

## Appendix 6. Example of the first and last writing assignments from two students.

### Example 1 - The student was a female Senior Biology major.

**First assignment:** "I know very little about the actual experiments and procedure usually used in cell biology.<sup>1</sup> I would assume that most experiments deal with examining cells<sup>2</sup> and their components in terms of how they grow, function, regulate, reproduce, etc. Microscopes<sup>3</sup> must be an important tool for molecular biologists, and the probably often use enzymes to destroy certain cell components, and tags to follow certain components as the cell undergoes changes. Obtaining the cells themselves it seems could be tricky, particularly in the case of studying stem cells and other culturally sensitive cells.<sup>4</sup>

In order to have one's research accepted, a cell and molecular biologist must ask relevant questions<sup>5</sup> about cells in terms of their function and reproduction. They must follow strict scientific procedures, record their data, and analyze their results logically and truthfully<sup>6</sup>."

#### Qualitative analysis:

1. expressed uncertainty
2. named "cells" as biological material
3. named "microscopes" as instruments
4. raised an ethical issue
5. considered an acceptable experiment to be one address relevant questions. Not scored as "considered an acceptable experiment to be reproducible"
6. discussed a personal attribute of a scientist, truthfulness

**Second assignment:** "Molecular cell biologists seek to understand the structure and function of a wide range of living cells. They also study the relationships between cells that compose multicellular organisms in order to understand how cells differentiate and communicate with one another. Cells<sup>1</sup> and cellular components are, of course, an essential biological material that these scientists use to carry out research.

As with most scientific fields, the largest focus of cellular study seeks to elucidate the structure and function of the human body. Unfortunately, it can be difficult and expensive<sup>2</sup> to obtain human cells for study. Molecular cell biologists deal with this problem through the use of model organisms.<sup>3</sup> By studying cellular mechanisms that function similarly in humans and lower level organisms, important findings about human cells can be indirectly revealed. Common model organisms include *Arabidopsis thaliana*, *Caenorhabditis elegans*, and *danio rerio*(argued to be the ideal model organism). These model organisms are relatively cheap to obtain, house and care for, and have short generation times.

In order to study particular cellular components such as DNA,<sup>4</sup> biologists employ methods such as cloning through a plasmid vector, hybridization, and various blotting techniques. Bacterial DNA is an essential material for cloning segments of DNA. The use of high power microscopes<sup>5</sup> and radioactive probes are often used when performing these techniques, as well as silica gel and blotting paper for Northern and Southern blots.<sup>6</sup>

Researchers use these techniques to attempt to understand the mechanisms through which cells function; understanding the genetic code is one current popular field of research. Scientists are attempting to "crack" the genetic code by documenting the genes that are encoded for each region of DNA in an organism, and by comparing genes in various organisms to determine how slight differences in related genes affect