Killer genes, green beards...

...and other dynamic stories on the politics of genetic behaviour. The evidence, of course, is scientific

Lausanne, Switzerland, and Kenneth Ross of the University of Georgia, USA. Keller and Ross have been studying the Argentinean red fire ant (*Solenopsis invicta*) which has been accidentally introduced into the US and has become something of a pest.

Keller and Ross have been looking for variable genes because this permits them to estimate the genetic proximity among different members of the ant colony. This is where answers to altruism among close genetic relatives lie, as predicted by Hamilton. Colonies of social insects like ants are the best place to look for examples of altruism as most individuals in these colonies are sterile workers who sacrifice personal reproduction and spend their entire lives assisting their queens to reproduce.

Keller and Ross identified a gene called Gp-9, which has some peculiar properties. This gene exists in two forms, which the researchers label as B and b. Such variables of a gene are called alleles. Each female ant inherits one copy of the gene from its mother and another from its father, and has any one of the three possible genotypic compositions: BB, Bb or bb.

The first peculiarity they found was that both workers and queens possessing the bb gene combination die early. This is not surprising as such genes, known as recessive lethals, are quite common. Many genetic disorders in humans are caused by recessive lethal genes when one bad allele remains harmless in the presence of a good partner. But two copies of the bad allele can be fatal.

However, the real peculiarity that Keller and Ross found was that while both BB and Bb types exist among the workers, only Bb types are to be found among the queens. Whatever happens
to all the BB queens?

Shocking as it may seem, all BB queens attempting to reproduce are killed by workers who primarily have the Bb gene combination. This means that workers who possess at least one copy of the gene b (Bb workers) recognise the presence of b in the queens (BB queens) and permit them to reproduce. But they kill all queens who do not possess any copy of the gene b (BB queens).

Keller and Ross conclude that b is a green beard gene as it permits its bearers to recognise other bearers of itself and be nice to them. What is equivalent of green beard here? In other word what is the label of queens possessing the gene b? It appears that BB queens and Bb queens smell different. Moreover, this smell has something to do with reproduction — BB queens are not killed until they begin to reproduce.

The researchers also found that Bb workers who involved in killing BB queens sometimes acquire the peculiar smell of BB queens and thereby become victims of aggression by other Bb workers.

Why do Bb workers kill BB queens attempting to reproduce? There appears to be indirect evidence that BB queens are so strong that if allowed to reproduce, they will outcompete all other queens, whereas Bb queens are moderate and will permit the coexistence of many queens in the colony. This is something that the workers seem to prefer. It is most remarkable indeed that workers possessing the moderate gene b can recognise queens who do not possess it. This is the moderate gene’s strategy for survival: strike before your opponent does.

Why has not b gene completely eliminated its opponent B? As bb individuals die prematurely, b can never completely eliminate B. The only individuals that possess b and survive are individuals who have the Bb gene combination, and thus harbour a copy of B themselves. Bb individuals kill BB queens, but B can never be completely eliminated. It is because of this inability of b to completely eliminate B that we still recognise b as a green beard gene. Otherwise, B would have been completely lost. And scientists could never have recognised the green beard gene.