

Medical Student Summer Research Program

Sample Application

I. Long-Term Career Goals:

The role of a doctor is becoming more extensive as doctors take on more and more responsibilities given to them by society. Doctors must be psychologists, counseling patients; social workers, mending family problems; businessmen, dealing with finances; and biomedical scientists, as the field of medicine currently requires many molecular, biological, genetic, and physiologic techniques in order to optimally provide medical care for patients. An important part of this ever-expanding profession is the job of the researcher. As a future doctor, I feel that it is very important to have a background in biomedical research. Even if a doctor wants solely to provide clinical care to patients, they will still need to keep abreast of the latest technological advances and discoveries. Patients will ask for the pros and cons of new drugs and clinical procedures. Patients are also exposed to the media that provides statistics and information from journal articles or recently published studies. As their doctor, I must be able to understand and critically analyze these studies and be able to discern the facts from the distortions.

I have had a strong interest in research ever since high school. The summer of my freshman year, I was selected as a Waksman Student Scholar at Rutgers University. I spent four weeks performing genetic research, learning cell biology and molecular techniques including growing bacteria cultures, gel electrophoresis, PCR, RAPD, and DNA sequencing. During my sophomore year, I continued a yearlong research project analyzing the onion genome with a team of students from my high school. The Waksman program was an exciting experience for me because it provided me with hands-on experience learning the latest lab techniques in the growing field of genetics.

Two summers ago, I also had the opportunity to work at a major pharmaceutical company. I was chosen as a summer intern in the Drug Discovery Department at the Schering-Plough Corporation headquarters in Kenilworth, New Jersey. Working with a senior scientist, I conducted a research project on low recovery Schering drug disposition in the Caco2 cell permeability system. I studied whether the Caco2 permeability system could be used as a minimal estimate for *in vivo* absorption projection. I worked with radioactively labeled Schering drugs and learned how to write my own computer programs for high tech equipment such as a Packard Multiprobe II. At the end of ten weeks, I presented my scientific findings at a poster presentation to the corporation's scientific community. I thoroughly enjoyed my experience at Schering-Plough because I was assigned an individual project with my mentor's guidance. It was a great feeling at the end of the summer to know that my research findings would meaningfully contribute to the advancement of drug absorption studies at Schering-Plough.

This summer, I again hope to have an independent project in Dr. X's laboratory. He has graciously offered his mentorship and supervision on an exciting and meaningful project examining the transcriptional regulation of an organic cation transporter using H35 cell cultures. Utilizing both of my previous research experiences, I look forward to being able to continue to learn additional techniques, hone my analytical thinking and data interpretation skills, and obtain additional exposure to medically related research. Furthermore, a research experience in a basic science

laboratory will also expose me to this area of medicine. With no family members who are doctors, I have not had any experiences in the fields of medicine or biomedical research.

Whether one becomes a clinician, a medical school professor, a clinical researcher, or a basic science researcher, a strong research background is an essential component of developing into a well-rounded, knowledgeable doctor. A summer fellowship with Dr. X will provide me with this invaluable experience and I hope that I will be afforded funding for this unique opportunity.

II. Research Plan:

Slca11 (OCT 1) is the major hepatic organic cation transporter in the liver. This gene is responsible for the hepatic uptake of numerous clinically used drugs, and is required for the transport of the essential organic nutrient choline, which is used for hepatic lipid metabolism. Previous studies from the laboratory of the Faculty Preceptor have demonstrated that the treatment of mice with inflammatory stimuli result in significantly decreased gene expression of *Slca11*. Therefore, we have hypothesized that inflammatory cytokines such as tumor necrosis factor alpha and interleukins (IL-2, IL-6, etc.) will decrease transcription of *Slca11*. The preceptor's laboratory has previously developed chimeric *Slca11* promoter-firefly luciferase constructs that have been successfully employed for transfection studies in liver-specific H35 cells lines.

The proposed project will involve transfection studies, utilizing these chimeric constructs, in the presence or absence of inflammatory cytokines in order to further delineate the transcriptional regulation of this transporter. Transfections will be performed using standard lipofection techniques, as have been extensively performed in the laboratory of Dr. X. All transfections will be normalized using co-transfection with Renilla luciferase, using a commercially available Stop-and Glow transfection/detection system. We have identified putative cis-acting elements in the promoter region of *Slca11* which may mediate transcriptional regulation by inflammatory cytokines. After demonstration the cytokine effect, 5'-deletional analysis of these cis-acting (or site-directed mutagenesis) will be utilized to confirm the relevance of the cis-acting element.

All of these techniques are currently available in the laboratory of Dr. X. All data will be obtained using luciferase activity, and comparison between two groups will be used t-tests or ANOVA.

This project will have important significance on the hepatocellular uptake and metabolism of numerous pharmacologic drugs and on hepatic lipid metabolism in inflammatory states such as hepatitis, fatty liver disease and sepsis. These studies are novel and will provide important insights into the regulation of this liver transporter by inflammation. The regulation of this liver transporter will have significant import regarding the potential alterations in drug pharmacokinetics of organic cationic drugs in disease states.

III. Research Environment:

Dr. X currently runs a laboratory which examines hepatocellular transport and lipid metabolism. There are several collaborating physicians, research fellows and technicians in the laboratory, and the laboratory is fully equipped for all studies which are required for completion of the Specific Aims of this project. "MS1" will be expected to attend weekly laboratory meetings where his experimental design will be reviewed by all laboratory members, and he will present his data on a weekly basis. In addition, he will be expected to attend a weekly didactic research symposium to extend his knowledge in basic research methodology. His project will be closely supervised by Dr. X who will meet a minimum of twice weekly with "MS1". The focus of the laboratory extends to the regulation of numerous liver specific transport proteins, however, his project will be unique. Therefore, it is expected that "MS1" will obtain novel data which he will present at the student research symposium and at national meetings. All equipment, necessary facilities and supplies will be provided by Dr. X. All data analysis and experimental design, as well as instruction in methodologies and all techniques will be provided by Dr. X or members of his laboratory.

IV. Student/Preceptor Interaction:

The focus of this research experience will be on the development of experimental design and data interpretation for “MS1”, as well as the generation of novel data. All methodologies which are required for the completion of this project are currently available in the laboratory of Dr. X, and “MS1” will be instructed and closely supervised in the performance of the Specific Aims. The student and preceptor will meet twice weekly to discuss the student’s data as well as the relevance of the project to his career development as a physician and scientist. The student will also be expected to present his data on a weekly basis at a laboratory meeting. Although it is hopeful that these studies will provide important and novel data, the central focus of this project will be to extend a meaningful research training experience to “MS1 which will provide him with skills and expertise which he will find invaluable in his future career.