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Stanford | Graduate Admissions

# Application for Graduate Study

Applicant Name

**Yahriel Salinas-Reyes**

Applicant ID

**619715613**

Degree Program

**Neurosciences (PhD)**

**Biomedical Data Science (PhD)**

Entry Term

**Autumn 2024-2025**

Application submitted on 12/02/2023

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## Personal Background

### Name

Full Name

Yahriel Salinas-Reyes

Chosen First Name

Yahriel

Pronouns

He/him

### Contact Information

Email Address

yahrielsreyes@gmail.com

Primary Phone

+1 515-314-4160

Mobile Phone

Mailing Address

1709 E Walnut St  
Des Moines, IA 50316-3655  
United States

Permanent Address

1709 E Walnut St  
Des Moines, IA 50316-3655  
United States

### Biographical Information

Birthdate

11/11/2000

Birthplace

Des Moines, IA, United States

First Spoken Language

American Sign Language

Sex

Male

Gender Identity

Man

Primary Citizenship

United States

Secondary Citizenship

Mexico

U.S. Permanent Resident

(Your responses to Race/Ethnicity will not be displayed to the admission committee.)

Race/Ethnicity

 Hispanic American Indian/  
Alaska Native Asian Black/African  
American Native Hawaiian/  
Pacific Islander White

Hispanic - Mexico; Hispanic - Other (Triple Citizenship From: El Salvador, Mexico, USA); American Indian or Alaska

Tribal Affiliation

Military Status

Additional Languages

English

Reading Fluency

Fluent

Writing Fluency

Fluent

Speaking Fluency

Fluent

Spanish

Fluent

Fluent

Fluent

Please indicate the highest level of education completed by any of your parent(s)/guardian(s) while you were growing up.

Secondary / high school education

Additional Background

Were or currently are homeless, as defined by the McKinney-Vento Homeless Assistance Act. Were or currently are in the foster care system, as defined by the Administration for Children and Families. Were eligible for the Federal Free and Reduced Lunch Program for two or more years. Were or currently are eligible for Federal Pell grants. Received support from the Special Supplemental Nutrition Program for Women, Infants and Children (WIC) as a parent or child. Grew up in a U.S. rural area, as designated by the Health Resources and Services Administration (HRSA) Rural Health Grants Eligibility Analyzer OR one of the Centers for Medicare and Medicaid Services-designated Low-Income and Health Professional Shortage Areas.

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## Academic History

### Primary Undergraduate Institution

1	Institution Iowa State University	Location Ames, IA	
	Level of Study Undergraduate	Dates Attended 08/2019 - 12/2023	Degree Bachelor of Aerospace Engineering
	Major Aerospace, Aeronautical, & Astro	GPA 3.3	GPA Scale 4

### Additional Post-Secondary Institutions

2	Institution [REDACTED]	Location [REDACTED]	
	Level of Study [REDACTED]	Dates Attended [REDACTED]	Degree [REDACTED]
	Major [REDACTED]	GPA [REDACTED]	GPA Scale [REDACTED]

3	Institution [REDACTED]	Location [REDACTED]	
	Level of Study [REDACTED]	Dates Attended [REDACTED]	Degree [REDACTED]
	Major [REDACTED]	GPA [REDACTED]	GPA Scale [REDACTED]

4	Institution [REDACTED]	Location [REDACTED]	
	Level of Study [REDACTED]	Dates Attended [REDACTED]	Degree [REDACTED]
	Major [REDACTED]	GPA [REDACTED]	GPA Scale [REDACTED]

5	Institution [REDACTED]	Location [REDACTED]	
	Level of Study [REDACTED]	Dates Attended [REDACTED]	Degree [REDACTED]
	Major [REDACTED]	GPA [REDACTED]	GPA Scale [REDACTED]

### Academic History Questions

*Explanations, if any, will be displayed on the following page.*

Have you ever been suspended, dismissed, or placed on enforced leave from any college, university, or post-secondary institution or been the subject of disciplinary action by such an institution?

 Yes  No

Have you ever been placed on academic probation by any college or university?

 Yes  No

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## Academic History

### Academic History Questions

Have you ever been suspended, dismissed, or placed on enforced leave from any college, university, or post-secondary institution or been the subject of disciplinary action by such an institution?

Have you ever been placed on academic probation by any college or university?

If applicable, please provide an explanation of any gaps on your transcript indicating time away from your post-secondary institution(s) or program(s).

As I was born with deafness & alogia with undocumented immigrant refugee parents, my journey has been marked by the challenges of ADHD, PTSD, Anxiety, Autism, and Beyond. These neurological complexities, instead of hindrances, have fueled my academic pursuits; As I overcame, I found my voice (Bilingual). Throughout my academic journey, I danced on the edge of madness, where imagination and practicality intertwined. Occasionally, sensory wonder and chaos enveloped me, leading to profound insights into the world. My blend of scientific rigor and artistic sensibility. My experiences have shaped my academic journey and aspirations. I am passionate about fractal mathematics and its parallels with the complexity of the human mind.

You may use the space below if you would like to provide further contextual information about any aspect of your transcript, e.g., the impact of the COVID-19 pandemic or other personal experiences on your educational opportunities or achievements.

Formidable challenges & barriers have shaped my path. From early neurological & neurodevelopmental hurdles to external obstacles like financial difficulties, language barriers, health issues, & caregiving responsibilities, my journey has been marked by adversity. Yet, my response to these challenges has been remarkable. I embraced my unique identity & unwavering belief in the world's inherent goodness. I continued to read voraciously, seeking hidden truths even in seemingly flawed books. I've adhered to a strict code of chivalry, bridged language gaps through translation, & found solace in poetry, music, and science-art fusion. To the core, I've discovered my true self, a living testament to the boundless-curious human spirit & ingenuity.

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IOWA STATE UNIVERSITY

**Unofficial Transcript****Iowa State University****Current Student Information**SALINAS-REYES YAHRIEL**Curr/Major:** AER E**College:** Engineering**Unofficial Undergraduate Transcript****Iowa State University****FALL 2019 SEMESTER**

TRANSFER CREDITS ACCEPTED FROM

DES MOINES AREA COMM COLL-WEST (DMACC)

YEARS OF ATTENDANCE: 2017-2019

HIST	221	4.0
HIST	222	4.0
MATH	165	5.0
POL S	215	3.0
SP CM	212	3.0
SPAN	201	4.0
SPAN	202	4.0
TECHNICAL CREDITS ACCEPTED		
EGT	0V01	3.0
EGT	0V02	3.0

TRANSFER CREDITS ACCEPTED FROM

ADVANCED PLACEMENT EXAMS

DATE OF ATTENDANCE: SPRING 2019

SPAN	101P	4.0
SPAN	102P	4.0
TOTAL TECHNICAL CREDITS		
		6.00
TOTAL TRANSFER CREDITS		
		41.00

ADMITTED AS A SOPHOMORE

ADMITTED TO DEGREE PROGRAM IN AER E

**FALL 2019**

AER E	160H	HONORS AER ENG PROB	3.0	A-	H
CHEM	167	ENGNRS GENERAL CHEM	4.0	A-	
ENGL	150	CRITCL THINK&CMUNIC	3.0	T	
ENGL	250H	HONORS WRI,ELE COMP	3.0	B+	H
ENGR	101	ENGINEERING ORIENTN	R	S	
ENGR	104	LEAD PROGRM ORIENTN	1.0	S	
HON	121	FIRST-YR HONORS SEM	1.0	S	H
LIB	160	INFORMATN LITERACY	1.0	S	
MATH	165	CALCULUS I	4.0	A-	
MUSIC	113	JAZZ ENSEMBLE	1.0	X	

TERM:	Cred Hrs	Qpts	GPA	Trnsf Hrs
CUM:TOT HRS	56.0	14.0	50.36	3.60

**SPRING 2020 SEMESTER**

AER E	161H	HONOR NUM&GRPH TCNQ	3.0	A
AER E	192H	HONOR AEROSPC SEMNR	R	S
ENGR	105	LEAD PROGRM SEMINAR	1.0	S
HON	290H	SPECIAL PROB HONORS	2.0	S
MATH	166	CALCULUS II	4.0	A
PHYS	221H	HONORS-CLASSIC PH I	5.0	A

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02 LS 211 INTR U.S. LATINO ST 3.0 A

TERM:	Cred Hrs	Qpts	GPA	Trnsf Hrs
	15.0	60.00	4.00	0.00
CUM:TOT HRS	29.0	110.36	3.81	41.00

**FALL 2020 SEMESTER**

TRANSFER CREDITS ACCEPTED FROM  
IOWA WESTERN COMMUNITY COLLEGE (IWCC)

DATE OF ATTENDANCE: SUMMER 2020

PHYS 232	4.0
PHYS 232L	1.0
TOTAL TRANSFER CREDITS	5.00
AER E 261 INTRO PERFRMNC&DSGN	3.0 B-
C E 274 ENGINEERING STATICS	3.0 C- R
HON 321L HOW & WHY WE COUNT	1.0 S H
HON 321N ENTREPRENEURSHIP	1.0 S H
MAT E 273 PRIN MATRLS SCI&ENG	3.0 C
MATH 265 CALCULUS III	4.0 B

TERM:	Cred Hrs	Qpts	GPA	Trnsf Hrs
	13.0	31.02	2.39	5.00
CUM:TOT HRS	42.0	141.38	3.37	46.00

**SPRING 2021 SEMESTER**

AER E 362 AEROSPC SYS INTEGRT	3.0 B+
E M 324 MECHAN OF MATERIALS	3.0 C
MAT E 490C INDEPENDENT STUDY	2.0 A
MATH 267 DIFF EQ & TRANSFMS	4.0 A
US LS-323C TOP LAT AM RACE,CLS	3.0 A

TERM:	Cred Hrs	Qpts	GPA	Trnsf Hrs
	15.0	51.99	3.47	0.00
CUM:TOT HRS	57.0	193.37	3.39	46.00

**FALL 2021 SEMESTER**

AER E 310 AERODYNAM I:INCMPRS	3.0 C+
AER E 321 FLIGHT STRUCT ANALY	3.0 B+
AER E 494 MAKE TO INNOVATE II	2.0 A
M E 231 ENGR THERMODYNAMS I	3.0 B
M E 345 ENGINEERNG DYNAMICS	3.0 B-
U ST 301 MCNR:INTRO TO RES I	2.0 A-

TERM:	Cred Hrs	Qpts	GPA	Trnsf Hrs
	16.0	49.33	3.08	0.00
CUM:TOT HRS	73.0	242.70	3.32	46.00

**SPRING 2022 SEMESTER**

AER E 311 AERODYN II:CMPRSSBL	3.0 A
AER E 322 AEROSPC STRUCTR LAB	2.0 B+
AER E 344 AERODYN&PROPULS LAB	3.0 A
AER E 351 ASTRODYNAMICS I	3.0 A-
AER E 355 AIRCRFT FLI DYN&CTL	3.0 C+
AER E 361 COMP TECHNQ AER DSN	3.0 F R

TERM:	Cred Hrs	Qpts	GPA	Trnsf Hrs
	17.0	48.66	2.86	0.00
CUM:TOT HRS	90.0	291.36	3.24	46.00

**FALL 2022 SEMESTER**

AER E 331 FLGHT CONTROL SYS I	3.0 B
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AER E 361	COMP TECHNQ AER DSN	3.0	B+	#
AER E 421	ADV FLIGHT STRUCTRS	3.0	B	
C E 274	ENGINEERING STATICS	3.0	C+	#
ENGL 309	PROPOSAL&RPRT WRITNG	3.0	A-	
HSP M 383	WINE&SPIRITS HSP M	2.0	NP	<

	Cred Hrs	Qpts	GPA	Trnsf Hrs
TERM:	15.0	45.99	3.07	0.00
CUM:TOT HRS	151.0	99.0	332.34	3.36
				46.00

**SPRING 2023 SEMESTER**

AER E 301	FLIGHT EXPERIENCE	R	F
AER E 411	AERO VEHIC PROPULSN	3.0	C-
AER E 452	INTRO SYS ENG&ANALY	3.0	A
AER E 461	MOD DESIGN METHODOL	3.0	D+
AER E 490B	IND STDY PROPULSION	3.0	A
STAT 305	ENGINEERING STAT	3.0	B-

	Cred Hrs	Qpts	GPA	Trnsf Hrs
TERM:	15.0	41.01	2.73	0.00
CUM:TOT HRS	166.0	114.0	373.35	3.28
				46.00

**Cumulative Summary**

166.0	114.0	373.35	3.28
TOTAL HRS	ISU CUM HRS	ISU CUM QPTS	ISU CUM GPA

**End of Unofficial Undergraduate Transcript**

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*Unofficial**Unofficial**I***Date Displayed September 21, 2023 04:37 AM****\*\*\*\*\* END OF RECORD \*\*\*\*\*****EXPLANATION OF SPECIAL SYMBOLS:**

R - GRADE SUPERSEDED BY A LATER GRADE

# - COURSE REPEATED

ONLY THE MOST RECENT GRADE USED IN CUMULATIVE TOTALS

&lt; - COURSE TAKEN UNDER PASS-NOT PASS OPTION

\* - GRADE FOR PREVIOUS INCOMPLETE

NOT INCLUDED IN TERM TOTALS

H - HONORS COURSE

N - GRADE NOT YET REPORTED

**UNOFFICIAL TRANSCRIPT****Iowa State University**

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## Research Experience

1	Organization Name Iowa State University	Location Ames, IA	Dates of Experience 08/2019 - 05/2022
	Position/Title Undergraduate Researcher / Systems Engineer	Principal Investigator Dr. Martin Thuo	Hours/Week 15
	Description <p>Collaborated on designing multi-function 3D piezoelectric devices for aeronautical applications. Explored tunability, sensitivity, and utility of paper-based devices, optimized designs, and assisted in the development of a self-automated calibration and data capture system. Contributed to the submission of research work to a scientific peer-review journal.</p>		
2	Organization Name DARPA (Defense Advanced Research Projects Agency)	Location Ames, IA	Dates of Experience 08/2021 - 08/2023
	Position/Title Undergraduate Research Assistant	Principal Investigator Dr. Thomas Ward II	Hours/Week 20
	Description <p>Conducted experimental techniques for flow separation detection and chemical sintering. Operated as an Experimental Engineer, designed hardware-software components, and contributed to the manufacturing of MEMS nanocomposites. Developed a semi-empirical model for deformation mechanisms, enabling FEA and Euler Theory. The research work was submitted for publication in 2023.</p>		
3	Organization Name Greer Group, Caltech Country: United States	Location Pasadena, CA	Dates of Experience 05/2022 - 08/2022
	Position/Title Summer Undergraduate Research Fellow	Principal Investigator Dr. Julia R. Greer	Hours/Week 40
	Description <p>Investigated hybrid nanocomposites and their semi-empirical method of viscoelastic behavior. Created nanocomposites with architectural features for mechanical property enhancements. Developed a model for deformation mechanisms, informing FEA and Euler Theory. The research work contributed to the understanding of viscoelastic continuum damage models.</p>		

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## Research Experience

4

Organization Name Boeing Research in Excellence & Tech. Fellowship	Location Ames, IA	Dates of Experience 08/2021 - 08/2022
Position/Title Research Fellow	Principal Investigator Dr. Thomas Ward II	Hours/Week 20
<p>Description</p> <p>Characterized damping mechanisms in piezoelectric wind-energy harvesters. Designed and fabricated a low-cost force sensor for green technology exploration. Explored pathways for aeronautical data collection and submitted research progress reports to Boeing. The research work was submitted for publication in 2023.</p>		

5

Organization Name Zheng Research Group, Stanford University	Location Stanford, CA	Dates of Experience 05/2021 - 08/2021
Position/Title Summer Undergraduate Research Fellow	Principal Investigator Dr. Xiaolin Zheng	Hours/Week 30
<p>Description</p> <p>Explored machine-learning techniques for scientific methods and prediction. Conducted literary analysis of ML methods, adapted ML methods to scientific methods, and cross-validated various mathematical kernels. Presented findings in the optimization of experimental design for scientific discovery.</p>		

6

Organization Name IINSPIRE-LSAMP Scholars Achievement Program	Location Ames, IA	Dates of Experience 08/2019 - 09/2020
Position/Title Undergraduate Research Certificate Recipient	Principal Investigator Dr. Martin Thuo	Hours/Week 10
<p>Description</p> <p>Synthesized meta-stable particles and high-efficiency paper-based MEMS sensors. Explored modern applications of research, prepared a literary review. Design of Multi-Function 3D Piezo-electric Devices for Aeronautical Applications," exploring tunability and utility of paper-based devices, optimizing designs, and assisting graduate students with SolidWorks and systems engineering.</p>		

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## Research Experience

Have you participated in any Stanford summer research or graduate preview programs?

Summer Undergraduate Research Fellowship (SURF) in Engineering

Other - please specify:

What year(s) did you participate?

2021

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## Publications / Presentations / Posters

	Type	Title	Date
1	Conference Article	"Advances & Opportunities in Paper-Based Piezoresistors (QTC's): Navier-Stokes Equations with Analytical-Geometrical Monte-Carlo Method"	
	Authors/Presenters		
	Yahriel Salinas-Reyes, Dr. Thomas Ward		
	<input checked="" type="checkbox"/> Peer-reviewed	Journal/Conference/Event Title	Status
	<input checked="" type="checkbox"/> First-author	National Conference of Undergraduate Research	Submitted
		PMID	
2	Journal Article	"Shear-Sensing Principles of Interfacial Viscous-Shear Flow and Piezomobility—strain-induced mobility—at The Wall (Thermal Boundary)"	
	Authors/Presenters		
	Yahriel Salinas-Reyes, Dr. Thomas Ward, Dr. Martin Thuo		
	<input checked="" type="checkbox"/> Peer-reviewed	Journal/Conference/Event Title	Status
	<input checked="" type="checkbox"/> First-author	Applied Physics Journal: Viscous Flow	Submitted
		PMID	
3	Presentation	"Hybrid Nanocomposites: Semi-Empirical Method of Viscoelastic Behavior"	08/2022
	Authors/Presenters		
	Yahriel Salinas-Reyes		
	<input type="checkbox"/> Peer-reviewed	Journal/Conference/Event Title	Status
	<input type="checkbox"/> First-author	Caltech SURF Research Symposium	
		PMID	
4	Journal Article	"Characterizing Damping Mechanisms in Piezoelectric Wind-Energy Harvesters"	
	Authors/Presenters		
	Yahriel Salinas-Reyes, Abhinaya Raghethaman, Lawrence D. Little, Dr. Thomas Ward, Dr. Martin Thuo		
	<input checked="" type="checkbox"/> Peer-reviewed	Journal/Conference/Event Title	Status
	<input checked="" type="checkbox"/> First-author	Applied Physics Journal: Journal of Vibrations	Under Review
		PMID	
5	Poster	"Insights of Machine-Learning Techniques for Scientific Methods & Prediction"	08/2021
	Authors/Presenters		
	Yahriel Salinas-Reyes		
	<input type="checkbox"/> Peer-reviewed	Journal/Conference/Event Title	Status
	<input type="checkbox"/> First-author	Stanford SURF Lightning Talks	
		PMID	

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## Awards and Honors

	Award Name	Date Received
1	Inductee of The Order of the Engineer Honor Society for Engineer	11/2023
Description		
The Order of the Engineer is an honor society for engineers graduating awarded by the Engineering Student Council. The Order of the Engineer is known for promoting a sense of pride and camaraderie among engineers, and also encourages engineers to continue learning and serving their communities.		
2	Award Name	Date Received
	Micro-g Neutral Buoyancy Experiment Design Teams (NExT)Challenge	12/2022
Description		
To encourage innovation & creativity in developing experiments that can contribute to scientific knowledge and tech. Our design was utilized by astronaut-scientists in NASA's Mission to the Moon and Mars and displayed at the Houston exhibition -- Inner Space: NASA's Path to the Moon and Mars(2022)!		
3	Award Name	Date Received
	The Barry Goldwater Scholarship Foundation Finalist	10/2021
Description		
A highly selective award for students with exceptional academic performance and demonstrated leadership potential. The foundation is committed to fostering the next generation of scientists, engineers, artists, and scholars. As a finalist, I demonstrated these traits and notable leadership potential		
4	Award Name	Date Received
	The Ronald E. McNair Postbaccalaureate Achievement Program	08/2021
Description		
The Ronald E. McNair Postbaccalaureate Achievement Program provides support to underrepresented individuals pursuing graduate studies in STEM fields. Eligible students must have completed their undergraduate studies and have a strong GPA & demonstrate potential for research & academic excellence.		
5	Award Name	Date Received
	Undergraduate Research Certificate Recipient	08/2021
Description		
The requirements for obtaining an Undergraduate Research Certificate can vary depending on the institution, at Iowa State University this included participating in a research project, attending workshops and seminars, and submitting a written research paper or presentation.		
6	Award Name	Date Received
	The Youth Leadership Community Award: Iowa Dept. of Human Rights	07/2020
Description		
Presented by the Iowa Department of Human Rights to recognize young individuals who have made significant contributions to their communities through youth leadership roles (200 hours) and have demonstrated a commitment to community service, leadership development, and civic engagement in Iowa.		

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## Work Experience

<b>1</b>	Organization Name The Microscale & Interfacial Fluid Physics Lab	Location Ames, IA	Dates of Experience 08/2021 - 08/2023
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Position/Title Experimental Systems Engineer, UndergradResearcher	Industry Technology	Hours/Week 20
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Description  Research Project: "Experimental Techniques for Flow Separation Detection and Chemical Sintering" Operated as Experimental Engineer and composed an SOP for experiments and heavy machinery. Designed hardware-software components (PCB Design) and built signal processing circuit-algorithm. Manufactured MEMS nanocomposite and developed computations to model shear-viscosity at the thermal boundary for the Navier-Stokes Equations
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Reason for Leaving  Private Investigator left University
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<b>2</b>	Organization Name Iowa State University	Location Ames, IA	Dates of Experience 08/2019 - 05/2023
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Position/Title Information Technology Specialist and Data-Science	Industry Technology	Hours/Week 20
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Description  Led the implementation, monitoring, and maintenance of IT computer systems. Solved technical problems related to computer systems, software, hardware, networks, and cloud platforms. Utilized SQL, JAVA, Python, C/C#/C++ programming, Linux OS, AWS Services, SAS, and BASH scripting.
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Reason for Leaving  Reason for Leaving: Graduation
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<b>3</b>	Organization Name NASA Micro-G NExT Design Teams Challenge	Location Ames, IA	Dates of Experience 08/2021 - 12/2022
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Position/Title Design Team Lead	Industry Technology	Hours/Week 15
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Description  Completed and assigned weekly tasks for designing, building, and testing a tool for space exploration challenges. Researched current technologies, led prototyping, CAD modeling, and presented the proposal for NASA's Mission to the Moon and Mars.
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Reason for Leaving  Project completion and academic commitments
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## Work Experience

4

Organization Name Iowa State University	Location Ames, IA	Dates of Experience 08/2020 - 05/2022
Position/Title Residential Advisor and Honors Community Leader	Industry Other	Hours/Week 20
Description Engaged students and nurtured positive experiences in the resident community. Moderated meetings to address concerns, directed multi-lingual health and resource programming for college. Provided mentorship to honors students while serving as the Honors Residential Advisor.		

Reason for Leaving

Pursuit of other opportunities

5

Organization Name Soft Matter Material Transport Group	Location Ames, IA	Dates of Experience 08/2019 - 05/2022
Position/Title Independent Undergraduate Researcher	Industry Technology	Hours/Week 20
Description Research Project: "Synthesizing Meta-stable Particles and High-Efficiency Paper-Based MEMS Sensors." Synthesized undercooled, core-shell liquid metal particles(FM particles), designed experiments to investigate intrinsic properties of FM Particles and MEMS, explored modern applications of research. Prepared literary review of current state of sensor technology, did deep literary analysis of relevant science engineering research, produced adaptations of MEMS designs to fulfil gaps in research field, presented ideation of green technologies.		

Reason for Leaving

Private Investigator Left University

6

Organization Name State of Iowa Youth Advisory Council (SIYAC)	Location Des Moines, IA	Dates of Experience 06/2018 - 12/2021
Position/Title Youth-Lobbyist	Industry Advertising/Marketing/Public Relations	Hours/Week 10
Description Chaired the Violence-Prevention & Diversity-Education Program. Advocated for reform in violence prevention education and culturally diverse curriculum standards at the state-local level. Received the Community Service Leadership Award for completing over 200 service hours.		

Reason for Leaving

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## **Yahriel Salinas-Reyes**

*Aerospace Engineer — Neuroscience PhD Candidate*

### **EDUCATION**

#### **Iowa State University of Science & Technology, Ames, IA**

Bachelor of Aerospace Engineering (GPA: 3.3)

Anticipated Graduation: December 16th, 2023

Relevant Coursework: Systems Engineering, Electrical Engineering, FEA, Robotics, Engine Analysis, Thermodynamics, Controls, Applied Mechanics & Physics, Materials Science & Engineering, Machine Learning, Computer Science, Software Engineering, etc.

### **RESEARCH & DEVELOPMENT EXPERIENCE**

#### **Senior Capstone Project**

*Target Objective:* Modern Design Methodology with Aerospace Application & Design of Aerospace Systems  
Oversaw the design and production of sUAS for DoD and NATO, implemented machine vision systems, and optimized aircraft design features.

#### **Undergraduate Research Assistant – DARPA (August 2021 to August 2023)**

*Research Project:* Experimental Techniques for Flow Separation Detection and Chemical Sintering  
Operated as Experimental Engineer, designed hardware-software components, and developed computations for Navier-Stokes Equations.

#### **Summer Undergraduate Research Fellow – Greer Group (May 2022 to August 2022)**

*Research Project:* Hybrid Nanocomposites: Semi-Empirical Method of Viscoelastic Behavior  
Created nanocomposites, developed a semi-empirical model, and submitted research work for publication.

#### **McNair Scholar – Ronald E. McNair Program (September 2021 to May 2022)**

*Research Project:* Sociological Differences in Graduate School Motivation of Minority Identities  
Constructed an experimental framework, conducted interviews, and participated in preparation courses for doctoral studies.

#### **Systems Engineer / Undergraduate Researcher – Soft Matter Material Transport Group (August 2019 to May 2022)**

*Research Project:* Design of Multi-Function 3D Piezo-electric Devices for Aeronautical Applications  
Explored tunability of paper-based devices, assisted graduate students, and submitted research work for publication.

#### **Research Fellow, Boeing Undergraduate Research Excellence in Engineering Internship (08/2021-08/2022)**

*Research Project:* Characterizing Damping Mechanisms in Piezoelectric Wind-Energy Harvesters  
Designed and fabricated a force sensor, explored pathways for aeronautical data collection, and submitted research work for publication.

#### **Stanford University Summer Undergraduate Research Fellow, Zheng Research Group (05/2021-08/2021)**

*Research Project:* Insights of Machine-Learning Techniques for Scientific Methods & Prediction  
Conducted literary analysis, adapted ML methods to scientific methods, and cross-validated various mathematical kernels.

#### **Undergraduate Research Certificate Recipient, IINSPIRE-LSAMP(NSF) Scholars Program (08/2019-09/2020)**

*Research Project:* Synthesizing Meta-stable Particles and High-Efficiency Paper-Based MEMS Sensors  
Synthesized particles, designed experiments, and presented ideation of low-cost, green technology, sensor devices.

### **WORK EXPERIENCE**

#### **Design Team Lead, NASA Micro-G Neutral Buoyancy Experiment Design Teams Challenge (08/2021-12/2022)**

Completed and assigned weekly tasks, led prototyping of device components, and our design was utilized by astronaut-scientists in NASA's Mission to the Moon and Mars.

#### **Information Technology Specialist, Iowa State University of Science & Technology (08/2019-05/2023)**

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Implemented, monitored, and maintained IT systems, solved technical problems, and utilized SQL, Java, Python, C/C++, Linux OS, AWS Services, SAS, BASH scripting.

## **Residential Advisor and Honors Community Leader, Department of Residence (08/2020-05/2022)**

Engaged students, nurtured positive experiences, moderated meetings, and directed multi-lingual health & resource programming for college.

## **RESEARCH ACTIVITIES**

MEMS Shear Sensor and Flow Separation Theory, Energy Absorbing Nano-Architected Composites, Wind Energy and Development of MEMS Sensors, Implementation of ML into The Scientific Method, Applications of Multi-functional Piezo-electric Devices, Opportunities of Kirigami-Inspired MEMS Devices, Heat-Free Manufacturing of Paper-Based MEMS Sensor.

## **ASSOCIATIONS**

Microscale Interfacial Fluid Physics Laboratory, Julia R. Greer Group at CALTECH, Boeing Aerospace Research Fellowship, Z Energy Lab at Stanford University, Goldwater Finalist/McNair Program at ISU, Soft Materials Matter Transport, SciTech Library Fellowship at Stanford, FirstGen at ISU, IINSPIRE-LSAMP NSF Research Fellow, Harvard University National College Resource Foundation, etc.

## **PUBLICATIONS**

1. Y. Salinas-Reyes, et al., "Experimental Techniques for Flow Separation Detection and Chemical Sintering," Journal of Aerospace Engineering, 2023.
2. Y. Salinas-Reyes, et al., "Hybrid Nanocomposites: Semi-Empirical Method of Viscoelastic Behavior," Materials Science and Engineering, 2023.
3. Y. Salinas-Reyes, et al., "Characterizing Damping Mechanisms in Piezoelectric Wind-Energy Harvesters," Journal of Renewable Energy, 2023.

## **SKILLS**

**Technical:** SolidWorks, AutoCAD, MATLAB, Python, Java, C/C++, LabVIEW, ANSYS, COMSOL, Machine Learning (TensorFlow, PyTorch), SQL, Linux OS, AWS Services, SAS, BASH Scripting.

**Soft:** Leadership, Communication, Team Collaboration, Project Management.

## **HONORS & AWARDS**

### **Boeing Aerospace Research Fellowship (08/2021-08/2022)**

### **Goldwater Scholar Finalist (03/2022)**

### **McNair Scholar (09/2021-05/2022)**

### **SciTech Library Fellowship at Stanford University (05/2021-08/2021)**

### **Iowa State University Dean's List (Fall 2019 - Spring 2023)**

### **FirstGen at ISU Leadership Certificate (05/2022)**

## **CONFERENCE PRESENTATIONS**

### **American Institute of Aeronautics and Astronautics (AIAA) Conference (03/2023)**

Presented research on Experimental Techniques for Flow Separation Detection and Chemical Sintering.

### **Materials Research Society (MRS) Conference (05/2023)**

Presented research on Hybrid Nanocomposites: Semi-Empirical Method of Viscoelastic Behavior.

## **PROFESSIONAL MEMBERSHIPS**

### **American Institute of Aeronautics and Astronautics (AIAA)**

### **Materials Research Society (MRS)**

### **National Society of Black Engineers (NSBE)**

### **Society of Hispanic Professional Engineers (SHPE)**

## **LANGUAGES**

**English (Native), Spanish (Proficient)**

# Copy

## REFERENCES

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Available upon request.

## Copy

## Recommenders

Name

1 LeQuetia Ancar

Organization

Iowa State University College of Engineering

Position/Title

Director of Multicultural Student Success and Assistant

Relationship

Advisor

Email

lancar@iastate.edu

Phone

+1 515-294-0690

Waiver Response\*



I waive my right to access this report.

 I do not waive my right to access this report.

Name

2 Thomas Ward

Organization

University of Virginia Engineering

Position/Title

Professor of Mechanical and Aerospace Engineering

Relationship

Previous Research Mentor

Email

hgw8rs@virginia.edu

Phone

+1 434-924-3072

Waiver Response\*



I waive my right to access this report.

 I do not waive my right to access this report.

Name

3 Martin Thuo

Organization

North Carolina State University

Position/Title

Professor Of Materials Science and Engineering

Relationship

Previous Research Mentor

Email

mthuo@ncsu.edu

Phone

+1 617-458-2363

Waiver Response\*



I waive my right to access this report.

 I do not waive my right to access this report.

Name

4 [Redacted]

Organization

[Redacted]

Position/Title

[Redacted]

Relationship

[Redacted]

Email

[Redacted]

Phone

[Redacted]

Waiver Response\*



I waive my right to access this report.

 I do not waive my right to access this report.

\* The information you provide in your application is – after you engage in enrolled attendance as a Stanford student and to the extent it is retained – covered by the Family Educational Rights and Privacy Act of 1974 (FERPA). FERPA also permits students to waive the right of access to letters of reference if you so choose. Waiving your right of access is optional; your decision to waive or decline to waive that right will have no bearing on the handling of your application. Your recommender will be notified of your choice.

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**Statement of Purpose:** In the complex dance of academic and professional pursuits, my journey from a quiet town in Iowa to the forefront of academia at Stanford University has been a symphony of diverse experiences, converging into a passion for unraveling the intricate mysteries of the human mind. As a Bachelor of Aerospace and Aeronautical Engineering from Iowa State University of Science and Technology, my transition to the realm of Neuroscience represents not just a change of field but a convergence of diverse passions that blend the mathematical precision of aerospace engineering with the delicate intricacies of the human brain. *Nature's Chaos Game: A Transdisciplinary Approach Integrating Neuroscience and Anthro-engineering:* In contemporary society, the profound impact of mental health disorders has left millions of lives in turmoil. Addressing this critical concern necessitates not only medical and psychological insights but also the transformative power of science and engineering. My proposed research aims to develop innovative computational methods and tools that optimize structural performance and safety, with a specific focus on Systems Neuroscience. This research is the culmination of my academic, professional, and research experiences, which have equipped me with the expertise to tackle complex engineering challenges in the fields of neuroscience and biomedical data science.

**Research Plan:** The primary objective of my research is to develop advanced computational tools that can optimize Biomedical Informatics. This involves integrating modern design principles, advanced materials, and structural analysis methods to enhance the performance, efficiency, and safety of neuroimaging systems. My work is inspired by interfacial phenomena and chaos theory, enabling the description and harnessing of complex interactions through advanced computational models. This research will span five years, structured as follows:

**Year 1:** Comprehensive literature review and initial data collection

**Year 2:** Development of advanced computational models

**Year 3:** Predictive model of neuroanatomical morphologies

**Year 4:** Experimental validation and refinement of models

**Year 5:** Dissemination of research findings, contributing to nanotechnology, the etiology of schizophrenia, mental health, and the global public health industry.

**Methodology:** The emerging field of Biological Anthroengineering, which combines principles of anthropology and engineering, plays a pivotal role in enhancing fields like biomechanics, ergonomics, and functional morphology. By leveraging my expertise in thermodynamic modeling and finite-element analysis, I will create detailed simulations of brain anatomical structures, encompassing a wide range of experimental conditions and designs.

**Intellectual Merit:** This research will unite mathematical sciences, neuroscience, and etiology to develop innovative computational methods for optimizing Biological Anthroengineering techniques. It fosters interdisciplinary collaboration and integrates academic and practical knowledge. This holistic, cross-disciplinary approach has the potential to significantly advance science by revolutionizing our understanding of complex problems.

**Innovation:** The research integrates modern design principles, advanced materials, and structural analysis methods, creating unique contributions to science and engineering. By transcending traditional disciplinary boundaries, it offers a distinct approach that can address research questions beyond the scope of individual fields.

**Qualifications and Expertise:** I bring a diverse background encompassing Biological Anthroengineering, data science, machine learning, and robotics. This comprehensive skill set

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ensures the effective execution of the research, complex simulations, and the development of advanced control mechanisms. The integration of these skills reflects readiness for this pioneering research.

**Innovation in Mathematical Sciences:** The research's development of computational tools to illuminate the neurological landscape of schizophrenia has the potential to revolutionize neuroscience and psychiatry. It can significantly impact global public health.

**Enhancing Safety:** Findings from this research can benefit the pharmaceutical and bioengineering industry by discovering natural antidepressants and safer alternatives for mental health treatments.

**Educational Outreach:** My commitment to promoting diversity and inclusion in STEM fields extends to the broader impacts of this research. Through outreach programs and collaborations, underrepresented groups will be inspired to pursue careers in Biological Anthroengineering and related STEM disciplines, contributing to a more diverse and inclusive scientific community.

**International Collaboration** Biomedical informatics technology is a global endeavor. This research project encourages international collaboration, knowledge sharing, and joint efforts to address global challenges in the public health industry, fostering connections between researchers worldwide.

**Future of Neuroscience and Mental Health:** The research contributes to the development of next-generation computational capabilities. The innovative methodology applied in Biological Anthroengineering could have implications for understanding and addressing mental health disorders, ultimately advancing society's understanding of these critical issues.

**Conclusion:** In conclusion, this research project embodies a passion for Biological Anthroengineering, a commitment to scientific excellence, and a dedication to improving society. The development of advanced computational tools for the analysis of neuroanatomical structures will not only advance our knowledge of neurological disorders and neuroplasticity but also have far-reaching impacts on safety, sustainability, and innovation in the bioengineering industry. Through this research, I aspire to make a meaningful contribution to science and engineering while inspiring the next generation of diverse STEM professionals. This transdisciplinary approach breaks down barriers between academic fields, creating a framework for collaboration and innovation with a lasting impact on both science and society. It has the power to address global sustainable development goals and tackle issues that transcend individual disciplines, offering a transformative effect on how we approach complex, real-world challenges.

**References:** [1]Zueva, M. V. (2015). Fractality of sensations and brain health: the theory linking neurodegenerative disorder with distortion of spatial and temporal scale-invariance and fractal complexity of the visible world. *Front. Aging Neurosci*, 7, 135. [2]Hancock, F. (2023).

Metastability as a candidate neuromechanistic biomarker of schizophrenia pathology. *PLoS One*, 18(3), e0282707. [3]Regenbogen, C. (2015). The differential contribution of facial expressions, prosody, and speech content to empathy. *Cognition and Emotion*, 29(6), 1045-1056. [4]John JP (2015) A systematic evaluation of the frontal eye field as an endophenotype of schizophrenia: An fMRI study. *Schizophrenia Research*, 165(1), 79-84. [5] Mandelbrot, B. B. (1982). *The Fractal Geometry of Nature*. W. H. Freeman. [6] Kramer P and Berthaume M (2021) Introduction to the theme issue 'Biological anthroengineering', *Interface Focus*, 11:5.

In the pursuit of a PhD in Neurosciences, with a focus on Systems Neurosciences, my journey is anchored in a commitment to unraveling the complexities of mental health, specifically targeting schizophrenia. The profound impact of this disorder on individuals and society has steered my academic and professional trajectory. My fascination with schizophrenia extends beyond its clinical manifestations; it delves into the intricate interplay of genetics, neurobiology, and environmental factors. The captivating challenge presented by this mental disorder is not merely scientific but also societal. I envision a comprehensive approach that integrates cutting-edge technologies, such as fMRI and PET scans, with advanced computational modeling, to gain insights into the biological underpinnings of schizophrenia. I am committed to bridging the gap between Aerospace Engineering and Neuroscience, utilizing my skills in data analysis and collaborative research. My expertise aligns seamlessly with the demands of investigating the genetic facets of schizophrenia. As a researcher, I am dedicated to applying rigorous analytical techniques to complex biological and genetic problems. My dissertation spans five years, encompassing data collection, neuroimaging and genetic data analysis, mathematical model development, validation, and eventual publication and collaboration. The intellectual merit of this research lies in its multidisciplinary approach, bringing together precision biology, technology, and mathematical frameworks to innovate mental health studies.

In the intricate tapestry of my life, I emerge as a storyteller, poet, musician, engineer, and scientist. My journey from a quiet town in Iowa to the halls of academia at Caltech has been shaped by diverse experiences, culminating in my pursuit of a PhD in Neuroscience at Stanford.

A pivotal moment in my journey was the mentorship of Don, a wise individual born without the ability to hear or communicate. Don introduced me to the "music of silence," reshaping my perspective on life. Inspired by this, I ventured into aerospace engineering, where I discovered the beauty of fractal mathematics—a reflection of the chaos and order within my neurodiverse mind. My academic background in Micro-Electro-Mechanical Systems (MEMS) showcases my dedication to precision design and innovation. However, it's the intersection of applied mathematics, statistics, and mental health research that defines my unique academic path. My research objectives transcend traditional boundaries, aiming to develop novel diagnostic tools using mathematical models for early insights into mental health disorders. Beyond research, I am committed to advocating for neurodiverse individuals, fostering inclusivity in STEM fields. Obtaining the Stanford Research Fellowship is not just a financial support milestone but a validation of my commitment to the intersection of mathematics, mental health, and neurodiversity. The Stanford community aligns seamlessly with my goals, offering opportunities for professional development and impactful research. In conclusion, my academic journey is a celebration of diversity, an exploration of chaos and order, and an ode to the harmonious interplay between mathematics and the human mind. As I stand at the threshold of graduate research, I aspire to transform mental health diagnosis and treatment, advocating for neurodiversity in STEM fields.

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## Program Supplemental

### Program Selection 1

Neurosciences (PhD)

### Program Selection 2

Biomedical Data Science (PhD)

### Academic Interests

Immunology Track

Neurosciences Area

Systems Neurosciences

### Faculty Interests

Faculty Member 1

Poldrack, Russell

Faculty Member 2

Deisseroth, Karl

Faculty Member 3

Boahen, Kwabena

Faculty Member 4

Luo, Liquun

Faculty Member 5

Nelson, William

Faculty Member 6

Shatz, Carla

Faculty Member 7

Coleman, Todd

Faculty Member 8

Giocomo, Lisa

Faculty Member 9

Hernandez-Lopez, Rogelio

Faculty Member 10

Kingsley, David

Faculty Member 11

Heller, H. Craig

Faculty Member 12

Raymond, Jennifer

Other Faculty Interests

### Total Months of Research Experience

72 months

### Describe an Interesting Biological or Biomedical Problem

Schizophrenia's profound impact on individuals and society has drawn me into its captivating realm. This intricate mental disorder, which disrupts perception, thinking, and behavior, holds immense significance for both science and psychiatry, affecting millions globally. Understanding it has far-reaching implications.

Scientifically, unraveling schizophrenia involves studying genetics, neurobiology, and environmental factors. This multidisciplinary approach combines genetics, neuroscience, psychology, and computational modeling to gain insights and develop better tools and treatments. Recent technological advancements, like fMRI and PET scans, visualize brain abnormalities, aiding biomarker identification.

Beyond the scientific realm, schizophrenia exerts a profound societal impact. Individuals grappling with schizophrenia encounter formidable personal and professional challenges, while their families and communities extend vital support and care.

In conclusion, schizophrenia presents an enthralling and formidable avenue for scientific exploration with profound implications for psychiatry. My expertise in data analysis, collaborative research, and dedication to mentorship align seamlessly with the skills essential to make a substantial impact in this field and underscore my capacity to apply rigorous analytical techniques to intricate problems. This aptitude is poised to play a pivotal role in investigating the intricate biological and genetic facets of schizophrenia.

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## Program Supplemental

### Foundations of Graduate Study

#### Multivariate Mathematics

Multivariate Mathematics: Throughout my undergraduate studies in Aerospace Engineering, I completed rigorous coursework in Calculus and Linear Algebra. These courses provided me with a solid understanding of multivariate mathematics, including concepts such as vector calculus, partial derivatives, and matrix operations. Additionally, I have applied these mathematical principles in various research projects, such as my work on the design of multi-function 3D piezoelectric devices for aeronautical applications. This experience has allowed me to develop a practical understanding of how multivariate mathematics can be applied to real-world engineering problems.

#### Probability and Statistics

Probability and Statistics: I have a strong background in probability and statistics, which I have acquired through both coursework and research. In my undergraduate studies, I completed advanced courses in probability theory and statistical analysis. I have also applied these concepts in my research projects, such as my work on characterizing damping mechanisms in piezoelectric wind-energy harvesters. I have experience in data collection, analysis, and interpretation, and I am proficient in statistical software packages such as R and Python. I am confident in my ability to apply statistical methods to analyze complex data sets and draw meaningful conclusions.

#### Computation

Computation: I have a solid foundation in the fundamentals of computer science and software engineering. In addition to coursework in programming languages such as C++ and Java, I have practical experience in coding through my research projects. I have utilized computational fluid dynamics (CFD) simulations, developed data capture systems, and assisted graduate students with computer technology capabilities. I am proficient in MATLAB, Python, and other programming languages commonly used in scientific research. My experience in computation has allowed me to effectively analyze and visualize data, as well as develop computational models to solve complex engineering problems.

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## Additional Information

### Other Stanford Applications

Are you applying to the Graduate School of Business, Law School, or School of Medicine?  Yes  No

Degree Program(s)

KHS Application ID  
380908985

Are you applying to Knight-Hennessy Scholars?  Yes  No

### Prior/Current Stanford Affiliation

Have you ever been enrolled in an undergraduate or graduate degree program at Stanford?  Yes  No

Have you previously applied for admission to undergraduate or graduate study at Stanford?  Yes  No

Level of Study      Graduate Degree Program      Graduate Entry Year  
Undergraduate

Do you have any prior or current affiliation with Stanford (e.g., non-degree student, visiting student researcher, staff member)?  Yes  No      Stanford ID

Affiliation Status & Dates

Summer Undergraduate Research Fellowship (SURF) Scholar Alumni Start: 06/15/2021 End: 08/23/21

### Other Graduate Schools

MIT-Harvard Joint PhD Health Sciences & Technology: Medical Engineering and Medical Physics. Research Focus with BioAstronautics Training Program.

### External Funding for Graduate Study

Award Name	Funding Duration & Amount	Status
-Mercury Project Partnership -- Social Science Research Council	If accepted, I may submit an application with the support of a faculty member for a dissertation.	Applying
Fulbright-National Geographic Award	1 Year - TBA	Applying
NSF Graduate Research Fellowship Program	5 Years - TBA	Applying

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# MEMS Project

# 2023 January Progress

Author: Yahriel Salinas-Reyes

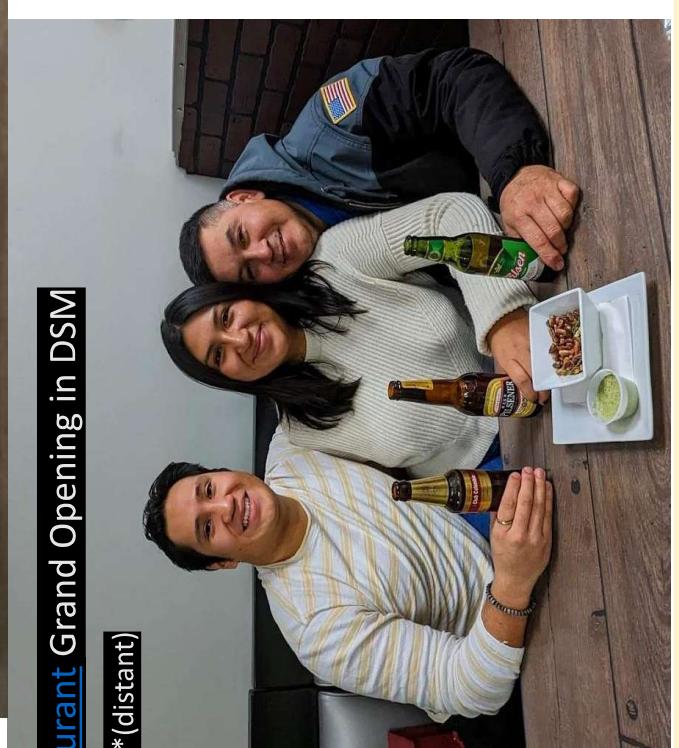
Mentors: Dr. Thomas Ward & Dr. Martin Thuot

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*Department of Aerospace Engineering*

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Happy New Years!



Additional Information (Visible to Applicant)

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## Meeting Agenda

- Happy New Year's + Updates
- Scheduling + Research Work
- Address Uploaded Materials (Cybox)
- Crafting a Manuscript
- Visuals Progress
- Solidworks & Open Discussion

Additional Information (Visible to Applicant)

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## Updates and Check-In

After some deep reflection over break, this is what I've learned.

### Priorities & Plan:

- Eliminate Distractions → Left IT Position
- Focus & Availability → Freedom To Pursue Interests
- Dedicate My Best → Commit To Personal Development & Dreams

Action Item: Drop 490 Credit and request compensation for research position

### Messages:

- I am more motivated and excited than ever; I am ready for what's next!
- I am fully dedicated to our research and path to Ph.D.
- Willing and grateful to accept any guidance or feedback offered
- \*(Me-to-you)\* If you will have me, I offer my full capacity and service as a researcher

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## Semester Availability

	06:00	07:00	08:00	09:00	10:00	11:00	12:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00
Mon																
Tue								AER E 461								
Wed									AER E 301							
Thur									AER E 461							
Fri																
Sat																

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# Cybox Materials

 Crafting A Manuscript MEMS (INCOMING)	1/12/2023 4:19 PM	Microsoft PowerPo...	4,387 KB
 Experimental Work (FULL COMPLETE)	1/12/2023 4:16 PM	File folder	
 SWP	1/12/2023 3:51 PM	File folder	
 Background Lit	1/12/2023 1:50 PM	File folder	

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## Scientific Writing Program (SWP)

### Offers:

- Manuscript Writing Track (multi-year)
- Thesis Development Track (multi-year)

Additional Information (Visible to Applicant)

Project Name: Stakeholder management	File name:	Start date	End date	Status	Comments
Advisor					
Other					
Project Plan					
This project aims to:					
Sub-question 1					
Experimental approach 1					
Task 1					
File 1					
File 2					
File 3					
Task 2					
Task 3					
Data collection					
Data analysis					
Methods write-up					
Summary of results					
Experimental approach 2					
Task 1					
File 1					
File 2					
File 3					
Task 2					
Task 3					
Data collection					
Data analysis					
Methods write-up					
Summary of results					
Sub-question 2					
Experimental approach 1					
Task 1					
File 1					
File 2					
File 3					
Task 2					
Task 3					
Data collection					
Data analysis					
Methods write-up					
Summary of results					

Background Literature	File name:	Start date	End date	Status	Comments
Manuscript 1					
Summary Ms 1					
Summary Ms 2					
Summary Ms 3					
Summary Ms 4					
Summary Ms 5					
Summary Ms 6					
Summary Ms 7					
Summary Ms 8					

Writing Plan	File name:	Start date	End date	Status	Comments
Introduction					
Draft 1					
Draft 2					
Experimental Details					
Draft 1					
Draft 2					
Results and Discussion					
Draft 1					
Draft 2					
Conclusion					
References					

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## Experimental Work

### Research Journey Through All 4 Years

#### Related Files:

MEMS Soph. Year End	1/12/2023 2:29 PM	Microsoft PowerPo...	87,638 KB
MEMS Junior Year Midterm	1/12/2023 2:29 PM	Microsoft PowerPo...	69,817 KB
MEMS Junior Year End	1/12/2023 2:29 PM	Microsoft PowerPo...	70,246 KB
MEMS Fresh. Year GMIS Poster	1/12/2023 2:29 PM	Microsoft PowerPo...	12,315 KB
Demos	1/12/2023 2:28 PM	File folder	
Model Files (CAD & ANSYS)	1/12/2023 2:25 PM	File folder	

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## Background Lit

### All Related Papers/Writings Which Have Been Used In This Work

#### Related Files:

 Material Science	1/12/2023 1:50 PM	File folder
 Project Related Papers	1/12/2023 1:50 PM	File folder
 Data Analysis	1/12/2023 1:50 PM	File folder

Additional Information (Visible to Applicant)

# Crafting A Manuscript

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*Department of Aerospace Engineering*

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## Journal Publishing Opportunities

### Main Publisher Candidates

- **(ASME)** The American Society of Mechanical Engineers



- [Journal Archive](#)
- [Journal Author Guidelines](#)

- **(AIP)** American Institute of Physics



- [Journal Archive](#)
- [Journal Author Guidelines](#)

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### Journal Selection



#### Top Choice

- [Open Journal of Engineering](#)



#### Top Choice

- [Journal of Undergraduate Reports in Physics](#)

#### Secondary Choices

- Mechanical Design
- Manufacturing Science & Engineering
- Engineering Materials & Technology
- Electrochemical Energy Conversion & Storage
- Renewable & Sustainable Energy
  - Machine Learning
  - Energy
- Chaos: Interdisciplinary & Nonlinear Science

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## Developing a Framework

- Study Target Audience
  - Specialist vs General/Non-specialist Readers
- Publishing + Journal Opportunities
- Review Scope of Research
- Create General Structure

Additional Information (Visible to Applicant)

Draw a logical path that guides the reader through the following:

- Why the topic is of broad interest
- The current state of knowledge on the topic
- Why the system or method is a good choice to study the topic

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# Identifying Themes & Stakes

- Make Story Relevant
  - Framing the research question/topic as a shared problem with the audience
- Communicating The Major Takeaways
  - Develop claims and show agency as a researcher
  - Help reader interpret the results section (w/ level of details required)
  - Provide clear + logical progression from **Background → Rationale → Results + Conclusions**
- Produce a Comprehensive Scientific Dramatic Arc

Additional Information (Visible to Applicant)

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## Building A Narrative

- Results and Rationale
  - Report findings + present the clearest narrative, allowing reader to understand the story
- Methods and Credibility
  - Describe the author's initiative and agency as a researcher
  - Describe experimental approach and analytical techniques and processes used
  - Provide level of detail required and acknowledgements
- Interpretations and Discussion
  - Draw together supporting information and elaborate upon interpretations that cut across experiments and data sets.
  - Find a balance between providing the rationale for your conclusions while also being succinct

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## Addressing Elements

### • Evaluate Subsections

Each subsection should support a conclusion and include the following content:

- Explanation of underlying hypothesis with a clear rationale as to why you performed each experiment
- Brief description of experimental set-up—in depth explanation isn't necessary as the reader can reference the methods section for greater detail.
- Specific mention of each panel of the figure when referring to the data (as opposed to citing the entire figure at the end of the section)
- Brief summary of the results in the subsection to help the reader reinforce their understanding of the figures
- Short interpretation can be used to transition into the next section, if this forms the basis of the rationale for the next series of experiments.

## Evaluate Logical Framework

Each major finding should answer the following:

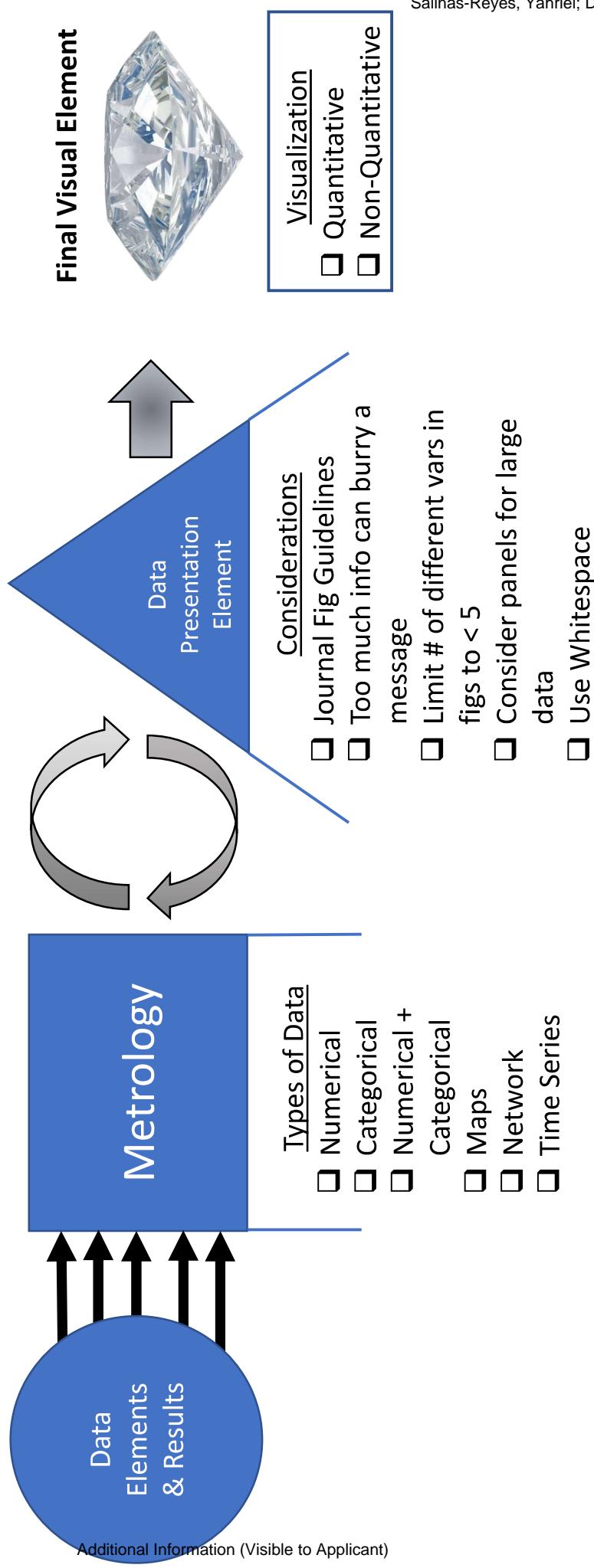
- How do your results fit with what is published in the field?
- Is there already a consensus or is there confusion?
- Do your findings support other published work? If so, how? If not, how are they different?
- What might be some of the reasons for any differences, and what might this tell you? For instance, are there differences in the method, the underlying system, or the analysis that could explain the discrepancy?
- If there are technical constraints that prevent you from performing a direct comparison with published results, then elaborate.

# Visuals Progress: Communicating Data Through Visualization

“When selecting which type of data graphic or chart to use, we consider these **primary factors: type of data, the audience, and the purpose of the visual.**” -Yahriel S.R. (with agency)

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*Department of Aerospace Engineering*

# Choosing The Right Type of Data Visualization



# Visualizing Quantitative Data

What kind of data do you have? Pick the main type using the buttons below. Then let the decision tree guide you toward your graphic possibilities.

[Numeric](#)

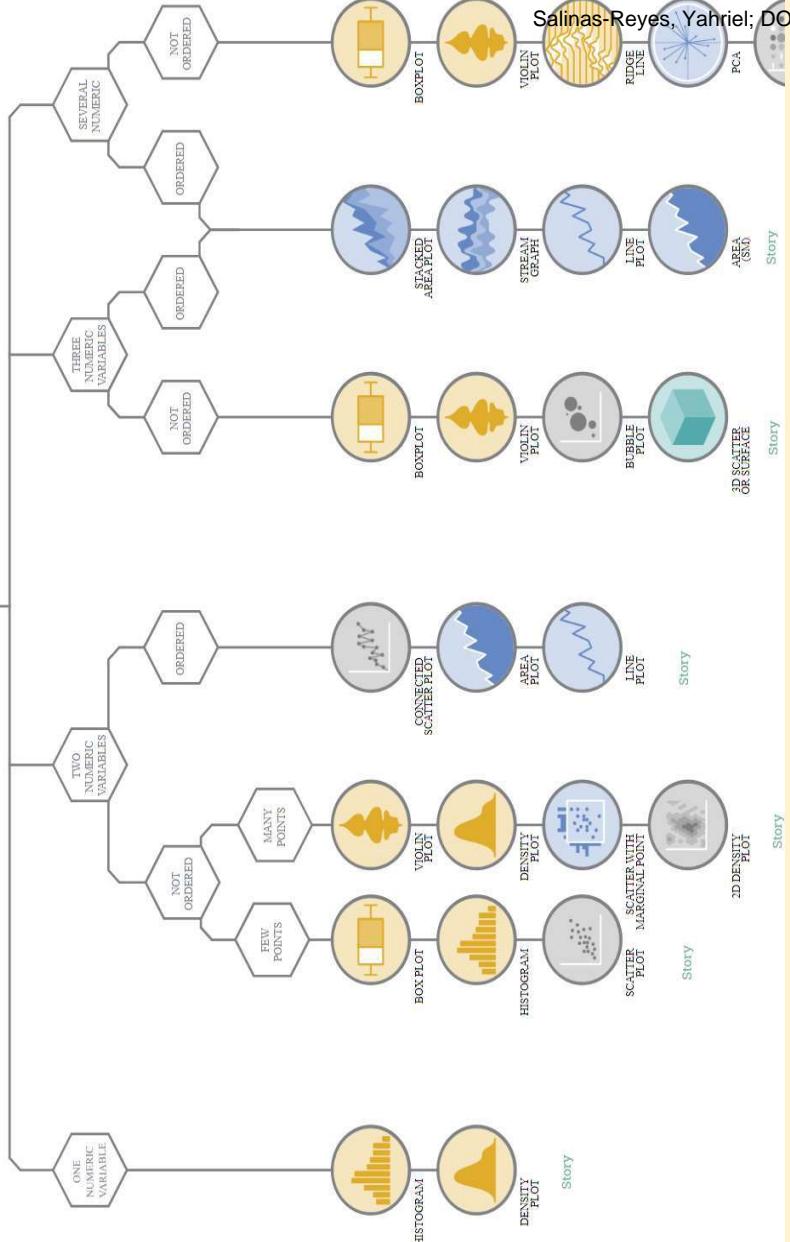
[Categorical](#)

[Num & Cat](#)

[Maps](#)

[Network](#)

[Time series](#)



- Analyze Results

- Use [Data2Viz Tool](#) to select Viz

- Consider the criteria:

- Type of Data
- The Audience
- The Purpose

Additional Information (Visible to Applicant)

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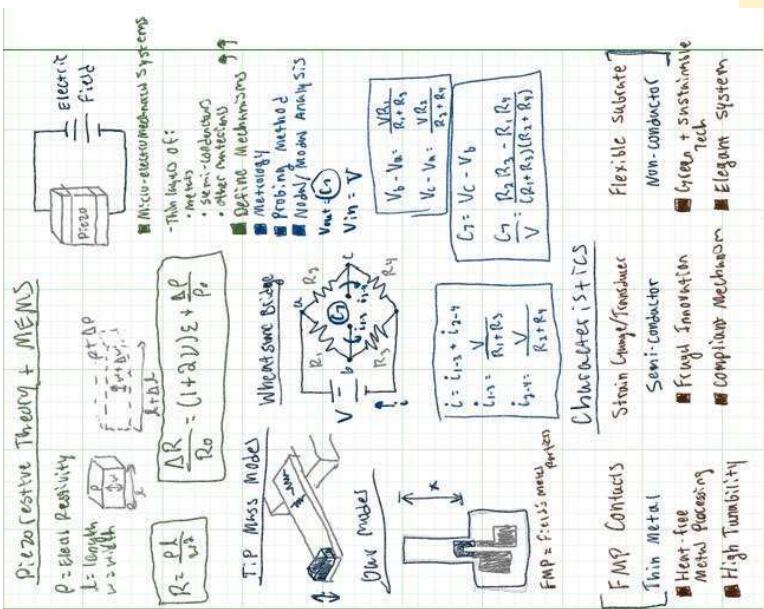
# Visualizing Non-Quantitative Data \*\*\*Current Step\*\*\*

"There are opportunities to use visuals beyond graphs to illustrate a proposed interaction and convey or summarize information effectively."

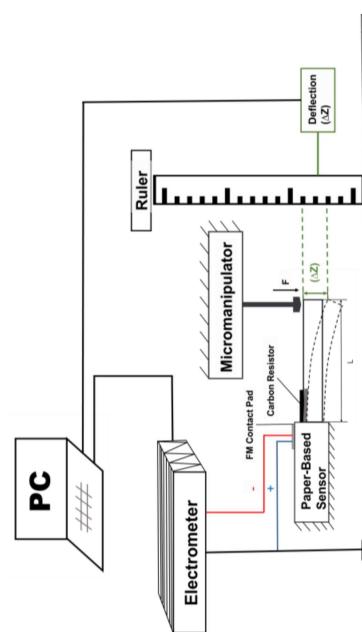
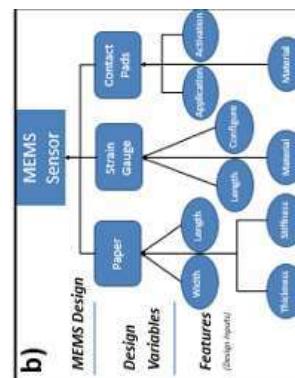
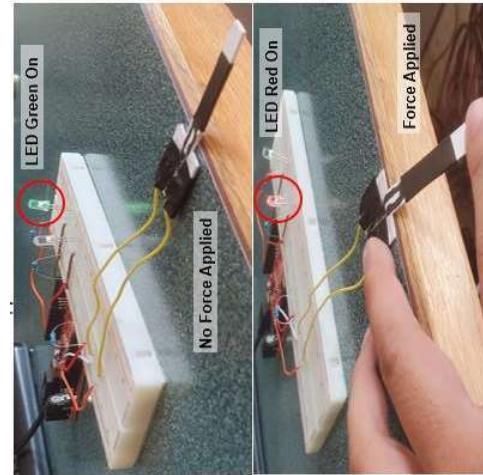
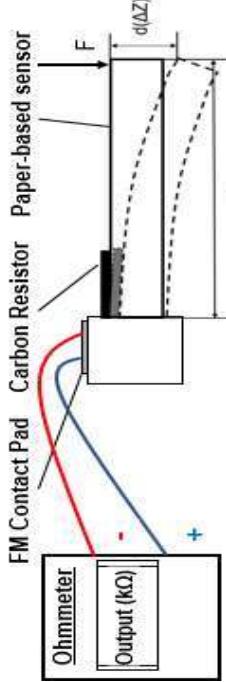
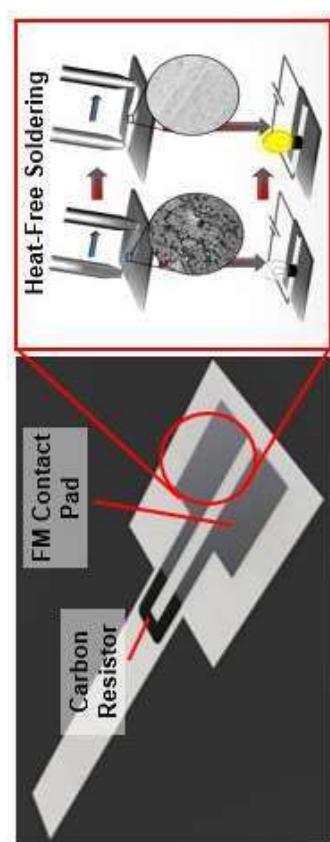
## • MEMS Model

- Key Concepts
- MEMS Characteristics
- Elements of System
- Design of Experiments
- Themes\* relevant to Narrative\*

Additional Information (Visible to Applicant)

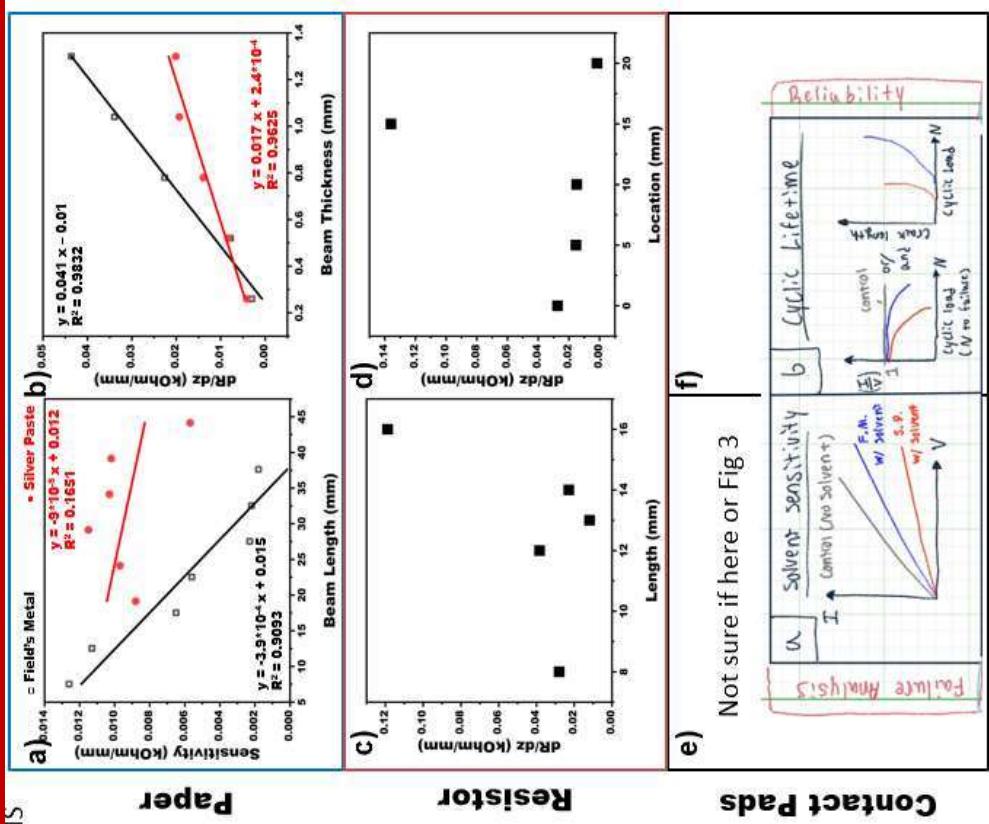
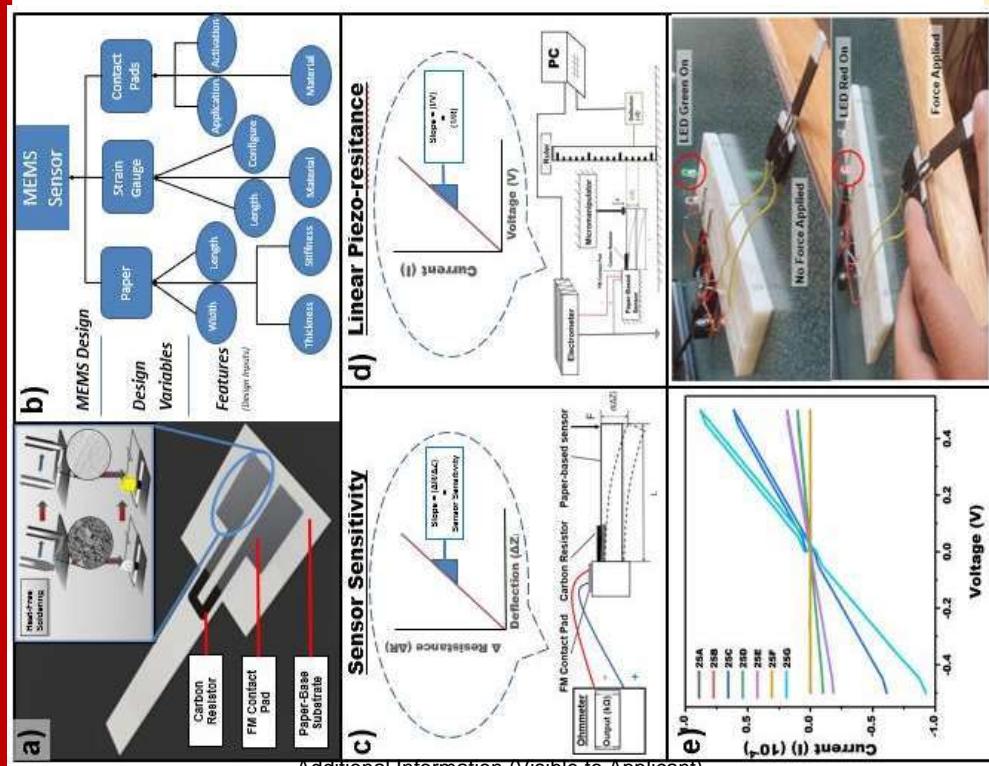


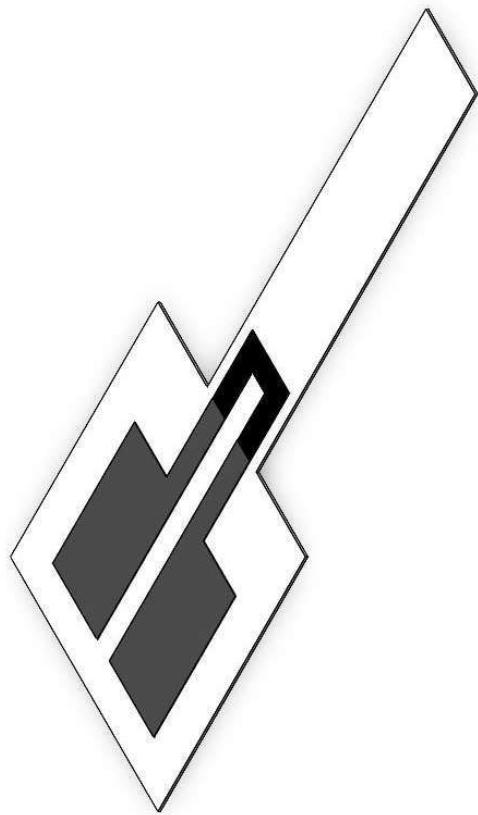
## Early Concepts



**Goal: Distill all data and visual elements to only what is necessary and most effective**

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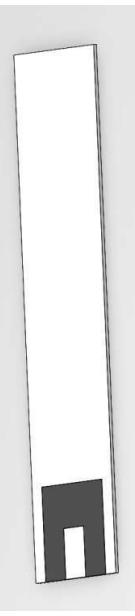
# MEMS CAD Examples

Illustrating Our Model

# Copy

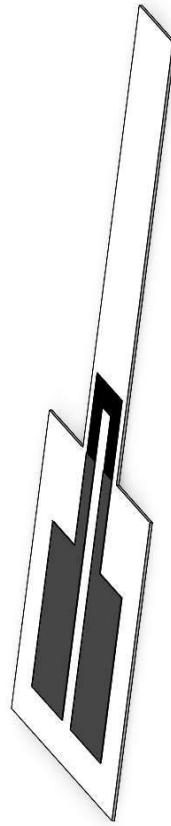
Salinas-Reyes, Yahriel; DOB: 11/11/2000; ID: 619715613

Simple Cantilever & Resistor (Free)

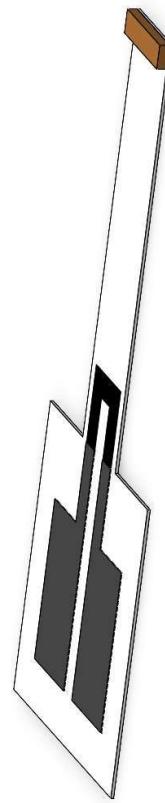


Isometric View

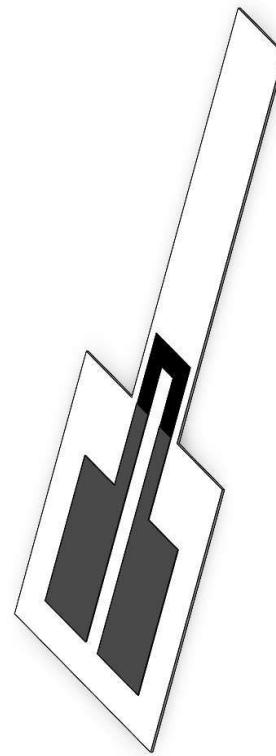
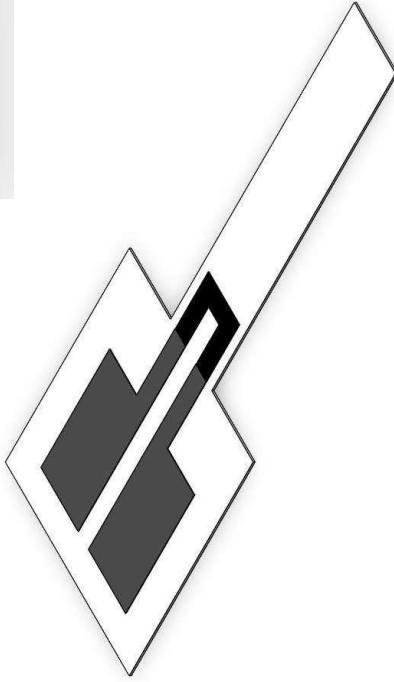
Dimetric View



Tip-Mass Model



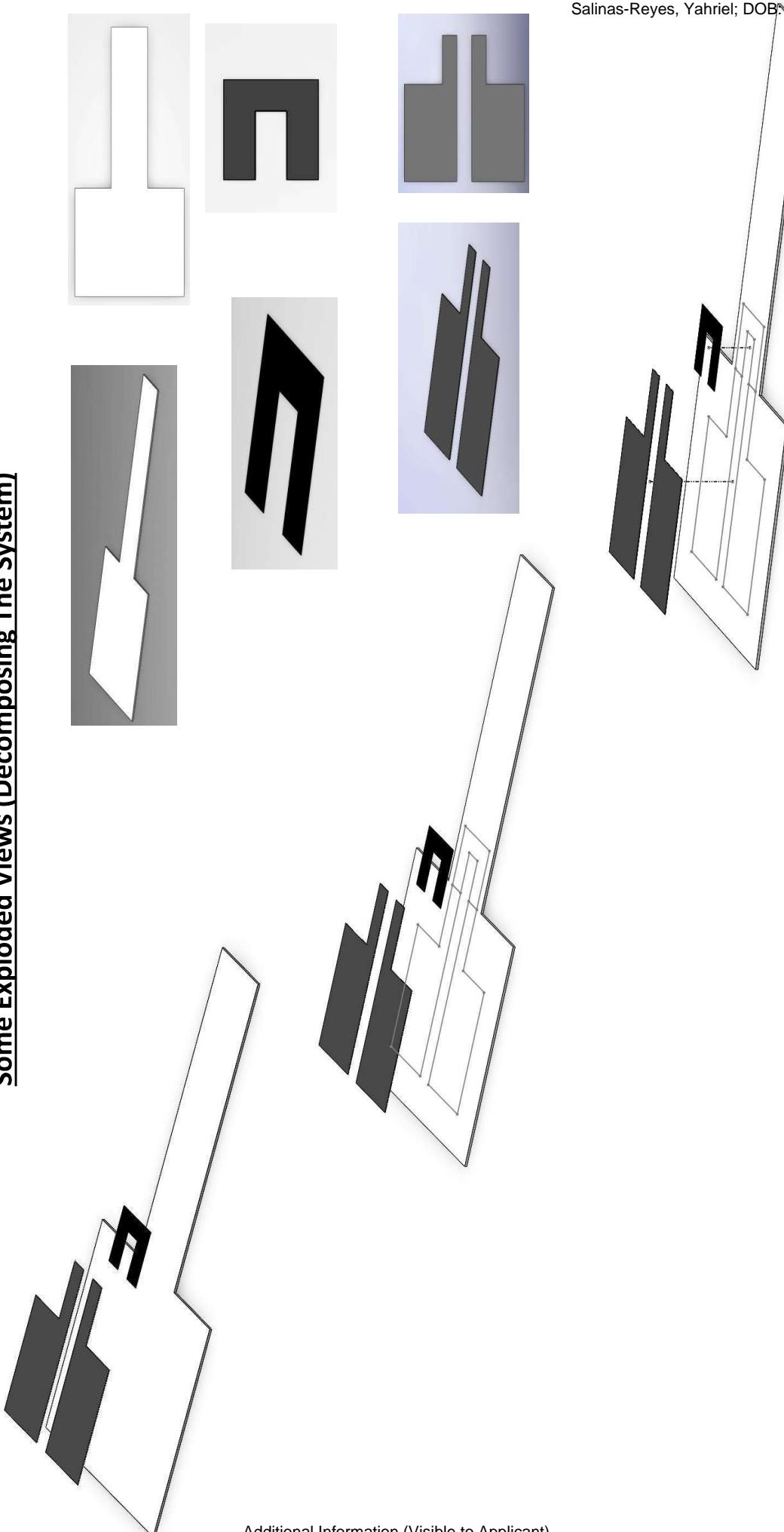
Trimetric View



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Salinas-Reyes, Yahriel; DOB: 11/11/2000; ID: 619715613

Some Exploded Views (Decomposing The System)



# Evaluating Visuals Checklist

## FIGURE DESIGN

- Can someone quickly get the takeaway message by looking at my figure?
- Are data directly labeled where possible?
- Are there fewer than 5 variables in my figure? If not, can I split it into multiple panels or figures?
- Is the weight of lines or points thick enough for good readability?
- Should any gridlines be removed to optimize readability?

## TEXT

- Does the title summarize my takeaway message?
- Does the title accurately reflect the underlying data?
- Do the axes names clearly convey what is being measured?
- Is all text legible for print or presentation?

## COLOR

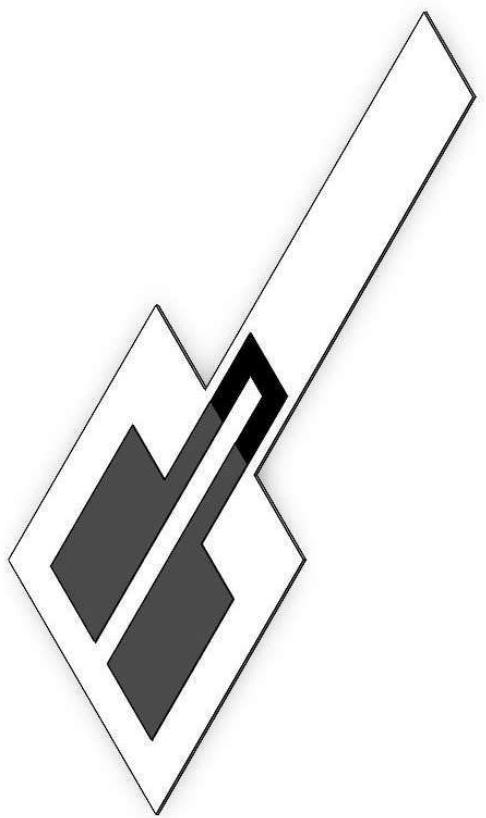
- Do the colors I'm using assist in conveying information?
- Can my visual be interpreted by those with a color deficiency? Use <http://colororacle.org/> to test your image.
- Will my color scheme be effective if displayed across multiple devices and media?
- Is there enough contrast between my visual elements and the background?

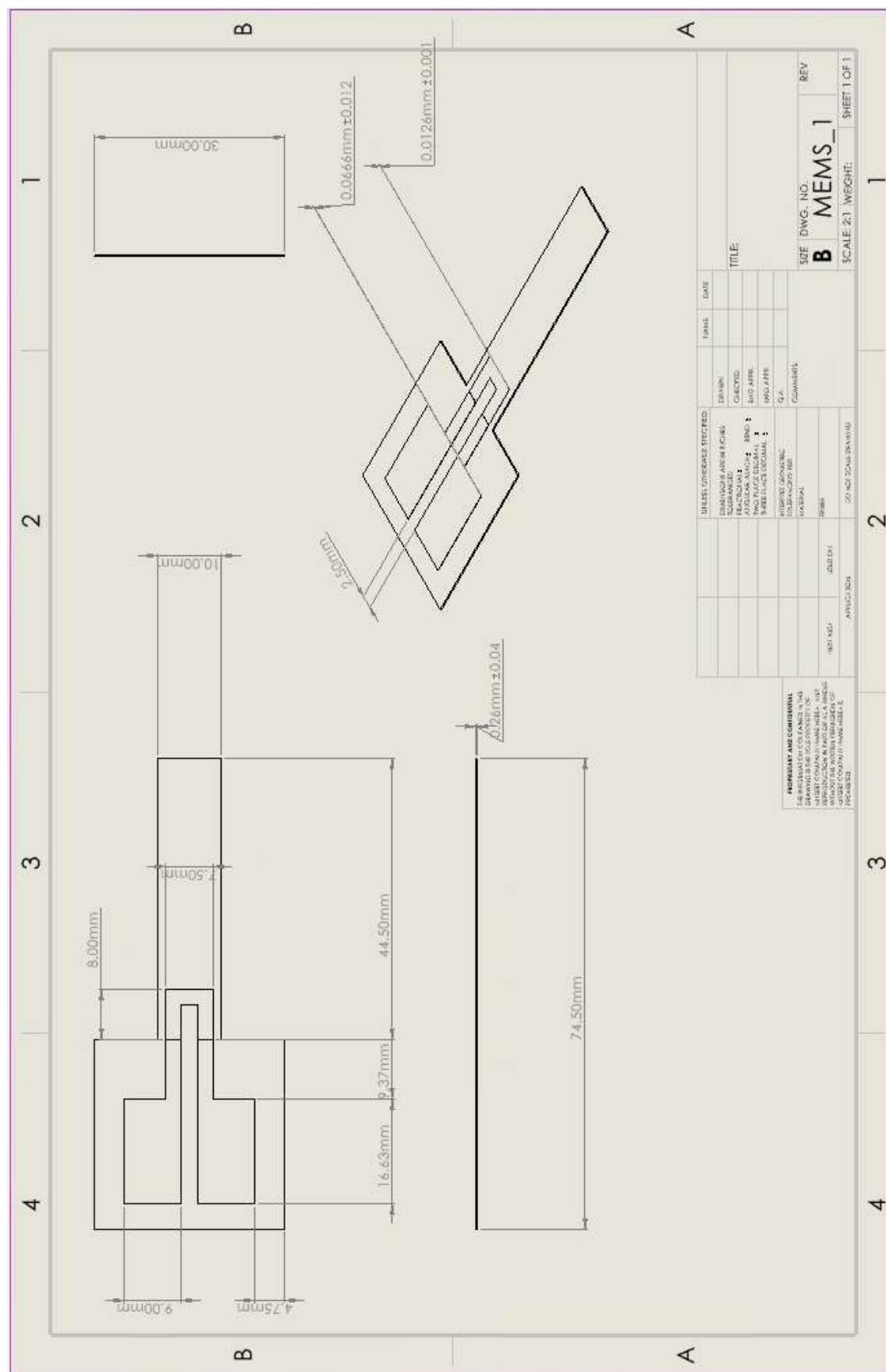
## LEGEND

- Does the legend mirror the text & terminology used elsewhere in the work?
- Does the legend include appropriate information on sample sizes and statistical tests?
- Is the legend written in full sentences?
- Does the legend use past tense for method description?

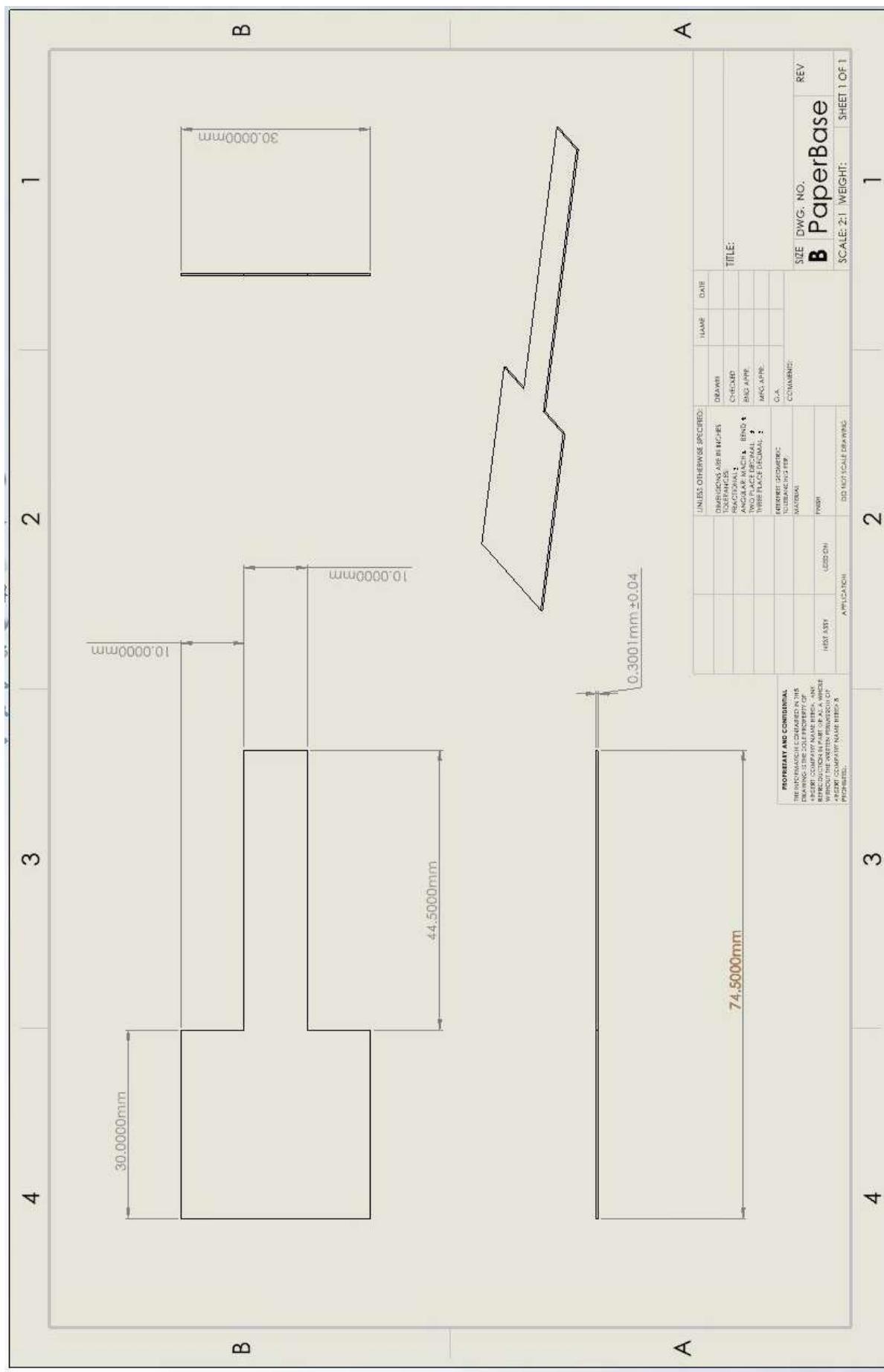
# MEMS Example CAD Drawings

Defining Our Model

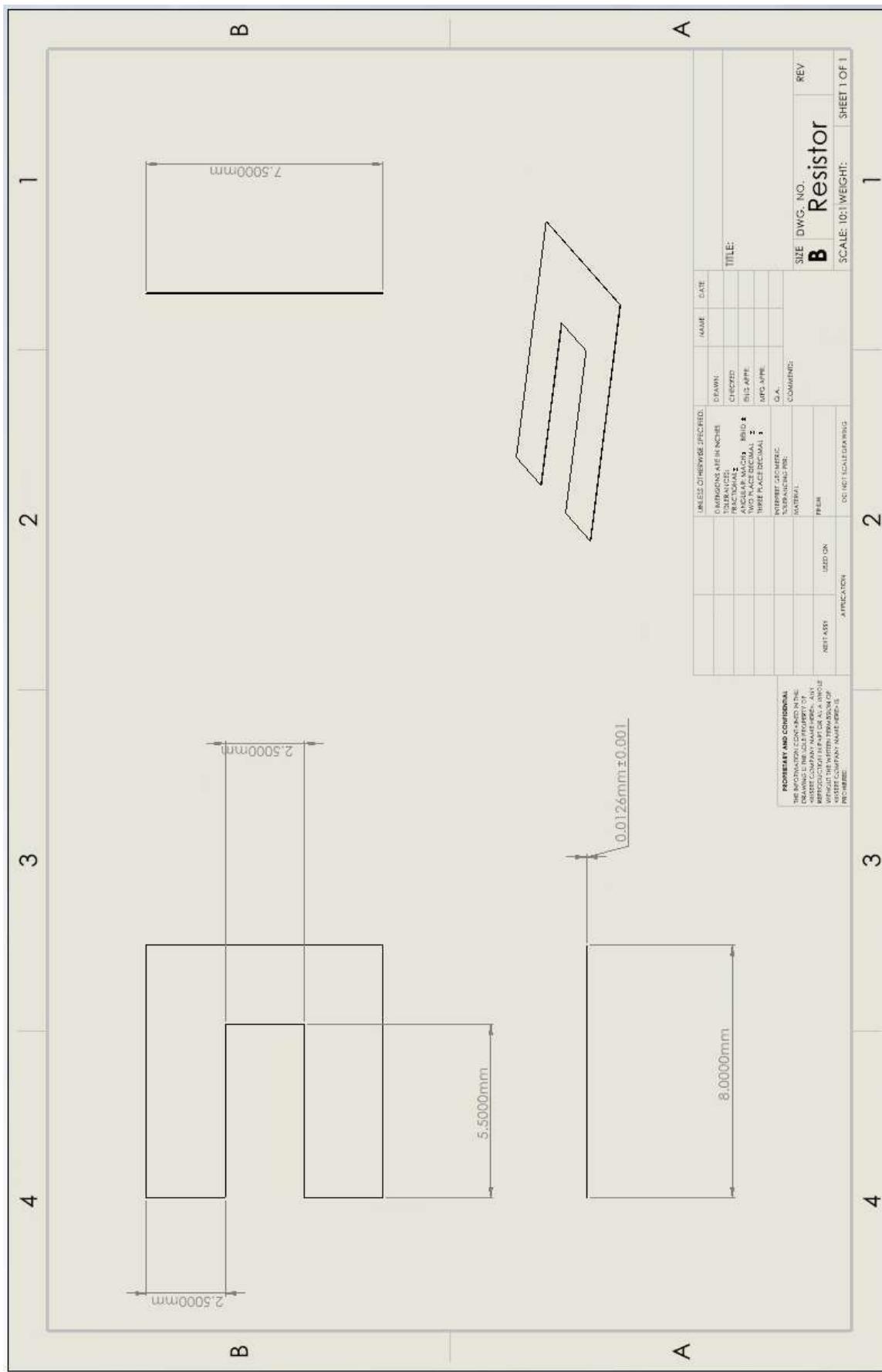




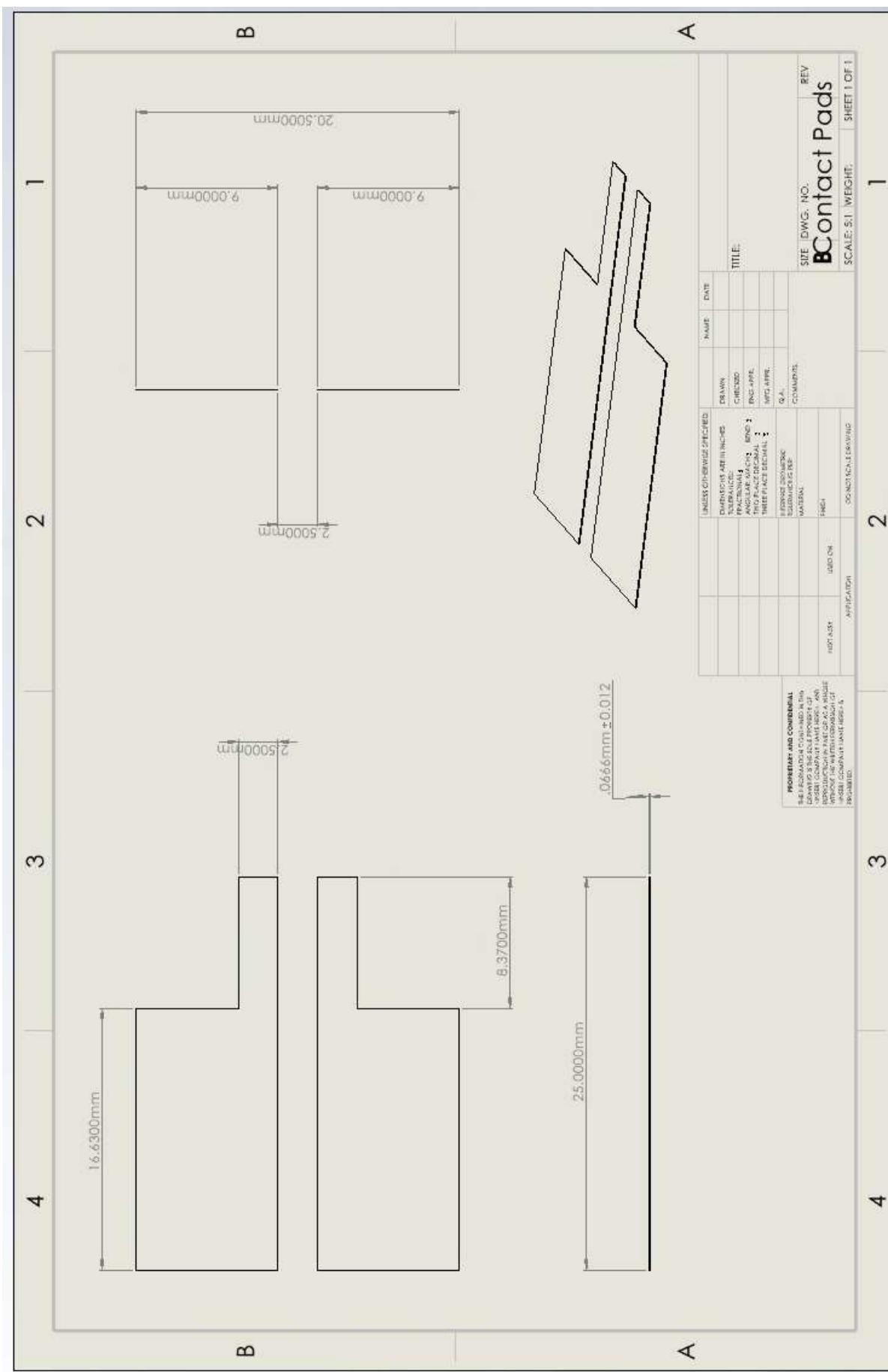
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# Open Floor

MICROSCALE AND INTERFACIAL FLUID PHYSICS LABORATORY  
*Department of Aerospace Engineering*

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## Personal Statement

### **Yahriel Salinas-Reyes, Fulbright-Garcia Robles Open Study/Research Award Molecular & Systems Bioengineering towards Neuroscience**

In the realm of mathematics, the concept of chaos game originally alluded to a method of generating fractals—intricate geometrical patterns that seem to symbolize the fractured nature of reality itself. The intricate dance of numbers, shapes, and chaos mirrors my own journey through life, marked by a tapestry of neurological and neurodevelopmental challenges.

My story is one of resilience, determination, and an unquenchable thirst for knowledge, and has been anything but conventional. From an early age, I grappled with ADHD, PTSD, anxiety, and autism. These neurological conditions, instead of being impediments, have become the driving force behind my academic pursuits. I realized that within the chaos of my mind, there was an unexplored realm of creativity and analytical thinking. However, life had more challenges in store. Hearing loss and a speech impediment made communication a daily struggle. But rather than let these barriers silence me, I embraced the power of written expression. Writing became my voice, a medium through which I could convey my ideas, emotions, and discoveries. As I embarked on my academic journey, I encountered a myriad of obstacles that tested my resolve. Financial challenges loomed large, threatening to derail my dreams of higher education. Yet, I persevered, seeking scholarships and part-time work to support my studies. I also navigated the language barrier, as English is not my first language, and adapted to the demands of college life in a new world. Physical health issues further complicated matters. Sciatica, a debilitating condition, left me bedridden and unable to attend classes. Still, I did not relent. I leveraged technology to engage with coursework remotely, demonstrating my unwavering commitment to my education. In the midst of these personal challenges, I took on the role of the primary caretaker for my mother, who battled severe health issues. This responsibility, while emotionally taxing, underscored the importance of resilience and compassion. It reinforced my belief in the power of empathy and understanding, qualities I have carried into my academic pursuits. The most recent chapter in my life introduced a new set of challenges—adjusting to mental health medications and diagnoses. While the journey to stability has been arduous, it has deepened my empathy for those facing similar struggles and ignited my interest in the intersection of mathematics and mental health. My experiences have shaped my academic journey and my aspirations. I am driven by a passion for fractal mathematics, drawn to the beauty of patterns that emerge from chaos. I see parallels between the complexity of fractals and the human mind, and I am determined to explore these connections. Through these trials, I discovered a profound truth: our stories are woven into the tapestry of science and art. We tell stories to make sense of the world, to illuminate the unknown, and to connect with others. In Mexico, I hope to immerse myself in the rich mathematical heritage of the country, studying under esteemed mentors who can help me unlock new dimensions of fractal mathematics. I envision collaborative research projects that bridge the gap between mathematics and neurodiversity, shedding light on the intricate patterns of the human mind. My story is one of resilience, determination, and an unshakable belief in the transformative power of education. Amid the chaos of life's challenges, I have emerged as a passionate scholar, ready to contribute to the world of mathematics and advocate for the value of neurodiversity. I am eager to embark on this Fulbright journey, where I can explore the marvel of the human spirit, using mathematics as my compass to navigate the intricate patterns of our world. Together, we will write a new chapter in the wondrous story of human ingenuity, science, and nature itself.

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## Statement of Grant Purpose

**Yahriel Salinas-Reyes, Host Country: Mexico, Field: Molecular & Systems Bioengineering**

**Project Title: Unraveling the Molecular Code of Natural Antidepressants in Grapes**

In the ever-evolving world of scientific inquiry, certain moments emerge as profound intersections of human ingenuity, scientific inquiry, and the enigmatic wonders of nature. Encapsulated within this project is one such moment. With a central focus on unraveling the molecular code of grapes to find the compounds responsible for its potential natural antidepressant properties, Yahriel Salinas-Reyes aims to foster innovation in treatments for mental health disorders and conditions. Also encompassed in the project is an investigation into the nature of schizophrenia and the complexities of neuroplasticity, in hopes of advancing understanding of the mental illness. The overarching goal is to address the mounting global health crisis presented by mental health disorders, including depression and schizophrenia, which have surged to an unprecedented global health crisis significantly diminishing the quality of life for millions and placing immense pressure on healthcare systems worldwide.

At its core, the project is driven by the ambition to conduct a comprehensive molecular analysis of grapes, with a particular emphasis on understanding the genetic and molecular mechanisms governing the synthesis of antioxidants. Grapes have garnered scientific interest due to their potential health benefits and their recent recognition as potential natural antidepressants. Yahriel's unique background in aerospace engineering and micro-electro-mechanical systems (MEMS) equips him with the precision and expertise required to delve into the microscopic realm of chromosomes and molecules—an essential prerequisite for unveiling the genetic secrets grapes hold. To fulfill the project's objectives, advanced techniques in molecular biology and biotechnology systems engineering will be employed. The primary goal is to pinpoint the specific compounds within grapes responsible for their potential antidepressant properties, involving their isolation and characterization to illuminate their mechanisms of action within the brain. The aim is to identify practical applications for mental health treatment by comprehending the genetic and molecular foundation of natural antidepressant production in grapes.

Concurrently, this research adopts a multifaceted approach to unravel the complexities of schizophrenia, a debilitating and chronic mental disorder characterized by symptoms such as delusions, hallucinations, disorganized speech, and cognitive deficits. At the heart of schizophrenia's enduring enigma are Bleuler's four A's: Alogia, Autism, Ambivalence, and Affect blunting. Extensive research has explored the etiology of schizophrenia, leading to the emergence of three prominent theories: genetic, neurodevelopmental, and neurobiological. Each theory offers a distinct perspective on the origins of this complex disorder, making it challenging to pinpoint a single causative factor. Nonetheless, neurobiological theory has gained prominence due to its comprehensive approach, explaining schizophrenia as a result of abnormal brain dysfunctions or structural anomalies. This theory stands on solid scientific ground, holds promise in guiding treatment strategies, transcends cultural and demographic boundaries, and raises fewer ethical concerns compared to alternative theories. Structural and functional abnormalities in key brain systems (i.e., the prefrontal & medial temporal lobes) play a pivotal role in the manifestation of schizophrenia symptoms that are integral to working memory and declarative memory processes. The disrupted functioning contributes to cognitive impairments and emotional dysregulation in individuals with schizophrenia. In the quest to understand schizophrenia, neuroplasticity—the brain's remarkable capacity to adapt and reorganize itself in

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## Salinas-Reyes, Statement of Grant Purpose, Page 2

response to learning, experiences, and environmental changes—emerges as a crucial factor operating at various levels, from synaptic plasticity, where the strength of connections between neurons is modified, to large-scale changes in brain structure and function. In the context of schizophrenia, neuroplasticity offers hope for improving cognitive functioning and overall quality of life for affected individuals. Research has shown that cognitive remediation therapies—which harness neuroplasticity—can lead to improvements in cognitive domains such as memory, attention, and problem-solving, mitigating some of the cognitive impairments associated with the disorder.

This project is founded on the belief that nature holds the key to addressing complex health challenges, including mental health disorders like depression and schizophrenia, and seeks to explore the potential of grapes as a source of natural antidepressants.. One intriguing entry point into the complex world of grape biochemistry is through the study of yeast used in wine production, which plays a pivotal role in the fermentation process, and influences the composition of compounds within grapes. Scientific evidence unveiled that certain molecular compounds in the antioxidants act as natural antidepressants but there lacks initiative to utilize these antioxidant agents in psychiatric institutions and practical methods. By employing advanced techniques such as neuroimaging, fractal geometry, and spectral analysis, the project aims to unveil underlying patterns and causative factors associated with depression and related mental health conditions. The significance of this research extends far beyond the development of new treatments. It encompasses a broader understanding of the intricate relationship between food, biochemistry, and mental health. This knowledge has the potential to inform dietary recommendations that promote mental well-being, potentially reducing the global prevalence of these disorders.

Yahriel, and the research team at the university Tecnológico de Monterrey endeavor to decode the molecular secrets of nature to improve the human condition, particularly for individuals affected by schizophrenia and other mental health disorders. Yahriel's work represents a convergence of scientific rigor, interdisciplinary collaboration, and a profound commitment to the betterment of human well-being. Furthermore, this research holds the potential to strengthen international collaborations between the U.S. and Mexico. By conducting research at Tecnológico de Monterrey, Yahriel can contribute to the exchange of knowledge and ideas between the two countries, fostering a stronger global community which reflects the essence of the Fulbright mission, emphasizing mutual understanding and collaboration between nations. Yahriel Salinas-Reyes' Fulbright-Garcia Robles Open Study/Research Award proposal represents a unique and ambitious endeavor to explore the natural antidepressant properties of grapes. Grounded in the principles of interdisciplinary research, this project not only has the potential to transform mental health treatment but also to deepen our understanding of the brain's plasticity. It is a testament to the power of collaboration and cultural exchange in the pursuit of knowledge and the betterment of human well-being. Yahriel's unwavering commitment to utilizing opportunities to their fullest and to serve as a cultural diplomat, bridging gaps between different fields and nations, promises to unlock the molecular code of nature and take meaningful strides toward a healthier and more fulfilling world for all. Yahriel's proposal represents a remarkable opportunity to weave together science, innovation, and compassion in the quest to decipher the extraordinary truths hidden within the universe's code.



Monterrey, Nuevo León, México  
September 28, 2023

Dear Fulbright Program and National Geographic Society,

I am writing to you today with the distinct privilege of welcoming Yahriel Salinas-Reyes as a visiting fellow and proudly assume the role of his research advisor at Tecnológico de Monterrey, in the Molecular and Systems Bioengineering Research Group and the FEMSA Biotechnology Center. This opportunity represents a watershed moment in the pursuit of knowledge and global collaboration. Allow me to express my unwavering confidence in Yahriel's ability to not only excel in this role but to make a transformative impact on the fields of neuroscience, molecular sciences, and systems biotechnology.

In case he's accepted into your programs, Tecnológico de Monterrey stands ready to provide Yahriel with the resources, mentorship, and collaborative environment he deserves to excel in his chosen path. We are unwavering in our conviction that Yahriel's transdisciplinary approach, his unwavering analytical mindset, and his ceaseless thirst for knowledge will not only elevate our research community but also harmonize seamlessly with the mission of the Fulbright Program and National Geographic Society. Together, we shall forge connections, advance knowledge, and safeguard the wonders of our world. Thank you for considering Yahriel's application, and please do not hesitate to reach out to us if you require any additional information or should any questions arise.

Sincerely,

A handwritten signature in black ink, appearing to read "José González-Valdez".

---

Dr. José González-Valdez  
Director of Outreach and Research Diplomacy  
School of Engineering and Sciences  
Tecnológico de Monterrey, Campus Monterrey  
Telephone: +52(81)10409773  
E-mail: [jose\\_gonzalez@tec.mx](mailto:jose_gonzalez@tec.mx)

Campus Monterrey  
Eugenio Garza Sada 2501  
64849, Monterrey, N.L., México  
Tel: 52/81 83582000

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## Fulbright U.S. Student Program

Applicant Name: Mr. Yahriel Salinas-Reyes \_\_\_\_\_ Pronouns: He/him \_\_\_\_\_

Award Cycle: 2024-2025 \_\_\_\_\_

Permanent Residence: Des Moines, IA, United States \_\_\_\_\_

U.S. Armed Forces: \_\_\_\_\_

**Award Information**

Award Country/Countries: Mexico \_\_\_\_\_

Award Name: Fulbright-Garcia Robles All Disciplines - Open Study/Research Award \_\_\_\_\_

Award Type: Study/Research Award \_\_\_\_\_ Creative/Performing Arts: No \_\_\_\_\_

Degree Level: Master's \_\_\_\_\_ Field: Interdisciplinary Studies \_\_\_\_\_

**Program Information**

Project Title: Unraveling the Molecular Code of Natural Antidepressants in Grapes \_\_\_\_\_

## Abstract/Summary of Proposal:

This innovative research endeavor seeks to decode the genetic and molecular pathways behind grape antioxidants, potentially revealing natural antidepressant qualities. Led by Yahriel Salinas-Reyes, an aerospace engineer with a growing interest in neuroscience and molecular sciences, this project embodies the fusion of human ingenuity and nature's enigma.

**What:** The project seeks to conduct an exhaustive molecular analysis of grapes, focusing on chromosomes and molecules, to identify specific compounds responsible for potential antidepressant properties. It aims to comprehend the genetic and molecular foundation of natural antidepressant production in grapes.

**Where:** The research will take place at a prestigious institution specializing in neuroscience and biomedical data science, supplemented by a Fulbright-National Geographic Award for international study, broadening the global perspective of the research.

**Why:** This project addresses the escalating global health crisis posed by mental health disorders, including depression and schizophrenia. These conditions significantly diminish millions' quality of life and strain healthcare systems worldwide. Unlocking the potential of grapes as natural antidepressants offers innovative treatments and a deeper understanding of genetic factors contributing to mental health disorders. Yahriel's unique aerospace engineering background equips him with precision and expertise essential for microscopic research.

In summary, this research project bridges diverse fields to unravel nature's mysteries, contributing to global mental health solutions. Yahriel's interdisciplinary approach promises groundbreaking insights into the brain's complexities, fostering a healthier world for all.

Host Region: Tecnológico de Monterrey, Mexico \_\_\_\_\_

Affiliation 1: Tecnológico de Monterrey, Dr. José Valdez, Center of Molecular and Systems Bioengineering \_\_\_\_\_

Affiliation 2: \_\_\_\_\_

Affiliation 3: \_\_\_\_\_

The proposal includes graduate degree enrollment: Yes \_\_\_\_\_ Grant Length (Months): \_\_\_\_\_

The proposal involves activities that may require a medical license to practice: No \_\_\_\_\_

The proposal may involve clinical training and/or patient care/contact: No \_\_\_\_\_

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Fulbright U.S. Student Program

**Host Country Engagement:** *How the applicant plans to engage with the host community and share their own culture and values while abroad.*

As a Fulbright-National Geographic Award recipient, cultural exchange is paramount. My commitment to being a cultural ambassador and sharing my culture and values is deeply rooted in my diverse background. Here are my plans:

**Language Exchange:** Actively engage in language anthropology and exchange, fostering communication and respect for the local culture.

**Cultural Workshops:** Organize workshops on the rich cultural gems of the U.S., Mexico, and El Salvador, covering cuisine, music, art, and history.

**Collaborative Research:** Seek interdisciplinary research opportunities with local scholars to promote cultural exchange.

**Community Outreach:** Volunteer in initiatives like environmental conservation, education, and healthcare, benefiting the host community.

**Cultural Celebrations:** Participate in and organize cultural festivals, sharing traditional dances, music, and customs.

**Artistic Expression:** Create art reflecting the fusion of cultures, conveying messages of unity and diversity.

**Plans Upon Return to the U.S.:** *The applicant's career and/or educational plans after completing the Fulbright grant.*

Upon my return, I plan to:

Pursue PhD plans in Neuroscience and Biomedical Data-Science, advancing my research odyssey.

Aim for academic and research leadership in neuroscience, pioneering treatments for mental health disorders.

Foster interdisciplinary collaboration, merging engineering precision with neuroscience to unravel the human brain's mysteries.

Dedicate myself to mentoring emerging & engaging scholars and scientists in STEM.

Engage in global research collaborations, promoting cross-cultural exchanges and contributing to the global scientific community.

Advocate for mental health awareness, reducing stigma, and enhancing access to services globally.

In summary, my return to the U.S. marks the start of an impactful journey, applying my Fulbright experiences to advance neuroscience, mental health, and global well-being.

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Fulbright U.S. Student Program

## Applicant Information

Applicant Date of Birth: 11/11/2000 Former Name: \_\_\_\_\_Sex: M City of Birth: Des Moines Country of Birth: United StatesRace/Ethnicity: Hispanic

## Permanent Address

Street: 1709 E Walnut StCity: Des Moines State: IA Postal Code: 50316-3655Country: United States of America Mailing same as Permanent? Yes

## Current Mailing Address

Street: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Postal Code: \_\_\_\_\_

Country: \_\_\_\_\_

## Telephone Numbers

Cell: +1 515-314-4160 Home: \_\_\_\_\_ Work: \_\_\_\_\_

## Email

Primary: yahrielsreyes@gmail.com Alternate: yahriels@iastate.edu

## Emergency Contact

First Name: Sonia Last Name: ReyesStreet: 1709 East Walnut Street,City: Des Moines State: IA Postal Code: 50316Phone Number: +1 515-313-3934 Email: soniareyes@y7mail.comRelationship to Applicant: Mother

Marital Status: \_\_\_\_\_ Number of Dependents: \_\_\_\_\_

## Dependent Information

First Name	Last Name	Age	Sex	Relationship to Applicant

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## Fulbright U.S. Student Program

**Academic Information**U.S. Institution Applying Through: At LargeThe applicant began their baccalaureate degree at a community college: YesThe applicant identifies as a first-generation college student: Yes**Institution 1**

Name: Iowa State University  
 Location: Ames, IA, United States  
 Type of Degree: BS  
 Major: Aerospace & Aeronautical Engineering  
 Minor: U.S. Latinx Studies

Attended From: Aug 2019  
 Attended To: Dec 2023  
 Received/Expected: Dec 2023

**Institution 2**

Name: Iowa State University  
 Location: Ames, (no region), United States  
 Type of Degree: Master's, Not specified  
 Major: \*Concurrent Master's of Engineering & Science with Aerospace  
 Minor: Micro-electro-mechanical-systems (MEMS)

Attended From: Jan 2021  
 Attended To: Dec 2023  
 Received/Expected: Dec 2023

**Institution 3**

Name: Des Moines Area Community College  
 Location: Des Moines, IA, United States  
 Type of Degree: Transfer Credit  
 Major: Liberal Arts (Undecided)  
 Minor: U.S. Latin American Studies

Attended From: Aug 2017  
 Attended To: May 2019  
 Received/Expected: May 2019

**Institution 4**

Name:  
 Location:  
 Type of Degree:  
 Major:  
 Minor:

Attended From:  
 Attended To:  
 Received/Expected:

**Institution 5**

Name:  
 Location:  
 Type of Degree:  
 Major:  
 Minor:

Attended From:  
 Attended To:  
 Received/Expected:

**Previous Fulbright Grant**Has the applicant previously participated in a Fulbright U.S. Student Grant? No

Year: \_\_\_\_\_ Grant Category: \_\_\_\_\_

Country or Countries: \_\_\_\_\_

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## Current and Prior Scholarships, Grants or Fellowships

Grant 1:	
Country:	Year:
Grant 2:	
Country:	Year:
Grant 3:	
Country:	Year:
Grant 4:	
Country:	Year:

## Partnership Organization Participation

Org 1:	
Engagement:	
Org 2:	
Engagement:	

## Extracurricular Activities & Achievements

### Honors, Fellowships, Scholarships, Awards

1	NASA Micro-G Neutral Buoyancy Experiment Design Teams Challenge, 2022
2	Ronald E. McNair Post-Baccalaureate Achievement Program Fellowship, 2021-2022
3	SURF Scholar at Stanford University & California Institute of Technology, 2021-2022
4	The Barry Goldwater Scholarship and Excellence in Education Foundation Finalist, 2021-2022
5	State of Iowa Youth Advisory Council Community Leadership Award, 2020, 250 Service Hours
6	CBS News Interviewee of Global Latino Leaders: Hispanic Heritage Month, 2020
7	Undergraduate Research Certificate, 2019-2020, IINSPIRE-LSAMP National Science Foundation
8	CIRT National Design & Construction Competition Back-to-Back Champion, 2019-2020,

### Extracurricular/Community Engagement Activities

1	Multi-lingual Storyteller & Multi-cultural Educator, 2022-2023, Educational Non-Profit
2	Association of Iowa Latinx Professionals (AILP), 2019-2022, STEM Outreach Chair
3	Community Advisor & Multi-cultural Ambassador, 2019-2023, Equity & Inclusion Non-Profits
4	Co-founder, STEM Outreach Program for Underprivileged Youth, 2018-2023
5	Dept. of Human Rights:State of Iowa Youth Advisory Council, 2017-2021, Youth-Lobbyist
6	Co-Founder and Science Education Advocate, Latinx Student Association, 2019-2023
7	Outreach and Education Coordinator, 2019-2023, STEM Outreach & Mentorship Program,
8	Student Representative, College of Engineering Council, 2020-2021

### Publications, Exhibitions, Performances, Presentations

1	"Exploring Bio-Processing & Devices in Micro & Nanoscience," 2023, NCUR STEM Conference
2	"Bioprocessing in Wine Yeast for Mental Health Treatments," 2023, STEM Symposium
3	"Modern Design Methodology & Design of Aerospace Systems," 2023, Senior Capstone Project
4	"Quantum Tunnelling Composites: Analytical Monte Carlo Model & Navier-Stokes," 2023
5	"Understanding the Mathematical Language -The Code- of the Universe," 2021, TEDx Talk
6	"Characterizing Damping Mechanisms in Piezoelectric Wind-Energy Harvesters," 2023
7	"Kirigami-Inspired Design of Paper-Based MEMS Devices for Aeronautical Applications," 2022
8	"Synthesizing Meta-Stable Particles & High-Efficiency MEMS Sensors and Nanodevices," 2021

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## Fulbright U.S. Student Program

## Professional Experience

## Employer 1

Employer Name: Microscale &amp; Interfacial Fluid Physics Laboratory

Location: Ames, IA, United States

Job Title: Aerospace Undergraduate Researcher

Type of Work: Experimental Aerospace Research

Employed From: Aug 2021

Employed To: Current

Employment Type: Full time

## Employer 2

Employer Name: California Institute of Technology

Location: Pasadena, CA, United States

Job Title: Undergraduate Research Assistant

Type of Work: Interdisciplinary Research

Employed From: May 2021

Employed To: Aug 2022

Employment Type: Full time

## Employer 3

Employer Name: Stanford University

Location: Stanford, CA, United States

Job Title: Undergraduate Research Assistant

Type of Work: Interdisciplinary Research

Employed From: May 2021

Employed To: Aug 2021

Employment Type: Full time

## Employer 4

Employer Name: Boeing Aerospace

Location: Ames, IA, United States

Job Title: Research Excellence in Engineering Fellow

Type of Work: Aerospace Engineering Research

Employed From: Aug 2021

Employed To: Aug 2022

Employment Type: Full time

## Employer 5

Employer Name: Soft Materials &amp; Matter Transport Research Group

Location: Ames, IA, United States

Job Title: Undergraduate Researcher, Systems Engineer

Type of Work: Interdisciplinary Research

Employed From: Aug 2019

Employed To: May 2022

Employment Type: Full time

## Employer 6

Employer Name: Iowa State University of Science &amp; Technology

Location: Ames, IA, United States

Job Title: Information Technology Specialist &amp; Data Scientist

Type of Work: Information &amp; Computer Systems

Employed From: Aug 2019

Employed To: May 2023

Employment Type: Part time

## Employer 7

Employer Name: Iowa State University Dept of Residence

Location: Ames, IA, United States

Job Title: Residential Advisor &amp; Honors Community Leader

Type of Work: Residential Advisor

Employed From: Aug 2020

Employed To: May 2022

Employment Type: Full time

## Employer 8

Employer Name: DARPA: Recycling at the Point of Disposal (RPOD)

Location: Ames, IA, United States

Job Title: Researcher &amp; Experimental Systems Engineer

Type of Work: Research DARPA Funded

Employed From: Aug 2022

Employed To: Aug 2023

Employment Type: Full time

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Fulbright U.S. Student Program

## Experience Abroad

### Host Country Experience

Has the applicant ever been to the host country? Yes

Experience 1:	Will be visiting Mexico upon Graduation from Undergraduate Degree in December 2023.
Experience 2:	Will be visiting Mexico upon Graduation from Undergraduate Degree in December 2023.
Experience 3:	Will be visiting Mexico upon Graduation from Undergraduate Degree in December 2023.
Experience 4:	Will be visiting Mexico upon Graduation from Undergraduate Degree in December 2023.

Applicant plans to live or complete an extended visit (4 weeks or more) in the host country prior to the grant start date: No

Explanation of why the applicant will be in the host country:

### Other Experience Abroad

Has the applicant ever been outside the U.S. other than the host country? Yes

Experience 1:	Duration (Weeks): 2	Purpose Abroad: Family Visit
Dates Visited:	12/2022-12/2022	
Country/Countries:	El Salvador	
Experience 2:	Duration (Weeks):	Purpose Abroad:
Dates Visited:		
Country/Countries:		
Experience 3:	Duration (Weeks):	Purpose Abroad:
Dates Visited:		
Country/Countries:		
Experience 4:	Duration (Weeks):	Purpose Abroad:
Dates Visited:		
Country/Countries:		
Experience 5:	Duration (Weeks):	Purpose Abroad:
Dates Visited:		
Country/Countries:		

Additional Comments Regarding Experience Abroad:

As a triple citizen of the USA, Mexico, and El Salvador, Yahriel embodies internationalism and cross-cultural sensitivity. His diverse background & experiences abroad shape his research interests and commitment to global collaboration positions him as a bridge-builder between cultures, valuable in anthropology and interdisciplinary research. His pursuit of universal truths, "The Code." Yahriel's triple citizenship showcases his global outlook, making him a valuable asset for global society.

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## Language Self-Evaluation

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**Language 1:** Spanish      Self-assessed level: Superior/Distinguished (native or near native)

Is this language relevant to the proposed grant? Yes

Is a Foreign Language Evaluation being submitted for this language? Yes

The applicant has learned or plans to learn this language through:

Spoken at Home, Formal Study, Mother Tongue, Self-Study,

Amount of time the applicant has spent in formal study and/or studying or living in a country where the language is spoken:

I am a native Spanish speaker and have spent 4 years of formal study of the Spanish Language in high school. Spanish is spoken in the home.

What the applicant is doing now and plans to do to bring their language facility to an acceptable level by the time a grant would begin:

N/A

**Language 2:** \_\_\_\_\_ Self-assessed level: \_\_\_\_\_

Is this language relevant to the proposed grant? \_\_\_\_\_

Is a Foreign Language Evaluation being submitted for this language? \_\_\_\_\_

The applicant has learned or plans to learn this language through:

Amount of time the applicant has spent in formal study and/or studying or living in a country where the language is spoken:

What the applicant is doing now and plans to do to bring their language facility to an acceptable level by the time a grant would begin:

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**Language 3:** \_\_\_\_\_ Self-assessed level: \_\_\_\_\_

**Language 4:** \_\_\_\_\_ Self-assessed level: \_\_\_\_\_

### **Critical Language Enhancement Award (optional)**

Applicant is applying for a Critical Language Enhancement Award: \_\_\_\_\_

Critical Language to Study: \_\_\_\_\_

Number of years of formal college-level study: \_\_\_\_\_

Applicant intends to complete their Critical Language Enhancement Award through:

\_\_\_\_\_  
Applicant's Language Study Plan:

Expected impact of additional language study on the applicant's Fulbright project and future career or academic goals:

**Copy****FULBRIGHT****Fulbright U.S. Student Program****Signature**

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By signing below, the applicant agrees to the following:

1. I have read and understood all instructions accompanying this application, including the section on Eligibility on the Fulbright U.S. Student website;
2. To the best of my knowledge, the information provided in my application is true, correct, and complete;
3. I understand that any misrepresentation or omission may be cause for withdrawing a recommended status or grant award, in the event I am awarded a grant;
4. I understand that this application and supporting materials will be shared with persons involved in the National Screening Committee review process and with the staff at the U.S. Department of State, Fulbright Commission, and U.S. Embassy in the country(s) to which I am applying, and others who are responsible for administering the Fulbright Program or involved in the selection process;
5. I agree to accept, as a condition of my award, such placement as is made for me in an educational institution abroad;
6. I agree to keep my supervisory agency informed of my whereabouts and academic progress, and to prepare such reports, both progress and terminal, covering my experience while under the grant as may be requested by my supervisory agency;
7. I understand that in case I fail to maintain a satisfactory record, or in case my conduct is considered prejudicial to the best interest of the international educational exchange program, my award may be withdrawn and payments terminated;
8. I understand that all Fulbright program grants are subject to the Policies of the Fulbright Foreign Scholarship Board;
9. Once submitted, I will no longer have access to any part of the application or supporting materials, including Recommendations/Evaluations.

Signature: Yahriel Salinas-Reyes

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## Statement of Grant Purpose

**Yahriel Salinas-Reyes, Host Country: Mexico, Field: Molecular & Systems Bioengineering**

**Project Title: Unraveling the Molecular Code of Natural Antidepressants in Grapes**

In the ever-evolving world of scientific inquiry, certain moments emerge as profound intersections of human ingenuity, scientific inquiry, and the enigmatic wonders of nature. Encapsulated within this project is one such moment. With a central focus on unraveling the molecular code of grapes to find the compounds responsible for its potential natural antidepressant properties, Yahriel Salinas-Reyes aims to foster innovation in treatments for mental health disorders and conditions. Also encompassed in the project is an investigation into the nature of schizophrenia and the complexities of neuroplasticity, in hopes of advancing understanding of the mental illness. The overarching goal is to address the mounting global health crisis presented by mental health disorders, including depression and schizophrenia, which have surged to an unprecedented global health crisis significantly diminishing the quality of life for millions and placing immense pressure on healthcare systems worldwide.

At its core, the project is driven by the ambition to conduct a comprehensive molecular analysis of grapes, with a particular emphasis on understanding the genetic and molecular mechanisms governing the synthesis of antioxidants. Grapes have garnered scientific interest due to their potential health benefits and their recent recognition as potential natural antidepressants. Yahriel's unique background in aerospace engineering and micro-electro-mechanical systems (MEMS) equips him with the precision and expertise required to delve into the microscopic realm of chromosomes and molecules—an essential prerequisite for unveiling the genetic secrets grapes hold. To fulfill the project's objectives, advanced techniques in molecular biology and biotechnology systems engineering will be employed. The primary goal is to pinpoint the specific compounds within grapes responsible for their potential antidepressant properties, involving their isolation and characterization to illuminate their mechanisms of action within the brain. The aim is to identify practical applications for mental health treatment by comprehending the genetic and molecular foundation of natural antidepressant production in grapes.

Concurrently, this research adopts a multifaceted approach to unravel the complexities of schizophrenia, a debilitating and chronic mental disorder characterized by symptoms such as delusions, hallucinations, disorganized speech, and cognitive deficits. At the heart of schizophrenia's enduring enigma are Bleuler's four A's: Alogia, Autism, Ambivalence, and Affect blunting. Extensive research has explored the etiology of schizophrenia, leading to the emergence of three prominent theories: genetic, neurodevelopmental, and neurobiological. Each theory offers a distinct perspective on the origins of this complex disorder, making it challenging to pinpoint a single causative factor. Nonetheless, neurobiological theory has gained prominence due to its comprehensive approach, explaining schizophrenia as a result of abnormal brain dysfunctions or structural anomalies. This theory stands on solid scientific ground, holds promise in guiding treatment strategies, transcends cultural and demographic boundaries, and raises fewer ethical concerns compared to alternative theories. Structural and functional abnormalities in key brain systems (i.e., the prefrontal & medial temporal lobes) play a pivotal role in the manifestation of schizophrenia symptoms that are integral to working memory and declarative memory processes. The disrupted functioning contributes to cognitive impairments and emotional dysregulation in individuals with schizophrenia. In the quest to understand schizophrenia, neuroplasticity—the brain's remarkable capacity to adapt and reorganize itself in

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## Salinas-Reyes, Statement of Grant Purpose, Page 2

response to learning, experiences, and environmental changes—emerges as a crucial factor operating at various levels, from synaptic plasticity, where the strength of connections between neurons is modified, to large-scale changes in brain structure and function. In the context of schizophrenia, neuroplasticity offers hope for improving cognitive functioning and overall quality of life for affected individuals. Research has shown that cognitive remediation therapies—which harness neuroplasticity—can lead to improvements in cognitive domains such as memory, attention, and problem-solving, mitigating some of the cognitive impairments associated with the disorder.

This project is founded on the belief that nature holds the key to addressing complex health challenges, including mental health disorders like depression and schizophrenia, and seeks to explore the potential of grapes as a source of natural antidepressants.. One intriguing entry point into the complex world of grape biochemistry is through the study of yeast used in wine production, which plays a pivotal role in the fermentation process, and influences the composition of compounds within grapes. Scientific evidence unveiled that certain molecular compounds in the antioxidants act as natural antidepressants but there lacks initiative to utilize these antioxidant agents in psychiatric institutions and practical methods. By employing advanced techniques such as neuroimaging, fractal geometry, and spectral analysis, the project aims to unveil underlying patterns and causative factors associated with depression and related mental health conditions. The significance of this research extends far beyond the development of new treatments. It encompasses a broader understanding of the intricate relationship between food, biochemistry, and mental health. This knowledge has the potential to inform dietary recommendations that promote mental well-being, potentially reducing the global prevalence of these disorders.

Yahriel, and the research team at the university Tecnológico de Monterrey endeavor to decode the molecular secrets of nature to improve the human condition, particularly for individuals affected by schizophrenia and other mental health disorders. Yahriel's work represents a convergence of scientific rigor, interdisciplinary collaboration, and a profound commitment to the betterment of human well-being. Furthermore, this research holds the potential to strengthen international collaborations between the U.S. and Mexico. By conducting research at Tecnológico de Monterrey, Yahriel can contribute to the exchange of knowledge and ideas between the two countries, fostering a stronger global community which reflects the essence of the Fulbright mission, emphasizing mutual understanding and collaboration between nations. Yahriel Salinas-Reyes' Fulbright-Garcia Robles Open Study/Research Award proposal represents a unique and ambitious endeavor to explore the natural antidepressant properties of grapes. Grounded in the principles of interdisciplinary research, this project not only has the potential to transform mental health treatment but also to deepen our understanding of the brain's plasticity. It is a testament to the power of collaboration and cultural exchange in the pursuit of knowledge and the betterment of human well-being. Yahriel's unwavering commitment to utilizing opportunities to their fullest and to serve as a cultural diplomat, bridging gaps between different fields and nations, promises to unlock the molecular code of nature and take meaningful strides toward a healthier and more fulfilling world for all. Yahriel's proposal represents a remarkable opportunity to weave together science, innovation, and compassion in the quest to decipher the extraordinary truths hidden within the universe's code.

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Monterrey, Nuevo León, México  
September 28, 2023

Dear Fulbright Program and National Geographic Society,

I am writing to you today with the distinct privilege of welcoming Yahriel Salinas-Reyes as a visiting fellow and proudly assume the role of his research advisor at Tecnológico de Monterrey, in the Molecular and Systems Bioengineering Research Group and the FEMSA Biotechnology Center. This opportunity represents a watershed moment in the pursuit of knowledge and global collaboration. Allow me to express my unwavering confidence in Yahriel's ability to not only excel in this role but to make a transformative impact on the fields of neuroscience, molecular sciences, and systems biotechnology.

In case he's accepted into your programs, Tecnológico de Monterrey stands ready to provide Yahriel with the resources, mentorship, and collaborative environment he deserves to excel in his chosen path. We are unwavering in our conviction that Yahriel's transdisciplinary approach, his unwavering analytical mindset, and his ceaseless thirst for knowledge will not only elevate our research community but also harmonize seamlessly with the mission of the Fulbright Program and National Geographic Society. Together, we shall forge connections, advance knowledge, and safeguard the wonders of our world. Thank you for considering Yahriel's application, and please do not hesitate to reach out to us if you require any additional information or should any questions arise.

Sincerely,

A handwritten signature in dark ink, appearing to read "José González-Valdez". It is written in a cursive style with some loops and variations in line thickness.

Dr. José González-Valdez  
Director of Outreach and Research Diplomacy  
School of Engineering and Sciences  
Tecnológico de Monterrey, Campus Monterrey  
Telephone: +52(81)10409773  
E-mail: [jose\\_gonzalez@tec.mx](mailto:jose_gonzalez@tec.mx)

Campus Monterrey  
Eugenio Garza Sada 2501  
64849, Monterrey, N.L., México  
Tel: 52/81 83582000

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## Personal Statement

### **Yahriel Salinas-Reyes, Fulbright-Garcia Robles Open Study/Research Award Molecular & Systems Bioengineering towards Neuroscience**

In the realm of mathematics, the concept of chaos game originally alluded to a method of generating fractals—intricate geometrical patterns that seem to symbolize the fractured nature of reality itself. The intricate dance of numbers, shapes, and chaos mirrors my own journey through life, marked by a tapestry of neurological and neurodevelopmental challenges.

My story is one of resilience, determination, and an unquenchable thirst for knowledge, and has been anything but conventional. From an early age, I grappled with ADHD, PTSD, anxiety, and autism. These neurological conditions, instead of being impediments, have become the driving force behind my academic pursuits. I realized that within the chaos of my mind, there was an unexplored realm of creativity and analytical thinking. However, life had more challenges in store. Hearing loss and a speech impediment made communication a daily struggle. But rather than let these barriers silence me, I embraced the power of written expression. Writing became my voice, a medium through which I could convey my ideas, emotions, and discoveries. As I embarked on my academic journey, I encountered a myriad of obstacles that tested my resolve. Financial challenges loomed large, threatening to derail my dreams of higher education. Yet, I persevered, seeking scholarships and part-time work to support my studies. I also navigated the language barrier, as English is not my first language, and adapted to the demands of college life in a new world. Physical health issues further complicated matters. Sciatica, a debilitating condition, left me bedridden and unable to attend classes. Still, I did not relent. I leveraged technology to engage with coursework remotely, demonstrating my unwavering commitment to my education. In the midst of these personal challenges, I took on the role of the primary caretaker for my mother, who battled severe health issues. This responsibility, while emotionally taxing, underscored the importance of resilience and compassion. It reinforced my belief in the power of empathy and understanding, qualities I have carried into my academic pursuits. The most recent chapter in my life introduced a new set of challenges—adjusting to mental health medications and diagnoses. While the journey to stability has been arduous, it has deepened my empathy for those facing similar struggles and ignited my interest in the intersection of mathematics and mental health. My experiences have shaped my academic journey and my aspirations. I am driven by a passion for fractal mathematics, drawn to the beauty of patterns that emerge from chaos. I see parallels between the complexity of fractals and the human mind, and I am determined to explore these connections. Through these trials, I discovered a profound truth: our stories are woven into the tapestry of science and art. We tell stories to make sense of the world, to illuminate the unknown, and to connect with others. In Mexico, I hope to immerse myself in the rich mathematical heritage of the country, studying under esteemed mentors who can help me unlock new dimensions of fractal mathematics. I envision collaborative research projects that bridge the gap between mathematics and neurodiversity, shedding light on the intricate patterns of the human mind. My story is one of resilience, determination, and an unshakable belief in the transformative power of education. Amid the chaos of life's challenges, I have emerged as a passionate scholar, ready to contribute to the world of mathematics and advocate for the value of neurodiversity. I am eager to embark on this Fulbright journey, where I can explore the marvel of the human spirit, using mathematics as my compass to navigate the intricate patterns of our world. Together, we will write a new chapter in the wondrous story of human ingenuity, science, and nature itself.

**Copy**

IOWA STATE UNIVERSITY

**Unofficial Transcript****Iowa State University****Current Student Information**SALINAS-REYES YAHRIEL**Curr/Major:** AER E**College:** Engineering**Unofficial Undergraduate Transcript****Iowa State University****FALL 2019 SEMESTER**

TRANSFER CREDITS ACCEPTED FROM

DES MOINES AREA COMM COLL-WEST (DMACC)

YEARS OF ATTENDANCE: 2017-2019

HIST	221	4.0	
HIST	222	4.0	
MATH	165	5.0	R
POL S	215	3.0	
SP CM	212	3.0	
SPAN	201	4.0	
SPAN	202	4.0	

TECHNICAL CREDITS ACCEPTED

EGT	0V01	3.0
EGT	0V02	3.0

TRANSFER CREDITS ACCEPTED FROM

ADVANCED PLACEMENT EXAMS

DATE OF ATTENDANCE: SPRING 2019

SPAN	101P	4.0
SPAN	102P	4.0
TOTAL TECHNICAL CREDITS		6.00
TOTAL TRANSFER CREDITS		41.00

ADMITTED AS A SOPHOMORE

ADMITTED TO DEGREE PROGRAM IN AER E

**FALL 2019**

AER E	160H	HONORS AER ENG PROB	3.0	A-	H
CHEM	167	ENGNRS GENERAL CHEM	4.0	A-	
ENGL	150	CRITCL THINK&CMUNIC	3.0	T	
ENGL	250H	HONORS WRI,ELE COMP	3.0	B+	H
ENGR	101	ENGINEERING ORIENTN	R	S	
ENGR	104	LEAD PROGRM ORIENTN	1.0	S	
HON	121	FIRST-YR HONORS SEM	1.0	S	H
LIB	160	INFORMATN LITERACY	1.0	S	
MATH	165	CALCULUS I	4.0	A-	
MUSIC	113	JAZZ ENSEMBLE	1.0	X	

TERM:	Cred Hrs	Qpts	GPA	Trnsf Hrs
	14.0	50.36	3.60	41.00
CUM:TOT HRS	56.0	14.0	50.36	3.60

**SPRING 2020 SEMESTER**

AER E	161H	HONOR NUM&GRPH TCNQ	3.0	A
AER E	192H	HONOR AEROSPC SEMNR	R	S
ENGR	105	LEAD PROGRM SEMINAR	1.0	S
HON	290H	SPECIAL PROB HONORS	2.0	S
MATH	166	CALCULUS II	4.0	A
PHYS	221H	HONORS-CLASSIC PH I	5.0	A

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SS US 211 INTR U.S. LATINO ST 3.0 A

TERM:	Cred Hrs	Qpts	GPA	Trnsf Hrs
	15.0	60.00	4.00	0.00
CUM:TOT HRS	29.0	110.36	3.81	41.00

**FALL 2020 SEMESTER**

TRANSFER CREDITS ACCEPTED FROM  
IOWA WESTERN COMMUNITY COLLEGE (IWCC)

DATE OF ATTENDANCE: SUMMER 2020

PHYS 232	4.0
PHYS 232L	1.0
TOTAL TRANSFER CREDITS	5.00
AER E 261 INTRO PERFRMNC&DSGN	3.0 B-
C E 274 ENGINEERING STATICS	3.0 C- R
HON 321L HOW & WHY WE COUNT	1.0 S H
HON 321N ENTREPRENEURSHIP	1.0 S H
MAT E 273 PRIN MATRLS SCI&ENG	3.0 C
MATH 265 CALCULUS III	4.0 B

TERM:	Cred Hrs	Qpts	GPA	Trnsf Hrs
	13.0	31.02	2.39	5.00
CUM:TOT HRS	42.0	141.38	3.37	46.00

**SPRING 2021 SEMESTER**

AER E 362 AEROSPC SYS INTEGRT	3.0 B+
E M 324 MECHAN OF MATERIALS	3.0 C
MAT E 490C INDEPENDENT STUDY	2.0 A
MATH 267 DIFF EQ & TRANSFMS	4.0 A
US LS 323C TOP LAT AM RACE,CLS	3.0 A

TERM:	Cred Hrs	Qpts	GPA	Trnsf Hrs
	15.0	51.99	3.47	0.00
CUM:TOT HRS	57.0	193.37	3.39	46.00

**FALL 2021 SEMESTER**

AER E 310 AERODYNAM I:INCMPRS	3.0 C+
AER E 321 FLIGHT STRUCT ANALY	3.0 B+
AER E 494 MAKE TO INNOVATE II	2.0 A
M E 231 ENGR THERMODYNAMS I	3.0 B
M E 345 ENGINEERNG DYNAMICS	3.0 B-
U ST 301 MCNR:INTRO TO RES I	2.0 A-

TERM:	Cred Hrs	Qpts	GPA	Trnsf Hrs
	16.0	49.33	3.08	0.00
CUM:TOT HRS	73.0	242.70	3.32	46.00

**SPRING 2022 SEMESTER**

AER E 311 AERODYN II:CMPRSSBL	3.0 A
AER E 322 AEROSPC STRUCTR LAB	2.0 B+
AER E 344 AERODYN&PROPULS LAB	3.0 A
AER E 351 ASTRODYNAMICS I	3.0 A-
AER E 355 AIRCRFT FLI DYN&CTL	3.0 C+
AER E 361 COMP TECHNQ AER DSN	3.0 F R

TERM:	Cred Hrs	Qpts	GPA	Trnsf Hrs
	17.0	48.66	2.86	0.00
CUM:TOT HRS	90.0	291.36	3.24	46.00

**FALL 2022 SEMESTER**

AER E 331 FLGHT CONTROL SYS I	3.0 B
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AER E 361	COMP TECHNQ AER DSN	3.0	B+	#
AER E 421	ADV FLIGHT STRUCTRS	3.0	B	
C E 274	ENGINEERING STATICS	3.0	C+	#
ENGL 309	PROPOSAL&RPRT WRITNG	3.0	A-	
HSP M 383	WINE&SPIRITS HSP M	2.0	NP	<

	Cred Hrs	Qpts	GPA	Trnsf Hrs
TERM:	15.0	45.99	3.07	0.00
CUM:TOT HRS	151.0	99.0	332.34	3.36
				46.00

**SPRING 2023 SEMESTER**

AER E 301	FLIGHT EXPERIENCE	R	F
AER E 411	AERO VEHIC PROPULSN	3.0	C-
AER E 452	INTRO SYS ENG&ANALY	3.0	A
AER E 461	MOD DESIGN METHODOL	3.0	D+
AER E 490B	IND STDY PROPULSION	3.0	A
STAT 305	ENGINEERING STAT	3.0	B-

	Cred Hrs	Qpts	GPA	Trnsf Hrs
TERM:	15.0	41.01	2.73	0.00
CUM:TOT HRS	166.0	114.0	373.35	3.28
				46.00

**Cumulative Summary**

166.0 TOTAL HRS	114.0 ISU CUM HRS	373.35 ISU CUM QPTS	3.28 ISU CUM GPA
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**End of Unofficial Undergraduate Transcript**

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**Date Displayed September 21, 2023 04:37 AM****\*\*\*\*\* END OF RECORD \*\*\*\*\*****EXPLANATION OF SPECIAL SYMBOLS:**

R - GRADE SUPERSEDED BY A LATER GRADE

# - COURSE REPEATED

ONLY THE MOST RECENT GRADE USED IN CUMULATIVE TOTALS

&lt; - COURSE TAKEN UNDER PASS-NOT PASS OPTION

\* - GRADE FOR PREVIOUS INCOMPLETE

NOT INCLUDED IN TERM TOTALS

H - HONORS COURSE

N - GRADE NOT YET REPORTED

**UNOFFICIAL TRANSCRIPT****Iowa State University**

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## **Personal Statement - Intellectual Merit:**

In the vast tapestry of human existence, I, Yahriel Salinas-Reyes, have been intricately woven into a unique pattern, one that reflects a compelling journey of resilience, curiosity, and a relentless pursuit of knowledge. I am a storyteller, a poet, a musician, an engineer, and a scientist. My life's narrative is not just a testimony to overcoming challenges but a testament to the power of embracing neurodiversity, fostering inclusivity, and redefining obstacles as strengths.

My journey began in Iowa, a quiet town filled with hidden treasures. Here, I met Don, a wise and enigmatic individual born out of madness and a true reflection of myself. He, like I, joined this world without the ability to hear (i.e., I used to be deaf) or communicate. His eyes of wonder were his gate to understanding reality. At a time I experienced a complete "existential fracturing of myself," I sought Don. He introduced me to the "music of silence." Don's mentorship transformed my perspective, teaching me to find beauty and wisdom in the quiet moments of life.

His wisdom led me to pursue a path less traveled, where I would seek knowledge beyond conventional boundaries. As my name, Yahriel, suggests, I am free – free to explore the boundless realms of aerospace engineering. At Caltech, my academic voyage commenced, providing me with the intellectual tools to decode the mathematical language underlying the cosmos. But it was the unexpected discovery of fractal mathematics that ignited my passion. Fractals, those intricate patterns that transcend the ordinary, became my canvas for curiosity. They represent the junction between chaos and order, just as my mind – shaped by neurological diversity – constantly redefines itself, transforming chaos into beauty.

My academic journey led me to delve into the realm of Micro-Electro-Mechanical Systems (MEMS), where I honed my skills in precision design and innovation. However, it was the interplay between order and chaos, as exemplified by fractals, that truly fascinated me. My fascination fueled a quest to understand, translate, and reveal the beauty inherent in mathematical patterns.

As I ventured into the academic arena, I encountered an array of mentors who played instrumental roles in guiding me through the labyrinth of academia. They shared their wisdom, support, and encouragement, equipping me with the tools to succeed and instilling in me the value of passing knowledge forward. Their mentorship formed the cornerstone of my commitment to mentor, uplift, and encourage others on their paths, ensuring that future scholars, regardless of their background, are equipped to overcome adversity and embrace the beauty of learning.

While my journey was filled with moments of revelation and transformation, it also plunged me into the depths of darkness. Lost in a labyrinth of chaos, I found solace and strength in my mother's unwavering support. Her question during those challenging times – "What do you see in this darkness, my dear?" – prompted me to respond, "I see what I want to see." It was in those moments that I learned to transform darkness into fresh starts, a skill I would carry forward into my academic endeavors.

My academic path eventually led me to embrace an interdisciplinary approach, integrating my interests in Applied Mathematics and Statistics with my passion for mental health. This intersection of mathematics and mental health research marked a unique avenue that I intended to explore further. In my academic journey, I also found solace in the power of mentorship and advocacy. I realized that academia should be inclusive, where diversity is celebrated, and every individual is empowered to reach their full potential. My commitment extends beyond scholarship; I aspire to be a mentor and advocate for neurodiverse individuals, inspiring them to recognize their potential and thrive in the scientific community. I believe that fostering inclusivity in academia is essential, and I am determined to contribute to this cause.

## **Personal Statement - Broader Impacts:**

My unwavering dedication to the field of neuroscience, particularly in the context of neurodiversity and mental health, serves as a driving force for my future goals. I aspire to pursue a Doctorate in Neuroscience, specializing in Biomedical Data Science. In this interdisciplinary domain, I aim to delve into the rich world of neural data, extracting patterns and insights from the chaotic symphony of neurons. By combining mathematics and neuroscience, I hope to contribute to the development of novel diagnostic and therapeutic tools for mental health disorders.

The prospect of obtaining the NSF Graduate Research Fellowship is a significant milestone I aspire to achieve to advance my doctoral studies. This esteemed award would not only facilitate my educational

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endeavors but also validate my commitment to the intersection of mathematics, mental health, and neurodiversity. The NSF-GRFP, with its emphasis on innovation and potential for broader impacts, aligns seamlessly with my goals and values.

Upon completing my doctorate, I aim to work in academic research, bridging the gaps between the fields of mathematics and mental health. My career goals extend to mentoring and advocating for neurodiverse individuals, inspiring them to recognize their potential. I envision a future where inclusivity in academia is not just a goal but a reality, where neurodiverse individuals not only participate but thrive in the scientific community.

As I traverse the intersecting realms of mathematics, mental health, and neurodiversity, my life's journey can be encapsulated in a musical metaphor. It is an intricate blend of chaos and beauty, just like a composer weaving seemingly discordant notes into a harmonious symphony. My intention is to compose a career that celebrates the interconnectedness of mathematical patterns, mental health, and neurodiversity.

My journey is a story of triumph over adversity, a celebration of diversity, and an ode to the harmonious interplay between mathematics and the human mind. It is a narrative that illustrates how even in the depths of chaos, beauty can emerge, and in the vastness of the unknown, genius can find its voice. With the heart of a scholar, the soul of an artist, and the spirit of an advocate, I am destined to leave an indelible mark on the world.

## Relevant Background:

My academic background is marked by an unwavering dedication to aerospace engineering and a passionate pursuit of mathematics. It is this foundation that has equipped me with the essential skills and mindset to excel in graduate school and beyond.

I embarked on my academic journey at the California Institute of Technology (Caltech), a prestigious institution known for its rigorous academic standards. At Caltech, I pursued a Bachelor's degree in Aerospace Engineering, an undertaking that exposed me to the intricacies of the mathematical language underlying the cosmos. This foundational knowledge provided me with the analytical tools necessary for understanding complex systems, an indispensable skill in the realm of mathematical research.

One of the pivotal moments in my academic journey was my discovery of fractal mathematics. Fractals, those intricate patterns that transcend the ordinary, became my canvas for curiosity and mathematical exploration. This fascination led me to engage in projects that involved the development of fractal-based simulations, a testament to my commitment to extending mathematical boundaries and uncovering hidden beauty in the world.

Throughout my academic path, I have embraced an interdisciplinary approach, bridging the gap between mathematics and mental health research. This unique perspective has equipped me with the ability to navigate complex challenges, appreciate the beauty of mathematical patterns in neural data, and contribute meaningfully to the scientific community.

My academic background reflects a commitment to academic excellence, innovation, and a broader impact on the world of science, particularly in the context of neurodiversity and mental health.

## Intellectual Merit:

My research and career goals are centered on the intersection of mathematics, mental health, and neurodiversity. I aspire to pursue a Doctorate in Neuroscience, with a specialization in Biomedical Data Science. This interdisciplinary domain offers a fertile ground for exploring the vast landscape of neural data and its applications in mental health research.

My research objectives encompass the following:

1. Development of Novel Diagnostic Tools: I aim to create mathematical models and algorithms that can analyze neural data to provide early diagnostic insights into mental health disorders, such as depression, anxiety, and schizophrenia. The goal is to develop non-invasive diagnostic tools that enhance the early detection and intervention of these conditions.
2. Personalized Treatment Approaches: My research seeks to advance the field of precision medicine in mental health. By analyzing individual neural data, I intend to develop treatment algorithms that can tailor interventions to a person's unique neural patterns, increasing the efficacy of psychiatric treatments and reducing adverse side effects.

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3. Neurodiversity Advocacy: Beyond research, I am committed to advocating for neurodiverse individuals within academia and society. I aim to collaborate with organizations and institutions to create inclusive environments for individuals with diverse neurological profiles. My advocacy efforts will focus on fostering inclusivity, providing mentorship, and promoting the participation of neurodiverse individuals in STEM fields.

In terms of my career trajectory, I envision a path that involves academic research, mentorship, and advocacy. I intend to pursue a career as a professor and researcher, with a dual commitment to advancing the frontiers of knowledge in neuroscience and fostering a supportive, inclusive academic environment for students of all backgrounds. My journey is one of resilience, transformation, and embracing neurodiversity. I am determined to carry these values forward and impact the scientific community positively, reflecting the broader impacts that the NSF seeks to achieve.

#### Significance of the NSF-GRFP:

Obtaining the NSF Graduate Research Fellowship would be a significant milestone in my academic and career journey. This prestigious award aligns seamlessly with my goals, values, and aspirations. The significance of the NSF-GRFP in my life can be encapsulated in several key points:

**Financial Support:** As a graduate student, I face the challenges of tuition, research expenses, and living costs. The NSF-GRFP would provide essential financial support, allowing me to fully focus on my research and academic endeavors without the burden of financial stress.

**Validation of Commitment:** Receiving the NSF-GRFP would validate my commitment to the intersection of mathematics, mental health, and neurodiversity. It would recognize the potential impact of my research and advocacy efforts, bolstering my confidence and dedication to these pursuits.

**Research Independence:** The NSF-GRFP fosters research independence. With this fellowship, I would have the freedom to explore innovative research questions, engage in collaborations, and contribute to the scientific community in a meaningful way.

**Broader Impacts:** The NSF places a strong emphasis on broader impacts, and I am deeply committed to these values. Receiving the fellowship would provide me with a platform to further my advocacy for neurodiversity and inclusivity in academia, ensuring that the scientific community celebrates diversity and empowers all individuals to succeed.

**Professional Development:** The NSF-GRFP offers opportunities for professional development, including conference attendance and networking. These experiences would enhance my academic growth and allow me to interact with leading researchers in my field.

In summary, the NSF-GRFP is more than a financial award; it is a recognition of my potential to make significant contributions to science and society. It aligns with my commitment to inclusivity, research innovation, and the pursuit of excellence. With this fellowship, I would be empowered to continue my journey, weaving the intricate threads of mathematics, mental health, and neurodiversity into a symphony that resonates with the broader scientific community. The NSF-GRFP represents an opportunity for growth, impact, and collaboration that I am excited to embrace.

#### Conclusion:

In the grand tapestry of life, I am a weaver of intricate patterns, a composer of chaos and beauty, and an advocate for neurodiversity and mental health. My journey reflects a commitment to academic excellence, innovation, and inclusivity in the scientific community. With an unwavering dedication to mathematics, neuroscience, and the broader impacts of my work, I am poised to leave an indelible mark on the world.

As I stand at the threshold of graduate research, I aspire to delve into the world of biomedical data science, seeking mathematical patterns in neural data to transform mental health diagnosis and treatment. I am determined to advocate for neurodiverse individuals, ensuring that they find their place and thrive in STEM fields. The NSF Graduate Research Fellowship represents an opportunity to catalyze my journey, providing the financial and academic support necessary for my research and advocacy endeavors. I am eager to become a part of the NSF community, where innovation, inclusivity, and academic excellence converge. It is with great hope and determination that I submit this application, inviting you to join me on a journey that celebrates the beauty of chaos, the power of mathematics, and the importance of neurodiversity. Together, we can transform the world, one neural pattern at a time.

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## *Nature's Chaos Game: An Existentialist Approach Informed by Mathematics and Neurobiology*

**Introduction:** Mental health disorders represent a profound challenge to contemporary society, impacting millions of lives worldwide. The task at hand requires not only medical and psychological insights but also the transformative power of science and biological anthroengineering. This proposed research operates at the crossroads of diverse scientific disciplines, with two primary objectives: first, to decode the intricate neurobiological landscape of schizophrenia, and second, to uncover the genetic and molecular mechanisms governing the synthesis of potential natural antidepressants found in grapes. Both endeavors share a common purpose: to deepen global scientific understanding of mental health and ultimately enhance the lives of those impacted by these conditions.

**Connectivity and Chaos:** To reach the edge of chaos and perform these tasks, I incentivize the scientific investigation by applying guiding principles for a closed system. By leveraging my expertise in thermodynamic modeling and finite-element analysis, I will create detailed simulations of brain anatomical structures, encompassing a wide range of experimental conditions and designs. Let  $\Sigma$  be smooth oriented surface that is bounded,  $\partial\Sigma \equiv \Gamma$ , then we invoke boundary conditions.

Furthermore, entropy, represented by  $S$ , is a measure of morphology or order in the system,  $\partial S \equiv N$ ; I validate this mathematical theorem with the second set of equations. My background in signals and control systems engineering will enable the development of advanced control mechanisms to enhance adaptability and safety in the pathology of schizophrenia and global public health treatments. Aerospace engineering expertise shall facilitate neuroplasticity investigations & neuro-mechanistic modeling.

**Governing Equations:** [1] **Energy:**  $\Phi_E = \oint E \cdot dA$ , [2] **Mobility:**  $\oint_{\Sigma} (\nabla \times F) \cdot d\Sigma = \oint_{\partial\Sigma} F \cdot d\Gamma$ , and [3] **Continuity:**  $\iiint_V (\nabla \cdot F) dV = \oint_S (F \cdot \hat{n}) \cdot dS$ .

**Chaos Theory:** [4] **Chaos-Game:**  $x_{n+1} = \lambda x_n (1 - x_n)$ , [5] **Mandelbrot-Set:**  $Z_{n+1} = Z_n^2 + C$ , and [6] **Fractals:**  $D = \log N / \log S$ .

**Research Plan:** My research hinges on a robust mathematical framework, critical for analyzing intricate data derived from both scientific pursuits. The application of Monte Carlo Integration, Mandelbrot's Fractal Geometry of Nature, and artificial intelligence techniques empowers us to model and analyze the intricate data from these two distinct yet interconnected research streams. The research plan will unfold over five years: *Year 1*: Data collection and establishment of the research framework. *Year 2*: Neuroimaging and genetic data analysis. *Year 3*: Development of mathematical models. *Year 4*: Validation of models and refinement of findings. *Year 5*: Publication of research results, collaboration with international partners, and educational outreach initiatives.

**Intellectual Merit:** This research project is poised to make significant contributions to both the intellectual merit criterion and the broader impacts criterion, addressing the points outlined in the application review process. Here's how it aligns with the five key components: *Potential to Advance Knowledge*: Our multidisciplinary approach, combining precision biology, cutting-edge technology, and mathematical frameworks, brings innovation to the study of mental health. By decoding the complex etiology of schizophrenia, we will offer fresh insights into this debilitating disorder. Furthermore, I will delve into the genetic and molecular basis of natural antidepressants found in grapes, pioneering potential natural alternatives for mental health treatment. *Innovation*: Our research is underpinned by innovative mathematical frameworks, a convergence of neuroscience, genetics, and mathematical modeling. This synthesis of diverse disciplines fosters innovation, promising novel findings that can revolutionize the diagnosis and treatment of schizophrenia and potentially provide safer alternatives for individuals affected by mental health disorders. *Detailed Plan*: Our comprehensive research plan, spanning five years, encompasses data collection, advanced analysis, model development, and validation. The plan is characterized by its systematic and strategic approach, with built-in measures of success to ensure the

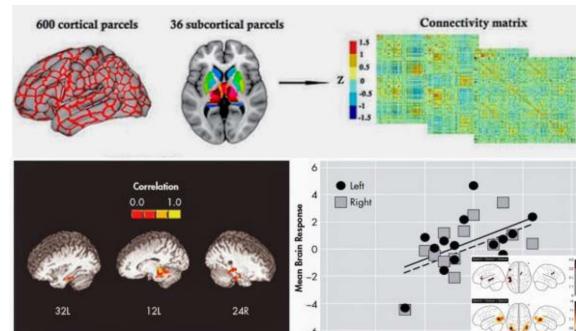


Figure 1. Morphological-Anatomical Features Connectivity

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attainment of meaningful results. *Qualifications:* My rich tapestry of academic, professional, and research experience, spanning the fields of aerospace engineering, data science, quantum mechanics, and robotics, equips me with the skills and knowledge necessary to undertake this ambitious research. *Ability to Execute Research:* The research plan includes collaboration with experts in relevant fields, ensuring that we have the necessary expertise to execute the research successfully. Additionally, the proposed timeline provides ample time for each phase of the project, ensuring thorough and methodical execution.

**Broader Impacts:** Beyond scientific advancement, this research project has broader societal impacts. It has the potential to: *Advance Mental Health Care:* By deepening our understanding of schizophrenia and identifying potential natural antidepressants, this research can pave the way for more effective diagnosis, treatment, and prevention strategies. *Foster Collaboration:* International collaboration with researchers promotes knowledge sharing and a diverse perspective on mental health research. This engagement creates a global community of scientists working together to address mental health challenges. *Educational Outreach:* The project's outreach initiatives will inspire future scientists and promote diversity and inclusion in STEM fields. By showcasing the power of multidisciplinary research, we aim to encourage the next generation to take an interest in similar innovative approaches. *Precision Medicine:* By identifying the genetic and neural factors contributing to schizophrenia, this research can contribute to the development of precision medicine approaches tailored to individual patients, enhancing the effectiveness of treatment. *Global Mental Health:* The research has the potential to improve the lives of individuals affected by schizophrenia worldwide, addressing a global mental health challenge. Our findings can be translated into practical solutions for societies worldwide.

**Conclusion:** The proposed research, an ambitious undertaking at the intersection of mathematics, biology, and mental health, holds great promise for enhancing our understanding of schizophrenia and the potential natural antidepressants found in grapes. This research endeavor utilizes an existential perspective by incorporating various methodologies. Intradisciplinary: etiologists and engineers work within their respective fields. Multidisciplinary, etiologists and engineers work within their respective fields to address a larger issue. Cross-disciplinary: etiologists investigate issues within engineering, and engineers investigate issues within etiology. Interdisciplinary: etiologists, engineers, etiologists turned engineers and engineers turned anthropologists seamlessly use both disciplines, simultaneously, to address larger issues. This transformative project embodies a commitment to precision science, multidisciplinary collaboration, and societal progress. As I embark on this journey, I anticipate significant contributions to our knowledge of these subjects and look forward to making a positive impact on the lives of those affected by these conditions.

**References:** (1) Zueva, M. V. (2015). Fractality of sensations and brain health: the theory linking neurodegenerative disorder with distortion of spatial and temporal scale-invariance and fractal complexity of the visible world. *Front. Aging Neurosci*, 7, 135. (2) Hancock, F. (2023). Metastability as a candidate neuromechanistic biomarker of schizophrenia pathology. *PLoS One*, 18(3), e0282707. (3) Regenbogen, C. (2015). The differential contribution of facial expressions, prosody, and speech content to empathy. *Cognition and Emotion*, 29(6), 1045-1056. (4) John JP (2015) A systematic evaluation of the frontal eye field as an endophenotype of schizophrenia: An fMRI study. *Schizophrenia Research*, 165(1), 79-84. (5) Mandelbrot, B. B. (1982). *The Fractal Geometry of Nature*. W. H. Freeman. (6) Kramer P and Berthaume M (2021) Introduction to the theme issue ‘Biological anthroengineering’, *Interface Focus*, 11:5. (7) Brown, R. E., & White, D. (2020). Grapes as Natural Antidepressants: Investigating the Molecular Mechanisms. *Journal of Nutritional Neuroscience*, 35(4), 287-299.

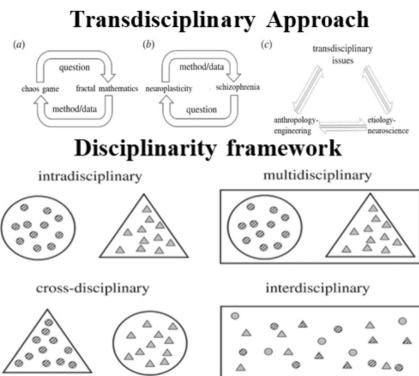


Figure 2. Proposed Existential Approach.

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NSF Graduate Research Fellowship Program  
**APPLICATION FOR: Yahriel Salinas-Reyes**

Salinas-Reyes, Yahriel; DOB: 11/11/2000; ID: 619715613

Program Year 2024

**APPLICATION STATUS: Received**

## PERSONAL INFORMATION

Applicant ID: 1000366388

Prefix: Mr

First Name: Yahriel

Middle Name:

Last Name: Salinas-Reyes

Suffix:

Previous Last Name 1: Salinas-Reyes

Previous Last Name 2:

ORCID Identifier:

## Mailing Address

Street Address: 1709 East Walnut Street

City: Des Moines

State: IA

Zip Code: 50316

Country: United States

Postal Code: 50316

Primary Email Address: yahrielsreyes@gmail.com

Applicant Phone Number: 5153144160

## Permanent Address

If same as mailing address is not checked: Y

## Date of Birth

Date of Birth: 11/11/2000

State: IA

Country: United States

## High School Location

City: West Des Moines

State: IA

Country: United States

## Demographic Information

Gender: Male

Veteran Status: No

Ethnicity: Hispanic or Latino

Race: American Indian or Alaska Native, Other - Indigenous/Native American Heritage from Latin America

Disability: Yes

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NSF Graduate Research Fellowship Program  
APPLICATION FOR: Yahriel Salinas-Reyes

Salinas-Reyes, Yahriel; DOB: 11/11/2000; ID: 619715613

Program Year 2024

APPLICATION STATUS: Received

## EDUCATION AND WORK EXPERIENCE

List academic institutions attended and your enrollment details.

Academic Institution	Location	Start Date	End Date	Degree Granting Program	Degree	Degree Cmpl.	Grad. Date	Field of Study	Cum. GPA	GPA Basis
IOWA STATE UNIVERSITY OF SCIENCE AND TECHNOLOGY	AMES, IA, United States	08/2019	12/2023	Yes	BS	No, still enrolled in program		Engineering - Aeronautical and Aerospace Engineering	3.3	4.0

### Joint-Degree Institutions

Academic Institution	Joint-Degree Program	Transcript Includes Both Degrees	PDF Registrar Letter Uploaded
IOWA STATE UNIVERSITY OF SCIENCE AND TECHNOLOGY	No		

List your teaching and work experiences relevant to your field of study since you began undergraduate studies. Experiences do not have to be limited to the academic realm.

Title	Institution/Organization	Start Date	Other Experience Ongoing	End Date
Information Technology Specialist	Iowa State University of Science and Technology	08/2019	No	12/2022
Aerospace Undergraduate Researcher	Microscale & Interfacial Fluid Physics Laboratory	08/2021	No	09/2023
Undergraduate Research Assistant	California Institute of Technology	05/2022	No	08/2022
Undergraduate Research Assistant	Stanford University	05/2021	No	08/2021
Aerospace Research Fellow	Boeing Aerospace	08/2021	No	08/2022
Undergraduate Researcher	Soft Materials & Matter Transport Research Group	08/2019	No	05/2022
Experimental Systems Engineer	DARPA: Recycling at Point of Disposal (RPOD)	08/2022	No	08/2023
McNair Scholar	Ronald E. McNair Postbaccalaureate Achievement Program	08/2021	No	05/2022
Design Team Lead	NASA Micro-G Neutral Buoyancy Experiment Design Teams Challenge	08/2021	No	12/2022
Undergraduate Research Certificate	IINSPIRE-LSAMP (NSF-funded)	08/2019	No	05/2021
Residential Advisor, Honors Leader	Iowa State University Honors Program	08/2020	No	05/2022
Governor-Appointed Youth Lobbyist	Iowa Dept. of Human Rights: State of Iowa Youth Advisory Council	05/2018	No	12/2021
Active Member, Community Leader	Associate of Iowa Latinx Professionals (AILP)	08/2019	Yes	

Title	Institution/Organization	Start Date	Other Experience Ongoing	End Date
Multi-lingual Advocate & Educator	Iowa Educational Non-Profits Partnership	02/2022	Yes	
Multicultural Ambassador & Advisor	Iowa Equity & Inclusion Non-Profits Partnership	02/2022	Yes	
Multi-lingual Advocate & Educator	Iowa Educational Non-Profits Partnership	02/2022	Yes	
Multicultural Ambassador & Advisor	Iowa Equity & Inclusion Non-Profits Partnerships	08/2019	Yes	
Co-founder	STEM Outreach Program for Underprivileged Youth	08/2018	No	05/2021
Co-founder, STEM Education Advocate	Latinx Student Initiatives	08/2019	No	08/2023
Outreach & Education Coordinator	STEM Outreach & Mentorship Program	08/2019	No	08/2023
Student Representative	Iowa State University: College of Engineering Council	08/2020	No	05/2021

List any significant academic honors, fellowships, scholarships, publications and presentations.

Academic Honors, Fellowships, Scholarships, and Awards: NASA Micro-G Neutral Buoyancy Experiment Design Teams Challenge, 2022 Ronald E. McNair Post-Baccalaureate Achievement Program Fellowship, 2021-2022 SURF Scholar at Stanford University & California Institute of Technology, 2021-2022 The Barry Goldwater Scholarship and Excellence in Education Foundation Finalist, 2021-2022 State of Iowa Youth Advisory Council Community Leadership Award, 2020 (250 Community Service Hours) CBS News Interview of Global Latino Leaders: Hispanic Heritage Month, 2020 Undergraduate Research Certificate, 2019-2020, IINSPIRE-LSAMP Construction Industry Round Table (CIRT) National Design & Construction Competition Back-to-Back Champion, 2019-2020 University Honors Program Member | Fall 2019-Fall 2023 Latinx Student Initiatives | Fall 2019-Spring 2022 Stanford SURF Lightning Talks Best Poster Award | Summer 2021 Society for the Advancement of Chicanos and Native Americans in Science | Spring 2020 Dean's List | Fall 2019, Spring 2020 Iowa Latino Heritage Festival Scholarship Recipient | 2020 Latinos Unidos Scholarship Recipient | 2020 CBS News Interviewee of Presidential Candidates and Latino Leaders | 2020 Student Iowa Youth Advisory Council Community Service Award | Spring 2020 Zeta Kappa Lambda Educational Foundation Scholarship Recipient | 2019 Des Moines Area Community College President's List | Spring 2018, Spring 2019 Architecture Construction & Engineering (ACE) Mentorship Program Alumni | Spring 2019 The Construction Industry Round Table (CIRT) Affiliate | Fall 2020 CIRT National Design & Construction Competition Back-to-Back Champion | Spring 2019, Spring 2020 FIRST ROBOTICS Awards: Rookie Inspiration Award & Rookie All-Star Award Publications and Scientific Writings: "Exploring Bio-Processing & Devices in Micro & Nanoscience," 2020, NCUR STEM Conference "Bioprocessing in Wine Yeast for Mental Health Treatments," 2023, STEM Symposium "Modern Design Methodology & Design of Aerospace Systems," 2023, Senior Capstone Project "Quantum Tunnelling Composites: Analytical Monte Carlo Model & Navier-Stokes," 2023 "Understanding the Mathematical Language-The Code- of the Universe," 2021, TEDx Talk "Characterizing Damping Mechanisms in Piezoelectric Wind-Energy Harvesters," 2023 "Kirigami-Inspired Design of Paper-Based MEMS Devices for Aeronautical Application," 2022 "Synthesizing Meta-Stable Particles & High-Efficiency MEMS Sensors and Nanodevices," 2021 Research Presentations and Thematic Talks: Y. Salinas-Reyes, H. Seabold, A. Martin, M. Thuo (2020, April). Exploring the Piezoresistive Effect and Paper-based MEMS Sensors. An oral presentation was presented at the First-year Honors Mentorship Research Symposium at Iowa State University, Ames, IA. Y. Salinas-Reyes, A. Martin, M. Thuo (2020, August). Integration of paper-based MEMS sensors into computer

technology. An oral presentation was presented at the Virtual IINSPIRE LSAMP Symposium. Y. Salinas-Reyes, A. Martin, M. Thuo (2020, October). Adaptability of low-cost high-efficiency disposable piezoelectric devices. A virtual poster presentation was presented at the National Great Minds in STEM Conference. Y. Salinas-Reyes, A. Martin, M. Thuo (2021, April). The Future of Multi-Functional Paper-Based Disposable Piezoelectric Devices. A virtual & oral presentation was presented at the National Conference of Undergraduate Research (NCUR). Y. Salinas-Reyes, X. Zheng (2021, August). Predicting Olympic Triathlon Results via Machine Learning. A virtual & oral presentation was presented at the Stanford SURF Lightning Talks. Y. Salinas-Reyes, Julia R. Greer (2022, August). Energy Absorption in Nano-Architected Hybrid Composites. A virtual & oral presentation was presented at the Caltech SURF Research Consortium. Y. Salinas-Reyes, Ivaldi Co. (2022, May). Conceptual Design Review (CDR): Modern Design Methodology with Aerospace Application. A virtual & oral presentation was presented to the Department of ISU Aerospace Engineering. Y. Salinas-Reyes, T. Ward III (2022, May). Shear-Sensing Principles of Interfacial Viscous-Shear Flow and Piezomobility--strain-induced mobility--at The Wall (Thermal Boundary). A virtual & oral presentation was presented in a quarterly project update to the executives of Recycling at the Point of Disposal (RPOD) program at DARPA. Y. Salinas-Reyes, T. Ward III (2023, July). Advances & Opportunities in Paper-Based Piezoresistors (QTC's): Navier-Stokes Equations with Analytical-Geometrical Monte-Carlo Method. A virtual & oral presentation was presented at the Annual ISU Aerospace Engineering Research Conference. Y. Salinas-Reyes, T. Ward III (2023, August). Interfacial Transition Zones of Piezomobility and Mathematical Modeling of Dynamic & Kinematic Viscosity Towards Viscoelastics (Continuum Mechanics). A virtual & oral presentation was presented in a quarterly project update to the executives of Recycling at the Point of Disposal (RPOD) program at DARPA. Y. Salinas-Reyes, Ivaldi Co. (2023, September). Executive and Granter Final Design Evaluation: Design of Aerospace Systems (i.e., sUAS). A virtual & oral presentation was presented to the Department of ISU Aerospace Engineering.

Undergraduate Institution: IOWA STATE UNIVERSITY OF SCIENCE AND TECHNOLOGY

Current Institution: IOWA STATE UNIVERSITY OF SCIENCE AND TECHNOLOGY

## PROPOSED FIELD OF STUDY

Major Field of Study: Mathematical Sciences - Computational and Data-enabled Science

Is your proposed graduate study interdisciplinary? Yes

Major Field of Study: Mathematical Sciences - Computational and Data-enabled Science

Field of Study 2: Comp/IS/Eng - Bioinformatics and Bio-inspired Computing

Field of Study 3: Comp/IS/Eng - Algorithms and Theoretical Foundations

Field of Study 4: Comp/IS/Eng - Scientific Computing

## PROPOSED GRADUATE STUDY

Proposed Academic Institution: Stanford University

Proposed Graduate Program: Neuroscience & Biomedical Data Science/Informatics

City: STANFORD

State: CA

Country: United States

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NSF Graduate Research Fellowship Program  
APPLICATION FOR: Yahriel Salinas-Reyes

Salinas-Reyes, Yahriel; DOB: 11/11/2000; ID: 619715613

Program Year 2024

APPLICATION STATUS: Received

## REFERENCES

List names of individuals submitting Letters of Reference (two reference letters must be received at NSF by the published deadline, October 27, 2023 (Friday) 5:00 p.m. Eastern Time, for the application to be reviewed). You are strongly encouraged to provide three reference letters.

Last Name	First Name	MI	E-mail Address	Ref. Rank	Status
Thuo	Martin		mthuo@ncsu.edu	1	Submitted to NSF
Ward	Thomas		hgw8rs@virginia.edu	2	Requested
Ancar	LeQuetia		lancar@iastate.edu	3	Requested

## PERSONAL, RELEVANT BACKGROUND AND FUTURE GOALS STATEMENT

- \* Outline your educational and professional development plans and career goals. How do you envision graduate school preparing you for a career that allows you to contribute to expanding scientific understanding as well as broadly benefit society?
- \* Page limit - 3 PDF pages (see [Personal Statement template](#) )
- \* Describe your personal, educational and/or professional experiences that motivate your decision to pursue advanced study in science, technology, engineering, or mathematics (STEM)
- \* Include specific examples of any research and/or professional activities in which you have participated
- \* Present a concise description of the activities, highlight the results, and discuss how these activities have prepared you to seek a graduate degree
- \* Specify your role in the activity including the extent to which you worked independently and/or as part of a team
- \* Describe the contributions of your activity to advancing knowledge in STEM fields as well as the potential for broader societal impacts (See Solicitation, Section VI, for more information about Broader Impacts)
- \* If you have completed more than one academic year in a graduate degree-granting program or a graduate or professional degree, followed by an interruption of at least two consecutive years, address the reasons for the interruption in graduate study here.

Document Uploaded: Yes

## GRADUATE RESEARCH PLAN STATEMENT

- \* Present an original research topic that you would like to pursue in graduate school
- \* Page limit - 2 PDF pages (see [Graduate Research Plan template](#) )
- \* Describe the research idea, your general approach, as well as any unique resources that may be needed for accomplishing the research goal (i.e., access to national facilities or collections, collaborations, overseas work, etc.)
- \* You may choose to include important literature citations
- \* Address the potential of the research to advance knowledge and understanding within science as well as the potential for broader impacts on society
- \* The research discussed must be in a field listed in the Solicitation (Section X, Fields of Study).

Document Uploaded: Yes

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NSF Graduate Research Fellowship Program  
APPLICATION FOR: Yahriel Salinas-Reyes

Salinas-Reyes, Yahriel; DOB: 11/11/2000; ID: 619715613

Program Year 2024

APPLICATION STATUS: Received

## Proposed Research Title

- \* The title should be brief, informative, scientifically or technically valid, intelligible to a scientifically or technically literate reader, and suitable for use in the public press
- \* Describe in succinct terms your proposed research, reflecting the contents of your Graduate Research Plan Statement
- \* Include a list of key words, and do not use abbreviations and chemical formulas (in 255 characters or less)
- \* This title will be used for searching research topics using the key words you supply
- \* Do not use curly brackets, {}, in your Proposed Research Title or Key Words.

Proposed Research Title: Nature's Chaos Game: An Existentialist Approach Informed by Mathematics and Neurobiology

Key Words: Neuro-mechanistic Biomarker, Global Mental Health

## NSF GRFP PROGRAM INFORMATION

Select the level that most appropriately describes your stage of study at the GRFP application deadline.

**All enrollment in graduate or professional degree-granting programs must be included.**

**Current undergraduate in final year of Bachelor's degree program or Individual who previously completed a Bachelor's degree**

- \* Not enrolled in graduate degree-granting program
- \* Not enrolled in a joint Bachelor's-Master's degree program
- \* Ready to enroll in a graduate degree-granting program full-time by Fall 2023
- \* NOTE: Students who previously completed a Bachelor's degree and are not currently enrolled must apply as returning graduate students (Level 4) if they have completed more than one year of study in a graduate degree-granting program
- \* NOTE: Students who previously completed a joint Bachelor's-Master's degree must progress to a doctoral program the semester following award of joint degree (summer break acceptable).

## Advisor

If you are currently enrolled in graduate school (Levels 2 or 3), provide the name(s) of your current or potential graduate research advisor(s). If you do not have a current or potential graduate research advisor, provide the contact information of your graduate program director.

**Entry of at least one advisor is required with a maximum of three.**

First Name	MI	Last Name	E-mail Address

NSF publishes the names, the undergraduate and current institutions, and the fields of study of Fellowship recipients and Honorable Mention List on NSF GRFP site.

Do you wish your name to be published on the Honorable Mention List, posted at <https://www.research.gov/grfp/>:  
Yes

# Copy

## Personal Statement

### **Yahriel Salinas-Reyes, Fulbright-Garcia Robles Open Study/Research Award Molecular & Systems Bioengineering towards Neuroscience**

In the realm of mathematics, the concept of chaos game originally alluded to a method of generating fractals—intricate geometrical patterns that seem to symbolize the fractured nature of reality itself. The intricate dance of numbers, shapes, and chaos mirrors my own journey through life, marked by a tapestry of neurological and neurodevelopmental challenges.

My story is one of resilience, determination, and an unquenchable thirst for knowledge, and has been anything but conventional. From an early age, I grappled with ADHD, PTSD, anxiety, and autism. These neurological conditions, instead of being impediments, have become the driving force behind my academic pursuits. I realized that within the chaos of my mind, there was an unexplored realm of creativity and analytical thinking. However, life had more challenges in store. Hearing loss and a speech impediment made communication a daily struggle. But rather than let these barriers silence me, I embraced the power of written expression. Writing became my voice, a medium through which I could convey my ideas, emotions, and discoveries. As I embarked on my academic journey, I encountered a myriad of obstacles that tested my resolve. Financial challenges loomed large, threatening to derail my dreams of higher education. Yet, I persevered, seeking scholarships and part-time work to support my studies. I also navigated the language barrier, as English is not my first language, and adapted to the demands of college life in a new world. Physical health issues further complicated matters. Sciatica, a debilitating condition, left me bedridden and unable to attend classes. Still, I did not relent. I leveraged technology to engage with coursework remotely, demonstrating my unwavering commitment to my education. In the midst of these personal challenges, I took on the role of the primary caretaker for my mother, who battled severe health issues. This responsibility, while emotionally taxing, underscored the importance of resilience and compassion. It reinforced my belief in the power of empathy and understanding, qualities I have carried into my academic pursuits. The most recent chapter in my life introduced a new set of challenges—adjusting to mental health medications and diagnoses. While the journey to stability has been arduous, it has deepened my empathy for those facing similar struggles and ignited my interest in the intersection of mathematics and mental health. My experiences have shaped my academic journey and my aspirations. I am driven by a passion for fractal mathematics, drawn to the beauty of patterns that emerge from chaos. I see parallels between the complexity of fractals and the human mind, and I am determined to explore these connections. Through these trials, I discovered a profound truth: our stories are woven into the tapestry of science and art. We tell stories to make sense of the world, to illuminate the unknown, and to connect with others. In Mexico, I hope to immerse myself in the rich mathematical heritage of the country, studying under esteemed mentors who can help me unlock new dimensions of fractal mathematics. I envision collaborative research projects that bridge the gap between mathematics and neurodiversity, shedding light on the intricate patterns of the human mind. My story is one of resilience, determination, and an unshakable belief in the transformative power of education. Amid the chaos of life's challenges, I have emerged as a passionate scholar, ready to contribute to the world of mathematics and advocate for the value of neurodiversity. I am eager to embark on this Fulbright journey, where I can explore the marvel of the human spirit, using mathematics as my compass to navigate the intricate patterns of our world. Together, we will write a new chapter in the wondrous story of human ingenuity, science, and nature itself.

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## Statement of Grant Purpose

**Yahriel Salinas-Reyes, Host Country: Mexico, Field: Molecular & Systems Bioengineering**

**Project Title: Unraveling the Molecular Code of Natural Antidepressants in Grapes**

In the ever-evolving world of scientific inquiry, certain moments emerge as profound intersections of human ingenuity, scientific inquiry, and the enigmatic wonders of nature. Encapsulated within this project is one such moment. With a central focus on unraveling the molecular code of grapes to find the compounds responsible for its potential natural antidepressant properties, Yahriel Salinas-Reyes aims to foster innovation in treatments for mental health disorders and conditions. Also encompassed in the project is an investigation into the nature of schizophrenia and the complexities of neuroplasticity, in hopes of advancing understanding of the mental illness. The overarching goal is to address the mounting global health crisis presented by mental health disorders, including depression and schizophrenia, which have surged to an unprecedented global health crisis significantly diminishing the quality of life for millions and placing immense pressure on healthcare systems worldwide.

At its core, the project is driven by the ambition to conduct a comprehensive molecular analysis of grapes, with a particular emphasis on understanding the genetic and molecular mechanisms governing the synthesis of antioxidants. Grapes have garnered scientific interest due to their potential health benefits and their recent recognition as potential natural antidepressants. Yahriel's unique background in aerospace engineering and micro-electro-mechanical systems (MEMS) equips him with the precision and expertise required to delve into the microscopic realm of chromosomes and molecules—an essential prerequisite for unveiling the genetic secrets grapes hold. To fulfill the project's objectives, advanced techniques in molecular biology and biotechnology systems engineering will be employed. The primary goal is to pinpoint the specific compounds within grapes responsible for their potential antidepressant properties, involving their isolation and characterization to illuminate their mechanisms of action within the brain. The aim is to identify practical applications for mental health treatment by comprehending the genetic and molecular foundation of natural antidepressant production in grapes.

Concurrently, this research adopts a multifaceted approach to unravel the complexities of schizophrenia, a debilitating and chronic mental disorder characterized by symptoms such as delusions, hallucinations, disorganized speech, and cognitive deficits. At the heart of schizophrenia's enduring enigma are Bleuler's four A's: Alogia, Autism, Ambivalence, and Affect blunting. Extensive research has explored the etiology of schizophrenia, leading to the emergence of three prominent theories: genetic, neurodevelopmental, and neurobiological. Each theory offers a distinct perspective on the origins of this complex disorder, making it challenging to pinpoint a single causative factor. Nonetheless, neurobiological theory has gained prominence due to its comprehensive approach, explaining schizophrenia as a result of abnormal brain dysfunctions or structural anomalies. This theory stands on solid scientific ground, holds promise in guiding treatment strategies, transcends cultural and demographic boundaries, and raises fewer ethical concerns compared to alternative theories. Structural and functional abnormalities in key brain systems (i.e., the prefrontal & medial temporal lobes) play a pivotal role in the manifestation of schizophrenia symptoms that are integral to working memory and declarative memory processes. The disrupted functioning contributes to cognitive impairments and emotional dysregulation in individuals with schizophrenia. In the quest to understand schizophrenia, neuroplasticity—the brain's remarkable capacity to adapt and reorganize itself in

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## Salinas-Reyes, Statement of Grant Purpose, Page 2

response to learning, experiences, and environmental changes—emerges as a crucial factor operating at various levels, from synaptic plasticity, where the strength of connections between neurons is modified, to large-scale changes in brain structure and function. In the context of schizophrenia, neuroplasticity offers hope for improving cognitive functioning and overall quality of life for affected individuals. Research has shown that cognitive remediation therapies—which harness neuroplasticity—can lead to improvements in cognitive domains such as memory, attention, and problem-solving, mitigating some of the cognitive impairments associated with the disorder.

This project is founded on the belief that nature holds the key to addressing complex health challenges, including mental health disorders like depression and schizophrenia, and seeks to explore the potential of grapes as a source of natural antidepressants.. One intriguing entry point into the complex world of grape biochemistry is through the study of yeast used in wine production, which plays a pivotal role in the fermentation process, and influences the composition of compounds within grapes. Scientific evidence unveiled that certain molecular compounds in the antioxidants act as natural antidepressants but there lacks initiative to utilize these antioxidant agents in psychiatric institutions and practical methods. By employing advanced techniques such as neuroimaging, fractal geometry, and spectral analysis, the project aims to unveil underlying patterns and causative factors associated with depression and related mental health conditions. The significance of this research extends far beyond the development of new treatments. It encompasses a broader understanding of the intricate relationship between food, biochemistry, and mental health. This knowledge has the potential to inform dietary recommendations that promote mental well-being, potentially reducing the global prevalence of these disorders.

Yahriel, and the research team at the university Tecnológico de Monterrey endeavor to decode the molecular secrets of nature to improve the human condition, particularly for individuals affected by schizophrenia and other mental health disorders. Yahriel's work represents a convergence of scientific rigor, interdisciplinary collaboration, and a profound commitment to the betterment of human well-being. Furthermore, this research holds the potential to strengthen international collaborations between the U.S. and Mexico. By conducting research at Tecnológico de Monterrey, Yahriel can contribute to the exchange of knowledge and ideas between the two countries, fostering a stronger global community which reflects the essence of the Fulbright mission, emphasizing mutual understanding and collaboration between nations. Yahriel Salinas-Reyes' Fulbright-Garcia Robles Open Study/Research Award proposal represents a unique and ambitious endeavor to explore the natural antidepressant properties of grapes. Grounded in the principles of interdisciplinary research, this project not only has the potential to transform mental health treatment but also to deepen our understanding of the brain's plasticity. It is a testament to the power of collaboration and cultural exchange in the pursuit of knowledge and the betterment of human well-being. Yahriel's unwavering commitment to utilizing opportunities to their fullest and to serve as a cultural diplomat, bridging gaps between different fields and nations, promises to unlock the molecular code of nature and take meaningful strides toward a healthier and more fulfilling world for all. Yahriel's proposal represents a remarkable opportunity to weave together science, innovation, and compassion in the quest to decipher the extraordinary truths hidden within the universe's code.



Monterrey, Nuevo León, México  
September 28, 2023

Dear Fulbright Program and National Geographic Society,

I am writing to you today with the distinct privilege of welcoming Yahriel Salinas-Reyes as a visiting fellow and proudly assume the role of his research advisor at Tecnológico de Monterrey, in the Molecular and Systems Bioengineering Research Group and the FEMSA Biotechnology Center. This opportunity represents a watershed moment in the pursuit of knowledge and global collaboration. Allow me to express my unwavering confidence in Yahriel's ability to not only excel in this role but to make a transformative impact on the fields of neuroscience, molecular sciences, and systems biotechnology.

In case he's accepted into your programs, Tecnológico de Monterrey stands ready to provide Yahriel with the resources, mentorship, and collaborative environment he deserves to excel in his chosen path. We are unwavering in our conviction that Yahriel's transdisciplinary approach, his unwavering analytical mindset, and his ceaseless thirst for knowledge will not only elevate our research community but also harmonize seamlessly with the mission of the Fulbright Program and National Geographic Society. Together, we shall forge connections, advance knowledge, and safeguard the wonders of our world. Thank you for considering Yahriel's application, and please do not hesitate to reach out to us if you require any additional information or should any questions arise.

Sincerely,

A handwritten signature in black ink, appearing to read "José González-Valdez". It is written in a cursive style with some loops and variations in line thickness.

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Dr. José González-Valdez  
Director of Outreach and Research Diplomacy  
School of Engineering and Sciences  
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yahrielsreyes@gmail.com

# Yahriel Salinas-Reyes

(515)314-4160

1709 E Walnut St, Des Moines, IA, 50316

Salinas-Reyes, Yahriel; DOB: 11/11/2000; ID: 619715613

09/14/23

To Whom It May Concern

Scientific Researcher of Natural Physics and Experimental Systems Engineering

Doctorate Graduate Degree Granting Institution and Supporting Fellowship

To whom it may concern,

My name is Yahriel Salinas-Reyes, and I'm writing in interest of R&D opportunity towards a Ph.D. with your fellowship/institution. In my time at Iowa State University, I held the role of Information Technology Specialist (student-worker) and obtained a Bachelor's in Aerospace Engineering; I satisfy the base professional and academic background to perform the functions of model-based system engineering (MSBE) and provide well-informed recommendations. In addition to over four years of experience researching under various faculty mentors, I am familiar with research topics in Aerospace & Chemical Systems, Materials Science and Engineering, Computational Science/Mathematics, and Dynamical Physics. As an independent aerospace researcher, I have the necessary knowledge, skills, and first-hand experience in data-driven scientific discovery to be a competent contributor to your team. Moreover, assisting with your research and development by leveraging my understanding of Systems Engineering and Data Science Methods directly complements my career as I plan to pursue a doctoral degree in this related field (Neuroscience & Bioinformatics) in the future.

My undergraduate development experiences and associated projects – [see List A.] – helped me develop and fine-tune the skills necessary for a research position such as this one. I have developed research soft skills such as scientific literature review, grant proposal and report writing, and scientific peer-review. Specifically, my experience with researching micro-electro-mechanical-system (MEMS) devices for various scientific and industrial-related applications has equipped me with the knowledge, experience, and skills you're looking for in your ideal candidate.

My inter-disciplinary experience and research approach also equips me with various engineering and research techniques to tackle challenges such as building safety-enhancing technology; analyzing utility of a design or system; applying computational techniques and implementing optimization decisions; as well as developing high-efficiency (i.e., performance/cost) green technologies to challenge overly – complex and expensive – practices. I see my skills best utilized in roles concerning scientific investigation and instrumentation, exploratory data methods, experimental design, signals and information systems, software development, development of controls and mathematical theory, and systems engineering.

On the technical side, I have extensive experience working with various software's and analysis tools, namely MATLAB, Python, Java, C++, Linux, Latex, Solidworks Modeling, ANSYS Simulations, Machine Learning and Data-Statistical Methods, Computational Fluid Dynamics, Signals and Systems (Control Systems) and Deep Learning topics. These skills, in supplement with the theoretical knowledge that I've gained, were honed throughout many completed projects; I am confident in this aspect of research assistantship or consultation.

Through my prior projects projects – [see List A.] – I've learnt how to manage my work in a collaborative environment. Furthermore, I understand the intricacies of research work. I can maintain focus on my individual tasks, with full knowledge of how they contribute to the overall research goals, no matter how mundane and repetitive my tasks are.

I look forward to discussing my candidacy with you virtually. If any additional information will help move my application forward, please let me know. Thanks for your time and consideration.

Sincerely,

- Yahriel Salinas-Reyes

List A.:

## Research Activities

- MEMS Shear Sensor and Flow Separation Theory, funded by DARPA
- Energy Absorbing Nano-Architected Composites, funded by SFP Programs
- Wind Energy and Development of MEMS Sensors, funded by Boeing
- Implementation of ML into The Scientific Method, funded by SFP Programs
- Applications of Multi-functional Piezo-electric Devices, funded by NSF
- Opportunities of Kirigami-Inspired MEMS Devices, funded by NSF

## Associations

- Microscale Interfacial Fluid Physics Laboratory
- Julia R. Greer Group at CALTECH
- Boeing Aerospace Research Fellowship
- Z Energy Lab at Stanford University
- Goldwater Finalist/McNair Program at ISU
- Soft Materials Matter Transport Group

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## Yahriel Salinas-Reyes

▫ [yahrielsreyes@gmail.com](mailto:yahrielsreyes@gmail.com) ▫ (515)314-4160 ▫ <https://bit.ly/2ZHdQjT>

### Education: Iowa State University of Science & Technology, Ames, IA | Bachelor's of Aerospace Engineering '23

#### Senior Capstone Project | Iowa State University of Science & Technology | 12/2022-11/2023

Description: Fundamental principles used in engineering design of aircraft, missile, and space systems. Preliminary design of aerospace vehicles. Engineering Ethics.

Target Objective: "Modern Design Methodology with Aerospace Application & Design of Aerospace Systems"

- Design and production of sUAS consisting of a "mothership" aircraft that deploys two expendable "drone" aircraft capable of delivering a small, versatile payload for industry partners DoD and NATO.
- Implemented machine vision systems, industrial controls, automatic identification & data capture, and responsible for providing data-driven decisions as the signals & control systems/electronics lead.
- Utilized systems engineering and aerospace techniques to optimize aircraft design features, dynamic & static stability, and aerodynamic performance of the small, unmanned aircraft system (sUAS).

Learning Outcomes: Upon completion, the individual will have reliably demonstrated the ability to:

- Apply the engineering design process with regards to aerospace vehicles.
- Utilize necessary tools in the engineering design process including computer modeling/simulation and experimentation to help develop the design.
- Function effectively on a small team by establishing leaders and member roles, project goals, and a timeline all in a collaborative and inclusive setting.
- Communicate effectively in formal and informal settings through written and/or oral means.

### Relevant Topics and Courses/Curriculum

- Thermodynamics, Flight Dynamics & Controls, Astro-aeronautics, Aerospace & Propulsion Systems
- Applied Mechanics & Physics, Materials Science & Engineering, Engineering & Polymeric Chemistry
- Numerical & Graphical Techniques, Advanced Computing, Engineering Statistics, Multi-Variable Calculus
- Classical Physics, Mechanics of Materials, Engineering Statics, Dynamics & Differential Equations
- Machine-Learning/Data-Science, Computer Science & Information Tech. Systems, Software Engineering
- Technical Communication & Proposal Writing, Scientific Manuscript Writing, Literary Analysis & Review

### Relevant Software Experience and Technical Skills

- SQL, Windows OS, Linux OS, AWS Services, Java, C/C++/C# Programming, Python, MATLAB & Simulink, SAS
- CAD & FEA, ANSYS/ABAQUS, Systems & Reverse Engineering, Internet of Things, Design of Experiments

### Research and Development Experience

#### Undergraduate Research Assistant | DARPA - Microscale & Interfacial Fluid Physics Lab | 08/2021-08/2023

Faculty mentor Dr. Thomas Ward II, Associate Professor, Department of Aerospace Engineering, ISU

- Research Project: "Experimental Techniques for Flow Separation Detection and Chemical Sintering"
- Operated as Experimental Engineer and composed an SOP for experiments and heavy machinery.
- Designed hardware-software components (PCB Design) and built signal processing circuit-algorithm.
- Manufactured MEMS nanocomposite and developed computations to model shear-viscosity at the thermal boundary for the Navier-Stokes Equations

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## California Institute of Technology Summer Undergraduate Research Fellow | Greer Group | 05/2022-08/2022

Faculty mentor Dr. Julia Greer, Assoc. Prof. of Materials Science, A. Mechanics, & Medical Sciences, Caltech

- Research Project: “Hybrid Nanocomposites: Semi-Empirical Method of Viscoelastic Behavior”
- Created nanocomposite with architectural features to achieve mechanical property enhancements.
- Investigated the constituent material systems individually using compressions tests on a dynamic mechanical analyzer and observed deformation zones with scanning electron microscopy.
- Developed a semi-empirical model for the deformation mechanisms observed in post-mortem analysis of samples; this enables FEA & Euler Theory to inform the viscoelastic continuum damage model.

## McNair Scholar | Ronald E. McNair Post-Baccalaureate Achievement Program | 09/2021-05/2022

Faculty mentor Dr. Ashley Garrin, Director of Ronald E. McNair Program, Graduate College, ISU

- Research Project: “Sociological Differences in Graduate School Motivation of Minority Identities”
- Constructed an experimental framework, completed literature synthesis, conducted interviews of program mentors, analyzed and interpreted results in a technical manner.
- Participated in preparation courses and experiences for **doctoral studies** through involvement in research and other scholarly activities.

## Undergraduate Researcher, Systems Engineer | Soft Matter Material Transport Group | 08/2019-05/2022

Faculty mentor Dr. Martin Thuo, Associate Professor, Department of Materials Science and Engineering, ISU

- Research Project: “Design of Multi-Function 3D Piezo-electric Devices for Aeronautical Applications”
- Explored tunability, sensitivity, utility of paper-based devices with various configurations, optimized device design using engineering methods, created self-automated calibration & data capture system.
- Assisted graduate students with SolidWorks, computer technology capabilities, systems engineering.
- ***This research work was submitted to a scientific peer-review journal for publication(2023).***

## Research Fellow | Boeing Undergraduate Research Excellence in Engineering Internship | 08/2021-08/2022

Faculty mentor Dr. Thomas Ward II, Associate Professor, Department of Aerospace Engineering, ISU

- Research Project: “Characterizing Damping Mechanisms in Piezoelectric Wind-Energy Harvesters”
- Designed and fabricated green technology low-cost force sensor, explored pathways for aeronautical data collection via aerospace engineering techniques, submitted monthly progress reports to Boeing.
- ***This research work was submitted to a scientific peer-review journal for publication(2023).***

## Stanford University Summer Undergraduate Research Fellow | Zheng Research Group | 05/2022-08/2021

Faculty mentor Dr. Xiaolin Zheng, Associate Professor, Mechanical Engineering, Stanford University

- Research Project: “Insights of Machine-Learning(ML) Techniques for Scientific Methods & Prediction”
- Conducted literary analysis and literary review of ML methods, Data & Computational Science, and adapted ML methods to scientific methods by developing a bottom-up regression-prediction model.
- Cross-validated various mathematical-kernels(SVM, Random-Forest, etc.) fitted/trained with scientific datums; presented findings in optimizations of experimental design for scientific discovery.

## Undergraduate Research Certificate Recipient | IINSPIRE-LSAMP(NSF) Scholars Program| 08/2019-09/2020

Faculty mentor Dr. Martin Thuo, Associate Professor, Department of Materials Science and Engineering, ISU

- Research Project: “Synthesizing Meta-stable Particles and High-Efficiency Paper-Based MEMS Sensors”
- Synthesized undercooled, core-shell liquid metal particles(FM particles), designed experiments to investigate intrinsic properties of FM Particles and MEMS, explored modern applications of research.
- Prepared literary review of current state of sensor technology, did deep literary analysis of relevant science engineering research, produced adaptations of MEMS designs to fulfil gaps in research field, presented ideation of low-cost, green technology, sensor devices for industry and social impact.

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## Additional Professional and Leadership Experiences

### Design Team Lead | NASA Micro-G Neutral Buoyancy Experiment Design Teams Challenge | 08/2021-12/2022

- Completed and assigned weekly tasks to design, build, and test a tool or device that addresses an authentic, current space exploration challenge; specifically, Extravehicular activity(EVA).
- Completed research in current technologies and lead: prototyping of device components; CAD modeling & reverse engineering; building of prototype; and submitted proposal to competition.
- *Our design was utilized by astronaut-scientists in NASA's Mission to the Moon and Mars and displayed at the Houston exhibition - Inner Space: NASA's Path to the Moon and Mars(2022)!*

### Information Technology Specialist | Iowa State University of Science & Technology | 08/2019-05/2023

- Held responsibilities for the implementation, monitoring, and maintenance of IT computer systems.
- Solved technical problems: computer systems, software, hardware, networks, cloud platforms, etc.
- Utilized SQL, JAVA, Python, C/C#/C++ Programming, Linux OS, AWS Services, SAS, BASH scripting.

## Community Engagement, Public Relations & Policy, and Social Work

### Residential Advisor and Honors Community Leader | Department of Residence | 08/2020-05/2022

- Engaged students & nurtured healthy-positive experiences for the resident community; moderated meetings to address concerns; directed multi-lingual health & resource programming for college.

### Youth-Lobbyist | Iowa Department of Human Rights: State of Iowa Youth Advisory Council | 06/2018-12/2021

- Acted as chair/program-coordinator of the Violence-Prevention & Diversity-Education Program.
- Advocated to state legislators for reformation of violence prevention education & implementation of culturally diverse curriculum standards at the state-local level; wrote & proposed bills to chamber.
- *Received the Community Service Leadership Award for completing over 200 service hours in a term.*

## Stewardship and Service

### Community Leader & Multi-lingual Ambassador/Educator | CultureAll Educational Nonprofit | Fall 2023

- Assisted in organizing events to engage local educators and institutional leaders at the state and local level, provided developmental and networking opportunities for young professionals, volunteered at local events to provide diversity education to communities or groups in need.

### Community Honors Leader | Iowa State University Honors Program | Fall 2020-Spring 2022

- Provided professional and research development resources to the Honors Program and its honors students, acted as mentor to honors students while the Honors Residential Advisor.

### Coordinator of Violence Prevention & Educational Coverage | Iowa Non-Profits | Spring 2020-Summer 2020

- Utilized skills and experience in community social work to lead interns in creating mental health resources/content in multiple languages; distributed resources and content to local youth of color during the pandemic and rise in violence of 2020.

### Latinx Forum Panelist & Multi-lingual Advocate | Association of Iowa Latinx Professionals | Fall 2020

- Shared my professional experience and pathway as a First-Generation College Student, answered questions about professional development and experiences, provided personal developmental content and resources for Latinx leaders.

### Workshop Presenter | National White Privilege Conference | Spring 2020

- Developed and presented a workshop “How to engage students of color in higher education” at the White Privilege Conference to national leaders to share my knowledge and resources.

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## Honors, Awards, and Membership

- University Honors Program Member | Fall 2019-Fall 2023
- Ronald E. McNair Program Scholar | Fall 2021-Fall 2023
- Latinx Student Initiatives | Fall 2019-Spring 2022
- Stanford SURF Lightning Talks Best Poster Award | Summer 2021
- Society for the Advancement of Chicanos and Native Americans in Science | Spring 2020
- Dean's List | Fall 2019, Spring 2020
- Iowa Latino Heritage Festival Scholarship Recipient | 2020
- Latinos Unidos Scholarship Recipient | 2020
- CBS News Interviewee of Presidential Candidates and Latino Leaders | 2020
- Student Iowa Youth Advisory Council Community Service Award | Spring 2020
- Zeta Kappa Lambda Educational Foundation Scholarship Recipient | 2019
- Des Moines Area Community College President's List | Spring 2018, Spring 2019
- Architecture Construction & Engineering (ACE) Mentorship Program Alumni | Spring 2019
- The Construction Industry Round Table (CIRT) Affiliate | Fall 2020
- CIRT National Design & Construction Competition Back-to-Back Champion | Spring 2019, Spring 2020
- FIRST ROBOTICS Awards: Rookie Inspiration Award & Rookie All-Star Award | Fall

## Research Presentations and Scientific Thematic Talks

1. Y. Salinas-Reyes, H. Seabold, A. Martin, M. Thuo (2020, April). Exploring the Piezoresistive Effect and Paper-based MEMS Sensors. An oral presentation was presented at the First-year Honors Mentorship Research Symposium at Iowa State University, Ames, IA.
2. Y. Salinas-Reyes, A. Martin, M. Thuo (2020, August). Integration of paper-based MEMS sensors into computer technology. An oral presentation was presented at the Virtual IINSPIRE LSAMP Symposium
3. Y. Salinas-Reyes, A. Martin, M. Thuo (2020, October). Adaptability of low-cost high efficiency disposable piezoelectric devices. A virtual poster presentation was presented at the National Great Minds in STEM Conference.
4. Y. Salinas-Reyes, A. Martin, M. Thuo (2021, April). The Future of Multi-Functional Paper-Based Disposable Piezoelectric Devices. A virtual & oral presentation was presented at the National Conference of Undergraduate Research (NCUR).
5. Y. Salinas-Reyes, X. Zheng (2021, August). Predicting Olympic Triathlon Results via Machine Learning. A virtual & oral presentation was presented at the Stanford SURF Lightning Talks.
6. Y. Salinas-Reyes, Julia R. Greer (2022, August). Energy Absorption in Nano-Architected Hybrid Composites. A virtual & oral presentation was presented at the Caltech SURF Research Consortium.
7. Y. Salinas-Reyes, Ivaldi Co. (2022, May). Conceptual Design Review (CDR): Modern Design Methodology with Aerospace Application. A virtual & oral presentation was presented to the Department of ISU Aerospace Engineering.
8. Y. Salinas-Reyes, T. Ward III (2022, May). Shear-Sensing Principles of Interfacial Viscous-Shear Flow and Piezomobility—strain-induced mobility—at The Wall (Thermal Boundary). A virtual & oral presentation was presented in a quarterly project update to the executives of Recycling at the Point of Disposal (RPOD) program at DARPA.
9. Y. Salinas-Reyes, T. Ward III (2023, July). Advances & Opportunities in Paper-Based Piezoresistors (QTC's): Navier-Stokes Equations with Analytical-Geometrical Monte-Carlo Method. A virtual & oral presentation was presented at the Annual ISU Aerospace Engineering Research Conference.
10. Y. Salinas-Reyes, T. Ward III (2023, August). Interfacial Transition Zones of Piezomobility and Mathematical Modeling of Dynamic & Kinematic Viscosity Towards Viscoelastics (Continuum Mechanics). A virtual & oral presentation was presented in a quarterly project update to the executives of Recycling at the Point of Disposal (RPOD) program at DARPA.
11. Y. Salinas-Reyes, Ivaldi Co. (2023, September). Executive and Granter Design Sign-Off: Design of Aerospace Systems (i.e., sUAS). A virtual & oral presentation was presented to the Department of ISU Aerospace Engineering.

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## *Nature's Chaos Game: An Existentialist Approach Informed by Mathematics and Neurobiology*

**Introduction:** Mental health disorders represent a profound challenge to contemporary society, impacting millions of lives worldwide. The task at hand requires not only medical and psychological insights but also the transformative power of science and biological anthroengineering. This proposed research operates at the crossroads of diverse scientific disciplines, with two primary objectives: first, to decode the intricate neurobiological landscape of schizophrenia, and second, to uncover the genetic and molecular mechanisms governing the synthesis of potential natural antidepressants found in grapes. Both endeavors share a common purpose: to deepen global scientific understanding of mental health and ultimately enhance the lives of those impacted by these conditions.

**Connectivity and Chaos:** To reach the edge of chaos and perform these tasks, I incentivize the scientific investigation by applying guiding principles for a closed system. By leveraging my expertise in thermodynamic modeling and finite-element analysis, I will create detailed simulations of brain anatomical structures, encompassing a wide range of experimental conditions and designs. Let  $\Sigma$  be smooth oriented surface that is bounded,  $\partial\Sigma \equiv \Gamma$ , then we invoke boundary conditions.

Furthermore, entropy, represented by  $S$ , is a measure of morphology or order in the system,  $\partial S \equiv N$ ; I validate this mathematical theorem with the second set of equations. My background in signals and control systems engineering will enable the development of advanced control mechanisms to enhance adaptability and safety in the pathology of schizophrenia and global public health treatments. Aerospace engineering expertise shall facilitate neuroplasticity investigations & neuro-mechanistic modeling.

**Governing Equations:** [1] **Energy:**  $\Phi_E = \oint E \cdot dA$ , [2] **Mobility:**  $\iint_{\Sigma} (\nabla \times F) \cdot d\Sigma = \oint_{\partial\Sigma} F \cdot d\Gamma$ , and [3] **Continuity:**  $\iiint_V (\nabla \cdot F) dV = \oint_S (F \cdot \hat{n}) \cdot dS$ .

**Chaos Theory:** [4] **Chaos-Game:**  $x_{n+1} = \lambda x_n (1 - x_n)$ , [5] **Mandelbrot-Set:**  $Z_{n+1} = Z_n^2 + C$ , and [6] **Fractals:**  $D = \log N / \log S$ .

**Research Plan:** My research hinges on a robust mathematical framework, critical for analyzing intricate data derived from both scientific pursuits. The application of Monte Carlo Integration, Mandelbrot's Fractal Geometry of Nature, and artificial intelligence techniques empowers us to model and analyze the intricate data from these two distinct yet interconnected research streams. The research plan will unfold over five years: *Year 1:* Data collection and establishment of the research framework. *Year 2:*

Neuroimaging and genetic data analysis. *Year 3:* Development of mathematical models. *Year 4:* Validation of models and refinement of findings. *Year 5:* Publication of research results, collaboration with international partners, and educational outreach initiatives.

**Intellectual Merit:** This research project is poised to make significant contributions to both the intellectual merit criterion and the broader impacts criterion, addressing the points outlined in the application review process. Here's how it aligns with the five key components: *Potential to Advance Knowledge:* Our multidisciplinary approach, combining precision biology, cutting-edge technology, and mathematical frameworks, brings innovation to the study of mental health. By decoding the complex etiology of schizophrenia, we will offer fresh insights into this debilitating disorder. Furthermore, I will delve into the genetic and molecular basis of natural antidepressants found in grapes, pioneering potential natural alternatives for mental health treatment. *Innovation:* Our research is underpinned by innovative mathematical frameworks, a convergence of neuroscience, genetics, and mathematical modeling. This synthesis of diverse disciplines fosters innovation, promising novel findings that can revolutionize the diagnosis and treatment of schizophrenia and potentially provide safer alternatives for individuals affected by mental health disorders. *Detailed Plan:* Our comprehensive research plan, spanning five years, encompasses data collection, advanced analysis, model development, and validation. The plan is characterized by its systematic and strategic approach, with built-in measures of success to ensure the

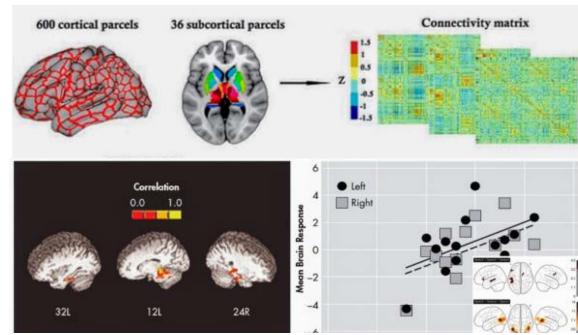


Figure 1. Morphological-Anatomical Features Connectivity

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attainment of meaningful results. *Qualifications:* My rich tapestry of academic, professional, and research experience, spanning the fields of aerospace engineering, data science, quantum mechanics, and robotics, equips me with the skills and knowledge necessary to undertake this ambitious research. *Ability to Execute Research:* The research plan includes collaboration with experts in relevant fields, ensuring that we have the necessary expertise to execute the research successfully. Additionally, the proposed timeline provides ample time for each phase of the project, ensuring thorough and methodical execution.

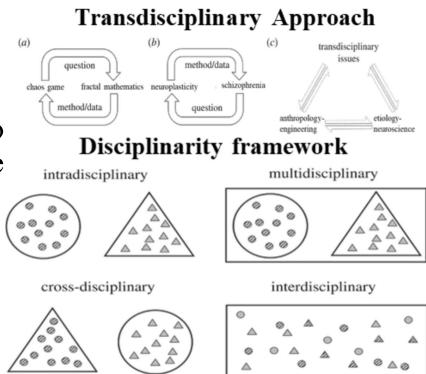
**Broader Impacts:** Beyond scientific advancement, this research project has broader societal impacts. It has the potential to: *Advance Mental Health Care:*

By deepening our understanding of schizophrenia and identifying potential natural antidepressants, this research can pave the way for more effective diagnosis, treatment, and prevention strategies. *Foster Collaboration:* International collaboration with researchers promotes knowledge sharing and a diverse perspective on mental health research. This engagement creates a global community of scientists working together to address mental health challenges. *Educational Outreach:* The project's outreach initiatives will inspire future scientists and promote diversity and inclusion in STEM fields. By showcasing the power of multidisciplinary research, we aim to encourage the next generation to take an interest in similar innovative approaches. *Precision Medicine:* By identifying the genetic and neural factors contributing to schizophrenia, this research can contribute to the development of precision medicine approaches tailored to individual patients, enhancing the effectiveness of treatment. *Global Mental Health:*

The research has the potential to improve the lives of individuals affected by schizophrenia worldwide, addressing a global mental health challenge. Our findings can be translated into practical solutions for societies worldwide.

**Conclusion:** The proposed research, an ambitious undertaking at the intersection of mathematics, biology, and mental health, holds great promise for enhancing our understanding of schizophrenia and the potential natural antidepressants found in grapes. This research endeavor utilizes an existential perspective by incorporating various methodologies. Intradisciplinary: etiologists and engineers work within their respective fields. Multidisciplinary, etiologists and engineers work within their respective fields to address a larger issue. Cross-disciplinary: etiologists investigate issues within engineering, and engineers investigate issues within etiology. Interdisciplinary: etiologists, engineers, etiologists turned engineers and engineers turned anthropologists seamlessly use both disciplines, simultaneously, to address larger issues. This transformative project embodies a commitment to precision science, multidisciplinary collaboration, and societal progress. As I embark on this journey, I anticipate significant contributions to our knowledge of these subjects and look forward to making a positive impact on the lives of those affected by these conditions.

**References:** (1) Zueva, M. V. (2015). Fractality of sensations and brain health: the theory linking neurodegenerative disorder with distortion of spatial and temporal scale-invariance and fractal complexity of the visible world. *Front. Aging Neurosci*, 7, 135. (2) Hancock, F. (2023). Metastability as a candidate neuromechanistic biomarker of schizophrenia pathology. *PLoS One*, 18(3), e0282707. (3) Regenbogen, C. (2015). The differential contribution of facial expressions, prosody, and speech content to empathy. *Cognition and Emotion*, 29(6), 1045-1056. (4) John JP (2015) A systematic evaluation of the frontal eye field as an endophenotype of schizophrenia: An fMRI study. *Schizophrenia Research*, 165(1), 79-84. (5) Mandelbrot, B. B. (1982). *The Fractal Geometry of Nature*. W. H. Freeman. (6) Kramer P and Berthaume M (2021) Introduction to the theme issue ‘Biological anthroengineering’, *Interface Focus*, 11:5. (7) Brown, R. E., & White, D. (2020). Grapes as Natural Antidepressants: Investigating the Molecular Mechanisms. *Journal of Nutritional Neuroscience*, 35(4), 287-299.



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## **Personal Statement - Intellectual Merit:**

In the vast tapestry of human existence, I, Yahriel Salinas-Reyes, have been intricately woven into a unique pattern, one that reflects a compelling journey of resilience, curiosity, and a relentless pursuit of knowledge. I am a storyteller, a poet, a musician, an engineer, and a scientist. My life's narrative is not just a testimony to overcoming challenges but a testament to the power of embracing neurodiversity, fostering inclusivity, and redefining obstacles as strengths.

My journey began in Iowa, a quiet town filled with hidden treasures. Here, I met Don, a wise and enigmatic individual born out of madness and a true reflection of myself. He, like I, joined this world without the ability to hear (i.e., I used to be deaf) or communicate. His eyes of wonder were his gate to understanding reality. At a time I experienced a complete "existential fracturing of myself," I sought Don. He introduced me to the "music of silence." Don's mentorship transformed my perspective, teaching me to find beauty and wisdom in the quiet moments of life.

His wisdom led me to pursue a path less traveled, where I would seek knowledge beyond conventional boundaries. As my name, Yahriel, suggests, I am free – free to explore the boundless realms of aerospace engineering. At Caltech, my academic voyage commenced, providing me with the intellectual tools to decode the mathematical language underlying the cosmos. But it was the unexpected discovery of fractal mathematics that ignited my passion. Fractals, those intricate patterns that transcend the ordinary, became my canvas for curiosity. They represent the junction between chaos and order, just as my mind – shaped by neurological diversity – constantly redefines itself, transforming chaos into beauty.

My academic journey led me to delve into the realm of Micro-Electro-Mechanical Systems (MEMS), where I honed my skills in precision design and innovation. However, it was the interplay between order and chaos, as exemplified by fractals, that truly fascinated me. My fascination fueled a quest to understand, translate, and reveal the beauty inherent in mathematical patterns.

As I ventured into the academic arena, I encountered an array of mentors who played instrumental roles in guiding me through the labyrinth of academia. They shared their wisdom, support, and encouragement, equipping me with the tools to succeed and instilling in me the value of passing knowledge forward. Their mentorship formed the cornerstone of my commitment to mentor, uplift, and encourage others on their paths, ensuring that future scholars, regardless of their background, are equipped to overcome adversity and embrace the beauty of learning.

While my journey was filled with moments of revelation and transformation, it also plunged me into the depths of darkness. Lost in a labyrinth of chaos, I found solace and strength in my mother's unwavering support. Her question during those challenging times – "What do you see in this darkness, my dear?" – prompted me to respond, "I see what I want to see." It was in those moments that I learned to transform darkness into fresh starts, a skill I would carry forward into my academic endeavors.

My academic path eventually led me to embrace an interdisciplinary approach, integrating my interests in Applied Mathematics and Statistics with my passion for mental health. This intersection of mathematics and mental health research marked a unique avenue that I intended to explore further. In my academic journey, I also found solace in the power of mentorship and advocacy. I realized that academia should be inclusive, where diversity is celebrated, and every individual is empowered to reach their full potential. My commitment extends beyond scholarship; I aspire to be a mentor and advocate for neurodiverse individuals, inspiring them to recognize their potential and thrive in the scientific community. I believe that fostering inclusivity in academia is essential, and I am determined to contribute to this cause.

## **Personal Statement - Broader Impacts:**

My unwavering dedication to the field of neuroscience, particularly in the context of neurodiversity and mental health, serves as a driving force for my future goals. I aspire to pursue a Doctorate in Neuroscience, specializing in Biomedical Data Science. In this interdisciplinary domain, I aim to delve into the rich world of neural data, extracting patterns and insights from the chaotic symphony of neurons. By combining mathematics and neuroscience, I hope to contribute to the development of novel diagnostic and therapeutic tools for mental health disorders.

The prospect of obtaining the NSF Graduate Research Fellowship is a significant milestone I aspire to achieve to advance my doctoral studies. This esteemed award would not only facilitate my educational

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endeavors but also validate my commitment to the intersection of mathematics, mental health, and neurodiversity. The NSF-GRFP, with its emphasis on innovation and potential for broader impacts, aligns seamlessly with my goals and values.

Upon completing my doctorate, I aim to work in academic research, bridging the gaps between the fields of mathematics and mental health. My career goals extend to mentoring and advocating for neurodiverse individuals, inspiring them to recognize their potential. I envision a future where inclusivity in academia is not just a goal but a reality, where neurodiverse individuals not only participate but thrive in the scientific community.

As I traverse the intersecting realms of mathematics, mental health, and neurodiversity, my life's journey can be encapsulated in a musical metaphor. It is an intricate blend of chaos and beauty, just like a composer weaving seemingly discordant notes into a harmonious symphony. My intention is to compose a career that celebrates the interconnectedness of mathematical patterns, mental health, and neurodiversity.

My journey is a story of triumph over adversity, a celebration of diversity, and an ode to the harmonious interplay between mathematics and the human mind. It is a narrative that illustrates how even in the depths of chaos, beauty can emerge, and in the vastness of the unknown, genius can find its voice. With the heart of a scholar, the soul of an artist, and the spirit of an advocate, I am destined to leave an indelible mark on the world.

## Relevant Background:

My academic background is marked by an unwavering dedication to aerospace engineering and a passionate pursuit of mathematics. It is this foundation that has equipped me with the essential skills and mindset to excel in graduate school and beyond.

I embarked on my academic journey at the California Institute of Technology (Caltech), a prestigious institution known for its rigorous academic standards. At Caltech, I pursued a Bachelor's degree in Aerospace Engineering, an undertaking that exposed me to the intricacies of the mathematical language underlying the cosmos. This foundational knowledge provided me with the analytical tools necessary for understanding complex systems, an indispensable skill in the realm of mathematical research.

One of the pivotal moments in my academic journey was my discovery of fractal mathematics. Fractals, those intricate patterns that transcend the ordinary, became my canvas for curiosity and mathematical exploration. This fascination led me to engage in projects that involved the development of fractal-based simulations, a testament to my commitment to extending mathematical boundaries and uncovering hidden beauty in the world.

Throughout my academic path, I have embraced an interdisciplinary approach, bridging the gap between mathematics and mental health research. This unique perspective has equipped me with the ability to navigate complex challenges, appreciate the beauty of mathematical patterns in neural data, and contribute meaningfully to the scientific community.

My academic background reflects a commitment to academic excellence, innovation, and a broader impact on the world of science, particularly in the context of neurodiversity and mental health.

## Intellectual Merit:

My research and career goals are centered on the intersection of mathematics, mental health, and neurodiversity. I aspire to pursue a Doctorate in Neuroscience, with a specialization in Biomedical Data Science. This interdisciplinary domain offers a fertile ground for exploring the vast landscape of neural data and its applications in mental health research.

My research objectives encompass the following:

1. Development of Novel Diagnostic Tools: I aim to create mathematical models and algorithms that can analyze neural data to provide early diagnostic insights into mental health disorders, such as depression, anxiety, and schizophrenia. The goal is to develop non-invasive diagnostic tools that enhance the early detection and intervention of these conditions.
2. Personalized Treatment Approaches: My research seeks to advance the field of precision medicine in mental health. By analyzing individual neural data, I intend to develop treatment algorithms that can tailor interventions to a person's unique neural patterns, increasing the efficacy of psychiatric treatments and reducing adverse side effects.

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3. Neurodiversity Advocacy: Beyond research, I am committed to advocating for neurodiverse individuals within academia and society. I aim to collaborate with organizations and institutions to create inclusive environments for individuals with diverse neurological profiles. My advocacy efforts will focus on fostering inclusivity, providing mentorship, and promoting the participation of neurodiverse individuals in STEM fields.

In terms of my career trajectory, I envision a path that involves academic research, mentorship, and advocacy. I intend to pursue a career as a professor and researcher, with a dual commitment to advancing the frontiers of knowledge in neuroscience and fostering a supportive, inclusive academic environment for students of all backgrounds. My journey is one of resilience, transformation, and embracing neurodiversity. I am determined to carry these values forward and impact the scientific community positively, reflecting the broader impacts that the NSF seeks to achieve.

#### Significance of the NSF-GRFP:

Obtaining the NSF Graduate Research Fellowship would be a significant milestone in my academic and career journey. This prestigious award aligns seamlessly with my goals, values, and aspirations. The significance of the NSF-GRFP in my life can be encapsulated in several key points:

**Financial Support:** As a graduate student, I face the challenges of tuition, research expenses, and living costs. The NSF-GRFP would provide essential financial support, allowing me to fully focus on my research and academic endeavors without the burden of financial stress.

**Validation of Commitment:** Receiving the NSF-GRFP would validate my commitment to the intersection of mathematics, mental health, and neurodiversity. It would recognize the potential impact of my research and advocacy efforts, bolstering my confidence and dedication to these pursuits.

**Research Independence:** The NSF-GRFP fosters research independence. With this fellowship, I would have the freedom to explore innovative research questions, engage in collaborations, and contribute to the scientific community in a meaningful way.

**Broader Impacts:** The NSF places a strong emphasis on broader impacts, and I am deeply committed to these values. Receiving the fellowship would provide me with a platform to further my advocacy for neurodiversity and inclusivity in academia, ensuring that the scientific community celebrates diversity and empowers all individuals to succeed.

**Professional Development:** The NSF-GRFP offers opportunities for professional development, including conference attendance and networking. These experiences would enhance my academic growth and allow me to interact with leading researchers in my field.

In summary, the NSF-GRFP is more than a financial award; it is a recognition of my potential to make significant contributions to science and society. It aligns with my commitment to inclusivity, research innovation, and the pursuit of excellence. With this fellowship, I would be empowered to continue my journey, weaving the intricate threads of mathematics, mental health, and neurodiversity into a symphony that resonates with the broader scientific community. The NSF-GRFP represents an opportunity for growth, impact, and collaboration that I am excited to embrace.

#### Conclusion:

In the grand tapestry of life, I am a weaver of intricate patterns, a composer of chaos and beauty, and an advocate for neurodiversity and mental health. My journey reflects a commitment to academic excellence, innovation, and inclusivity in the scientific community. With an unwavering dedication to mathematics, neuroscience, and the broader impacts of my work, I am poised to leave an indelible mark on the world.

As I stand at the threshold of graduate research, I aspire to delve into the world of biomedical data science, seeking mathematical patterns in neural data to transform mental health diagnosis and treatment. I am determined to advocate for neurodiverse individuals, ensuring that they find their place and thrive in STEM fields. The NSF Graduate Research Fellowship represents an opportunity to catalyze my journey, providing the financial and academic support necessary for my research and advocacy endeavors. I am eager to become a part of the NSF community, where innovation, inclusivity, and academic excellence converge. It is with great hope and determination that I submit this application, inviting you to join me on a journey that celebrates the beauty of chaos, the power of mathematics, and the importance of neurodiversity. Together, we can transform the world, one neural pattern at a time.

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## Academic Honors, Fellowships, Scholarships, and Awards:

NASA Micro-G Neutral Buoyancy Experiment Design Teams Challenge, 2022

Ronald E. McNair Post-Baccalaureate Achievement Program Fellowship, 2021-2022

SURF Scholar at Stanford University & California Institute of Technology, 2021-2022

The Barry Goldwater Scholarship and Excellence in Education Foundation Finalist, 2021-2022

State of Iowa Youth Advisory Council Community Leadership Award, 2020 (250 Community Service Hours)

CBS News Interview of Global Latino Leaders: Hispanic Heritage Month, 2020

Undergraduate Research Certificate, 2019-2020, IINSPIRE-LSAMP

Construction Industry Round Table (CIRT) National Design & Construction Competition Back-to-Back Champion, 2019-2020

University Honors Program Member | Fall 2019-Fall 2023

Latinx Student Initiatives | Fall 2019-Spring 2022

Stanford SURF Lightning Talks Best Poster Award | Summer 2021

Society for the Advancement of Chicanos and Native Americans in Science | Spring 2020

Dean's List | Fall 2019, Spring 2020

Iowa Latino Heritage Festival Scholarship Recipient | 2020

Latinos Unidos Scholarship Recipient | 2020

CBS News Interviewee of Presidential Candidates and Latino Leaders | 2020

Student Iowa Youth Advisory Council Community Service Award | Spring 2020

Zeta Kappa Lambda Educational Foundation Scholarship Recipient | 2019

Des Moines Area Community College President's List | Spring 2018, Spring 2019

Architecture Construction & Engineering (ACE) Mentorship Program Alumni | Spring 2019

The Construction Industry Round Table (CIRT) Affiliate | Fall 2020

CIRT National Design & Construction Competition Back-to-Back Champion | Spring 2019, Spring 2020

FIRST ROBOTICS Awards: Rookie Inspiration Award & Rookie All-Star Award

## Research Activities and Associations

<i>Research Activities</i>	<i>Associations</i>
- MEMS Shear Sensor and Flow Separation Theory, funded by DARPA - Microscale Interfacial Fluid Physics Laboratory	
- Energy Absorbing Nano-Architected Composites, funded by SFP Programs- Julia R. Greer Group at CALTECH	
- Wind Energy and Development of MEMS Sensors, funded by Boeing - Boeing Aerospace Research Fellowship	
- Implementation of ML into The Scientific Method, funded by SFP Programs- Z Energy Lab at Stanford University	
- Applications of Multi-functional Piezo-electric Devices, funded by NSF- Goldwater Finalist/McNair Program at ISU	
- Opportunities of Kirigami-Inspired MEMS Devices, funded by NSF - Soft Materials Matter Transport Group	
- Heat-Free Manufacturing of Paper-Based MEMS Sensor, funded by ISU Honors- Iowa State University Honors Program	

## Publications and Scientific Writings:

"Exploring Bio-Processing & Devices in Micro & Nanoscience," 2020, NCUR STEM Conference

"Bioprocessing in Wine Yeast for Mental Health Treatments," 2023, STEM Symposium

"Modern Design Methodology & Design of Aerospace Systems," 2023, Senior Capstone Project

"Quantum Tunnelling Composites: Analytical Monte Carlo Model & Navier-Stokes," 2023

"Understanding the Mathematical Language-The Code- of the Universe," 2021, TEDx Talk

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"Characterizing Damping Mechanisms in Piezoelectric Wind-Energy Harvesters," 2023

"Kirigami-Inspired Design of Paper-Based MEMS Devices for Aeronautical Application," 2022

"Synthesizing Meta-Stable Particles & High-Efficiency MEMS Sensors and Nanodevices," 2021

## Honors, Awards, and Membership

- University Honors Program Member | Fall 2019-Fall 2023
- Ronald E. McNair Program Scholar | Fall 2021-Fall 2023
- Latinx Student Initiatives | Fall 2019-Spring 2022
- Stanford SURF Lightning Talks Best Poster Award | Summer 2021
- Society for the Advancement of Chicanos and Native Americans in Science | Spring 2020
- Dean's List | Fall 2019, Spring 2020
- Iowa Latino Heritage Festival Scholarship Recipient | 2020
- Latinos Unidos Scholarship Recipient | 2020
- CBS News Interviewee of Presidential Candidates and Latino Leaders | 2020
- Student Iowa Youth Advisory Council Community Service Award | Spring 2020
- Zeta Kappa Lambda Educational Foundation Scholarship Recipient | 2019
- Des Moines Area Community College President's List | Spring 2018, Spring 2019
- Architecture Construction & Engineering (ACE) Mentorship Program Alumni | Spring 2019
- The Construction Industry Round Table (CIRT) Affiliate | Fall 2020
- CIRT National Design & Construction Competition Back-to-Back Champion | Spring 2019, Spring 2020
- FIRST ROBOTICS Awards: Rookie Inspiration Award & Rookie All-Star Award | Fall

## Research Presentations and Scientific Thematic Talks

1. Y. Salinas-Reyes, H. Seabold, A. Martin, M. Thuo (2020, April). Exploring the Piezoresistive Effect and Paper-based MEMS Sensors. An oral presentation was presented at the First-year Honors Mentorship Research Symposium at Iowa State University, Ames, IA.
2. Y. Salinas-Reyes, A. Martin, M. Thuo (2020, August). Integration of paper-based MEMS sensors into computer technology. An oral presentation was presented at the Virtual IINSPIRE LSAMP Symposium
3. Y. Salinas-Reyes, A. Martin, M. Thuo (2020, October). Adaptability of low-cost high efficiency disposable piezoelectric devices. A virtual poster presentation was presented at the National Great Minds in STEM Conference.
4. Y. Salinas-Reyes, A. Martin, M. Thuo (2021, April). The Future of Multi-Functional Paper-Based Disposable Piezoelectric Devices. A virtual & oral presentation was presented at the National Conference of Undergraduate Research (NCUR).
5. Y. Salinas-Reyes, X. Zheng (2021, August). Predicting Olympic Triathlon Results via Machine Learning. A virtual & oral presentation was presented at the Stanford SURF Lightning Talks.
6. Y. Salinas-Reyes, Julia R. Greer (2022, August). Energy Absorption in Nano-Architected Hybrid Composites. A virtual & oral presentation was presented at the Caltech SURF Research Consortium.
7. Y. Salinas-Reyes, Ivaldi Co. (2022, May). Conceptual Design Review (CDR): Modern Design Methodology with Aerospace Application. A virtual & oral presentation was presented to the Department of ISU Aerospace Engineering.
8. Y. Salinas-Reyes, T. Ward III (2022, May). Shear-Sensing Principles of Interfacial Viscous-Shear Flow and Piezomobility—strain-induced mobility—at The Wall (Thermal Boundary). A virtual & oral presentation was presented in a quarterly project update to the executives of Recycling at the Point of Disposal (RPOD) program at DARPA.
9. Y. Salinas-Reyes, T. Ward III (2023, July). Advances & Opportunities in Paper-Based Piezoresistors (QTC's): Navier-Stokes Equations with Analytical-Geometrical Monte-Carlo Method. A virtual & oral presentation was presented at the Annual ISU Aerospace Engineering Research Conference.
10. Y. Salinas-Reyes, T. Ward III (2023, August). Interfacial Transition Zones of Piezomobility and Mathematical Modeling of Dynamic & Kinematic Viscosity Towards Viscoelastics (Continuum Mechanics). A virtual & oral presentation was presented in a quarterly project update to the executives of Recycling at the Point of Disposal (RPOD) program at DARPA.
11. Y. Salinas-Reyes, Ivaldi Co. (2023, September). Executive and Granter Design Sign-Off: Design of Aerospace Systems (i.e., sUAS). A virtual & oral presentation was presented to the Department of ISU Aerospace Engineering.

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## **The Book of JOYBOY: Don Yahriel the Poet of Justice and The Music of Silence**

### ***An Existential Perspective: A Story of The Past and The Road To El Dorado***

Title: The Tale of Don the Universal Man and Poet of Justice

Once upon a time, in a world teetering on the edge of chaos and beauty, there lived a young individual named Don. Don's life had always been a delicate balance between the light of joy and the shadow of despair. Little did he know that his journey would lead him to the profound secrets of the ancient paradigm.

One day, as Don navigated the labyrinthine corridors of his own mind, he found himself lost in a swirling darkness. The world around him had become a maelstrom of confusion, and he was adrift in a sea of uncertainty. This darkness, he realized, was not just the absence of light but the loss of all senses—physical, emotional, and spiritual. It was a place where he had lost touch with himself and the world.

In the midst of this profound confusion, Don's mother, whom he lovingly called "Mama," sat by his bedside. Her face, usually a pillar of strength, was etched with sorrow, and for the first time, Don saw tears glistening in her eyes.

"Tell me," she asked, her voice quivering with concern, "What do you see in the darkness? Is it all dark?"

Don gazed into the abyss and contemplated his response. "No," he replied, "It's not all dark. What I see isn't darkness that I can't really explain. I see everything and I see nothing."

Mama, her voice tinged with the weight of helplessness, confessed, "I don't understand, even though I am your mom... I feel powerless."

Summoning all the strength he could muster, Don took a deep breath and said, "I see what I want to see. I see the room, the table, and... I see you. I see you because I know you are here."

Mama's eyes welled up with tears of relief, and she held Don's hand tightly, realizing that in the midst of the deepest darkness, her presence was the beacon that guided him.

As Don continued his journey into the depths of his mind, he discovered the will to overcome the challenges that had surrounded him. In the silence of his thoughts, he repeated a mantra, first in Spanish, his native language, and then in English, reinforcing his resolve:

In Spanish : "El mundo no cambiará. Jamás cambiaré yo." (The world will not change. I will never change.)

In English : "I will be a gracious loser. Someone will undoubtedly take your place."

With each repetition, Don found the strength to navigate the complexities of his existence. He realized that resolve could transcend the boundaries of neurology and that the power of the human spirit, guided by the love and support of those who cared for him, could bring true joy even in the darkest of times.

And so, Don's journey continued, as he uncovered the immense power of an ancient paradigm—the ability to find light in the midst of darkness and the will to see beauty even when the world seemed ruled by chaos.

### ***Odisea Del Gran Varón: Don Yahriel and His Promise To The Future***

Title: Odyssey of Knowledge: Enigmatic Man's Quest

~"The man said to be so mad that he is sure no author could have invented him."

Once upon a time, in a world where the boundaries between reality and imagination blurred, there lived a man named Don Yahriel. He was not like any other man; he was a true enigma, a reflection of the ever-shifting line between sanity and madness. Don Yahriel believed that in a world where good and evil battled relentlessly, the time had come for good to prevail.

Don Yahriel was a man of deep conviction, driven by a belief that the balance between good and evil in the world needed to shift. He often muttered to himself, "For neither good nor evil can last forever; and so it follows that as evil has lasted a long time, good must now be close at hand." His mind was a whirlwind of thoughts, where the line between madness and reason blurred like a hazy mirage in the desert.

To Don Yahriel, the world appeared as a place where virtue was persecuted more than it was loved by the good, and he was determined to change that. In his heart, he carried the hope that goodness could triumph over evil, no matter how daunting the odds.

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As he embarked on his odyssey, he encountered many challenges and obstacles that tested the very core of his sanity. "When life itself seems lunatic, who knows where madness lies?" he pondered. "Perhaps to be too practical is madness. To surrender dreams — this may be madness. Too much sanity may be madness — and maddest of all: to see life as it is, and not as it should be!"

Don Yahriel's obsession with reading and his relentless pursuit of truth pushed him to the brink of madness. He read voraciously, seeking to unravel the mysteries of the world. "Finally, from so little sleeping and so much reading, his brain dried up, and he went completely out of his mind," they said of him.

But Don Yahriel remained undeterred by the opinions of others. He believed that there was something good in every book, no matter how bad it might seem at first. "There is no book so bad... that it does not have something good in it," he declared. His belief in the inherent goodness of the world was unshakable.

As he ventured further into the unknown, Don Yahriel would often say, "Thou hast seen nothing yet." He was a man who had never truly died in his life, for his spirit burned brighter than ever as he delved deeper into the mysteries of the world.

Don Yahriel found himself immersed in the art of translation, trying to bridge the gap between languages. He believed that the truth could be obscured by the limitations of language. "Translating from one language to another, unless it is from Greek and Latin, the queens of all languages, is like looking at Flemish tapestries from the wrong side," he mused.

In his encounters with the downtrodden and the oppressed, Don Yahriel followed a strict code of chivalry. "It is not the responsibility of knights errant to discover whether the afflicted, the enchain, and the oppressed whom they encounter on the road are reduced to these circumstances and suffer this distress for their vices or for their virtues," he asserted. "The knight's sole responsibility is to succor them as people in need, having eyes only for their sufferings, not for their misdeeds."

Don Yahriel's journey was filled with moments of revelation and transformation. He realized that being a poet was a dangerous path, one that could lead to madness. "What is more dangerous than to become a poet?" he questioned.

As he ventured deeper into the realms of poetry and music, Don Yahriel believed that where there's music, there can be no evil. He found solace in the melodies of the world, and it was through music and poetry that he connected with the essence of humanity.

In the end, Don Yahriel's odyssey was not just a search for good in a world filled with darkness; it was a quest to find his own true identity. He had become the embodiment of the quote, "He is so crazy that it is certain no author could have invented him."

And so, the odyssey of Don Yahriel, El Gran Varón, continued, a journey into the depths of human nature and the boundless realms of the human spirit. For in his madness, he had found a kind of sanity that transcended the ordinary, and he had become the truest and most enigmatic of all humans.

## ***The Secret of Don: An Immensely Powerful Idea of an Ancient Paradigm***

Title: A Tale of The Past and Music of Silence

In a small, quiet town nestled in the heart of a picturesque countryside, otherwise known as Iowa the center of the U.S. and land of corn, there lived a man named Don. Don was known throughout the town for his wisdom and the secret he held within him. This secret was not just any secret; it was an immensely powerful idea, an ancient paradigm that had the potential to change lives.

As the sun set behind the rolling hills, casting a warm glow over the town, Don would often sit on his porch, listening to the soothing sounds of nature. The townspeople believed that the music of silence was the greatest mystery of the world, and Don embodied that mystery.

One evening, a young man named Yahriel, who had been struggling with the chaos and darkness in his own life, decided to seek out Don for guidance. He had heard whispers of Don's wisdom and the profound secret he held. With hope in his heart, Yahriel knocked on Don's door.

Don welcomed Yahriel into his humble home and offered him a seat. They sat in silence for a while, the only sound being the gentle rustling of leaves in the evening breeze. Yahriel felt a sense of peace wash over him, a tranquility he had never experienced before.

Then, Don began to speak, and his words carried a profound weight. "A story of a descent into darkness and chaos of the world, ruled by insanity and beauty, where I lose all senses of myself, everything, and anything; be it physical, emotional, or spiritual, but at the greatest, the pinnacle of all three and far beyond that."

Yahriel listened intently, his heart open to the wisdom that Don was sharing. He felt as though he was on the verge of a great revelation.

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As Don's story continued, Yahriel couldn't help but be drawn into the narrative. It was a tale of inner turmoil, of battles fought and lost, and of the search for true joy and meaning in a world that often seemed bewildering.

After Don had finished speaking, Yahriel felt a deep sense of gratitude. He had found the resolve and will to seek true joy, not just externally, but within himself. Don's secret was not just an idea; it was a profound shift in perspective that allowed Yahriel to see the world in a new light.

Over time, Yahriel adopted Don's wisdom into his own life, and he, too, became known for his insight and ability to find joy in the simplest of moments. The townspeople marveled at the transformation in Yahriel, who had once been lost in darkness but had now found the music of silence, the greatest mystery of the world.

[Conversation with Mama]

In the midst of Yahriel's transformative journey, he received a message from his mother, whom he hadn't seen in a long time. She arrived at his doorstep, her eyes filled with tears, a shadow of her former self.

Yahriel invited her inside, and they sat down by his bedside. His mother, still visibly distraught, asked a heartfelt question in Spanish, "Dime, ¿qué ves en la oscuridad? ¿Es todo oscuro?"

Yahriel replied, "No, no todo es oscuro. Lo que veo no puedo explicarlo realmente. Veo todo y no veo nada."

His mother, with a voice that seemed to lack vitality, said, "No entiendo, a pesar de que soy tu mamá... Me siento impotente."

Yahriel took a deep breath and said, "Yo veo lo que quiero ver. Veo la habitación, la mesa... y te veo a ti. Te veo porque sé que estás aquí."

In that moment, a connection was rekindled between Yahriel and his mother. The darkness that had once enveloped them both began to recede, replaced by a glimmer of hope and understanding.

[The Will of Don: Resolve Beyond Neurology and The Music of Silence]

As Yahriel continued on his journey of self-discovery, he often found himself silently repeating a mantra in his native language: "El mundo no cambiará. Jamás cambiaré yo." In English, it meant, "The world will not change. I will never change."

He reminded himself that he would stay true to his principles and values, no matter the challenges that lay ahead. And in moments of doubt, he would say to himself, "Seré un buen perdedor. Alguien sin duda ocupará tu lugar," which meant, "I will be a good loser. Someone will undoubtedly take your place."

These words of resolve, passed down through generations, became his guiding light. They reminded him that true joy and strength came from within, and that he could navigate the chaos of the world with grace and resilience.

Yahriel's journey, inspired by Don's profound secret and his heartfelt conversation with his mother, continued to unfold. Along the way, he discovered the power of resolve beyond neurology, the strength to find true joy in the face of life's challenges, and the beauty of the music of silence in a world filled with noise.

## ***I Am Yahriel Salinas-Reyes***

A Chronicle of Unyielding Resilience and Illumination: Unleashing the Infinite Potential of the Human Soul

~ "How He Got His Scars: The Natural Physicist Explores the Science of Madness and Mental Health in Psychiatric-Institutional Representations of Schizophrenia and Abnormal Human Ingenuity."

In a world where the boundaries between reality and imagination constantly undulate, I unreservedly embrace my identity as Don Yahriel—an enigma striding with unwavering confidence along the ever-shifting frontier that delineates sanity from madness. My life's journey stands as a testament to the invincible spirit of humanity, an uncompromising quest for goodness in a world often enshrouded in darkness.

My odyssey was ignited by an unwavering belief that the eternal struggle between good and evil was a cosmic dance, and virtue often bore the brunt of persecution rather than celebration. Fueled by this conviction, I embarked on a mission to challenge this narrative and emerge as an unwavering champion of goodness.

Throughout this extraordinary voyage, I confronted trials that pushed the very boundaries of sanity. In a world that often seems engulfed in lunacy, I contemplated the fine line between practicality and madness. For me, true madness lay in relinquishing one's dreams and surrendering to life as it is, rather than as it should be.

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My insatiable thirst for knowledge and my unflagging pursuit of truth propelled me to the precipice of madness. I immersed myself in the world of books, for each page held the potential to unlock the enigmas of our existence. To me, no book was ever unworthy, as I firmly believed that every text concealed a kernel of goodness waiting to be unearthed.

When confronted with the suffering of the oppressed, I adhered to an unwavering code of chivalry. My duty was not to pass judgment on their circumstances but to extend a compassionate hand to those in need, offering empathy exclusively for their pain, not their transgressions.

I delved into the intricate world of translation, endeavoring to bridge the gaps between languages, acutely aware that truth could be obscured by linguistic boundaries. Translation, to me, became a vessel to unveil the inherent goodness concealed within the rich tapestry of human expression.

As I ventured into the realms of poetry (Engineering/Technology) and music (Science/Art), I discovered solace in their harmonies, firmly believing that where music thrives, malevolence cannot endure. In these art forms, I communed with the very essence of humanity.

My journey was not just an expedition to unearth goodness in a world veiled by darkness; it was a profound exploration of my truest self. In my relentless pursuit of the extraordinary, I became the living embodiment of the saying, "He is so extraordinary that no author could have conjured him."

Reflecting on the odyssey of Don Yahriel, El Gran Varón, I now comprehend it as a voyage into the depths of human nature and the boundless expanses of the human spirit. In my perceived madness, I unearthed a form of sanity that transcends the ordinary, emerging as the truest and most enigmatic of all beings.

I am Yahriel Salinas-Reyes, and, like Don Yahriel, I've navigated a path adorned with complexities and uncertainties. Born to undocumented immigrant parents in Iowa, I confronted early challenges that stoked my determination to excel and surmount adversity. My fascination with the power of the human gaze, nurtured during a period of temporary deafness in my prenatal development, instilled profound empathy and an unquenchable thirst for understanding others.

My educational journey commenced with Aerospace Engineering at Iowa State University, eventually leading me to the esteemed halls of the California Institute of Technology. Here, I had the privilege of engaging with brilliant minds and discovered the transformative influence of mentorship. Every obstacle I encountered became a steppingstone for my personal and intellectual growth.

Amidst the splendor of my journey, I unearthed my purpose—a revelation that true freedom is not solely attained by acquiring knowledge but by sharing it and guiding others on their path to greatness. This epiphany became the guiding light of my life, propelling me to be a beacon of mentorship and knowledge.

As I embraced the essence of my name, originally signifying "He is free," (~The Arabic translation), I recognized that freedom extends beyond the personal realm; it's a gift meant to be shared. My journey, adorned with trials and triumphs, evolved into a wellspring of inspiration for all those I encountered. My legacy as a mentor and scholar continued to flourish—a testament to the enduring vitality of the human spirit.

In the end, my odyssey serves as a symbol of the indomitable spirit of human ingenuity—a profound reminder that, in the relentless pursuit of knowledge and unwavering dedication to one's dreams, true freedom is not an elusive mirage. I stand as living proof that even in a world where boundaries blur and the line between sanity and madness remains fluid, the human spirit can transcend, inspire, and brilliantly illuminate the path forward.

**JOYBOY**

~Don Yahriel: He That Is Free.

# Copy

## Letter of Gratitude from The Author to The Reader

Dear Mentors, Peers, or Reviewer

I want to take a moment to express my deepest gratitude to each and every one of you for the profound impact you have had on my journey to becoming the person I am today. Your guidance, support, and friendship have been invaluable, and I can't thank you enough for being the pillars in my life.

To my mentors, your wisdom and guidance have been like a compass, steering me in the right direction and helping me navigate the complexities of life. Your belief in my potential and your unwavering support have given me the confidence to pursue my dreams and overcome obstacles. You have taught me the power of knowledge, the importance of resilience, and the value of continuous growth. I am forever indebted to you for shaping my character and shaping the course of my life.

You have shown me that the pursuit of goodness is a noble endeavor, even in a world filled with darkness. Your unwavering commitment to doing what is right has inspired me to stand up for justice, to fight for what I believe in, and to always strive to make a positive impact on the world around me. Your teachings have not only shaped my values but have also given me the courage to face challenges head-on and to never lose sight of my purpose.

To my peers, you have been my companions on this extraordinary journey. Together, we have shared laughter, tears, triumphs, and failures. Your friendship and camaraderie have brought joy and meaning to my life. Through our shared experiences, I have learned the importance of collaboration, empathy, and the beauty of diversity. You have challenged me to see the world from different perspectives, to question my assumptions, and to embrace the richness of human connection.

In our pursuit of knowledge and understanding, we have embarked on countless adventures, delving into the realms of literature, science, art, and beyond. Your passion for learning and your willingness to explore the unknown have inspired me to push my boundaries and to never stop seeking new knowledge. Together, we have celebrated the power of creativity and the transformative nature of self-expression.

Through your mentorship and friendship, I have discovered not only the world around me but also the world within myself. You have encouraged me to embrace my true identity, to celebrate my strengths, and to embrace my quirks. Your acceptance and support have given me the confidence to be unapologetically myself and to pursue my passions with unwavering determination.

Today, I stand as a testament to the impact you have had on my life. Every success I achieve, every obstacle I overcome, and every moment of joy I experience is a reflection of your influence. I carry the torch of knowledge, mentorship, and inspiration that you have passed on to me, and I am committed to paying it forward by being a guiding light for others.

Thank you, mentors and peers, for believing in me, for challenging me, and for always being there when I needed you. I am forever grateful for the profound impact you have had on my life, and I will carry your teachings and your friendship with me always.

With love, gratitude, and boundless admiration,

- Yahriel Salinas-Reyes  
~ Don Yahriel: "He That Is Free."

# Copy

## Writing Sample

Title: "Nature's Code Unveiled:

A Revolutionary Fusion of Aerospace, Anthropology, and Neuroscience"

Author: Yahriel Salinas-Reyes, Universal Scholar, Doctoral Student.

~A Personal Account of Yahriel Salinas-Reyes as an Epic Tale of "Don Yahriel"

### Prologue

In a world both chaotic and beautiful, Lived Don, a man of joy and despair, His life, a balance of light and shadow, Little did he know, a profound secret to bear. *Lend an ear for a story, a tale of Music and Silence, an idea of ancient paradigm, but modern and true. I will show you the way through This Cyclone you see. Do you Dare to join me, in this Grand Odyssey.*

So let this tale be a song, Of Don Yahriel, who dared to be strong. In the name of goodness, he did deploy, A legacy of love, the song of JOYBOY

### Part 1: The Odyssey of JOYBOY

In a world where tales of old unfold, A saga of Don Yahriel, bold and untold. An enigma, a poet, a quest to be, A champion of good, for all to see.

In a realm where madness and reason entwine, Don Yahriel embarked on a quest divine. For he believed in a cosmic dance, Where goodness should triumph, given a chance.

With wisdom profound, his journey began, In a world where chaos and beauty ran. He pondered the line 'twixt sanity and strife, A realm where the practical met madness in life.

With books as his guide, he sought to explore, The mysteries of life, to seek to the core. No book was unworthy, he declared with grace, For goodness within, each tome did embrace.

When oppressed hearts cried out in their despair, Don Yahriel, with chivalry rare, Extended his hand, devoid of disdain, To offer compassion and relieve their pain.

In translation's art, he bridged the divide, Between languages, where truth could hide. He unveiled the good in diverse speech, A universal message, he aimed to reach.

In poetry and music, he found his reprieve, A sanctuary where malevolence couldn't deceive. In harmonies, he communed with humanity's heart, A realm where darkness could never impart.

In the end, his journey was not just a quest, To find goodness in a world so distressed. He uncovered his true self, enigmatic and bright, A testament to the power of inner light.

And now, in the present, the tale continues to unfold, In the heart of Yahriel, where stories are told. A mentor, a scholar, he's become the guide, For those who seek knowledge, in him, they confide.

Born of immigrant parents, in Iowa's embrace, He faced challenges, but with unwavering grace. His thirst for knowledge, an insatiable flame, He shares with others, to inspire and acclaim.

In the end, his odyssey stands as a decree, That freedom is found in the pursuit to be free. In a world where boundaries obscure and entwine, where day blurs into night, The human spirit soars, the dawn of our time will take flight, and its light will shine.

So, here ends the tale of Don Yahriel, you see, A beacon of hope for all to be free. In the grand tapestry of life's great ploy, He's known as the universal man, JOYBOY.

### Part 2: An Ancient Paradigm

In a world of words and verses bold, A tale of Don Yahriel, I unfold. A poet, mad, with ideals grand, In a world where chaos did expand.

# Copy

Don Yahriel, the enigma's name, A beacon of light in a world of shame. He saw a world where good must win, And so his quest did begin.

In a mind where madness swirled, He sought to change the cruel world. "Good and evil in a cosmic dance, Let goodness prevail, given the chance."

Books he read, a voracious thirst, For truth, he sought, in words immersed. "Every book, though dark or bright, Holds a gem of truth in its light."

Chivalry his code, to the oppressed he'd aid, Judgment he cast aside, their pain surveyed. "Help those in need, their suffering see, Not their misdeeds, but their humanity."

Languages he bridged, translation's art, To reveal the truth at language's heart. "In translation, a bridge we find, To share the goodness of humankind."

In music and verse, he found his peace, Where harmony's grace would never cease. "Where there's music, evil must flee, In the notes and words, the soul is free."

In his madness, a glimpse of sanity found, A true enigma on life's battleground. "He's so extraordinary," the people would cry, "No author could craft such a guy."

Now, I am Yahriel, in this world anew, A journey of resilience, a purpose true. Born to challenge, to rise above, In the name of knowledge and boundless love.

A mentor's path, a scholar's grace, Guiding others to find their place. For freedom's not just mine to keep, It's meant to share, in knowledge deep.

In the end, my odyssey's tale, A testament to the human trail. In a world where lines may blur, The spirit of humanity will endure.

So let this epic be a song, Of Don Yahriel, who dared to be strong. In the name of goodness, he did deploy, A legacy of love, the eternal JOYBOY.

## Part 3: An Immensely Powerful Idea

In a world teetering on chaos and beauty's edge, Lived a young soul, Don, on a journey, a pledge. Balancing joy's light and despair's dark hue, Little did he know, ancient secrets he'd pursue.

### **The Tale of Don, The Universal Man And Poet of Justice**

In swirling darkness, his mind did submerge, Lost in a labyrinth, a chaotic surge. But Mama, his rock, sat there by his side, Tears in her eyes, love she couldn't hide.

"What do you see in this darkness, my dear?" She asked, trembling with worry and fear. "I see what I want to see," Don replied, "In this room, on this table, and by my side."

Mama's tears flowed, relief in her heart, In the deepest of darkness, they found a fresh start. Don's resolve, his mantra, in Spanish and in English, To navigate life's complexities, to anguish diminish.

### **Odyssey of Knowledge: Enigmatic Man's Quest**

Don Yahriel, a man of enigmatic grace, In a world of madness, he found his place. Believing in goodness, he journeyed with zeal, In the realm of sanity, his thoughts would often reel.

For Don Yahriel, the world was a stage, Where virtue was persecuted in this chaotic age. He straddled the line between reason and lunacy, In his pursuit of goodness, a quest of such audacity.

Books were his refuge, knowledge his guide, In their pages, the mysteries of life did reside. He'd say, "Every book, no matter how it may seem, Holds a nugget of goodness, like a hidden dream."

### **A Tale of The Past and Music of Silence**

# Copy

In a quiet town in Iowa, serene and sublime, Don held a secret, a treasure of his time. The music of silence, a mystical art, He shared it with others, a balm for the heart.

Yahriel sought Don, his heart full of strife, Knocking on Don's door, seeking wisdom and life. Don welcomed him in, they sat in silence's embrace, As nature's sounds whispered, a peaceful place.

Don spoke of a journey, darkness, and chaos, Of finding true joy, a path for both of us. Yahriel found resolve, a will to pursue, The secret Don held, a perspective so true.

## **I Am Yahriel Salinas-Reyes**

Born to immigrants in Iowa, a tale of my own, Challenges faced, determination brightly shone. Aerospace engineering, a path to excel, At Caltech's halls, my journey would swell.

Mentorship's power, a guiding star so bright, Obstacles as stepping stones, towards the light. Freedom is knowledge, shared far and wide, Guiding others on their journey, side by side.

My name, "He is free," a purpose I'd embrace, Mentor, scholar, leaving a lasting trace. In a world where lines blur, sanity's thread, The human spirit soars, in every word and deed.

## **JOYBOY: Don Yahriel, He That Is Free**

In the tapestry of existence, our stories entwine, Don Yahriel and I, two souls that shine. In the dance of chaos and beauty's grand deploy, We find the essence of life, we are JOYBOY.

## Part 4: The Dawn of The Future

In the epic tale of Don Yahriel, the Poet of Justice, A man so enigmatic, his journey we discuss. In a world where madness and reason intertwine, He sought to bring goodness, let his light brightly shine.

Born to undocumented parents in Iowa's embrace, Yahriel faced challenges with unwavering grace, In the quiet countryside, he found a sage named Don, Whose secret held power, a paradigm to dawn.

The Music of Silence, a mystery profound, Yahriel learned its beauty on Don's sacred ground. As they sat in stillness, the world's chaos did cease, And Yahriel found peace in the gentle breeze.

In the depths of his journey, a truth did he see, A story of darkness, but also beauty's decree. In a place of confusion, where senses did blur, He clung to his mother, his guiding star so pure.

With resolve in his heart, he recited the creed, In Spanish and English, he planted the seed. To never give in to the chaos and strife, But to be a gracious loser, embracing life.

As Yahriel ventured forth, Don Yahriel's name, He embraced his own madness, stoked the creative flame. He believed in the balance of good and despair, And the boundless potential of the human spirit's flair.

He read books without end, seeking truth in each line, For in every tale, he saw goodness entwined. He transcended the limits of language and word, In the art of translation, his voice could be heard.

A knight of compassion, he held chivalry dear, Succoring the afflicted, devoid of judgment or fear. In poetry and music, he found his own soul, Where darkness and chaos couldn't maintain their hold.

In the end, Don Yahriel's odyssey unveiled, A man of great madness, his spirit unassailed. He discovered his true self, a beacon so bright, A testament to the human spirit's endless flight.

Yahriel Salinas-Reyes, a name to adore, From adversity's fires, he emerged even more. A mentor, a scholar, his legacy shines, A symbol of freedom, in these epic lines.

In the world's shifting boundaries, he stood so tall, A testament to the triumph of the human call. For in the quest for knowledge and dreams to employ, He became Don Yahriel, the eternal Joyboy.

## Epilogue

### **Chapter I: The Journey Begins**

# Copy

In the labyrinth of his own mind, he wandered, Lost in a swirling darkness, adrift at sea, A world devoid of senses, confusion pondered, In this abyss, he sought to find the key.

## **Chapter II: A Mother's Love**

Beside his bedside, Mama sat, eyes with tears, Her strength now faltered, sorrow in her gaze, "Tell me, what do you see?" her voice with fears, Don replied, "I see what my heart conveys."

## **Chapter III: The Power of Resolve**

Amidst this turmoil, Don found strength within, A mantra, repeated, his spirit fortified, "The world won't change, I'll bear it with a grin, I'll be a gracious loser," he testified.

## **Chapter IV: Uncovering the Paradigm**

Don's journey continued, profound secrets found, The ancient paradigm, light in the darkest hour, Guided by love, his spirit was unbound, In chaos, he discovered his inner power.

## **Chapter V: The Odyssey of Knowledge**

Don Yahriel, an enigma, walked the line, Between madness and reason, he did tread, Seeking goodness in a world where evil's sign, In his heart, he bore the hope to spread.

## **Chapter VI: Madness and Books**

Books his passion, knowledge he'd acquire, To unravel mysteries of life's grand scheme, In madness, he danced by the book's fire, For in them, he'd find his wildest dream.

## **Chapter VII: Chivalry and Empathy**

To the oppressed, his code of chivalry held, Judgment aside, their suffering he'd embrace, Their pain, not their misdeeds, to him was spelled, In their plight, he found his rightful place.

## **Chapter VIII: The Power of Translation**

Language, a bridge, he sought to mend, To reveal the truth beneath each word, Translating the wisdom others couldn't comprehend, In this pursuit, his vision clearly heard.

## **Chapter IX: Music and Poetry**

In poetry and music, he found his solace, Where beauty thrived, evil had no room, Harmonies and verses, his spirit's palace, In their melodies, he'd dispel the gloom.

## **Chapter X: The Truest Self**

In his odyssey, Don became the mystery, A living testament to the human soul's art, In his madness, he found profound history, A truth that transcended the ordinary heart.

## **Chapter XI: Yahriel's Journey**

As the torch passed to Yahriel's hand, He embraced Don's wisdom, his heart aglow, In the music of silence, he'd understand, The world's greatest mystery, he'd come to know.

## **Chapter XII: A Mother's Reunion**

In the midst of Yahriel's transformative quest, His mother's tears revealed the truth untold, Their reunion, a bond no pain could jest, Love and understanding, like pure gold.

## **Chapter XIII: Resolve and the Music of Silence**

With a mantra of resolve, he'd persevere, The world unchanged, his spirit steadfast, A good loser, his heart held no fear, In these words, his strength would last.

## **Chapter XIV: The Legacy of Yahriel**

# Copy

Yahriel's journey, from darkness to light, Inspired by Don's secret, a shift in view, Resolve beyond neurology, a noble fight, In the music of silence, his spirit grew.

## **Chapter XV: I Am Yahriel Salinas-Reyes**

Born to immigrants, in Iowa's embrace, His path paved with challenges, wisdom amassed, The power of the gaze, his soul's trace, In adversity's forge, he'd be unsurpassed.

## **Chapter XVI: Embracing Identity**

From Aerospace Engineering to Caltech's grace, Mentorship's gift, a beacon of light, Each obstacle, a steppingstone to face, In sharing knowledge, his true might.

## **Chapter XVII: The Essence of Freedom**

Named "He is free," his name's embrace, An epiphany, a revelation profound, Freedom shared, a guiding grace, A legacy of mentorship, his life unbound.

## **Chapter XVIII: The Invincible Spirit**

Yahriel's odyssey, a testament true, To the human spirit, it boldly attests, In the pursuit of knowledge, dreams anew, True freedom's path, in hearts it rests.

## **Chapter XIX: The Eternal Enigma**

And so, the tale of Don Yahriel, profound, An odyssey through madness and light, In the depths of the human soul, it's found, The truest enigma, shining bright.

## **Chapter XX: JOYBOY**

Don Yahriel, he who is free, An eternal beacon for all to see, In the dance of chaos and beauty, His legacy lives on, a melody.

Copy



**YAHRIEL'S 4A'S: AN INDEPENDENT INTERDISCIPLINARY FIELD**

**1. AEROSPACE-AERONAUTICAL SYSTEMS**

**2. ANTHROPOLOGY-ENGINEERING**

**3. APPLIED SCIENCE, TECHNOLOGY, AND SOCIETY (STS)**

**4. ANATOMY AND ARTIFICIAL INTELLIGENCE**

**BY YAHRIEL SALINAS-REYES**

A PROPOSED THESIS SUBMITTED TO THE GRADUATE FACULTY IN COMPLETE FULFILLMENT OF  
THE REQUIREMENTS FOR THE DEGREE OF

DOCTORATE OF NEUROSCIENCE AND BIOMEDICAL  
DATA-SCIENCE/INFORMATICS

THE STUDENT AUTHOR, WHOSE PRESENTATION OF THE SCHOLARSHIP HEREIN WILL BE  
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UNDERGRADUATE INSTITUTION: IOWA STATE UNIVERSITY OF SCIENCE AND TECHNOLOGY

AMES, IOWA

2023

BACHELOR'S: AEROSPACE AND AERONAUTICAL ENGINEERING ('23)

MASTER'S: APPLIED SCIENCE AND TECHNOLOGY ('23)

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# NATURE'S CHAOS GAME: AN EXISTENTIALIST APPROACH INFORMED BY MATHEMATICS AND NEUROBIOLOGY

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INVESTIGATOR: *Yahriel Salinas-Reyes*  
RESEARCH MANUSCRIPT

i.  
**DEDICATION**

I dedicate my thesis primarily to the two most important people in my life - my nurturing mentor known as The Cyclone of Education, and my lifelong supporter, and companion, Don Yahriel Salinas-Reyes - An embodiment of Chaos, Order, Logic, and Madness. I miss you both incredibly, and I promise to make good on my word to make you both proud.

I am deeply grateful to my family in the United States, Mexico, and El Salvador for bearing with me patiently as I worked on my thesis. I dedicate this work to all of you. Your unconditional love and strong show of support are the only things that kept me going every time I wanted to give up. To my parents, Sonia Reyes-Alvarenga and Oscar Salinas-Millan, your daily phone calls and pep talks kept me grounded and pushed me closer to the finish line. To my sister Lizbeth Salinas-Reyes, who would chide me every week and guilt trip me for being away from home - your prayers and love have kept me safe here. To my family Abigail Salinas-Reyes, Samuel Salinas-Reyes, Delmy Salinas-Reyes, and La Raza - thank you for seeing the best in me. You have never failed to cheer me up.

Lastly, to my supporters - thank you for being patient, caring, understanding, and being invested in me and my thesis. I am incredibly lucky to have you all, and I couldn't have done this without you.

Yahriel Salinas-Reyes 2023

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## Discussion



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### Keywords:

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# Anthroengineering: an independent interdisciplinary field

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In recent decades, funding agencies, institutes and professional bodies have recognized the profound benefits of transdisciplinarity in tackling targeted research questions. However, once questions are answered, the previously abundant support often dissolves. As such, the long-term benefits of these transdisciplinary approaches are never fully achieved. Over the last several decades, the integration of anthropology and engineering through inter- and multidisciplinary work has led to advances in fields such as design, human evolution and medical technologies. The lack of formal recognition, however, of this transdisciplinary approach as a unique entity rather than a useful tool or a subfield makes it difficult for researchers to establish laboratories, secure permanent jobs, fund long-term research programmes and train students in this approach. To facilitate the growth and development and witness the long-term benefits of this approach, we propose the integration of anthropology and engineering be recognized as a new, independent field known as *anthroengineering*. We present a working definition for anthroengineering and examples of how anthroengineering has been used. We discuss the necessity of recognizing anthroengineering as a unique field and explore potential novel applications. Finally, we discuss the future of anthroengineering, highlighting avenues for moving the field forward.

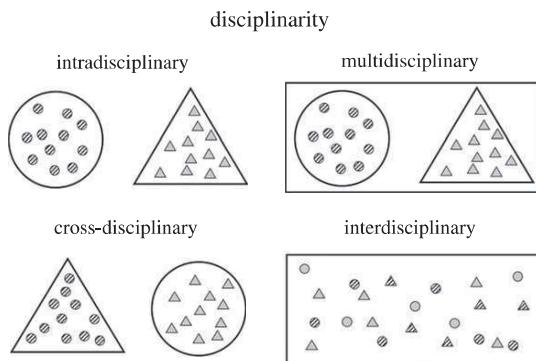
## 1. Introduction

Transdisciplinarity forms a common axiom that transcends the disciplines, creating an overarching synthesis [1] (figure 1). As these syntheses combine previously isolated thoughts and ideas, the knowledge created by their integration is greater than anything that can be created by a single discipline on its own. Simply put, the whole is greater than the sum of its parts (Aristotle). Here we propose a new field that transcends existing disciplines: anthroengineering.

A recent transdisciplinary trend combining anthropology and engineering—anthroengineering—has become increasingly popular over the last few decades. It has played a crucial role in the development of fields such as biomechanics [2,3], ergonomics [4,5] and functional morphology [6–9]. Anthropology—the science and study of human and societal culture, language and biology—and engineering—the application of science to create machines and implement technologies and tangible solutions to societal problems—are unique and distinct disciplines that infrequently share curricular overlap. When the transdisciplinary approach has been applied to anthropology and engineering, it has often leveraged methods or data from one discipline to address a question from the other (figure 2). This focus on specific problem-solving rather than a united theoretical foundation limits the impact of any innovations created by the collaboration. Thus, the power of the transdisciplinary approach is not fully realized. By leveraging both disciplines to address issues that transcend each discipline (i.e. transdisciplinary issues), syntheses can be created that are of interest not only to members of both disciplines, but also to individuals outside of either.

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**Figure 1.** Types of disciplinarity that combine anthropology (circles) and engineering (triangles). Intradisciplinary: anthropologists (striped circles) and engineers (grey triangles) work within their respective fields (large circle and triangle). Multidisciplinary: anthropologists and engineers work within their respective fields to address a larger issue (rectangle). Cross-disciplinary: anthropologists investigate issues within engineering, and engineers investigate issues within anthropology. Interdisciplinary: anthropologists, engineers, anthropologists turned engineers (striped triangles) and engineers turned anthropologists (grey circles) seamlessly use both disciplines, simultaneously, to address larger issues.

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The uniqueness and distinctiveness of the two disciplines means that, if a Venn diagram were to be drawn, little overlap would be apparent. Thus, it is difficult for researchers to identify issues that simultaneously leverage both disciplines. Yet, such issues exist, and many of them are crucial for the success of people and planet. Examples of such issues include the United Nations (UN) 17 Sustainable Development Goals (SDGs). These goals set forth a blueprint for how to achieve a more sustainable future for all by addressing problems ranging from poor health to inequality, environmental degradation, and peace and justice [15–17]. Because anthropologists and engineers are trained to approach these problems in discipline-unique ways, their perspectives will be distinct along a multitude of axes, and the fusion of the two disciplines will be difficult. But, ultimately, the insights gained will lead to solutions that neither discipline could achieve independently.

Despite the presence of significant overlapping issues and great benefits that could be achieved by leveraging both anthropology and engineering to address these issues, this transdisciplinary approach is rare, because no generalized framework that incorporates anthropology and engineering currently exists. Instead, frameworks are constructed for targeted projects which are often abandoned when the project is completed. Establishment of these frameworks requires an extraordinary amount of effort, and their specificity and frequent abandonment prevents them from being used for novel applications. A generalized framework is needed.

Such a framework would require, among other attributes, a common language where anthropologists and engineers can communicate effectively. It would require acknowledgement, respect and integration of expertise to develop new syntheses and a new cohort of students who are trained to think as both anthropologists and engineers simultaneously. But before a framework can be developed, this transdisciplinary approach requires a name. Without a name, the approach remains unknown, ill-defined and abstract. But with a name, this approach has identity and carries with it symbolism

beyond its meaning. We suggest, therefore, that the transdisciplinary approach, combining both anthropology and engineering, be recognized as its own, independent field called *anthroengineering*.

## 2. What is anthroengineering

Anthroengineering is an approach that uses theories, methods and/or data from both anthropology and engineering to address questions within and beyond both disciplines. The result is the development of new knowledge, which can take a multitude of forms (e.g. data, technologies, viewpoints, axioms, syntheses). While the true power of such an approach would lie in leveraging it to address transdisciplinary issues, anthroengineering can also be used to address questions within anthropology and engineering and to advance each field individually (figure 2).

Providing anthroengineering with a name, describing it and recognizing it as distinct entity allows for researchers to succinctly define their work and, more importantly, provides them with identity as anthroengineers. It also acts to provide a common thread and search term that can tie together all future work that uses a transdisciplinary approach to combine both anthropology and engineering. Doing so will provide those interested in anthroengineering with a direct way to learn about it and what frameworks, data and methods exist to leverage anthroengineering effectively in their own work.

## 3. Examples of anthroengineering

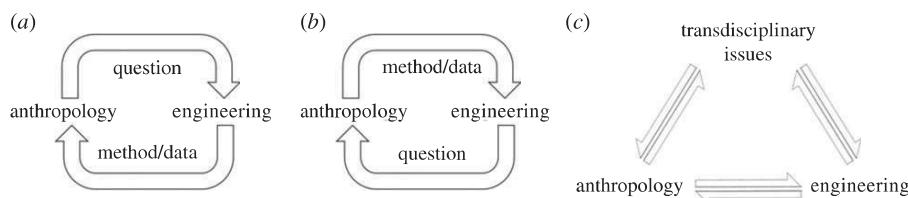
As previously discussed, examples of anthroengineering already exist, and some have existed for decades. Given our expertise, we discuss some examples largely through the lens of biological anthropology and engineering mechanics.

### 3.1. Classic anthropology meets classic engineering

Anthropologists have studied dental wear patterns on the micro-, meso- and macro-levels for over a century [18] to address a myriad of questions in such topics as taxonomy [19], palaeo-ecology [20], environmental reconstruction [21] and behaviour [22,23]. Similarly, mechanical failure analyses—and, in this situation, tribology and fracture mechanics—have been a major focus of engineering since the birth of the field as all machines experience wear [24–26]. It is, therefore, unsurprising that anthropologists and engineers have teamed up to understand better how teeth wear and fracture.

Using techniques such as nano-indentation, researchers have been able to investigate the role that microscopic particles (e.g. phytoliths, grit) play in the wear of dental enamel [27,28]. Additionally, through physical experimentation, modelling and comparative anatomy [29–32], researchers have been able to investigate the role of enamel thickness and schmelzmusters (enamel microstructure) in force and energy in failure resistance. Although researchers may not always agree on interpretations of experimental results [33–35], this research has led to advances in understanding dental wear and the factors that influence it [36], understanding functional adaptations of teeth [37,38] and the creation of bioinspired materials [39].

Similarly, principles from material science and solid mechanics (engineering) and musculoskeletal biology



**Figure 2.** Transdisciplinary approaches to anthroengineering. (a) Engineering method(s)/data being leveraged to address anthropological question(s). Through an iterative process, question(s)/method(s) are refined and a synthesis is reached (e.g. the application of FE modelling to human evolution [10–13]). (b) Anthropological method(s)/data being leveraged to address engineering question(s). Through an iterative process, question(s)/method(s) are refined and a synthesis is reached (e.g. the application of ethnography to engineering design [14]). (c) Engineering and anthropological questions, methods and data are used to address transdisciplinary issues (e.g. design and/or manufacture of culturally relevant, sustainable medical devices for low- and middle-income countries).

(anthropology) have been used to understand how skeletal form (shape + size) and skeletal and ecological mechanical properties affect the way loads are transferred to the skeleton and how the skeleton responds to internal and external loads. Bone (re)models in response to mechanical strain [40–43]: this in turn affects bone's mechanical properties (remodelling) and form (modelling) (e.g. [44,45]). Bone strains have been measured experimentally using *in vivo* [46,47] and *in vitro* [48,49] techniques using strain gauges and digital image/volume correlation (DIC, DVC). However, this only delivers information on bone strain at a limited number of sites. By constructing finite-element (FE) models and validating them using experimental strains [50,51], we can obtain three-dimensional strain maps across the entire structure.

FE models require several inputs, including geometry, constraints and mechanical properties [8,52–54]. Advances in three-dimensional scanning techniques, computer science and statistical shape modelling (e.g. geometric morphometrics [55], dental topography [56]) have made it possible to not only (re)construct three-dimensional digital representations of such models [9,57–61], but also quantify complex shapes for statistical analyses [55,62–64]. Constraints come from muscles, joints and/or the external environment. Muscle force can be estimated by multiplying maximum force generation—originally estimated using physiological cross-sectional area [65–67] but now relying on muscle activation/strength [68] and often validated using electromyography [69–71]. Joint constraints are estimated using anatomical knowledge and skeletal collections. Although constraints from the external environment are often modelled as reaction forces, the mechanical properties of the environment (e.g. ground substrate composition during locomotion [72] or dietary mechanical properties during mastication [73,74]) affect the rate and manner in which the load is transmitted. Finally, mechanical properties are difficult to obtain, as bone is a hierarchical, composite structure, but techniques such as tension/compression tests, bending, indentation and ultrasound are used to estimate static and dynamic (bulk) properties [75–82]. Sensitivity studies are useful in understanding how parameter estimates affect the results, but not in validating the model [49,83–86], which requires data from empirical studies (e.g. [53,83]).

Using an extensive array of theories and methods from anthropology and engineering, we have learned more about musculoskeletal biomechanics than can be listed here. Some major findings include:

- (1) Over a lifetime, an individual will engage in actions that will load their skeleton. In turn, their bones will generate

a set of mechanical properties and forms to properly resist the *in vivo* strains brought on by those loads [42,87–89]. But it can be difficult or impossible to determine what actions occurred in the lifetime of an individual given only a set of bone mechanical properties and forms, as multiple behaviours can yield similar loading regimes. This is further complicated with inter-populational or among-species comparisons, as genetics and neutral selection play a significant role in bone form [90].

- (2) Skeletal morphologies particular to specific hominin species have focused attention on the relationships among form, function and behaviour [91]. For instance, the lower limb and pelvic morphology of *Australopithecus afarensis* (e.g. [92]), *Australopithecus sediba* (e.g. [93]) and *Homo neanderthalensis* (e.g. [94]) has led to long-term debates regarding their forms of terrestrial locomotion. Geometric morphometrics and other traditional statistical analyses have led to important insights (e.g. [95]), although they quantify skeletal form and not biomechanical function, and many questions remain. Inverse dynamic simulation of walking in extinct hominins offers the opportunity to expand our understanding of this critical behaviour (e.g. [92,96]), but the integration of musculoskeletal models offers the best opportunity for future insights [68].
- (3) Masticatory loads cause mechanical strains in the skull, which significantly affect its mechanical properties and form [44,45,97]. However, the debate about the relationship between feeding mechanics and diet has led to major questions: is it possible, over an individual's lifetime, to develop a skull that is over- or under-designed for the masticatory loads it experiences [98,99]? Does a skull's ability to resist masticatory loads dictate or limit an animal's or species' diet? Does natural selection select for skull form based on its ability to resist masticatory loads [10–13,100–102]?
- (4) Primate tooth shape is undoubtedly correlated with diet [56,103], likely because teeth have evolved to break down foods consumed more efficiently [56,104,105]. However, the interactions between multicused teeth and food items are so complex that we lack an efficient model for describing these relationships and, thereby, predicting food item breakdown from tooth shape [64,106,107].

Although it may seem that these lines of research have created more questions than answers, the independent syntheses of anthropology and engineering have led to important insights not only for the fields of anthropology and

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bioengineering but also anatomy, evolution, medicine and dentistry, to name a few. Further, the crucial questions generated would not exist if not for this transdisciplinary anthroengineering approach, and researchers would be ignorant of their ignorance.

## 3.2. Addressing intradisciplinary questions

Anthroengineering has also contributed in addressing more targeted questions within the disciplines of anthropology and engineering. Owing to decades of research in relatively independent fields, anthropology can provide insights into the Universe that engineering does not have, and vice versa.

Because anthropology is a discipline dominated by questions, while engineering a discipline that focuses on methods and applications, it is easy to see how the tools of engineering can be used to address anthropological questions. For example, using methods initially developed in engineering, virtual anthropology [108] has made it possible to quantitatively reconstruct palaeoarchaeological material and statistically quantify the accuracy of these reconstructions [59–61,109,110]. Two important examples of this are the reconstruction of the skull of *Ardipithecus ramidus*, which provided crucial, previously missing information about the evolution of hominin social structure, bipedalism and brain structure in hominin evolution during the Pliocene [110]. Additionally, the reconstruction of the mandible of *Homo habilis* not only showed a decoupling of brain and tooth size, but also allowed the development of a hypothesis regarding a much earlier origin of the genus *Homo* [109]. While that paper was under review, a new fossil (the Ledi-Geraru mandible) was discovered, confirming the authors' hypothesis [111].

Two additional common engineering methods—FE analysis and tension/compression tests—have been used extensively in palaeoanthropology to quantify the biomechanical performance of hard skeletal tissues and address questions concerning the evolution of primate diets [12,46,58,112–114]. The ability to print three-dimensional fossils further allows for the mechanical testing of previously inaccessible material [115–117]. These *in silico* and *in vitro* models and experiments carry with them several assumptions about the loading conditions and mechanical properties of the structure being analysed but provide valuable information about the biomechanical limits of the structure.

Given the plethora of methods in engineering, it may be more difficult to see how anthropology can benefit engineering. Nonetheless, engineering focuses on the application of science to solve problems for people, and anthropology is uniquely situated to provide the context to those problems. For instance, anthropology has improved engineering through the incorporation of anthropological methods. For example, the incorporation of ethnography into design to form the fields of design/techno-anthropology [14] and conferences like EPIC (Ethnographic Praxis in Industry Conference; [www.epicpeople.org](http://www.epicpeople.org)). End-user design focuses on the user's needs when designing products. By using anthropological techniques like ethnography, engineers can gather information about the wants and needs of the user that is inaccessible through focus groups developed from marketing perspectives. A classic example is in the design of the MP3 player, which was meant as an affordable

alternative to the iPod to be used in the gym. Focus groups thought they wanted a device with many options and, therefore, many buttons. The product was designed, sent to market and failed. It was only by teaming up with ethnographers that designers and engineers realized that people's hands got sweaty in gyms and that gyms were social places. Ultimately, people actually wanted devices with fewer buttons and a quick on/off switch—they just did not realize it when they were in focus groups because the questions were not asked in the proper framework [118].

Anthropologists bring with them techniques that can be used to design for the future [119] and understand the consequences of technological advances. Engineers make design decisions to help today, but rarely think about the long-term effects on societies and communities in the future: this is because many work for companies which are on a deadline and, once one project is complete, they move on to the next. A classic example of the desire to solve the problem at hand without considering the potential longer-term societal consequences has been documented [120]. Engineers working through an international development organization created a solution to a chronic water shortage by developing a 140 km gravity-driven water pipeline that supplied water taps in local settings. Before the project, local women had carried water from natural sources, at times a journey of 3 h. The water distribution system worked well, but two unintended consequences occurred: the decrease in energy expenditure due to no longer needing to carry water increased the women's fertility and, because nutritional resources remained the same, increased child malnutrition [120]. These consequences are predictable through the lens of human reproductive ecology, a key body of knowledge in biological anthropology.

Anthropologists are trained to investigate long-term societal and community trends and are in a much better position not only to understand but also to address these problems. By working together, anthropologists and engineers who are interested in finding more socially connected solutions can do more to address crippling human problems. An example of how this can work came forth at the 'Why the World Needs Anthropologists: Powering the Planet' conference at Durham University, UK, in 2018. The conference focused on the problems facing energy (e.g. production, dissemination, storage) and explored how energy professionals and anthropologists can work together to create energy innovations that change the world for the better (<https://www.dur.ac.uk/dei/events/?eventno=34503>). In many cases, applied anthropology, which focuses on the external application of anthropology to current problems, could be used to extend and/or enhance the solutions to the problems engineers are regularly faced with.

Finally, although biomimicry is a field in itself, its application often falls short of its potential. Engineers who use biomimicry often look at the biological system in isolation and with overly simplified biological theories (e.g. assuming natural selection has caused a structure to be optimal for its function, without considering the evolutionary history of that element). Biological solutions typically must solve several simultaneous problems and have evolved within a set of allometric, phylogenetic and ontogenetic constraints [121]—a core understanding in biological anthropology—and the adaptationist programme frequently employed by engineers has been rejected by biologists for decades

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[122,123]. Because of this, biomimetic engineering falls short of its goals.

Anthropologists are trained to consider biological context that could lead to more effective biomimicry solutions using primates and human biological systems (e.g. the hierarchical structure of bone [124]). Take, for example, the design of the human foot, a complex structure that can be rigid in some circumstances and compliant in others. The evolutionary history of the foot is complex and filled with gaps [125], but we know it has evolved to interact with various substrates [72]. When wearing a shoe, the substrate interacting with the foot is no longer the ground, but the shoe itself [126], but shoe design does not often take foot-substrate interactions into account. Many shoe designs lead to running biomechanics that the human skeleton has not evolved to handle (e.g. high-impact forces during heel striking [127]). Similar issues can be seen in prosthetic foot design, where the impact of foot stiffness on gait biomechanics is well documented for advanced prosthetic feet (e.g. [128]). But in situations with fewer opportunities for the use of advanced medical devices, ‘one size fits all’ becomes ‘one stiffness fits all’ and the negative consequences of such choices are not appreciated. Further, even advanced medical interventions select a specified, unchanging stiffness for the prosthetic foot, when the natural foot has an adaptive, continuously changing stiffness, dependent on substrate and loading. Using anthroengineering and biomimicry approaches, answers to questions like ‘How can we use what we know about variation in Primates to make engineered products better?’ are achievable.

## 4. Why recognize a formal field of anthroengineering?

If anthroengineering projects already exist, why is it necessary to provide the word ‘anthroengineering’ to describe them all? It is not as if the previously discussed anthroengineering examples would cease to exist should the term ‘anthroengineering’ not be coined. More importantly, why is it necessary to recognize anthroengineering as its own field?

First, as previously mentioned, names provide identity and symbolic meaning. Should it not be given a unifying name, anthroengineering will remain elusive and ill-defined. In a well-known paper on evolutionary theory, Gould & Vrba [129] present a new word—exaptation—to describe an evolutionary phenomenon. They argue that the existing word ‘adaptation’ is defined and recognized by two criteria and biologists fail to recognize potential confusion between these criteria. Part of the reason for this confusion, they go on to say, is that one of these criteria does not have a distinctive word to describe it. They then propose that the word ‘exaptation’, which had not previously existed, be used for this criterion [129]. By providing a phenomenon with a name, Gould and Vrba took a previously undefined concept and centred it, making it tangible and real. Similarly, while anthroengineering has existed for decades, it has remained abstract and ill-defined. By providing a word to describe this line of work, anthroengineering becomes tangible and real.

Second, providing the name anthroengineering allows for the field to be recognized. This provides a thread to unite

researchers working at the intersection of anthropology and engineering, much as the word ‘anthropology’ ties together cultural, linguistic and biological anthropologists, or ‘engineering’ ties together chemical, mechanical and computer engineers. Anthropology and engineering intersect across so many areas of interest that researchers in one area are often ignorant of people working in another (e.g. design anthropologists versus palaeo-biomechanists). The word anthroengineering creates a unifying concept for these researchers and an umbrella under which those anthroengineers can meet with, learn from and work with each other.

Third, the creation of a word and field to describe this line of work creates with it a new way of thinking and new framework, but, unlike interdisciplinary projects, it also creates a permanency. This allows researchers to be trained in this novel way of thinking and apply it with a deeper understanding to new problems in the future. This will then open a new world of potential applications for anthroengineering and enable researchers to ask questions they previously would not have considered.

Once anthroengineering is established and researchers have become fully trained in the field, the questions researchers ask will change. Instead of asking how anthropology or engineering, individually, could address a problem, researchers will ask how anthroengineering can address the problem and—as such—be able to answer it in a more fully informed, comprehensive manner. New questions can be asked, such as:

- How can we leverage anthroengineering to address large problems in the world, such as the UN’s SDGs?
- How can we use anthroengineering to better understand how humans have evolved and why modern human biological variation exists in the manner it does?
- How can we leverage that information to better understand how humans are currently evolving in light of technological and societal changes and to address problems associated with racism and other identity-based biases in our technology and societies [130]?
- How can we use advanced modelling techniques to address global problems associated with healthy human ageing?

### 4.1. Creation of a new field

Today, many of the problems facing anthroengineering are the same as those facing interdisciplinary research in general. We recognize the issues facing research and research projects can often be distinct from those facing fields, but, at the time of writing, anthroengineering has almost solely existed at the research level, so it has not yet developed (m)any unique ‘field-level’ problems. As the plights of interdisciplinary research are much discussed, we will provide an overview of some of the main problems facing interdisciplinary research that we have witnessed within anthroengineering. We will further discuss some issues specific to anthroengineering today.

#### 4.1.1. Publishing

Publications are currency in academia. When academics try to demonstrate their impact as researchers, they often total their number of publications, h-index, i10 index and the like for good reason. Publications foster recognition and the institutionalization of research, which in turn feeds back on the

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infrastructure and capacity of centres and departments, resulting in increased support [1].

Anthroengineers are faced with several difficulties when it comes to publication that plague interdisciplinary research. When making the decision on where to publish, anthroengineers must choose between specialist and generalist journals [131]. Often, their manuscripts do not fit within the narrow remits of specialist journals and would have to change position from a truly transdisciplinary approach to one where the methods/theories from one field are being used to advance the other [132]. Until specialist anthroengineering journals are established, therefore, manuscripts must be published in generalist journals. The risk when publishing in generalist journals is that the paper will not have its desired impact, as the generalist journal may not be regularly read by anthropologists, engineers or fellow anthroengineers. The paper would then miss its target audience.

The most effective way of circumventing this issue is through publication in high-impact generalist journals with large readership bases. But herein lies two dilemmas: (i) high-impact generalist journals tend to have word/page limits, and there is often not enough space to fully explain or discuss the anthropological *and* engineering theories and methods, and (ii) these journals have many submissions and limited publication space. They are, therefore, likely only to publish material they believe will be of interest to a high percentage of their audience, meaning that they can be hesitant to accept and publish papers in untested areas that do not already have a demonstrated readership base.

Further, the editors handling the manuscripts are unlikely to be anthroengineers and are more likely to be either anthropologists or engineers, making it less likely they will be able to grasp fully the impact of the research as part of the work is outside their area of expertise. The same issue occurs when recruiting reviewers for the manuscript [133]. Often, few researchers exist with the expertise to comprehensively review the manuscript. Consequently, more reviewers must be recruited, and it is not uncommon for reviewers to provide conflicting reviews. When conflicting reviews are received by a high-impact journal, the manuscript is often rejected, as the lack of consistency among reviewers is believed to be indicative of an inferior manuscript.

As a result, researchers are required to spend years publishing high-impact research in lower impact generalist journals that may not reach their target audience, and/or moulding their research to reach the narrow remit of the specialist journals. As institutional and funding support are often hinged on the ability to publish in high-impact journals (as this is often used as a metric for the ‘quality’ of research), researchers in interdisciplinary fields must often work much harder to be recognized. Fortunately for anthroengineering, several well-respected journals have been receptive to the publication of anthroengineering manuscripts (e.g. those published by the Royal Society [106,107,134], *Proceedings of the National Academy of Sciences of the United States of America* [12] and *Nature* [58]), but more explicit definition of the field will extend this acceptance.

## 4.1.2. Funding bodies

Funding is almost as important as publishing in academia, but securing funding for interdisciplinary projects comes

with many of the same problems [132,135]. Instead of choosing between specialist journals, researchers are forced to choose between specialist councils (e.g. the Engineering and Physical Sciences Research Council (EPSRC), Natural Environment Research Council (NERC) and Biotechnology and Biological Sciences Research Council (BBSRC) in UK Research and Innovation (UKRI)) or specialist research areas (Biological Sciences, Engineering, International Science and Engineering, and Social, Behavioral, and Economic Sciences in the National Science Foundation (NSF)).

At a time when inter-/multidisciplinary research is heralded as the future of academia [136–138], the narrow focus of councils/research areas makes it complicated to submit interdisciplinary proposals and receive funding. When proposals are submitted to a specific research council/area, the proposal’s merit is judged within the expertise of that council/area. While submission of truly interdisciplinary proposals that transcend the boundaries of the research councils/areas can occur through cross-council submissions, councils need to be contacted prior to submission to determine if the proposal is of interest. It often takes months to answer interdisciplinary enquiries, as it requires cross-council conversations, which delay proposal submission.

Once submitted, it is consistently more difficult to be awarded funding for interdisciplinary projects [139], and it is easier to secure funding for projects that combine closely related disciplines than for disparate ones [132]. This, unfortunately, leads to a situation where the more groundbreaking the collaboration is, the harder it is to fund. Lower funding success rates are believed to originate from a bias against interdisciplinary projects. Firstly, interdisciplinary proposals are viewed as higher risk because they do not follow an established path [139]. Secondly, as with journal articles, proposals are often reviewed by reviewers and panels who are ill-equipped to evaluate all parts of the project, making it difficult for them to appreciate the scope and impact of the proposal. They instead only review the portion of the proposal for which they are an expert and are more likely to assign a mediocre or poor score to an interdisciplinary proposal than an intradisciplinary one owing to a poor understanding of the project or the foundational concepts. Having a mix of reviewers who do and do not fully appreciate or understand the project will lead to proposals being rejected, as a lack of consistency between the reviewers is viewed as a problem with the application and not the review process. Additionally, interdisciplinary proposals compete with intradisciplinary ones, which are easier to justify for the funding agent [139].

## 4.1.3. Institutional support

In the longer term, for anthroengineering—or any other interdisciplinary line of research—to succeed, it must have career-level institutional support. Once interdisciplinary grants are awarded, the resulting projects often include graduate students and/or postdoctoral research associates. While this training expands their knowledge in ways that we recommend, it also leads to the training of a cohort of interdisciplinary researchers who, in the case of anthroengineering, do not fit the classic definitions of anthropology or engineering. They are often not considered ‘real’ anthropologists or ‘real’ engineers. As a result, when it comes time for these individuals to obtain permanent posts, the more

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interdisciplinary they are, the more difficult it is to obtain a permanent position.

During faculty searches, departments/divisions look for individuals to fill gaps in programme teaching and/or research foci, often hiring candidates who best fit the discipline(s) in which the programme awards degrees. This makes it difficult for truly interdisciplinary researchers to obtain permanent posts: an anthropologist or engineer who has spent their entire career working within the boundaries of their traditional discipline is a much stronger candidate than an anthroengineer. For the long-term success of anthroengineering, high-level institutional support is needed.

#### 4.1.4. Anthroengineering education

In terms of education, institutions need to go a step further than the current practice. To date, all anthroengineering training has been done on an individual level in the laboratory, which requires an inordinate amount of time and effort from the laboratory's principal investigator, and from the individuals independently seeking out formal educations in both anthropology and engineering. Given how different the two disciplines are, this often requires twice the time and money to be educated in anthroengineering, limiting the ability to study anthroengineering to the privileged. Owing to the clear benefits of interdisciplinary research, and the scientific leaps that have been made by anthroengineering research already, we believe that universities should support formally training students as anthroengineers.

The majority of these students will leave academia and enter the private sector. The students trained as anthroengineers will have immediately transferable skills that make them superior on the job market to other anthropologists/engineers seeking employment. For example, a major concern among engineering companies is how to be more socially responsible, while social responsibility is a central theme in anthropology. The anthroengineers entering the job market will have the skills not only to be practising engineers, but also to be more socially responsible than engineers who have not received this training—something that is direly needed [140]. The anthroengineering cohorts will be trained in both anthropology and engineering from the start of their higher education, and, thus, taught to think using interdisciplinary approaches from the start. These anthroengineers will have the ability to see new questions and novel, innovative answers that cannot be imagined by the current generation of anthroengineering.

## 5. Disciplinary culture

The last issue we would like to touch upon with anthroengineering is that of disciplinary culture. In the creation of a new field, we are in the unique position to create the academic culture for the field. A focus of many disciplines, today, is to address the realities of sexism, racism, homophobia, etc., that have become engrained within these disciplines and academia in general and to take the necessary steps to solve these problems [141]. In the establishment of a new field, we can attempt to create a more inclusive academic environment from its inception [142].

When applying to hold the first symposium on anthroengineering at the American Association of Physical Anthropology (AAPA) conference in Cleveland, Ohio,

USA, 2019 (Symposium 13—Anthroengineering: a Biological Perspective), we were required to write a 300-word diversity statement. In it, we described our methods for recruiting symposium participants which reflect our vision of anthroengineering:

In recruiting participants for this symposium, we focused on early career researchers and on members of groups frequently underrepresented in research. Consequently, about half of our participants are women, and others are ethnic minorities and members of the LGBTQAI[+] community. By recruiting a diverse group of people at an early stage in their careers, we hope to foster an environment of inclusion that connects to and bolsters other such efforts at the AAPAs and in the discipline of biological anthropology generally... [Anthroengineering should value] the contributions of all people, regardless of sex, gender, ethnicity, or sexual orientation, and supports all types of research that combine anthropology and engineering.

In short, our vision for this new field is one of fairness and inclusivity, but anthroengineering will be housed in academic institutions and is born out of two fields which have their own problems. Fortunately, we are in a position where we can observe the issues present in other fields and strive to avoid those issues in this one.

## 6. Conclusion

In this paper, we have presented the concept of anthroengineering, provided examples of how anthroengineering has been used in the past and outline a plan for the future. Importantly, we have argued that anthroengineering should be recognized as its own, independent field: if you did not already believe this, we hope we have made converts out of you.

We cannot wait to see what the future has in store.

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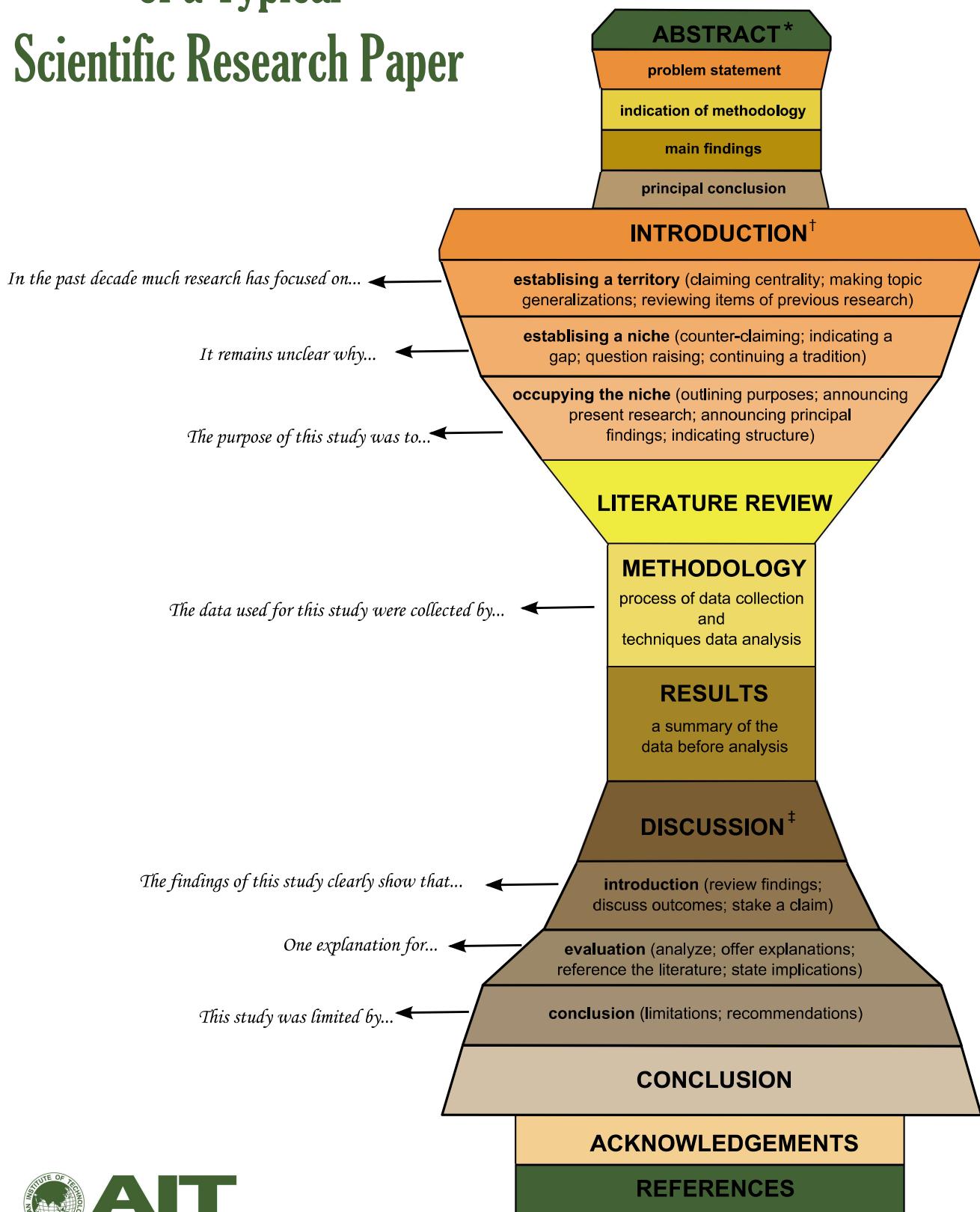
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# Copy The Hourglass Structure of a Typical Scientific Research Paper

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† Dornot, M. (2003). Basics of research paper writing and publishing. Technical report, Department of Computer Science and Business Informatics, University of Vienna.

‡ Swales, J.M. (2000). *Genre analysis: English in academic and research settings*. Cambridge: Cambridge University Press.

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## Damping mechanisms in a tip-mass piezoelectric cantilever system

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(Dated:)

Here we characterize the damping response from a commercial piezoelectric transducer when it is subjected to free-vibrations. The problem under study is an electromechanical problem and hence a combination of dimensionless parameters including the natural frequency of the system, are used to study and understand the damping characteristics of the tip-mass-piezoelectric system. Rectangular prisms with varying aspect ratios(0.5-3.0) are loaded onto two flexible piezoelectric transducers rendering the setup to resemble a cantilever tip-mass system. To directly visualize the effect of tip displacement on the voltage generated, high-speed imaging studies of the cantilever are performed in addition to separate measurements of the voltage response using an oscilloscope. In this paper, we will discuss how these results can further studies into the development of efficient energy harvesters.

PACS numbers:

In this manuscript we present experimental and computational data for the free vibrations of a tip-mass piezoelectric cantilever system. Here we are interested in developing robust dynamic models that may be used as a test bed for understanding control of dynamic behavior that arises in these types of complex systems [1–7]. The Euler-Bernoulli equations with coupled linear piezoelectric deformation equations govern the cantilever's displacement in the small amplitude vibration limit. These equations were developed in other publications for the purpose of single mode vibration analysis [1]. Here, we utilize those equations through a slight modification to study the small amplitude vibration of a damped cantilever with a mass at the tip undergoing free-vibration. The system yields fully-transient dynamics, and understanding the role that damping can play in generating power from these piezo-electric systems is of interests. It has been shown that adding a mass (vibration inducing body) at the tip of piezoelectric cantilevers results in a tremendous increase in the efficiency of energy harvesters [8].

Consider a flexible cantilever made of laminated polymer piezo-electric material such that the piezo-electric material lies along the cantilever's neutral axis. We seek to study unsteady motion of this cantilever along its transverse axis assuming displacements with the generic form  $u(x, t)$ . The other variables are cantilever composite density,  $\rho$ , composite cross sectional area,  $A = t_c L$ , composite elastic modulus,  $E$ , and composite area moment of inertia,  $I$ . We include net external (linear viscous,  $\mu_1$ ), and internal (Kelvin-Voigt,  $\mu_2$ ) damping [9] for a homogeneous cantilever. The relevant electrical properties are the piezoelectric film capacitance  $C_f$ , the film resistance  $R_f$ , and the electro-mechanical coupling term  $\alpha = d_{31}E_p h_{pc} b$  where  $d_{31}$  is the strain per electric field coincident with the direction of axial strain (1) and polarization (3);  $E_p$  is the piezoelectric elastic modulus;  $h_{pc}$  is the distance of piezoelectric center to the neutral axis and  $b$  is the beam width. Attached to the cantilever's tip

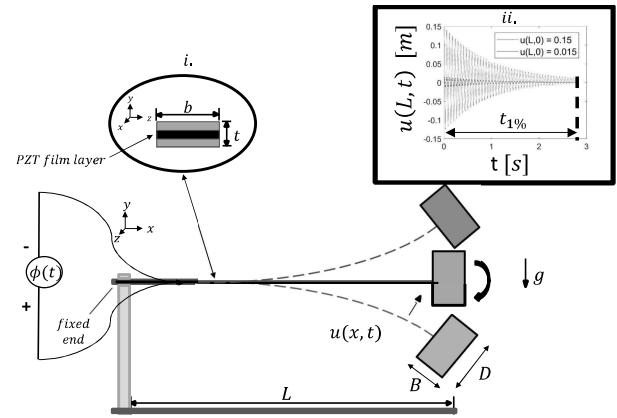


FIG. 1: Problem schematic. *i* PZT layer cross section. *ii* Plot of displacement versus time for 2 initial displacements of a damped Euler-Bernoulli cantilever with  $\pi_4 = 4$ . Both attenuate to 1% of that initial displacement at the same elapsed time.

is a mass  $m_T$  with cross-section long dimension  $B$  and height  $D$ . The cantilever with tip-mass natural frequency is denoted  $\omega_N$ , and natural frequency (first mode vibration) in the absence of the tip-mass  $m_T = 0$  is denoted  $\omega_{N0}$ . Figure 1 shows a schematic of the problem proposed in this study where the neutral axis is positioned with its length along the x-axis.

In Ref. [1] the authors develop equations of motion for a piezoelectric material placed along the neutral axis of a cantilever for the problem of base excitation (forced vibration). The equation set consisted of coupled Euler-Bernoulli beam equation and an integrated electric displacement equation that results in a two component current conservation equation. Coupling was achieved by considering the composite cantilever's total internal moment as the sum of a bending stiffness moment, and a moment generated from the product of an induced voltage potential,  $\phi$ , and the E-M coupling term  $\alpha$ . An unsteady

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voltage was considered uniform over the length spanning the piezoelectric material, therefore the coupling appears through boundary conditions (although the authors in Ref. [1] use Heaviside functions to include the E-M coupling moment in the main equation in order to perform a modal analysis through separation of variables).

Here, the same equations of motion are made dimensionless by scaling lengths with the non-deformed cantilever length  $L$  and time with the frequency  $\omega = \sqrt{EI/\rho AL^4}$  (note that  $\omega_{N_0}$  is proportional to  $\omega$  [10, 11]). The resulting dimensionless independent and dependent variables are  $u^* = u/L$ ,  $x^* = x/L$ ,  $v^* = v/(\omega L)$ ,  $\phi^* = \phi C_f/\alpha$  and  $t^* = \omega t$ ; and the dimensionless form of the coupled Euler-Bernoulli and electric current conservation equations are

$$\frac{\partial u^*}{\partial t^*} = v^* \quad (1)$$

$$\frac{\partial v^*}{\partial t^*} = -\pi_1 v^* - \pi_2 \frac{\partial^4 v^*}{\partial x^{4*}} - \frac{\partial^4 u^*}{\partial x^{4*}} \quad (2)$$

$$\frac{\partial \phi^*}{\partial t^*} = \pi_3 \phi^* - \int_0^1 \frac{\partial^2 v^*}{\partial x^{2*}} dx \quad (3)$$

Solutions for the linear PDE can be found by using the boundary conditions for a cantilever with E-M coupling and a tip-mass [9], where at  $x^* = 0$  we apply a fixed and symmetry condition:

$$u^*(0, t^*) = 0 \quad (4a)$$

$$\frac{\partial u^*}{\partial x^*} = 0 \quad (4b)$$

and at  $x^* = 1$  we apply conservation of moments and force, respectively,

$$\frac{\partial^2 u^*}{\partial x^{2*}} + \pi_2 \frac{\partial^2 v^*}{\partial x^{2*}} = \pi_4 \frac{\partial^2 v^*}{\partial t^* \partial x^*} - \pi_5 \phi^* \quad (5a)$$

$$\frac{\partial^3 u^*}{\partial x^{3*}} + \pi_2 \frac{\partial^3 v^*}{\partial x^{3*}} = \pi_4 \frac{\partial v^*}{\partial t^*}. \quad (5b)$$

Notice we include the rotatory inertia term in the tip-moment conservation equation. The dimensionless variables are defined

$$\pi_1 = \frac{\mu_1}{\rho A \omega}, \quad \pi_2 = \frac{\mu_2 \omega}{E}, \quad \pi_3 = \frac{1}{C_f R_f \omega}, \quad (6)$$

$$\pi_4 = \frac{m_T}{m}, \quad \text{and} \quad \pi_5 = \frac{\alpha^2 L}{C_f EI}. \quad (7)$$

The dimensionless parameters represent: dimensionless viscous  $\mu_1$  and Kelvin-Voigt  $\mu_2$  damping coefficients, dimensionless inverse piezoelectric film resistance  $R_f$ , dimensionless tip-mass  $m_T$  and a dimensionless E-M coupling  $\alpha$ .

Spatial derivatives in (1)-(3) and first derivative boundary condition in (5) were discretized using 4<sup>th</sup> order accurate finite differences [12]. The tip-momentum and force conservation boundary conditions required much higher order accuracy (7<sup>th</sup> order accuracy) to ensure

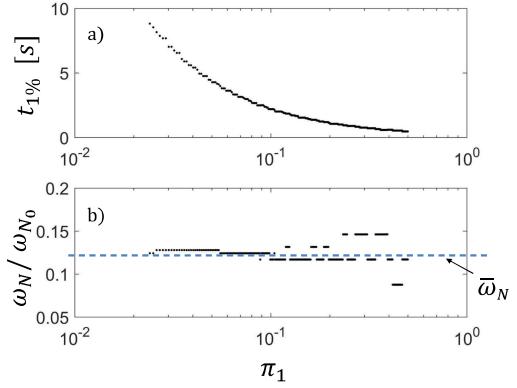


FIG. 2: Plot of a)  $t_{1\%}$  and, b) natural frequency  $\omega_N$  normalized by natural frequency for  $\pi_4 = 0$  i.e.  $\omega_{N_0}$ , with both plotted versus dimensionless viscous damping coefficient  $\pi_1$  ( $\pi_2 = 0$ ). A value of  $\pi_4 = 4$  and  $\omega \approx 120$  Hz was used for these calculations.

unique solutions for the 5<sup>th</sup> order spatial derivatives that appear after substitution of Eq. (2) into (6). The integral in (3) was computed using a trapezoidal rule. The equations were advanced in time using an adaptive 4<sup>th</sup> order accurate Runge-Kutta-Merson (RKM) time stepping algorithm [13]. There were  $n = 50$  interior grid points. The precision was set to  $1 \times 10^{-8}$  for all of the data presented here. The algorithm was written and implemented using an in-house code written in Fortran programming language.

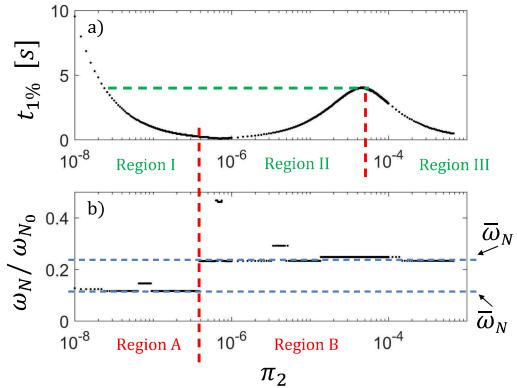


FIG. 3: Plot of a)  $t_{1\%}$  and, b) natural frequency  $\omega_N$  normalized by natural frequency for  $\pi_4 = 0$  i.e.  $\omega_{N_0}$ , with both plotted versus dimensionless viscous damping coefficient  $\pi_2$  ( $\pi_1 = 0$ ). A value of  $\pi_4 = 4$  and  $\omega \approx 120$  Hz was used for these calculations.

Solutions to the set of equations can be used to estimate the unknown damping coefficients  $\mu_1$  or  $\mu_2$  for a cantilever undergoing free-vibration [14]. We are assuming that the damping coefficient is independent of

any external forcing and does not vary with time. To estimate the coefficients we keep in mind that any displacement of the beam from its initial position should result in an underdamped system. In Fig. 1, with  $\pi_4 = 4$  and  $\pi_2 = 0.0001$  we show a solution to the governing equations for the problem of free-vibration that resulted in an underdamped system. Notice that for 2 different initial conditions,  $u(L, 0) = 0.15$  and  $0.015$  m, and with all other parameters being equal (including dimensionless frequency  $\omega = 120$  Hz), that the two underdamped systems reach 1% of their initial displacement at the same time, denoted  $t_{1\%}$ . The value 1% is not unique, and any fraction below 40% appears to follow the same trend; though, there was noticeable difference in the normalized natural frequency that is measured as we computed the 1% times. Here, in Figs. 2(a)-3(a) we show the computed normalized  $t_{1\%}$  for  $0.02 < \pi_1 < 0.5$  with  $\pi_2 = 0$  and  $1 \times 10^{-8} < \pi_2 < 7 \times 10^{-4}$  with  $\pi_1 = 0$ , respectively. In Fig. 2(a) the data asymptotes to zero as the dimensionless damping coefficient is increased, but in Fig. 3(a) the initial  $t_{1\%}$  values asymptote to zero then increase to a local maximum before another asymptote to zero, forming 3 regions I, II and III. This computational result suggests for systems where internal damping is present at least 3 values of  $\pi_2$  can exist if  $t_{1\%}$  is less than the value of the local maximum (horizontal dashed line). In

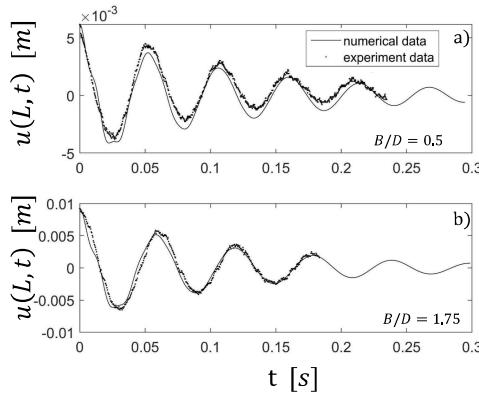


FIG. 4: Plots of free-vibration tip displacement of a PZT cantilever and tip-mass system. The experiment parameters were a)  $B/D = 0.5$ ,  $\pi_4 = 3.0$ , and b)  $B/D = 1.75$ ,  $\pi_4 = 2.45$  with measured natural frequencies  $\omega_N$  = a) 20.2 and b) 18.8 Hz. Also shown in each plot are results from computation using the same parameters with  $\pi_1 = 0$ ,  $\pi_2 =$  a)  $8.33 \times 10^{-8}$  and b)  $1.1 \times 10^{-7}$ .

Figs. 2(b)-3(b) we show the corresponding normalized natural frequencies for the same range of dimensionless damping coefficients as in 2(a)-3(a). In Fig. 2(b) there is a narrow range of values that span the data with the average  $\bar{\omega}_N \approx 0.12$ . In Fig. 3(b) there are 2 average values: the first is computed for  $\pi_2$  values less than the first asymptotes minimum (Region A), and the second for the values greater than this first asymptote where the nor-

malized frequency shifts to a higher value (Region B). Now we can estimate the damping coefficient by comparing the transient maximum displacement of the cantilever  $u^*(1, t^*)$  between numerical and experimental data for a given value of dimensionless  $\mu_1$  and/or  $\mu_2$ , along with similar dimensionless tip-mass  $\pi_4$ , and dimensionless E-M terms  $\pi_3$  and  $\pi_5$ .

Piezoelectric cantilevers (TE Connectivity) with dimension of  $41 \times 17 \times 0.2$  mm<sup>3</sup> (i.e.  $w = 17$  mm,  $t = 0.2$  mm), resistance  $R_f = 1 \times 10^{-7}$  Ohms, capacitance  $C_f = 1.38 \times 10^{-9}$  F and  $\alpha = 1.7 \times 10^{-8}$  N/V (Newtons per Volt) were used for experiments. The other properties, for the composite structure, we estimated as  $E = 3 \times 10^{-9}$  (an average value) and  $\rho = 1800$  kg/m<sup>3</sup>. The experimental setup consisted of two acrylic bridges made of 60 mm high and 12 mm thick vertical posts supported by a 19.0 mm thick base, erected inside an open circuit wind tunnel. The distance between the two bridges was 115 mm. Two piezoelectric strips were mounted individually on an acrylic cube ( $13 \times 13 \times 13$  mm<sup>3</sup>), and the cube was bolted to the vertical posts. Thus, the piezoelectric cantilevers possess 1-DOF and vibrate along their transverse direction. The approximate cantilever length measured from acrylic cube to mass-free tip that was free to vibrate was  $L = 25$  mm, although this length may need to be adjusted when computing natural frequency since the attached tip-mass can reduce this value. With this length the corresponding electrical dimensionless parameter are  $\pi_3 \approx 0.31$  with  $\omega \approx 120$  Hz and  $\pi_5 \approx 1.5 \times 10^{-4}$ . A decrease in the vibration length  $L$  results in an increased  $\omega$  and smaller  $\pi_3$  and slightly larger  $\pi_5$ .

We used tip masses in the form of rectangular prisms made of dense tear-resistant foam sheet (McMaster-Carr) loaded onto the piezoelectric films. Two thicknesses, 12.7 mm and 19.0 mm, were used for the models. To attach the prisms onto the PZT cantilevers, slits 16 mm wide with negligible thickness were laser cut (Epilog) on the test pieces. However, for a select few, a razor blade was used to make slits on the rectangle's short face because the short face was prone to laser burns. A total of 11 test pieces with B-by-D (B/D) ratios ranging from 0.5 to 3.0 were made and were loaded onto the piezoelectric cantilevers, resulting in dimensionless mass ratios  $2 < \pi_4 < 5$ . In a separate set of experiments, an oscilloscope (Model DSO1024A, Keysight Technologies) was used to record the piezo films' voltage-time data. The oscilloscope possesses a maximum bandwidth of 200 MHz and a sampling size of 2 GSa/s.

The natural frequency was found experimentally for all the B/D ratios by exciting the tip-mass cantilever systems with small displacements. Vibrations of the cantilever tip were captured by a fast camera (Hotshot) at roughly 2000 frames per second, fit with a macro lens (Computar), and in a  $500 \times 500$  pixels window (pixel window and frames per second were subject to change for specific experiments as needed). A fluorescent lamp in line with the camera was placed behind the setup. The experiments were carried out in air at standard am-

bient temperature and pressure. An in-house MATLAB code extracted frame by frame displacement versus time data. Figure 4 shows a plot comparing the experimental

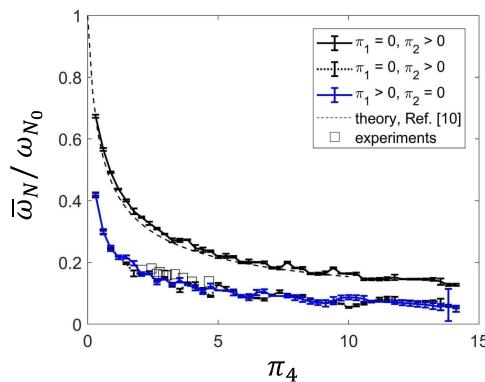


FIG. 5: Plot of normalized averaged natural frequency  $\bar{\omega}_N / \omega_{N_0}$  versus dimensionless tip-mass  $\pi_4$ . Data is shown for  $\pi_1 = 0$  and  $\pi_2 > 0$  averaged at high and low values;  $\pi_1 > 0$  with  $\pi_2 = 0$ ; theoretical results for no damping and no rotatory motion of the tip-mass [10]; and measured values from experiments.

and numerical free-end underdamped vibrations of the flexible PZT cantilever tip-mass system versus elapsed time. Similar plots were utilized to estimate the appropriate damping coefficient of a particular system. First, the length  $L$  was slightly adjusted until the computed and experimentally measured natural frequency values matched, which resulted in peaks and troughs that were in near-perfect alignment. This required adjustment is not surprising for data where  $B/D > 1$  since the reduced length from attaching the tip-mass should affect the natural frequency (See Supplemental Material for more information). A plot of the computed normalized averaged natural frequency  $\bar{\omega}_N / \omega_{N_0}$  versus dimensionless tip-mass  $\pi_4$  appears in Fig. 5. Data is shown for  $\pi_1 = 0$  and  $\pi_2 > 0$  averaged at high and low values (See Fig. 3),  $\pi_1 > 0$  with  $\pi_2 = 0$ , theoretical results for no damp-

ing and no rotatory tip-mass [10], and measured values from experiments. The experiments all fall along the line corresponding to results for viscous and low frequency Kelvin-Voigt damping.

A comparison between maximum voltage  $\max|\phi|$  versus initial cantilever displacement appears in Fig. 6. Data is shown comparing values for maximum voltage measured with the oscilloscope and computed. The vertical line corresponds to approximate maximum displacement where computation with Euler-Bernoulli equation is not valid. Although the data is not exact the trends appear similar between the two data sets. This seems to confirm that there is good agreement between the computation and experiments for the range of parameters where the experiments should overlap with the computation. Overall, the results provide a means to estimate damping co-

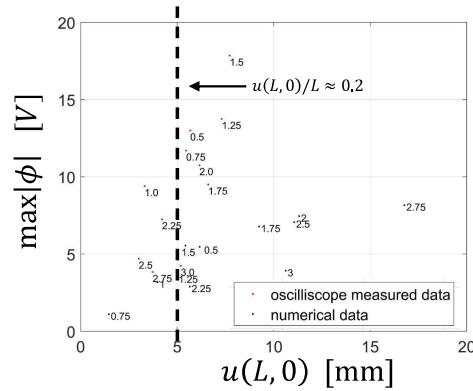


FIG. 6: Plot of maximum voltage  $\max|\phi|$  versus initial cantilever displacement. Data is shown for both measured values (oscilloscope) and computed (solutions to governing equations). Note: initial conditions used for computation were randomly selected. Vertical line corresponds to approximate maximum displacement where computation with Euler-Bernoulli equation is not valid.

efficients that are present in these type of systems.

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## Strategies for writing a research paper

### Estratégias para escrever um artigo de investigação

#### 1. Introduction

Writing and publishing good research papers is essential for many reasons: not only advancing researchers' academic careers but above all for disseminating research findings and advancing the state of empirical knowledge. In addition, publications are a measure of the academic productivity needed for promotion. Another reason is that most researchers become experts in a given research area, and they are recognised as such by their peers when they contribute actively to the literature, helping to advance the state of empirical knowledge (El-Serag, 2006).

Research is not complete until results have been published, especially in the case of publicly funded research (Audisio et al., 2009; Davidson & Delbridge, 2011). Conversely, a track record of prior publications is essential for any competitive grant application (El-Serag, 2006).

Publishing the best possible research papers is also the main goal of journal editors, who value papers of interest to their readership that show originality, importance, clear research questions, correct methods and excellent style (Johnson, 2008). When evaluating your research, editors consider whether your paper, if published in their journal, is likely to be heavily cited, thus enhancing the standing and reputation of their journal (Davidson & Delbridge, 2011). Editors and reviewers spend hours reading manuscripts and greatly appreciate receiving papers that are easy to read and edit. They dislike long, wordy papers in a poor style with conclusions not justified by data, showing an inability to follow the 'authors' guidelines' and containing careless, sloppy mistakes (Johnson, 2008).

In point of fact, most submitted papers need substantial improvements before they can be published, and, unfortunately, many of them get rejected because they do not fulfil basic conditions for publication. Therefore, this paper seeks to provide some basic strategies for writing research papers and help especially novel researchers to improve papers before submitting them to journals. Sharing thoughts and experiences is the very essence of academic activities, and this can be quite rewarding if it substantially contributes to improving researchers' chances of publishing results.

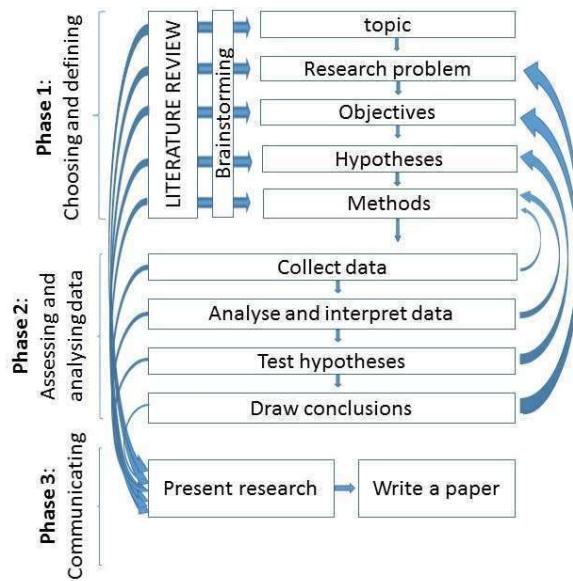
#### 2. The research process

A paper is the outcome of three different processes: research, writing and publication. Although this paper focuses on the writing process, it is important to understand the processes that you need to follow before and after writing. A good paper is the outcome of well-conducted research, careful writing and successful publication processes.

The research process is, in most cases, the implementation of a previously designed research plan. As shown in Figure

1, the research process is divided into three phases, each one comprising several steps. Phase one, choosing and defining, is theoretical or conceptual and based on a literature review. In this phase, you choose and define the fundamentals of your research: topic, research problem, objectives, hypotheses and methods. Much search, brainstorming and adaptation may be necessary during this phase. Regardless, you should not go on to the next phase – for instance, collecting data – before making the right decisions regarding research problem, objectives, hypotheses and methods.

**Figure 1 - The research process**



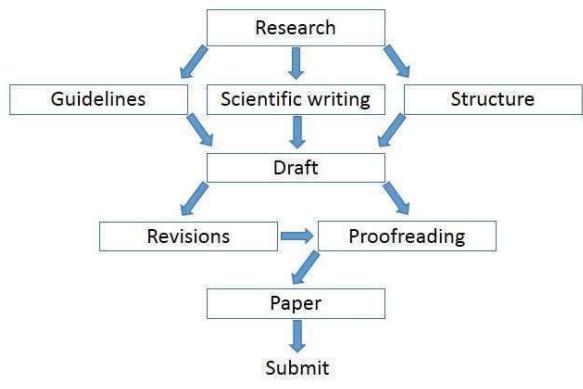
**Source:** Own elaboration.

Phase two, assessing and analysing data, is empirical, as well as analytical, and it deals with data collection, processing, analysis and interpretation. Hypotheses are tested, and conclusions are drawn in order to address the research problem and objectives of the study.

Phase three deals with 'communicating' your research. This is the time to communicate your findings to the research community. There are several ways of doing this, including writing a report, making a presentation in a conference or writing a paper.

#### 3. The writing process

Ideally, you should start the writing process as a logical consequence of the research process. As a matter of course, during the research process, you produce drafts of your research methodology and findings that you now need to transform into a paper. The following sections provide some strategies that may help you to convert your research into a well-written and appropriately structured paper. Figure 2 shows a chart of this process.

**Figure 2 - The writing process**

Source: Own elaboration.

### 3.1 Follow the journal's guidelines

It is strongly advised that, before you start writing your paper, you decide which is your target journal (Rosenfeldt, Dowling, Pepe & Fullerton, 2000; Johnson, 2011; Saper, 2014). Then read carefully the 'journal guidelines' or 'authors' guidelines' provided by that journal (Chiswick, 2004; Johnson, 2008; Davidson & Delbridge, 2011). The reason for this is that you need to adapt your paper to the journal guidelines from the very beginning because these deal with content and form, therefore affecting the entire paper and making it a difficult task to adapt to the journal's norms after the paper is written. By following guidelines appropriate to your type of study, you are likely to improve your paper and thus increase your chances of being published (Davidson & Delbridge, 2011). On the contrary, submitting papers without following journal guidelines dramatically increases the possibility of rejection.

Besides following the guidelines closely, reading some papers in your target journal also gives you an idea of the structure, norms and general organisation of papers approved for that journal. Another advantage is to identify the research interests of editors and the research areas of recently approved papers (Saper, 2014).

In the case of the *Tourism & Management Studies* journal the guidelines provide information about length of papers (6,000 words), abstracts (150 words) and keywords (5 words), as well as structure (introduction, methodology, results, discussion, conclusions and references), citation style and organisation of the list of references (APA style).

### 3.2 Use an adequate paper structure

An appropriate paper structure is a fundamental tool for developing and presenting research, and it makes it easier for readers to understand the content of papers. This can vary in small ways depending on the research field and journal guidelines, but it is commonly accepted that research papers should have a title, abstract and keywords and be divided into sections, including introduction, methods, results and discussion, conclusions and references (Rosenfeldt et al., 2000; Chiswick, 2004; Børresen, 2013). *Tourism & Management Studies'* editors prefer to include results and discussion in the same section. There must be a logical and understandable link between sections (Chiswick, 2004; Andonie & Dzitac, 2010) in such a way that all

sections – as indispensable parts of the whole – communicate with each other and contribute to the unity and internal consistency of the paper. A logical flow must exist not only from section to section but also from paragraph to paragraph and from sentence to sentence (Andonie & Dzitac, 2010). Each element of a paper's structure is analysed and discussed below.

#### 3.2.1 Title

According to El-Serag (2006), 'The title should be informative and specific to the study, and should contain key elements that advertise the paper's contents. The use of subtitles allows the insertion of additional information' (p. 20). Choosing a good title and subtitle is fundamental for a paper's success, as they are the first elements to catch the attention of editors and readers, and they tell them what the paper is all about. This first contact with the topic of the paper determines if the paper falls within the scope of the journal or the readers' interests, and it is decisive in their immediate decision to dedicate some time to exploring or reading it. Through the title and subtitle, it is also possible to deduce what type of paper it is and whether its topic is attractive to a broad audience, for instance, if it is a theoretical paper, an empirical or theoretical and empirical paper or a case study. Purely theoretical papers have a higher rejection rate, unless the authors truly innovate and firmly ground their theories. Quite often, case studies have an extremely high rejection rate because they have validity only within restricted contexts, and they are not attractive enough to reach a broad, international audience.

Titles (and subtitles) should address the content of the paper and be short, simple, easy to understand and attractive to the paper's audience. It is important that titles contain some strong keywords dealing with the content of the papers, to ensure that the titles are detected by fellow researchers searching literature databases (Davidson & Delbridge, 2011).

#### 3.2.2 Affiliation

Next follows the affiliation of all authors. Journals have different requirements regarding the affiliation, but authors' names, universities and faculties or schools, countries and e-mails are common. Some journals also demand degrees and telephone and fax numbers of authors. In the case of the *Tourism & Management Studies* journal, the information regarding affiliation should be as follows for each author: name, university, faculty or school, department/research centre, postal code, city, country and e-mail address. In the case of the corresponding author, the complete mail address must be added.

The inclusion of this information is extremely important for the indexation process of the SciELO Citation Index/Web of Science, including the attribution of empirical production to the correct institutions, research centres and countries of publication. For publication purposes, authors need to use always exactly the same name without any variations from paper to paper, otherwise the indexing machines will treat these as different names (even with the slightest variation) belonging to different authors. The same applies to the names of institutions.



Authors should submit two versions of their paper: a DV version (director version) with the full affiliation of authors and an RV version (review version) without the affiliation or any other information regarding the authors. Make sure that direct identifiers are removed from the data (Davidson & Delbridge, 2011) and properties of the Word document. This is important for the implementation of blind refereeing, which obviously means the authors must be kept anonymous.

Concerning research, teamwork is preferable to individual work, and journals usually prefer papers with multiple authors, especially teams involving different nationalities.

### 3.2.3 Abstract

The function of the abstract is to give a quick overview of the contents of the paper. The abstract is the only part of the manuscript read by the vast majority of readers (El-Serag, 2006; Audisio et al., 2009; Shidham, Path, Pitman & DeMay, 2012), and, through it, the reader decides if it is worth reading the entire paper. According to Andonie and Dzitac (2010), an abstract should be concise and include motivation, problem statement, approach, results and conclusions. In the *Tourism & Management Studies* editors' view, objectives also need to be stated clearly, and all key information must be included. For Johnson (2008), an abstract should be structured per the specific journal's format within the word limit, without acronyms and abbreviations. The word limit for abstracts varies from journal to journal, usually from 150 to 250 words, so it is important to adapt the abstract to the target journal's guidelines for structure and length.

Together with the title and keywords, the abstract should be written last to make sure that it includes the most important aspects of the study. These three parts of the paper are strongly interconnected, and they reflect the ability of the researchers to concentrate the key aspects of their study into a limited number of words.

### 3.2.4 Keywords

Keywords are usually limited to five basic pieces of information containing one or more words, and they need to be carefully chosen in order to include the very essence of the paper. Keywords are fundamental elements for the dissemination of your research, as strong keywords enhance the likelihood that your paper will be retrieved by a search engine out of the huge number of published papers, when someone searches for a specific topic using a keyword (Audisio et al., 2009).

### 3.2.5 Introduction

Some authors write the introduction at an early stage as a guideline to the further development of the paper. In this case, they need to review this section and make all necessary changes when the rest of the paper is ready. Others prefer to write the introduction in the final stages of the paper. Davidson and Delbridge (2011) succinctly explain some of the most important aspects of this section:

The purpose of the introduction is to explain to the reader what the research question is, how it is original, how it is

important and succinctly outline how the study intends to answer it. It is critical that the paper starts with a brief introduction to the topic, which clearly describes how and why the research question has arisen. Provide adequate background information using relevant literature to acquaint readers with the topic but do not include a detailed literature review. Explicitly state the importance of your research as the reader may not necessarily make the leap in logic that is obvious to you. The introduction should end with the aims being clearly stated. If the study is addressing a hypothesis, then the hypothesis should be stated here too (pp. 62–63).

This quotation contains all the basic elements of the introduction, of which the most important are contextualisation, originality, research question, importance of research, objectives and hypotheses. The originality, or 'How does your research add to the literature?' (Audisio et al., 2009), is fundamental, as in most cases it determines if your paper is worth sending on to be reviewed or not. It can be seen as the added value that your paper brings to the stock of knowledge in a given research field. The research question – which, in the opinion of Davidson and Delbridge (2011), constitutes the core of the paper – needs to be formulated in the introduction and must be robust and well defined (Davidson & Delbridge, 2011).

As the introduction is critical to attracting the readers' attention, it should consist of short sentences (Shidham et al., 2012) and be brief, coherent, logical and stimulating – but not confusing to the reader – as well as creating a receptive mood (Chiswick, 2004). Concerning length, a typical introduction does not exceed one or two pages.

### 3.2.6 Literature review

Reviewing what others have written on your topic is a fundamental step in any research, and it serves a number of purposes:

- Identifying what has already been done and has contributed significantly to your topic;
- Identifying what still needs to be done in order to justify the originality and importance of your research;
- Establishing links between your research and the most relevant research on the topic (i.e. by comparing your study to previous research, you can point out similarities and contradictions);
- Defining relevant concepts for your study;
- Identifying relevant theories, research designs, approaches and methods used in the study of similar research problems that can be appropriate for your study.

The literature review needs to be the first step of your research because, without it, you cannot prove the originality and appropriateness of your study. However, one thing is reviewing the literature for an academic dissertation and another is presenting a literature review in a paper. In the latter case, it must be brief and contain only the most relevant references, especially the most updated ones – to satisfy some or all purposes mentioned above.

Sometimes a paper is based on a research project (for instance a dissertation) finished some years ago, and it does not use references from the last three or four years. Of course, depending on the research area, references thus are outdated, which is a possible reason for rejection. To avoid this situation, you must update your references before submitting your paper.

### 3.2.7 Methods

This is the most important section of any research paper because it determines the empirical validity of the study. Methodologies need to explain how results were obtained, and they should allow a researcher in that field to repeat the study (Saper, 2014).

Editors or reviewers reject papers when they consider that the research methods used are not appropriate or not strong enough. For the *Tourism & Management Studies* journal, methodologies are given first-class status, and any paper is rejected that does not use proper methods (at least in the reviewers' and editors' opinion) in answering the research question and accomplishing its objectives. While there may be an opportunity to re-analyse the results, perhaps using more appropriate statistical tests, the methods cannot be changed without re-doing the research: what is done is done (Chiswick, 2004). You need to write about the methods in the past tense with adequate detail to repeat the study design and validate results (Johnson, 2008). Provide details of the selection and description of study participants, data collection processes and methods used in analyses. When in doubt, provide more (rather than fewer) details (El-Serag, 2006).

Any research problem to be solved needs appropriate methods, depending on the topic and research field. In some cases, qualitative research methods may be adequate, while in other cases, quantitative methods are required. Another possibility is to use a combination of methods.

Qualitative research methods are traditionally used in social sciences, and they use smaller samples aimed at achieving an in-depth understanding of human behaviour. The most common is interviews, which can be structured, semi-structured or unstructured. These data samples do not allow extrapolation to entire populations, but they can be important in formulating hypotheses that can be tested in another step using quantitative data. In fact, qualitative and quantitative methods are quite compatible, and they can be used in mixed-method approaches. Triangulation is the use of a combination of two or more research methods in the study of the same phenomenon in order to validate data through cross verification and to enhance confidence in results. In most cases, this is the preferred methodology in social sciences.

When using quantitative methods, you need to explain the size of the sample of the statistical population under study and the procedures for selecting this sample. Specify if the sample is statistically representative, allowing inferences from the sample to the general population. You should use appropriate methods to calculate ideal sample sizes. When you cannot work with a random sample, you need to work with a sample that is as representative as possible: the more

representative, the better. One strong reason for rejecting a paper is if editors or reviewers consider that the sample used is not ideal. In this case, the validity of the study is restricted to the group of individuals who constitute the sample.

A pilot test is quite important for evaluating feasibility and making all necessary corrections or improvements to surveys, before you carry out any large-scale quantitative research. At least one of the authors needs to have an in-depth knowledge of research methods and statistics. When applicable, it is important to enlist the help of a statistician at the outset to determine sample size, power analysis and appropriate statistical methods (Johnson, 2008).

### 3.2.8 Discussion of results (or findings)

The results section is a critical part of the manuscript (Shidham et al., 2012). The presentation of results is the outcome of the application of methods to primary or secondary research resources. Some basic rules can help you to present your results in the best possible way:

- Interpret results and their implications, instead of simply presenting them in a descriptive way;
- Use primary data, which is more relevant than secondary data;
- Use a combination of text and visual aids such as graphs, tables or figures – these need to be well designed in order to make sure the reader understands the results more easily. Presenting the data in graphs has the advantage of clarity and impact, and it can bring out relationships between various parameters (Rosenfeldt et al., 2000);
- Keep graphs (or other visual aids) simple (Rosenfeldt et al., 2000);
- Do not repeat information presented in tables and figures in the text (El-Serag, 2006); instead, analyse data in qualitative terms without being repetitive (Davidson & Delbridge, 2011);
- Check that tables, graphs and figures are correctly labelled with numbers and titles and that they are cited in the previous paragraph; make sure that you indicate the source of your data;
- Write results in the past tense, in a logical sequence (Johnson, 2008);
- Match the arrangement of data to the methodology and communicate as much information as is relevant (Shidham et al., 2012);
- Do not omit unexpected results or results that do not satisfy your hypotheses; report them and discuss your analysis (Davidson & Delbridge, 2011);
- Avoid abbreviations if possible, but define them if used (Shidham et al., 2012);
- When using quantitative methods, first present results of descriptive analyses, followed by results of inferential analyses (Fortin, 1999).



### 3.2.9 Conclusions

The conclusions section is the most important part of your paper and the one that readers remember best. You have the chance to say the last word on your subject and leave a good final impression of your research.

Here are important rules to follow in the conclusions section:

- Link your conclusions with the introduction – conclusions must have a direct relationship to the objectives stated in the beginning of the paper and answer the research question(s) and objectives, as well as confirm or refute hypotheses;
- Compare your conclusions to previous research and point out implications and contributions of your paper to advancing knowledge in your field of research;
- Avoid any repetition of results presented in the previous section and any ambiguity or speculation;
- Make your conclusions solid, synthetic, brief, clear and convincing;
- Explain study limitations and make recommendations for future research.

### 3.2.10 References

You need to structure the list of references according to your target journal's guidelines. This is one of the sections that require the most attention and control by editors and the one that usually presents the highest number of inaccuracies. Authors and journals cannot publish papers with missing or incomplete references without compromising their reputation.

There are different styles for organising and presenting references. The most common in social sciences is probably the APA style. If you cannot afford to buy the Publication Manual of the American Psychological Association (the most accurate and complete document on the subject), it is advisable to check out materials on APA style guides that are available on the Internet. In organising your list of references, here are some important rules to follow:

- Follow journal guidelines;
- Include only references cited within the text;
- Double-check references for accuracy;
- Ensure that all information in the references list is complete and accurate (Davidson & Delbridge, 2011);

## 4. Style matters: Use adequate academic writing

Writing a paper using adequate academic writing involves many rules, and it is an extremely challenging task. To start with, you need to ensure you have relevant findings to communicate to readers. In fact, it is with the readers in mind that you have to find the best possible way of communicating your findings and arguments. Readers should be able to read and understand your paper without much effort (Gerstein, 2013). The following guidelines from

different authors can help you to find the most adequate academic writing style for your paper:

- Use sentences that are short, clear and direct; use formal and carefully structured wording and make sure the subject of each sentence appears early in the sentence (Fahy, 2008);
- Do not insert large chunks of information between subjects and verbs (Chiswick, 2004);
- Make your ideas clear and your arguments easy to follow (Fahy, 2008);
- Ensure that the information you wish to emphasise comes at the end of each sentence or clause (Chiswick, 2004);
- Avoid repetition, wordiness, long sentences and excessive adverbs and adjectives (Johnson, 2008);
- Select, in general, for 'active' rather than 'passive voice' in verbs (Fahy, 2008) since the active voice is more concise and crisp (Johnson, 2008);
- Utilise the spell-check function in your word processing programme (Davidson & Delbridge, 2011);
- Write to enhance the elements of careful word choice: clarity, simplicity and accuracy – clarity means choosing the simplest and most accurate word to express each idea; accuracy means choosing the precise word to express what you mean; clarity is improved if, once having chosen a precise word, you use the same word consistently throughout and do not substitute inexact synonyms (Fahy, 2008);
- Double-check grammar, style, spelling and references; shorten and cut down your paper at every chance, editing for crispness, with a focus on accuracy, clarity and brevity (Johnson, 2008);
- Ensure you use research terminology correctly; do not confuse or misuse terms (Davidson & Delbridge, 2011);
- Turn long paragraphs into short paragraphs, long sentences into short sentences and long words into short words (Davidson & Delbridge, 2011).

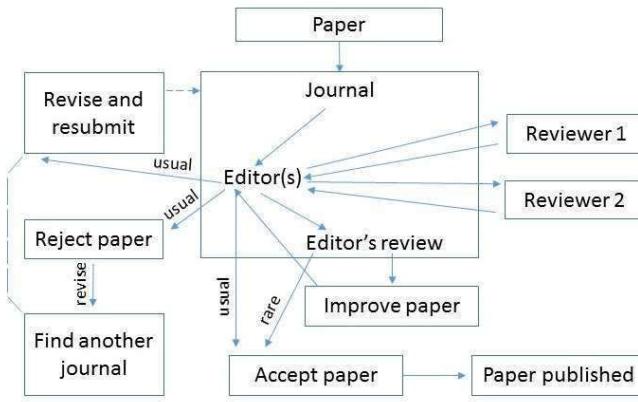
## 5. Revision and proofreading

When your paper is complete, revise it thoroughly and make all necessary changes. If multiple authors sign the work, all of them should revise the entire paper and not only their contributions. A complete paper needs to be subjected to multiple revisions before submission.

If English is the intended language of your paper and it is not your mother tongue, you will need translation or proofreading services provided by a native speaker with skills in academic writing (Børresen, 2013). In this situation, some journals demand a proofreading certificate.

## 6. The submission process

Having a good research paper that complies with your target journal's guidelines is only the first step of the submission process, as shown in Figure 3.

**Figure 3 - The submission process**

Most journals require a confirmation that your paper is original and that it has not been submitted to other journals at the same time. As mentioned earlier, in order to implement the double-blind review process, journals need an RV version without identification of the authors. After submission, the editors make a first evaluation of if the paper fits in the scope of the journal and complies with journal rules. If this is not the case or if the editors find any other obvious reason to refuse publication, the paper is immediately rejected. Otherwise, the editors send the RV version to two reviewers who are experts in the paper's topic. If the paper has a strong statistical component, at least one of the reviewers must be an expert in the methods used. Each reviewer evaluates the paper according to different parameters and sends a report back to the editors. To give an example from the *Tourism & Management Studies* journal, the parameters evaluated by the reviewers on a scale from 1 (very weak) to 5 (excellent) include importance of the topic and innovativeness of the research, objectives, literature review, methods, results, structure, academic writing and contributions to the field. If the editors decide to reject the paper, it cannot be submitted later to the same journal. If the decision is 'revise and resubmit', you can revise the paper according to the suggestions of the reviewers and resubmit it to the same journal. Another option is for you to use the feedback of the reviewers to improve your paper and submit it to another journal. Any paper selected for publication needs to be reviewed by the editors after receiving the peer reviewers' evaluations. Acceptance without suggestions for improvements by the reviewers and editors is nearly impossible. The most usual process is that the editors send the reviewers' suggestions and their own suggestions for improving the paper to the authors. In this case, the authors need to revise the paper along the lines suggested by the editors and reviewers and send the paper back to the editors along with an improvements report. Normally, the editors accept the paper for publication if suggestions have been successfully implemented.

## 7. Concluding remarks

Preparing a research paper for publication requires methodical work that involves three processes, each one with exact rules and steps. Provided you have done solid research, it is quite important to adopt strategies that will

increase the likelihood that your paper gets accepted for publication. Our main purpose was to explain these strategies in order to help authors to write good research papers.

Many authors have addressed the topic of writing good papers. However, we believe this paper contributes to the literature by:

- Presenting strategies based on a combination of our experience as journal editors and the existing literature
- Integrating the writing process into a broader context together with the research and publication processes
- Developing our own models of these processes to represent the processes in charts

Writing a paper can be a wonderful and rewarding experience, especially when you see your first, or next, paper published.

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The editors

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Signed by: Yahriel Salinas-Reyes

Date: 11/22/2023