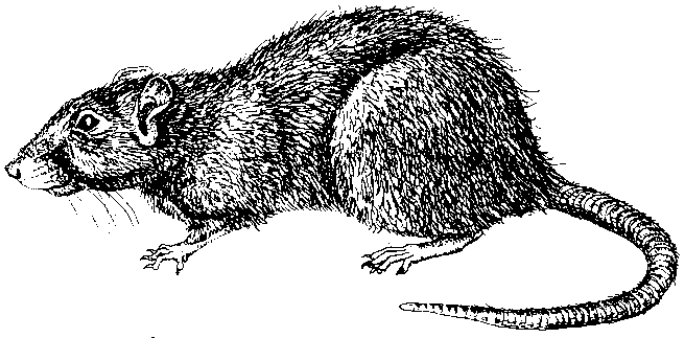
Rats

(Tamil: *eli*)



Drawing courtesy of Bombay Natural History Society

Rats? OK, everyone knows they're more or less universally disliked, but any creature so successful and so intricately involved with human life on Earth at least merits further consideration!

Rodents and their success

Mammals are the highest class of animals on Earth. Of this class, the rodents comprise approximately one third, making them the most numerous of all higher animals, with over 1,000 species varying in size from the 5-gram Tropical Field Mouse of India and Africa to the 1.2m/4ft long 50 kgs South American Capybara and in form from porcupines, voles, marmots, hamsters, flying squirrels, bandicoots, mice and jerboas to beavers, lemmings, guinea pigs, chinchillas, gerbils and others. All have in common two chisel-like incisor teeth at the front of each jaw, with which they gnaw their food.

Overall, what makes rodents so successful is that they have evolved into forms capable of occupying almost every nook and cranny of the world's surface, except Antarctica. There are species that can glide, species that live their whole life in trees, and species that can survive extremes of temperature by living in underground burrows. Some species in our part of the world can live without hibernating and can find food even under 2m/6½ft of snow (the Murree Vole). Others sleep out the long winter curled up together in an underground nest chamber for up to 8 months of the year or, like the Lesser Bandicoot, may collect and store food underground for use in time of need. Still others have developed long legs to enable them to scamper over sand dunes and burrow into the dunes for shelter e.g. jerboas. They are all interesting, but none exceed the rat in their importance to human life on Earth.

Most common rat

The world's commonest rat is the Brown (Norwegian) Rat (*Rattus norvegicus*), also called the Sewer Rat, which is larger, bolder and tougher than most other rats, eats a wider variety of foods, and is more resistant to weather extremes. It usually succeeds in steadily pushing out other species wherever it becomes established. In England, for example, it has been so successful that the once ubiquitous Black Rat (*Rattus Rattus*) has almost become an endangered species! Only in countries like India does the Black Rat, which thrives better in the heat of the tropics, outnumber the Brown Rat. Both, however, are broadly similar in habit and appearance, and both breed profusely.

General characteristics

General characteristics of rats are that they are larger than mice, have 5-digit limbs, hairy bodies with whiskers, long, slender, mostly naked and rather scaly tails, poor vision but highly developed senses of smell, hearing and touch (the latter largely via their whiskers), and sharp teeth with which they can gnaw through wood, plastic, and even a variety of metals, including lead, aluminium and copper. They vary by colour within species depending on the environment, and tend to be richer coloured in the wild. They consume from 5 to 20% of their body weight in food daily, and pregnant females have the extraordinary ability to reabsorb their foetus in times of stress or food shortage.

Rats and humans

Rats are among humanity's most serious pests, both as destroyers of food and agricultural crops and as carriers of disease. As such they have been intensively studied, and much is known about their physiology, intelligence and social behaviour. In S.E.Asia, which seems to be where rats first originated, there are now some 20 species, of which most are forest dwellers. Best known to us, however, are the globally-spread Brown Rat, the Black (Common House) Rat, and the Bandicoot Rat, thanks to their involvement with human populations and the damage they do to our food supplies.

To give some idea of the scale of this damage in India (which is thought to be home to over 5 billion rats; 500 crores!), it is estimated that they eat or damage over 5% of annual food grain tonnage each year, which is around 11 million tons annually. In some godowns it's estimated there are more than two rats per square metre of floor space! In one studied godown with 244m^2 of floor area the resident rats were found to consume over 4,200 kgs of grain a year, enough to feed 7,000 people for a day. These are staggering statistics, and clearly indicate that for India the saving of food already harvested or being grown is just as important as growing more food; in fact probably more so. (*It should also explain why it was said at the start of this article that these creatures merit our attention!*)

Importance to humans as disease carriers

As disease carriers rats directly or indirectly pass to humans a variety of serious illnesses, including typhus, typhoid fever, toxoplasmosis, rat bite fever and plague, an instance of the latter being the Black Death in Europe during the 14th century, the 3rd deadliest pandemic in human history, which peaked around 1350, led to several major social, economic and religious consequences, and killed an estimated 75-200 million people. They also pass to animals swine fever and foot & mouth disease.

Slightly offsetting this broad picture, however, is their contribution to the field of medicine, where they are widely used in the testing of new drugs, food additives and other concoctions potentially harmful to us humans. They also make contributions to other fields of research, including psychology, learning, group behaviour and overcrowding, which – like it or not – often result in extremely broad conclusions being drawn regarding our own behaviour. For such purposes labs around the world keep a specially bred stock of rats which, though clean and white, are actually just albino Sewer Rats, psychologically unrelated to humans.

Reproduction and control

Rat offspring are born hairless with their eyes and ears closed, though these open in a fortnight and they become furry at the same time. They are totally weaned at 4-5 weeks; soon learn to avoid traps and poisons from their mother; and when aged 3 months leave their mother, start to mate, and either live in the same location or move to a new area. In nature they may live for about a year; in captivity up to 3 years. They can breed as often as 6-10 times a year, each time producing around 10 young, though up to 18 at a time is not unknown. (A pair of rats living 3 years could theoretically produce 350 million offspring.) Can you imagine, with such fecundity, where we'd be without predators such as snakes, cats, mongooses, the larger lizards, birds of prey and various small carnivores – plus the parasites rats are vulnerable to – to control them?! It doesn't bear thinking about, though there are other natural control mechanisms. The weather may cause populations to fall when monsoon rains drown offspring in burrows, and availability of food can also play a major role. In reverse, however, lack of rain and abundant food can cause surges in population.

Rats control their own population

All the above controls on rat numbers help, but rats themselves also control their own population to maintain it in proportion to available food, water and shelter in the area. For instance, in a building or given area of land with enough of these three needs to sustain, say, 100 rats, if the population were to increase to 150 the colony itself would reduce the number back to the maximum for sustainable life i.e. 100 rats. The decrease would be achieved through death – killing of each other in fights, eating of the young, and loss via predators – or by emigration of some of the rats to another area. Similarly, if one was trying to eliminate these 100 rats by rodent control and only killed 70-80%, the remainder would reproduce rapidly until the colony reached 100 again!

Rats in human diet

Repulsive as the thought may be to most of us, there are many people who eat rats (*apparently they taste quite good!*). As food, their meat is forbidden in some cultures, including Islam, being seen as diseased and unclean, though in others it is a common dietary item and seen as acceptable to a particular social

or economic class. Bandicoots, for example, are so plentiful in some places compared to other sources of protein that it is logical for people to include them in their diet. In the Mishmi culture of India rats are seen as essential to the traditional diet, and the Musahar community in north India has commercialised rat farming by promoting them as an exotic delicacy. The United Nations Food and Agriculture Organization even estimates that rat meat makes up half the locally produced meat consumed in Ghana, where cane rats are farmed and hunted. Rats are also eaten in the Philippines, Vietnam, parts of Thailand and Cambodia (Cambodia exports around a metric ton of rats daily to Vietnam as food).

While all this may seem extraordinary to many people, it should be noted that rural rat populations are not like town rats, in that they are less likely to live in filthy disease-ridden circumstances. Even in Spain, rats used to be eaten in rice-producing regions of the country, and were one of the main ingredients in traditional paella (later replaced by rabbit, chicken and seafood). They are also a common food item for pet snakes. Captive-bred pythons, in particular, are fed mostly rats, though in animal-loving Britain the government in 2007 banned the feeding of any live mammal to another animal in response to pressure from the RSPCA (Royal Society for Prevention of Cruelty to Animals). While the move satisfied the more extremist animal lovers, in so doing they banned nature from functioning naturally!

Toxoplasma

Returning for a moment to mention of "toxoplasmosis" above, few people have heard of this illness, but it seems worth a few lines here because it involves a fascinating transfer process.

The eggs of the single-celled toxoplasma parasite, which is closely related to the malaria parasite, find their way into rats that nibble on the faeces of infected cats. After living inside the rat, when it's time to reproduce the 'toxo' parasite has to get back into a cat again, but rats are pathologically averse to cats; the mere smell of one is enough to drive them away. So how does toxo make the jump back from prey to predator? There is, of course, the possibility that a cat may catch and eat the rat, but nature has given toxo an ingenious alternative. Without touching any of the other functions, it cuts particular neurons in the rat's brain, making them fearless of cats (*how does it know which to cut?*). The parasite then goes even further, fiddling with a neural pathway in the brain so the smell of cats becomes attractive to the rat! The poor rat then throws caution to the wind and presents itself to the cat, with suicidal results. No matter; toxo has hit the jackpot, and can now happily reproduce! (*Wow! Mother Nature, I really do marvel at your ingenuity!*)

Their teeth

To return fully to rats, their most noticeable feature, which they share with all other rodents, is their strong jaw muscles and their already-mentioned single pair of incisor teeth in the front of each jaw. Unlike normal teeth these don't have roots, and grow continuously throughout their life at the rate of 12½cms/5in. a year, with the possible result that if they are not ground down they can grow up through the roof of the mouth and pierce the brain. They are covered only on the front side with (usually) yellow-orange coloured hard enamel, the rest of the tooth consisting of softer cement. The result of this combination is that as rats gnaw away at foodstuffs and other materials, thereby keeping the incisors ground down to a reasonable length, the two components wear unevenly, providing them with chisel-like hard cutting edges in front.

Vocalisation

Although rats are generally perceived as silent animals, they may emit short, high frequency, ultrasonic, socially induced sounds during rough & tumble play, before mating, and when tickled, described as a distinct "chirping". The phenomenon has been likened to laughter, and is seen as an expectation by the rats of something pleasurable. However, like most rat vocalizations the sound is too high pitched for us to hear without special equipment. In clinical studies, the chirping is associated with positive emotional feelings, and social bonding occurs with the tickler, resulting in the rats becoming conditioned to seek the tickling. In addition to these sounds, Brown Rats also produce sounds which can be heard by humans. The most common in pet Browns is tooth-grinding, best described as either a quick clicking or "burring" sound, which is usually triggered by happiness, but can also be 'self-comforting' in stressful situations, such as when they are taken to see a vet. (Visits to the vet being comparable to visits to the dentist for us, the phenomenon can perhaps be compared to when some people's teeth chatter in fear?)

Breeding and life cycle

When it comes to reproduction and their life cycle, the Brown Rat can breed throughout the year if conditions are suitable, with a female typically producing up to 5 litters of 6-12 pups at a time (more is not uncommon) following a gestation period of only 3 weeks. However, it is common for the mother rat to kill

and eat several of her pups in their first hours. Research suggests that when she does so she identifies the smallest and weakest for slaughter. This horrifying act (in human terms) is actually one of the keys to the species' success, because if the mother tries to wean too many pups she risks underfeeding all of them, thus leaving herself and the brood vulnerable to predators. By reducing the number she has to feed, she also rebuilds her reserves to ensure that her remaining pups get the best chance of survival.

Habitat and behaviour

Regarding habitat and behaviour, Brown Rats live in large hierarchical groups, mostly in burrows or subsurface places such as sewers and cellars, each rat with its own social position in the pack, and with dominant males and females occupying the best nest sites. In such groups it is common for them to groom each other and sleep together. They also have the habit of "play fighting" together, which can involve any combination of jumping, chasing, tumbling and boxing. During such "fighting" they go for each other's necks, while serious fighting involves attacks on the other's back end. On the whole they live on good terms with each other, though they will attack and eat a sick or injured fellow rat. When food is in short supply those lowest in the hierarchy are first to die, and females may limit themselves to just one litter a year. Noting that on average they live for around a year in the wild, their overall annual mortality rate is estimated at 95%.

The success of rats

The incredible success of rats can be attributed to a number of things besides their prolific breeding. They are generally tough, intelligent, cunning, agile, timid or bold as the occasion warrants, and also secretive and wary, being mostly active at night. They can survive individually, but also live happily in crowded circumstances such as those just described or the earlier-mentioned godown. They also readily switch habitats, moving into towns/houses with the coming of monsoon rains, and then moving out to the countryside later when the crops are ripening. They will also – like cockroaches – take a wide variety of foodstuffs in addition to favourite foods like grain. Hungry rats, specially when numerous, become very bold and sometimes even dangerous. They have been known to gnaw the feet of captive elephants, and to attack domestic pigs and poultry as well as to take eggs and the young of wild birds. They have even occasionally attacked humans, specially babies, though more often they will only bite a sleeping person.

Bandicoots

So far we have talked mostly in general terms about rats, but the huge Indian Bandicoot (*Bandicota indica*) and Lesser Bandicoot (*B.bengalensis*), although not true rats in the sense that they are not members of the genus Rattus (64 species worldwide), also deserve special mention here, partly because we see them in Auroville. Particularly noteworthy is the Indian Bandicoot, because it is the largest 'rat' in Asia, measuring 30-38cms/12-15in. from its nose to the root of its tail, plus a similar length of tail, and weighing up to 1.4 kgs. Their size, plus their aggressive nature and habit of raising the long piles of hair along their backs and grunting harshly when disturbed or excited, makes them formidable creatures to face. They are more or less parasitic on man, rarely living far from towns or human dwellings, though they are not as common as other rats in south India. They chiefly occupy outer buildings such as stables and storerooms, and do a lot of damage to gardens with their burrowing habits. They can even penetrate bricks and masonry.

The second type of Bandicoot (*B.bengalensis*), more commonly known as the Mole Rat, which at one time was estimated to form 98% of the rat population of Calcutta, is much smaller than the aforementioned version, being only 15-18cms/6-9in. nose to tail base, with another 12-18cms/5-7in. of tail. Its common name springs from its mole-like burrowing habit, in course of which it throws up piles of fresh earth around the place, and often causes damage to bunds. Like its giant cousin it frequents towns and houses, but is also found commonly in country areas. Its burrow consists of an entrance hole leading down to a circular chamber some 60cms/2ft below ground, off which other tunnels may radiate as far as 15-18m/50-60ft, with occasional small circular chambers leading off where grain is stored at harvest time (as is well known by tribals, who dig up the contents!). In one field investigated by scientists it was estimated that at least 10% of the complete grain crop had been harvested and stored underground by these creatures. At such times of abundant food the females produce up to double the normal size of litter, with maybe 10-18 pups, and the adults build up large body-fat reserves, doubling their normal weight within a few weeks. Thereafter they are equipped to survive months of drought if necessary, living underground on their stored grain and body-fat, and requiring no water intake. Average life expectancy, however, is relatively low, maybe less than a year, though in ideal circumstances they may live for up to 4 or 5 years. Sexual maturity is achieved by

males in under 2 months, and females in 3 months, after which the latter may have 10 or more pregnancies a year i.e. one every 5 weeks or less.

Rats as pets

Finally, it is interesting to note that specially bred rats – usually Brown Rats descended from those bred for research – have been kept as domesticated pets at least since the late 19th century, specially in the more developed countries. Such rats tend to be more docile than their wild ancestors, but more disease prone, presumably due to inbreeding. They don't pose any more of a health risk to us than our cats and dogs, and are generally found to be friendly, clean, intelligent, playful, and capable of performing a few tricks.

Meanwhile, it is amusing to note that although mere mention of "sewer rats" conjures up revulsion, fear and disgust in practically every human being, in places like Europe and America those same people unhesitatingly buy them as pets for their children, little realizing that the furry, intelligent white creatures they purchase in pet shops are nothing more glamorous than albino Sewer Rats!

How's that for something to chew on?

Additional miscellania

* Male rats are called "bucks", unmated females "does", pregnant or parent females "dams", and infants "kittens" or "pups". A group of rats is either referred to as a "mischief" or a "pack" (Frank Sinatra and his friends were known as The Rat Pack!).
* Because rats have a very good sense of smell and are easy to train, they have been used in landmine and tuberculosis detection.
* Rats can leave up to 25,000 droppings a year i.e. over 60 a day.
* Because rodent urine glows blue-white under UV light, it can be used at night to check for their presence.
* In the English language a "rat" is a contemptible person or unscrupulous character e.g. a deserter. Other examples are: to smell a rat = detect something suspicious; to be ratty = bad tempered or irritable; and to be caught up in the rat race = to be involved in hectic competitive activity. "Rat" also refers in criminal slang to an informant i.e. "to rat on someone" means to betray them by telling the authorities of a crime they committed.
* In Hinduism rats are seen as the vehicle of Lord Ganesh, and a rat's statue is normally found in any Ganesh temple. In the north-western city of Deshnoke the rats at the Karni Mata Temple are believed to be destined for reincarnation as Sadhus. The attending priests feed milk and grain to them, of which the pilgrims also partake.
* In Imperial Chinese culture the rat (sometimes referred to as a mouse) is the first of the 12 animals of the Chinese zodiac. People born in rat years are said to possess rat-like qualities, such as creativity, intelligence, honesty, generosity, ambition, a quick temper and wastefulness. They are said to get along well with "monkeys" and "dragons", and to get along poorly with "horses."
* European associations with the rat are generally negative, in that they see them only as vicious, unclean, parasitic animals that steal food and spread disease.
* One of the oldest and most historic stories about rats is 'The Pied Piper of Hamelin' (Germany), in which a rat-catcher leads away a rat infestation with enchanted music, but is refused payment. In retaliation he then leads away the town's children. This tale, placed around the 13th century, has inspired films, theatre, literature and even opera.
* The so-called (Brown) "Norwegian Rat" didn't originate in Norway. In the 18th century English observers wrongly thought it came from there on ships, and named it accordingly, though it hadn't even reached that country at the time!
* Rats can leap up 90cms/3ft vertically from a flat surface; jump horizontally nearly 4ft; squeeze through any opening larger than an inch; survive falls of 12-15m/40-50ft; dive through plumbing traps and swim up sewer lines against swift currents; climb the inside of vertical pipes 5-10cms/2-4in. in diameter; and – specially Brown Rats – swim on the surface of water for up to a kilometre, dive and swim under water for short periods, and tread water for a day or more.