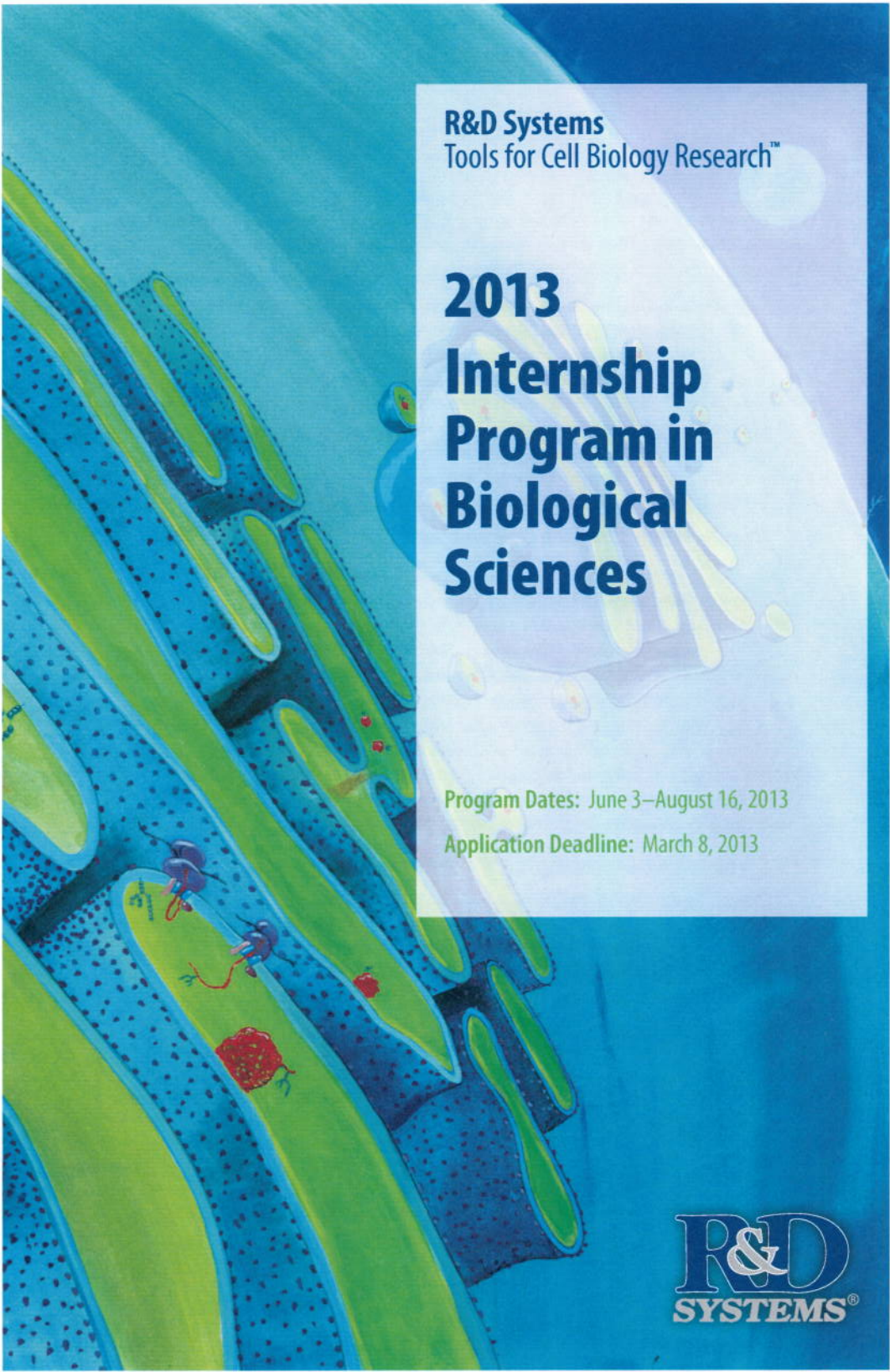




R&D Systems
Tools for Cell Biology Research™

2013 Internship Program in Biological Sciences

Program Dates: June 3–August 16, 2013

Application Deadline: March 8, 2013

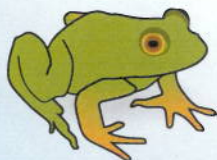
R&D
SYSTEMS®

Summer Internship Positions

All internship positions are designed to give Junior level college students an opportunity to apply techniques learned in an academic setting to scientific research projects that result in product development. It is anticipated that new skills will be obtained during the process. All interns will be required to conclude the project by giving a formal presentation on his or her work.

Listed below are the areas in which internship positions are available. Projects are described to the right and on the back side of this brochure. You may select up to four areas of interest. In the cover letter accompanying your application, please indicate the four projects that you're interested in and rank your selections (1–4), with 1 being the project that you would most like to work on. We will honor your top choice to the best of our ability.

- ___ **A.** Development of a Cell Array Platform for Immunocytochemical High Content Screening Applications (IN/69)
- ___ **B.** Mining for Sales Opportunities through Customer Profiling (IN/71)
- ___ **C.** Development & Optimization of a Novel Cell-Based Enzyme-Linked Immunosorbent Assay for Measuring Protein Phosphorylation (IN/73)
- ___ **D.** Bioassay Development (IN/76)
- ___ **E.** Determination of Antibody Cross-Reactivity (IN/77)
- ___ **F.** Protein Process Development (IN/90)
- ___ **G.** Enzymes (IN/92)
- ___ **H.** Development & Optimization of Cell Culture Media for Mammalian Recombinant Protein Expression (IN/94)
- ___ **I.** Optimization of Recombinant Protein Expression in Cell Culture (IN/394)
- ___ **J.** Characterization of Stem Cell Derivatives by Flow Cytometry (IN/96)



R&D Systems

Research and Diagnostic Systems, Inc. (R&D Systems) is a specialty manufacturer of biological research reagents. TECHNE, our parent company, has been included in Forbes magazine's list of "The 200 Best Small Companies in America" for 17 of the past 20 years. We have two operating divisions: Biotechnology and Hematology. The Biotechnology division services the basic and clinical research communities, and the clinical diagnostic markets with cytokine- and growth factor-related products. The Hematology Division continues to rank among the world's leading developers and manufacturers of hematology controls. We are located just 1.7 miles from the University of Minnesota campus in Northeast Minneapolis. More company details are available on our home page at www.RnDSystems.com.

R&D Systems Internship Program

R&D Systems is pleased to offer internship opportunities for Junior level college students interested in the biological sciences. These internships are designed to provide training and research experience at R&D Systems for students who want to develop their skills in a professional, industrial environment.

These are paid internship positions and have an hourly wage of \$14.50. All positions are full-time, with the 40 hours generally worked between the hours of 8:00–5:00, Monday through Friday. Parking at R&D Systems is free.

Internships are awarded for an eleven-week period starting June 3rd and ending August 16th.

Eligibility Requirements

Eligible students must be at the Junior level in college, which will be determined by the amount of completed college credits at the application deadline, hold a GPA of 3.0 or better in **major science courses**, and have declared their major in biology, chemistry, or a related field.

How to Apply

The application deadline is March 8, 2013. Required materials include: a cover letter, resume, official transcript(s) from all colleges attended, and names plus contact information of two professional or academic references. A letter of recommendation is also preferred, but is not required. Interviewed applicants will be notified no later than May 10, 2013 of internship selections.

To apply, applicants should submit a cover letter and resume online on the Career Opportunities page of our company website, located at http://www.rndsistemas.com/career_opportunities.aspx. From this page, select "Internships" under the Job Category heading and click the "Search" button to access the Internships job listing. Click on the "2013 Internship Positions" job listing to view a summary of each internship project that we are offering this summer and to "Submit Your Application." The cover letter should include the selection and rank of your top internship choices (up to four total). All other application materials including official transcript(s) should be mailed directly to the company. All mailed application materials must be postmarked by March 8, 2013. Only one copy of your application materials is needed. Deliver or mail your official transcripts and any additional application materials to:

R&D Systems, Inc., Attn: Internship Program,
614 McKinley Place NE, Minneapolis, MN 55413-2610

Questions can be directed to (612) 656-4555 or hr@RnDSystems.com.

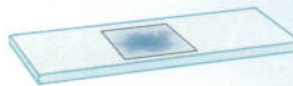
www.RnDSystems.com



Project Descriptions

A. Development of a Cell Array Platform for Immunocytochemical High Content Screening Applications (IN/69)

High content screening (HCS) is a novel technique for intracellular detection of multiple protein targets within cells and tissues. HTS is a key drug discovery assay that allows not only for detection of the presence of the protein of interest, but also for precise determination of its intracellular localization in relation to other protein targets. Since the quality of cellular material is of critical importance for the success of HTS, the key objective of this project is the development of robust high-density cell arrays for multiplex immunocytochemistry. Applicants are expected to have some knowledge about culturing cells, preparing basic chemical solutions, immunocytochemistry and microscopy. Cytological and laser confocal microscopy experience is a plus. The intern will learn how to create a cell array, grow and maintain cell lines, perform immunocytochemical experiments as well as collect digital images and interpret results. The intern will be expected to give a formal presentation on her or his work at the conclusion of the summer project.



B. Mining for Sales Opportunities through Customer Profiling (IN/71)

Sales in most organizations are similar in that knowing your customer and their needs helps to identify what products or solutions they might be interested in purchasing. In Biotech research, academics can be organized into smaller labs or functional groups within programs and departments. The intern we would like to work with would be able to help us identify lab groups at academic institutions, read about their research areas and enter this information into the company CRM software. We will then link the profiled labs to existing sales and identify areas of possible opportunities. Applicants must have good internet search capabilities, typing and pattern analysis skills. The intern will be expected to give a formal presentation on her or his work at the conclusion of the summer project.

C. Development & Optimization of a Novel Cell-Based Enzyme-Linked Immunosorbent Assay for Measuring Protein Phosphorylation (IN/73)

Phosphorylation of intracellular signaling proteins regulates a broad range of cellular activities including cell cycle progression, differentiation, metabolism, and neuronal communication. More importantly, abnormal phosphorylation events are implicated in many disease states, such as cancer, diabetes, and chronic inflammatory diseases. Given the important role protein phosphorylation plays, quantification of protein phosphorylation within specific signaling pathways is of utmost importance in biomedical research. Although Western blot is the most widely used method to investigate intracellular protein content and phosphorylation, this is labor-intensive and time-consuming. The plate-based immunoassay has become a popular alternative method for rapid protein detection. R&D Systems has developed and commercialized several such assays using phospho-specific antibodies for analysis of protein phosphorylation. The goal of this project is to develop for commercialization a novel cell-based enzyme-linked immunosorbent assay (ELISA) for measuring the phosphorylation of select target proteins in whole cells, thus eliminating the need for cell lysate preparation, which may reflect the intracellular environment more closely. Under the guidance of a scientist/senior research associate in our group, the intern will characterize and screen antibodies for assay development using ELISA and Western Blotting procedures. The intern will conduct experiments related to the optimization of assay performance. He/she will also validate the assay in terms of sensitivity, specificity, and precision. He/she will grow, maintain, and treat mammalian cell cultures for developing and validating the new assays. He/she will evaluate the effects of kinase stimulators and inhibitors on target protein phosphorylation using the cell-based ELISA, and compare the results with Western blot. The intern will be expected to give a formal presentation on her or his work at the conclusion of the summer project.

D. Bioassay Development (IN/76)

The intern will conduct experiments to develop and improve several current bioassays for testing the activities of recombinant proteins. Under the supervision of research scientists, the intern will optimize conditions such as cell lines, growth conditions, and detection methods, that are utilized to study the functions of the proteins in primary cells and different tumor cell lines. The activities of the recombinant proteins will be determined using multiple bioassays to assess cell proliferation, survival, adhesion, or colony formation. This position requires knowledge of cell biology and previous training in laboratory techniques such as pipetting and reagent preparation. Knowledge of aseptic technique is desirable. The intern will be expected to give a formal presentation on his or her work at the conclusion of the summer project.

E. Determination of Antibody Cross-Reactivity (IN/77)

Antibodies are very important reagents for research and therapeutic development. The utility of antibodies for those applications depends on, to a great extent, their specificity. The specificity is routinely assessed by measuring its non-specific binding as well as its cross-reactivity with antigen-related molecules. This project is intended to optimize current cross-reactivity testing practices to achieve better efficiency and quality. The intern will determine the correlation between antigen-cross-reactant sequence homology and antibody cross-reactivity, and evaluate the cross-reactant choices and data accuracy. The data of those experiments will potentially lead to the optimization of current cross-reactant selection criteria. In addition, the intern will compare two commonly used assays (direct ELISA and Western Blot) to determine if one assay (direct ELISA) is sufficient or if both assays are needed. From this study, the intern will learn useful analytical techniques, project design, data analysis, and scientific presentation, which will be beneficial to her or his career. The intern will be expected to give a formal presentation on her or his work at the conclusion of the summer project.

F. Protein Process Development (IN/90)

We are currently conducting several projects that involve important protein families including the TGF- β , TNF- α , FGF, VEGF, Wnt, adhesion molecule, and neuronal protein families. Molecules from these families play important roles in development (embryonic through adult), inflammation, and immune responses, suggesting that they may be useful for treating diseases. The intern will participate in developing methods for small-scale purification and refolding of recombinant proteins expressed in mammalian, insect, and bacterial cells. Based on the properties of the proteins (amino acid sequences, pI, structures, etc.), the intern will determine the best method(s) to obtain active proteins. The intern will learn about protein measurement, protein structure, how to decide on purification strategies based on protein structure, and commonly used purification methods such as gel electrophoresis, centrifugation, and column chromatography. The intern will work under the supervision of scientists and research associates and will be expected to give a formal presentation on her or his work at the conclusion of the summer project.



G. Enzymes (IN/92)

Catalyzing chemical reactions in our bodies, enzymes are essential for transcription, translation, and modifications of DNA, RNA, proteins, lipids, and carbohydrates. Enzymes play important roles in many physiological processes such as blood coagulation, wound healing, and embryonic development. They are also important targets in the diagnosis and treatment of serious diseases such as HIV, cancer, Alzheimer's disease, and influenza outbreaks. Our goal is to develop high quality enzyme reagents to facilitate basic research and disease intervention. The intern will gain a basic knowledge of enzymes and inhibitors, and valuable research experience in this area from a team of accomplished scientists. Projects will involve protein purification, enzyme characterization, and antibody analysis. The techniques employed may include column chromatography, protein refolding, enzyme and inhibitor assays, SDS-PAGE, Western blotting, immunoprecipitation, neutralization, and ELISA. Over the course of the summer, the intern will learn how to design experiments, document procedures, and interpret results. At the end of the summer, the intern will be expected to give a formal presentation to the company summarizing his/her achievements.

H. Development & Optimization of Cell Culture Media for Mammalian Recombinant Protein Expression (IN/94)

Cell culture media is critical to cell growth and the expression of recombinant proteins. The goal of this project is to develop and optimize proper media formulations and cell culture conditions for improving recombinant protein expression in mammalian cell lines such as NS0, CHO, and HEK293. The summer intern is expected to have a basic understanding of cell physiology, media composition, cell culture processes, and recombinant protein expression technology. She or he will be asked to conduct experiments designed to test various media components under different cell culture conditions and to perform Western blot analysis or other protein assays to quantify protein expression. The intern will also be responsible for analyzing data and reporting results in both a written and an oral format. The selected intern will be guided by a motivated team of scientists and research associates. Students in bioprocess, biochemical engineering, or cell biology-related disciplines are encouraged to apply. The intern will be expected to give a formal presentation on her or his work at the conclusion of the summer project.



I. Optimization of Recombinant Protein Expression in Cell Culture (IN/394)

The intern will work on developing new techniques for protein expression in *E. coli* or insect cell culture. This will involve one or more of the following: 1) cloning genes under new or modified promoters; 2) modifying genes at the level of their DNA sequence; or 3) optimizing media formulations and cell culture conditions. The intern will be guided by a scientist/senior research associate in the Cell Culture Department. The intern will be expected to have previous experience with general laboratory techniques such as pipetting and preparing solutions. In addition, knowledge of aseptic techniques in microbiology, or experience in molecular biology (i.e. methods for DNA manipulation) will be useful. The intern will be responsible for preparing solutions and buffers, cloning, culturing cells for the production of recombinant proteins, SDS-PAGE, Western blotting, and data analysis. The intern will be expected to give a formal presentation on her or his work at the conclusion of the summer project.

J. Characterization of Stem Cell Derivatives by Flow Cytometry (IN/96)

Pluripotent stem cells are defined by their ability to differentiate into each of the three germ layers, ectoderm, mesoderm, and endoderm. Due to this differentiation ability, these cells are of great interest to the research and medical communities for their therapeutic potential. Although there are some good surface markers to define the pluripotent state of these stem cells, there is a deficit of good surface markers that can be used to identify and select early derivatives. Flow cytometry is a powerful technique that can be used to rapidly screen many potential surface markers on these differentiated cells. Multi-color flow can then be used to correlate the expression of novel surface markers with known markers, such as transcription factors, in these cell types. The intern for this project will conduct experiments designed to induce pluripotent stem cell differentiation followed by large scale screening of our library of conjugated surface antibodies. The major techniques employed will include, but are not limited to, cell culture, flow cytometry, and immunocytochemistry. This is an excellent opportunity for a student to gain exposure to both a scientific and industrial setting, and to provide beneficial technical support to the principal investigators in the laboratory. The intern will be expected to give a formal presentation on her or his work at the conclusion of the summer project.



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