

# Nanoscience and Community Building

**SDNI-NNCI Annual Educational Symposium 2020**

**Daniella Duran**

**BS Psychobiology, UCLA      MA Education, Stanford**



# My Story



- First Generation College Student
- Public high school- 36 students per class
- 25 years of teaching experience at 5 public high schools = **4500** students!!
- Biology, Chemistry, Nanoscience Teacher



# My Story



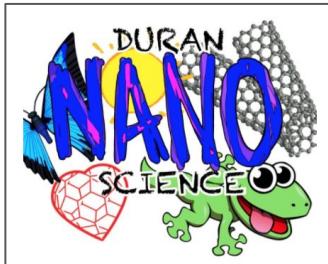
Teacher Facilitator at UCLA  
California Nanosystems Institute-  
Nanoscience Teacher Workshops



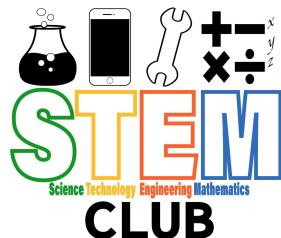
2 time RET at UCSB with NNIN and  
MRL

# My Mission-

Enhance STEM learning while promoting diversity and equity by community building, promoting learner agency, and modeling the research process

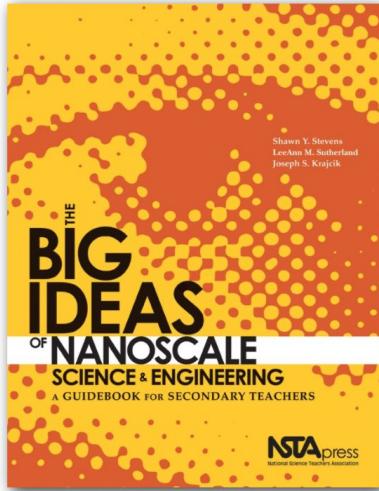


Honors Nanoscience Class- UC approved 5 point class!



Science Technology Engineering and Math  
(STEM) club advisor

# Honors Nanoscience at VHS



UCLA  
NNIN  
RET

Learning Novel Materials Solving Today's Problems

Welcome Letter

UNIT 1 : Nanoscience- Tools/ Design

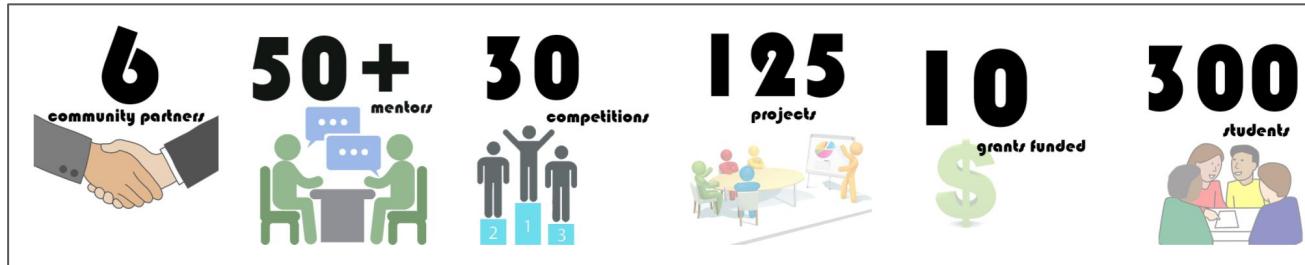
UNIT 2 : Size and Scale

UNIT 3 : Forces and Interactions

UNIT 4 : Self Assembly/ Nano-materials

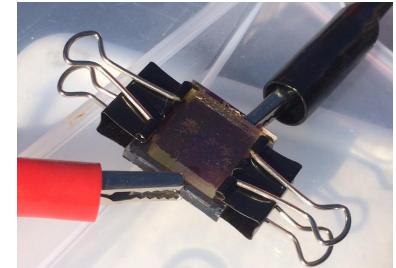
UNIT 5 : Design/Carbon Nano-materials

UNIT 6 : Science Technology Society



# Honors Nanoscience at VHS

## Guest Speakers, Field Trips, Failure and FUN!!



# Honors Nanoscience at VHS

## Competitions, Failure and FUN!!

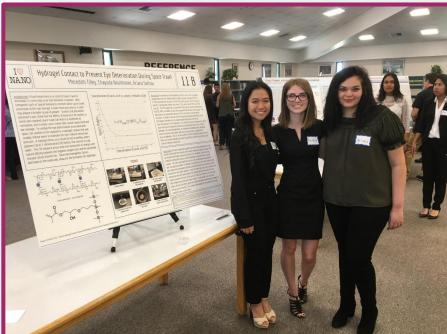


### Plasmon Butterfly Solar Glass PBSG



# Honors Nanoscience Presentations at VHS

## Mentoring, Public Display



**Sodium Alginate Hydrogels To Replace Single-use Plastic Packaging**

**Paige Brunson, Ryan Jones**  
Valencia High School Nanoscience Spring 2018

**Objective**

The disposal of non-biodegradable plastic is raising serious health and environmental concerns worldwide. Americans contribute to this in their food and use. Bisphenol A (BPA) is an epoxy resin used in the production of most consumer plastic goods and has been recognized by the EPA as a "known endocrine disruptor". The disposal of plastic creates many salient issues that can be resolved through a single-use hydrogel packaging alternative, which would not only benefit the environment by reducing waste through its biodegradability, but will also save people's lives through counteracting the toxic effects of plastic.

**Introduction**

Hydrogels are polymer networks extensively swollen with water. The tested samples consisted of a sodium alginate(SA) and calcium lactate(CL) hydrogel. Cross linking reactions are instrumental in the cross linking of polymer chains. Cross linking is a stabilization process which bonds polymer chains to other substances. This reaction is often used to bind materials together, trap water and restrict movement, therefore transforming the once liquid solutions into solid gels. This process occurs on the molecular level where the hydrogel network becomes more predominant. An edible hydrogel coating can be applied to foods through a multi-nozzle spray bottle. At room temperature the hydrogel solution is applied to the food item, which is then dried before spraying directly onto the desired food or pouring into a mold. The single hydrogel bottle can replace plastic bags, containers, and wraps. It can also be used as a coating alternative to plastic such as, bioplastics and reusable food wraps. However, some of these can be unsanitary or may not be compostable. Hydrogels are becoming more popular among food vendors in high-end grocery stores, where environmental friendliness is more valued.

**Young's Modulus of 9:1 Sodium Alginate Hydrogels Made With Varying Calcium Lactate Solution Concentrations**

A graph showing the relationship between Calcium Lactate Solution Concentration (%) and Young's Modulus (Pa). The data points show a positive correlation, with a trend line fit.

Concentration of Calcium Lactate Solution (%)	Young's Modulus (Pa)
0.5	~1000
1.0	~2000
1.5	~3000
2.0	~4000
2.5	~5000
3.0	~6000

**Results Statement**

There is a direct relationship between calcium lactate concentration and Young's Modulus values, with higher concentrations producing gels with higher values. An inverse relationship exists between the proportional volume of sodium alginate solution used and the amount of excess liquid, with more sodium alginate resulting in less excess liquid in the samples.

**Works Cited**

**Conclusion**

The tested hydrogel is known to biodegrade, effectively solving problems associated with plastic packaging waste. Optimal ratios were determined to reduce excess liquid and a more concentrated crosslinking solution was made in attempt to increase the hydrogel's Young's modulus. While attempting to increase the hydrogel's Young's modulus, it was determined that an evaporated hydrogel leaves behind a usable plastic-like film. This would change the product model to be in the form of pre-made sheets rather than requiring the consumer to heat and form the hydrogel themselves.

**Acknowledgements**

Thank you to our mentors, Adriana Brunson, Michelle Flores, and Maurita Denley for their guidance, as well as our partner group for their valuable research and support.

A detailed view of the research poster. It includes sections for Objective, Introduction, Results Statement, and Conclusion. It features several photographs of the experimental setup, including a hot plate, glassware, and a spray bottle. A graph shows the relationship between calcium lactate concentration and young's modulus. The poster is signed off by Paige Brunson and Ryan Jones from Valencia High School Nanoscience Spring 2018.

# STEM club- community outreach

Mission-----> Promote Science and Technology in Our Community.

- Open house
- Back to school night
- Elementary school visits
- Boys N Girls Club
- Public Library/ nonprofits

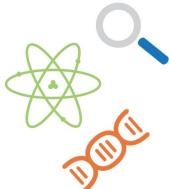


# Validation!

NAPE- National Alliance for Partnerships in Equity

NSF 2016 Report

## What are Some Effective Strategies to Broaden Participation in STEM?



- » **Culturally Responsive Pedagogical Practices:**  
The practice of infusing cultural knowledge and real-life experiences into teaching and learning practices;
- » **Family Support:**  
Engaging family members to encourage and support students to enter and stay in STEM educational experiences;
- » **Hands-on Learning:**  
Experiential learning in which students are encouraged to participate in STEM fields through a variety of activities;
- » **Summer Bridge Programs:**  
Academic programs that focus on including underrepresented groups for participation, with the aim to increase STEM education and workforce recruitment;



- » **Research Experiences:**  
Undergraduate students' immersion in meaningful research experiences, which often is associated with increased interest in STEM careers;



- » **Counterspaces/Safe Spaces:**  
Supportive environments that provide safe and inclusive experiences that promote belonging;



- » **Mentoring:**  
The process by which more experienced researchers guide, advise, and establish long-term relationships that benefit a mentee's educational and career development.



# Partners

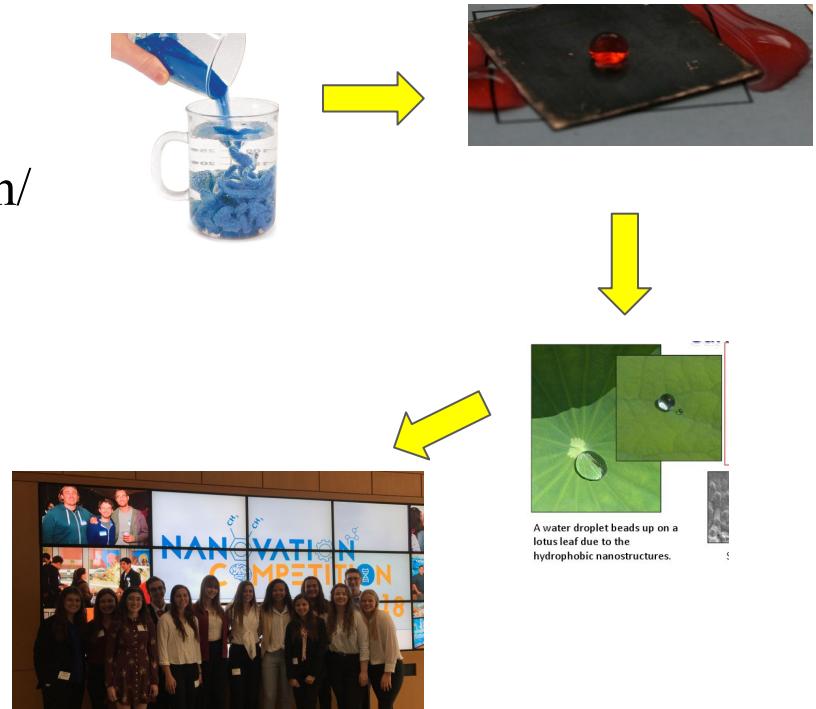


# So HOW did this happen? Building Partnerships

**Patience, No Fear, Tons of Pictures!!**

Start small (pun intended)-

- Add one Nano activity to your curriculum/club (magic sand and nitinol are mesmerizing!!)
- Invite teachers, admin, parents to see
- Self promotion :)



# So HOW did this happen? Building Partnerships

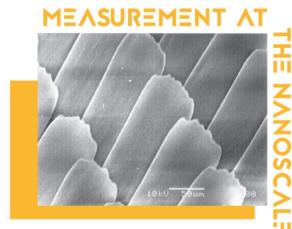
## Patience, No Fear, Pictures!!

- Examine your own community for resources- non profits, universities, community colleges, businesses, parents first
- Send emails, lots of them!
- Use social media
- Play the teacher card :)



# Teacher Resources

## UCLA CNSI



## Science News for Students

More Stories from *Science News for Students* on Chemistry

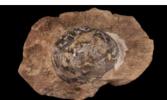


**ANIMALS**  
A single chemical may draw lonely locusts into a hungry swarm  
By Jonathan Lambert • September 7, 2020



**AGRICULTURE**  
**Scientists Say:** Carbohydrate

By Bethany Brookshire • August 24, 2020

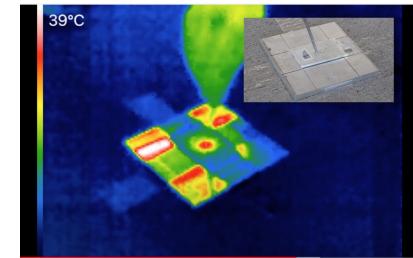


**FOSSILS**  
Early dinosaurs may have laid soft-shelled eggs  
By Jack J. Lee • August 3, 2020



**ENVIRONMENT**  
Australian wildfires pumped smoke to record heights  
By Maria Temming • July 27, 2020

## UCSB MRL



## My site

Duran's Science Site



Chemistry



Nano science



STEM Club

# Teacher Resources

## Society for Science and the Public

### High School Research Teachers Conference

Bringing research teachers of all experience levels together to share best practices, troubleshoot challenges, and learn more about the Society for Science & the Public and the Regeneron Science Talent Search.

## OmniNano

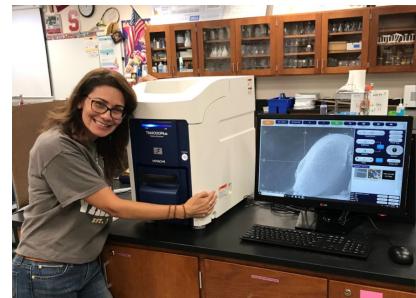


## NNCI

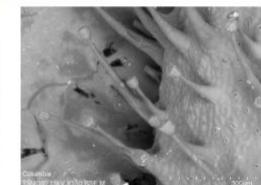


National Nanotechnology  
Coordinated Infrastructure

## Hitachi Remote SEM



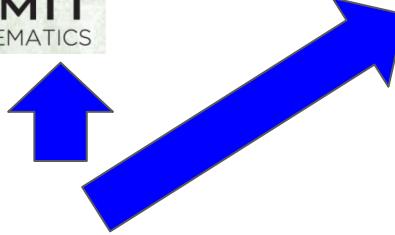
Flower Bud- x150

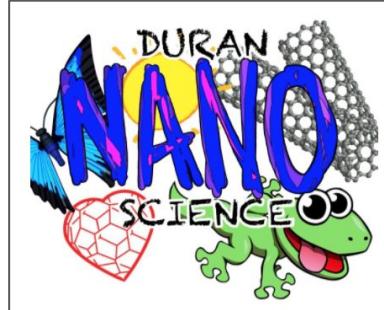


# Student Opportunities



Signup Now!!





# Nanoscience and Community Building

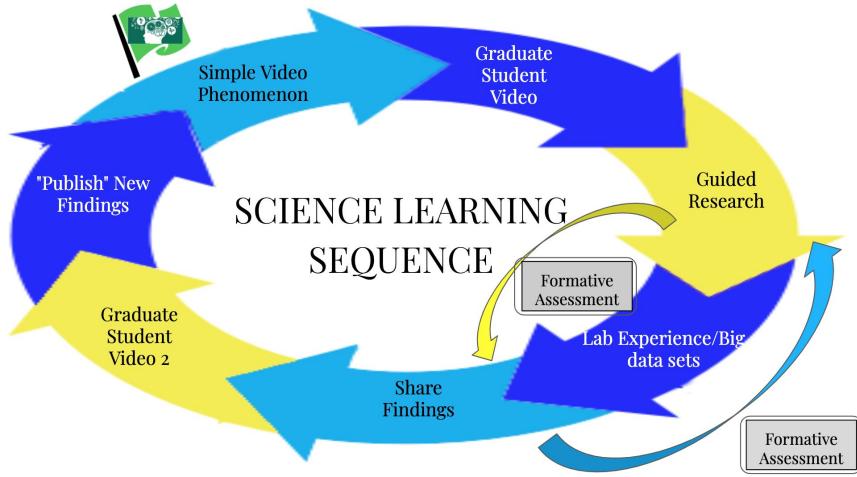
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# Current Projects



**UCSB RET**

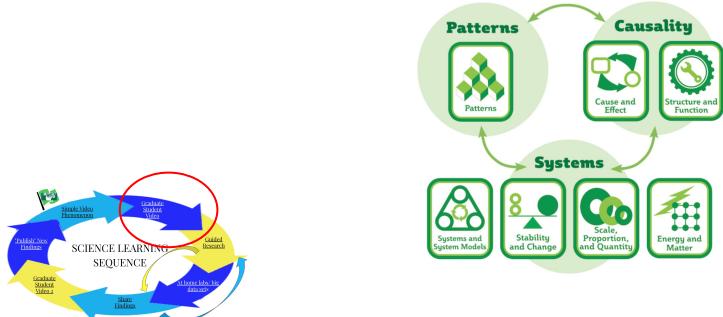


**Project Invent**

# Engage: Graduate Student/ Professional Video

Purpose is to

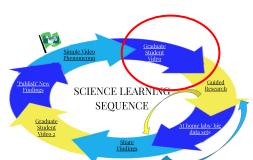
- Introduce library of diverse people working in STEM fields
- Graduate students relate their research to a Cross Cutting Concept ([CCC](#)) using a demonstration



# Added Value- Graduate Student/ Professional Video

There are many videos out there on youtube where graduate students/professionals talk about their research- how is this different?

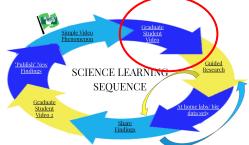
- Talk about their research in terms of a Cross Cutting Concept (CCC) that will be a key component of their learning cycle
- CCC can be used in any science classroom so very flexible for multiple subjects and grade levels.



# Added Value- Graduate Student/ Professional Video

There are many videos out there on youtube where graduate students/professionals talk about their research- how is this different?

- It's the little things...relating to student failure/obstacles, mentioning the activity students are working on in class, challenging students directly to continue learning!
- Enhance underrepresented STEM student interest, competencies, and retention rates by seeing “self” in the videos



# **Student Recruitment Slides**

# Honors nanoscience

Who knew tiny things could have such a big impact!



# ADVANTAGES

- **5 point class** for colleges
  - an AP without the test
  - no summer assignment

Video examples:

- [Microplastic water filter](#)
- [self repairing car bumper](#)
- hydrogel [contacts to speed healing](#)
- [mudslide prevention](#) material



- **YOU** choose what topic you want to investigate and demonstrate your learning in the Spring with the help of a **mentor!**

# ADVANTAGES

- Unique, invaluable experiences for college and scholarship essays
  - researching and designing a solution to a real problem of your choice
  - working with mentors from Lockheed, College of the Canyons, Hitachi, other local business, and UCLA
    - (participating in competitions optional)



# ADVANTAGES

- A great bridge between...
  - Business
  - Social good
  - Science
- Learn **cutting edge** solutions to today's problems using physics, chemistry, biology, and design!



- Opportunities to participate in activities at UCLA- such as [Project Echo](#) OR [California Nanosystems Institute](#)

# nanovation competition



- 4-5 per group
- Cutting-edge **nanotechnology design** business proposals
  - Help from a UCLA PhD student mentor
  - Instruction in market analysis, design theory, and product comparison
  - \$\$\$ too !!