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# Reagentless Real-time Identification of Individual Microorganisms by Bio-Aerosol Mass Spectrometry

Eric E. Gard

March 8, 2004

Reagentless Real-time Identification of Individual PITTCON  
2004

Chicago, IL, United States

March 9, 2004 through March 11, 2004

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Pittcon March 8 - 12<sup>th</sup> 2004, Chicago, IL

Eric Gard

Lawrence Livermore National Laboratory

This work was performed under the auspices of the U.S. Department of Energy by University of California Lawrence Livermore National Laboratory under Contract W-7405-ENG-48. t  
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# Bio-aerosol Mass Spectrometry Team

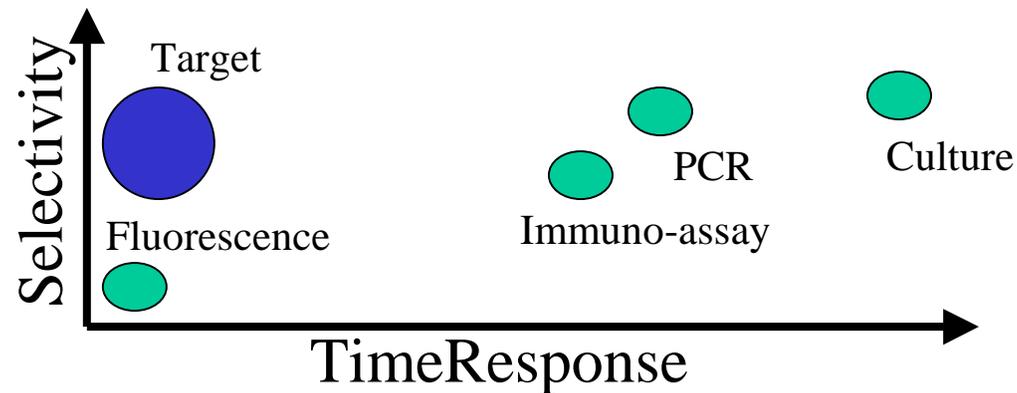
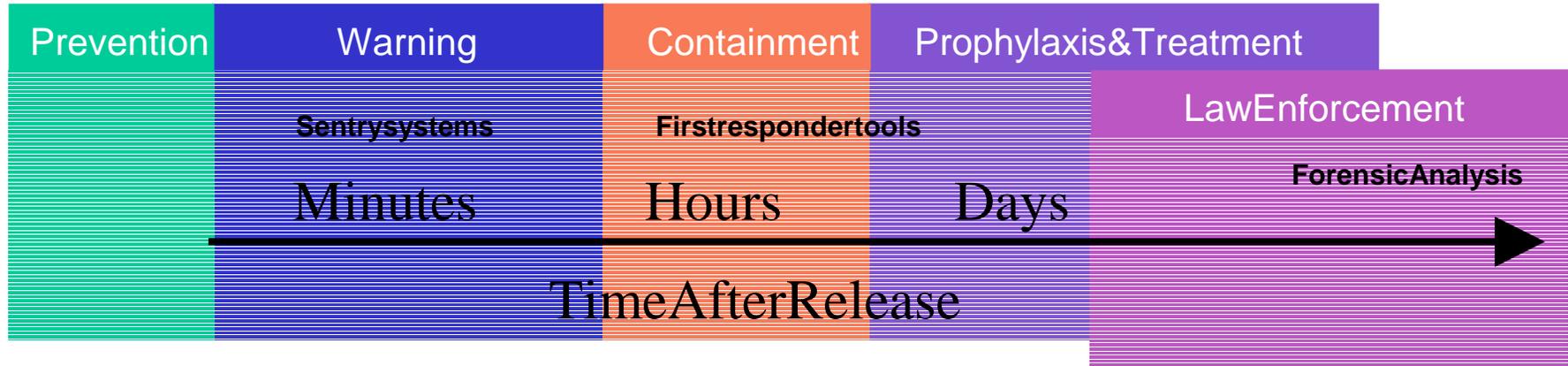
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- Team Members
  - David Ferguson
  - Herb Tobias (poster 10B1)
  - Maurice Pitesky
  - Joanne Horn
  - Matthias Frank
  - Paul Steele
  - Professor Carlito Lebrilla
  - Abneesh Srivastava
  - Shubha Ramani
  - Keith Coffee
  - James Birch
  - Norm Madden
  - Vincent Riot
  - Bruce Woods
  - Darryl Spurlock
  - Gregg Czerwieniec
  - Scott Russell
  - Cherie Napier
  - Eric Gard
- Collaborations
  - Millie Shafer, Ph.D., CDC - NIOSH, Cincinnati Ohio
  - Segaran P. Pillai, M.D., Florida Department of Health, Bureau of Laboratories - Miami, Miami, FL
- Focus areas
  - **Organism signatures @ 266nm**
  - Advanced ionization methods
  - Aerosol sampling methods
  - Single particle analysis methods
  - Microbiology methods
  - Data analysis methods
- Funding
  - LLNLLDRD funding
  - Technical Support Working Group (TSWG) U.S. DoD.
  - Defense Advanced Research Project Agency (DARPA) U.S. DoD.



# Early detection is the key to mitigation and consequence management





# Several Examples of Bio-aerosol Bacterial Targets

Organism (surrogate)	Common Name	Microbial Group	Microbial Type	Individual Organism Size and shape	Communicable
<i>B. anthracis</i> ( <i>B. atrophaeus</i> *, <i>B. thuringiensis</i> )	Anthrax	Bacteria	Spore (Veg)	1.0 $\mu\text{m}$ 	No
<i>Yersinia pestis</i> ( <i>E. coli</i> , <i>Eh</i> )	Plague	Bacteria	Veg.	2.0 $\mu\text{m}$ 	Yes
<i>M. tuberculosis</i> ( <i>M. smegmatis</i> )	TB	Bacteria	Veg.	3.0 $\mu\text{m}$ 	Yes

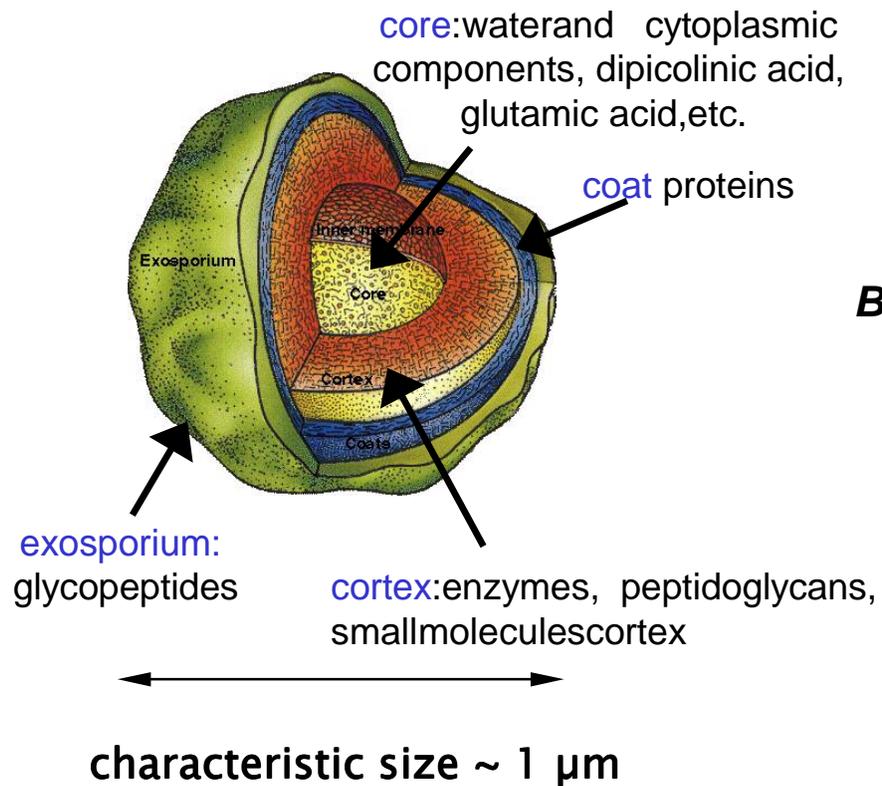
\* *B. subtilis* var. *niger* a.k.a *B. g.* is now called *B. atrophaeus*.



# The Bacterial Spore

- Dormant form of bacteria
- Formation induced by environmental stress

## Diagram of a bacterial spore



*Bacillus licheniformis* endospore exterior

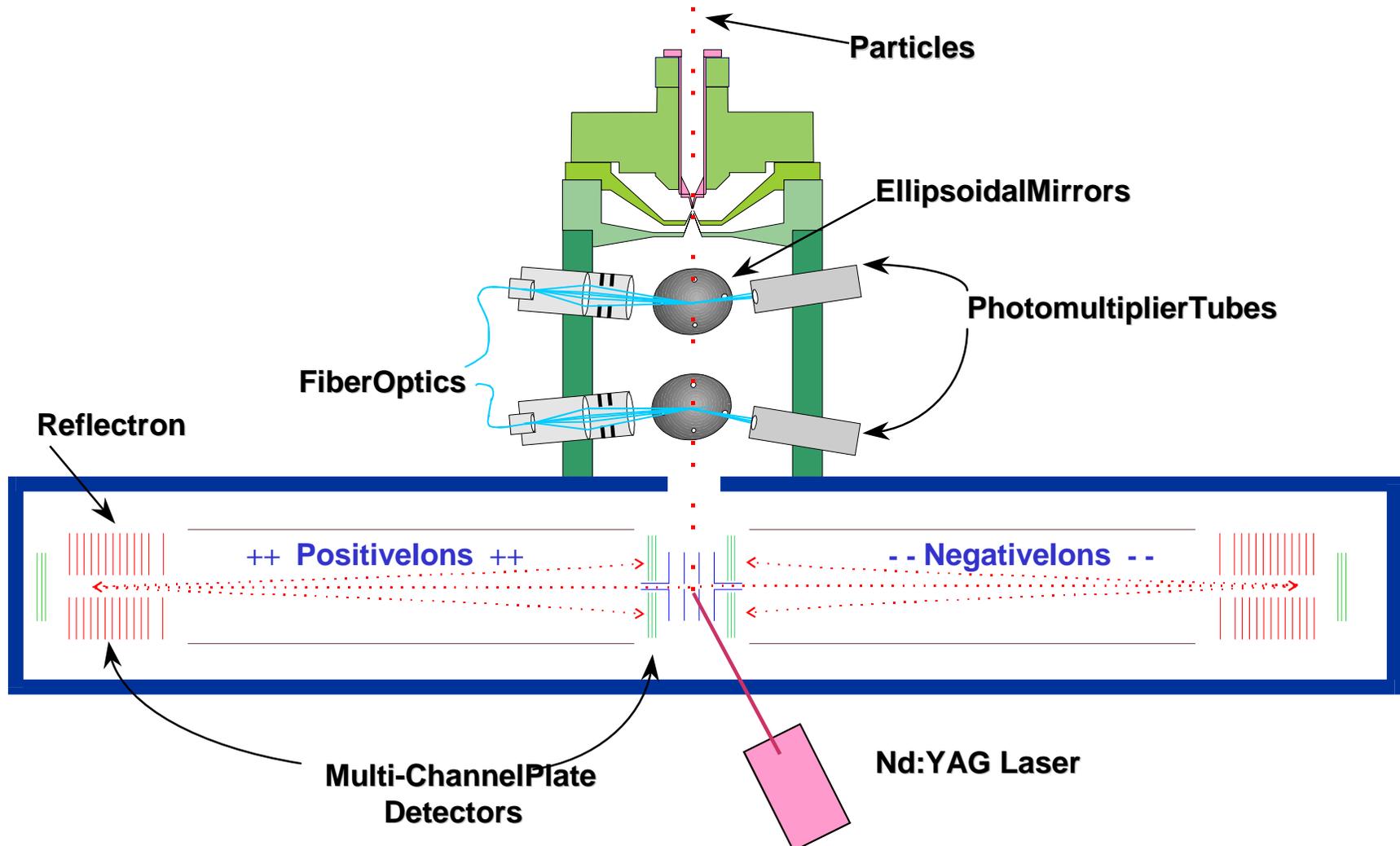


*Bacillus megaterium* endospore crosssection





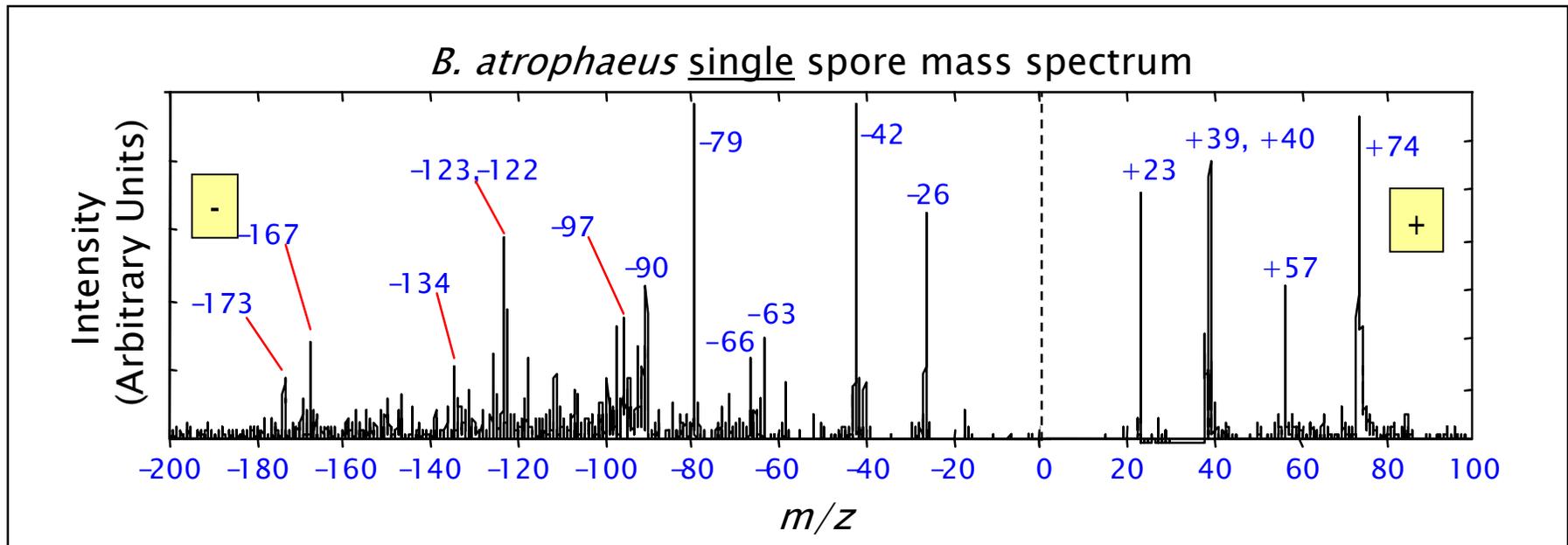
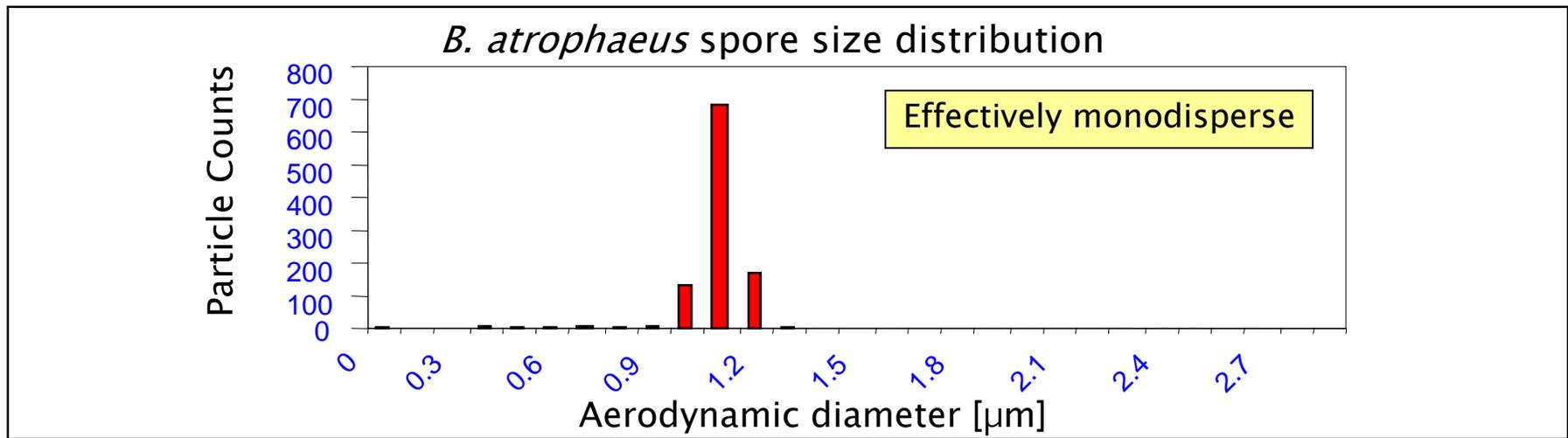
# Single Particle Mass Spectrometry



\*Gard,E;Mayer,JE; Morrill,BD; Dienes,T;Ferguson,DP;Prather,KA.ANALYTICALCHEMISTRY,  
OCT15,1997,V69(N20):4083 -4091.  
Has since been commercialized by TSI, Model 3800.



# *B. atrophaeus* SporeSignature



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