preferentially binds to mismatch-containing DNA[10]. Further, mutations in the yeast *MSH1* gene resulted in mtDNA accumulating point mutations[10]. These observations support the view that *S.g* mtMSH functions in mismatch repair, and suggest that it would be worthwhile to examine relative rates of nucleotide substitution in mitochondrial and nuclear genes of octocorals. It seems likely that a mismatch recognition function for *S.g* mtMSH would be concerned only with post-replicative repair, as there is no evidence for intermolecular recombination in metazoan mtDNA[2].

Finally, it can be inferred from the size of the *S. glaucum* mitochondrial genome (18.2 kb) and the likely inclusion of all protein and rRNA genes common to other metazoan mtDNAs[6], that additional components of a mitochondrial mismatch repair pathway in this organism would be nuclear-encoded.

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Climate and CCN

SIR — Toumi *et al.*[1] estimate a substantial cooling effect on climate caused by an increase in the formation of aerosol particles and cloud condensation nuclei (CCN). This is associated with a possible increase in OH radicals in the troposphere, in turn caused by increased penetration of ultraviolet radiation through the depleted ozone layer.

The authors should be credited for pointing out a potentially important process. However, we feel that a quantitative estimate of such a complex series of events requires a more sophisticated analysis. In particular, we would like to point out the following, potentially important effects not considered by the authors. They would generally tend to counteract the estimated negative climate forcing.

(1) The depletion of stratospheric ozone is most pronounced in winter and early spring in mid and high latitudes, whereas the impact on climate of changes in the aerosol abundance is largest in summer and in low latitudes. Unfortunately, Toumi *et al.* give no information about the seasonal dependence of the effect.

(2) An increase in tropospheric OH would lead to a more than proportional increase in H_2O_2, leading to a more efficient oxidation of SO_2 in cloud droplets. This would suppress the concentration of SO_2 outside the cloud and thereby tend to decrease the formation of new particles through the OH reaction. The authors argue, referring to our own previous work[2], that oxidation in cloud droplets is not limited by oxidants (like H_2O_2) but by the occurrence of clouds. However, we never made such a categorical claim. We believe that H_2O_2 may well be in short supply, especially during the darker months, as well as in regions affected by pollution.

(3) Even in remote regions, the net impact on the CCN population of changes in OH is not easily estimated. If the hypothesis by Raes *et al.*[3] is correct, most CCN in the marine environment are formed in the free troposphere where, especially in the subtropics, OH may be the dominant pathway for SO_2 oxidation. If this is the case, the formation of H_2SO_4 (and CCN) would be limited by the vertical transport of dimethyl sulphide and the subsequent formation of SO_2, and not by the concentration of OH.

We would also like to point out an error in Fig. 1 of ref. 1. If the numbers presented were correct, the total rate of aerosol formation would be less than 0.01 Tg S per yr, far too small a figure to make this process at all significant.

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TOUMI *ET AL.* REPLY — We agree with the points raised by Rodhe and Crutzen. However, we still maintain that the main uncertainty is the relationship between H_2SO_4 and cloud droplets and not the extent to which H_2SO_4 production has changed. We are encouraged by a recent modelling study[4], confirming that the number of cloud condensation nuclei may indeed be very sensitive to OH. We apologize for the error in Fig. 1 caption: it should read $\times 10^3$ mol $cm^{-3}s^{-1}$ (error in the proof).

Regarding the specific points raised by Rodhe and Crutzen:

(1) The relative importance of cloud scattering increases with solar zenith angle. This may offset the seasonal variation of the ozone trend. Note that other modifications of stratospheric ozone (for example, by the QBO, solar cycle, volcanic eruptions) have different seasonal and latitudinal dependencies. The main objective of our paper was to demonstrate the potential importance of the mechanism relative to the direct radiative effect from stratospheric O_3 changes.

(2) Our radiative forcing calculation was intended for marine stratus clouds. We cannot quantify the effect of SO_2 oxidation limited by H_2O_2, but do not think that that this effect is large globally.

(3) The variation of SO_2 oxidation with cloud lifetime and OH as a function of altitude and latitude was included in the model.

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Amazon molly and Muller's ratchet

SIR — The Amazon molly, *Poecilia formosa*, is a gynogenetic fish and a hybrid between *P. mexicana* and *P. latipinna*. The all-female *P. formosa* need to mate with males of *P. mexicana* or *P. latipinna,* as parthenogenetic egg development can start only after sperm fusion. It is generally believed that the sperm chromosomes are subsequently eliminated and that there is no genetic contribution from the male. Schartl *et al.*[1] now claim that heterospecific males may occasionally contribute genetically to the offspring of *P. formosa* females. They reason that such a process could counteract the operation of Muller's ratchet (accumulation of deleterious mutations in clonally reproducing organisms). We think, however, that such a conclusion is not supported by their data and unlikely for theoretical reasons.

To state that a species avoids Muller's ratchet, it is necessary to show that deleterious mutations are replaced by 'healthy' ones through recombination. However, Schartl *et al.* have presented no evidence for such a process. They found that the genetic trait "black pigmentation", which is typical for the black molly males used in routine laboratory crosses with *P. formosa*, is occasionally present in *P. formosa* offspring, and that such offspring contained heritable microchromosomes in addition to the normal chromosomes. These results do not indicate that (parts of) these supernumeraries recombine with the *P. formosa* standard chromosomes. Therefore, the title "incorporation of subgenomic amounts of DNA as compensation for mutational load in a gynogenetic fish" is not justified.

Even if one assumes that paternal genetic material becomes a stable in-