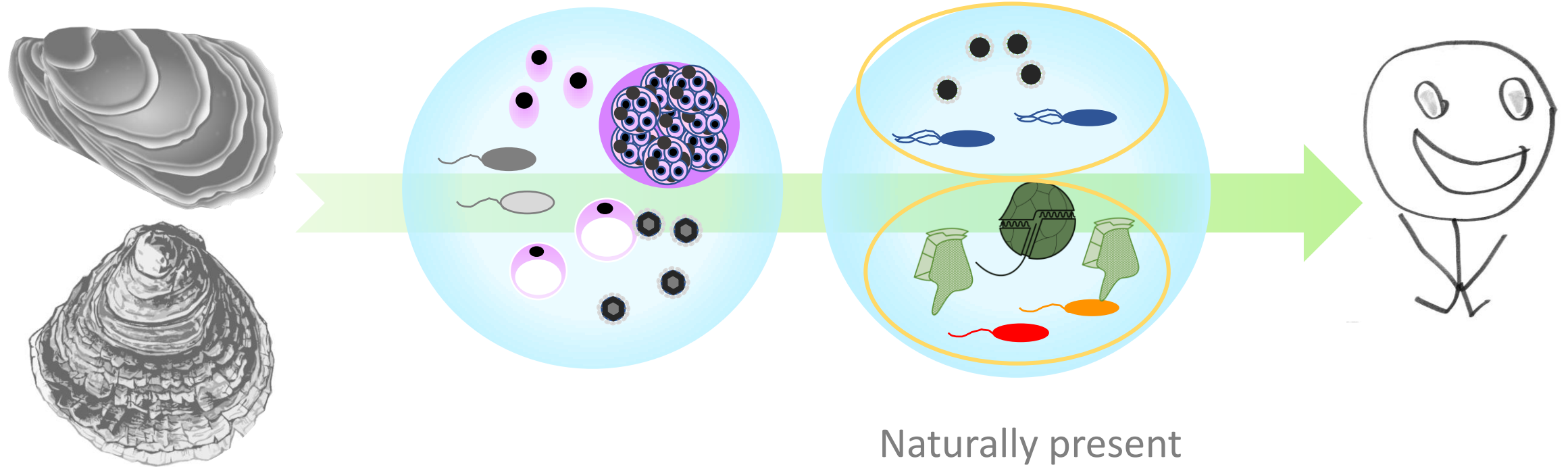


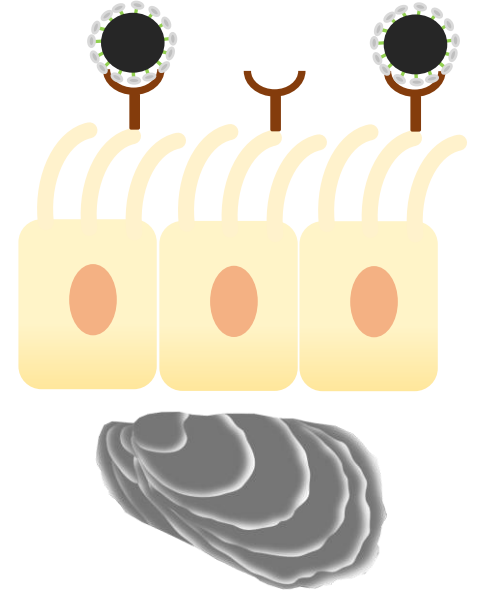
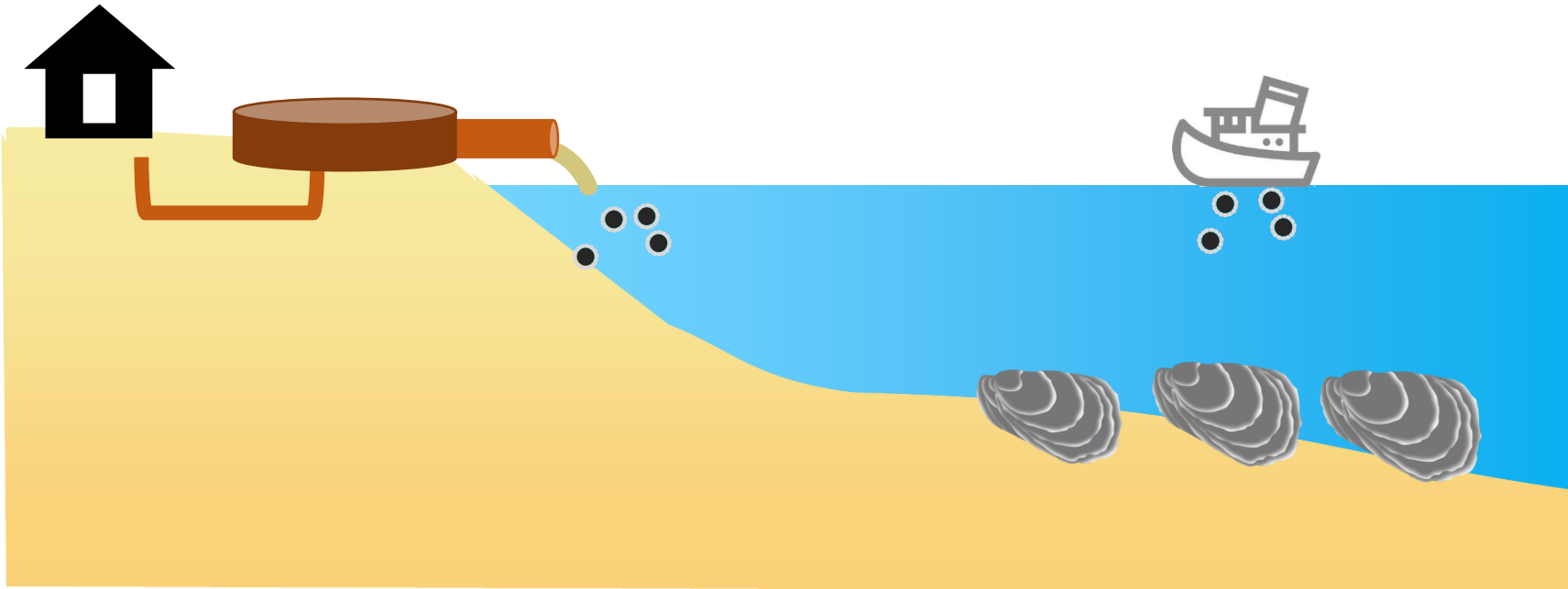
Ensuring the safety of shellfish for human consumption

Corinne Audemard

Oyster production and pathogens



Norovirus: resistance and persistence



Depuration
Relay ?

Bacteria ~~X~~ Indicators

Norovirus: detection and infectivity

TECHNICAL
SPECIFICATION

ISO/TS
15216-1

First edition
2013-03-15
Corrected version
2013-05-01

Microbiology of food and animal feed —
Horizontal method for determination
of hepatitis A virus and norovirus in
food using real-time RT-PCR —



Proteinase K



RNA extraction



GI & GII real-
time RT PCRs



“x” detectable
copies of virus
genome per g

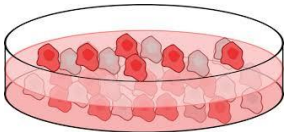
Science

RESEARCH ARTICLES

Cite as: K. Ettayebi *et al.*, *Science*
10.1126/science.aaf5211 (2016).

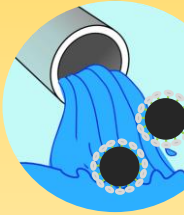
Replication of human noroviruses in stem cell–derived human enteroids

Khalil Ettayebi,^{1*} Sue E. Crawford,^{1*} Kosuke Murakami,^{1*} James R. Broughman,¹ Umesh Karandikar,¹ Victoria R. Tenge,¹ Frederick H. Neill,¹ Sarah E. Blutt,¹ Xi-Lei Zeng,¹ Lin Qu,¹ Baijun Kou,¹ Antone R. Opekun,^{2,3,4} Douglas Burrin,^{3,4} David Y. Graham,^{1,2,5} Sasirekha Ramani,¹ Robert L. Atmar,^{1,2} Mary K. Estes^{1,2†}



Safety with regards to Norovirus

Improve & adapt
treatment



ScienceNews

MAGAZINE OF THE SOCIETY FOR SCIENCE & THE PUBLIC

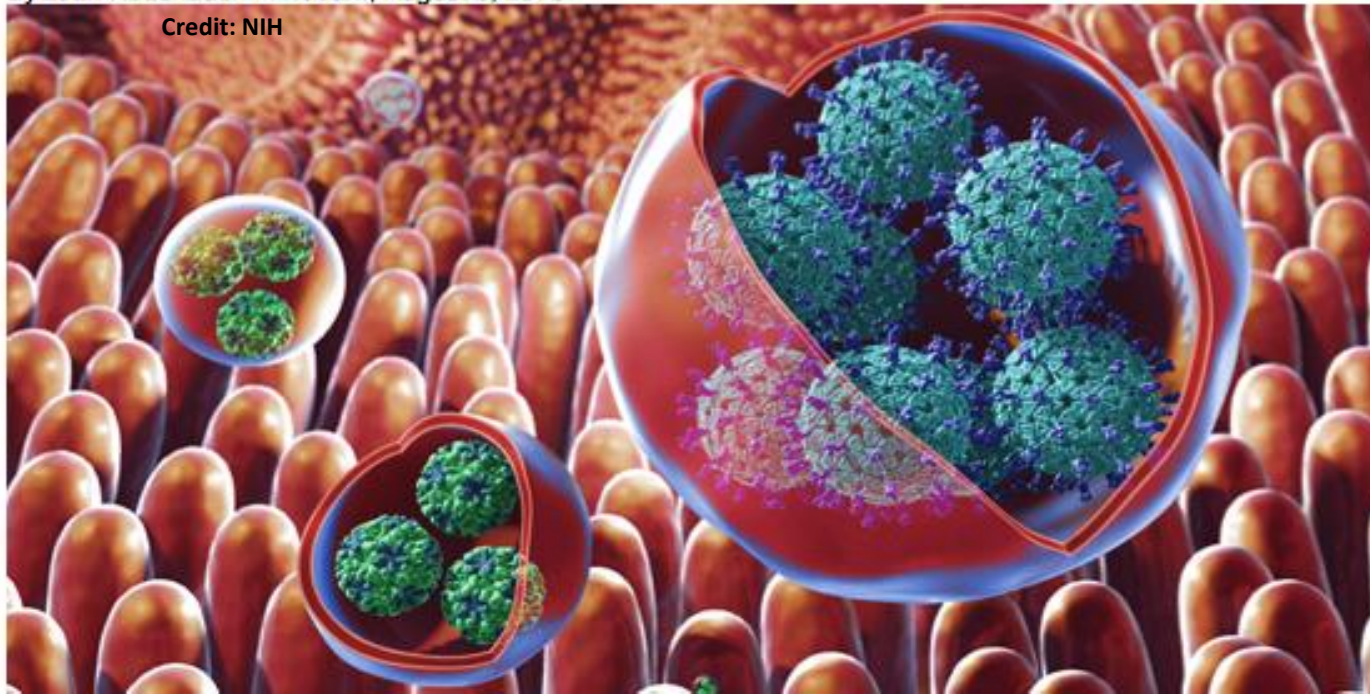
News: Cells, Immune Science, Microbiology

Nasty stomach viruses can travel in packs

In mice, rotavirus and norovirus clumps caused more severe infections than viruses working solo

By Leah Rosenbaum 11:00am, August 8, 2018

Credit: NIH



ce & early
system

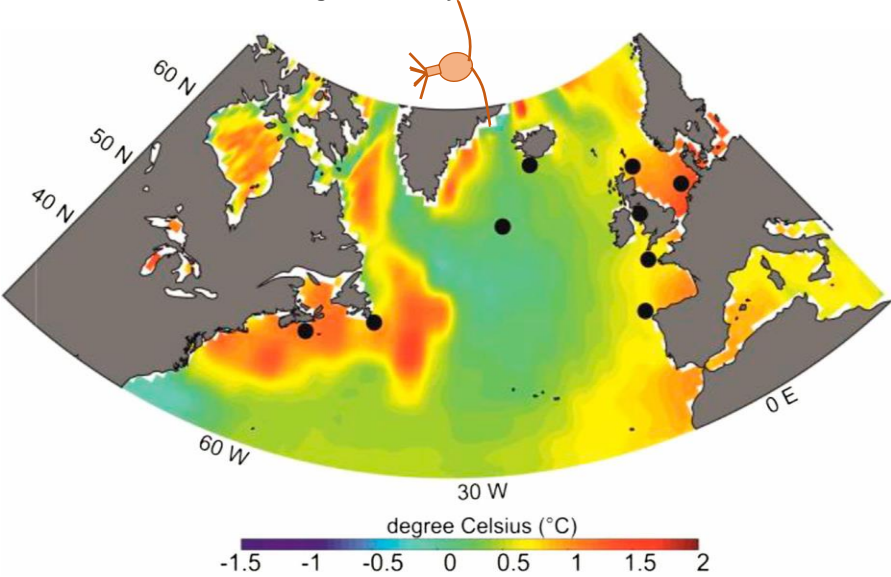


Human-pathogenic Vibrios

Vibrio vulnificus

Low number of cases
Fatal in ~50% of the cases

Change in North Atlantic SST (degrees Celsius) over the study period calculated as delta between SST averaged over the years 2000–2011 and 1890–1958.



Luigi Vezzulli et al. PNAS 2016;113:34:E5062-E5071

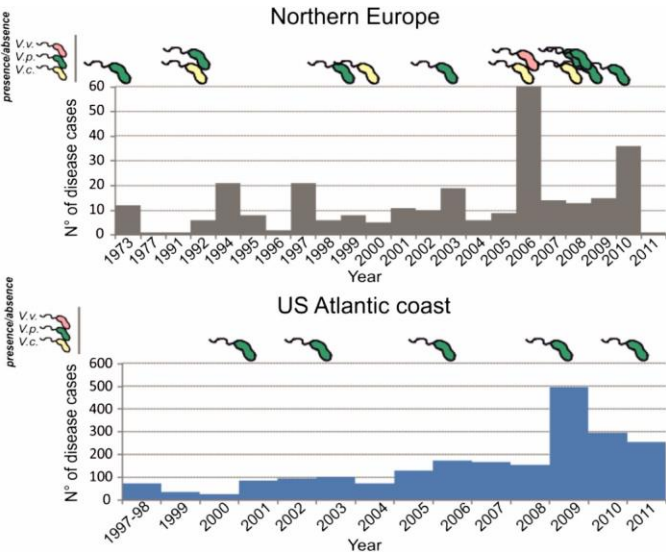
PNAS



Vibrio parahaemolyticus

High number of cases
Spread worldwide

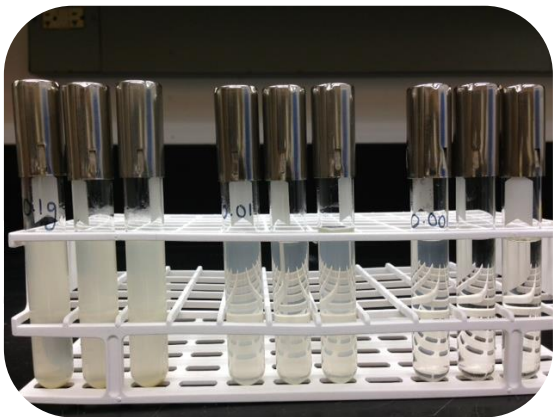
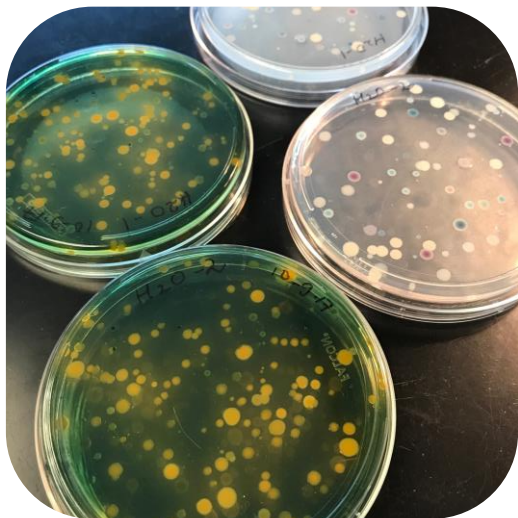
Cases of *Vibrio* infections reported for Northern European countries (including the Baltic Sea) and Atlantic coast of the United States, 1958–2011.



Luigi Vezzulli et al. PNAS 2016;113:34:E5062-E5071

PNAS

Human-pathogenic Vibrios: detection



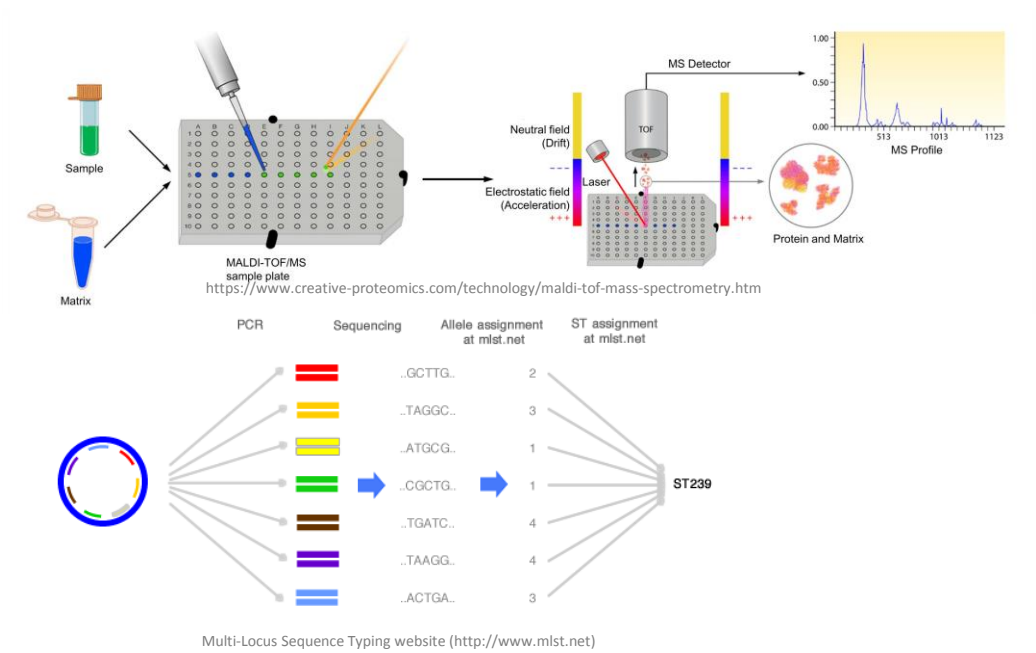
Biochemical
identification

Mass
spectrometry
MALDI-TOF MS

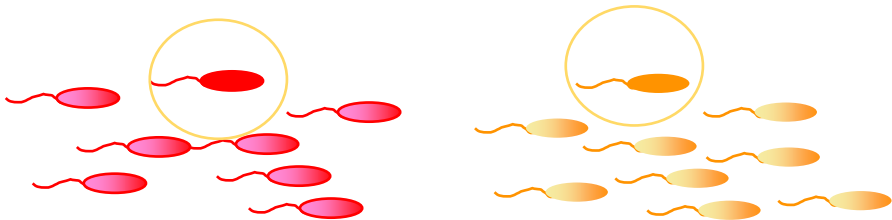
Multi-Locus
Sequence Typing

Whole genome
sequencing

Specific qPCR
assay

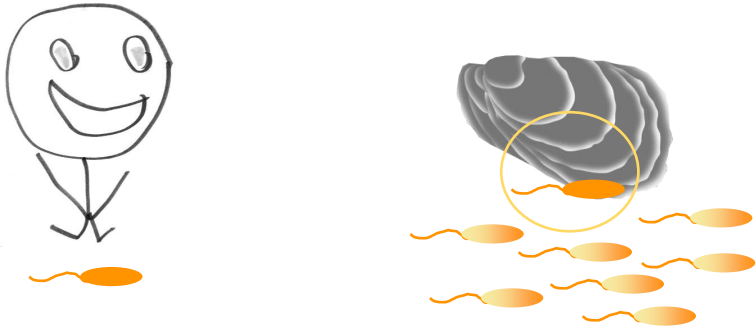


Virulent strain?



Human-pathogenic Vibrios: virulent strain detection

Vibrio vulnificus



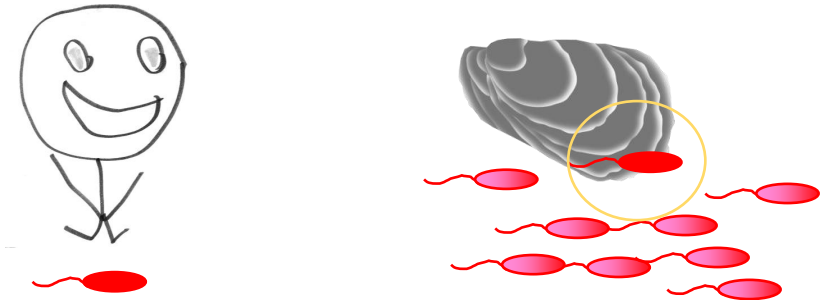
Genotype C & E
(Rosche et al. 2005)

Ecotype A & B
(Kim et al. 2005, Raz et al. 2014)

Marker for virulent strain:



Vibrio parahaemolyticus

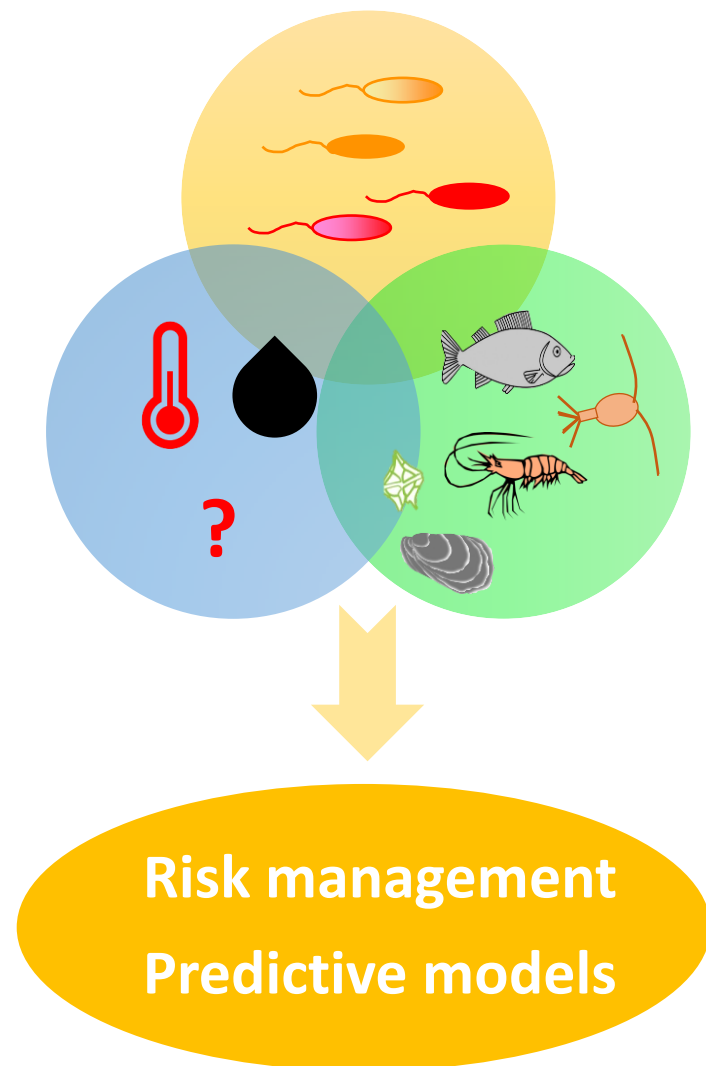


Thermostable direct hemolysin gene (*tdh*)
Thermostable direct-related hemolysin gene (*trh*)

Marker for pandemic strain:



Safety with regards to human-pathogenic Vibrios



OYSTER PROCESSING METHODS

Last month, the Food and Drug Administration announced that by 2011, raw Gulf Coast oysters eaten from April through October would have to go through a bacterial treatment process to largely eliminate the risk of a rare but potentially deadly disease. The FDA has now backed off that proposal, but the debate has spurred a new interest in two methods used to treat the oysters.

BANDING: In both methods, all oysters have bands placed around them to prevent the shells from opening.

HEAT-COOL PASTEURIZATION

- 1 Oysters are placed on trays and submerged in warm water, about 127° F, for 24 minutes.
- 2 Oyster trays are then immediately placed in cold water, about 40° F, for 15 minutes.

HIGH HYDROSTATIC PRESSURE

- 1 Oysters are placed into a steel container with water.
- 2 More water is pumped in around the container at extremely high pressures of about 35,000 to 40,000 pounds per square inch.
- 3 Oysters are kept at the high pressure for 3 minutes.

Sources: Motivatt Seafoods; AmenPure Oysters; www.beoystersaware.com; www.avure.com

THE TIMES-PICAYUNE

FOOD FACTS

From the U.S. Food and Drug Administration

Food Irradiation: What You Need to Know

Food irradiation (the application of ionizing radiation to food) is a technology that improves the safety and extends the shelf life of foods by reducing or eliminating microorganisms and insects. Like pasteurizing milk and canning fruits and vegetables, irradiation can make food safer for the consumer. The Food and Drug Administration (FDA) is responsible for regulating the sources of radiation that are used to irradiate food. The FDA approves a source of radiation for use on foods only after it has determined that irradiating the food is safe.

Why Irradiate Food?

Irradiation can serve many purposes.

- **Prevention of Foodborne Illness** – to effectively eliminate organisms that cause foodborne illness, such as *Salmonella* and *Escherichia coli* (*E. coli*).
- **Preservation** – to destroy or inactivate organisms that cause spoilage and decomposition and extend the shelf life of foods.
- **Control of Insects** – to destroy insects in or on tropical fruits imported into the United States. Irradiation also decreases the need for other pest-control practices that may harm the fruit.
- **Delay of Sprouting and Ripening** – to inhibit sprouting (e.g., potatoes) and delay ripening of fruit to increase longevity.
- **Sterilization** – irradiation can be used to sterilize foods, which can then be stored for years without refrigeration. Sterilized foods are useful in hospitals for patients with severely impaired immune systems, such as patients with AIDS or undergoing chemotherapy. Foods that are sterilized by irradiation are exposed to substantially higher levels of treatment than those approved for general use.

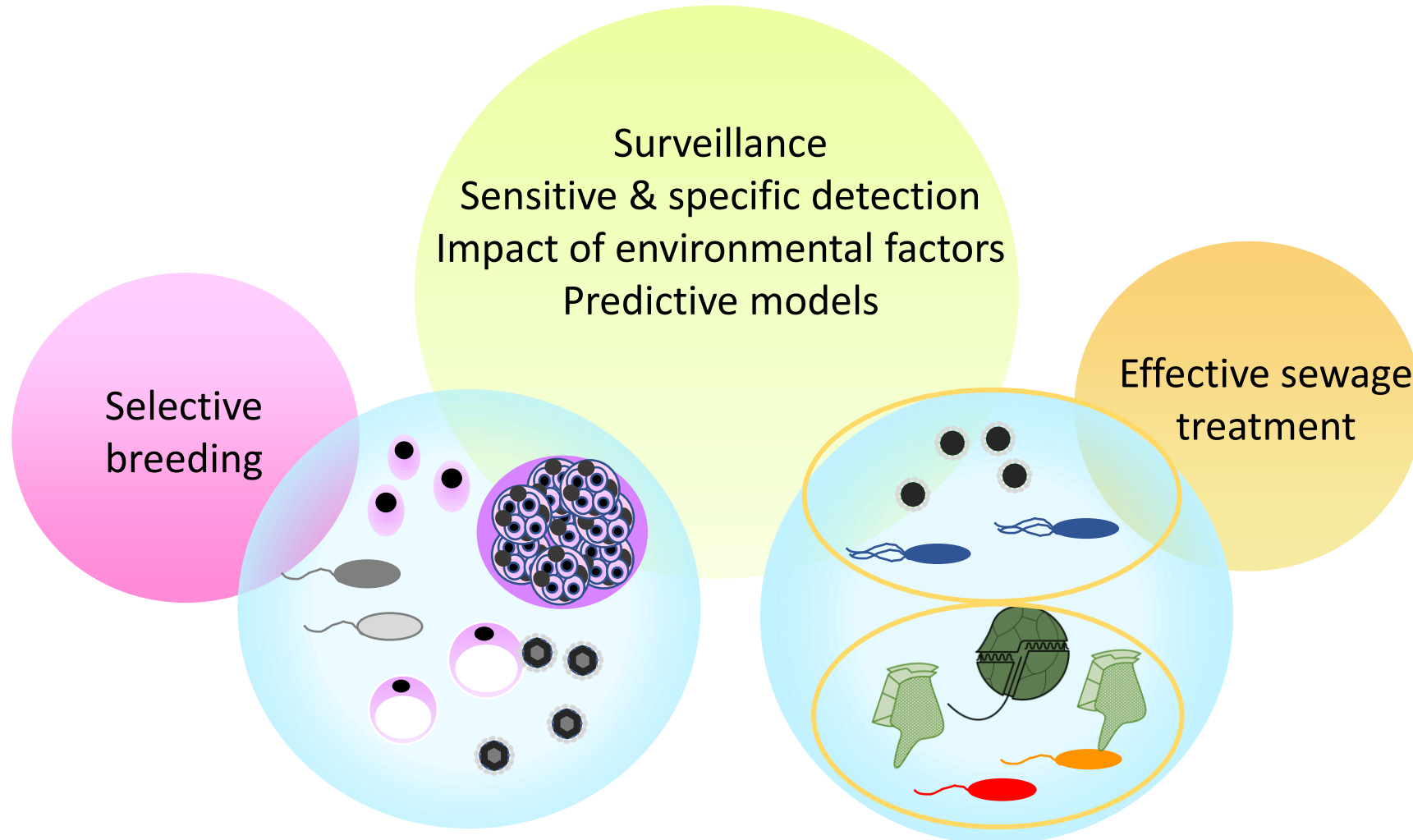
Did you know?

National Aeronautics and Space Administration (NASA) astronauts eat meat that has been sterilized by irradiation to avoid getting foodborne illnesses when they fly in space.

Post-harvest processing methods

The diagram shows an oyster with a red circle and slash over a heart symbol, and a money bag icon next to it, suggesting a focus on safety and cost in post-harvest processing.

Shellfish pathogens & human pathogens: similar approach?



Thank you for your attention

