



Public Health Microbiology and Food Safety Train-the-Trainer Workshop for Changing Climate in Jamaica

Trip Report (December 2024): USAID Project on December 1 to 12, 2024 in Jamaica

*Dr. Aliyar Cyrus Fouladkhah, PhD, MS, MPH, CFS, CPH
Founding Director, Public Health Microbiology FoundationSM
Associate Professor, Tennessee State University
Yale School of Public Health Alumnus*



It was a great pleasure for me to return to beautiful and culturally-rich country of Jamaica to conduct another multi-day climate change, Public Health Microbiology, and food safety workshop for the faculty and students of HEART Institute in Newport, Mandeville, Jamaica. This event was hosted by the HEART Institute and logistics of the event were funded by USAID Partners of America in Washington and Kingston offices. The workshop and certification of the event was sponsored by the Public Health Microbiology FoundationSM in Nashville. During the workshop that was attended by 16 faculty and students of the host institute in addition to FSPCA curriculum that is recognized as adequate by the U.S. Food and Drug Administration for PC QI training associated with human food production, I discussed important information about climate change, microbial food safety, and transboundary infectious diseases with the participants. Excerpts of the teaching material and evaluation of the participants are included in this report. In addition to the workshop, outreach and support were provided to a local food manufacturer and a local department of public health division of environmental health. A PC QI certification workshop using the same curriculum is scheduled in Italy on December 17 2024 with cost of 1,000 Euros per participant and one is scheduled in the United States on May 16, 2025 for \$799 per attendees. Thus, very conservative estimating, the value of sponsorship from Public Health Microbiology FoundationSM for these 16 certificates are \$9,600 (16 certificates of \$600 each) or roughly 1.5 million Jamaican Dollars. Participants additionally received 6 copies of food safety plans (valued at \$20 per attendee) thus the total value of sponsorship from the Public Health Microbiology FoundationSM is \$9,920 USD for this event (\$320 for handouts and \$9,600 for the certificates). A productive and impactful workshop like this event is the result of work of several agencies so I would like to wholeheartedly thank esteemed colleagues in Washington and Kingston USAID Partners of America Program for their support and the host institution for their hospitality and enthusiasm. I wish the participants of workshop further success in implementing the food safety, infectious disease, and climate changes topics that we discussed for further ensuring the safety of great citizens of Jamaica and numerous individuals who visit this great island every year.



Submitted with best wishes,

Aliyar Cyrus Fouladkhah, PhD, MS, MPH, CFS, CPH

Founding Director, Public Health Microbiology Foundation

Associate Professor, Tennessee State University

Yale School of Public Health Alumnus



Climate Change and Food Safety Workshop
Sole/Lead Instructor: Dr. Aliyar Cyrus Fouladkhah
(Dec. 2024 by USAID Partners of America Jamaica)

Participants' Certifications



Public Health Microbiology™
Foundation
Dr. Aliyar Cyrus Fouladkhah

Public Health Microbiology Foundation™:

<https://publichealthmicrobiology.education>



FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

CERTIFICATE OF TRAINING

is awarded to

**in recognition for having successfully completed
the Food Safety Preventive Controls Alliance course:**

delivered by Lead Instructor

completed on

Brian Schaneberg

Brian Schaneberg, PhD, Director
Institute for Food Safety and Health



Gerald Wojtala

Gerald Wojtala, Executive Director
International Food Protection Training Institute



Certificate #

Steve Mandernach

Steve Mandernach, JD, Executive Director
Association of Food and Drug Officials





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Workshop Evaluation by Participants



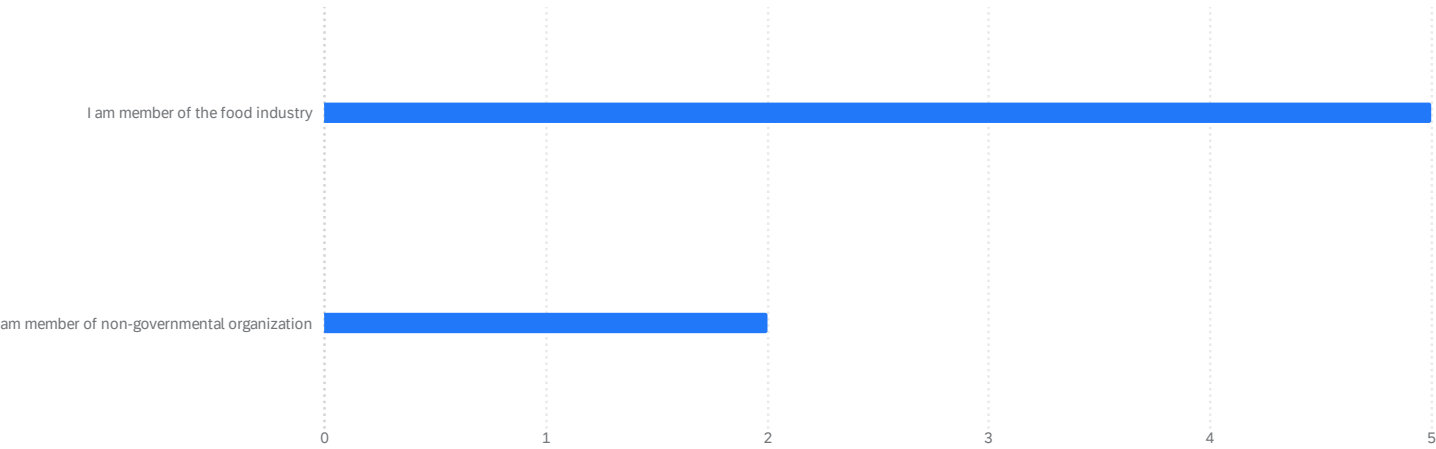
**Public Health Microbiology™
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Responses: 7

What is your primary career association? 7 ⓘ



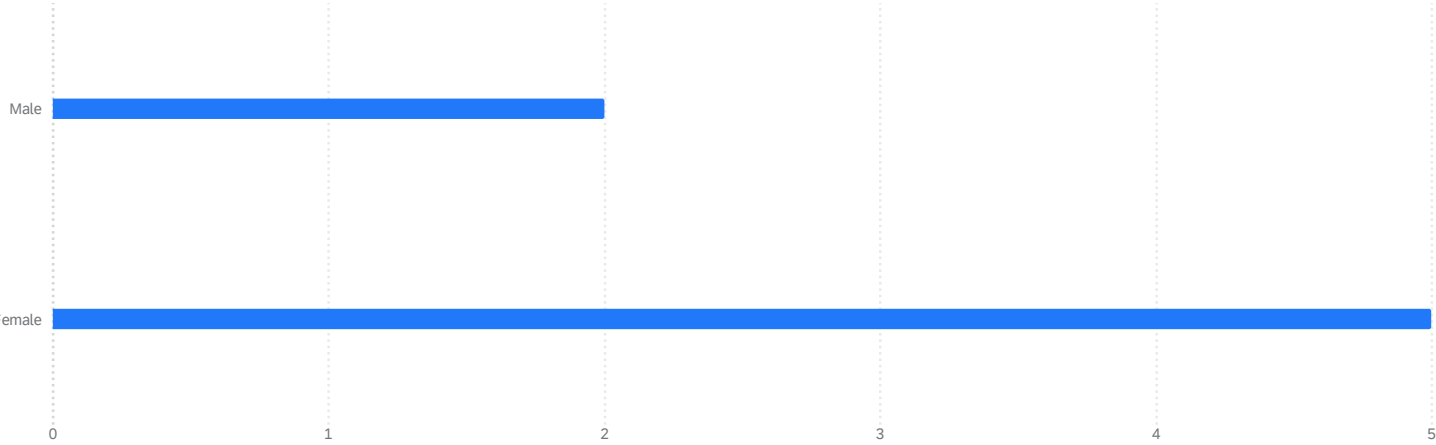
What is your primary career association? 7 ⓘ

Q1 - What is your primary career association?	Percentage	Count
I am member of the food industry	71%	5
I am member of non-governmental organization	29%	2

What is your primary career association? 7 ⓘ

What is your primary career association?	Average	Minimum	Maximum	Count
I am member of the food industry	1.00	1.00	1.00	5
I am member of non-governmental organization	3.00	3.00	3.00	2

What is your gender? 7 ⓘ



What is your gender? 7 ⓘ

Q2 - What is your gender?	Percentage	Count
Male	29%	2
Female	71%	5

What is your gender? 7 ⓘ

What is your gender?	Average	Minimum	Maximum	Count
Male	1.00	1.00	1.00	2
Female	2.00	2.00	2.00	5

How satisfied are you for attending this workshop: 0=Not satisfied at all; 100=extremely satisfied 7 ⓘ

How satisfied are you for attending this workshop: 0=Not satisfied at all;...	Average	Minimum	Maximum	Count
My instructor is knowledgeable of the subject matter.	98.71	91.00	100.00	7
My instructor communicated effectively.	95.57	80.00	100.00	7
My instructor stimulated my interest in the subject.	96.29	89.00	100.00	7
My instructor answered questions thoroughly.	98.29	90.00	100.00	7
My instructor treated all students with respect.	100.00	100.00	100.00	7
I would recommend this instructor to my friends.	97.57	90.00	100.00	7
My knowledge of the subject increased as a result of this workshop.	96.57	90.00	100.00	7
This workshop made a significant contribution to my career.	95.43	76.00	100.00	7

Please share any information or feedback you would like with the instructor about your experience in this workshop: 7 ⓘ

Please share any information or feedback you would like with the instructor...

It was good and enlighten.

This workshop was very informative, I got insights on the impacts of climate change, food safety etc. We were informed about the new technologies and how the world is being affected by certain issues. The instructor made sure that the information was clear, gave ample activities and answered every question.

This workshop has enlightened my know about so many this, it was very informative and the facilitator is extremely knowledgeable. I really appreciate the experience provided to us. Thank you 🙏

I would like some more information on food hazard analysis.

Lesson was well received and excellent time management.

I would like to express my gratitude to Dr. Fouladkhah and his organisation for giving me the opportunity to broaden my knowledge and understanding with the information shared.

Excerpts of Teaching Material



Public Health Microbiology™
Foundation
Dr. Aliyar Cyrus Fouladkhah

Public Health Microbiology Foundation™:

<https://publichealthmicrobiology.education>


**Importance of Food
Safety Modernization Act**

**Implications for North
America**
[12-2-2024]




Aliyar Cyrus Fouladkhah, PhD, MPH, CFS, CPH
Public Health Microbiology Foundation

1



Food Safety Modernization Act (FSMA)

- Signed to law in January of 2011, FSMA is the largest expansion of U.S. food safety authorities since the 1930s.
- Many sectors of agriculture and manufacturing will undergo strict regulations for the **first time in the history of the country**.
- Shifting responses from food safety problems to **proactively prevent** the episodes
- FSMA, a large and comprehensive legislation **broaden FDA's ability** to:
 - Mandatory recall** of contaminated food products
 - Enhanced surveillance** to investigate foodborne illness outbreaks
 - Established **new preventive controls** and food safety plans at some food processing facilities and farms
 - Enhanced FDA's **traceability capacity**
 - Increased inspection** frequencies of high-risk food facilities (both domestic and foreign facilities)
 - Expanded authority and oversight capabilities with regard to **foreign companies**

3

Regulatory Landscape of Food Industry Before FSMA

Very small companies:
Exemption from federal requirements, need to follow state policies

Restaurant operations:
Exemption from federal requirements, need to follow state policies (food code)

Food Safety Inspection Service (FSIS) of USDA:
Meat, Poultry and Egg products, HACCP requirements

Food and Drug Administration of DHHS:
High Risk Foods: Juices, seafood, and shell egg, HACCP requirements

Farmers and other food products:
No federal regulation




2

Mandated by FSMA

- Food manufacturing (processors)
- Farmers and growers (producers)
- Transportation, retailers
- Imported foods
- Third party laboratories
- Local, state, and federal agencies
- Foreign governments

Not mandated by FSMA

- FSMA does not directly address sectors under **pre-existing jurisdictions**. HACCP will remain the dominant regulation for:
 - Meat, poultry, and egg products (USDA-FSIS)
 - Juices, seafood, and shell eggs (DHHA-FDA)
- Very small producers and processors could receive exception from FSMA requirements (**cottage industry**).
- FSMA does not mandate **GM products, antibiotic resistant organisms, organic production, and pesticide and fertilizer use**.



4

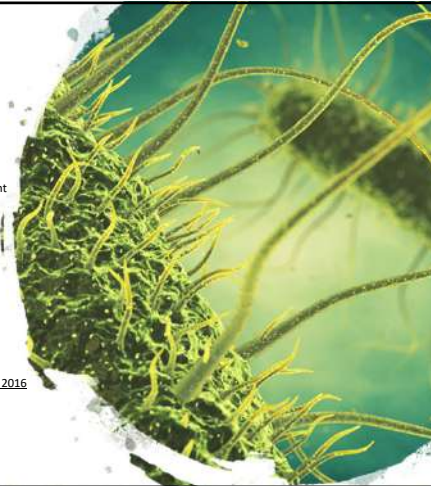
FSMA Implementation Schedule

FSMA was signed into law on **January, 2011**

Regulations were supposed to be finalized within one to two years of enactment (roughly **January 2012 and January 2013**)

Revised implementation dates: (all drafts are currently publicly available)

- **Preventative controls:** FSMA §103(a) and (c): August 30, 2015
- **Foreign supplier verification program:** FSMA §301(a): October 31, 2015
- **Accreditation of third party auditors:** FSMA §307: October 31, 2015
- **Produce safety Rule:** FSMA §105(a): October 31, 2015 (Week 11+ Survey)
- **Sanitary transportation practices for food and feed:** FSMA §111: March 31, 2016
- **Intentional adulteration of food:** FSMA §106(b): May 31, 2016



5

Preventive Control for Human Food Rule: Overview (PC QI)

- Regulate “**processors**”
- Under the regulation all “**facilities**” have to be registered with FDA
- The rule has **two sections**: **Hazard Analysis (HARPC)** and **GMP**, facilities obligated to have one or both.
- **Exemptions:** Juice, seafood, and shell egg sectors and businesses that store agricultural commodities. (differs with preventive rule)

Modified Requirements:

- Three-year average sales less than \$500K, AND
 - Direct sales to restaurants and consumers within 275 mile radius, or
 - Within states sales in 275 mile radius.



7

Produce and Preventive Rules and Land-grant Institutions

- Standards for the Growing, Harvesting, Packing, and Holding of Produce for Human Consumption (**Produce Rule**): **Producers**
- Current Good Manufacturing Practice and Hazard Analysis and Risk-Based Preventive Controls for Human Food (**Preventive Rule**): **Processors**
- Large producers and processors
- Small and medium size producers and processors
- Very small (hobbyists) producers and processors (local and cottage industry)
- Many of small and medium size entrepreneur will require assistance from the nation's 75 land-grant institution for **safe and economical access to market**.



6

Requirements of Preventive Rule cGMP-Current Good Manufacturing Practices

- Similar to prerequisite program in HACCP
- **Nearly all facilities are required** to follow this section of the rule

Exemption:

- (1) Businesses that store agricultural commodities
- (2) Businesses that selling directly to a manufacturing facility like canning operation (vertically integrated farms)

Main Principles:

- Sanitation
- Employee training
- Environmental control and training
- Recall contingency plan
- Allergen control
- Supplier verifications
- Sanitary transportation



8



Release Year	Movie / TV Series	Streaming Service	Release Date	Genre	Rating	Availability	Region	Language	Format
2023	Oppenheimer	Warner Bros. Pictures	Jul 20, 2023	Drama	PG-13	Available	USA	English	4K Ultra HD Blu-ray
	Barbie	Warner Bros. Pictures	Jul 20, 2023	Comedy	PG	Available	USA	English	4K Ultra HD Blu-ray
2022	Spider-Man: Across the Spider-Verse	Sony Pictures Animation	Jun 3, 2022	Animation	PG	Available	USA	English	Digital
	Top Gun: Maverick	Paramount Pictures	May 27, 2022	Action	PG-13	Available	USA	English	4K Ultra HD Blu-ray
2021	Encanto	Walt Disney Animation Studios	Nov 24, 2021	Animation	PG	Available	USA	English	Digital
	On the Beach	Netflix	Oct 15, 2021	Drama	TV-MA	Available	USA	English	Digital
2020	Wonder Woman 1984	DC Studios	Jun 18, 2020	Action	PG-13	Available	USA	English	Digital
	Black Widow	Marvel Studios	Jul 9, 2020	Action	PG-13	Available	USA	English	Digital
2019	Toy Story 4	Pixar Animation Studios	Jun 21, 2019	Animation	PG	Available	USA	English	Digital
	Avengers: Endgame	Marvel Studios	Apr 26, 2019	Action	PG-13	Available	USA	English	Digital
2018	Deadpool 2	20th Century Fox	Dec 14, 2018	Action	PG-13	Available	USA	English	Digital
	Avengers: Infinity War	Marvel Studios	Jul 6, 2018	Action	PG-13	Available	USA	English	Digital
2017	Star Wars: The Last Jedi	Lucasfilm Ltd.	Dec 15, 2017	Science Fiction	PG-13	Available	USA	English	Digital
	Avengers: Civil War	Marvel Studios	May 4, 2017	Action	PG-13	Available	USA	English	Digital
2016	Star Wars: The Force Awakens	Lucasfilm Ltd.	Dec 16, 2016	Science Fiction	PG	Available	USA	English	Digital
	Avengers: Age of Ultron	Marvel Studios	May 1, 2016	Action	PG-13	Available	USA	English	Digital
2015	Star Wars: Episode VII - The Force Awakens	Lucasfilm Ltd.	Dec 18, 2015	Science Fiction	PG	Available	USA	English	Digital
	Avengers: Age of Ultron	Marvel Studios	May 1, 2015	Action	PG-13	Available	USA	English	Digital
2014	Star Wars: Episode VII - The Force Awakens	Lucasfilm Ltd.	Dec 18, 2014	Science Fiction	PG	Available	USA	English	Digital
	Avengers: Age of Ultron	Marvel Studios	May 1, 2014	Action	PG-13	Available	USA	English	Digital
2013	Star Wars: Episode VII - The Force Awakens	Lucasfilm Ltd.	Dec 18, 2013	Science Fiction	PG	Available	USA	English	Digital
	Avengers: Age of Ultron	Marvel Studios	May 1, 2013	Action	PG-13	Available	USA	English	Digital
2012	Star Wars: Episode VII - The Force Awakens	Lucasfilm Ltd.	Dec 18, 2012	Science Fiction	PG	Available	USA	English	Digital
	Avengers: Age of Ultron	Marvel Studios	May 1, 2012	Action	PG-13	Available	USA	English	Digital
2011	Star Wars: Episode VII - The Force Awakens	Lucasfilm Ltd.	Dec 18, 2011	Science Fiction	PG	Available	USA	English	Digital
	Avengers: Age of Ultron	Marvel Studios	May 1, 2011	Action	PG-13	Available	USA	English	Digital
2010	Star Wars: Episode VII - The Force Awakens	Lucasfilm Ltd.	Dec 18, 2010	Science Fiction	PG	Available	USA	English	Digital
	Avengers: Age of Ultron	Marvel Studios	May 1, 2010	Action	PG-13	Available	USA	English	Digital
2009	Star Wars: Episode VII - The Force Awakens	Lucasfilm Ltd.	Dec 18, 2009	Science Fiction	PG	Available	USA	English	Digital
	Avengers: Age of Ultron	Marvel Studios	May 1, 2009	Action	PG-13	Available	USA	English	Digital
2008	Star Wars: Episode VII - The Force Awakens	Lucasfilm Ltd.	Dec 18, 2008	Science Fiction	PG	Available	USA	English	Digital
	Avengers: Age of Ultron	Marvel Studios	May 1, 2008	Action	PG-13	Available	USA	English	Digital
2007	Star Wars: Episode VII - The Force Awakens	Lucasfilm Ltd.	Dec 18, 2007	Science Fiction	PG	Available	USA	English	Digital
	Avengers: Age of Ultron	Marvel Studios	May 1, 2007	Action	PG-13	Available	USA	English	Digital
2006	Star Wars: Episode VII - The Force Awakens	Lucasfilm Ltd.	Dec 18, 2006	Science Fiction	PG	Available	USA	English	Digital
	Avengers: Age of Ultron	Marvel Studios	May 1, 2006	Action	PG-13	Available	USA	English	Digital
2005	Star Wars: Episode VII - The Force Awakens	Lucasfilm Ltd.	Dec 18, 2005	Science Fiction	PG	Available	USA	English	Digital
	Avengers: Age of Ultron	Marvel Studios	May 1, 2005	Action	PG-13	Available	USA	English	Digital
2004	Star Wars: Episode VII - The Force Awakens	Lucasfilm Ltd.	Dec 18, 2004	Science Fiction	PG	Available	USA	English	Digital
	Avengers: Age of Ultron	Marvel Studios	May 1, 2004	Action	PG-13	Available	USA	English	Digital
2003	Star Wars: Episode VII - The Force Awakens	Lucasfilm Ltd.	Dec 18, 2003	Science Fiction	PG	Available	USA	English	Digital
	Avengers: Age of Ultron	Marvel Studios	May 1, 2003	Action	PG-13	Available	USA	English	Digital
2002	Star Wars: Episode VII - The Force Awakens	Lucasfilm Ltd.	Dec 18, 2002	Science Fiction	PG	Available	USA	English	Digital
	Avengers: Age of Ultron	Marvel Studios	May 1, 2002	Action	PG-13	Available	USA	English	Digital
2001	Star Wars: Episode VII - The Force Awakens	Lucasfilm Ltd.	Dec 18, 2001	Science Fiction	PG	Available	USA	English	Digital
	Avengers: Age of Ultron	Marvel Studios	May 1, 2001	Action	PG-13	Available	USA	English	Digital
2000	Star Wars: Episode VII - The Force Awakens	Lucasfilm Ltd.	Dec 18, 2000	Science Fiction	PG	Available	USA	English	Digital
	Avengers: Age of Ultron	Marvel Studios	May 1, 2000	Action	PG-13	Available	USA	English	Digital
1999	Star Wars: Episode VII - The Force Awakens	Lucasfilm Ltd.	Dec 18, 1999	Science Fiction	PG	Available	USA	English	Digital
	Avengers: Age of Ultron	Marvel Studios	May 1, 1999	Action	PG-13	Available	USA	English	Digital

*Total annual sale: the categories differ in preventive and produce rules.

Developed by the
FSPCA
FISH SPOON POND CATCHING ASSOCIATION





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Photos courtesy: Adobe Stock, royalty (standard license) purchased by public health microbiology laboratory

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Participant Manual

COURSE TYPE	LEAD INSTRUCTOR	COURSE START	WEB ADDRESS TO REGISTER	COST	CONTACT EMAIL	ADDRESS	LANGUAGE	FORMAT
Animal Food	RACHEL MONTGOMERY	Jan 2, 2023	Register	USD 795	Contact	Montgomery, Lisa, Interchange Industry- Experienced Lead Instructor, Parlat Day, Comment Eastern to Pacific United States	English	Virtual - Online, Web Based Live
Animal Food	RACHEL MONTGOMERY	Dec 5, 2022	Register	USD 795	Contact	Montgomery, Lisa, Interchange Industry- Experienced Lead Instructor, Parlat Day, Comment Eastern to Pacific United States	English	Virtual - Online, Web Based Live
Animal Food	RACHEL MONTGOMERY	Nov 7, 2022	Register	USD 795	Contact	Montgomery, Lisa, Interchange Industry- Experienced Lead Instructor, Parlat Day, Comment Eastern to Pacific Time United States	English	Virtual - Online, Web Based Live
Animal Food	Ella Said	Dec 21, 2022	Register	USD 795	Contact	Live Virtual - Live Virtual United States	English	Virtual - Online, Web Based Live
Animal Food	Ella Said	Nov 2, 2022	Register	USD 795	Contact	Live Virtual - Live Virtual United States	English	Virtual - Online, Web Based Live
Animal Food	RACHEL MONTGOMERY	Feb 6, 2023	Register	USD 795	Contact	Montgomery, Lisa, Interchange Industry- Experienced Lead Instructor, Parlat Day, Comment Eastern to Pacific United States	English	Virtual - Online, Web Based Live
Animal Food	RACHEL MONTGOMERY	May 8, 2023	Register	USD 795	Contact	Montgomery, Lisa, Interchange Industry- Experienced Lead Instructor, Parlat Day, Comment Eastern to Pacific United States	English	Virtual - Online, Web Based Live

Animal Food PC QJ:
https://fspca.force.com/FSPCA/s/courselist?language=en_US

14

Dear Dr. Aliyar,

Great talking to you this afternoon. Below is some preliminary information about the litigation we have:

We purchased an ingredient from [redacted] Corp, which was labeled as a Natural Flavor. It's use was as a natural preservative for a fresh cheese spread type of product.

This ingredient was successfully tested in our product and was used in the commercialization of our product which got sold to Cargill. After the product launched, Bavaria notified us of a potential allergen issue. Update as a result of Lupin extract being present in their product which was deemed as an allergen. We had no problem with this, as we would handle it through a label update on our end and also at the customers end. However, during these conversations, we started suspecting that Bavaria was not being transparent as to the source of the lupin extract. After pushing them for full disclosure, they connected us with their supplier which told us in writing and via conference call that the lupin extract was [redacted] from Portugal was only sent to them as an experimental sample, and that it had not received approval to be used as a food ingredient for consumption.

Additionally, [redacted] had not followed or complied with the foreign material verification process by FDA and therefore sold us a product containing an ingredient illegally imported into the US.

Once we learned about these details, we withdrew the product from Cargill causing us a 400k+ liability. We filed a law suit with [redacted] to recover these costs.

In summary, [redacted] sold an adulterated ingredient with an ingredient illegally imported, not GRAS listed, that contained an agricultural pesticide called BLAD that <https://www.ars.usda.gov/tech/hot-active-ingredient/> which was not sold to them, but rather sent to them by CEV as an experimental sample.

Let me know if with this information you feel that you could help us and I will be happy to connect you with our attorneys.

I really appreciate it and look forward to hearing your thoughts.

Regards,

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Global Public Health Burden of our Changing Climate

Aliyar Cyrus Fouladkhah, PhD, MPH, MACE, CFS, CPH
Associate Professor, Microbial Food Safety/Epidemiology
Faculty Director, Public Health Microbiology Laboratory
Founding Director, Public Health Microbiology Foundation
Tennessee State University

Presented at:
December 2, 2024
USAID F2F Partners of America- Jamaica

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Presentation Content

Part I: Brief Introduction to my Program

Part II: Global Climate Change Impact

Part III: Public Health Microbiology Under the Landscape of Climate Change



- Microbiology and Food Safety, PhD (CSU)
- Applied Statistics and Data Analysis, Graduate Certificate (CSU Statistics Dept.)
- Food Science & Human Nutrition, MS (CSU Food Science Dept.)

Yale SCHOOL OF PUBLIC HEALTH

- Biostatistics and Epidemiology, Advanced Professional MPH
- Food and Drug Regulatory Affairs, Graduate Certificate
- Climate Change and Health, Graduate Certificate



Website: <https://yesh.yale.edu/school-of-public-health/graduate-program/accelerated-mph-program/>
Video: <https://www.youtube.com/watch?v=GVN6f6d4>

Public Health Microbiology Laboratory Tennessee State University

MPH Curriculum Food Safety and Applied Epidemiology (now under CEPH certification)

- ❖ Secured extramural support >\$4.5M as PD or Co-PD since 2015
- ❖ **Funding sources**
- (1) **Dean's Office:** \$10,000/year and a Research Technician
- (2) **Association of Food and Drug Officials (AFDO)** Process Authority: \$15-50K per year depending on the projects
- (3) **Extramural Funding:** >\$4.5M since 2015
- ❖ National Institute of Health: **\$33,680** (PD of Sub-award, 2020-21)*
- ❖ Pressure BioScience Inc.: **\$35,000** (Role: PD, 2019-2024)
- ❖ USDA-NIFA CBG: **\$350,000** (Role: PD, 2018-2022)
- ❖ USDA-NIFA HEC: **\$50,000** (Role: PD, 2018-2021)
- ❖ USDA-NIFA FSOP: **\$165,000** (Role: PD, 2018-2021)
- ❖ Pressure BioScience Inc.: **\$23,500** (Role: PD, 2017-2019)
- ❖ USDA-NIFA FSOP: **\$59,750** (Role: PD, 2016-2019)
- ❖ Pressure BioScience Inc.: **\$9,400** (Role: PD, 2017-2019)
- ❖ NIFA FSOP: **\$880,000** (Role: CO-PD, 2019-2023)**
- ❖ USDA-NIFA FSOP: **\$1,197,751** (Role: CO-PD, 2015-2020)**
- ❖ NIFA CBG: **\$300,000** (Role: CO-PD, 2018-2022)

*Pending account setting and internal administrative approval.
** Sub-awardee of Southern Center Main Awards.



Public Health Microbiology™
Foundation
Dr. Aliyar Cyrus Fouladkhah

Website: <https://publichealthmicrobiology.education/>



PROSPECTIVE STUDENTS, EDUCATORS, AND SHAREHOLDERS



Website performance: 4/22/2020

Public Health Microbiology Laboratory Success Story- Extramurally Funded Student

- Recent Graduates/Alumni
- Dr. Niamul Kabir (Currently: Assistant Professor in Albany State U.)
- Dr. Abimbola Allison (Currently: Faculty Member in TSU Biological Sciences)
- Dr. Sadat Naraghi- Visiting Scholar (Currently: VUMC- Research Instructor)
- Ms. Sabrina Wadood (Microbiologist in Nashville)
- Ms. Monica Henry-Smith, MS (TN Government-Cargill)



Students Awards

Adviser: A. Fouladkhah

> 50 awards and Scholarships (2017-2022)

Students Success Available at:
<https://publichealthmicrobiology.education/students-awards>

Public Health Microbiology Laboratory

2021 Tennessee Academy of Science

Virtual Health and Medical Sciences Division

Students: Samira H. Wadood (center left) and Sadique Aris (center right) won first and second place in the oral and poster events at the 2021 Tennessee Academy of Science competitions.

2020 Tennessee Academy of Science

Virtual Health and Medical Sciences Division

1st (S. Wadood), 2nd (S. Aris), 3rd (N. Kabir). Adviser: A. Fouladkhah

2019 Tennessee Academy of Science

Health and Medical Sciences Division

1st (A. Allison), 2nd (S. Aris), 3rd (M. Henry). Adviser: A. Fouladkhah

2018 Tennessee Academy of Science

Health and Medical Sciences Division

1st (M. Henry), 2nd (A. Allison), 3rd (J. Adhikari). Adviser: A. Fouladkhah

M. Henry (2nd from left), Outstanding MS Student in College of Agriculture, Received an Award from Dean Reddy.

Annual State-Wide Competitions For Food Safety Modernization Act, Food Safety and Infectious Disease Students

- Networking and Stakeholder Engagement
- Competition
- Regulatory Compliance Booth
- Tour of HPP Facilities
- Categories:
- Graduate Poster and Oral
- Undergraduate Poster
- Emerging Leader (Post Doc and recent graduates) [Added in 2020]
- 2017-2021: 39 funded award (extramural grants of A. Fouladkhah)



Available at: <https://publichealthmicrobiology.education/annual-competitions>

Annual State-Wide Competitions For Food Safety Modernization Act, Food Safety and Infectious Disease Students

A. Fouladkhah: Competition Founder and Director

5th (2021) Annual State-Wide Competition for Food Safety Modernization Act, Food Safety, and Food Science Students

Students Awarded Public Categories:

- Best Poster: Sadique Aris, University of Tennessee at Chattanooga (UT Chattanooga)
- Best Oral: Sadique Aris, University of Tennessee at Chattanooga (UT Chattanooga)
- Best Graduate Poster: Sadique Aris, University of Tennessee at Chattanooga (UT Chattanooga)
- Best Graduate Oral: Sadique Aris, University of Tennessee at Chattanooga (UT Chattanooga)
- Best Undergraduate Poster: Sadique Aris, University of Tennessee at Chattanooga (UT Chattanooga)
- Best Undergraduate Oral: Sadique Aris, University of Tennessee at Chattanooga (UT Chattanooga)

Graduate Oral Competition for Students:

- Best Poster: Sadique Aris, University of Tennessee at Chattanooga (UT Chattanooga)
- Best Oral: Sadique Aris, University of Tennessee at Chattanooga (UT Chattanooga)

Undergraduate Oral Competition for Students:

- Best Poster: Sadique Aris, University of Tennessee at Chattanooga (UT Chattanooga)
- Best Oral: Sadique Aris, University of Tennessee at Chattanooga (UT Chattanooga)

SPACE FOOD: PRESENT AND FUTURE

Vickie L. Khoris

Former Manager International Space Station Food System

Also Available at: <https://www.ifl.org/events/event-listing/2020-sep-4th-annual-statewide-competition-for-food-safety-modernization-act-food-safety-and-food-science-stud>

Teaching in Tennessee and Internationally

Teaching in Tennessee and Internationally

Graduate Course in Food Policy and Regulations

2020 Student Evaluation:

- "Dr. Fouladkhah is easily the nicest professor I have ever had the pleasure of meeting. He seriously cares about you and how you're doing."
- "I loved this class it was so interactive and different from any other class I have taken here at TSU!"

2019 Student Evaluation:

- "Dr. Fouladkhah is an excellent professor. He does the absolute best job of making students feel comfortable making discussion in class and is exceptionally knowledgeable in the area of food sciences. The in class exercises are definitely helpful to make sure the lectures are being retained and assists in requiring little to no studying outside of the class meetings."
- "This course is top notch, one of the best courses I have ever taken. Much gratitude to the lead instructor Dr. Fouladkhah. I learned so much in the class and my knowledge on food policies and regulation has increased a thousandfold."
- "Everything was well organized, I think it is perfect. Nothing else is needed."

2018 Student Evaluation:

- "This man is so amazing. Learned so much in his class thank you Dr. Fouladkhah."
- "He is very helpful and always very encouraging. He helped me planned my studies and even future goals."

Additional Global Health Information Available at:

<https://publichealthmicrobiology.education/global-health-programs>

2022: Georgia, Columbia

March 2020/2021

2020, and 2022, Haiti

Haiti Government, Fortification with iron, vitamin b12, and zinc

2019, Philippines Township, Cape Town, South Africa:

HIV Prevention Training

2018, 2020, 2022 Guatemala

Food Safety Training for Food Industry Leadership

2017 Santiago, Dominican Republic

USAID Public Health and Microbiology Training Faculty and Staff of ISA University

2017, 2018, 2019, 2020, 2021, 2022

USAID Public Health and Microbiology Training Faculty and Staff of ISA University

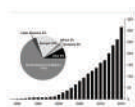
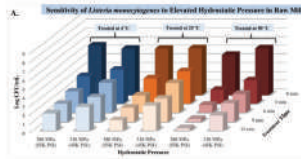
Research Responsibility:

1. Elevated Hydrostatic Pressure
2. Bacterial Biofilm
3. Effects of Climate Change on Infectious Diseases

PBI Pressure BioSciences Inc.



- Elevated Hydrostatics Pressure:
- Hub880, up to **650 MPa**
- Deepest part of Oceans (Mariana Trench): c. **110 MPa**
- Programable unit Hub 440, 380 MPa
- Controlling the temperature
- Synergism with bacteriocin and bactericidal compounds

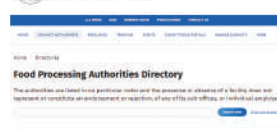


High Pressure Processing, Public Health Microbiology Laboratory

High Pressure Processing, Public Health Microbiology Laboratory
Information about the units: <https://pressurebiosciences.com/press-releases/detail/284/pressure-biosciences-announces-commercial-release-of-the>

Process Authority

Association of Food and Drug Officials
https://www.afdo.org/directories/fpa/results/?loc=Tennessee



As of 2023:
> 106 companies

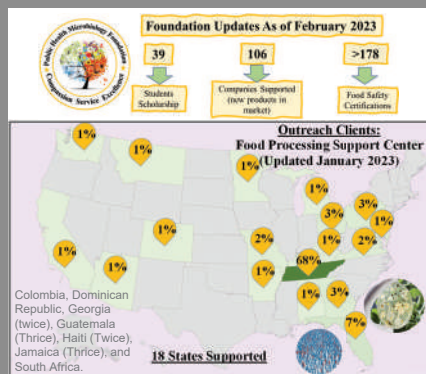
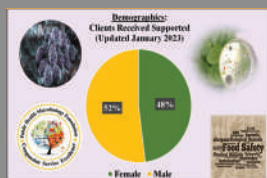
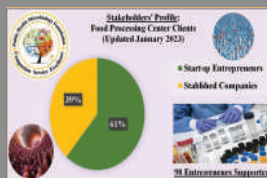


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246 Glenstone Circle,
Nashville, Tennessee 37227

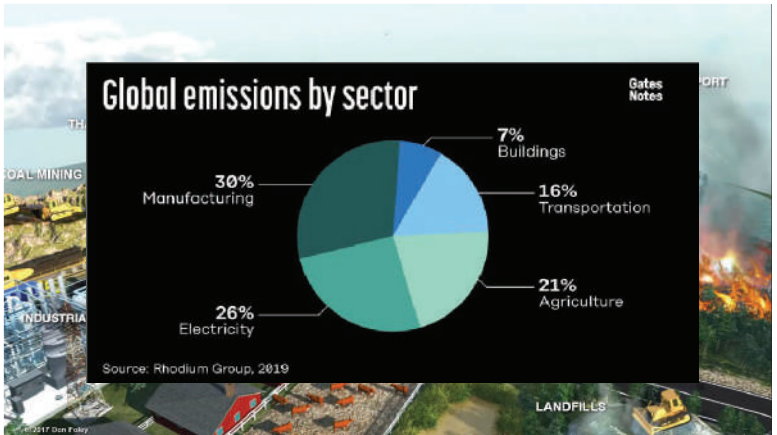
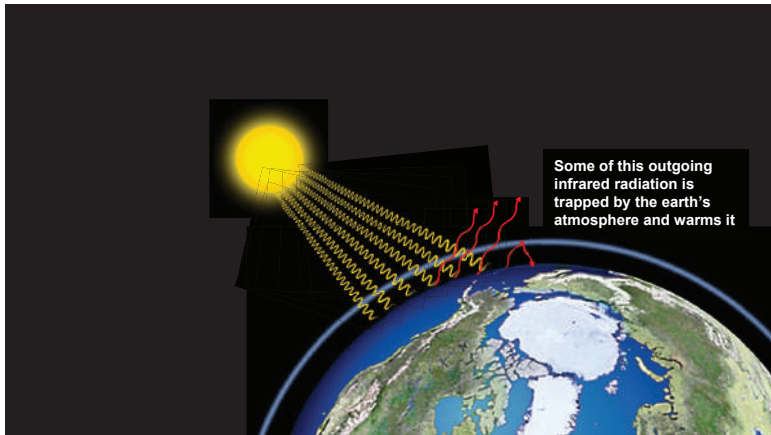
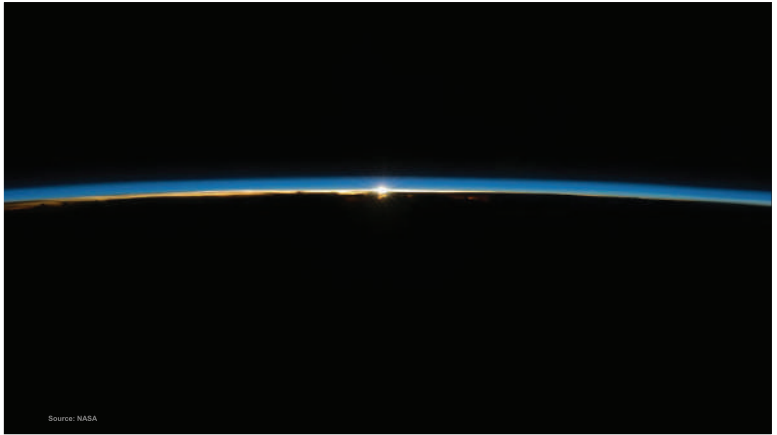
FOOD TYPE:
USDA Regulated Products,
FDA Regulated Products

FOOD PROCESS:
Acidified Foods, HACCP,
Food Safety Modernization
Act, Thermal Processing,
Low Temperature
Processing, High Pressure
Processing

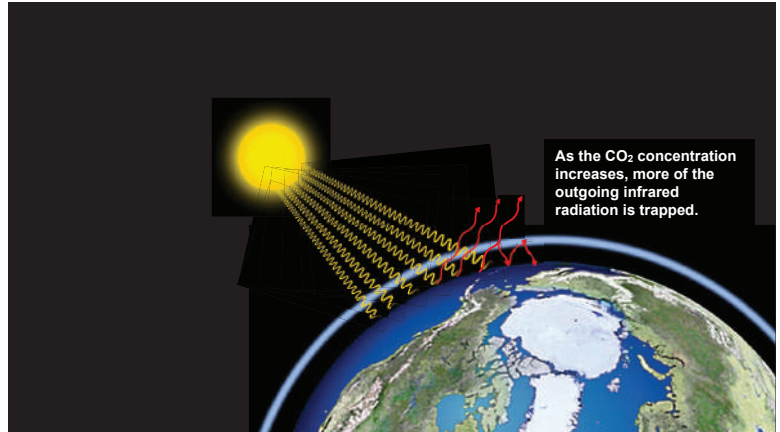
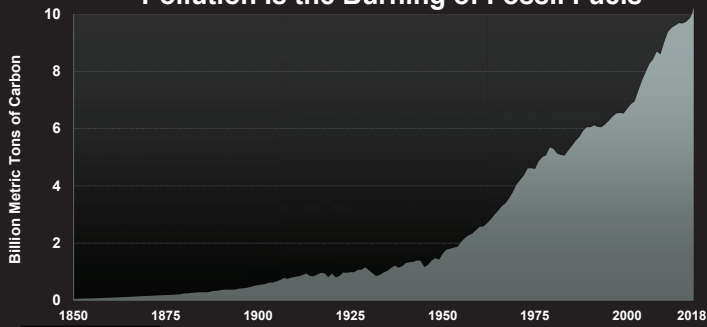


Part II: Global Climate Change in Impact

Public Health Microbiology Laboratory
Tennessee State University, Nashville, TN
A. Fouladkhah: Director, Public Health Microbiology Laboratory



The Largest Source of Global Warming Pollution Is the Burning of Fossil Fuels



The energy trapped by man-made global warming pollution is now
“...equivalent to exploding

600,000

First-generation atomic bombs
per day 365 days per year.”

James Hansen
Former Director, NASA Goddard Institute for Space Studies

At least **224 locations** around the world **set all-time heat records** in 2018.



The Hottest of All Have Been the Last Seven Years
19 of the 20 Hottest Years on Record Have
Occurred Since the Year 2002



Data: NASA/GISS

The U.S. Southeast is projected to warm up to **8 °F** this century.

Of the 100 U.S. counties projected to suffer the worst impacts of the climate crisis, **97 are located in the U.S. South.**

Without steep cuts in greenhouse gas emissions, the average temperature in **South America** could rise **6.7 °C** by 2100.

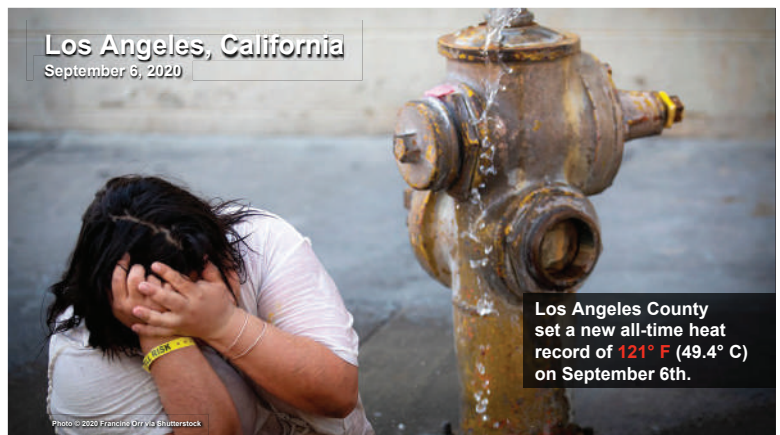
In **Central America**, the temperature could rise by **4 °C**.

By 2040, **90%** of the population in **Colombia and Venezuela** may be threatened by extreme heat.

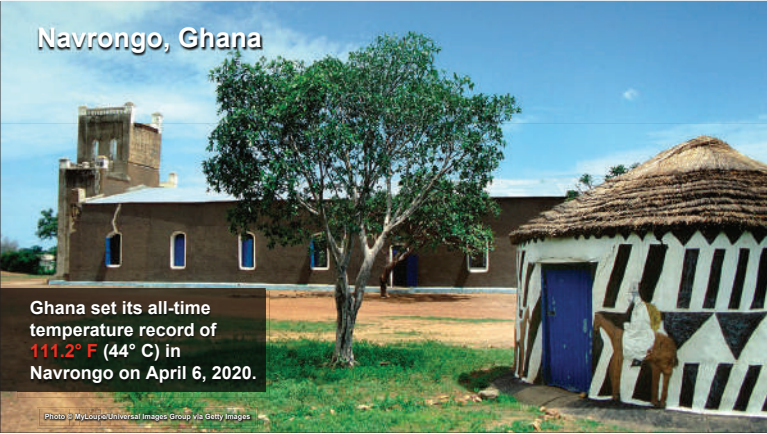
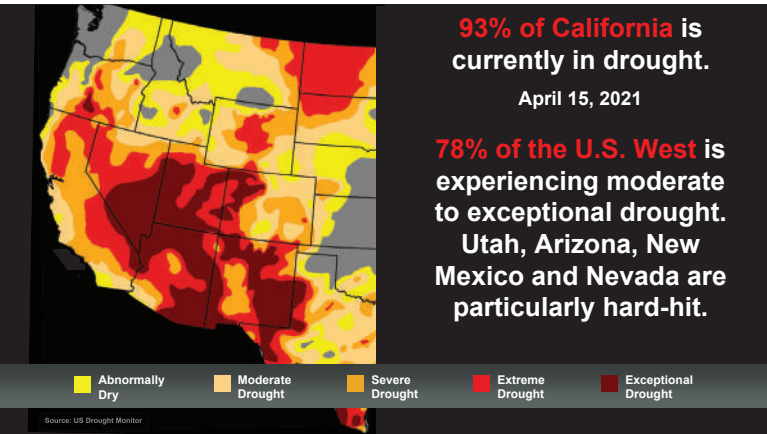
Kuwait City experienced temperatures up to **51° C (124° F)** in July 2017.

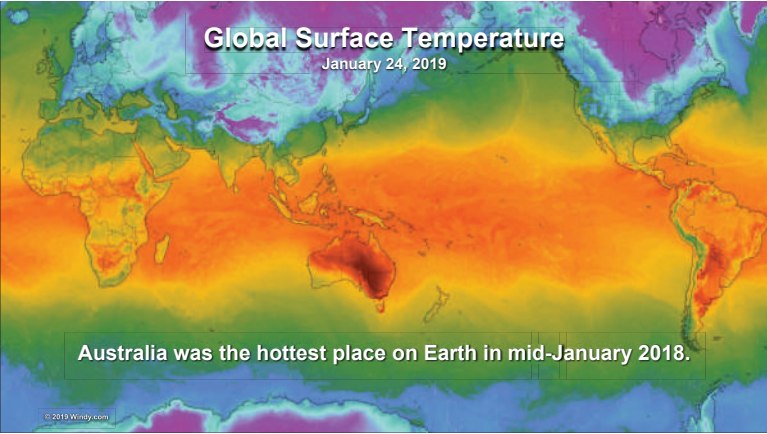
In August, birds in the city died and fell from the sky from heat exposure.

Los Angeles, California
September 6, 2020



Los Angeles County set a new all-time heat record of **121° F (49.4° C)** on September 6th.







**“Unrestrained climate change
means we will see
many more Harveys
in the future.”**

Michael Mann
Director, Earth System Science Center, Penn State
August 2017

Risk of Hurricane Sandy-Intensity Events in New York

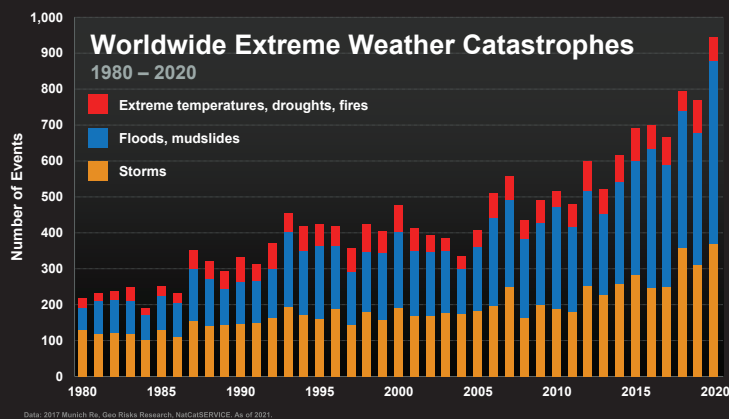
One in
500
Years

One in
25
Years

One in
5
Years

1880 2017 2030–2045
Year

Data: A.J. Garner, et al., "Impact of climate change on New York City's coastal flood hazard: Increasing flood heights from the preindustrial to 2300 CE," PNAS, October 2017
Image: 2012 NASA

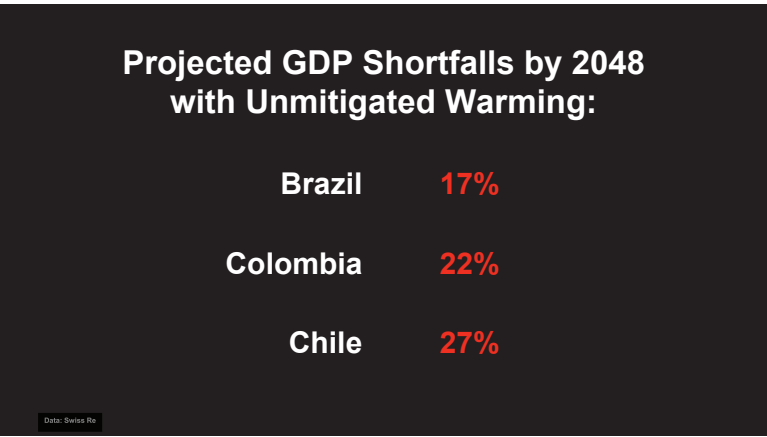


Toa Alta, Puerto Rico
September 28, 2017

For the 20 year period ending in 2019, Puerto Rico ranked #1 on the Global Climate Risk Index for exposure to extreme weather.

Photo © 2017 AP Photo/Gerald Herbert

Hurricane Maria aftermath







Pocone, Brazil
September 26, 2020

Brazil's drought caused \$3 billion in damages in 2020.



Schwüblingsen, Germany
August 22, 2018

2018's droughts in Europe resulted in \$3.9 billion in economic losses.



Rossinière, Switzerland
August 7, 2018

The Swiss Army had to airlift water to thousands of cows affected by drought.



Saint-André-de-Corcy, Ain, France
July 23, 2017





The 2006 – 2010 drought
turned **60%** of Syria's
fertile land into desert

...and drove
1.5 million people
into Syria's
already crowded cities

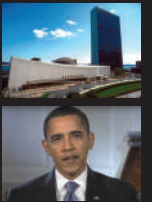
**"...the Syrian minister of agriculture
...stated publicly that economic and social fallout
from the drought was
'beyond our capacity as a country to deal with.'"**

Cable from the U.S. Embassy in Damascus
to the State Department
November 8, 2008

United Nation Building Entrance, NY, USA

"Human beings are members of a whole,
In creation of one essence and soul.
If one member is afflicted with pain,
Other members uneasy will remain.
**If you have no sympathy for human pain,
The name of human you cannot retain."**

Poem from S. Shirazi 1210-1291











“In future, the climate in large parts of the Middle East and North Africa could... render some regions **uninhabitable**, which will surely contribute to the pressure to migrate.”

Jos Lelieveld
The Max Planck Institute for Chemistry
May 2016

The **heat index** in Bandar Mahshahr reached **165° F** (74° C) on July 31, 2015

Safe Minimum Internal Temperature for Food Preparation

Source: <https://www.fda.gov>

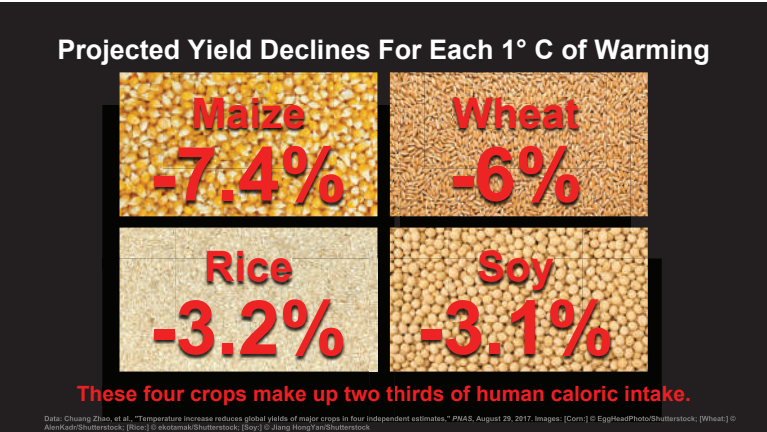
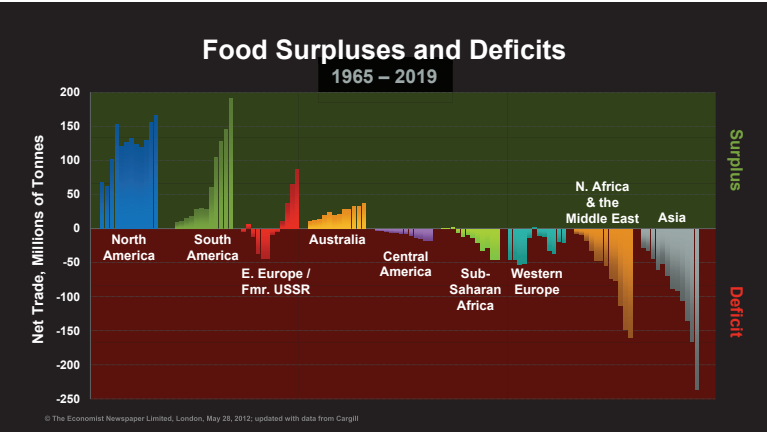
	Beef, Pork, & Lamb: 145 °F (62.8 °C) + rest for 3 min		Ham (fresh uncooked): 145 °F (62.8 °C) + rest for 3 min
	Ground Meats: 160 °F (71.1 °C)		All Poultry: 165 °F (73.9 °C)
	Ground Poultry: 165 °F (73.9 °C)		Eggs: 160 °F (71.1 °C)
	Leftovers & Casseroles: 165 °F (73.9 °C)		Fish & Shellfish: 145 °F (62.8 °C)

Public Health Microbiology Laboratory: Education, Research, Outreach, and Technical Assistance:
<https://publichealthmicrobiology.education/>

Public Health Microbiology Laboratory

The world could see over **1 billion climate migrants** by the end of this century.

The Lancet Countdown Report
October 2017





Sea turtle sex is determined by temperature.

At the northern edge of Australia's Great Barrier Reef, **99% of young green sea turtles are now female.**

Since 1980, 85% of Jamaica coral reefs have been reduced
Coral reefs 0.1% of Oceans, 25% of ocean lives
Recently, great progress by "coral gardeners"


Source: World Wildlife Fund 2015
Photo: © 2008 Alamy Ltd/Alamy/Whitcomb/Alamy

Allergies Will Be Much Worse by 2040

2000

Grains of pollen per cubic meter:

8,455




2040

Grains of pollen per cubic meter:

21,735

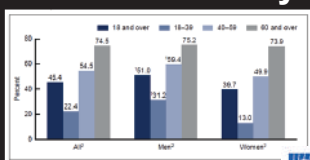
Average pollen counts are specific to North America
Source: Dr. Barbara Bessy, Visiting Professor, Center for Environmental Prediction, SEBS, Rutgers University.
Image: © Jill Fromer/Photodisc/Getty Images

We now risk losing up to **50% of all land-based species** in this century




Most common blood pressure medication (ACE Inhibitor- Captopril) is originally isolated from a snake Venom....

We only have access to non-extinct species.



Category	10 and over	15-20	25-30	35-40	45 and over
AP	45.4	22.4	54.9	74.5	74.5
Mar?	51.0	31.2	70.0	75.2	75.2
Unseen?	38.1	13.0	49.9	73.9	73.9

Source: Nicholas Stern, The Economics of Climate Change
Photo: © Dirk Ercken/Shutterstock




Part III: Public Health Microbiology Under the Landscape of Climate Change

Binary Fission: 20 minutes or less when intrinsic and extrinsic factors are optimal.

Time	# of Bacteria
0 minutes	1
20 minutes	2
40 minutes	4
1 hour	8
2 hours	64
4 hours	4,096
6 hours	262,144
8 hours	16,777,216
12 hours	68,719,476,736

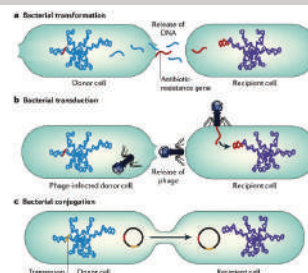
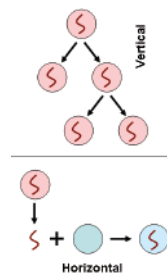
Bacteria	Estimated Infective Dose*
<i>Salmonella</i> serovars	<10 cells
Shiga toxin-producing <i>E. coli</i>	10 to 100 cells
<i>Cronobacter sakazakii</i>	10 to 100 cells
<i>Listeria monocytogenes</i>	<1000 cells
<i>Campylobacter</i> spp.	5000 to 10,000 cells
<i>Staphylococcus aureus</i>	>100,000 cells
<i>Vibrio cholerae</i>	1,000,000 cells

Information and photos are modified and adapted from RDS of Food and Drug Administration, RLM Resources of Centers for Disease Control and Prevention, Photo Courtesy: Adobe Stock (unpublished license of photos purchased by the Public Health Microbiology Laboratory)

Public Health Microbiology Laboratory: Education, Research, Outreach, and Technical Assistance: <http://publichealthmicrobiology.education/>

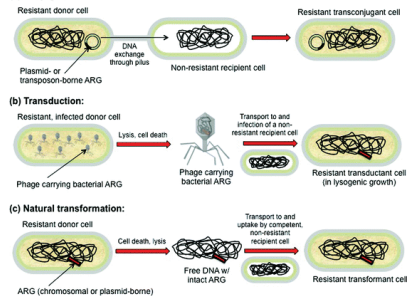


Photo Courtesy:
http://www.daviddarling.info/encyclopedia/B/binary_fission.html

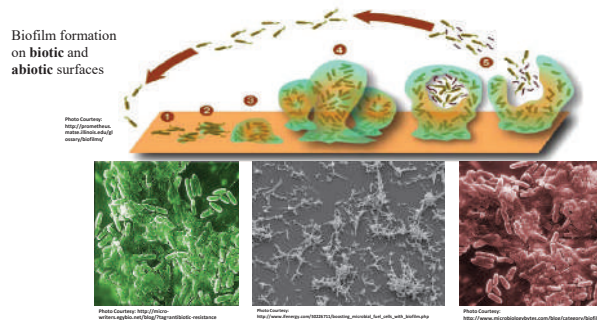


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(a) Conjugation:

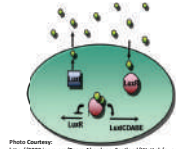
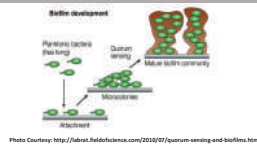
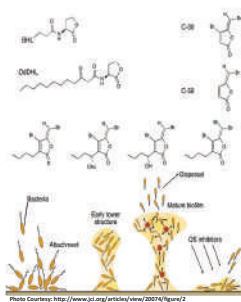


Planktonic cells and Biofilm Communities



Quorum Sensing and Biofilm formation

Shiga toxin producing *E. coli*, not antibiotic treatment due to Quorum Sensing Concerns



Infectious Diseases is a Moving Target...

- It is estimated only 1% of microbial community has been identified.
- Currently **etiological agent** of 80.3% of foodborne illnesses, **56.2% of hospitalization**, and 55.5% of deaths remain unknown (in a typical year, Scallan et al., 2011).

“Emerging” Pathogens:

- Vertical and horizontal gene transfer spores and biofilm formation
- Quorum sensing and cell to cell communication

“It is the microbes who will have the last word.”
-Louis Pasteur

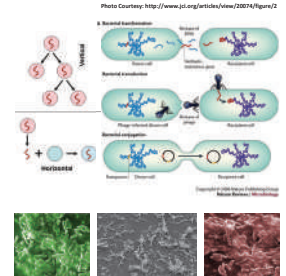
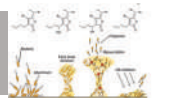


Photo Courtesy: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC282741/figure/fig1>
http://www.themagazine.com/2012/07/10/Quorum_sensing_microbial_communication
<http://www.scribd.com/doc/100000000/Quorum-sensing-microbes>

Epidemiology of Foodborne Diseases in the United States

Based on data from 1990s: (Mead et al., 1999)

76 million illnesses, 323,000 hospitalizations, 5,200 deaths in the United States.

More recent estimates show: (Scallan et al., 2011)

- 47.8 million illnesses, 127,839 hospitalizations, and more than 3,037 deaths in the United States. (c. 1.7M cases **300K deaths/year of sepsis**)
- 9.4 million illnesses, 55,961 hospitalizations, and 1,351 deaths are caused by 31 known foodborne agents.
- In addition to consumer insecurity, foodborne diseases cause around **\$77.7 billion** for losses in productivity and economical losses.
- Approximately 30% of population are especially “at risk” for foodborne diseases (The YOP’s: The young, the old, Pregnant, and Immunocompromised)

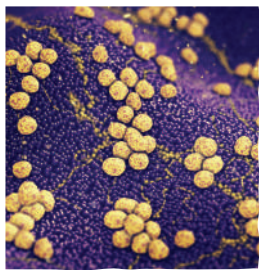


Significant foodborne pathogens...

based on Mead et al., 1999 and Scallan et al., 2011 studies

- Leading etiological agents for illnesses:** **Norovirus** (58%), Nontyphoidal *Salmonella* serovars (11%), *Clostridium perfringens* (10%), and *Campylobacter* spp (9%).
- Leading etiological agents for hospitalization:** Nontyphoidal *Salmonella* serovars (35%), **Norovirus** (26%), *Campylobacter* spp (15%), and *Toxoplasma gondii* (8%).
- Leading etiological agents for death:** Nontyphoidal *Salmonella* serovars (28%), *T. gondii* (24%), *Listeria monocytogenes* (19%), and **Norovirus** (11%).





Signs and Symptoms of Foodborne Diseases

- Mild illness (no medical care sought)
- **Guillain-Barré syndrome** (*Campylobacter* and *Salmonella*)
- **Post-infectious irritable bowel syndrome** (*Campylobacter* and *Salmonella*)
- **Reactive arthritis** (*Campylobacter* and *Salmonella*)
- **Haemolytic uraemic syndrome** (*E. coli* O157)
- **End-stage renal disease** (*E. coli* O157)
- Death

Significant foodborne pathogens...

based on Scallan et al., 2015 study

- **Disability adjusted life year (DALY)**. DALY: *Loss of life and health due to illness*

One DALY can be thought of as one **lost year of "healthy" life**.

- Non-typhoidal *Salmonella* (329000)
- Toxoplasma (32700)
- *Campylobacter* (22500)
- Norovirus (9900)
- *Listeria monocytogenes* (8800)
- *Clostridium perfringens* (4000)
- *Escherichia coli* O157 (1200)

DALY = YLL + YLD

YLL: Years of Life Lost (YLL) due to **premature mortality** in the population
YLD: Years Lost due to Disability (YLD) for **people living with the health condition**

Source: WHO, 2019

62% bacterial agents; 29% parasitic agents; 9% viral agents

Are these outbreaks associated with corporates and lager manufactures?

Prevalence of Pathogens in Medium-sized Poultry Operations

- 200–300 ft houses, 3000 to 5000 birds, conventional operation

(Alali et al., 2010)

	<i>Salmonella</i> serovars
Fecal samples (n=420)	38.8%
Feed (n=140)	27.5%

- Total of 135 sample from commercial free-range chicken producers (Bailey et al., 2005)

	<i>Salmonella</i> serovars
Chicken Carcasses in Operation 1	64%
Chicken Carcasses in Operation 2	31%

Alali et al., 2010, *J Foodborne Pathogens and Diseases*; Bailey et al., 2005, *J Food Protection*

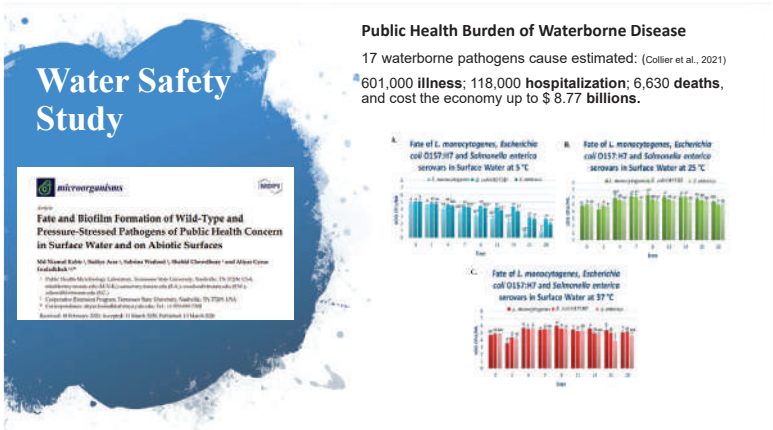
Prevalence of Pathogens in Small Poultry Farms

- Study of 60 Small poultry slaughterhouses (fewer than 200 birds slaughtered per day)

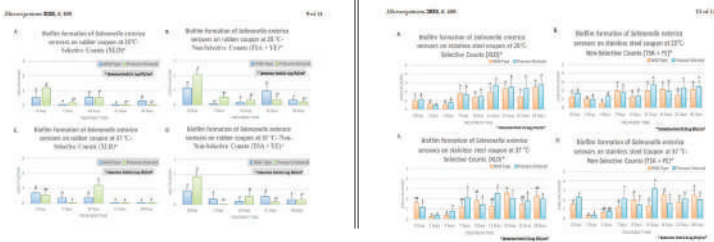
Sampling sites	Salmonella serovars (Albany, Hadar, Indiana, and Enteritidis sub-species)
Carcasses after slaughter	42%
Utensils	23.1%
Storage freezers and refrigerators	71.4%

- The Study concluded “The widespread occurrence of Salmonella in small slaughterhouses reinforces the need for implementation of effective control measures...”

Terumi et al., 2000, Journal of Food Protection



Water Safety Study- Biofilm Formation on Abiotic Surfaces



Salmonella serovars (Non-typhoidal)



- Annual illness (death): 1,027,561 (378) in humans
- Infection causes nausea, vomiting, diarrhea, fever, headache
- Primary sources: Intestinal tract of people and animals
- Transmitted by meat, poultry, eggs, raw milk, unpasteurized juice, many other foods (nuts, spices, produce, chocolate, flour)
- Contributing factors: cross-contamination, undercooked food, poor agricultural practices

Growth parameters	Minimum	Optimum	Maximum
Temperature	41°F (5.2°C)	95-109°F (35-43°C)	115°F (46.2°C)
pH	3.7	7-7.5	9.5
a _w	0.94	0.99	>0.99
Other	Non-spore former		
Atmosphere	Facultative - grows with or without oxygen		

Sources: ICMSF 1995 and Bad Bug Book 2nd edition, Scallan et al., 2011, and FSPCA

Climate Change and Public Health Microbiology

Non-typhoidal *Salmonella enterica* serovars

- Global death: 50,000 global death in 2010 (WHO, 2020)
- Public Health Burden in the U.S.: >1 million annual cases in 2011 (CDC, 2011)

Climate Change:

- 1 °C increase : 5 to 10% increases in Salmonellosis (WHO, 2010)
- 2500 to 5000 additional global death
- 50,000 to 100,000 U.S. morbidity

At our current rate (2021 IPCC report)

- >1.5 °C by 2040
- >4.8 °C by 2100



Vibrio spp.

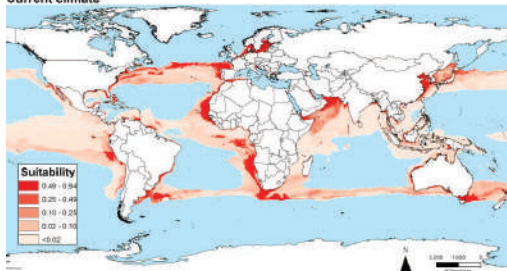
Currently 760,000 global illness/24,000 death per year.

- Causing about 80,000 illness and 100 death annually in the United States.
- Infection symptoms vary depending on strain, ranging from diarrhea to high fever
- Vibrio* is a **halophilic bacterium** and is a major concern in aquaculture industry
- Primary sources: Salt water environments and seafood
- Requires salt to reproduce (halophile)

Growth parameters	Minimum	Optimum	Maximum
Temperature	41°F (5°C)	99°F (37°C)	114°F (45.3°C)
pH	4.8	7.8-8.6	11
a _w	0.94	0.98	0.996 (10% NaCl)
Other	Non-sporeformer, requires salt		
Atmosphere	Facultative - grows with or without		

Vibrio cholerae proliferation in sea water: Current Climate

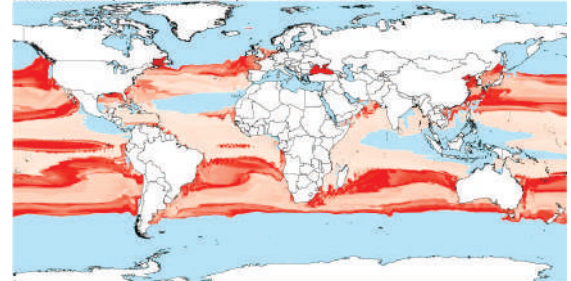
Vibrio Cholerae: currently 760,000 global illness/24,000 death per year
Current climate



Escobar LE et al. Acta Tropica 2015;149:202-11

Vibrio cholerae proliferation in sea water: Business-as-Usual Projection in 2100

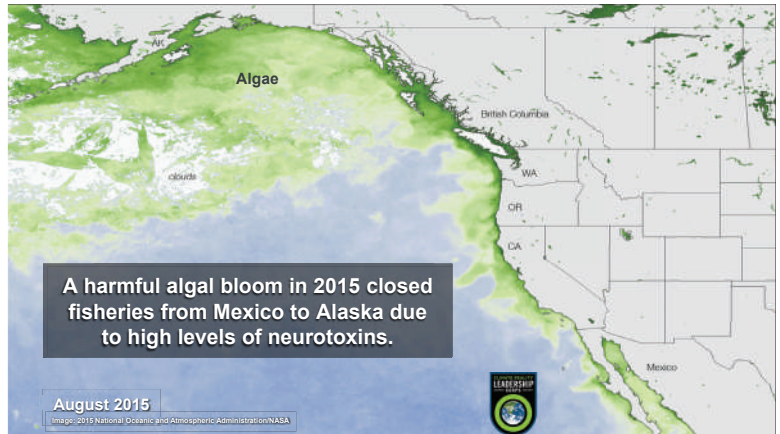
Future climate (model transference)



Escobar LE et al. Acta Tropica 2015;149:202-11

Other Climate-Sensitive Challenges

- **Mycotoxins** (At 2°C increase, aflatoxin, North America and Europe).
 - **Aflatoxins:** Peanuts, dried corn (maize), tree nuts, certain spices
 - **Ochratoxin A:** Coffee, raisins, wine, cereal grains, certain spices
 - **Patulin:** Fruits (apple and apple juice)
- Attraction of pests, plant diseases, weeds
- Changes in pesticide use pattern is likely
- Survival and proliferation of the pathogen (e.g. *Salmonella* serovars)
- Antibiotic use and antibiotic residue
- Changes in migration pathways (e.g. for avian influenza)
- Changes in carriers and vectors (e.g. Zika virus)
- Changes in natural ecosystem
- Phycotoxins



Ecology | Aliyar Fouladkhah

Changing climate

A 'threat multiplier' for foodborne and waterborne infectious diseases and antibiotic resistance

Antibiotic resistance is a growing public health concern, and climate change is one of the most significant public health challenges of our time and threatens the safety of our food and water supplies.

Climate change is one of the most significant public health challenges of our time and threatens the safety of our food and water supplies.

research OUTREACH

Connecting science with society

IMPACT ANALYSIS

Issue RO 114

Aliyar Fouladkhah

Impact Analyses

Outreach Article Available at:
<https://researchoutreach.org/articles/changing-climate-threat-multiplier-foodborne-waterborne-infectious-diseases-antibiotic-resistance/>

Twitter @ResOutreach analysis

This link to your Twitter post

Demographics

Male 77% Female 45% Unknown 7%

Device stats

iPhone 43% Android 47% Desktop 10%

Key metrics for all content presented on Twitter

Interactions

Retweets 50% Likes 20% Replies 40%

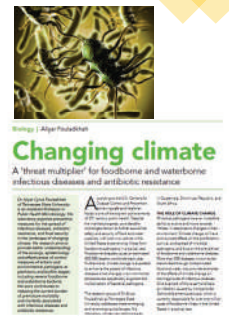
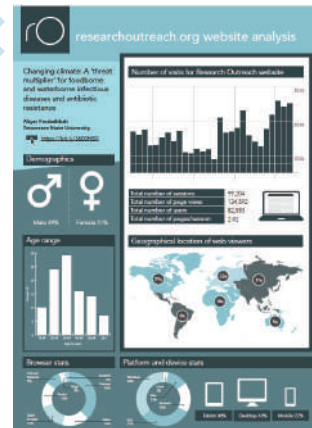
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Climate change is one of the most significant public health challenges of our time and threatens the safety of our food and water supplies.



Exercise

- How can we reduce the negative impact of climate change as **an individual**?
- What **government agencies** could do to minimize the negative impact of climate change?
- In what ways do you think our life in Jamaica and around the world will be affected by climate change?



Foodborne Diseases of Public Health Importance and Transboundary Diseases in Jamaica

Presented at:

December 2, 2024

USAID Partners of America- Jamaica

Tennessee State University, Nashville, TN

Aliyar Cyrus Fouladkhah, PhD, MS, MPH, CFS, CPH

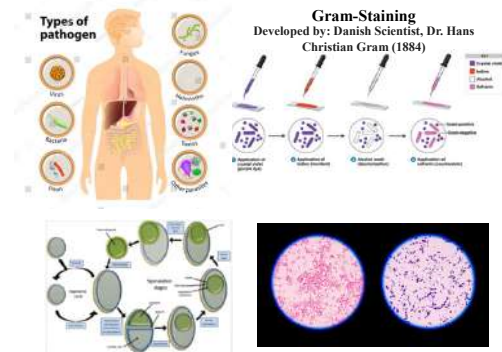
Founding Director, Public Health Microbiology Foundation



1

Anthrax

- Causative agent: *Bacillus anthracis*
- A **Gram-positive** and **spore-forming** bacteria
- Can be found as a spore in the **soil worldwide**
- Spores **viable for decades in soil**
- Common in parts of Africa, Asia, and Middle East
- In Human:
 - Skin
 - Intestine
 - Inhalation
- Animal disease
 - Septicemia and rapid death



2

Anthrax

- Spores highly infective
- Remain effective during aerosolization
- Low lethal dose
- High mortality
- Person-to-person transmission rare
- **Symptoms** begin between **one day** and **two months** after the infection

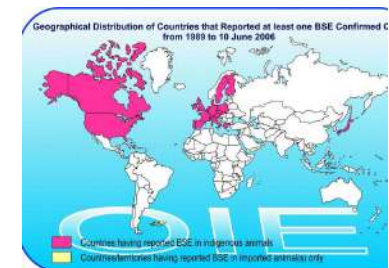


3

BSE- Bovine Spongiform Encephalopathy

Commonly known as *Mad Cow Disease*

- Caused by **prions** (infectious protein particles)
- **Cattle and humans** are susceptible
- A neurological disease that could be fatal
- **Transmitted by:**
 - Consumption of **scrapie-infected feed**
 - **Spontaneous mutation**
- Distribution is worldwide



4

Symptoms of BSE

- In Cattle
 - Incubation period is 2-8 **years**
 - Initial signs are mild and subtle
 - At final stages
 - tremors
 - loss of balance
 - death
- In Humans
 - **Unknown incubation period** (many years to many decades)
 - Neurological signs
 - Depression and schizophrenia-like symptoms
 - Could lead to death



BSE Management

- **Very resistant infectious agent** (sanitization very difficult)
- **Currently no effective treatment or vaccine**
- Prevention:
 - **Surveillance program and testing**
 - **Restriction in trade**
 - **Animal feed regulation** (bone meals and mammalian products)
- Outbreak in 2001-2002 in United Kingdom: Cost the industry 3.7 billion Euro



5

6

Brucellosis

- Caused by bacteria (several species)
(Genus *Brucella* e.g. *B. melitensis*, *B. abortus*, *B. suis*, and *B. canis*)
 - **Highly infectious** (N95 or KN95 mask during farm visits?)
 - Easily aerosolized
- **Transmission:**
 - Ingestion
 - Inhalation
 - Direct contact
- **Signs in animal:**
 - Reproductive complications
- **Signs in humans:**
 - Cyclic fever and
 - Flu-like symptoms



Brucellosis- Treatment & Prevention


- Treatment: long-term antibiotics (Problem: Diversity of causative agents)
- Prevention:
 - **Vaccination of calves**
 - **Minimizing exposure to wildlife**
 - **Segregation of infected animals**
 - **Disinfection of environment**
- **No vaccine available for human**
- **Main infection source for human:**
 - Contaminated milk, cheese, and ice-creams
 - Handling farm animals (glove, goggles, secondary outfit +mask?)
 - Hunting Activities



7

8

Equine Encephalitis Viruses




- Three viruses:
 - Eastern (EEE)
 - Western (WEE)
 - Venezuelan (VEE)
- Transmitted by mosquitoes (**vector-borne disease**)
- **Birds** could be **asymptomatic carrier**
- **Clinical signs** in human and Equids (Horses, mules, donkeys)
 - No to mild signs to
 - Flu-like illness
 - Encephalitis in small proportions
 - **Can also infect a wide range of animals including:** mammals, birds, reptiles, and amphibians

9


Equine Encephalitis Viruses

- The viruses are **very unstable** in environment
- **Supportive care** is the only current treatment
- **Vaccine are available** for Equine
- **Vaccine for human very expensive** primarily for:
 - Researchers
 - Public health workers with enhanced exposure
- **Travel Clinics for International Travel**



10


Hendra Virus



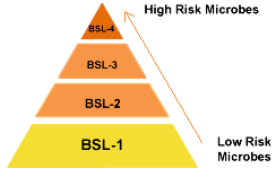
- Viral disease **consider as emerging** (first observed in Australia)
- Natural infections had been **reported only** in:
 - Horses
 - Humans (first reported in 1994, very rare and under-reported)
- Current transmission by:
 - Fruit bats
 - **Bodily fluids and urine** of those infected
- Clinical signs in horses
 - Sudden respiratory signs
 - Nasal discharge
 - Fever
 - Encephalitis
 - Sudden death
- Clinical signs in Humans
 - Flu-like illness
 - respiratory complications
 - **Highly fatal in human, could be as high as 2 in 3 cases**

11

Hendra Virus



- Little is known about pathogen
- **People at risk:**
 - Those occupational or recreational **exposure to horses**
 - Those **living close to "Flying fox" bats** (genus *Pteropus*)
 - **Researchers**
- Highest level of security (**CDC biosafety level 4**) needed for studying the pathogen (around 4 labs in the US and <50 in the words, as of 2021 [US has about 1,500 BSL3])
- Could cause high mortality in humans
- Currently no treatment option is available



12

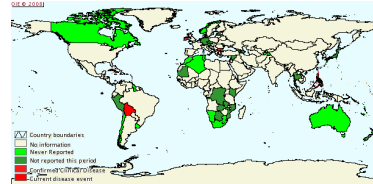
Pseudorabies

- Contagious viral diseases from herpes family
- Primary concern in domestic pigs and feral swine (around 75 million hogs in the United States in 2021)
- Primarily spread through direct animal-to-animal (nose-to-nose)
- Other mammals
 - Reproductive
 - Nervous system
- Humans are not affected
- Could be a ubiquitous virus in some area
- Eradicated in many countries
 - Still occurs in parts of world
- Current USDA Surveillance to detect any potential case



-Different than rabies that is an important zoonotic diseases.
 -Rabies death in the U.S. now < 5 per year
 -About 59,000 annually worldwide (>98% from stray dogs)

Source: CDC, 2021



13

Pseudorabies

- Transmission:
 - Direct contact,
 - Reproductive,
 - Aerosol,
 - Ingestion
- Incubation period: 2-6 days (for COVID-19 currently believed to be 2 to 14 days, CDC, 2021)
- Common symptoms:
 - Neurological
 - Respiratory issues
 - Itching intensively
 - Stillbirths and abortion
- Morbidity and mortality up to 100%
- Neonates are particularly susceptible to the virus



14

Main Foodborne Bacterial Pathogens Associated with Human Health Diseases

15

Bacterial Multiplication

Binary Fission: 20 minutes or less when intrinsic and extrinsic factors are optimal.

Time	# of Bacteria
0 minutes	1
20 minutes	2
40 minutes	4
1 hour	8
2 hours	64
4 hours	4,096
6 hours	262,144
8 hours	16,777,216
12 hours	68,719,476,736

Information and photos are recycled and adapted from BRF of Food and Drug Administration, EELH, Bureau of Centers for Disease Control and Prevention. Photo Courtesy: Adobe Stock (standard license of photos purchased in the Public Health Microbiology laboratory).

Bacteria	Estimated Infective Dose*
<i>Salmonella</i> serovars	<10 cells
Shiga toxin-producing <i>E. coli</i>	10 to 100 cells
<i>Cronobacter sakazakii</i>	10 to 100 cells
<i>Listeria monocytogenes</i>	<1000 cells
<i>Campylobacter</i> spp.	5000 to 10,000 cells
<i>Staphylococcus aureus</i>	>100,000 cells
<i>Vibrio cholerae</i>	1,000,000 cells

* Calculated for oral ingestion based on epidemiological data from outbreaks and human feeding trials of volunteers. Data obtained from BRF of Food and Drug Administration (2019) reference.

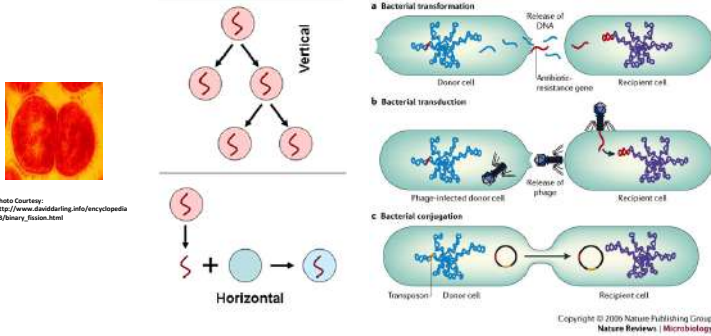
Public Health Microbiology Laboratory: Education, Research, Outreach, and Technical Assistance: <https://publichealthmicrobiologyeducation.org>



16

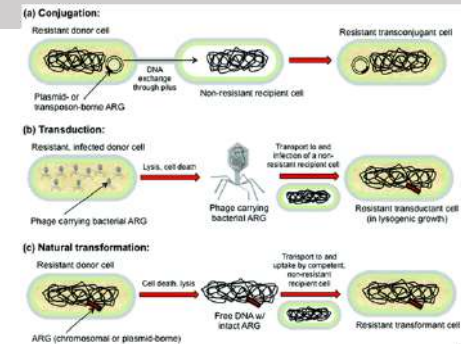
Emerging pathogens

Diversity, moving towards "fitness" and Emerging Pathogens



17

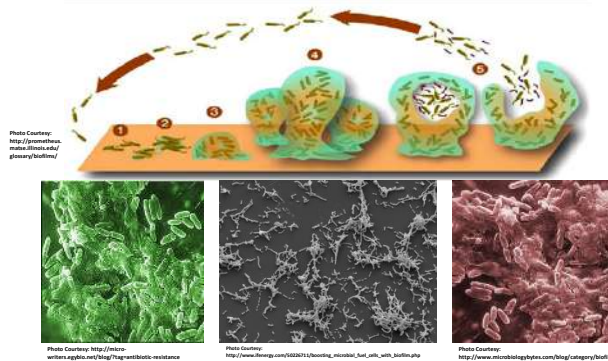
Horizontal Gene Transfer



Donn, 2012

18

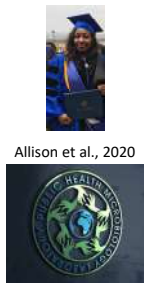
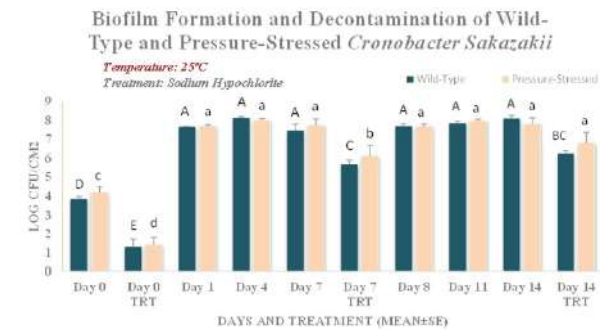
Planktonic cells and Biofilm Communities



19

Cronobacter sakazakii

Two outbreaks in Tennessee (1998, Memphis; 2001 Knoxville)



Allison et al., 2020

20

Quorum Sensing and Biofilm formation

Shiga toxin producing *E. coli*, not antibiotic treatment due to Quorum Sensing Concerns

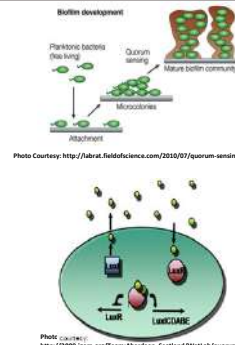
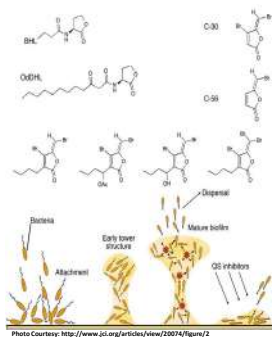


Photo Courtesy: <http://labrat.fieldofscience.com/2010/07/quorum-sensing-and-biofilms.html>

Photo courtesy:
http://2009.igem.org/Team:Aberdeen_Scotland/WetLab/quorumsensing

Infectious Diseases in Animals and Human is a Moving Target...

- It is estimated only 1% of microbial community has been identified.
- Currently **etiological agent of 80.3% of foodborne illnesses, 56.2% of hospitalization, and 55.5% of deaths** remain unknown.

“Emerging” Pathogens:

- Vertical and horizontal gene transfer spores and biofilm formation
- Quorum sensing and cell to cell communication

"It is the microbes who will have the last word."
-Louis Pasteur

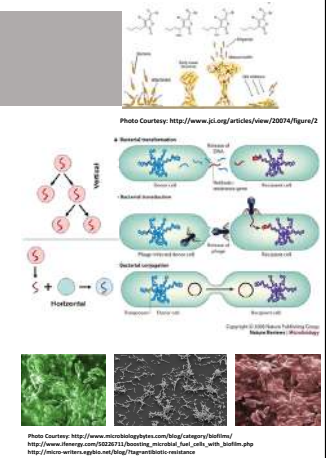


Photo Courtesy: <http://www.microbiologybytes.com/blog/category/biofilms/>
http://www.lifenergy.com/50226711/boosting_microbial_fuel_cells_with_biofilm.php
<http://micro-writers.eggbo.net/blog/?tag=antibiotic-resistance>

A superbug resistant to every available antibiotic in the U.S. kills Nevada woman

Raw strain of *E. coli* strains across Canada: source unknown.



New outbreaks linked to Italian style meats; one third of patients hospitalized

Almost 200 sick in UK-wide Salmonella outbreak


Downloaded from <http://ajphaphysiol.org/> by guest on September 11, 2015



CDC says outbreak traced to raw clover sprouts has come to an end

The Food and Drug Administration's investigation of an outbreak of E. coli O157 in

Multidrug-resistant salmonella outbreak characterized



Investigations of recent measles epidemics (2004) have revealed a very high measles vaccine uptake, affecting parents of 10 babies who subsequently fell sick, and had no contact with a health professional in the Aug. 12 case of 10-year-old boy from north-western Australia. Medical and vaccine records



New outbreaks linked to Italian style meats; one third of patients hospitalized

Almost 200 sick in UK-wide Salmonella outbreak

Downloaded from <http://ajphaphysiol.org/> by guest on September 11, 2015



Eat Smart chopped salad kit recalled in Canada over Listeria concerns

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Raw goat milk recalled because of positive test for *Campylobacter*

State officials in California have ordered a recall of prescriptions of oral contraceptives sold by the manufacturer because of contamination with a carcinogenic chemical.

Epidemiology of Foodborne Diseases in the United States

Based on data from 1990s: (Mead et al., 1999)

76 million illnesses, 323,000 hospitalizations, 5,200 deaths in the United States.

More recent estimates show: (Scallan et al., 2011,

- **47.8 million illnesses, 127,839 hospitalizations, and more than 3,087 deaths** in the United States. (**c. 1.7M cases 300 deaths/year of sepsis**)
- 9.4 million illnesses, 55,961 hospitalizations, and 1,351 deaths are caused by 31 known foodborne agents.
- In addition to consumer insecurity, foodborne diseases cause around **\$77.7 billion** for losses in productivity and economic losses. (**2021 GDP of Jamaica 14.7 Billion**)
- Approximately **30% of population** are especially "at risk" for foodborne diseases (The YOPi: The young, the old, Pregnant, and Immunocompromised)



Significant foodborne pathogens... based on Mead et al., 1999 and Scallan et al., 2011 studies

- **Leading etiological agents for illnesses:** *Norovirus* (58%), Nontyphoidal *Salmonella* serovars (11%), *Clostridium perfringens* (10%), and *Campylobacter* spp (9%).
- **Leading etiological agents for hospitalization:** Nontyphoidal *Salmonella* serovars (35%), *Norovirus* (26%), *Campylobacter* spp (15%), and *Toxoplasma gondii* (8%).
- **Leading etiological agents for death:** Nontyphoidal *Salmonella* serovars (28%), *T. gondii* (24%), *Listeria monocytogenes* (19%), and *Norovirus* (11%).



Signs and Symptoms of Foodborne Diseases

- Mild illness (no medical care sought)
- **Guillain-Barré syndrome** (*Campylobacter* and *Salmonella*)
- **Post-infectious irritable bowel syndrome** (*Campylobacter* and *Salmonella*)
- **Reactive arthritis** (*Campylobacter* and *Salmonella*)
- **Haemolytic uraemic syndrome** (*E. coli* O157)
- **End-stage renal disease** (*E. coli* O157)
- Death



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26

Significant foodborne pathogens... based on Scallan et al., 2015 study

- **Disability adjusted life year (DALY).** DALY: Loss of life and health due to illness
- Non-typhoidal *Salmonella* (329000)
- *Toxoplasma* (32700)
- *Campylobacter* (22500)
- *Norovirus* (9900)
- *Listeria monocytogenes* (8800)
- *Clostridium perfringens* (4000)
- *Escherichia coli* O157 (1200)

One DALY can be thought of as one lost year of "healthy" life.

DALY= YLL+YLD

YLL: Years of Life Lost (YLL) due to premature mortality in the population
YLD: Years Lost due to Disability (YLD) for people living with the health condition

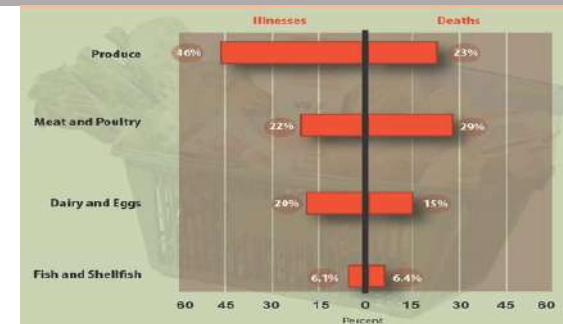
Source: WHO, 2019

62% bacterial agents; 29% parasitic agents; 9% viral agents

27

CDC Estimates of Food Safety Burden

<http://www.cdc.gov/foodborneburden/attribution-image.html#foodborne-illnesses>

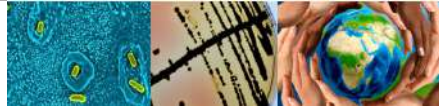


*Chart does not show 5% of illnesses and 2% of deaths attributed to other commodities. In addition, 1% of illnesses and 25% of deaths were not attributed to commodities; these were caused by pathogens not in the outbreak database, mainly *Toxoplasma* and *Shiga toxin*.

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Foodborne Pathogens of Public Health Concerns *>200 foodborne diseases*

- *Salmonella* serovars
- *Staphylococcus aureus*
- *Campylobacter* spp.
- *Bacillus cereus*
- Shiga Toxin-Producing *Escherichia coli* (STEC)
- *Vibrio* spp.
- *Yersinia enterocolitica*
- *Streptococcus* spp.
- *Shigella* spp.
- *Listeria monocytogenes*
- *Mycobacterium bovis*
- *Cronobacter sakazakii*



29

Salmonella serovars

- **Annual illness (death): 1,027,561 (378) in American adults and children**
- **Infection** causes nausea, vomiting, diarrhea, fever, headache
- **Primary sources:** Intestinal tract of people and animals
- **Transmitted by** meat, poultry, eggs, raw milk, unpasteurized juice, many other foods (nuts, spices, produce, chocolate, flour) [**Low-moisture environment**]
- **Contributing factors:** cross-contamination, undercooked food, poor agricultural practices

Growth parameters	Minimum	Optimum	Maximum
Temperature	41°F (5.2°C)	95-109°F (35-43°C)	115°F (46.2°C)
pH	3.7	7-7.5	9.5
a _w	0.94	0.99	>0.99
Other	Non-spore former		
Atmosphere	Facultative - grows with or without oxygen		

Sources: ICMSF 1995 and Bad Bug Book 2nd edition, Scallan et al., 2011, and FSPCA

30

Salmonella serovars

- **Carriers:** **Reptiles** (turtles, lizards, and snakes); **Amphibians** (frogs and toads); **Poultry** (chicks, chickens, ducklings, ducks, geese, and turkeys); **Other birds** (parakeets, parrots, and wild birds); **Rodents** (mice, rats, hamsters, and guinea pigs); Other **small mammals** (hedgehogs); **Farm animals** (goats, calves, cows, sheep, and pigs); **Dogs; Cats; Horses.** [**Pretty much ubiquitous!**]
 - **Dogs and cats** that become ill from *Salmonella* infection generally will have **diarrhea** that may contain blood or mucus
 - Some cats do not have diarrhea, but will have a **decreased appetite, fever, and excess salivation.**
- Prevention:**
- **Minimizing direct contact, washing hands, and cleaning up after the pets** could minimize the risk of transmission from infected animals to human.

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Salmonella serovars



Salmonella Outbreaks Linked to Backyard Poultry

Investigation Notice

Posted July 23, 2021

One in four sick people is a child younger than 5 years. Don't let young children touch chicks, ducklings, or other backyard poultry.

Fast Facts

- Illnesses: 672 (186 new)
- Hospitalizations: 157 (54 new)
- Deaths: 2 (1 new)
- States: 47 (1 new)
- Investigation status: Active

Pet Turtles: Cute But Commonly Contaminated with Salmonella

Turtles commonly carry bacteria on their outer skin and shell surfaces that can make people very ill. Geckos and bearded dragons can also infect people.



32

Staphylococcus aureus

Foodborne Diseases

- Infection
- Intoxication
- Toxicoinfection

- Annual illness (death): 241,148 (6) Americans every year
- Both causes **infection** and **toxico-infection**
- Produces **heat stable toxins** after extensive growth
- Primary sources: Boils, nasal passages and skin (around 20% positive on nasal passage, >10% hands)
- Transmitted by recontaminated **cooked foods**, and foods with high salt or high sugar (**Gram-positive, poor competitor**)
- Contributing factors: Recontamination and time/temperature abuse

Growth parameters	Minimum		Optimum		Maximum	
	Growth	Toxin	Growth	Toxin	Growth	Toxin
Temperature	45°F (7°C)	50°F (10°C)	99°F (37°C)	104-113°F (40-45°C)	122°F (50°C)	118°F (48°C)
pH	4	4	6-7	7-8	10	9.8
a _w	0.83	0.85	0.98		>0.99	
Other	Poor competitor, non-sporeformer					
Atmosphere	Facultative – grows with or without oxygen, but slower without					

Sources: ICMSF 1995 and Bad Bug Book 2nd edition, Scallan et al. 2011, and FSPCA

33

Staphylococcus aureus

- Methicillin-resistant *Staphylococcus aureus* (MRSA) a **major concern for animal and human health**.
- Humans **working closely in animal** feeding operations are in elevated risk of exposure to this pathogen particularly the **antibiotic resistant phenotypes**
- A contagious bacterium responsible for vast majority of environmental **Mastitis in dairy** operations.
- Cause of “bumblefoot” in chickens
- A major pathogen of farm rabbits



34

Campylobacter spp.

- Annual illness (death): 845,024(76)
- Infection causes diarrhea, and **potential nerve damage**
- Primary sources: Intestinal tract of animals
- Transmitted by raw poultry, raw milk products, contaminated water, poultry
- Contributing factor: cross contamination and undercooking



Growth parameters	Minimum	Optimum	Maximum
Temperature	86°F (30°C)	108-109°F (42-43°C)	113°F (45°C)
pH	4.9	6.5-7.5	9.5
a _w	>0.987	0.997	-
Other	Non-spore former		
Atmosphere	3-5% oxygen optimum		

Sources: ICMSF 1995 and Bad Bug Book 2nd edition and FSPCA

35

Bacillus cereus

- Annual illness (death): 63,400 (0)
- Produces **spores** and **toxins** and **extensive growth is required for illness**
- Primary source: soil and GI track
- Transmitted by: rice and starchy foods, meats, vegetables, milk products, sauces
- Contributing factors: **temperature abuse**

Growth parameters	Minimum	Optimum	Maximum
Temperature	39°F (4°C)	82-95° F (28-35°C)	131°F (55°C)
pH	4.3	6.0-7.0	9.3
a _w	0.92	-	-
Other	Spore former; toxin is heat stable		
Atmosphere	Facultative – grows with or without oxygen		

Sources: Seafood Hazards Guide, ICMSF 1995, Bad Bug Book, Scallan et al. 2011, and FSOCA

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Shiga Toxin-Producing *Escherichia coli* (STEC)

- **Annual illness (death): 176,152 (20)**
- **Notable outbreak:** 1992-1993 outbreak in pacific northwest- Very important **regulatory status (adulterant)**
- **Infection causes** bloody diarrhea, and sometimes kidney failure and death [**HUS in kids**]
- **Primary sources:** Intestinal tract of ruminant animals (e.g., cows, sheep)
- **Transmitted** by raw and undercooked beef, poultry, leafy greens, and unpasteurized milk and juices
- **Contributing factors:** poor GAP, inadequate heating, and person-to-person

Growth parameters	Minimum	Optimum	Maximum
Temperature	44°F (6.5°C)	95-104°F (35-40°C)	121°F (49.4°C)
pH	4	6-7	10
a _w	0.95	0.995	-
Other	Non-spore forming		
Atmosphere	Facultative - grows with or without oxygen		

Sources: ICMF 1995 and Bad Bug Book 2nd edition, Scallan et al. 2011, and FSPCA

37

Shiga Toxin-Producing *Escherichia coli* (STEC)

- **Animals that can spread *E. coli* O157 to humans include:**

- Cattle, especially calves (As high 80% in some herds),
[**Concentrated and genetic similarity**]
- Goats
- Sheep
- Deer



- *E. coli* infection very common in **cats and puppies younger than one week.**
- **Colostrum**, plays a pivotal role in protecting a newborn the animal's undeveloped immune system against *E. coli* infection.
- As high as **80% of agricultural animals** could carry various serogroups of shiga-toxigenic *E. coli* without having symptoms

38

Vibrio spp.

- Causing about **80,000 illness and 100 death** annually in the United States.
- **Infection symptoms** vary depending on strain, ranging from diarrhea to high fever
- *Vibrio* is a **halophilic bacterium** and is a major concern in aquaculture industry
- **Primary sources:** Salt water environments and seafood
- Requires salt to reproduce (halophile)

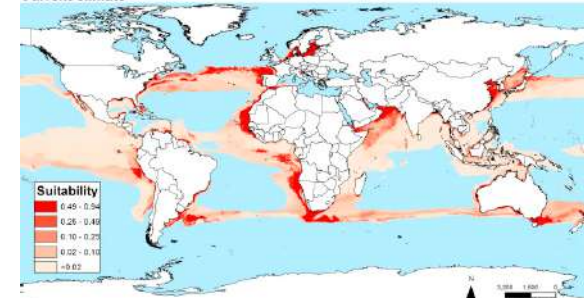
Growth parameters	Minimum	Optimum	Maximum
Temperature	41°F (5°C)	99°F (37°C)	114°F (45.3°C)
pH	4.8	7.8-8.6	11
a _w	0.94	0.98	0.996 (10% NaCl)
Other	Non-sporeformer, requires salt		
Atmosphere	Facultative - grows with or without oxygen		

Sources: Seafood Hazards Guide 2011, ICMF 1995 and Bad Bug Book 2nd edition

39

Vibrio cholerae proliferation in sea water: **Current Climate**

***Vibrio Cholerae*:** currently 760,000 global illness/24,000 death per year
Current climate

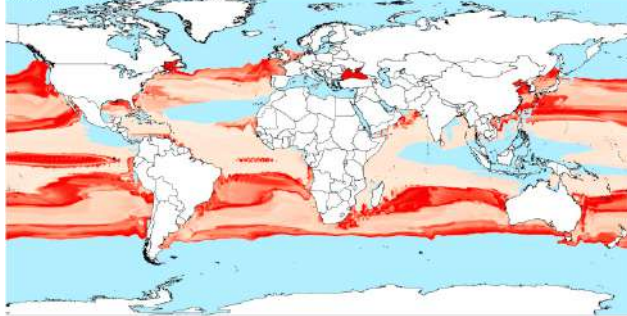


Escobar LE et al. Acta Tropica 2015;149:202-11

40

Vibrio cholerae proliferation in sea water: **Business-as-Usual Projection in 2100**

Future climate (model transference)



Escobar LE et al. *Acta Tropica* 2015;149:202-11

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Yersinia enterocolitica

Yersinia pestis

14th Century Outbreak in Europe, c. 30 to 50% of the population

Antoni van Leeuwenhoek:
Discovery of bacteria in 1676 (c. 350 years)

Viruses discovered in 1890s

- **Not a reportable disease, no statistics available**
- **Infection causes** abdominal pain, fever and diarrhea. May mimic appendicitis.
- **Primary sources:** Raw pork, **raw milk**
- **Contributing factors:** Cross-contamination between raw pork products and RTE foods

Growth parameters	Minimum	Optimum	Maximum
Temperature	30°F (-1.3°C)	77-99°F (25-37°C)	108°F (42°C)
pH	4.2	7.2	10
a _w	0.945	-	-
Other	Non-spore former, raw milk in fridge?		
Atmosphere	Facultative - grows with or without oxygen		

Sources: Seafood Hazards Guide, ICMSF 1995, and Bad Bug Book

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Listeria monocytogenes

- **Infection causes** severe illness in susceptible people – **mortality 15-30%**
- **Primary sources:** Occurs widely in agriculture (soil, plants and water) – **(Important during pregnancy)**
- **Transmitted by:** Refrigerated **RTE foods** that support growth (**South Africa, Largest in History in 2018**)
- **Contributing factors:** Environmental pathogen spread by environmental contamination, equipment, people, incoming raw ingredients (**ubiquitous in nature**)
- **Common in domesticated ruminants** particularly sheep, poultry, and birds.
- **Could cause sporadic and farm outbreaks in ruminants**
- **Could cause:** Encephalitis, late abortion, and GI problems in ruminants.

Growth parameters	Minimum	Optimum	Maximum
Temperature	31°F (-0.4°C)	99°F (37°C)	113°F (45°C)
pH	4.4	7.0	9.4
a _w	0.92	-	-
Other	Non-sporeformer		
Atmosphere	Facultative - grows with or without oxygen		

Sources: ICMSF 1995 and Bad Bug Book 2nd edition

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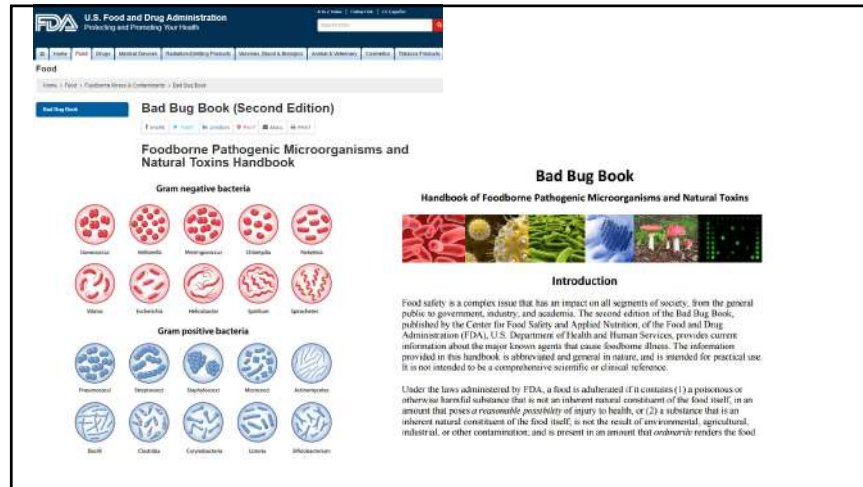


Cronobacter Sakazakii

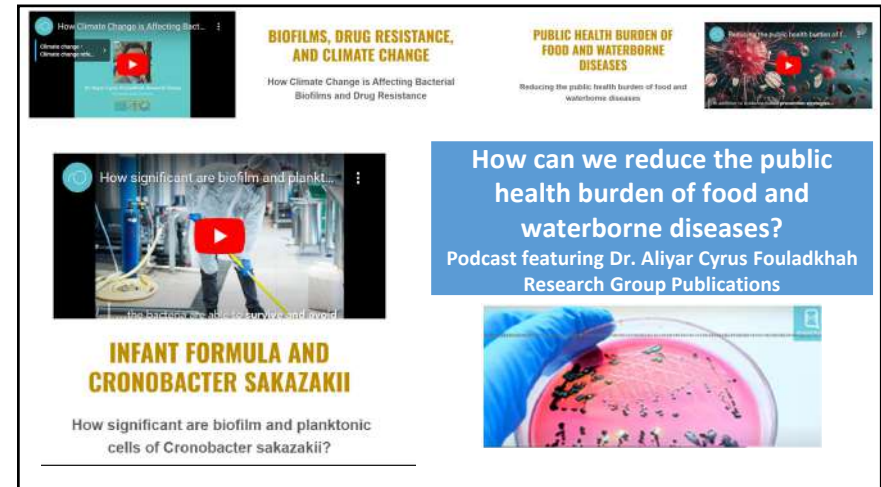
- **Recently reclassified** bacteria (2006-07), formerly known as *Enterobacter sakazakii*
- The **Genus Cronobacter** was derived from the Greek term "Cronos," a Titans of ancient mythology who swallowed each of his infants as soon as they were born (he was afraid to be replaced by his infants).
- The **species name, sakazakii**, is named in honor of the Japanese microbiologist, Riichi Sakazaki, when the bacterium was first explained in 1980.
- Gram-negative, rod-shaped bacteria.
- Facultative anaerobic
- The growing temperature range is 6°C-45°C
- Primarily associated with **Powered Infant Formula**
- There has been several outbreaks associated with the bacterium and neonatal meningitis and death including two outbreaks in **Tennessee (1998 and 2001)**.

APHA Compendium of Methods, Salfinger and Lou Tortorello, Fifth Edition

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Dr. Aliyar Cyrus Fouladkhah,
Faculty Director, Public
Health Microbiology
Laboratory, Tennessee State
University
afouladk@tnstate.edu
Phone: (970) 690-7392

Photos Courtesy: Adobe Stock, royalty purchased (standard license) by public health microbiology laboratory

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Recommendations for the Future



Public Health Microbiology™
Foundation
Dr. Aliyar Cyrus Fouladkhah

Public Health Microbiology Foundation™:

<https://publichealthmicrobiology.education>



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FARMER^TFARMER
The USAID John Ogonowski and Doug Bereuter Farmer-to-Farmer Program

FARMER-TO-FARMER VOLUNTEER ASSIGNMENT FORM

Partners of the Americas' USAID-funded Farmer-to-Farmer Program (F2F) provides technical assistance to agricultural producers, organizations, agribusinesses, and universities in Latin America and the Caribbean. Through F2F, U.S. specialists spend two to three weeks on specific technical assignments, working directly with counterparts in the region to address local needs.

GENERAL INFORMATION

Type of Volunteer Requested: Food Safety Specialist

Country: Jamaica

Country Project: Indigenous & Youth Agribusiness Development

Best Dates for Volunteer Visit: December 1-15, 2024

PROJECT OVERVIEW

Increasing the participation of youth and indigenous peoples in the agriculture sector is crucial for sustainable development in Jamaica. Youth and indigenous women particularly lack the resources and capacity to engage in agribusiness. Targeted technical capacity building can unlock productivity and profitability of agribusinesses in Jamaica.

The Jamaica Indigenous and Youth Agribusiness Development Farmer-to-Farmer (F2F) Country Project seeks to improve the capacity of indigenous and youth populations working in the agriculture sector in Jamaica. F2F volunteers will support youth and indigenous peoples in agriculture production and processing to increase the resilience of agribusinesses to climate related shocks and stressors. POA will leverage expert volunteers to improve hosts' food safety, business operations, marketing, product development, and sustainability to improve livelihoods. F2F assignments will focus on agriculture cooperatives, government agencies, agribusinesses, local non-government organizations (NGOs), and schools. F2F volunteer technical assistance will build the capacity of hosts through hands-on workshops and technical training in a variety of areas that include food certifications, value-added recipe development, grant writing, and social media marketing.

ASSIGNMENT PURPOSE AND EXPECTED RESULTS

The Southwest Technical and Vocation Training Institute (STVETI) has seen the need to build the capacity of its youth trainees in their commercial food preparation department to be equipped with the skills for potential agri-business development. Food Safety management is a critical component of this. This training will allow participants to acquire comprehensive knowledge about food safety, including hygiene practices, foodborne illnesses, safe food handling, and preservation techniques.

A Farmer-to-Farmer (F2F) volunteer is requested to train their students in establishing and maintaining food safety standards in all facets of commercial food operations. It is expected that at the end of the assignment, participants will be aware of the requirements for meeting food safety standards, how to



adjust different food facilities, and track changes required to meet health and safety standards.

This assignment contributes to the broader goals and objectives of the Indigenous & Youth Agri-business Development project by integrating food safety management into the curriculum of the institute which can help a build a workforce that is well-prepared to meet the demands of the agriculture value added food industry while promoting health and safety in their communities.

DESIRED QUALIFICATIONS OF VOLUNTEER

- Education: Master's degree in food safety management or related field;
- Experience: Food Quality Control, HACCP implementation or Food Safety Preventive Controls Alliance (FSPCA);
- Language: Language of training will be English;
- Experience working in a developing country preferred;
- Flexibility.

EXPECTED DELIVERABLES

- 15+ youth participants will be trained in Food Safety Management;
- 15+ youth participants will be given certificates for their participation;
- F2F trip report (to be completed on the final Friday of the assignment);
- F2F Recommendations Form (to be completed on the final Friday of the assignment);
- One social media post on your F2F experience.

PARTNER ORGANIZATION(S) & HOST ORGANIZATION(S)

The Southwest Technical and Vocation Training Institute (STVETI) is in Newport, Mandeville. The Institute is dedicated to fostering a skilled, competent workforce that meets the needs of the modern economy. With its commitment to excellence, innovation, and community development, STVETI is poised to play a vital role in shaping the future of technical and vocational education in the region.

STVETI offers a wide array of programs designed to equip students with the necessary skills for employment in high-demand sectors. Some of these programs include Tourism & Hospitality, Commercial Food Preparation and Food & Beverage Management. Each program is designed to meet industry standards, with a strong emphasis on practical learning through internships, workshops, and real-world projects.

RESOURCES TO BE CONTRIBUTED BY HOSTS AND LOCAL PARTNERS

- Coordinate the work in the field and provide technical personnel to accompany the volunteer;
- Provide in-country transportation, office space for meetings, and facilities for trainings and/or workshops; and
- Provide supplies, equipment, and other resources for training activities.



ASSIGNMENT ITINERARY (GENERAL)

A more detailed itinerary will be prepared once the volunteer and travel dates are confirmed. After receiving a detailed itinerary, volunteers are encouraged to directly contact field staff to ask specific questions regarding their assignment.

Location(s): Newport, Mandeville

Accommodations: F2F will directly reserve and pay for all hotels in the field.

Transportation: F2F field staff will arrange airport pickup and provide all transportation to and from hotels in the field.

Food: Volunteers will be provided a per diem to cover meals and incidental expenses. The F2F field staff will help in identifying places to eat.

USAID CLASSIFICATION OF VOLUNTEER ASSISTANCE AND ACTIVITIES

Primary classification for volunteer assistance (select one)

- ☐ On Farm/Technology Transfer (T)
- ☒ Processing/Technology Transfer (P)
- ☐ Business/Enterprise Development (E)
- ☐ Organizational Development (O)
- ☐ Building Capacity of Support Services (e.g., extension services) (S)
- ☐ Administrative (A)

Primary classification of type of Climate-Smart Agriculture (Select one)

- ☒ Productivity (Sustainably increasing agricultural productivity and incomes)
- ☐ Adaptation/Resilience (Adapting and building resilience to climate change)
- ☐ Mitigation (Reducing and/or removing greenhouse gas emissions, where appropriate)
- ☐ Not applicable

PERSUAP – Volunteer Assignment Type

- ☐ Type 1 Volunteers provide direct assistance for the use or procurement of pesticides and are likely to recommend and/or provide advice on specific pesticide active ingredients or products.



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- ☐ Type 2 Volunteers provide indirect assistance for the use or procurement of pesticides; they are not expected to recommend or provide advice on specific pesticide active ingredients or products.
- ☒ Type 3 Volunteers are not expected to be involved in pesticide issues.
- ☐ Type 4 Volunteers work on a separately-funded USAID project/activity which may have a PERSUAP governing its operations related to the use and procurement of pesticides.

RECOMMENDED PREPARATION

- Please thoroughly read and follow the instructions provided in the volunteer orientation manual.
- Bring comfortable shoes for walking and a hat for sun protection.
- Bring any videos, posters, PowerPoints, or other materials that are important to your training and activities; if translation is required, please send materials to the field staff at least two weeks before your assignment. We recommend you bring these materials uploaded on both a USB flash drive and to cloud storage (ex: Google drive) as flash drives may be prone to viruses.
- The F2F field office has a projector, flash drives, and other materials that can be used for trainings and workshops.
- Please advise the field staff if you have any specific dietary restrictions, special medical needs, food allergies, etc.
- The F2F field staff will provide a cell phone as needed to contact field staff and make emergency calls.

CONTACT INFORMATION

F2F Field Office address:

Partners Technical Exchange Jamaica Limited, Shop # 205, 34 Annette Crescent, Kingston 10

Office Phone: (876) 622-2798

Country Director: Marsha Johnson, mjohnson@partners.net, (876) 584-0453

Field Officer: Howard Williams, hwilliams@partners.net, (876) 805-4360

Administrative Assistant: Kacia Darson-Hibbert, khibbert@partners.net, (876) 340-5832

Partners Farmer-to-Farmer (F2F) Program – Assignment Report Template

Farmer-to-Farmer volunteers are required to submit a trip report and recommendations form for the host organization. Reports are shared with hosts and field offices.

INSTRUCTIONS

- **Topics and Format:** Your report should answer all questions below in the text boxes and be within the paragraph range recommended in the prompt. You may include any additional content as annexes attached to your submission email.
- **Submission:** Please email your report before the end of your assignment to the field staff once you and the assignment field officer agree it is finalized.
- **Attendance Sheets:** Sign attendance sheets and send to field officer

VOLUNTEER NAME: Dr. Aliyar Cyrus Fouladkhah, PhD, MPH

ASSIGNMENT DATES: December 1 to 12, 2024

ASSIGNMENT TITLE: Food Safety Specialists

EXECUTIVE SUMMARY - Please include a summary of major accomplishments during your assignment, key findings and recommendations, and observations of impact or progress to date.

- Certification of 16 faculty and students of a training institute in Jamaica.
- Discussions and training about climate changes and food security.
- Discussions and training about transboundary infectious diseases.
- Training for control of biological, chemical, and physical hazards associated with human food.
- Visit and Support of local health department and a food manufacturing facility.



BACKGROUND and OBSERVATIONS - Summarize, in 3-6 paragraphs, the purpose and objectives of your assignment and information that will help future volunteers. How has the host progressed? What are the host's obstacles and opportunities?

It was a great pleasure for me to return to beautiful and culturally-rich country of Jamaica to conduct another multi-day climate change, Public Health Microbiology, and food safety workshop for the faculty and students of HEART Institute in Newport, Mandeville, Jamaica. This event was hosted by the HEART Institute and logistics of the event were funded by USAID Partners of America in Washington and Kingston offices. The workshop and certification of the event was sponsored by the Public Health Microbiology FoundationSM in Nashville. During the workshop that was attended by 16 faculty and students of the host institute in addition to FSPCA curriculum that is recognized as adequate by the U.S. Food and Drug Administration for PC QI training associated with human food production, I discussed important information about climate change, microbial food safety, and transboundary infectious diseases with the participants. Excerpts of the teaching material and evaluation of the participants are included in this report. In addition to the workshop, outreach and support were provided to local food manufacturer and a local department of public health division of environmental health. A PC QI certification workshop using the same curriculum is scheduled in Italy on December 17, 2024 with cost of 1,000 Euros per participant and one is scheduled in the United States on May 16, 2025 for \$799 per attendees. Thus, very conservative estimating, the value of sponsorship from Public Health Microbiology FoundationSM for these 16 certificates are \$9,600 (16 certificates of \$600 each) or roughly 1.5 million Jamaican Dollars. Participants additionally received 6 copies of food safety plans (valued at \$20 per attendee) thus the total value of sponsorship from the Public Health Microbiology FoundationSM is \$9,920 USD for this event (\$320 for handouts and \$9,600 for the certificates). A productive and impactful workshop like this event is the result of work of several agencies so I would like to wholeheartedly thank esteemed colleagues in Washington and Kingston USAID Partners of America Program for their support and the host institution for their hospitality and enthusiasm. I wish the participants of workshop further success in implementing the food safety, infectious disease, and climate changes topics that we discussed for further ensuring the safety of great citizens of Jamaica and numerous individuals who visit this great island every year.

Submitted with best wishes,
Aliyar Cyrus Fouladkhah, PhD, MS, MPH, CFS, CPH
Founding Director, Public Health Microbiology Foundation
Associate Professor, Tennessee State University
Yale School of Public Health Alumnus

ACTIVITIES - In 3-6 paragraphs, please summarize discussions held, workshops conducted, lectures or clinics given, or other services or activities performed during your assignment.

See the report for further details.



Climate Change and Food Safety Workshop
Sole/Lead Instructor: Dr. Aliyar Cyrus Fouladkhah
(Dec. 2024 by USAID Partners of America Jamaica)

HOSTS - List groups and people with whom you met or worked. The field staff can help you with the specific names of groups, farmers, and other hosts with whom you collaborated.

This event was hosted by the HEART Institute and logistics of the event were funded by USAID Partners of America in Washington and Kingston offices. The workshop and certification of the event was sponsored by the Public Health Microbiology FoundationSM in Nashville.

RESULTS - In 2-4 paragraphs, describe any changes you expect will occur as a result of your work. If applicable, describe any recommendations from previous Farmer-to-Farmer volunteers that hosts have adopted. Did you observe any other impacts from Farmer-to-Farmer? Were there separate local interventions that may impact results?

The workshop and certification of the event was sponsored by the Public Health Microbiology FoundationSM in Nashville. During the workshop that was attended by 16 faculty and students of the host institute in addition to FSPCA curriculum that is recognized as adequate by the U.S. Food and Drug Administration for PC QI training associated with human food production, I discussed important information about climate change, microbial food safety, and transboundary infectious diseases with the participants. Excerpts of the teaching material and evaluation of the participants are included in this report. In addition to the workshop, outreach and support were provided to local food manufacturer and a local department of public health division of environmental health. A PC QI certification workshop using the same curriculum is scheduled in Italy on December 17, 2024 with cost of 1,000 Euros per participant and one is scheduled in the United States on May 16, 2025 for \$799 per attendees. Thus, very conservative estimating, the value of sponsorship from Public Health Microbiology FoundationSM for these 16 certificates are \$9,600 (16 certificates of \$600 each) or roughly 1.5 million Jamaican Dollars. Participants additionally received 6 copies of food safety plans (valued at \$20 per attendee) thus the total value of sponsorship from the Public Health Microbiology FoundationSM is \$9,920 USD for this event (\$320 for handouts and \$9,600 for the certificates).



NEXT STEPS and FUTURE VOLUNTEER NEEDS - In 1-3 paragraphs, please describe the recommended next steps. What future volunteer assignments are needed? These should coincide with the recommendations you make. Please also note areas where future volunteers, in-country staff, technicians, or extension agents could provide follow-up.

During this assignment we had a chance to visit a local health department for support and important discussions, and they expressed great interest to host a similar certification event in near future. Additionally, a visit and consultation was made to a local food manufacturer and they similarly expressed great interest to be part of future trainings and certifications. A follow up assignment for these two entities would be a very feasible future plan for other volunteers

PERSONAL REFLECTION - In 1-2, paragraphs, share how the assignment affected you personally or professionally and other general comments. These may be shared with future volunteers, hosts, or field staff.

A productive and impactful workshop like this event is the result of work of several agencies so I would like to wholeheartedly thank esteemed colleagues in Washington and Kingston USAID Partners of America Program for their support and the host institution for their hospitality and enthusiasm. I wish the participants of workshop further success in implementing the food safety, infectious disease, and climate changes topics that we discussed for further ensuring the safety of great citizens of Jamaica and numerous individuals who visit this great island every year.

Please send any additional content as attachments to this document. This **must** include participant attendance lists for each workshop or event using the format provided by POA.

“SMART+” Volunteer Recommendation Guidelines for Field Staff:

Instructions for forming effective F2F volunteer recommendations:

Procedural Requirements:

1. Before submission to HQ staff, recommendations should be made by the **Host, Partners Field Staff, and Volunteer** to form a consensus about every recommendation. This will save time later when we don't have to call the volunteer for clarification.
2. HQ Staff will review the recommendations and make any comments to the field staff. Field staff will then determine if the recommendations can be changed without contacting the volunteer.
3. Each recommendation must fit into the **SMART+** framework. The following criteria combine to form a complete recommendation:

Specific: Words like “improve”, “streamline” are too difficult to measure. We must be able to confirm that an action has taken place to assure that the recommendation is adopted. Are we addressing a specific action? Is it too **complex** or broad of a recommendation for the host participating?

Measurable: Will the field staff be able to determine if (“yes” or “no”) the host adopted it? Will a specific change associated with the recommendation be observable at follow up? Can you **observe** the benefits of the change?

Actionable: Are there clear next steps that the host can take to adopt it? “Create a marketing strategy” may be specific but can be broken up into steps. “As a first step in the marketing strategy, research the most rapidly growing markets for coffee exporters and rank them in order of feasibility”. The recommendation should be written to be **trialable**, or easily tested, by the implementing hosts.

Relevant: Does it fit into your volunteer assignment, align with the country strategy, and meet the host's own goals and/or confer a **relative advantage** in the hosts industry? Even if volunteers are experts in several categories, we need a narrow focus on the problem for which the volunteer was recruited.

Time-bound: Specify a date by when the recommendations should be applied. Recommendations that have a deadline attached to them are easier to monitor than those written as open-ended. Recommendations with continuous monitoring should have multiple dates listed for check-ins with host.

Feasible: Can the host adopt the recommendation given their constraints? Is it affordable and cost-effective? Are materials and resources locally available? Please help the volunteers understand local contexts and mention when something is unreasonable with a recommendation.

Environmentally Conscious/Socially or Culturally Appropriate: Have you considered the education level, gender, ability, religion, and cultural context of the host? Does it consider and avoid possible harmful environmental impacts? Is it **compatible** with the local context?

- **Example from F2F volunteer assignment in Integrated Pest Management (IPM):**

“Reduce use of Organophosphates & Carbamates (Specific and Environmentally Sound). Replace (Measurable and Actionable) these insecticides with newer narrow-spectrum insecticides, such as azadirachtin, Bt, oils, soaps, systemics (Feasible), or in some cases pyrethroids. Implement by January 2020. (Time-bound and Relevant to IPM assignment)”

John Ogonowski and Doug Bereuter Farmer-to-Farmer Program

Volunteer Recommendations Form

Name of Volunteer: Dr. Aliyar Cyrus Fouladkhah, PhD, MPH
Country of Service: Jamaica Dates of Trip: December 1 to 12

# of Persons <i>Formally</i> Trained ¹ – male:	6
# of Persons <i>Formally</i> Trained – female:	10
# of Persons <i>Formally</i> Trained – non-binary:	0
# of Persons <i>Formally</i> Trained who are youth (USAID defines ages 15 – 29 as youth):	9
# of Persons <i>Formally</i> Trained who are youth – female:	4
# of Persons <i>Formally</i> Trained who are youth – male:	5
# of Persons <i>Formally</i> Trained who are youth – non-binary	0
# of Persons <i>Formally</i> Trained who identify as Indigenous:	0
# of Persons <i>Formally</i> Trained – total = male + female + nonbinary (Don't add youth or Indigenous persons):	16

****Please review footnotes for definitions of “persons trained” and “persons directly assisted” ****

Value of Host Contributions -

Field Officer should provide this monetary value from host, as applicable (includes expenses such as transportation, translation services, home stay, meals, etc.)

\$ 5000 Currency Type: Jamaican Dollar

Recommendations Made by the Volunteer:²

Please keep recommendations short; details of the recommendations should be included in results section the trip report. Use specific dates for timeframe. Please try to limit recommendations to no more than six per host.

Recommendation	Host	Time frame to implement change
Implementation of climate change mitigation strategies discussed in every day activities and teaching	HEART Institute	8 to 12 months

¹ **Persons Formally Trained:** number of persons who received technical/instructional training in a “formal” setting: classroom, workshop, institute/university or on-the-job setting with specific learning objectives and outcomes.

² **Recommendations Made by the Volunteer:** The definition of “recommendation” is quite subjective, but might include an improved procedure, a technological or management innovation, a useful product or marketing tool, etc. Volunteers might make numerous detailed recommendations to a variety of hosts. Recommendations should be written in a way that is clear and measurable. *Please try to limit recommendations to no more than six per host.*



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Incorporation of food safety biological hazards discussed in the workshop as part of the teaching curriculum	HEART Institute	8 to 12 months
Incorporation of food safety Chemical and physical hazards discussed in the workshop as part of the teaching curriculum	HEART Institute	8 to 12 months
Incorporation of allergen control strategies discussed in the workshop as part of the teaching curriculum	HEART Institute	8 to 12 months
Follow-up assignment with a local health department per connections made and interest expressed locally	USAID F2F Partners of America Office of Jamaica	8 to 12 months