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The games nature plays

Understanding living things sometimes calls for a second look, says S.Ananthanarayanan.

John Nash, who was in town (Mumbai) recently, got the 1994 Noble prize for his work on ‘game theory’, the mathematical analyses of strategies to maximize benefits where payoffs depend dynamically on moves by different players.

Classic games

A simple ‘gamy’ situation arises when ‘self interest’ clashes with ‘general good’ - for example, when the village asks each family to add its bottle of wine to the communal punch bowl, should a family slyly pour a bottle of water instead? At first glance, it is a bright thing to do, because the family saves a bottle of wine and the punch will still be as good. The rub is that if all the families took this rational approach, then the celebrations may lack a certain something.

But if a family decided to do its bit and pour in real wine, the altruism may be pointless if the others did not follow suit.

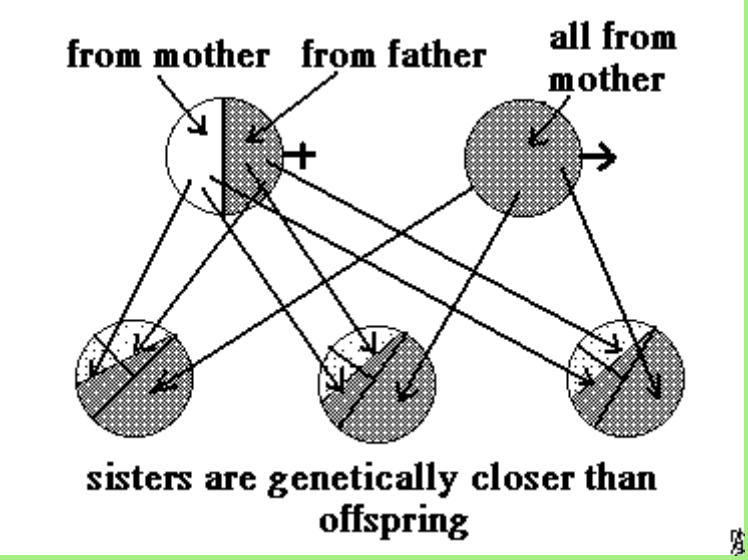
Straightforward game theory analysis says all families should pour water, because this is the behaviour that can guarantee zero loss, at worst. Co-operative behaviour, which results in doing better than this kind of low return but stable economics, arises only with special effort and energy, as found in religions, or with charismatic leaders. But organic or natural systems just evolve to follow the best strategies, including mixed strategies, for survival.

‘Wired-in’ co-operation

Bee and ant communities consist of a queen, female workers and male drones. The workers are all capable of reproduction, but still, they do not mate with the drones, to propagate themselves. They leave this role to the queen bee and thereby maintain the social order of the hive or nest. How is it that the workers cooperate and do not pursue the objective of propagating their own genes?

The answer lies in the peculiar genetics of ‘Hymenoptera’, the family of ants, bees and wasps. Here, the females lay both fertilized as well as unfertilized eggs. The fertilised eggs, which have the genetic material of both the mother and the father, all produce female offspring. But the unfertilized eggs, which have only the mother’s genes, result in males. The result is that the males, unlike the females, have only one set of chromosomes, the one they inherited from their mother and they pass these on, entirely, that is without selecting only half, to offspring, when they mate.

In the normal course, as in humans, siblings have half each of each parent, or half the total genetic material in common. But in bees and ants, female siblings, have half the mother's genes, but all of the father's genetic estate, in common. Thus they have 75% genes in common.



Hence, if the females were all to mate, each one separately, to reproduce, the offspring would each have 50% of themselves. But if they did not compete with the queen bee, but allowed reproduction to be her sole province, then, the hive is populated with more sisters, each with 75% of the genes of each worker!