

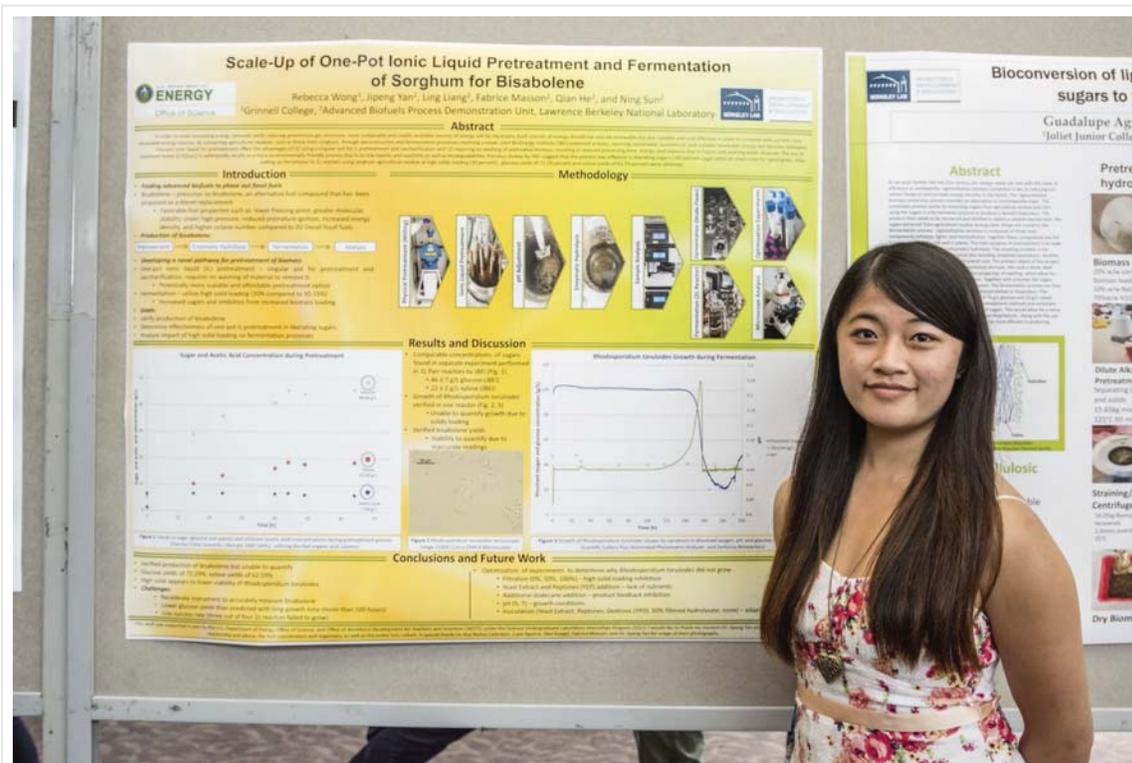
Next Generation of Scientists at the Biosciences Area

Join us as we celebrate the Biosciences Area's staff outreach efforts and the work of our interns!



We are celebrating [#STEMEducation @LBNLBioSci](#) this month! Please like and RT our [#BioSciNextGen](#) tweets! pic.twitter.com/YjfVDsY7xo

 LBNL BIOSCI @LBNLBIOSCI · 11 MONTHS AGO



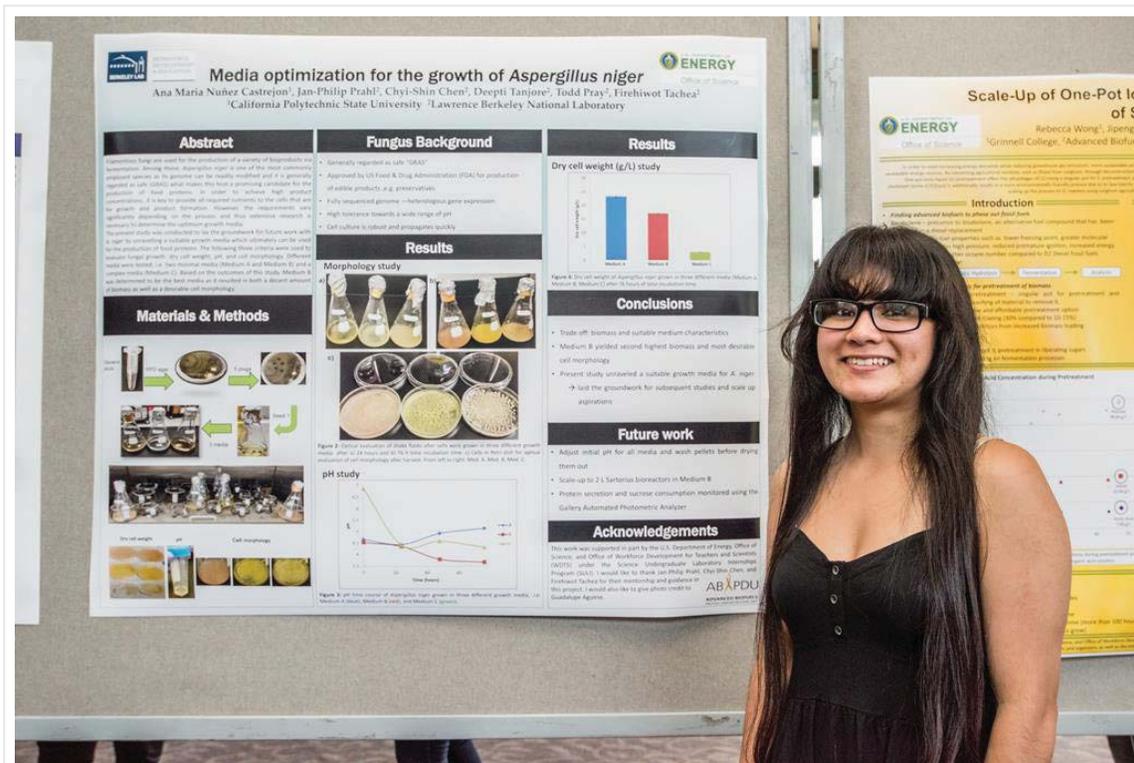
Rebecca Wong @GrinnellCollege interned #ABPDU #BioBSE scaling-up #pretreatment & #fermentation of #sorghum for #bisabolene. #BioSciNextGen pic.twitter.com/F4Uejy4qSX

 LBNL BIOSCI @LBNLBIOSCI · 11 MONTHS AGO



We need more [#scientists](#) like Mary Wildermuth, creator of 'Be a Scientist', 7th gr program!
[#BioEGSB](#) [#BioSciNextGen](#) ow.ly/SlvE30caEjq pic.twitter.com/IRqQsXrupA

 LBNL BIOSCI @LBNLBIOSCI · 11 MONTHS AGO



Ana Maria Nunez @CalPoly optimized media for the growth of #AspergillusNiger @ #ABPDU #BioBSE. #BioSciNextGen pic.twitter.com/k0XxyPd3Ej

 LBNL BIOSCI @LBNLBIOSCI · 11 MONTHS AGO



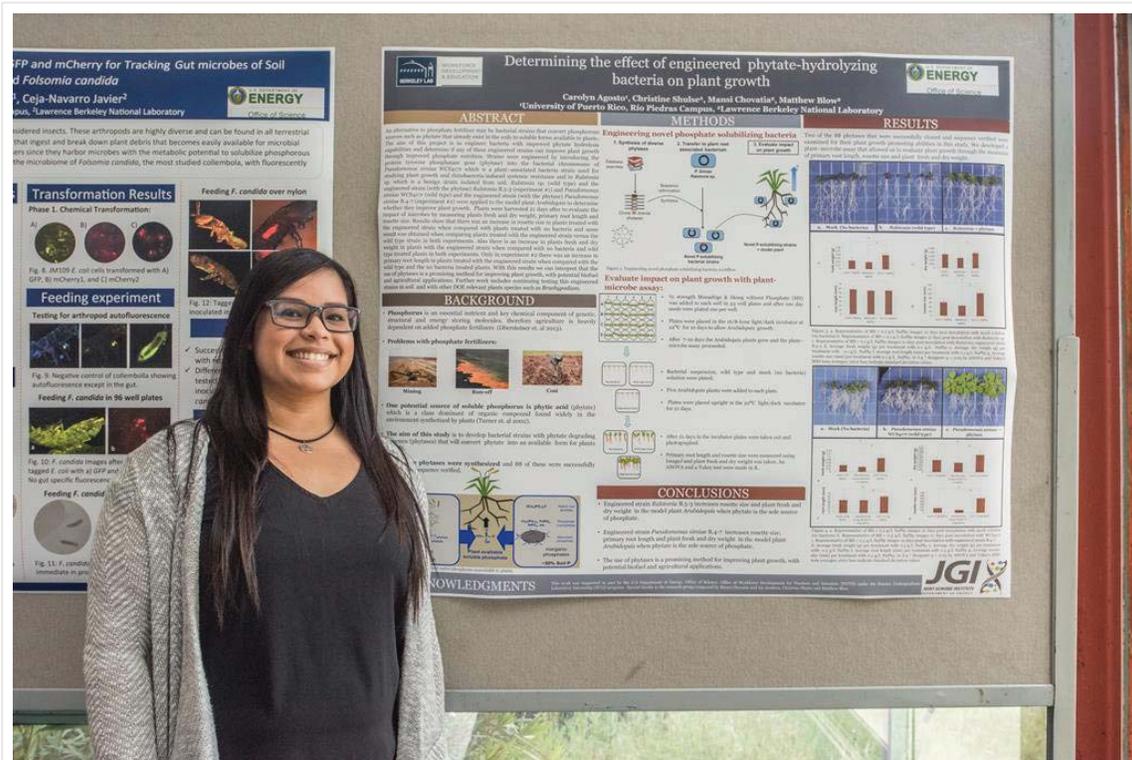
Irina Silva @jbei_ recognized as Exceptional Mentoring Partner by @BiotechPartner #BioSciNextGen #BioBSE ow.ly/DAXf30cr3kD pic.twitter.com/r7FtxUSr2J

 LBNL BIOSCI @LBNLBIOSCI · 11 MONTHS AGO



We are proud of Sabrina Yeh, #BioMBIB @advlightsource intern, who is headed to @BarnardCollege this fall! #BioSciNextGen pic.twitter.com/CNCzNH6kRp

 LBNL BIOSCI @LBNLBIOSCI · 11 MONTHS AGO



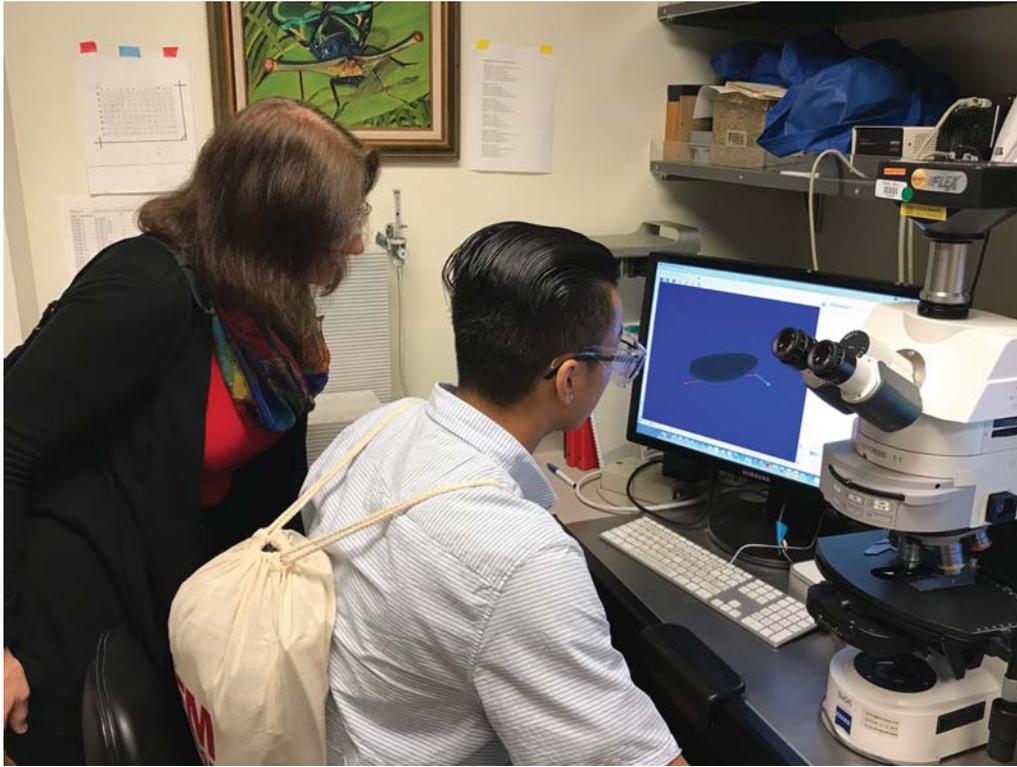
Carolyn Agosto @uprrp interned @doe_jgi to determine the effect of engineered phytate-hydrolyzing #bacteria on #plant growth #BioSciNextGen pic.twitter.com/hvohxFY10C

LBNL BIOSCI @LBNLBIOSCI · 11 MONTHS AGO



Paul Yaswen teaching #EastBay HS students abt methods of detecting environmental carcinogens
#BioEGSB #BioSciNextGen ow.ly/mhAf30caFoa pic.twitter.com/rQ60zrnl6O

 LBNL BIOSCI @LBNLBIOSCI · 11 MONTHS AGO



#EastBay HS students learned about #Drosophila melanogaster @LBNLBioSci lab facility #BioBSE #BioSciNextGen ow.ly/vYUo30caFRS pic.twitter.com/ZqErHMmsTw

 LBNL BIOSCI @LBNLBIOSCI · 11 MONTHS AGO



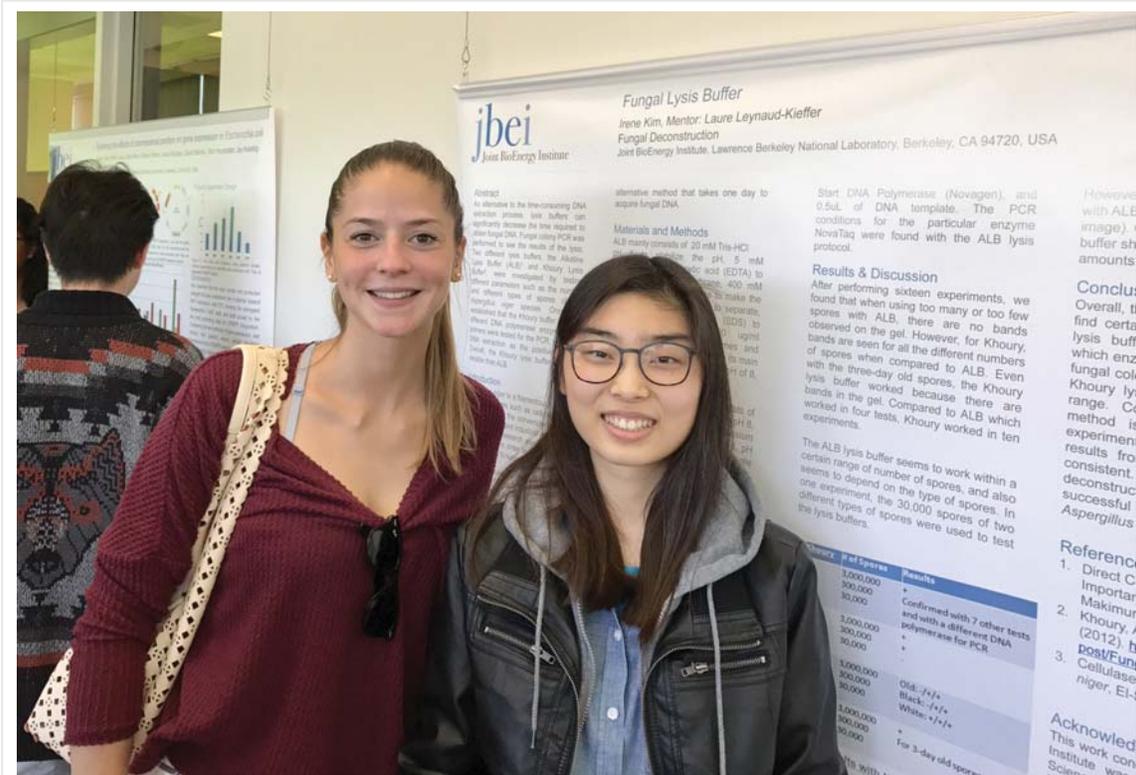
Welcome #BerkLab summer interns! #LBNLnext #BioSciNextGen #STEMEducation
pic.twitter.com/yY6TSn9q4H

 LBNL BIOSCI @LBNLBIOSCI · 11 MONTHS AGO



Vyn Ngo @jbei_ awarded Grace Fimognari Memorial Prize! #BioBSE #BioSciNextGen #STEMProud
#WomenInScience ow.ly/P4rx30cmNld pic.twitter.com/skVK7Zxuqa

 LBNL BIOSCI @LBNLBIOSCI · 11 MONTHS AGO



Proud mentor Laure Leynaud-Kieffer w/ @UCBerkeley undergrad Irene Kim intern @jbei_ Decon Div #BioBSE #BioSciNextGen ow.ly/t0pj30caFZA pic.twitter.com/LfGk1uoi2I

LBNL BIOSCI @LBNLBIOSCI · 11 MONTHS AGO

Analysis of Free Fatty Acids in Waste Oil Sources
 Alexandra Koegel¹, Qian He¹, and Ning Sun¹
¹University of Wisconsin – Stevens Point, ¹Advanced Biofuels Process Demonstration Unit

Abstract
 One quarter of all petroleum used in the United States is imported from foreign countries. In line with Department of Energy (DOE) goals to reduce dependence on foreign oil and increase domestic bioenergy, security and economic opportunity, innovations must be made to not just fuel bioenergy, utilizing waste oils as these fuel sources are an effective option to the fuel crisis as they are non-food grade, widely available, and have the capability to be easily incorporated into existing infrastructure. These oils were quantitatively analyzed by High Performance Liquid Chromatography and related to complex short chain fatty acid and free fatty acid (FFA) profiles. High percentages of long chain FFAs with a increased acid time and low concentrations of short chain fatty acids (i.e. 14 g/L butyric acid and 3.2 g/L acetic acid) were as expected.

Introduction
 How do we reduce dependence on foreign oil to increase domestic sustainability, security, and economic opportunity?
 - Utilize waste oils as a useful diesel fuel additive.
 - Non-food grade – does not affect food supply/demand
 - Splash-blend technology
 - Easily integrated into existing infrastructure
 Which waste oils do we want to use?
 - Waste oils with high concentrations of unsaturated free fatty acids (e.g. oleic acid C₁₈H₃₄O₂) as opposed to saturated free fatty acids.
 - Lower melting point
 - Better for fuel blending
 - Allows for easy integration
 - Waste oils with low concentrations of short chain fatty acids.
 - Less breakdown of long chain fatty acids – majority of fuel
 Goal: Facilitate the development of waste oil source selection for engine testing and fuel blending through quantitative bio-oil analysis.

Methodology

Collection → Preparation → Calibration → Analysis

Samples collected from client company
 Samples prepared through various methods
 Internal standards were used for HPLC calibration
 Samples analyzed by HPLC methodology

Analysis run:
 - free fatty acid (FFA) (as oleic acid)
 - Titrations
 - How concentration of FFAs change over time (short chain fatty acid (as formic and acetic acid))
 - High Performance Liquid Chromatography
 - Determine breakdown of long chain free fatty acids

Results/Discussion
 - Free Fatty Acid Profile
 - Calculated using the following equation:

$$\text{mg of alkali} \cdot N = 29.2 \cdot \text{MM} \cdot \rho \cdot V \cdot \text{sample}$$

 Sample S1 S2 S3 S4 S5 S6 S7 S8 S9 S10 S11
 Oleic Acid % 70.11 62.37 7.66 6.53 108.72 101.23 54.23 67.94 96.21 60.19 59.46
 Acid % 1.4 1.2 0.2 0.1 2.2 2.0 1.1 1.7 1.9 1.2 1.2
 *Values are in %
 Figure 1. Free Fatty Acid Profile and acid values in waste oil. *mg of KOH necessary to neutralize 1 g of sample. Highlighted samples were tested for degradation tests.
 - Percentages of oleic acid over 100%
 - Over-saturating acids with lower carbons than 18
 - Short Chain Fatty Acid Profile
 - Formic Acid
 - Acetic Acid
 - HPLC Standards run
 - Formic Acid @ 13.617 min
 - Acetic Acid @ 14.805 min
 - 1x, 2x, 4x STD
 - Samples run
 - Formic Acid @ 13.617 min
 - 13.844 g/L
 - Acetic Acid @ 14.813 min
 - 0.2 g/L
 Figure 2 and 3. Unknown high standards used to determine HPLC chromatography, relating known HPLC retention times to the time of acid in the waste oil. 1x, 2x, 4x before and after water. Formic and acetic acid were analyzed before.

Summary
 - Waste oil sources would ideally have profiles with the following
 - High concentrations of unsaturated FFA (i.e. oleic acid)
 - Low concentrations of short chain fatty acids
 - Sources with profiles as described above will allow for simplified down stream processing, scale up processes, and easier integration into existing infrastructure.

Acknowledgements
 The presenter would like to recognize and thank the staff of the Advanced Biofuels Process Demonstration Unit (ABPDU) for their thoughtful instruction, insight, and support. This work was supported in part by the U.S. Department of Energy, Office of Science, Office of Biological and Environmental Research (OBER), under the National Undergraduate Laboratory Internship Program (NUIIP).

Alexandra Koegel @UWMadison analysed free fatty acids in waste oil sources during #ABPDU #internship. #BioBSE #BioSciNextGen pic.twitter.com/lAgZLdCc4u

LBNL BIOSCI @LBNLBIOSCI · 10 MONTHS AGO



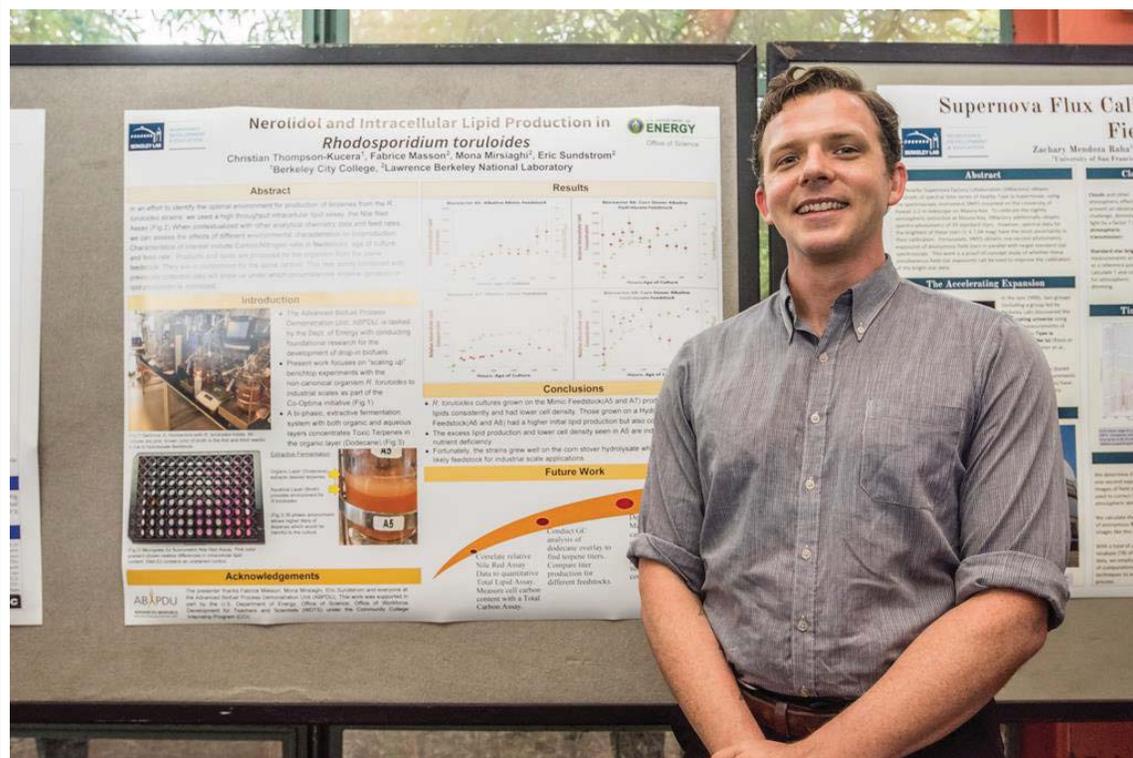
Advanced Microscopy Facility @LBNLBioSci a great place for #STEMEducation. #BioMBIB
#BioSciNextGen ow.ly/u0Ft30caHbU pic.twitter.com/Wd7iaJIWl

 LBNL BIOSCI @LBNLBIOSCI · 10 MONTHS AGO



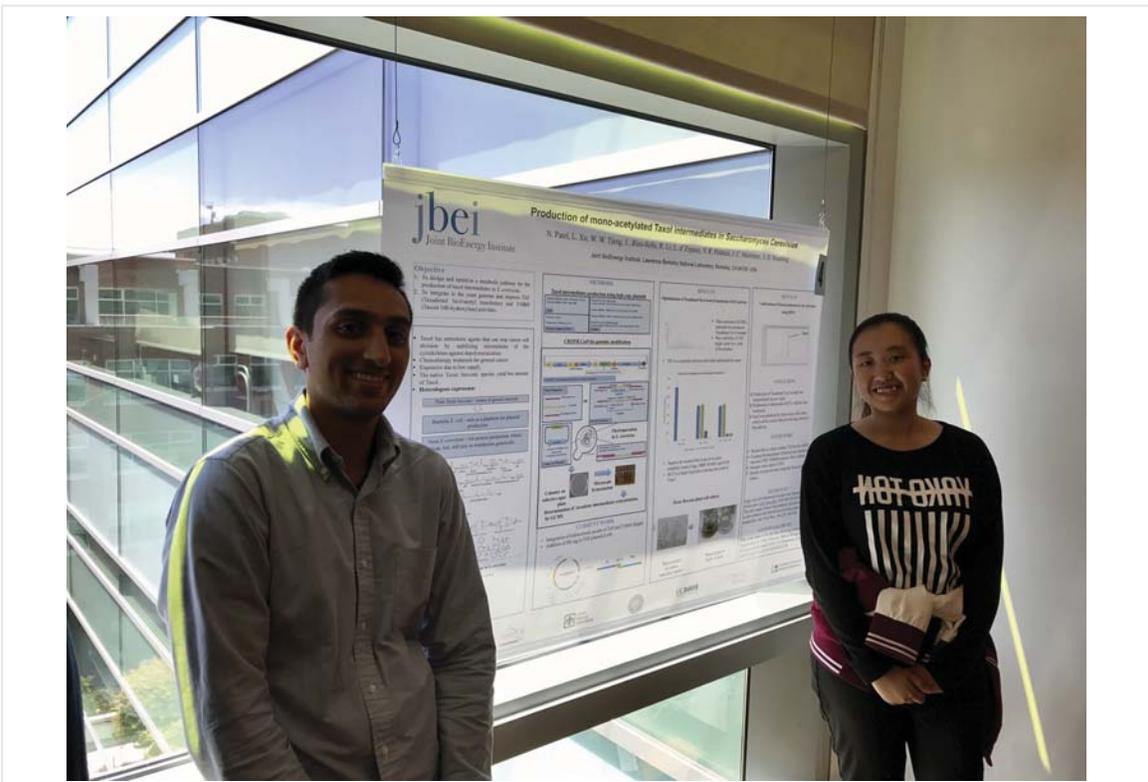
Maya & Yvette @UCBerkeley winners of @jbei_ #Undergrad Poster Session! #BioBSE
#BioSciNextGen ow.ly/XDeB30caHE2 pic.twitter.com/zFn7B7p1j4

 LBNL BIOSCI @LBNLBIOSCI · 10 MONTHS AGO



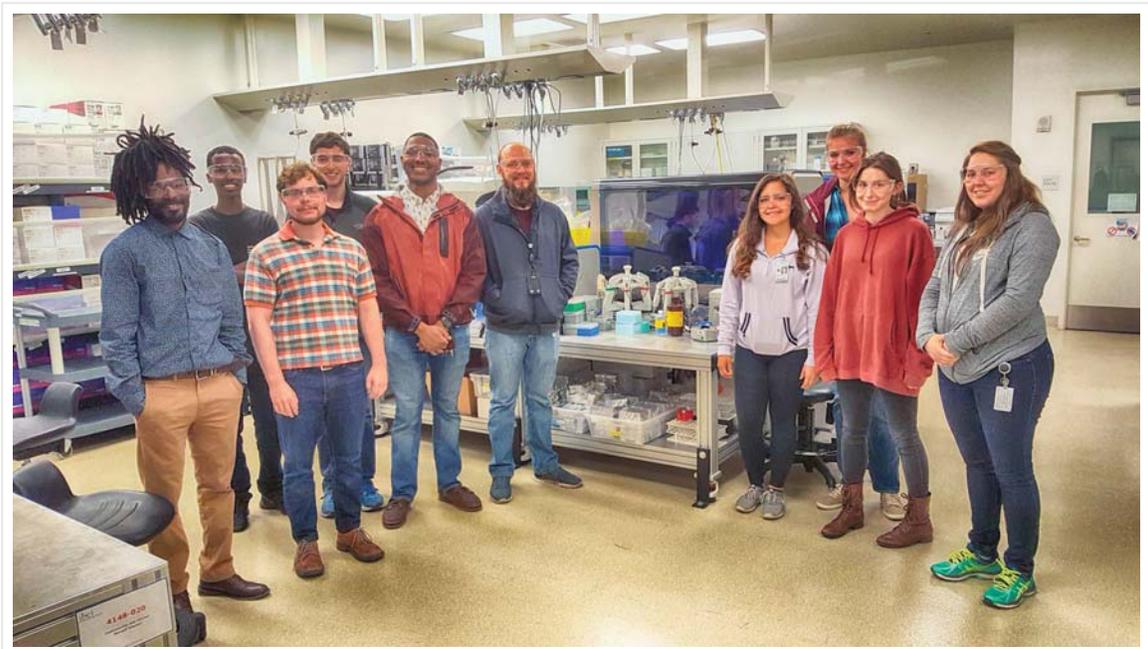
Christian Thompson-Kucera @berkeleycc researched lipid production in #Rhodospiridium #toruloides @ #ABPDU #BioBSE. #BioSciNextGen pic.twitter.com/nErM0eDxBM

 LBNL BIOSCI @LBNLBIOSCI · 10 MONTHS AGO



#Undergrads Nikit Paterl & Linda Xu @UCBerkeley interned @jbei_ Fuels Synthesis Div. #LabLife #BioBSE #BioSciNextGen ow.ly/a9id30caEQb pic.twitter.com/fe71aBqm4u

 LBNL BIOSCI @LBNLBIOSCI · 10 MONTHS AGO



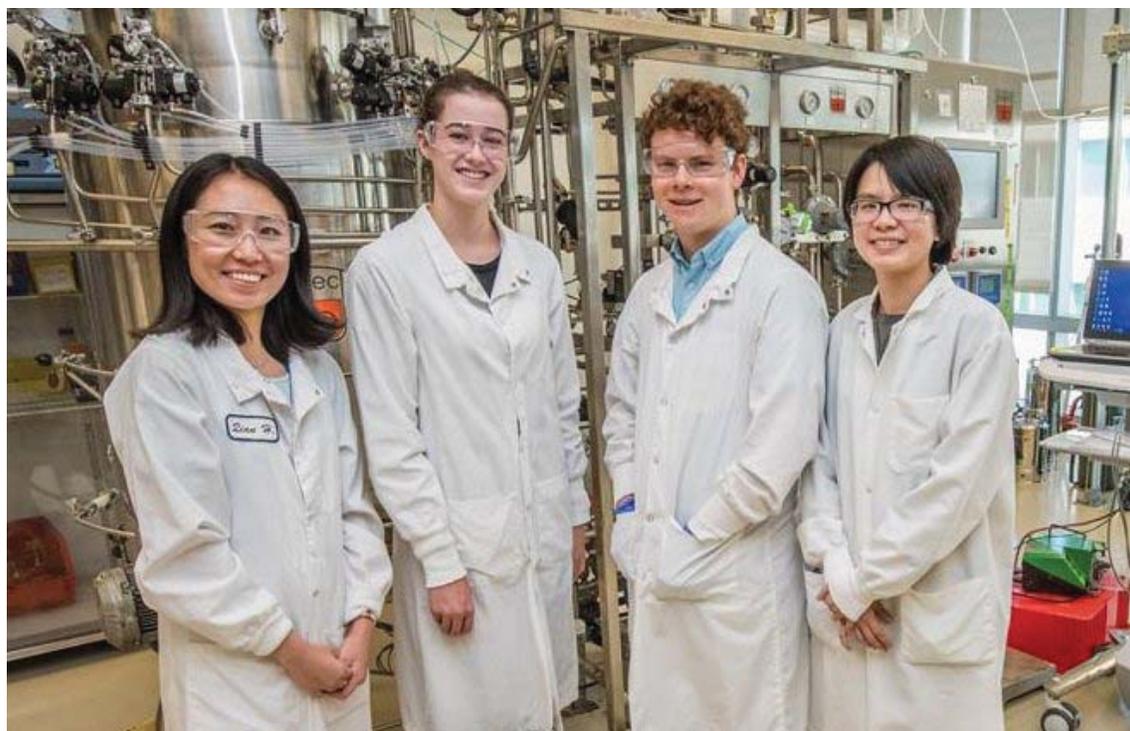
Today's lesson? Biofuel production! #LBNLnext interns visit @jbei_ & hang with #robots. @ENERGY @LBNLBioSci #BioSciNextGen pic.twitter.com/KuVu7Y7jEL

 BERKELEY LAB @BERKELEYLAB · 10 MONTHS AGO



Fun photoshoot yesterday w/ #iCLEM2017 & @BiotechPartner students & mentors #STEMEducation @jbei_ #ABPDU #BioSciNextGen @BerkeleyLab pic.twitter.com/BD2p9dr8WK

JOINTBIOENERGYINST @JBEI_ · 9 MONTHS AGO



.@BiotechPartner interns Olivia & Max worked #ABPDU this summer. Consider mentoring, visit ow.ly/pS1430egzWH #BioSciNextGen #BioBSE pic.twitter.com/tVwe8m9e0x

LBNL BIOSCI @LBNLBIOSCI · 9 MONTHS AGO



Liam Quigley #undergrad @LBNLBioSci produced a video abt #SULI #internships. #BioSciNextGen #STEMEducation @ENERGY ow.ly/HiTr30ekag3 pic.twitter.com/mEZtlilmth

 LBNL BIOSCI @LBNLBIOSCI · 9 MONTHS AGO



HS intern Max Rodman getting hands on experience @ #ABPDU this summer. #BioSciNextGen #ABPDU #BioBSE @BiotechPartner ow.ly/G9yt30egCaL pic.twitter.com/6t1z9kdLrZ

 LBNL BIOSCI @LBNLBIOSCI · 9 MONTHS AGO



Liam Quigley #undergrad @LBNLBioSci produced a video abt #SULI #internships. #BioSciNextGen #STEMEducation @ENERGY ow.ly/HiTr30ekag3 pic.twitter.com/bBckNxFlaq

 LBNL BIOSCI @LBNLBIOSCI · 9 MONTHS AGO



#ABPDU intern Carolina Gutierrez took over @BerkeleyLab Instagram #BioSciNextGen
ow.ly/xvHU30esSUt pic.twitter.com/2acZkaiXWh

 LBNL BIOSCI @LBNLBIOSCI · 9 MONTHS AGO



HS student Olivia interning at #ABPDU #LabLife #BioSciNextGen @BerkeleyLab @BiotechPartner ow.ly/uV4b30egDEo pic.twitter.com/ttUDKm6JY1

 LBNL BIOSCI @LBNLBIOSCI · 9 MONTHS AGO



Proud of our @BiotechPartner interns! #YoungScientists #HardWorkers #BioSciNextGen #BioBSE #ABPDU #BioEGSB @doe_jgi ow.ly/zdFQ30esjri pic.twitter.com/F0stsTV4rh

 LBNL BIOSCI @LBNLBIOSCI · 9 MONTHS AGO



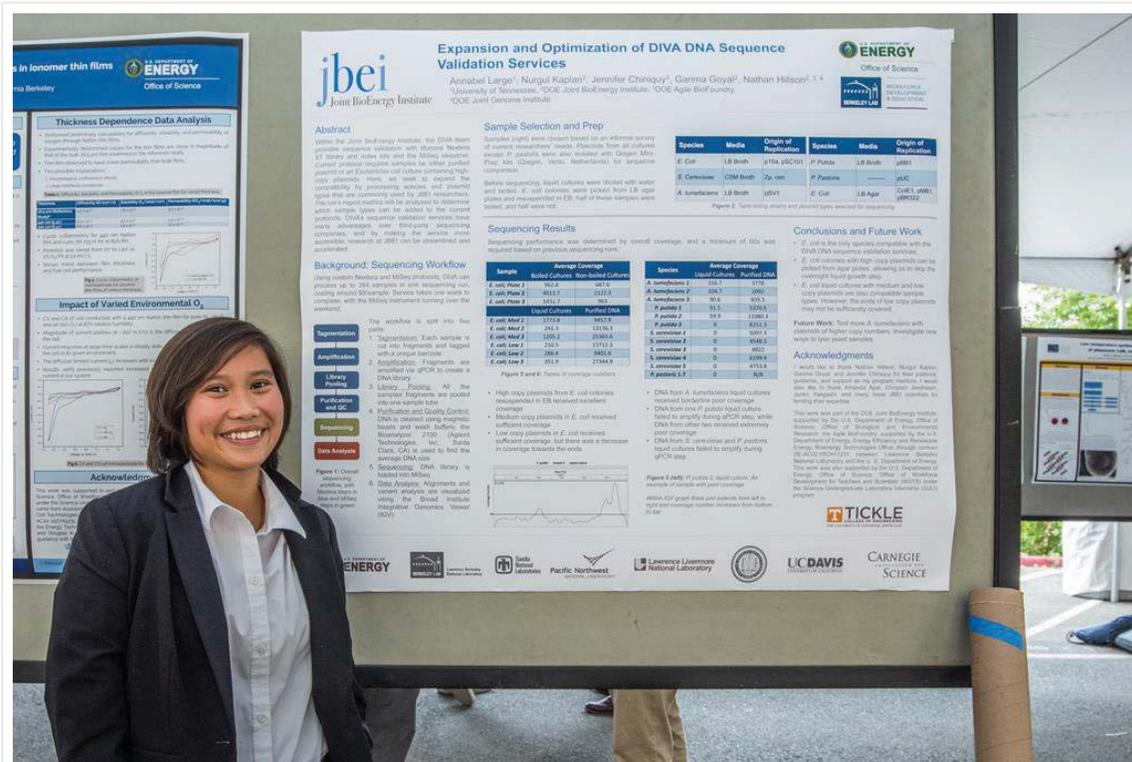
Liam Quigley #undergrad @UW @LBNLBioSci produced a video abt #SULI #internships.
#BioSciNextGen #STEMEducation ow.ly/gS8530eBbck pic.twitter.com/Y3o159q4cB

 LBNL BIOSCI @LBNLBIOSCI · 8 MONTHS AGO



Check out @BerkeleyLab videos ft. #interns #mentors. #STEMEducation #LabLife
ow.ly/E3jo30esSpQ pic.twitter.com/RP2Lt8cNhx

 LBNL BIOSCI @LBNLBIOSCI · 8 MONTHS AGO



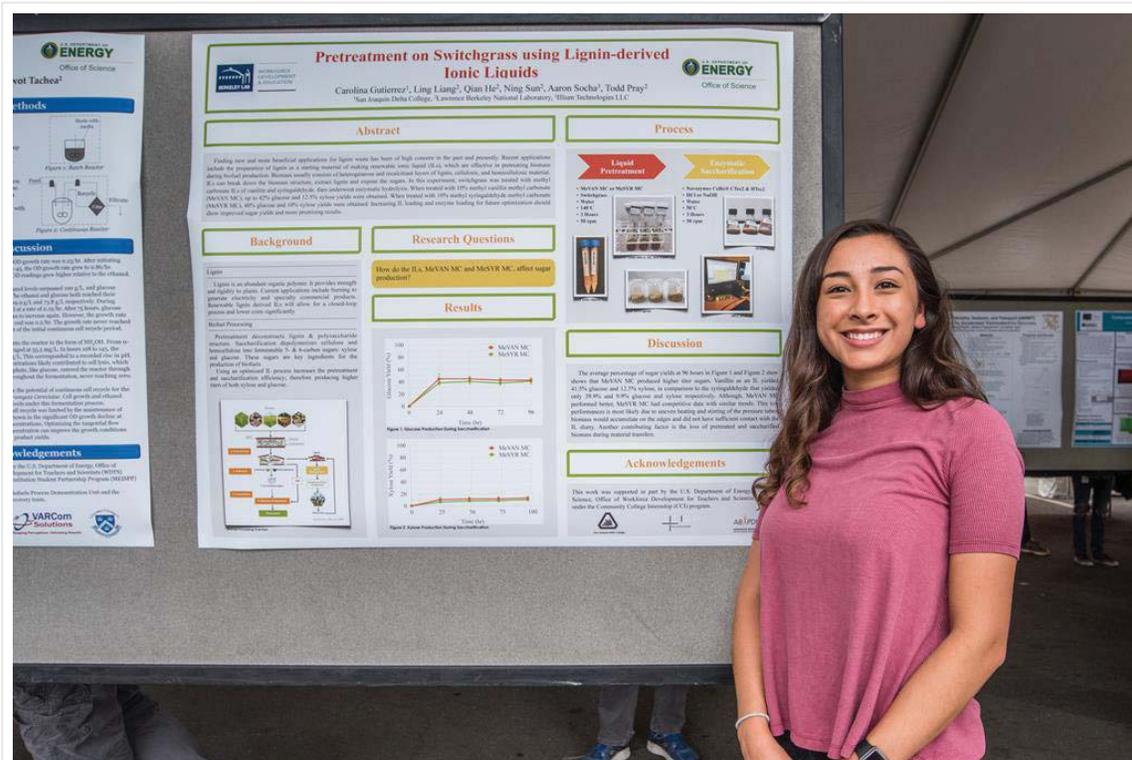
#Intern Annabel Large @UTKnoxville worked on @jbei_ DIVA #DNA sequence validation platform #BioBSE #BioSciNextGen pic.twitter.com/LsVRnZ3Vw3

LBNL BIOSCI @LBNLBIOSCI · 8 MONTHS AGO



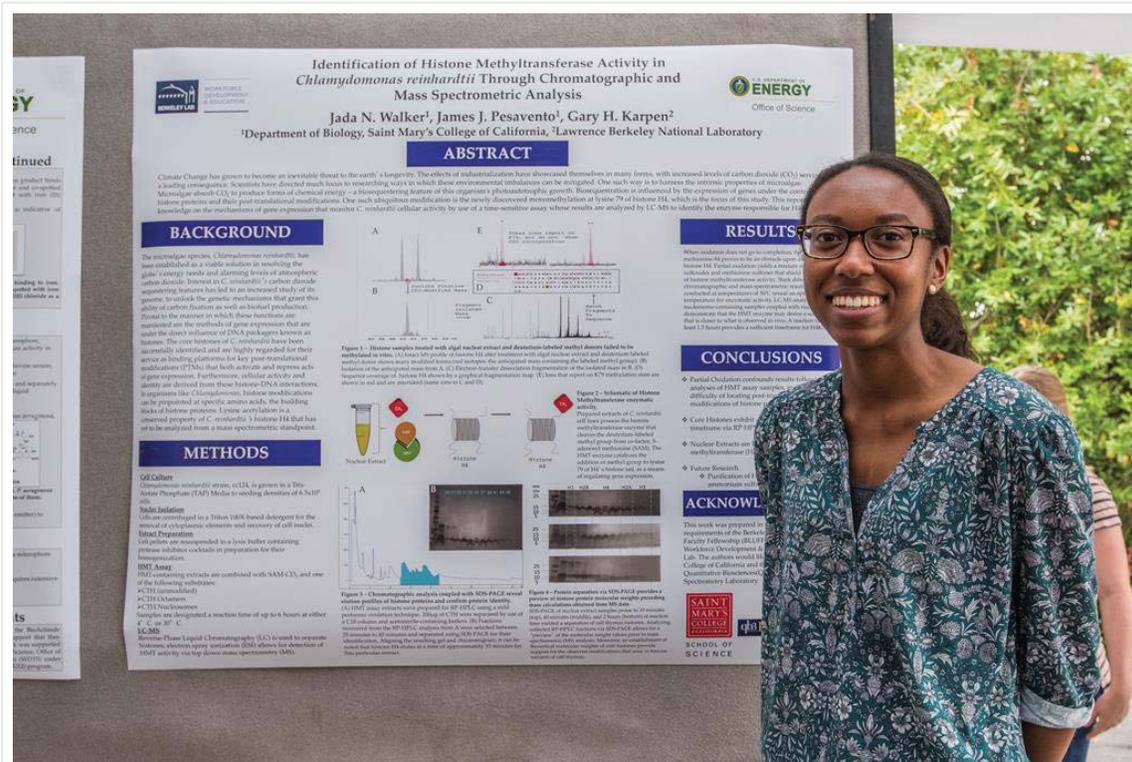
Camila Hayashi interned at #ABPDU learning about #biofuels #bioproducts. #BioBSE #BioSciNextGen #STEMEducation pic.twitter.com/uu2EAviZOH

 LBNL BIOSCI @LBNLBIOSCI · 8 MONTHS AGO



Intern Carolina Gutierrez @SJDeltaCollege focused on switchgrass pretreatment w/ lignin-derived #ionicliquids #ABPDU #BioBSE #BioSciNextGen pic.twitter.com/mM5d3Z0PVe

LBNL BIOSCI @LBNLBIOSCI · 8 MONTHS AGO



Walker & Pesavento @stmarysca formed faculty & undergraduate research team under the BLUFF Fellowship @BerkeleyLab #BioBSE #BioSciNextGen pic.twitter.com/hY9PRx9fxp

LBNL BIOSCI @LBNLBIOSCI · 8 MONTHS AGO

 **LBNL BioSci**
@LBNLBioSci

We are always happy to host @CCSFbitech Interns! twitter.com/CCSFbitech/st...

 8 MONTHS AGO