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**Close and Critical Reading**

**Symbiosis**

**Mentor Model**

Directions: Read the following article, paying attention to puzzling words or phrases, posing questions in the margins, writing responses in the margins, and reading to understand deeply. Mark up the article as you read.

**Living in Sym: An Introduction to Symbiotic Relationships**

**Five basic questions to keep in mind when studying symbiotic interactions:**

* 1. What is the basis of the relationship?
	2. What are the costs/benefits for each partner?
	3. What is the scale, in space and time, of the relationship?
	4. Does the relationship vary over time or space?
	5. Does the relationship vary between sets of partners?

**Some definitions:**

*Symbiosis:* Properly, it is a neutral term, meaning "the living together in close association of two dissimilar organisms." It has the implication that the relationship is beneficial to the organisms involved, but that is properly a *mutualistic* relationship. *Mutualism, commensalism, amensalism* and *parasitism* are all types of symbiotic relationships.

*Mutualism*: A symbiotic relationship in which both (or all) organisms involved benefit.

*Commensalism*: A symbiotic relationship in which one partner benefits and the other is unaffected.

*Amensalism*: A symbiotic relationship in which one partner is harmed and the other is unaffected. (if you know of a clean, stable example of this, please let me know)

*Parasitism*: A symbiotic relationship in which one partner (the parasite) benefits and the other (the host) is harmed, though typically not killed directly by the action of the parasite.

*Pathogen*: A symbiotic relationship in which one partner (the pathogen) causes disease within the other (the host) and which can disable or kill the host….

**The Real World**

The problem with such nice definitions is that unwary people can get trapped into thinking of these terms as discrete categories. Mutualisms are always beneficial, parasitisms are bad, and amensalisms make no sense (after all, if neither partner is benefiting, why do it?). Furthermore, organisms do not switch from one category to another, except under special circumstances.

In the real world, relationships are much more complicated. As humans, we know this from our own relationships, be they with pets, friends or spouses. Even though all of these relationships are (or should be) mutually beneficial, they usually are not at all times. Anyone who has ever been in an argument knows this, as does anyone who has helped a friend through a crisis. Dogs can bite as well as lick, and while they are wonderful companions, they also need to be taken for walks.

The same is true for symbioses. For instance, mycorrhizae can take up to one quarter of a plant's photosynthate, and if they do not provide adequate nutrients in return, they are acting as functional parasites at that point. Bees may steal nectar from flowers without pollinating them….

Even units of analysis have their shortcomings. Pets are an excellent example of this. By any energetic standard, most dogs are parasites. We feed them and take care of them, but (for the most part) they do not provide any care or feeding in return. Energetically and nutritionally, the flow is all one way--dogs, in this analysis, are parasites. However, if a dog stops an intruder from killing a human, then the dog might have enormous value. This provisional value can be calculated, although it is more difficult. But how does one quantify the value of companionship? Dogs help people live happier, possibly longer, lives, simply by being companions. Quantifying this benefit is extremely difficult, but it may be the most important one that dogs provide, one that makes them mutualists to humans, not parasites….

This is why symbiotic relationships should not be understood simplistically. The way one analyzes a relationship in large part determines what one sees. Short-term parasitic relationships may be mutualistic in the long run, and vice-versa. Moreover, a relationship may swing from beneficial to harmful over time. In this context, terms such as amensal make sense. They are stages which organisms pass through, rather than stable, long-lasting relationships. Awareness of these potential complexities is critical.