



**USAID**  
FROM THE AMERICAN PEOPLE



LAND O'LAKES  
**VENTURE37**

# Climate Change and Food Safety Training and Process Authority Consultation for Entrepreneurs and Academic Practitioners

Trip Report (April 2023): USAID Project on March 18 to April 2, Beirut, Lebanon

*Dr. Aliyar Cyrus Fouladkhah, PhD, MPH, CFS, CPH  
Founding Director, Public Health Microbiology Foundation<sup>SM</sup>  
Associate Professor, Tennessee State University  
Yale School of Public Health Alumnus*



It was a great pleasure for me to come to the culturally-rich country of Lebanon for a workshop and process authority consultation for the food industry. The travel and logistics of this trip were funded by the USAID F2F program and Land O'Lakes Venture37. Help and support of USAID officers both from Washington and Lebanon are thus sincerely appreciated, especially, the support of Ms. Rawan Shamieh (Senior Field Coordinator, Farmer-to-Farmer FSQ in Labanon) and Mr. Charbel Abou Haidar (Deputy Program Director, Farmer-to-Farmer FSQ in Labanon). Support from the Lebanese American University for providing a conference room for this event is additionally sincerely appreciated and acknowledged.

The workshop of this program, as further illustrated below, was funded by the Public Health Microbiology Foundation in Nashville. Overall, 24 individuals received the certification including three university professors (from Saint Joseph University, Lebanese American University, American University of Beirut) and students and industry members (overall 4 male and 20 female participants). The value of the certification sponsored by the Public Health Microbiology Foundation for each participant was \$650 for the course certificate and registration, \$40 for each book (course manual) provided, and \$20 for six food safety plans provided as handouts (\$710 per person, overall \$17,040). The curriculum used for this workshop is currently the only material considered as adequate by a leading regulatory agency in the United States and is developed by Food Safety Preventive Control Alliance. Additional information about the impact of climate change on food security, transboundary infectious diseases, and food additives was delivered using the educational material of the Public Health Microbiology Foundation. Excerpts of these teaching materials could be accessed in the accompany report. The workshop was accompanied by three onsite visits to the dairy farm and production facility, honey processing facility, and local ready-to-eat commodities manufacturer with spending one day in each location for a process authority consultation.

This productive and impactful event was the result of work of several agencies and individuals, and I would like to once again sincerely and wholeheartedly thank the support of colleagues both from Washington and Beirut F2F offices and the financial support of the Public Health Microbiology Foundation for this event.

Submitted with best wishes,



Aliyar Cyrus Fouladkhah, PhD, MS, MPH, MACE, 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**  
**(March 22 to 24 2023, Lebanese American University, Beirut, Lebanon)**



# *Workshop Invitation & Evaluation by Participants*



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

*Public Health Microbiology Foundation<sup>SM</sup>:*

*<https://publichealthmicrobiology.education>*



**Public Health Microbiology Laboratory  
Tennessee State University**

Aliyar Cyrus Fouladkhah, Faculty Director  
CARP Research Complex Laboratories 112 & 114,  
3500 John A. Merritt Boulevard, Nashville, TN 37209  
Office: (615)963-7471; Lab: (615)963-1578; Mobile: (970)690-7392  
Email: afouladk@tnstate.edu or aliyar.fouladkhah@aya.yale.edu

**Public Health & FSMA Preventive Control for Qualified Individual (PC QI) Workshop  
March 22 to 23 2022, Lead Instructor: Dr. Aliyar Cyrus Fouladkhah\* February 20, 2023**

Dear participants,

It is my pleasure to welcome you to our 2023 food safety and public health certification workshop. This event is sponsored by the Public Health Microbiology Foundation in Nashville, TN and Washington and Lebanon USIAD Farmer-to-Farmer FSQ program (Land O'Lakes Venture37) and is hosted by Lebanese American University. During this multiday event, 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 pandemic/endemic participants are requested to adhere to public health guidelines including wearing high-quality masks and practicing social distancing to minimize the risk of respiratory disease transmission.

In-person participants are expected on March 22 to 24 2023, during the below-mentioned times. We will additionally hold optional meetings on week of March 27, 2023 for further specific and one-by-one discussions/consultation about food safety and public health practices for students and entrepreneurs. 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 further enhancing your education and improving the safety of your operation and meeting and exceeding the regulatory requirements for national and global commerce while ensuring the public's health.

If you have any question 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.*



**Public Health Microbiology Laboratory  
Tennessee State University**

Aliyar Cyrus Fouladkhah, Faculty Director  
CARP Research Complex Laboratories 112 & 114,  
3500 John A. Merritt Boulevard, Nashville, TN 37209  
Office: (615)963-7471; Lab: (615)963-1578; Mobile: (970)690-7392  
Email: afouladk@tnstate.edu or aliyar.fouladkhah@aya.yale.edu

**Tentative Workshop Schedule:**

**Wednesday, March 22, 2023** (required): 8:30 am to 5:00 pm

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

*Day one has tentative 30-minute breaks for 10:30 am, 12:00 pm, and 2:30 pm*

**Thursday, March 23, 2023** (required): 8:30 am to 4:00 pm

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

*Day one has tentative 30-minute breaks for 10:30 am, 12:00 pm, and 2:30 pm. The workshop is expected to be concluded on 4:00 in honor of Ramadan.*

**Friday, March 24, 2023** (required): 8:30 am to 4:00 pm

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

*Day one has tentative 30-minute breaks for 10:30 am, 12:00 pm, and 2:30 pm. The workshop is expected to be concluded on 4:00 in honor of Ramadan.*

**Monday, March 27, 2023** (Optional): 8:30 am to 4:00 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:**

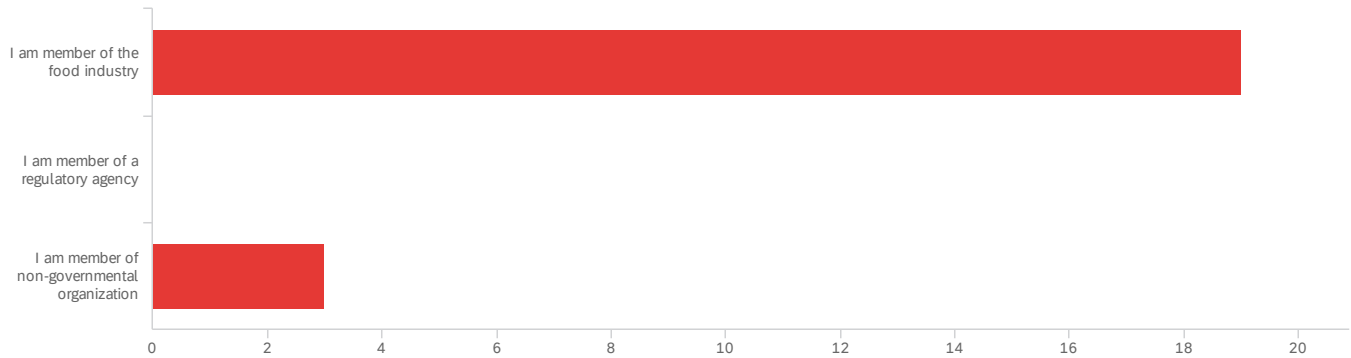
[https://tnstateu.az1.qualtrics.com/jfe/form/SV\\_3D9RcylkHSbNtrg](https://tnstateu.az1.qualtrics.com/jfe/form/SV_3D9RcylkHSbNtrg)



# Default Report

2023 FSMA PC QI Workshop (3-22 to 24-2023): Lead Instructor: Dr. Aliyar Cyrus Fouladkhah - Copy - Co  
 March 24, 2023 7:15 AM MDT

## Q1 - What is your primary career association?

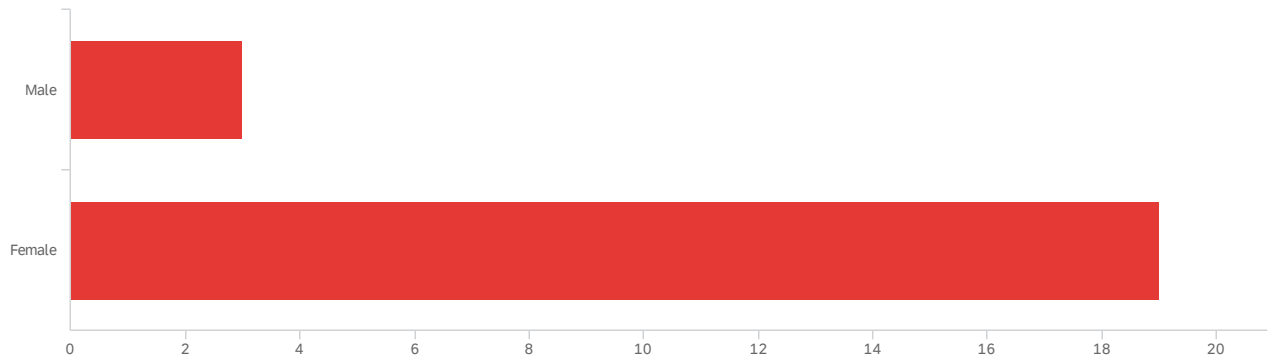


#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	What is your primary career association?	1.00	3.00	1.27	0.69	0.47	22

#	Field	Choice Count
1	I am member of the food industry	86.36% 19
2	I am member of a regulatory agency	0.00% 0
3	I am member of non-governmental organization	13.64% 3
		22

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	1.86	0.34	0.12	22

#	Field	Choice Count
1	Male	13.64% 3
2	Female	86.36% 19

22

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.	93.00	100.00	99.45	1.75	3.07	22
2	My instructor communicated effectively.	80.00	100.00	95.91	7.40	54.72	22
3	My instructor stimulated my interest in the subject.	80.00	100.00	96.32	7.27	52.85	22
4	My instructor answered questions thoroughly.	95.00	100.00	99.64	1.19	1.41	22
5	My instructor treated all students with respect.	100.00	100.00	100.00	0.00	0.00	22
6	I would recommend this instructor to my friends.	90.00	100.00	99.55	2.08	4.34	22
7	My knowledge of the subject increased as a result of this workshop.	34.00	100.00	90.59	17.03	289.97	22
8	This workshop made a significant contribution to my career.	33.00	100.00	91.36	15.81	249.87	22

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...

---

The workshop was very instructive and clear. I would like to suggest to mix the groups a little bit more (between undergraduates, professionals and professors). Thank you for the opportunity and for our amazing instructor Dr. Aliyar.

I would like to thank the instructor for his time, for explaining every chapter clearly and for assistong us during the exercises, it was such a great and intresting experience and I'm looking forward for more trainings

On site training to better link all informations to the true life

One of the most fruitful conference I had attended

This workshop is extremely helpful

**End of Report**


# Excerpts of Teaching Material



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

*Public Health Microbiology Foundation<sup>SM</sup>:*

*<https://publichealthmicrobiology.education>*



## FSMA Preventive Control for Qualified Individual (PC QI) Workshop

Conducted by:  
**Aliyar Cyrus Fouladkhah** (PhD, MPH)

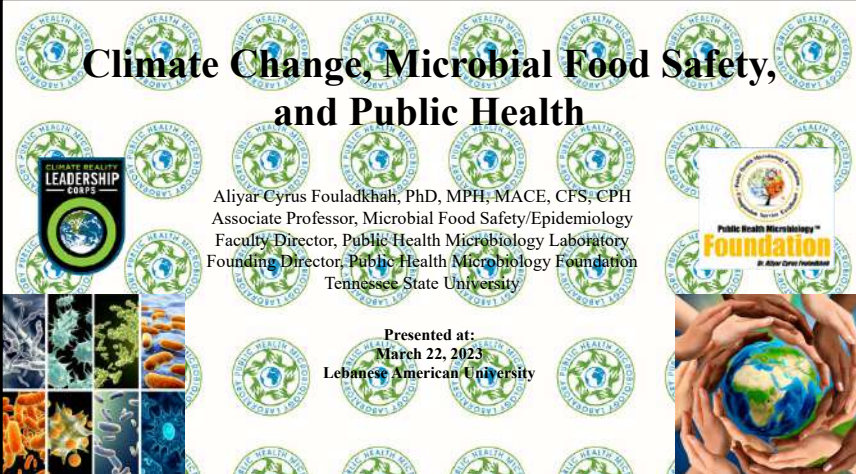
Lebanese American University  
March 22-24, 2023

1

## Climate Change, Microbial Food Safety, and Public Health

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

Presented at:  
March 22, 2023  
Lebanese American University




2

### 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



3

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

**Yale SCHOOL OF PUBLIC HEALTH**

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



Website: <https://yph.yale.edu/school-of-public-health/graduate-programs/accelerated-mph-program/>  
Video: <https://www.youtube.com/watch?v=GVN9JfoI8>

4

# 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, 2018-2024)
- ❖ 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.: **\$36,000** (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)

\*Funding account setting and Internal administrative approval.  
\*\* Sub-awardee of Southern Center Main Awards.

**Public Health Microbiology Foundation**  
Dr. Allayar Corcoran Fouladkhah

**Website:** <https://publichealthmicrobiologyeducation/>

**PROSPECTIVE STUDENTS, EDUCATORS, AND STAKEHOLDERS**

**Website performance: 4/22/2020**

5

# 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)

**TN Department of Human Resources**  
Tennessee Leaders of Tomorrow Internship

9/12/2019

Monica Smith  
3282 Venture 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

6

# Students Awards Adviser: A. Fouladkhah

Students Success Available at:  
<https://publichealthmicrobiologyeducation/students-awards>

**Public Health Microbiology Laboratory**

**2021 Tennessee Academy of Science Virtual Health and Medical Sciences Division**

**2020 Tennessee Academy of Science Virtual Health and Medical Sciences Division**  
1<sup>st</sup> (S. Wadood); 2<sup>nd</sup> (S. Aras); 3<sup>rd</sup> (N. Kabir); Adviser: A. Fouladkhah

**2019 Tennessee Academy of Science Health and Medical Sciences Division**  
1<sup>st</sup> (A. Allison); 2<sup>nd</sup> (S. Aras); 3<sup>rd</sup> (M. Henry) Adviser: A. Fouladkhah

**2018 Tennessee Academy of Science Health and Medical Sciences Division**  
1<sup>st</sup> (M. Henry); 2<sup>nd</sup> (A. Allison); 3<sup>rd</sup> (J. Adhikari) Adviser: A. Fouladkhah

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

7

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

A. Fouladkhah: 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. Fouladkhah)



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

Public Health Microbiology Laboratory, Tennessee State University

**SPACE FOOD: PRESENT AND FUTURE**

Yickie L. Khoris  
Former Manager International Space Station Food System

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

8



### Teaching in Tennessee and Internationally

**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**  
 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

**2020 Student Evaluation:**

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

**2019 Student Evaluation:**

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

**2018 Student Evaluation:**

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

**Public Health Microbiology Laboratory**

**Fortification of Staple Commodities and Microbial Safety Requirements for Human Food Production**

**USAID**

**USAID Public Health and Microbiology Training**

**Celebration of UNWFP Food Safety Day**

9

### Research Responsibility:

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

**PBI Pressure BioSciences Inc.**

**HIGHEST AND DEEPEST POINTS ON EARTH**

**Mountain Everest**  
 8,848 m

**Mariana Trench**  
 10,911 m

**Sensitivity of *Listeria monocytogenes* to Elevated Hydrostatic Pressure in Raw Milk**

**High Pressure Processing, Public Health Microbiology Laboratory**

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

10

### Process Authority

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

**Allya Fouladkhah**  
 ASSISTANT PROFESSOR  
 Tennessee State University  
 afouladk@tnstate.edu

**As of 2023:**  
 > 106 companies

**PHONE:** (615) 650-7392

**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**  
 PUBLIC HEALTH MICROBIOLOGY CENTER

11

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

10% Start-up Entrepreneurs  
 61% Established Companies  
 29 Entrepreneurs Supported

**Demographics:**  
 Clients Received Supported  
 (Updated January 2023)

53% Female  
 48% Male

**Foundation Updates As of February 2023**

39 Student Scholarships  
 106 Companies Supported (new products in market)  
 >178 Food Safety Certifications

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

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

**18 States Supported**

12

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

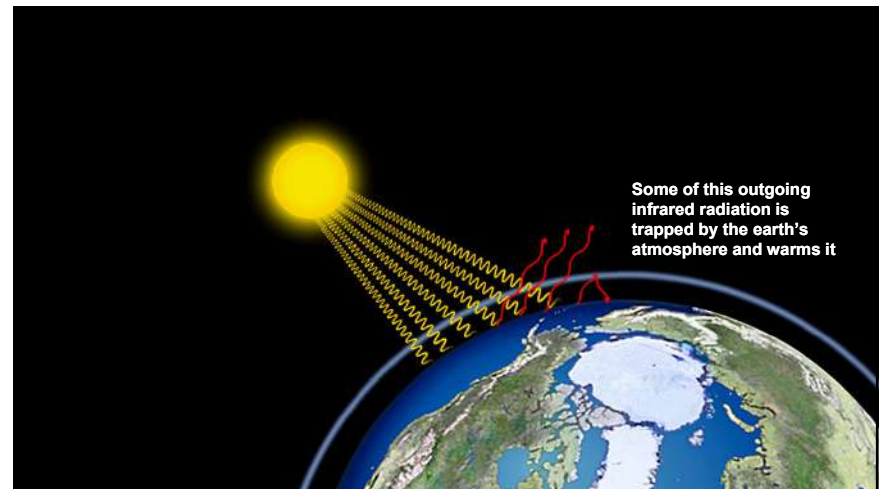
13



14



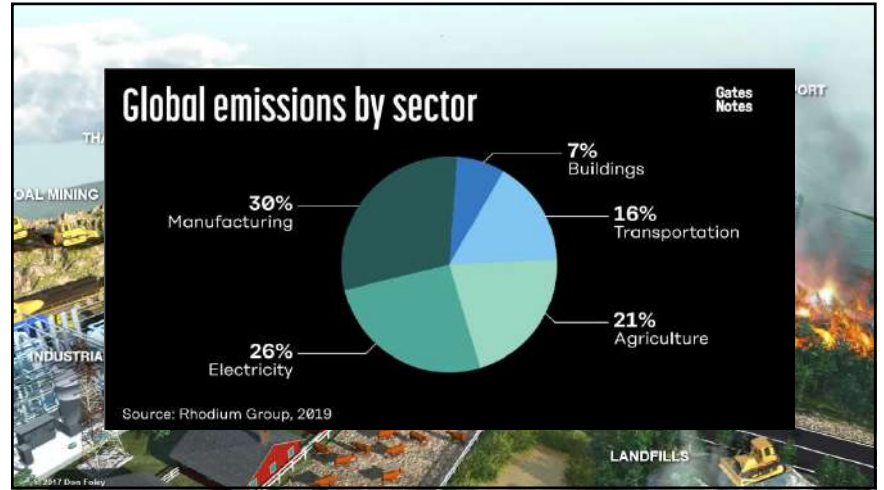
15



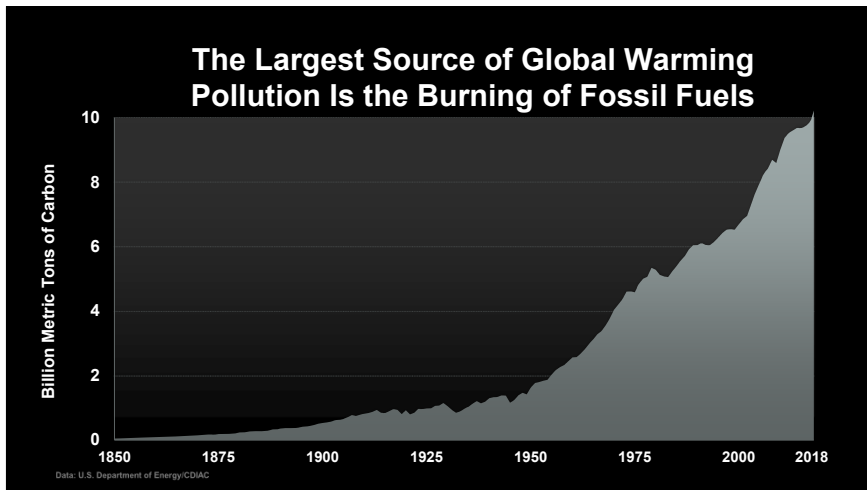
16



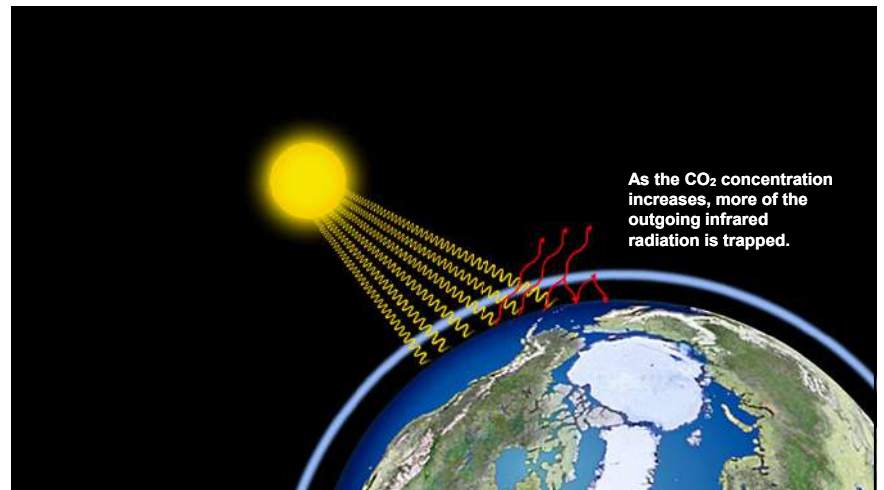
17



18



19



20



21

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

**600,000**

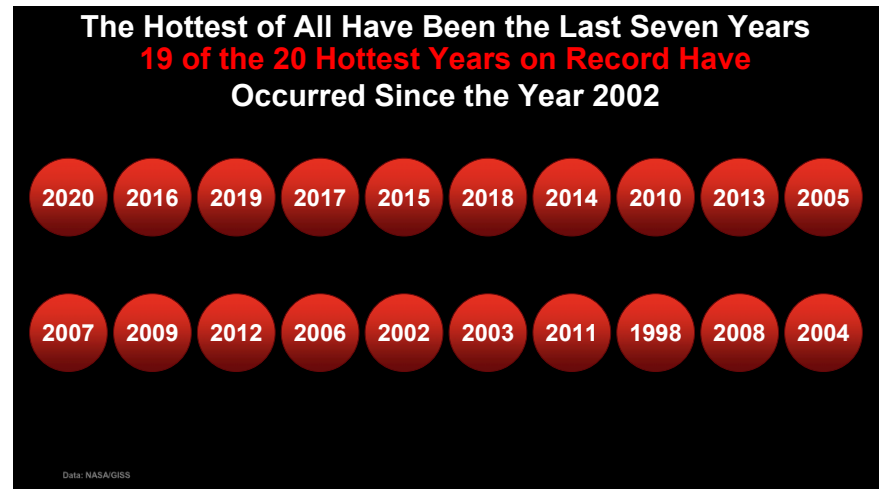
First-generation atomic bombs  
 per day 365 days per year."

James Hansen  
 Former Director, NASA Goddard Institute for Space Studies

22



23



24



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

25

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

26

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**.

27

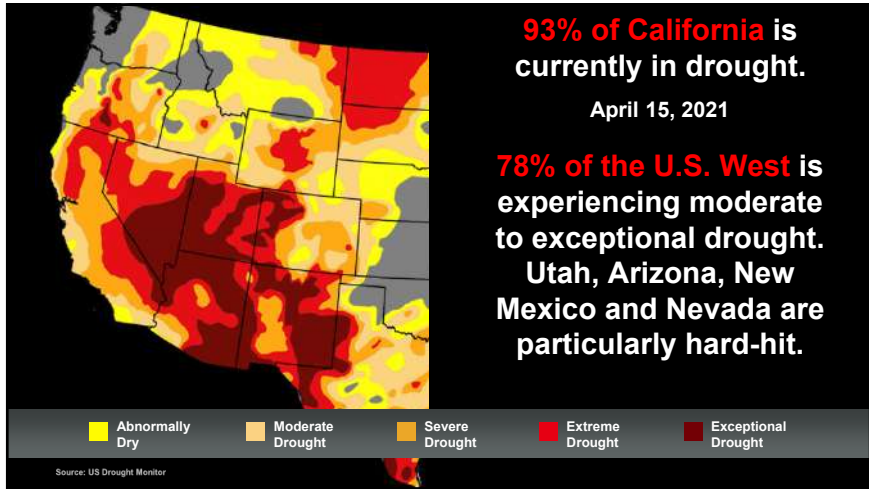
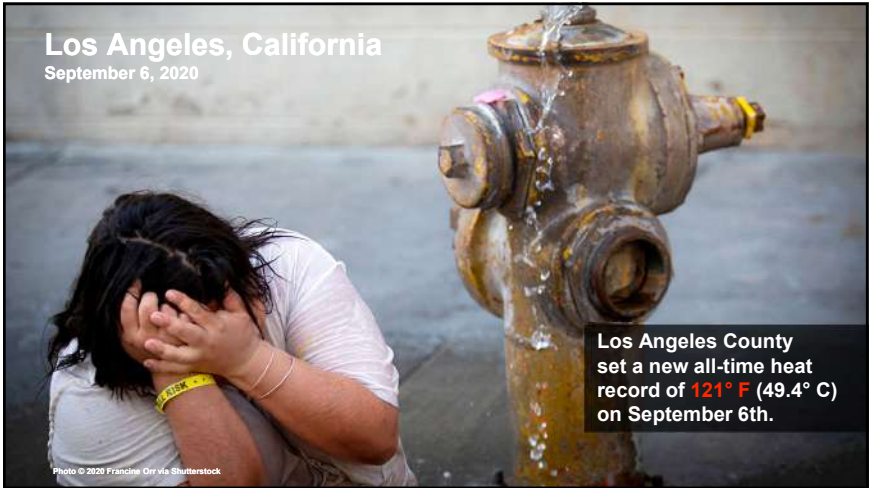
By 2040, **90%** of the population in **Colombia and Venezuela** may be threatened by extreme heat.

28



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.



## Navrongo, Ghana



33

## Montreal, Canada

July 5, 2018



34

## Mezairaa, United Arab Emirates



35

On July 22nd, 2016  
Basra, Iraq reached  
**53.9° C (129.0° F)**

On July 21st, 2016  
Mitribah, Kuwait  
reached  
**54° C (129.2° F)**

Source: WeatherUnderground  
© James Hastings-Trew



36

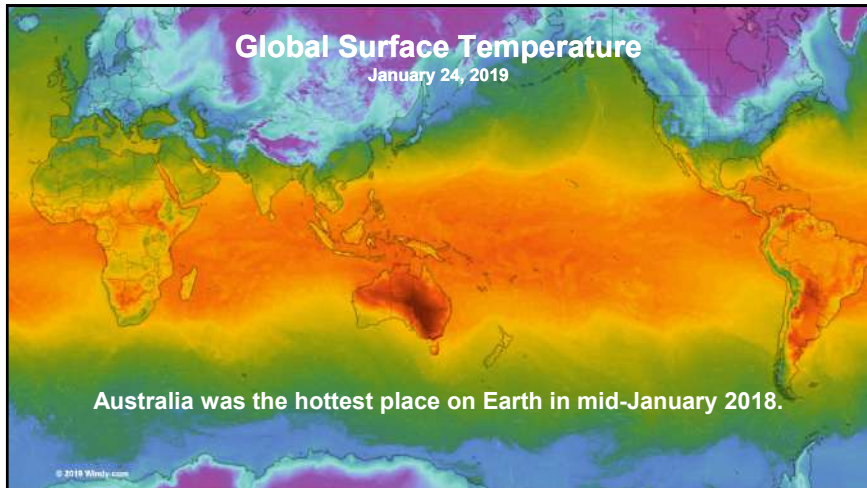




37



38



39



40



**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

41

**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

42

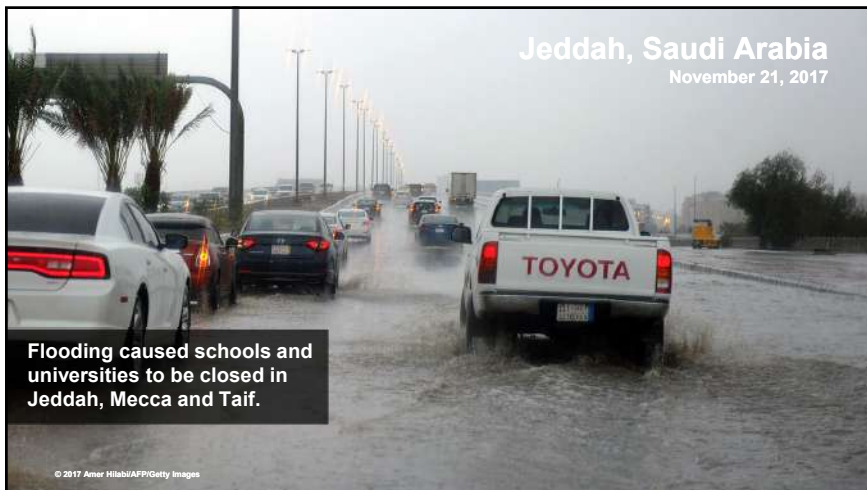
**Tacloban City, Philippines**  
November 10, 2013



© 2013 Reuters / Erik De Meer

43

**Jeddah, Saudi Arabia**  
November 21, 2017



Flooding caused schools and universities to be closed in Jeddah, Mecca and Taif.

© 2017 Amer Hilabi/AFP/Getty Images

44



45

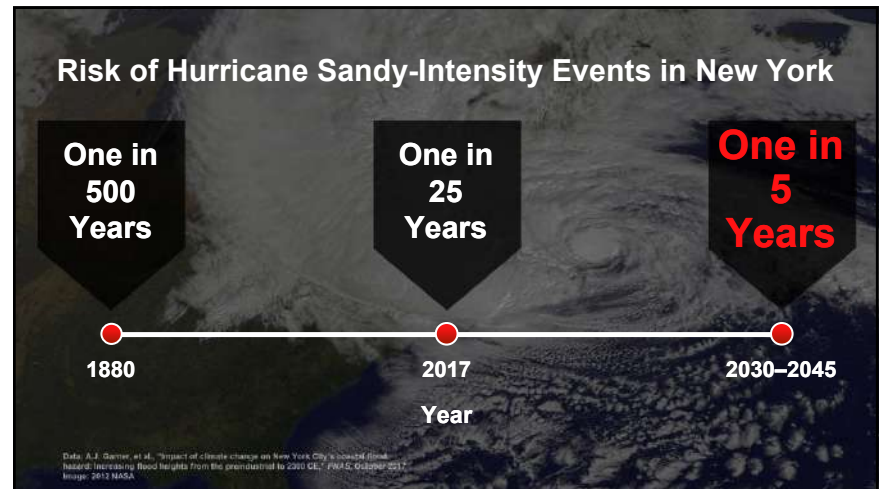


46

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

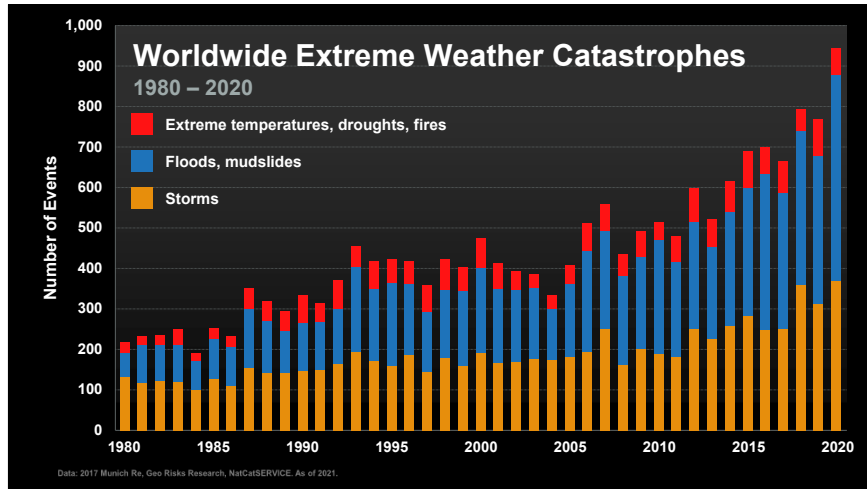
**Michael Mann**  
Director, Earth System Science Center, Penn State  
August 2017

47



48





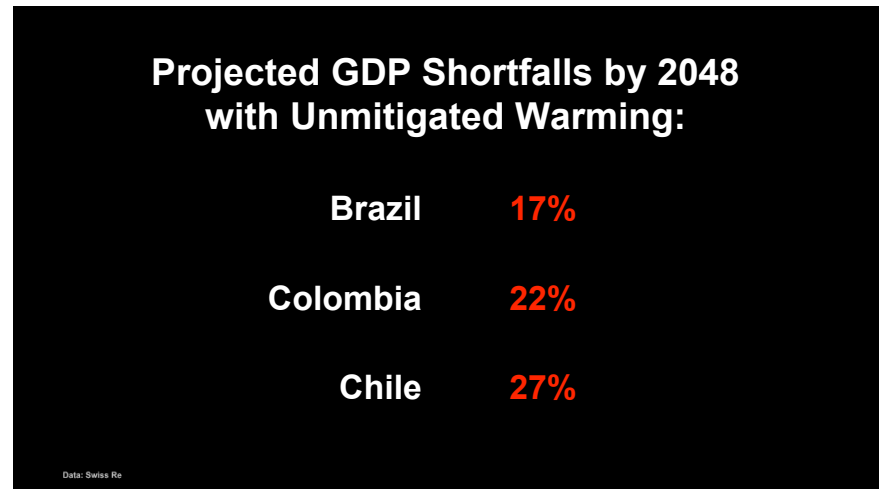
49



50



51



52





53



54



55



56





57



58



59



60





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

Rossinière, Switzerland  
August 7, 2018

© 2018 Reuters/Denis Balibouse

61



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

© 2017 Kostas K. Rigos AP Images

62



Gila National Forest, New Mexico  
June 24, 2018

The Buzzard fire burned over 50,000 acres.

© U.S. Forest Service/Gila National Forest

63



Edwards, Colorado  
April 1, 2018

The fire season in the U.S. west is now 105 days longer than in 1970.

Photo: © 2018 Chris Dillman-Viel Daily via AP Source: Climate Central/Wedenski/Wildfire—A Fiery Future, 2016

64





**Paradise, California**  
November, 2018

The Camp fire killed 86 people and burned over 14,000 homes and businesses.

© 2018 Justin Edelstein/AFIP/Getty Images

65



**Durango, Colorado**  
June 2018

© 2018 Jerry McIbride/The Durango Herald via AP

66

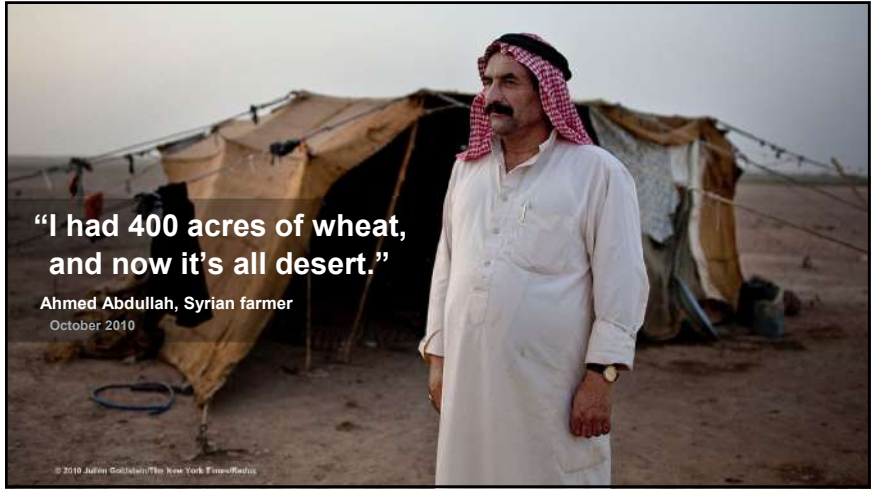


**Rosetta, Egypt**

Mohamed Hamid's land is now infertile due to saltwater intrusion

© 2019 Khalid Dessouki/AFIP/Getty Images

67



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

Ahmed Abdullah, Syrian farmer  
October 2010

© 2010 Julian Goldstein/The New York Times/Redux

68

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

69

“...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

70

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*

71

“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

72

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

73

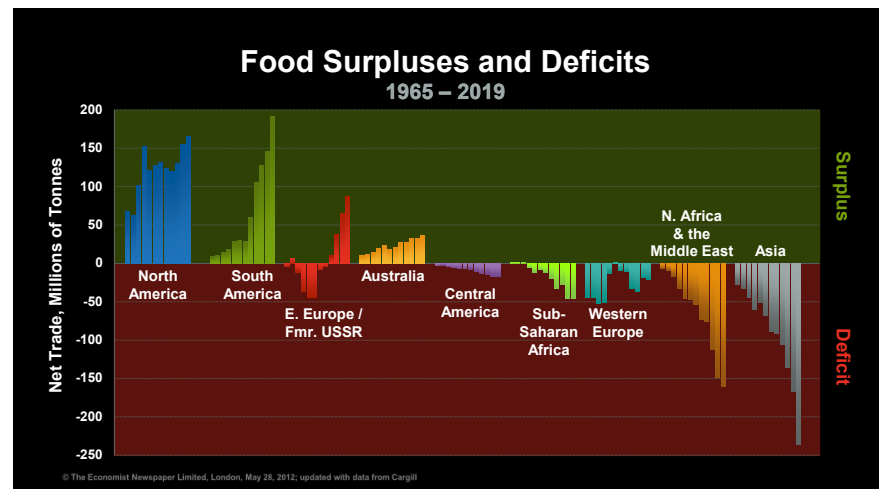


74

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

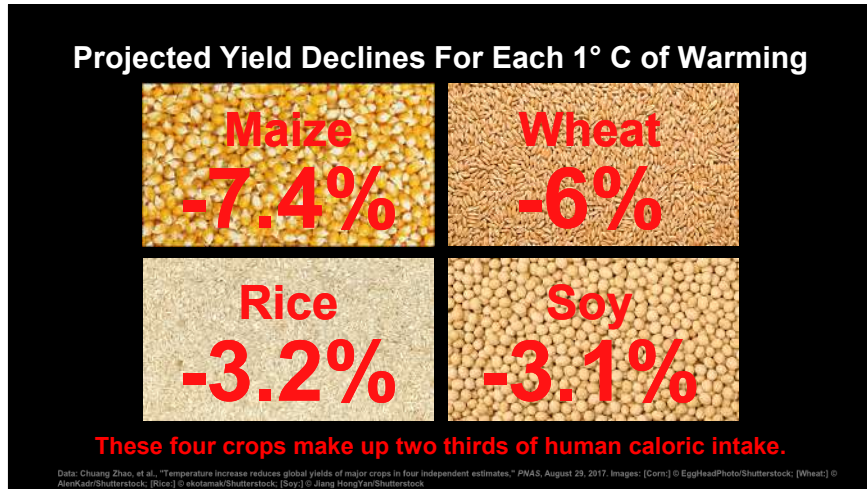
The Lancet Countdown Report  
 October 2017

75



76





77



78

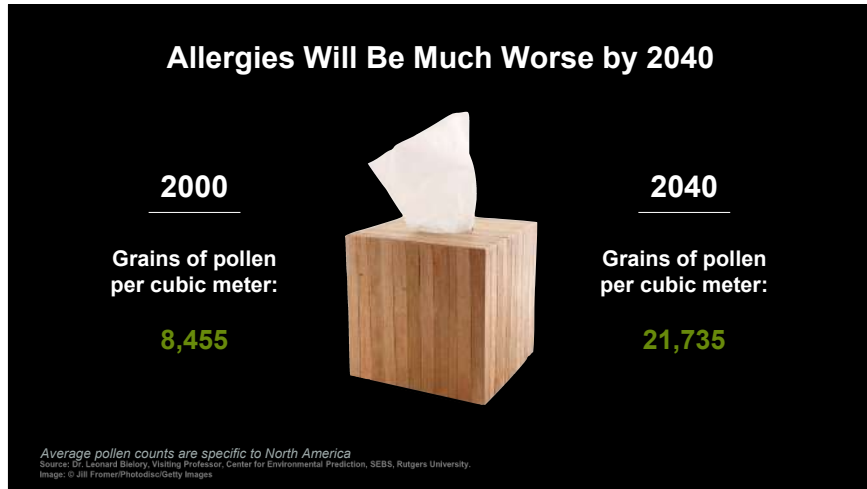


79

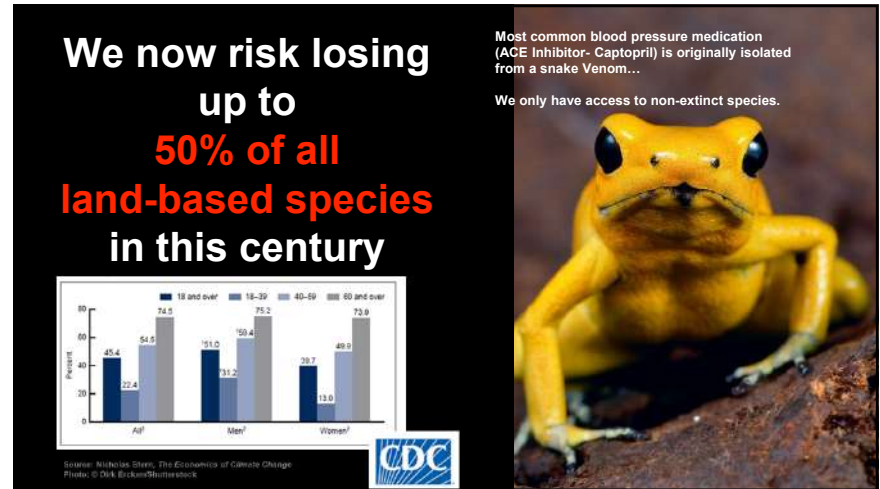


80





81



82



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

83

## 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

\* Calculated for oral ingestion based on epidemiological data from outbreaks and human feeding trials of volunteers. Data obtained from *Food and Drug Administration* (2014) reference.

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

84

# Emerging pathogens

Vertical and Horizontal Gene Transfer and Emerging Pathogens

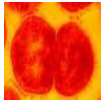
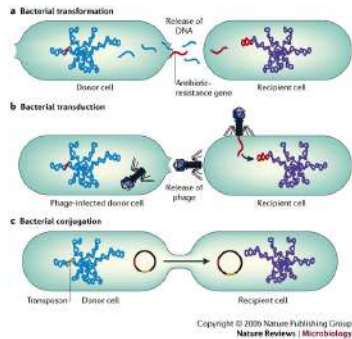
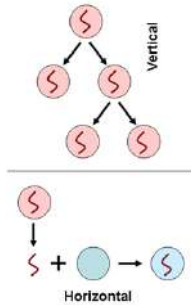
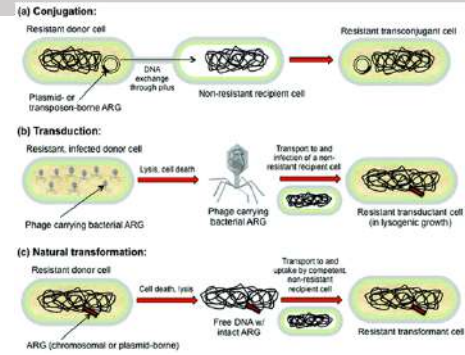


Photo Courtesy: <http://www.dailymail.co.uk/health/article.html>



Copyright © 2009 Nature Publishing Group  
Nature Reviews | Microbiology

# Horizontal Gene Transfer



Donn, 2012

# Planktonic cells and Biofilm Communities

Biofilm formation on biotic and abiotic surfaces

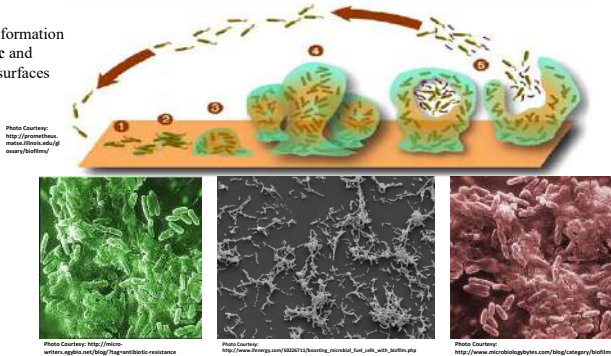


Photo Courtesy: <http://www.microbiology.com/biofilms>

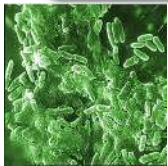


Photo Courtesy: <http://microbiology.com/biofilms>

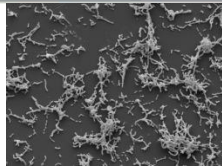


Photo Courtesy: [http://www.energy.com/2007/12/14/biofilm\\_mixed.html](http://www.energy.com/2007/12/14/biofilm_mixed.html)

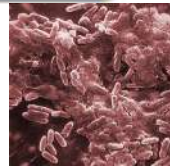


Photo Courtesy: <http://www.microbiology.com/biofilms>

# Quorum Sensing and Biofilm formation

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

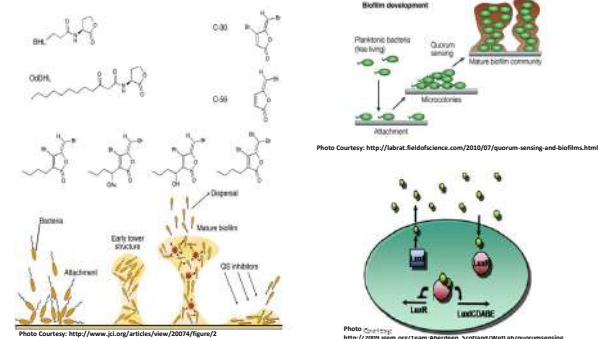


Photo Courtesy: <http://www.gi.org/article/view/2007/figure/2>

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

Photo Courtesy: [http://2009.gem.org/ram-abderrahman\\_quorum-sensing-quorum-sensing](http://2009.gem.org/ram-abderrahman_quorum-sensing-quorum-sensing)

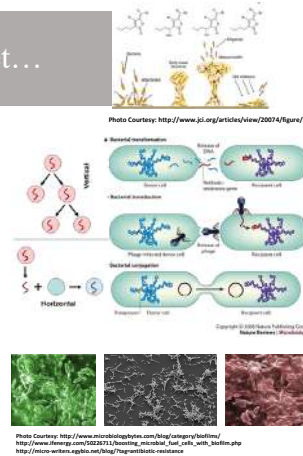
## Infectious Diseases is a Moving Target...

- 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



89

## 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 YOPs: The young, the old, Pregnant, and immunocompromised)



90

## 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%).



## 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



91

92

## 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**

93

Are these outbreaks associated with corporates and lager manufactures?

94

## 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

95

## 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 <small>(Albany, Hadar, Indiana, and Enteritidis sub-species)</small>
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

96





## Vibrio spp.

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

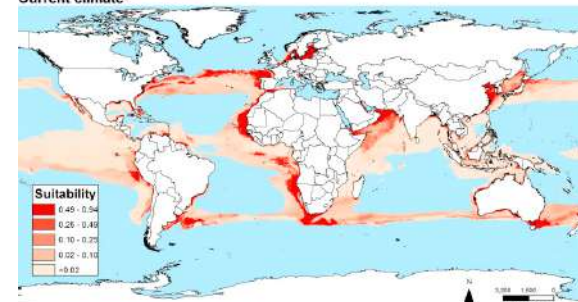
- Causing about 80,000 illness and 100 death annually in the United States.
- Infection symptoms vary depending on strain, ranging from diarrhea to high fever
- Vibrio is a halophilic bacterium and is a major concern in aquaculture industry
- Primary sources: Salt water environments and seafood
- Requires 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 <sub>w</sub>	0.94	0.98	0.996 (10% NaCl)
Other	Non-sporeformer, requires salt		
Atmosphere	Facultative - grows with or without		

101

## Vibrio cholerae proliferation in sea water: Current Climate

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

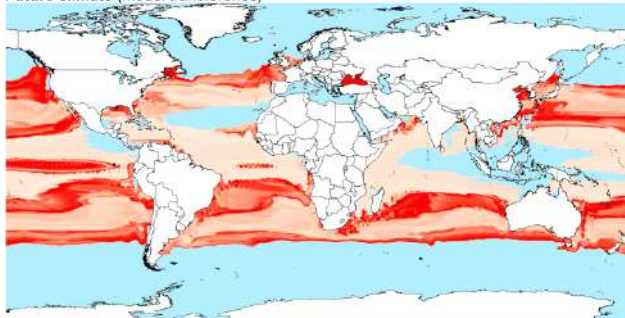


Escobar LE et al. Acta Tropica 2015;149:202-11

102

## 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

103

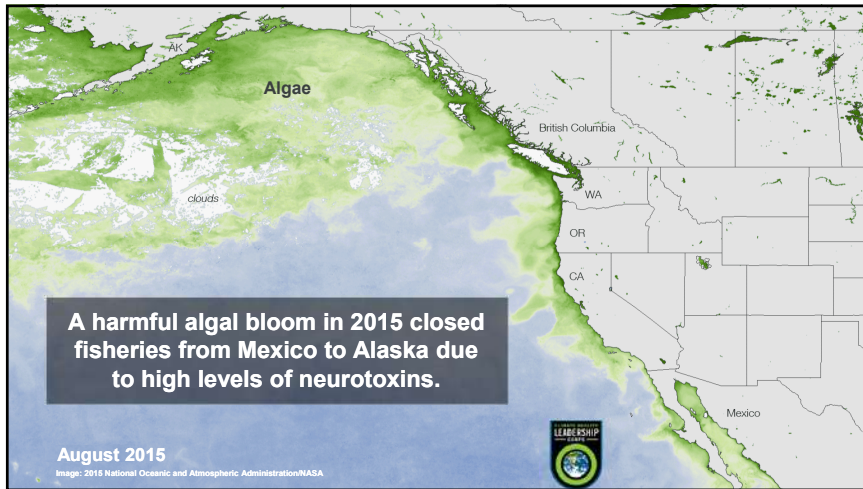
## Other Climate-Sensitive Challenges

- 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



bioRxiv preprint doi: <https://doi.org/10.1101/014888>; this version posted October 1, 2014. The copyright holder for this preprint (which was not certified by peer review) is the author/funder, who has granted bioRxiv a license to display the preprint in perpetuity. It is made available under aCC-BY-NC-ND 4.0 International license.

104



105

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

*Impact Analyses*

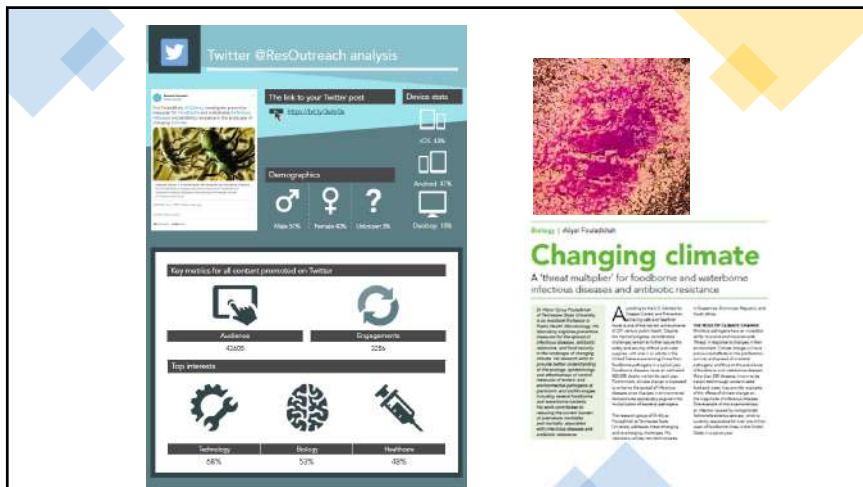
**Outreach Article Available at:**  
<https://researchoutreach.org/articles/changing-climate-threat-multiplier-foodborne-waterborne-infectious-diseases-antibiotic-resistance/>

**research OUTREACH**  
Connecting science with society

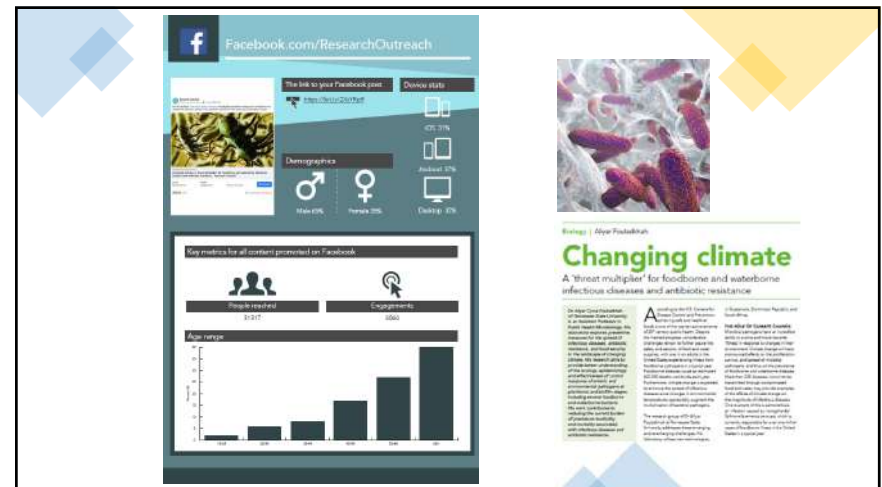
**IMPACT ANALYSIS**  
Issue RO 114

**Aliyar Fouladkhah**

106

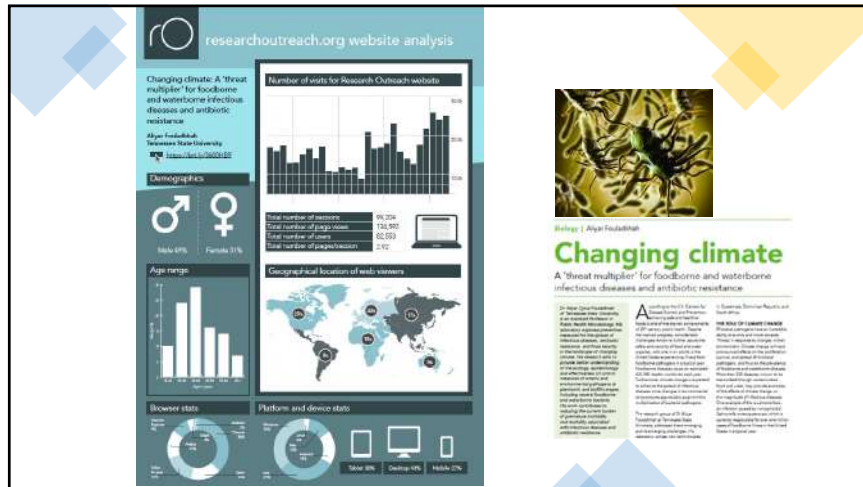


107



108





109



110

Thank you!

Dr. Aliyar Cyrus Fouladkhah,  
 Founding Director, Public Health Microbiology Foundation  
 Associate Professor, Tennessee State University  
 Email: [afouladk@tnstate.edu](mailto:afouladk@tnstate.edu) or [aliyar.fouladkhah@aya.yale.edu](mailto:aliyar.fouladkhah@aya.yale.edu) (direct email account)  
 Phone: +1 (970) 690-7392  
 Website: <https://publichealthmicrobiology.education/>

Contributions of members of the Public Health Microbiology Laboratory is greatly acknowledged. Funding supports of the program, donors and individuals are gratefully acknowledged.

Public Health Microbiology™  
 Foundation  
 Dr. Aliyar Cyrus Fouladkhah

CLIMATE REALITY  
 LEADERSHIP  
 CORP.

Public Health Microbiology Foundation  
 Commission Service Exchange

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

111



### 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 Lebanon and around the country will be affected by climate change?

112

Food Safety  
Modernization Act  
Certification

[3-22 to 24-2023]

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 in 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

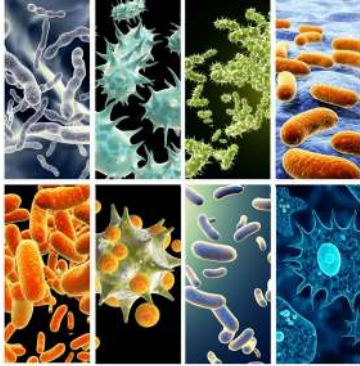


8



### 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 3-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	RACHEL MONTGOMERY	Nov 26, 2022	Register	USD 789	Control	Microbiologist, Livs, Interactive Industry, Experienced Lead Instructor, Partial Days, Converter, Eastern US Pacific, United States	English	Whisk, Critical, High, Sealed Live
Human Food	RACHEL MONTGOMERY	Oct 17, 2022	Register	USD 789	Control	Microbiologist, Livs, Interactive Industry, Experienced Lead Instructor, Partial Days, Converter, Eastern US Pacific, United States	English	Whisk, Critical, High, Sealed Live
Human Food	Denise Payne	Dec 13, 2022	Register	USD 350	Control	IL, United States	English	Whisk, Critical, High, Sealed Live
Human Food	Alex Kaler	Nov 1, 2022	Register	USD 895	Control	Lithouon Heights, MD, United States	English	In Petition, Low
Human Food	Valerie Charrel	Dec 14, 2022	Register	CAD 995	Control	Live-Vital, Quebec, Canada	French	Whisk, Critical, High, Sealed Live
Human Food	Valerie Charrel	Nov 2, 2022	Register	CAD 995	Control	Live-Vital, Quebec, Canada	French	Whisk, Critical, High, Sealed Live
Human Food	Valerie Charrel	Feb 22, 2023	Register	CAD 995	Control	Live-Vital, Quebec, Canada	French	Whisk, Critical, High, Sealed Live
Human Food	Valerie Charrel	Apr 19, 2023	Register	CAD 995	Control	Live-Vital, Quebec, Canada	French	Whisk, Critical, High, Sealed Live

- Our course 3-21-2023 to 3-24-2023



11

### FSPCA PREVENTIVE CONTROLS FOR HUMAN FOOD

Exercise Workbook


Including Food Safety Plan Worksheets

Developed by the FSPCA



Participant Manual

12



**FSPCA**  
FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

**Preventive Controls for Animal Food**  
First Edition - 2016

**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	<a href="#">Register</a>	USD 795	<a href="#">Contact</a>	Microbiologist, Livestock Industry, Experienced Lead Instructor, Pacific West, Convent Eastern to Pacific, United States	English	Virtual - Onsite, Web Based Live
Animal Food	RACHEL MONTGOMERY	Dec 5, 2022	<a href="#">Register</a>	USD 795	<a href="#">Contact</a>	Microbiologist, Livestock Industry, Experienced Lead Instructor, Pacific West, Convent Eastern to Pacific, United States	English	Virtual - Onsite, Web Based Live
Animal Food	RACHEL MONTGOMERY	Nov 7, 2022	<a href="#">Register</a>	USD 795	<a href="#">Contact</a>	Microbiologist, Livestock Industry, Experienced Lead Instructor, Pacific West, Convent Eastern to Pacific, Time United States	English	Virtual - Onsite, Web Based Live
Animal Food	Bita Sardi	Dec 21, 2022	<a href="#">Register</a>	USD 795	<a href="#">Contact</a>	Live-Virtual Live-Virtual United States	English	Virtual - Onsite, Web Based Live
Animal Food	Bita Sardi	Nov 2, 2022	<a href="#">Register</a>	USD 795	<a href="#">Contact</a>	Live-Virtual Live-Virtual United States	English	Virtual - Onsite, Web Based Live
Animal Food	RACHEL MONTGOMERY	Feb 6, 2023	<a href="#">Register</a>	USD 795	<a href="#">Contact</a>	Microbiologist, Livestock Industry, Experienced Lead Instructor, Pacific West, Convent Eastern to Pacific, United States	English	Virtual - Onsite, Web Based Live
Animal Food	RACHEL MONTGOMERY	May 8, 2023	<a href="#">Register</a>	USD 795	<a href="#">Contact</a>	Microbiologist, Livestock Industry, Experienced Lead Instructor, Pacific West, Convent Eastern to Pacific, United States	English	Virtual - Onsite, Web Based Live

Animal Food PC QI:  
[https://fspca.force.com/FSPCA/s/courselist?language=en\\_US](https://fspca.force.com/FSPCA/s/courselist?language=en_US)

13



**FSPCA**  
FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

**CERTIFICATE OF TRAINING**

Is awarded to  
**Dr. Minoos 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 Fouladkhan**

Completed on  
**12/08/2021**

*Joseph West, Executive Director*  
FSPCA  
FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

*Dr. Minoos Bagheri*  
Certificate Holder, Executive Director  
International Food Protection Training Institute

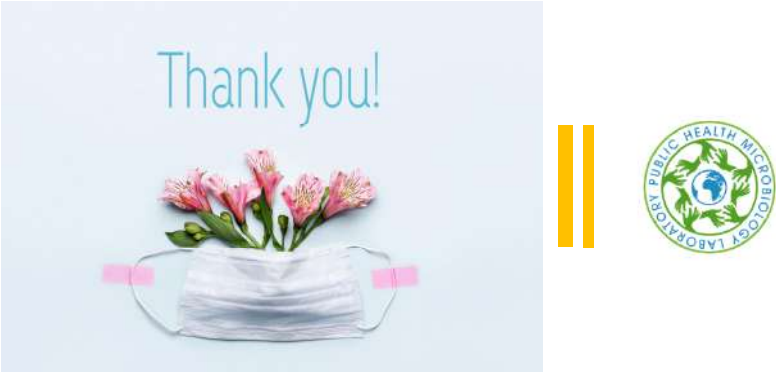
*Dr. Aliyar Cyrus Fouladkhan, Executive Director*  
FSPCA

**IFSH** INSTITUTE FOR FOOD SAFETY AND HEALTH

**ifpti**  
INTERNATIONAL FOOD PROTECTION TRAINING INSTITUTE

Certificate # 35cb61ad

14



Thank you!

**PUBLIC HEALTH MICROBIOLOGY LABORATORY**

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

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 problems with this, as we would handle it through a label update on our end and also at the customers end. However, during these conversations, we started suspecting that Bavaria was not being transparent as to the source of the lupin extract. After pushing them for full disclosure, they connected us with their supplier which told us in writing and via conference call that the lupin extract was from Portugal and 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.ecy.wa.gov/education/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



## Food Labeling and Packaging Claims FDA's Generally Recognized as Safety List

Presented at:  
March 23, 2023  
Lebanese American University  
Tennessee State University, Nashville, TN  
Aliyar Cyrus Fouladkhah, PhD, MS, MPH, CFS, CPH  
Founding Director, Public Health Microbiology Foundation

1

### Food Labeling and Advertising

**Food Labeling:**

- Valuable source of information for consumers
- Could be false, misleading, or true-but-trivial marketing claims


*e.g.* Cholesterol-free potato chips; No Added sugar (added juice); Made with real fruit; N&A flavors; WONF vanilla extract

**Challenge for consumers:**

- Distinguishing the signal from noise

**Challenge for policy makers:**

- Strengthening the signal to noise ration



2



### Food Labeling and Advertising

**Regulation for food producers:**

- Mandatory information
- Voluntary information: weakly regulated
- Voluntary information: strongly regulated
- Prohibited Claims

**Consumers can get information:**

- Search properties:** comparing products in market
- Experience properties:** relying on personal experience
- Credence properties:** consumers cannot confirm product quality

*e.g.:* organic production; country of origin; nutrition and health claims; humane treatment of workers or animals (fair trade)

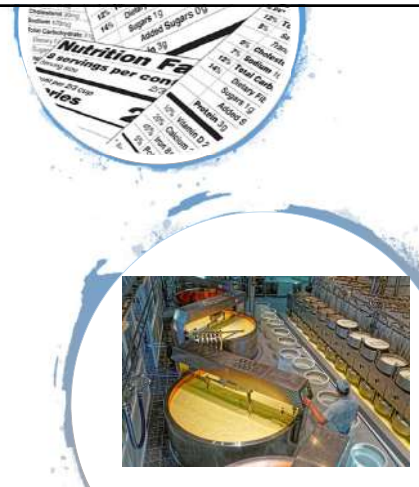
3

### Food Labeling and Advertising

- The food industry is one of the United States' largest manufacturing sector
- 10 percent of all shipments in the United States are associated food industry
- More than a third of the world's top 50 food and beverage processing firms are headquartered in the United States (CASE, 2021)
- Efficiency and public health?

**FDA's Four Flavor Categories**

- Natural Flavors
- Natural With Other Natural Flavors (WONF)
- Artificial Flavors
- Natural and Artificial (N&A) Flavors




4



## Claims About Nutrition and Health

- Four Types of Claims are Possible for Food Products:
  - (1) Nutrient Content Claim
  - (2) Health Claim
  - (3) Qualified Health Claims
  - (4) Structure/Function Claims
- **All must be in close harmony with Dietary Guidelines for Americans**
- **Must be evaluated by regulatory agencies**



5



**DIETARY GUIDELINES FOR AMERICANS 2015-2020 EIGHTH EDITION**

**DGA Dietary Guidelines for Americans 2020-2025**

**Physical Activity Guidelines for Americans 2nd edition**

Oral Comment Meeting

Meeting Materials

Advisory Committee Meetings

USDA

USDA


6

## Claims About Nutrition and Health

**(1) Nutrient Content Claim:**  
 Describes level of nutrient or food component  
 e.g. "Low sodium," "Low fat," "High in oat bran."  
 Must follow specific requirements of NLEA  
**The Nutrition Labeling and Education Act of 1990 (NLEA)**

**Sodium as an example:**  
 < 5 mg per reference amount\*: "Sodium Free"  
 Reduced by at least 25% from reference amount "Reduced Sodium"  
 Reduced by at least 50% from reference amount "Light in Sodium"  
 140 mg or less per reference amount "Low Sodium"

*Reference amount should be obtained from: Reference Amount Customarily Consumed (RACC)*



7

## Claims about Nutrition and Health

**(1) Nutrient Content Claim:**


- **True-but-misleading claims** must be prohibited e.g. "low-fat broccoli"
- **Half-truth** and misleading claims must be prohibited e.g. if the product: **Both high in saturated fat and high in fiber, the claim:**

**Claim could not just mention "High in fiber"**  
**Reason:** Against the Dietary guideline: Food high in Saturated fat could not be promoted



8

# Claims about Nutrition and Health



## Authorized Health Claims That Meet the Significant Scientific Agreement (SSA) Standard

- (2) Health Claim (aka *Real or Authorized Health Claim*)
  - Connects a food product to disease or health condition
  - e.g. “ may reduce the risk of heart diseases”

Another example: Adequate calcium and vitamin D as part of a healthful diet, along with physical activity, may reduce the risk of osteoporosis later in life.

- This requires approval from **Food and Drug Administration**
- Only approved if there is “significant scientific agreement”
- Has to be derived from a statement from Dietary Guideline or highly respected authorities/institutions (IOM)
- Usually, a **lengthy process and rare in food industry /Out and Cholesterol/**
- [Cost for clinical trials >\$40K per patient, >\$19m for a new drug or health claim]**

**Approved Health Claims**

**Calcium, Vitamin D, and Osteoporosis**

- 2015 FDA Health Claims Guidance on Osteoporosis
- Food Labels, Food Labels, Health Claims, Calcium and Osteoporosis, and Calcium, Vitamin D, and Osteoporosis (September 2015)

**Heart Disease (Heart and Cancer)**

- 2015 FDA Health Claims Guidance on Heart and Cancer

**Dietary Intake of Fat and Cholesterol and Risk of Coronary Heart Disease**

- 2015 FDA Health Claims Guidance on Dietary Intake of Fat and Cholesterol and Risk of Coronary Heart Disease
- 2015 FDA Health Claims Guidance on Dietary Intake of Fat and Cholesterol and Risk of Coronary Heart Disease (October 2015)

**Whole Grains (Whole Grains, Dietary Intake, Cardiovascular Disease, and Cancer)**

- 2015 FDA Health Claims Guidance on Dietary Intake of Whole Grains and Cardiovascular Disease
- Food Labels, Food Labels, Health Claims, Dietary Intake, Cardiovascular Disease, and Cancer (October 2015)
- Food Labels, Food Labels, Health Claims, Dietary Intake, Cardiovascular Disease, and Cancer (February 2016)
- Food Labels, Food Labels, Health Claims, Dietary Intake, Cardiovascular Disease, and Cancer (December 2017)
- Food Labels, Food Labels, Health Claims, Dietary Intake, Cardiovascular Disease, and Cancer (August 2019)

**Fiber-containing Cereals, Fruits, and Vegetables and Cancer**


- 2015 FDA Health Claims, Dietary Intake, Cereals, Fruits, and Vegetables and Cancer

9

# Claims about Nutrition and Health

## (3) Qualified Health Claim

- Is a claim that lack significant scientific agreement
- FDA allows such claim when some health benefit studies are available.
- Label should indicate:
  - “FDA has determined that this evidence is limited and not conclusive”
  - They should also indicate “This statement is not approved by FDA.”
- “Scientific evidence suggests, but does not prove, that whole grains (three servings or 48 grams per day), as part of a low saturated fat, low cholesterol diet, may reduce the risk of diabetes mellitus type 2.”
- Could lead to legal complication for companies if not stated correctly.




10

# Claims about Nutrition and Health

## (4) Structure and Function Claim



- Connects food to structure or function of human body
- Most common in the food industry
- Allows food industry to “hint” at health benefits
- Does not requires FDA approval
- But companies would need to have strong scientific evidence [DGA or IOM]



“Prevents Osteoporosis” is a health claim requires lengthily FDA approval  
 “Builds strong bones” is a structure/function claim that does not require FDA approval

11

# FDA GRAS LIST

- Any substance that is intentionally added to food is a food additive
- All additives are: subject to premarket review and approval by FDA, unless those with GRAS status
- Food Industry is extremely dynamic with many ingredients (natural and artificial)
- Practically impossible for companies to test all ingredients for safety
- There is a similar list (Animal Food GRAS) for feed industry
- When an ingredient is not listed in GRAS list:
  - Manufacturer may obtain GRAS status by applying to the FDA
  - This is much less conservative than pharmaceutical industry. [LD50 in animals/100]
  - Takes over 10 years to receive approval for new drugs [typically >\$19 B]

12

## Pre-market safety evaluation process

- **1958:** Congress enacted the **Food Additives Amendment** to the **Federal Food, Drug, and Cosmetic Act**
- **1960:** Color Additive Amendments to the **Federal Food, Drug, and Cosmetic Act**

Flow Chart Depicting the Various Groups Involved in the Assessment of Cancer Risk at the Center for Food Safety and Applied Nutrition (CFSAN) of the Food and Drug Administration

Chapter II  
Agency Review of Technology Submissions in Petition for New Food Additives and Color Additives Not in Food

Introduction

Guidance document for WHO monographers and reviewers evaluating food additives (excluding enzyme preparations and flavouring agents)

13

## FDA GRAS LIST

- GRAS (Generally Recognized as Safe) list of FDA:
- **Help producers avoid unnecessary testing**
- Provide a list of all **approved ingredients** and **approval concentrations** [e.g. *nisin 900 IU/gram*]
- **Created in 1958** as amendment to Food and Drug Cosmetic Act
- Ingredients already in use **before 1958** received GRAS status **without testing (Old Additives)**
- **This created some problem:**
- Example: **1985 cinnamyl anthranilate** (artificial cinnamon flavor) linked to liver cancer.
- **Was part of GRAS list from 1958 to 1985, banned in 1985.**

Generally Recognized as Safe (GRAS)

"GRAS" is an acronym for the phrase Generally Recognized As Safe. Under section 201(s)(2) and (3) of the Federal Food, Drug, and Cosmetic Act (the act), any substance that is intentionally added to food as a food additive, that is neither a preservative nor an approved color additive, is generally recognized as safe if qualified experts, after having been otherwise advised to the contrary, believe the substance to be a food additive, or believe the use of the substance to be otherwise exempt from the definition of a food additive.

• Under section 201(s)(2) and (3) of the act, and FDCA implementing regulations in 21 CFR 170.3 and 21 CFR 170.30, the use of a food additive that is GRAS under FDCA is not subject to the premarket notification requirements of the act. However, manufacturers based on information in food additive regulations, general recognition of safety through scientific procedures require the same scientific and quality of evidence as those used to support the approval of the substance as a food additive. General recognition of safety through scientific procedures is based upon the application of generally available and accepted scientific data, information, or methods, which includes, but is not limited to, the application of scientific principles, and may be based on the application of established scientific data, information, or methods.

• Under 21 CFR 170.303 and 170.305, general recognition of safety through scientific procedures based on evidence on a food requires a substantial history of consumption for food use by a significant number of consumers.

14

## FDA GRAS LIST

- A large online data inventory: **GRAS Notice Inventory**
- **Some decision controversial:**
- **Stevia (Erythritol)**, approved since **2001**, new concerns?
- **Lysozyme**: an natural enzyme in human breastmilk
- In 2006, Artificially produced Lysozyme did not receive GRAS status for **infant formula**
- Other examples:
- **Caffeine** did not receive GRAS status for **caffeinated alcoholic beverages**
- **Trans fats** were part of GRAS list until 2015
- **Sodium chloride** is still on GRAS list, **IOM recommends removal**

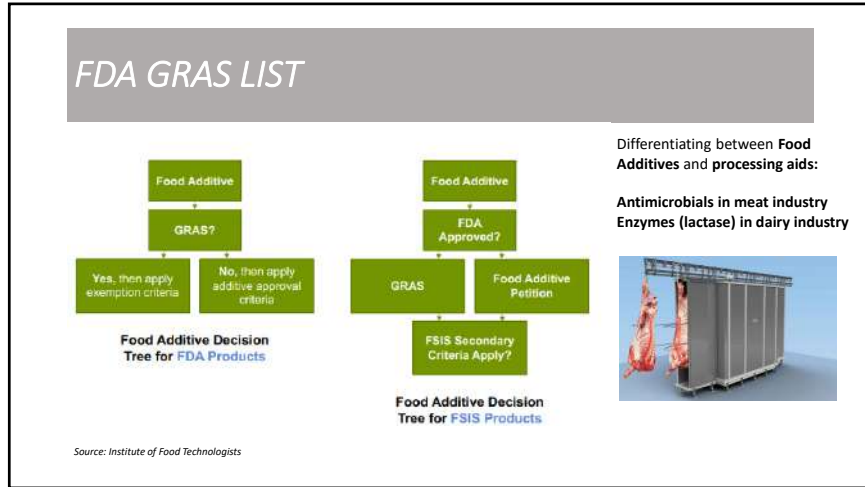
15

## FDA GRAS LIST

- **Major problems with GRAS list:**
- **Old additives** were not all reviewed
- Studies are not from **human clinical trials** (in vivo or animal studies) [*LD50 in animals divided by 100*]
- Do not consider the additives **synergism** [*Benzoic acid, sulfate, phosphoric acid, citric acid*]
- Does not address **color additives** (covered by FD&C act)
- Does not address **pesticides**
- Does not address **GMO**
- **Other agencies have additional requirements:**
- **USDA FSIS:** additives for meat products
- **Animal Food GRAS List**

16






**Thank you!**

**Public Health Microbiology Laboratory**  
Aliyar Cyrus Fouladkhah, PhD, MPH

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


**PUBLIC HEALTH MICROBIOLOGY LABORATORY**

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



## Foodborne Diseases of Public Health Importance and Transboundary Diseases

Presented at:  
March 23, 2023  
Lebanese American University  
Tennessee State University,  
Nashville, TN  
Aliyar Cyrus Fouladkhah, PhD, MS, MPH, CFS, CPH  
Founding Director, Public Health Microbiology Foundation




1


## Anthrax

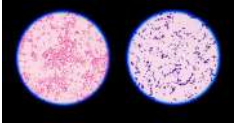
- Causative agent: *Bacillus anthracis*
- A **Gram-positive** and **spore-forming** bacteria
- Can be found as a spore in the **soil worldwide**
- Spores **viable for decades in soil**
- Common in parts of Africa, Asia, and Middle East
- **In Human:**
  - Skin
  - Intestine
  - Inhalation
- Animal disease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



## BSE Management

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



5

6

## Brucellosis

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



## Brucellosis- Treatment & Prevention

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




7

8



## Equine Encephalitis Viruses




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

9

## Equine Encephalitis Viruses


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



10

## Hendra Virus


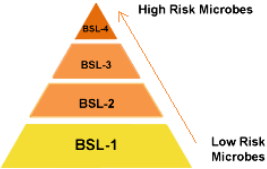
- Viral disease **consider as emerging** (first observed in Australia)
- Natural infections had been **reported only** in:
  - Horses
  - Humans (first reported in 1994, very rare and under-reported)
- Current transmission by:
  - Fruit bats
  - **Bodily fluids and urine** of those infected
- Clinical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



11

## Hendra Virus

- Little is known about pathogen
- **People at risk:**
  - Those occupational or recreational **exposure to horses**
  - Those **living close to "Flying fox" bats** (genus *Pteropus*)
  - **Researchers**
- Highest level of security (**CDC biosafety level 4**) needed for studying the pathogen (around 4 labs in the US and <50 in the 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

# Main Bacterial Pathogens Associated with Animal and Human Health Diseases

13

## Emerging pathogens

Diversity, moving towards "fitness" and Emerging Pathogens

**Vertical**

**Horizontal**

**a Bacterial transformation**  
 Release of DNA  
 Donor cell → Recipient cell

**b Bacterial transduction**  
 Phage-infected donor cell → Release of phage → Recipient cell

**c Bacterial conjugation**  
 Donor cell → Recipient cell

Copyright © 2009 Nature Publishing Group  
 Nature Reviews | Microbiology

14

## Horizontal Gene Transfer

**(a) Conjugation:**  
 Resistant donor cell → DNA exchange through pilus → Non-resistant recipient cell → Resistant transconjugant cell  
 Plasmid- or transposon-borne ARG

**(b) Transduction:**  
 Resistant, infected donor cell → Loss, cell death → Phage carrying bacterial ARG → Transport to and infection of a non-resistant recipient cell → Resistant transducing cell (in lysogenic growth)

**(c) Natural transformation:**  
 Resistant donor cell → Cell death, lysis → Free DNA w/ intact ARG → Transport to and uptake by competent, non-resistant recipient cell → Resistant transformant cell  
 ARG (chromosomal or plasmid-borne)

Donn, 2012

15

## Planktonic cells and Biofilm Communities

Photo Courtesy: [http://microbiology.wikia.com/wiki/Planktonic\\_cells](http://microbiology.wikia.com/wiki/Planktonic_cells)

Photo Courtesy: [http://www.farnham.com/660712/biofilm\\_microbial\\_fat\\_108\\_with\\_3d01n.jpg](http://www.farnham.com/660712/biofilm_microbial_fat_108_with_3d01n.jpg)

Photo Courtesy: <http://www.microbiologyjournal.com/2014/04/24/014042401/>

16

## Quorum Sensing and Biofilm formation

### Shiga toxin-Producing E. coli and antibiotics treatment

Photo Courtesy: <http://www.pci.org/articles/view/20074/figure2>

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

Photo Courtesy: [http://2009.sgm.org/Team/Aberdeen\\_Scotland/WatLab/quorum-sensing](http://2009.sgm.org/Team/Aberdeen_Scotland/WatLab/quorum-sensing)

17

## 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.pci.org/articles/view/20074/figure2>

Photo Courtesy: <http://www.microbiologyjournal.com/blog/category/foodborne>

Photo Courtesy: <http://www.jfmp.org/2020/11/15/boosting-microbial-fauna-with-biofilm.php>

Photo Courtesy: <http://micro-writer.epdsu.com/blog/The-antibiotic-resistance>

18

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

Runaway of E. coli strains across Canada: warning issued

APRIL 23, 2017

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

ALMOST 200 sick in UK-wide Salmonella outbreak

#### Multidrug-resistant salmonella outbreak characterized

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

#### Eat Smart chopped salad kit recalled in Canada over Listeria concerns

Raw goat milk recalled because of positive test for Campylobacter

19

## Epidemiology of Foodborne Diseases

- 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.
- 9.4 million illnesses, 55,961 hospitalizations, and 1,351 deaths are cause 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 YOPi's: The young, the old, Pregnant, and Immunocompromised)

20



## 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%).

21

## 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



22

## Significant Foodborne Pathogens of Public Health

Concern: Considering DALY and QALY (Scallan et al., 2015)

- **Disability Adjusted Life Year (DALY).** Loss of life and health due to illness compared with 'perfect' health

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

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

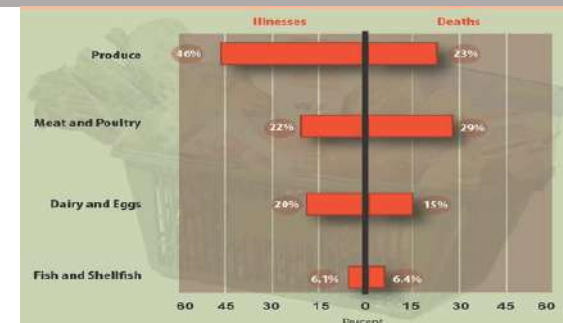


- Mild illness (no medical care sought)
- **Guillain-Barré syndrome** (*Campylobacter* and *Salmonella*)
- **Post-infectious irritable bowel syndrome** (*Campylobacter* and *Salmonella*)
- **Reactive arthritis** (*Campylobacter* and *Salmonella*)
- **Haemolytic uraemic syndrome** (*E. coli* O157)
- **End-stage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

23

## CDC Estimates of Food Safety Burden

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

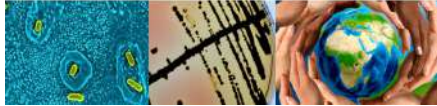


\*Chart does not show 5% of illnesses and 2% of deaths attributed to other commodities. In addition, 1% of illnesses and 25% of deaths were not attributed to commodities; these were caused by pathogens not in the outbreak database, mainly *Toxoplasma* and *Wolbachia*.

24

## 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*



25

## 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 <sub>w</sub>	0.94	0.99	>0.99
Other	Non-spore former		
Atmosphere	Facultative - grows with or without oxygen		

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

26

## 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.

27

## 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 (166 news)
- Hospitalizations: 157 (54 news)
- Deaths: 2 (1 news)
- States: 47 (1 news)
- 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.



28

## 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 <sub>w</sub>	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 2<sup>nd</sup> edition, Scallan et al. 2011, and FSPCA

29

## 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 (dump tank, nearly 80%). Relatively high infective dose
- 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 <sub>w</sub>	>0.987	0.997	-
Other	Non-spore former		
Atmosphere	3-5% oxygen optimum		

Sources: ICMSF 1995 and Bad Bug Book 2<sup>nd</sup> edition and FSPCA

30

## 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 <sub>w</sub>	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

31

## 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 <sub>w</sub>	0.95	0.995	-
Other	Non-spore forming		
Atmosphere	Facultative - grows with or without oxygen		

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

32



## 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

33

## *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 <sub>w</sub>	0.94	0.98	0.996 (10% NaCl)
Other	Non-sporeformer, <b>requires salt</b>		
Atmosphere	Facultative - grows with or without oxygen		

Sources: Seafood Hazards Guide 2011, ICMSF 1995 and Bad Bug Book 2<sup>nd</sup> edition

34

## *Yersinia enterocolitica*

*Yersinia pestis*

14<sup>th</sup> 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 <sub>w</sub>	0.945	-	-
Other	Non-spore former, <b>raw milk in fridge?</b>		
Atmosphere	Facultative - grows with or without oxygen		

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

35

## *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 <sub>w</sub>	0.92	-	-
Other	Non-sporeformer		
Atmosphere	Facultative - grows with or without oxygen		

Sources: ICMSF 1995 and Bad Bug Book 2<sup>nd</sup> edition

36



## *Cronobacter Sakazakii*

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

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

37



**Thank you!**

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

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

38

# Participants' Certifications



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

*Public Health Microbiology Foundation<sup>SM</sup>:*

*<https://publichealthmicrobiology.education>*





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

# CERTIFICATE OF TRAINING

is awarded to

**Adriana Diab**

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

03/23/2023

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 # e66fa767





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

# CERTIFICATE OF TRAINING

is awarded to

**Alaa Osseiran**

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

03/23/2023

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

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

A handwritten signature in black ink, reading 'Gerald Wojtala'.

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 # 4cf46f54





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

# CERTIFICATE OF TRAINING

is awarded to

**Andre El Khoury**

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

03/23/2023

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 # 85b4042f







FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

# CERTIFICATE OF TRAINING

is awarded to

**Cendrella Tannous**

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

03/23/2023

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 # edf05c23





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

# CERTIFICATE OF TRAINING

is awarded to

**Christie Sakr**

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

03/23/2023

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

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

A handwritten signature in black ink, reading 'Gerald Wojtala'.

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 # 847f9c55





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

# CERTIFICATE OF TRAINING

is awarded to

**Elie AL Zein**

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

03/23/2023

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

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

A handwritten signature in black ink, reading 'Gerald Wojtala'.

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 # d2841757





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

# CERTIFICATE OF TRAINING

is awarded to

**Hiba Hani Dorzi**

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

03/23/2023

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 # 63cb9160







FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

# CERTIFICATE OF TRAINING

is awarded to

**Hussein Hassan**

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

03/23/2023

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

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

A handwritten signature in black ink, reading 'Gerald Wojtala'.

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 # d3e59547





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

# CERTIFICATE OF TRAINING

is awarded to

**Inass Al Souki**

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

03/23/2023

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

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

A handwritten signature in black ink, reading 'Gerald Wojtala'.

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 # 3e70d9f2





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

# CERTIFICATE OF TRAINING

is awarded to

**Julia El Khoury Wardini**

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

03/23/2023

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

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

A handwritten signature in black ink, reading 'Gerald Wojtala'.

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 # d11ed577





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

# CERTIFICATE OF TRAINING

is awarded to

**Layla Daher**

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

03/23/2023

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 # a22e757b







FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

# CERTIFICATE OF TRAINING

is awarded to

**Leila Tauk**

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

03/23/2023

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 # 39be3d5b





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

# CERTIFICATE OF TRAINING

is awarded to

**Michella Nehme**

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

03/23/2023

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

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

A handwritten signature in black ink, reading 'Gerald Wojtala'.

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 # fc502e08





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

# CERTIFICATE OF TRAINING

is awarded to

**Mira Sidnawy**

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

03/23/2023

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 # 09317128





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

# CERTIFICATE OF TRAINING

is awarded to

**Mohammad Mahdi Hassan**

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

03/23/2023

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

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

A handwritten signature in black ink, reading 'Gerald Wojtala'.

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 # 359d7b72







FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

# CERTIFICATE OF TRAINING

is awarded to  
**Nour Fares**

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  
03/23/2023

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

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

A handwritten signature in black ink, reading 'Gerald Wojtala'.

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 # e7c19289





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

# CERTIFICATE OF TRAINING

is awarded to

**Pamela Hindieh**

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

03/23/2023

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 # ce8b7e13





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

# CERTIFICATE OF TRAINING

is awarded to

**Rania Mosarah**

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

03/23/2023

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

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

A handwritten signature in black ink, reading 'Gerald Wojtala'.

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 # c5727a57





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

# CERTIFICATE OF TRAINING

is awarded to

**Rawan Shamieh**

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

03/23/2023

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

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

A handwritten signature in black ink, reading 'Gerald Wojtala'.

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 # 0b179dff







FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

# CERTIFICATE OF TRAINING

is awarded to

**Sabine Chahine**

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

03/23/2023

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 # fcc4b6fd





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

# CERTIFICATE OF TRAINING

is awarded to

**Souhad Aboul Hosn**

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

03/23/2023

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

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

A handwritten signature in black ink, reading 'Gerald Wojtala'.

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 # 7449c8f5





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

# CERTIFICATE OF TRAINING

is awarded to  
**Tala Zein**

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

03/23/2023

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

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

A handwritten signature in black ink, reading 'Gerald Wojtala'.

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 # 05e2a11e





FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

# CERTIFICATE OF TRAINING

is awarded to

**Tatiana Hannoush**

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

03/23/2023

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 # a242a103







FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

# CERTIFICATE OF TRAINING

is awarded to

**Tiana El Hachache**

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

03/23/2023

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

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

A handwritten signature in black ink, reading 'Gerald Wojtala'.

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 # 3c0c23db



# Workshop News on Social Media



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

*Public Health Microbiology Foundation<sup>SM</sup>:*

*<https://publichealthmicrobiology.education>*



Farmer-to-Farmer Venture37

5h · 🌐

USAID - US Agency for International Development's Farmer-to-Farmer activity is keen on engaging youth and providing them with the needed information and opportunities to pursue their life goals and contribute to the development of their communities.

Under this objective, #F2F recruited Dr. Aliyar Cyrus Fouladkhah to deliver the Food Safety Preventive Controls Alliance #PCQA training.

The 3-day intensive training was hosted at Lebanese American University - LAU and attended by 25 students, food safety professionals and university professors. At the end of the training sessions, trainees received certificates funded by the Public Health Microbiology Foundation.

As a result of this training, attendees were able to increase their understanding of food preventive controls which will enable them to perform better food inspections and improve their Food Safety and Quality practices in the food facilities.

#farmertofarmerlebanon #USAIDTransforms #USAID #PCQA #foodsafetytraining



Inass A. Al Souki, José Eduardo Cano Ozaeta and 20 others

1 🗨️ 6 📲

👍 Like

💬 Comment

➦ Share

Most relevant ▾



Write a comment...



👑 Top fan  
José Eduardo Cano Ozaeta  
Great job Dr. Aliyar Cyrus Fouladkhah

👍 Like Reply 1h



2






**Sabine Chahine, MBA, PCQI**

Agro Food Engineer | MBA | PCQI | Agriculture Development Programs | Humanitarian

[View full profile](#)



**Sabine Chahine, MBA, PCQI** • 1st

Agro Food Engineer | MBA | PCQI | Agriculture Development Programs | Humanitari...  
1d • Edited • 

Officially PCQI CERTIFIED!

Successfully unlocking milestone after the other!!

Thank you for Dr [Aliyar Cyrus Fouladkhah](#) for the amazing training and for meeting such an inspiring individual, and [Farmer-to-Farmer Program Land O'Lakes Venture37](#) Lebanon for the amazing opportunity!

7 months Baby also attended training!



  You and 47 others 1 comment

Reactions





# Recommendations for the Future



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

*Public Health Microbiology Foundation™:*

*<https://publichealthmicrobiology.education>*

## Farmer-to-Farmer Program

### Food Safety and Quality F2F FSQ

#### Beneficiary Visitation Form

**Volunteer Name:** Dr. Aliyar Cyrus Fouladkhah, PhD, MPH

**SOW Code:** \_\_\_\_\_

Type of Assistance:  T – Technology Transfer     O- Organizational Development     E-Enterprise Development  
 F- Financial Services     C-Environmental Conversation     A-Administrative

**Visit Purpose:** Recommendation for Improving Safety and Quality/ Process Authority Consultation

**Visit Date:** 3-27 and 28-2023    **Visit Location:** Farhat Dairy and Dairy Farm

**Visit #:** Twice in processing plant and twice in the dairy farm

**Beneficiary Info:**

Name: Ms.Farah Farhat and Mr. Yousef Farhat	Occupation: managers	Organization: Farhat Dairy
Gender: Age 15 – 29 (Yes/NO): Yes	Mobile:	Email:

**Findings**

The company asked for help for increasing the shelf-life of their products. They expressed concern that about low shelf-life of their product and quality issues associated with their processed dairy products. Both managers were new and had been there for less than one year and very receptive to new ideas and suggestions.

**Recommendations/instructions given by Volunteer**

Major food safety improvement needed in this facility.

Some of the quality issues associated with the products could be associated with enzyme they are using in their operation. Only one product that has chymosin-like enzymes are used in the operation. The company was recommended to source additional chymosin and chymosin-like enzymes to test for improving the quality of their products. For improving shelf-life the company was suggested to incorporate lactic acid and nisin in concentrations approved by FDA’s GRAS list and local regulatory agencies. It was additionally recommended to develop a written sanitation procedure using validated food contact and non-food contact sanitizers. The company was advised to use pasteurization for all cheese products to reduce chance of listeriosis from their products. In the long term, and if the budget permits, the company was recommended to start testing for antibiotics residue for their receiving line and incorporate a water bath with sanitizers at the entrance to sanitize boots. Control of mold and condensation in the facility was another recommendation discussed in detail.

**Follow up actions**

1. Improvement in GMP (entrance sanitization of boots; securing the entrances with plastic and/or air curtain etc.).
2. Incorporation of pasteurization for the milk used for their cheese production, control of condensation and molds grow.
3. Research and development for alternative chymosin (or chymosin-like enzymes) and incorporation of GRAS-listed antimicrobials such as lactic acid and nisin.

Volunteer Signature:



Dr. Aliyar Cyrus Fouladkhah

3-31-2023

Beneficiary Signature

\_\_\_\_\_

## Farmer-to-Farmer Program

### Food Safety and Quality F2F FSQ

#### Beneficiary Visitation Form

**Volunteer Name:** Dr. Aliyar Cyrus Fouladkhah, PhD, MPH

**SOW Code:** \_\_\_\_\_

**Type of Assistance:**  T – Technology Transfer     O- Organizational Development     E-Enterprise Development  
 F- Financial Services     C-Environmental Conversation     A-Administrative

**Visit Purpose:** Recommendation for Improving Safety and Quality/ Process Authority Consultation

**Visit Date:** 3-28-2023

**Visit Location:** Hosco Agri (Honey Processing)

**Visit #:** Once

#### Beneficiary Info:

Name: Mr. Chadi Hosri and Mrs. Michella Nehme (Dr. Samar Azzi)	Occupation: Co-wonder (and local professor)	Organization: Hosco Agri
Gender: Age 15 – 29 (Yes/NO): No	Mobile:	Email:

#### Findings

The company has recently purchased equipment for further processing and packing of honey products. Co-owner of the company attended the food safety workshop and PC QI certification conducted by the Public Health Microbiology Foundation in Lebanese American University.

#### Recommendations/instructions given by Volunteer

1. Incorporating information about infant botulism on their products label to notify the customer that the product is not suitable for infants under the age of 12 months.
2. Develop supplier verification program and improve documentation upon receiving of the raw ingredients.
3. Implementation of procedures to control the physical hazards and control of moisture during manufacturing.

#### Follow up actions

Ensuring that the company has improved labeling, standard operating procedures for receiving the raw material, and better processing preventive controls for control and standardization of physical hazards and moisture in their operation, respectively. Reducing the cross-contamination from the wax cleaning part to honey packaging line of the company.

Volunteer Signature:



*Dr. Aliyar Cyrus Fouladkhah*

Beneficiary Signature

\_\_\_\_\_

3-31-2023



## Farmer-to-Farmer Program

### Food Safety and Quality

#### F2F FSQ

### Beneficiary Visitation Form

**Volunteer Name:** Dr. Aliyar Cyrus Fouladkhah, PhD, MPH

**SOW Code:** \_\_\_\_\_

**Type of Assistance:**  T – Technology Transfer  O- Organizational Development  E-Enterprise Development  
 F- Financial Services  C-Environmental Conversation  A-Administrative

**Visit Purpose:** Recommendation for Improving Safety and Quality/ Process Authority Consultation

**Visit Date:** 3-30-2023

**Visit Location:** Triple A Company

**Visit #:** Once

### Beneficiary Info:

Name: Mr. Awni kallas	Occupation: Owner	Organization: Triple A Company
Gender: Age 15 – 29 (Yes/NO): No	Mobile:	Email:

### Findings

This is a very small company that operates in a commercial facility for producing locally favorite products such as hummus and other ready-to-eat products. The company expressed need for improving the shelf-life of their products and reported oxidation and topical contamination with molds during the shelf-life.

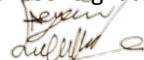
### Recommendations/instructions given by Volunteer

The current pH of the product could support the growth and toxin formation of *C. botulinum*. The company was suggested to acidify the product to below 4.6 (or preferably to below 4.2), to ensure the microbial safety of the product. Company was instructed to better utilize sanitation standard operating procedures to eliminate the existing microbial issues of the product and molds in their facility. Utilization of antimicrobials such as lactic acid and several improvements in GMP and processing conditions were discussed with the entrepreneur.

### Follow up actions

Ensuring that the pH of product is adjusted to ensuring the safety of the product. Ensuring that the GMP and processing recommendations are incorporated. Ensuring that the company has procedures to control the mold in the facility as discussed with them.

Volunteer Signature:

  
Dr. Aliyar Cyrus Fouladkhah

Beneficiary Signature

\_\_\_\_\_

3-31-2023