

inter- and intra-specific competition is overwhelming and the distribution patterns are easily explained in terms of orthodox neo-darwinian theory. However, although a growing body of research has shown competition to play a critical role in determining habitat selection, survivorship and, ultimately, Darwinian fitness in some stream insects<sup>21</sup>, in other species, for example, mayfly larvae, little interspecific interaction was evident under certain conditions<sup>22,23</sup>. There exist an immense variety of possible interspecific interactions, and dangers are inherent in overemphasizing any single aspect, and in overgeneralizing from observations taken either over a limited period, in a limited situation, or on a restricted range of species.

Scientific evidence should be based upon sound scientific data, and in this respect Imanishi's theory is found to be seriously wanting. Viewed from the ethereal realm of the philosopher, biological phenomena often differ in quite fundamental aspects than when viewed from the quantitative world of the scientist. Thus, Imanishi may have suffered the singular misfortune of basing his evolutionary theory upon non-quantitative observations made in a situation where little or no interaction occurred during the observation period. Such vague and essentially untestable theories are always difficult to disprove, but quantitative evidence usually eventually supercedes bad philosophy. As Wordsworth so eloquently phrased it, "Our meddling intellect misshapes the beauteous form of things", yet accuracy is the goal we seek. In this respect, the proposed translations of Imanishi's 'classics' may prove productive since, in addition to being "unrefined and crude"<sup>24</sup>, subjective analysis, coupled with the quantitative evidence from a growing body of research may reveal them to contain the ingredients of their own implausibility.

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- Sibatani, A. *Nature* **320**, 492 (1986).
- Halstead, L.B. *Nature* **317**, 587 (1985).
- Barber, E.W. & Kevevorn, N.R. *Hydrobiologia* **43**, 53-75 (1973).
- Wright, L.L. & Mattice, J.S. *Aquatic Insects* **3**, 13-24 (1981).
- Hawkins, C.P. & Sedell, J.R. *Ecology* **62**, 387-397 (1981).
- Cummins, K.W. *Ecol. Monogr.* **34**, 271-295 (1964).
- Schoener, T.W. *Am. Nat.* **122**, 240-285 (1983).
- Sweeney, B.W. in *Ecology of Aquatic Insects* (eds Resh, V.H. & Rosenberg, D.M.) (Praeger, New York, 1984).
- Krebs, C.J. *Ecology: The Experimental Analysis of Distribution and Abundance* (Harper & Row, New York, 1978).
- Ferson, S. et al. *Am. Nat.* **127**, 571-576 (1986).
- Tanida, K. *Physiol. Ecol. Jap.* **21**, 115-130 (1984).
- Edington, J.M. & Hildrew, A.G. *Caseless Caddis Larvae of the British Isles* (FBA Pub. No. 43, 1981).
- Edington, J.M. & Hildrew, A.G. *Verh. int. Verein. theor. angew. Limnol.* **18**, 1549-1558 (1979).
- Boon, P.J. *Hydrobiologia* **57**, 167-174 (1978).
- Hildrew, A.G. & Edington, J.M. *J. Anim. Ecol.* **48**, 557-576 (1979).
- May, R.M. & MacArthur, R.H. *Proc. natn. Acad. Sci. U.S.A.* **69**, 1109-1113 (1972).

- Royama, T. *J. Anim. Ecol.* **42**, 693-726 (1974).
- Hassell, M.P. & May, R.M. *J. Anim. Ecol.* **42**, 693-726 (1974).
- Odum, E.P. *Fundamentals of Ecology* (Saunders, Philadelphia, 1971).
- Jansson, A. & Vuoristo, T. *Behaviour* **71**, 168-186 (1979).
- Hart, D.D. in *Stream Ecology: Application and Testing of General Ecological Theory* (eds Barnes, J.R. & Minshall, G.W.) (Plenum, New York, 1983).
- Peckarsky, B.L. & Dodson S.I. *Ecology* **61**, 1275-1282 (1980).
- Corkum, L.D. & Clifford, H.F. in *Advances in Ephemeropteran Biology* (eds Flannagan, J.F. & Marshall, K.E.) (Plenum, New York, 1980).

## Recent discoveries of a supermass in the Universe

SIR—A pair of quasars with very similar redshifts was recently interpreted as a pair of images produced by a gravitational lens of enormous mass<sup>1</sup>. However, I and the other astronomers who originally discovered the quasars<sup>2,3</sup> pointed out that this pair belonged to a tight association of five quasars on the sky. The spatial grouping alone was equivalent to a 20 sigma density enhancement. The similarities in redshift of these quasars — four were at redshifts  $z=0.9$ , 1.0, 1.0 and 1.1 — had in addition only a chance of  $\approx 10^{-4}$  of being accidental. Later it was shown<sup>4</sup> that all the densest concentrations of quasars known in the sky had this concentration of redshifts around  $z \approx 1$ .

For gravitational lens advocates to now fasten on certain aspects of only two objects in these physical groups which fit their interpretation — and totally ignore the other information which does not fit — is tantamount to distorting the scientific data.

The enormity of the derived mass also makes it clear that there is no result which is sufficiently absurd to force rejection of the original assumption. A scientific theory must be capable of being disproved which apparently this is not.

A fascinating sequel quickly emerges when it is shown that the two supposed images of the same object are not identical in the red<sup>5</sup>. The simple conclusion which follows is that these two quasars, which have almost identical spectra, are really two separate objects. But then what happens to the arguments for the original gravitational lens? (called Q0957+561; see refs 6-8).

The argument that it had to be a gravitational lens rested on the claim that there was no other explanation for how the spectra could be so similar. (Actually one was considerably redder than the other.) What is the evidence now for gravitational lenses?

In general we should not disguise the fact that gravitational lens theories are really just another variation of 'hidden mass' or 'dark matter' hypotheses. Just as undetected (or undetectable) matter is supposed to close the Universe, so unmeasured mass in clusters of galaxies is supposed to explain large redshift dispersions

and unseen and implausibly distributed mass is supposed to explain flat rotation curves in spiral galaxies. Until scientific detection and measures of these hypothesized entities is made they should be recognized as really just statements that some part of our current physical laws are contradicted by the observations.

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- Turner, E.L. et al. *Nature* **321**, 142 (1986).
- Hazard, C., Arp, H. & Morton, D.C. *Nature* **282**, 271 (1979).
- Arp, H. & Hazard, C. *Astrophys. J.* **240**, 726 (1980).
- Arp, H., 307-352 (Universite de Liege, Institut d'Astrophysique, 1983); *Quasars Redshifts and Controversies*, (Interstellar Media, Berkeley, California, 1986).
- Shaver, P. & Christiani, S., *Nature* in press.
- Walsh, D., Carswell, R.F. & Weymann, R.J. *Nature* **279**, 381 (1979).
- Weymann, R.J., et al. *Astrophys. J.* **233**, L43 (1979).
- Young, P., Gunn, J.E., Kristian, J., Oke, J.B. & Westphal, J.A. *Astrophys. J.* **241**, 507-520 (1980).

## Espresso coffee emporia take note

SIR—Apfel and Davy's report (*Nature* **321**, 658; 1986) of the superheating of water by microwave ovens is totally consistent with empirical evidence obtained while using our laboratory microwave oven for preparing hot drinks (a practice sure to get us into hot water with our safety officer). I had placed a cup of tap water in the microwave and set it to boil but at first was prevented from making the drink by an experiment that required attention. On the third occasion of activating the oven, I responded to the timer bell by rushing to the oven, removing the cup and stirring my hot chocolate powder into the water which promptly erupted into a foaming cascade.

An interpretation of this dramatic event was that the water had become superheated and that the chocolate powder simply provided nucleation sites for the water to boil. In the light of Apfel and Davy's quantitative study of the superheating of water in microwave ovens it would seem that the explanation was correct. As well as offering supportive evidence and perhaps a cautionary tale, we think that a practical application of this phenomenon with coffee might be the production of energy-efficient espressos!

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