Clinical Interview #2

For this assignment we were asked to interview two subjects, a novice and an expert, and compare the thought processes of each subject. We were told to choose subjects within our field of study and for me that was science. Since my topic was science related, in particular the nitrogen cycle, I chose to interview an aquarist at the Children's Aquarium at Fair Park who has spent many decades working with the nitrogen cycle. For my novice, called Novice, I chose a University student that had taken several courses in biology in High School. It took me a long time to think of a particular topic to question an expert about as, unlike math, there are very few questions you can ask that result in a specific calculated answer. Generally speaking this assignment is geared towards experts and questions that are very specific such as mitosis/meiosis and chemical equations. I tried to pick a science subject in which I could obtain these exact answers and still feel somewhat comfortable asking the questions.

I first asked each of the subjects about nitrogen but as I began the novice interview I realized that he did not have enough knowledge to answer the even basic questions. I tried to find an alternative novice who would be interviewed but I was denied several times. Additionally, if the interviews were reassigned, I would formulate different questions.

The official expert interview did not take long but we had a very lengthy discussion before and after the interview began. Mr. M, just referred from now on as M, explained many facets of the nitrogen cycle and how it related to many different species of fish. I was originally going to just ask him to explain the nitrogen cycle. However, I changed my mind at the last minute because I realized that the nitrogen cycle is very complicated so I just asked him to explain it as it relates to his profession.

Novice Interview Transcript:

Interviewer: Have taken any biology classes in high school or college?

Novice: Yes. I took several biology classes in high school.

Interviewer: Can you tell me what you know about Nitrogen and the Nitrogen cycle.

Novice: I remember that's it's about 28-30% of what we breathe…no it's more than that. Nitrogen is around 60% of what's in the atmosphere or what we breathe.

Interviewer: I'm sorry. Did you say that our atmosphere has 60% Nitrogen?

Novice: Yeah.

Interviewer: Okay. Can you explain the Nitrogen cycle?

Novice: Uh, I wouldn't say that I know a whole lot. It's something that I don't really recall…does it have something to do with plants? (laughs) I do believe that the chemical symbol in an N.

Interviewer: That's right. How do you know that N means nitrogen?

Novice: [shrug] What I do remember is that carbon, nitrogen and oxygen are all essential to life. I don't quite remember why. I know that nitrogen has something to do with why soil is fertile…it has something to do with growing plants. Again, I don't quite remember what it quite has to do with anything.

Interviewer: So nitrogen can be used in the soil by plants and it can be in the air we breathe. Do you know how it gets into those places?

Novice: I'd never thought about it. I have no idea.

Novice Interview Analysis

The novice I interviewed knew very little about chemistry and even less about the nitrogen cycle. When I asked him to describe what he knew about nitrogen he started with the chemical letter N. This seemed to be what he remembered and he tried to fill in the blanks from there. This reminded of Schools For Thought by Bruer. "Novices reason backwards from goals to givens" and this was certainly the case here (145). He tried to reason out what he needed from what he knew. As he searched for the right information he accessed several other bits of the word nitrogen related to the nitrogen cycle. Finally he started to hit on part of the right information but this was only after I asked about the nitrogen cycle in several different ways. Novice started his analysis with the superficial, the letter N, before delving into the deeper information. This process was almost identical to the process described by Bruer, on page 149, in regards to categorizing physics problems. In a similar process the novices in that experiment arranged problems by one aspect of the word problem. In essence they didn't see the "whole picture" and neither did my novice. He was very tied up with the letter N instead of the various forms of nitrogen and how it cycled through Earth's systems.

Expert Interview Transcript:

Interviewer: Would you state your name and title please?

M: I'm an aquarist at the Children's Aquarium at Fair Park.

Interviewer: What qualifications do you have?

M: I have an Undergraduate in Oceanography. I have a Masters of Science in Mariculture. I went to Texas A&M University and worked at Texas State Aquarium as an aquarist. I've worked most of my life in mariculture. The principles that you learn as a mariculturist also apply to aquariums. Everything is pretty much the same but you just go

about it a little differently. …You still take care of fish. From Texas State Aquarium I went to Sea Center of Texas for five years and they have an aquarium that is primarily a fish hatchery. We raised red spotted sea trout so I worked in a hatchery and the aquarium side of things for five years. For the last ten years I…actually ten years and one week…I've been at the Children's Aquarium at Fair Park.

Interviewer: You've been at the Children's Aquarium at Fair Park for ten years now?

M: Yep…ten years now. Phew! (laughs)

Interviewer: So, in mariculture, would you consider yourself to be an expert?

M: I would say so…yes, I guess so.

Interviewer: In mariculture you have to understand the nitrogen cycle. Can you explain the nitrogen cycle?

M: Well, fish in general be it in mariculture or aquarium …um, fish and their wastes produce ammonia which is toxic. When you put fish in a closed environment, such as a fish hatchery or aquarium, you'll get a build up of that ammonia which will end up eventually killing the fish after the ammonia level gets too high. Different fish have different tolerance levels for ammonia. In order to counteract the ammonia you have to set up a biofiltration. Biofiltration is actually a natural type of filtration. There are two different bacteria which are involved in the nitrogen cycle and grow in the wild. One bacterium will convert the ammonia to nitrite. Nitrite is also toxic but not as toxic as the ammonia. Then the second bacteria will convert the nitrite to nitrate which is hardly toxic at all. It has to be super high levels to be toxic to the fish. Nitrate also gets used up by plants in the water so that will be taken up by things like algae. In a closed environment you can also get rid of the nitrite by doing water changes so the nitrite and nitrates get flushed out. You have to make such that you have that biofiltration established.

Interviewer: Is nitrogen just in water?

M: No. There is a cycle of nitrogen that happens here. As I said, algae uses it, it's in the air and of course in the water. It goes around and around but in a closed cycle, such as an aquarium, you have to use biofiltration to control the cycle.

Interviewer: How do you know about the levels of nitrite and nitrate in the nitrogen cycle?

M: There are different tests that you can do. At the aquarium we have a spectrophotometer that you can use. The test takes about fifteen minutes. You put sample water into a vial, add reagent and set. After that you read it with the spectrophotometer. After you get the readings you can adjust the levels in the tank accordingly. You can either do a water change or there are chemicals that you can add. Um, Amquel that's on the market will take the ammonia out of the water chemically. There is also Amquel Plus that will take the ammonia and the nitrite out of the water. So, if you get to a level to where the biofiltration can't keep up with it than either of those additions will neutralize it.

Interviewer: Can you draw a diagram of the Nitrogen cycle for me please?

M: (laughs) I have to draw? It's a little complicated but here you go. Nitrogen starts in the air, and um, in food for fish. Then the fish excrete ammonia…in their wastes and such. The bacteria I was talking about earlier changes it to Nitrites here (writes NO2 on chart) but another bacteria changes it to NO3.

Interviewer: So, NO2 is Nitrites and NO3 is Nitrates?

M: Yes and that's what we can test with a spectrophotometer and also take out with a water change. The key is to make sure that the biofiltration can keep up with the amount of ammonia that the fish excrete, or uh, do a lot of water changes until it can keep up.

Interviewer: So what does the N and O stand for?

M: …The N stands for nitrogen and the O stands for oxygen. The bacteria that change ammonia to NO2 are called nitrosomas. Well, really its ammonium to NO2. Oh, well maybe I'm thinking about something else…anyway, the bacteria that change NO2 to NO3 are called nitrospira. If you don't set up your tank right the fish die of the build up called "new tank syndrome" and it takes sometimes two weeks to two months to complete a good cycle in order to be safe for the fish. You know…in the old days they would throw pieces of dead fish in an empty tank for the cycle to begin.

Expert Interview Analysis:

M was very proficient in the details of the nitrogen system. The official expert interview was short but the discussion before and after the interview was about the nitrogen cycle and related subjects in science. It was very clear that M could have spoken

for days on the subject. Bruer suggests that experts are fluid with their connections and are very deep thinking. Personally, I was not aware of how deep and how related the Earth's nitrogen is to our everyday life. M spoke about the adaptations of levels of oxygen and nitrogen from our earliest ancestors. He also mentioned the development of our lungs, as well as the breathing mechanisms of aquatic animals, to the current level of nitrogen. These were not superficial as a novice but these answers made deep connections to not only his expertise in the aquarium but to all life on this planet.