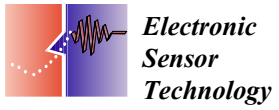
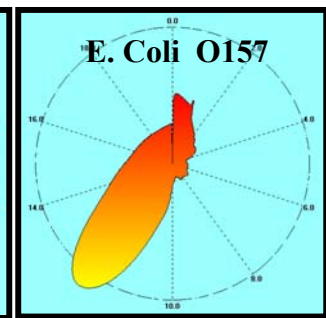
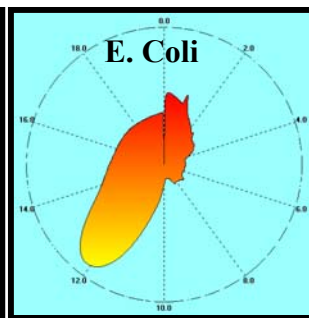
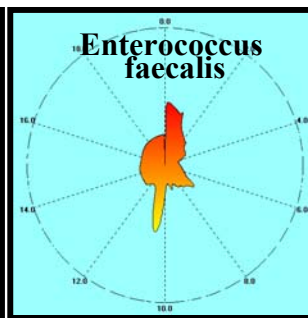
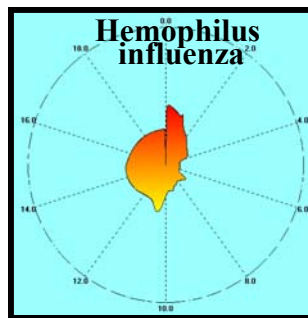
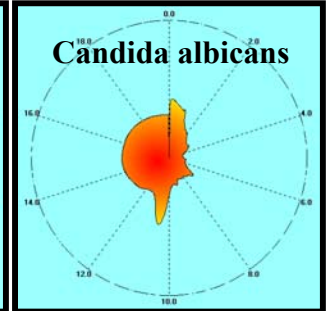
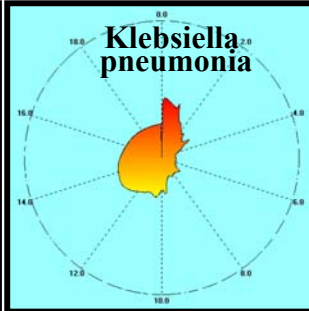
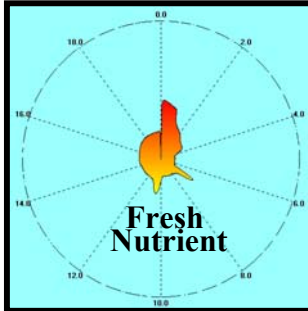
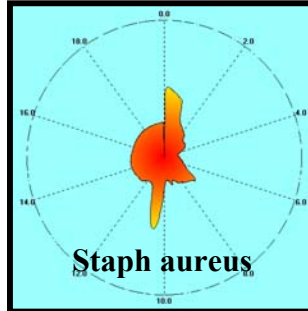
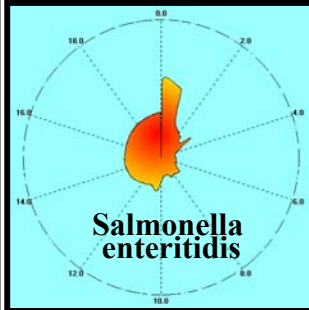
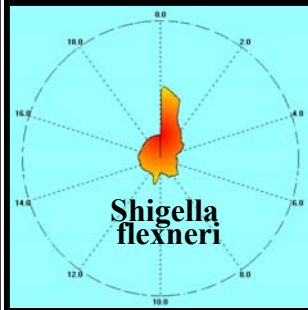
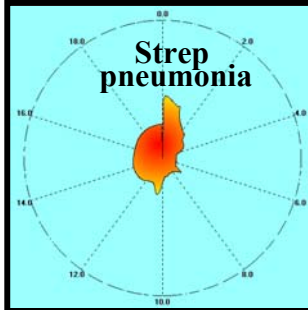
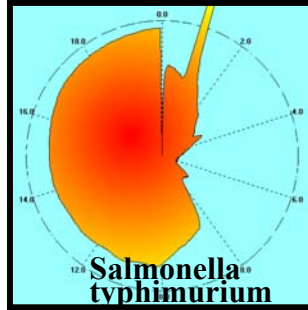


# VaporPrint™ of Infectious Bacteria Cultures



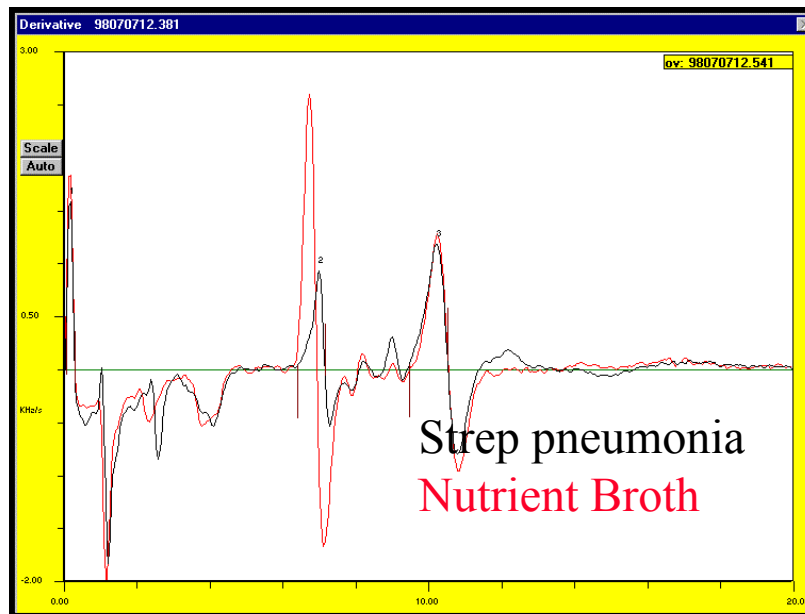
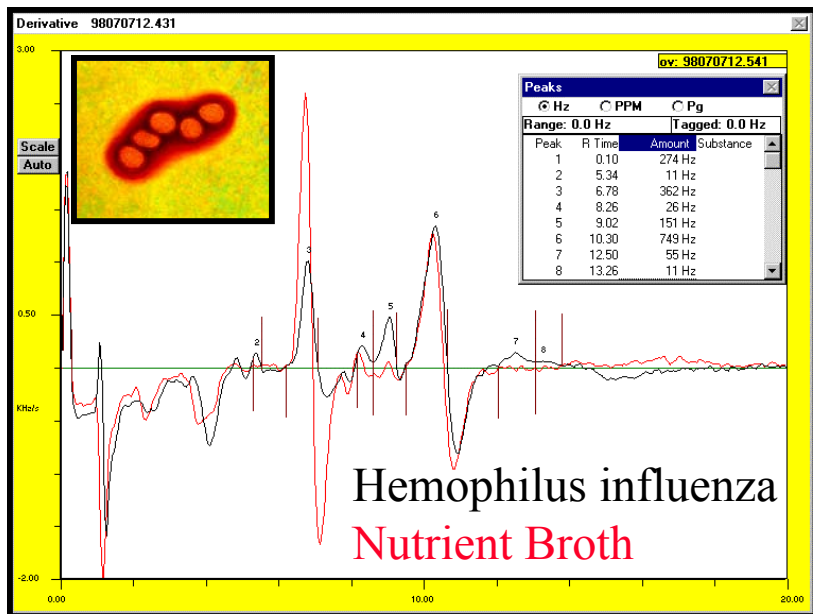
*Cultures Prepared by: Department of Pathology and Laboratory Medicine, State Public Health Laboratory of Nevada*

# An Investigation of Infectious Bacteria With a GC/SAW Electronic Nose

- Water based cultures were inoculated with 12 infectious bacteria and allowed to incubate at 37°C for 24 hours before analyzing headspace vapors with GC/SAW Electronic nose. Two of the twelve cultures did not develop and contained no bacteria.
- Headspace vapor of cultures without bacteria displayed two primary nutrient analyte peaks and three small analyte peaks located midway between the two nutrient peaks.
- Bacteria growth dynamically interacted with nutrient compounds as well as created new analyte vapors specific to the bacteria itself. The concentrations of new analytes together with modified nutrient vapors created VaporPrints™ images specific to bacteria type.
- E.Coli and E.Coli )157 produced nearly identical VaporPrints™, however, one analyte was found to be specific to only O157.
- In general each bacteria type could be recognized by its unique VaporPrint™ image.

<i>Bacteria Tested</i>	<i>Ease of Identification</i>	<i>Summary of Results</i>
1. <i>Strep pneumonia</i>	0	Negative Culture Growth
2. <i>Hemophilus influenza</i>	0	Negative Culture Growth
3. <i>Candida albicans</i>	4	Doubled 2nd nutrient peak and 2 persursors
4. <i>Shegella flexneri</i>	5	Nutrients diminished, percursor and precursor ripple
5. <i>Staphylococcus aureus</i>	3	Increased nutrients, doubled 2nd
6. <i>Pseudomonas aeruginosa</i>	10	Reduced 1st nutrient, 10X new ripple peak
7. <i>Salmonella enteritidis</i>	7	Reduced 1st nutrient, Large percursor peak
8. <i>Enterococcus faecalis</i>	5	Reduced 1st nutrient, Large increase in 2nd
9. <i>Klebsiella pneumonia</i>	10	Reduced nutrients, large new ripple and percursors
10 <i>Escherichia coli O157</i>	10	Reduced 1st, increased 2nd, large post, added ripple
11 <i>Escherichia coli (benign)</i>	10	Same as O157 except 4th ripple peak not present
12 <i>Salmonella typhimurium</i>	10	Reduced nuturients, large new ripple, precursors

# No Growth Confirmed for Hemophilus influenza and Strep pneumonia Culture Bottles



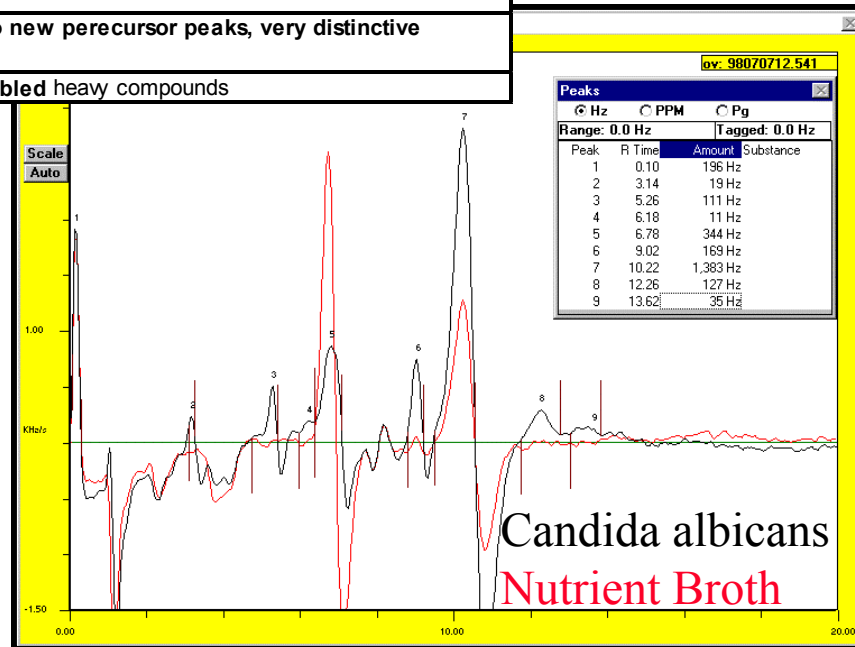
## Analytes Present in Nutrient Broth

	Retention Time	Amount after 24 hr @ 37° C	
<b>Primary Nutrient Peaks (2)</b>	6.8	362	Quantitative results based upon no-growth chromatograms of H. influenza and S. pneumonia
	10.3	749	
<b>Ripple Peaks (3)</b>	7.8	10	Small set of 3 peaks prominent and generally always present but much smaller than primary nutrient peaks
	8.2	26	
	9	151	
<b>Post Peaks (1)</b>	12.5	55	Broad low vapor pressure compounds generally present

# Candida albicans

Analytes Present in Candida albicans

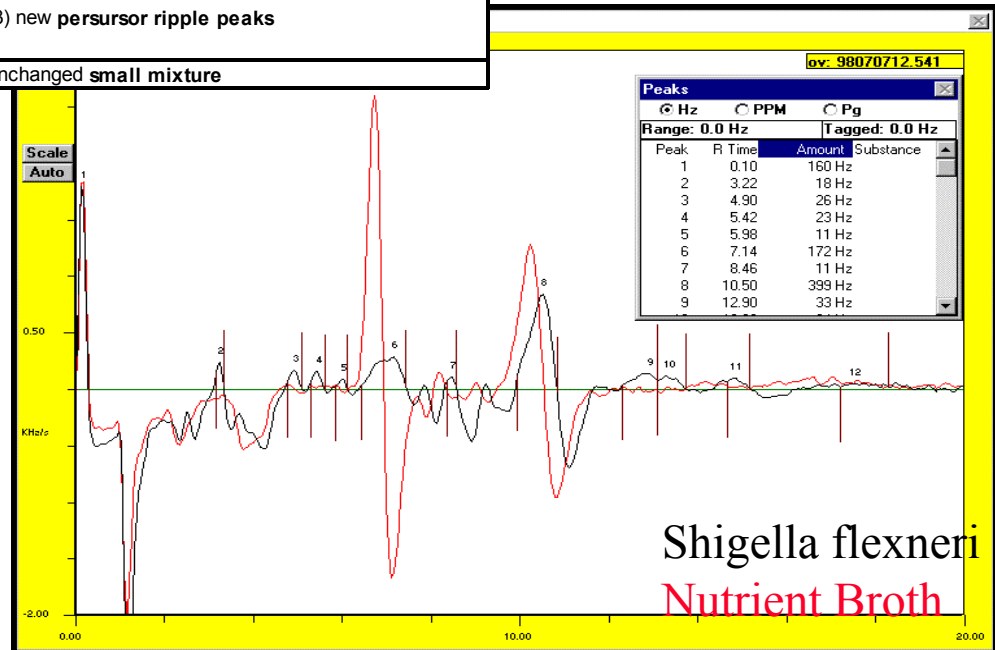
	Retention Time	Amount after 24 hr @ 37° C	
Primary Nutrient Peaks (2)	6.8	344	First peak unchanged but second doubled
	10.2	1383	
Ripple Peaks (3)	7.8	10	ripple peaks unchanged
	8.2	26	
	9.0	169	
New Peaks (2)	3.14	40	Two new perecursor peaks, very distinctive
	5.26	111	
Post Peaks (1)	12.26	127	Doubled heavy compounds



# Shigella flexneri

Analytes Present in Shegella flexneri

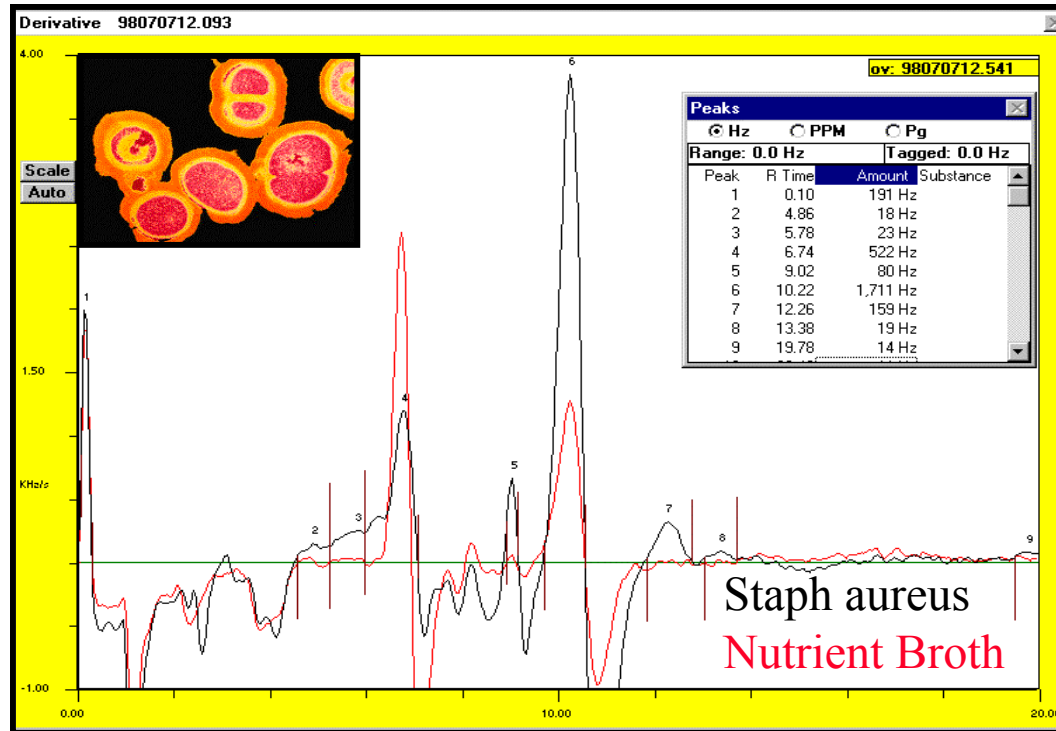
	Retention Time	Amount after 24 hr @ 37° C	
<b>Primary Nutrient Peaks (2)</b>	7.1	172	First peak <b>almost gone</b> and second <b>greatly reduced</b>
	10.5	399	
<b>Ripple Peaks (3)</b>	7.8	10	ripple peaks <b>unchanged</b>
	8.2	26	
	9.0	155	
<b>Precursor Peaks (4)</b>	3.22	30	(1) precursor peak
	4.9	26	(3) new precursor ripple peaks
	5.42	23	
	5.98	11	
<b>Post Peaks (1)</b>	12.26	32	unchanged <b>small mixture</b>



# Staphylococcus aureus

## Analytes Present in Staphylococcus aureus

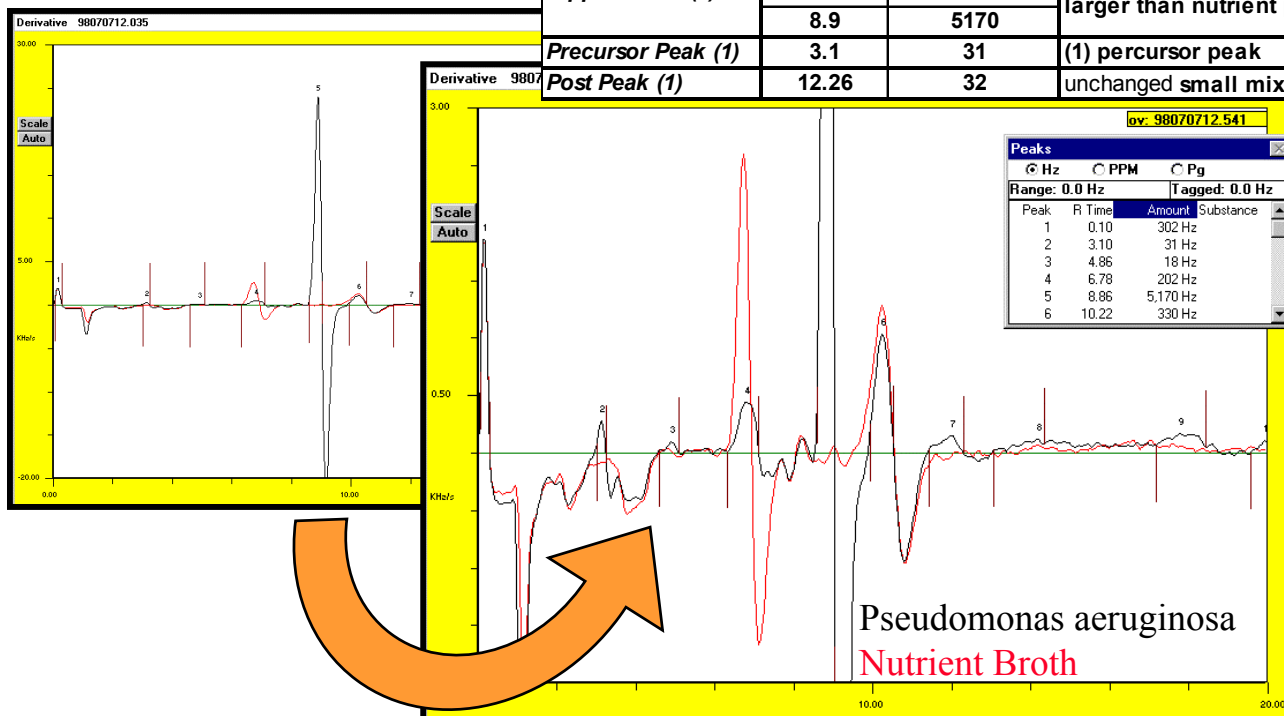
	Retention Time	Amount after 24 hr @ 37° C	
<b>Primary Nutrient Peaks (2)</b>	6.74	522	First peak <b>slight increase</b> and second <b>doubled++</b>
	10.22	1711	
<b>Ripple Peaks (3)</b>	7.8	10	ripple peaks <b>unchanged</b>
	8.2	26	
	9.0	155	
<b>Post Peaks (1)</b>	12.26	159	well defined <b>unchanged</b>



# Pseudomonas aeruginosa

## Analytes Present in Pseudomonas aeruginosa

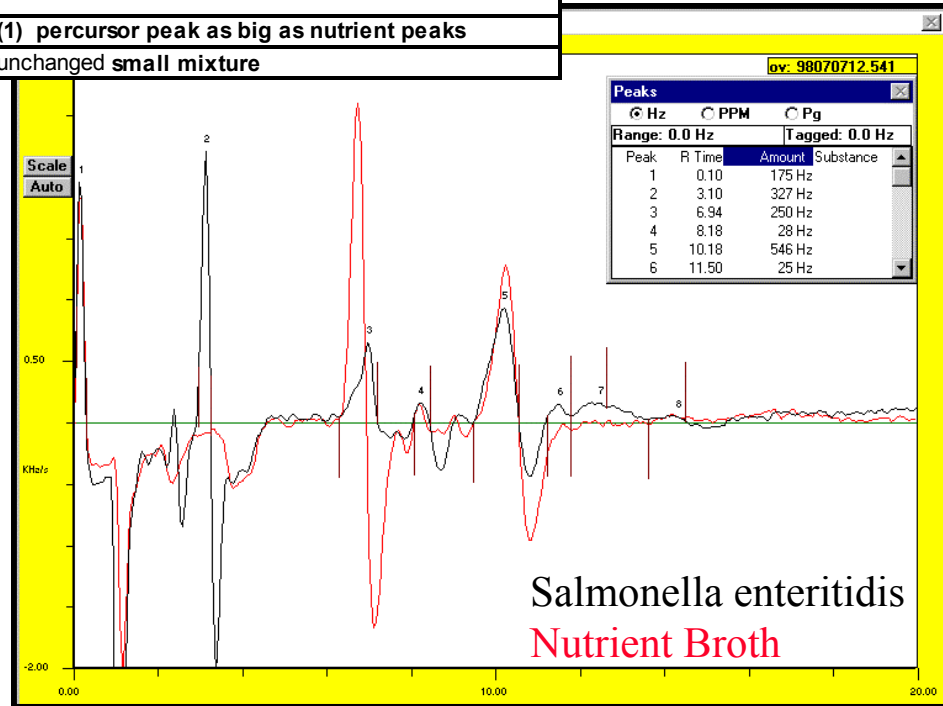
	Retention Time	Amount after 24 hr @ 37° C	
<b>Primary Nutrient Peaks (2)</b>	6.78	202	First peak <b>almost gone</b> and second <b>slightly reduced</b>
	10.22	330	
<b>Ripple Peaks (3)</b>	7.8	10	first two ripple peaks <b>unchanged</b> but <b>third is 10 times larger than nutrient peaks</b>
	8.2	26	
	8.9	5170	
<b>Precursor Peak (1)</b>	3.1	31	<b>(1) precursor peak</b>
<b>Post Peak (1)</b>	12.26	32	<b>unchanged small mixture</b>



# Salmonella enteritidis

## Analytes Present in Salmonella enteritidis

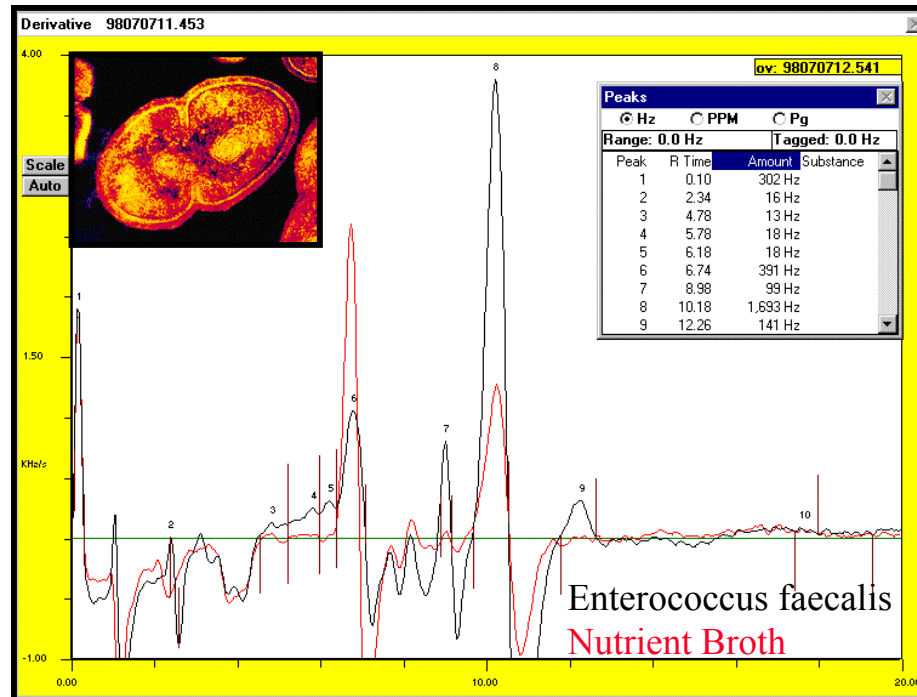
	Retention Time	Amount after 24 hr @ 37° C	
Primary Nutrient Peaks (2)	6.94	250	First peak <b>almost gone</b> and second <b>unchanged</b>
	10.18	546	
Ripple Peaks (3)	7.8	10	ripple peaks <b>unchanged</b>
	8.2	28	
	9.0	155	
Precursor Peak (1)	3.1	327	(1) precursor peak as big as nutrient peaks
Post Peaks (1)	11.5	25	unchanged <b>small mixture</b>



# Enterococcus faecalis

Analytes Present in Enterococcus faecalis

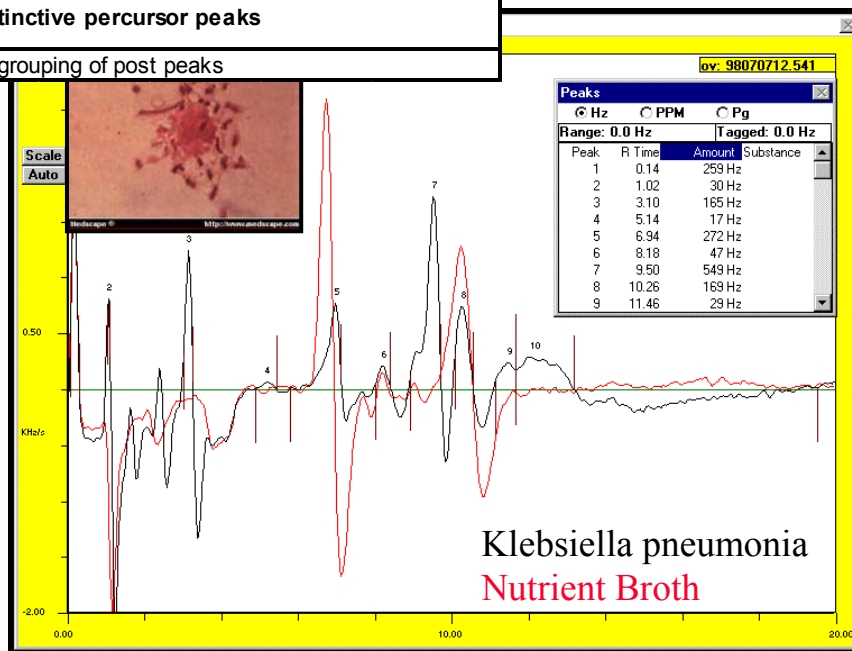
	Retention Time	Amount after 24 hr @ 37° C	
Primary Nutrient Peaks (2)	6.74	391	First peak slight decrease and second greatly increased
	10.18	1693	
Ripple Peaks (3)	7.8	10	ripple peaks unchanged
	8.2	26	
	9.0	155	
Precursor Peak (1)	2.34	16	(1) small precursor peak
Post Peaks (1)	12.26	141	distinctive small peak



# Klebsiella pneumonia

Analytes Present in Klebsiella pneumonia

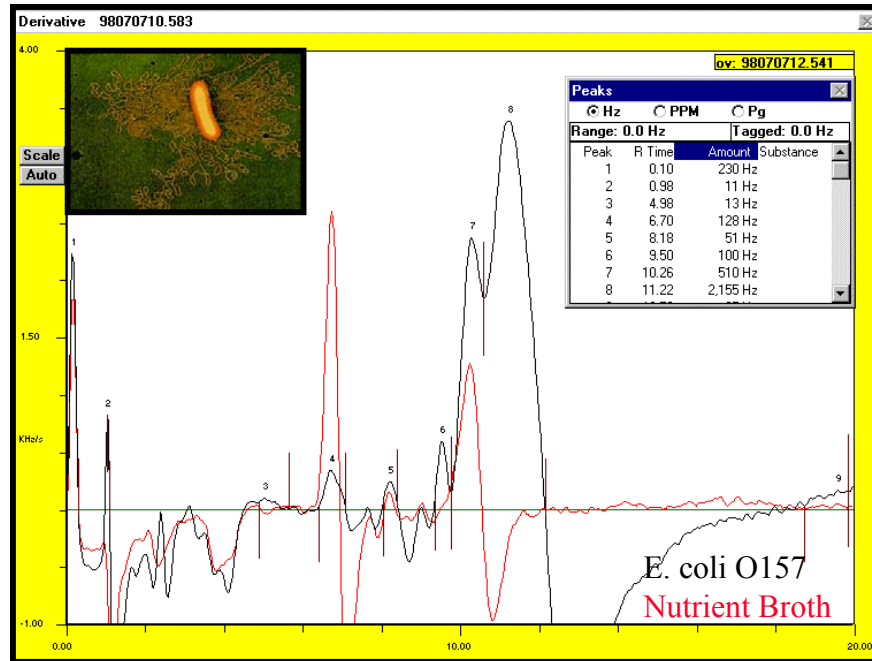
	Retention Time	Amount after 24 hr @ 37° C	
Primary Nutrient Peaks (2)	6.94	272	Both nutrient peaks reduced
	10.26	169	
Ripple Peaks (4)	7.8	10	original (3) ripple peaks unchanged but with a fourth large new peak
	8.2	26	
	9.0	155	
	9.5	549	
Precursor Peaks (2)	1.02	30	(2) distinctive precursor peaks
	3.1	165	
Post Peaks (1)	11.46	169	large grouping of post peaks



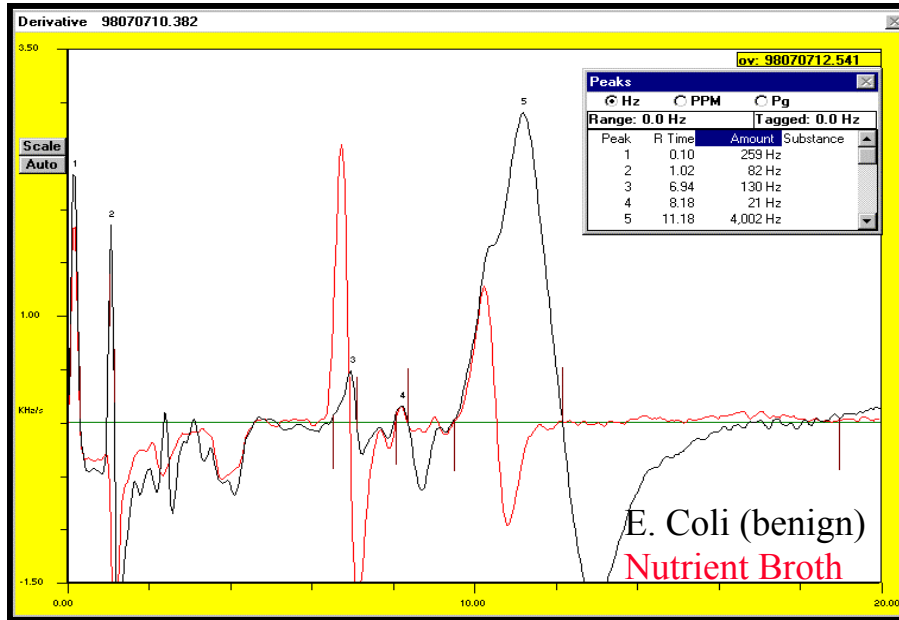
# Escherichia coli O157

Analytes Present in Escherichia coli O157

	Retention Time	Amount after 24 hr @ 37° C	
Primary Nutrient Peaks (2)	6.7	129	early peak reduced and second peak increased
	10.26	510	
Ripple Peaks (4)	7.8	10	original (3) ripple peaks unchanged but with a fourth new peak
	8.2	26	
	9.0	155	
	9.5	100	
Post Peaks (1)	11.22	2135	large new post peak



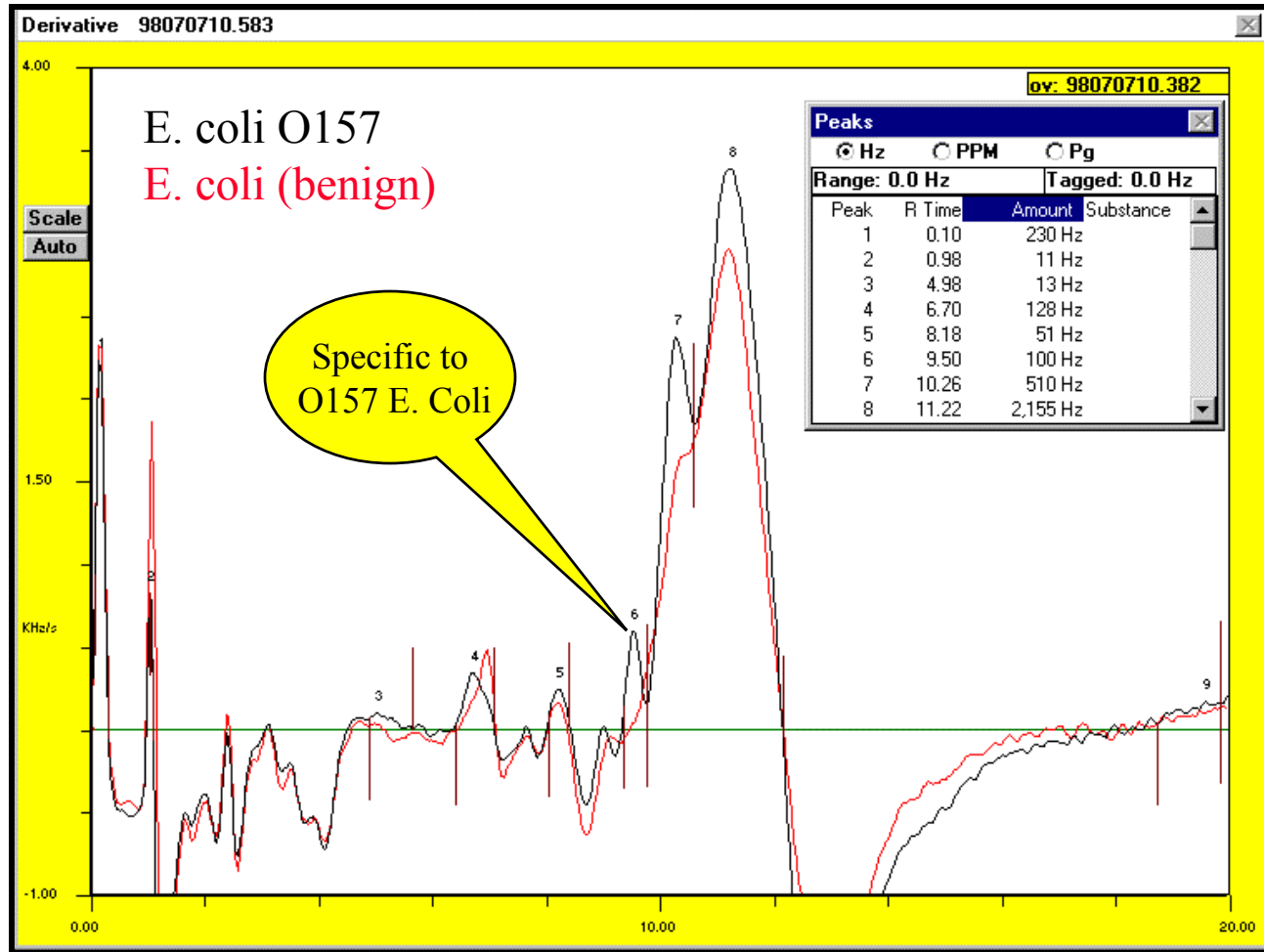
# E. coli (benign)



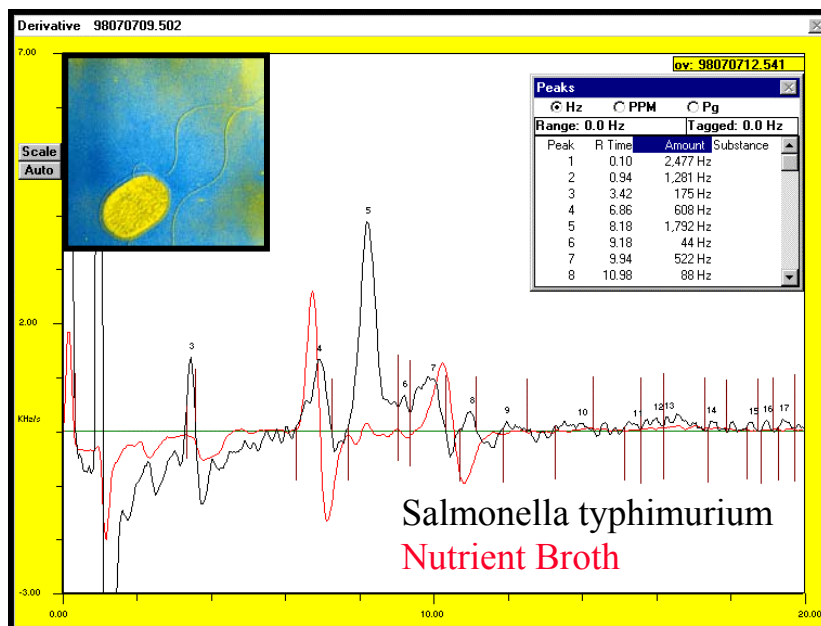
## Analytes Present in Escherichia coli (benign)

	Retention Time	Amount after 24 hr @ 37° C	
<b>Primary Nutrient Peaks (2)</b>	6.7	129	early peak reduced and second peak increased
	10.26	510	
<b>Ripple Peaks (3)</b>	7.8	10	original (3) ripple peaks unchanged
	8.2	26	
	9.0	155	
<b>Post Peaks (1)</b>	11.22	4002	large new post peak

# Comparison of E. coli



# Salmonella typhimurium



## Analytes Present in Salmonella typhimurium

	<i>Retention Time</i>	<i>Amount after 24 hr @ 37° C</i>	
<b>Primary Nutrient Peaks (2)</b>	<b>6.86</b>	<b>608</b>	First peak <b>reduced</b> and second <b>almost gone</b>
	<b>9.94</b>	<b>522</b>	
<b>Ripple Peaks (3)</b>	<b>7.8</b>	<b>10</b>	large new ripple peak
	<b>8.18</b>	<b>1792</b>	
<b>Precursor Peak (2)</b>	<b>0.94</b>	<b>1281</b>	(2) distinctive precursor peaks
	<b>3.42</b>	<b>175</b>	
<b>Post Peaks (1)</b>	<b>10.9</b>	<b>25</b>	many low volatility analytes present