

# STUPKA

UNDERGRADUATE  
RESEARCH  
SYMPOSIUM



**April 5, 2018**

Presented by the  
Undergraduates  
of the Roy J. Carver  
Department of Biochemistry,  
Biophysics & Molecular Biology

IOWA STATE UNIVERSITY  
OF SCIENCE AND TECHNOLOGY

# EVENTS SCHEDULE

## THURSDAY

- 8:30 am Breakfast** – Open to all – Hosted by BBMB Breakfast Club  
*Keynote and Alumni Speaker Meet and Greet*  
Atrium
- 11:00 am Alumni and Stupka Family Reception and Lunch**  
Atrium
- 12:10 pm Dr. Virginia Zakian Lunch**  
*Undergraduates and Graduates Only*  
1102 MBB
- 1:10 pm Dr. Douglas Weibel Lunch**  
*Undergraduates and Graduates Only*  
1102 MBB
- 2:10 pm Poster Session 1**  
Atrium
- 3:10 pm Poster Session 2**  
Atrium
- 4:10 pm Welcome**  
*Wendy Wintersteen, President of Iowa State University*  
*Beate Schmittmann, Dean of the College of Liberal Arts and Sciences*  
1414 MBB
- 4:20 pm Jena Gilbertson – STUDENT SPEAKER**  
*Imaging the Non-uniform Spatial Distribution Energy Dense Metabolites for Efficient Capture and Chemical Storage of Solar Energy by Plants*
- 4:35 pm Dr. Virginia Zakian – KEYNOTE SPEAKER**  
*Stressing at the ends: telomerase regulation*
- 5:15 pm Matthew Cook – STUDENT SPEAKER**  
*Optimizing the biosynthetic pathway producing UDP-xylose*
- 5:30 pm Break and Refreshments**
- 5:50 pm Andrew Tonsager – STUDENT SPEAKER**  
*Investigating the Arabidopsis QQS gene and its impact on carbon-nitrogen partitioning in Saccharomyces cerevisiae*
- 6:05 pm Anthony Cyr, M.D, Ph.D – ALUMNI SPEAKER**  
*Breaking the Cycle: Mitochondrial responses to traumatic injury in cells of the innate immune system*
- 6:30 pm Dr. Douglas Weibel – KEYNOTE SPEAKER**  
*Mechanical Genomics Reveals New Bacterial Biochemistry*
- 7:10 pm Poster Awards**  
1414 MBB
- 7:15 pm Dinner**  
Atrium

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SAVE THE DATE FOR THE 14<sup>TH</sup> ANNUAL  
**Stupka Symposium**  
**Thursday, April 4, 2019**

email: [stupkaugrs@iastate.edu](mailto:stupkaugrs@iastate.edu)  
website: [stupka.bb.iastate.edu](http://stupka.bb.iastate.edu)

# REMEMBERING ROB



Rob Stupka was an undergraduate student majoring in Biochemistry at Iowa State University. His passion for science and research led the effort to establish the BBMB research symposium. His unparalleled enthusiasm propelled the planning process forward. Rob was the chair and with fellow students Tony Cyr, Claire Kruesel, Adam Krupicka and Jordan Witmer; they planned the first symposium for spring 2006. Their vision for this symposium was for it to be a medium for scientific research interactions between undergraduates and professionals. Rob also wanted this to be a place where undergraduate researchers could be recognized for their achievements in science.

Rob's life was tragically cut short, on November 30, 2005, after a pedestrian vehicle accident in front of the Molecular Biology Building. In tribute to Rob's drive and passion to create this event, the BBMB Undergraduate Symposium bears his name. BBMB undergraduates, who are inspired by Rob's story, continue to organize this event. We believe that through your attendance and participation, we continue to honor Rob's memory.

The 2018 Stupka Undergraduate Research Symposium planning committee would like to thank you for being here. We hope you enjoy the wonderful research presented by our promising young scientists.

## LIPID TRANSFER PROTEIN

Rob and his father visited several universities in early 2002. In June of that year, they visited Iowa State University. The beauty of the campus and the friendliness of the staff convinced them that this was Rob's new home. Rob initially entered ISU in the fall of 2002 as a chemical engineering student. During his first semester, he took BBMB 101: Introduction to Biochemistry as an elective. Rob was so captivated by the biochemical discoveries explained in class, that he became a biochemistry student at the end of his first semester. He worked on making cDNA libraries from floral nectaries. This molecule is the nectary Lipid Transfer Protein (LTP2). The cDNA that encodes this protein was made by Rob. It was subsequently cloned and characterized. It is currently being expressed in bacterial cells with the goal of determining its antimicrobial activity.



# 2018 STUPKA COMMITTEE



**Front row (blue shirts):** (from left) Joseph Wurtz, Olivia Gray, Alicia Miltner, Grace Trembath, Madeline Farringer, Ana DiSpirito

**Second row (gray shirts):** Makayla Villela, Bailey Mooney, Immaculate Edwin, Christian Johnson, Spydel Nardy

**Third row (green shirts):** Kayla Uthe, Jacqueline Ehrlich, Alex Donelson, Emily Knuth, Emily Juhl, Samuel Tufts, Alyssa Lantz, Sarah Zelle, Laura Kurr

**Fourth row (green shirts):** Lauran Chambers, Julia Nguyen, Courtney Smith, Dirk Winkelman, Isaac Stine, Tiffany Farrell, Rachel Garlock, Lisa Warnock, Matthew Cook

**Not Pictured:** Emily Boettger, Brittany Bolerjack, Jacky Cardenas, Jurnie Hinde, Gabrielle Klemme, Daniel Kubrak, Natalie McClure, Jacob Schmieder, Rick Weerts, Dorian Twedt

## 2018 Committee Leadership

**Symposium Chairs:** Lauran Chambers, Julia Nguyen

**Treasurer:** Laura Kurr

**Secretary:** Spydel Nardy

### Sub-committee Coordinators

**Speaker:** Samuel Tufts, Emily Juhl

**Publicity:** Jacqueline Ehrlich

**Sponsorship:** Matthew Cook

**Fundraising:** Emily Knuth

**Operations:** Dirk Winkelman

**Food:** Sarah Zelle

**Website:** Brittany Bolerjack, Christian Johnson

**Registration:** Tiffany Farrell, Alyssa Lantz

**Poster:** Kayla Uthe

**Volunteer:** Lisa Warnock

**T-Shirt:** Olivia Gray, Isaac Stine


**Alumni:** Alex Donelson


**Advisers:** Desi Gunning, Gustavo MacIntosh

**Photographers:** Brittany Bolerjack, Dorian Twedt

# POSTER SESSION 1 (2:10-3:00)

1	 <b>Rachel Garlock</b>	Functional Characterization of Three Mitochondrial Acyl Carrier Protein Isoforms in <i>Arabidopsis thaliana</i>
2	 <b>Emily Knuth</b>	Mutagenesis and Enzymology of Ketoacyl-acyl Carrier Protein Synthase III (FabH) for Novel Production of Biorenewable Chemicals
3	 <b>Samuel Tufts</b>	Promiscuity Investigations of Class I Diterpene Synthases Reveals the Structural Activity Relationship of Diterpene Substrates
4	 <b>Jacqueline Ehrlich</b>	Mutagenesis, Homology Modeling, Crystallization, and Functional Characterization of Xyloglucan Xylosyltransferases
5	 <b>Juan Zhang</b>	Inferring Roles in Defense from Metabolic Allocation – Rice Diterpenoids
6	 <b>Le Zhao</b>	Metabolite profiling of the terpenoid indole alkaloids in engineered <i>Catharanthus roseus</i> hairy root lines
7	 <b>Lauren Kueffer</b>	Development of an in vivo small molecule screen exploiting the autoinhibitory interaction within BTK
8	 <b>Hanna Wokpetah</b>	Illuminating the scaffolding and kinase regulation mechanism of Pyk2
9	 <b>Neha Amatya</b>	Mapping the binding interface between the Btk kinase and PTH domain
10	 <b>Lauran Chambers</b>	<i>Arabidopsis</i> Plants Expressing a Fungal Pectin Methyltransferase Exhibit Dwarfism and Resistance to Stresses
11	 <b>Mark Heggen</b>	Comparative Metabolite Profiling of Consumable Peppers an Insight into what Makes Peppers “Hot” or “Sweet”
12	 <b>Steven Siang</b>	Role of DISC1-ATF4 interaction in the cAMP pathway
13	 <b>Katelyn Campbell</b>	Functional analysis of maize cuticle-synthesizing genes via yeast heterologous system as a means of producing biorenewable chemicals
14	 <b>Daniel Falconer</b>	Antibody fucosylation restricts Fc $\gamma$ receptor IIIA (CD16A) N-glycan motion to reduce affinity
15	 <b>Jared Haupt</b>	The Role of Interactions between the N-Terminal Region and the Exonuclease Domain of <i>Plasmodium falciparum</i> Apicoplast DNA Polymerase
16	 <b>Adem Selimovic</b>	Functional characterization of the <i>Drosophila melanogaster</i> Lysosome-associated membrane glycoprotein Lamp1
17	 <b>Brenden Hawk</b>	Effect of $\alpha$ -Synuclein Oligomerization States on SNARE-dependent Vesicle Docking
18	 <b>Sarah Grambo</b>	Understanding the role of isoflavones in the soybean-soybean aphid interaction

 Undergraduate

 Graduate


 Staff

## POSTER SESSION 2 (3:10-4:00)

19	<b>Daniel Kramer</b>	Biochemical and Structural Study of Novel Interactions between Membrane Receptors and the WAVE Complex
20	<b>Justin Miller</b>	Determining the Origin of Plasmodium falciparum Associated Volatiles
21	<b>Cody Lemke</b>	Probing conserved residues in class II diterpene cyclases to investigate control on product outcome
22	<b>Sayane Shome</b>	Transport pathways in membrane transporters
23	<b>Reid Brown</b>	Functional Characterization of Putative Diterpene Synthases to Probe Evolutionary Relationships
24	<b>Sharif Anisuzzaman</b>	Investigations of the Interactions of Fluorinated Superligands with the Broccoli and Spinach 2 Aptamers
25	<b>Sarah Zelle</b>	Defining SynGAP substrate specificity determinants in membranes
26	<b>Hayun Lee</b>	Cas4-dependent prespacer processing ensures high-fidelity programming of CRISPR arrays
27	<b>Kayla Uthe</b>	The Study of the Xyloglucan Synthesizing Complex Formation
28	<b>Justin Ling</b>	Development of split Cas6 for inducible dimerization modules
29	<b>Bailey Mooney</b>	Investigating retinal development using gain and loss of function strategies
30	<b>Liza Alexander</b>	Exploring the intracellular and extracellular lipid metabolic networks at the level of individual cells
31	<b>Raegan Hoefler</b>	Induction of Novel Transposable Element Insertions in Response to Combined UVC and X-Ray Irradiation in Maize
32	<b>Simon Kuihon</b>	Developing a FRET sensor to report activation of the WAVE Regulatory Complex
33	<b>Courtney Smith*</b>	ALS-linked genes show CNS expression in the zebrafish
34	<b>Hannah Piper</b>	Reconstituting the WASH Regulatory Complex
35	<b>Emily Juhl</b>	Reverse Genetic Analysis of Central Metabolism in Maize Endosperm

\* denotes Goldwater Scholar

 Alumni

 Stupka scholar

 Linder scholar

## Jena Gilbertson



Jena is currently a senior at Iowa State pursuing a major in biochemistry and a minor in Spanish. She is currently researching in Dr. Basil Nikolau's laboratory studying the spatial distribution of metabolites in mutant forms of *Arabidopsis thaliana* flowers using mass spectrometry imaging. Jena is a piccolo section guide in the marching band and has been a member for four years. She is also involved in pep band and her sorority. After graduation, Jena plans on attending optometry school.

### ABSTRACT

#### Imaging the Non-uniform Spatial Distribution Energy Dense Metabolites for Efficient Capture and Chemical Storage of Solar Energy by Plants

Plants are responsible for capturing and converting renewable solar energy to assemble the initial molecules of the biosphere. These chemical transformations are catalyzed by various biochemical structures and can be localized using the distribution of enzymes or other components of the metabolic network. Extracellular epicuticular lipids are the most energy dense compounds that biological systems produce. These surface lipids are constituents of a protective hydrophobic lipid-based structure, the cuticle, which covers aerial organs of all terrestrial plants and functions as a protective barrier against biotic and abiotic stresses. Chemically, the epicuticular lipids are derivatives of very-long chain fatty acids (VLCFAs), which include hydrocarbons, free fatty acids, ketones, alcohols, aldehydes and wax esters, and other terpene-type specialized metabolites. By observing the spatial distribution of these lipids, the nature and regulation of the metabolic network can be better understood. Mass spectrometric (MS) imaging is a method that can provide high-resolution, localized and spatio-temporal images that reveal the operation of metabolism. In this study, the differences in spatial distributions of surface lipids on adaxial (upper) and abaxial (lower)-positioned organs of *Arabidopsis thaliana* flowers from three genotypes: wild-type Col-0, *cer2* mutant and *ZmGlossy2*-like transgene in *cer2* mutant, were analyzed via MALDI FT-ICR MS. The data was compared to parallel-generated quantitative data from extracts prepared from single flowers; these latter analyses were conducted via PTV-GC-MS. Our results show that a greater presence of overall metabolites is observed on the abaxial floral surface when compared to the adaxial side, and majority of the extracellular surface lipids are expressed on the sepals, with little on the distal part of both sides of petals. Additionally, while *cer2* mutant blocked long chain fatty acid elongation beyond carbon-28, the *ZmGlossy2*-like transgene was able to restore the long acyl-chain fatty acids and their derivatives, demonstrating that *ZmGlossy2*-like is a functional homolog of *Cer2* gene. We envision that these fundamental data streams will better connect the gene regulatory network and the metabolic network that determines the biosynthesis of these energy dense compounds. Ultimately, bioengineering these networks in heterologous hosts can recapitulate an efficient metabolic network to produce biofuels analogous to existing fossil carbon liquid fuels.





## Douglas Weibel

UNIVERSITY OF WISCONSIN – MADISON



Douglas B. Weibel is a Professor of Biochemistry, Chemistry, and Biomedical Engineering at the University of Wisconsin-Madison. He received his B.S. degree in chemistry in 1996 from the University of Utah (with Prof. C. Dale Poulter). From 1996-1997 he was a Fulbright Fellow at Tohoku University, Japan and studied organometallic chemistry (with Prof. Yoshinori Yamamoto). He received his Ph.D. in organic chemistry from Cornell University in 2002 (with Prof. Jerrold Meinwald), during which time he was an intern at Orchid Biosciences Inc. (now LabCorp) and a visiting scientist at the Max Planck Institute for Chemical Ecology, Jena, Germany (with Prof. Wilhelm Boland).

From 2002-2006 he was a postdoctoral fellow (with Prof. George M. Whitesides) at Harvard University and in 2005 he was a student in the Physiology Course (“Modern Cell Biology using Microscopic, Biochemical, and Computational Approaches”) at the Marine Biological Laboratory at Woods Hole. He joined the faculty at UW-Madison in 2006 and has concurrently held multiple appointments outside of the university: he was a visiting professor of physics at the University of Washington, Seattle (2014), a visiting professor at Google [X] (2013-2014), and has been a principal scientist at Amazon (2014). He has consulted for a range of public and privately held companies in the areas of biotechnology, chemistry, engineering, and manufacturing and has participated in a range of government advisory positions in the areas of biodefense, infectious diseases, and biomedicine. His research interests span the fields of chemistry, biochemistry, biophysics, agriculture, materials science and engineering, and microbiology.

### ABSTRACT

#### **Mechanical Genomics Reveals New Bacterial Biochemistry**

Bacteria and other microbes have to solve an important physical problem to survive: how do they mechanically resist the large pressure drop across their cell wall (~105Pa) that arises due to mismatch in concentrations of dissolved solutes inside and outside of the cell? We still know very little about microbial mechanics, and yet some of the most powerful classes of antibiotics control infections by altering cell mechanics and exploiting the pressure drop across the cell wall. We anticipate that studying this question in bacteria will reveal new biology, provide insight into new classes of bacterial materials, and lay the foundation for studying mechanobiology in the most tractable model organism available. In this talk I describe two approaches we have developed to identify the biochemical regulators of mechanical properties in bacteria: 1) CLAMP (cell length analysis of mechanical properties) is a medium-throughput technique to measure the effective Young's modulus of growing bacterial cells; and 2) GRABS (general regulators affecting bacterial stiffness) is a high-throughput technique that assigns stiffness scores to every gene in a bacterial genome. Using this suite of tools, I describe the surprising regulators of stiffness in bacteria and how these techniques are enabling us to lay the foundation for understanding mechanobiology in microbes (from components of the human microbiome, to bacterial pathogens, to infectious eukaryotic microbes).

## Matthew Cook

**LINDER SCHOLAR 2017**  
**STUPKA SCHOLAR 2018**



Matt is a senior double-majoring in biochemistry and genetics with minors in Spanish and mathematics. He has worked as an undergraduate research assistant in Dr. Olga Zabolina's lab since the spring of 2015 studying enzymes involved in plant cell wall synthesis. He is the Vice President of the BBMB Club, the Sponsorship Chair of the Stupka Symposium Planning Committee, and an instructional assistant for BBMB 102. Matt was awarded the Goldwater Scholarship in the spring of 2017. Matt plans on pursuing a Ph.D. in structural biology after graduating this spring.

### ABSTRACT

#### Optimizing the biosynthetic pathway producing UDP-xylose

The plant cell wall is of interest for agriculture and biofuel production; understanding the biosynthesis of plant cell walls is critical for improving the viability of biorenewable energy as a replacement for traditional energy sources. Xyloglucan is an important cell wall constituent and has high degrees of xylosylation. However, studies of xylosylation of hemicelluloses and other biomolecules are hampered, partially due to the low supply of the primary substrate for xylosylation, UDP-xylose (UDPX). The goal of this project has been to optimize the known biological pathway for UDPX synthesis for laboratory use. The two-enzyme UDPX biosynthesis pathway produces UDPX from UDP-glucose (UDPG), a more readily available substrate chemical. The project also characterized enzymatic properties of the enzymes UDP-glucose dehydrogenase (Ugd) and UDP-xylose synthase (Uxs), which perform the catalytic activities in the pathway of interest.

Ugd and Uxs were expressed and purified using the plasmids prepared in Dr. Adam Barb's lab. While homologs of Ugd and Uxs have been partially characterized before, neither has been studied to the degree required for this project and the specific homologs used herein have never been reported. Enzymatic assays were used to determine the optimum conditions for each enzyme and spectrophotometry and high-performance liquid chromatography were used to measure the products of the reactions. Biologically relevant conditions, including pH, salt content, reducing agent content, presence of metal ions, et cetera were optimized. Subsequently, methods of combining the reaction systems have been attempted. Due to the significantly different pH optimums of the two enzymes and the generation of inhibitory compounds, the synthesis of UDPX cannot be performed as a one-pot reaction and will require two independent, consecutive reactions. Additionally, kinetics data collected has provided interesting insights into the enzymatic properties of Ugd and Uxs. Thus, it was shown that Ugd experiences substrate inhibition, but substrate inhibition can be relieved by the addition of a chemical unrelated to the actual reactions catalyzed by Ugd and Uxs.

The primary goal of the project has been the efficient synthesis of UDPX from UDPG. To that end, the individual assay conditions have been improved to over 90% conversion efficiency for both enzymes, individually. The conversion of UDPG to UDPX is now being performed in a consecutive reaction series and the efficiency of this reaction series is being improved.

## Andrew Tonsager

STUPKA SCHOLAR 2017



Drew is a fifth year Iowa State student pursuing concurrent Bachelor's and Master's degrees in biochemistry. He currently works with the Campbell/Nikolau lab group, where he investigates the Arabidopsis *Qua-Quinine-Starch* gene and its impact on carbon-nitrogen partitioning in yeast. After graduating from Iowa State, Drew plans to continue his education and pursue a doctorate in biochemistry at Colorado State University.

## ABSTRACT

**Investigating the Arabidopsis QQS gene and its impact on carbon-nitrogen partitioning in Saccharomyces cerevisiae**

Carbon and nitrogen partitioning in plant metabolism is a highly complicated process that is not well understood. *Qua-Quinine-Starch (QQS)* is an "orphan" gene native to *Arabidopsis thaliana* that appears to be influential in the plant's ability to allocate carbon and nitrogen resources. Moreover, the interaction between the NF-YC4 subunit of the multimeric nuclear factor Y (NF-Y) complex and QQS has been shown to modulate protein (nitrogen) and starch (carbon) content in Arabidopsis and soybean. NF-Y is a highly conserved complex; in *Saccharomyces cerevisiae* the HAP complex is homologous to NF-Y, which is composed of the *HAP2*, *HAP3*, *HAP4* and *HAP5* gene products. To test if *QQS* contributes in a similar manner to carbon/nitrogen partitioning in a simplified system, *QQS* and the *NF-YC4* homolog, *HAP5*, were overexpressed in *Saccharomyces cerevisiae* in single, double, triple and quadruple knockout mutant combinations of the HAP complex. To date all strains have been generated towards completion of *QQS* related yeast genotypes. The metabolite content of each strain is currently being examined in order to evaluate the extent to which *QQS* can modulate carbon-nitrogen partitioning in yeast. Specifically, we are testing protein content as the nitrogen carrier, and lipid composition, glycogen content and fatty acid accumulation as the carbon-carriers. Data collected from extraction and assay experiments indicate that *QQS* may influence glycogen accumulation when introduced into yeast. More experiments are in progress to aid in the elucidation of the importance of orphan genes in generating novel traits, and additional research on the resulting strains has the potential to reveal how cellular processes regulate carbon-nitrogen allocations.



## Anthony Cyr, M.D., Ph.D.

UNIVERSITY OF PITTSBURGH



Tony Cyr is a 2006 graduate of the ISU Department of Biochemistry, Biophysics, and Molecular Biology. During his undergraduate studies, he worked in the laboratory of Dr. Reuben Peters, where he studied methods for engineering *E. coli* to produce complex diterpene molecules for chemical study. He was Rob Stupka's lab partner for the BBMB capstone laboratory class in the fall of 2005, when Rob's life was tragically cut short. Along with fellow students Adam Krupikca, Jordan Witmer, and Claire Kreusel, Tony worked to establish the first Stupka Undergraduate Research Symposium in the spring of 2006.

After graduation from ISU, Tony pursued a combined M.D./Ph.D.

degree at the University of Iowa, in the laboratories of Dr. Rick Domann and Dr. Ron Weigel. There, he studied the contributions of oxidative metabolism to epigenetic signaling processes, as well as the role of AP-2 transcription factors in the pathogenesis of breast cancer. In 2014, he successfully matched into the general surgery residency program at the University of Pittsburgh Medical Center, where he continues to pursue surgical training. He currently is engaged in a three-year dedicated research period in the laboratory of Dr. Brian Zuckerbraun and is studying the contributions of mitochondrial metabolism and metabolomic flux to the pathogenesis of immunosuppression in the post-trauma period. Upon finishing his clinical training, he anticipates fellowship training, then pursuing a career balancing basic science work with clinical practice in trauma and acute care surgery.

**ABSTRACT**
**Breaking the cycle: mitochondrial responses to traumatic injury in cells of the innate immune system**

Traumatic injury is the leading cause of death in the United States from childhood through middle age. It is estimated to account for 30% of all life years lost in the U.S. population, exceeding both cancer and heart disease. Trauma produces a complex physiological response in the injured, encompassing both metabolic and immunologic phenomena in the immediate injury phase that govern the clinical trajectory of the patient. The regulation of these responses is critical, as an appropriately tuned inflammatory response is necessary for survival. Recently, metabolomic studies in trauma patients have identified the Krebs cycle intermediate succinate as a novel biomarker for both injury severity and mortality. In parallel, the burgeoning field of immunometabolism has highlighted that cells of the innate immune system undergo targeted metabolic reprogramming during effector differentiation, leading to a broken Krebs cycle and elevated succinate levels. These cells accomplish this through immunoresponsive gene 1, an inducible mitochondrial enzyme that shunts the Krebs cycle intermediate aconitate to the production of itaconate. Itaconate is a remarkable immunometabolite with numerous downstream effects, including direct metabolic reprogramming via inhibition of another Krebs cycle enzyme, succinate dehydrogenase. The potential synergism of systemic succinate buildup following traumatic injury along with the nominal metabolic reprogramming that happens in immune cells during inflammation is a potentially valuable target for therapeutic intervention in the severely injured patient. Collectively, these findings have led our laboratory to investigate the effects of itaconate on both the physiologic responses to trauma in a murine model, as well as the downstream effect of itaconate and other Krebs cycle-associated agents on mitochondrial bioenergetics in cells of the innate immune system. In this talk, I will highlight the current information in the immunometabolism of trauma, and discuss some of our research efforts in this exciting field.

## Dr. Virginia A. Zakian

PRINCETON UNIVERSITY

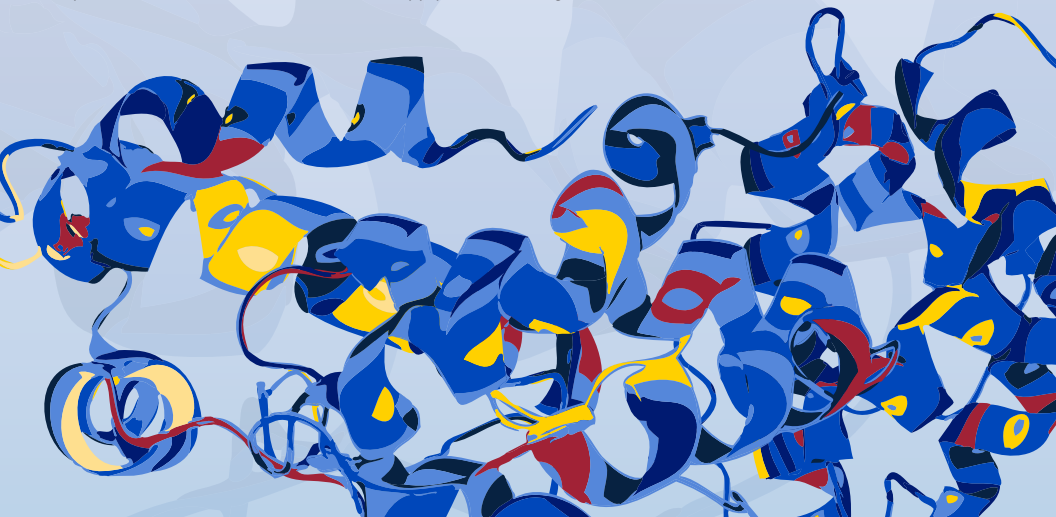


Virginia A. Zakian, known to most as Ginger, has been a Professor of Molecular Biology at Princeton University since 1995. Before that, she spent 17 years on the faculty in the Division of Basic Science at the Fred Hutchinson Cancer Research in Seattle. Ginger thinks of herself as a chromosome biologist. Currently, her research falls into two areas. First is telomeres with a focus on regulation of telomerase. The second is replication fork progression, with a focus on DNA helicases that help the replication fork maneuver past natural replication impediments. Most of her research is carried out in budding or fission yeast, although she also works in mammalian cells.

### ABSTRACT

#### Stressing at the ends: telomerase regulation

Virginia Zakian has made critical contributions in two areas of chromosome biology: telomeres and replication fork progression. Her lab used ciliates to isolate the first telomere single-strand DNA binding proteins, the prototype of Pot1, and demonstrated that they protect DNA ends from degradation. Her lab discovered telomeric silencing and cell cycle dependent degradation of C-strand telomeric DNA in budding yeast, features now known to occur in diverse eukaryotes. They also identified proteins required for cell cycle and length-dependent regulation of telomerase. Her work on fork progression focuses on the Pif1 family of DNA helicases, which her lab showed are conserved from bacteria to humans. These studies began with the discovery that the budding yeast Pif1 acts catalytically to eject telomerase from telomeres and double strand breaks, thereby inhibiting telomerase. Two other members of the Pif1 helicase family, budding yeast Rrm3 and fission yeast Pfh1, promote semi-conservative replication through telomeric DNA. Moreover, budding and fission yeast Pif1 family helicases have more general roles in combatting the replication stress that arises at naturally occurring replication barriers, such as stable protein complexes, converged replication forks, and DNA secondary structures; e.g., the Zakian lab used a combination of biochemistry and genetics to demonstrate an evolutionarily conserved role for Pif1 family helicases in promoting replication and suppressing DNA damage at G-quadruplex DNA. Her lab also discovered that highly transcribed RNA polymerase II genes are the most potent obstacles for DNA replication in wild type yeast cells, a conclusion later found to apply to diverse organisms.



## 2017-2018

### Lauran Chambers



Lauran is currently a senior at Iowa State University pursuing a major in biochemistry and a minor in Nutrition. She is an undergraduate research assistant in Dr. Olga Zabolotina's laboratory studying the addition of hydrolases to the plant cell wall and their effects on plant fitness. Lauran is the Co-Chair of the 2018 Stupka Symposium, Chair of the Iowa One Health Conference, and is a volunteer at LifeServe Blood Center of Des Moines. After graduation, she plans on attending medical school.

### Matthew Cook



Matt is a senior double-majoring in biochemistry and genetics with minors in Spanish and mathematics. He has worked as an undergraduate research assistant in Dr. Olga Zabolotina's lab since the spring of 2015 studying enzymes involved in plant cell wall synthesis. He is the Vice President of the BBMB Club, the Sponsorship Chair of the Stupka Symposium Planning Committee, and an instructional assistant for BBMB 102. Matt was awarded the Goldwater Scholarship in the spring of 2017. Matt plans on pursuing a Ph.D. in structural biology after graduating this spring.

### Alex Donelson



Alex is a senior at Iowa State University pursuing a B.S. in biochemistry and a minor in philosophy. Alex is an active member in both the BBMB Undergraduate Club and the Stupka Committee; he serves as the President of the BBMB Club and as the Alumni Chair for the Stupka Symposium Planning Committee. As for his future after ISU, he is tentatively planning to pursue a Ph.D. in cognitive science. Outside of school, he is an amateur astronomer and a professional Trekkie.

## 2018-2019

### Jacqueline Ehrlich



Jacqueline is a sophomore studying agricultural biochemistry with a minor in nutrition. Since the beginning of her life as a Cyclone, she has enjoyed researching in the Zabolotina lab, focusing on substrate binding in the active site of xyloglucan xylosyltransferases 1, 2, and 5. Outside of class and lab, Jacqueline is a B&B peer mentor, Co-Chair for the Breakfast Club, and Publicity committee chair for the Stupka Symposium Planning Committee. She has also recently been honored with an exciting title as the Iowa State Fair Queen. Following graduation, Jacqueline plans to pursue a doctorate in nutritional biochemistry.

### Emily Knuth



Emily is currently a junior at Iowa State pursuing a major in agricultural biochemistry with minors in agronomy and nutrition. Emily is currently involved in research in Dr. Adam Barb's laboratory where she is studying FabH, a key enzyme in fatty acid synthesis. Emily is an undergraduate instructional assistant for BBMB 102, Fundraising Chair for the Stupka Symposium Planning Committee, and Outreach Chair for the BBMB club. After graduating, Emily plans to attend graduate school to pursue a Ph.D.

### Bailey Mooney



Bailey is currently a junior at Iowa State majoring in biochemistry and genetics with a minor in philosophy. Her research in Dr. Trimarchi's lab is focusing on six different types of neurons produced that later make retina tissue and how the development is controlled by a variety of genetic factors. Bailey is the President of the Genetics Club, Secretary of the BBMB Club, Treasurer Chair of the Stupka Symposium Planning Committee, B&B Learning Community peer mentor, Honors Ambassador, and serves as a volunteer at Mary Greeley Medical Center Emergency Department. Bailey plans on continuing her education in medical school after she graduates Iowa State.

# STUPKA SCHOLARS PAST

- Claire Kruesel** 2006  
M.S. English  
Lecturer for the English Department at Iowa State University, yoga instructor and business owner
- Mara Determan Alexeev** 2007  
M.D. University of Iowa  
M.S. Public Health, UC-Berkeley  
Pediatrician New York City – Office of School Health
- Luke Helgeson** 2008  
Ph.D. Biochemistry  
Postdoctoral fellow at the University of Washington
- Mina Farahbakhsh** 2009  
Completed M.D. 2016  
Ph.D. program at the University of Kansas
- Dayna Peterson-Forsbrook** 2010  
Ph.D. Arizona State University 2017
- Jackie Souleyrette Rivas** 2011  
Ph.D. in Immunology, University of Texas Southwestern Medical Center  
Scientist with Biogen, Lexington, KY
- Craig Brown** 2011  
M.D. from University of Chicago 2016  
Surgical residence at University of Michigan
- Johanna Jass Bailey** 2011  
Master of Public Health, University of Missouri. Lab and Site Manager, Elemental Enzymes, Jacksonville, FL
- Mollie Tiernan Schubert** 2011  
Research Scientist III in the Molecular Genetics group at Integrated DNA Technologies, Coralville, IA
- Samson Condon** 2012  
Ph.D. candidate at the University of Wisconsin – Madison
- Alana Jackson** 2012  
M.D. in rural medicine  
University of Minnesota  
Residency Spokane, WS
- Kristen McKibben** 2013  
Ph.D. candidate at the University of Pennsylvania
- Kinsey Cornick** 2013  
Fourth year osteopathic medicine student at Des Moines University
- Jennifer Kaczynski Meyer** 2013  
Scribe in the dermatology department at Unity and Mercy Hospital, MN
- Denis Tamiev** 2014  
Second year graduate school, Biochemistry and Biological Engineering at Iowa State University
- Zack Young** 2014  
Research assistant at Oklahoma Medical Research Foundation
- Flora Yen** 2015  
Second year student at the University of Iowa School of Dentistry
- Adrienne Smith** 2015, 2016  
Completed her B.S. in Biochemistry, fall 2016 and graduated *Summa Cum Laude*  
She passed away in 2017.
- Morgan Barrett** 2016  
Graduate training in Forensics at University of New Haven fall 2018
- Natalie Whitis** 2016  
Graduate training in molecular biology at the University of California – San Francisco
- Drew Tonsager** 2017  
Complete M.S. 2018 in Biochemistry  
Begins Ph.D. training fall 2018 at Colorado State University

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