

Biology as a Science

Please read the following article. Class discussion will focus on the article, and center around the questions that follow.

Please refer to the following article:

Leake, Jonathan, Science editor. "Mobile phones can cut a man's fertility by a third." *The Sunday Times - Britain*, June 27, 2004.

1. Based on the article, what was the hypothesis tested in this study?
The hypothesis was that heavy cell phone use negatively impacts sperm quality.
2. What was the experiment designed to test the hypothesis?
To test the hypothesis, researchers followed a group of 221 men over the course of 13 months, and compared sperm quality results of the men who used cell phones with results of those who did not.
3. What were the conclusions drawn from the results of the experiment?
Experimental results showed that men who used their cell phones heavily had sperm count that was 30% reduced when compared to men who did not use cell phones heavily. Moreover, they also found reduced morphology in the surviving sperm of the cell phone users. Researchers then concluded that heavy cell phone use causes reduced sperm quantity and quality.
4. Are there alternative hypotheses that fit the data?
One alternative hypothesis is that heavy use of cell phones correlates with a life style that causes reduced sperm quantity and morphology.
5. Based on the article, do you think the researchers proved their hypothesis true? Is the quote from Dr. Fejes justified given the data? Why or why not?
*Researchers did not design the experiment to address alternative hypotheses, nor did they perform follow up experiments to address such hypotheses. Therefore, we can not conclude that researchers proved their hypothesis true.
Notice that in his quote, Dr. Fejes says that cell phone use “may have a negative effect,” rather than stating that it does. The statement as quoted is technically correct, given data. It is, however, significantly more modest than the claims the article makes about the study.*
6. What follow-up experiments would need to be performed to validate the results of this study?
One such experiment would be to find a group of men with as homogeneous a lifestyle as possible, who do not use cell phones on regular basis. To establish the baseline, test their sperm quantity and quality for a short time (say, two months), and exclude any who show bad results. Then randomly assign subjects to either the experimental or control groups. Subjects in the experimental group would then receive cell phones, and frequent calls on these cell phones from the researchers. Subjects in the control group would lead their normal lifestyle. If the subjects in the experimental group show a decrease in sperm quantity and quality, it would support the hypothesis that the cell phones cause reduced sperm quantity and quality. To further validate the hypothesis, another group of subjects who do not use cell phones alot, but are put under stress would be informative.
7. Look again at the synopsis just below the title. Do you think it accurately describes the results of the study? Is it informative or misleading?
The synopsis is sensationalist, particularly in the last part of the sentence. Nowhere in the article was it suggested that the study showed reduced chance of conception in men who use cell phones heavily. In addition, the synopsis makes the results of the study

sound a lot more convincing than they actually are by not alluding to alternative explanations, and by using a relatively strong term “suggested.”

8. Look again at the first and third paragraphs. Do you think the advice to put the phone in a bag would be justified given the data we have now? Why or why not?
The advice, again, is not supported by evidence. Nowhere in the article does it say that the men in the study who experienced reduced sperm count and quality do not already carry their cell phones in their bags or briefcases.

9. Look again at the description of how the study was performed in paragraph two. What would you like to know about the procedures used in the study before concluding that the observed results are not an artifact of how the study was done?
Laboratory tests of sperm quality are usually performed on subjects who have abstained from sexual activity for 2-3 days. The article does not mention details of the study procedures, so we do not know how often the sperm was tested, and whether the subjects were told to abstain from sexual activity for any particular time before each test. If this was not the case, the results may be artifacts of the sexual habits of the men in each group.

Most sections spent some time talking about the scientific method and progression from observation to theory or law. Below is a concise description of the process taken from http://phyun5.ucr.edu/~wudka/Physics7/Notes_www/node5.html

The scientific method is the best way yet discovered for winnowing the truth from lies and delusion. The simple version looks something like this:

1. Observe some aspect of the universe.
2. Invent a tentative description, called a *hypothesis*, that is consistent with what you have observed.
3. Use the hypothesis to make predictions.
4. Test those predictions by experiments or further observations and modify the hypothesis in the light of your results.
5. Repeat steps 3 and 4 until there are no discrepancies between theory and experiment and/or observation.

When consistency is obtained the hypothesis becomes a *theory* and provides a coherent set of propositions which explain a class of phenomena. A theory is then a framework within which observations are explained and predictions are made.

The site contains much more useful information on scientific method. Another good site on the subject is http://teacher.nsrll.rochester.edu/phy_labs/AppendixE/AppendixE.html