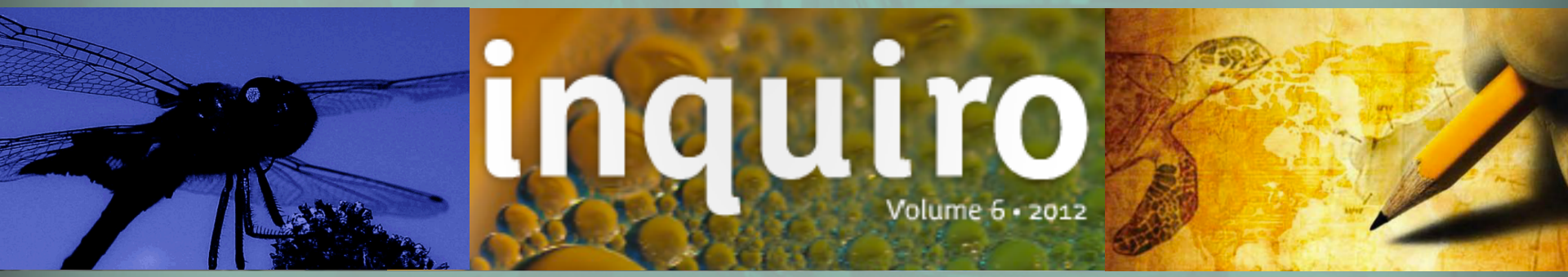
Inquiro Information Session

September 18, 2013



UAB THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

What is Inquiro?

inquiro
UAB Undergraduate
Scientific Research Journal

Faculty-reviewed science journal that publishes the original work of undergraduates.

Who is eligible to submit to Inquiro?

- UAB undergraduate students
- Undergraduates whose research was conducted at UAB (e.g. summer program students)

What areas of research does *Inquiro* publish?

- Biology, chemistry, engineering, mathematics, psychology, physics

How is *Inquiro* managed?

- Editorial board consists entirely of distinguished undergraduate students
- Faculty advisors and reviewers

Why publish in Inquiro?

inquiro
UAB Undergraduate
Scientific Research Journal

Exposure
- Share your work with others

Experience
- Learn the publication process
- Improve your scientific writing and analytical skills

Prestige
- Add a faculty-reviewed publication to your CV

Contribute to UAB's community of research scholars.

Timeline

inquiro
UAB Undergraduate
Scientific Research Journal

Deadlines:

- October 9 - deadline for research submissions
- November 1 - deadline for cover art submission

Publication process

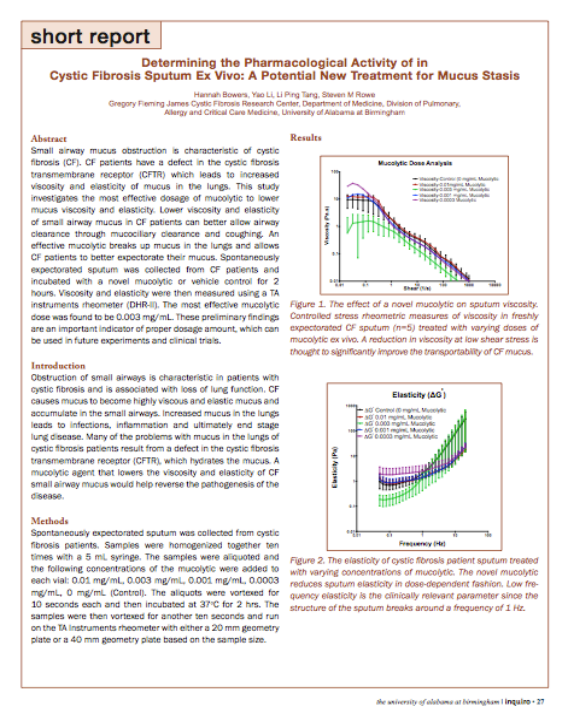
- October/November – faculty review of manuscripts
- December/January – revision of manuscripts by authors
- February/March – journal design and editing
- Late March/Early April – publication and release event

Types of submissions

inquiro
UAB Undergraduate
Scientific Research Journal

Short report

- Comparable to a poster
- 1000-2000 words (suggested)



short report

Determining the Pharmacological Activity of in Cystic Fibrosis Sputum Ex Vivo: A Potential New Treatment for Mucus Stasis

Hannah Bowers, Yao Li, Li Ping Tang, Steven M Rowe
Gregory Fleming James Cystic Fibrosis Research Center, Department of Medicine, Division of Pulmonary, Allergy and Critical Care Medicine, University of Alabama at Birmingham

Abstract
Small airway mucus obstruction is characteristic of cystic fibrosis (CF). CF patients have a defect in the cystic fibrosis transmembrane receptor (CFTR) which leads to increased viscosity and elasticity of mucus in the lungs. This study investigates the most effective dosage of mucolytic to lower mucus viscosity and elasticity. Lower viscosity and elasticity of small airway mucus in CF patients can better allow airway clearance through mucociliary clearance and coughing. An effective mucolytic breaks up mucus in the lungs and allows CF patients to better expectorate their mucus. Spontaneously expectorated sputum was collected from CF patients and incubated with a novel mucolytic or vehicle control for 2 hours. Viscosity and elasticity were then measured using a TA instruments rheometer (DHR-II). The most effective mucolytic dose was found to be 0.003 mg/mL. These preliminary findings are an important indicator of proper dosage amount, which can be used in future experiments and clinical trials.

Introduction
Obstruction of small airways is characteristic in patients with cystic fibrosis and is associated with loss of lung function. CF causes mucus to become highly viscous and elastic mucus and accumulate in the small airways. Increased mucus in the lungs leads to infections, inflammation and ultimately end stage lung disease. Many of the problems with mucus in the lungs of cystic fibrosis patients result from a defect in the cystic fibrosis transmembrane receptor (CFTR), which hydrates the mucus. A mucolytic agent that lowers the viscosity and elasticity of CF small airway mucus would help reverse the pathogenesis of the disease.

Methods
Spontaneously expectorated sputum was collected from cystic fibrosis patients. Samples were homogenized together ten times with a 5 mL syringe. The samples were aliquoted and the following concentrations of the mucolytic were added to each vial: 0.01 mg/mL, 0.003 mg/mL, 0.001 mg/mL, 0.0003 mg/mL, 0 mg/mL (Control). The aliquots were vortexed for 10 seconds each and then incubated at 37°C for 2 hrs. The samples were then vortexed for another ten seconds and run on the TA instruments rheometer with either a 20 mm geometry plate or a 40 mm geometry plate based on the sample size.

Results

Figure 1. The effect of a novel mucolytic on sputum viscosity. Controlled stress rheometric measures of viscosity in freshly expectorated CF sputum (n=5) treated with varying doses of mucolytic ex vivo. A reduction in viscosity at low shear stress is thought to significantly improve the transportability of CF mucus.

Figure 2. The elasticity of cystic fibrosis patient sputum treated with varying concentrations of mucolytic. The novel mucolytic reduces sputum elasticity in dose-dependent fashion. Low frequency elasticity is the clinically relevant parameter since the structure of the sputum breaks around a frequency of 1 Hz.

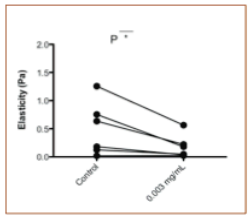


*Figure 3. Dose response of the novel mucolytic on sputum elasticity. The elasticity of sputum from CF patients (n=6) at a shear of 0.063 Hz is lowest at the 0.003 mg/mL concentration of the mucolytic. *P < 0.05.*

Conclusions
When 0.003 mg/mL mucolytic is added to the sputum from CF patients, the viscosity and elasticity are significantly decreased compared to the control sample. A dose response was observed for these parameters, which will be used to select doses to be advanced in further studies.

Future Directions
Further research in the Rowe laboratory will include varying molecular weights of the mucolytic along with varying incubation times to identify the maximum efficacy of this mucolytic as a potential treatment for CF patients. Additional experiments will examine the effect of mucolytic on mucus transportability. The promising results of decreased viscosity and elasticity from this study support the effectiveness of this mucolytic and provide a strong rationale for *in vivo* testing.

short report

Statistical Analysis of Differential Gene Expression in the Coat Patterns of the Striped Mouse

Lacey Kennedy
Barsh Lab, HudsonAlpha Institute for Biotechnology, Huntsville, AL

Introduction
The striped mouse, *Rhabdomys pumilio*, is a small rodent native to South Africa. Its appearance is characterized by the presence of alternating black and white stripes, similar to a chipmunk. The mechanism by which this pattern forms is not known; however, differential gene expression between the striped regions has been hypothesized to play a role. To better understand the mechanisms by which these stripes are produced, the Barsh lab, in collaboration with Drs. Hopi Hoekstra, Marie Manceau, and Ricardo Mallarino, has initiated experiments to identify genes that are differentially expressed between each striped region. We hypothesized that independent black stripes (BIA and BIB) would exhibit similar patterns of gene expression, and that these patterns differ from those of the intervening (Wh) and central (DrW) stripes.

Statistical analysis of sequencing results of EcoP151 Digital Gene Expression (EDGE) was used to compare transcriptional product abundance of dermal tissue samples from the striped areas of adult specimens for specific genes. Incidences of genes with low false discovery rates were used to evaluate which type of analysis would be more statistically powerful with respect to detecting differentially expressed genes.

The first objective of the study was to determine whether paired or unpaired analysis is more statistically powerful for identifying genes that are differentially expressed in each striped region. Once this was determined, the second objective was to use the superior analysis to identify patterns of differential gene expression between given striped regions.

Methods
Creation of a genomic library using EcoP151 Digital Gene Expression (EDGE tagging)
Dermal skin tissue samples were collected from the striped and dorsal midline areas of adult striped mice. Each sample represents tissue from a single stripe (BIA, BIB, Wh, or DrW) on a single mouse (Fig. 1). Total RNA was isolated from each sample, and mRNA was extracted using oligo-dT paramagnetic beads. These beads bear sequences of multiple thymine nucleotides that attract only mRNA by targeting the polyA sequences that are added to transcripts after processing. The EcoP151 Digital Gene Expression (EDGE) method was selected to analyze the mRNA concentrations because it has been shown to be less susceptible to amplification bias than other techniques, such as RNA sequencing, since every molecule is exactly the same

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

Types of submissions

inquiro
UAB Undergraduate
Scientific Research Journal

Long research paper

- Result from substantial projects
- 2500-4000 words (suggested)

research paper

Development of Dot Array Biosensor using Dip-Pen Nanolithography of Polyacrylamide Ink

Aditi R. Naik[1], Ethan J. White[2], Dr. Aaron Catledge[2]*
[1] Cornell University, Department of Chemical Engineering, Cornell University
[2] University of Alabama at Birmingham, Department of Physics, University of Alabama at Birmingham
*Corresponding author

Abstract
The general goal of this project was to develop an acrylamide-based biosensor that may be used to capture and detect biomolecules, such as the cardiac protein troponin T. This paper demonstrates the ability to print nanodots of polyacrylamide hydrogel on a silicon dioxide substrate using dip-pen nanolithography. Solutions of 3-30%T (w/v) acrylamide monomer were polymerized by adding 3%C(w/w) N,N'-methylene-bis-acrylamide. The addition of polyethylene glycol into the polymer solution resulted in greater stability of the nanodots. Optimal printing conditions were determined by considering the visible gelation time, initial and final viscosity, and porosity of polyacrylamide gel. Individual dots were examined using optical and atomic force microscopy. Fluorescent nanodiamond particles were incorporated into microdots of polyacrylamide on glass slides. It is anticipated that the captured protein will result in a variation in fluorescence, which can be measured to determine the concentration of protein detected. The presence of nanodiamond was confirmed by Raman spectroscopy and fluorescent microscopy.

Introduction
Elevated levels of cardiac troponin T within the bloodstream is associated with heart failure. Detection of high levels of troponin T is currently considered the golden standard to diagnose patients who have experienced symptoms of a heart attack or other cardiac injury [1]. Currently, many available troponin test immunoassays use antibody-antigen bonding, which is constrained by poor stability, high cost, and lack of portability. The purpose of this research is to create a biosensor from the polymer polyacrylamide. Polyacrylamide gels are predominately used for gel electrophoresis, which is a common method for separating proteins, and are nontoxic, water-absorbent, and nonreactive toward proteins [3].

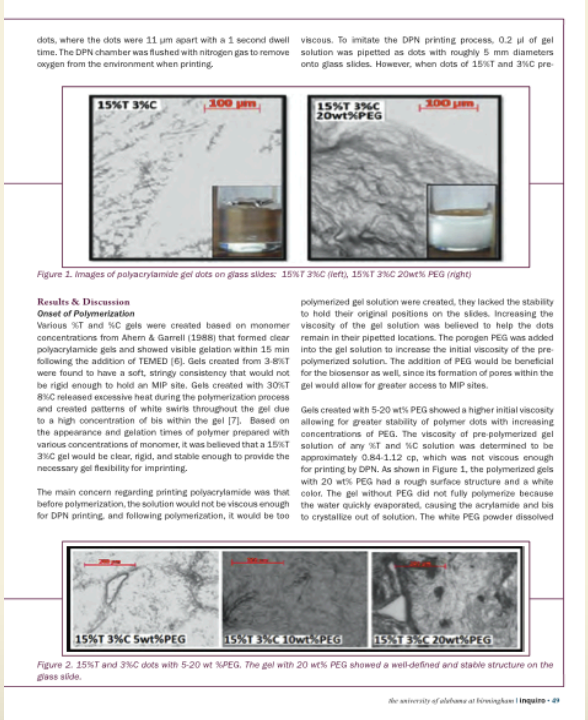
The biosensor would use a molecularly imprinted polymer (MIP) approach for protein capture. For this, the polymer is constructed to have specific recognition sites for a certain template molecule, which would be troponin T [4]. To improve access to the recognition sites on the MIP, the polymer will be printed as nanoscale dot array using dip-pen nanolithography (DPN). A cantilever with a DPN tip that is roughly 100 µm across is dipped into an "ink," which can then be printed in any pattern on a substrate [5]. A biosensor printed in the form of a dot array using DPN will allow for a high surface area-to-volume ratio, which will facilitate the binding of protein into the recognition sites. The concentration of protein captured will be measured using fluorescent nanodiamond (ND) particles incorporated uniformly within the polymer. The captured protein will lower the fluorescence of nanodiamond, which can be calculated to determine the amount of protein.

This paper focuses on the work involved in determining the optimal chemical ratios and conditions for printing polyacrylamide hydrogel dots on a silicon oxide substrate using DPN. The variables considered include chemical concentrations, gelation times, viscosity, and porosity of the final polymer created both with and without the addition of ND.

Materials & Methods
Polyacrylamide gels were synthesized by a radically initiated vinyl addition polymerization using the following reagents: acrylamide, N,N'-methylene-bis-acrylamide (bis), ammonium persulfate (APS), tetramethylethylenediamine (TEMED), polyethylene glycol 8000 (PEG), 2 wt% nanodiamond (ND) (aq); (0-0.2 µm and 0.35-0.5 µm), and Milipore water [3]. For initial experiments, polymer concentrations ranging from 3-30%T (=100*grams bis + acrylamide / mL water) with 3%C (=100*grams bis / grams bis + acrylamide) were analyzed to observe initial viscosities and changes in onset of polymerization. Gel volumes of 5 mL, 1 mL, and/or 0.5 mL were created in 5 mL capped glass vials by adding the appropriate amounts of monomer, initiator, and catalyst into solution.

To prepare monomer solutions, acrylamide and bis were dissolved in water. Both monomer and 15% (wt/vol) APS solutions were prepared fresh daily to prevent chemical degradation and degassed in a vacuum dessicator for 15 min at 200 torr to remove excess oxygen from the environment. Initiator solution and catalyst were pipetted directly into the monomer solution in the ratio of 1 mL water: 5 µL APS solution: 1 µL TEMED. Visible gelation times were measured from the addition of TEMED until the solution exhibited resistance to movement when vial was shaken.

For DPN, roughly 1 µl of gel solution was placed in the appropriate inkwell. A DPN tip was dipped into the ink, blotted on the substrate 2-3 times, and then printed on a silicon dioxide (SiO_2) substrate. The dots were printed in grids of 6 dots by 6



dots, where the dots were 11 µm apart with a 1 second dwell time. The DPN chamber was flushed with nitrogen gas to remove oxygen from the environment when printing.

viscous. To imitate the DPN printing process, 0.2 µl of gel solution was pipetted as dots with roughly 5 mm diameters onto glass slides. However, when dots of 15%T and 3%C pre-

Figure 1. Images of polyacrylamide gel dots on glass slides: 15%T 3%C (left), 15%T 3%C 20wt% PEG (right)

Results & Discussion
Onset of Polymerization
Various %T and %C gels were created based on monomer concentrations from Ahern & Garrell (1988) that formed clear polyacrylamide gels and showed visible gelation within 15 min following the addition of TEMED [6]. Gels created from 3-8%T were found to have a soft, stringy consistency that would not be rigid enough to hold an MIP site. Gels created with 30%T 8%C released excessive heat during the polymerization process and created patterns of white swirls throughout the gel due to a high concentration of bis within the gel [7]. Based on the appearance and gelation times of polymer prepared with various concentrations of monomer, it was believed that a 15%T 3%C gel would be clear, rigid, and stable enough to provide the necessary gel flexibility for imprinting.

The main concern regarding printing polyacrylamide was that before polymerization, the solution would not be viscous enough for DPN printing, and following polymerization, it would be too

polymerized gel solution were created, they lacked the stability to hold their original positions on the slides. Increasing the viscosity of the gel solution was believed to help the dots remain in their pipetted locations. The porogen PEG was added into the gel solution to increase the initial viscosity of the pre-polymerized solution. The addition of PEG would be beneficial for the biosensor as well, since its formation of pores within the gel would allow for greater access to MIP sites.

Gels created with 5-20 wt% PEG showed a higher initial viscosity allowing for greater stability of polymer dots with increasing concentrations of PEG. The viscosity of pre-polymerized gel solution of any %T and %C solution was determined to be approximately 0.84-1.12 cp, which was not viscous enough for printing by DPN. As shown in Figure 1, the polymerized gels with 20 wt% PEG had a rough surface structure and a white color. The gel without PEG did not fully polymerize because the water quickly evaporated, causing the acrylamide and bis to crystallize out of solution. The white PEG powder dissolved

Figure 2. 15%T and 3%C dots with 5-20 wt %PEG. The gel with 20 wt% PEG showed a well-defined and stable structure on the glass slide.

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

Types of submissions

inquiro
UAB Undergraduate
Scientific Research Journal

Research narrative

- Accounts personal experiences with research
- 600-800 words (suggested)

research narrative

Fishing for Success

Katherine Beaufait

When I applied for the BioTrain program, I really did not think I stood a chance. Here I was, 19 years old with no research experience or even a college biology class under my belt, applying to a world class research institute. A friend claimed I had a better chance of being struck by lightning than getting the internship. And so, when I eventually did receive a letter stating that the program had an opening for me, I could not contain my excitement. To top it off, the spot was in Dr. Myers' lab- I would be working with the president of the institute himself.

The first week of the internship was titled Biotech Boo 7amp, where each intern learns the basic skills needed to thrive in a research lab: pipetting, serial dilutions, plating bacteria, and electrophoresis just to name a few. However, as soon as I met with Kelly Williams, PhD, of Dr. Myers' lab, I began to learn more complex techniques. For example, I was taken down to the fish room where I learned to feed the fish and to change the system's water to ensure they were kept in optimal conditions. Very quickly, I was pulling out tanks and moving fish around to set up crosses, which is the term for breeding. Initially, I have to admit, it was quite frightening as a fish accidentally fell out of the net, and in shock, all I did at first was stare at it flopping on the table. However, it did not take long to overcome the fear and feel confident to move the fish around like the other two technicians.

Meanwhile, up in the lab, I continued to acquire new techniques and procedures, like the BCA and acetylcholinesterase assays I would be using as a major data source for my poster presentation later that summer. My favorite procedure was definitely the Western blotting technique, even when we could not ma7Ih a primary anti-body that worked well with our samples. It seemed strange at first to put up with a two-day process only to find out at the end that it did not work as intended, but I soon realized these struggles are just part of the whole research experience. As with any kind of scientific discovery, to make progress, you must fail many times first.

Upon returning to UAB I was so grateful for the internship opportunity. Not only was I put into a renowned research facility, but I was also put in to a lab that cared about my learning and wanted me to grow as a scientist. As I continue my research on campus, I often think about the people I got to spend my entire summer with. Every one of them treated me as an equal, despite my lesser knowledge on the research matter. They also helped me understand how and why I was performing the experiments.. I still talk to most of the lab technicians and post-doctoral fellows I worked with during the summer of 2011, and I plan on going back to visit once or twice this year. I am so proud to call the Myers lab my first research lab experience and if possible wish to return in the coming summer.

Inquiro does NOT accept…

inquiro
UAB Undergraduate
Scientific Research Journal

Non-original research reports

Literature reviews

Humanities and social sciences

Survey-based studies

Preparing your manuscript

inquiro
UAB Undergraduate
Scientific Research Journal

Manuscript Guidelines for Authors

- Document available on website
- Formatting, content, structure and organization

Options

- Convert a poster to a short report
- Revise a summer research paper

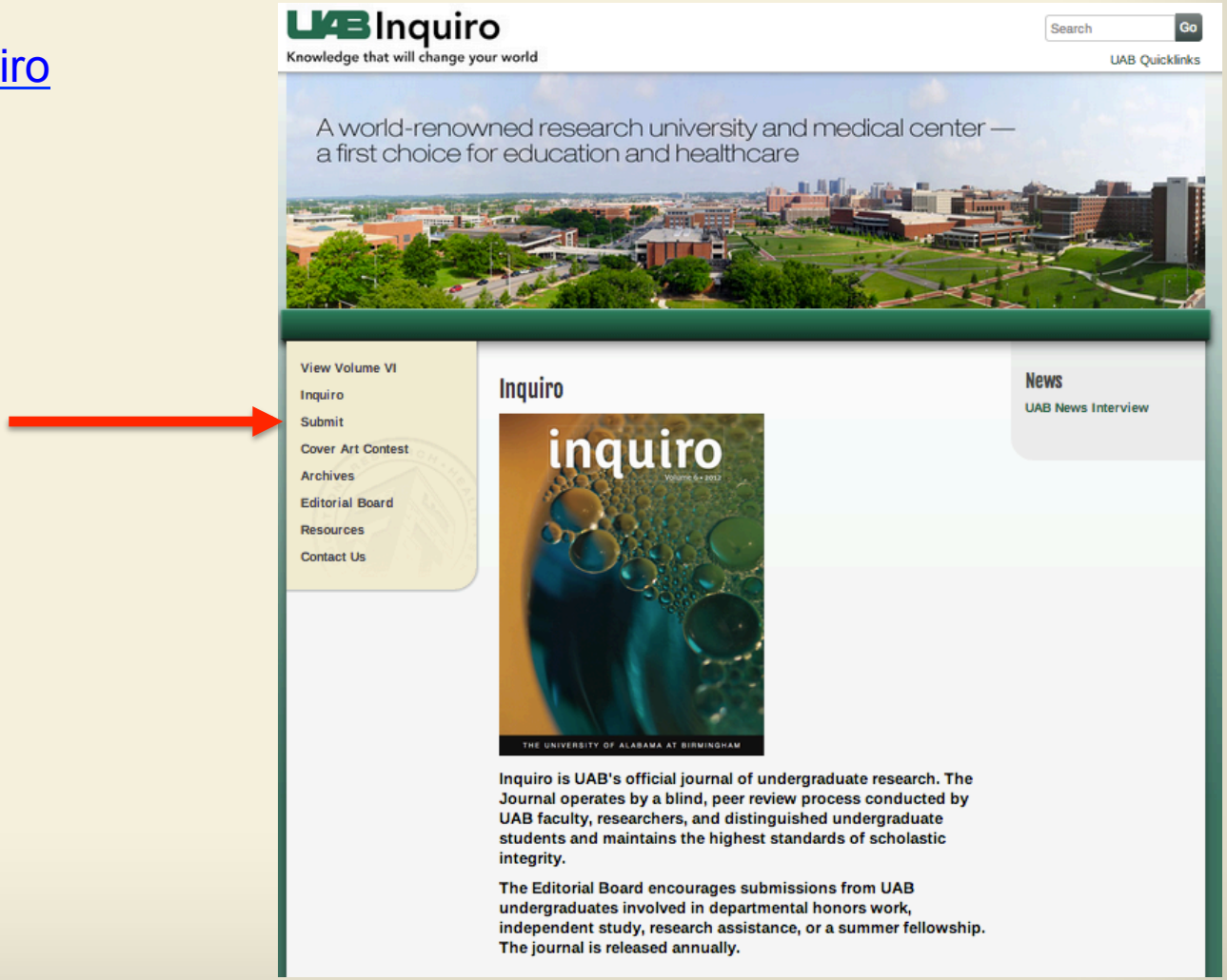
Work with your mentor and with fellow students and post-docs in your lab

- Have others read drafts

Submitting a manuscript

inquiro
UAB Undergraduate
Scientific Research Journal

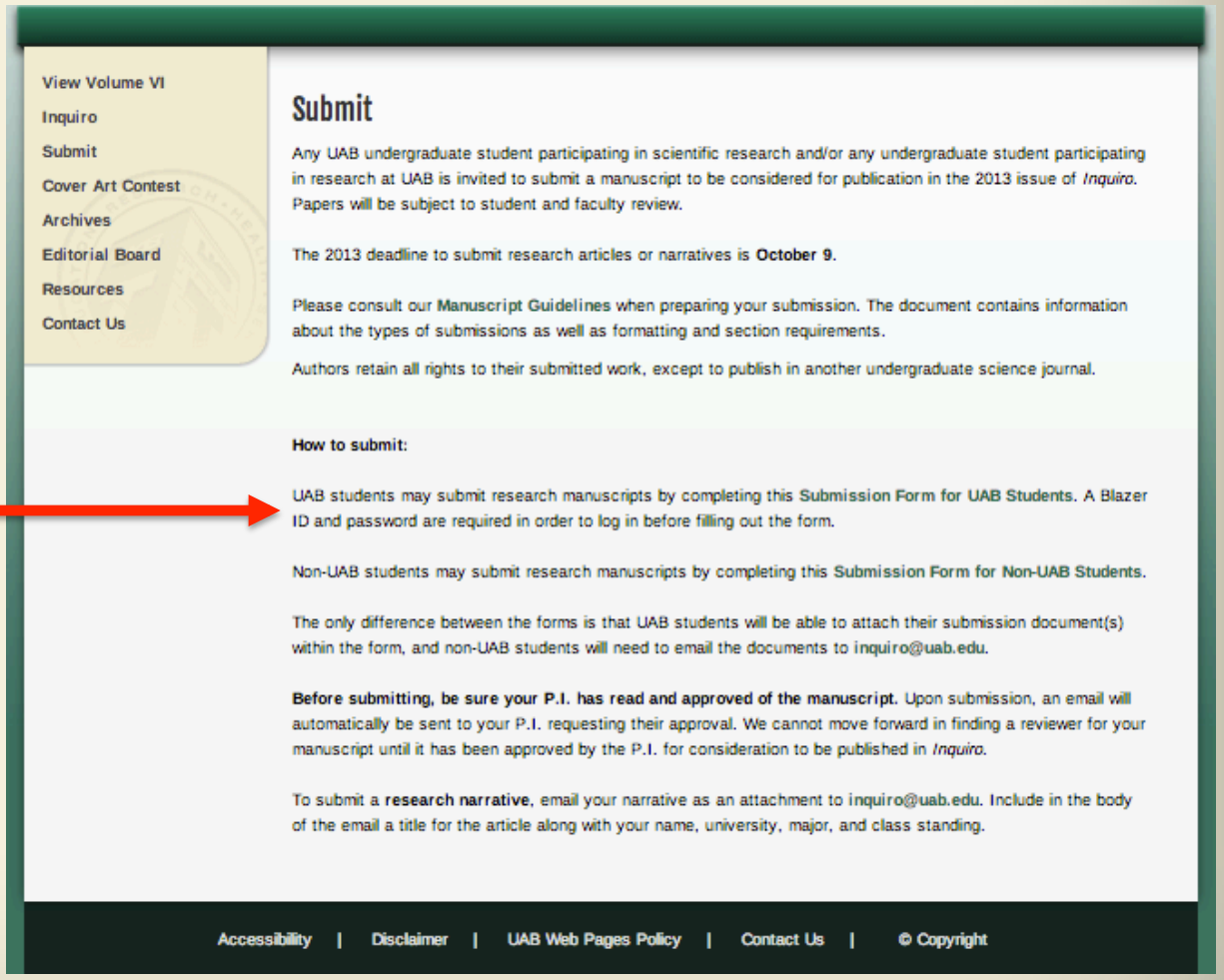
www.uab.edu/inquiro



Submitting a manuscript

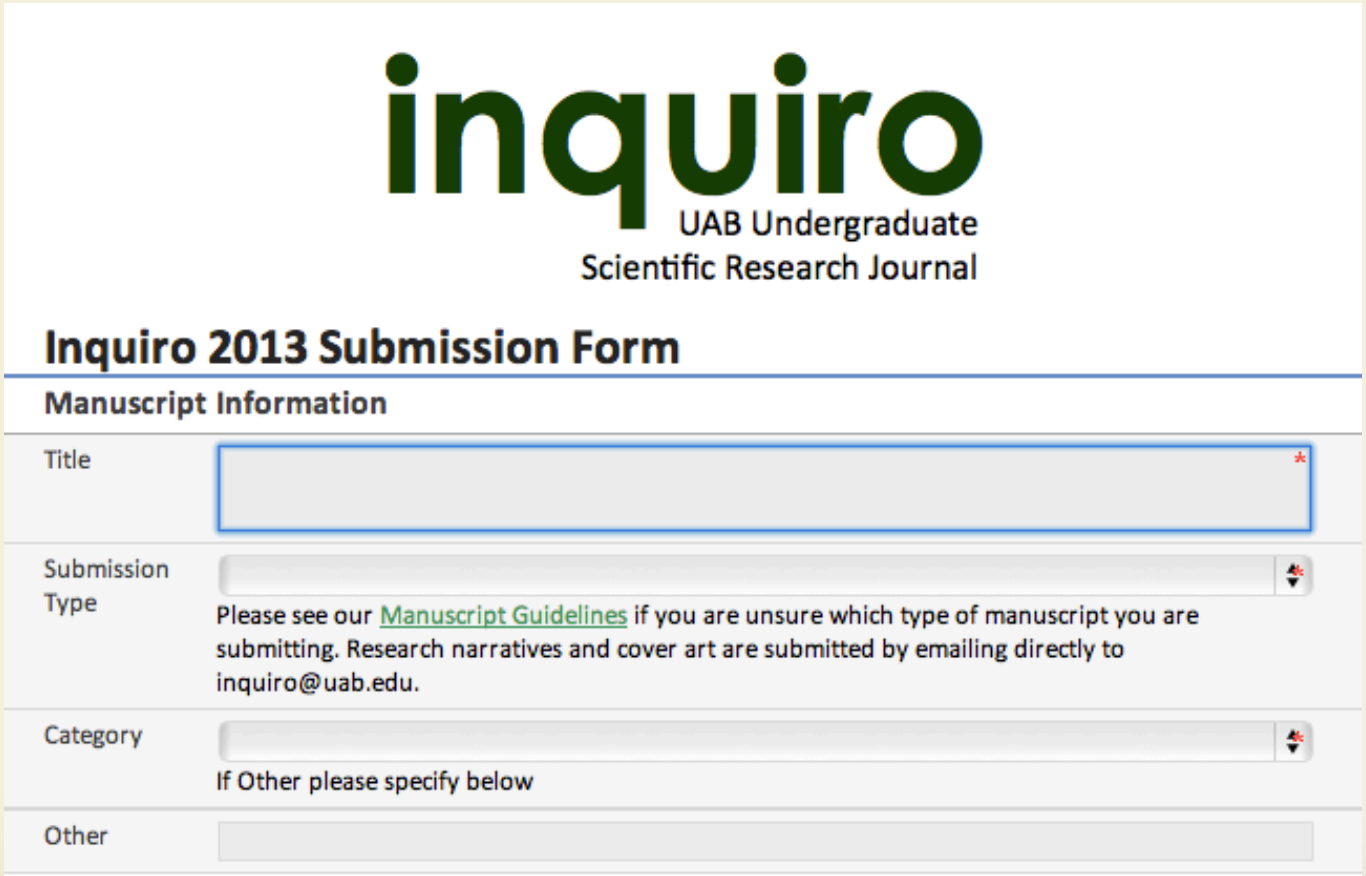
inquiro
UAB Undergraduate
Scientific Research Journal

www.uab.edu/inquiro



Submitting a manuscript

inquiro
UAB Undergraduate
Scientific Research Journal



inquiro
UAB Undergraduate
Scientific Research Journal

Inquiro 2013 Submission Form

Manuscript Information

Title *

Submission Type *

Please see our Manuscript Guidelines if you are unsure which type of manuscript you are submitting. Research narratives and cover art are submitted by emailing directly to inquiro@uab.edu.

Category *

If Other please specify below

Other

Submitting a manuscript

inquiro
UAB Undergraduate
Scientific Research Journal

First Author Information

Name	*
Email	*
Institution	Specify your university if you do not attend UAB
Major	*
Class Standing	* Based on number of years until graduation, not credit hours

Co-Author Information

Co-Author	Does not refer to P.I. If two undergraduate students co-wrote the manuscript, please fill out co-author information. If multiple authors contributed who are not undergraduate students, leave this section blank and complete the Additional Author Information section below.
Email	
Institution	Specify university if the co-author does not attend UAB
Class Standing	Based on number of years until graduation, not credit hours

Submitting a manuscript

inquiro
UAB Undergraduate
Scientific Research Journal

Mentor/Principal Investigator Information

Name	*
Email	* Mentors will receive an email requesting confirmation that they have read and approved the manuscript being submitted.
Department	* If the mentor is not a UAB faculty member, indicate his or her affiliation here following the department, i.e. "Department of Microbiology, University of X."
Institution	Specify mentor's institution or university if it is not UAB.
Additional Author Information	If there are authors in addition to the submitter(s) and the mentor, please list them in the format "Name, Department, Institution; Name 2, Department 2, Institution 2;" etc. in the order in which the authors should be listed in the published article. We will list the submitter(s) as the first author(s) and the P.I. as the last author.

In order to ensure the anonymity of *Inquiro*'s review process, we ask that you remove ALL author information from the manuscript itself before attaching and submitting it.

Conditions of Publication

inquiro
UAB Undergraduate
Scientific Research Journal

- Authors retain copyrights, i.e. you may publish anything published in *Inquiro* in another form of media, including any professional journal
- *Inquiro* has the right to reproduce and distribute copies of the article
- Authors will not receive financial compensation for publishing articles
- Articles are not guaranteed to be published
- The article cannot have been published in another undergraduate journal

Mentor approval

inquiro
UAB Undergraduate
Scientific Research Journal

Before submitting:

- Discuss your intent to submit a manuscript with your mentor
- Have your mentor read over the manuscript

After submitting:

- An automatic email will be sent to your mentor
- Your mentor will indicate that he/she has read and approved the manuscript

Submitting a narrative

inquiro
UAB Undergraduate
Scientific Research Journal

- Research narratives are submitted through email to inquiro@uab.edu

- Include in the body of the email:
  - Article title
  - Your name
  - University
  - Major
  - Class standing

- Submit the research narrative as an attached document

Faculty review process

inquiro
UAB Undergraduate Scientific Research Journal

All reviews are double-blind

- You will not know who reviews your manuscript
- Your reviewer will not be given your name

Who reviews the manuscripts?

- UAB faculty and post-doctoral fellows with the expertise to critique each particular submission's subject matter
- English faculty review research narratives

What are reviewers asked to critique?

- Title
- Clarity, conciseness
- Figures and tables
- Originality of material
- Is rationale stated?
- Is methodology sound?
- Are conclusions supported?

Revising your manuscript

inquiro
UAB Undergraduate
Scientific Research Journal

The Inquiro staff returns reviewers' suggestions to the author.

- Authors are given time to revise and resubmit

Revised submission undergoes internal editing by the Board

- Check for adherence to reviewer suggestions
- Formatting
- Grammar and syntax
- Final edits

Submissions are sent to our graphic designer at UAB Printing.

Board approves final proofs of the journal.

Publication

inquiro
UAB Undergraduate
Scientific Research Journal

Release event during Spring semester

All authors receive up to 3 physical copies of the journal free of charge

Entire journal is made available online in our archives

- Linked to individual articles

Publicity at Spring Expo

Resources

inquiro
UAB Undergraduate
Scientific Research Journal

On the website:

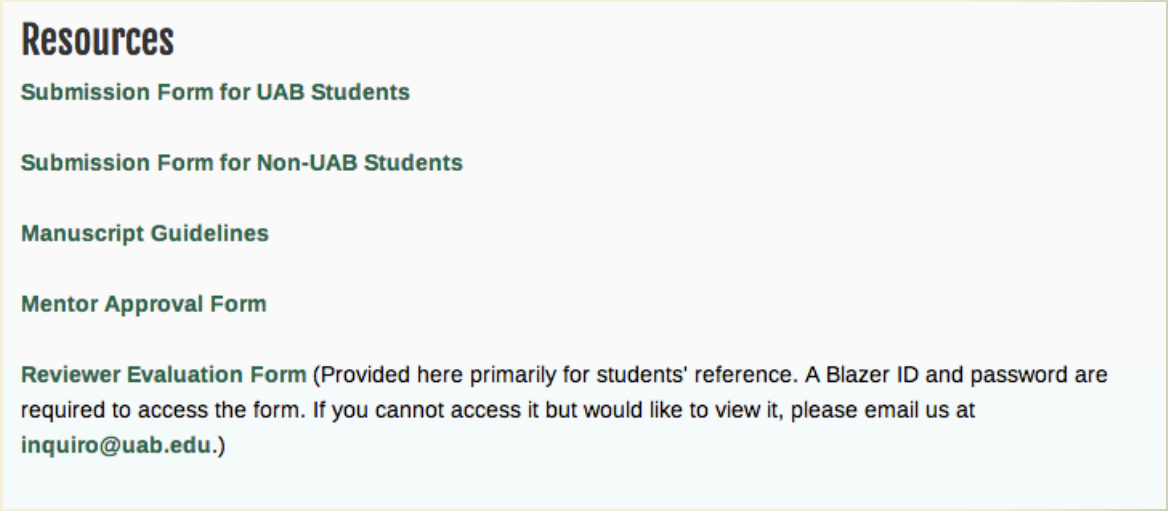
www.uab.edu/inquiro

Resources

inquiro
UAB Undergraduate Scientific Research Journal

On the website:

- Links to submission forms
- Manuscript guidelines
- Links to mentor and reviewer forms (for reference)



Resources

Submission Form for UAB Students

Submission Form for Non-UAB Students

Manuscript Guidelines

Mentor Approval Form

Reviewer Evaluation Form (Provided here primarily for students' reference. A Blazer ID and password are required to access the form. If you cannot access it but would like to view it, please email us at inquiro@uab.edu.)

Other resources:

- Mentors, post-docs, and other professionals in your department
- Undergraduate peers
- University Writing Center

Timeline

inquiro
UAB Undergraduate
Scientific Research Journal

Deadlines:

- October 9 - deadline for research submissions
- November 1 - deadline for cover art submission

Publication process

- October/November – faculty review of manuscripts
- December/January – revision of manuscripts by authors
- February/March – journal design and editing
- Late March/Early April – publication and release event