APPLICATION FOR UNIVERSITY OF CALIFORNIA F SUBJECT REQUIREMENT

COURSE TITLE: S.T.A.R.: SCIENCE TECHNOLOGY AND RESEARCH 2 AB
(a Biomedical Research Course)

BACKGROUND:
The USC Science, Technology And Research (STAR Program is a collaborative science education venture between the University of Southern California Health Science Campus and Francisco Bravo Medical Magnet High School. The STAR Program provides inner city junior and senior high school students the opportunity to learn science by joining a USC basic science research team at the University of Southern California Health Sciences and University Park Campuses. The STAR 1 class, which takes place on the high school campus, prepares students for the STAR 2 class. Both STAR 1 and STAR 2 students participate in research projects as an integral part of their high school curriculum and conduct their own science research project during their tenure in the STAR Program.

COURSE DESCRIPTION:
This class is a 10 credit (2 classes in one) course in which students are assigned to a research laboratory on the USC Health Science or University Park Campus, to work two or more hours per day on a research project, under the supervision and guidance of an investigator, in some area of biomedical research. As a result, the student will learn to read and understand scientific journal articles, perform experiments, collect data, analyze data, and construct a scientific poster demonstrating the results of their research project. Students will also learn how to give a seminar presentation for their experiments. Both parents and researchers are invited to attend the seminar presentations with the STAR students. Seminar presentations will take place every two or three weeks.

The majority of time (Monday through Friday, 5th and 6th periods, as well as after school at least two days a week) the students will be off campus working in their assigned laboratories.

The STAR 2 teacher will visit students in the laboratories to discuss the progress of the student's research. The student laboratory notebook will be checked, as well as the posting of their emergency card and monthy calendar/timesheet. The teacher will meet with the mentor researcher, when possible, to discuss the student's progress. The STAR teacher will also arrange the seminar presentations, and advise the mentors of when their student will give a seminar.

INSTRUCTIONAL UNITS:

September: Study text, *DNA Science,* Chapters 1-3
Off campus requirements, forms to complete, badges for presence on USC campus and to go off school campus
Laboratory Safety Class at USC: Chemical Safety, Radiation Safety, and Airborne Particle Safety
Laboratory Safety by laboratory mentors
Chemical Solutions, preparing buffers
Sterile Technique
Use of the Laminar Flow Hood/Tissue Culture Techniques
Prepare seminar presentation (5-6 students present each month)
Attend seminar presentation

October: Textbook *DNA Science*, Chapter 4
Continue the above techniques
PCR (Polemerase Chain Reaction) technique
Imbedding Tissue and Sectioning with the microtome
Electrophoresis techniques
Attend seminar presentation
Photomicroscopy techniques

November: Textbook, *DNA Science*, Laboratory skills pp. 197-246
Continue techniques learned
Internet literature search on the computer
Library research to obtain journal articles
H&E Staining of slides
Immunostaining techniques
Attend seminar presentation

December: Textbook, *DNA Science*, Laboratory skills pp. 247-292
Use of video to record or measure data
Select and begin science project
Attend seminar presentation

January: Textbook, *DNA Science*, Laboratory skills pp. 293-340 and Chapter 5
Continue techniques learned
Attend seminar presentation
Semester Exam

February: Textbook, *DNA Science*, Chapter 6
Continue science project
Attend seminar presentation
Semester Exam

March: Textbook, *DNA Science*, Laboratory skills pp. 341-360
Design poster for science project
Attend seminar presentation

April: Textbook, *DNA Science*, Chapter 7
Prepare for the County Science Fair
Continue refining project
Attend seminar presentation

May: Textbook, *DNA Science*, Laboratory skills pp. 361-419
State Science Fair for those selected
Continue laboratory research techniques
Final seminar presentations (second presentations)

June: Review of text and procedures learned
Poster presentation at the USC Medical Sciences Campus
Preparation to be a summer mentor to next years' STAR 2 students

REPRESENTATIVE OBJECTIVES:

1. Learn the basics of laboratory safety through an inservice by the USC Laboratory Safety Office
2. Learn the basics of radiation safety through an inservice by the USC Radiation Safety Office
3. Learn conceptual and technical fundamentals of basic science research
4. Learn hypothesis testing
5. Achieve scientific literacy in their research area
6. Achieve computer literacy in the programs used by researchers

EXPECTATIONS FOR PERFORMANCE:

1. Laboratory Safety: safety practices in the laboratory including storage of chemicals, use and removal of gloves, limited talking, no talking in the hood, disposal of chemicals, no food in the laboratory, type of clothing and shoes to be worn
2. Chemical Solutions: making the correct molar or percent solution for an experiment, use of formulas to obtain a particular solution
3. Sterile Technique: use of ethanol to clean areas, limited movement of hands, flaming of pipettes and openings of containers
4. Use of the Laminar Flow Hood (Tissue Culture Hood): position of person using the hood, sterilizing and lighting of the Bunsen burner, placement of materials in the hood, no passing of the hands over materials to be cultured
5. PCR (Polemerase Chain Reaction) Technique: purpose of PCR, why the need for varying temperatures, use of the results
6. Histology: Dissecting of tissue, fixing the tissue, embedding the tissue in wax, sectioning the tissue with a microtome, staining the tissue

7. Immunostaining: purpose of immunostaining, use of antibodies in the immunostaining technique, importance of precision in immunostaining, need for varying the technique to obtain better signals in the staining
8. Electrophoresis: purpose and understanding the procedure of electrophoresis,
9. Measuring of the bands after electrophoresis, photographing the bands, interpretation of the bands, differences in Western, Northern and Southern blots
10. Mini-Preps: reason for using mini-preps, procedure and interpretation of mini-preps
11. Video Techniques: for measuring and recording data such as the length of dendrites of neurons
12. Photomicroscopy: use of the microscope and attached camera to photograph samples, use of digital photography and transferring photographs to a CD, adjusting the color of a photograph through a computer photography program
13. Internet Research: performing a literature search of the research topic, how to locate the various library sites
14. Poster Presentation: use of the computer to type and design the poster data
15. Seminar Presentation: how to present a seminar using overheads, slides, and a computer program such as Powerpoint

Depending on the type of research in the laboratory, students may not learn all of these procedures (namely #5-11).

PARTIAL LIST OF SCIENCE PROJECT TOPICS:

Apoptosis
DNA Fragmentation
Regulation of Desmin Expression
P53 Expression
Monoclonal Antibodies
Opiods
Cancer Promoting Chemicals
Vitamin AVasopressin
Hybrid Proteins
Arrestin in a Transgenic Mouse
Fibrolase

TEXTS AND/OR OTHER MATERIALS USED:

1. Basic textbook: DNA Science, A First Course in Recombinant DNA Technology, by David A. Micklos and Greg A. Freyer, Cold Spring Harbor Laboratory Press.

2. Published journal articles, assigned by USC investigators, to students working in their laboratories

3. STAR Student Manual: Includes information on laboratory and radiation safety, solution preparation, and other science techniques, as well as class information

METHODS OF STUDENT EVALUATION:

1. Laboratory participation
2. Laboratory notebooks: daily log, scientific method, data, photographs, errors, additional procedures
3. Seminar presentations
4. Seminar participation
5. Semester final exams
6. Quizzes on textbook
7. Completion and presentation of a research project for the school science fair
8. Evaluation by their USC laboratory mentor

PREREQUISITES:

Biology AB
Chemistry AB
Math Analysis (highly recommended)

GENERAL SKILL LEVEL OF STUDENTS ADMITTED TO THE COURSE:

The skill level of students accepted into this course is above average.

HOW THE COURSE ADDRESSES THE FOUR FUNDMENTAL ARTS COMPONENTS AS IDENTIFIED IN THE STATE FRAMEWORK:

This is an enrichment class that provides challenges for critical thinking, independent organization and analysis, evaluation skills and opportunities for redesigning and reevaluating previous work. This class also provides an opportunity to enhance the students ability to communicate about scientific work by giving seminars and therefore enhance their oral presentation skills.