In this issue

Fullerenes

There have been few discoveries in recent times that have had as much of an impact on chemistry as the discovery of the fullerenes. Ever since C_{60}, buckminsterfullerene (named after the father of the geodesic dome, Buckminster Fuller) was conveniently synthesized, by laser ablation of graphite, the literature of chemistry has been flooded with innumerable investigations of new forms of carbon. The inevitable happened in 1996, when the impact of the fullerenes was finally felt in Stockholm with the award of the Nobel Prize in chemistry to Kroto, Smalley and Curl, the three original discoverers of C_{60}. Pradeep (**page 124**) presents an overview of recent research on these new carbon forms, which have stimulated thousands of chemists all over the world. Despite much initial promise in diverse areas ranging from superconductivity to near pharmaceuticals, the fullerenes are primarily still a laboratory curiosity.

In retrospect, the surge of interest in the fullerenes was really fuelled by the remarkable beauty and simplicity of the C_{60} structure and the realization that there must be a treasure trove of all carbon molecules to be discovered. The idea that there could be several new carbon allotropes led to a 'gold rush' resulting in an amazing flood of publications.

The fullerenes brought to chemistry the same frenzied race for new discoveries that was witnessed in physics, following the discovery of high T_c superconducting materials. To the historians of science, superconductivity and fullerenes will provide fascinating case studies, when an analysis is conducted of the state of chemistry and physics in the final decades of the twentieth century.

P. Balaram

Suicide in amoebae – altruism or selfishness?

When a honeybee colony is disturbed, worker bees will unhesitatingly attack the marauder with a painful sting, notwithstanding the fact that for the bee, to sting means to commit suicide. The sting of the honeybee is armed with barbs pointing inwards so that when firmly lodged into the skin of the victim, it cannot be withdrawn. When the bee flies away, its abdomen will rupture and the sting, the poison gland and a portion of the bee's intestines will be left behind. This ensures that although the bee dies in a few minutes, the almost invisible poison gland will keep pumping venom into the victim's body for considerably longer than the bee might have been able to do. When free-living amoebae of the cellular slime mold *Dictyostelium discoideum* exhaust their local food supply, they will come together and form a multicellular slug which will differentiate into a stalk made of dead cells and a spore filled with live cells. The stalk helps the spore rise above the ground and thus increase its chances of being carried away to a new, hopefully nutrient-rich habitat. None of the amoebae are individually up to this task of dispersal but by the sacrifice of some of them, others have gained a finite chance of survival. Despite the extremely different proximate mechanisms by which such altruistic behaviour may be achieved in the bees and the amoebae, there is an underlying similarity in the evolutionary consequences of their behaviour – some individuals behave in a manner that increases the Darwanian fitness of others while decreasing their own fitness.

Providing a common interpretation for the behaviour of amoebae and bees is a triumph of modern evolutionary biology but the mechanism by which such behaviours are shaped by natural selection remains a matter of much debate. Prior to the 1960s, the standard explanation was that any behaviour that is good for the group as a whole would be favoured by natural selection even if it is bad for the individual performing it, because natural selection was thought to always act at the level of the group and override the interests of the individual for the sake of the group. Although this interpretation found much favour in Victorian England, the recognition of the susceptibility of such group selection to invasion by cheaters led to the development of the theory of kin selection, a theory which argued that altruism towards genetic relatives is more likely to evolve as the sacrifice by the altruist can be compensated by the reproductive success of the recipient. Amotz Zahavi, who sees in the arguments of kin selection, the same instability due to invasion by cheaters that others see in group selection, has achieved the status of a lone crusader for the lost cause of good old individual selection. According to Zahavi, there is really no altruism – all apparently altruistic acts are a veiled form of selfishness as individuals attempt to do the best they can under the circumstances they find themselves in. In this crusade, Zahavi is literally moving from place to place and from organism to organism, enlisting the cooperation (altruism?) of the not too skeptical, to push individual selecon arguments to their logical con-lusion.

On **page 142** of this issue we see ıe result of this stop-over at angalore and at the cellular slime ıolds, as Daniella Atzmony, Amotz ahavi and Vidyanand Nanjundiah tempt to explain the apparently al-uistic behaviour of the amoebae ı the basis of individual selection. ccording to their bold hypothesis, high quality amoebae produce a poison and coerce low quality amoebae to accept an altruistic role, the alternative for the latter being even more certain death. Whether or not individual selection will eventually be adjudged as a satis-factory explanation for altruism in the slime molds and other organ-isms, an honest attempt to examine the possible role of individual selection is extremely valuable, a will prove to have been so even the final answer is in the negati And the biochemical implicati of the concepts they introduce quality, poison and coercion – bound to provide new directions more empirically minded inve gators.

Raghavendra Gadag

Current Science

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