Philosophy 1103: Introduction to Philosophy of Science

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Solutions to Practice Quiz 4

Total: 40 marks

1. (i) According to Thomas Kuhn, how does a scientific community restrict the scientific ideas that a researcher can investigate? (You may refer the duck-rabbit story that I told near the start of the course.) [3 marks]

Kuhn says that science students are taught to see the world in terms of the reigning paradigm. For example Alice Grant was taught to see the world as a duck, and not permitted to study the PCI, which was a meaningless detail on the duck paradigm.

(ii) Journal editors and peer reviewers are said to act as 'gatekeepers', in keeping some papers from getting published. What is one way in which such gatekeeping can be *beneficial* to science? [3 marks]

Peer reviewers can prevent papers that are of very poor quality from taking up valuable space in scientific journals. Some papers might even get basic ideas wrong, or repeat things that others have said.

(iii) What is one strategy that scientists can use to increase the chance that one of their papers will pass peer review? [3 marks]

One trick is to (favourably) cite the work of other researchers who are likely to be selected to review your paper.

(iv) According to Sydney Brenner, how can a scientific orthodoxy, operating through the bureaucracies that award research grants, harm scientific progress? [3 marks]

Orthodoxies tend to reject new theories that contradict the existing dogmas. So, the most innovative and revolutionary research proposals are likely not to get funded.

2. Health Canada's website has the following information about asbestos. [N.B. "serpentine" means flexible and curly, like a snake. Amphibole fibres are straight and stiff, like needles.] [Note also that Health Canada is not necessarily a reliable source of information on health matters.]

"Asbestos is the generic name for a variety of fibrous minerals found naturally in rock formations around the world. Because asbestos fibres are strong, durable and non-combustible, they were widely used by industry, mainly in construction and friction materials. Commercial asbestos fibres belong in two broad mineralogical groups: serpentine (chrysotile) and amphibole (tremolite, actinolyte and others).

- **Amphibole** asbestos often contains more iron and resists acid and extremely high temperatures. Because of this, it has been heavily used in industrial furnaces and heating systems. However when inhaled, amphibole fibres stay much longer in the lungs than chrysotile fibres and they are more likely to inflict damage and cause disease, including cancer. Accordingly, amphibole asbestos has been drastically controlled and largely replaced.

- **Chrysotile** is the only serpentine asbestos that is found in almost all asbestos-based products available today and is the main form of asbestos still mined. Chrysotile is different from the amphiboles both structurally and chemically. It is generally accepted that chrysotile asbestos is less potent and does less damage to the lungs than the amphiboles."

(i) From the information above identify any statement(s) that support the view that asbestos is a natural kind. [3 marks]

There isn't much evidence here. Asbestos minerals are all fibrous, and the fibres are strong, durable and non-combustible, but these are superficial properties.

(ii) From the information above, identify any statements that support the view that asbestos is not a natural kind, but merely a pragmatic one. (Also say what pragmatic value the category of asbestos might have.) [3 marks]

The text says that "Chrysotile is different from the amphiboles both structurally and chemically." All kinds of asbestos have similar industrial uses, in construction and friction materials, so it's pragmatic to group them.

(iii) After considering your answers to parts (i) and (ii), would you say that asbestos is a natural kind or a pragmatic one? Briefly justify your answer. [2 marks]

I would say pragmatic. The text doesn't mention any scientific properties (chemical, structural, etc.) that apply to all kinds of asbestos, and to nothing else.

3. In August 2004 an article by Steve Meyer appeared in the prestigious journal *Proceedings of the Biological Society of Washington*, edited by Richard Sternberg. The article reviewed various unsuccessful attempts to explain the origin of new information during evolutionary history, and then argued that an 'intelligent designer' could overcome these difficulties. Meyer concluded that,

> "An experience-based analysis of the causal powers of various explanatory hypotheses suggests purposive or intelligent design as a causally adequate—and perhaps the most causally adequate—explanation for the origin of the complex specified information required to build the Cambrian animals and the novel forms they represent."

Reaction to the article being published was near-instantaneous and furious. A senior Smithsonian scientist wrote in an e-mail: "We are evolutionary biologists and I am sorry to see us made into the laughing stock of the world, even if this kind of rubbish sells well in backwoods USA." Meyer's article was withdrawn by the publisher, and Sternberg alleges that he was then "targeted for retaliation and harassment" at the Smithsonian Museum, where he worked.

(i) Given that Meyer's ideas had previously been published in various forms, what explains the furious reaction to this paper appearing in this journal? [3 marks]

Being published in a prestigious, peer-reviewed scientific journal gives a paper authority and legitimacy. Scientists don't want false, backward ideas to get this kind of platform.

(ii) Suppose Meyer had kept the bulk of his paper exactly the same (his criticism of standard theories of evolution) but left out any mention of intelligent design, and altered the conclusion of his paper to something like, "The mechanism by which evolution creates information remains mysterious. More research is needed." Would that have changed the reception of his paper? Explain your answer. [3 marks]

I think it wouldn't have attracted much attention in that case, as he wouldn't have been challenging the accepted naturalistic evolutionary paradigm by suggesting a supernatural alternative. It's usually fine to point out difficulties with the present paradigm, as long as you seem to assume that they will be solved at some point.

4. Thomas Kuhn says that, during a 'scientific revolution', or 'paradigm shift', the meanings of scientific terms can change. The term 'planet' seem to be an example of this, as its meaning changed after the Copernican revolution.

(i) Which celestial bodies were considered planets, in Ptolemy's cosmology? [2]

Moon, Mercury, Venus, Sun, Mars, Jupiter, Saturn.

(ii) What was the common feature of these bodies, that made them 'planets'? [2]

They all moved through the heavens, relative to the fixed stars.

(iii) What celestial bodies were considered planets, by Copernicans? [2]

Mercury, Venus, Earth, Mars, Jupiter, Saturn.

(iv) What was the meaning of 'planet' for the Copernicans? [2]

A body that orbits the sun.

(v) Kepler (a Copernican) introduced a new category of 'satellite', which included the newly discovered bodies orbiting Jupiter, as well as our moon. Why did Kepler think that this new category was needed? [3]

For Copernicans, the moon isn't a planet because it doesn't orbit the sun. So what is it then? A new category it needed, of bodies that orbit planets.

5. Galileo wrote that, "In questions of science, the authority of a thousand is not worth the humble reasoning of a single individual." There is evidence, however, that Darwin disagreed. What was that evidence? [3 marks]

Before publishing his book The Origin of Species, Darwin worked hard to secure the support of respected scientists like Lyell, Hooker and Huxley. He even told Lyell that his support would be more persuasive than all the arguments in his book!