RET Project:

Lyophilization of LAMP Reagents for COVID-19 Point-of-Care Saliva Test

Brianne Loya

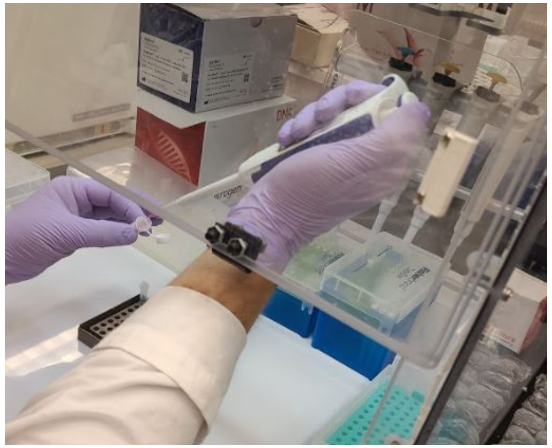
10th Grade Biology/Chemistry

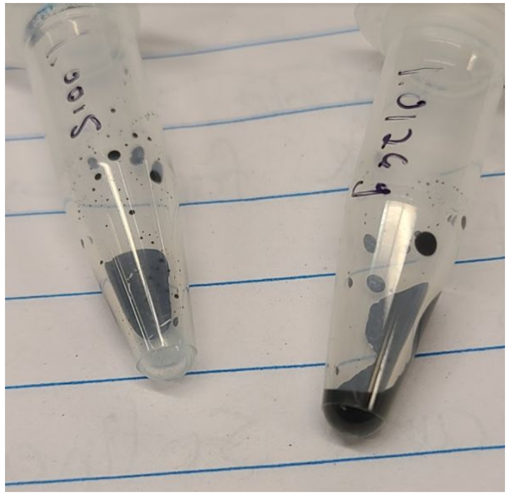
Bioscience High School

Mentors: Ryan Flores, Michael Hansen, Dr. Jennifer Blain Christen

NSF Award 1953745

https://sensip.engineering.asu.edu/ret/



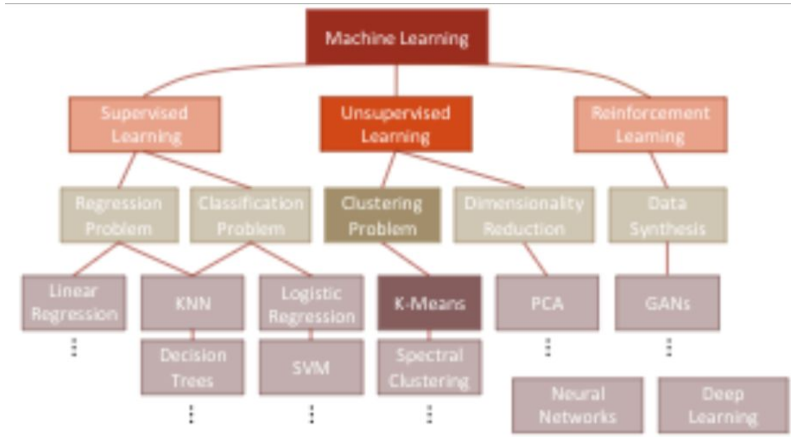


RET Research and Training

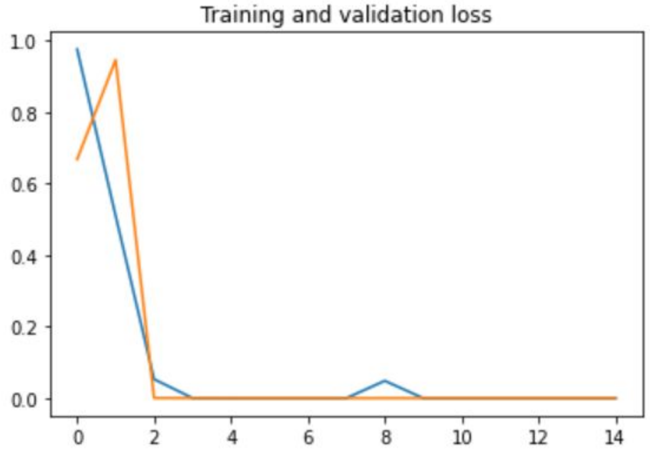
RET Schedule and Training

Hands On Technical Training

- Participated asynchronously in daily machine learning and embedded hardware lectures posted in Canvas
- Practiced ML using google colab



K. Jaskie Machine Learning Lecture



RET Schedule and Training

Technical Exposition

- Watched video lectures on various topics including the following:
  - Signal processes and ML
  - Clinical Applications of ML
  - Social Implications of ML

- Gained broad understanding of how ML is used in our everyday lives.

```
def show_images(images, image_dir):
  # visualize random 2x4 subset of images
  nrows = 2
  ncols = 4

  # Set up matplotlib fig, and size it to fit
  fig = plt.gcf()
  fig.set_size_inches(ncols * 3, nrows * 1.5)

  # choose random images to display
  for i in range(nrows * ncols):
    pic_index = random.randint(0, len(images)-1)
    sp = plt.subplot(nrows, ncols, i + 1)
    sp.axis('Off')

    img = mpimg.imread(os.path.join(image_dir, images[pic_index]))
    plt.imshow(img)

  plt.show()

show_images(image_names_no, image_dir + '/No')
show_images(image_names_yes, image_dir + '/Yes')
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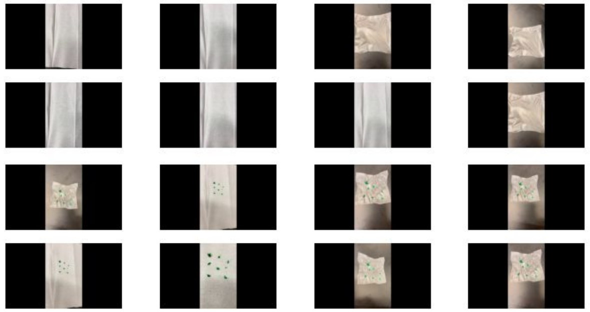


RET Lab Experience Research Summary

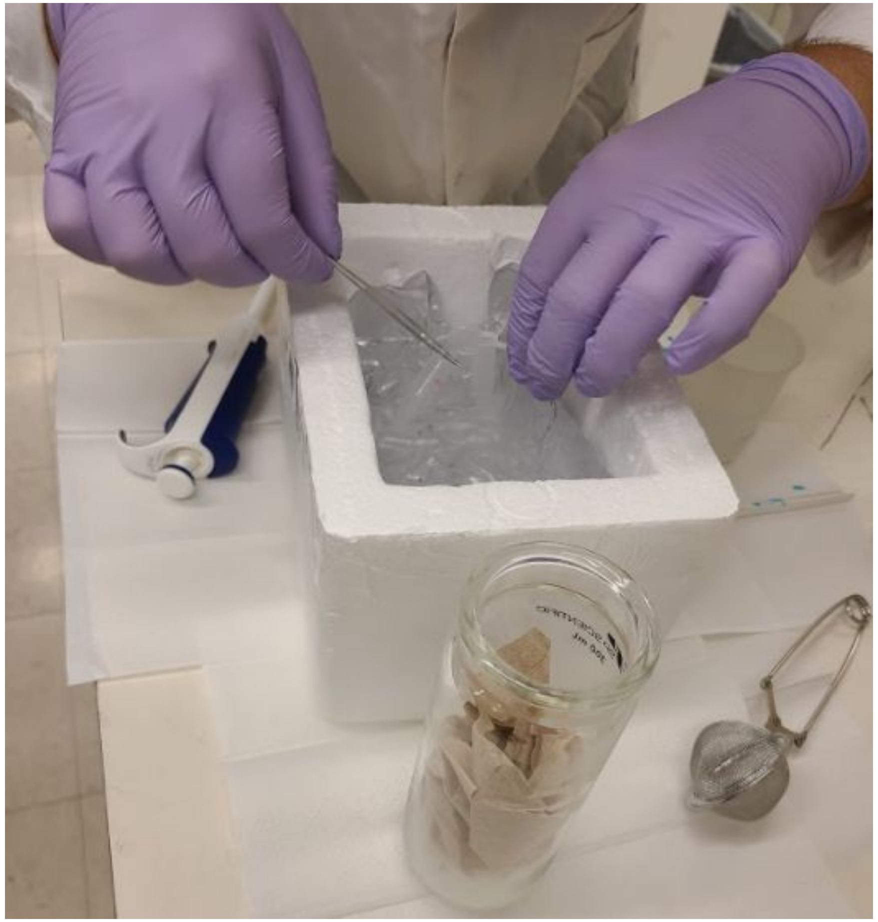
Research Background

- COVID-19 point-of-care (POC) testing is critical in low income, developing countries in order to mitigate the harmful health, social and economic effects on already vulnerable populations. The lyophilization of reagents will aid in the development of a disposable, single use point-of-care testing device. Reagents contain a variety of components, including enzymes and need to be refrigerated in order to keep enzymes active. Lyophilization will eliminate the need for refrigeration, which may not be available in rural areas of developing countries.

RET Lab Experience Research Summary

Research Objectives

- Determine the ideal formulation of lyophilized sugars to:
  - Form 3-D Crystal Structure
  - Quick rehydration
  - Act as cryoprotectant to LAMP reagents

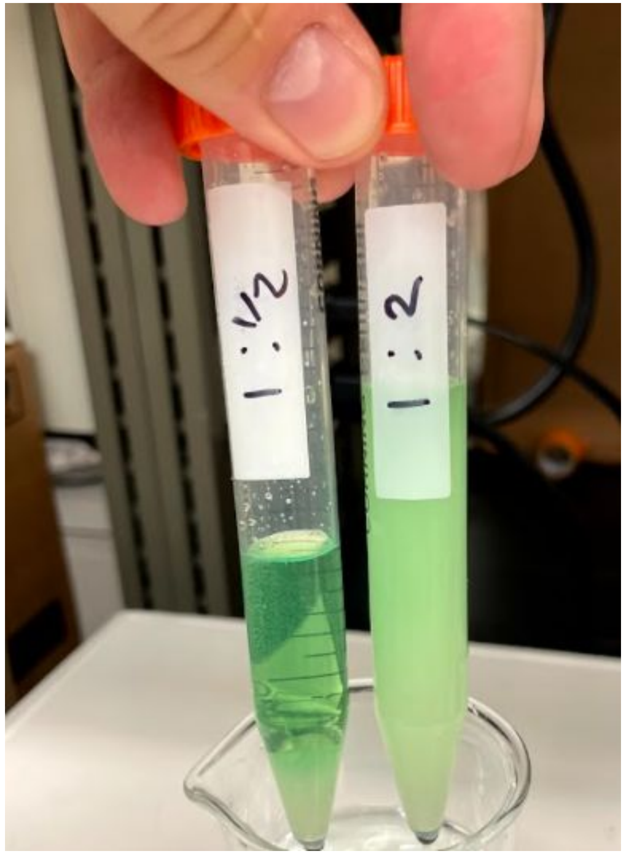


RET Lab Experience Research Summary

Research Conclusions

- No formulation of trehalose and/or xylitol with water and dye was ideal
- Mannitol may be used in future trials
- Lyophilizer was not ideal for the development of pellets

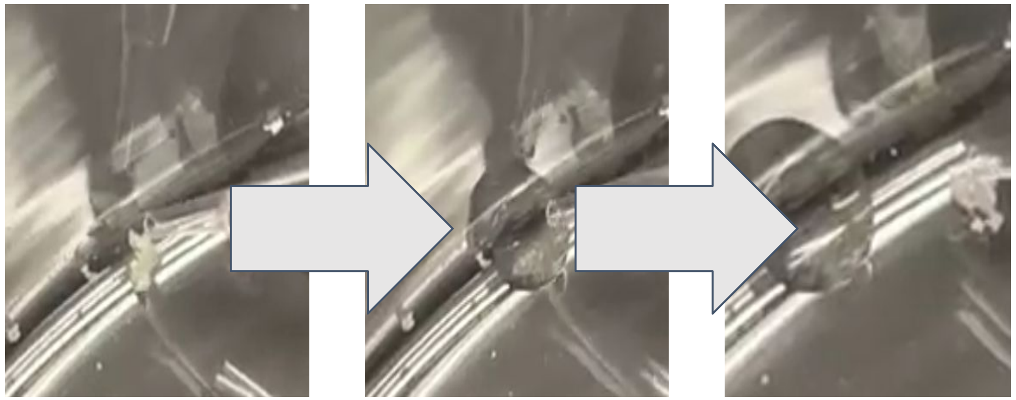
Results Pending

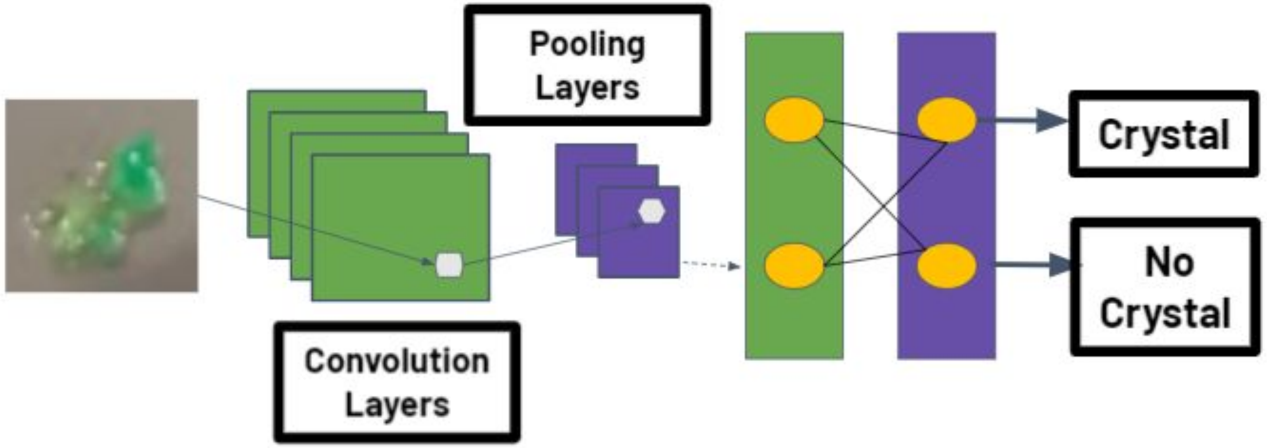


Next STEPS in Research

- Build machine learning classification model to classify crystal structures before, during and after rehydration

- Use data collected with new lyophilizer and LAMP reagents to create pellets

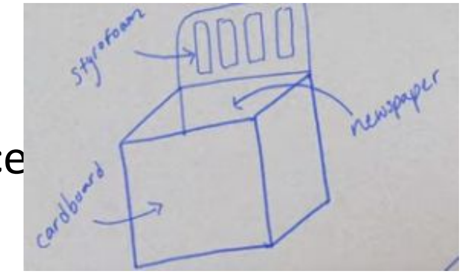




RET Instructional Lesson Implementation

Lesson Description

This activity is based on the COVID-19 point of care device research at ASU. Students will design and build a device capable of insulating "LAMP reagents" exposed to a hair dryer for two minutes to mimic the issue of needing to keep reagents cold when delivering to developing countries. An ice cube will be used to represent the reagents. In this open-ended inquiry based activity, students will be required to critically think about structure and function of the materials they wish to use to build a device to solve a complex real-world problem. Students must consider the thermal properties of the materials, density and will collect data on structure density, time to melt, and change in temperature inside the device etc.



By the end of this activity, students should be able to

- Compare and contrast the insulating properties of various materials.
- Discuss the thermal energy flow in a system.
- Apply the thermal properties of the materials to predict and control the thermal flow of energy in a system.

Self Assessment

- The student perspective
- Connecting science in classroom to the scientific research
- Exposing students to new concepts, possible career ideas, skills, etc.

<u>Overall</u>

Programs like this help me to become a better learner and a better teacher

References

Song J, Liu C, Mauk MG, Rankin SC, Lok JB, Greenberg RM, Bau HH. Two-Stage Isothermal Enzymatic Amplification for Concurrent Multiplex Molecular Detection. Clin Chem. 2017 Mar;63(3):714-722. doi: 10.1373/clinchem.2016.263665. Epub 2017 Jan 10. PMID: 28073898; PMCID: PMC5913740.

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Augustine, R., Hasan, A., Das, S., Ahmed, R., Mori, Y., Notomi, T., Kevadiya, B. D., & Thakor, A. S. (2020). Loop-Mediated Isothermal Amplification (LAMP): A Rapid, Sensitive, Specific, and Cost-Effective Point-of-Care Test for Coronaviruses in the Context of COVID-19 Pandemic. Biology (Basel, Switzerland), 9(8), 182–. https://doi.org/10.3390/biology9080182

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