CBTS Biothreat Defense Summer Research Institute 2023

DHS Centers of Excellence

CROSS-BORDER THREAT SCREENING
Center of Excellence

- **COE Purpose:** "The DHS COEs are university consortia that work closely with DHS Components and their partners to conduct research, develop and transition mission-relevant science and technology, educate the next generation of homeland security technical experts and train the current workforce in the latest scientific applications."
- **Long-term relationships:** 5 to 10-year cooperative agreements
- **Nationwide: 7** active COEs and 13 emeritus COEs
  - Two at Texas A&M!!!
  - https://www.dhs.gov/science-and-technology/centers-excellence

Background

CROSS-BORDER THREAT SCREENING
Center of Excellence

- **DHS was established by the Homeland Security Act of 2002 –** Consolidated 22 diverse agencies and bureaus into DHS
  Mandate of preventing and responding to natural and man-made disasters
- **DHS Science and Technology Directorate (DHS S&T) –** "Science Advisor" to the DHS Secretary and serves and the research and development arm of DHS
- **DHS Office of University Programs (DHS S&T OUP) –** Harnesses the intellectual power of America's universities to provide innovative research, development and education to the Homeland Security Enterprise
  - Centers of Excellence
  - Minority Serving Institutions Program
  - Workforce Development Initiatives

Science and Technology

Countering Weapons of Mass Destruction

CBTS Purpose

CROSS-BORDER THREAT SCREENING
Center of Excellence

"New biological threats and hazards have the potential to significantly affect the health and well-being of DHS personnel. These threats may also spread to people, animals, plants, and negatively affect the Nation's economy and critical infrastructure."

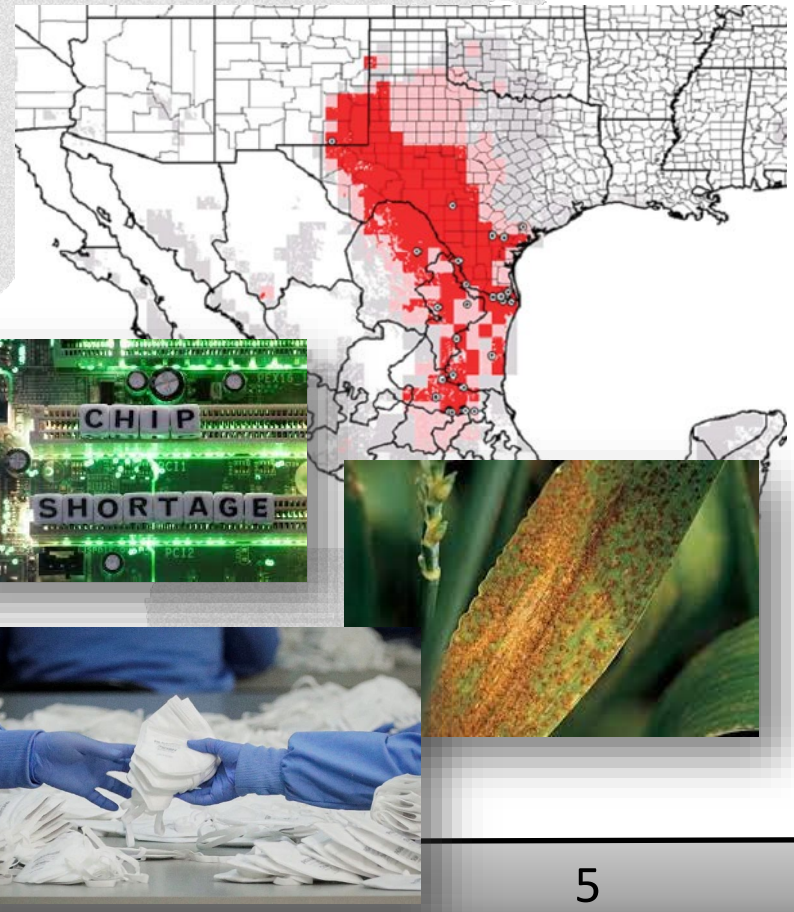
- **What:** "Prevent, detect and respond to biological threats and hazards…strengthen global supply chains and increase resilience"
- **Why:** "Invasive species, novel biological agents and materials, infectious human and zoonotic diseases, counterfeit goods, transnational agro- and bio-terrorism, pandemics, and transboundary animal diseases"
- **Where:** "…at borders, ports of entry (land, air, sea)…and within the global supply chain"

Threats…

CROSS-BORDER THREAT SCREENING
Center of Excellence

Threats to…people, animals, plants that negatively affect the Nation's economy and critical infrastructure."

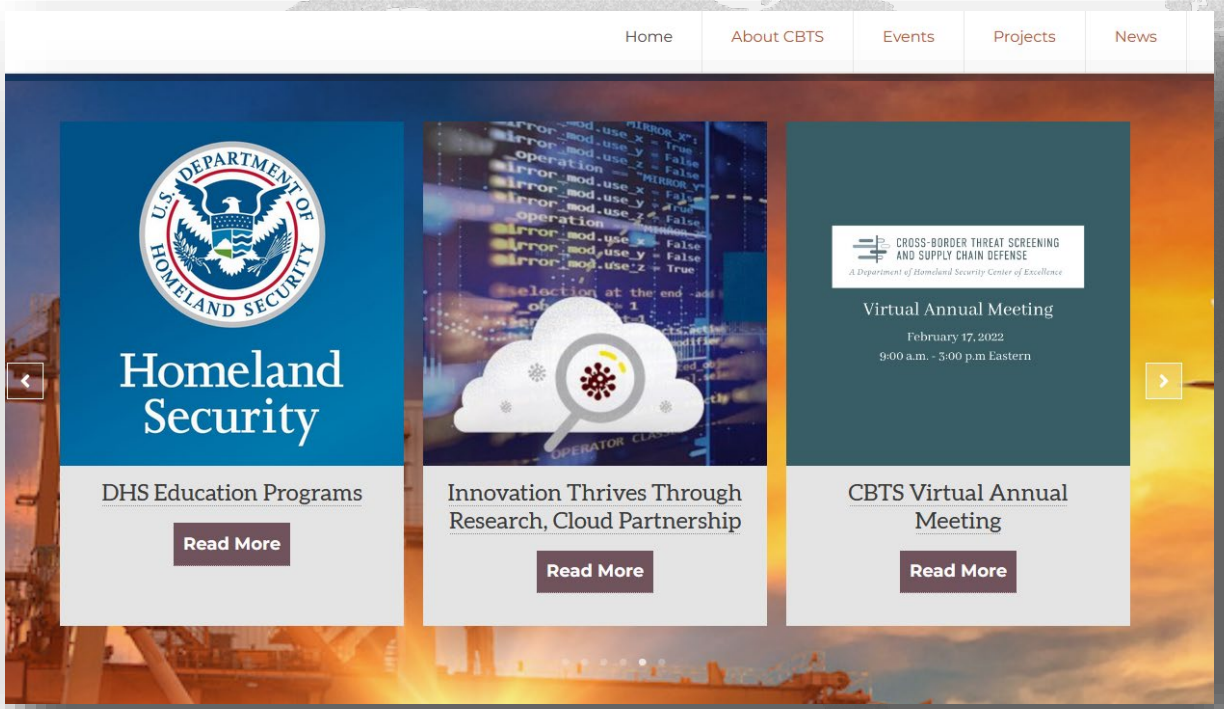
- **Critical Infrastructure – 16 critical sectors**
- **Human Health –** Workforce and public health, bacterial or viral pathogens, insect pests, toxic chemicals and substances
- **Agricultural Health –** Agricultural plants, livestock, agricultural products, bacterial or viral pathogens, insect pests, fertilizer
- **Supply Chains –** Precursor materials, finished products, transportation

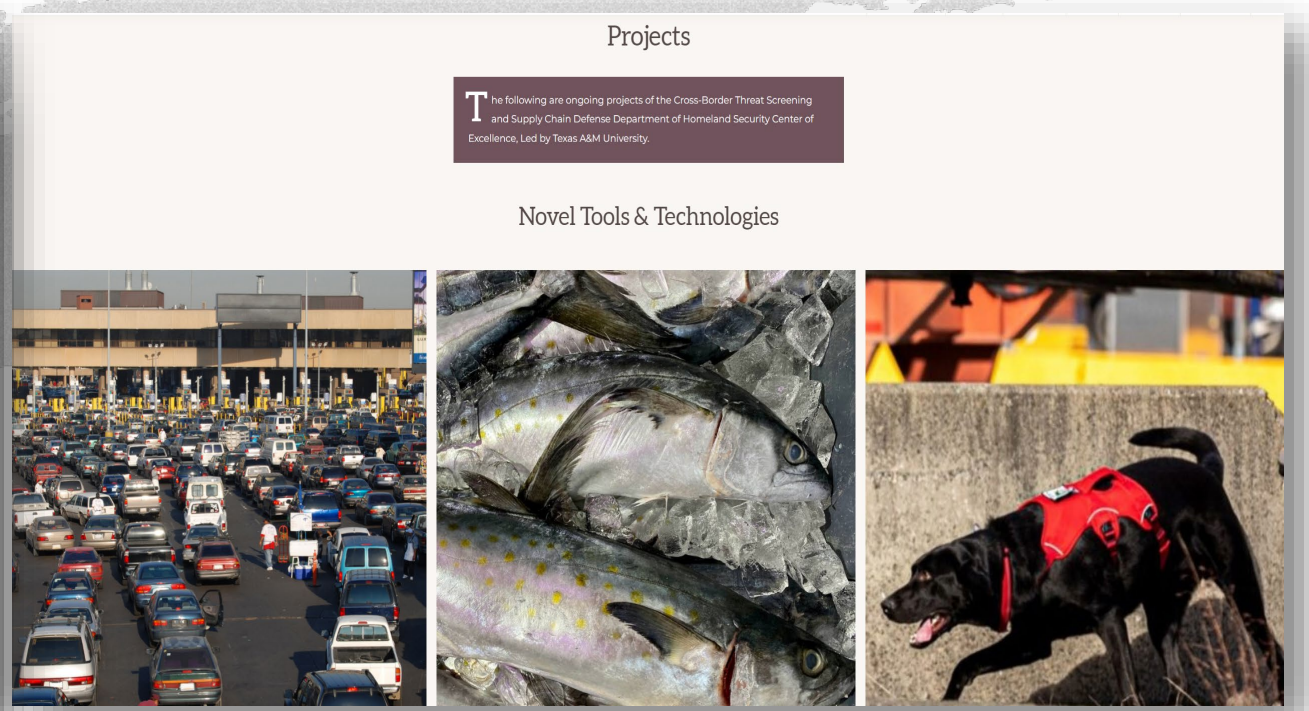


CBTS Website

CROSS-BORDER THREAT SCREENING
Center of Excellence

https://cbts.tamu.edu





Program Details

CROSS-BORDER THREAT SCREENING
Center of Excellence

Summary:

- 10-week program: **May 30 - Aug 4th, 2023**
- Student Stipend offered
- Hands-on work in the laboratory with faculty mentors
- Guest Lectures
- Professional development
- Field trips
- Engagement with Department of Homeland Security

Application

CROSS-BORDER THREAT SCREENING
Center of Excellence

Application criteria:

- Must be a U.S. Citizen
- Open to Junior and Senior STEM majors

How to Apply:

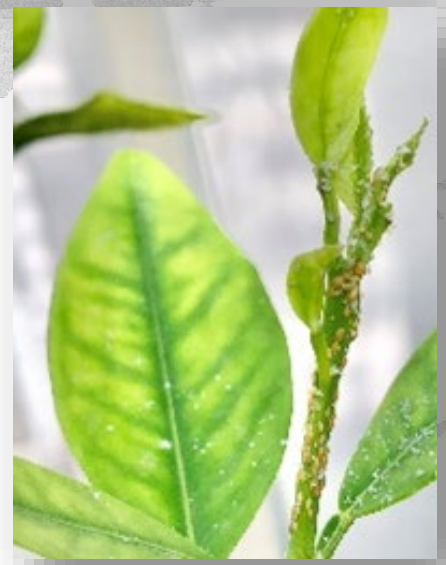
- Must fill out the application link –
  - Application link includes applicant information, personal statement of purpose, name of a professional reference and areas to upload a resume and your transcript
  - Professional references will be emailed a form for electronic submission
- Link to Qualtrics application is on the CBTS Website –
  - https://cbts.tamu.edu/cbts-summer-research-institute/
  - https://tamuag.az1.qualtrics.com/jfe/form/SV_77EiV4zxQEaNAFw

Application deadline:

- **April 11, 2023, *no later than* midnight (central time) – for ALL materials**

CBTS Biothreat Defense

Summer Research Institute



Faculty Mentors

CROSS-BORDER THREAT SCREENING
Center of Excellence

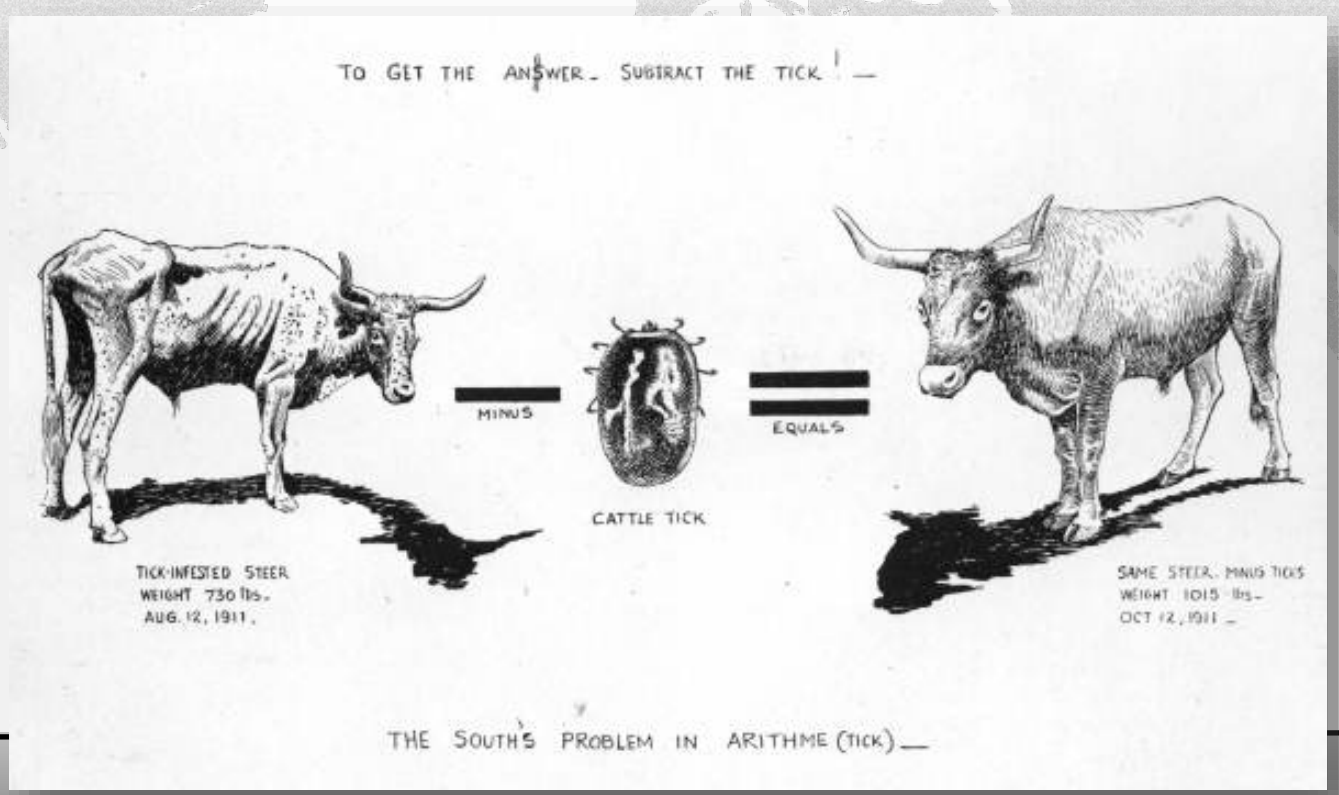
TEXAS A&M UNIVERSITY
College of Agriculture & Life Sciences

- Dr. Dmitry Kurouski
- Assistant Professor, Biochemistry & Biophysics, Biomedical Engineering
- Office: BICH/216
- Email: Dmitry.Kurouski@ag.tamu.edu
- Location: Texas A&M University, College Station, TX

TEXAS A&M AGRILIFE RESEARCH AND EXTENSION CENTER AT
WESLACO

- Dr. Kranthi Mandadi
- Associate Professor, Department of Plant Pathology and Microbiology
- Email: kkmandadi@tamu.edu
- Location: AgriLife Research and Extension Center, Weslaco, TX

RAMAN-BASED IDENTIFICATION OF TICK SPECIES



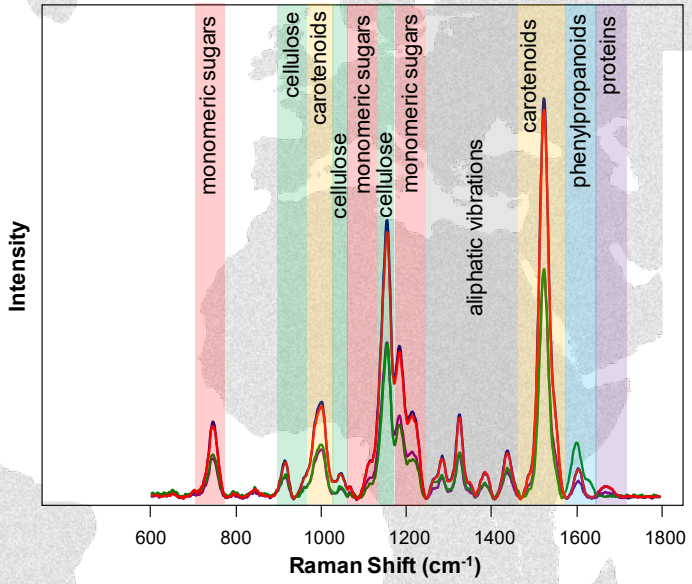
Summary

- Ticks are blood-feeding parasites that serve as vectors for a number of pathogens of medical and veterinary importance. Timely detection of certain tick species on cattle can halt the spread of devastating diseases, such as Bovine babesiosis and anaplasmosis.
- Currently, ticks are detected using scout-based inspection of cattle, which is slow and labor-intensive.
- The student projects will focus on the detection of ticks and pathogens of cattle using Raman spectroscopy to investigate the possibility of identifying tick species (Ixodidae) using feces.
- The ultimate goal is to demonstrate that diagnostics of tick species present on cattle can be achieved using a hand-held Raman spectrometer. These findings can be used by US border control for non-invasive, non-destructive and confirmatory on-site analysis of tick species present on cattle.

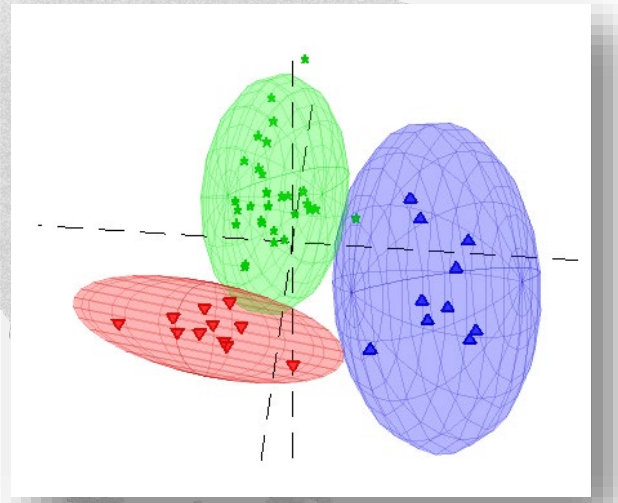
How Raman Works

1 Acquisition of spectra

2 Analysis of spectra



3 Chemometrics



- Label/chemical-free, non-destructive diagnostics.
- Accuracy of prediction: on average >95%.
- Analysis time: 1s.

Raman-Based Identification of Tick Species by Spectroscopic Analysis of Their Feces

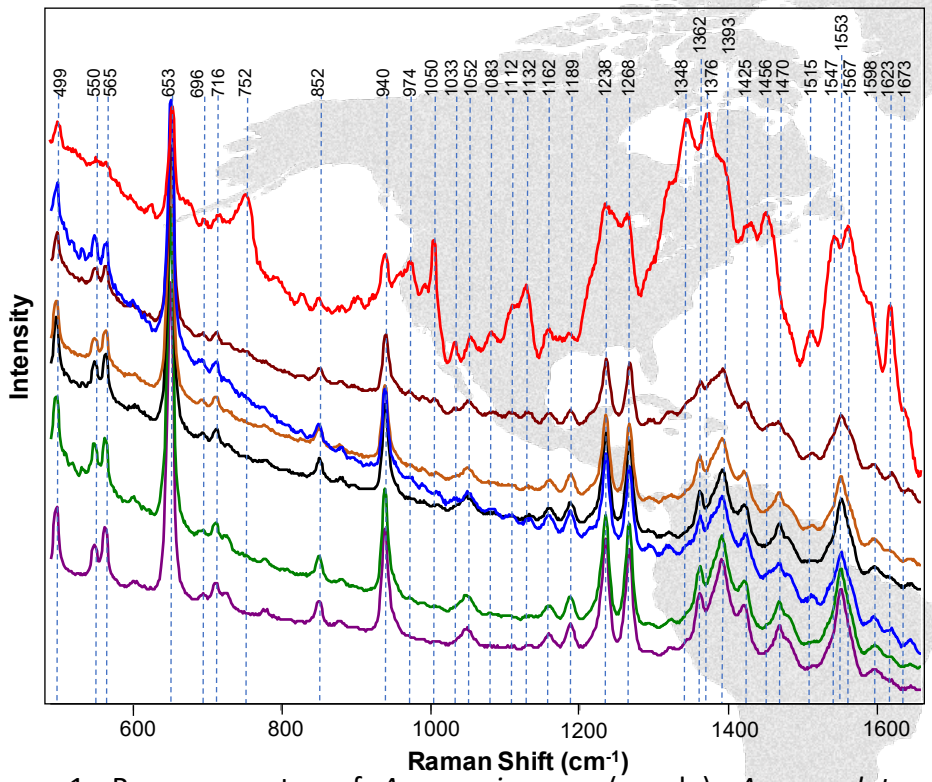
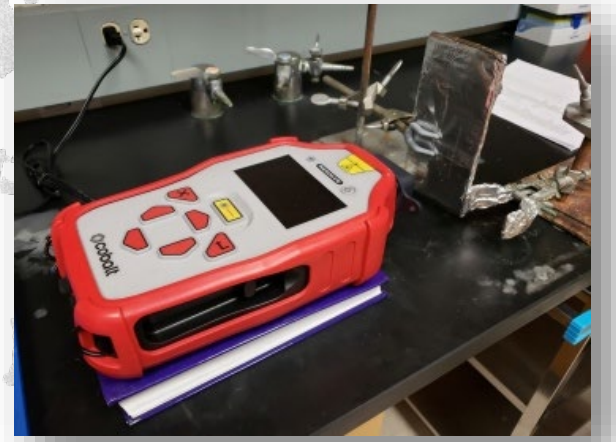


Figure 1. Raman spectra of *A. americanum* (purple), *A. maculatum* (green), *A. tenellum* (blue), *A. mixtum* (black), *Boophilus microplus* (orange), *B. annualatus* (maroon) and *Dermacentor albipictus* (red).

	Amblyomma	Boophilus	Dermacentor
Predicted as Amblyomma	447	0	0
Predicted as Boophilus	1	296	8
Predicted as Dermacentor	2	14	223
TPR (%)	99.3	95.5	96.5

	A. ame	A. mac	A. mix	A. ten
Predicted as A. ame	142	0	0	0
Predicted as A. mac	0	97	0	0
Predicted as A. mix	0	0	165	0
Predicted as A. ten	0	0	0	46
TPR (%)	100	100	100	100

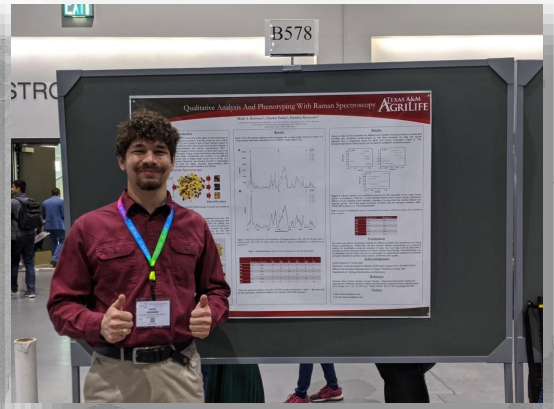


Past and Current Students

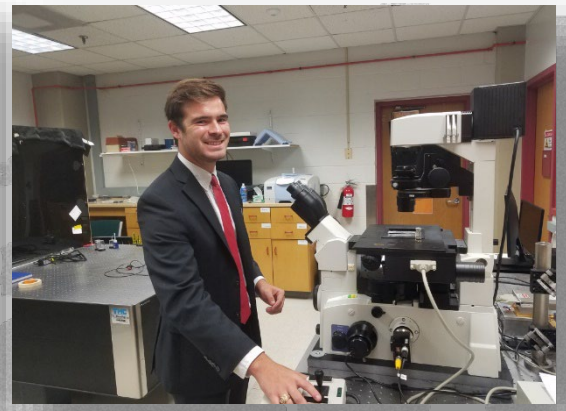
CROSS-BORDER THREAT SCREENING
Center of Excellence

Kurouski Group

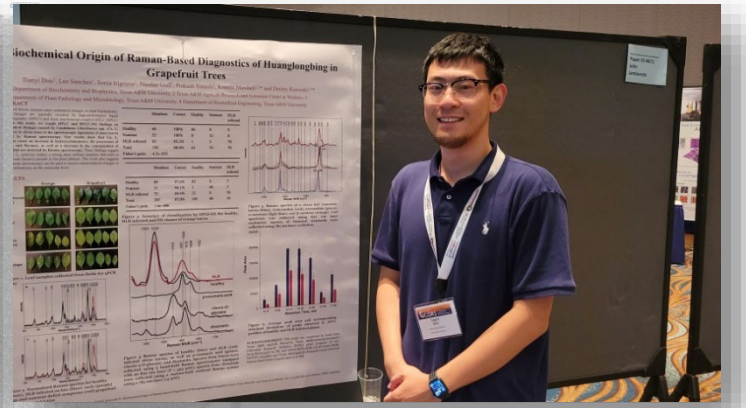
Dr. Charles Farber
Now at Bruker Nano, Engineer



Mark Krimmer
Now Research Scientist, Aerotek



Nico Goff, Now Medical Student at Dell Medical School , Austin, TX



Tianyi Dou, Now PhD student at TAMU

Lee Sanchez
Now at student in Texas Dental School

Dillon Humpal
Now Medical Student UTHealth Houston

Kyle McCellan and Isaac Juarez
Now PhD students at TAMU

Aidan Holman, Michael Lynn, Axell Rodriguez, Kiryl Zhaliazka and Zack Hoover, Now PhD Students at TAMU

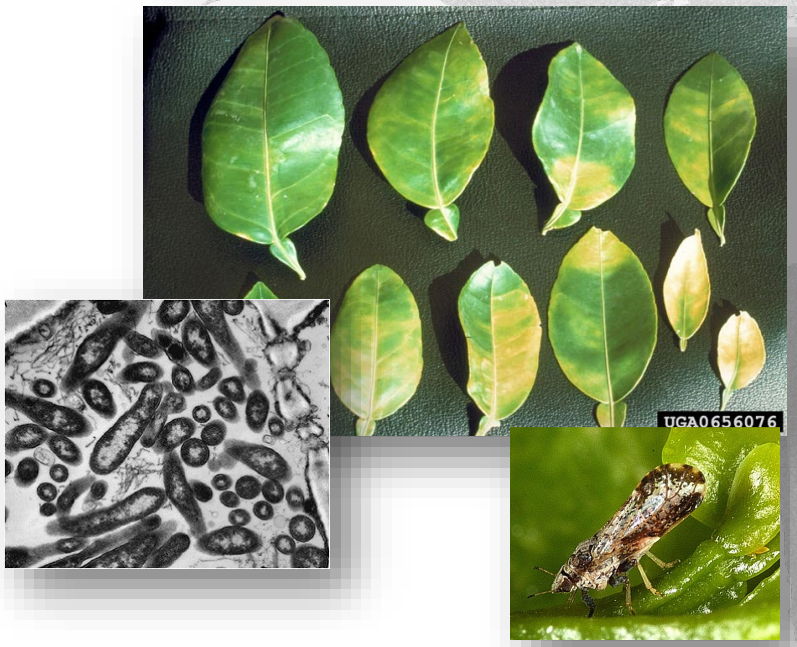
PESTS AND DISEASES OF SIGNIFICANCE TO SOUTH TEXAS AGRICULTURE

Summary

- Focus on pests and diseases of significance to South Texas agriculture.
- Students will be exposed to research methods that include
  - Disease identification using symptomatology, molecular (e.g., PCR), and other advanced early detection technologies,
  - Identification of pests and insect vectors that transmit the various diseases,
  - Sterile plant tissue culture and micropropagation techniques to produce disease-free clean plant materials,
  - Evaluation of novel therapies and antimicrobials in greenhouse or field studies,
  - Collecting scientific experimental results, data analysis, and reporting.
- The ultimate goal is to improve response to emerging zoonotic and agricultural threats through rapid and responsive changes to inspections of products and materials at U.S. ports of entry.

Rio Grande Valley (RGV): Frontline in the fight against invasive agricultural pests and pathogens

***Citrus greening* (*Candidatus* Liberibacter asiaticus and Asian Citrus Psyllid)**



***Potato Zebrachip* (*Candidatus* Liberibacter solanacearum and potato psyllid)**

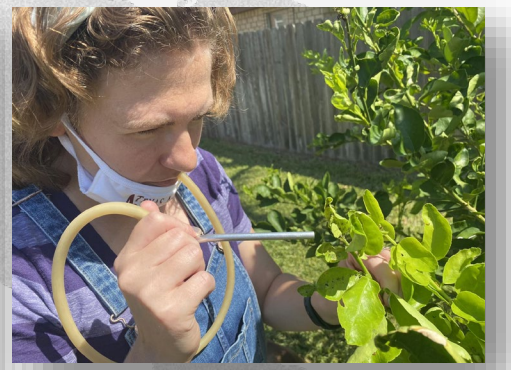
***Pierces Disease* (*Xylella fastidiosa* and glassy winged sharp-shooter)**

Student Training Activities

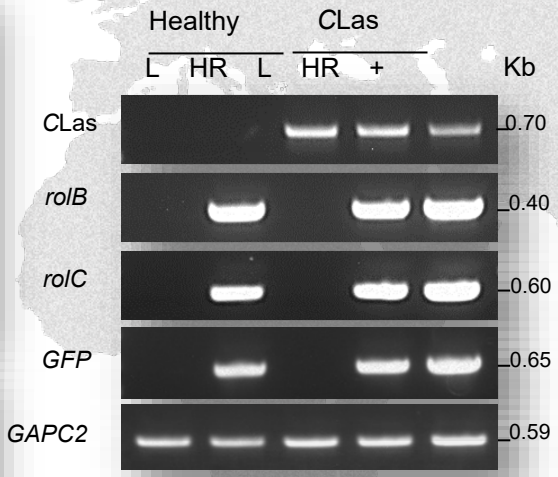
CROSS-BORDER THREAT SCREENING
Center of Excellence

- **Plant pest & disease diagnostics (symptoms, PCR, RAMAN)**

Symptoms and sampling



PCR



RAMAN Diagnostics

Student Training Activities

CROSS-BORDER THREAT SCREENING
Center of Excellence

- Clean plant propagation
- Microbiology and biotechnology

Past Student Trainees

CROSS-BORDER THREAT SCREENING
Center of Excellence

Mandadi Group

Ashley Jacques
UT-RGV Biology
Class of 2017

Stephanie Cantu
UT-RGV Biology
Class of 2018

Carissa Villarreal
UT-RGV Biology
Class of 2019

Victoria R. Garza
UT-RGV Biology
Class of 2019

Romeo Segura
UT-RGV Biology
Class of 2020

Esmeralda Mendez
UT-RGV Biology
Class of 2020

Victoria Mora
TAMUK PLSS

Briana Jacques
UT-RGV Business Administration
Class of 2021

Bibiano Alvarez
UT-RGV Biology
Class of 2023