Quality-assurance and philosophy

Raw materials

Our company has two levels of controlling the quality of raw materials.
First we test the following properties of each batch of every raw materials: clarity, pH, moisture, toxicity, growth or inhibition properties with several organisms. We use HTS (High Throughput Screening) to test the growth properties (log phase, lag time, growth rate, maximum peak).
Raw materials properties are tested under real application circumstances by incorporation into different culture media, to prove their compatibility with other components, haemolysis patterns, antibiotic resistency, diagnostic properties.

Manufacturing process

All media components are milled to ensure finess and homogenity of the media. The uniqe multifunctional blending machines are able to mix, blend and siev in one process, to meet our customers's requirements, and result ultimate finess. We measure very accuratly each components of each batches into every media and storing all of the details in computer for easy recall.

Quality control of ready to use dry media

We test routinely on every batch is tested routinely for the pH, clarity, gel strength, colour where appropriate and the microbiological properties such as growth characteristics, chemical reactions and colour changes, comparison with previous batch.

The recorded parameters of growth on culture media are:
- *Lag time*
- *Organisms grown from known inoculum*
- *Organisms inhibited from known inoculum*
- *Comparative growth with standard inoculum*
- *Comparative inhibition with standard inoculum*
- *Colory size*
- *Colonial appearance*

For easy recording of the growth properties, the ecometric technique of Mossel is simple and gives numerical readings, both absolute growth index (AG) and relative growth index (RGI) can be obtained. We always show tests data for QC organisms on the Certificate of Analysis.
Determining the productivity ratio of a medium is another way to check its performance related to a control medium. The inoculum used must be the same for both media and the P.R. is calculated by counting the colonies on the test and control media. The method to obtain the P.R. of a medium is using the modified Miles-Misra technique.

For routine testing we are using **ATCC** and **NCTC** organisms. We using the method advised by **NCCLS** to maintain our stock cultures.

Preparation of ready to use media

It is advisable to use only fresh purified water with a conductivity of less that 10 microsiemens. Stored water tends to become acidic because it absorbs atmospheric CO2. Tap water is not recommended because of the potential presence of heavy metal ions which can cause inhibition and precipitation problems. Culture media reactions affected by pH – acidity: bile salts precipitated; H2S reactions depressed; sugar fermentation; antibiotics less active (aminoglycocides, cephalosporins, macrolides). Alkalinity – potentiates amioglycocides; sugar fermentation; antibiotics less active (fusidin, tetracycline, penicillins).

Autoclaving process: There are two important temperatures during the autoclaving. Firstly the total time above 50C° is important because both nutrients and agar will be undergoing a denaturation process. Secondly the total time spent above 100 C° is important, because this is the temperature cause most damage to the mediums perfomance. The aim of effective sterilisation is using minimum necessary heat input in order to ensure maximum lethal rate. This can be obtain from the equation or tables of Stumbo (1973). Using the equation or table (shown below) between 100 C° and 121 C° for both the heating and cooling stages can be converted into an equivalent time at 121 C° . The time is added together and the total time removed from the holding time. The heating and cooling periods of large volumes of media are longer than for small volumes of media. Please refer the table below for correct autovlaving time.

TABLE – Heat penetration times

Heat penetration in an overloaded autoclave will be hampered as will evacuation of air. Ensure sufficient space is left between items in a load to allow free passage of steam. The continuous agitation of a medium during sterilisation greatly shortens the heating and cooling times. Modern modia preparators have this ability which gives them a significant advantage over general purpose autoclaves. The quoted holding times are sufficient to kill clostridial spores but may not be sufficient for heat-resistant spores of *Bacillus stearothermophilus*.
The BPC/MRC recommended holding times are:

Temperature (C) 121 126 134 C°
Time (min.) 15 10 3

Overheating is a common cause of pH drift, darkening, precipitation, poor gel strength and reduced bacteriological performance. All culture media should be in solution before sterilization. Agar media, with pH values at or below 5.0, are very sensitive to overheating in any form because the agar is hydrolysed and the gel strength fails.

Molten media

Molten media should be poured as soon as possible, holding at 47 C° for 4 hours should be the maximum holding time for any medium. If a medium is likely to be allowed to set then re-melted, it is doubly important that holding at 47 C° in a water bath is minimised. Never re-melt an agar more than once. Remelting can decrease the performance of the medium and lower gel strength.
Media should be cooled in a water bath to 47 C° before pouring. Immediately before pouring the medium should be swirled gently to ensure thorough mixing. Plates should contain at least 5 mm of medium if they are to be stored before use to miminise the effects of the drying.
In order to achieve well isolated colonies on agar plates streaked for single colonies, it is necessary to make sure the agar is free from surface moisture by drying, but caution must be taken to ensure over drying does not occur as this can be detrimental to the performance of the agar.
Use water prepared by distillation, deionisation or reverse osmosis. Check the pH of the water, if below 5.5, heat to drive off CO2 and re-check. The conductivity of the water should ideally be below 15 micro siemens (·S) but must be below 50 micro siemens (·S) to avoid precipitation with phosphates present in culture media. Heat-labile supplements should be added to the medium after it has cooled to 50 C°. Blood used for the preparation of blood agar should be as fresh as possible and should have been stored at 2-8 C° (blood must not be frozen). Warm the blood in an incubator to about 35-37 C° before addition to sterile molten agar base, which has been cooled to 40-45 C°.

In practice, proceed as follows:
·Pour the powder in about half the quantitiy of water required for reconstitution.
·Stir slowly and regularly to dissolve the components and homoheneously distribute the agar. The agar should be allowed to seell for 10 minutes before heating.
· Add the remaining quantity of water required to rehydrate the dry medium, rinding the walls of the recipient.

Adjusting the pH:
The pH of media is normally adjusted to the value of utilization.
The values found depend on: the temperature of the medium at the moment of reading.

Agar media are poured in Petri dishes at temperatures not exceeding 50 C° in order to avoid the formation of fine condensation water droplets on the covers. Before surface inoculationm the plates are dried inverted in a 37 C° oven for 20 minutes to 1 hour.

Table of Faults and Possible Causes in Media Sterilization

Fault 1.
Wrong pH value

Possible Causes
pH test carried out above 25 C°.
Overheating through prolonged sterilization, remelting or overlong period at 50 C°.
Incomplete solution of medium.
Poor quality water or containers.
Dehydrated medium stored incorrectly or beyond the stated shelf-life.

Fault 2.
Turbidity, precipitation.

Possible Causes
Poor quality water or containers.
Overheating or prolonged storage at 50 C°.
pH value incorrect.
Incomplete solution.

Fault 3.
Darkening.

Possible Causes
Overheating, incomplete solution or pH drift.

Fault 4.
Soft gel.

Possible Causes
Agar not in solution, poor mixing, prolonged storage at 50 C°.
Overheating at low pH values.
Error in weighing or overdilution with inoculum or media supplements.

Fault 5.
Poor bacterial growth.

Possible Causes
Prolonged and excessive heating, incomplete solution.
Inhibitory substances in water or containers.
Darkening and pH drift.
- Realtive humidity too high
Dehydrated medium solidified in - Recipient left open too long
clumps or in a solid block - Recipient not tightly closed after use
- Shelf life exceeded (expiration)
- Dehydrated medium deteriorated.
- Shelf life exceeded.
- Glassware poorly rinsed, may
contain toxic residues (detergents,
antiseptics, other inhibitors.
- Water for reconstituion improperly
deionized.
- Wrong pH.
Atypucal cultures - Quantities of additives incorrect - Medium ovetheated or remelted
several times.
- Autoclave incorrectly adjusted.
- Pouring temperature too high.
- Medium incubated with an
insufficient quantity of sample.
- Petri dishes insufficiently dried.
- Poor incubation conditions.

Destruction of contaminated media
Cultures in Petri dishes can be destroyed by autoclaving for 1 hour at 120 C° in high melting point plastic bags or by incineration. Autoclave contaminated tubes in the same conditions.

Storage
Dehaydrated media are very hygroscopic and some may contain light-sensitive compounds. They should therefore be stored in a dry place, protected from light and at a temperature between 15 and 30 C°. Bottles or plastic sacks should be tightly closed after each use. The lid on the container should be replaced quickly after media has been taken out and closed tightly to avoid mosituring. Most plates stored medium side up at 4 C° in the dark will have a minimum life of 7 days.This can be extended up to 3-4 weeks for simple nutrient media by using some form of air tihgt packaging. Any medium in an air tight capped container will have a longer shelf life than in a plate. Many simple nutrient media can be stored at 15-20 C° for 3 months in the dark.
Dehydrated media stored unopened under optimal conditions have a shelf life of 3-5 years but once the container is opened the contents should be used within six months.
Keep it in dry, dark place but DO NOT FREEZE!! Keeping in refrigator could cause condensation and lumping and thus decreases the media performance.
When a container is opened for the first time the date should be noted on the container.

User-Laboratory Quality Control Tests on Prepared Media

Each lot/batch of prepared medium should be subjected to a minimal testing programme which will ensure that it is acceptable and will demonstrate a typical bacterial performance.

1 pH value: check that the pH of the prepared medium, when tested in final form at ambient temperature (25 C°) lies within the range given on the product label. The medium should be discarded if the pH value lies outside the specified range.

2 Sterility: a representative sample of each lot/batch of medium should be incubated for 2-5 days at 35-30 C°. As a general rule, for a lot of 100 or less units a 3-5% sample should be tested. For a larger lot, 10 random plates or tubes are taken. There should be no evidence of microbial growth after incubation. Discard all sterility samples when the tests have been completed.

3 Growth :performance: test the growth support properties of the product by inoculating the medium with appropriate stock cultures and / or fresh isolates. Use a standard inoculation procedure and examine the quatitative and qualitative results obtained. If tsting new lots/bacthes of media, inoculate old and new lots in one test and compare the performance of the two lots side by side.

4 Stability: periodically perform the above procedures on stored prepared media in order to determine whether the storage conditions will give optimal results.

Grouping of culture media products

Media in general use are listed in this chapter. Significant part of these media are applied first of all in medical/veterinary practice but special kinds of them are developed to industrial purpose.

Media in medical and veterinary bacteorology

Laboratories of hospitals, public health stations, medical university institutes use media which are identical or belong to the same family, they are replaceable with each other, selection is a sovereign decision of the laboratory. Veterinary laboratories observe similar pathogens or due to the numerous kinds of antropozonotic diseases, these pathogens should be identical for humans and animals. By these reason, bacteriological media and methods must be suitable for both purposes.

General purpose media

Simple media

Based on peptone and beef extract, for culture nonfastidious bacteria.

Type of medium	Name of medium	Catalogue number	Substantial composition
Minimal media	Nutrient agar	MM0073	peptone, meat extract, NaCl
	Nutrient broth No2,APHA, Nutrient broth „E”	MM0037 MM0036	

Media for fastidous bacteria

Type of medium	Name of medium	Catalogue number	Substantial composition
Rich agar media	Columbia agar, Columbia CNA agar	MM0137 MM0133	special peptone, yeast extract
	Brain Heart Infusion agar	MM0175	calf brain and heart homogenized
	Tryptone Soy agar	MM0107	tryptic digested casein and soy pepton
Blood agar	Brain Heart Infusion agar Columbia agar, Columbia CNA agar, Nutrient agar, Tryptone Soy agar, Blood agar base, Blood agar base No2,APHA	MM0175 MM0137 MM0133 MM0073 MM0107 MM0109 MM0120	supplemented with 5-10% sheep or horse blood
Chocolate agar	Brain Heart Infusion agar Columbia agar, Columbia CNA agar, Nutrient agar, Tryptone Soy agar, Blood agar base, Blood agar base No2,APHA	MM0175 MM0137 MM0133 MM0073 MM0107 MM0109 MM0120	supplemented with heat-hemolysed sheep or horse blood
Media for *Neisseriaceae* (*N. meningitidis, N. gonorrhoeae*)	Brain Heart Infusion agar, Columbia agar, GC agar, Tryptone Soy agar	MM0175 MM0137 MM0116 MM0107	supplemented with heat- or detergent-hemolysed sheep or horse blood
Brucella media	Brucella agar	MM0131	high nutritive value, low oxido-reductive potential

Selective and differentiating media

Special media with selectivity or ability to generate interspecific differentiation between colonies by morphological characters.

Type of medium	Name of medium	Catalogue number	Substantial composition
Differentiating media for *Enterobacter-iaceae*	C.L.E.D. DI agar, C.L.E.D. SI agar, Eosin Methylene Blue agar (Levine), Endo agar, MacConkey agar No.3, Tryptone Bile agar, Violet Red Bile Agar Lactose (VRBL), Violet Red Bile Glucose Agar (VRBG) Chromogenic Salmonella agar	MM0096, MM0097 MM0110 MM0132 MM0172 MM0102 MM0114 MM0115 MM0426	Gram positive microorganisms and spread of *Proteus* spp. is inhibited, selectivity, species specific colony morphology (sodium desoxycholate, detergents, anilin sugars, carbohydrates, pH indicators, and special stains, respectively)
Differentiating media for enteropathogens	Bismuth Sulphit agar, Brilliant green agar, Campylobacter bloodfree medium, Chine blue lactose agar, Chromogenic Salmonella agar Desoxycholate citrate agar (Leifson), Desoxycholate citrate agar (Hynes), DCLS agar, Hektoen enteric agar, Helicobacter pylori agar, S.S. agar, T.C.B.S. agar, X.L.D. agar, Yersinia CIN agar	MM0283 MM0182 MM0130 MM0261 MM0426 MM0162 MM0173 MM0165 MM0207 MM0145 MM0202 MM0183 MM0179 MM0192	For detection and culture of salmonellae, shigellae, *Yersinia enterocolitica, Vibrio cholerae, Campylobacter jejuni, Helicobacter pylori*; coexisting flora is inhibited, recognition of enteropathogenic bacteria is promoted by characteristic colony morphology
Selective media for pathogens of urinary tract infections	C.L.E.D. DI agar, C.L.E.D. SI agar, URIColor agar	MM0096 MM0097 MM0425	special composition to reach different colony morphologies of most frequent pathogens of urinary tract infections
Selective media for nonfermenting Gram negative rods	Aeromonas agar, Cetrimide agar, Fluorescence agar, GSP agar, Pseudomonas agar	MM0190 MM0148 MM0101 MM0264 MM0160	For differentiation of *Pseudomonas* spp., *Achromobacter* spp, *Aeromonas* spp.
Selective isolation media of *Staphylococcus*	Baird-Parker agar,	MM0203	lithium chloride, tellurite, egg yolk
	Columbia CNA agar	MM0133	colistin, nalidixic acid
Differentiation media of *Enterococcus*	Bile Esculin agar, Bile Esculin Azide agar, Kanamycin Esculin Azide agar	MM0136 MM0259 MM0154	esculin, tellurite or bile salts, sodium azide
Listeria isolation media	Listeria agar Oxford, Palcam agar	MM0188, MM0206	lithium chloride, esculin

Antibiotic sensitivity testing

Media which are well defined and permanent in composition, their pH is optimal to testing of activity of the most antimicrobial agents. They do not contain any antibiotic antagonists, their composition prevents accumulation of toxic metabolites of bacteria that inhibit antibiotic effect.

Type of medium	Name of medium	Catalogue number	Substantial composition
Natural based	Mueller-Hinton agar	MM0135	peptone, meat extract, starch
Semisynthetic	Sensitivity Test agar	MM0121	peptone, nucleic acid precursors
	DSTA agar	MM0123	peptone, meat extract, nucleic acid precursors
Synthetic	Iso-Sensitest agar	MM0085	low thymine and thymidine content, constant composition

Anaerobe media

Basic composition or additives allows low oxido-reductive potential and special growth requirements necessary for anaerobic conditions.

Type of medium	Name of medium	Catalogue number	Substantial composition
For isolation	Anaerobe Isolation agar, Schaedler agar	MM0151 MM0140	Na-piruvate / cysteine, vitamins and cofactors
For isolation and sterility testing	Thioglycollate medium	MM0069	cystine, Na-thioglycollate
For culture of *Clostridium* spp.	Reinforced Clostridial agar	MM0168	cysteine
	Differential Reinforced Clostridial agar	MM0240	cysteine, Fe-ammonium citrate
For culture of *Clostridium perfringens*	Perfringens agar	MM0150	Fe-ammonium citrate, Na-metabisulphite
For culture of *Bacteroides* spp.	Kanamycin Esculin Azide agar	MM0154	Fe-citrate, Na-azide, esculin, kanamycin
For culture of *Brucella* spp.	Brucella agar	MM0131	Na-bisulphite

Special media for difficult-to-culture microorganisms

The true special media are not simply supplemented liquid or agar based solid media selective to one or more species but original compositions which are partially or completly synthetic and their well defined composition is constant.

Type of medium	Name of medium	Catalogue number	Substantial composition
Mycobacterium	Löwenstein-Jensen medium	MM0351	starch, glycerol, L-asparagine, malachite green, egg yolk
Campylobacter	Campylobacter blood free medium	MM0130	Na-pyruvate, Na-desoxycholate, charcoal, antibiotics
Helicobacter	Helicobacter pylori medium	MM0145	Na-pyruvate, horse serum, charcoal, antibiotics

Enrichment media

Liquid media for preculturing of samples containing low colony number of microorganisms or pathogens in accompanied with indigenous biota. Use of enrichment media is recommended when microorganisms expected should occur in less than 100 in milliliters of the original sample or in mixed microbiota.

Type of medium	Name of medium	Catalogue number	Substantial composition
Minimal broth	Nutrient broth No2,APHA, Nutrient broth „E”	MM0037 MM0036	pepton, meat extract, NaCl, for culture of nonfastidious bacteria
Nutritious media	Brain Heart Infusion broth Tryptone-Soy broth Tryptose Phosphate broth	MM0106 MM0080 MM0078	calf brain and heart homogenized tryptic digested casein
Anaerobe enrichment media	Anaerobe Isolation broth, Differential Reinforced Clostridial broth, Reinforced Clostridial broth, C.M. broth	MM0087 MM0240 MM0112 MM0214	fluid media based on peptones and meat extract, low oxido-reductive potential is supplied by high concentration of cystine or ground meat
Enrichment media for fastidious bacteria	Brain Heart Infusion broth, Campylobacter Enrichment broth, C.M. broth, Tryptone-Soy broth , Tryptose Phosphate broth	MM0106 MM0072 MM0214 MM0080 MM0078	high nutritive potential and glucose concentration is advantageous for development of antigenic properties
Salmonella enrichment media	Lactose broth, Lactose Peptone broth, Müller-Kaufmann Tetrathionate broth, Buffered Peptone Water, Modified Semisolid Rappaport-Vassiliadis broth, Rappaport-Vassiliadis broth, Selenite broth, Selenite Cystine broth	MM0035, MM0252 MM0211 MM0049 MM0086 MM0070 MM0046 MM0047	anilin sugars / Na-biselenite / Na-citrate / lactose fermentation / tetrathionate reduction

Media used for identification

Type of medium	Name of medium	Catalogue number	Substantial composition
Nuclease production	DNase Test agar	MM0134	Calf thymus DNA
Citrate utilization	Simmons Citrate agar	MM0063	Na-citrate as the only carbon source
Esculin hydrolisis	Bile Esculin agar, Bile Esculin Azide agar, Kanamycin Esculin Azide agar	MM0136 MM0259 MM0154	esculin (±bile salts, Na-azide, antibiotic)
Indole production	Indole medium, Tryptone Water Indole Nitrite medium, Motility Indole Urea Test medium	MM0403 MM0039 MM0068 MM0111	triptophan
Urease production	Urea broth base, Urea agar base, Motility Indole Urea Test medium	MM0028 MM0066 MM0111	carbamide
Nitrate	Indole Nitrite broth	MM0068	K-nitrate
Motility	Motility Test medium, Motility Indole Urea Test medium	MM0218 MM0111	low (2-4%) agar concentration
Substrate utilization	Peptone water	MM0038	1% peptone water
Composite media	Lysine Iron agar, T.S.I. (Triple Sugar Iron) agar	MM0090 MM0204	oxidative/fermentative mode of carbohydrate breakdown, gas- and H_2S-production,
Pseudomonas pigment production	King B agar	MM0291	acid casein, K-phosphate

Microbiology of food and animal feed stuff

Methodological guides of the food microbiology are exceedingly stringent regulated by national and international norms. All the steps of the examination process and the detailed composition of the media authorized to use are summarized in directives and compliance with protocol is controlled.
Laboratories test sterility of raw materials or alimentary products, composition of microbiota of the samples, presence of pathogenic microorganisms, enumerate total biota or specifically one species or group of bacteria.
Media produced by MicroMedia Trading House correspond to the international standards or recommendations as *APHA, ISO, DIN, National Canners Association, European Pharmacopeia, USP, etc.*

Type of medium	Name of medium	Catalogue number	Substantial composition / ***use***
Colony counting	China Blue Lactose agar,	MM0239	lactose / *dairy industry*
	Milk Plate Count agar	MM0061	skimmed milk / *dairy industry*
	Plate Count agar	MM0064	*total cfu*
	Violet Red Bile Glucose Agar	MM0115	*coliform cfu*
	Wort agar	MM0178	*fungal cfu*
Staphylococcus	Giolitti-Cantoni broth Baird-Parker broth Baird-Parker agar	MM0401 MM0141 MM0203	lithium chloride, tellurite, (mannitol, lecithin)
Listeria	Listeria enrichment media, Fraser broth, Listeria agar Oxford Palcam agar	MM0098, MM0189 MM0189 MM0206	lithium chloride, esculin
Bacillus	Bacillus cereus agar Glucose Tryptone agar	MM0289 MM0077	lecithin, glucose
Fecal streptococci and enterococci	Azide Glucose broth, Bile Esculin Azide agar, Kanamycin Esculin Azide agar, Slanetz Bartley agar	MM0299 MM0259 MM0154 MM0143	Na-azide, esculin or TTC
Fastidious bacteria	Tryptone Phosphate broth	MM0078	detection of *Brucella,* streptococci, neisseriae
Lactobacilli	M.R.S. (deMan, Rogosa, Sharpe) broth / agar	MM0177 MM0205	Na-acetate, ammonium-citrate, TWEEN80
Anaerobe bacteria	Differential Reinforced Clostridial media, Reinforced Clostridial medium	MM0240 MM0168	cystein, Fe- ammonium-citrate
	Perfringens agar	MM0150	Fe- ammonium-citrate, Na-metabisulphite
	Lactose Sulphite broth	MM0219	Na- metabisulphite, Fe-citrate
	Tyrobutiricum broth	MM0402	Na-acetate, Na-lactate

Detection of enteropathogenic bacteria

Type of medium	Name of medium	Catalogue number	Substantial composition
Coliforms (*Enterobacteri-aceae*)	Brilliant Green Bile broth	MM0127	brilliant green, lactose, bile
	E.C. broth	MM0250	lactose, bile salts
	E.E. broth	MM0161	brilliant green, bile salts
	Endo agar	MM0132	Na-sulphite, basic fuchsine
	Chromogenic Salmonella agar	MM0426	propilene glycol
	Lactose broth	MM0035	lactose, Durham tube
	Lactose Peptone broth	MM0252	
	Lauryl Tryptose Fluorescent broth (MUG), Lauryl Tryptose broth	MM0298 MM0297	Na-laurylsulphate, (MUG)
	Violet Red Bile Glucose Agar	MM0115	crystal violet, bile salts, glucose
	Tryptone Bile agar	MM0102	bile salts, cellulose acetate membran
	Violet Red Bile agar	MM0114	crystal violet, bile salts, lactose
Salmonella	Lactose broth	MM0035	lactose, Durham tube
	Buffered Peptone Water	MM0049	peptones
	Mueller-Kaufmann Tetrathionate broth	MM0211	tetrathionate
	Bismuth Sulphite agar	MM0283	brilliant green, Bi-sulphite
	Brilliant Green agar	MM0167	brilliant green, lactose
	Rappaport Vassiliadis broth	MM0070 MM0086	malachit green, Mg-chloride
	Selenite broth	MM0046	Na-biselenite
	Selenite cystine broth	MM047	Na-H-selenite, L-cystine
	Hektoen Enteric agar	MM0207	thiosulphate, Fe-ammonium citrate, bile salts, salicin
	Chromogenic Salmonella agar	MM0426	propylene glycol, chromogenic mixture
	X.L.D. agar	MM0179	xylose, lysine, desoxycholate
Campylobacter	Campylobacter Enrichment medium	MM0072	metabisulphite, pyruvate, keto-glutaric acid, hemin
Pseudomonas and/or Aeromonas	Aeromonas agar	MM0190	xylose, lysine, bile salts
	GSP agar	MM0160	starch, glutamate, penicillin

Industrial and enviromental microbiology

Industrial microbiology is a special distinct territory regulated by strict local and international standards. For pharmaceutical and cosmetical technology, only limited number of media are authorized to use. In water testing and food testing, microorganisms potentially pathogenic to humans, to domestical or wild animals or to cultivated plants in agriculture are the target organisms.

Type of medium	Name of medium	Catalogue number	Substantial composition / *use*
Colony counting	Nutrient agar	MM0073	*total cfu*
	Plate Count agar	MM0064	
	Violet Red Bile Glucose Agar	MM0115	*coliform cfu*
	Wort agar	MM0178	*fungal cfu*
Coliforms (*Enterobacteri-aceae*)	Brilliant Green Bile broth	MM0127	brilliant green, lactose, bile
	Brilliant Green agar	MM0167	brilliant green, lactose
	E.C. broth	MM0250	lactose, bile salts
	E.E. broth	MM0142	brilliant green, bile salts
	Endo agar	MM0132	Na-sulphite, basic fuchsine
	Eosin Methylene Blue agar (Levine)	MM0110	Na-desoxycholate, lactose, eosin
	Chromogenic SC agar	MM0088	propilén glikol
	Lactose broth	MM0035	lactose, Durham tube
	Lactose Peptone broth	MM0252	
	Lauryl Tryptose Fluorescent broth (MUG), Lauryl Tryptose broth	MM0298 MM0297	Na-laurylsulphate, (MUG)
	Violet Red Bile Glucose Agar	MM0115	crystal violet, bile salts, glucose
	Tryptone Bile agar	MM0102	bile salts, cellulose acetate membran
	Violet red bile agar	MM0114	crystal violet, bile salts, lactose
Salmonella	Bismuthsulphite agar	MM0283	brilliant green, Bi-sulphite
	Brilliant Green agar	MM0167	brilliant green, lactose
	Rappaport Vassiliadis media, Modified Semisold Rappaport Vassiliadis media	MM0070 MM0086	malachit green, Mg-chlorid
	Selenite broth	MM046	Na-biselenite
	Hektoen Enteric agar	MM0207	thiosulphate, Fe-ammonium citrate, bile salts, salicin
	Chromogenic Salmonella agar	MM0426	propylene glycol, chromogenic mixture
	X.L.D. agar	MM0179	xilóz, lizin, dezoxikolát
Pseudomonas	Cetrimide agar	MM0148	Cetiltrimethyl-ammonium bromide
Fecal streptococci and enterococci	Azide Glucose broth, Bile Esculin agar, Bile Esculin Azide agar, Slanetz Bartley agar	MM0299 MM0136 MM0259 MM0143	Na-azide, esculin or TTC

RESEARCH

Research laboratories use either general media of their speiciality or individually prepared media from bnasic products.
Luria broth (**MM0241**) is dedicated for multiplication of recipient strains for transformation or transduction in molecular genetics or used for plasmid amplification and phage propagating.

Transport media

Swabs are commonly used for obtaining many types of cultures; however, they are generally inferior to other methods for collecting specimens, and their use should be discouraged as much as possible. Cotton swabs may contain residual fatty acids, and calcium alginate may emit toxic products that inhibit certain fastidious bacteria. Specimens should not be allowed to remain in contact with the swab any longer than necessary. Except of throat swabs, for which drying does not seem to affect the recovery of streptococci, swabs should be placed in a transport medium or moist container to prevent drying and death of bacteria.
Good recovery of most bacterial species from transport media has been demonstrated for up to 48 hrs or longer. The use of culture tubes containing semisolid Stuart`s or Amies` transport medium, with or without charcoal, also serves as an adequate means for holding swab cultures during transport.
The use of swabs for collection of specimens for anerobe cultures is discouraged. Aspiration with a needle and syringe or use of transport systems is recommended. Specimens must be protected from exposure to ambient oxygen and kept from drying until they can be processed in the laboratory.
These systems are easy to use, are readily available, and require no special equipment or storage conditions. Long delays in transport and exposure to extremes in temperature may compromise succesful recovery of the organism. Transport medium containing activated charcoal is preferable if cotton swabs are used for the collection of the specimen.
Nonnutritive swab transport systems contain any carbon sources. In these media, growth of the bacteria is inhibited, the original count of microorganisms and composition of the microbiota may be examined.

Amies Transport with Charcoal (*MM0048*): for *Neisseria gonorrhoeae* and **without Charcoal (*MM0030*)**: a general purpose transport medium for aerobic and anaerobic bacteria.

Carey Blair Transport medium (***MM054***): moderately basics transport medium suitable for Gram negative bacteria and anaerobe microorganisms. It is also recommended to transport pathogenic stool bacteria as *Salmonella, Shigella, Vibrio, Campylobacter, Yersinia* spp.

Maximal Recovery Diluent *(MM029)*: physiological saline with peptones provides a constant osmotic support.

¼ strength Ringer solution (*MM027*): transport medium for dilution of milk and dairy products.

Media for mycology

In mycological practice, parallel use of at least two different media is recommended for selectively getting rid of the contaminations or to serve nutritives for the different fungal pathogens. Most of the fungi grow well on simple bacteriological media with higher carbohydrate concentration and with lower pH, in aerobic conditions. High content of vitamin B of yeast extract is advantageous for yeasts, numerous moulds and dermatophyta with special nutritive requirements; thus in a part of mycological media, peptons are partially substituted by yeast extract. On the other hand, due to the optimal conditions to fungal cultivation, these madia are not usable for morphological characterization.
Most frequently known and used mycological media are the liquid and solid Sabouraud media, agar containing anti-mould agent cycloheximide (Actidione®) and a range of antibiotics for isolation of dermatophyton strains, corn and potato-carrot based agars for induction of chlamydospore production.

Type of medium	Name of medium	Catalogue number	Substantial composition
Culture	Sabouraud Dextrose agar	MM0197	acid pH, glucose
	Sabouraud Dextrose -Maltose agar	MM0275	acid pH, glucose, maltose
	Sabouraud Dextrose Chloramphenicol agar(0.5%/0.05%)	MM0200, MM0393	acid pH, glucose, chloramphenicol
	Sabouraud broth	MM0157	acid pH, glucose
Isolation of yests and moulds	Malt Extract agar	MM0164	acid pH, malt extract
	Malt Extract broth	MM050	
	Wort agar,	MM0178	acid pH, malt extract, maltose
	Wort broth	MM0100	
Culture from water samples and dairy products	Yeast Extract agar,	MM059	acid pH, yeast extract
	Yeast Extract Dextrose Chloramphenicol agar	MM0125	acid pH, glucose, yeast extract, chloramphenicol
Examination of fungal contamination of alimentary products	Potato Dextrose agar	MM0117	acid pH, glucose potato extract,

Pilot microbiological examinations using MicroMedia products

Detection of *Escherichia coli* by *MicroMedia*				
Sample	**Enrichment**	**Isolation, maintenance**	**Identification**	**Susceptibility**
Ia Misc. clinical specimen	MacConkey broth	Eosin Methylene Blue agar *or* MacConkey agar	Urea broth or agar, indole medium, Kovács' reagens, Tryptone water, Lysine iron agar *or* TSI agar, Motility test medium, Peptone water (sugar utilization)	Mueller-Hinton agar *or* Iso-Sensitest agar *or* Diagnostic Sensitivity Test agar *or* Sensitivity Test agar
Ib Stool	Nutrient broth	DC agar (Hynes)		
Ic Urine	Nutrient broth	Eosin Methylene Blue agar *or* MacConkey agar		
II Food	Brilliant Green Bile broth, EC broth, Lactose broth	VRBGA agar		
III. Water	Brilliant Green Bile broth, EC broth, Lactose broth	Eosin Methylene Blue agar		

Detection of coliforms (*Enterobacteriaceae* group) by *MicroMedia*				
Sample	**Enrichment**	**Isolation, maintenance**	**Identification**	**Susceptibility**
Ia Misc. clinical specimen	MacConkey broth	Eosin Methylene Blue agar *or* Chromogenic SC agar *or* MacConkey agar	Urea broth or agar, indole medium, Tryptone water, broth, Lysine iron agar *or* TSI agar, Motility test medium, Motility Indole Urea Test Medium, Peptone water (sugar utilization), Simmons citrate	Mueller-Hinton agar *or* Iso-Sensitest agar *or* Diagnostic Sensitivity Test agar *or* Sensitivity Test agar
Ib Stool	Nutrient broth	Chromogenic SC agar		
Ic Urine	Nutrient broth	CLED agar *or* Eosin Methylene Blue agar *or* MacConkey agar,		
II Food	Brilliant Green Bile broth, EE broth, Lactose broth, Lactose peptone broth, Lauryl tryptose broth,	Endo agar *or* VRBGA agar *or* Tryptone bile agar *or* VRBA agar		
III. Water	Brilliant Green Bile broth, Lactose peptone broth, Lauryl tryptose broth	Endo agar *or* Eosin Methylene Blue agar *or* Tryptone bile agar *or* VRBA agar		

Detection of *Shigella* spp. by *MicroMedia*				
Sample	**Enrichment**	**Isolation, maintenance**	**Identification**	**Susceptibility**
I. Stool	-	DC agar (Hynes) *or* DC agar (Leifson) *or* DCLS agar *or* Hektoen enteric agar *or* Salmonella-Shigella agar	Urea broth or agar, Motility Indole Urea Test Medium , Peptone water (sugar utilization), Lysine iron agar *or* TSI agar, Motility test medium, Simmons citrate	Mueller-Hinton agar *or* Iso-Sensitest agar *or* Diagnostic Sensitivity Test agar *or* Sensitivity Test agar

Detection of *Salmonella* spp. by *MicroMedia*				
Sample	**Enrichment**	**Isolation, maintenance**	**Identification**	**Susceptibility**
Ia Misc. clinical specimen	Mueller-Kaufmann tetrathionate broth, Selenite cystine broth, Tetrathionate broth	Bismuthsulphite agar *and* Brilliant green agar *or* Chromogenic SC agar *or* XLD agar	Urea broth or agar, indole medium, indole nitrate broth, Lysine iron agar *or* TSI agar, Motility test medium, Motility Indole Urea Test Medium, Peptone water (sugar utilization), Simmons citrate	Mueller-Hinton agar *or* Iso-Sensitest agar *or* Diagnostic Sensitivity Test agar *or* Sensitivity Test agar
Ib Stool	Mueller-Kaufmann tetrathionate broth, Selenite broth, Selenite cystine broth, Tetrathionate broth	Bismuthsulphite agar and Brilliant green agar *or* DC agar (Hynes) *or* DCLS agar *or* Hektoen enteric agar *or* Chromogenic SC agar *or* Salmonella-Shigella agar *or* XLD agar		
Ic Urine	Mueller-Kaufmann tetrathionate broth, Selenite cystine broth, Tetrathionate broth	Bismuthsulphite agar and Brilliant green agar *or* XLD agar		
II Food	Brilliant Green Bile broth, Mueller-Kaufmann tetrathionate broth, Buffered peptone water, Rappaport-Vassiliadis broth, Selenite broth, Selenite cystine broth, Tetrathionate broth	Bismuthsulphite agar *or* XLD agar		
III. Water	Brilliant Green Bile broth, Selenite cystine broth	Bismuthsulphite agar *or* Brilliant green agar *or* XLD agar		

Detection of *Pseudomonas* spp. by *MicroMedia*				
Sample	**Enrichment**	**Isolation, maintenance**	**Identification**	**Susceptibility**
I. Clinical specimen	Nutrient broth	Cetrimide agar *or* Pseudomonas agar,	Oxidase reagent, Fluorescent agar, King B agar, Lysine iron agar *or* TSI agar, Motility test medium, Motility Indole Urea Test Medium	Mueller-Hinton agar *or* Iso-Sensitest agar *or* Diagnostic Sensitivity Test agar *or* Sensitivity Test agar
II. Food	Nutrient broth	GSP agar		
III. Water	Nutrient broth	GSP agar		

Detection of *Staphylococcus aureus* by *MicroMedia*				
Sample	**Enrichment**	**Isolation, maintenance**	**Identification**	**Susceptibility**
I. Clinical specimen	Nutrient broth *or* Brain Heart Infusion broth	Blood agar (Columbia agar, TSA, Blood agar base) *or* Columbia CNA agar, Mannitol salt agar	DNase test agar, Urea broth or agar, Peptone water (sugar utilization), TSI agar	Mueller-Hinton agar *or* Iso-Sensitest agar *or* Diagnostic Sensitivity Test agar *or* Sensitivity Test agar
II. Food	Giolitti-Cantoni broth *or* Brain Heart Infusion broth	Baird-Parker agar *or* Blood agar		
III. Water	Brain Heart Infusion broth	Mannitol salt agar		

Detection of *Neisseria* spp. by *MicroMedia*				
Sample	**Enrichment**	**Isolation, maintenance**	**Identification**	**Susceptibility**
I. Clinical specimen	CM broth Tryptose phosphate broth	GC Agar or Chocolate agar (Columbia,TSA,Brain heart infusion agar) +LCAT supplement	Oxidase reagent	Mueller Hinton agar or ISO-Sensitest agar or Diagnostic Sensitivity Test Agar or Sensitivity test agar + LCAT supplement

Detection of *Enterococcus* spp. by *MicroMedia*				
Sample	**Enrichment**	**Isolation, maintenance**	**Identification**	**Susceptibility**
I. Clinical specimen	Nutrient broth	Nutrient agar, Blood agar (Columbia agar, TSA, Blood agar alap)	Bile esculin agar, Bile esculin azid agar	Mueller-Hinton agar *or* Iso-Sensitest agar *or* Diagnostic Sensitivity Test agar *or* Sensitivity Test agar
II. Food	Azide dextrose broth	Kanamycin esculin azid agar *or* Slanetz-Bartley agar		
III. Water	Azide dextrose broth	Bile esculin agar *or* Bile esculin azid agar *or* Slanetz-Bartley agar		

Detection of *Listeria* spp. by *MicroMedia*				
Sample	**Enrichment**	**Isolation, maintenance**	**Identification**	**Susceptibility**
I. Clinical specimen	Brain Heart Infusion broth, Fraser broth	Blood agar (Columbia agar, TSA, Blood agar alap) *or* Listeria agar Oxford *or* Palcam agar	Urea broth or agar, Motility test medium, Motility Indole Urea Test Medium , Peptone water (sugar utilization)	Mueller-Hinton agar *or* Iso-Sensitest agar *or* Diagnostic Sensitivity Test agar *or* Sensitivity Test agar
II. Food	Fraser broth, Listeria enrichment (FDA, UVM), Buffered peptone water	Listeria agar Oxford *or* Palcam agar		

Detection of anaerobe species by *MicroMedia*				
Sample	**Enrichment**	**Isolation, maintenance**	**Identification**	**Susceptibility**
I. Clinical specimen	Anaerobe isolation broth, CM broth,	Anaerobe isolation agar *or* Schaedler agar	Kanamycin esculin azide agar	Mueller-Hinton agar *or* Iso-Sensitest agar *or* Diagnostic Sensitivity Test agar *or* Sensitivity Test agar

Detection of *Clostridium* spp. by *MicroMedia*				
Sample	**Enrichment**	**Isolation, maintenance**	**Identification**	**Susceptibility**
I. Clinical specimen	Reinforced Clostridial broth, CM broth,	Reinforced Clostridial agar	Tyrobutiricum broth, Mozgás nitrate táptalaj	Mueller-Hinton agar *or* Iso-Sensitest agar *or* Diagnostic Sensitivity Test agar *or* Sensitivity Test agar
II. Food	Differencial Reinforced Clostridial broth, Lactose sulphite broth, Tyrobutiricum broth	Differencial Reinforced Clostridial agar *or* Perfringens agar *or* Thioglycollate táptalaj		
III. Water	Differenciáló Differencial Reinforced Clostridial broth	Differenciáló Differencial Reinforced Clostridial agar		

Detection of pathogenic fungi by *MicroMedia*			
Sample	**Enrichment**	**Isolation, maintenance**	**Identification**
Ia. Clinical specimen	Brain Heart Infusion broth	CandiColor agar *or* Sabouraud dextrose agar *or* Sabouraud dextrose chloramphenicol agar *or* Sabouraud dextrose -maltose agar	CandiColor agar
Ib. Stool	-	Sabouraud dextrose chloramphenicol agar	
Ic. Urine	-	CandiColor agar *or* Sabouraud dextrose chloramphenicol agar,	
II. Food	Malt extract broth, Sabouraud broth, Wort broth	Potato dextrose agar *or* Yeast extract agar *or* Yeast extract dextrose chloramphenicol agar *or* Malt extract agar *or* Wort agar	
III. Water	-	Yeast extract agar *or* Yeast extract dextrose chloramphenicol agar	

Differentiation of most frequently isolated Gram-positive genera

Shape	S	S	S	S	S	S	S	S	R	R	R	R	R	R	R	R	R	R	R	R	R
Acid-fast stain	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(+)	+
Spore formation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-
Motility	-	-	-	-	-	+	-	-	+	-	-	+	-	-	-	-	+/-	+/-	-	-	-
Growth O_2	+	+	+	+	+	+	+	-	+	+	+	+	+	+	-	-	-	+	+	+	+
Growth anO_2	-	+	+	(+)	(+)	+	+	+	-	+	+	+	+	-	+	+	+	+	+/-	-	-	·
Catalase	+	+	-/(+)	(+)	-	-	-	-	+	+	+	+	-	+	+	-	-	-	+	+	+	+
Oxidase	+*	-	-	-	-	-	-	-	-	-	-	-	-	·	·	·	·	·	d	-	-	-
Acid from glucose	+/-	+	+	+	+	+	+	+/-	-	-	+	+	+	+	+	+	-	+/-	+/-	+	+	+
Type of glucose utilization	O/-	F	F	F	F	F	F	F/-	-	-	F	F	F	F	F	F	-	F/-	F/O/-	O	O	O/-
Micrococcus	+																					
Staphylococcus		+																				
Stomatococcus			+																			
Aerococcus				+	+																	
Streptococcus						+	+															
Enterococcus							+															
Pediococcus							+															
Gemella							+															
Anaerob cocci								+														
Kurthia									+													
Corynebacterium										+	+											
Listeria												+										
Erysipelothrix													+									
Lactobacillus													+									
Arachnia													+									
Rothia														+								
Propionobacterium															+							
Actinomyces																+						
Bifidobacterium																+						
Eubacterium																+	+					
Clostridium																+	+	+				
Bacillus										+	+	+		+					+			
Nocardia																				+	+	
Mycobacterium																						+

Abbreviations:
+ - 90% or more strains positive; **-** - 90% or more strains negative; **(+)** weekly positive; **d** - 11%-89% of strains positive; **O** - oxidative; **F** - fermentative; **S** - spherical; **R** - rods;
***** - modified oxidase probe with tetramethyl-*p*-phenildiamine reagent on dimethyl-sulphoxid saturated filter.

Differentiation of most frequently isolated Gram-negative genera

Shape	R	S	S	S	S/R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	P
Motility	-	-	-	-	-	-	+	+	-	+	+	-	-	+	+	+/-	-	-	+	-
Growth O_2	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-*	+
Growth anO_2	+	+	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	-	-
Catalase	D	+/-	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+/-	-	+/-	-
Oxidase	-	▪	+	+	-	+	+	+	+	+	-	+	+	+	+	-	-	+	+	-
Acid from glucose	+/-	-	+	-	+	-	+	-	+	+	+/-	+	+	+	+	+	+/-	-	-	+
Type of glucose utilization	F/-	-	O	-	O	-	O	-	O	O	O	F	F	F	F	F	▪	-	-	F
Bacteroides	+																			
Veillonella		+																		
Neisseria			+																	
Branhamella				+																
Acinetobacter					+															
Moraxella						+														
Brucella						+														
Bordetella						+														
Chromobacterium Lividium							+													
Alcaligenes								+												
Pseudomonas									+											
Burkholderia									+											
Stenotrophomonas										+										
Actinobacillus											+									
Pasteurella											+									
Necromonas											+									
Cardiobacterium												+								
Kingella													+							
Chromobacterium Violaceum														+						
Vibrio														+						
Plesiomonas														+						
Aeromonas														+						
Enterobacteriaceae															+					
Haemophilus																+				
Eikenella																	+			
Campylobacter																		+		
Streptobacillus																			+	
Mycoplasma																			+	

Abbreviations:
+ - 90% or more strains positive; **-** - 90% or more strains negative; **(+)** weekly positive; **d** - 11%-89% of strains positive; **O** - oxidative; **F** - fermentative; **S** - spherical; **R** - rods; ***** - microaerophilic

Identification of most frequent Gram-negative rods

Species	Oxidase	Spreading	Motility	Characteristics on TSI			Urease	Indol	Citrate	Inosit
				butt	slant	H_2S				
Acinetobacter baumannii	-	-	-	-	-/A	-	d	-	+	-
Acinetobacter lwoffii	-	-	-	-	-	-	-	-	-	-
Aeromonas	+	-	+	A	-	-	-	d	d	-
Alcaligenes faecalis	+	-	+	-/B	-/B	-	-	-	·	·
Pseudomonas aeruginosa	+	·	+	-/B	-/B	-	d	-	d	d
Pseudomonas alcali group	+	·	+	-	B	-	d	-	d	d
Escherichia coli	-	-	+	A,G	A	-	-	+	-	-
Citrobacter diversus	-	-	+	A,G	A	-	-	+	+	-
Citrobacter freundii	-	-	+	A,G	A/-	+	-	-	+	-
Klebsiella spp	-	-	-	A/A,G	A/B	-	(+)	-	+	+
Klebsiella oxytoca	-	-	-	A,G	A	-	(+)	+	+	+
Enterobacter spp	-	-	+	A,G	A/-	-	d	-	+	d
Serratia marcescens	-	-	+	A,G	-/A	-	-	-	+	d
Proteus mirabilis	-	+	+	A/A,G	-/B/A	+	+	-	d	-
Proteus vulgaris	-	+	+	A/A,G	-/B	+	+	+	d	-
Proteus morganii	-	-	+	A/A,G	-/B	-	+	+	-	-
Providencia rettgeri	-	-	+	A/B	-/B	-	+	+	+	+
Providencia stuartii	-	-	+	A	-	-	-	+	+	-
*Salmonella typhi**	-	-	+	A	-/B	+/(+)	-	-	+	-
*Salmonella typhimurium**	-	-	+	A,G	-/B	+	-	-	+	·
*Salmonella paratyphi B**	-	-	+	A,G	-/B	+	-	-	+	·
*Salmonella enteritidis**	-	-	+	A,G	-/B	+	-	-	+	·
*Salmonella paratyphi A**	-	-	+	A,G	-/B	d	-	-	-	-
*Salmonella choleraesuis**	-	-	+	A,G	-/B	d	-	-	d	-
*Shigella flexneri**	-	-	-	A/A,G	-/B	-	-	d	-	-
*Shigella dysenteriae**	-	-	-	A	-/B	-	-	d	-	-
*Shigella boydii**	-	-	-	A	-/B	-	-	d	-	-
*Shigella sonnei**	-	-	-	A	-/B	-	-	-	-	-

Abbreviations: + - 90% or more strains positive; **-** - 90% or more strains negative; **(+)** weekly positive; **d** - 11%-89% of strains positive; **A**-acid production; **B** - basic; **G** - gas; ***** - serological confirmation is necessary.

Applications of mostly used media - click here