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Climate Change and Food Safety Train-the-Trainer Workshop for Environmental Health Inspectors in St. Ann Health Department in Jamaica

Trip Report (June 2023): USAID Project on May 27 to June 4 in Jamaica

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



It was an honor for me to return to beautiful and culturally-rich country of Jamaica to conduct a multi-day climate change, infectious diseases, and food safety workshop for health inspectors in St. Ann Health Department. This event was hosted by Northeast Regional Health Authority in partnership with St. Ann Health Department in Jamaica 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 14 environmental health inspectors of St. Ann Health Department and one field officer of USAID Jamaica, 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 policies, 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. A workshop using the same curriculum is scheduled in Netherland on November 1 2023 for 1,495 Euros per participant and one is scheduled in the United States on June 7, 2023 for \$695 per attendees. Thus, very conservative estimating, the value of sponsorship from Public Health Microbiology FoundationSM for these 15 certificates are \$9,750 (15 certificates of \$650 each) or roughly 1.5 million Jamaican Dollars. Participants additional received a participation book (valued at \$40 per attendee) and 10 copies of food safety plans (valued at \$120 per attendee) thus the total value of sponsorship from the Public Health Microbiology FoundationSM is \$12,150 USD for this event (\$2,400 for books and handouts and \$9,750 for the certificates).



A productive and impactful workshop like this event is 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 great inspectors from St. Ann Health Department of Jamaica 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

Faculty Director, Public Health Microbiology Laboratory

Associate Professor, Tennessee State University

Yale School of Public Health Alumnus



Climate Change and Food Safety Workshop

Sole/Lead Instructor: Dr. Aliyar Cyrus Fouladkhah

(May 31 to June 1, 2023, host in Jamaica by Northeast Regional Health Authority in partnership with St. Ann Health Department)

Workshop Invitation & Evaluation by Participants



**Public Health Microbiology™
Foundation**
Dr. Aliyar Cyrus Fouladkhah

Public Health Microbiology FoundationSM:

<https://publichealthmicrobiology.education>



Public Health Microbiology FoundationSM

Founding Director, Aliyar Cyrus Fouladkhah, PhD, MPH, CFS, CPH

Webpage: <https://publichealthmicrobiology.education/phm-foundation>

Email: support@publichealthmicrobiology.education | Phone: +1 (970)690-7392

2023 Food Safety and Public Health Workshop*

PC QI Workshop 5-30 to 6-1-2023

Lead Instructor Dr. Aliyar Cyrus Fouladkhah

Public Health Microbiology Foundation, Nashville, TN

Host in Jamaica: Northeast Regional Health Authority in partnership with

St. Ann Health Department

May 5, 2023

Dear esteemed participants,

It is my pleasure to welcome you to our 2023 food safety and public health workshop. This event is sponsored by the Public Health Microbiology FoundationSM in Nashville, National Institute of Food and Agriculture, and USAID F2F program in Washington and Kingston, TN and hosted in Jamaica by Northeast Regional Health Authority in partnership with St. Ann Health Department.

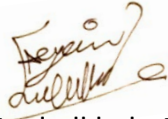
In addition to information from the public health microbiology program in Nashville, I will cover the FSPCA curriculum, currently recognized as adequate by one of the leading food safety regulatory institutions in the United States for Food Safety Modernization Act (FSMA) Preventive Control for Qualified Individuals (PC QI) training. This workshop will be held in person. Due to ongoing national and global respiratory COVID-19 endemic, participants are requested to adhere to public health guidelines including considering wearing high-quality masks and practicing social distancing to minimize the risk of respiratory disease transmission.

In-person participants are expected from May 30 to June 1 2023, during the below-mentioned times. We will additionally hold optional meetings on June 2, 2023 for further specific and one-by-one discussions/consultation about food safety and public health practices. Below please find the tentative agenda for the meeting.

You could also access the survey weblink and QR code that you could use for providing feedback to the instructor at the end of the workshop. I hope you find this important and timely workshop of assistance for meeting and exceeding the regulatory requirements for national and global commerce while ensuring the public's health.

If you have any questions about the workshop, please take the liberty in contacting me at +1(970) 690-7392 or via email (aliyar.fouladkhah@aya.yale.edu).

Best wishes,



Dr. Aliyar Cyrus Fouladkhah, PhD, MS, MPH, MACE, CFS, CPS

Associate Professor, Tennessee State University

Faculty Director, Public Health Microbiology Laboratory

Founding Director, Public Health Microbiology Foundation

Yale School of Public Health Alumnus

** Funding support from the National Institute of Food and Agriculture, USAID, and Public Health Microbiology Foundation is gratefully acknowledged.*

Tentative Workshop Schedule:

Tuesday, May 29, 2023 (required): 9:00 am to 4:00 pm

- ✚ Introductions from instructor and participants
- ✚ Food Safety under the Landscape of Climate Change*
- ✚ FSMA Overview*
- ✚ Chapters 1 to 7^

Wednesday, May 30, 2023 (required): 9:00 am to 4:00 pm

- ✚ Exotic and Transboundary Diseases*
- ✚ Chapters 8 to 12^

Thursday, June 1, 2023 (required): 8:30 am to 5:00 pm

- ✚ Labeling and Claims and GRAS List*
- ✚ Chapters 13 to 16
- ✚ Watching 2 videos: Regulation Overview and FSMA Technical Assistance
- ✚ Awarding of the certificates

Friday, June 2, 2023 (Optional): 8:30 am to 5:00 pm

- ✚ One-on-one consultation with a process authority
- ✚ Individual discussions about product safety and regulatory affairs
- ✚ Discussing education opportunities in Tennessee State University

** From the public health microbiology foundation, ^from the FSPCA curriculum*

For completion of workshop evaluation survey, you could use the below weblink or Scan this QR code with your cellphone:

https://tnstateu.az1.qualtrics.com/jfe/form/SV_eg5MTLjYIMiDo46

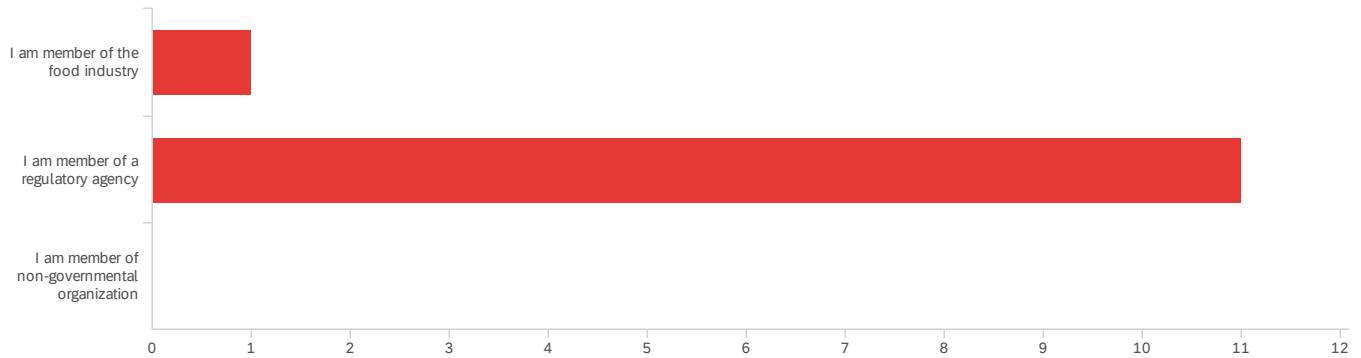


Default Report

2023 FSPCA Workshop: Lead Instructor: Dr. Fouladkhah (5-30 to 6-1-2023) - St. Ann Jamaica

June 1, 2023 5:29 PM MDT

Q1 - What is your primary career association?

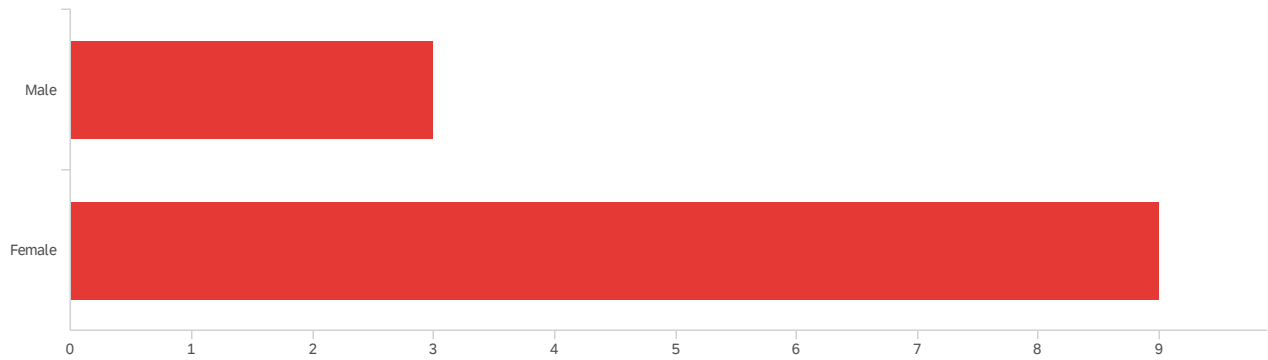


#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	What is your primary career association?	1.00	2.00	1.92	0.28	0.08	12

#	Field	Choice Count
1	I am member of the food industry	8.33% 1
2	I am member of a regulatory agency	91.67% 11
3	I am member of non-governmental organization	0.00% 0
		12

Showing rows 1 - 4 of 4

Q2 - What is your gender?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	What is your gender?	1.00	2.00	1.75	0.43	0.19	12

#	Field	Choice Count
1	Male	25.00% 3
2	Female	75.00% 9

12

Showing rows 1 - 3 of 3

Q3 - How satisfied are you for attending this workshop: 0=Not satisfied at all;

100=extremely satisfied

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	My instructor is knowledgeable of the subject matter.	90.00	100.00	98.50	3.38	11.42	12
2	My instructor communicated effectively.	90.00	100.00	98.09	3.32	10.99	11
3	My instructor stimulated my interest in the subject.	90.00	100.00	97.42	3.75	14.08	12
4	My instructor answered questions thoroughly.	95.00	100.00	99.09	1.93	3.72	11
5	My instructor treated all students with respect.	100.00	100.00	100.00	0.00	0.00	12
6	I would recommend this instructor to my friends.	69.00	100.00	97.18	8.91	79.42	11
7	My knowledge of the subject increased as a result of this workshop.	89.00	100.00	97.40	4.22	17.84	10
8	This workshop made a significant contribution to my career.	80.00	100.00	95.91	6.33	40.08	11

Q4 - Please share any information or feedback you would like with the instructor about your experience in this workshop:

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

Extremely informative. Expert facilitator.

I was a very good delivery. The aim of this workshop was met in order to break down the subject matter to a level that is understandable for effective implementation

Dr. Aliyar is a true leader in his field. His delivery was clear and properly composed to allow for thorough understanding of the content being presented. Dr. Aliyar expressed huge respect for all participants and encouraged participation. The knowledge garnered from this workshop will indeed help in my daily activities. I am forever grateful.

It has been a very empowering workshop. I have learned a lot. The instructor was very expert. I'm looking forward to future endeavours.

Great workshop

Dr. Aliyar is extremely knowledgeable and accommodating. His method of delivery encouraged participation which enabled discussions on topical issues. The presentations done are greatly appreciated and have helped in increasing my knowledge in the area of Food Safety Management.

Relevant to my area of work and gain valuable information to aid in capacity building among my fellow public health inspectors

I was very satisfied with the level of training. I learned a lot. I can't wait to be invited to another training session. Thank you Dr. Aliyar Cyrus Fouladkhah

The instructor communicated well and was very respectful and accommodating. Kudos to him.

End of Report

Participants' Certifications



Public Health Microbiology™
Foundation
Dr. Aliyar Cyrus Fouladkhah

Public Health Microbiology FoundationSM:

<https://publichealthmicrobiology.education>



FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

CERTIFICATE OF TRAINING

is awarded to
Alicia Bailey

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

delivered by Lead Instructor
Dr. Aliyar Cyrus Fouladkhah

completed on
06/01/2023

A handwritten signature in black ink that reads 'Brian Schaneberg'.

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

A handwritten signature in black ink that reads 'Gerald Wojtala'.

Gerald Wojtala, Executive Director
International Food Protection Training Institute

A handwritten signature in black ink that reads 'Steve Mandernach'.

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



Certificate # 82e17616





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

CERTIFICATE OF TRAINING

is awarded to

Asma Dundee

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

delivered by Lead Instructor

Dr. Aliyar Cyrus Fouladkhah

completed on

06/01/2023

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

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Gerald Wojtala, Executive Director
International Food Protection Training Institute

A handwritten signature in black ink, reading 'Steve Mandernach'.

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



Certificate # 7884b261





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

CERTIFICATE OF TRAINING

is awarded to

Chandale Thomas

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

delivered by Lead Instructor

Dr. Aliyar Cyrus Fouladkhah

completed on

06/01/2023

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

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Gerald Wojtala, Executive Director
International Food Protection Training Institute

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



Certificate # c322a96a





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

CERTIFICATE OF TRAINING

is awarded to

Cleodeen Gordon

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

delivered by Lead Instructor

Dr. Aliyar Cyrus Fouladkhah

completed on

06/01/2023

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

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Gerald Wojtala, Executive Director
International Food Protection Training Institute

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



Certificate # 4efe6211





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

CERTIFICATE OF TRAINING

is awarded to

Elaine Cunningham-Parkinson

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

delivered by Lead Instructor

Dr. Aliyar Cyrus Fouladkhah

completed on

06/01/2023

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

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Gerald Wojtala, Executive Director
International Food Protection Training Institute

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



Certificate # 9cc95d32





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

CERTIFICATE OF TRAINING

is awarded to

Howard Williams

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

delivered by Lead Instructor

Dr. Aliyar Cyrus Fouladkhah

completed on

06/01/2023

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

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Gerald Wojtala, Executive Director
International Food Protection Training Institute

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



Certificate # f20ff8b3





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

CERTIFICATE OF TRAINING

is awarded to

Karen Brown

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

delivered by Lead Instructor

Dr. Aliyar Cyrus Fouladkhah

completed on

06/01/2023

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

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Gerald Wojtala, Executive Director
International Food Protection Training Institute

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



Certificate # a848bf91





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

CERTIFICATE OF TRAINING

is awarded to

Kemeisha Cameron

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

delivered by Lead Instructor

Dr. Aliyar Cyrus Fouladkhah

completed on

06/01/2023

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

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Gerald Wojtala, Executive Director
International Food Protection Training Institute

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



Certificate # 52c3f31d





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

CERTIFICATE OF TRAINING

is awarded to

Norda Spencer-DeKid

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

delivered by Lead Instructor

Dr. Aliyar Cyrus Fouladkhah

completed on

06/01/2023

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

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Gerald Wojtala, Executive Director
International Food Protection Training Institute

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



Certificate # e953226f





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

CERTIFICATE OF TRAINING

is awarded to

Patrick Dehaney

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

delivered by Lead Instructor

Dr. Aliyar Cyrus Fouladkhah

completed on

06/01/2023

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

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Gerald Wojtala, Executive Director
International Food Protection Training Institute

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



Certificate # 50a529ba





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

CERTIFICATE OF TRAINING

is awarded to

Racquel Dixon

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

delivered by Lead Instructor

Dr. Aliyar Cyrus Fouladkhah

completed on

06/01/2023

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

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Gerald Wojtala, Executive Director
International Food Protection Training Institute

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



Certificate # 1d575b7d



FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

CERTIFICATE OF TRAINING

is awarded to

Samantha-Gaye Anderson-Ashley

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

delivered by Lead Instructor

Dr. Aliyar Cyrus Fouladkhah

completed on

06/01/2023

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

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Gerald Wojtala, Executive Director
International Food Protection Training Institute

A handwritten signature in black ink that reads 'Steve Mandernach'.

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



Certificate # f05d9890





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

CERTIFICATE OF TRAINING

is awarded to

Sasha Jae Hawthorne

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

delivered by Lead Instructor

Dr. Aliyar Cyrus Fouladkhah

completed on

06/01/2023

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

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Gerald Wojtala, Executive Director
International Food Protection Training Institute

A handwritten signature in black ink, reading 'Steve Mandernach'.

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



Certificate # d826ede9





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

CERTIFICATE OF TRAINING

is awarded to

Sherrine Williams

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

delivered by Lead Instructor

Dr. Aliyar Cyrus Fouladkhah

completed on

06/01/2023

A handwritten signature in black ink, reading 'Brian Schaneberg'.

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

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Gerald Wojtala, Executive Director
International Food Protection Training Institute

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



Certificate # 07760e75





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

CERTIFICATE OF TRAINING

is awarded to

Wayne Watkis

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

delivered by Lead Instructor

Dr. Aliyar Cyrus Fouladkhah

completed on

06/01/2023

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

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Gerald Wojtala, Executive Director
International Food Protection Training Institute

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



Certificate # 38d3803e



Excerpts of Teaching Material



Public Health Microbiology™
Foundation
Dr. Aliyar Cyrus Fouladkhah

Public Health Microbiology FoundationSM:

<https://publichealthmicrobiology.education>

Global Public Health Burden of our Changing Climate

Aliyar Cyrus Fouladkhan, 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:
 May 30, 2023
 USAID T2F Partners of America
 Host in Jamaica: Northeast Regional Health Authority in
 partnership with St. Ann Health Department

1

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

2

- 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

CPH Certified in Public Health | **sas** | Certified Base Programmer for SAS®9

Colorado State University
Microbac

BOULDER BRANDS | **RODELE**
 established eggs

Advanced Professional MPH Program

Website: <https://ysph.yale.edu/school-of-public-health/graduate-programs/accelerated-mph-program/>
 Video: <https://www.youtube.com/watch?v=IGVNSj0tts>

3

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)


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

92 Website performance: 4/22/2020


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

4

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)



9/12/2019

Monica Smith
3282 Vantage Pointe Rd - Apt. 304
Ashland City, TN 37015

Dear Monica,

Congratulations! You have been selected for an internship with Tennessee State Government. Being selected for this internship is very competitive and is a great honor. So, be proud of your accomplishment! We are excited to have you as a member of our customer focused team. We hope that this opportunity provides you with the professional development experience that you are seeking.

Below are the details of your internship offer

Job Title: Tennessee Department of Agriculture - Intern

5

Students Awards Adviser: A. Fouladkhal

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 Sabrina H. Wadood (center left) and Sadiya Aras (center right) won first and second place in the oral and poster events at the 2021 Tennessee Academy of Science competitions.

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

2020 Tennessee Academy of Science
Virtual Health and Medical Sciences Division

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

2019 Tennessee Academy of Science
Health and Medical Sciences Division

1st (A. Allison), 2nd (S. Aras), 3rd (M. Henry) 1st (M. Henry), 2nd (A. Allison), 3rd (J. Adhkar). Adviser: A. Fouladkhal


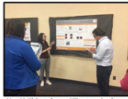
6

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

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

A. Fouladkhal: Competition Founder and Director

- 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. Fouladkhal)

SPACE FOOD: PRESENT AND FUTURE

Yekie L. Kneris
Former Manager International Space Station Food System

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

7

Teaching in Tennessee and Internationally

Graduate Course in Food Policy and Regulations

2020 Student Evaluation:

- "...Dr. Fouladkhal 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. Fouladkhal 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 assist 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. Fouladkhal. 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. Fouladkhal."
- "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/July 2021
- 2021, 2022 Jamaica Nov./March 2021
- 2020, and 2022, Haiti Government, Fortification with iron, vitamin b12, and zinc
- 2019, Philippi 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



8

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

PBI Pressure BioSciences Inc.

Public Health Microbiology Laboratory

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

Information about the units: <https://www.pressurebiosciences.com/press-releases/detail/284/pressure-biosciences-announces-commercial-release-of-the>

High Pressure Processing, Public Health Microbiology Laboratory

9

Process Authority

Association of Food and Drug Officials
 Many perspectives, one voice, since 1956.

<https://www.afdo.org/directories/fpa/results/?loc=Tennessee>

Food Processing Authorities Directory
 The authorities are listed in no particular order and the presence or absence of a facility does not represent or constitute an endorsement or rejection, of any of its sub-offices, or individual employees.

Allyra Fouladkhah
 ASSISTANT PROFESSOR
 Tennessee State University
 afoulad@trstate.edu
 Download vCard

As of 2023:
 > 106 companies

PHONE: (970) 690-7392
ADDRESS: 246 Glenstone Circle, Nashville, Tennessee 37027

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

PCA
 PRESERVE CONTROLS ALLIANCE

10

Stakeholders' Profile: Food Processing Center Clients (Updated January 2023)

39% Start-up Entrepreneurs
 61% Established Companies
 98 Entrepreneurs Supported

Demographics: Clients Received Supported (Updated January 2023)

52% Female
 48% Male

Foundation Updates As of February 2023

39 Students Scholarship
 106 Companies Supported (new products in market)
 >178 Food Safety Certifications

Outreach Clients: Food Processing Support Center (Updated January 2023)

18 States Supported

Colombia, Dominican Republic, Georgia (twice), Guatemala (Thrice), Haiti (Twice), Jamaica (Thrice), and South Africa.

11

CLIMATE REALITY LEADERSHIP CORPS

Public Health Microbiology Laboratory

Part II: Global Climate Change in Impact

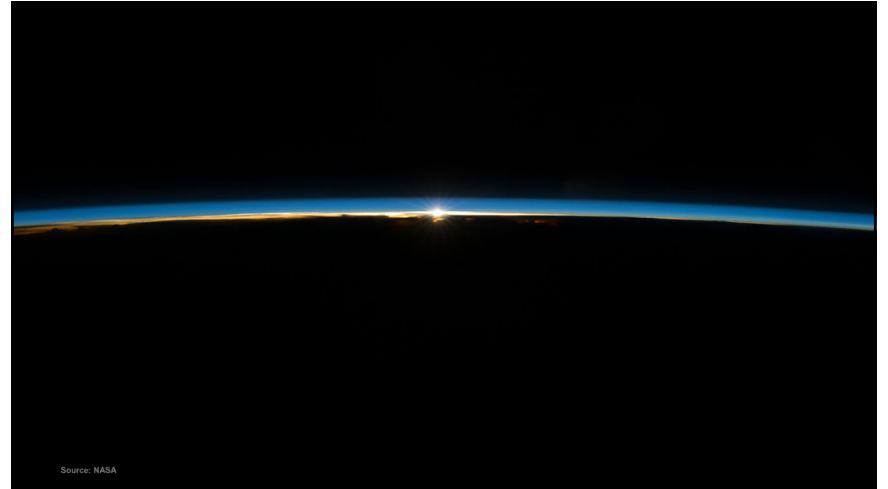
Public Health Microbiology Laboratory
 Tennessee State University, Nashville, TN

A. Fouladkhah: Director, Public Health Microbiology Laboratory

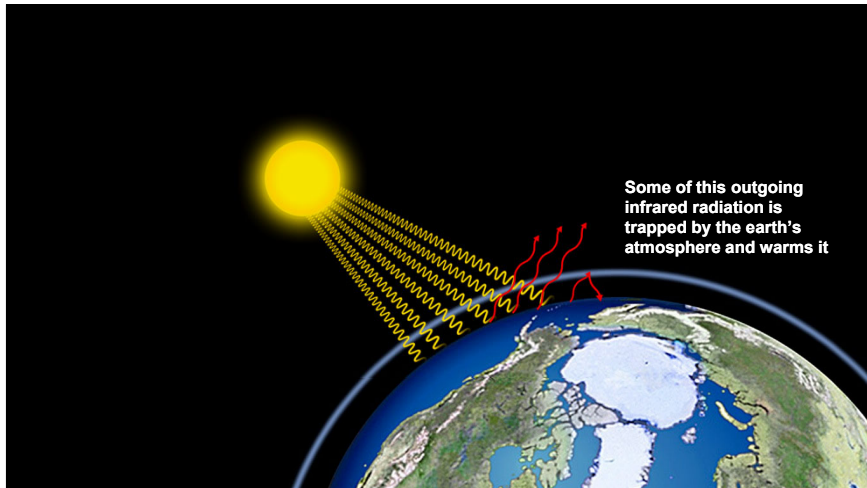
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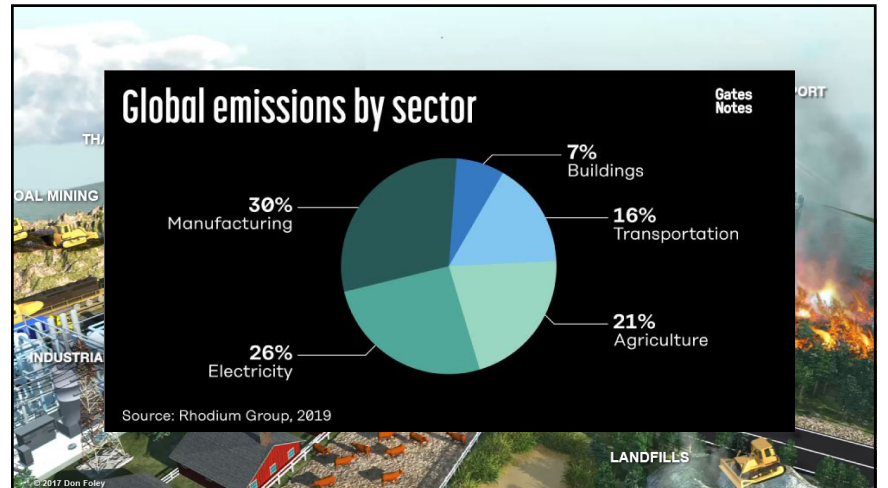
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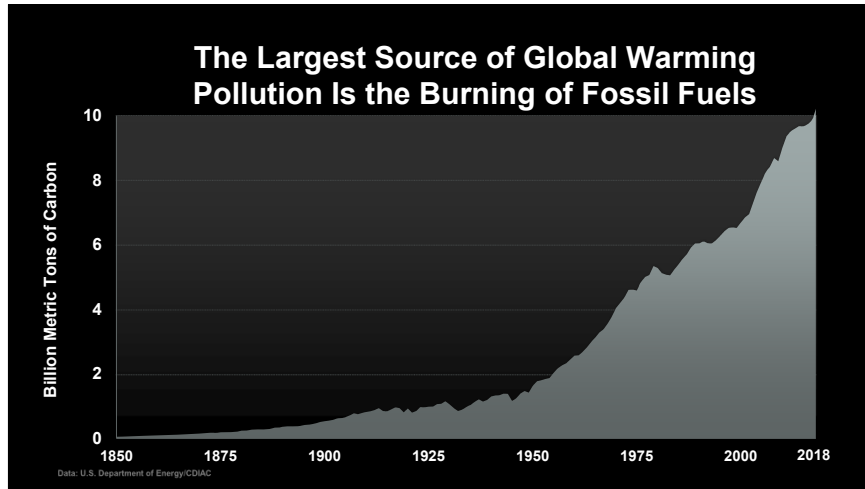
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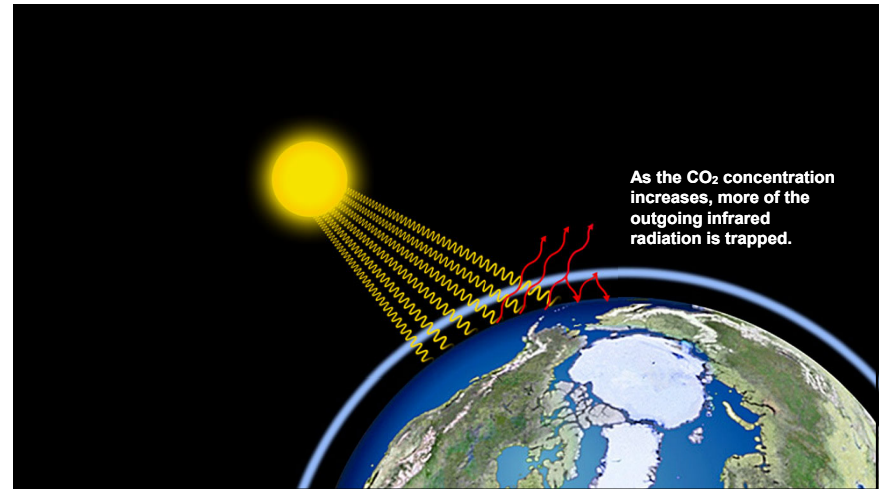
15



16



17



18



19

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

20

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



21

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

22

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

23

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

24

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**.

25

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

26

Kuwait City experienced temperatures up to

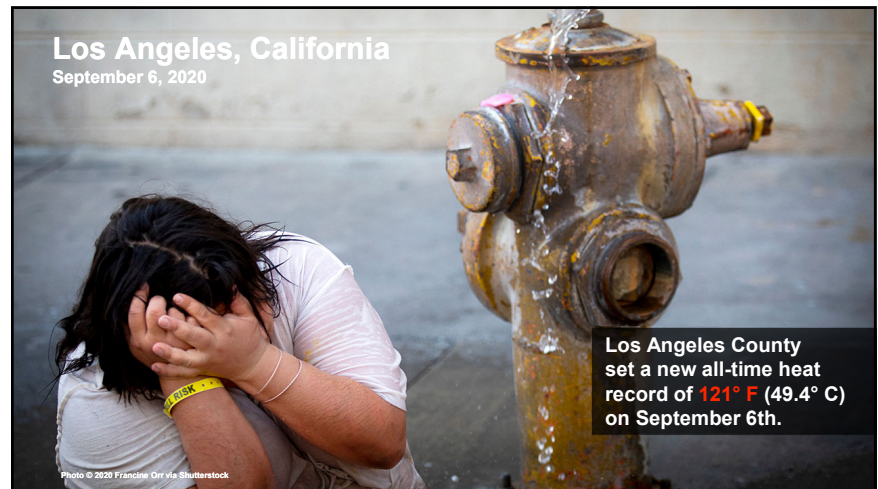
51° C (124° F)

in July 2017.

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

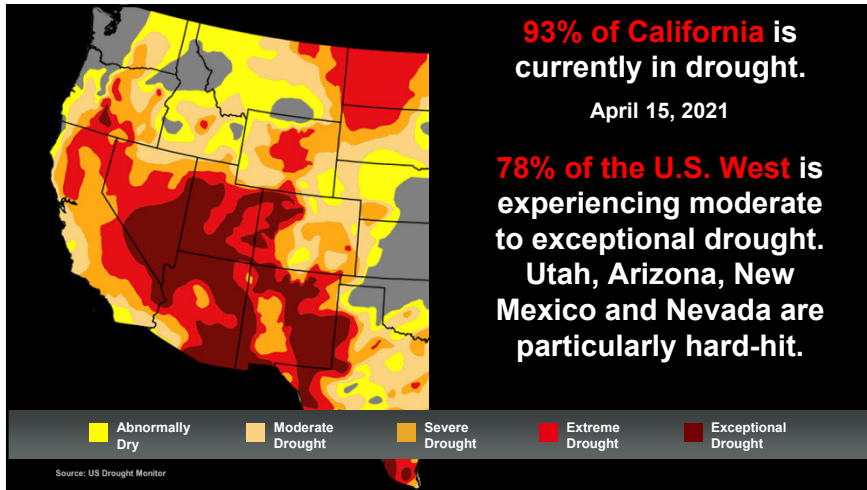
27

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.

28



29



30



31



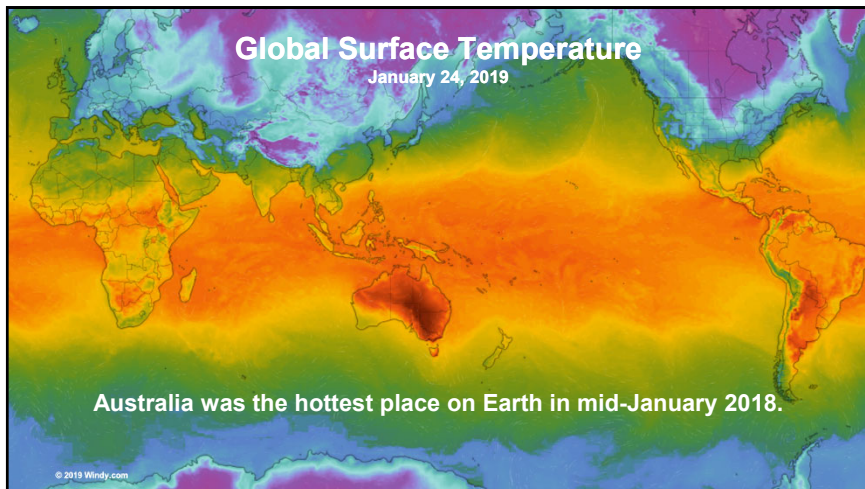
32



33



34



35



36

Macon County, Georgia
October 11, 2018



Hurricane Michael caused at least \$2.5 billion in damages to Georgia's agricultural sector.

© 2018 Jason Vorhees/The Macon Telegraph via AP

37

Corozal, Puerto Rico
September 24, 2017



An estimated **2,975 people** died in Puerto Rico as a result of Hurricane Maria.

© 2017 Ricardo Arduengo/AFP/Getty Images

38

Tacloban City, Philippines
November 10, 2013



© 2013 Reuters/ERIK D...

39

Houston, Texas
August 27, 2017



© 2017 Harris County Sheriff's Office

40

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

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

41

Risk of Hurricane Sandy-Intensity Events in New York

One in 500 Years

One in 25 Years

One in 5 Years

1880

2017
Year

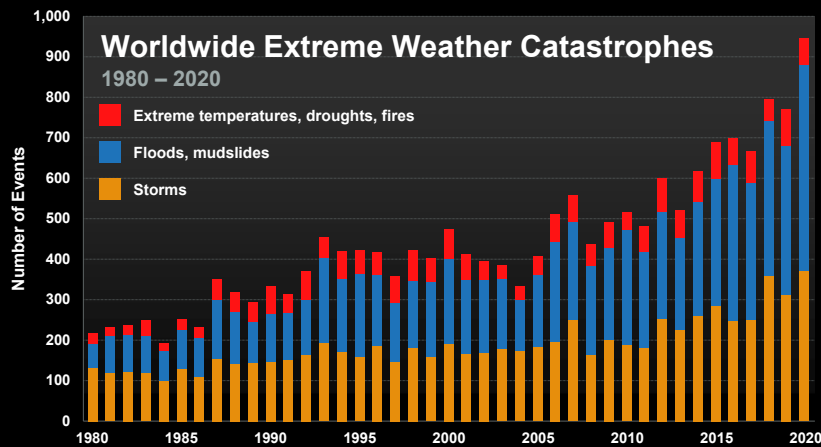
2030–2045

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

42

Worldwide Extreme Weather Catastrophes

1980 – 2020



Data: 2017 Munich Re, Geo Risks Research, NatCatSERVICE, As of 2021.

43

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.

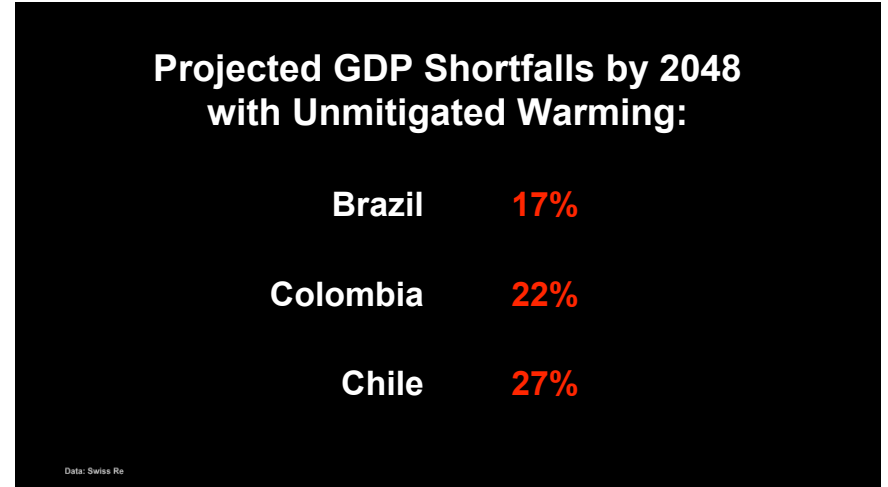
Photo © 2017 AP Photo/Gerald Herbert

Hurricane María aftermath

44



45



46



47



48



Kitui County, Kenya
March 17, 2021

Invasive pests and plants in Africa cause more than \$65 billion in crop losses every year.

49



Harbin, China
June 1, 2018

50



Yangtze River, Chongqing, China
May 8, 2020

2.4 million people in the lower Yangtze river basin were still affected by drought in early 2021.

51



Chennai, India
May 17, 2017

Chennai's state of Tamil Nadu experienced its worst drought in 140 years.

52



Pocone, Brazil
September 26, 2020

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

Photo © 2020 Duda Machado/Getty Images

53



Schwüblingsen, Germany
August 22, 2018

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

© 2018 Julian Stratenschulte/Photo Alliance via Getty Images

54



Rossinière, Switzerland
August 7, 2018

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

© 2018 Reuters/Denis Balibouse

55



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

© 2017 Konrad K. B. Spe. AP Images

56



57



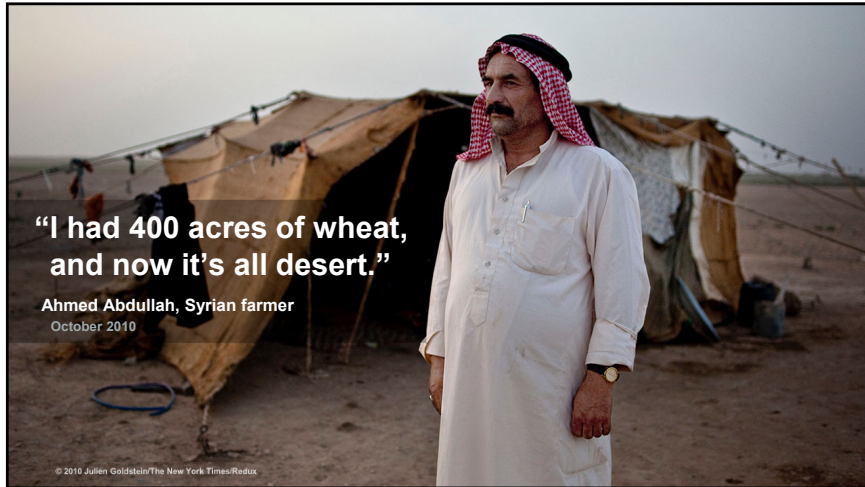
58



59



60



**"I had 400 acres of wheat,
and now it's all desert."**

Ahmed Abdullah, Syrian farmer
October 2010

© 2010 Julien Goldblain/The New York Times/Redux

61

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

62

**"...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

63

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



64

“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

65

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

66

Safe Minimum Internal Temperature for Food Preparation
Source: <https://www.fsis.usda.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)

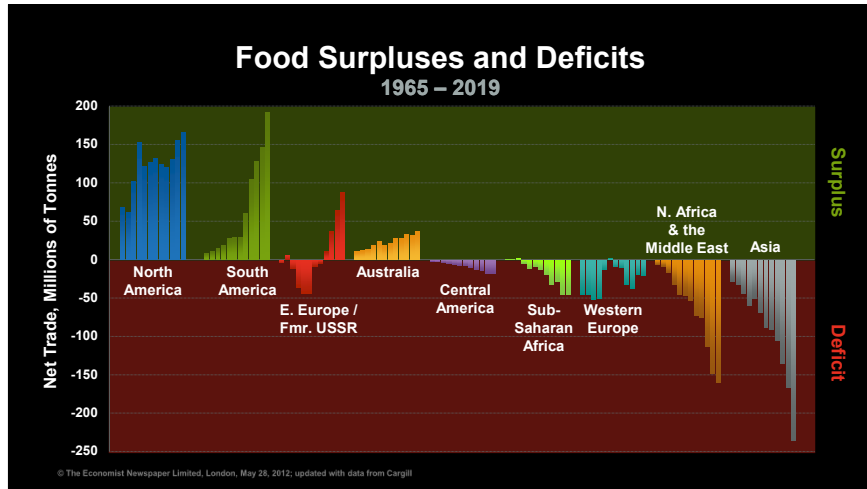
Public Health Microbiology Laboratory: Education, Research, Outreach, and Technical Assistance: <https://publichealthmicrobiology.education/>

67

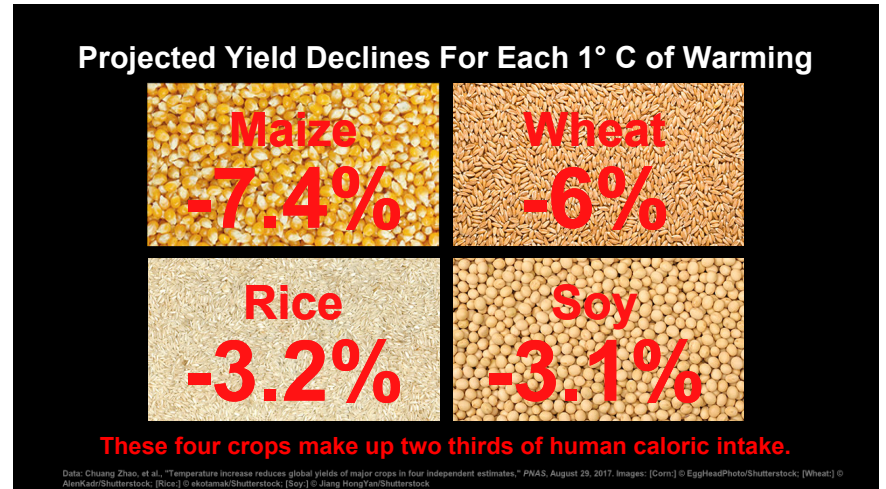
The world could see over **1 billion climate migrants** by the end of this century.

The Lancet Countdown Report
October 2017

68



69



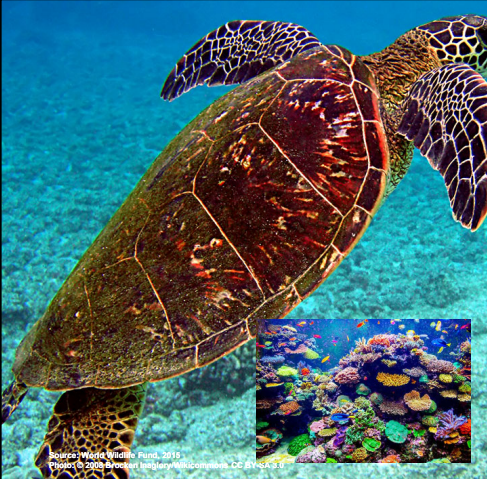
70



71



72



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 corral reefs have been reduced
Corral reefs 0.1% of Oceans,
25% of ocean lives
Recently, great progress by "coral gardeners"

Source: World Wildlife Fund, 2015
Photo: © 2008 Andrew Hatcher/Photodisc/LLZ


73

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


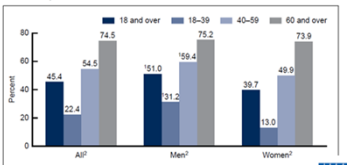
Average pollen counts are specific to North America
Source: Dr. Leonard Bielory, Visiting Professor, Center for Environmental Prediction, SEBS, Rutgers University.
Image: © Jill Fromer/Photodisc/Getty Images

74

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.

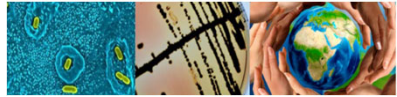



Category	18 and over	19-39	40-59	60 and over
All?	45.4	54.5	74.5	74.5
Men?	22.4	31.2	59.4	75.2
Women?	13.0	39.7	49.9	73.9

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



75



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

76

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

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 adopted from BBB of Food and Drug Administration, B.A.M. Resources of Centers for Disease Control and Prevention. Photo Courtesy: Adobe Stock (standard license of photos purchased by the Public Health Microbiology Laboratory).

* Calculated for oral ingestion based on epidemiological data from outbreaks and human feeding trials of volunteers. Data obtained from BBB of Food and Drug Administration (2nd edition).

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

Emerging pathogens

Vertical and Horizontal Gene Transfer and Emerging Pathogens

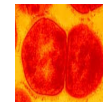
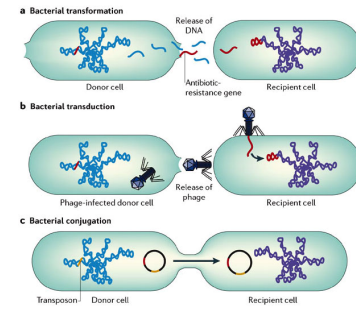
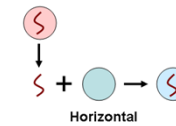
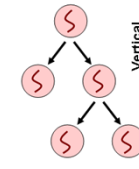
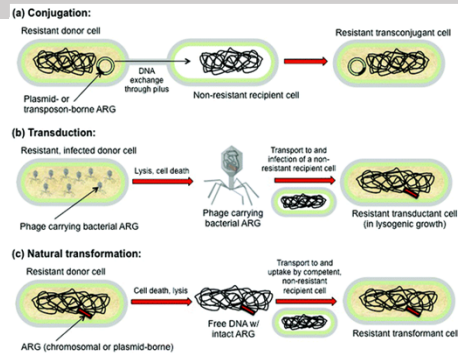


Photo Courtesy: http://www.dorlandliving.info/encyclopedia/b/binary_fission.html



Copyright © 2006 Nature Publishing Group
Nature Reviews | Microbiology

Horizontal Gene Transfer



Donn, 2012

Planktonic cells and Biofilm Communities

Biofilm formation on biotic and abiotic surfaces

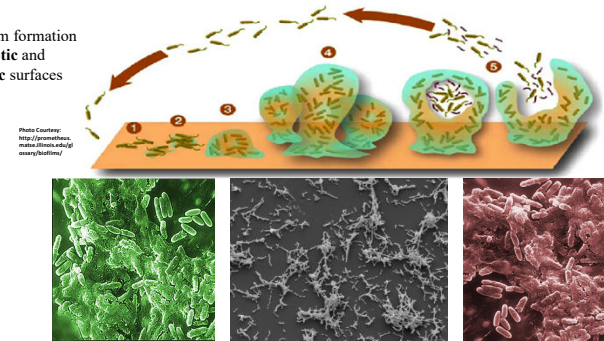


Photo Courtesy: <http://www.researchgate.net/publication/234411111>

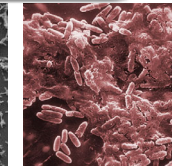
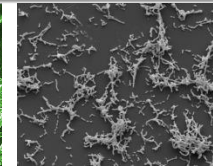
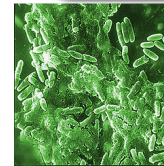


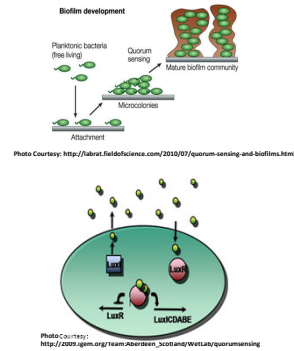
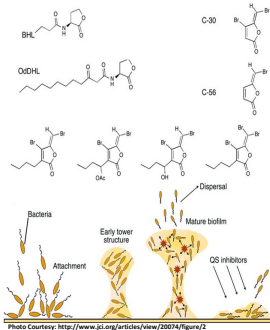
Photo Courtesy: <http://microscopie.org/2012/07/17/biofilm-resistance>

Photo Courtesy: http://www.ars.org/562271/biofilm_microbial_fat_eat_eat_eat_baflm.php

Photo Courtesy: <http://www.microworld.com/506/catspaw/baflm/>

Quorum Sensing and Biofilm formation

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



81

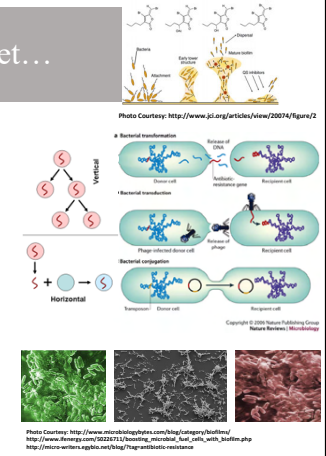
Infectious Diseases is a Moving Target...

- It is estimated only 1% of microbial community has been identified.
- Currently **etiologic 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



82

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)



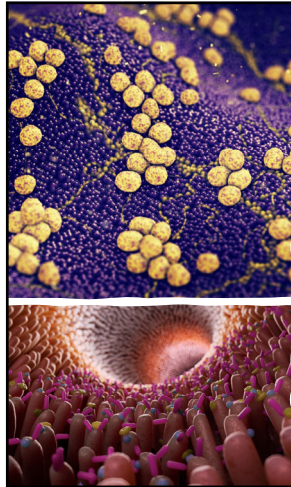
83

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

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



84



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

85

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

86

Are these outbreaks associated with corporates and lager manufactures?

87

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

88

Prevalence of Pathogens in Small Poultry Farms

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

Sampling sites	<i>Salmonella</i> 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

89

Water Safety Study

Fate and Biofilm Formation of Wild-Type and Pressure-Stressed Pathogens of Public Health Concern in Surface Water and on Abiotic Surfaces

Md Naimul Kabir¹, Sadjya Aron¹, Sabrina Wadood¹, Shabid Chowdhury¹ and Altya Cyrus Ferdinands^{1,2*}

¹ Public Health Microbiology Laboratory, Tennessee State University, Nashville, TN 37203, USA; ² Infectious Diseases Unit, (D.M.S.) Veterinary Institute, (V.I.), Westwood Institute, (W.I.), Nashville, TN 37203, USA; ³ Cooperative Extension Program, Tennessee State University, Nashville, TN 37203, USA

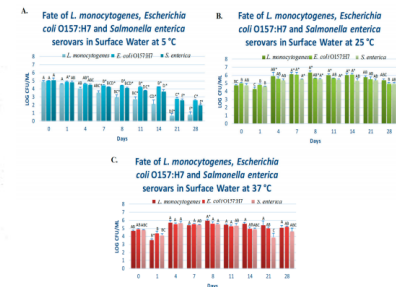
* Correspondence: altya.ferdinands@tsu.edu; Tel: +1 615 256 7302

Received: 18 February 2020; Accepted: 11 March 2020; Published: 13 March 2020

Public Health Burden of Waterborne Disease

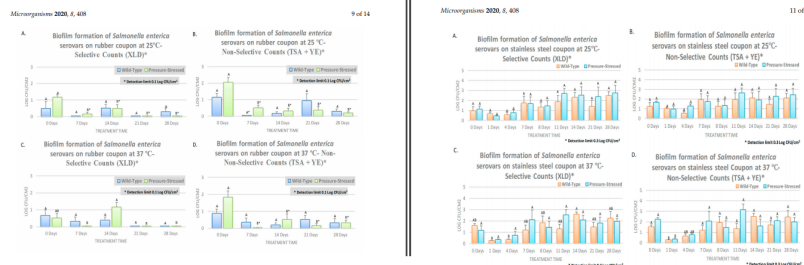
17 waterborne pathogens cause estimated: (Collier et al., 2021)

601,000 illness; 118,000 hospitalization; 6,630 deaths, and cost the economy up to \$ 8.77 billions.



90

Water Safety Study- Biofilm Formation on Abiotic Surfaces



91

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

92

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



Changing climate

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

Abstract
 Climate change is a complex phenomenon that is expected to have significant impacts on human health and the environment. This review examines the potential impacts of climate change on foodborne and waterborne infectious diseases and antibiotic resistance. The review discusses the mechanisms by which climate change may affect the distribution and abundance of these pathogens, as well as the potential for increased antibiotic resistance. The review also discusses the potential for climate change to affect the effectiveness of public health interventions and the need for a more integrated approach to addressing these challenges.

microorganisms

Safety of Food and Water Supplies in the Landscape of Changing Climate

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

Abstract
 Climate change is a complex phenomenon that is expected to have significant impacts on human health and the environment. This review examines the potential impacts of climate change on foodborne and waterborne infectious diseases and antibiotic resistance. The review discusses the mechanisms by which climate change may affect the distribution and abundance of these pathogens, as well as the potential for increased antibiotic resistance. The review also discusses the potential for climate change to affect the effectiveness of public health interventions and the need for a more integrated approach to addressing these challenges.

Keywords
 Climate change, food safety, water safety, infectious diseases, antibiotic resistance

Introduction
 Climate change is a complex phenomenon that is expected to have significant impacts on human health and the environment. This review examines the potential impacts of climate change on foodborne and waterborne infectious diseases and antibiotic resistance. The review discusses the mechanisms by which climate change may affect the distribution and abundance of these pathogens, as well as the potential for increased antibiotic resistance. The review also discusses the potential for climate change to affect the effectiveness of public health interventions and the need for a more integrated approach to addressing these challenges.

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References
 WHO (2020) Global burden of disease 2019. Geneva: World Health Organization.

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93

Vibrio spp.

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

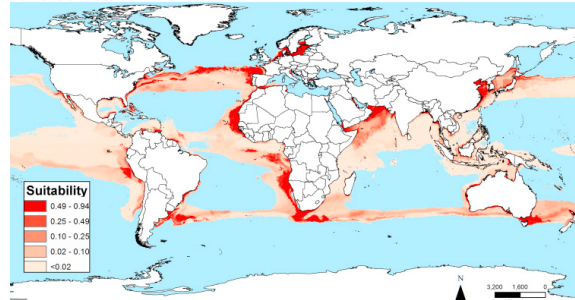
- Causing about 80,000 illness and 100 death annually in the United States.
- Infection symptoms vary depending on strain, ranging from diarrhea to high fever
- Vibrio is a halophilic bacterium and is a major concern in aquaculture industry
- Primary sources: Salt water environments and seafood
- Requires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

94

Vibrio cholerae proliferation in sea water: Current Climate

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

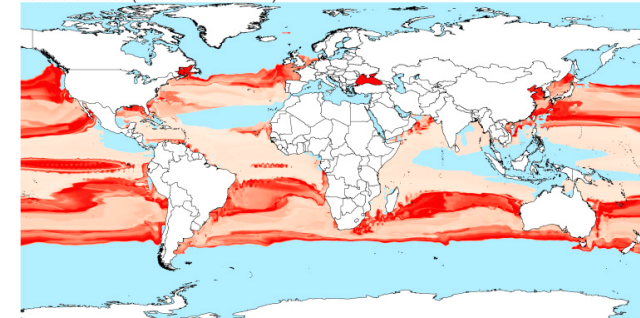


Escobar LE et al. Acta Tropica 2015;149:202-11

95

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

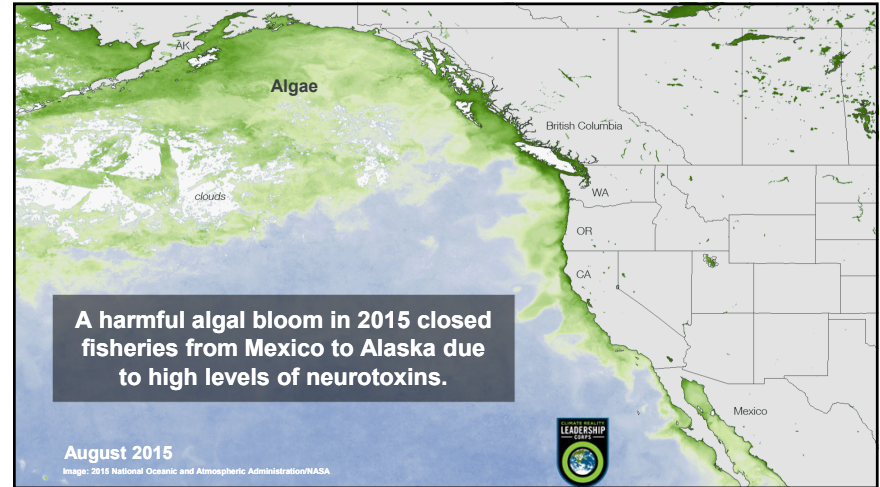
96

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**



The Threat of Antibiotic Resistance in Changing Climate
 What's the Problem? "New Research" and "New Tools" from the Center for Global Health and the Center for Disease Dynamics and Mathematical Modeling.



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

Impact Analyses

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

research OUTREACH
 Connecting science with society

IMPACT ANALYSIS
 Issue RO 114

Aliyar Fouladkhah

Twitter @ResOutreach analysis

The link to your Twitter post: <https://t.co/3d4kda>

Demographics
 Male 57%, Female 40%, Unknown 3%

Device stats
 iOS 43%, Android 47%, Desktop 10%

Key metrics for all content promoted on Twitter

Audience	Engagements
42605	3256

Top interests

Technology	Biology	Healthcare
68%	53%	48%

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

Facebook.com/ResearchOutreach

The link to your Facebook post: <https://www.facebook.com/ResearchOutreach>

Device stats: iOS 31%, Android 37%, Desktop 32%

Demographics: Male 65%, Female 35%

Key metrics for all content promoted on Facebook:

- People reached: 31317
- Engagements: 406

Age range: [Bar chart showing engagement by age group]

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

Biology | Aliyar Fouadkhah

Abstract: A study by the U.S. Centers for Disease Control and Prevention (CDC) found that climate change is a "threat multiplier" for foodborne and waterborne infectious diseases and antibiotic resistance. The study found that climate change is likely to increase the prevalence of these diseases and resistance, particularly in developing countries. The researchers found that climate change is likely to increase the prevalence of these diseases and resistance, particularly in developing countries. The researchers found that climate change is likely to increase the prevalence of these diseases and resistance, particularly in developing countries.

101

researchoutreach.org website analysis

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

Aliyar Fouadkhah
Tennessee State University
<https://www.facebook.com/ResearchOutreach>

Number of visits for Research Outreach website: [Bar chart showing daily visits]

Demographics: Male 40%, Female 51%

Age range: [Bar chart showing visitor age distribution]

Geographical location of web viewers: [World map showing visitor locations]

Platform and device stats: Tablet 82%, Desktop 12%, Mobile 27%

Key statistics:

- Total number of visitors: 99,204
- Total number of page views: 134,392
- Total number of users: 46,553
- Total number of page/session: 2.92

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

Biology | Aliyar Fouadkhah

Abstract: A study by the U.S. Centers for Disease Control and Prevention (CDC) found that climate change is a "threat multiplier" for foodborne and waterborne infectious diseases and antibiotic resistance. The study found that climate change is likely to increase the prevalence of these diseases and resistance, particularly in developing countries. The researchers found that climate change is likely to increase the prevalence of these diseases and resistance, particularly in developing countries.

102



103

Thank you!

Public Health Microbiology Laboratory
Aliyar Cyrus Fouadkhah, PhD, MPH

Dr. Aliyar Cyrus Fouadkhah,
Founding Director, Public Health Microbiology Foundation
Associate Professor, Tennessee State University
Email: afouadk@tstate.edu or aliyar.fouadkhah@tva.tnsc.edu (old email address)
Phone: +1 (970) 690-7392
Website: <https://publichealthmicrobiology.education/>

Contributions of members of the Public Health Microbiology laboratory is greatly appreciated. Funding supports of the program fosters and sustains quality and growth in microbiology.

Public Health Microbiology™
Foundation
Dr. Aliyar Cyrus Fouadkhah

CLIMATE REALITY LEADERSHIP COAFS

Public Health Microbiology Foundation
Commission Service Excellence

Photos Courtesy: Adobe Stock, royalty purchased (standard license) by public health microbiology laboratory and Climate Reality Leadership Corps.

104

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?

National and International Importance of Food Safety Modernization Act [5-30-2023]

Public Health Microbiology™ Foundation
Dr. Aliyar Cyrus Fouladkhah

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

1

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



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

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

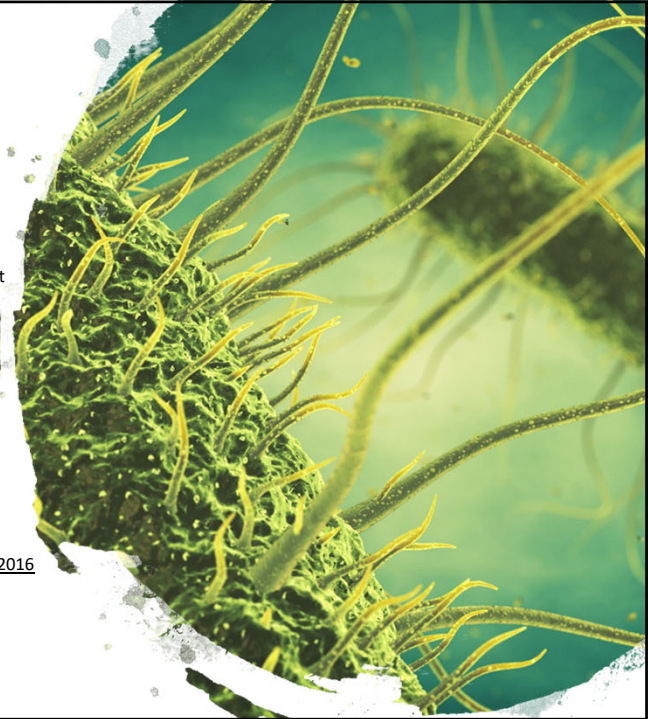
FSMA Implementation Schedule

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

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 nations 75 land-grant institution for **safe and economical access to market.**



6

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

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:

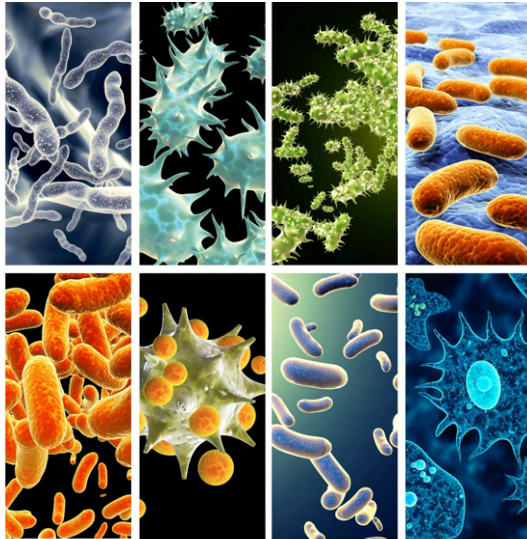
- Sanitation
- Employee training
- Environmental control and training
- Recall contingency plan
- Allergen control
- Supplier verifications
- Sanitary transportation



8

Requirements of Preventive Rule *Hazard Analysis and Risk-Based Preventative Controls (HARPC)*

- Previous a 7-step plan for FSIS HACCP, 12-step plan for Codex HACCP, and currently 5-step plan for HARPC:
- **Hazard analysis**
- Identification and implementation **preventive controls**.
- **Monitoring** the performance of controls.
- Developing **corrective actions** for preventative deviation.
- **Verification and recordkeeping** of preventative controls effectiveness
- 2.5 day workshop Preventive Control Qualified Individuals (PC QI)



9

Preventive Rule: Implementation and compliance dates

- **Implementation date:** August 30, 2015
- **Compliance date:**
 - **Very small facility** (\$2.5*m and below): 3 year
 - **Small facility** (less than 500 employee and does not qualified for exception): 2 years
 - **“Other” facilities:** 1 years

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.

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

10

Preventive Control for Human Food: PC QI

Human Food	Maxime Ndayizeye	Jun 28, 2023	Register	USD 500	Contact	Montréal QC Canada	English	Virtual - Online, Web Based Live
Human Food	SONIA AKBARZADEH	Jun 7, 2023	Register	USD 695	Contact	FIC Pacific and Central Time Zones United States	English	Virtual - Online, Web Based Live
Human Food	Catherine Martin	May 30, 2023	Register	USD 549	Contact	No Travel No Travel United States	English	Virtual - Online, Web Based Live
Human Food	SONIA AKBARZADEH	Jun 28, 2023	Register	USD 695	Contact	FIC Pacific and Central Time Zones United States	English	Virtual - Online, Web Based Live
Human Food	Lauren Applegate	Jul 25, 2023	Register	USD 650	Contact	San Antonio Texas USA	English	In Person - Live
Human Food	Sjoerd Remmers	Nov 29, 2023	Register	EUR 1,510	Contact	Den Bosch Noord-Brabant Netherlands	English	In Person - Live
Human Food	Camiel Aalberts	Jun 20, 2023	Register	EUR 1,495	Contact	Bunnik Noord Holland Netherlands	Dutch	In Person - Live
Human Food	Camiel Aalberts	Nov 1, 2023	Register	EUR 1,495	Contact	Bunnik Noord Holland Netherlands	Dutch	In Person - Live
Human Food	Dr Dima Faour-Klingbeil	Sep 19, 2023	Register	EUR 1,600	Contact	Hamburg Lower Saxony Germany	English	In Person - Live

• Our course 5-30-2023 to 6-1-2023



Public Health Microbiology™
Foundation
Dr. Aliyar Cyrus Ferozkhani

11

FSPCA PREVENTIVE CONTROLS FOR HUMAN FOOD

Exercise Workbook

Including Food Safety Plan Worksheets

Developed by the
FSPCA
FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE



FSPCA
FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

Preventive Controls for Human Food

First Edition - 2016

Participant Manual

12

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	Microbiologist, Live, Interactive Industry-Experienced Lead Instructor Partial Days, Convenient Eastern to Pacific United States	English	Virtual - Online, Web Based Live
Animal Food	RACHEL MONTGOMERY	Dec 5, 2022	Register	USD 795	Contact	Microbiologist, Live, Interactive Industry-Experienced Lead Instructor Partial Days, Convenient Eastern to Pacific United States	English	Virtual - Online, Web Based Live
Animal Food	RACHEL MONTGOMERY	Nov 7, 2022	Register	USD 795	Contact	Microbiologist, Live, Interactive Industry-Experienced Lead Instructor Partial Days, Convenient Eastern to Pacific Time United States	English	Virtual - Online, Web Based Live
Animal Food	Bita Saïdi	Dec 21, 2022	Register	USD 795	Contact	Live-Virtual Live-Virtual United States	English	Virtual - Online, Web Based Live
Animal Food	Bita Saïdi	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	Microbiologist, Live, Interactive Industry-Experienced Lead Instructor Partial Days Convenient Eastern to Pacific United States	English	Virtual - Online, Web Based Live
Animal Food	RACHEL MONTGOMERY	May 8, 2023	Register	USD 795	Contact	Microbiologist, Live, Interactive, Industry-Experienced Lead Instructor Partial Days Convenient Eastern to Pacific United States	English	Virtual - Online, Web Based Live

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

13

CERTIFICATE OF TRAINING

Is awarded to
Dr. Minoo Bagheri

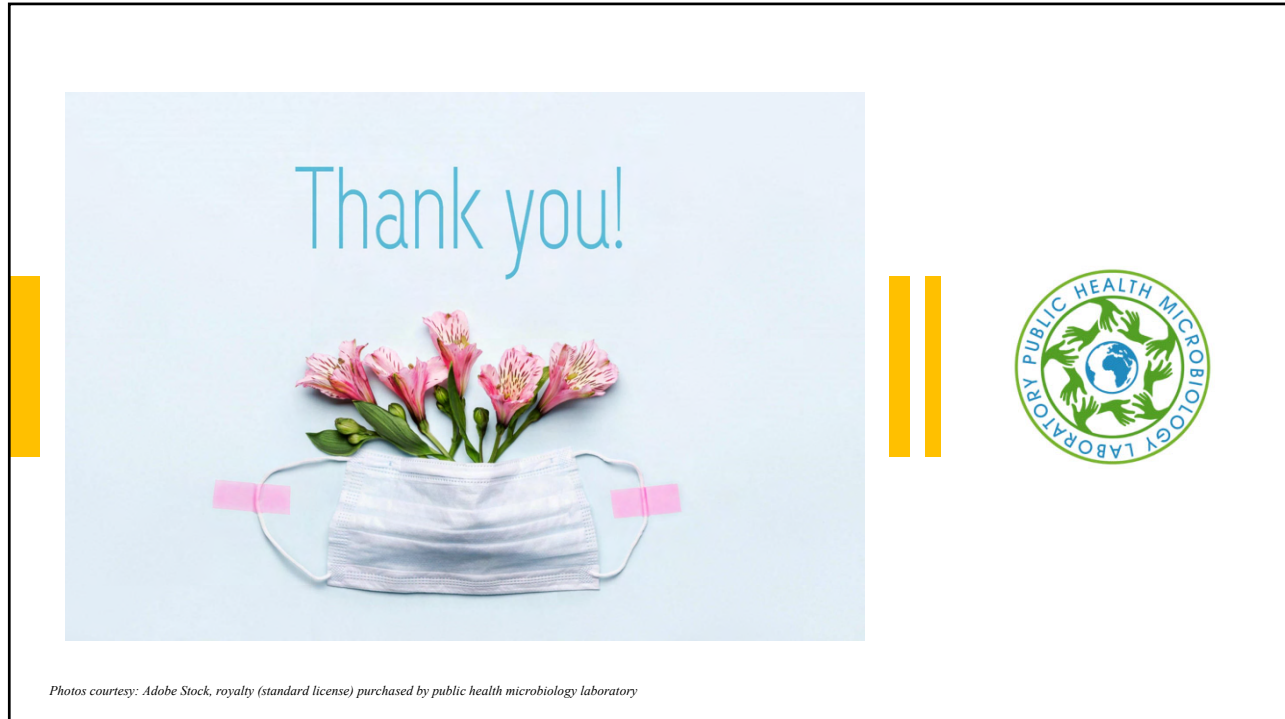
In recognition for having successfully completed
the Food Safety Preventive Controls Alliance course:
FSPCA Preventive Controls for Human Food
 delivered by Lead Instructor
Dr. Aliyar Cyrus Fouladkhah
 completed on
12/08/2021

Jason Wan, Interim Director
Institute for Food Safety and Health

Gerald Wojtala, Executive Director
International Food Protection Training Institute

Steve Mandemach, Executive Director
Association of Food and Drug Officials

14



15

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 sent to [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.cev.com.pt/en/blad-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,

16



Foodborne Diseases of Public Health Importance and Transboundary Diseases in Jamaica

Presented at:

June 1, 2023

St. Ann, 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

Types of pathogen

Gram-Staining

Developed by: Danish Scientist, Dr. Hans Christian Gram (1884)

2

Anthrax



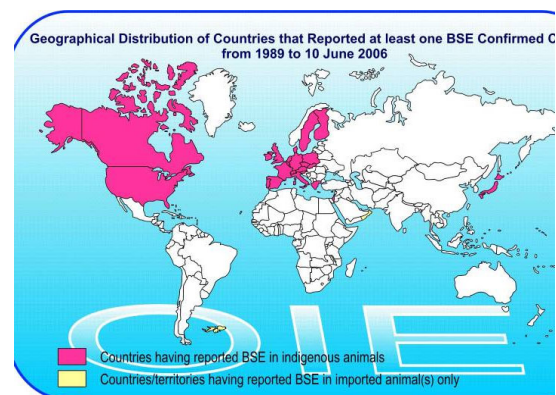
- Spores highly infective
- Remain effective during aerosolization
- Low lethal dose
- High mortality
- Person-to-person transmission rare
- **Symptoms** begin between **one day** and **two months** after the infection

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



5



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

6

Brucellosis

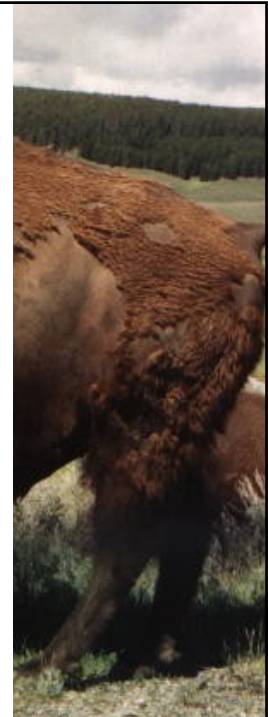
- Caused by bacteria (several species)
- (Genus *Brucella* e.g. *B. melitensis*, *B. abortus*, *B. suis*, and *B. canis*)
- **Highly infectious (N95 or KN95 mask during farm visits?)**
 - Easily aerosolized
- **Transmission:**
 - Ingestion
 - Inhalation
 - Direct contact
 - **Signs in animal:**
 - Reproductive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




7

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, goggle, secondary outfit +mask?)
 - Hunting Activities



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**

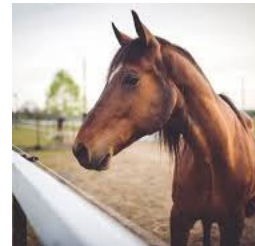


11

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 world, as of 2021 [US has about 1,500 BSL3])
- Could cause high mortality in humans
- Currently no treatment option is available

(Great topic for term paper)



12

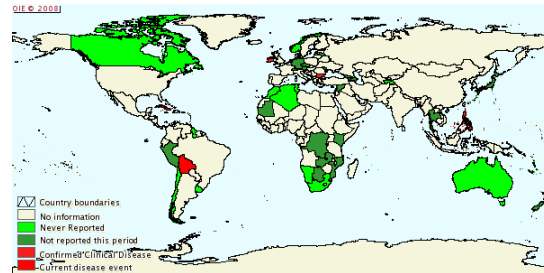
Pseudorabies

- **Contagious** viral diseases from **herpes family**
- Primary concern in domesticated **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



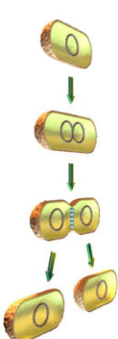
14

Main Foodborne Bacterial Pathogens Associated with Human Health Diseases

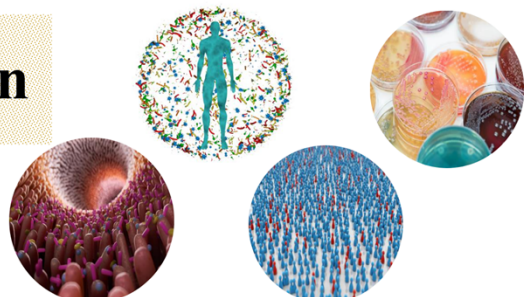
15

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




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 BBB of Food and Drug Administration, BAM Resources of Centers for Disease Control and Prevention. Photo Courtesy: Adobe Stock (standard license of photos purchased by the Public Health Microbiology laboratory).

* Calculated for oral ingestion based on epidemiological data from outbreaks and human feeding trials of volunteers. Data obtained from BBB of Food and Drug Administration (2nd edition).

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



16

Emerging pathogens

Diversity, moving towards "fitness" and Emerging Pathogens

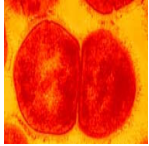
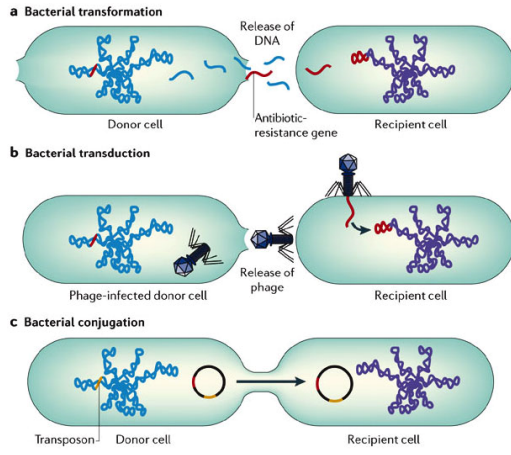
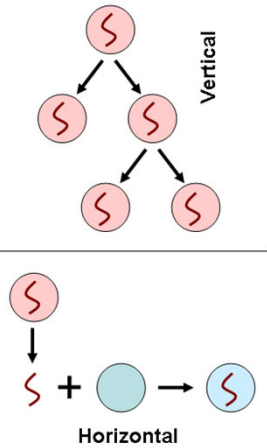


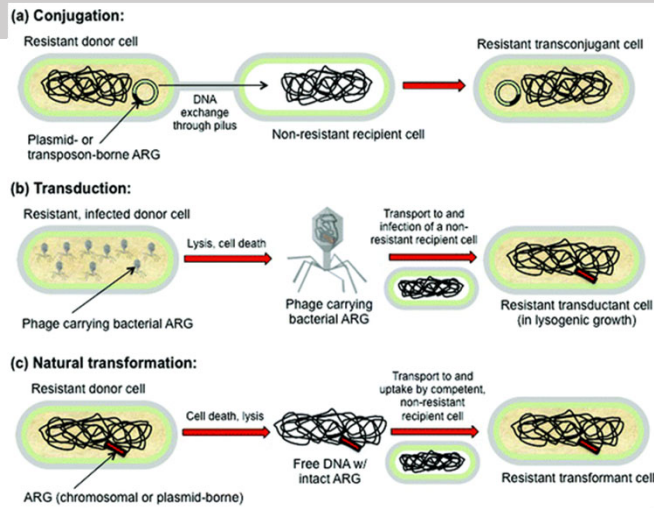
Photo Courtesy: http://www.daviddarling.info/encyclopedia/B/binary_fission.html



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17

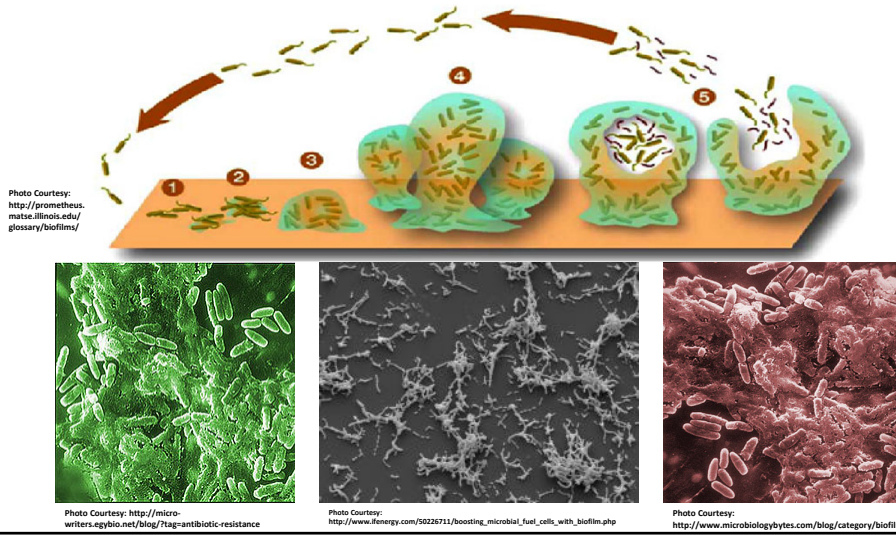
Horizontal Gene Transfer



Donn, 2012

18

Planktonic cells and Biofilm Communities

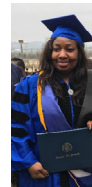
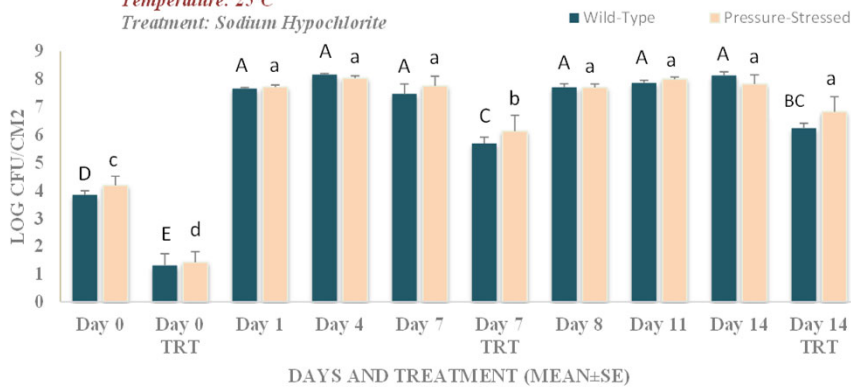


19

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

Biofilm Formation and Decontamination of Wild-Type and Pressure-Stressed *Cronobacter Sakazakii*

Temperature: 25°C
Treatment: Sodium Hypochlorite



Allison et al., 2020



20

Quorum Sensing and Biofilm formation

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

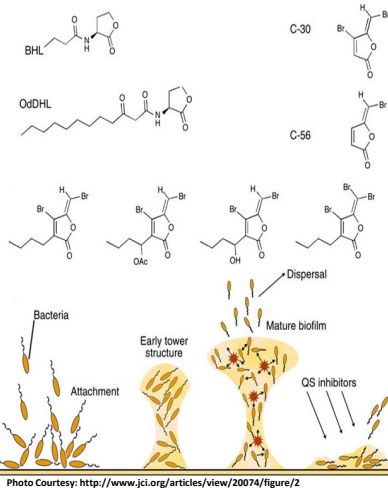


Photo Courtesy: <http://www.jci.org/articles/view/20074/figure/2>

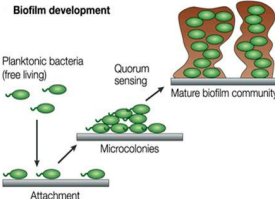


Photo Courtesy: <http://labrat.fieldofscience.com/2010/07/quorum-sensing-and-biofilms.html>

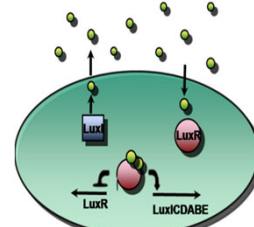


Photo Courtesy: http://2009.igem.org/Team:Aberdeen_Scotland/WetLab/quorumsensing

21

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

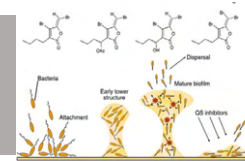
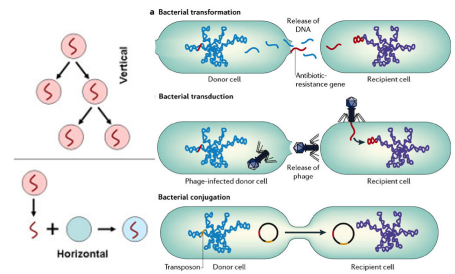


Photo Courtesy: <http://www.jci.org/articles/view/20074/figure/2>



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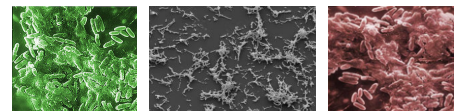
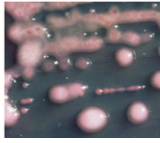


Photo Courtesy: <http://www.microbiologybytes.com/blog/category/biofilms/>
http://www.ifenergy.com/50226711/boosting_microbial_fuel_cells_with_biofilm.php
<http://micro-writers.egybio.net/blog/?tag=antibiotic-resistance>

22

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

BY HELEN BRANSWELL, STAT January 13, 2017




Rare strain of E. coli strikes across Canada: source unknown

A dozen cases of E. coli O157 have been confirmed in three Canadian provinces, according to matching genetic fingerprint data, but the source of the outbreak has not yet been identified.

The Public Health Agency of Canada reports four of the rare O157 cases were confirmed in British Columbia, four in Saskatchewan and two in Newfoundland and Labrador. The illness most often occurs in November and December of each year.

Four of the victims have been hospitalized. These individuals have recovered or are in the process of recovery. An investigation to determine the source of the relatively rare E. coli O157 is under way.


The Public Health Agency of Canada says improper handling of ground meat and eating raw ground meat are two of the most common sources of E. coli illnesses. Other common sources are contaminated raw fruits.



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

By Coral Bouch on August 24, 2021


Inspectors are looking for specific sources of two new Salmonella outbreaks that have been associated with Italian-style meats. Three dozen people from 17 states have been confirmed infected so far.



Almost 200 sick in UK-wide Salmonella outbreak

By Joe Whitworth on August 24, 2021

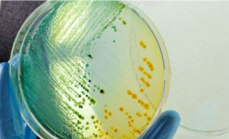
Nearly 200 people across the United Kingdom are part of a Salmonella outbreak linked to pork scratching products.



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


By News Desk on April 23, 2020

The Food and Drug Administration's investigation of an outbreak of E. coli O103 in



Multidrug-resistant salmonella outbreak characterized


HealthDay—A recent multidrug-resistant (MDR) Salmonella enteritidis Newport outbreak, affecting patients in 32 states, was associated with soft cheese and beef consumption, according to a report published in the Aug. 23 issue of the U.S. Centers for Disease Control and Prevention Morbidity and Mortality Weekly Report.



Eat Smart chopped salad kit recalled in Canada over Listeria concerns

By News Desk on August 25, 2021

Curation Foods is recalling Eat Smart brand "Asian Sesame (Sesame asiatico) Chopped Salad Kit" because of possible Listeria monocytogenes contamination.



Raw goat milk recalled because of positive test for Campylobacter

By News Desk on August 25, 2021

State officials in California have ordered a recall and quarantine of certain raw goat milk because tests have shown it to be contaminated with Campylobacter.

23


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. (**2021 GDP of Jamaica 14.7 Billion**)
- Approximately **30% of population** are especially "at risk" for foodborne diseases (The YOPIs: The young, the old, Pregnant, and Immunocompromised)



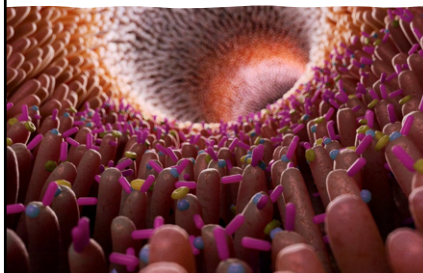
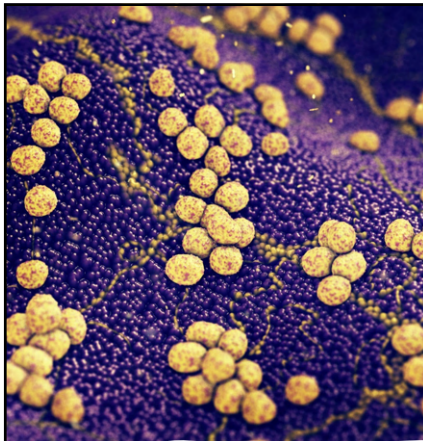
24

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%).



25



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

26

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

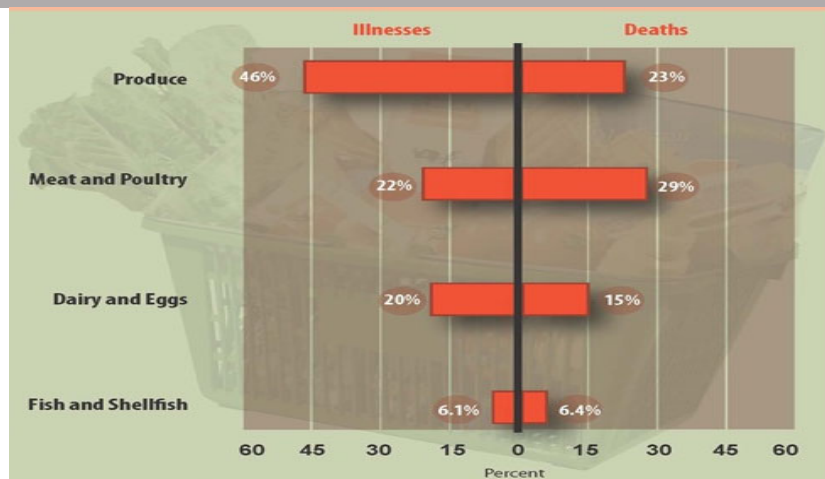
- **Disability adjusted life year (DALY).** *DALY: Loss of life and health due to illness*
 - Non-typhoidal *Salmonella* (329000)
 - Toxoplasma (32700)
 - *Campylobacter* (22500)
 - Norovirus (9900)
 - *Listeria monocytogenes* (8800)
 - *Clostridium perfringens* (4000)
 - *Escherichia coli* O157 (1200)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

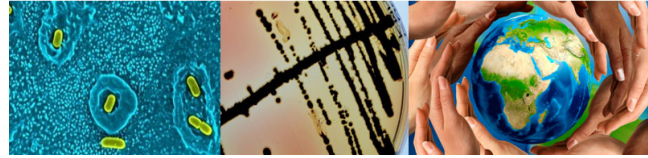


*Chart does not show 5% of illnesses and 2% of deaths attributed to other commodities. In addition, 1% of illnesses and 25% of deaths were not attributed to commodities; these were caused by pathogens not in the outbreak database, mainly *Toxoplasma* and *Vibrio vulnificus*.

28

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.

31

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 (198 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.

[Subscribe to Email updates](#) [Share](#) [Tweet](#) [LinkedIn](#) [Email](#) [Print](#)



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

36

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: ICMSF 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)

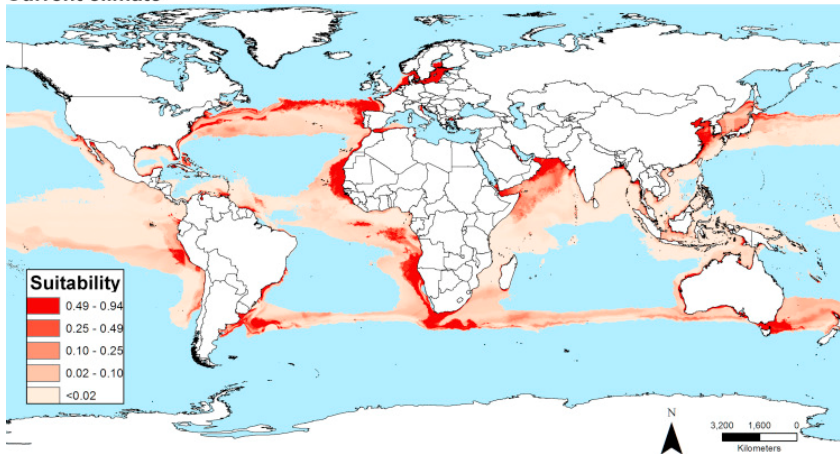
Growth parameters	Minimum	Optimum	Maximum
Temperature	41°F (5°C)	99°F (37°C)	114°F (45.3°C)
pH	4.8	7.8-8.6	11
a _w	0.94	0.98	0.996 (10% NaCl)
Other	Non-sporeformer, requires salt		
Atmosphere	Facultative - grows with or without oxygen		

Sources: Seafood Hazards Guide 2011, ICMSF 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

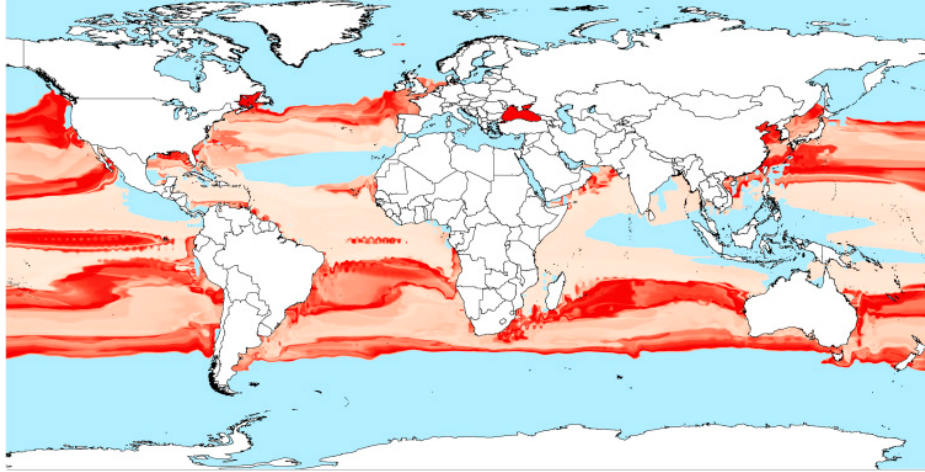


Escobar LE et al. Acta Tropica 2015;149:202-11

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

41

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

42

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 ruminates** 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: ICMSE 1995 and Bad Bug Book 2nd edition

43



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)**.



microorganisms



Review

Outbreak History, Biofilm Formation, and Preventive Measures for Control of *Cronobacter sakazakii* in Infant Formula and Infant Care Settings

Monica Henry¹ and Aliyar Fouladkhah^{1,2,*}

¹ Public Health Microbiology Laboratory, Tennessee State University, Nashville, TN 37209, USA;

mhenry3@tnstate.edu

² Cooperative Extension Program, Tennessee State University, Nashville, TN 37209, USA

* Correspondence: afouladk@tnstate.edu or aliyar.fouladkhah@aya.yale.edu; Tel.: +1-970-690-7392

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

44

Bad Bug Book (Second Edition)
Foodborne Pathogenic Microorganisms and Natural Toxins Handbook

Gram negative bacteria

- Gonococcus
- Yersinia
- Meningococcus
- Chlamydia
- Rickettsia
- Vibrios
- Escherichia
- Helicobacter
- Spirillum
- Spirochetes

Gram positive bacteria

- Pneumococci
- Streptococci
- Staphylococci
- Micrococci
- Actinomycetes
- Bacilli
- Clostridia
- Corynebacteria
- Listeria
- Bifidobacterium

Bad Bug Book
Handbook of Foodborne Pathogenic Microorganisms and Natural Toxins

Introduction

Food safety is a complex issue that has an impact on all segments of society, from the general public to government, industry, and academia. The second edition of the Bad Bug Book, published by the Center for Food Safety and Applied Nutrition, of the Food and Drug Administration (FDA), U.S. Department of Health and Human Services, provides current information about the major known agents that cause foodborne illness. The information provided in this handbook is abbreviated and general in nature, and is intended for practical use. It is not intended to be a comprehensive scientific or clinical reference.

Under the laws administered by FDA, a food is adulterated if it contains (1) a poisonous or otherwise harmful substance that is not an inherent natural constituent of the food itself, in an amount that poses a *reasonable possibility* of injury to health, or (2) a substance that is an inherent natural constituent of the food itself, is not the result of environmental, agricultural, industrial, or other contamination, and is present in an amount that *ordinarily* renders the food

45

How Climate Change is Affecting Bact...
 Climate change is affecting bacterial biofilms and drug resistance.

BIOFILMS, DRUG RESISTANCE, AND CLIMATE CHANGE
 How Climate Change is Affecting Bacterial Biofilms and Drug Resistance

PUBLIC HEALTH BURDEN OF FOOD AND WATERBORNE DISEASES
 Reducing the public health burden of food and waterborne diseases

How significant are biofilm and plankt...
 ...the bacteria are able to survive and avoid

INFANT FORMULA AND CRONOBACTER SAKAZAKII
 How significant are biofilm and planktonic cells of Cronobacter sakazakii?

How can we reduce the public health burden of food and waterborne diseases?
 Podcast featuring Dr. Aliyar Cyrus Fouladkhan Research Group Publications

46



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



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Recommendations for the Future



Public Health Microbiology™
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Dr. Aliyar Cyrus Fouladkhah

Public Health Microbiology FoundationSM:

<https://publichealthmicrobiology.education>



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

ASSIGNMENT TITLE: **Microbial Food Safety Specialists- Meat Processing Safety and Regulatory Affairs**

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

A workshop using the same curriculum is scheduled in Netherland on November 1 2023 for 1,495 Euros per participant and one is scheduled in the United States on June 7, 2023 for \$695 per attendees. Thus, very conservative estimating, the value of sponsorship from Public Health Microbiology FoundationSM for these 15 certificates are \$9,750 (15 certificates of \$650 each) or roughly 1.5 million Jamaican Dollars. Participants additional received a participation book (valued at \$40 per attendee) and 10 copies of food safety plans (valued at \$120 per attendee) thus the total value of sponsorship from the Public Health Microbiology FoundationSM is \$12,150 USD for this event (\$2,400 for books and handouts and \$9,750 for the certificates).

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?

Participants were health inspector of a regional Department of Public Health (Environmental Health Agency) in St. Ann, Jamaica.



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

Participants received extensive training on infectious diseases of importance in Jamaica, climate change, and food safety regulatory affairs for human food production and inspection.

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 Northeast Regional Health Authority in partnership with St. Ann Health Department in Jamaica 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?



During the workshop that was attended by 14 environmental health inspectors of St. Ann Health Department and one field officer of USAID Jamaica, 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 policies, 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.

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.

A productive and impactful workshop like this event is 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 great inspectors from St. Ann Health Department of Jamaica 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.

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.



It was an honor for me to return to beautiful and culturally-rich country of Jamaica to conduct a multi-day climate change, infectious diseases, and food safety workshop for health inspectors in St. Ann Health Department.

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 hosts implementing the innovation.

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 (Measureable 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

Country of Service: Jamaica Dates of Trip: 05/27/2023 – 06/06/2023

# of Persons <i>Formally</i> Trained ¹ – male:	3
# of Persons <i>Formally</i> Trained – female:	12
# of Persons <i>Formally</i> Trained – Non-binary:	#
# of Persons <i>Formally</i> Trained who are youth (USAID defines 15 – 29 as youth):	#
# of Persons <i>Formally</i> Trained – total = male + female + non binary (don’t add youth)	#

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

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.

Recommendation	Host	Time frame to implement change
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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.*



Implementing procedures discussed in the workshop for control of foodborne biological hazards during future inspections	St. Ann Health Department	6 to 24 months
Implementing procedures discussed in the workshop for control of foodborne chemical hazards during future inspections	St. Ann Health Department	6 to 24 months
Closely inspecting corrective actions taken by facilities they inspect based on information from the workshop.	St. Ann Health Department	6 to 24 months
Implement climate change mitigation strategies discussed in the workshop.	St. Ann Health Department	6 to 24 months
Continuation of capacity building and professional development for inspectors of the St. Ann Health Department.	St. Ann Health Department	6 to 24 months

Workshop News on Social Media



Public Health Microbiology™
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Dr. Aliyar Cyrus Fouladkhah

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<https://publichealthmicrobiology.education>



Aliyar Cyrus Fouladkhah

June 1 at 6:44 PM · 🌐



mohnerha

May 31 at 5:28 PM · 🌐

Food Safety Training for Public Health Instructors.

This 3 day workshop was sponsored by the public health Microbiology Foundation in Nashville, National Institute of Food and Agriculture, and USAID Farmer 2 Farmer Programme in Washington and Kingston, TN and was hosted in Jamaica by the NERHA.

[#publichealthinspectors](#) [#phi](#)

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3 🗨️

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Ashesh Basnet
Wonderful Job Dr. Aliyar!

Like Reply 2d



Rabin Raut
That's awesome

Like Reply 2d



José Eduardo Cano Ozaeta
Great job Aliyar Cyrus Fouladkhah hope I see you in DC

Like Reply 54m