



# Microgen<sup>®</sup> GnA+B-ID System

An identification system for all currently recognised Enterobacteriaceae and an extensive range of oxidase-positive and negative, Gram negative Bacilli.

## Instructions for Use



**MID-644CE A/B microwell test strips**



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# MICROGEN GN ID

## Quick Reference

	GN A	GN A+B	GN A+B
<b>OXIDASE</b>	<b>NEGATIVE</b>	<b>NEGATIVE</b>	<b>POSITIVE</b>
<b>INOCULUM</b>	1 colony in 3ml saline	1 colony in 5ml saline	1 colony in 5ml saline Add 1 drop sterile horse serum /ml saline if <i>Actinobacillus</i> or <i>Pasteurella spp.</i> suspected.
<b>INOCULATION</b>	3-4 drops (100µl) per well	3-4 drops (100µl) per well	3-4 drops (100µl) per well
<b>OVERLAY WITH OIL</b>	Well 1 – Lysine Well 2 – Ornithine Well 3 – H <sub>2</sub> S Well 9 - Urease	Wells 1, 2, 3 and 9 plus <b>Well 20 – Arabinose</b> Well 24 – Arginine	<b>Wells 1, 2, 3 and 9 plus</b> Well 24 – Arginine
<b>INCUBATION TIME</b>	18 - 24 hours	18 - 24 hours	48 hours
<b>TEMPERATURE</b>	35 - 37°C	35 - 37°C	35 - 37°C (25°C for <i>Ps. fluorescens</i> )
<b>INITIAL READINGS</b>	Well 8: Indole - Add 2 drops Kovac's reagent. Read after 60 seconds	As for GN A	As for GN A Well 7 – record ONPG result. Add 1 drop Nitrate A+1 drop Nitrate B – read after 60 seconds
<b>ADDITION OF REAGENTS</b>	Well 10: VP – Add 1 drop VPI reagent and 1 drop VPII reagent. Read after 15-30mins	Gelatin: Interpret at 24 hours	Gelatin – interpret at 48 hours
<b>FINAL READING (Optional Microgen Software)</b>	Well 12: TDA – Add 1 drop of TDA reagent and read after 60 seconds	Well 24: Arginine - Yellow = Negative Green/Blue = Positive	Well 24: Arginine - Yellow = Negative Blue = Positive

Note: A black circle around the top of a well indicates a well requiring the addition of mineral oil prior to incubation. A broken black circle around a well requires the addition of mineral oil prior to incubation only if the isolate is oxidase negative. A green circle around the top of a well indicates a well requiring addition of reagents after incubation.

## INTENDED USE

The Microgen GN-ID system employs 30 (12xGNA + 12xGNB) standardised biochemical substrates in microwells to identify the family *Enterobacteriaceae* and other non-fastidious gram negative bacilli (oxidase negative and positive). The kit is intended for professional laboratory use only.

## PRINCIPLE OF THE TEST

The Microgen GN-ID system comprises two separate microwell test strips, GNA and GNB. Each Microwell test strip contains 12 standardised biochemical substrates which have been selected on the basis of extensive computer analysis (1) of published databases for the identification of the family *Enterobacteriaceae* and commonly encountered non-fastidious oxidase positive and negative gram negative bacilli (2,3,4,5). The dehydrated substrates in each well are reconstituted with a saline suspension of the organism to be identified. If the individual substrates are metabolised by the organism, a colour change occurs during incubation or after addition of specific reagents (see Substrate Reference Table). The permutation of metabolised substrates can be interpreted using the Microgen Identification System Software (MID-60) to identify the test organism.

The GNA microwell test strip is intended for the identification of oxidase negative, nitrate positive glucose fermenters comprising the most commonly occurring genera of the family *Enterobacteriaceae*. The GNA and GNB microwell test strips are used together to produce a 24 substrate system to identify non-fastidious gram negative bacilli (oxidase negative and positive) in addition to all currently recognised species of the family *Enterobacteriaceae* (28 genera) - see data tables.

The GNB microwell test strip is designed to be used in conjunction with the GNA strip and not on its own.

CONT	KIT PRESENTATION		
GNA/B	MID-644	GN-ID A/B microwell test strip	30 A test strips 30 B test strips

(MID64a) Microwell test strips containing 12 biochemical substrates for identification of GN A organisms - see data tables

(MID65a) Microwell test strips containing 12 biochemical substrates to be used with GN A microwell test strip for identification of GN B organisms - see data tables

Holding frame microwell test strip

Result forms

Instructions for Use

### Additional Requirements:

- a) Microgen Identification System Software (MID-60) - Provides identification based on probability, % probability and likelihood with an analysis of the quality of differentiation. Full definition of these terms is provided with the software Help manual.
- b) Oxidase Strips (6)
- c) Mineral Oil
- d) VP I and VP II Reagents (7)
- e) Nitrate A&B Reagents (8)
- f) TDA Reagent (9)
- g) Kovac's Reagent (10)
- h) Colour chart for reading results – A4 size available from your distributor on request.
- i) Sterile 0.85% saline
- j) Sterile pipettes and bacteriological loops
- k) Incubator, not fan-assisted (35-37°C)
- l) Motility medium
- m) Sterile horse serum (if *Actinobacillus spp.* or *Pasteurella spp.* are suspected)
- n) Bunsen burner.

(To ensure correct colour response Items b-g should be purchased from Microgen Bioproducts Ltd.)

## WARNINGS AND PRECAUTIONS

### Safety:

1. The reagents supplied in this kit are for in vitro diagnostic use only.
2. Appropriate precautions should be taken when handling or disposing of potential pathogens. After use, dispose of all contaminated materials by autoclaving, incineration or immersion in an appropriate disinfectant e.g. sodium hypochlorite at a final concentration of 3% for 30 minutes. Liquid waste containing acid must be neutralised before treatment.

### Procedure:

1. The Microgen GN-ID system should be used according to the kit instructions.
2. The microwell test strips must **not** be incubated in a CO<sub>2</sub> incubator.
3. Due to their more demanding nutritional requirements, *Actinobacillus spp.* and *Pasteurella spp.* will require the addition of some form of enrichment to the inoculum. The addition of 1 drop of sterile inactivated horse serum per mL of sterile saline when preparing the inoculum is recommended.
4. If *Pseudomonas fluorescens* is suspected, the microwell test strips A & B should be incubated at 25°C.
5. Incorrect incubation, inadequate filling of wells, or inadequate inoculum density may give false results.

## STORAGE AND SHELF LIFE

GN A and GN B microwell test strips are stable in unopened foil pouches at 2-8°C until the expiry date on the label. Opened and partially used pouches of microwell test strips can be stored for up to 14 days at 2-8°C provided that the pouch is resealed and contains the desiccant sachets.

## SPECIMENS

A pure 18-24 hour culture of the bacterial isolate to be identified must always be used. An oxidase test must be carried out on the isolate prior to microwell test strip inoculation

## PROCEDURE - INOCULATION AND INCUBATIONS

1. Carry out an oxidase test on the isolate. Oxidase positive organisms can only be identified by inoculating both GN A and GN B microwell test strips.
2. Emulsify a single colony from an 18-24 hour culture in 3mL sterile 0.85% saline for the GN A microwell test strip. If both GN A and GN B microwell test strips are to be inoculated, the colony should be emulsified in 3-5mL sterile 0.85% saline. Mix thoroughly.
3. Carefully peel back the adhesive tape sealing the microwell test strip (s). **Do NOT discard the sealing strip(s) as they will be required later.**
4. Using a sterile pasteur pipette, add 3-4 drops (approximately 100µL) of the bacterial suspension to each well of the microwell test strip(s).
5. As a purity check, transfer 1 drop of the bacterial suspension on to a purity plate using a non-selective differential medium. Incubate the plate aerobically at 35-37°C for 18-24 hours.
6. After inoculation, overlay wells 1, 2, 3 and 9 (GN A microwell test strip counting from the tabbed end) and wells 20 and 24 (GN B microwell test strip - well 13 is at the tabbed end) with 3-4 drops of mineral oil. **(NB Do NOT overlay well 20 if isolate is oxidase positive).**
7. These wells are highlighted with a black circle (broken black circle in the case of well 20) around the well to assist in decision making in respect of oil overlays.
8. Seal the top of the microwell test strip (s) with the adhesive tape removed earlier and incubate at 35-37°C. **Ensure that the punctures in the adhesive tape are over wells 7, 11 and 12 in the GN A strip and over well 14 in the GN B strip.**
9. The GN A and GN B microwell test strips are read after 18-24 hours incubation for *Enterobacteriaceae*, and after 48 hours for oxidase positive isolates.

## PROCEDURE - READING AND ADDITION OF REAGENTS

### GN A Strip

1. Remove the adhesive tape and record all positive reactions with the aid of the colour chart (included in this booklet). Record the results on the forms provided.
2. Add the appropriate reagents to the following microwells:

- a) Add 2 drops of Kovac's reagent to well 8. Read and record the results after 60 seconds. Formation of a red colour indicates a positive result.
  - b) Add 1 drop of VP I reagent and 1 drop of VP II reagent to well 10 and read after 15-30 minutes. Formation of a deep pink/red colour indicates a positive result.
  - c) Add 1 drop of TDA reagent to well 12 and read after 60 seconds. Formation of a cherry red colour indicates a positive result.
3. For oxidase positive organisms, perform the nitrate reduction test on well 7 after reading and recording the ONPG result. Add 1 drop of Nitrate A reagent and 1 drop of Nitrate B reagent to the well and read after 60 seconds. The development of a red colour indicates that nitrate has been reduced to nitrite. If well 7 remains yellow or colourless after addition of nitrate reagents, add a small amount of zinc powder. This will indicate whether nitrate has been completely reduced to nitrogen gas.
- i.e. After addition of Nitrate A + B:
    - Red = Positive
    - Colourless/Yellow = Negative
- After addition of zinc powder:
- Colourless/Yellow = Positive
  - Red = Negative
4. Record these additional results on the forms provided.

### GN B Strip

1. Remove the adhesive tape and record all positive reactions with the aid of the colour chart. Record the results on the forms provided.
2. Read specific well as follows:
  - a) the gelatin well (13) must be read after 18-24 hours for *Enterobacteriaceae* and after 48 hours for oxidase positive isolates. A positive gelatin liquefaction result is indicated by black particles visible throughout the well.
  - b) The arginine well is interpreted differently after 24 hours and 48 hours incubations:
    - 24 hours (*Enterobacteriaceae*)
      - Yellow = Negative
      - Green/Blue = Positive
    - 48 hours (Oxidase positive organisms)
      - Yellow/Green = Negative
      - Blue = Positive

### IDENTIFICATION

On the Microgen GN-ID A+B Report Form, the substrates have been organised into triplets (sets of 3 reactions) with each substrate assigned a numerical value (1, 2 or 4). The sum of the positive reactions for each triplet forms a single digit of the Octal Code that is used to determine the identity of the isolate. The Octal Code is entered into the Microgen Identification System Software (MID-60), which generates a report of the five most likely organisms in the selected database.

The software provides an identification based on probability, % probability and likelihood with an analysis of the quality of differentiation. Full definition of these terms and an explanation of their usefulness in interpretation is provided with the software Help manual.

Note: For oxidase positive organisms (miscellaneous gram negative bacilli):

- Record weak reactions as negative
- The results for oxidase, nitrate reduction and motility must be included to form a 9 digit Octal Code

### Example of Report Form

GN-ID A+B PANEL REPORT FORM			MICROGEN BIOPRODUCTS																		
Lab. No:		Specimen Type:																			
		Date:																			
Reference		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Reaction	Oxidase	Indole	VP I	VP II	ONPG	DNase	Starch	Urease	Arginine	Lysozyme	TDA	TPA	TPA	TPA	TPA	TPA	TPA	TPA	TPA	TPA	TPA
Result	4	2	1	4	2	1	4	2	1	4	2	1	4	2	1	4	2	1	4	2	1
Reaction profile	4	2	1	4	2	1	4	2	1	4	2	1	4	2	1	4	2	1	4	2	1
Sum of positive reactions	4	2	1	4	2	1	4	2	1	4	2	1	4	2	1	4	2	1	4	2	1
Octal Code																					
Final identification																					

**Important:**

The Microgen GN-ID A microwell test strip will generate a 4 digit Octal Code.

The Microgen GN-ID A+B microwell test strips will generate an 8 digit Octal Code.

The Microgen GN-ID A+B microwell test strips will generate a 9 digit Octal Code for oxidase positive isolates

**LIMITATIONS OF USE**

1. Results should be interpreted in the context of all available laboratory information.
2. The Microgen ID system is intended for identification of those organisms included in the database. It should not be used to identify any other bacteria.
3. Test only pure, single colonies since mixed colonies may give erroneous results.
4. Reactions obtained using Microgen GN-ID may differ from published data obtained using alternative substrate formulations or reagents.
5. Some bacterial strains may have atypical biochemical reactions and may be difficult to identify.
6. Computer generated identification results should be interpreted by suitably trained personnel.
7. When determining the final identification of an isolate, the source of the isolate, gram staining, colonial morphology, additional tests and tests against the suggested identification should be considered.
8. Motility and nitrate tests must be performed on oxidase positive, gram negative bacilli. A 9 digit Octal Code is required to interpret the results using the Microgen Identification System Software.
9. The GN-ID A microwell test strip may not be able to differentiate accurately between *Klebsiella* spp, *Enterobacter* spp and *Serratia* spp. Species within these three genera may be differentiated by using GN-ID A+B. Alternatively, additional tests such as motility and DNase tests can be used.
10. The confirmation of *Salmonella* spp and the full identification requires the performance of serotyping. Whenever the Microgen Identification Software suggests an identification of Salmonella, the following additional comment will be displayed: 'Salmonella cannot be fully identified using biochemistry alone. Perform Polyvalent 'O' and 'H' slide agglutination to confirm and serotype.'
11. The full identification of *Shigella* spp requires the performance of serotyping. Whenever the Microgen Identification Software suggests an identification of Shigella, the following additional comment will be displayed: 'Shigella species cannot be identified using biochemistry alone, perform serology to confirm the species type.'
12. If the Glucose reaction is negative for any isolate being identified using the oxidase negative databases, the Microgen Identification Software will display a comment stating: 'Isolate is GLUCOSE NEGATIVE – it is recommended that you check it is not OXIDASE POSITIVE'

**QUALITY CONTROL**

The performance of the Microgen GN-ID system should be monitored using appropriate control strains. The following cultures are recommended for independent laboratory assessment:

*Klebsiella pneumoniae* NCTC 9528

*Acinetobacter baumannii* ATCC 19606

*Proteus mirabilis* ATCC 14153

*Escherichia coli* ATCC 25922

	GNA													GNB												
	L Y S	O R N	H 2 S	G L U	M A N	X Y L	O N P	I N D	U R E	V P	C I T	T D A	N I T	G E L	M A L	I N O	S O R	R H A	S U C	L A C	A R A	A D O	R A F	S A L	A R G	
<i>K.pneumoniae</i> NCTC 9528	+	-	-	+	+	+	+	-	+	+	+	-	+	-	+	+	+	+	+	+	+	+	+	+	-	
<i>A.baumannii</i> ATCC 19606	-	-	-	+	-	+	-	-	-	-	+	-	-	-	+	-	-	-	-	-	+	-	-	-	-	
<i>P.mirabilis</i> NCIMB 13283	-	+	+	+	-	+	-	-	+	-	+	+	-	+	-	-	-	-	-	-	-	-	-	-	-	
<i>E.coli</i> ATCC 25922	+	+	-	+	+	+	+	+	-	-	-	-	+	-	-	-	+	+	-	+	+	-	-	-	-	

## DATABASE

The Microgen GN-ID systems are based on standard biochemical testing methods. The data provided for interpretation of reaction profiles is based on established literature sources <sup>(2,3,4)</sup>.

## PERFORMANCE CHARACTERISTICS

Microgen GN-ID A (MID-64) has been evaluated in comparison with two well-established commercially available products for identification of cultured bacterial isolates. 197 fully characterised strains of *Enterobacteriaceae* were tested with all three products.

Organism	Total number	Microgen GN A	Comm. Test 1	Comm. Test 2
<i>E. coli</i>	43	43	43	43
<i>Shigella spp</i>	4	4	4	4
<i>S. sonnei</i>	3	3	3	3
<i>K. Pneumoniae</i>	13	13	13	13
<i>K. oxytoca</i>	11	11	11	11
<i>E. cloacae</i>	8	7*	8	0**
<i>E. aerogenes</i>	3	3	3	1 <sup>+</sup>
<i>S. marcescens</i>	2	2	2	2
<i>C. freundii</i>	9	9	9	8 <sup>++</sup>
<i>C. diversus</i>	2	2	2	2
<i>H. alvei</i>	1	1	1	1
<i>P. mirabilis</i>	11	11	11	11
<i>P. vulgaris</i>	2	2	2	2
<i>P. stuartii</i>	2	2	2	2
<i>Salmonella spp</i>	83	83	83	83
<b>Total correctly identified</b>	197	196	197	186

\*1 strain was identified as *E. cloacae* with Microgen GN A but as *E. gergoviae* by commercial test 1. However, *E. gergoviae* is not included in the Microgen GN A database; (it is included in the extended Microgen GN A+B database). As this isolate was identified to the correct genus, it was considered that Microgen GN A was equivalent to commercial test 1.

\*\*6 strains identified by commercial test 2 as *C. diversus*, 1 strain as *S. liquefaciens*, 1 strain as *K. ozaneae*.

+2 strains identified by commercial test 2 as *K. liquefaciens*

++1 strain identified by commercial test 2 as *K. ozaneae*

Microgen GN-ID A+B (MID-64 & 65) has been evaluated in comparison with two well-established commercially available products. 190 fully characterised strains of *Enterobacteriaceae* were tested with all three products.

Organism	Total number	Microgen GN A+B	Comm. Test 1	Comm. Test 2
<i>E. coli</i>	43	43	43	43
<i>Shigella spp</i>	3	3	3	3
<i>S. sonnei</i>	4	4	4	4
<i>K. pneumoniae</i>	12	12	12	12
<i>K. oxytoca</i>	2	2	2	2
<i>K. terrigena</i>	1	1	0*	1
<i>E. cloacae</i>	9	9	9	8**
<i>E. aerogenes</i>	3	3	3	1***
<i>S. marcescens</i>	4	4	4	4
<i>C. freundii</i>	2	2	2	2
<i>C. youngae</i>	4	4	0 <sup>+</sup>	4
<i>C. brakki</i>	2	2	2	2
<i>C. amalonaticus</i>	1	1	1	1
<i>H. alvei</i>	2	2	2	1 <sup>++</sup>
<i>P. mirabilis</i>	11	11	11	11
<i>P. vulgaris</i>	2	2	2	2
<i>P. stuartii</i>	2	2	2	2
<i>Salmonella spp</i>	83	83	83	83
<b>Total correctly identified</b>	190	190	185	186

- \* 1 isolate of *K. terrigena* mis-identified as *K. pneumoniae* by Commercial Test 1  
 \*\* 1 isolate of *E. cloacae* mis-identified as *K. pneumoniae* by Commercial Test 2  
 \*\*\* 2 isolates of *E. aerogenes* mis-identified as *S. fonticola* by Commercial Test 2  
 \* All 4 isolates of *C. youngae* not identified by Commercial Test 1  
 \*\* 1 isolate of *H. aizei* mis-identified as *Y. ruckeri* by Commercial Test 2

## REPRODUCIBILITY

**Intra-batch:** A panel of seven bacterial cultures was tested using three batches of GN A and 1 batch of GN B. Each batch of product was used on 3 occasions using a different operator on each occasion. Test results obtained by the three operators correlated very closely giving an overall intra-assay reproducibility of >99%.

**Inter-batch:** Three batches of GN A and two batches of GN B were tested using a panel of seven bacterial cultures. This gave an overall inter-batch reproducibility of >99%.

## REFERENCES

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## TECHNICAL SUPPORT

For all Technical Issues Contact Microgen Bioproducts  
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## SUBSTRATE REFERENCE TABLE

Well	Reaction	Description	Positive	Negative
1	Lysine	Lysine decarboxylase - Bromothymol blue changes to green/blue indicating the production of the amine cadaverine.	Green / Blue	Yellow
2	Ornithine	Ornithine decarboxylase - Bromothymol blue changes to blue indicating the production of the amine putrescine.	Blue	Yellow / Green
3	H <sub>2</sub> S	H <sub>2</sub> S production - Thiosulphate is reduced to H <sub>2</sub> S that reacts with ferric salts producing a black precipitate.	Brown/ Black	Straw
4	Glucose	Fermentation - Bromothymol blue changes from blue to yellow as a result of acid produced from the carbohydrate fermentation.	Yellow	Blue / Green
5	Mannitol			
6	Xylose			
7	ONPG	Hydrolysis - ONPG hydrolysis by B-galactosidase results in the production of yellow ortho-nitrophenol.	Yellow	Colourless
7a	NITRATE (for oxidase Positive organisms)	Reduction of Nitrate to Nitrite is indicated by the formation of a red colour on addition of Nitrate A and B Reagents	Red	Colourless /yellow
7b	NITRATE (for oxidase positive organisms)	If nitrate has been completely reduced to Nitrogen, 7a will remain colourless/yellow – addition of zinc powder will confirm complete reduction	Colourless/ yellow	Red
8	Indole	Indole is produced from tryptophan and gives a pink/red complex when Kovac's reagent is added.	Pink / Red	Colourless
9	Urease	Hydrolysis of urea results in the formation of ammonia leading to an increase in pH which turns phenol red from yellow to pink / red.	V. Deep Pink	Straw to pale salmon pink colour
10	VP	Acetoin production from glucose is detected by the formation of a pink / red complex after the addition of alpha naphthol and creatine in the presence of KOH.	Deep Pink / Red	Colourless to Pale Pink
11	Citrate	Utilisation of citrate (only carbon source) leading to a pH increase giving a colour change in bromothymol blue from green to blue.	Blue	Yellow/ Green
12	TDA	Indole pyruvic acid is produced from tryptophan by tryptophan deaminase giving a cherry red colour when ferric ions are added. Indole positive isolates may give a brown colour – this is a negative result.	Cherry red	Straw colour
13	Gelatin	Proteolytic enzymes liquefy gelatin resulting in black particles being dispersed throughout the well.	Black	Colourless
14	Malonate	Inhibition of the conversion of succinic acid to fumaric acid occurs when sodium malonate is the only source of carbon. An isolate incapable of using this substrate results in the accumulation of succinic acid and the organism does not grow. A positive reaction is the result of the use of sodium malonate at the same time that ammonium sulphate is used as the nitrogen source giving sodium hydroxide which increases the alkalinity giving a blue colour.	Blue	Yellow
15	Inositol	Fermentation - Bromothymol blue changes from blue to yellow as a result of acid produced from the carbohydrate fermentation.	Yellow	Blue
16	Sorbitol			
17	Rhamnose			
18	Sucrose			
19	Lactose			
20	Arabinose			
21	Adonitol			
22	Raffinose			
23	Salicin			
24	Arginine	Arginine is converted to ornithine, ammonia and CO <sub>2</sub> by arginine dihydrolase resulting in an increase in pH and a change in colour of the bromothymol blue from green to blue. At 48 hours green reactions are negative.	Green/ Blue Blue	Yellow Yellow / Green

## Species identified using GN A microwell test strip

<i>Acinetobacter baumannii</i>	<i>Shigella sonnei</i> (Group D)	<i>Salmonella cholerae-suis</i>
<i>Acinetobacter lwoffii</i>	<i>Hafnia alvei</i>	<i>Salmonella paratyphi A</i>
<i>Acinetobacter haemolyticus</i>	<i>Klebsiella pneumoniae</i>	<i>Salmonella gallinarum</i>
<i>Citrobacter freundii</i>	<i>Klebsiella oxytoca</i>	<i>Salmonella pullorum</i>
<i>Citrobacter diversus/ koseri</i>	<i>Klebsiella ozaenae</i>	<i>Salmonella arizonae</i>
<i>Edwardsiella tarda</i>	<i>Klebsiella rhinoscleromatis</i>	<i>Serratia marcescens</i>
<i>Enterobacter aerogenes</i>	<i>Morganella morganii</i>	<i>Serratia liquefaciens</i>
<i>Enterobacter cloacae</i>	<i>Proteus mirabilis</i>	<i>Serratia rubidaea</i>
<i>Pantoea agglomerans</i>	<i>Proteus vulgaris</i>	<i>Yersinia enterocolitica</i>
<i>Enterobacter gergoviae</i>	<i>Providencia rettgeri</i>	
<i>Enterobacter sakazakii</i>	<i>Providencia stuartii</i>	
<i>Escherichia coli</i>	<i>Providencia alcalifaciens</i>	
<i>Escherichia coli</i> – inactive	<i>Salmonella species</i>	
<i>Shigella Serogroups A,B and C</i>	<i>Salmonella typhi</i>	

## Species identified Using the GN A + GN B microwell test strips

In addition to the species listed above, the following species may be identified using the combined GN A + B microwell test strips.

### Oxidase Negative Non Fastidious Gram Negative Bacilli

<i>Acinetobacter baumannii</i>	<i>Enterobacter gergoviae</i>	<i>Moellerella wisconsensis</i>
<i>Acinetobacter lwoffii</i>	<i>Enterobacter sakazakii</i>	<i>Morganella morganii</i>
<i>Acinetobacter haemolyticus</i>	<i>Enterobacteraylorae</i> (cancerogenus)	<i>Morganella morganii ss morganii</i>
<i>Averyella dalhousiensis</i>	<i>Enterobacter amnigenus biogp 1</i>	<i>Morganella morganii biogp 1</i>
<i>Budvicia aquatica</i>	<i>Enterobacter amnigenus biogp 2</i>	<i>Morganella morganii ss Sibonii 1</i>
<i>Buttiauxella agrestis</i>	<i>Enterobacter asburiae</i>	<i>Obesumbacterium proteus biogp 2</i>
<i>Buttiauxella brennerae</i>	<i>Enterobacter hormaechei</i>	<i>Pragia fontium</i>
<i>Buttiauxella ferrugutiae</i>	<i>Enterobacter cancerogenus</i>	<i>Pantoea dispersa</i>
<i>Buttiauxella gaviniae</i>	<i>Enterobacter dissolvens</i>	<i>Pantoea agglomerans</i>
<i>Buttiauxella izardi</i>	<i>Enterobacter nimipressuralis</i>	<i>Photorhabdus luminescens (25C)</i>
<i>Buttiauxella noackiae</i>	<i>Enterobacter pyrinus</i>	<i>Photorhabdus asymbiotica</i>
<i>Buttiauxella wamboldiae</i>	<i>Escherichia coli</i>	<i>Proteus mirabilis</i>
<i>Cedecea davisae</i>	<i>Escherichia coli - inactive</i>	<i>Proteus vulgaris</i>
<i>Cedecea lapagei</i>	<i>Escherichia fergusonii</i>	<i>Proteus penneri</i>
<i>Cedecea neteri</i>	<i>Escherichia hermannii</i>	<i>Proteus myxofaciens</i>
<i>Cedecea sp 3</i>	<i>Escherichia vulneris</i>	<i>Providencia rettgeri</i>
<i>Cedecea sp 5</i>	<i>Escherichia blattae</i>	<i>Providencia stuartii</i>
<i>Citrobacter freundii</i>	<i>Shigella Serogroups A,B,C</i>	<i>Providencia alcalifaciens</i>
<i>Citrobacter diversus/koseri</i>	<i>Shigella sonnei</i> (Group D)	<i>Providencia rustigianii</i>
<i>Citrobacter amalonicus</i>	<i>Ewingella americana</i>	<i>Providencia heimbachae</i>
<i>Citrobacter farmeri</i>	<i>Hafnia alvei</i>	<i>Rahnella aquatilis</i>
<i>Citrobacter youngae</i>	<i>Hafnia alvei biogp 1</i>	<i>Salmonella enterica Group I</i>
<i>Citrobacter braakii</i>	<i>Klebsiella pneumoniae</i>	<i>Salmonella serotype Typhi</i>
<i>Citrobacter werkmanii</i>	<i>Klebsiella oxytoca</i>	<i>Salmonella Cholerae-suis</i>
<i>Citrobacter sedlakii</i>	<i>Klebsiella ornithinolytica</i>	<i>Salmonella Paratyphi A</i>
<i>Citrobacter rodentium</i>	<i>Klebsiella ozaenae</i>	<i>Salmonella gallinarum</i>
<i>Citrobacter gilleni</i>	<i>Klebsiella rhinoscleromatis</i>	<i>Salmonella pullorum</i>
<i>Citrobacter Group 137</i>	<i>Klebsiella terrigena</i>	<i>Salmonella Group II</i>
<i>Edwardsiella tarda</i>	<i>Kluyvera ascorbata</i>	<i>Salmonella Group IIIa</i>
<i>Edwardsiella tarda biogp 1</i>	<i>Kluyvera cryocrescens</i>	<i>Salmonella Group IIIb</i>
<i>Edwardsiella hoshinae</i>	<i>Kluyvera georgiana</i>	<i>Salmonella Group IV</i>
<i>Edwardsiella ictaluri</i>	<i>Kluyvera intermedia</i>	<i>Salmonella bongori (Group V)</i>
<i>Enterobacter aerogenes</i>	<i>Leclercia adecarboxylata</i>	<i>Salmonella Group VI</i>
<i>Enterobacter cloacae</i>	<i>Leminorella grimonitii</i>	<i>Serratia marcescens</i>
<i>Enterobacter agglomerans</i>	<i>Leminorella richardii</i>	<i>Serratia marcescens biogp 1</i>

*Serratia liquefaciens*  
*Serratia rubidaea*  
*Serratia odorifera* biogp 1  
*Serratia odorifera* biogp 2  
*Serratia plymuthica*  
*Serratia ficaria*  
*Serratia entomophila*  
*Serratia fonticola*  
*Tatumella ptyseos*  
*Trabulsiella guamensis*  
*Xenorhabdus nematophilis* (25°C)

*Xanthomonas (Stenotrophomonas)*  
*maltophilia*  
*Yersinia enterocolitica*  
*Yersinia frederiksenii*  
*Yersinia intermedia*  
*Yersinia kristensenii*  
*Yersinia rohdei*  
*Yersinia aldovae*  
*Yersinia bercovieri*  
*Yersinia mollaretii*

*Yersinia pestis*  
*Yersinia pseudotuberculosis*  
*Yersinia ruckeri*  
*Yokenella regensburgi*  
  
*Enteric Gp59*  
*Enteric Gp60*  
*Enteric Gp63*  
*Enteric Gp64*  
*Enteric Gp68*  
*Enteric Gp69*

## Oxidase Positive Non Fastidious Gram Negative Bacilli

*Pseudomonas aeruginosa*  
*Pseudomonas fluorescens*  
25°C  
*Pseudomonas fluorescens*  
37°C  
*Burkholderia cepacia*  
*Pseudomonas putida*  
*Pseudomonas stutzeri*  
*Pseudomonas diminuta*  
*Burkholderia pseudomallei*  
*Shewanella putrefaciens*  
*Alcaligenes faecalis* type 11  
*Alcaligenes faecalis*  
*Alcaligenes xylosoxidans* ss  
*xylos*  
*Actinobacillus* spp.

*Flavobacterium*  
*meningosepticum*  
*Flavobacterium odoratum*  
*Flavobacterium breve*  
*Flavobacterium*  
*oindologenes*  
*Vibrio fluvialis*  
*Vibrio furnissii*  
*Vibrio mimicus*  
*Vibrio vulnificus*  
*Vibrio hollisae*  
*Vibrio cholerae*  
*Vibrio parahaemolyticus*  
*Vibrio alginolyticus*  
*Vibrio cincinnatiensis*

*Vibrio damsela*  
*Vibrio carchariae*  
*Moraxella* spp.  
*Plesiomonas shigelloides*  
*Aeromonas hydrophila*  
*Aeromonas veronii bio*  
*sobria*  
*Aeromonas veronii bio*  
*veronii*  
*Aeromonas caviae*  
*Weeksella virosa*  
*Weeksella zoohelcum*  
*Pasteurella multocida*  
*Pasteurella haemolytica*

## COMMONLY ENCOUNTERED GRAM NEGATIVE DATA TABLE

	LYS	ORN	H2S	GLU	MAN	XYL	ONP	IND	UR	VP	CIT	TDA
<i>Acinetobacter baumannii</i>	60	8	0.1	99.9	0.1	97	0.1	0.1	9	0.1	99.9	0.1
<i>Acinetobacter lwoffii</i>	40	0.1	0.1	6	0.1	0.1	0.1	0.1	3	0.1	0.1	0.1
<i>Acinetobacter haemolyticus</i>	40	0.1	0.1	0.1	0.1	0.1	0.1	0.1	3	0.1	9	0.1
<i>Citrobacter freundii</i>	0.1	0.1	78	99.9	99.9	89	89	33	44	0.1	78	0.1
<i>Citrobacter diversus / koseri</i>	0.1	99	0.1	99.9	99	99.9	99	99	75	0.1	99	0.1
<i>Edwardsiella tarda</i>	99.9	99.9	99.9	99.9	0.1	0.1	0.1	99	0.1	0.1	1	0.1
<i>Enterobacter aerogenes</i>	98	98	0.1	99.9	99.9	99.9	99.9	0.1	2	98	95	0.1
<i>Enterobacter cloacae</i>	0.1	96	0.1	99.9	99.9	99	99	0.1	65	99.9	99.9	0.1
<i>Parvtoea agglomerans</i>	0.1	0.1	0.1	99.9	99.9	93	90	20	20	70	50	20
<i>Enterobacter gergoviae</i>	90	99.9	0.1	99.9	99	99	97	0.1	93	99.9	99	0.1
<i>Enterobacter sakazakii</i>	0.1	91	0.1	99.9	99.9	99.9	99.9	11	1	99.9	99	50
<i>Escherichia coli</i>	85	85	1	99.9	98	95	95	99.9	1	0.1	1	0.1
<i>Escherichia coli</i> - inactive	40	20	1	99.9	93	70	45	80	1	0.1	1	0.1
<i>Shigella</i> Serogroups A,B&C	0.1	1	0.1	99.9	93	2	2	50	0.1	0.1	0.1	0.1
<i>Shigella sonnei</i> (Group D)	0.1	98	0.1	99.9	99	2	90	0.1	0.1	0.1	0.1	0.1
<i>Hafnia alvei</i>	99.9	98	0.1	99.9	99	98	90	0.1	4	85	10	0.1
<i>Klebsiella pneumoniae</i>	98	0.1	0.1	99.9	99	99	99	0.1	95	98	98	0.1
<i>Klebsiella oxytoca</i>	99	0.1	0.1	99.9	99	99.9	99.9	99	90	95	95	1
<i>Klebsiella ozaenae</i>	40	3	0.1	99.9	99.9	95	80	0.1	10	0.1	30	0.1
<i>Klebsiella rhinoscleromatis</i>	0.1	0.1	0.1	99.9	99.9	99.9	0.1	0.1	0.1	0.1	0.1	0.1
<i>Morganella morganii</i>	24	97	0.1	99.9	0.1	0.1	0.1	99	98	0.1	0.1	95
<i>Proteus mirabilis</i>	0.1	99	98	99.9	0.1	98	0.1	2	98	50	65	98
<i>Proteus vulgaris</i>	0.1	0.1	95	99.9	0.1	95	1	98	95	0.1	15	99
<i>Providencia rettgeri</i>	0.1	0.1	0.1	99.9	99.9	10	5	99	98	0.1	95	98
<i>Providencia stuartii</i>	0.1	0.1	0.1	99.9	10	7	10	98	30	0.1	93	95
<i>Providencia alcalifaciens</i>	0.1	1	0.1	99.9	2	1	1	99	0.1	0.1	98	98
<i>Salmonella</i> species	98	97	95	99.9	99.9	97	2	1	1	0.1	95	0.1
<i>Salmonella Typhi</i>	98	0.1	97	99.9	99.9	82	0.1	0.1	0.1	0.1	0.1	0.1
<i>Salmonella Choleraesuis</i>	95	99.9	50	99.9	98	98	0.1	0.1	0.1	0.1	25	0.1
<i>Salmonella Paratyphi A</i>	0.1	95	10	99.9	99.9	0.1	0.1	0.1	0.1	0.1	0.1	0.1
<i>Salmonella Gallinarum</i>	90	1	99.9	99.9	99.9	70	0.1	0.1	0.1	0.1	0.1	0.1
<i>Salmonella Pullorum</i>	99.9	95	90	99.9	99.9	90	0.1	0.1	0.1	0.1	0.1	0.1
<i>Salmonella Arizonae</i>	99	99	99	99.9	99.9	99.9	92	2	0.1	0.1	98	0.1
<i>Serratia marcescens</i>	99	99	0.1	99.9	99	7	95	1	15	98	98	0.1
<i>Serratia liquefaciens</i>	95	95	0.1	99.9	99.9	99.9	93	1	3	93	90	0.1
<i>Serratia rubidaea</i>	55	0.1	0.1	99.9	99.9	99	99.9	0.1	2	99.9	95	0.1
<i>Yersinia enterocolitica</i>	0.1	95	0.1	99.9	98	70	95	50	90	2	0.1	0.1





# OXIDASE POSITIVE DATA TABLE

ORGANISM	OXI	MOT	NIT	LYS	ORN	H2S	GLU	MAN	XYL	ONP	IND	UR	VP	CIT	TDA	GEL	MAL	INO	SOR	RHA	SUC	LAC	ARA	ADO	RAF	SAL	ARG	
<i>Pseudomonas aeruginosa</i>	100	93	85	89	3	0	85	40	81	0	0	56	0	95	0	64	94	0	0	0	0	45	0	0	0	100		
<i>Pseudomonas fluorescens</i> 25°C	100	94	55	46	0	0	78	12	74	0	0	7	0	100	0	50	78	2	7	0	44	0	48	0	0	48		
<i>Pseudomonas fluorescens</i> 37°C	100	94	5	26	0	0	0	7	0	0	0	0	0	63	0	0	41	0	0	0	0	7	0	0	0	74		
<i>Burkholderia cepacia</i>	91	100	5	98	0	0	94	0	25	76	0	30	0	95	5	87	87	12	0	0	48	84	95	3	0	5	0	
<i>Pseudomonas putida</i>	100	100	0	75	0	0	24	0	56	0	0	5	0	95	0	5	53	0	0	0	0	1	1	0	0	95		
<i>Pseudomonas stutzeri</i>	100	100	81	48	0	0	18	18	9	0	0	17	0	72	0	3	33	0	0	0	0	0	0	0	0	14		
<i>Pseudomonas diminuta</i>	100	100	10	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0		
<i>Burkholderia pseudomallei</i>	100	100	90	12	0	0	95	95	51	0	0	39	0	86	0	75	80	95	80	6	70	70	80	56	6	9	85	
<i>Shewanella putrefaciens</i>	100	100	100	80	80	100	0	0	0	0	0	20	0	80	0	80	0	0	0	0	0	0	0	0	0	0		
<i>Alcaligenes faecalis</i> type 11	91	91	40	26	0	0	0	0	0	0	0	0	0	58	0	0	40	0	0	0	0	0	0	0	0	0		
<i>Alcaligenes faecalis</i>	100	80	0	36	9	0	0	0	0	0	0	0	0	100	0	0	1	0	0	0	0	0	0	0	0	0		
<i>Alcaligenes xylosoxidans</i> ss xylos	100	100	100	95	0	0	0	0	0	0	0	0	0	80	0	3	4	0	0	0	0	0	0	0	0	0		
<i>Flavobacterium meningosepticum</i>	100	5	2	0	0	0	0	0	0	45	100	0	0	27	0	79	0	0	0	0	0	3	5	0	0	0		
<i>Flavobacterium odoratum</i>	99	3	0	0	0	0	0	0	0	0	0	100	0	60	0	60	0	0	0	0	0	0	0	0	0	0		
<i>Flavobacterium breve</i>	100	5	1	0	0	0	0	0	0	0	60	2	0	60	0	60	0	0	0	0	0	0	0	0	0	0		
<i>Flavobacterium oindologenes</i>	100	4	31	0	0	0	0	0	0	0	100	0	0	70	0	100	0	0	0	0	0	0	0	0	0	0		
<i>Vibrio fluvialis</i>	100	70	96	0	0	0	100	100	0	42	15	0	0	84	0	79	5	0	0	8	100	0	100	0	0	49	98	
<i>Vibrio furnissii</i>	100	90	98	0	0	0	100	100	0	35	11	0	0	90	0	80	12	0	0	45	100	0	95	0	5	0	95	
<i>Vibrio mimicus</i>	98	100	100	97	92	0	100	80	0	90	94	0	5	90	0	63	0	0	0	0	1	19	1	0	0	0	0	
<i>Vibrio vulnificus</i>	99	99	100	98	93	0	100	43	0	75	95	0	0	75	35	79	0	0	0	0	15	86	0	0	0	95	0	
<i>Vibrio cholerae</i>	100	0	100	0	0	0	100	0	0	0	38	0	0	0	0	0	0	0	0	0	0	0	94	0	0	0	0	
<i>Vibrio cholerae</i>	100	97	99	98	98	0	100	98	0	93	88	0	65	96	0	43	2	0	0	0	100	9	0	0	0	5	0	
<i>Vibrio parahaemolyticus</i>	100	99	100	93	59	0	80	93	10	20	65	0	0	31	0	55	0	0	0	0	0	34	0	0	28	0	0	
<i>Vibrio alginolyticus</i>	100	100	100	90	70	0	50	20	0	10	20	0	70	10	0	30	10	0	0	0	60	0	10	0	10	0	0	
<i>Vibrio cincinnatiensis</i>	100	86	100	57	0	0	100	100	43	86	8	0	0	21	0	0	0	100	0	0	100	0	100	0	0	100	0	
<i>Vibrio damsela</i>	95	25	100	50	0	0	100	0	0	0	0	0	95	0	0	6	0	0	0	0	5	0	93	0	0	0	95	
<i>Vibrio carchariae</i>	100	0	100	100	0	0	50	50	0	0	100	0	50	0	0	0	0	0	0	0	50	0	0	0	0	0	0	
<i>Moraxella</i> spp.	100	0	65	50	50	0	0	0	0	0	0	9	0	50	0	19	2	0	0	0	0	0	0	0	0	0	0	
<i>Plesiomonas shigelloides</i>	97	85	99	95	50	0	100	0	0	94	100	0	0	0	0	5	0	99	0	0	0	40	0	0	0	20	95	
<i>Aeromonas hydrophila</i>	100	100	98	72	1	5	100	96	1	93	99	5	76	26	0	83	1	0	1	9	93	27	62	3	3	65	90	
<i>Aeromonas veronii</i> bio sobria	100	100	100	91	2	0	100	100	0	88	96	0	80	77	0	60	4	1	0	0	88	5	11	2	2	2	98	
<i>Aeromonas veronii</i> bio veronii	100	100	100	91	87	0	100	100	0	88	96	0	80	77	0	60	4	1	0	0	88	5	11	2	2	83	10	
<i>Aeromonas caviae</i>	100	100	100	40	0	1	100	97	2	96	92	0	22	3	0	50	0	0	1	22	100	15	84	0	1	33	84	
<i>Weeksellia virosa</i>	99	0	0	0	0	0	0	0	0	0	0	0	0	80	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Weeksellia zoohelcum</i>	99	0	0	0	0	0	0	0	0	0	20	85	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	
<i>Pasteurella multocida</i>	100	0	45	1	78	0	100	90	34	10	90	3	0	0	0	1	5	84	1	88	9	3	0	1	1	1		
<i>Pasteurella haemolytica</i>	95	0	95	0	0	0	100	90	40	70	0	0	0	0	0	0	0	70	70	0	90	20	5	10	70	0	0	
<i>Actinobacillus</i> spp.	90	0	91	0	0	10	33	27	11	78	0	100	0	0	0	0	5	0	0	5	0	27	27	0	0	33	33	0

Number denotes the percentage of positive strains

## Colour chart/Farbtafel/Tableau 'de couleurs

### Microgen™ GN A ID

WELL/NAFFCHEN /GODET	1	2	3	4	5	6	7	8	9	10	11	12	7
Reaction	Lysine	Ornithine	H <sub>2</sub> S	Glucose	Mannitol	Xylose	O.N.P.G.	Indole	Urease	V.P.	Citrate	T.D.A.	Nitrate
1. Negative													
2. Positive													

### Microgen™ GN B ID

WELL/NAFFCHEN /GODET	13	14	15	16	17	18	19	20	21	22	23	24	24
Reaction	Gelatin	Malonate	Inositol	Sorbitol	Rhamnose	Sucrose	Lactose	Arabinose	Adonitol	Raffinose	Salicin	Arginine 24hrs	Arginine 48hrs
1. Negative													
2. Positive													

**CAUTION:** Keep out of direct sunlight. Due to laminate discolouration and paper ageing, the colours on this chart will change.

These colours are provided as general guide to the range of test colours.

#### Legend:

- Appropriate reagents to be added prior to reading.
- Overlaid with sterile mineral oil.
- Not overlaid with oil for oxidase positive organism.

MICROGEN  
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