Philosophy 3334: Philosophy of Biology
Summer 2021
Homework 2

Answers should be uploaded into Blackboard before class on Wednesday, June 16th.

1) Lets say that "siblings" refers to just any young animals raised together when they are still somewhat dependent on at least one adult to keep them alive. Some social behaviors between siblings we can call "sibling rivalry" where they one sibling harms another (sometimes even killing each other) and other behaviors are cooperative. Animal species exhibit a huge variety of types of family structures. Here are some possibilities: In species A children are born one at a time and raised by their mother. The species is like humans – many siblings have the same father but not all. Species B is like A except it is strictly monogamous. All siblings have the same father. Species C is like A except they aren't born one at a time but rather in litters like dogs. Remember that puppies in the same litter sometimes have the same father but do not always. It is the same way in species C. Species D is like A except they are raised in groups by multiple mothers who collectively take care of all of the groups' children. Which, if any, of these changes do you expect would increase sibling rivalry? Which would increase cooperation? Explain why. (So compare ALL of A-D that you can).

2) Across the animal kingdom (ignoring the social insects) do males or females tend to have more children on average? Why? Do males or females tend to have a higher variance in the number of offspring they have? (A higher variance means a wider "spread" so that they are more likely to have more or less than the average). Why?

3) Imagine a species of bird that gets parasites on its head that the individual with the parasite can't remove, but that other birds could remove. We will assume that each interaction follows the following payoff matrix.

	Groomer	Non-Groomer
Groomer	8,8	1,9
Non-Groomer	9,1	2,2

3 cont) Assume that players in the population meet at random and play this game one time. Which strategies are ESSs in this game? (the answer could be either one of them, both, or neither). Explain why.

Introductory text:
If you think about Dawkins' definition of altruism in terms of outcomes (ignoring motivations) you will see that "Groomer" counts as an altruistic strategy. So it would

seem that it is impossible for grooming to evolve in a natural game like this. But it is possible in at least two different scenarios.

4) If the pairing of players is not random, then it is possible for grooming to evolve by kin selection. What would the average r (relatedness coefficient) between partners have to be in order for grooming to evolve by natural selection? Explain your answer. HINT: You can do this by calculating the inclusive fitness of each of the strategies (the payoff to you plus the payoff to your partner weighted by how closely related they are to you) or by using Hamilton's rule (the benefit is how much better off the recipient of the altruism is than they would otherwise be and the cost is how much worse off the altruistic actor is than they would otherwise be).

5) Assume that the pairing stays random but that they play the game three times against the same partner before reproducing. Now there are numerous possible strategies including "conditional" strategies in the game. We will consider four of them: "Groomer" means you groom your partner on every round no matter what. "Non-Groomer" means you never groom your partner. "tit-for-tat" means you groom on the first round and then on every subsequent round do what your partner did on the previous round. "Odd" means you groom on the first and third rounds (the odd numbered rounds) and do not groom on the second round. Create a 4x4 table that shows the payoffs for each of the sixteen possible pairings in this game. HINT: The total payoff is the sum of the payoffs on each of the three rounds of the game.

Essays – You must do either problem 6 or problem 7

6) Write a short essay on the subject of memes. At minimum, you should explain what Dawkins means by a "meme", explain why Dawkins thinks that memes might be subject to natural selection just like genes are, and discuss the extent to which you think that Dawkins is right about memes and how important you think they are for understanding cultural evolution.

Here are some questions you may want to consider:
1) Can memes be subject to natural selection in the same way that genes are?
2) Does the science of "memetics" just look like the theory of biological evolution?
3) What are some important differences between biology and culture which might undermine the analogy? Do they actually undermine it? How could Dawkins respond?

In discussing the importance of memes for culture, it is probably helpful to keep a few different kinds of cases in mind for discussion. For example, various kinds of entertainment (songs, movies, websites), ideas such as religious ideas as well as scientific ones, and behaviors such as etiquette and manners are part of our culture and change over time. Does thinking about memes prove useful in these cases? Or misleading?

I would expect a good essay to be something like 400-600 words here.

7) Compose a long email message to a family member or a friend who is not in the class and who has not read *The Selfish Gene*. Imagine that they asked, "So what are you doing in your Philosophy of Biology class" and you felt like giving a very long-winded answer. You should describe what *The Selfish Gene* is about and describe some of its main conclusions. Then you should evaluate whether you think it is a good book and what ways it is good or bad. What is the most interesting thing you learned? What is the most important? Has the book achieved its goal? Do you think it is flawed in any important ways? Would you recommend that they read the book? Why or why not?

I am not sure how long something like this could take. I expect it could be as short as 400 words (if it is much shorter, I am sure you could and should say more) but it could be much longer if you want.

-- NOTE: I would encourage you to actually send your email, but this is not actually required for the assignment.