# Dirt and disgust

## A Darwinian perspective on hygiene

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*Hoewel veel auteurs de symbolische en culturele aard van hygiëne, verontreiniging en regels om vuil te vermijden hebben bestudeerd, is tot dusver niemand in staat geweest te verklaren waarom bepaalde zaken en handelingen zo'n afstotingskracht hebben Een universele afkeer van faeces, lichaamsuitscheidingen, verontreinigd voedsel, kleine dieren en insecten wijzen op een of andere vorm van emotie-ontwikkeling. Afkeer is waarschijnlijk de minst bestudeerde emotie onder psychologen. Dit artikel verkent de aard van de emotie van afkeer of walging met behulp van veld-werk in Nederland en India en met behulp van literatuur en biedt een hypothese omtrent het doel van deze menselijke drijfveer. Mensen hebben verschillende manieren ontwikkeld om zich te verdedigen tegen fysieke en gedragsstoornissen. Afgestoten worden door bronnen als parasitaire insecten die bijvoorbeeld in faeces voorkomen, kan onze voorouders geholpen hebben ziekte te vermijden. Hoewel vermijding van ziekte d kern van walging is, hebben cultuur en moraliteit dit thema opgepakt en verbreed, zodat het nu een veel grotere rol in een samenleving speelt. Walging is een van de drijfveren voor hygiënisch gedrag en kan nuttig worden aangewend in de promotie van veilige hygiëne.*

*[hygiëne, walging, evolutie, diarree, excrementen]*

> The brimmings of cesspits, the green rot of markets, the scum of the sewers, the swill of the gutters, the refuse of gullies, the stench of offal, the vapour of privies, the crust of drains, the sweat of bird-catchers, the lime of seducers, the lint of navels, the foulings of footpaths, the footbaths of postmen, the leakings of oilmen, the oilings of lechers, the slime of ruttings, the scale-cakes of fish-stands, the mire of fowl-houses, the squirtings of cats, the grime of urchins, the dribblings of ancients, the pap of infants, the navel-cords of outcastes… the shavings of padres, the spittle of mendicants, the turds of soldiers, the pickings of schoolboys, the scabs of traitors, the piss of bullies... (Sealy 1990).

There is not much that is hygienic in this Indian fantasy about the contents of the drains in Lucknow. Drains are revolting everywhere in the world. But why is it better that these drains are far away and not in our own neighbourhood? Why does the list evoke unease, an itch and slight turning of the stomach? What is so revolting about 'turds', 'scabs', 'stench' and 'slime'?[1] Disgust has been recognised as one of the basic human

emotions since the days of Darwin (Rozin & Fallon 1987). But why do we react like this and what does it have to do with hygiene? In this article we explore some of the core objects of disgust – bodily excretions and other offensive substances. We suggest that anthropology has shed much light on our disgust classifications, but has not fully explained the specific content of the disgusting. A potential explanation, which fits the facts well, is Darwinian. We humans may have evolved this emotion because it helped to keep our ancestors from coming into contact with disease-causing pathogens in the Pleistocene era and before. Hence the extraordinary power that certain objects and events have to revolt us.

## Hygiene and disgust

Promoting safe hygiene behaviour has been, and will continue to be, one of the great goals of public health whether in the North or the South or in the public or the private domain (Cairncross et al. 1996). Yet there are no societies that do not already have rules of hygiene, rules that date to long before Pasteur and the microscope (Brown 1991). This complex set of rules relates to bodily and environmental cleanliness, to grooming and to ordering and tidying the self and the living space. Hygiene concerns not only the private practices of individuals, but is also a social requirement. Hygiene is invoked not only by public health scientists, but also by moral theologians. Hygiene provides not only a barrier to the transmission of disease, but it also provides a barrier to disorder, chaos and social collapse. Hygiene mixes science and myth, emotion and reason and has, at times, concealed prejudice and the policies of oppression. It is, perhaps, no wonder that the efforts of the health educators to promote hygiene have often been both confused and confusing.

In an effort to find more effective ways of promoting safe hygiene, we have been trying to disentangle some of the threads of this rich fabric. We have been able to clarify, for example, that the main concern of hygiene promotion should be the prevention of the fecal-oral spread of the diarrhoeal pathogens, responsible for the deaths of over three million children every year (Bern et al. 1992). Hygiene promotion should thus focus on practices that serve to keep faecal matter out of the domestic environment where children spend their time. In most settings this means safe stool disposal and hand-washing with soap after stool contact (Curtis et al. 1997). However, though diarrhoea avoidance may be why health workers want hygiene, people want hygiene for many other reasons. Cleaning leads to self-satisfaction and helps gain the respect of others, it also satisfies an aesthetic need to beautify the environment. Hygienic practices create order, they help keep things in their 'right places' in conformity with cultural ideals and to please God (Douglas 1966). Finally the hygiene practices that people adopt are clearly also influenced by the physical environment and factors such as the availability of latrines and adequate water (Curtis et al. 1995).

However, running through all of our studies of hygiene behaviour is a puzzling warp of threads which is not fully explained by Douglas' analysis of the pollution laws

of societies. Certain disgusting acts and objects crop up again and again. This puzzled Reinhart in his discussion of the purity rules of Islam:

> ... pus, vomit, urination, menstruation, sexual fluids and so on – all substances and acts that, for some reason, many cultures tend to see as repellent and, despite their constant presence in human life, as abnormal (Reinhart 1999).

Disgust is an omnipresent emotion and, though the exact details vary from culture to culture, it appears that there is a core set of events and substances that stimulate it.

## Indian and Dutch dirt

We carried out a study to investigate the factors that motivate hygienic behaviour in two very different societies: Lucknow, India and the Netherlands, in 1998. Both samples concerned about fifty mothers of small children from both rural and urban backgrounds (Lucknow town and surrounding villages, villages in Gelderland and the city of Eindhoven). Using a mixture of direct and indirect techniques including focus group discussions, photocues, laddering[2] and semi-structured interview, we probed how mothers of small children explained their own actions in relation to hygiene. In addition fifty 14 to 16 year old girls at an English medium high school in Lucknow were asked to write a short essay on purity. Though disgust was not initially a particular focus of our attention, in every interaction we found that we returned to a litany of acts and objects that were disgusting. Usually it was not possible for respondents to explain why this was; the objects were just unacceptable.
First, and most disgusting in both settings, were faeces.

> Shit smells and looks dirty; you feel you have to wash your hands at once, using water and soap. NL-A3[3]

> People, especially elders, say you must take a bath and change clothes after defecating. IN-MG5

And faeces contaminate everything they come into contact with:

> Toilet is *ganda* [dirty], it stinks, we close our mouth to avoid diseases…of the lungs. IN-AN9

> Pig is *ganda* because it eats faeces. IN-AN11

Faeces are so dirty they even contaminate the soap and water needed to clean them off.

> If we use the latrine soap to wash our eyes then it will make our eyes *ganda*. IN-FGD-AN

And faeces must not come near food:

> [Children cannot use the pot] not near the dining table, at least not during the meal. NL-A19

> Flies ... They sit on faeces and come in the house and sit over food, this has danger of getting sick. IN-MG12

Though faeces are extremely polluting, cows are extremely holy in India. There was much disagreement over whether cow dung was pure '*pavitra'* or dirty, *ganda*.

> Everyone likes cow-dung, in fact they find it pure. But, in my opinion, it is dirty and impure because it stinks. If I besmear my house with it I feel very bad. My hands stink and they turn yellow which doesn't look good. I don't feel like eating when I have touched it. IN-HK10

Other bodily emanations apart from faeces evoke disgust in both countries:
... one day I finally resolved to break her friendship. I saw her wiping her sweat with my towel, that was the day I refused to even stand next to her. IN-Lb2

> To smell is dirty. A lot of people smell, especially during the summer they smell of sweat. NL-B23

Menstrual blood is disgusting in both cultures, and in India birth is impure because of the bodily matter that accompanies the child.

> When a child is born the wife is always *gandi* for 8 days. It does not matter how *saaf* [clean] she tries to be. She does smell. IN-FGD

> [During birth] the *gandagi* comes out. The child comes out. The child is *saaf* and everything else which comes out is *ganda*. IN-FGD

And women in both countries found cut or fallen hair revolting:

> Hair I find very dirty. If it is wet I cannot stand it, gives me the itch. It has to be thrown away using paper or plastic gloves. NL-A18

Little insects revolted both Dutch and Indian mothers:

> ... she felt like someone had made her to drink sour water with some dead insect in it ... IN-Lb40

> One look at the man made them full of repulsion… His skull was clearly visible and so were small, wriggling, slithering, white, pulpy insects who had eaten away a major part of his flesh. IN-Mem3

> I remove remains of food on the table to prevent *beestjes*.[4] I think flies are dirty, ants less so. NL-A8

> Dust is unhealthy, not because of asthma, but because it is a source of ongedierte.[5] NL-A3

Small animals such as rats and mice were objects of disgust in India, though not mentioned in the Netherlands interviews. The idea of vermin associated with the possibility of ingestion were even more unacceptable ...

My father scooped up the curry, To his surprise he saw a mouse in the spoon…The whole party was ruined, we all felt sick, we almost vomited seeing such a dreadful thing in our dinner ... IN-Lb2

The majority of households in Lucknow are vegetarian. Meats evoke much disgust.

Meat is *ganda*, it is of animal who eats dirty things and there is a fear of getting diseases. If anyone in my house eats meat, like my brother, and I come to know about it then I don't let him drink water in the utensils of the house. Why? Because sister I don't feel nice and from inside I don't like it, I feel like puking. IN-AN5

But Netherlanders dislike meat and fish and their wastes too:

Garbage is dirty, [it may contain] offal of meat which is unhygienic. NL-A1

Money is unhygienic, everybody touches it. For instance, a fish-monger in the market-place. NL-B3

Most disgusting of all is the smell of rotten meat or of a dead animal.

On the way, a foul smell of a dead animal came into the car ... IN-LB26
When I smelt the bad odour of dead rat, I got very disturbed and I felt impurity in myself as I was praying to God. IN-Lb

Wastes and decay were dirty and to be avoided in both sites:

... rubbish in the house is not *ganda* but when thrown out it becomes *ganda*. It happens because it starts to decay. IN-FGD-MG

Keeping garbage in the house is unhealthy. I do not use the green bucket in my kitchen, since I do not want any decaying or rotting things in the house. NL-A3

The nappy is disposed of… in the refuse-bin in the shed. I do not want any waste in the house, just as with the decaying vegetable matter. NL-A3

Smell is a signal [of dirtiness]... For instance, rotting fruit. NL-B7

And food leftovers are to be cleaned up and not eaten or served to others, even if they are not rotten:

We don't serve whatever has been eaten by others. Neither do we serve stale food to others. NL-HK3

The leftovers of food are unhygienic and dirty. NL-A9

The dirtiness of others is more disgusting than one's own:

Touching the rail of the stairs is dirty, the idea that everyone has touched it… I put paper on the tables at picnic places… It's not illness, but just the idea that everybody is touching a thing. NL-A13

> Toilet seat. Unhygienic. My children will not go to a public toilet. At home you know who used the toilet and what went on…. NL-A17

> [Changing nappies on the kitchen table is] normal. But I put a sheet underneath with a child for whom I baby-sit. NL-B19

> I take extra care to clean after my children's friends have used the toilet. NL-B17

> In the clinic I had to sit for one full hour with all kind of people. And one such person who was sitting very close to me …was stinking badly. I couldn't tolerate his body odour ... I cannot forget how sick I felt by his presence next to me ... IN-Lb4

> Other people's dirt is dirtier than one's own. NL-A19

The data also gave us glimpses of a moral disgust which was related to inappropriate, immodest or insulting behaviour.

> They are clever and grown up still they do not have clothes on their bodies. They are standing nude before everyone. That's why they are bad. They are *ganda*. IN-FGD-HK.

> ... but suddenly, her true face came in front of me, when I saw her drinking alcohol. She was looking so dirty and impure ... IN-Lb21

> The Belgian soccer player who called Kluivert a rapist ... [was dirty] NL-B12

Lower castes are a source of contamination, even disgust, to higher castes in India, even though some people feel that they should know better.

> One day my mother took a bath and the sweeper touched her, she got very annoyed …But my mother controlled herself very much, and she took a bath again. After some time her temperament cool down and said schedule caste people are also general people we should not behave with them like this. Lb44-20

> Pig-farming is done by low-caste people... HK3-48

Characteristics that people cited of disgust objects include smell in particular, but also the look and the quality; for example stickiness and dampness made an object more disgusting.

> If dung is liquid and sticky then it is dirty but when it is dry it is not. MG1-101

> If the wet cloth is hung up it is *ganda* and it is *saaf* when it is dried. FGD-AN-492

## Making sense of disgust

Though our field work was intended to be comparative, we found a striking similarity between the objects and events that evoked disgust. The boundary between disgust and dislike is, of course hard to draw, but the Indian list of suspect objects included faeces, urine, sweat, menstrual blood, cut hair, childbirth, vomitus, flies, insects, mice and rats,

dogs, meat and fish, rotting, parasitised flesh, pigs, alcohol, lower castes and decaying waste. In the Netherlands faeces, hairs and dust, *beestjes*, *ongedierte*, sweat, stickiness, offal, fish-mongers' hands, cats and dogs, insulting behaviour, fat people and rotten waste provoked disgust. Miller's study of disgust in North America offers a less inhibited panoply of the revolting which includes: faeces, bodily fluids, pustules, rotting wastes, severed limbs, pubic hair, sexual fluids, graveyards, slaughter houses, compost, carrion, slugs, maggots, blood sucking parasites and deformity.

How are we to make sense of this hotch-potch of revulsion, this list of the unwanted exiles from our cultures? Douglas' proposal that the boundary transgressors and the anomalous have to be rejected, so as to keep pure the demarcation lines of cultural coherence is clearly incomplete as an explanation. Why do these particular everyday objects revolt and not others? Why is sweat repulsive, but not tears? Why is cow dung dirty, but not (usually) cow's milk? And why the fear of toilets, but not of doorways? Since disgust is an emotion we should perhaps turn to psychology to see if the explanation lies there.

In a review of the psychology of disgust Rozin and Fallon describe it thus:

> Like other basic emotions, disgust has a characteristic facial expression [wrinkling of the nose, narrowing of the eyes and pursing of the lips], an appropriate action (distancing of the self from the offending object), a distinctive physiological manifestation (nausea) and a characteristic feeling state (revulsion) (Rozin and Fallon 1987).

And they add the remark:

> With these impeccable credentials it is surprising that disgust is hardly mentioned in introductory psychology texts or texts on social psychology or motivation.

Disgust is thus both widely present, but invisible in the literature in the same way that faeces are invisible in many cultures (Van der Geest 1989a). Rozin and Fallon sketch some of the essential characteristics of disgust. They define it as a food-related emotion of revulsion at the prospect of ingestion of offensive objects. They suggest that almost all objects that qualify as disgusting are animals or parts of animals, animal body products or objects that have had contact with, or resemble, any of the above. Humans are, of course, animals and the prospect of consuming things contacted by people who are disliked or viewed as unsavoury elicits disgust. Faeces are a universal and primal disgust object (Angyal 1941). However, the reviewers point out that one's own bodily products have a peculiar status with regard to the self, where one's own faeces and urine are less revolting than those of others, and that ones' saliva only becomes disgusting once it is outside the body. Hence experimental subjects disliked the idea of a bowl of soup into which they themselves had spat. Furthermore, the idea of the potential for contagion from disgust objects is a powerful one. They point out that few people would be prepared to drink soup from a brand new chamber pot, or drink from a glass into which a sterilised cockroach had been dunked.

Miller's (1997) wide ranging exploration of disgust goes beyond the psychologists concern with the animal and the physical. He suggests that our conscience of life itself is the source: "fat, greasy, teeming, rank, festering, viscous life." He highlights the role

that the disgust emotion plays in morality: by condemning hypocrisy, vulgarity, servility, cruelty and gluttony it helps to keep us from offending and alarming others. He takes issue with Douglas as well as with the psychologists, suggesting that disgust items such as faeces are not a product of difficulties of classification, but actually underlie the classification system and force it into the shape it takes. However, he does not attempt to explain why this should be so, and dismisses attempts to explain disgust with reference to hygiene as reductionist.

The Dutch and Indian data illustrate both the physical and moral concerns of the disgust emotion. Faeces occupy a prime place, being revolting enough to override other classification systems. Even cow dung, which is regarded as pure by Hindus, retains a power to disgust. Soap, pigs and lower castes can all be contaminated by their association with faeces. Defecation in an eating area is unacceptable, possibly because the idea of ingestion makes faeces especially revolting. Yet even this apparently universal rule can be suspended for the faeces of one's own children, which can and must be tolerated (Curtis 1997). The rotten, the leftover, the bodily wastes, the insect and the animal, the 'other' and the morally reprehensible all occasion revulsion. Though psychological and cultural explanations of disgust agree well with our findings, they do not advance us in our central question; why these particular disgust objects and not others? Why should faeces be the archetypal disgust object, and have such power to contaminate? Why are food leftovers, of both animal and vegetable origin, rejected in both cultures? What could explain the disgust evoked by the smell of rotten vegetable matter and the dislike of damp and stickiness? Why the concern with little animals and certain insects? What could possibly be the explanation for the revulsion that such things provoke?

## The uses of disgust

There is a potential answer to this puzzle and it lies in the process that made human beings what they are, that created legs, guts and highly developed brains. Evolution, the selective acquisition of beneficial, heritable mutations, produced the characteristics that enabled the ancestors of humans to survive and reproduce successfully in the environment in which they lived. These adaptive characteristics were not all purely physical. Feelings of hunger drove our ancestors to indulge in the beneficial behaviour of eating; fear occasioned by the sight of a large object moving towards them led them to flee predators; a sex drive led them to indulge in reproductive behaviour; sensations of fatigue or laziness led them to restrict their activities to conserve energy. The basic emotions thus originated as drives to cause the organism do something; mobilising the mind and body to meet one of the challenges of living and reproducing in the environment in which we evolved. A further part of the challenge of that environment was the group; the other human beings with which lives were shared. Pinker suggests that we have emotions both about things and about people and that emotions about things are probably less complex than emotions about people because things are generally simpler than people (Pinker 1998).

Take emotions about the food 'thing' for example. Few people would dispute the idea that appetite is a biological drive that led our ancestors to behave in ways that were good for survival and reproduction. Primates, or proto-primates, with a sweet tooth were driven by this appetite to seek out sugar-rich fruits, which were an excellent source of energy and nutrition. A 'sweet tooth gene' which caused the sweet eater to feel pleasure, would therefore have had the advantage over its non-sweet tooth allele because it would have found itself in better nourished, more energetic humans. Copies would therefore have been more likely to have been found in succeeding generations. Selection pressure was such that a liking for the sensation of sweetness is now almost ubiquitous in modern humans, (even if this has maladaptive consequences in an environment offering abundant, cheap sucrose.) However, humans also have to deal with food not just as a thing, but in relation to other people; emotions concerning nurturing, sharing, competing, imitating and belonging all modulate our food behaviour. Tradition, history and learning creates a food culture which builds on and embroiders these basic emotions.

In the same way that we have a basic repertoire of feelings about food, in service of the goal of nutrition, we also have a basic repertoire of feelings about non-food. The evolutionary end that shaped these feelings was not nutrition but good health.

Humans are in the thick of a constant battle against the pathogens and parasites which have made a living by preying on us and other animals. We have evolved defences that include a coherent skin, an ever-adapting immune system and antibiotics in our tears (Nesse & Williams 1995). If we have evolved physical defences to these invaders over the aeons then it seems reasonable to test the hypothesis that we have also developed behavioural defences against disease that are, at least partly, innate. Imagine a person who was not equipped with the feeling of disgust. Imagine that this person was quite prepared to eat parasitised meat, to watch flies on his food, to share clothing with strangers, to taste the faeces of his neighbour. Before long this unfortunate person would be loaded with parasites, debilitated by dysentery and be highly unlikely to find a mate or pass on his genes.

Disgust may appear to be irrational today but in the past the cues to disgust must have helped to keep our ancestors from situations and objects that would have made them sick. What sort of behaviours would have helped avoid sickness in the past? Faeces, as we saw at the beginning, are the archetypal source of gut pathogens. Gut infections are still among the top three killers in the world today. A short list of enteric infections includes hepatitis, viral gastroenteritis, giardiasis, polio, salmonellosis, cryptosporidiosis, amoebiasis, campylobacteriosis, shigellosis and cholera. It has been estimated that a third of the world's population is infected with intestinal worms (Warren et al. 1991). Avoiding faeces, especially those of others, would have been highly advantageous to the health of our ancestors and the selection pressure for defensive adaptations was thus high. The oral route is an easy way for pathogens to gain access to well-defended bodies. Avoiding any possibility of the ingestion of contaminated or toxic foods would have assisted survival.

Animal and vegetable wastes that harbour microbial or fungal growth would have been dangerous as sources of food (as well as would have been the leftovers of others)

hence any genes that led proto-humans to avoid such things would have carried a strong selective advantage. Moist and damp surfaces favour such growth and should therefore also signal possible danger. Miller suggests that lukewarm temperatures cue disgust:

> Temperature, it seems, disgusts precisely in those ranges in which life teems…the temperature must be sufficient to get the old life soup bubbling, seething, wriggling and writhing but not so great as to kill it (Miller 1997, p 64).

Though he would disagree that disease avoidance is the ultimate explanation, Miller is describing exactly those conditions which favour the multiplication of pathogenic bacteria.

This hypothesis holds up for disgust objects beyond faeces. Meat and fish are, or were, contaminated by vast numbers of parasites (we see little of these today, except in abattoirs and in rural areas of developing countries). Though many have no significance for human health, avoiding tapeworm and roundworms would have given proto-humans a distinct advantage. The sight of worms, bugs and maggots especially in food should therefore be a potent sign to avoid eating it. Shed hair can transmit a number of parasitic infections such as ringworm (Tinea capitis) and so should evoke revulsion. Monkeys and domestic animals such as cats, dogs and sheep harbour viruses, microbes and parasites which can cause a huge variety of diseases including salmonellosis, toxoplasmosis and rabies. Rats, mice and other rodents are known to be involved in the transmission of at least fifteen viral, microbial or parasitic diseases including plague and the viral haemorrhagic fevers. Disgusting little insects or *beestjes* resemble surface parasites such as scabies, mites, lice, ticks and fleas that can transmit typhus, plague, arboviral infections and relapsing fever as well as cause serious skin infections. Indeed most animals have instinctive deparasitising, grooming behaviours to care for their body surfaces (Holdblar & Wilson 1990; Dunbar 1997), so we should expect human primates to have the same urges.

Open wounds are a route of transmission for infection so humans should be repulsed by blood and pus, especially that of others. The airways allow the ingress of airborne pathogens. Rhinoviruses, Flu viruses and other viral infections like measles are hard to avoid by behavioural means, except perhaps by a tendency to keep one's distance from others, and the avoidance of nasal mucus. Hence we might expect a dislike of being breathed on, or coughed at, by strangers to be a human universal. We should also expect not to be attracted to the sight of nasal mucus or anything that resembles it.[6]

If the gut, the skin and the airways are vulnerable to infection then so are the genitals. The ambivalent disgust-attraction that surrounds the subject may well arise from the fact that sex is both necessary for reproduction and dangerous for survival, because it provides another route for pathogens to enter the body. Sexual mores and taboos are another invisible, under-researched subject (Van der Geest 1998b), perhaps for this reason.

For Miller bodily orifices are vulnerable because they are routes by which the soul can become polluted. This may be so, but they are also routes for the ingress of pathogens. Bodily emissions, especially those of others threaten our physical health before

our mental health. The only bodily emission that is not generally thought disgusting is tears, an exception which fits well with our hypothesis because they are sterile and contain antibacterial compounds.

The hypothesis that disgust arose as a mechanism causing humans to avoid the acts and objects that might cause infection seems to fit the observed facts. Though our modern diseases may differ in detail from those that placed selection pressure on our ancestors, the principle that the bugs are out to get us, (or more precisely that parasitising humans is a good way for bugs to make a living) and that they will evolve to use any available port of entry, remains the same.

## Nature *and* nurture

Many objections can be raised to this scenario. Firstly, as Rozin and Fallon point out, disgust does not arise at birth, but is generally acquired before the fifth birthday. Surely this suggests that culture, not biology, is at the heart of our behavioural tendencies. One response to this argument is that children easily learn to be disgusted by faeces and worms, they do not easily learn to be disgusted by sweets or biscuits, no matter how hard parents might try. In the laboratory a dislike of a foul smell such as ammonia can easily be conditioned and not easily eradicated, whilst dislike for a fresh smell is harder to condition and easier to remove (Bergh 1995). Aversion to pictures of spiders and snakes can be more easily conditioned than to pictures of flowers and houses (McNally 1987). Human nature is not infinitely plastic, a clean slate on which culture, any culture, can be written (Tooby & Cosmides 1992). Just because a behavioural trait or predisposition becomes apparent after babyhood does not mean it is not innate, it may be present as a predisposition (Seligman 1971). No amount of cultural conditioning can prevent girls from getting interested in sex in the teenage years, for example. And a child does not need to develop a disgust emotion until it reaches the toddling age when it leaves the close supervision of its caretakers.

A more fundamental objection to such biological reasoning is that humans have evolved culture, rationality and will-power, that we are no longer slaves to our animal heritage and so dance to a different tune. Culture and rationality do, of course, play a large part in our hygiene behaviour. In some societies pork is liked, in others it is the object of a cultural prohibition; some people do stop eating eggs because of a rational fear of salmonella. But simple introspection shows that this is not the full story; we scratch our arm in response to an itch, wrinkle our noses when we sniff a bad odour or jump when we are startled in microseconds, long before the conscious brain has a chance to get involved, a fact which has recently been confirmed by brain imaging (Carter 1998). Brain imaging has also located a disgust centre in the brain (Phillips et al. 1997) and associated this with a lack of disgust in sufferers of Huntingdon's disease (Sprengelmeyer et al. 1996). That disgust is a part of our basic psychological makeup seems incontrovertible. Yet the specific way in which it develops and many of the specific objects, acts and events which occasion it are the domain of the social and cultural scientists. Few social scientists have, as yet, been keen to engage with biological reality

of human behaviour. Perhaps this reluctance to own up to our animal nature is animal disgust by extension.

The debate as to whether purity and pollution are cultural constructions or adaptations is, of course, an old one. Tylor (1958) proposed that ritual pollution must have had practical health functions, whilst Harris (1985) has suggested that primitive hygiene was related to economic factors: insects are not a cost-effective food source, for example. However, neither were able to explain the mechanism by which hygiene behaviours arose nor the way in which they became a part of culture. Modern evolutionary theory does provide a sensible and plausible mechanism for the psychological origins of hygiene. However, modern evolutionists still have a huge programme of work ahead of them to explain how basic psychological tendencies are subsumed into culture; how they are built upon, modified, enhanced and exploited, and used in metaphor, symbol and ritual. This programme has begun with detailed studies of human behaviour related to such things as childcare, family structure, sexuality, risk taking, co-operation and warfare, all of which appear to have both evolved psychological and cultural determinants. The study of hygiene is another promising area for cross-disciplinary evolutionary research.

## Medical materialism revisited

So was Mary Douglas wrong after all; should we return to the medical materialism that she so despised? Douglas has offered excellent explanations as to how symbols, rituals and boundaries make up culture. She is undoubtedly right that dirt is matter that is out of its proper place, and that anything that violates body boundaries is perceived as dangerous. Her explanations of the symbolic and metaphorical use of these categories within culture make perfect sense. However, they make even better sense in the light of evolutionary explanations for the origins of these phenomena. Douglas' work on culture is not complete without the perspective of evolutionary psychology, which explains why the specific objects and acts of impurity and danger have such power to repel. Miller's exploration of disgust would be enhanced, not reduced by serious enquiry into the biological basis of disgust.

We have offered a working hypothesis that fits the observed facts and seems plausible. But scientific hypotheses require efforts to falsify them before they can be accepted. Testable predictions need to be made and evaluated. The next step is to work back from the disease hypothesis to predict exactly which objects and sensory cues should provoke disgust and then verify whether this is the case across cultures. We might also test predictions across-species; we should expect that animals with a fixed abode would exhibit faecal hygiene, as seems to be the case for ants (Hölldobler & Wilson 1990). Much work is still needed in this area. But by adding the disgust thread to the hygiene weave the pattern becomes clearer. And the clearer pattern gives us a better basis for action.

So what would be the practical consequences of accepting a biological basis for human hygiene behaviour? If emotions do have their origins as drivers of adaptive behaviour, as is increasingly accepted, then this has important consequences for the

applied behavioural sciences that include health promotion. Behaviour cannot be changed if it is not understood, which is perhaps why current efforts at health education and promotion have had disappointing results. Efforts at encouraging safer hygiene for the sake of health are currently hampered by the myth and confusion surrounding the subject. If disgust does have its origins in adaptations for disease avoidance then we have a powerful weapon on the side of hygiene. If culture has made faeces invisible then perhaps we can make them visible again; harnessing the power of disgust for the sake of public health. However, disgust is only one of the drives that relate to hygiene, others include a need for order and classification, for beauty and for dignity and respect. When woven together with history, culture and individual learning they produce hygiene. The work cataloguing and examining these threads needs to proceed further before the whole pattern can emerge.

## Notes

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1. For those who know Lucknow, the continuation of Sealy's narration may seem more apt:

   "Well it is known to all the people of the earth that the city of ... Lakhnau ... stands without equal for the beauty of its gateways, the majesty of its walls, the grace of its towers, the sheen of its domes, the lustre of its meanest dwellings washed with lime and shimmering under an indigo sky. Who has not heard of Chowk, with its heaven-embracing markets loaded with silks and incense, sugar and mangoes, its colonnades festooned with peacocks, its fragrant stairs washed hourly with crimson juices? Here, veiled, pass heart-expanding women with chaplets of flowers and comely boys with languid gait ..."

2. Laddering is a techniques used by market researchers to elicit consumers' motivations in relation to the attributes of particular products. We used it here to explore how people felt about hand-washing and bathroom cleanliness. Typically, questioning begins by asking what is it about hand-washing that is appreciated and then asks "why is this important to you?" repeatedly up a hierarchy of reasoning until respondents can go no further.
3. Codes relate to the location where the exchange took place. IN denotes India and NL the Netherlands.
4. *Beestje* is the diminutive of beast, or wild animal. *Beestje* as a diminutive can express tenderness, but in its plural form (*beestjes*) it often refers to loathsome insects like lice. A famous popular song of about 40 years ago had a line in that sense ("*allemaal beestjes*").
5. *Ongedierte* usually refers to '*beestjes*' out of place. A person cleaning the house may refer to the dirt in house as *'ongedierte*' (woodworms, spiders, flies, etc). The prefix 'on' here signifies 'bad'. The woman who has just cleaned her house may say: "*Het zat vol ongedierte*".
6. Of course, when a drive is felt, the immediate goal is the reduction of discomfort, to spit out the offending object, to distance oneself from the revolting object. These drives operate on sensory cues of sight and smell and may or may not be rational in our current environment. For example a plastic joke-shop turd that one of the authors uses in teaching has to be carried about in a brown paper bag for fear of causing offence.

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