skeleton is reminiscent of the position of the mummies of cats, even though the disposal of the hindlimbs is different. In the case of the lion, the forelimbs and the hindlimbs are stretched down along the front of the body, with the tail returned between the paws, but in the cats' mummies, the hindlimbs were tucked up against the pelvis with the tail curled up between the feet (Fig. 2). The bones are in strict connection, except the calvarium, which had fallen slightly behind, probably when the packaging disintegrated.

As the bone measurements are among the largest recorded for a male lion and outside the range of variation shown by females (C. Gross, personal communication), there is no doubt that this skeleton is from a male lion (see supplementary information). In contrast to results revealed by X-rays of many cat mummies[1,2], there is no indication that the animal was killed when young in order to be mummified and buried. It is likely that it died naturally.

Complete epiphyseal fusion of the skeleton and the very weak pulp chamber of the teeth show that they belong to an adult. The wear and pathology of the teeth (Fig. 2) suggest that the lion lived to be old and was kept in captivity. Seven ribs, on the same side of the chest, are fractured in the middle and have calluses formed on them; they may have broken as a result of a fall or a violent knock.

The existence of lions during the time of the pharaohs has been frequently described[3], but to our knowledge this is the first complete skeleton to be found in Egypt (though some bones were found in Abydos[4]). The discovery should convey valuable information about the animal and its life (age, pathologies and accidents). Although buried in the tomb of a woman from the XVIIIth dynasty (about 1430 BC), the animal belongs to the later Bubasteion catacombs connected to the cult of animals that was so important in Late and Hellenistic Egypt (see supplementary information).

As a male, the mummified lion may have been considered as an incarnation of the god Mahes (Miysis)[5], son of the goddess Sekhmet or Bastet. Although a single lion burial does not constitute a lion necropolis, this Memphite specimen confirms the existence of lions in Egypt in the last centuries BC. Lions are thought to have been bred in sanctuary precincts and buried in a sacred animal necropolis, including the Memphite necropolis (as suggested by demotic and Greek inscriptions[6] and by some claws with evidence of mummification[7]).

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Olfaction

Mosquito receptor for human-sweat odorant

Female *Anopheles* mosquitoes, the world's most important vector of *Plasmodium falciparum* malaria, locate their human hosts primarily through olfactory cues[1], but the molecular mechanisms that underlie this recognition are a mystery. Here we show that the *Anopheles gambiae* protein AgOr1, a female-specific member of a family of putative odorant receptors[2,3], responds to a component of human sweat. Compounds designed to activate or block receptors of this type could function as attractants for trapping mosquitoes or as insect repellents in helping to control *Anopheles* and other insect pests.

A member of the *AgOr* gene family, *AgOr1*, was expressed in an engineered neuron of the fruitfly *Drosophila*. The neuron failed to respond normally to odours because its endogenous odorant-receptor genes, *Or22a* and *Or22b*, had been deleted. AgOr1 was expressed in this mutant by using an *Or22a* promoter and the *GAL4–UAS* system[4]. We assayed the response of this neuron to individual odours by single-unit electrophysiology.

We found that AgOr1 confers a strong response to the odorant 4-methylphenol (Fig. 1a). As this compound is a component of human sweat that elicits an electrophysiological response from the antenna of female *A. gambiae*[5], it may contribute to the anthropophilic host-seeking behaviour of this mosquito. This idea is supported by the fact that *AgOr1* is expressed specifically in the olfactory tissue of only female mosquitoes, and its expression is downregulated after a blood meal[2] (the host-seeking behaviour of these mosquitoes is specific to the female and is reduced after blood-feeding[6]). Furthermore, 4-methylphenol increases the effectiveness of traps for the tsetse fly *Glossina morsitans morsitans*[7].

We tested a second *AgOr* gene, *AgOr2*, and found a different odour-response spectrum (Fig. 1b). In contrast to *AgOr1*, *AgOr2* confers a strong response to 2-methylphenol but not to 4-methylphenol. There was no response in the case of the deletion mutant carrying no transgene (Fig. 1c).

These results indicate that this pair of *AgOr* genes encodes odorant receptors, and that the female-specific receptor AgOr1 may participate in the host-seeking behaviour of *A. gambiae*. As mosquito odorant receptors can function in *Drosophila* in the absence of other mosquito proteins, there could be a compatibility between odorant receptors and olfactory-receptor neurons from different species, which would allow the fruitfly to be used as an *in vivo* model for the study of odorant receptors derived from less genetically tractable insect species.

Anopheles mosquitoes transmit malaria and are responsible for the death of more than one million people each year. Our discovery that this mosquito possesses odorant receptors for particular components of human sweat means that different ligands could be screened for their activation or inhibition of these receptors, potentially

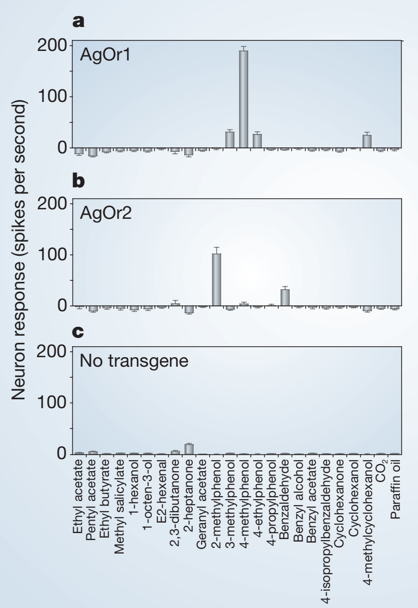

Figure 1 Identification of a mosquito odorant receptor that responds to a component of human sweat by expression in a *Drosophila* olfactory receptor neuron. **a–c,** Odour-response spectrum conferred by AgOr1 (**a**) and AgOr2 (**b**) on a *Drosophila* olfactory neuron carrying a deletion of its endogenous receptor genes (response of deletion mutant without transgenes is shown in **c**). Transgenic flies were of the genotype w^{1118}; *Δhalo/Δhalo*; *UAS-AgOr/Or22a promoter-Gal4* (refs 4,8). Single-unit recordings were obtained[4] from animals that were less than one week old. Liquid odour sources were diluted by 10^{-4} in paraffin oil; solid odour sources were diluted to 0.2 mg ml^{-1} in paraffin oil; CO_2 was administered as described in ref. 4. Responses were quantified by subtracting the number of spikes in 500 ms of spontaneous activity from the number in the 500 ms after the onset of odour stimulation ($n = 12$; error bars represent s.e.m.). *AgOr* cDNA clones were from *Anopheles gambiae sensu stricto* (G3 strain); embryos (provided by M. Benedict) were reared as described[2].

leading to new, more effective insect traps and repellents.

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COMMUNICATIONS ARISING

Climatology

Rural land-use change and climate

Kalnay and Cai[1] claim that urbanization and land-use change have a major effect on the climate in the United States. They used surface temperatures obtained from NCEP/NCAR 50-year reanalyses (NNR) and their difference compared with observed station surface temperatures as the basis for their conclusions, on the grounds that the NNR did not include these anthropogenic effects. However, we note that the NNR also overlooked other factors, such as known changes in clouds and in surface moisture, which are more likely to explain Kalnay and Cai's findings. Although urban heat-island effects are real in cities, direct estimates of the effects of rural land-use change indicate a cooling rather than a warming influence that is due to a greater reflection of sunlight.

The NNR use upper-air observations to produce analyses of atmospheric fields every 6 hours by using four-dimensional data assimilation that capitalizes on available multivariate data. As a consequence of the procedures used, the NNR do not directly include local surface influences or observations. Therefore, land-use and urbanization effects may contribute to differences detected with high-quality, measured station surface temperatures.

In addition, the reanalyses do not include effects of the changing atmospheric composition on radiation, despite carbon dioxide concentrations in the atmosphere increasing from 318 p.p.m.v. in 1960 to more than 370 p.p.m.v. — an increase of about 17% — over this time. Neither do the reanalyses deal with changes in surface wetness. Increases in cloudiness and rainfall over the Mississippi River Basin have increased evaporation but decreased potential evapotranspiration[2]. These trends have an important influence on the surface-heat balance.

The NNR did not include cloud information, and the depiction of clouds in the NNR is poor and the surface-heat budget has serious errors[3]. Detailed studies of the surface-heat budget and of why minimum temperatures are increasing at a faster rate than maximum temperatures reveal that the decreasing diurnal temperature range (DTR) is linked to a worldwide increase in cloud cover[4]. Clouds reduce DTR by sharply decreasing surface solar radiation and reducing radiative heat losses at night.

Processes involved in DTR, including radiation, surface fluxes of sensible and latent heat, and soil-moisture effects, have been investigated by using comprehensive measurements from the First ISLSCP (International Satellite Land Surface Climatology Project) Field Experiment (FIFE) in Kansas[4]. Changes in clouds, especially low clouds, largely determine the patterns of change of DTR. Soil moisture also decreases DTR by increasing cooling through daytime surface evaporation. Empirical relationships[4] using 3-hourly weather observations extend the results globally to show that DTR varies inversely with cloud cover and precipitation on several timescales, particularly over the United States. The reported decreases[1] in DTR are therefore consistent with the observed increases in cloud cover.

Across the southern two-thirds of the eastern United States, the DTR peaks in spring and autumn, with minima in winter and mid- to late summer[5]. Changes in DTR are traceable to the lengthening growing season, especially on sunny days, indicating that the increases in vegetation and associated evapotranspiration are important.

However, a direct assessment of the effects of changes in land use and vegetation[6,7] show that conversion of forests to crop land generally causes an increase in reflected sunlight that is greatest after the harvest in the autumn. The increased reflection results in a relative cooling, estimated to be in excess of 1 °C in autumn[6], which is due to changes in land use rather than to warming[1]. After the 1960s, the greatest land-use changes have been in the increase in crop land area in the midwestern United States and in reforestation in the northeast[6]. By contrast, urban heat-island effects are localized in cities, whose stations are not used in compilations of climate change. Also, changing snow cover contributes to the decrease in DTR during winter in the United States[8].

Changes in cloudiness and surface moisture are probably the main source of the discrepancies in trends found by Kalnay and Cai[1]. The NNR omit these influences in computing the surface-heat budget, although they are critical for getting surface-air temperatures right. Influences by processes not in the NNR model (including urbanization and land-use change) will be included in variables whose observations are analysed, but not in those variables calculated from the model (including surface-air temperature).

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Climate

Impact of land-use change on climate

Urbanization and other changes in land use have an impact on surface-air temperatures. Kalnay and Cai[1] report that the observed surface-temperature trend in part of the United States exceeds the trend in the NCEP/NCAR 50-year reanalysis (NNR) and conclude that changes in land use account for the difference (0.035 °C per decade according to their corrected values). Although land-use change may explain some of this discrepancy, the authors do not quantify the impact of the many changes in observational practice that occurred during the analysis period. Our findings indicate that these 'non-climatic' changes have a systematic effect that overwhelms the reported difference in trends and therefore calls Kalnay and Cai's central conclusion into question.

Historical archives kept at the National Climatic Data Center document many non-climatic changes in the area's observation stations. For example, from 1950 to 1999, over 25% of the stations switched from afternoon to morning observation schedules, imparting a gradual and systematic bias towards cooling to the area's temperature record[2]. More than 75% of all stations experienced some change in instrumentation, and many were also relocated on one or more occasions.

The Baltimore Customs House, whose record is shown in Kalnay and Cai's Fig. 1,