ANIMAL BEHAVIOUR

Animal behaviour, the concept, broadly considered, referring to everything animals do, including movement and other activities and underlying mental processes. Human fascination with animal behaviour probably extends back millions of years, perhaps even to times before the ancestors of the species became human in the modern sense. Initially, animals were probably observed for practical reasons because early human survival depended on knowledge of animal behaviour. Whether hunting wild game, keeping domesticated animals, or escaping an attacking predator, success required intimate knowledge of an animal’s habits. Even today, information about animal behaviour is of considerable importance. For example, in Britain, studies on the social organization and the ranging patterns of badgers (Meles meles) have helped reduce the spread of tuberculosis among cattle, and studies of sociality in foxes (Vulpes vulpes) assist in the development of models that predict how quickly rabies would spread should it ever cross the English Channel. Likewise in Sweden, where collisions involving moose (Alces alces) are among the most common traﬃc accidents in rural areas, research on moose behaviour has yielded ways of keeping them off roads and verges. In addition, investigation of the foraging of insect pollinators, such as honeybees, have led to impressive increases in agricultural crop yields throughout the world.Even if there were no practical beneﬁts to be gained from learning about animal behaviour, the subject would still merit exploration. Humans (Homo sapiens) are animals themselves, and most humans are deeply interested in the lives and minds of their fellow humans, their pets, and other creatures. British ethologist Jane Goodall and American ﬁeld biologist George Schaller, as well as British broadcaster David Attenborough and Australian wildlife conservationist Steve Irwin, have brought the wonders of animal behaviour to the attention and appreciation of the general public. Books, television programs, and movies on the subject of animal behaviour abound.History And Basic ConceptsDarwin’s inﬂuenceThe origins of the scientiﬁc study of animal behaviour lie in the works of various European thinkers of the 17th to 19th centuries, such as British naturalists John Ray and Charles Darwin and French naturalist Charles LeRoy. These individuals appreciated the complexity and apparent purposefulness of the actions of animals, and they knew that understanding behaviour demands long-term observations of animals in their natural settings. At ﬁrst, the principal attraction of natural history studies was to conﬁrm the ingenuity of God. The publication of Darwin’s On the Origin of Species in 1859 changed this attitude. In his chapter on instinct, Darwin was concerned with whether Animal communication Aggressive behaviour Feeding behaviour Avoidance behaviour Nest Display behavior behavioral traits, like anatomical ones, can evolve as a result of natural selection. Since then, biologists have recognized that the behaviours of animals, like their anatomical structures, are adaptations that exist because they have, over evolutionary time (that is, throughout the formation of new species and the evolution of their special characteristics), helped their bearers to survive and reproduce.Furthermore, humans have long appreciated how beautifully and intricately the behaviours of animals are adapted to their surroundings. For example, young birds that possess camouﬂaged colour patterns for protection against predators will freeze when the parent spots a predator and calls the alarm. Darwin’s achievement was to explain how such wondrously adapted creatures could arise from a process other than special creation. He showed that adaptation is an inexorable result of four basic characteristics of living organisms:An inevitable consequence of variation, inheritance, and differential reproduction is that, over time, the frequency of traits that render individuals better able to survive and reproduce in their present environment increases. There is variation among individuals of the same species. Even closely related individuals, such as parent and offspring or sibling and sibling, differ considerably. Familiar human examples include differences in facial features, hair and eye colour, height, and weight.1.Many of these variations are inheritable—that is, offspring resemble their parents in many traits as a result of the genes they share.2.There are differences in numbers of surviving offspring among parents in every species. For example, one female snapping turtle (family Chelydridae) may lay 24 eggs; however, only 5 may survive to adulthood. In contrast, another female may lay only 18 eggs, with 1 of her offspring surviving to adulthood.3.The individuals that are best equipped to survive and reproduce perpetuate the highest frequency of genes to descendant populations. This is the principle known colloquially as “survival of the ﬁttest,” where ﬁtness denotes an individual’s overall ability to pass copies of his genes on to successive generations. For example, a woman who rears six healthy offspring has greater ﬁtness than one who rears just two.Ecological and ethological approaches to the study of behaviourThe natural history approach of Darwin and his predecessors gradually evolved into the twin sciences of animal ecology, the study of the interactions between an animal and its environment, and ethology, the biological study of animal behaviour. The roots of ethology can be traced to the late 19th and early 20th centuries, when scientists from several countries began exploring the behaviours of selected vertebrate species: dogs by the Russian physiologist Ivan Pavlov; rodents by American psychologists John B. Watson, Edward Tolman, and Karl Lashley; birds by American psychologist B.F. Skinner; and primates by German American psychologist Wolfgang Köhler and American psychologist Robert Yerkes. The studies were carried out in laboratories, in the case of dogs, rodents and pigeons, or in artiﬁcial colonies and laboratories, in the case of primates. These studies were oriented toward psychological and physiological questions rather than ecological or evolutionary ones. The goal of the psychologists was to formulate behavioral hypotheses that claimed to have general applications (e.g., about learning as a single, all- purpose phenomenon). Later they would proceed using a deductive approach by testing their hypotheses through experimentation on captive animals. In contrast, the ethologists advocated an inductive approach, one that begins with observing and describing what animals do and then proceeds to address a general question: Why do these animals behave as they do? By this they meant “How do the speciﬁc behaviours of these animals lead to differential reproduction?” Since its birth in the 1930s, the ethological approach—which stresses the direct observation of a broad array of animal species in nature, embraces the vast variety of behaviours found in the animal kingdom, and commits to investigating behaviour from a broad biological perspective—has proved highly effective.One of Tinbergen’s most important contributions to the study of animal behaviour was to stress that ethology is like any other branch of biology, in that a comprehensive study of any behaviour must address four categories of questions, which today are called “levels of analysis,” including causation, ontogeny, function, and evolutionary history. Although each of these four approaches requires a different kind of scientiﬁc investigation, all contribute to solving the enduring puzzle of how and why animals, including humans,behave as they do. A familiar example of animal behaviour—a dog wagging its tail—serves to illustrate the levels of analysis framework. When a dog senses the approach of a companion (dog or human), it stands still, ﬁxates on the approaching individual, raises its tail, and begins swishing it from side to side. Why does this dog wag its tail? To answer this general question, four speciﬁc questions must be address.With respect to causation, the question becomes: What makes the behaviour happen? To answer this question, it becomes important to identify the physiological and cognitive mechanisms that underlie the tail-wagging behaviour. For example, the way the dog’s hormonal system adjusts its responsiveness to stimuli, how the dog’s nervous system transmits signals from its brain to its tail, and how the dog’s skeletal-muscular system generates tail movements need to be understood. Causation can also be addressed from the perspective of cognitive processes (that is, knowing how the dog processes information when greeting a companion with tail wagging). This perspective includes determining how the dog senses the approach of another individual, how it recognizes that individual as a friend, and how it decides to wag its tail. The dog’s possible intentions (for example, receiving a pat on the head), feelings, and awareness of self become the focus of the investigation.With respect to ontogeny, the question becomes: How does the dog’s tail- wagging behaviour develop? The focus here is on investigating the underlying developmental mechanisms that lead to the occurrence of the behaviour. The answer derives from understanding how the sensory-motor mechanisms producing the behaviour are shaped as the dog matures from a puppy into a functional adult animal. Both internal and external factors can shape the behavioral machinery, so understanding the development of the dog’s tail- wagging behaviour requires investigating the inﬂuence of the dog’s genes and its experiences.With respect to function: How does the dog’s tail-wagging behaviour contribute to genetic success? The focus of this question is rooted in the subﬁeld called behavioral ecology; the answer requires investigating the effects of tail wagging on the dog’s survival and reproduction (that is, determining how the tail-wagging behaviour helps the dog survive to adulthood, mate, and rear young in order to perpetuate its genes).Lastly, with respect to evolutionary history, the question becomes: How did tail-wagging behaviour evolve from its ancestral form to its present form? To address this question, scientists must hypothesize evolutionary antecedent behaviours in ancestral species and attempt to reconstruct the sequence of events over evolutionary time that led from the origin of the trait to the one observed today. For example, an antecedent behaviour to tail wagging by dogs might be tail-raising and tail-vibrating behaviours in ancestral wolves. Perhaps when a prey animal was sighted, such behaviours were used to signal other pack members that a chase was about to begin.Both the biological and the physical sciences seek explanations of natural phenomena in physicochemical terms. The biological sciences (which include the study of behaviour), however, have an extra dimension relative to the physical sciences. In biology, physicochemical explanations are addressed by Tinbergen’s questions on causation and ontogeny, which taken together are known as “proximate” causes. The extra dimension of biology seeks explanations of biological phenomena in terms of function and evolutionary history, which together are known as “ultimate” causes. In biology, it is legitimate to ask questions concerning the use of this life process today (its function) and how it came to be over geologic time (its evolutionary history). More speciﬁcally, the words use and came to be are applied in special ways, namely “promoting genetic success” and “evolved by means of natural selection.” In physics and chemistry, these types of questions are out of bounds. For example, questions concerning the use of the movements of a dog’s tail are reasonable, whereas questions regarding the use of the movements of an ocean’s tides are more metaphysical.