OBJECTIVES:

1. To explore the field of bioelectromagnetics and maybe to push the frontier a little bit.
2. To have you become acquainted with the complexity of going from the physics through the chemistry to the biology and possible health effects to public policy for risk.
3. To have you gain some experience in acquiring information from the literature and putting it into a useful form.

OUTLINE OF THE COURSE

1. A review of some of the electrical properties of biological materials and the problems of coupling electric and magnetic fields in to them.
2. A review of the physics of the effects of electric fields on biological systems at low frequencies.
3. A review of the physics of the effects of magnetic fields on biological systems
4. A discussion of some possible health effects of these fields
5. A review of radio and microwaves
   A. The coupling of radio waves into a biological system
   B. Some physics of the interactions of RF on biological systems and some effects.
6. A review of lasers and laser safety

APPROACH TO THE SUBJECT

Start with the physics at the simplest levels and work up through the layers of biological complexity.
The scope of the problem is from:
1. $10^{-12}$ seconds to generations.
2. From electrons and atoms to the whole body.
3. From DC to gamma rays
The major part of the problem is our lack of understanding of the biology.

COURSE OPERATIONS.

Assigned reading. “Handbook of Biological Effects of Electromagnetic Fields” Third Edition Edited by Frank Barnes and Ben Greenebaum and other literature much of which will be handed out.

Requirements.
1. Work through a large part of the material in the Handbook Biological effects of Electromagnetic fields.
2. Bring at least two new reprints on the subject of the class discussion to class each week and be prepared to present it to the class. For example an early assignment will be to find papers on the measurement of the electrical properties of biological materials and related it to the material in the Handbook.
3. Two term papers. These papers will be presented to the class and discussed. They may also be handed back for further development.
4. One hour test and a final.
The course will be flexible in the choice of material to be covered to match the interests of the class. Research topics that we might include:
1. The effects of DC Magnets on pain
2. The treatment of electromagnetic fields as a source of biological stress. What do we mean by stress?
3. What are the effects of small periodic temperature variations on biological systems? In particular what might they do to the brain and nerve cells?
4. What are the differences between cancer and normal tissues that can be observed with electromagnetic fields from DC to light? Can we build an optical fiber system that will detect cancer that will fit in a needle?
5. Can we change growth patterns with magnetic fields?
6. There are some exciting new ways to use electric or magnetic fields in therapy. What needs to be done to explore these possibilities and put them in a position to be used?
7. What are the effects of electric and magnetic fields on the immune system?