



IDEXX

Microbiological Test Products for Water

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Agenda

- Introduction to indicator organisms
- Evolution of water testing
- Enzymatic water test methods: P/A and Quantification
- Quality Control
- Questions

Requirements for an Indicator Organism

- Present when pathogens are present
- Absent in uncontaminated waters
- Present in higher numbers than pathogens in contaminated water
- Better survival in water than pathogens
- Easy and Safe to analyze
- Rapid results
- Inexpensive
- Accurate

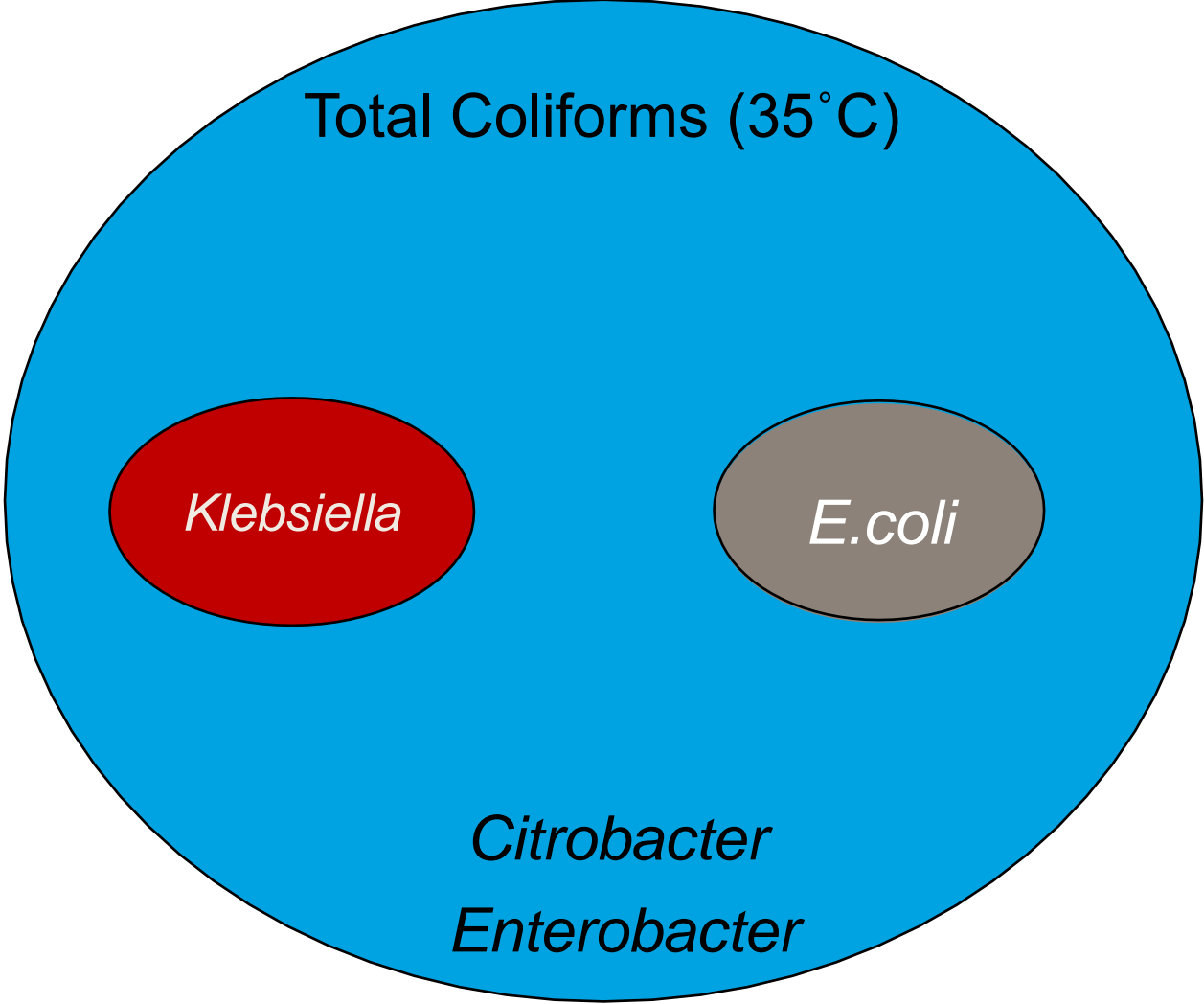


E. coli (non-pathogenic)

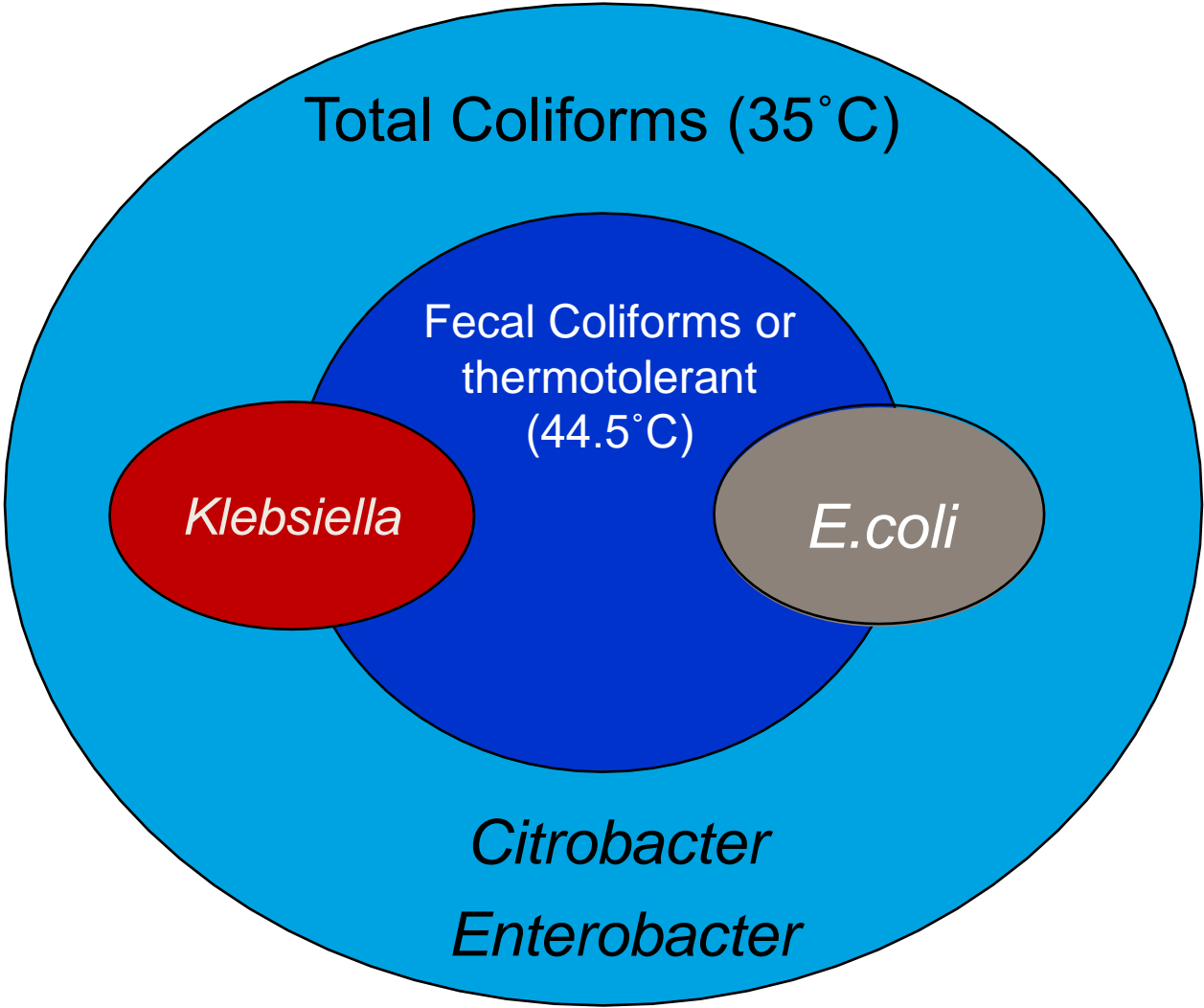
- Major inhabitant of gastrointestinal tract in warm-blooded animals, birds and humans
- Shed in feces at high levels
- Does not occur naturally in the environment
- Thus, true indicator of fecal contamination
- Gram negative
- Thermotolerant



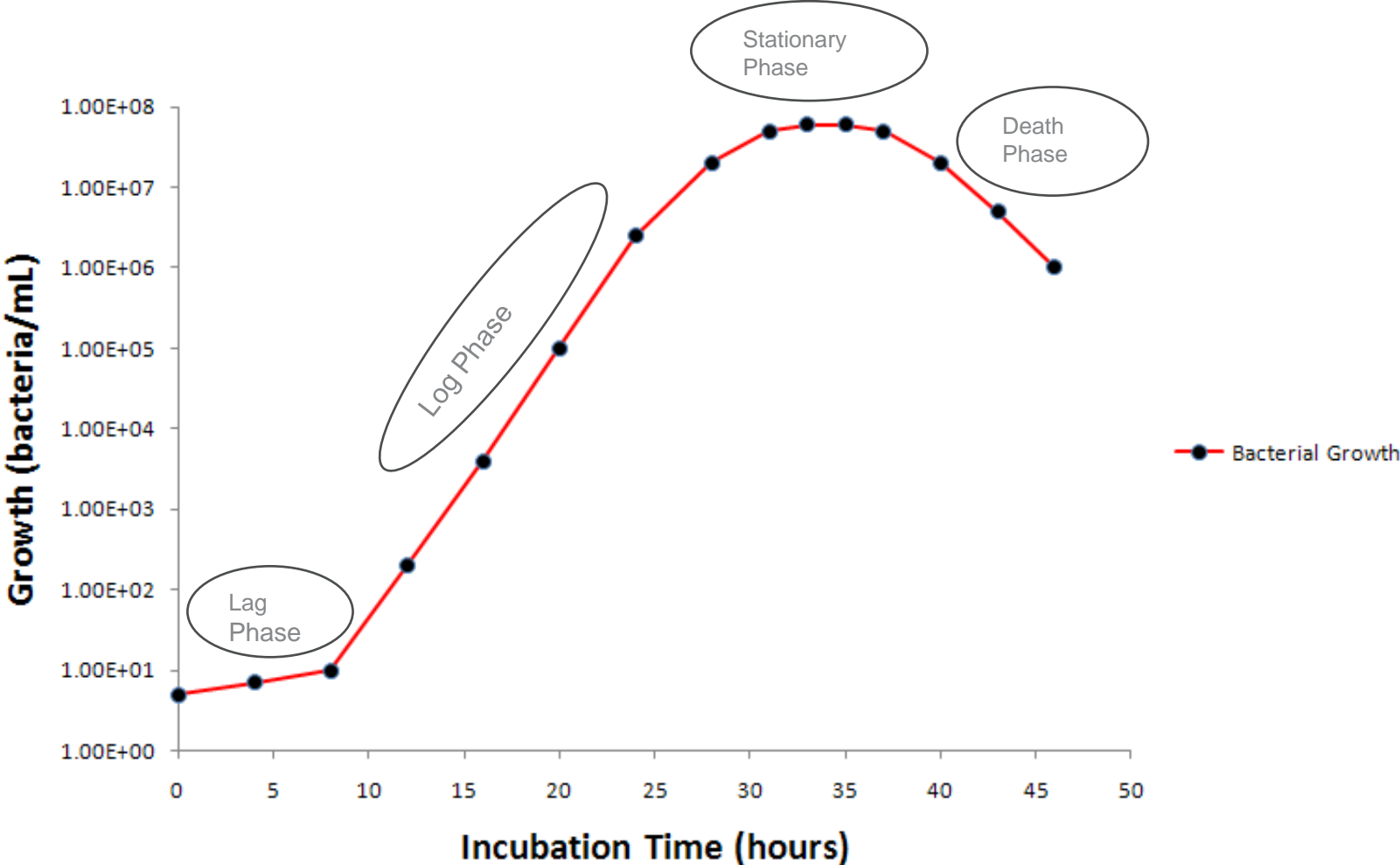
Coliform Bacteria Group



Coliform Bacteria Group



Coliform Bacteria Group



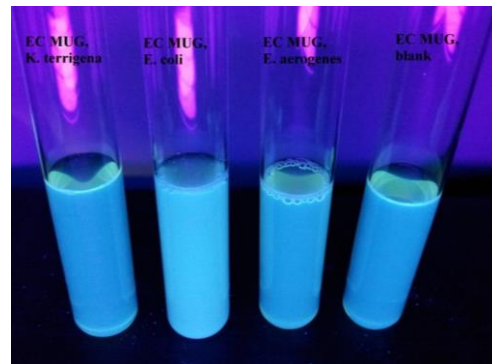
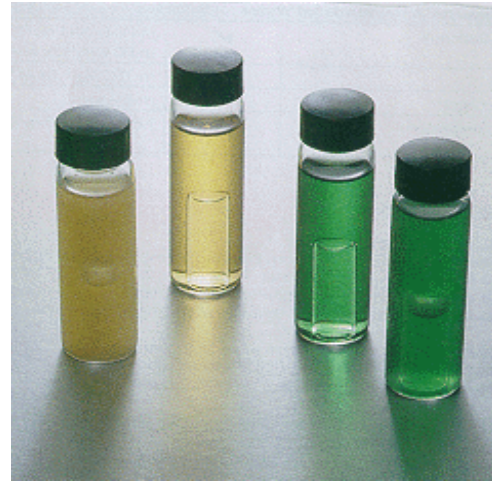
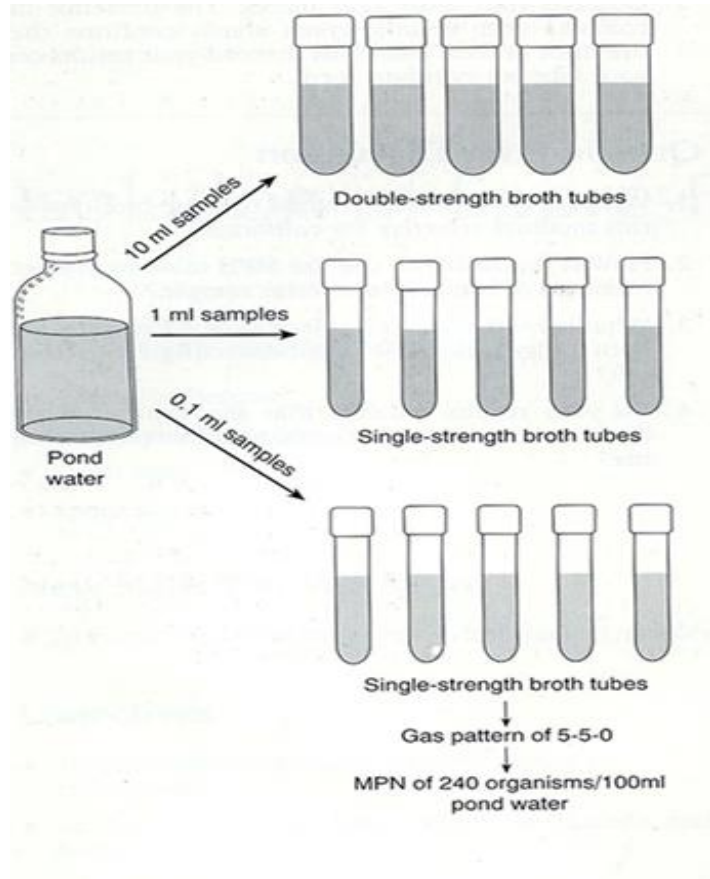
Drinking Water & Wastewater Methods – Evolution Over Time

**Multiple Tube
Fermentation**

Up to 60
Steps
48-96
Hours

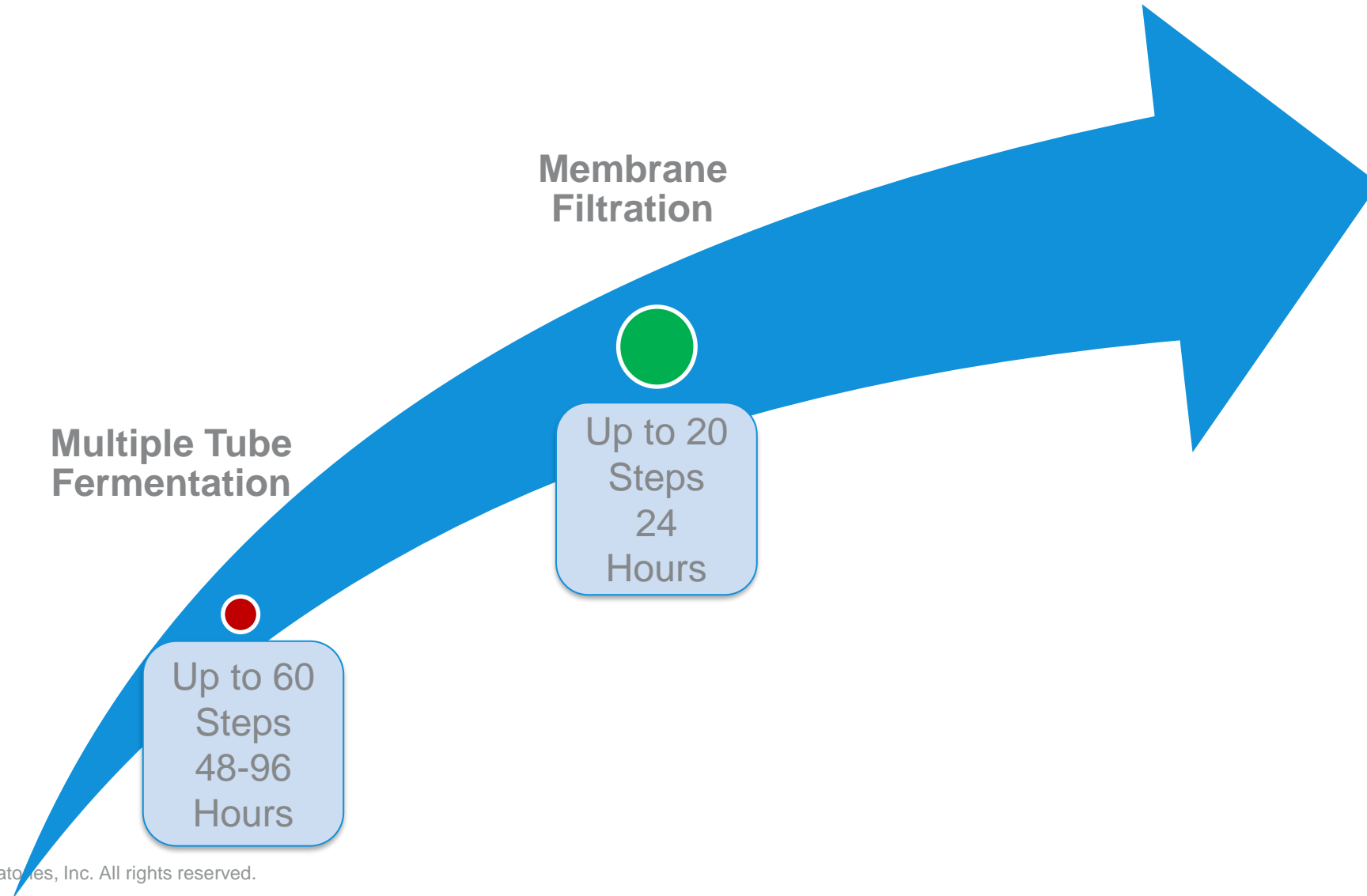
Multiple Tube Fermentation

Multiple Tube Fermentation
Up to 60 Steps
48-96 Hours



- MTF is a Presumptive test
- Confirmation test is required for final results
- Media are either prepared or purchased and tested prior to testing samples
 - pH must be within tolerance
 - Tested prior to use with positive & negative controls
 - Media must be stored refrigerated
 - Discard prepared media after 2 weeks; purchased media cannot be used beyond the assigned exp. date
 - QC conducted with every test run

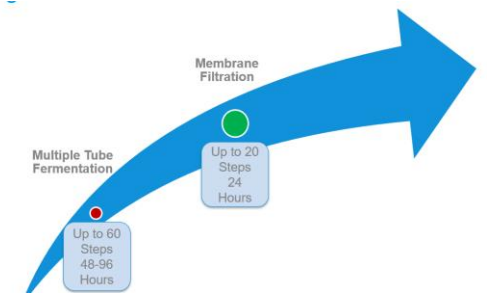
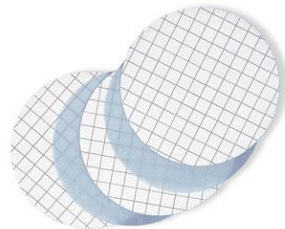
Drinking Water & Wastewater Methods – Evolution Over Time



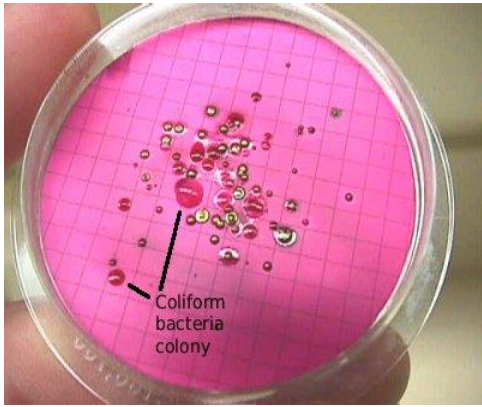
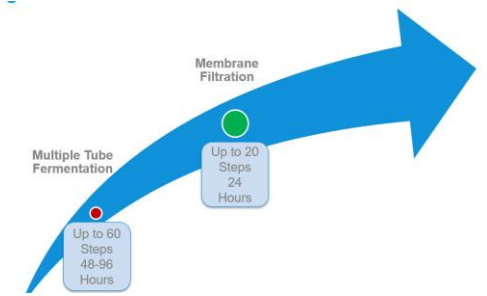
Membrane Filtration

Equipment needed:

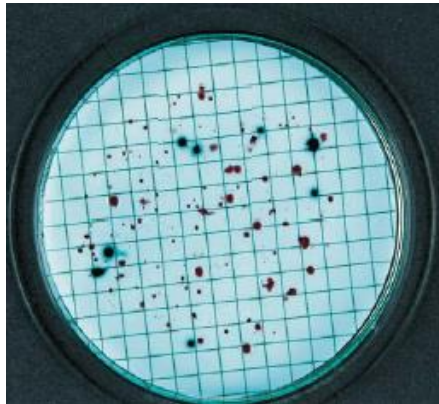
- Manifold
- Sterile Filter funnel
- Pump & Tubing
- Collection flask
- Sterile forceps
- Filter/membrane
- Sterile media
- Incubator / Water bath



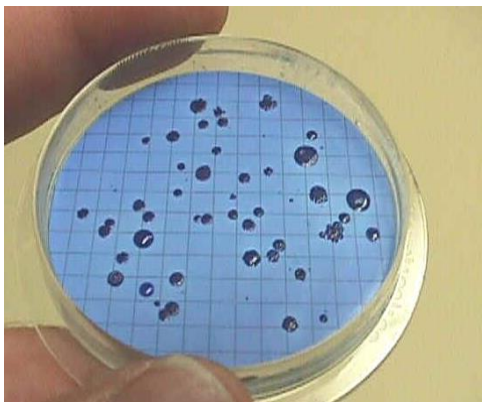
Membrane Filtration



M-Endo



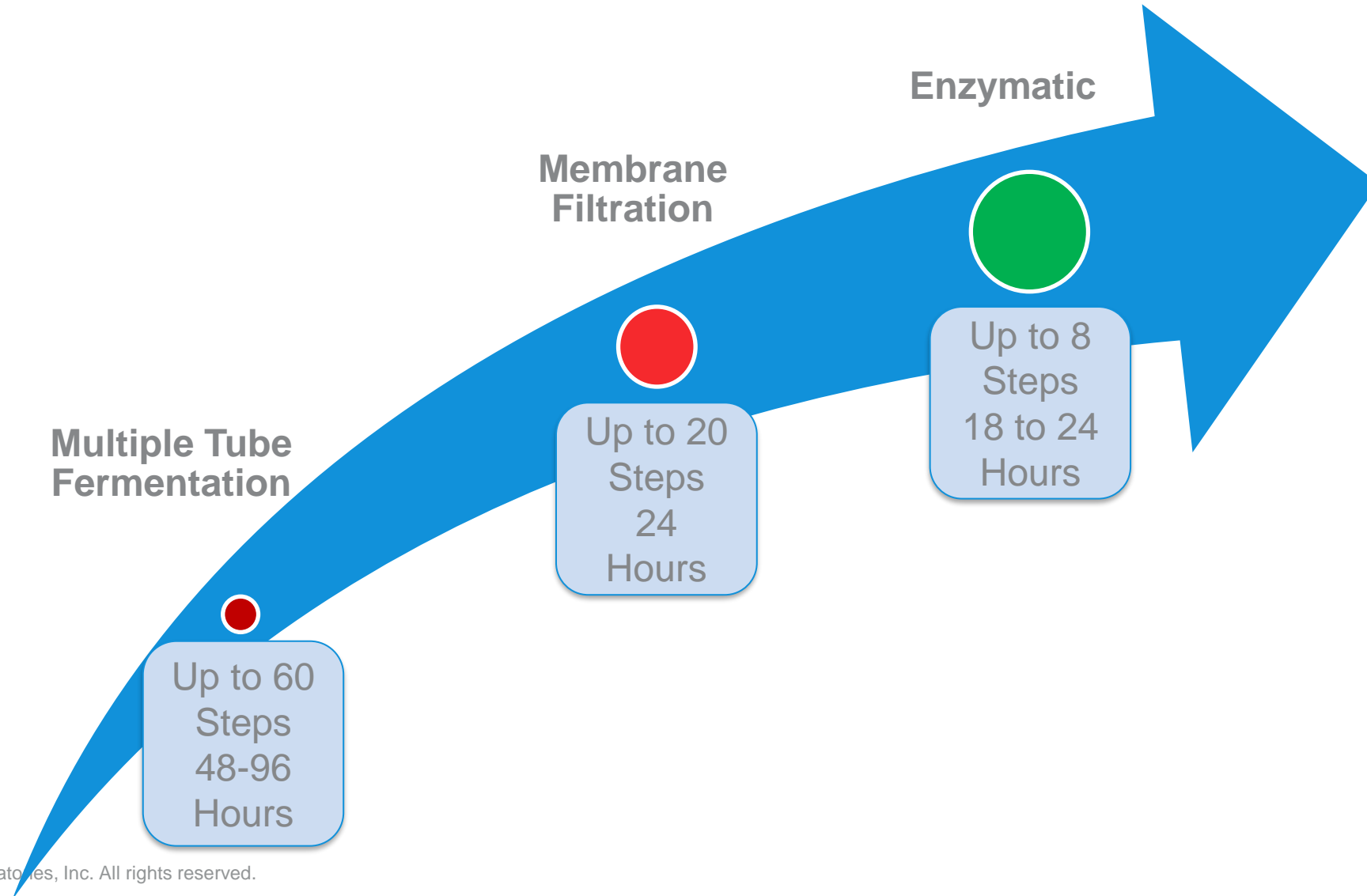
m-ColiBlue



m-FC

- Colonies of specific color / morphology are counted
- Confirmations may be required
- May required media prep, extensive QC
- Minimum of 20 steps
- Blanks required
- Positive control required for each run
- 20-80 colonies for TC & EC; (20-60 for fecals)
- Risk of confluent growth, risk of clogged filters, risk of air bubbles under membrane
- Difficult to read, magnification required

Drinking Water & Wastewater Methods – Evolution Over Time





Enzymatic Testing Method Formats: Presence/Absence and Quantification

Presence/Absence

Step 1



Add reagent to
water sample
and mix well

Step 2



Incubate vessel

Step 3



Read and record
results

Multiple Tube Quantification

- Multiple Tube can be used for quantification using enzymatic tests

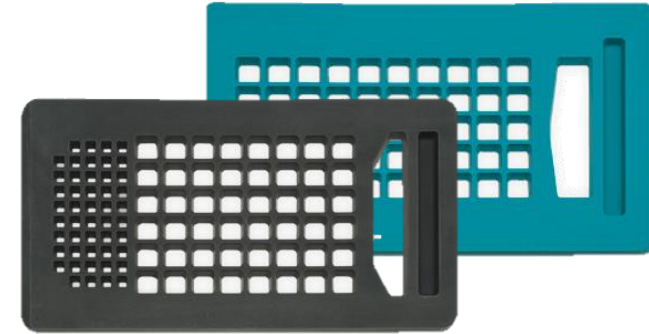


- Refer to SM 9223 for 5 and 10 MPN tube procedure
- Refer to SM 9221 for MPN tables

Multi-well Quantification: Quanti-Tray System



Quanti-Trays



Quanti-Tray Inserts



Quanti-Tray Sealer PLUS

Multi-well Quantification: Quanti-Tray System



1

Add reagent to the sample



2

Pour into Quanti-Tray



3

Seal using Quanti-Tray Sealer PLUS



4

Incubate



5

Read and refer to MPN table



Colilert, Colilert-18, and Colisure:
Total Coliform, *E. coli*, and Fecal Coliform Tests

Colilert



- 24 hour test
- Store at 2-30°C
- Total Coliform and *E. coli*

- EPA approved, *Standard Methods 9223B*
 - Drinking Water
 - Ground Water
 - Recreational Water: Fresh/Marine Water
 - Wastewater (*E. coli*)

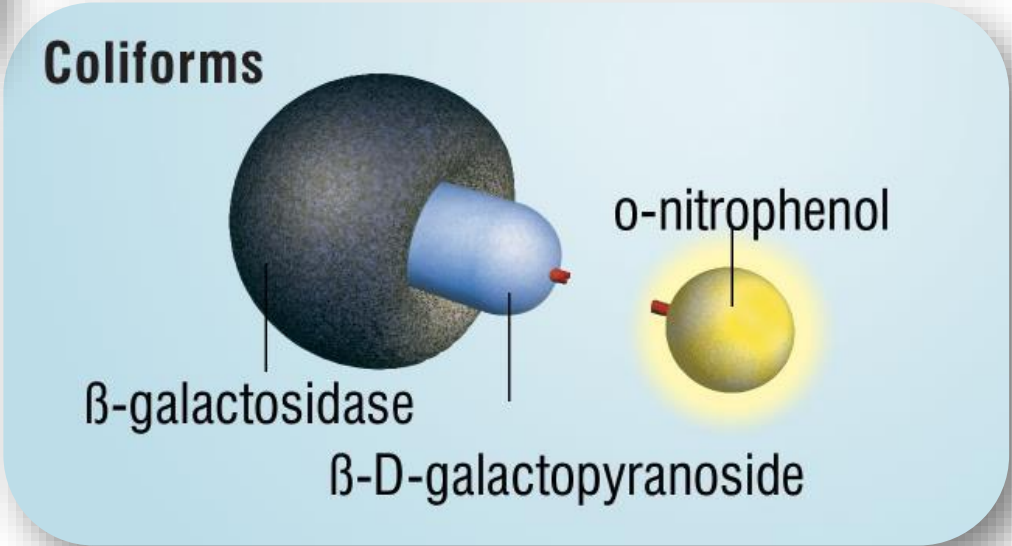
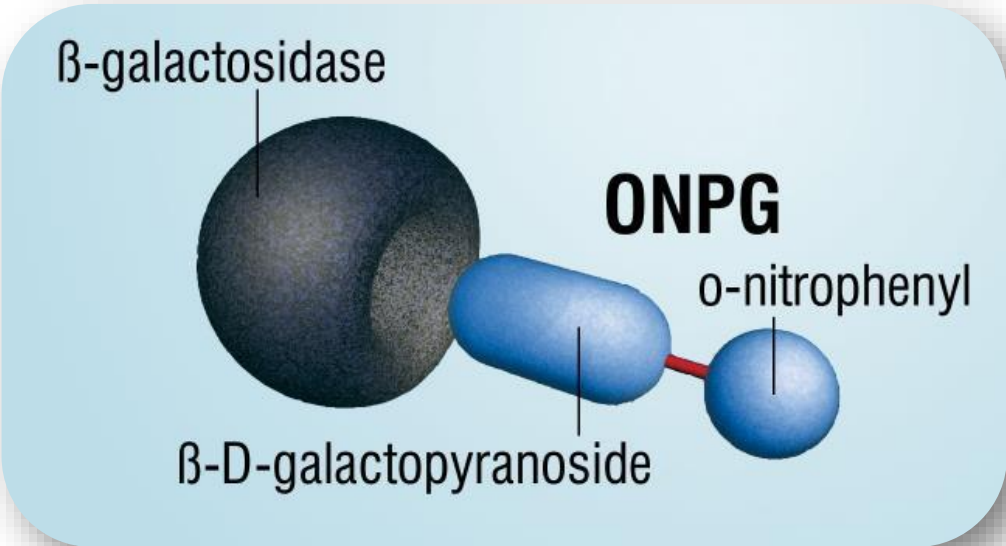
Colilert-18



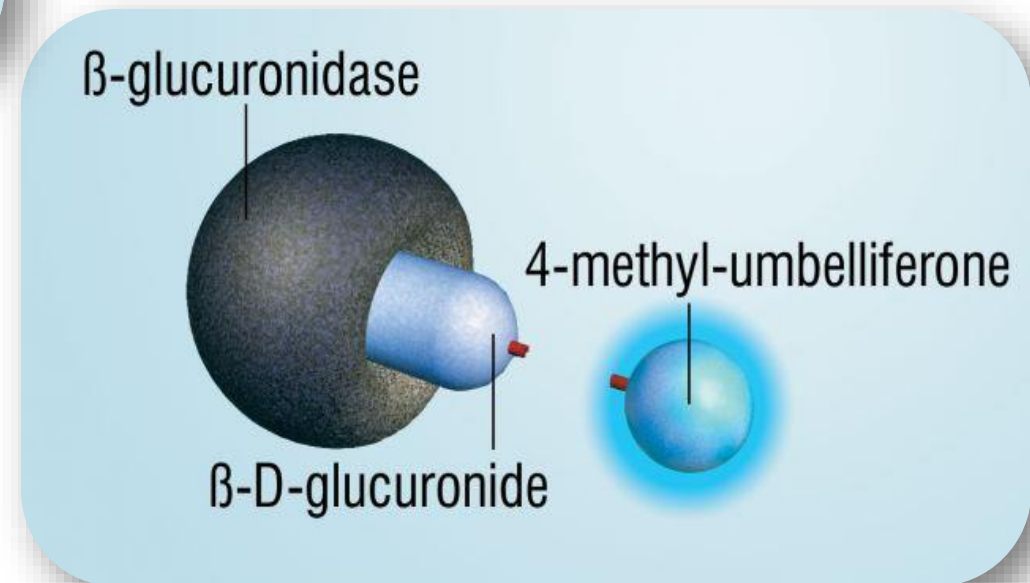
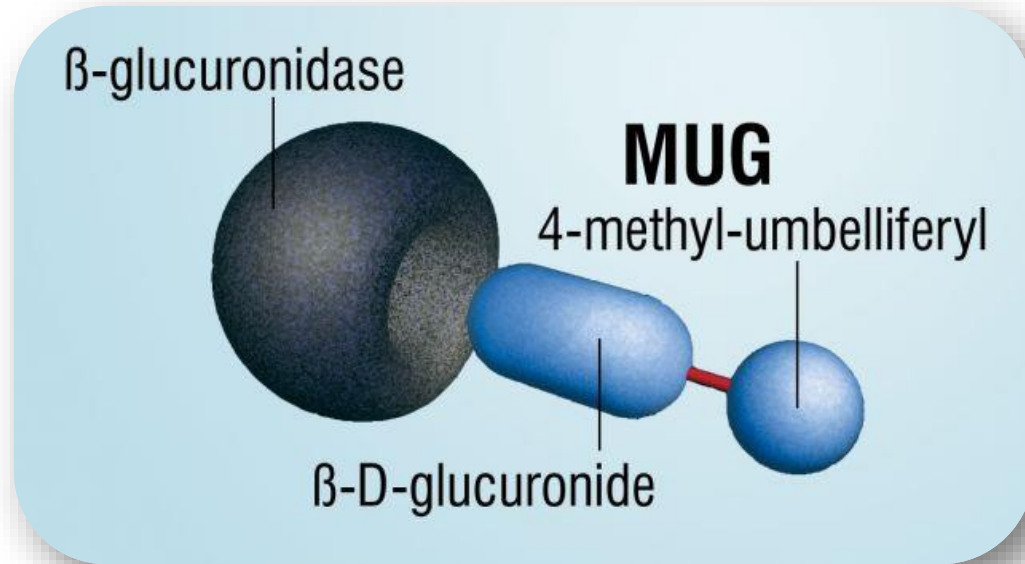
- 18 hour test
- Store at 2-25°C
- Total Coliform and *E. coli* (35°C)
- Fecal Coliform (44.5°C)

- EPA approved, *Standard Methods* 9223B
 - Drinking Water (Standard Methods 9223B, ISO 9308-2)
 - Ground Water (Standard Methods 9223B, ISO 9308-2)
 - Recreational Water (Standard Methods, ISO 9308-2)
 - Wastewater (*E. coli*) (Standard Methods 9223B)
 - Wastewater (Fecal) (EPA approved)

Colilert and Colilert-18: Total coliform and fecal coliforms



Colilert and Colilert-18: *E. coli*



Colilert and Colilert-18: Incubation - Total coliform and *E. coli*



Temperature

- Total coliforms / *E.coli*:
 - $35 \pm 0.5^{\circ}\text{C}$

Time

- Colilert: 24-28 hours
- Colilert-18: 18-22 hours

Colilert and Colilert-18: Reading Results



Yellow color indicates
positive for Total Coliforms



Fluorescence and yellow color
indicates positive for *E. coli*.

Read *E. coli* under 365nm long
wavelength 6 watt UV light

Colilert-18: Incubation - Fecal coliform



Temperature

- Fecal coliform:
 - $44.5 \pm 0.2^{\circ}\text{C}$

Time

- Colilert-18: 18-22 hours

Colilert-18: Reading Results - Fecal Coliforms



Yellow color indicates positive for Fecal Coliforms

Colilert and Colilert-18: Comparator

- Comparator is used when reading results
 - Available in both Quanti-Tray and P/A
- Comparator provides the minimum yellow (and fluorescence) for positive results



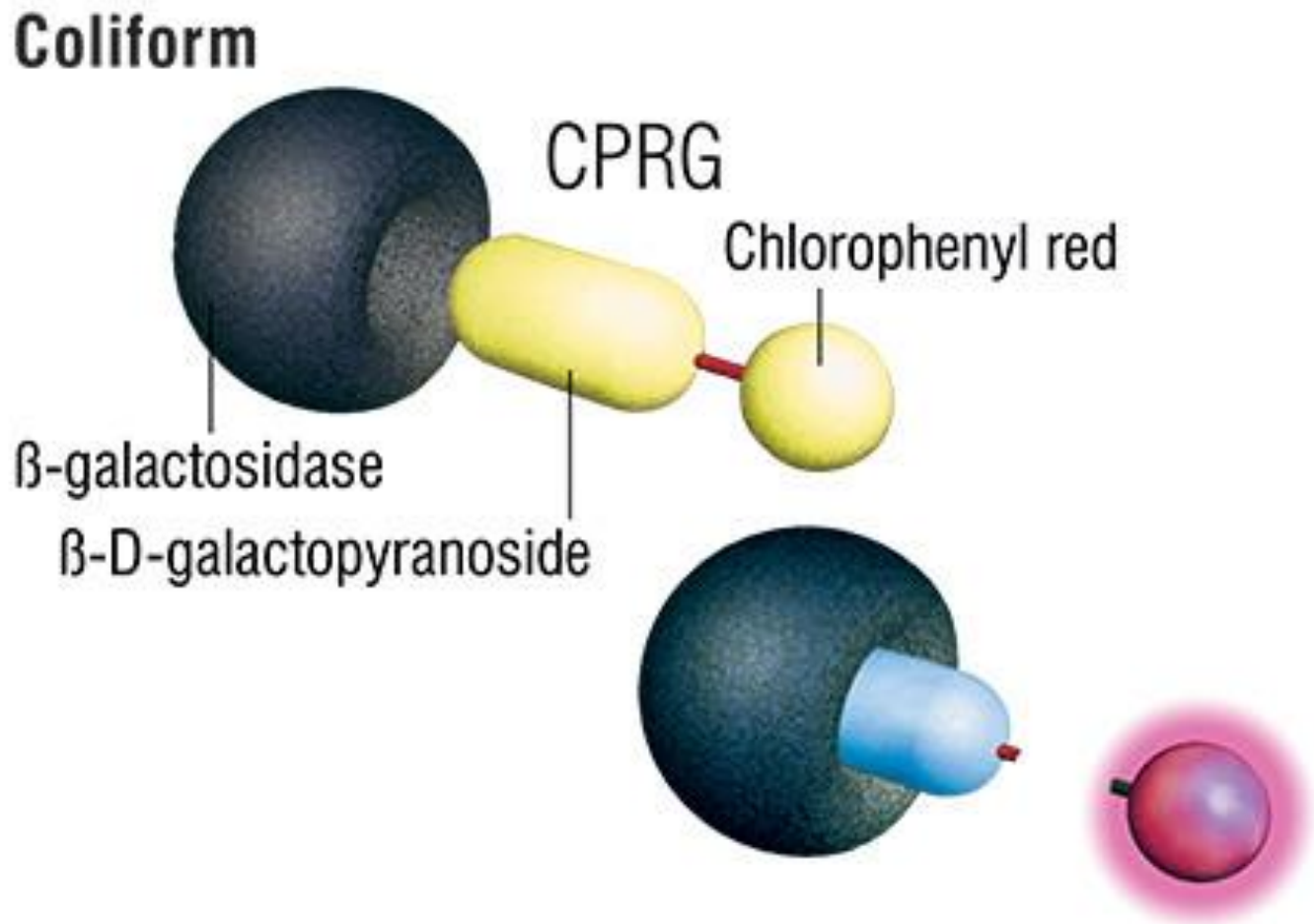
Colisure



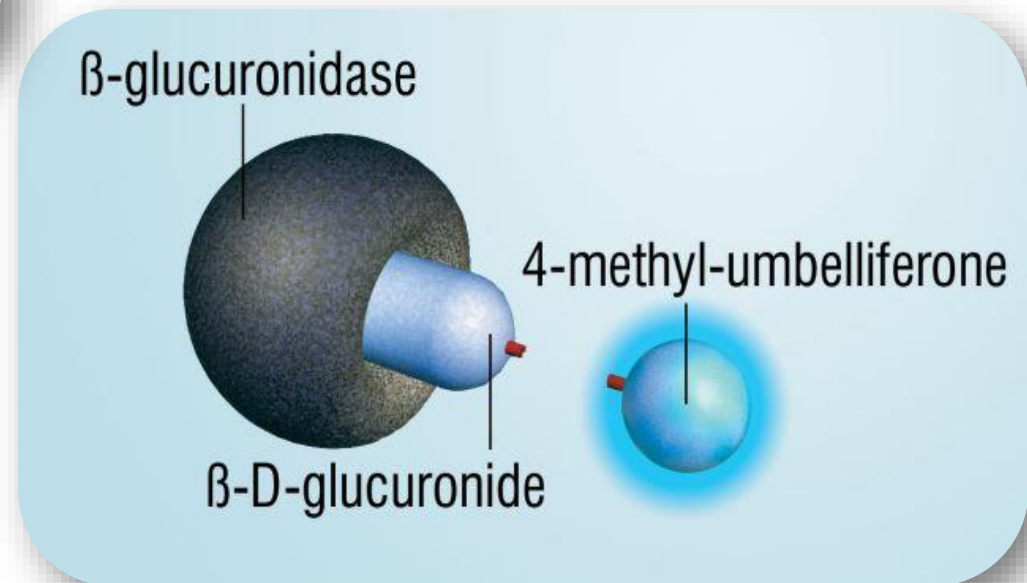
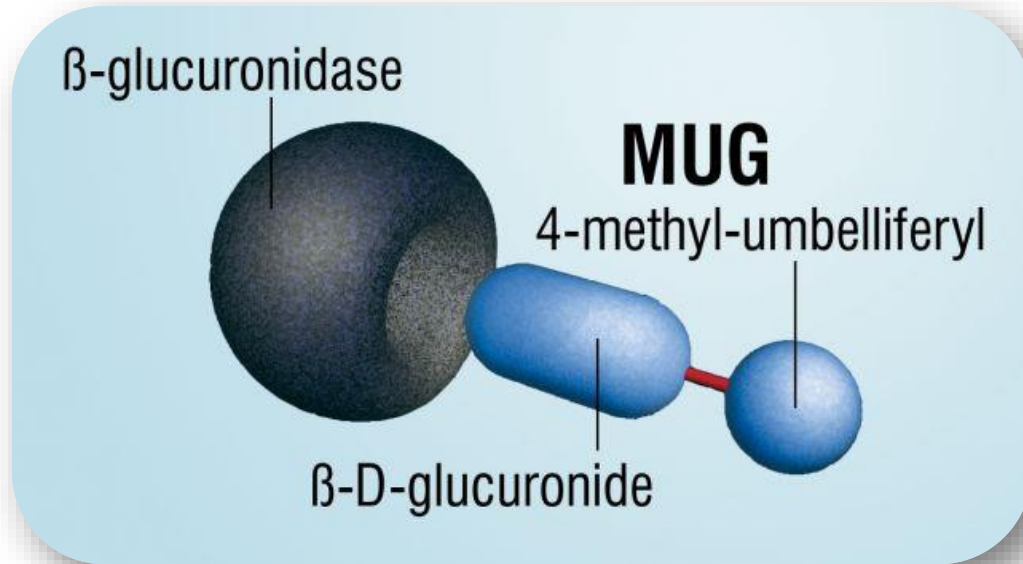
- 24 to 48 hour test
- Store at 2-25°C
- Total Coliform and *E. coli*

- EPA approved, *Standard Methods 9223B*
 - Drinking water
 - Ground water

Colisure: Total coliform



Colisure: *E. coli*



Colisure: Incubation - Total coliform and *E. coli*



Temperature

- Total coliforms/*E.coli*:
 - $35 \pm 0.5^{\circ}\text{C}$

Time

- 24-48 hours

Colisure: Reading Results



Magenta color indicates positive
for Total Coliforms



Fluorescence and magenta color
indicates positive for *E. coli*

Read *E. coli* under 365nm long
wavelength 6 watt UV light

51-Well Quanti-Tray MPN Table

51-Well Quanti-Tray MPN Table

Number of wells giving positive reaction per 100 mL sample	Most Probable Number (MPN)	95% Confidence Limits	
		Lower	Upper
0	<1	0.0	3.7
1	1.0	0.3	5.6
2	2.0	0.6	7.3
3	3.1	1.1	9.0
4	4.2	1.7	10.7
5	5.3	2.3	12.3
6	6.4	3.0	13.9
7	7.5	3.7	15.5
8	8.7	4.5	17.1
9	9.9	5.3	18.8
10	11.1	6.1	20.5
11	12.4	7.0	22.1
12	13.7	7.9	23.9
13	15.0	8.8	25.7
14	16.4	9.8	27.5
15	17.8	10.8	29.4
16	19.2	11.9	31.3
17	20.7	13.0	33.3
18	22.2	14.1	35.2
19	23.8	15.3	37.3
20	25.4	16.5	39.4
21	27.1	17.7	41.6
22	28.8	19.0	43.9
23	30.6	20.4	46.3
24	32.4	21.8	48.7
25	34.4	23.3	51.2
26	36.4	24.7	53.9
27	38.4	26.4	56.6
28	40.6	28.0	59.5
29	42.9	29.7	62.5
30	45.3	31.5	65.6
31	47.8	33.4	69.0
32	50.4	35.4	72.5
33	53.1	37.5	76.2
34	56.0	39.7	80.1
35	59.1	42.0	84.4
36	62.4	44.6	88.8
37	65.9	47.2	93.7
38	69.7	50.0	99.0
39	73.8	53.1	104.8
40	78.2	56.4	111.2
41	83.1	59.9	118.3
42	88.5	63.9	126.2
43	94.5	68.2	135.4
44	101.3	73.1	146.0
45	109.1	78.6	158.7
46	118.4	85.0	174.5
47	129.8	92.7	195.0
48	144.5	102.3	224.1
49	165.2	115.2	272.2
50	200.5	135.8	387.6
51	> 200.5	146.1	infinite

Number of wells giving positive reaction per 100 mL sample	Most Probable Number (MPN)	95% Confidence Limits	
		Lower	Upper
0	<1	0.0	3.7
1	1.0	0.3	5.6
2	2.0	0.6	7.3
3	3.1	1.1	9.0
4	4.2	1.7	10.7
5	5.3	2.3	12.3

Example:

- Positive Wells: 4
- MPN: 4.2

Quanti-Tray / 2000 MPN Table

IDEXX Quanti-Tray®/2000 MPN Table

# Large Wells Positive	# Small Wells Positive															
	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
0	25.3	26.4	27.4	28.4	29.5	30.5	31.5	32.6	33.6	34.7	35.7	36.8	37.8	38.8	39.8	40.8
1	26.6	27.7	28.7	29.8	30.8	31.9	32.9	34.0	35.0	36.1	37.2	38.2	39.3	40.3	41.3	42.3
2	27.9	29.0	30.0	31.1	32.2	33.2	34.3	35.4	36.5	37.5	38.6	39.7	40.8	41.8	42.8	43.8
3	29.3	30.4	31.4	32.5	33.6	34.7	35.8	36.8	37.9	39.0	40.1	41.2	42.3	43.3	44.3	45.3
4	30.7	31.8	32.8	33.9	35.0	36.1	37.2	38.3	39.4	40.5	41.6	42.8	43.9	45.0	46.0	47.0
5	32.1	33.2	34.3	35.4	36.5	37.6	38.7	39.9	41.0	42.1	43.2	44.4	45.5	46.6	47.7	48.7
6	33.5	34.7	35.8	36.9	38.0	39.2	40.3	41.4	42.6	43.7	44.8	46.0	47.1	48.2	49.3	50.3
7	35.0	36.2	37.3	38.4	39.6	40.7	41.9	43.0	44.2	45.3	46.5	47.7	48.8	50.0	51.1	52.1
8	36.6	37.7	38.9	40.0	41.2	42.3	43.5	44.7	45.9	47.0	48.2	49.4	50.6	51.7	52.8	53.8
9	38.1	39.3	40.5	41.6	42.8	44.0	45.2	46.4	47.6	48.8	50.0	51.2	52.4	53.5	54.6	55.6
10	39.7	40.9	42.1	43.3	44.5	45.7	46.9	48.1	49.3	50.6	51.8	53.0	54.2	55.3	56.4	57.4
11	41.4	42.6	43.8	45.0	46.3	47.5	48.7	49.9	51.2	52.4	53.7	54.9	56.1	57.2	58.3	59.3
12	43.1	44.3	45.6	46.8	48.1	49.3	50.6	51.8	53.1	54.3	55.6	56.8	58.0	59.1	60.2	61.2
13	44.9	46.1	47.4	48.6	49.9	51.2	52.5	53.7	55.0	56.3	57.6	58.9	60.2	61.3	62.3	63.3
14	46.7	48.0	49.3	50.5	51.8	53.1	54.4	55.7	57.0	58.3	59.6	60.9	62.3	63.4	64.4	65.4
15	48.6	49.9	51.2	52.5	53.8	55.1	56.4	57.8	59.1	60.4	61.8	63.1	64.5	65.6	66.6	67.6
16	50.5	51.8	53.2	54.5	55.8	57.2	58.5	59.9	61.2	62.6	64.0	65.3	66.7	67.8	68.8	69.8
17	52.5	53.9	55.2	56.6	58.0	59.3	60.7	62.1	63.5	64.9	66.3	67.7	69.0	70.1	71.1	72.1
18	54.6	56.0	57.4	58.8	60.2	61.6	63.0	64.4	65.8	67.2	68.6	70.1	71.5	72.6	73.6	74.6
19	56.8	58.2	59.6	61.0	62.4	63.9	65.3	66.8	68.2	69.7	71.1	72.6	74.1	75.2	76.2	77.2
20	59.0	60.4	61.9	63.3	64.8	66.3	67.7	69.2	70.7	72.2	73.7	75.2	76.7	77.8	78.8	79.8
21	61.3	62.8	64.3	65.8	67.3	68.8	70.3	71.8	73.3	74.9	76.4	77.9	79.5	80.6	81.6	82.6
22	63.8	65.3	66.8	68.3	69.8	71.4	72.9	74.5	76.1	77.6	79.2	80.8	82.4	83.5	84.5	85.5
23	66.3	67.8	69.4	71.0	72.5	74.1	75.7	77.3	78.9	80.5	82.2	83.8	85.4	86.5	87.5	88.5
24	68.9	70.5	72.1	73.7	75.3	77.0	78.6	80.3	81.9	83.6	85.2	86.9	88.6	89.7	90.7	91.7
25	71.7	73.3	75.0	76.6	78.3	80.0	81.7	83.3	85.1	86.8	88.5	90.2	92.0	93.1	94.1	95.1
26	74.6	76.3	78.0	79.7	81.4	83.1	84.8	86.6	88.4	90.1	91.9	93.7	95.5	96.6	97.6	98.6
27	77.6	79.4	81.1	82.9	84.6	86.4	88.2	90.0	91.9	93.7	95.5	97.4	99.3	100.4	101.4	102.4
28	80.8	82.6	84.4	86.3	88.1	89.9	91.8	93.7	95.6	97.5	99.4	101.3	103.3	104.4	105.4	106.4
29	84.2	86.1	87.9	89.8	91.7	93.7	95.6	97.5	99.5	101.5	103.5	105.5	107.5	108.6	109.6	110.6
30	87.8	89.7	91.7	93.6	95.6	97.6	99.6	101.6	103.7	105.7	107.8	109.9	112.0	113.1	114.1	115.1
31	91.6	93.6	95.6	97.7	99.7	101.8	103.9	106.0	108.2	110.3	112.5	114.7	116.9	118.0	119.0	120.0
32	95.7	97.8	99.9	102.0	104.2	106.3	108.5	110.7	113.0	115.2	117.5	119.8	122.1	123.2	124.2	125.2
33	100.0	102.2	104.4	106.6	108.9	111.2	113.5	115.8	118.2	120.5	122.9	125.4	127.8	128.9	129.9	130.9
34	104.7	107.0	109.3	111.7	114.0	116.4	118.9	121.3	123.8	126.3	128.8	131.4	134.0	135.1	136.1	137.1
35	109.7	112.2	114.6	117.1	119.6	122.2	124.7	127.3	129.9	132.6	135.3	138.0	140.8	141.9	142.9	143.9
36	115.2	117.8	120.4	123.0	125.7	128.4	131.1	133.9	136.7	139.5	142.4	145.3	148.3	149.4	150.4	151.4
37	121.3	124.0	126.8	129.6	132.4	135.3	138.2	141.2	144.2	147.3	150.3	153.5	156.7	157.8	158.8	159.8
38	127.9	130.8	133.8	136.8	139.9	143.0	146.2	149.4	152.6	155.9	159.2	162.6	166.1	167.2	168.2	169.2
39	135.3	138.5	141.7	145.0	148.3	151.7	155.1	158.6	162.1	165.7	169.4	173.1	176.9	178.0	179.0	180.0
40	143.7	147.1	150.6	154.2	157.8	161.5	165.3	169.1	173.0	177.0	181.1	185.2	189.4	190.5	191.5	192.5
41	153.2	157.0	160.9	164.8	168.9	173.0	177.2	181.5	185.8	190.3	194.8	199.5	204.2	205.3	206.3	207.3
42	164.3	168.6	172.9	177.3	181.9	186.5	191.3	196.1	201.1	206.2	211.4	216.7	222.2	223.3	224.3	225.3
43	177.5	182.3	187.3	192.4	197.6	202.9	208.4	214.0	219.8	225.8	231.8	238.1	244.5	245.6	246.6	247.6
44	193.6	199.3	205.1	211.0	217.2	223.5	230.0	236.7	243.6	250.8	258.1	265.6	273.3	274.4	275.4	276.4
45	214.1	220.9	227.9	235.2	242.7	250.4	258.4	266.7	275.3	284.1	293.3	302.6	312.3	313.4	314.4	315.4
46	241.5	250.0	258.9	268.2	277.8	287.8	298.1	308.8	319.9	331.4	343.3	355.5	368.1	369.2	370.2	371.2
47	280.9	292.4	304.4	316.9	330.0	343.6	357.8	372.5	387.7	403.4	419.8	436.6	454.1	455.2	456.2	457.2
48	344.1	360.9	378.4	396.8	416.0	436.0	456.9	478.6	501.2	524.7	549.3	574.8	601.5	602.6	603.6	604.6
49	461.1	488.4	517.2	547.5	579.4	613.1	648.8	686.7	727.0	770.1	816.4	866.4	920.8	921.9	922.9	923.9

41	153.2	157.0	160.9	164.8	168.9	173.0	177.2
42	164.3	168.6	172.9	177.3	181.9	186.5	191.3
43	177.5	182.3	187.3	192.4	197.6	202.9	208.4
44	193.6	199.3	205.1	211.0	217.2	223.5	230.0
45	214.1	220.9	227.9	235.2	242.7	250.4	258.4
46	241.5	250.0	258.9	268.2	277.8	287.8	298.1
47	280.9	292.4	304.4	316.9	330.0	343.6	357.8
48	344.1	360.9	378.4	396.8	416.0	436.0	456.9
49	461.1	488.4	517.2	547.5	579.4	613.1	648.8

Example:

- Positive Wells: 48 Large and 25 Small
- MPN: 344.1

MPN vs. CFU

Is there a difference? The simple answer is no!

- It is based on the method used
 - MPN (Most Probable Number) used for bacteria grown in a liquid medium (e.g., Colilert)
 - CFU (Colony Forming Units) used for bacteria grown on a solid medium (e.g., agar)
- It is the label or unit associated with the numerical result
- Reported as MPN/100 mL or CFU /100 mL based on the method used for testing between the 2 reported units
- Both methods have a lower and upper 95% confidence limit

Quanti-Tray- Dilutions

- The Quanti-Tray system reduces the needs for dilutions due to the increased counting range
- If the expected MPN value is greater than 200/100mL or 2419/100mL, the sample can be diluted prior to addition of reagent
- Sample is diluted with sterile DI water (diluent)
- Reagent is added to the diluted sample

- Dilution examples that can be done:
 - 1:1 dilution = 50 ml of sample + 50 mL of diluent
 - 1:10 dilution = 10 mL of sample + 90 mL of diluent



Quality Control

Quality Controls

- Positive & negative control with each new reagent
 - National collection type strains (i.e. ATCC)
 - IDEXX offers QC product for total coliform / *E. coli* and fecal coliform

Test	Code	Contents	Bacteria
Total Coliforms- <i>E. coli</i>	WQC-TEC	3 each	<i>E. coli</i> <i>K. variicola</i> <i>P. aeruginosa</i>
Fecal Coliforms	WQC-FC	3 each	<i>E. coli</i> <i>P. aeruginosa</i>

IDEXX Certificates of Analysis

- Important to have a copy for your records and audits
- Obtain a C of A for all our products from our website
 - <https://www.idexx.com/en/water/resources/certificates-analysis-water/>
 - Indicates all the testing performed for the specific product and lot
 - All products are under quarantined until the batch records are reviewed and approved by QA
 - Once approved by QA, the specific product and lot is released for distribution
- ISO Certification for: 9001,17025, and 14001

QC Certificates

QUALITY CONTROL CERTIFICATE

Product and Company Contact Information
 Product Catalog Number: WP020I-18
 Part Number: 98-08876-00
 Lot Number: TEST123



Technical Support Inquiries:
 1-207-556-4496
 1-800-321-0207 (US/CAN)
 00-800-4339-9111 (Europe)
 Email: water@idexx.com

Physical Properties
 Powder Appearance** White to off-white, free flowing
 pH Tested for pH range 7.0 - 7.6.

Product Performance
Coliforms and E. coli
 Representative samples of this lot have been tested with the following methods at 30.0°C with reads at 18 hours for target organisms and 22 hours for non-target organisms. Quantitative testing is performed on spread plate counts using Tryptic Soy Agar with or without 0.5% sodium thiosulfate. The passing range is ≥ 0.5 to ≤ 1.4 (i.e. greater than or equal to 0.5 and less than or equal to 1.4).
 Note: Testing performed in accordance with ISO 11133:2013

Target Bacteria	P/A Result
<i>Escherichia coli</i> ATCC 25922 / WDCM 00013 ATCC 11775 / WDCM 00090	Yellow color change and positive fluorescence \geq control
<i>Klebsiella pneumoniae</i> ATCC 31488 / WDCM 00206	Yellow color change and no fluorescence
<i>Enterobacter aerogenes</i> ATCC 13048 / WDCM 00175	Yellow color change and no fluorescence
Non-Target Bacteria	P/A Result
<i>Pseudomonas aeruginosa</i> ATCC 10145 / WDCM 00024	No color change, no fluorescence

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 **Parameter does not fall under the IDEXX ISO/IEC 17025:2005 certification.



 IDEXX Water Quality
 ISO 17025
Testing Laboratory
 Accreditation #AT-1931

QUALITY CONTROL CERTIFICATE

Product and Company Contact Information
 Product Catalog Number: WP020I-18
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 1-800-321-0207 (US/CAN)
 00-800-4339-9111 (Europe)
 Email: water@idexx.com

Fecal Coliforms**
 Representative Quanti-tray samples of this lot have been tested with reads at 18 hours for target organisms and 22 hours for non-target organisms. Quantitative testing is performed on spread plate counts using Tryptic Soy Agar with or without 0.5% sodium thiosulfate. The passing range is ≥ 0.5 to ≤ 1.4 (i.e. greater than or equal to 0.5 and less than or equal to 1.4).
 Note: Testing performed in accordance with ISO 11133:2013



Target Bacteria	Result
<i>Escherichia coli</i> ATCC 11775 / WDCM 00090	Yellow color change
Non-Target Bacteria	Result
<i>Pseudomonas aeruginosa</i> ATCC 10145 / WDCM 00024	No color change

Coliform-free
 Lot has been tested and found to be coliform-free after irradiation.

**This product was performance tested and has met all quality control specifications required for release.
 This information is released by IDEXX Quality Assurance:**
 Name: Tom Bannen, Sr. Quality Assurance Specialist

Signature: 
 Date: June 12, 2015

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 ISO 17025
Testing Laboratory
 Accreditation #AT-1931

QUALITY CONTROL CERTIFICATE

120mL Sterile

Product and Company Contact Information
 Product Catalog Number: WV120SBST-200
 Part Number: 98-09221-00

Technical Support Inquiries:
 1-207-556-4496
 1-800-321-0207 (US/CAN)
 00-800-4339-9111 (Europe)
 Email: water@idexx.com

Physical Properties
Fill Line Accuracy
 Lot has been tested and found to be within $\pm 2\%$.


Sterility
 Lot has been tested and found to be sterile in accordance with assurance level. No growth after 48 hours incubation at 35°C \pm 0.5°C with sterile Tryptic Soy Broth.

Appearance
 Absence of non-sterile particles.



Sodium Thiosulfate Content
 Lot is able to be used with methods for thiosulfate content.

Fluorescence Test
 Result: Negative

**This product was performance tested and has met all quality control specifications required for release.
 This information is released by IDEXX Quality Assurance:**
 Name: Lisa Johnson, Sr. Quality Assurance Specialist

Signature: 
 Date: June 01, 2015

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Testing Laboratory
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QUALITY CONTROL CERTIFICATE

Quanti-Tray*/2000

Product and Company Contact Information
 Product Catalog Number: WQT-2K
 Part Number: 98-21675-00

Technical Support Inquiries:
 1-207-556-4496
 1-800-321-0207 (US/CAN)
 00-800-4339-9111 (Europe)
 Email: water@idexx.com

Lot Number: EL014
Expiration date: 12 May 2018

Manufacturer:
 IDEXX Laboratories, Inc.
 One IDEXX Drive
 Westbrook, ME 04092 USA
 Fax: 1-207-556-4630
 idexx.com/water


Physical Properties
Product Sterility: This lot was sterilized with Ethylene Oxide using a process cycle that has been validated in accordance with the standards of ANSI/AAMI/ISO 11135 (2007), Method C (Overkill Method). Biological indicator strips with a minimum population of 1×10^6 spores of *Bacillus atrophaeus* per strip were processed with the lot and tested negative for growth.

No growth after 48 hours incubation at 35°C \pm 0.5°C with sterile Tryptic Soy Broth.



Representative samples of this lot have been tested by IDEXX Laboratories for the following requirements and passed:

- Volume of 96 wells: 98 \pm 2.0 mL.
- Average volume of overflow well: > 10.0 mL.
- Volume ratio large wells to small wells: between 11:1 and 13:1
- Dye Test: sealed with 100 mL dye and checked for absence of leaks
- Seal Integrity: trays sealed with 100 mL water, Colisure*, and anti-foam: wells withstood 18 PSI of pressure without leaking

**This product was performance tested and has met all quality control specifications required for release.
 This information is released by IDEXX Quality Assurance:**
 Name: Lisa Johnson, Sr. Quality Assurance Specialist

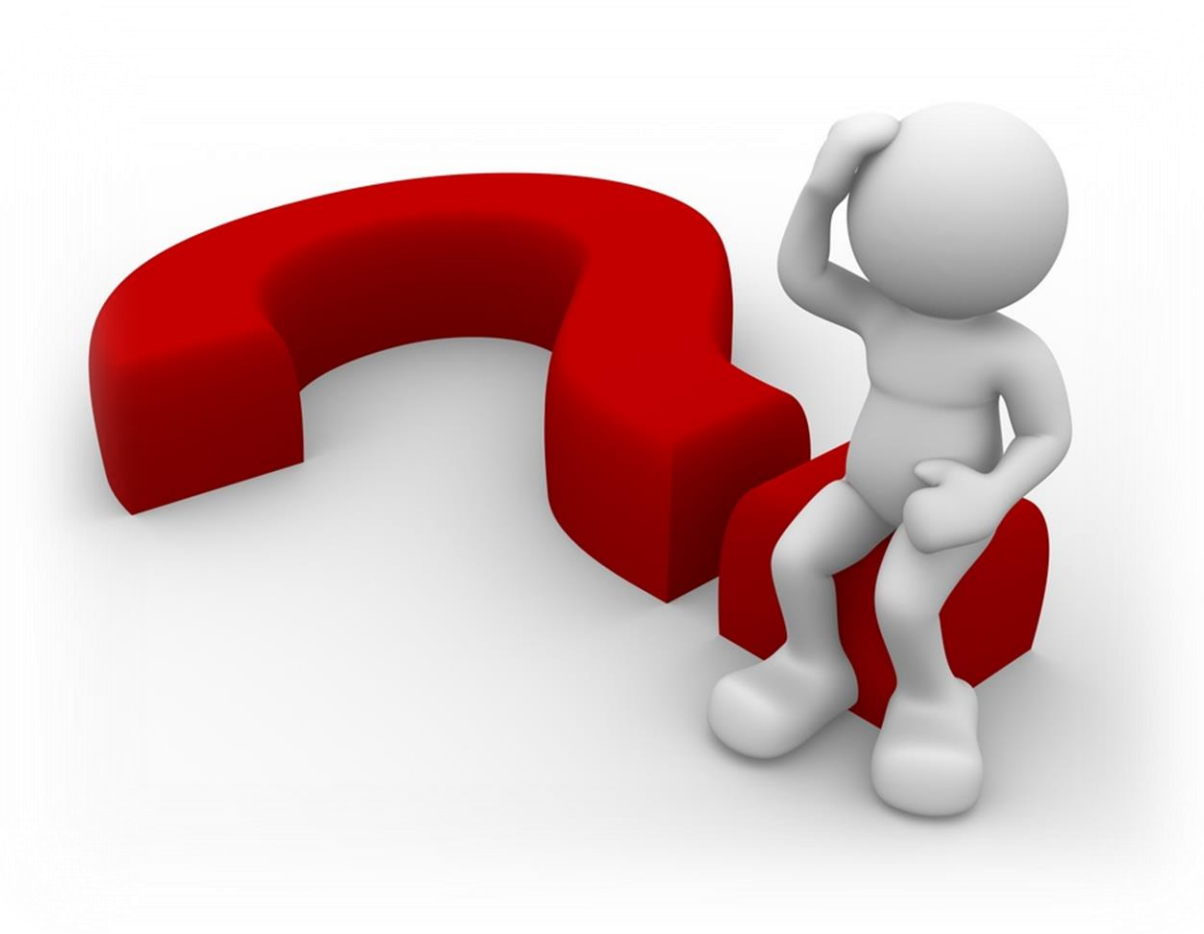
Signature: 
 Date: Monday, June 01, 2015

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Questions





For more information on how IDEXX can streamline your testing contact:

[Boyd Hawkins](#) - Inside Sales Account Manager

1-800-321-0207 ext. 64637

Boyd-Hawkins@IDEXX.com