

Hygiene

Hygiene, in its modern sense the act of personal and domestic cleansing, is an adaptive behavior practiced by insects, birds, fish, and animals (including humans); organisms that can best reduce the costs of disease through the avoidance of parasites become more evolutionarily “fit.” Hygienic behavior in humans has been culturally elaborated to serve symbolic, ritual, and moral functions.

H ygiene is the set of behaviors that keeps individuals and their environments clean, especially to prevent infection. The word hygiene has narrowed its meaning through history. Its roots are Indo-European; *hy* is thought to have meant “well” and *gies* to have meant “live.” The Greek word *hygies* means “in good health” or a force “good for health, promoting health.” Hygieia, daughter of Asclepius, was the Greek goddess of health (Parker 1983). Hygiene still had this broader connotation as the science of public health in the Anglophone world of the nineteenth and twentieth centuries, but in recent decades it has taken on a narrower sense as personal and domestic cleaning, and some now use it even more narrowly to denote behavior or rituals involved in avoiding germs.

All animals, including humans, exhibit hygienic behavior because it is adaptive. Animals are under constant pressure from microparasites such as viruses, fungi and bacteria, and macroparasites such as nematodes (roundworms), helminths (intestinal worms), and insects that are seeking nutrition, shelter, and reproductive opportunities within, or on, their bodies. Those animals that can best reduce the costs of disease through the avoidance of parasites do best in the evolutionary fitness stakes, all else being equal.

Hence, animals invest energy in carrying out the hygienic behaviors that serve to detect, deter, avoid, and remove damaging parasites from their bodies and environments. In humans hygienic behavior has been culturally elaborated beyond these basic functions to serve symbolic, ritual, and moral functions.

Animal Hygiene

To judge from its ubiquity today, hygienic behavior is probably almost as old as animal life itself. So, for example, the simple nematode worm *Caenorhabditis elegans*, which has only 302 neurons, can detect the presence of a parasitic species of bacterium in its petri dish and flee from it. Insects display many hygiene behaviors. Social insects such as ants and termites groom each other, and they build nests using materials that incorporate antifungals and antibacterials. Many social species employ separate castes to carry wastes, as well as the sick and the dead, to dung-hills; if an ant relegated to the status of a “cleaner” tries to contact other ants it is repulsed with aggression (Holldobler and Wilson 1990). Insects avoid fouling their ranges with their own feces (frass) by shooting it out, flicking or pushing it away, walling it up in their webs, or disposing of it in disused tunnels (Weiss 2006). Lobsters make sure their dens are clean and ventilated; the gregarious Caribbean spiny lobster demonstrates social hygiene by refusing to share a den with others infected with the lethal PaV1 virus. Similarly, killifish avoid shoaling with other fish that appear to have parasites. In the Red Sea, the surgeonfish stops feeding on the reef every five to ten minutes and swims to a spot beyond the reef edge to defecate. Reptiles demonstrate similar



The chickadee's nest. Parent birds remove excrement, eggshells, foreign debris, and ectoparasites from nests to preserve the health of their offspring. From *In the Morning Glow* by Roy Rolfe Gilson, illustrated by Alice Barber. New York: Harper, 1903. New York Public Library.

behaviors. Geckos, for example, defecate around the edges of their territories. Bullfrog tadpoles avoid other tadpoles that have a dangerous yeast infection. Salamanders that observe the food hygiene practice of not cannibalizing others reduce the risk of acquiring parasites.

Birds, such as the oystercatcher, are careful to avoid eating food that may contain parasites. Nestlings are particularly vulnerable. Parent birds therefore remove nestling excrement, eggshells, foreign debris, ectoparasites, and dead nestlings from their nests. Parent birds defecate away from nests; penguins, for example, can shoot out a projectile excrement that hits the ground about half a meter away from the nest, making stains that are used in biodiversity monitoring by satellite. The Great Tit, a common woodland species in Europe, cuts down on sleep to clean its nest if nestlings have a heavy infestation of fleas. Blue tits, falcons and starlings bring fragments of aromatic plants, which contain the same active compounds used by humans to make house cleaners and herbal medicines, to their nests. More than 250 bird species

are known to “ant,” that is, to rub crushed insects over their plumage. This behavior distributes compounds such as formic acid that protect from parasitic bacteria, fungi, and arthropods.

Mammals demonstrate myriad hygienic behaviors including: nest cleaning (badgers change nest material regularly); selective feeding (sheep avoid eating from patches of grass that are heavily dosed with dung); avoiding the sick of their species (female house mice distinguish the smell of sick males and refuse to mate with them); feces disposal (blind mole rats have latrine chambers; tapirs, badgers, raccoons, and lemurs use latrine sites); and grooming behavior (impala use their teeth to comb off lice). It seems that the reindeer’s annual migration may even be for hygienic purposes—moving in response to the build up of dung in calving grounds.

Primates are well known for grooming each other. Chimpanzees keep themselves clean too, for example, by engaging in penile hygiene—wiping themselves off with leaves after mating—while mother chimps sometimes wipe the behinds of their infants who have just defecated. Colobus monkeys rub their fur with the juices of leaves and fruit, probably to deter parasites, and many primate species avoid defecating on, or near, food plants. Primate troops limit their size, especially in parasite-dense ecozones, and quarantine new members until it is clear that they are healthy.

Extant animals across taxonomic groups thus demonstrate food hygiene (avoiding the consumption of parasites), personal hygiene (removing and discouraging ectoparasites), social hygiene, (avoiding contact or sex with sick others or outsiders who may be harboring parasites), and domestic hygiene (removing parasites, vectors [hosts], and parasite-containing wastes from the living environment). Some sedentary and social animals also display sanitary behavior (constructing a niche that is not conducive to parasites).

Human Hygiene

As recently evolved primates, *Homo sapiens* have inherited the gamut of food, social, personal, domestic, and sanitary hygiene behaviors from their ancestors.



Gerard ter Borch, *Woman Washing Hands* (1655).
Oil on oak.

avoidance of the twelve impurities of the body: oily exudations, semen, blood, urine, feces, the mucous of the nose, ear wax, phlegm, tears, the rheum of the eyes and sweat. Similarly, Leviticus 11–16 provides detailed rules about purity and impurity, listing, for example, animals that are clean and unclean, unclean bodily fluids, and unclean acts requiring ritual purification.

Mary Douglas's influential work on purity and pollution argues that such rules about impurity are byproducts of the ways in which societies organize themselves. She writes: "Dirt then, is never a unique, isolated event. Where there is dirt there is a system. Dirt is the by-product of a systematic ordering and classification of matter, in so far as ordering involves rejecting inappropriate elements" (Douglas 1966, 35).

But as we have seen, rules about pollution and contamination arise out of ancient hygiene instincts, driven by the evolved emotion of disgust, and so they cannot be explained purely as a product of culture. Although there is some limited variation between cultures in the substances and events labeled as "polluting," overall the historical and ethnographic record shows patterns that are consistent, with the

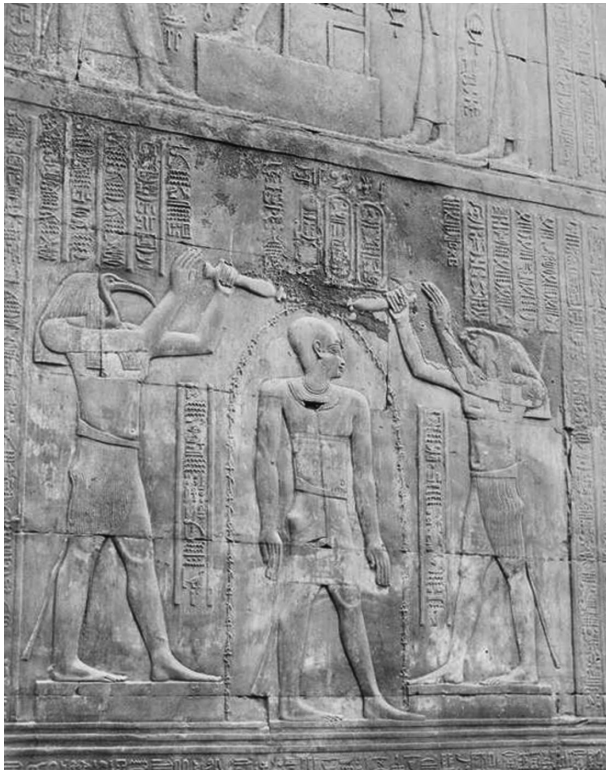
instinctual avoidance of those objects and situations where the risk of parasitic infection is highest.

Hygiene in Recent History

Prescientific thinking about hygiene had the gods intervene to punish pollutions. Secular beliefs—about contaminating bad airs or miasma as a cause of disease—replaced this thinking and continued to hold sway in western Europe for over 2000 years. Eventually those ideas too gave way to germ theory. There is much debate over the details of how and when the germ theory of disease took hold. A key development was, of course, the microscope. Yet it was more than three hundred years after Anton van Leewenhoek (1632–1723) demonstrated the teeming animalcules in the white matter between his "usually very clean" teeth that belief in germs became an established norm in Western medical discourse. The idea that invisible living organisms were responsible for disease spread in fits and starts through Europe and America over the second half of the nineteenth century.

This epidemiologic spread of Western ideas into other cultures was underpinned by the same intuitive concern for hygiene—that it could not be good for one to be invaded by disgusting tiny insects, fungus, or seeds (germs). It gained ground because it was taught by respected others who were known to have real cures for disease—in this case, the powerful colonizers, with their science and their microscopes. Nevertheless, germ theory spread unevenly across much of the world, sometimes to replace, and sometimes to live side-by-side, or hybridize with, local beliefs about the origins of disease. For example, in Burkina Faso, the intuition that dirt causes disease is well established. Diarrhea in children is thought to be caused by contamination of the mothers' milk by sperm if sexual relations have been resumed postpartum and by worms. But only *toubaboukonoboli*, translated as "white's diarrhea," is attributed to germs.

Hygienic behavior is universal in modern humans (Brown 1991). Irrespective of their knowledge of, or belief in, germs, every cultural group that has been



Pharaoh Ptolemy undergoes a purification ritual performed by Egyptian gods Thoth (left) and Horus (right). From a collection of nineteenth-century photographs of Egypt and Nubia by Antonio Beato and others. New York Public Library.

studied demonstrates and values food, personal, social, and domestic hygiene. While economic and scientific development has led to major improvements in environmental health and hygiene in the

West, epidemiological studies show that greater investment is needed in public health and hygiene in less developed countries. The widespread adoption of hand washing with soap, the removal of fecal contamination from water, better food hygiene, and the provision of modern sanitation systems could still save many millions of lives from infectious diseases in developing countries (Curtis and Cairncross, 2003).

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