

Crises and Opportunities in a Life's Long Practice of Veterinary Public Health Or was it ONE HEALTH?

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ECVPH 29/9/2022 Meeting, Athens,

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- When former WVA president Rantsios discussed with me of being a speaker I was wondering about presenting something informative and of value to you
- On the other hand, with nearly 60 years practice of Veterinary Public Health I thought I can find something tantalizing, at times entertaining, mostly professional challenge stories with opportunities for further growth and advancement.
- Administratively I retired early from UC Davis in 1991 because of an invitation to return to Greece
- I had to retire from AUTH in 2000 **because of AGE and not mental incapacity!**
- After that, I continued my professional activities and expanded my associations with academic, government and market entities interested in the creative power of the brain, rather than my birthday.
- **To better understand my diversified professional activities as:**
 - a teacher, researcher, conference organizer,
 - consultant, new product developer, patent interpreter,
 - reviewer, brain storming contributor,
 - risk manager's helper and
 - even a high mountain climber, ball room dancer, track and field competitor and harmonica payer and entertainer when the organizers of a Conference did not provide that,
- **I will touch briefly on my Academic preparations which open the world of opportunities**

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Academic preparation

- I was a Member of the 2nd class to graduate from the first Greek Veterinary School.
- I served as a Veterinary Officer in the Greek Army for two years.
- I came to UC Davis on a Greek government scholarship for graduate studies in the field of “Food Hygiene”
- Being a Veterinarian, I was assigned to professor Walter Sadler Chair of the Department of Public Health and to the **graduate Group of Comparative Pathology.**
- **Comparative Pathology was a multi –campus umbrella program handled by over 150 professors from UCD, UC Berkeley and UC Medical School in San Francisco representing issues of human and animal Health**
- DVM and MD graduate students were exposed
- a. To courses foundational to HOST /PARASITE interactions in health and disease
- b. And had options to take additional elective courses.
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In my own course work I attended

Foundational courses for Comparative Pathology namely :

- Advanced Pathology
- Advanced Physiology
- Advanced Immunology
- Advanced Microbial Physiology
- Advanced Medical Microbiology

B. And for building breadth and depth I took additional courses offered by various department in:

- Bacteriology,
- Public Health,
- Food Science,
- Dairy Science,
- Poultry science,
- Food Hygiene (currently Food Safety),
- Biochemistry, Nucleic acids chemistry, Ecology
- Statistics, Computer Science

Even as a Professor I and my colleague Sir Hans Riemann we audited advanced courses to build cutting edge knowledge for our next project

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Becoming Mr. Staphylococcus!

- **My first research assignment:**
- Within the objectives of a USDA project correlating slaughtered poultry inspection decisions to histopathologic findings and microbial ecology of the carcasses.
- **I was asked to investigate the Public Health Significance of Staphylococci Isolated Aseptically from Chicken Livers.**
- **Staphylococcal intoxications at the time were nearly as frequent as Salmonellosis.**
- **My first paper submitted to the J..Clinical Microb was rejected as reporting unacceptable findings!**
- That was the aseptic isolation from chicken livers of highly epidemic and antibiotic resistant Staphylococcus aureus strains phage 80/81 incriminated in hospital infections!
- Soon after, Japanese investigators verified my findings
- The Paper was accepted by Poultry Science

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- **Running the cat house of Davis.**
- Assessing the potential of enterotoxin production by the isolated S.aureus strains I used a colony of 50-cats as test animals
- Professor Sadler joked by introducing me to the UC Davis social circles as the young Greek who is running the cat house on the Campus and is using the cats every day in significant numbers!
- Poor I it took a year before a lady told me about the true meaning of the words CAT HOUSE!
-
- **At the time One existed only by a Nevada Casino, 120 miles from Davis!!**

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Getting My first Research Grant from the National Institutes of Health while competing with the Pros

- At the end of the Greek Scholarship, I asked Sadler to hire me as a laboratory helper!.
- Instead, he encouraged me to incorporate my “great ideas” into a NIH proposal and get survival funding!
- Yes, a Graduate student competing with the pros!
- I got my proposal funded with complementary comments.
- The first use of fluorescence antibody technique in the world to detect toxins in foods was developed successfully.
- I got also a salary 3 times my former Greek scholarship and the fancy title of Postgraduate Research Scientist!
- I became a scientist admired by the other graduate students and especially the female student body.
- Here is the proof:

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Tino teaching three California beauties Greek Syrtaki as Greek God Pan,
playing a harmonica instead of a flute
after impressing them with his body structure!

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Getting Sadler`s respect

Advancing in research and expanding my circle of acquaintances by going to meetings helped me acquired a lot of respect from Sadler as his graduate student.

But sometimes he went too far!

So, when a colleague asked him about our research progress Sadler calmly responded by saying:

George please do not ask me, I am only the chicken shit professor, Ask Kostas he is the SCIENTIST!

He was reflecting his trips to poultry slaughterhouses to collect samples including fecal! as part of his Salmonella ecology studies!

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The anonymous attendee

- In 1965 as a graduate student, on my own expenses, I attended my first International Meeting in Lincoln Nebraska organized by the recently established World Association of Veterinary Food Hygienists, a specialty branch of the World Veterinary Association .
- Applying my father`s philosophy: **if you want to be among the best, associate with the best!**
I placed myself in the front row during the commemorative picture taking session
- In the proceedings book everybody in the picture was identified by a name except I.
- **The participants in that meeting can be considered as the forefathers of Veterinary Public Health as a specialty of the veterinary profession.**
- **The association went extinct in the 1990`s for unknown to me reasons.**
- **I am happy to say that this College carries the torch and advances the philosophies of the early 1960`s pioneers !**

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Receiving a 5-year a NIH Mega grant (1966-1971)

After completing my PhD studies I received a NIH competitive grant worth \$182,445! . to continue my staphylococcal work

Interesting activities of the project included :

- Advancing immunological techniques to detect staphylococcal enterotoxins in foods,
- Determining whether coagulase negative staphylococci incriminated in intoxications were other than *S. aureus*, **an issue so significant in risk assessment.**
- Determining DNA CG ratio was the best discriminatory technique at the time to distinguish bacteria relationships!
- Think about how primitive we were in microbial genetic sequencing at the time!
- Quantifying *S. aureus* growth and toxigenesis potential as affected by substrates, preservatives, starter cultures and environmental conditions
-
- Defining mathematically the **"probability of growth initiation by one bacterial cell"** as affected by above independent variables

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- My probability concept was based on the notion that food composition and environment as independent variables may define the proportion of contaminating microbial cells which will survive, die or remain non-viable.
- Next, the surviving cell will initiate growth at rates depended on the intensity of the independent variables which can be calculated also mathematically using kinetic models.
- The recent work by professor Koutsoumakis has verified the original concept that not all cells contaminating the food have the same physiological potential to grow.
- My concept was foundational to the evolution of today's Predictive Microbiology
- In the 1969 World Association of Veterinary Food Hygienists Meeting in Opatijia Yugoslavia I presented the first models in the world on the probability of growth initiation by 5 S. aureus strains producing the known at the time enterotoxins as affected by the independent variables of pH and Salt concentration as the next slide shows:

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Ye = a + b₁x₁ + b₂x₂ + b₃x₁² + b₄x₂² + b₅x₁x₂ + b₆ = regression coefficients,
 x₁ = salt, x₂ = pH, a = intercept, Ye = estimated decimal reductions

Strain 243	Log = 60.52 - 0.20 (salt) * - 16.98 (pH) + 0.01 (salt) ² + 1.19 (pH) ² + 0.06 (salt) (pH)
Strain S-6	Log = 52.45 - 0.26 (salt) - 14.50 (pH) + 0.003 (salt) ² + 1.0 (pH) ² + 0.09 (salt) (pH)
Strain 264	Log = 38.59 - 0.10 (salt) - 10.50 (pH) + 0.009 (salt) ² + 0.72 (pH) ² + 0.06 (salt) (pH)
Strain 137	Log = 46.16 + 0.08 (salt) - 12.86 (pH) - 0.009 (salt) ² + 0.88 (pH) ² + 0.07 (salt) (pH)
Strain 472	Log = 44.76 + 0.09 (salt) - 13.24 (pH) - 0.02 (salt) ² + 0.95 (pH) ² + 0.03 (salt) (pH)

* salt % (w/v)

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Earliest mathematical models to determine D and z values of Cl.botulinum thermal destruction

GRAPHICALLY by Esty and Meyer (a Swiss Veterinarian) in 1922

I invited Meyer in his 90`s to lecture in my Foodborne Diseases class at UC Davis in the 1970`s

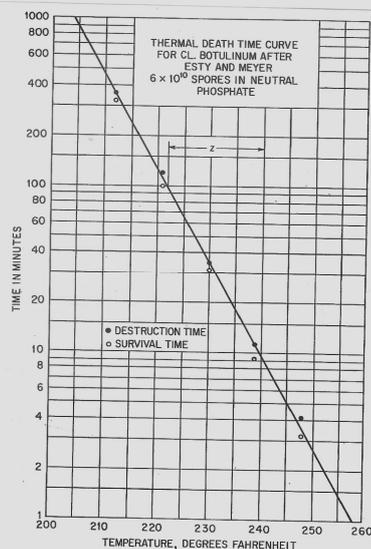


FIG. 29. Typical thermal-death-time curve for *Clostridium botulinum* in neutral phosphate solution. (From data of Esty and Meyer.) Points below line represent survival times; those on or above, death times. (American Can Co.)

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Early mathematical models to determined bacterial growth rates

- In advanced Microbial Physiology class in 1962 we determined the depended variable **Rate of Growth K** by plotting on semi-log graph paper!!
- **What a primitive methodology with today`s computational power.**
- Yet both approaches lead to a very close end result.

Predicting Number of Cells after t time of Growth

$\text{Log } N_t = \text{log } N_0 + k t/2.303$

k = rate of growth, **No** = Initial number of bacteria, **Nt** = Number of bacteria after t time

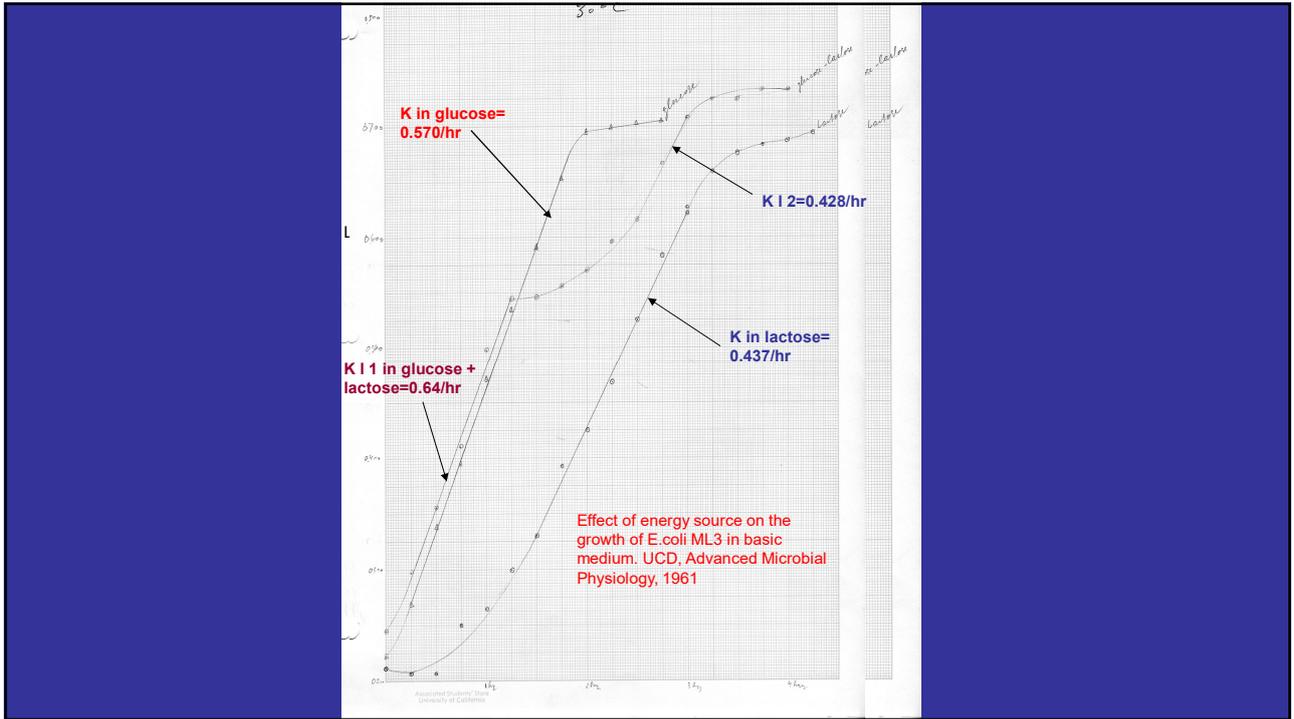
Generation time or doubling time = 0.697/k

Activation Energy= $\ln(k_2/k_1) = E_a/R \times (1/T_1 - 1/T_2)$ where

Ea = the activation energy of the reaction in J/mol, **R** = the ideal gas constant = 8.3145 J/K·mol

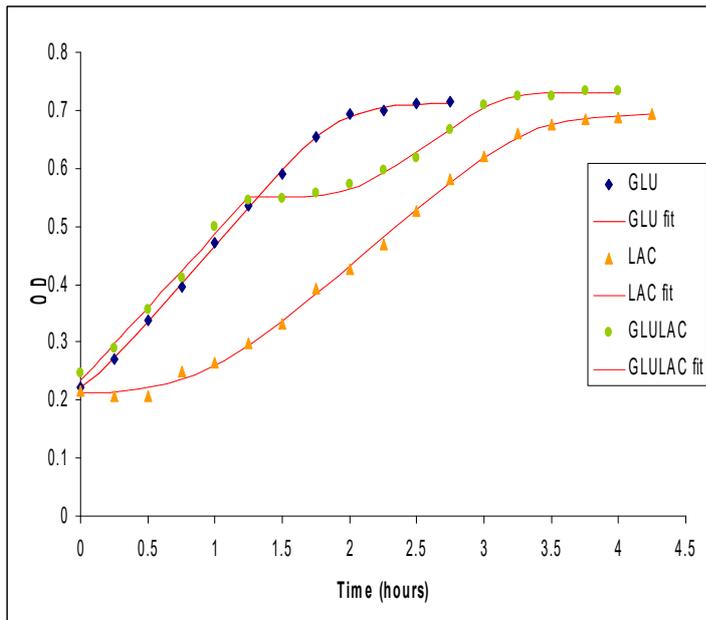
T1 and T2 = absolute temperatures (in Kelvin), **k1 and k2** = the reaction rate constants at T1 and T2

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Effect of energy source on E.coli ML 3 growth in minimal medium at 30 C according to Baranyi and Roberts (1994) plot



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Specific growth rates of E.coli ML3 growing in minimal medium with three different energy sources as determined graphically by TINO`S hand and Baranyi and Roberts equation (1994).

**Source: Advanced Microbial Physiology Laboratory Class.
University of California, Davis 1961 taught by Professors: J. Ingraham, J. Marr, R. Hungate
All became presidents of American Society of Microbiology)**

Energy source	Determination Method		
	Graphical 1961	Baranyi and Roberts Equation 2007	
	Specific growth rate/hr	Specific growth rate/hr	Lag phase
Glucose	0.570	0.619	0.088
Lactose	0.437	0.461	0.905
Glucose+Lactose Phase 1	0.640	0.580	0.000
Glucose+Lactose Phase 2	0.428	0.368	0.763

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Creating the First Graduate Program in the World in Preventive Veterinary Medicine and Epidemiology

- In 1967 Professor Calvin Schwabe was hired to chair the new Department of Epidemiology and Preventive Medicine at the UC Davis Veterinary School and coordinate the first in the world program in Veterinary Epidemiology and Preventive Medicine as a professional degree named **Master in Preventive Veterinary Medicine.(MPVM)**.
- He was also a professor in the Medical School
- So far over 1000 Veterinarians have gone through the program, the earliest ones becoming the beacons of establishing similar departments and programs in other countries.
- Calvin Schwabe is considered the father of Veterinary Epidemiology.
- He published his foundational concepts of Preventive Medicine in his book Veterinary Medicine and Human Health in 1964 and 1984 where he stated: **"The final objective of Veterinary Medicine does not lie in the animal species that the veterinarian commonly treats It lies very definitely in man and above all to Humanity"**
- Schwabe, Sir Hans Riemann and Charlie Franti published the first book of Epidemiology in Veterinary Practice in 1977.

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1967-2017

Celebrating the 50th Anniversary of the MPVM Program after

Flooding the World with

Veterinary Epidemiologists,

Veterinary Economists and

Food Safety Professionals !

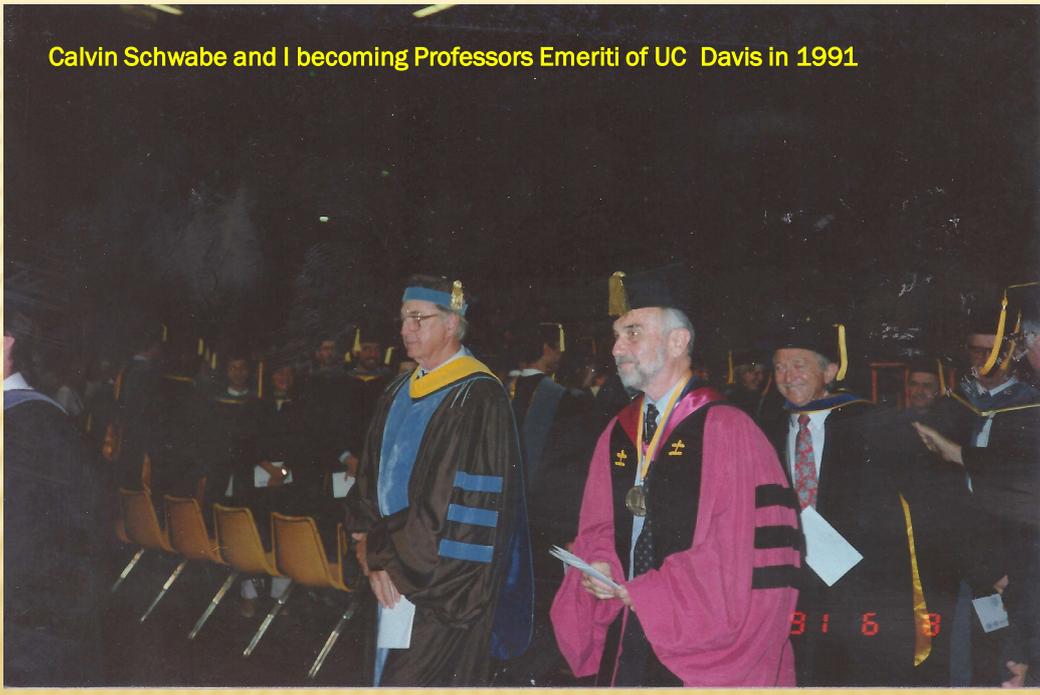
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Coming Aboard the MPVM Program as a Teacher and Academic Mentor

- A year or so after the beginning of the MPVM program, paralleled to being a researcher I was hired to develop the needed courses for the new subspecialty in Food Safety. which I directed for nearly 20 years.
- Realizing the significance of the new program in my own professional evolution I audited the Program`s courses during the first year of its inception.
- In addition to course work my contribution to the program included the Thesis supervision of 31 MPVM students
- Many continued their studies getting additional degrees with one getting an MSC in Food science, an MPH, an MD and a PhD in Virology! What a human monstar!
- By the way Schwabe and I retired (?) in 1991.
- For the next 5 years I was recalled back to active duty until a new professor was hired in my place.
- Each Spring Quarter I was back from Greece delivering 130 lectures in 3 months!
- The next slide presents the demographics of my mentoring and research supervision of scientists from around the world

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Calvin Schwabe and I becoming Professors Emeriti of UC Davis in 1991



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Guiding diversified graduate student degree research: 1969-today

A. Academic and Professional Degrees

- **18** MSc in Comparative Pathology, Food Science, MPH, Food Quality Management
- **31** Master in Veterinary Preventive Medicine (MPVM)
- **22** PhD in Comparative Pathology, Microbiology, Food Hygiene, Public Health, Ecology
- **11** Postdoctoral/Sabbatical.
- **TOTAL:81**

B. None academic degree specialization for regulatory personnel including military

Total number: BY the dozens

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CRISES, EMERGING ISSUES AND OPPORTUNITIES

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1. *Cl. perfringens* Ecology and Public Health Risks as a Food borne Pathogen 6/72 - 5/74. U.S.P.H. Service Grant FD - 00456. (\$44,488).

- In the mid 1970s *Cl. perfringens* Type A was still one of the three most important food borne pathogens.
- Its epidemiology from farm to table was not well defined.

With the grant's support we attempted:

- To disclose important reservoirs and sources of the pathogen in poultry, cattle, slaughterhouse environment, restaurants and identify risk factors in selected human and animal populations.
- Fecal shedding rates, antibody titers to enterotoxin over time as well as demographic characteristics and nutritional habits among human cohorts in California and Brazil were corelated.
- The pathogen's enterotoxin was purified, and diagnostic immunological techniques were developed for its detection in human fecal samples and use in human and animal sero-epidemiologic studies.

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2. Safety of Fermented Meats (1974-1981)

A single case of staphylococcal poisoning from fermented meat changed industry's attitude to assure a improved safety for consumer

- In 1974 there was a Staphylococcal food poisoning outbreak due to Italian Dry Salami manufactured by one of San Francisco companies which lost about 300,000 lbs salami to USDA condemnations.
- In an emergency meeting of a dozen companies producing similar products, I emphasized the need to transform processing practices from an Italian Art to a science-based approach to accomplish product uniformity, safety and overall predictable quality.
- At the time no starter cultures were used routinely to drive the fermentation which was based on wild Lactic Acid Bacteria (LAB) present in the raw meat and the environment.
- Their initial numbers varied by day and therefore there was no uniformity in fermentation rates and product characteristics.
- The risk of foodborne pathogens like *S. aureus*, and *Salmonella* out-passing in growth the *Lactis* was a possibility needing corrective action.

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With support from major producers we explored the following :

- The microbial ecology of the natural fermentation, and identification of key players
- Developed LAB propagation methods for maximum yield.
- Developed unique lyophilization and freezing technologies in appropriate cryo-protectants to assure minimal death rates and functionality loss during storage.
- Use the cultures at predefined numbers to assure rapid fermentation, day to day uniformity and safety with respect to *S.aureus*
- The cultures adapted to product formulation hurdles cost \$25 for a day`s production of 60,000lbs, instead of \$1500-1800 for commercially cultures just arriving from Europe.
- Our USDA approved methodology, from starter production to successful application became a model for other manufactures

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TABLE 1. A model of regression equation developed for a particular plant process which predicts the potential degree of growth of *S.aureus* during fermentation of Italian Dry Salami, as affected by a number of processing variables (Genigeorgis, 1981)

$$\text{Staph}_i = -2.7 + 0.857(\text{staph}_0) - 0.085(t) + 0.285(\text{LAB}_0)(e)^{1/i} + 0.038(\text{pH}_0)^3 + 0.230(\text{pH}_0)(e)^{1/i} - 0.143(\text{pH}_0)(\text{LAB}_0) + 0.066(\text{LAB}_0)(t)^2 \pm 0.604.$$

where

- staph_i = log *S.aureus* at day i
- staph_0 = log/g *S.aureus* at day 0
- LAB_0 = log/g of lactic starter cells at the beginning of the fermentation
- pH_0 = Initial pH in the salami formulation

CORRECTIVE ACTION

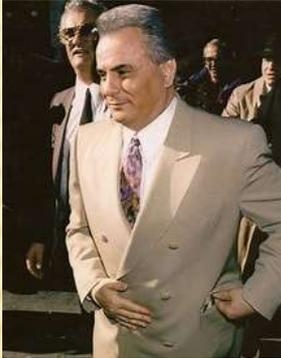
If *S.aureus* numbers in the finished salami were unacceptable then in the formulation we could

1. Increase starter numbers
2. Decrease initial numbers of *S.aureus* by eliminating high number containing meats, like masseter muscles (cheap meat) and
3. Lower the initial pH of the formulation (use lower pH meats) for predictable safety

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- My lengthy association with my Italian friends, the frequent brain storming meetings to report our findings
- in fancy resort rooms filled with Havana cigar smoke and men dressed in Brioni suits made me feel like a true member of the Corleone or Bonano family!
- Therefore, I had to change my wardrobe to fit into the dress code of the time for cultural enrichment and professional advancement as the next pictures show!

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Tino in a 1974 Brioni, posing before entering the smoke filled room to meet the Meat Association members.

It seems that Tino came decades earlier than John Gotti in wearing Brioni suits!

You may ask of course how a university employee can afford a Brioni?

Extra discount my friends as very few people dared to buy and wear a Brioni without being followed by the ...FBI!

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VERY INTERESTING!

The company which contacted me in 1974 to solve its Staphylococcal problem, in 1994 was the first in the world to experience an E.coli O157:H7 outbreak from Italian style dry salami.

Needless to say that I was the first to be contacted by the company for help!

Being in Greece I recommended to them to seek help from other colleagues who were expert E.coli Hunters at the time!

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3. Emergence of Campylobacter as a human health problem (1980-1986)

(USDA FORMULA FUNDS \$33.000)

- In the late 1970's Campylobacter jejuni was emerging as a cause of outbreaks with frequency rivaling that of Salmonella.
- Undercooked chicken and raw milk were the incriminated foods in most cases.
- By 1980` WHO recognized the significance of Campylobacter jejuni in enteric infections of humans, especially in the developing countries and encouraged further research.
- I became interested in the emerging safety problem as California was and is a major chicken, turkey and duck meat producer.
- Soon my MPVM student team made of:
 - A Greek Boss
 - 2 US Military officers, a UC Berkeley Campus Veterinarian,
 - a Palestinian, a Libyan,
 - a Finn, an Indian,
 - an Ethiopian and a Nigerian
- embarked into epidemiologic studies to decipher the problem with the following research priorities:

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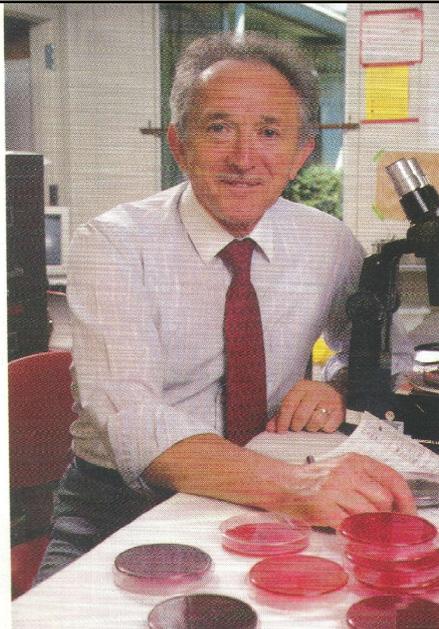
Research Priorities

1. Prevalence of Campylobacter in poultry meats at the supermarket level.
2. Impact of slaughtering practices on prevalence in finished products.
3. Identification of critical control points needed for HACCP installation
4. Ecology, epidemiology and dynamics of infections in the farms.
5. Corrective actions to minimize the risk of infections at the farm
6. Development of sero-epidemiologic techniques , from scratch, based on ELISA to assess the degree of infections in other food animals from C. jejuni and other pathogenic Campylobacters.

We became experts in the field and personalities in popular magazines!

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Photograph from an article on Genigeorgis in a popular magazine OLE!



Constantin Genigeorgis vs. campylobacter.

How about THAT!

July 14th 1984
Madison Squared Garden

Genigeorgis, middle weight champion of UC Davis

AGAINST

Campylobacter, Middle weight champion of the Global Poultry Industry!

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4. Exploring a public health concern in the city of Monterey, California, a top tourist attraction place

Question:

- What was the risk of human exposure, especially children, to Campylobacter and Salmonella when water from a large lake in the central city park was used to water the park s vegetation?
- Multiple local and migratory bird species shared the lake.

Objective:

- Determine carrier degree in birds,
- Survival of pathogens in the lake water throughout the year and
- Spreading of pathoges into the environment to become a risk factor for the children!

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5. Public Health Concerns for Aerosol Generation by Industrial Cooling Towers Using Treated Municipal Wastewater

7/1/79 - 6/30/81. California Air Resources Board. Contract A8-143-31

- In the late 1970`s there has been a concern at the Federal and State level about potential health issues from the presence of infectious agents in recycled wastewater and aerosols generated in cooling industrial towers using such water.
- **The objective of the contract was :**
- To assess the microbiological quality of make-up water and hot and cold-water basins of the cooling towers and aerosols generated in two municipal electric plants in Southern California.
- The agents assessed included Salmonella spp, Pseudomonas aeruginosa, Klebsiella pneumoniae, fecal streptococci, and E.coliphages.

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6. Global Marketing of Alaskan Salmon under Modified Atmosphere (MA) and the Risk of Cl.botulinum Toxigenesis (1982-1987)

- In the early 1980`s Alaskan Fisheries were interested in exporting fresh Salmon internationally.
- A proposal of mine addressing alternative to ice methods and potential safety risks was submitted to Department of Commerce and funded for 5 years (\$189,232) with the following objectives:
- To develop preservation methods based on MA packaging to delay product spoilage, extend self life and allow global marketing under refrigeration.
- To Assess the potential risk of non-proteolytic Clostridium botulinum toxigenesis in fishery products during marketing
- To Develop mathematical models estimating risk and determine safe product self life
- **Our publications placed us at the forefront of MA use for fresh and processed food preservation in a predictable safety.**
- **I was even asked to edit a three volumes book on the subject!**
- **Furthermore, I was one of the 5 invited Keynote speakers to open the World Veterinary Congress in Perth Australia in 1983 representing Food Safety and Public Health**

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Regression equation relating Lag phase of toxigenesis of non proteolytic Cl.botulinum in fresh fish in days

$$\text{Log LP} = 0.974 - 0.042(T) + (2.741/T) - 0.091(\text{Log I}) + 0.035(\text{Log APC})$$

Where :

(Log I) = Initial log of spore inoculum

(T) = Storage Temperature

(APC/g) = Initial Aerobic Plate Count of fish

Genigeorgis et al., 1986-9

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7. Sous Vide Studies

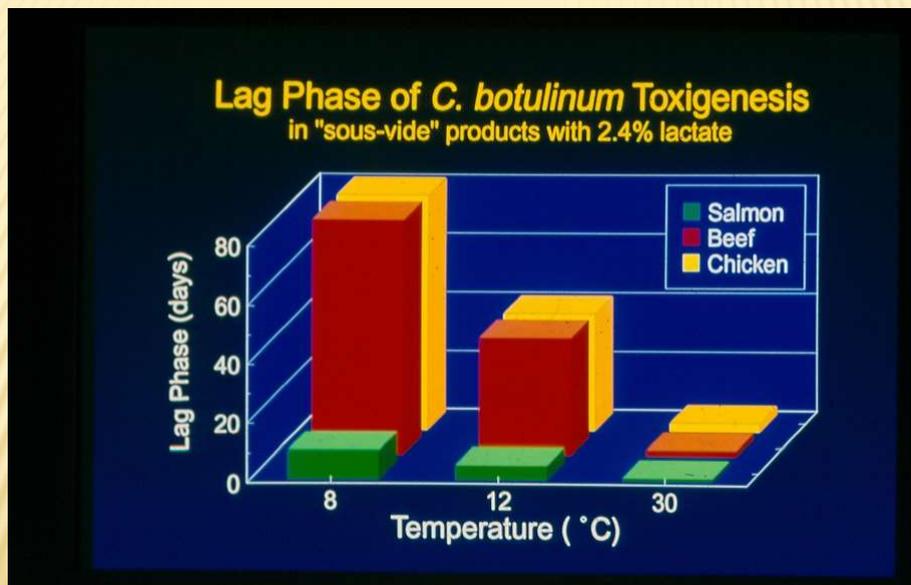
2/2/87 -1/31/90.) (\$174,000).

- Investors from Palo Alto California proposed to fund research on the technology and safety of ready to eat meals processed by the Sous Vide method invented by a French chef in mid 1970`s and marketed under refrigeration with extended life.
- The process maintained the organoleptic characteristics of meals, served immediately after re-warming
- Potential customers could be : 5 star hotels, first class airline customers and eventually supermarkets.

Research Objectives

- Determine optimum thermal processes for pasteurization and elimination of all non spore-forming pathogens
- Determine the risk of Cl.botulinum growth and toxigenesis during the extended marketing period.
- Explore the use of approved GRASS type additives as antimicrobial hurdles like lactate to minimize the risk of toxigenesis in a predictable way
- Develop mathematical models to predict the safety of the products under market conditions

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8. Nitrite Free Processed Poultry Products A California Story (1988-1992)

- Due to consumers demands for more natural products with fewer and least amounts of chemical additives
- A major vertically integrated producer introduced NO NITRITE, REDUCED SALT, PASTEURIZED PRODUCTS OF EXTENDED DURABILITY
- Non- sporo-forming pathogens (Salmonella, Listeria, E.coli S.aureus etc) were killed by the thermal process
- Yet *Cl. botulinum* spores were still alive and could grow under abusive storage temperatures
- With producer`s and UC Davis support (\$58,000) we addressed the concern proposing new formulations, processing methods and use of predictive models to estimate the lag time to toxigenesis
- Our reports became the base for further developments of no nitrite /low salt meat products offered by the meat industry nationwide and helped in the production of similar products in Greece!

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MODELING LAG PHASE OF CLOSTRIDIUM BOTULINUM IN COOKED TURKEY

Meng and Genigeorgis 1993. Inter.J.Food Microbiol: 19: 109-122.

DESIGN : FACTORIAL: 6x4x3x7x>10= >5040 samples

TEMPERATURE (T): 4, 8, 12, 16, 20, 30
SODIUM LACTATE (L): 0, 1.2, 2.0, 3.0 %
SODIUM CHLORIDE (S): 0, 1, 2, %
SPORE INOCULUM (I) Log: 10⁻², 10⁻¹, 10⁰, 10¹, 10², 10³, 10⁴
STORAGE TIME (DAYS): >120

DERIVED MODEL FOR LAG PHASE (LP) IN DAYS

$$\text{Log}(1/\text{LP}) = -2.288 - 0.124 (\text{S}) - 0.217 (\text{L}) + 0.439 (\text{T}) + 0.020 (\text{T})\text{x}(\text{I}) \quad \text{R}^2 = 0.945, \quad \text{T} = \text{Square root of T}$$

In the model:

65% of variation was due to T
21.2% of variation was due to Lactate
4.9% of variation was due to TxI

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9. The Listeriosis Crisis of the 1980's in California

The Safety of Hispanic Style Cheeses (1988-1992)

- In 1985 a major outbreak of Listeriosis among Hispanic women in the Los Angeles area was reported.
- Hispanic style soft cheeses found in abundance in Farmers Markets made without starter cultures, proper acidification and aging and even from inadequately pasteurized milk were incriminated.
- Frequently such cheeses were produced in non -approved places under unsanitary conditions as our undercover State agents found.
- In subsequent years Listeria became a major concern to the meat industry worldwide and even plant origin food
- With support from State and National Dairy Boards (\$213,750)
- We explored the growth rate of *Listeria monocytogenes*, *Salmonella* spp, *E.coli* O157:H7, *Yersinia enterocolitica* and *Cl.botulinum* in such cheeses as affected by processing variables and added innovative antimicrobial compounds.
- Predictive models were developed to estimate the growth risk in dairy products with new formulations.
- In dozens of inoculated market cheeses we determined the risk of *L.monocytogenes* growth as a result of cross contamination during cutting and packaging.

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Summary of intercepts (a), regression coefficient (b), and coefficient of determinations (R²) of regression models describing the square root of growth rate (K) or the square root of 1/ LP (lag phase in hours) as dependent variable (Y) of yersinia enterocolitica, salmonella, and hemorrhagic colitis E.coli as affected by the cheese formulation, and temperature of storage .

M. Kasrazadeh + G. Genigeorgis 1992-95

Organism	Cheese formulation	Y	Regression coefficients		
			a	b	R ²
Salmonella	Normal	K	-0.252	0.04	0.989
	Normal	LP	-0.356	0.049	0.985
	P+0.2%S	K	-0.0968	0.022	0.98
	P+0.2%S	LP	-0.1158	0.0158	0.95
Y. enterocolitica	Normal	K	0.153	0.022	0.98
	Normal	LP	0.053	0.027	0.945
	P+0.2%S	K	0.1015	0.011	0.99
	P+0.2%S	LP	0.032	0.002	0.90
E.coli (H.C.)	Normal	K	-0.205	0.036	0.98
	Normal	LP	-0.374	0.047	0.987
	P+0.3% S	K	No growth < 20 °C		
		Lp			

Model $Y = a + b(T)$ where $T = \text{temperature } (^\circ\text{C})$

Normal cheese pH=6.6

P+0.2%S = cheese with 0.2% K-sorbate (pH=6.1) made from milk acidified with 1N propionic acid to pH 6.0

Square Root models of growth

rate and lag phase of

Salmonella,

Y. enterocolitica

and E.coli O157:H7

as affected by

Hispanic cheese formulations

45

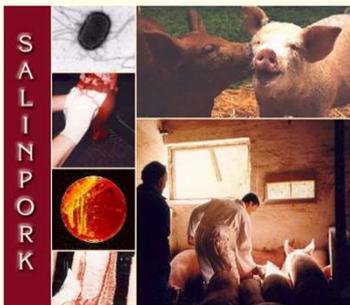
Salmonella in Pork

CONTRACT NO. FAIR1 CT95-0400

Salmonella in Pork (SALINPORK):

Pre-harvest and Harvest Control Options based on Epidemiologic, Diagnostic and Economic Research

Final Report



Editors:
Danilo M.A. Lo Fo Wong
Tine Hald

1996-1999 (250.000 Euros for my group)

In 1995 I was invited by professor Preben Willeberg to be a partner to the submission of a proposal to Brussels on the Epidemiology of Salmonella in the pork chain.

Salmonella was still the prime cause of food borne outbreaks in most countries.

9 partners and 4 sub-contractors participated in the project

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PROJECT OBJECTIVES

A. Main Objective:

- To establish the epidemiological basis, to develop the diagnostic tools, and to evaluate options for control of Salmonella in pork at the pre-harvest and at harvest levels.
- To establish international Conferences to address the issue of Salmonella in Pork

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AUTH Team`s Specific Objectives and some Findings

A. Epidemiology of Salmonella infections in Greek pig farms

- Prevalence study (antibody titers, isolation of Salmonella in animal and farm environment)
- Herd-level risk factors: Questionnaires with over 100 questions were distributed to all producers.
- Sources of Salmonella in pig herds.
- Faecal sampling in sero-positive herds
- Follow-up in sero-negative and sero-positive herds from birth to slaughterhouse.
- Evaluation and application of diagnostic tests for Salmonella

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B. Post- harvest Salmonella epidemiology

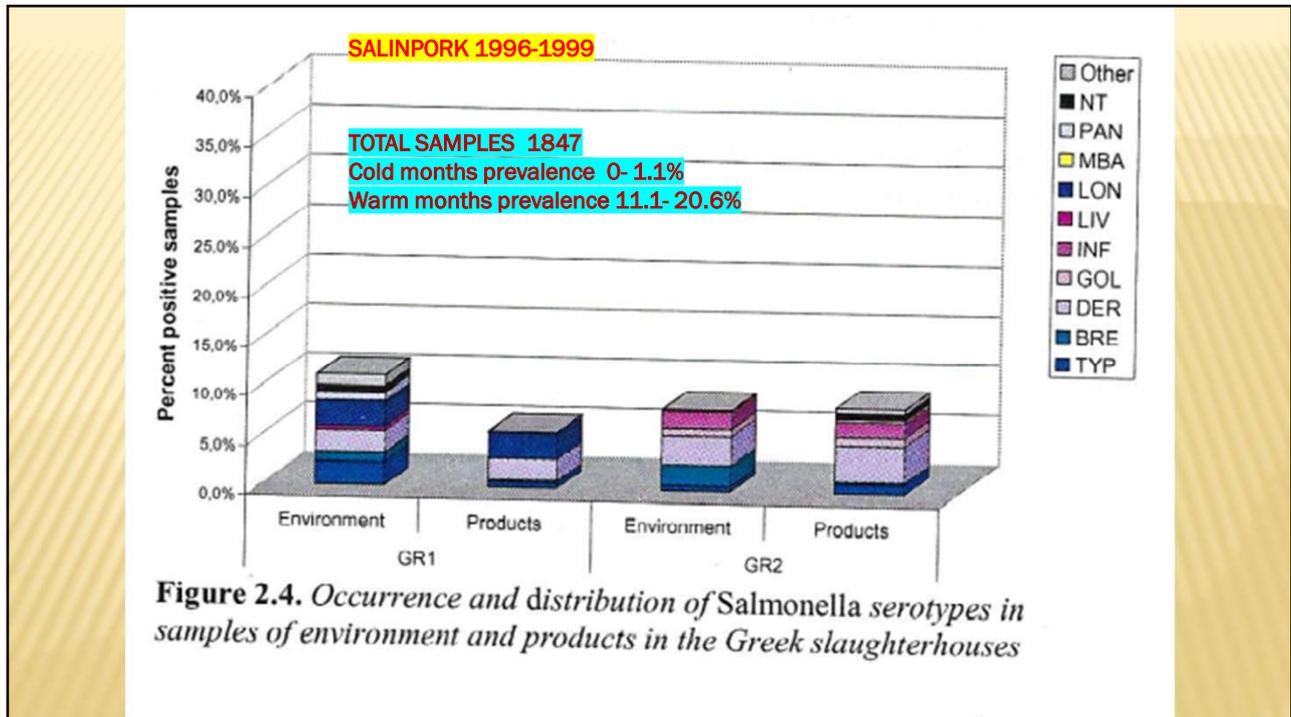
- Identification of critical control points and seasonal variation effect on Salmonella presence in arriving animals and slaughterhouse environment.
- Improvements in sampling methods

C. Serotyping and Antibiograms of all strains isolated in the preharvest and post-harvest study

D. The 5th International Symposium on the Epidemiology and Control of Foodborne Pathogens in Pork took place in Crete with myself chair of the organizing committee and member of the scientific committee

- I coined the term **SAFE PORK** for the coming Symposia.
- I was also member of the Scientific Committees of the previous 4 Symposia

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Interesting finding:

- In multivariable logistic regression models with random-effects the proportion of Salmonella positive carcasses in a sampling round was associated with the slaughterhouse, the period of the year the sampling was done, the sampling round, the sampling day and the results from environmental samples.
- The risk of carcass contamination was found to increase by 17 ($P < 0.0001$) or by 6.5 ($P = 0.0007$) times when the eviscerators' or the leaf fat removers' hands and/or knives were found contaminated, respectively.

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12. Effect of Wine on Traveler's Diarrhea (1997-2000)

- This was the MPH Thesis subject given to a Veterinarian in Athens who joined my group for a 2 years training in Food Safety.
- The student was unclear about which agent of the many causing the syndrome to use. I proposed to use the most "fashionable" agents of the time namely *E.coli* O157:H7, *Salmonella enteritidis* and *L.monocytogenes*.
- We did not have the means for Noroviruses, so frequently incriminated, especially on cruising ships .
- **A. My long term objectives were:**
 - Model bactericidal rates of wine type, brand, pH, alcohol and total phenols hurdles.
 - Repeat study in the presence of foods.
 - Compare wine data to bartender's cocktail recipes for hard liquor drinks.
 - My wishful thinking was to prove the beneficial effect of wines, especially reds, not only good for cardiovascular benefits (!) but also as a hurdle to minimize health issues during one's vacation in ...exotic places!

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Effect of Wine on Traveler s Diarrhea (1997-2000)

- Early work was done in Thessaloniki to be continued by another graduate student of mine in the MSc program of Food Quality Management at the Mediterranean Agronomic Institute, Chania., Crete (MAICH)

B. Early findings demonstrated:

- Significantly more decimal reductions by red wines than white for all pathogens.
- Alcohol and pH in wines were minor contributors though an interaction effect existed,
- Total phenol concentration seemed to be the major bactericidal contributor.
- The work was interrupted in 2000 due to my retirement

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13. "Development and application of a Time Temperature Indicator (TTI) based safety monitoring and assurance system (SMAS) for chilled meat products" 1/2003-12/2005. (120,000 euros).

In 2002, already retired, I was invited by Prof Taoukis of NTUA to be a partner in a research proposal under his direction.

A key contribution of mine to the proposal was to bring Creta Farm the biggest vertically integrated meat company in Greece as our industrial partner with myself as the planner and coordinator of the company`s contribution.

The project was not addressing a crisis but rather in a preventive way was attempting to develop an effective safety assurance and quality optimization management system of meat products extending from production to consumer in a predictable way.

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Development and application of a TTI based Safety Monitoring and Assurance System for Chilled Meat Products : **QLK1-CT-2002-02545**

EC FIFTH FRAMEWORK Programme – Quality of life and management of living resources
Key Action 1. Food, Nutrition and Health - Area 1.1. Development of safe and new and/or improved manufacturing processes and technologies - Thematic priority 1.1.3. Quality monitoring and traceability throughout the food chain

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Selected Objectives of Partner 7 (Creta Farm) with me in charge

Sub-contactor for Diagnostic Microbiology: The Food Safety laboratory, Medical School UOC (Dr Chris Panoulis my PhD student in charge):

1. Study the ecology of *Salmonella* spp and *Listeria monocytogenes* spreading during slaughtering and fabrication processes and identify CCPs for a future HACCP program.
2. Identify microbiological trends in meats (1/1 2001-31/12/2004) imported by Creta Farm from 33 companies and 7 EU countries. (U C DAVIS /MPVM Thesis by a student of mine, 2008)
3. Develop Modified Atmosphere (MA) Packaging Technologies for consumer size packages as this technology was in its infancy in Greece at the time.
4. Produce MA packaged meats for the benefit of our partners who were modeling microbial growth during transportation to other Greek locations in connection with storage fluctuating temperatures, and TTI utilization.

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5. The effectiveness of commercial thermal processing practices was assessed with respect to decimal reductions (DR) of important meat borne pathogens.

In inoculated pack studies we found that even 2.5 min at 70 c (FP 70) resulted in 7.4 DR of Salmonella, L.monocytogenes and E.coli O157:H7 in Frankfurter and Pariza sausages!

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Potential Decimal Reductions for *L.monocytogenes* During the Cooking and Cooling of the Emulsion Type Sausage

FP₇₀	Cooking	139.5
FP₇₀	Cooling	39.08
TOTAL FP₇₀		178.57
L.monocytogenes D₇₀ = 0.27		

Potential Decimal Reductions with an FP₇₀ = 178.57 min equals to: $178.57 : 0.27 = 661.4$ DR !!!WHO NEEDS THIS??

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14. Western Institute of Food Safety and Security (1/ 2006-12/ 2007)

Between 1996 and 2006 over 22 Salmonella and E.coli O157:H7 outbreaks due to leafy greens produced in California were recorded mostly as multistate outbreaks.

To address the problem affecting California Agriculture and economy the Western Institute of Food Safety and Security (WIFSS) was established at U C Davis in 2006

Federal and State Public Health Authorities, Industry Associations and the University of California reaction to the crisis was immediate.

Gaps in harvesting, processing and marketing needing additional research were identified and corrective actions were taken.

By 2016 hundreds of California audits indicated an over 99.5% compliance to the industry's set food safety standards.

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Joining the Western Institute of Food Safety and Security at U C Davis 1/ 2006-12/ 2007

Late in 2005 the first Director of the Institute, a classmate of mine in the Graduate School, invited me to join and contribute to the tasks of the Institute, as a senior consultant, considering my Food Safety/Food Science/VPH background.

My tasks were:

1. To developed priorities for research funding in view of the recent extensive outbreaks
2. To review production methods and identify risk factors contributing to the outbreaks.
3. With respect to the safety of leafy Greens I proposed over 100 critical areas to be considered for funding as competitive grants.
4. As a qualified teacher, to contribute to courses on Agro-terrorism Preparedness Curriculum for Frontline Responders, Nationally.
5. Some of courses of the Agroterrorism curriculum are presented next

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WIFSS Agroterrorism Preparedness Curriculum for Frontline Responders

Courses:

- *Understanding the Dangers of Agroterrorism*
- *Principles of Preparedness for Agroterrorism and Food Systems' Disasters*
- *Principles of Detection and Diagnosis—Strategies and Technologies*
- *Principles of National Incident Management System (NIMS), Team Building, and Risk Communication*
- *Principles of Frontline Response to Agroterrorism and Food Systems' Disasters*
- *Principles of Planning and Implementing Recovery*



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15. Establishing a multifunctional center for Food Safety at the Department of Clinical Microbiology, Parasitology, Zoonoses and Geographic Medicine/WHO Reference center for Zoonoses, University of Crete, Heraklion 1996-2015

- In 1996 in a meeting on Zoonoses I met professor I. Tselentis head of the Department and persuaded him to establish a diagnostic and consulting entity in Food Safety to be housed in his laboratory.
- My rationalization was that Crete was a major tourism attraction site.
- The use of the HACCP program by the food production and the mass feeding industry was in its infancy
- There was an urgent need for scientific and professional support of the food chain in the island.
- Financial support could be generated from fees for services.
- Conveniently 2 veterinarians, PhD students of mine were added to the personnel to run the laboratory which is still alive and well despite Tselentis and my retirements.
- Today Crete has 30% of the total of 5 star beds in Greece and 24.6% of 4 star beds respectively.
- Overall, I became the senior consultant and had a very active involvement in the program for nearly 2 decades.

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Some of my Activities in the Program can be described as:

- Develop continuing education programs for the food industry,
- Organize co-operative research in food safety,
- Attract contract work in diagnostic food safety,
- Establish and audit HACCP programs in processing plants and the mass feeding industry
- Contribute to training programs in public health for the Mediterranean Region countries supported by WHO
- Guide graduate students for MPH and PhD degrees in public health offered by the Medical School.
- The most extensive ever epidemiologic study on the Microbiological Quality of Foods and Environmental Hygiene in Mass Feeding Facilities in Greece was done during the Period 2003 – 2015.
- Over 92 establishments and 17778 ingredient and meal samples were collected and analyzed, each for at least 5 microbial indicators.
- The sampling periods of 2003-2010 to 2011- 2015 were compared to see whether the economic crisis during the 2nd sampling period had an impact on the safety of meals offered
- The presence of a HACCP program in establishments was correlated to the decrease in the % of microbiologically unacceptable samples as compared to establishment having no HACCP as the following slide shows

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With advanced statistics the reduction of unacceptable samples associated with the use of HACCP was determined for 5 microbial indicators						
Sampling location and type of samples	All microbiological parameters	E. coli	S. aureus	L. monocytogenes	Salmonella	Coliforms
Beta coefficient						
Hotel menu	-15.87	-21.36	-22.22	-17.30	-2.59	NA
Fast food menu	-9.83	-10.15	-12.61	-17.38	Cannot computed	NA
Catering menu	-9.72	-12.11	-11.16	-17.55	Cannot computed	NA
All establishments	-11.76	-14.10	-15.34	-17.38	-0.82	NA
Incoming materials	-6.81	-8.84	-8.33	-8.77	-1.29	NA
Environmental samples	-27.14	-28.46	NA	-23.83	NA	-29.14
NA =not applicable						

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- Panoulis, Ch., C. Genigeorgis and I. Tselentis. 2008. **Prevalence and behavior of Listeria monocytogenes in meat based menus, in all production phases, in mass feeding systems.** In: S Ramadanis (ed) Proceedings 1st Panhellenic Congress on meat and products thereof. From stable to table. pp. 417-424. October 10-12, 2008, Athens, Greece. ISBN 978-960-98537-0-5.
- Panoulis C., A. Papadakis A, C. Genigeorgis C et al. . 2011. **Microbiological safety and hygiene of ready to eat meals served on transportation and tourist ships serving the harbors of Crete, Greece.** Proceedings, 4th Hellenic Veterinary Medical Society Food Congress, "Modern Approach to Food Hygiene and Safety".2: 256-262. Thessaloniki, Greece November 11-13, 2011. Editor:A.Tyrpenou, Publisher HVMS/ www.hvms.g
- Panoulis C., C. Genigeorgis, I. Tselentis et al. 2011. **Microbiological assessment of produce, salads and preparation environment in hotels and fast food outlet kitchens in Southern Greece during the period 2000-2010.** Proceedings, 4th Hellenic Veterinary Medical Society Food Congress, "Modern Approach to Food Hygiene and Safety. 2: 77-84. Thessaloniki, Greece, November 11-13, 2011. Editor: A.Tyrpenou, Publisher HVMS/ www.hvms.gr
- Panoulis C., C. Genigeorgis C, A. Psaroulaki, et al.. 2011. **Assessment of microbiological hygiene and safety in Chinese and Sushi restaurants in hotels of Southern Greece.** Proceedings, 4th Hellenic Veterinary Medical Society Food Congress, "Modern Approach to Food Hygiene and Safety". 1: 67-74. Thessaloniki, Greece, November 11-13, 2011. Editor:A.Tyrpenou, Publisher HVMS/ www.hvms.gg
- Panoulis C., C. Genigeorgis, I. Tselentis, et al. 2011. **Assessment of microbiological hygiene and safety of foods and waters in 22 hotels in Crete participating in the hosting program for the Special Olympics 2011.** Proceedings, 4th Hellenic Veterinary Medical Society Food Congress, "Modern Approach to Food Hygiene and Safety".2: 113-122. Thessaloniki, Greece November 11-13, 2011. Editor: A.Tyrpenou, Publisher HVMS/ www.hvms.gr
- Genigeorgis, C., N. Thalassinaki and C. Panoulis. 2016. **Significance of HACCP implementation on the microbiological quality of foods and environmental hygiene in mass feeding facilities in Greece during the period 2003-2010.** Abstract Proceedings, IAFP` s 2016 European Symposium on Food Protection, Abstract T2-04. Athens, Greece, May 10-14, 2016.
- Panoulis, C and C. Genigeorgis. 2016. **Microbiological quality and safety of foods in mass feeding establishments during the Greek financial crisis period 2011-2015.** Abstract proceedings, IAFP` s 2016 European Symposium on Food Protection. Abstract T2-05. Athens, May 10-14, 2016.

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OTHER PROFESSIONAL ACTIVITIES DURING MY STAY IN GREECE

1. European Consortium for Continuing Education in Advanced Meat Science and Technology (ECCEAMST) 1990-1996

- In 1990 under the leadership of Professor Frank Smulders the Consortium was established with membership from all 12 EU member States and EFTA countries (Norway, Sweden, Finland and Austria).
- The Consortium, based at the University of Utrecht, in its initial stages was financed for 6 years by the E.U competitive programs COMETT and LEONARDO. The main objective was knowledge transfer by:
- Conducting, training needs across Europe,
- Development and organizing a coherent series of "face to face" advanced courses in meat science and technology, and long-distance training modules on selected issues,
- Organizing specific courses addressing issues of a more regional nature,
- Organizing transnational exchange of students and personnel,
- Finally, to secure dissemination of the developed course material a series of reference books and course proceedings were prepared (F. Smulders, RMC 48, 1995)
- I have served on the board since its inception from 1990 to 1996 contributing to the organization of two continuing education courses in Athens and being a repeated lecturer in other courses.

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ECCEAMST BOOKS AND CONTINUING EDUCATION COURSE PROCEEDINGS 1991-1995

- Book 1. The European Meat Industry in the 1990's: Advanced Technologies, Product Quality and Consumer Acceptability F.Smolders 1991
- Book 2. New Technologies for Meat and Meat Products: Fermentation and Starter Cultures, Muscle Enzymology and Meat Aging, Quality Control Systems F. Smolders et al, 1992
- Book 3. Expression of Tissue Proteinases and Regulation of Protein Degradation as Related to Meat Quality F. Smolders et al.,1995
- Book 4.* Meat Quality and Meat Packaging. M.Severini, et al., 1995
- Book 5.* Veterinary Aspects of Meat Processing. F.Smolders 1995
- Proc. Cleaning and Disinfection Technologies in the Meat Industry S. Burt 1995
- Proc. Upgrading of Slaughter By-Products for Animal Nutrition B. Urlings 1995
- Proc. New Challenges in Meat Hygiene: Specific Problems in Cleaning and Disinfection S.Burt et al.,1995
- Proc. The Functionality of Meat Compounds J. Buickley et al 1995
- Proc. The Use of Additives in Meat Products Throughout Europe: Necessity, Customs, Legislation K. Honikel 1995
- Proc. Rapid Methods in Meat Microbiology. N.Skovgaard et al., 1995
- Proc. Meat and Refrigeration: New Developments J.Daudin 1995
- Proc. Production Control and Plant Logistics. M.den Reijer 1995
- Proc. Shelf Life of Meat and Meat Products: Quality Aspects, Chemistry, Microbiology, Technology F.Bauer et al.,1995
- Proc. Curing Technology for Cooked Pig Meat Products: An Update J.Lenges, et al., 1995
- Proc. Automation and Robotics in the Meat Industry T.Kempster 1995
- Proc. Composition of Meat in Relation to Processing, Nutritional and Sensory Quality: From farm to fork. E. Wiklund 1995
- Proc. Meat Quality as Affected by Primary Production P.Barton-Gade et al,1995
- Proc. Meat Training for Europe: Making Training Effective F.Smolders, et al,1995
- Proc. Marketing Meat in Europe: Strategies and Techniques for Today and Tomorrow P.Sala, et al 1995
- Proc. Production of Processed Meats and Convenience Foods Constantin Genigeorgis 1995

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2. Establishments of the European College Of Veterinary Public Health

Founding Member of the College (2001-2014), Member of the Credential Committee for 8 years

- It was the Veterinary contributors to the ECCEAMST program who late in the 1990`s under Professor Frank Smolders leadership and additional colleagues set up the mechanism to create the European College of Veterinary Public Health.
- Our inaugural gathering took place in Vienna in 2001 during the International Symposium on "Safety assurance during food processing" Organized by the College.
- I was invited to address the subject " Understanding the role of contact materials in the contamination of foods of animal origin".
- I truly enjoyed very much my association with the College and especially serving 8 years, on the credentials committee and having the opportunity to review the personal files of over 200 candidate diplomates.

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Inaugural meeting of the founders of the European College of Veterinary Public Health, Vienna 10/2001



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3. 1999-2004: Member of the first Board of the National Food Authority of Greece.

- With Greece undertaking the responsibility of the 2004 Olympic Games the Government appointed, a 7-member Governing Board including myself to organize and put in motion a National Food Authority (EFET) with activities in the areas of food production and control, marketing, export, and consumer protection.
- I was also appointed member of the Scientific Advisory Committee of EFET to recommend to the Board expert opinion on new regulations and actions on food safety and nutritional crisis and publish production guidelines for the industry and consumer protection.

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4. WHO/Mediterranean Zoonoses Control center (MZCC. 1995-2004)

Consultant to the World Health Organization and the Mediterranean Zoonoses Control Centre in Athens.

Contributed to advanced continuing education courses in the Mediterranean Region in the areas of

- Food safety,
- Quality control management,
- Hazard Analysis Critical Control (HACCP) programs,
- Good Manufacturing Practices (GMP),
- Good Agricultural Practices (GAP) and
- Zoonoses Control in the Mediterranean Region.

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5. International Center of Mediterranean Agronomic Studies (MAICH). Chania Crete

- Invited Lecturer. 1997-2004. Taught graduate courses on "Food Microbiology, Food Preservation, and Risk Assessment" (20-40 hrs lectures each year) part of the international curriculum
- Leading to a MSc degree in Food Quality Management
- Acted as Major research professor for 3 MSc students.

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ADDITIONAL PROFESSIONAL ACTIVITIES DURING MY STAY IN GREECE

- **6. 1993-2000:** European Commission consultant. Review submitted research proposals or Final Audit of the results of the FLAIR, ÉCLAIR programs made over 250 projects.
- **7. 2008/Spring quarter:** Recalled professor to teach the professional course of food safety in the School of Veterinary Medicine, UC Davis because of the retirement of the responsible professor! **Probably I am faking effectively my retirement for the last 17 years!**
- **8. 2010-2014:** Greek Agency for Quality Assurance in Higher Education Auditor. Chair of international committees to assess educational and research programs in Greek institutions of higher learning
- **9.** Elected member of the Agricultural Academy of Greece (2008), and Veterinary Academy of Greece (2017)

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- **10. 2010:** **“The Outstanding Alumnus Achievement Award for 2010”** of the School of Veterinary Medicine, University of California, Davis, for his National and International Contributions to Veterinary Medicine, Food Safety and Public Health. The highest recognition given by one of the World’s best Schools of Veterinary Medicine.
- **11. 2018:** Recognized, with a plaque, by the Hellenic Veterinary Medical Society during the National Greek Veterinary Congress in Thessaloniki, May 11-13, for His Many Years of Contributions to Science, Education, Society and Veterinary Medicine.
- **12. 1982!** **Outstanding Teacher of Veterinary Food Hygiene Award, American Association of Food Hygiene and Public Health Veterinarians**

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CONCLUSIONS

In my life I have been involved academically and professionally in numerous diversified areas under the umbrella of Veterinary Public Health leading to an improvement of human health and well being.

My ability to wear different hats, to teach diversified subjects and address diversified problems to diversified audiences can be attributed:

- Strong science background from the Greek Gymnasium where we used university books in physics, Chemistry and Mathematics
- Global orientation of the Greek veterinary curriculum, at the time, especially in the area of zoonoses and food safety and extensive foundation in food science in general.
- In Davis I found Fort Knox in terms of available courses to build my own multifaceted curriculum
-
- Thus, I created broad foundations in sciences, biology, microbiology, food science,
- comparative medicine, and preventive medicine.
-
- My research activities, applied in nature fundamental in approach, were addressing a total quality control/management system for foods from primary production to consumer table.

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- The activities are well documented in the diversified publications, academic teaching, continuing education, public service and consulting record.
- My attitude toward potential donors to support academic research was to emphasize in scientific terms what is in for them and not for me and their significant contribution to educating the future leaders.
- My philosophical believes are on sand to be subjected to change as advances come and go
- I try to remember my roots when recognitions and wealth might change my character.
- Can you follow my model? You cannot repeat my life and style of life, but you can use my model as a compass!

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In Conclusion

Please do not think that I am all science!

I am a social animal also and here is a diversified proof

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Meeting Zeus and the other Olympic Gods



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Iztaccihuatl Mexico 5230m/ 17230 ft



79



80



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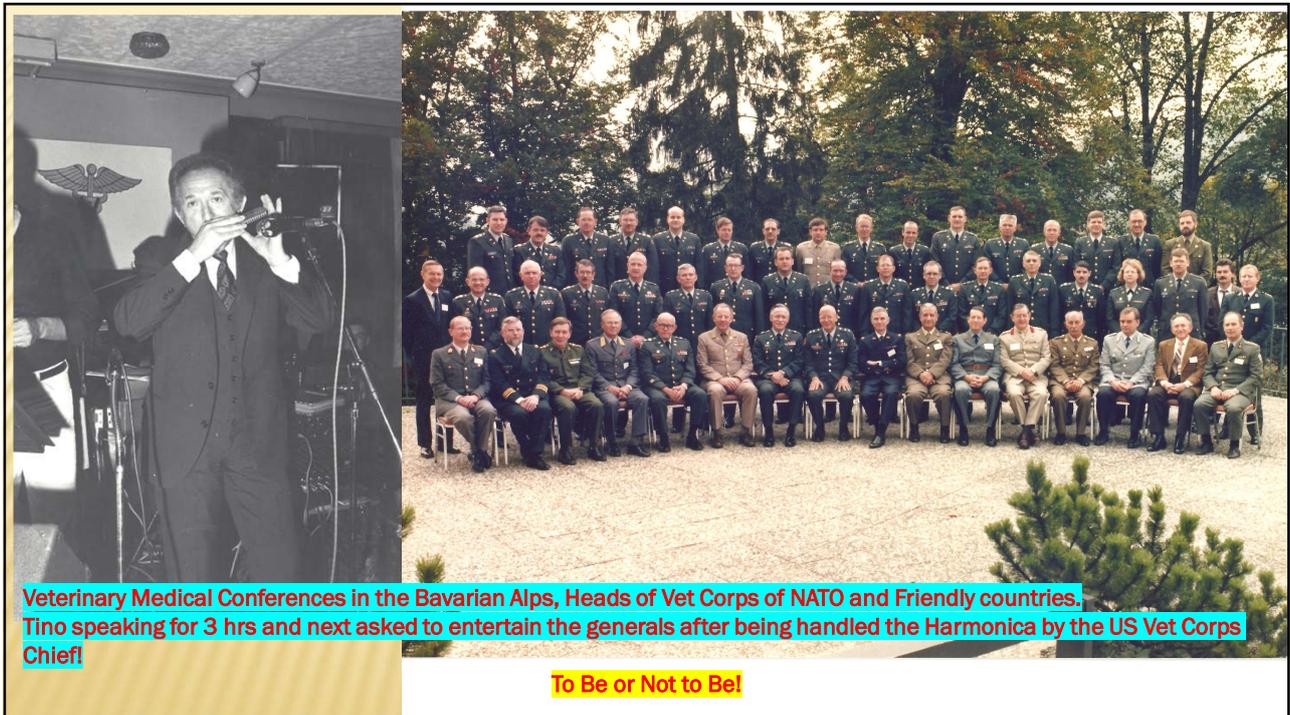


82



Tino pretending to be a modern-day
Fred Astaire
during a concert in Sacramento in 2018
honoring the music of the Great
George Gerschwin
of the 1920-30s

83



Veterinary Medical Conferences in the Bavarian Alps, Heads of Vet Corps of NATO and Friendly countries.
Tino speaking for 3 hrs and next asked to entertain the generals after being handed the Harmonica by the US Vet Corps
Chief!

To Be or Not to Be!

84



At 20, member of the Greek National Track Team as a Long Jumper

At 65, back to the track competition



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Representing California
in Long Jump, Javelin and High Jump
to the 1997 Senior National
Games in Tucson Arizona

86



Tino running with the Torch of
the Torino Winter Olympics
2004

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Memberships in Professional Societies and Associations

American Veterinary Medical Association*,
 American Association of Food Safety and Public Health Veterinarians*,
 American Society of Microbiology*,
 Society of Applied Bacteriology (UK)*,
 International Association for Food Protection (USA)*,
 Institute of Food Technologists (USA)*,
 American Meat Science Association*,
 Hellenic Veterinary Medical Society* (Honorary Member also),
 Greek Association of Food Protection*,
 Hellenic American Professional Society of Northern California (Founding Member)*,
 European College of Veterinary Public Health (founding member)*
 Agricultural Academy of Greece (Elected member 2008)
 Veterinary Academy of Greece (Elected member 2017)
 World Association of Veterinary Food Hygienists (1965-1997 when the Association became inactive),
 Greek Institute of Food Science and Technology (Elected Honorary member),
 American Association for the Advancement of Science,
 American Public Health Association,
 Royal Society of Health (UK),
 Council for Agricultural Science and Technology (CAST, USA),
 U.S. Animal Health Association
 New York Academy of Science,
 Gesellschaft für Ernährungsbiologie (Germany),
 ECCEAMST (founding member),
 (*Currently active).

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