1. Kin selection is an incidence of selection above the individual level, within families. Inclusive fitness is a two part term, that consists of direct fitness (whether or not an individual personally survives and reproduces) and indirect fitness (additional reproduction through relatives because of their shared genes).

b. The numbers could be used to describe the genes shared on average that would be passed on. The more distant the relatives, the more of them are required to be saved in order for the sacrifice to be “worth it”. 8 cousins are equal, genomically to 4 uncles, or 2 brothers.

Full siblings could potentially on average share ½ of Haldane’s genes, uncles share ¼ of his genes, and cousins share 1/8 of his genes. These fractions are also known as the coefficient of relatedness. To potentially have his genes passed onto the next generation as he could directly, those numbers of relatives would allow for this- if his brothers each could share on average ½ of his genes in common,

A brother shares 50% of your genetic makeup, approximately. So two of them would mean you’d potentially be saving 100% of your genetic lineage. The same is true for uncles (25%), and cousins (1/8). It’s about how much of your genes you approximately share with your kin which determines how willing you are to save them if it means risking your own life.

c. In populations where this occurs, the colonies consist of sisters and sex determination is a haploid-diploid system. This means that the males are haploid, and females develop from fertilized eggs and are diploid. Daughters share 50% of their genes from the mother and 100% from the father. Therefore, if the developing queens and these females were sired from the same father, they would share many genes. That means that if they were to sacrifice themselves, there genes would still be present in the colony. Daughters of a founding queen in social insect societies share 50% of their genes with their mother and 100% of their genes with their dad, so if developing queens share the same father, the coefficient of relatedness is extremely high between workers and future queens.

2. At least in vertebrates, it’s thought to be through the immune system, via scent or urine odor. This is due to the major histocompatibility gene complex, or MHC.

3. 3. Is there no selfish behavior in kin selected societies? (hint: meerkats)

Yes, there is selfish behavior in kin selected societies such as meerkats. If a meerkat gets pregnant, she will actively try to kill the pups of other females. And now it seems that the most dominant female in the group has an extra strategy for ensuring her pups' survival: she chases and persecutes her potential baby-making competitors until they become so stressed that their fertility collapses. Individuals should always value their own reproduction opportunities and there should be selection for individual to further their own reproduction even in societies where kin selection is operation.

4. The greater the number of herd, the less likely a specific member is to get killed by a predator. Sentinel behavior is often observed, though it may not always be to alert the group, but rather to alert the predator that they’ve been seen.

Selfish herds are when unrelated and not altruistic animals’ group. Benefits to this include more eyes watching out for predators and less chance of being the target **prey.**

5. Why do most evolutionists believe group selection is a weak evolutionary force usually swamped out by individual concerns (selection)?

For group selection to exist, one must have either a generation time less than an individual lifespan or a high extinction rate and a low emigration rate.

Evolutionist believe that group selection is a weak force because the rate of group extinction has to be high and migration of selfish genes into altruistic colonies low. Migration of selfish individuals destroys altruists unless extinction of selfish colonies is very high. The problem is where one would find this condition for groups, i.e. short generations (less than or equal to an individual life span) or high extinction rate and low migration

6. Reciprocal altruism is the explanation for altruistic behavior outside of familial groups. Reciprocal altruism is when an individual acts altruistically, lowering its own fitness, in order to help another individual raise theirs, with the assumption that the individual will “pay back” the favor at a future time. In order for this to work, the two individuals would have to exhibit altruistic behavior at equal frequencies. Cheaters would benefit off this system without ever exhibiting altruistic behavior, so for it to work, cheaters would have to be recognized and excluded. Cheaters would need to be recognized and removed from the system because they would eventually outcompete the others in the group who do not cheat- they take away the resources and do not help the donor out in return.

7. Human society runs on bartering and nobody is self-sufficient Sharing food, knowledge, helping those in crisis are all forms of reciprocal altruism or just altruism that pushes humans to survive in difficult situations.