MSE/BMED 6774:
Biomaterials: Structure and Function

PERSONNEL

Time and Location:
Mondays and Wednesdays, 4:05 to 5:20 pm, MSE (Love Bldg.) Room # 299

Instructors:
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TAs:
To be determined

ACADEMIC INTEGRITY

"Plagiarism is using others' ideas and words without clearly acknowledging the source of that information." (http://www.indiana.edu/~wts/wts/plagiarism.html)
An example would be incorporating information found on the internet into a paper without providing the appropriate reference.
Any student suspected of plagiarism will be referred to the Georgia Tech Office of Student Integrity.

SYNOPSIS

Structure-function relationships of biomaterials and biomaterial characterization will be covered. Materials for medical implants, tissue engineering, biosensing, imaging, and drug delivery will be covered. Course will include a comprehensive study of an area of biomaterials research and an oral presentation.

REFERENCES (NOT REQUIRED TEXTS)

Buddy Ratner. Biomaterials science. Second edition. Orlando, Academic Press, 2000.
Jonathan Black. Biological performance of materials: fundamentals of biocompatibility New York , Marcel Dekker, 1999.
Joon Park and Joseph Bronzino. Biomaterials: Principles and Applications. Fort Lauderdale FL, CRC Press, 2003.

GRADING

80% comprehensive paper
10 single-spaced per person on a core area of biomaterials research
References are required, and are to be written in ACS format
http://www.uwstout.edu/chemistry/schultz/chem-201/docs/ACSFormat.pdf

20% 20-minute oral presentation
PPT slides to be printed and provided to class
Grading will be based on content and presentation

PRESENTATION/PAPER TOPICS

1. Metals
2. Polymers
3. Textile Materials
4. Ceramics and Glasses
5. Composite Materials
6. Protein adsorption on biomaterials; surface modification of biomaterials
7. Characterization of metals and ceramics
8. Characterization of Polymers
9. Characterization of Composites
10. Biocompatibility testing
11. Cell-biomaterial Interaction
12. Inflammation hypersensitivity, carcinogenesis
13. Cardiovascular Grafts
14. Orthopedic Applications
15. Drug Delivery and Gene Therapy
16. Microencapsulation
17. Cardiovascular Tissue Engineering

COURSE SCHEDULE

1. Introduction to Biomaterials (1 lectures)
How do Biomaterials impact us? Discussion of state of the art, ethics of biomaterials use.

2. Introduction to 'Hard' biomaterials (8 lectures)
a. Metals: steel, cobalt-chromium, titanium, new titanium alloys, shape memory alloys, niobium alloys, tantalum alloys, and beyond.
b. Ceramics and glasses: alumina, zirconia, diamondlike carbon, hydroxyapatite, Bioglass, refractory nitrides (TiN), and refractory carbides (TiC).
c. Surface modification of biomaterials
d. Rapid prototyping of biomaterials
e. Corrosion: metal corrosion, pitting corrosion, fretting corrosion, crevice corrosion, intergranular corrosion, stress corrosion cracking, galvanic corrosion, fatigue and wear corrosion
f. Wear: abrasive wear, adhesive wear, fatigue wear, corrosive wear
g. Business of biomaterials: regulatory affairs; ethical issues associated with clinical trials; development of voluntary consensus standards for biocompatibility; medical device regulation by the FDA

3. Introduction to Soft Biomaterials (8 lectures)
a. Polymer synthesis: overview of common polymerization methods
b. Characterization of polymers: bulk and surface characterization, including degradation
c. Non-degradable polymer: representative examples and their applications
d. Degradable polymer: representative examples and their applications
e. Protein adsorption and biocompatibility
f. Applications of polymers in tissue engineering and drug delivery

4. Student Presentations (9 lectures)