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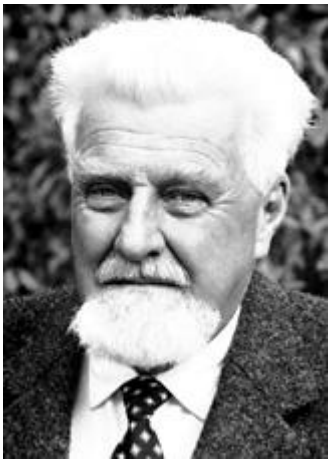
Nobel Prize in Medicines 1973


Karl von Frisch


Konrad Lorenz


Nikolaas Tinbergen

The Nobel Prize in Physiology or Medicine 1973 was awarded jointly to Karl von Frisch, Konrad Lorenz and Nikolaas Tinbergen "for their discoveries concerning organization and elicitation of individual and social behaviour patterns".

During the first decades of this century research concerning animal behaviour was on its way to be stuck in a blind alley. The vitalists believed in the instincts as mystical, wise and inexplicable forces inherent in the organism, governing the behaviour of the individual. On the other hand reflexologists interpreted behaviour in an one-side mechanical way, and behaviourists were preoccupied with learning as an explanation of all behavioural variations. The way out of this dilemma was indicated by investigators who focused on the survival value of various behaviour patterns in their studies of species differences. Behaviour patterns become explicable when interpreted as the result of natural selection, analogous with anatomical and physiological characteristics. This year's prize winners hold a unique position in this field. They are the most eminent founders of a new science, called "the comparative study of behaviour" or "ethology" (from ethos = habit, manner). Their

first discoveries were made on insects, fishes and birds, but the basal principles have proved to be applicable also on mammals, including man.

Karl von Frisch is known mainly for his research on the "language" of bees. By means of a comprehensive series of experiments he elucidated the ways bees use to communicate information to each other. A bee that has found a source of honey in the vicinity of the hive performs a "round dance" when returning. Other bees participate and thus become stimulated to circulate around the hive searching for the honey. If the source of honey is situated at a distance more than about 50 m from the hive, the returning bee performs a "waggle dance" instead. She runs straight forward for a short distance, wagging her abdomen, then turns to one side and runs back to the original position, repeats the waggle along the same straight route but turns to the other side to return to the point of origin, and so on. Normally, the dance is performed in darkness on a vertical honeycomb. The direction of the straight distance informs the hive bees about the direction of the honey source relative to the position of the sun, but the direction "to the sun" is translated "upwards". Even when the sun is not visible the bees are able to indicate the direction of the honey source by means of analysing polarized, ultraviolet light. The intensity of wagging etc informs about the distance according to the principle: the more intense, the closer. This complicated mode of communication is evidently genetically programmed and not learnt.

When Konrad Lorenz in the twenties started his studies on the "instinctive" activities of the birds, he found that they consisted to a large extent of "fixed action patterns" that were elicited by a specific "key stimuli" only, and performed in a robot-like way. By studying "naive" animals (e.g. young birds born in an incubator), he was able to prove that these fixed action patterns appeared as reactions to key stimuli without any previous experience, i.e. without any learning. On the other hand, adequate experience is of great importance for the development of some types of behaviour. Lorenz has especially studied one, quite specific type of learning, called "imprinting". During an early critical period of life a definite type of stimuli may be necessary for normal development. These

stimuli elicit a behaviour pattern that will be irreversible. The newborn duckling will be imprinted to follow the first moving object it sees, whether it is the mother, a cardboard box or a ballon. An animal's sexual attitudes later in life may be determined by early experiences of this type.

One of Nikolaas Tinbergen's most important contributions is that he has found ways to test his own and other's hypothesis by means of comprehensive, careful and quite often ingenious experiments. For example, by means of dummies he has measured the strength of key stimuli and their elements as regards their power of eliciting corresponding behaviour. He analysed for example those properties of the seagull's bill that elicit the nestling's food begging picking against it, i.e. its form, colours and the contrasts. One finding was that by exaggerating certain characteristics it is possible to produce "supranormal" stimuli that elicit more intense behaviour than the natural ones. Tinbergen has also studied the organization of instinctive behaviour, e.g. the complicated series of actions that constitutes the stickleback's courtship and reproductive behaviour.

The prize winners' discoveries, mainly the results of studies on insects, fishes and birds, have stimulated to comprehensive research also on mammals. This holds true both for their discoveries concerning organization, maturation and elicitation of genetically programmed behaviour, and for their demonstration of the necessity of adequate stimuli during critical periods for the normal development of the individual. As the brain cortex has developed, plastic and learnt behaviour has to a large extent been substituted for the more mechanical, fixed action patterns. However, also man is equipped with a number of fixed action patterns, elicited by specific key stimuli. This holds true for the smile of the infant and for the behaviour of a mother to her newborn child. Investigations on primates have shown that it has disastrous consequences for its future behaviour when an infant grows up in isolation, without any contact with its mother and siblings. Males who have grown up under these conditions will be incapable to copulate, and females will not take care of their offspring. Psychosocial situations leading to conflicts for example as a result of disturbances of the social organization of an animal society, may lead both to abnormal

behaviour and to somatic diseases such as hypertension and myocardial infarction. It is evident that it may have quite serious consequences when the psychosocial environment is too antagonistic to the biological qualities of the species. An example is that crowding within restricted space may lead to inadequate and destructive, aggressive behaviour both in animal and man. - Research within these fields has led to important results for, e.g. psychiatry and psychosomatic medicine, especially as regards possible means of adapting environment to the biological equipment of man with the aim of preventing maladaptation and disease.

For more details please visit:

http://www.nobelprize.org/nobel_prizes/medicine/laureates/1973/press.html