in a few centuries when the selection is powerful enough. When the selection goes on for thousands of centuries the change is going to be correspondingly greater - that's macroevolution. It's just microevolution going on for a long time.

It's difficult for the human mind to grasp how much time geology allows us, so various picturesque metaphors have been developed. The one I like is as follows: I stand with my arm outstretched and the distance from the center of my tie to my fingers represents the total time available since life began. That's about four thousand million years. Out to about my shoulder we still get nothing but bacteria. At my elbow you might be starting to get slightly more complicated cells - eukaryotic cells - but still single cells. About mid-forearm you start getting multicellular organisms, animals you can see without a microscope. At my palm you would get the dinosaurs. Somewhere toward the end of my finger you would get the mammals. At the beginning of my nail you would get early humans. And the whole of history - all of documented written human history, all the Babylonians, Biblical history, Egyptians, the Chinese, the whole of recorded history would fall as the dust from a nail file across the tip of my furthest finger.

This is hard for the human brain to grasp, time spans of that order. Remember that the time represented by the dust from the nail includes the time it took these cabbage varieties to evolve by artificial selection (human selection) and dogs to evolve from wolves. Just think how much change could be achieved by natural selection during the thousands of millions of years before recorded history.

To reinforce that point there was a theoretical calculation made by the great American botanical evolutionist, Ledyard Stebbins. He wanted to calculate theoretically how long it would take to evolve from a tiny

mouse sized animal (ancestor) to a descendant animal the size of an elephant. So what we are talking about is a selection pressure for increased size. Selection pressure means that in any generation slightly larger than average individuals have a slight advantage. They are slightly more likely to survive for whatever reason, slightly more likely to reproduce. Stebbins needed a number to represent that selection pressure, a way to show how strong to assume it to be. He decided to assume it (the pressure) to be so weak that you couldn't actually detect it if you were doing a field study out there trapping mice.

So Stebbins assumed his theoretical selection pressure to be so weak that it is undetectable, it vanishes in the sampling error of an ordinary research study. Nevertheless it's there. How long would it take under this small but relentless pressure for these mouse-like animals to grow and grow over the generations until they became the size of an elephant? He concluded that it would take about 20,000 generations. Well, mouse generations would be several in a year, elephant generations would take several years. Let's compromise and assume one year per generation. Even at 5 years per generation, that's not many years, say 100,000 years at the most. Well, 100,000 years is too short to be detected on the geological time scale for most of geologic history.

For most characteristics a selection pressure as weak as that, so weak that you couldn't even measure it, is sufficiently strong as to propel evolution so fast that it appears to be instantaneous on the geological time scale. In practice it probably isn't even as fast as that, but geological time is so vast that there is plenty of time for the evolution of all of life to have happened.

Another theoretical calculation was made by the Swedish biologist, Dan Nilsson. He took up the question which Darwin himself was interested in - the eye, the famous eye, the darling of creationist literature. Darwin himself recognized the eye as a difficult case because it is very complicated. Many people have thought, wrongly, that the eye is a difficult problem for evolutionists because - "Doesn't it have to be all there with all the bits working for the thing to work?"

No. Of course they don't all have to be there. An animal that has half an eye can see half as well as an animal with a whole eye. An animal with a quarter eye has a quarter vision. An animal with 1/100 eye has

1/100 quality vision. It's not quite as simple as that. The point I am making is that you can be aided in your survival by every little tiny increment in quality of eyesight. If you have 1/100 quality eyesight, you can't see an image but you can see light and that might be useful. The animal might be able to tell which direction the light is coming from or which direction a shadow is coming from which could portend a predator. There are all sorts of things you could do that help you to survive if you have a small fraction of an eye, to survive better than an animal which has no eye at all. With 1/100 of an eye you can just about survive. With 2/100 of an eye you can survive a little better. There is a slow, gradual ramp of increasing probability of surviving as the eye gradually gets better.

Going back to the question of the rate at which all this happens, Nilsson did a computer modeling exercise of the evolution of the eye (Slide 3). He starts from a computer model which is not really eye shaped at all but is just a flat sheet of light sensitive cells. You've got to start somewhere. You could start before that if you wanted to, but that's where he started. He made the computer gradually change the shapes of this model eye. The only rule was that the changes had to be small and each change had to result in an improvement in vision. The beautiful thing about the eye is that by using the actual rules of physics, the ordinary rules of optics, you can calculate how good each of the hypothetical intermediates would be at forming an image.

These intermediates all formed spontaneously in the computer as a result of gradual improvement in what the computer could measure as the optical quality of the model eye, and it goes all the way from a flat sheet of cells to a proper camera eye with a lens such as you might see in a fish. It is even better than that. The exact focusing of the lens is precisely as it should be. The details of this are written down in Nilsson's paper. By feeding in assumptions which are based upon field work in population genetics he was able to make calculations as to how long it would plausibly take under realistic conditions of natural selection. This is similar to the Stebbins calculation of how long it would take to go from the start of the series to the end. Once again it was startlingly fast. Nilsson calculated that it would take fewer than half a million generations. The sort of small animals we are talking about, in which the eye originally evolved, would probably have had about 1

generation/year. Half a million years is a very short time on the geologic time scale.

Therefore, it's not surprising that when you look around the animal kingdom you find all the intermediates you could wish for in the evolution of the eye, in various groups of worms, etc. The eye has evolved no less than 40 times independently around the animal kingdom, and possibly as many as 60 times. So, "the" eye is really some 40-60 different eyes and it evolves very rapidly and exceedingly easily. There are 9 different optical principles that have been used in the design of eyes and all 9 are represented more than once in the animal kingdom.

"EVOLUTION ALSO REFERS TO THE UNPROVEN BELIEF THAT RANDOM, UNDIRECTED FORCES PRODUCED A WORLD OF LIVING THINGS. "

Where did this ridiculous idea come from that evolution has something to do with randomness? The theory of evolution by natural selection has a random element -- mutation - but by far the most important part of the theory of evolution is non-random: natural selection. Mutation is random. Mutation is the process whereby parent genes are changed, at random. Random in the sense of not directed toward improvement. Improvement comes about through natural selection, through the survival of that minority of genes which are good at helping bodies survive and reproduce. It is the non-random natural selection we are talking about when we talk about the directing force which propels evolution in the direction of increasing complexity, increasing elegance and increasing apparent design.

The statement that "evolution refers to the unproven belief that random undirected forces. . ." is not only unproven itself, it is stupid. No rational person could believe that random forces could produce a world of living things.

Fred Hoyle, the eminent British astronomer who is less eminent in the field of biology, has likened the theory of evolution to the following metaphor: "it's like a tornado blowing through junk yard and having the luck to assemble a Boeing 747. " His statement is a classic example of the erroneous belief that natural selection is nothing but a theory of chance. A 'Boeing 747' is the end product that any theory of life must explain. The riddle for any theory to answer is, "how do you get complicated, statistically improbable apparent

design? " Darwin's theory of evolution by natural selection is the only known theory that can answer this riddle. It is also supported by a great deal of evidence. With his explanation Darwin, in effect, smears out the chance or "luck" factor. There is luck in the theory, but the luck is found in small steps. Each generational step in the evolutionary process is only a little bit different from the step before. These little bits of difference are not too great to come about by chance, by mutation. However if, after the accumulation of a sufficient number of these small steps (perhaps 100), one after the other, you've got something like an eye at the end of this process, it could not have come all of a sudden by chance. Each individual step could occur by chance, but all 100 steps together could not. All 100 steps are pieced together cumulatively by natural selection.

Another metaphor along these lines is of a bank robber who went into a bank and started fiddling with the combination lock on the safe. Theoretically the thief could fiddle with the lock and have the luck to open the safe. Of course you know in practice he couldn't do that. That's why your money is safe in the bank. But just suppose that every time you twiddled that knob and got a little bit closer to the correct number, a one dollar bill fell out of the safe. Then when you twiddled it another way and got a little closer still, another dollar fell out. You would very rapidly open the safe. It's like that with natural selection. Each step has a little bit of luck but when the steps are put together you end up with something that looks like a 'Boeing 747'.

"THERE ARE MANY UNANSWERED QUESTIONS ABOUT THE ORIGIN OF LIFE WHICH ARE NOT MENTIONED IN YOUR TEXTBOOK INCLUDING: WHY DID THE MAJOR GROUPS OF ANIMALS SUDDENLY APPEAR IN THE FOSSIL RECORD KNOWN AS THE "CAMBRIAN EXPLOSION."

We are very lucky to have fossils at all. After an animal dies, many conditions have to be met if it is to become a fossil, and one or other of those conditions usually is not met. Personally, I would consider it an honor to be fossilized but I don't have much hope of it. If all the creatures which had ever lived had in fact been fossilized we would be wading knee deep in fossils. The world would be filled with fossils. Perhaps it is just as well that it hasn't happened that way.

Because it is particularly difficult for an animal without a hard skeleton to be fossilized, most of the

fossils we find are of animals with hard skeletons - vertebrates with bones, mollusks with their shells, arthropods with their external skeleton. If the ancestors of these were all soft and then some offspring evolved a hard skeleton, the only fossilized animals would be those more recent varieties. Therefore, we expect fossils to appear suddenly in the geologic record and that's one reason groups of animals suddenly appear in the Cambrian Explosion.

There are rare instances in which the soft parts of animals are preserved as fossils. One case is the famous Burgess Shale which is one of the best beds from the Cambrian Era (between 500 million and 600 million years ago) mentioned in this quotation. What must have happened is that the ancestors of these creatures were evolving by the ordinary slow processes of evolution, but they were evolving before the Cambrian when fossilizing conditions were not very good and many of them did not have skeletons anyway. It is probably genuinely true that in the Cambrian there was a very rapid flowering of multicellular life and this may have been when a large number of the great animal phyla did evolve. If they did, their essential divergence during a period of about 10 million years is very fast. However, bearing in mind the Stebbins calculation and the Nilsson calculation, it is actually not all that fast. There is some recent evidence from molecular comparisons among modern animals which suggests that there may not have been a Cambrian explosion at all, anyway. Modern phyla may well have their most recent common ancestors way back in the Precambrian.

As I said, we're actually lucky to have fossils at all. In any case, it is misleading to think that fossils are the most important evidence for evolution. Even if there were not a single fossil anywhere in the earth, the evidence for evolution would still be utterly overwhelming. We would be in the position of a detective who comes upon a crime after the fact. You can't see the crime being committed because it has already happened. But there is evidence lying all around. To pursue any case, most detectives and most courts of law are happy with 2-3 clues that point in the right direction.

Even discounting fossils, the clues that are left for us to see that prove the truth of evolution are numbered in the tens of millions. The number of clues, the sheer weight of evidence, totally and utterly,

sledgehammeringly, overwhelmingly strongly supports the conclusion that evolution is true - unless you are prepared to believe the Almighty deliberately faked the evidence in order to make it look as though evolution is true. (And there are people who believe that.)

The evidence comes from comparative studies of modern animals. If you look at the millions of modern species and compare them with each other - looking at the comparative evidence of biochemistry, especially molecular evidence - you get a pattern, an exceedingly significant pattern, whereby some pairs of animals like rats and mice are very similar to each other. Other pairs of animals like rats and squirrels are a bit more different. Pairs like rats and porcupines are a bit more different still in all their characteristics. Others like rats and humans are a bit more different still, and so forth. The pattern that you see is a pattern of cousinship; that is the only way to interpret it. Some are close cousins like rats and mice; others are slightly more distant cousins (rats and porcupines) which means they have a common ancestor that lived a bit longer ago. More distinctly different cousins like rats and humans had a common ancestor who lived a bit longer ago still. Every single fact that you can find about animals is compatible with that pattern.

Similarly you can look at the geographical distribution of an animal species. Why do animals in the Galapagos Islands more closely resemble animals on neighboring islands and resemble less the animals on the mainland? It's all exactly what you would expect if evolution goes on in isolation on islands with occasional island hopping. New foci for evolution start with migration from mainland to island and then progress from there to other islands.

If you look at the imperfections of nature you see evidence for evolution. Slide 4 shows animals that don't necessarily fly but are at plausible intermediate stages on the way to flight. These stages are relevant to the discussion of what's the use of half an eye or what's the use of half a wing. These animals all glide and by gliding save themselves from falling out of trees.

There are two different ways of being a flat fish. The top fish in Slide 5 is a skate; the bottom one is a flounder. The skate is flat the way a designer might have designed: flattened out on its belly as symmetrically as it can be. The flounder is not symmetrical because when its ancestors went flat they lay on their side, their right side. That meant that the

right eye was looking down into the bottom of the sea (not good). Over many generations, natural selection favored the migration of the right eye from the underside to the top. The whole skull became distorted in an interesting way - no designer would ever have built a fish like that. The flounder has its history written all over it. Its ancestors were once free swimming in the normal way, like a trout or a salmon, and then over many generations changed into a flat fish.

"WHY HAVE NO NEW MAJOR GROUPS OF LIVING THINGS APPEARED IN THE FOSSIL RECORD FOR A LONG TIME?"

We are moving well down the list of the Alabama State Board of Education. In zoology, "major groups" would be called phyla - a phylum being a category such as mollusks, which includes snails and shellfish; echinoderms, which are starfish, sea urchins and so on; chordates, which are animals with spinal cords, including ourselves; arthropods which include insects and crustaceans. The question is, "Why have no major ones appeared in a long time?"

Well, major groups don't and shouldn't, according to the Darwinian Theory, just appear. They evolve gradually. Major phyla are different from each other, though ancestrally they were like brothers. They diverged and became separate species, then separate families, then separate orders. It takes time to do that.

Think of this analogy. Suppose you have a great oak tree with huge limbs at the base and smaller and smaller branches toward the outer layers where finally there are just lots and lots of little twigs. Obviously the little tiny twigs appeared most recently. The larger boughs appeared a long time ago and when they did appear, they were little twigs. What would you think if a gardener said, "Isn't it funny that no major boughs have appeared on this tree in recent years, only small twigs?" You'd say he is stupid.

"WHY DO MAJOR NEW GROUPS OF PLANTS AND ANIMALS HAVE NO TRANSITIONAL FORMS IN THE FOSSIL RECORD."

It's amazing how often this is stated in the creationist literature. It's amazing because it simply isn't true. There are plenty of transitional forms. There are gaps, of course, for reasons I have stated - not all animals fossilize. But what is significant is that not a single fossil has turned up in the wrong place. Fossils

are all in the right order. Creationists know that fossils all appear in the right order and it is quite an embarrassment for them. The best explanation they have come up with so far is based on Noah's flood. They say that when the great flood came the animals all rushed for the hills. The clever ones all got to the top of the hill while the stupid ones were stuck at the bottom and that's why the fossils are all neatly laid out in just the right order!

Part of the error about transitional forms may come from a misreading of a theory by my colleagues Niles Eldredge and Stephen J. Gould. Their theory is called 'punctuated equilibrium'. It is really about rapid gradualism or, to say it another way, gradual change that occurs rapidly separated by periods of stasis when nothing changes at all. Eldredge and Gould are rightly annoyed about the misuse of their idea by creationists, who in my terminology, think punctuated equilibrium is about huge Boeing 747 type mutations. I quote Stephen Gould, "We proposed punctuated equilibrium to explain trends; it is infuriating to be quoted again and again, whether through design or stupidity I do not know, as admitting 'the fossil record includes no transitional forms'. Transitional forms are generally lacking at the species level but they are abundant between larger group forms." Dr. Gould goes on, "I am both angry at and amused by the creationists and mostly I am deeply sad."

Finally, there is a semantic point about transitional forms. Zoologists, when they classify, are forced by the rules of the game to put each specimen in one species or another. In the classification business we are not allowed to say, "Well this is half-way between *Homo sapiens* and *Homo erectus*". People who dig up human fossils will always be forced to choose between one or the other. Is it *Homo erectus* or archaic *Homo sapiens*? It is forced to be one or the other. Given this definition, it is almost a legalistic point that fossils have got to be classified as one or the other. The analogy I'd offer is this. When you reach the age of majority - legal age - of 18 in Alabama you can vote. So, at the stroke of midnight on your eighteenth birthday you become an adult. Suppose somebody were to say, "Isn't it remarkable, there are no intermediates between children and adults?" That would be ridiculous.

"HOW DID YOU AND ALL LIVING THINGS COME TO POSSESS SUCH A COMPLETE AND COMPLEX

SET OF INSTRUCTIONS FOR BUILDING A LIVING BODY."

The set of instructions is our DNA. We got it from our parents and they got it from their parents. We can all look back through the generations, through 4000 million years to a tiny bacterium who lived in the sea and was the ancestor of us all. We are all cousins.

We can all look back at our ancestors and claim (it's a proud claim) we are all descended from the elite. Not a single one of my ancestors died in infancy; they all reached adulthood. Not one of my ancestors failed to achieve at least one heterosexual copulation. All our ancestors were good at surviving and reproducing. We are descended from an elite.

Thousands of our ancestors' contemporaries failed. None of our ancestors did. Our DNA is DNA that has come down through thousands of millions of successful ancestors. We have inherited DNA that is pretty good at the job of surviving and, when DNA survives, it programs bodies to be good at surviving and reproducing. The world is bound to become filled with DNA that is good at surviving and reproducing. The DNA that is alive today has survived thousands of filters. Millions of generations of ancestors that survived as a consequence of the efficient programming of their DNA, have produced an unbroken lineage. There is more to it than that. Evolution is progressive - not all the time, not uniformly - but generally it is progressive. Lineages become progressively better at what they do. Predators get better at catching prey. They have to because prey become better at getting away from predators. Just as in the human arms race there must be advances on one side to counterbalance advances on the other side.

Just a few examples of animals I would consider to be at the end of an arms race are: butterflies and leaf-insects (related to stick insects) that look exactly like leaves; and bugs that look like rose thorns and sit on rose stems. All of these are the result of generations of natural selection in which predators have been put off eating the ancestors of these insects. The ancestors that look most like leaves or rose thorns were the least likely to end up in predators' bellies.

The leafy sea dragon is a fish, related to sea horses. It has 'fronds' that look exactly like seaweed for camouflage. This constitutes the end of an arms race in which fish that did not look like seaweed were eaten, whereas fish that did look like seaweed swam on to reproduce another day.

It's not all just survival, it's also winning mates. Birds of paradise are brightly colored because that's what females like. Genes that make pretty males are more likely to get mates and have children. This is an arms race between the salesmanship of males and the sales resistance of females.

Finally, one of the most rapid and dramatic stories of evolution -- the evolution of the human brain from the brain of ape-like ancestors. The human brain constitutes the major difference between us and our close cousins, the great apes. Fossil evidence shows that our brain has blown up like a balloon during the last 2 or 3 million years as our evolution passed through the ancestral stage *Australopithecus*, *Homo erectus* and finally *Homo sapiens*. No one knows why the human brain blew up in this way. I suspect again it was like some kind of arms race - some kind of positive feedback.

"STUDY HARD AND KEEP AN OPEN MIND. SOMEDAY YOU MAY CONTRIBUTE TO THE THEORIES OF HOW LIVING THINGS APPEARED ON EARTH."

Well, at last we have found something we can agree with. This seems to me to be an admirable sentiment. I really have less trouble than some of my colleagues with so-called creation science being taught in the public schools as long as evolution is taught as well. By all means let creation science be taught in the schools. It should take all of about 10 minutes to teach it and then children can be allowed to make up their own minds in the face of evidence. For children who study hard and keep an open mind, it seems to me utterly inconceivable that they could conclude anything other than that evolution is true.

The Monstrous Myth at Loch Ness

By Stuart Campbell

This article is a revised version of an article which originally appeared in The British & Irish Skeptic (Vol 1, No. 3), May/June 1987. Stuart Campbell is a science writer and the author of The Loch Ness Monster: The Evidence (Edinburgh: Birlinn Ltd, 1996). He is also the author of The UFO Mystery Solved (Edinburgh: Explicit Books, 1994) and The Rise and Fall of Jesus (Edinburgh: Explicit Books, 1996). He has written many articles on unusual phenomena and mysteries and is a member of ASKE.

In 1933 the world learned of the belief that 'a fearsome-looking monster' had 'for generations' inhabited Loch Ness. In fact nearly every Highland lake was believed to be inhabited by a 'water horse' or 'kelpie', an evil spirit which lured travellers to their death by drowning and came from that mirror world below the surface. It usually took the form of a horse. Naturally, because it was such a large lake, Loch Ness was inhabited by 'The Great Kelpie' (Grimshaw and Lester 1976).

But now, perhaps in an attempt to modernise the myth, the spirit was incarnated in what the local water bailiff likened to a plesiosaur. Furthermore it had been seen cruising at the surface making a huge wash.

Surely this was the zoological find of the century, or any century (Inverness Courier 1933).

It is curious therefore that, over the subsequent decades and despite the strenuous efforts of individuals and teams, no reliable evidence for the Monster's existence has appeared.

Nessie buffs point to the existence of numerous photographs, taken both above and below water, a famous cine film and many sonar contacts as proof of Nessie's existence. However, when subjected to close scrutiny, all this so-called evidence crumbles to dust. It can be shown that all the still photographs are either hoaxes or pictures of conventional objects or phenomena, sometimes both. The first photograph

alleged to show Nessie (taken by Hugh Gray in 1933) is actually a blurred picture of a dog swimming with a stick in its mouth. The famous 'Surgeon's Photograph' (1934), which is repeatedly used to illustrate books and articles (as the definitive picture), can be shown to be of an object less than one metre high about 30 m or less from the camera (Campbell 1984). It has lately been alleged that it shows a neck constructed on a small model submarine (Langton 1994a and 1994b; Boyd and Martin 1994). Most of the above-water still pictures are hoaxes, perhaps produced in answer to prizes offered by the popular press.

It is less easy to fake cine film and buffs have long exhibited Tim Dinsdale's 1960 film as prime evidence. Their case was strengthened in 1966, when the RAF's photographic interpretation unit (JARIC) unofficially endorsed the film: they concluded that it 'probably' shows an animate object (see Loch Ness Investigation Bureau 1966 and the appendix to Costello 1974; but note that both contain transcription errors). This endorsement went unchallenged until 1986, when I showed that JARIC had made a fundamental error. They had assumed that the film was taken as one continuous sequence; their conclusion was based solely on the 'fact' that the unknown blob was moving too fast for it to be a powered dinghy (the only alternative explanation). They did not know that Dinsdale had exposed the film in short bursts, stopping occasionally to wind the camera's clockwork motor. Consequently, JARIC assumed an incorrect (shortened) time scale; when the correct scale is restored, the object is found to be moving at exactly the speed of a powered dinghy, which is what it was. Moreover, there was evidence that a local farmer habitually crossed the lake in such a dinghy at about the time Dinsdale took his film (Campbell 1986).

Another film was taken in 1977 by Gwen Smith. She and her husband saw a strange pole-like object rise and fall several times about 160 m away along the shore opposite Urquhart Castle. Coincidentally two Yorkshire schoolboys were in the same area, conducting (so they claimed) a school project. It is suspected that they had rigged their 'fishing line' so that it could raise or lower a log or post out in the water. It appears that the Smiths were the innocent victims of a hoax, but it was never admitted.

Because the results of above water photography were disappointing, many had high

expectations of the underwater flash photography undertaken by the Academy of Applied Science (AAS) from New England. In 1972 this organisation obtained two pictures which, when subjected to computer processing, appeared to show the diamond-shaped limb of a large creature. It is alleged that, at the same time, sonar showed the presence of large animals near the camera (although no evidence for simultaneity has been published). Doubt has since been cast on the legitimacy of these pictures: there is evidence that the prime enhancements do not show such limbs and the AAS has not fully detailed the process by which the pictures were obtained. The original (unenhanced) pictures appear to show debris on the bottom of Urquhart Bay caught in the flash as the cameras and its support boat drifted shorewards.

It is certain that further pictures obtained by the AAS in 1975 *do* show bottom debris. Subsequent investigation has shown that the camera rig must have touched bottom and rolled as its support boat was driven ashore by the wind. The AAS has not published computer enhancements of these pictures. Significantly, when, in 1972 and 1975, the AAS deployed their cameras on a secure mounting, they had no success (see Rines et al 1976; Demak 1984; and Razdan and Kielar 1984-85 on the AAS investigations).

Sonar is a tool that ought to be able to locate Nessie. However, the use of sonar in lakes is fraught with problems that do not arise in the open sea. The steep underwater walls on Loch Ness produce anomalous echoes and the sonar side-lobes produce signals that mingle with the main signal. Also, the thermocline between the warmer surface water and the deep cold water, causes refraction of the sonar signal and changes its direction. Nor have all the operators been expert with the apparatus they have used (Creasy 1977). The crews of several fishing boats have thought they detected Nessie and, once, a sonar hoax was perpetrated.

In 1972, the AAS thought that they had caught Nessie in a sonar beam aimed horizontally towards the boat carrying their camera rig. In fact the 'Monster' trace was caused by the boat itself and an overlaid second-time return from the bed of Urquhart Bay! They made similar mistakes in 1976, even when the sonar apparatus was firmly fixed (Klein and Finkelstein 1976).

Much was made in 1968 of the results obtained by the University of Birmingham, who were testing a

digital sonar system (Tucker and Braithwaite 1969; Tucker and Creasey 1970). Too late they discovered that some anomalous returns (which they had light-heartedly suggested might be Nessie) were due to strong refraction in the thermocline. The bottom of the lake was appearing in mid water!

Not only have photography and sonar produced no evidence for the existence of Nessie, searchers of the bottom of the lake have found no remains of the creatures who must have died there in the last ten thousand years. The need for a viable breeding population of monsters is another obstacle to belief (Sheldon and Kerr 1972; Sagan 1976); if there is not one but a herd, how come they are seen so rarely?

Because Loch Ness was filled by a glacier until the end of the last glaciation, it is obvious that any Monsters there now must have entered from the sea. But that supposes that Nessie's ancestors lived in the open sea 10,000 years ago and probably live there still. But there is no evidence of such creatures in the open seas (sea monsters appear to have gone out of fashion). It also assumes that, at one time, Loch Ness was an arm of the sea (a sea loch). But bottom cores show no evidence of this and it is now generally agreed that Loch Ness has always been a fresh-water lake (Shine n.d.). While sea level has risen, the land has also risen.

It is sometimes suggested that Monsters got into (or still get into) Loch Ness via a tunnel connecting it to the sea, or indeed to other Scottish lakes where Monsters are reported (this begs the questions of the existence of Monsters in the seas and how such a tunnel could have been created). This desperate idea fails to take account of the fact that the surface of Loch Ness is 16 metres above sea level: any tunnel would drain it down to sea level! It also ignores the lake's glacial origin, which is inconsistent with caves and tunnels (none are known underwater).

Faced with the failure of instrumentation to show Nessie, buffs point to the mass of eye-witness testimony. Surely, they say, all these witnesses cannot be wrong or mistaken. In fact they can, and they are. No one visiting Loch Ness can be unaware of the myth; nor can they avoid the mindset which predisposes them to see some evidence of Nessie's existence. Stimuli that, in other circumstance and in other places, would be attributed to innocent animals, objects or phenomena, are seen at Loch Ness as manifestations

of the Monster. Most of the witnesses and even many buffs are ignorant of the way in which human perception operates. They do not know that (generally) we see what we expect to see and that, faced with an anomalous stimulus, we will interpret it in terms of the current paradigm. At Loch Ness there is a powerful paradigm of a monstrous aquatic creature. It influences all anecdotal reports, making them practically useless. That is why instrumental evidence is preferable; instruments have no prejudices.

The simplest explanation for the repeated failure to obtain instrumental evidence for Nessie is that she does not exist. That would explain why the determined efforts of the Loch Ness Investigation Bureau brought no success. In 1962 a team of students from the University of Cambridge demonstrated that no monsters live in Loch Ness. Using several boats, they 'swept' the lake from end to end with a sonar 'curtain' that either had to record monsters as it passed or force them to one end where they could be discovered. Nothing was found (Baker and Westwood 1962). A similar sweep by the Loch Ness and Morar Project ('Operation Deepscan') in 1987 was also unsuccessful.

But if Nessie does not exist, what is the cause of the repeated eyewitness reports? Some are reports of animals. Many of the reports are of a creature which closely resembles an otter (except for size). Since otters do inhabit Loch Ness and since they are rarely observed, it may be concluded that these reports really are of otters, but with the size exaggerated. Isolated wakes are almost certainly due to otters, who can swim underwater for several minutes. One notorious report was caused was a young deer, leading to the belief that Nessie has horns.

Since Loch Ness is part of the Caledonian Canal system, it is sometimes traversed by large and powerful boats. These produce strong wakes which are especially evident in calm weather when the water surface is smooth. These wakes travel great distances and can be reflected by the steep shores so that they break as they encounter the vessel's screw wake. In the 1930s, the Canal was used to convey heavy traffic and passengers which today travel by road. The crews of several vessels reported being followed by what they thought was an enormous creature. Alternatively two opposing reflected wakes can meet to produce interference effects (alternate humps and dips) which must travel parallel to the course of the vessel, although

a long way behind. Moreover the two wakes pass through the interference enhanced, as if they were the result and not the cause of the disturbance. Observers can be forgiven for mistaking this phenomenon for Nessie. In 1992 a tourist at Urquhart Castle videoed an interference wave which rolled over and over in the same spot. Wakes and disturbances will also break in the shallows of the lake where observers often see a sudden and apparently mysterious upsurge of water. With no vessel insight, it is understandable that such events will be interpreted as evidence for the Monster.

Once it was generally believed that a large aquatic species lives in Loch Ness, it was inevitable that reports of such a creature would be received. Such reports then reinforce the myth, guaranteeing further reports. Ignorant of the tricks that Loch Ness can play, observers under the influence of the myth are bound to see Nessie in every anomalous stimulus. It is even likely that reports of monsters in other Scottish lakes, and in lakes in other parts of the world, have been generated by the Loch Ness myth, or at least by similar phenomena. Loch Ness has not spawned a Monster, but it has spawned a monstrous myth.

References

- Baker, P. and Westwood, M. 1962. Sounding out the monster. *The Observer*, 26 August 1962.
- Boyd, A. and Martin, D. 1994. Creating a monster. *BBC Wildlife*. April 1994: 22-23.
- Campbell, S. 1984. The Surgeon's Monster Hoax. *British Journal of Photography*, 131: 402-405 & 410.
- Campbell, S. 1986. Monster or boat? *Photographic Journal*, 126(2): 54-58.
- Costello, P. 1974. *In Search of Lake Monsters*. London: Garnstone Press. Reprinted by Panther. 1975.
- Creasey, D. J. 1977. On the use of sonar in Loch Ness searches. *Progress in Underwater Science*, 2: 91-98 (see also discussion at pp 100-102).
- Demak, R. 1984. The (Retouched) Loch Ness Monster. *Discover*, 5(9): 6.
- Grimshaw, R. and Lester P. 1976. *The Meaning of the Loch Ness Monster*. Birmingham: Centre for Contemporary Cultural Studies, University of Birmingham.
- Inverness Courier. 1933. From a Correspondent. *Inverness Courier*, 2 May 1933.
- Klein, M. and Finkelstein, C. 1976. Sonar serendipity in Loch Ness. *Technology Review*, 79(2): 44-57.
- Langton, J. 1994a. Revealed: the Loch Ness picture hoax. *The Sunday Telegraph*, 13 March 1994: 1.
- Langton, J. 1994b. 'Nessie and a big-game hunter's monster ego'. *The Sunday Telegraph*, 13 March 1994: 3.
- Loch Ness Investigation Bureau. 1966. *Report on a film taken by Tim Dinsdale* [Leaflet]. Loch Ness Investigation Bureau.
- Razdan, R and Kielar, A. 1984-85. Sonar and photographic searches for the Loch Ness Monster: a reassessment. *Skeptical Inquirer*, 9: 147-158.
- Rines, W. H., Edgerton, H. E., Wyckoff, C. W. and Klein, M. 1976. Search for the Loch Ness Monster. *Technology Review*, 78(5): 25-40.
- Sagan, C. 1976. If there are any, could there be many. *Nature*, 264: p 497.
- Sheldon, R. W. and Kerr, S. R. 1972. The Population Density of Monsters in Loch Ness. *Limnology and Oceanography*, 17: 796-798. See also comment in vol.18: 343-46
- Shine, A. *Loch Ness Project Report*. Drumadrochit: Loch Ness Centre.
- Tucker, D. G. and Braithwaite, H. 1969. Sonar picks up stirrings in Loch Ness. *New Scientist*, 40: 664-666.
- Tucker, D.G and Creasey, D. J. 1970. Some sonar observations in Loch Ness. *Proceedings of the Challenger Society*, 4: 91-92.

Pellagra and The Origin of a Myth: Evidence from European Literature and Folklore

By Jeffrey S Hampl PhD RD and William S Hampl III MA

This article first appeared in the Journal of the Royal Society of Medicine (1997; 90: 636-639) and is reprinted with kind permission. Jeffrey S Hampl, a registered dietician, holds a PhD in Nutrition from the University of Nebraska-Lincoln; having completed a research fellowship in preventative and behavioural medicine, he is currently a faculty member at Simmons College in Boston, MA. His main areas of interest are nutritional epidemiology and anthropology. William Hampl holds his Bachelor of Music from the University of Massachusetts at Lowell and his Master of Arts from Bridgewater State College. Now a graduate assistant in the doctoral program at the University