THE HUMANE SOCIETY OF THE UNITED STATES

About Chickens

The chicken is the world's most numerous domesticated bird, with over 52 billion farmed worldwide in 2008, rivaling the dog as the most ubiquitous domestic animal globally.[1,2] These birds have fascinated scholars and researchers since the dawn of Western civilization, and recent studies are beginning to reveal the depths of their complexity and cognitive ability. According to Andrew F. Fraser, professor of veterinary surgery at Memorial University of Newfoundland, and Donald M. Broom, professor of animal welfare at University of Cambridge: "Those who have studied the behaviour of the domestic fowl in detail…, especially those who have looked at feral fowl…, inevitably acquire much respect for the members of this species."[3]

Domestication

Charles Darwin proposed that domestic chickens descended from the Red Jungle Fowl (*Gallus gallus*), who are indigenous to parts of India and Southeast Asia.[4,5] Taxonomically, in fact, domestic chickens and Red Jungle Fowl are considered the same species (*Gallus gallus*).[6] Domestication likely began in India and China approximately 8,000 years ago and geographically expanded along with trade to the countries of the Mediterranean region.[7,8] Spanish explorers brought domestic fowl to the New World during the 16th century CE, and large-scale, commercial poultry production began in the 19th century.[9,10]

Ecology

Red Jungle Fowl inhabit second-growth forest areas, especially those that have been cleared by burning for agricultural use.[11] Both chickens and jungle fowl are capable of short-distance flight, but they primarily travel by foot[12] and prefer areas with dense vegetation for ground cover. The colors of their plumage make them well-camouflaged among the red and brown leaves that collect on the forest floor.[13] Jungle fowl usually segregate into small groups with one male and several females,[14] occupying a regular home range,[15] or territory during the breeding season.[16] Within their home range they have regular roosting sites, where they sleep high in the trees at night and rest during the hottest part of the day.[17,18]

The flock's activities are highly synchronized and consist of regular daily movements within the home range.[19,20] As natural water sources are essential for nourishment, the two loci of the jungle fowl's habitat are the roosting site and the water hole, which is shared with other animals in the area, including other jungle fowl flocks.[21] They also make use of tree hollows, where rain water accumulates and where they can find insects under the moist, decaying matter.[22]

Diet

Feral chickens (domesticated birds that have reverted to a wild state) have been observed to eat a wide variety of plant matter, including berries, seeds, and grasses, availing themselves of all food sources in their habitats. They scratch the forest floor for insects and snails, and they snatch figs and other fruits from the trees. Feral chickens have even been observed forming symbiotic relationships with cattle, by pecking at the flies that swarm around the cows' faces and by scavenging on their waste.[23,24,25] Feral domestic fowl have also been observed to eat carrion.[26]

In one study of feral chickens released on an island nature reserve, grasses and oats were the primary component of the diet. Young chicks consumed significantly more invertebrates than adults, for whom plant matter is the

most important part of the diet.[27] Chickens are also known to eat stones, sand, and fine grit, some of which are retained in the gizzard and help to grind food during digestion.[28]

Natural Behavior

The basic behavioral repertoire of domestic chickens is fundamentally the same as that of their wild ancestors.[29,30] That is to say, domesticated chickens who revert to a feral state are behaviorally similar to wild jungle fowl.[31]

Jungle fowl are generally crepuscular; active early in the morning, asleep during the day, and awake again from late afternoon until dusk. At dawn, the males, also known as roosters or cocks, start the day by crowing loudly, reinforcing territorial boundaries and dominance relationships.[32]

Jungle fowl spend a great part of their day foraging, walking, and pecking at the ground.[33] Foraging involves scratching the ground with both feet, quickly moving backwards, and pecking at anything edible that has been exposed.[34] A study of semi-wild jungle fowl at a British zoo found that, even though the staff fed the birds regularly, the jungle fowl continued to forage.[35] Foraging is important for domestic chickens as well and, when given a choice, hens prefer to find their own food rather than take freely from a feeder, a phenomenon called "contra free-loading."[36,37]

Chickens use their beaks as a primary means of touching and feeling, as well as for picking up and manipulating objects. Their beaks are used in much the same way that we use our hands. The beak is essential for activities such as preening, nesting, and defense.[38,39] Being extensively innervated and connected to the autonomic nervous system, the tip of the beak is very sensitive, and has neural receptors for touch, taste, and temperature.[40]

Vision is important to chickens and the combined weight of their eyes is equal to that of their brain.[41] Their visual ability surpasses that of humans, with color vision extending into the ultraviolet range and their visual field covering 330°.[42]

Preening, the combing and fluffing of the feathers, is part of a bird's routine grooming.[43] Chickens also keep their plumage in good condition by dustbathing, which helps to remove excess oils.[44,45]

Wild and feral fowl are capable of flying high up into trees to evade predators and they roost in the trees at night. They usually ascend gradually by flying short distances from lower to higher branches.[46,47,48] As the light fades in the evening, the birds begin to seek out their roosting sites so that they are settled in their perches before dark.[49]

Social Behavior

Red Jungle Fowl are highly social animals who naturally live in small, stable groups. A flock is often comprised of a single dominant male, who defends the territory, and several females and subordinate males.[50,51] They engage in many activities as a group, such as foraging, resting, and preening.[52] Males and females in the flock form separate dominance hierarchies, or pecking orders.[53] Chicks gradually develop a social order within their broods as well.[54]

The social nature of chickens is reflected in their communicatory abilities. Males call to the hens when they find edible items to share.[55,56] They perform "tidbitting" displays by picking up and dropping the food repeatedly and offering it to the hen.[57]

During the breeding season, males become very territorial and guard fixed areas. Dominant males patrol the boundaries of their territory and keep other roosters away from the hens.[58] Subordinate males may occupy areas within the dominant male's territory, including the roosting area, but without female partners. Subordinate males frequently move in and out of different groups.[59]

Nesting Behavior

Under natural conditions, hens leave the group and find a secluded nest site when they are ready to lay their eggs.[60] Wild jungle fowl nest in tall patches of grass, which provide cover for their broods. They may scratch out a shallow bed in the ground or under the roots of a tree, and line the "scrape" with vegetation and feathers.[61,62,63]

Unlike most domestic hens, who have been selectively bred to lay eggs year-round, wild fowl breed and lay primarily in spring.[64,65] The Red Jungle Fowl lays 10-15 eggs per year,[66] and the average size of each brood is 4-6 chicks.[67]

After laying her eggs, the hen sits on the nest all day and night for three weeks. She leaves her nest only once a day to quickly find food and drink water. It is also her only opportunity to dustbathe.[68,69,70] During this incubation period, the hen and her chicks call to each other. Calls emitted by the developing chick embryos stimulate the hen to turn her eggs or to return to the nest when she is away.[71]

Chick Development

Sensory systems, including sight, hearing, smell and touch, all begin to develop prior to hatching. The shell of the egg does not shield the developing embryo from sound and light, for example, and the external environment influences the neurological development of the chick. When the chick hatches, he or she already knows some characteristics of the hen's call. Chicks are very precocial, and quickly learn essential associations that are necessary for survival,[72] such as how to identify edible feedstuffs, recognize danger, and keep up with their mother.[73]

At hatching, chicks instinctively follow the first moving object they see and learn its characteristics, a process known as imprinting. Under natural conditions this is normally their mother but, when reared in an artificial environment such as a laboratory, they will imprint on the first moving object they encounter.[74]

Newly hatched chicks begin to explore and peck at small, spherical, food-like objects[75,76] and their pecking improves in accuracy over the first week of life.[77] Newly hatched chicks must learn to recognize food, so the hen's behavior is very important in encouraging chicks to peck at edible items.[78] The hen directs her chicks to appropriate food items by calling and pecking at the ground.[79]

Behavioral research has revealed that hens demonstrate remarkable ability to adjust to the foraging skills of their chicks. In a study conducted at Bristol University, chicks learned to eat color coded feed. While hens were taught that one color of feed was edible and another color inedible, their chicks were taught the opposite. When the hens observed chicks making apparent errors in food selection, they increased the intensity of their feeding display, scratching and ground pecking more, in response to perceived errors by their chicks.[80] In an interview, John Webster, emeritus professor at Bristol University, stated, "What this tells us is that the mother hen has learnt what food is good and what is bad for her, that she cares so much for her chicks she will not let them eat the bad food and she is passing on to her young what she has learnt. To me that is pretty close to culture—and an advanced one at that. Chickens are sentient creatures and have feelings of their own."[81]

During the first four days post-hatching the chicks remain very close to the hen,[82] who takes them under her wings and crouches over them. This brooding behavior, which can occupy as much as 2/5 of the daily activity of a hen, can be initiated by either the hen or her chicks. The chicks, for example, may insist on being brooded by peeping loudly and pressing up against the hen. Brooding keeps the chicks warm,[83] and a hen will brood her chicks during inclement weather, or will call them to hide under her at signs of danger.[84] Mother hens are very protective of their young and, if their camouflage and other defenses fail to avoid detection, a hen will become raucous and draw potential predators to herself in an attempt to divert attention away from her chicks.[85]

The chicks follow the hen on walking and foraging trips along the home range, and the hen keeps them nearby by clucking to them. If they wander away from the hen and the rest of the brood, chicks are often able to find their way back to the nesting site.[86]

By ten days of age, chicks begin moving further away from the hen, sometimes traveling out of her sight. Frolicking—a behavior in which one individual runs toward another with wings raised or flapping—peaks at 12 days of age.[87] Chicks will copy each other's behavior when playing, a psychological phenomenon known as social facilitation.[88]

A social order becomes apparent by 5-6 weeks of age.[89] By 6-7 weeks, the chicks begin to fly well enough that they move to safer roosting sites above ground with the mother hen.[90,91] By approximately 8-10 weeks post-hatching, the chicks start to forage independently of their mother, although they continue to associate with the brood and roost near the adult flock.[92] By approximately 18 weeks, the young birds join the rest of the flock.[93]

Communication

Communication begins prior to hatching. Embryos emit a distress call, when cold, for example, and the hen responds to such calls by moving the egg in the nest. Developing chicks also emit pleasure calls when the hen responds. Communication is not limited to the hen and her chicks, as nest mates also influence each other with their vocalizations. Clicking and bill clapping sounds made during late development are thought to help synchronize hatching, so that all the chicks in a clutch break free of their shells at approximately the same time.[94]

Young chickens develop a diverse vocal repertoire. Chicks display a dozen different types of calls and 19 additional calls have been identified for adult fowl.[95,96] Adults have two distinctive alarm calls, one for aerial predators such as hawks and another for threats from the ground. The aerial predator call is intended to warn other fowl in the vicinity while allowing the caller to quietly take cover. Others in the flock respond to these alarm calls by standing alert, crouching down, or taking cover.[97,98] Whereas young males will only give food calls in the presence of females, they will give alarm calls in the presence of both sexes, indicating selectivity and purpose in their communicative behavior.[99,100]

Every rooster's crow call is distinctive and its characteristics are correlated with his comb length,[101] which is an indicator of dominance.[102] Males use rate and quality of crow calls to assess the dominance status of other males.[103]

Intelligence

The intelligence of chickens is often underestimated. Studies are beginning to show that these birds have remarkable cognitive abilities. Christine Nicol, professor of animal welfare at the University of Bristol, has studied social learning in chickens and stated,

> Domestic chickens show remarkable abilities to learn socially and to benefit from the correct and incorrect responses and experiences of conspecifics. Their abilities to learn from others are not simple or 'fixed' in any way, but depend on the context and the social identity of both the observer and the demonstrator.[104]

In one study, chicks avoided pecking at a noxious stimulus after observing the responses of other chicks.[105] In studies with hens, those who had watched a trained hen peck one of two colored keys to obtain food performed better than those who did not observe a trained demonstrator, indicating that chickens can learn by observation.[106] Interestingly, the social status of the demonstrator affected the other hens' degree of learning. While the behavior of all the demonstrator hens was similar, the observers learned more readily by watching dominant hens.[107]

Research has shown that newly hatched chicks have basic numerical competencies[108]—in other words, they can count. A 2007 study showed that chicks have a basic understanding of ordinality up to ten. This experiment was the first to test numerical skills in such young animals (the chicks were only a few days old), and the upper limit of this ability has not yet been determined experimentally.[109]

A study published in 2002 found that chickens may also have a sense of time. Hens were trained in a laboratory to peck a touch screen computer six minutes after they were shown a symbol on the screen. After the six minute interval had passed, birds who correctly pecked were rewarded with feed. The combined data from many trials showed that hens tended to peck the screen 6-7.5 minutes after the designated start of the timed session, demonstrating that they had an approximate sense of the correct amount of elapsed time.[110]

Studies have also shown that domestic hens can form expectations and anticipate the future. In one study, after training hens to expect food in a particular situation, researchers subsequently prevented them from obtaining food under the same circumstances. When denied access to food, the hens emitted more of one specific type of call, the "gakel-call."[111] Subsequent research showed that the number of gakel-calls emitted increased with the length of time hens had been food-deprived. Together, these studies suggest that the gakel-call is indicative of frustration.[112] Researchers in the U.K. demonstrated that hens can predict outcomes and exhibit self-control in order to obtain the best outcome. When given a choice between a two-second delay followed by access to feed for three seconds, or a six-second delay followed by access to feed for 22 seconds, the hens often held out for the larger reward.[113]

Researchers in Italy have demonstrated that young chicks are capable of forming mental images and understanding that an object continues to exist even when it is no longer visible to them. In these studies, chicks were required to locate an object on which they had imprinted when it was only visible through a small window. To reach the object, they had to maneuver past several obstacles and retain a mental image of the object even when it was out of sight, a task which the chicks readily accomplished.[114,115] This experiment demonstrated that chicks have a sense of "object permanence," a theory in child developmental psychology devised by Jean Piaget. It could be said that this ability in chickens exceeds the mental capacity of infants,[116] because infants do not develop a sense of object permanence until around 6-7 months of age.[117]

Research conducted since the 1950's demonstrating the significant cognitive abilities of birds, combined with new insights into avian brain evolution, have led an international group of scientists to call for a revised classification system for the avian brain that finally acknowledges similarities to the mammalian brain. In fact, cognitive skills once thought uniquely human are now recognized in a variety of avian species.[118]

In her exhaustive work on the development of the chicken brain, Lesley Rogers, professor of neuroscience and animal behavior at University of New England in Australia, concludes: "With increased knowledge of the behaviour and cognitive abilities of the chicken has come the realization that the chicken is not an inferior species to be treated merely as a food source."[119]

Conclusion

While a chicken's natural lifespan is usually 5-8 years, it can last up to 30 years.[120] However, most hens used for commercial egg production live for 1-2 years before they are killed, and broiler chickens, raised for meat, are slaughtered at just 6-7 weeks of age.[121]

Observations of chickens in their natural environment and in laboratory tests have shown that these animals display complex behavior, social attachments, strong personalities, and impressive cognitive skills—attributes that rival those of mammals. Given the intricacies of their behavior and psychology, they are fully capable of experiencing both a positive and a negative quality of life. Our attitudes towards these animals may stem in part from simple lack of understanding, and this has largely led us to disregard their suffering as they are raised for meat and egg production.

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