Assignment 1

Great Ideas in Science 2 (BIOL 3028)

Written Assignment Due February 6

The ideas of higher dimensions and hyperspace are rather common in science fiction. However, these concepts are also commonly used in physics; we have seen, for example, that Einstein treats gravity as a bending of 4-dimensional spacetime. Groups of three students will be formed to explore these topics — their conceptual nature and application — in science, art, or science fiction. Each group will write a 1000 word report and give a 15–20 minute oral presentation (with PowerPoint slides, images, or *very brief* and *very relevant* video clips, if you like). Don't forget to list references in the written report!

Seven groups of three will be randomly formed. You will have the opportunity to "ask an expert" (Rick Norwood of the ETSU Math Department) on February 1. Groups will give their oral presentations on February 6 and 8, with each member of the group contributing.

Possible topics include:

1. The use of higher dimensions in string theory.
2. Time travel as a consequence of spacetime manipulation (and the causality problems resulting from time travel).
3. The use of nontrivially-connected manifolds in science fiction or video games.
4. Playing tick-tack-toe or chess on a 2-torus or Klein bottle.
5. God(s), angels, and ghosts in 4-dimensional space (try to keep this one meaningful and mathematically clean).
6. The math behind Flatland (or one of its relatives).
7. Charles H. Hinton and 4-dimensional space.
8. Exotic surfaces: the Möbius strip, the projective plane, and the Klein bottle.
9. The classification of surfaces (in terms of tori and Klein bottles).
10. Discussion of 3-manifolds: The 3-torus, hyperspheres and hypercubes
11. The geometry behind multi-universes/baby universes, and parallel universes.
12. The use of "hyperlinks" in the movies and literature (such as in *Poltergeist*, *The Lion, the Witch, and the Wardrobe*, and *The Simpson's* Treehouse of Horror segment "Homer 3D").
13. What it looks like to look through a wormhole.
14. Tricks a 4-D creature can perform (operations without incisions, untying knots, robbing banks).
15. Higher dimensional space ($\mathbb{R}^n$) and its properties. Infinite dimensional spaces (Hilbert spaces) and their geometry.