University of Idaho

THE INs AND OUTs OF UNDERGRADUATE RESEARCH

MARCH 1ST, 2023

ABSTRACTS AND POSTERS

HOSTED BY: OUR

UPCOMING DEADLINES

~~OUR SURF AWARD DEADLINE: FEBRUARY 15, 2023~~

~~OUR TRAVEL AWARDS FOR 2023~~

OUR SEMESTER AWARD DEADLINE (FOR FALL 2023): APRIL 1, 2023

https://www.uidaho.edu/research/students/undergraduates/getting-started/research-grants-program

ABSTRACTS AND ARTIST STATEMENTS NOW BEING ACCEPTED FOR O.U.R. UNDERGRADUATE RESEARCH SYMPOSIUM 2023 until APRIL 1, 2023

OFFICE OF UNDERGRADUATE RESEARCH

undergrad-research@uidaho.edu

Who are we and what do we do?

- The Office of Undergraduate Research (OUR) supports student engagement in research, scholarly and creative activities at the University of Idaho. We foster student engagement across all disciplines by raising the visibility of undergraduate research, facilitating research opportunities for students, and helping students showcase their work.
- We promote research and creative activity efforts
- We fund research and creative activity efforts
- We provide a forum to showcase research and creative activity efforts

WRITING AN OUR ~~SURF~~/SEMESTER PROPOSAL

START EARLY…

- Requirements for the ~~SURF~~/Semester proposals:
  - 3-4 page proposal WRITTEN BY THE STUDENT but with guidance from a faculty mentor.
  - Budget and Budget description
  - Letter of Support from the Faculty Mentor
  - Signed cover page

https://www.uidaho.edu/-/media/UIdaho-Responsive/Files/research/Students/Undergrad/2022-surf-program-guidelines.pdf?la=en&hash=50B23522C14C8999ECAC8F258E53B4A3851C33F5

Application Process
Students must submit a written proposal as outlined below and a letter of support from a UI faculty research advisor indicating willingness to support and mentor the student through the research project. The faculty mentor should assist the student in preparing the written proposal but the proposal must be the student's own work.

Research Proposal Components

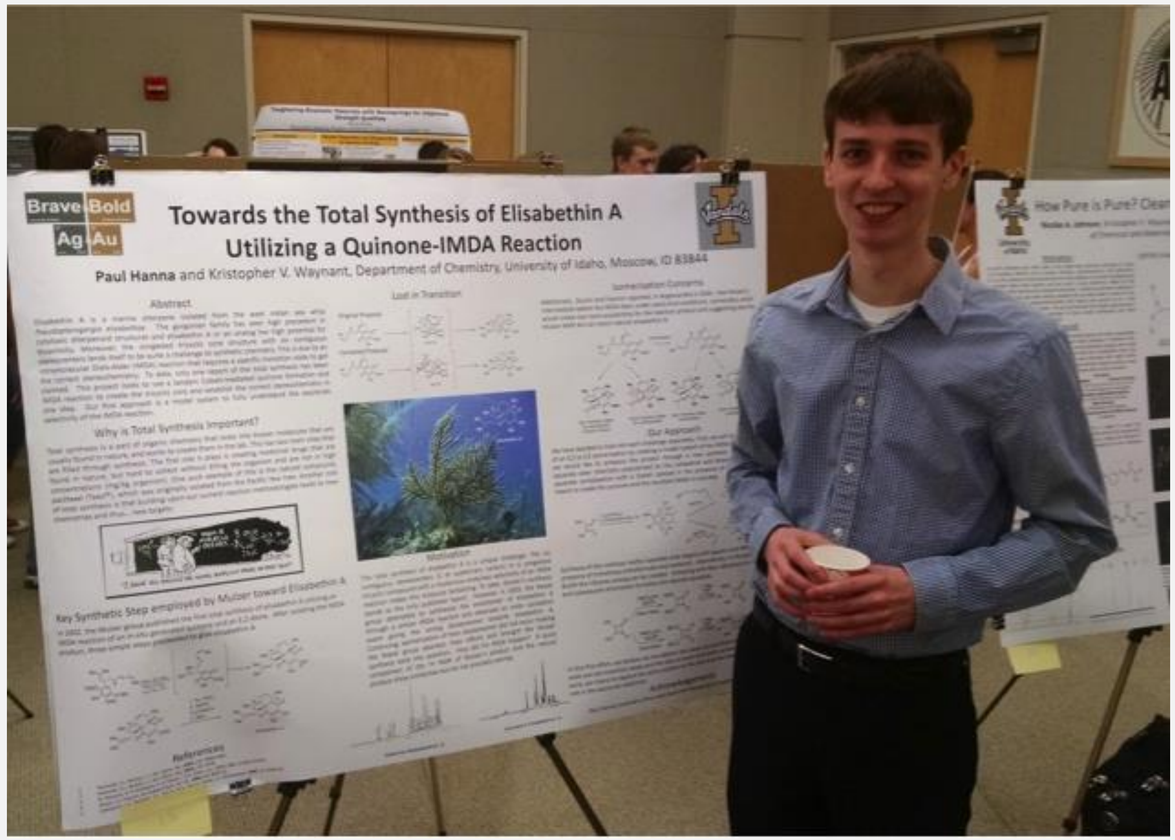
1. SURF Program Cover Sheet
2. Abstract (200 word limit)
3. Project Description (4 page limit)
   i. Introduction, including background and significance of the project
   ii. Project Design, including objectives, methods
   iii. Detailed Timeline, with goals and target completion dates
4. Literature/references
5. Budget and Budget Justification (1 page limit). Budgets should cover only what is absolutely needed for completion of the project. The budget should include $75 to cover the cost of poster printing for the Undergraduate Research Symposium.
6. Letter of recommendation from UI faculty research adviser

Applications will be judged on the following criteria:
Research proposal is clearly written and demonstrated the applicant's understanding of the nature and purpose of the project, how it related to other work in the field, and it includes a plan for accomplishing project goals.
Proposed project allows student to take intellectual ownership and can be reasonable completed in a 10-week period.
Student is prepared for the project (coursework, experience, etc.)
Mentor has submitted supportive recommendation

ANNUAL OUR SYMPOSIUM

MONDAY APRIL 24TH, 2023 – MEMORIAL GYM 2:30 - 4:30 PM

- OUR Symposium
  - The Office of Undergraduate Research hosts a University-wide Undergraduate Research and Creative Arts Symposium in April each year. This annual symposium is designed to showcase and celebrate the research and scholarly work in all disciplines by undergraduates at the University of Idaho. The event is open to the public.
  - SUBMIT Your ABSTRACT NOW!



https://www.uidaho.edu/research/students/undergraduates/symposia/undergraduate-research-symposium

UNDERGRADUATE
RESEARCH SYMPOSIUM

April 24, 2023 | Deadline to submit: April 1

uidaho.edu/UGR-Symposium

STUDENT POSTER SESSION

April 24, 2023

2:30 p.m. - 4:30 p.m.
Memorial Gym

Keynote Speaker, Laurel Lynch
5:00 p.m. - 6:00 p.m. | AgSci 106

SUBMISSION DEADLINE FOR PRESENTERS IS APRIL 1, 2023

FOR MORE INFORMATION
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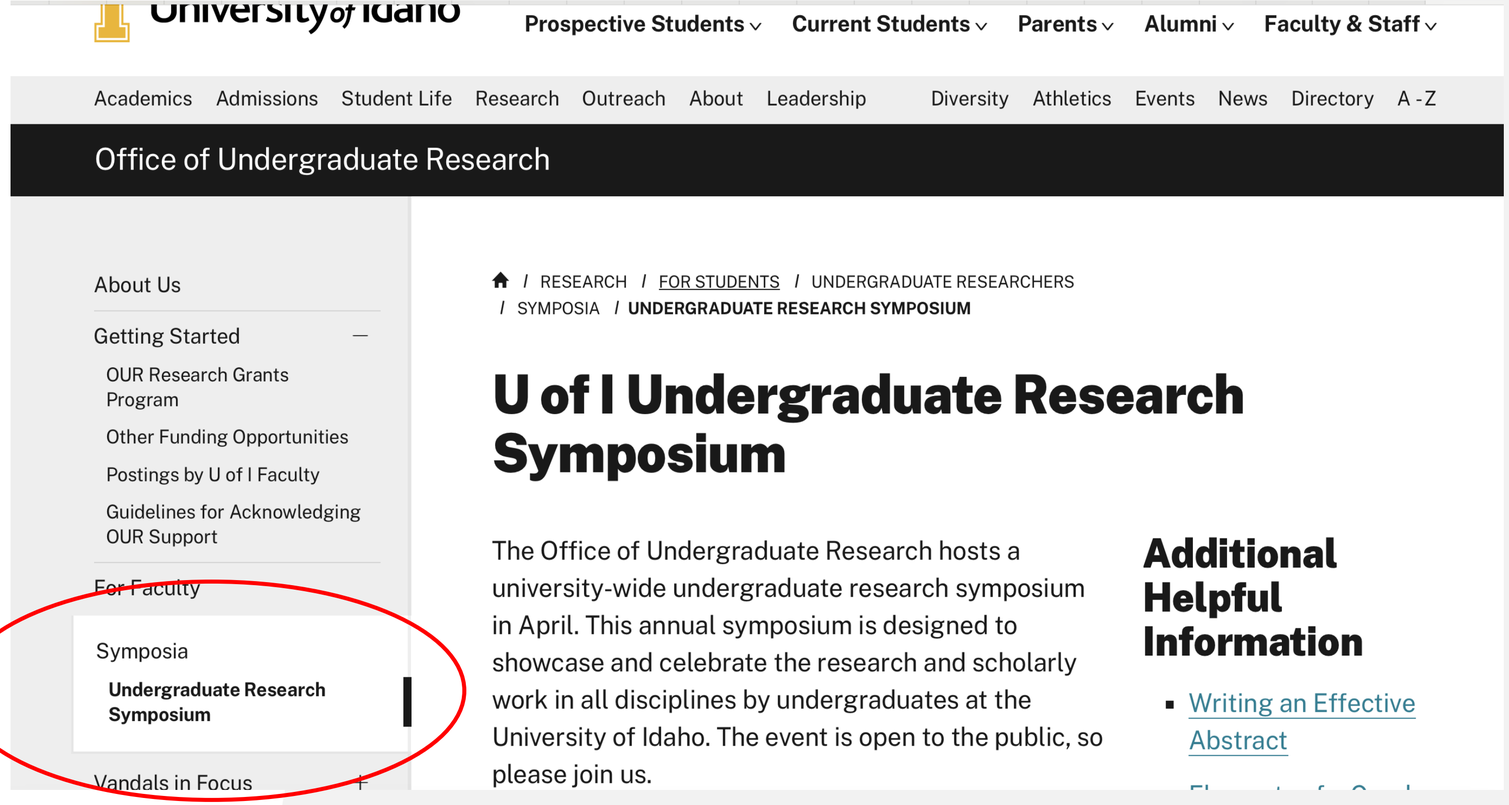
University of Idaho
Office of Undergraduate Research

WHERE DO WE SUBMIT ABSTRACTS?

OUR WEBSITE



- Requirements for Abstract Submission
  - Name / Major / Email
  - Faculty mentor name / Email
  - Faculty mentor Dept / College
  - Title of Project
  - Abstract (250 words max)
    - **THEN PRESS SUBMIT**

A Poster / Presentation is to <u>INFORM</u> not to Archive

ABSTRACT WRITING 101

FIRST NEED A TITLE

- The Title to your poster should capture the whole project
  - Example Titles:
    - **Synthesis and comparison of zwitterionic cross-linkers for the development of non-fouling hydrogels**
    - **Boosts in leaf-level photosynthetic capacity aid Pinus ponderosa recovery from wildfire**
    - **Clinoptilolite and iron sorption/desorption under multiple pH conditions: Testing a substrate for passive treatment of acidic, iron-rich solutions**

Synthesis and Comparison of Zwitterionic Cross-linkers for the Development of Non-fouling Hydrogels

Your Name, Names of other Authors, Department and University Affiliations

ABSTRACT WRITING 101

AN OVERVIEW OF THE PROJECT

- ABSTRACTS
  - Think about the **Motivation** of your project? – Why is it happening? The first sentence(s) can be very general and **describe the problem and why research is being done.** (Motivation/Problem)
  - Describe how you are solving that problem (what Methods / Approach)
  - What happened or if it's still ongoing – what is happening? (*The Results*)
  - What does it mean? (*The Conclusion*)

M
P
A
R
C

- This is why the Old adage is "write the abstract last" I disagree… Continually write and re-write your abstract. **A Poster / Presentation is to INFORM.**

https://users.ece.cmu.edu/~koopman/essays/abstract.html

ABSTRACT WRITING 101

AN OVERVIEW OF THE PROJECT – A SYNOPSIS THAT STANDS ALONE

- My most recent abstract… Submitted to a Journal on Monday…

- **TITLE**: Evaluation of Azothioformamides and Their Copper(I) and Silver(I) Complexes for Biological Activity

- Redox-active azothioformamides (ATFs) contain an NNCS 1,3-heterodiene motif typically found in other molecular subclasses that exhibit a wide range of cytotoxic and anti-neoplastic effects, either alone or as chelation complexes with various metals. For this study, a small library of ATF compounds was synthesized and tested across a range of microbes, fungi, and cancer cell lines for biological activity, both alone and as metal chelates of copper(I) and silver(I) salts. Alone, the ATF compounds exhibited little antimicrobial activity, but all inhibited the cell growth of A549 lung carcinoma cells (IC_{50} values of 1-6 μM). As copper(I) and silver(I) coordination complexes, several of the ATFs showed antimicrobial activity against gram positive *Staphylococcus aureus* and *Bacillus subtilis* cells (IC_{50} ~ 5-20 μM) and the fungi *Candida albicans* (IC_{50} ~ 8-12 μM); as well as cytotoxicity against both lung carcinoma A549 cells and lymphoblastic leukemia K562 cells.

Word Count: 144. Is it general enough?

ABSTRACT WRITING 101

AN OVERVIEW OF THE PROJECT – A SYNOPSIS THAT STANDS ALONE

- My most recent published abstract… Released last week (Feb 22, 2023)

Title: Catalytic Carboxylation of Terminal Alkynes with Copper(I) Azothioformamide Complexes

- Redox-active azothioformamide (ATF) ligands produce coordination complexes with Cu(I) salts. A series of monosubstituted ligands were used to synthesize Cu(I) complexes and investigated for the catalytic insertion of carbon dioxide into terminal alkynes. The optimal catalytic conditions were found using phenylacetylene with 4 mol % of a halogen-bridged (μ-I)-*para*-substituted [(*p*-MeOATF-Cu(I)I)]$_2$ dimer with 3 equiv of Cs_2CO_3 as the base in dimethyl sulfoxide under 1 atm of CO_2 at 40 °C for 24 h, followed by treatment with HCl. A variety of aryl and alkyl substrates were evaluated giving yields from 47 to 99%. The reaction was computationally deconstructed, and a series of likely intermediates and associated energies are provided along with a proposed mechanism. Additionally, it was found that the conditions were suitable for one-pot esterification.

Word Count: 126 words; Is it general enough?

A FEW SLIDES ON POSTERS

POSTERS ARE DESIGNED TO INFORM – NOT TO ARCHIVE…

- Requirements for your POSTER
  - 48 inches wide by 36 inches tall. Do not deviate!
  - Nothing smaller than 28 pt size ideally nothing smaller than 32 pt size
  - A person should be able to inform themselves of the research without you being there.
  - But…
- You should be able to inform an interested party in no more than 4 minutes total. Be able to ”walk through” your Poster from LEFT to RIGHT.
- Practice what you are going to say… Perhaps have a long version and a short version.

Towards the Development of Polymer-Coated Carbon Nanotubes for Printable Calcium Electrodes

DEPARTMENT OF CHEMISTRY, UNIVERSITY OF IDAHO

Abdulakeem Osumah, Garrett E. Larson, and Dr. Kristopher V. Waynant

Abstract

The printing of conductive Carbon nanotube (CNT) inks allows for the possibility of wearable electronic sensors. Towards this, there is need for the development of sensor-based material to be incorporated into the printable inks. This work focuses on the addition of ionophore materials to inks and the functionalization of carbon nanotubes with novel ionophore inspired monomers. The CNT is first coated with a layer of polydopamine (PDA) followed by monomer polymerization using surface-initiated activators regenerated by electron transfer atom transfer radical polymerization (SI-ARGET ATRP) of different methacrylate monomers with end functionalities capable of binding calcium ions. Transmission electron microscopy (TEM), Fourier transform infrared spectroscopy (FT-IR) and other characterization techniques were used to interpret the modification processes. TEM showed progressive increase in the thickness of the CNTs after each modification stage. The calcium binding properties of the polymer brush grafted CNTs will be investigated as printable inks towards the development of wearable/flexible calcium electrodes.

Introduction

This project involves a three-part approach:

A) A conductive CNT ink plus a calcium ion sensitive ionophore formulation[1] to ensure the ink + ionophore mixtures are compatible, printable, and calcium sensitive (figure 1A).

B) The use of polymer anionic ionophores to test the ability of the conductive ink with polymeric calcium ion selective electrode (CISE) material and their sensitivity (figure 1B). In this step we envision both mixing polymers with inks and growing polymers from CNTs.

C) A calcium ionophore-inspired monomer will be developed for calcium testing in the conductive ink mixtures (figure 1C).

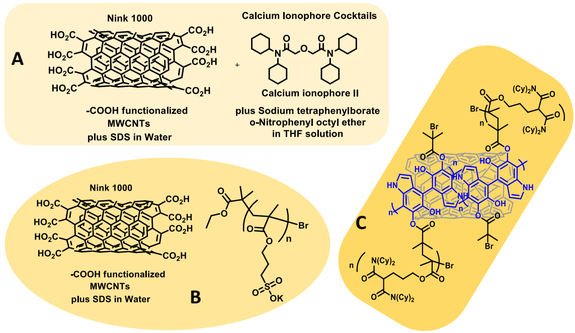


Figure 1. A three-part approach to polymer coated CNT Ionophores

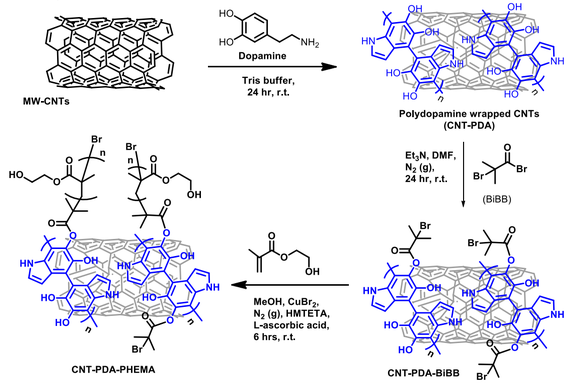
Results

Ink-Printing Experiments

Figure 2. (A) Schematic of drop-casted glass slide (B) Drop-casted glass slide (C) Schematic of calcium ionophore-ink mix on flexible surface; (D) Calcium ionophore-ink mix printed on flexible Kapton® surface.

Synthesis of Polymer Coated CNTs for preliminary studies

Surface modification with polydopamine (PDA) preserves the integrity of the CNT surface and provides catechol groups to facilitate anchoring of ATRP initiator molecules for the polymerization process (scheme 1). SI-ARGET ATRP was employed with commercially available 2-hydroxyethyl methacrylate (HEMA) to provide a polymer coated CNT.[2] Here we present CNT functionalized with poly(2-hydroxyethyl methacrylate) (PHEMA).



Scheme 1. Functionalization of CNTs with poly 2-hydroxyethyl methacrylate

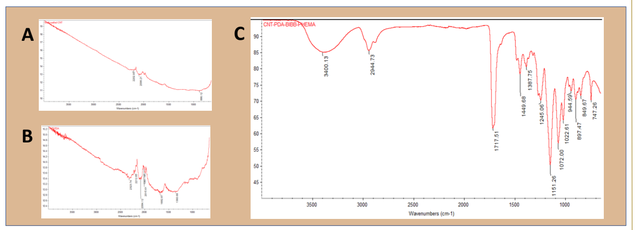


Figure 3. IR spectrum of (A) CNT (B) CNT-PDA (C) CNT-PDA-PHEMA

TEM Images of CNT Functionalization

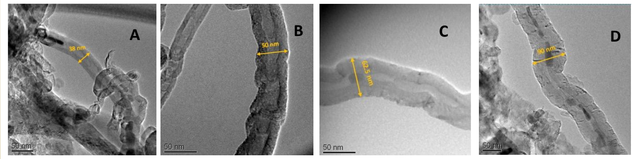


Figure 4. TEM Images of: (A) CNTs; (B) CNTs-PDA; (C) CNTs-PDA-BiBB; (D) CNTs-PDA-PHEMA.

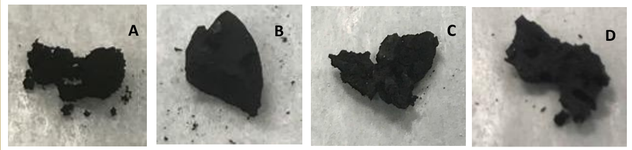
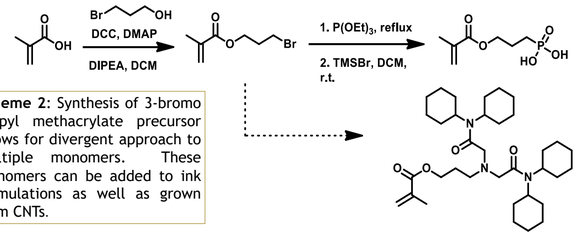


Figure 5. Images of: (A) CNTs; (B) CNTs-PDA; (C) CNTs-PDA-BiBB; (D) CNTs-PDA-PHEMA.

Synthetic Scheme for Ionophore-Inspired Monomers



Scheme 2: Synthesis of 3-bromo propyl methacrylate precursor allows for divergent approach to multiple monomers. These monomers can be added to ink formulations as well as grown from CNTs.

Conclusions and Future Directions

We successfully mixed calcium ionophore into Nink® solutions, printed the inks on multiple substrates including the flexible surface and have verified the viability as a CISE material. We have also grown polymers from CNTs using SI-ARGET ATRP. Modification of CNT surface enables its use in solutions and for a wide range of functionalization and potential applications such as in adsorption processes, electrochemical capacitors etc. Future work will focus on the controlled growth of ionophore inspired polymers on CNTs and their use in Nink® solution.

References

1. Brown, H. M.; Marron, S. K.; *Anal. Chem.* **1990**, *62*, 2153-2155
2. Matyjaszewski, K.; et al. *ACS Macro Lett.* **2016**, *5*, 382-386

Acknowledgements This work was supported by NASA EPSCoR grant. Travel for this conference was made possible by an Institutional Development Award (IDeA) from the National Institute of General Medical Sciences of the National Institutes of Health under Grant# P20GM103408. Special thanks to members of the Waynant Research Group and Md Humayun Kabir.

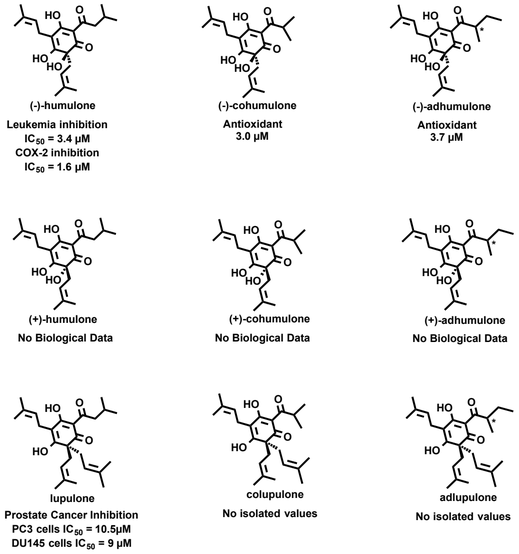
Exploring Hops Chemistry: Towards Efficient, Asymmetric Syntheses of Humulones and Lupulones

Lucas Sass and Kristopher V. Waynant*, Dept. of Chemistry, University of Idaho, Moscow, Idaho, 83844 kwaynant@uidaho.edu

Abstract

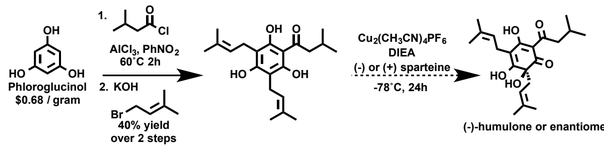
Humulones and lupulones have affirmed themselves as key ingredients in the multi-billion dollar brewing industry.[1] Originally exploited for their bacteriostatic properties, these compounds also exhibit high levels of biological activity against a variety of diseases.[2] Although quantifiable, the isolation and separation of specific humulones and lupulones is difficult, thus establishing efficient synthetic routes will be of value to those desiring exact bittering qualities and to the pharmaceutical community. Our investigations are towards developing a synthetic route to a library of humulones, lupulones, and their derivatives as possible biologically active agents against myriad diseases. New compounds will be biologically tested through our collaborations. Active agents may lead to a transformation in hops as sources to the next generation of medicines.

Biological Activity



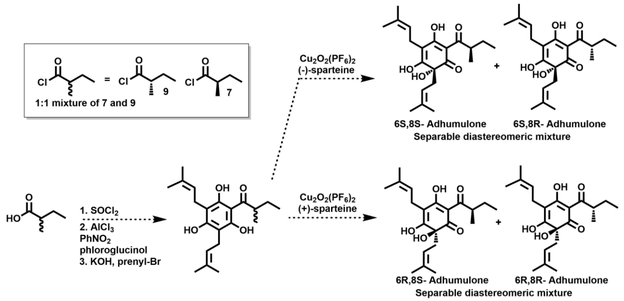
Humulones and lupulone have seen the most attention in biological testing (above is a small taste). Although structurally determined for 60 years and numerous reports have indicated biological activity, only recently has the absolute configuration of humulone been established.[3] Our goal is to synthetically create the pure asymmetric natural compound and unnatural stereoisomer to assess the precise activity.

Synthetic Strategy



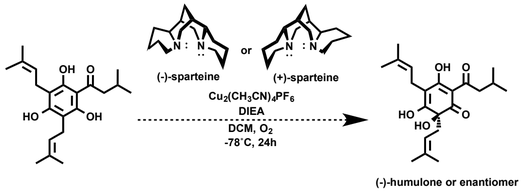
The common humulone/ lupulones intermediate begins with phloroglucinol at $0.68/g. Friedel-Crafts acylation followed by C-prenylation under basic conditions yields the polyprenylated acylphloroglucinol (PAP).[4,5] Copper-mediated asymmetric oxidative dearomatization will successfully install the alcohol and stereocenter.[6] By varying the acid chloride used in the first step, all of the desired humulone and lupulones products may be reached.

Adhumulone



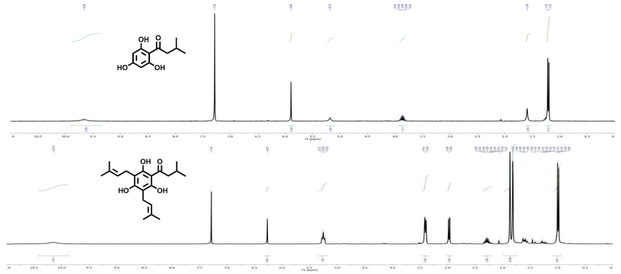
The exact stereochemistry of position 8 is currently unknown. We envision a common synthetic route to the 4 possible diastereomers through resolution of 2-methylbutyric acid and our general procedures. This will allow for absolute confirmation of the natural compound.

Asymmetric Oxidative Dearomatization



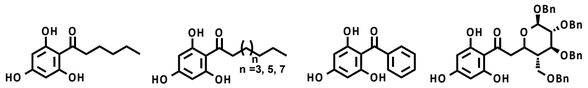
The Porco Jr. group and a recent patent report have highlighted this copper-mediated AOD strategy towards many PAP and PPAP natural products.[6,7] We look to broaden the scope of screenable compounds.

NMR Spectral Data

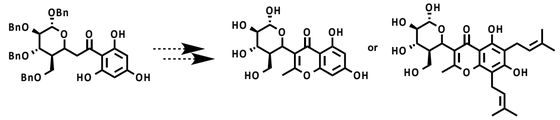


Future Work

We have found that the acylated phloroglucinols made in the first step of our synthesis may be purified through an improved aqueous workup utilizing concentrated HCl removing the products as a precipitated salt. This is followed by solvent washes and an aqueous recrystallization which eliminates the need for further purification on silica. Further exploration of this reaction will aim to optimize the conditions and broaden the product scope to the common and uncommon acylphloroglucinols shown below.



Another focus in our group is the synthesis of Carbon-linked glycosides which leads to the syntheses of C-linked chromone derivatives through our general strategy and subsequent ring closing.



References

1. Steenackers, B.; De Cooman, L.;De Vos, D. *Food Chemistry*, **2015**, *172*, 742-756.
2. Van Cleemput, M.; Cattoor, K.; De Bosscher, K.; Haegeman, G.; De keukeleire, D.; Heyerick, A. *J. Nat. Prod.* **2009**, *72*, 1220-1230.
3. Urban, J.; Dahlberg, C.J.; Carroll, B.J.; Kaminsky, W. *Angew. Chem. Int. Ed.* **2013**, *52*, 1553-1555.
4. Many acylation procedures in lit. for example: George, J.H.; Hesse, M.D.; Baldwin, J.E.; Adlington, R.M. *Org. Lett*. **2010**, *12*, 3532-3535.
5. U.S. Patent No. 4,101,585, 7/1978
6. Jianglong Zhu, Nicholas P. Grigoriadis, Jonathan P. Lee, John A. Porco, Jr. *J. Am. Chem. Soc.* **2005**, *127*, 9342-9343. (b) Qj,J. Porco, Jr., J.A. *J. Am. Chem. Soc.* **2007**, *129*, 12682-12683.
7. US Patent No. WO 2012/058649 A1, May 3, 2012 Urban, J. et al.

Acknowledgements

Lucas Sass has received a Fellowship from the NIH INBRE Program No. P20 GM103408 and an Idaho NSF EPSCoR MURI Award.

POSTERS

Hydronium Diffusion in Hydrogels Consisting of Contrasting Chemical Composition Ratios and Crosslinking Combinations

University of Idaho

Department of Chemistry, University of Idaho

Background

Trichloroethylene (TCE):
- A major carcinogenic pollutant that contaminates drinking water

What Hydrogels are Used For:
- Contain harmful substances
- Degrade TCE

The Goal:
- Reduce, remove and/or regulate environmental contaminants
- Create a cleanup method that's low cost and efficient

"Goldilocks' Zone":
- If the protons diffuse too slowly vs too quickly

Chemicals Used in Hydrogel Membranes:
- Sodium Alginate (SA)
- Polyvinyl Alcohol (PVA)
- Chitosan (Ch)
- 1.5 M NaOH
- 2%CaCl2 in saturated Boric Acid

Introduction

- Bioremediation uses microorganisms to reduce, remove, or regulate the transformation of environmental contaminants (Adams et. al., 2015).
- Hydrogel bio-beads will be placed in contaminated groundwater.
- The "transport triangle," makes the decontamination process efficient and effective.
  - TCE ⟶ DCE ⟶ VC ⟶ C2H4
- Within microbes, chemical reactions occur to degrade TCE

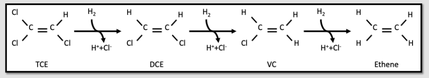


Figure 1: Chemical reactions that transform TCE into Ethene.
- The transitory substances can interrupt purification process if matrix does not allow them to diffuse properly
- Matrices must be specifically engineered to diffusion rates for successful decontamination.

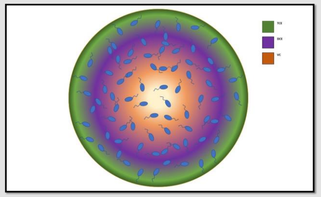


Figure 2: The 'Goldilocks' rate of diffusion within the hydrogel between transitory substances (Waynant 2021).

Methodology

1. Various amounts of SA, Ch, and PVA (2%:1%:10%, 2%:1%:5%, and 5%:1%:5%) were dissolved in DI water at 80° C .
2. The mixture was poured to fill the pucks halfway and then they were placed in the freezer for at least 1-hour and until solidified.
3. Pucks were crosslinked in either solutions of 1.5 M NaOH or 2%CaCl2 in saturated boric acid for 4 ½hours.
4. Pucks were removed and equilibrated in DI water until pH 7 was reached.

Figure 3: A set of hydrogel pucks equilibrating in DI water.

5. pH probes were calibrated and initial gel thicknesses were measured.
6. Gels were placed in the GellipHish "sinks." Each sink was filled with 92mL of DI water and a stir bar.
7. The GellipHish "source" was filled with about 650ml of 0.001M HCl and a stir bar.
8. pH probes were inserted into each sink and the source.

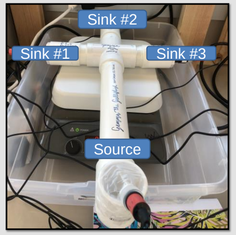


Figure 4: The PVC pipe GellipHish that was used to test the diffusion of the H+.

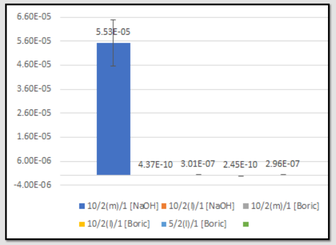
9. The experiment was run in 48-hour increments until evidence that H+ diffusion had ended was shown.

Figure 5: The program used for tracking the pH of the GellipHish's sinks and source.

10. The final thickness of each gel was measured.

Results

Diffusion Coefficients:



Figures 6 & 7: *The average diffusion rates of hydrogels of various compositions crosslinked in 1.5 M NaOH and 2% $CaCl_2$ in saturated boric acid.*

Hydrogel Ratio	Diffusion Coefficient
10/2(m)/1 [NaOH]	5.53E-05
10/2(l)/1 [NaOH]	4.37E-10
10/2(m)/1 [Boric]	3.01E-07
10/2(l)/1 [Boric]	2.45E-10
5/2(l)/1 [Boric]	2.96E-07

Swelling:

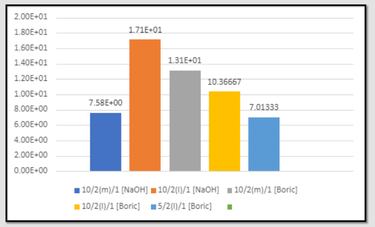


Figure 8: *The average percentage of gel swelling before and after diffusion.*

References

Adams, G. O., Fufeyin, P. T., Okoro, S. E., & Ehinomen, I. (2020). Bioremediation, Biostimulation and Bioaugmention: A Review. International Journal of Environmental Bioremediation & Biodegradation, 3(1), 28-39. doi:10.12691/ijebb-3-1-5

Waynant K 2021, diagram depicting the desired diffusion in biobeads, University of Idaho Office of Undergraduate Research Summer Undergraduate Research Fellowship, National Science Foundation, Idaho, accessed 19 April 2021

Conclusions

NaOH vs CaCl2 in Saturated Boric Acid:
- NaOH gels took significantly longer to equilibrate.

Medium Viscosity vs Low Viscosity SA:
- Medium viscosity SA more consistently passed the leak test.

SA Concentrations:
- SA concentrations exceeding 5%resulted in pucks swelling beyond useability.

Chitosan Gels:
- Gels containing chitosan require more time for diffusion compared to gels solely composed of SA and PVA.

Diffusion:
- **Highest coefficient:** 10%PVA, 2%SA (medium viscosity), 1%Chitosan gels crosslinked in 1.5 M NAOH
- **Lowest coefficient:** 10%PVA, 2%SA (low viscosity), 1%Chitosan gels crosslinked in 2%$CaCl_2$ solution

Swelling:
- **Highest % swell:** 10%PVA, 2%SA (low viscosity), 1% Chitosan gels crosslinked in 1.5 M NaOH
- **Lowest % swell:** 5%PVA, 2%SA (low viscosity), 1% Chitosan gels crosslinked in 2%$CaCl_2$ solution

Future Work

- Replicating the work that was done by this team to ensure the validity of the results.
- Testing if extreme swelling happened with both low and medium viscosity once it reached 5%or more.
- Isolating an experiment to effects of crosslinker on both preparation time and diffusion rate success would produce valuable results into production considerations
- More research regarding ratios of Chitosan should be considered due to its large effect on diffusion rates

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- Instructor: Dr. Kristopher Waynant
- Graduate Student: Carson Silsby

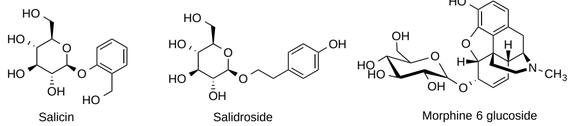
Carbon-Linked Glycosides as Potential Pharmaceuticals and Non-Lethal Pesticides: Making a Better Aspirin

Guadalupe Gutierrez and Prof. Kristopher V. Waynant, Department of Chemistry, University of Idaho, Moscow, ID 83844 kwaynant@uidaho.edu

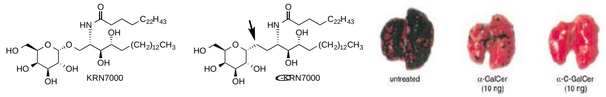
Motivation and Background:

Nature creates many small natural products that help regulate biological processes. Many of these compounds are also bioactive against many common ailments and a variety of disesases. To help dissolve these compounds, the natural sources contain carbohydrate (sugar) linkages. Once ingested orally, these sugars are quickly removed from the compound hydrolytically or enzymatically. Some common examples of carbohydrate linked medicinal pro-drugs are **Salicin**, a common anti-inflammatory agent and fever reducer found in the bark of the Willow tree and; **Salidroside**, a known antidepressant found in golden root (*Rhodiola rosea*). We believe that Carbon linked sugars will persist longer in the body and lengthen the availability of pharmaceuticals.

Glycosylation is also common in adsorption, distribution, and excretion mechanisms as many pharmaceutical agents are transported or excreted as either glucosides or glucuronides. Towards limiting toxic levels and to increase excretion, we hypothesize that Carbon-linked compounds will help aid in distribution and excretion, which could help many of the side effects of opioids, like the **Morphine 6-glucoside**.



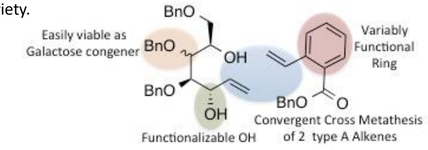
Continuing, as shown below, Franck and coworkers have found that the persistence of their C-KRN7000, an isosteric analog of the immunostimulant KRN7000 increased the activity and degradation of melanoma in a mouse lung model.

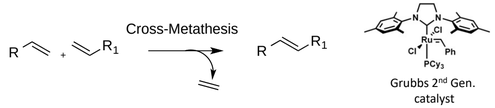


Through isosteric C-linkages the active immunostimulant is more resilient to degradation and its persistence increases its activity. C-linked API's are longer lasting.

Strategy:

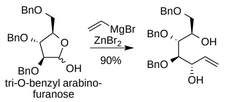
Our strategy is convergent in that the two pieces are synthesized separately and then linked through cross metathesis to allow for maximal functionality variety.





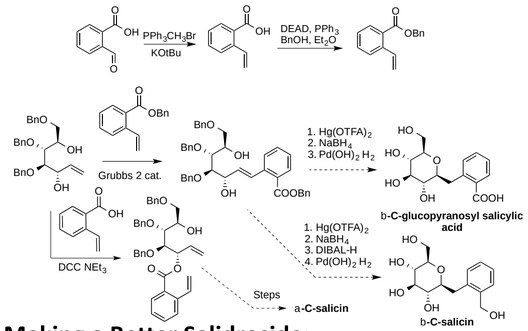
Potential Pharmaceuticals:

Synthesis of Key CM Coupling Partner:



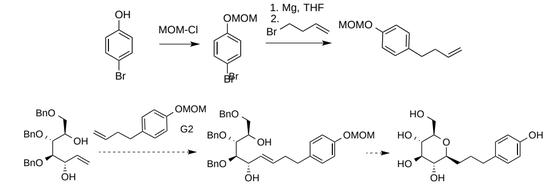
C-linked carbohydrate pharmaceuticals could increase both bioavailability and effectiveness while decreasing the dose.

Making a Better Aspirin:



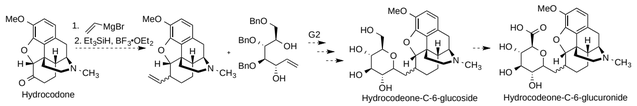
Making a Better Salidroside:

In a very similar pathway, ß-C-Salidroside can be constructed from the cross metathesis of the protected phenolic alkene and the common heptenitol as shown below.



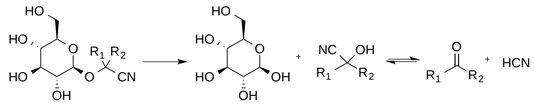
Making a Better Morphine:

Although current efforts are towards Salicin and Salidroside, future work will include the C-linking of sugars to opioids mimicking the excretory glycosylation and glucuronidation pathways. The Morphine-6-glucuronide displays high analgesic properties increasing euphoria and the addictive properties. We hypothesize that a single event through a C-glycosyl opioid (hydrocodone shown) will lead to less addictive properties with sustained analgesia.

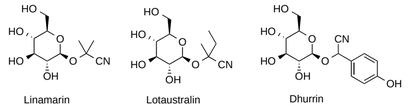


Cyanogenic Glycosides as Non-Lethal Pesticides:

Cyanogenic glycosides (CG) are common agents found in plants that act as natural pesticides. Common plants with CG's are Cassava, Almonds, and Limas. The cyanide functional groups are linked through the anomeric oxygen of a carbohydrate into an acetal. Glycosidase enzymes, released through herbivory hydrolyze the sugar and quickly produce hydrogen cyanide from the lesser favorable cyanohydrin. **Although extremely advantageous for the plants, cyanogenic glycosdies have not been used as commercial pesticides for obvious reasons.**

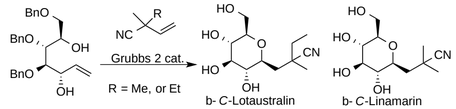


Common Cyanogenic Glycosides:

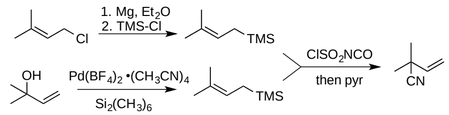


We hypothesize that C-linked cyanogenic glycosides may still deter pests through structural similarities yet lack the ability to release HCN and kill the pests. This could be highly receptive in bee communities.

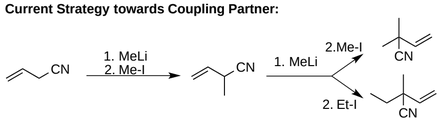
Scheme for Carbon linked-Cyanogenic Glycosides



Previous Strategies towards Coupling Partner:



Current Strategy towards Coupling Partner:



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Title (Size 86)

DEPARTMENT OR PROGRAM (SIZE 64), UNIVERSITY OF IDAHO

Names (Size 64) Your name (as speaker) is underlined

Abstract (size 52)

Words

Size 36

Introduction

Words at 36 size again (be consistent)

Figure 1: Same Font, size just under the norm - Size 32

Results

Another Figure: Same size as others (32)

Another Figure: same size (32).

Pictures of Results

Or more results

Conclusions and Future Directions

References

Acknowledgements

Thank to those who funded or helped you gain results/data

This award was funded by an OUR Semester (or SURF) award 2023

Learn more about me and my research project at the following website:

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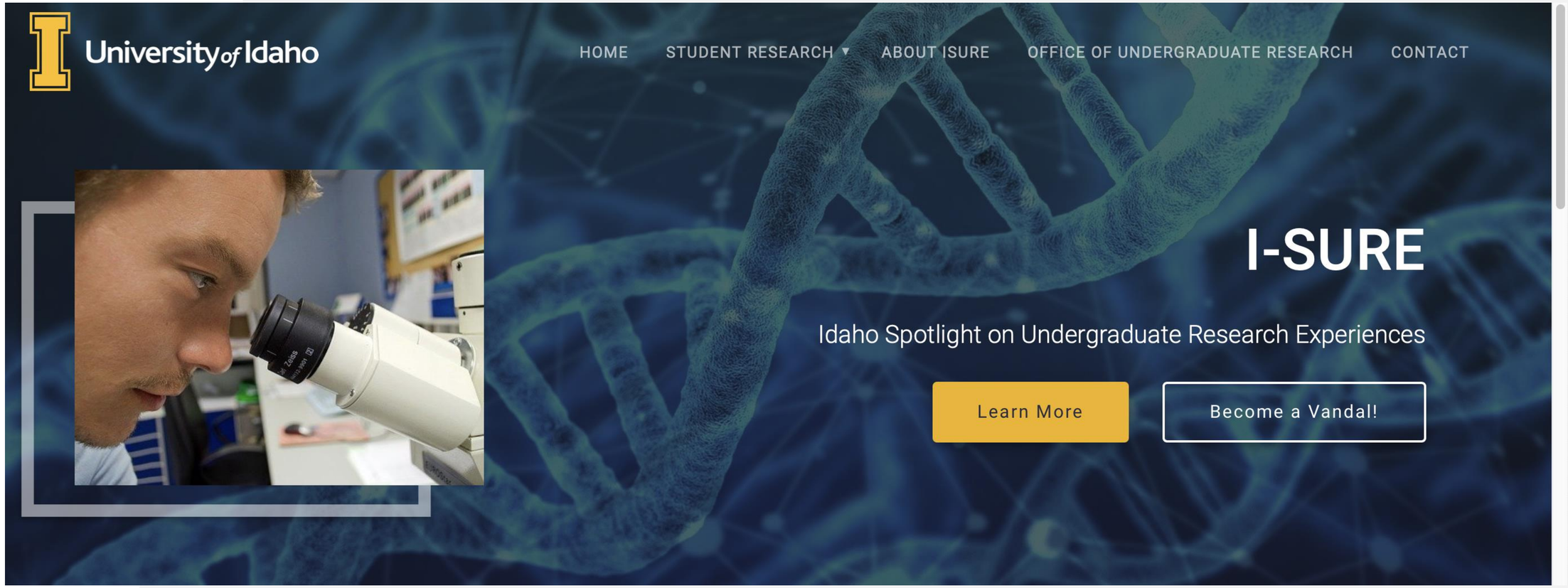

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There is also a link to I-SURE on the OUR website