

where the only two species that showed increased mortality at depth (*Diploria strigosa* and *Acropora cervicornis*) were very rare. Baker's "acutely stressed" corals, however, recovered under the higher light levels of a shallow-water site (2–4 m). From this experimental design, we cannot unequivocally conclude that the improved survival of the acutely stressed corals was due to their adoption of a new mix of dinoflagellates after bleaching, or to improved recovery conditions at the shallow site. As light energy is critical to the survival of reef-building corals⁶, stressed corals might be expected to survive better when transplanted to a more sunlit site and less well after transfer to deep water, irrespective of bleaching.

The ABH assumes that bleached corals favour new host–symbiont associations that optimize survival, necessitating rapid evolutionary adaptation (that is, genetic change) by populations of reef-building corals and their symbionts³. Although Baker claims that bleaching offers an ecological opportunity for reef corals to rid themselves rapidly of suboptimal algae and to acquire new partners¹, he relies on a molecular technique that is unable to distinguish newly invading genotypes from other rare genotypes that are already present in the host and which simply increase in proportion after conditions change. The latter is a phenotypic change (acclimatization) and, as such, is restricted in its provision of new genetic combinations for evolution.

We consider that the evidence in favour of the ABH remains scant in the absence of observations that the genotypes of symbionts in corals become more thermally robust during and after mass bleaching. Baker's finding that corals adopt a different mix of symbiont genotypes when moved from one light environment to another is an interesting addition to the well-known acclimatory responses of corals and their symbionts to changes in light quality and quantity⁷, but we cannot conclude that bleaching favours new host–symbiont combinations that guard populations of corals against rising sea temperature.

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Baker replies — Hoegh-Guldberg *et al.* suggest that corals that were transplanted downwards died more frequently than those transplanted upwards because they were deprived of critical sunlight energy at depth. My argument went a step further by explaining why this energy is so critical for these transplanted colonies.

Because corals that were transplanted downwards did not bleach in response to reduced irradiance, they failed to exchange their 'high-light' algal symbionts for the more suitable 'low-light' algae that were already found in the deep-water colonies at this site (and/or at other sites nearby). As a result, they contained inappropriate algae for their new environment, which led to chronic stress and eventual mortality.

In contrast, corals that were transplanted upwards experienced severe bleaching as a result of increased irradiance. Consequently, suboptimal low-light algae were removed, allowing high-light algae to become dominant in the newly vacant hosts. Such corals survived well as a result, despite their initial bleaching. This explanation is particularly powerful because it unifies coral bleaching, symbiont change and host mortality.

Hoegh-Guldberg *et al.* suggest that my findings fail to support the ABH because they do not provide evidence of 'new' symbionts in transplanted corals. The ABH is not limited to this constraint. Regardless of the origin of replacement symbionts (which, as I pointed out, may "colonize" and/or "proliferate inside" hosts) or the proximate environmental causes of bleaching (for example, light or temperature), if bleached reef corals change the composition of their symbiont communities faster than unbleached corals, and if more rapid symbiont change proves beneficial, then bleaching has adaptive value. Even if adult colonies are unable to form symbioses with unusual or new algae (which is unlikely, given the recent discovery of some scleractinian coral colonies containing symbionts that are usually found in foraminifera¹), cryptic populations of diverse symbionts may still occur at low abundance in many coral hosts².

There is no field evidence that symbiont genotypes change after bleaching events because the necessary molecular investigations have not yet been undertaken. Despite this, one of the best available long-term data sets on mass coral bleaching and mortality reveals that far fewer corals in the far-eastern Pacific Ocean died after the 1997–98 El Niño event (0–26%) than after the 1982–83 El Niño event (52–97%; ref. 3), even though the magnitude and duration of sea-surface temperature anomalies in the region in 1997–98 exceeded those of 1982–83 (ref. 4). These observations indicate that surviving reef corals may be more

resistant to recurrent thermal stress through having experienced earlier episodes of severe bleaching and mortality, as predicted by models of symbiont change⁵.

Furthermore, field experiments with bleached corals⁶ and laboratory studies of model invertebrate–algal symbioses⁷ support some of the assumptions of the ABH. We should not mistake an absence of evidence for evidence of absence, and instead need to document worldwide patterns of coral–algal associations and their response to mass-bleaching events. The real question is not whether coral–algal associations can adapt by recombining, but rather how, and over what timescales, they do so.

Although episodes of mass coral bleaching and mortality will occur in the future, my findings suggest that they may not recur with the frequency and severity predicted by some studies⁸. This should stimulate efforts to protect the remaining three-quarters of the world's coral-reef ecosystems⁹ by reducing the compounding effects of anthropogenic factors that are still under our influence.

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errata

Seeing through the face of deception

I. Pavlidis, N. L. Eberhardt, J. A. Levine
Nature **415**, 35 (2002)

It was not intended to convey the impression that this thermal-imaging technique is already suitable for mass security-screening purposes: indeed, the false-positive rate identified in this small study might preclude large-scale application.

Laterality in tool manufacture by crows

Gavin R. Hunt, Michael C. Corballis, Russell D. Gray
Nature **414**, 707 (2001)

The tool held in the beak of the bird shown in Fig. 1 of this communication was wrongly described as a crochet tool, whereas it is a simple leaf-stem tool that happens to be hooked.