

# MediaDive: the expert-curated cultivation media database

Julia Koblitz

28.09.2022



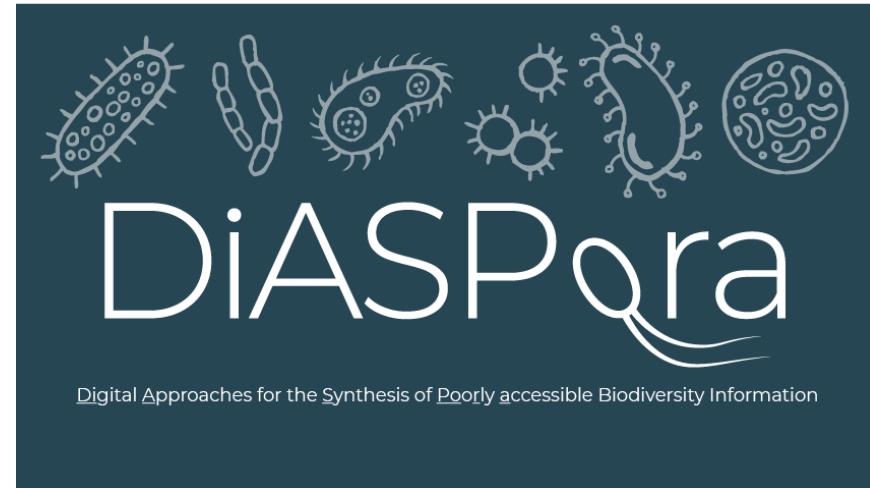
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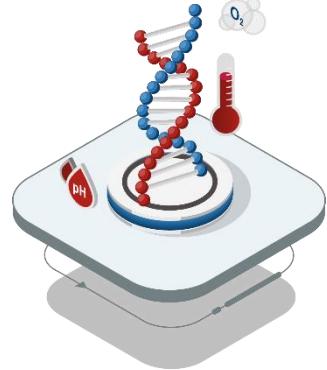
MediaDive  
.dsmz.de

# Why did we build this database?

- **The aim:** Predict cultivation conditions and media for uncultivable prokaryotes
- Based on genome sequences
- With use of artificial intelligence
- Part of the DiASPora project



[diaspora-project.de](http://diaspora-project.de)



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# The cultivation media landscape

## 1. NUTRIENT AGAR

Peptone  
Meat extract  
Agar, if necessary  
Distilled water  
  
Adjust pH to 7.0. For *Bacillus* strain recommended for sporulation.

5.0 g  
3.0 g  
15.0 g  
1000 ml

## Medium data

Search for medium no. [2].

Unless otherwise stated, sterilize media by auto.

## 2 XYLOSE-YP BROTH

Xylose  
Yeast extract (BD-Difco)  
Polypeptone (Nihon Pharm. Co.)  
Sodium acetate  
 $MgSO_4 \cdot 7H_2O$   
 $MnSO_4 \cdot xH_2O$   
 $FeSO_4 \cdot 7H_2O$   
NaCl  
Distilled water  
Adjust pH to 6.8.

2x concentrated stock:  
L-15 (Leibovitz medium) powder 1 pack  
DL-aspartic acid 0.5 g  
L-glutamic acid 10 ml  
L-glutamine (200 mM) 0.3 g  
L-proline 0.299 g  
 $\alpha$ -ketoglutaric acid 2.239 g  
D-glucose 1 ml  
Stock Solution D 1 ml  
Vitamin Stock solution 1 ml

Adjust pH to 6.8 with NaOH.  
Fill up to 346ml with demineralized water and filter sterilize through 0.2 $\mu$ m.  
Aliquot 17.3ml into 50ml tubes and store at -20°C.  
When ready to use add:  
sterile demineralized water 25 ml  
tryptose phosphate broth 5 ml  
FBS (heat inactivated) 2.5 ml  
cholesterol lipid concentrate (250x ) 200  $\mu$ l  
(ThermoFisher Scientific)

Filter sterilize each tube through 0.2 $\mu$ m filter.

**Stock Solution A (10 ml)**  
0.02g CoCl $_2 \cdot 6H_2O$   
0.02g CuSO $_4 \cdot 5H_2O$   
0.16g MnSO $_4 \cdot H_2O$   
0.2g ZnSO $_4 \cdot 7H_2O$

**Stock Solution B (10 ml)**  
0.02g NaMoO $_4 \cdot 2H_2O$

**Stock Solution C**  
0.02g Na $_2$ SeO $_3$

**Stock Solution D (10 ml)**  
1g Glutathione (reduced)  
1g Ascorbic acid  
0.05g FeSO $_4 \cdot 7H_2O$   
100 $\mu$ l Stock Solution A  
100 $\mu$ l Stock Solution B  
100 $\mu$ l Stock Solution C

**Vitamin Stock (10 ml)**  
0.1g p-aminobenzoic acid  
0.05g B $_{12}$  vitamin  
0.01g d-Biotin

## 12. SOIL EXTRACT MEDIUM

Sterilize 400.0 g of air-dried garden soil (with high content of organic matter) in 1000 ml tap water for one hour at 121°C. Allow it to sediment for a few hours at room temperature. Centrifuge the supernatant. Add 15.0 g agar per 1000 ml to the clear supernatant solution thus obtained. Adjust pH to 6.8 - 7.0 and sterilize.

	10	3.6
Na $_2$ -EDTA x 2H $_2O$	10	0.6
Trace metal mix	1.0	0.1

Adjust to 1000mL with H $_2O$  dist. and autoclave.

After cooling, add the following filter components

	Volume [mL/L]	Stock Solutions [g/L]
BG11-Mix	1.0	-
Vitamine B12	1.0	0.02

### BG11 - Stock Solutions

	[g/L]
BG11-Mix	K $_2$ HPO $_4 \cdot 3H_2O$ 20
-	Na $_2$ CO $_3$ 10
-	Fe-NH $_4$ -citrate 3.0

	[g/L]	[mL/L]
Trace metal Mix	H $_3$ BO $_3$ 2.9	<-
	MnCl $_2 \cdot 4H_2O$ 1.81	<-
	ZnSO $_4 \cdot 7H_2O$ 0.22	<-
	Na $_2$ MoO $_4 \cdot 2H_2O$ 0.39	<-
	CuSO $_4 \cdot 5H_2O$ >-	10 mL 0.8g/100mL Stock Sol.
	Co(NO $_3$ ) $_2 \cdot 6H_2O$ >-	10 mL 0.5g/100mL Stock Sol.

## 194a. DESULFOTOMACULUM OX39 MEDIUM (XYLENE)

### Solution A:

Na $_2$ SO $_4$	1.40 g
H $_2$ PO $_4$	0.20 g
H $_4$ Cl	0.30 g
HCl	1.00 g
Cl $_2 \times 6H_2O$	0.40 g
Cl $_2 \times 2H_2O$	0.50 g
nitrite-tungstate solution (see medium 385)	0.15 g
resazurin solution (0.1% w/v)	1.00 ml
distilled water	0.50 ml
	930.00 ml

### Solution B:

Trace element solution SL-10 (see medium 320)

1.00 mL

### Solution C:

Na $_2$ CO $_3$   
Distilled water

1.50 g  
30.00 mL

### Solution D:

m-Xylene  
2,2,4,6,8,8-Heptamethylnonane

0.30 mL  
20.00 mL

### Solution E:

Vitamin solution (see medium 503)

1.00 mL

### Solution F:

FeSO $_4 \cdot 7H_2O$   
0.2 N H $_2$ SO $_4$

0.80 g  
10.00 mL

### Solution G:

Na $_2$ S  $\times$  9 H $_2$ O  
Distilled water

0.40 g  
10.00 mL

Solution A is sparged with 80% N $_2$  and 20% CO $_2$  gas mixture to reach a pH below 6 (at least 30 min), then distributed under the same gas atmosphere in an autoclaved 50 mL medium in 100 mL serum bottles and autoclaved separately under 100 $\times$  for 20 min. e.g., 20% CO $_2$  gas atm.

## 1638. Minimum Essential Medium (MEM)

Cultivation of cell lines like DH82 (canine macrophage; ATCC CRL-10389)

Gibco 31095-029

MEM (1x)



# The cultivation media landscape

**1. NUTRIENT AGAR**

Peptone	5.0	g
Meat extract	3.0	g
Agar, if necessary	15.0	g
Distilled water	1000	ml

Adjust pH to 7.0. For *Bacillus* strain recommended for sporulation.

**1600. FRANCISELLA PERSICA MEDIUM**

2x concentrated stock:

L-15 (Leibovitz medium) powder	0.299 g	1 pack
DL-aspartic acid	0.5 g	10 ml

## 12. SOIL EXTRACT MEDIUM

Sterilize 400.0 g of air-dried garden soil (with high content of organic matter) in 1000 ml tap water for one hour at 121°C. Allow it to sediment for a few hours at room temperature. Centrifuge the supernatant. Add 15.0 g agar per 1000 ml to the clear supernatant solution thus obtained. Adjust pH to 6.8 - 7.0 and sterilize.

	10	3.6
Na <sub>2</sub> -EDTA x 2H <sub>2</sub> O	10	0.6
Trace metal mix		0.1

## 194a. DESULFOTOMACULUM OX39 MEDIUM (XYLENE)

<b>Solution A:</b>	
Na <sub>2</sub> SO <sub>4</sub>	1.40 g
H <sub>2</sub> PO <sub>4</sub>	0.20 g
H <sub>4</sub> Cl	0.30 g
NaCl	1.00 g
CaCl <sub>2</sub> x 6 H <sub>2</sub> O	0.40 g
Cl <sub>2</sub> x 2 H <sub>2</sub> O	0.50 g
vanadate-tungstate solution (see medium 385)	0.15 g
resazurin solution (0.1% w/v)	1.00 ml
Distilled water	0.50 ml
	930.00 ml

### Trace element solution SL-10 (see medium 320)

1.00 ml
1.50 g
30.00 ml
0.30 ml

20.00 ml
1.00 ml
0.80 g
10.00 ml

0.40 g
10.00 ml
0.30 ml
20.00 ml

1.00 ml
0.80 g
10.00 ml
0.40 g

10.00 ml
0.40 g
10.00 ml
0.40 g

at least 30 min), then distributed under the same gas atmosphere in an autoclaved separately under 100°C (e.g., 20% CO <sub>2</sub> gas atm)
50 ml medium in 100 ml serum bottles) and aut
are
and

20% CO <sub>2</sub> gas atm
50 ml medium in 100 ml serum bottles) and aut
are
and

Gibco 31095-029
MEM (1x)

Human-readable & suited for preparation in the lab

## Medium data

Search for medium no. = [2].

Unless otherwise stated, sterilize media by

## 2 XYLOSE-YP BROTH

Xylose  
Yeast extract (BD-Difco)  
Polypeptone (Nihon Pharm. Co.)  
Sodium acetate  
MgSO<sub>4</sub>·7H<sub>2</sub>O  
MnSO<sub>4</sub>·xH<sub>2</sub>O  
FeSO<sub>4</sub>·7H<sub>2</sub>O  
NaCl  
Distilled water  
Adjust pH to 6.8.

(ThermoFisher Scientific)
Filter sterilize each tube through 0.2μm filter.
<b>Stock Solution A (10 ml)</b>
0.02g CoCl <sub>2</sub> ·6H <sub>2</sub> O
0.02g CuSO <sub>4</sub> ·5H <sub>2</sub> O
0.16g MnSO <sub>4</sub> ·H <sub>2</sub> O
0.2g ZnSO <sub>4</sub> ·7H <sub>2</sub> O
<b>Stock Solution D (10 ml)</b>
1g Glutathione (reduced)
1g Ascorbic acid
0.05g FeSO <sub>4</sub> ·7H <sub>2</sub> O
100μl Stock Solution A
100μl Stock Solution B
100μl Stock Solution C
<b>Stock Solution B (10 ml)</b>
0.02g NaMoO <sub>4</sub> ·2H <sub>2</sub> O
<b>Stock Solution C</b>
0.02g Na <sub>2</sub> SeO <sub>3</sub>
<b>Vitamin Stock (10 ml)</b>
0.1g p-aminobenzoic acid
0.05g B <sub>12</sub> vitamin
0.01g d-Biotin

	[g/L]	[ml/L]
<b>BG11-Mix</b>	K <sub>2</sub> HPO <sub>4</sub> x 3H <sub>2</sub> O	20
-	Na <sub>2</sub> CO <sub>3</sub>	10
-	Fe-NH <sub>4</sub> -citrate	3.0
<b>Trace metal Mix</b>		
	H <sub>3</sub> BO <sub>3</sub>	2.9
	MnCl <sub>2</sub> x 4H <sub>2</sub> O	1.81
	ZnSO <sub>4</sub> x 7H <sub>2</sub> O	0.22
	Na <sub>2</sub> MoO <sub>4</sub> x 2H <sub>2</sub> O	0.39
	CuSO <sub>4</sub> x 5H <sub>2</sub> O	>
	Co(NO <sub>3</sub> ) <sub>2</sub> x 6H <sub>2</sub> O	>
		10 ml   0.8g/100mL Stock Sol.
		10 ml   0.5g/100mL Stock Sol.

1638. Minimum Essential Medium (MEM)
Cultivation of cell lines like DH82 (canine macrophage; ATCC CRL-10389)
MEM (1x)



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# The cultivation media landscape

**1. NUTRIENT AGAR**

Peptone	5.0	g
Meat extract	3.0	g
Agar, if necessary	15.0	g
Distilled water	1000	ml

Adjust pH to 7.0. For *Bacillus* strain recommended for sporulation.

**1600. FRANCISSELLA PERSICA MEDIUM**

2x concentrated stock:		
L-15 (Leibovitz medium) powder	1 pack	
DL-aspartic acid	0.299 g	
L-glutamic acid	0.5 g	
L-glutamine	10 ml	
L-proline		
α-ketoglutaric acid		
D-glucosamine		
Stock solution		
Vitamin stock		
Adjust pH to 7.0.		
Fill tubes.		
Add 10 ml medium per tube.		
sterilize at 121°C for 15 min.		
trypticase soy broth		
FBP		
chitosan		

**Medium data**

Search for medium no. = [2].

Unless otherwise stated, sterilize media by autoclaving at 121°C for 15 min.

## 2 XYLOSE-YP BROTH

Xylose	
Yeast extract (BD-Difco)	
Polypeptone (Nihon Pharm. Co.)	
Sodium acetate	
MgSO <sub>4</sub> ·7H <sub>2</sub> O	
MnSO <sub>4</sub> ·xH <sub>2</sub> O	
FeSO <sub>4</sub> ·7H <sub>2</sub> O	
NaCl	
Distilled water	
Adjust pH to 6.8.	

Neither standardized nor machine-readable

## 12. SOIL EXTRACT MEDIUM

Sterilize 400.0 g of air-dried garden soil (with high content of organic matter) in 1000 ml tap water for one hour at 121°C. Allow it to sediment for a few hours at room temperature. Centrifuge the supernatant. Add 15.0 g agar per 1000 ml to the clear supernatant solution thus obtained. Adjust pH to 6.8 - 7.0 and sterilize.

		10	3.6
Na <sub>2</sub> -EDTA x 2H <sub>2</sub> O		10	0.6
Trace metal stock			0.1

## 194a. DESULFOTOMACULUM OX39 MEDIUM (XYLENE)

<b>Solution A:</b>	
Na <sub>2</sub> SO <sub>4</sub>	1.40 g
H <sub>2</sub> PO <sub>4</sub>	0.20 g
H <sub>4</sub> Cl	0.30 g
NaCl	1.00 g
CaCl <sub>2</sub> x 6 H <sub>2</sub> O	0.40 g
Cl <sub>2</sub> x 2 H <sub>2</sub> O	0.50 g
vanadate-tungstate solution (see medium 385)	0.15 g
resazurin solution (0.1% w/v)	1.00 ml
Distilled water	0.50 ml
	930.00 ml

Trace element solution SL-10 (see medium 320)

1.00 ml

<b>Solution C:</b>	
Na <sub>2</sub> CO <sub>3</sub>	
Distilled water	

1.50 g

30.00 ml

<b>Solution D:</b>	
Na <sub>2</sub> S x 9 H <sub>2</sub> O	
Distilled water	

0.30 ml

20.00 ml

<b>Solution E:</b>	
Na <sub>2</sub> S	
Distilled water	

1.00 ml

<b>Solution F:</b>	
Na <sub>2</sub> S x 9 H <sub>2</sub> O	
Distilled water	

0.80 g

10.00 ml

<b>Solution G:</b>	
Na <sub>2</sub> S x 9 H <sub>2</sub> O	
Distilled water	

0.40 g

10.00 ml

<b>Solution H:</b>	
Na <sub>2</sub> S	
Distilled water	

Solution A is sparged with 80% N<sub>2</sub> and 20% CO<sub>2</sub> gas mixture to reach a pH below 6 (at least 30 min), then distributed under the same gas atmosphere in an autoclave (50 ml medium in 100 ml serum bottles) and autoclaved separately under 100°C for 15 min (e.g., 20% CO<sub>2</sub> gas atm).

## 1638. Minimum Essential Medium (MEM)

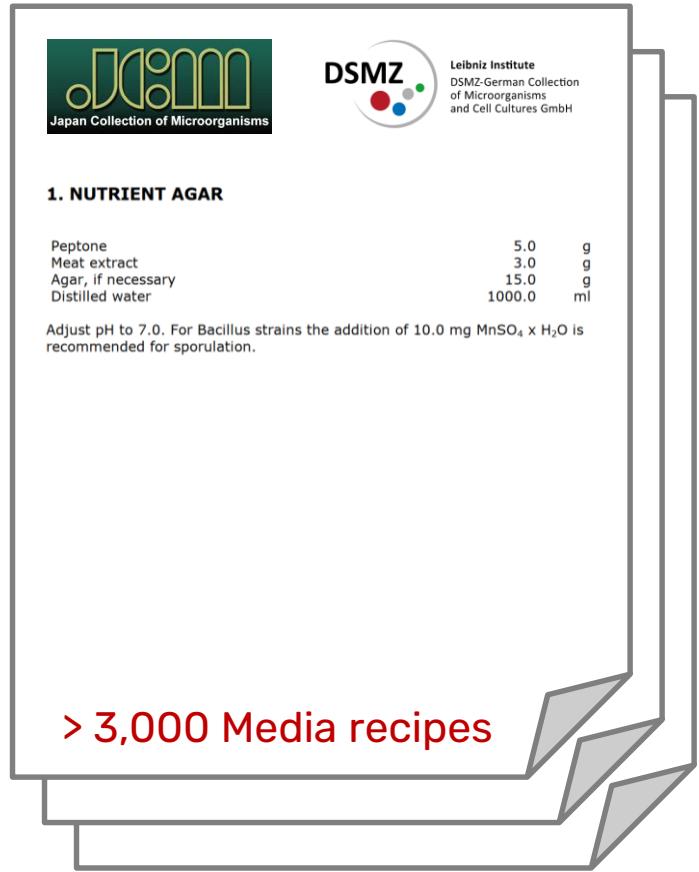
Cultivation of cell lines like DH82 (canine macrophage; ATCC CRL-10389)

Gibco 31095-029

MEM (1x)



# What we did to change this



**Japan Collection of Microorganisms**

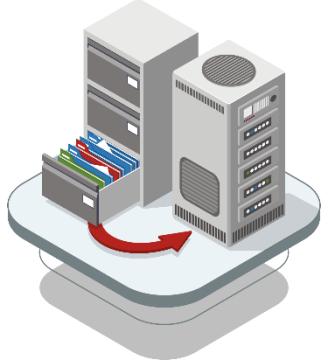
**DSMZ** Leibniz Institute  
DSMZ-German Collection  
of Microorganisms  
and Cell Cultures GmbH

**1. NUTRIENT AGAR**

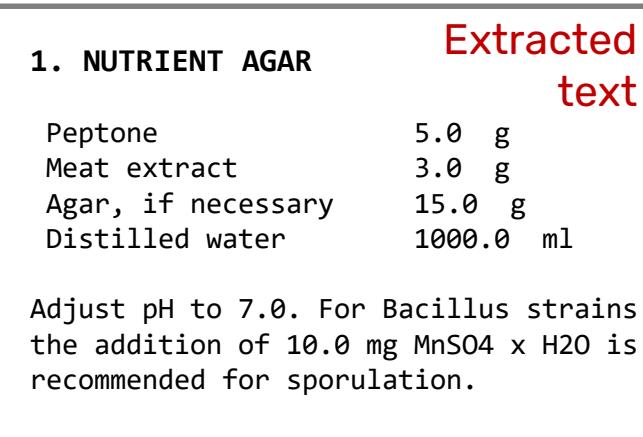
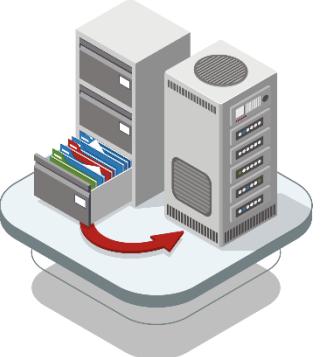
Peptone	5.0	g
Meat extract	3.0	g
Agar, if necessary	15.0	g
Distilled water	1000.0	ml

Adjust pH to 7.0. For *Bacillus* strains the addition of 10.0 mg MnSO<sub>4</sub> x H<sub>2</sub>O is recommended for sporulation.

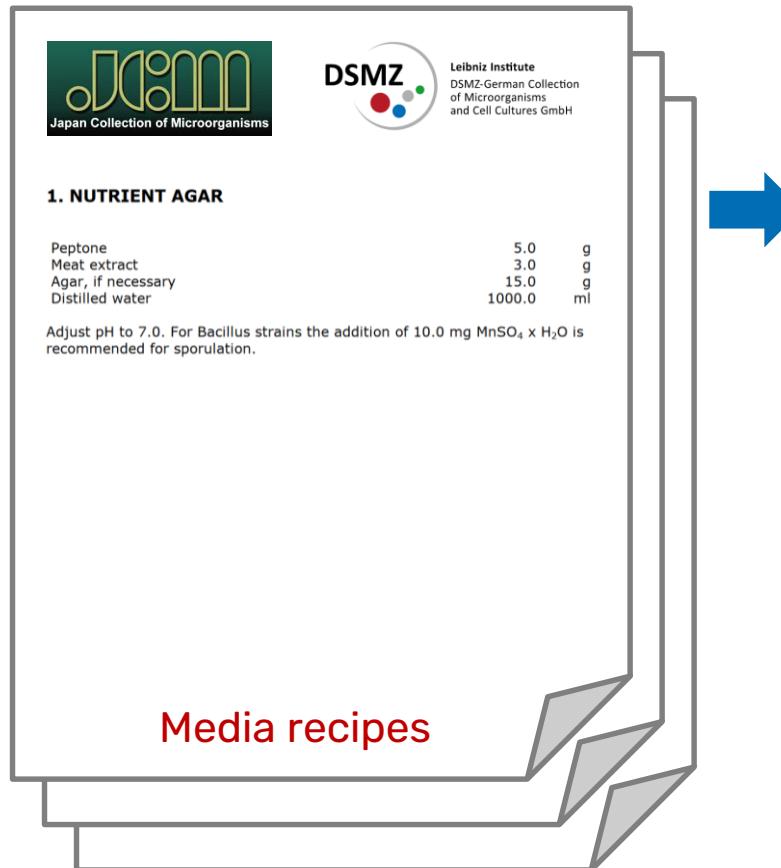
> 3,000 Media recipes



# What we did to change this



# What we did to change this



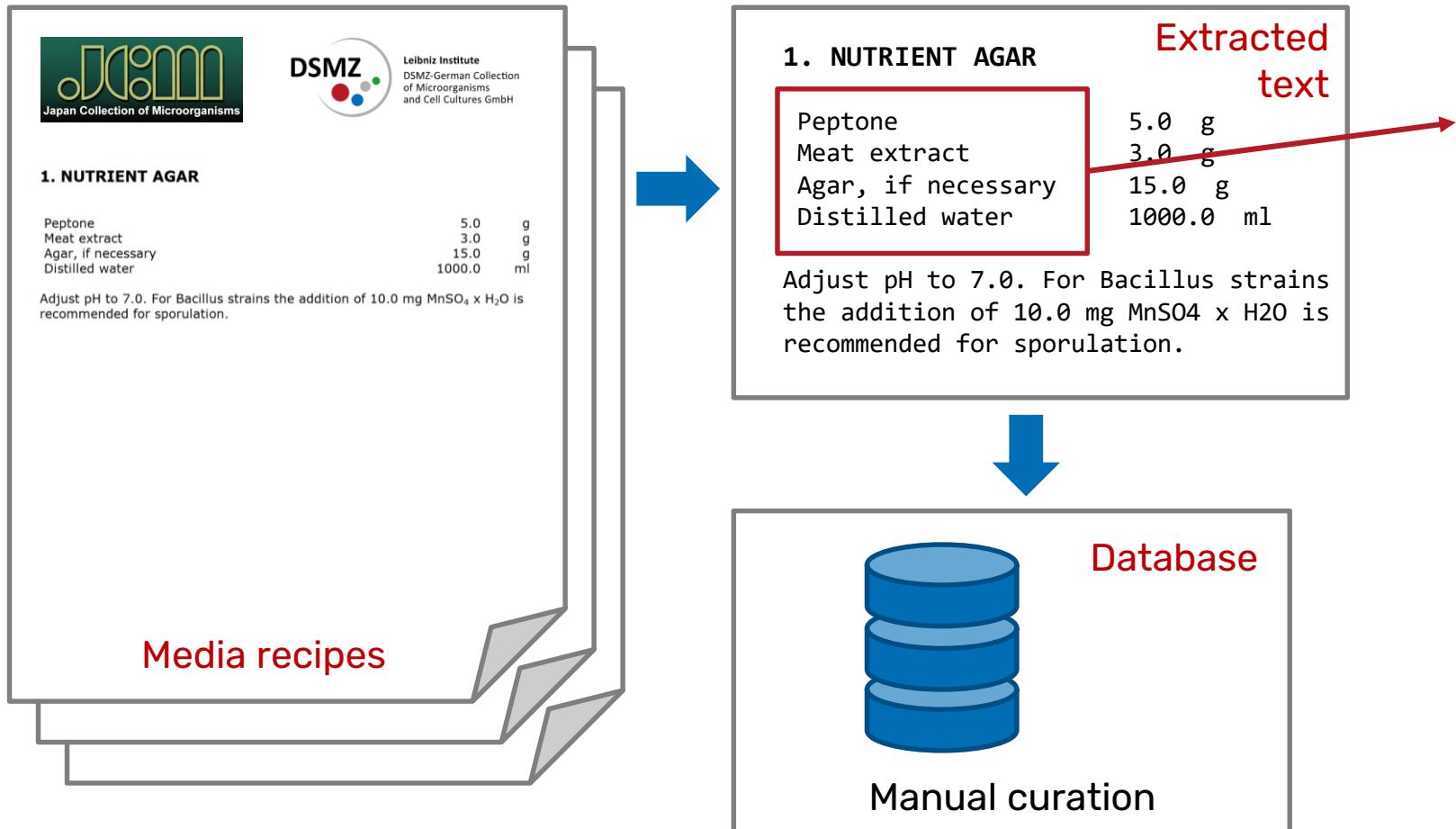
## Standardization:

- Synonyms
- Variant forms of spelling
- Spelling mistakes
- Attributes & conditions

## Mapping to other databases



# What we did to change this



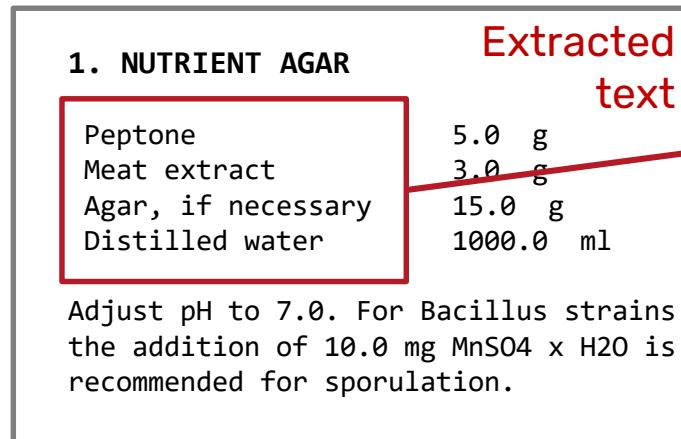
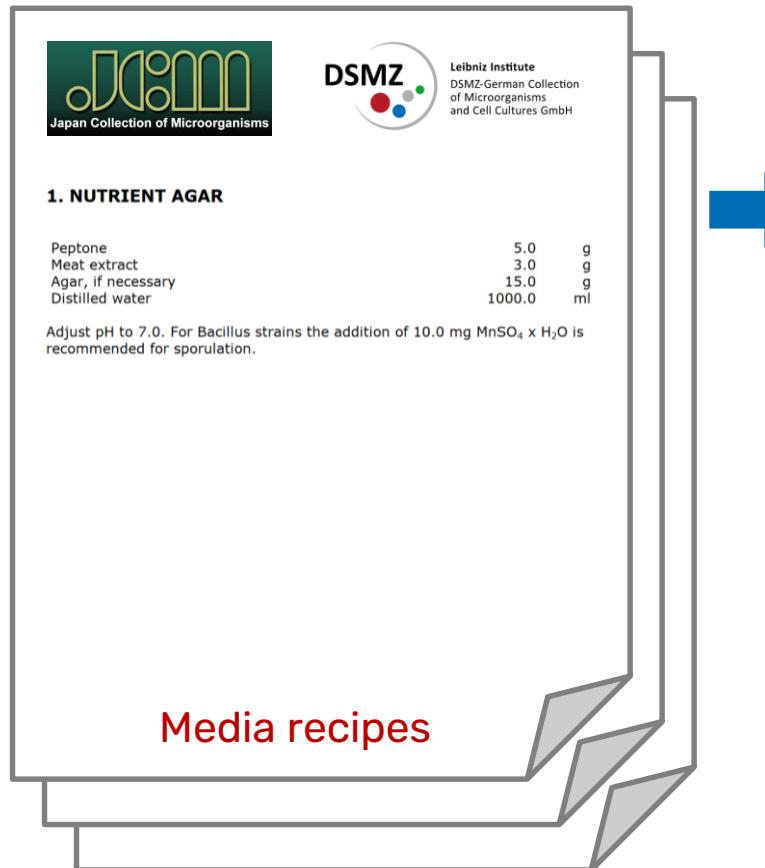
## Standardization:

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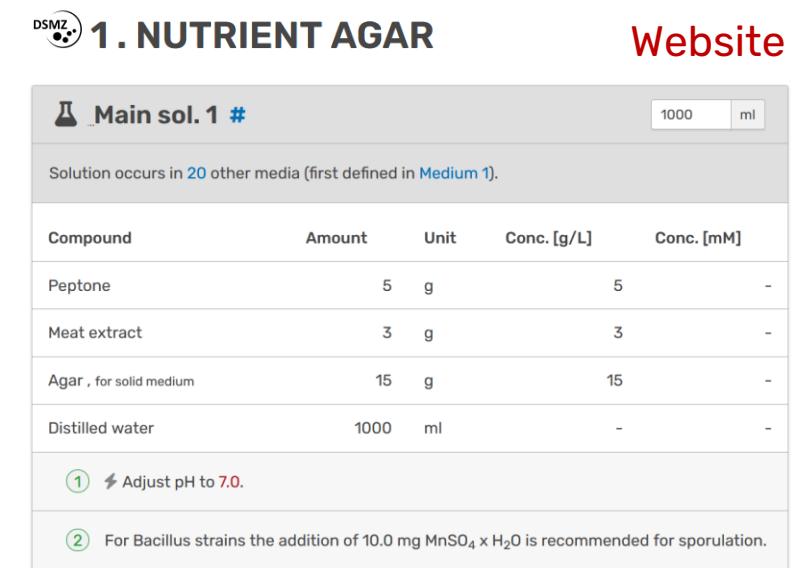
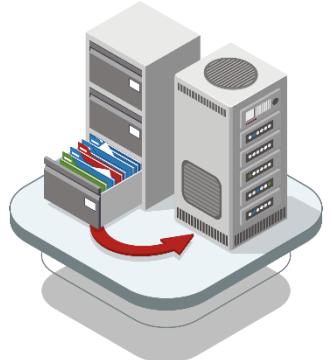
# What we did to change this



## Standardization:

- Synonyms
- Variant forms of spelling
- Spelling mistakes
- Attributes & conditions

## Mapping to other databases



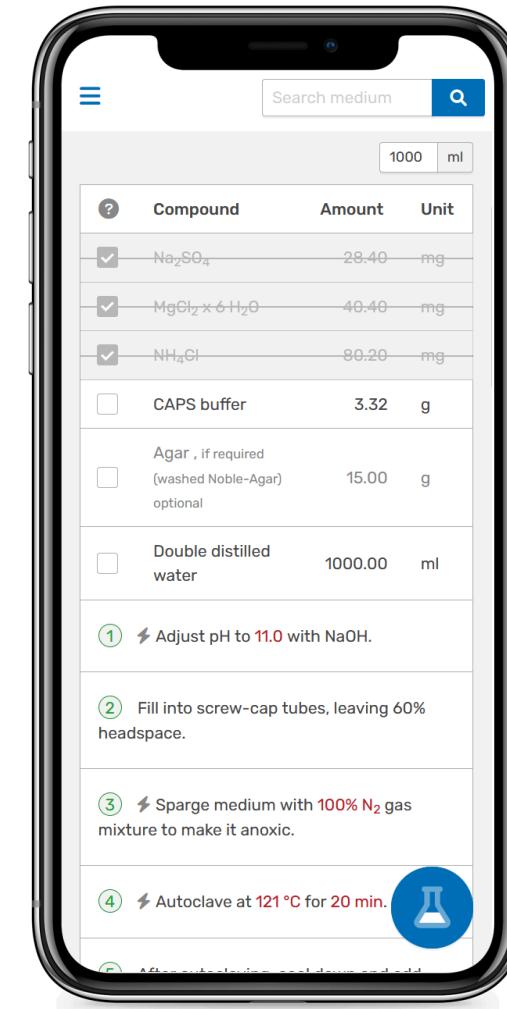
# FAIR & continuously extended

- All data is available online according to FAIR data principles
- Expert-curated and continuously extended



# FAIR & continuously extended

- All data is available online according to FAIR data principles
- Expert-curated and continuously extended
- Mobile friendly web page
- QR-code generation for easy switch to mobile
- Medium cooking guide on mobile devices

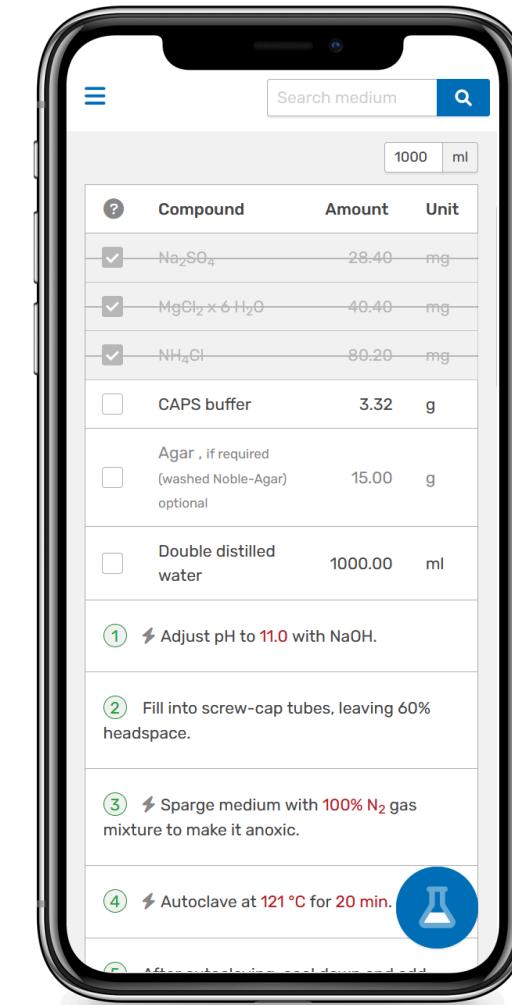


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# FAIR & continuously extended

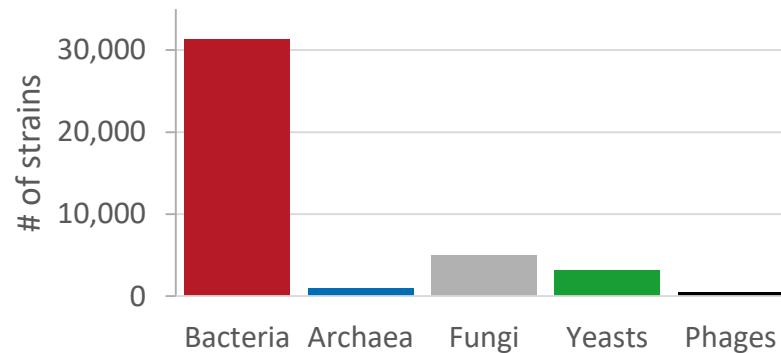
- All data is available online according to FAIR data principles
- Expert-curated and continuously extended
- Mobile friendly web page
- QR-code generation for easy switch to mobile
- Medium cooking guide on mobile devices
- Website available in English and German
- Accessibility features, e.g. for people with dyslexia



# Standardization leads to new possibilities

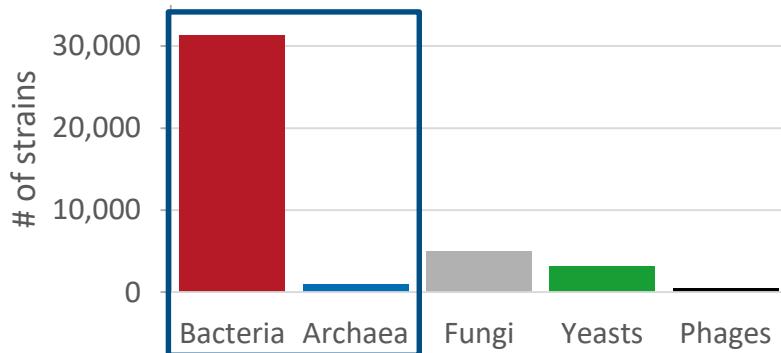


- Search & find cultivation media
  - by medium name and number
  - by ingredients & concentrations
  - by strains



# Standardization leads to new possibilities

- Search & find cultivation media
  - by medium name and number
  - by ingredients & concentrations
  - by strains
  - by taxonomy



Species  Sulfolobus acidocaldarius  Defined media only

**Taxonomic tree**

- Bacteria 2206 media
- ▼ Archaea 324 media
  - Euryarchaeota 250 media
  - Nitrososphaerota 3 media
  - ▼ Thermoproteota 77 media
    - ▼ Thermoprotei 77 media
      - Acidilobales 5 media
      - Desulfurococcales 31 media
      - Fervidicoccales 2 media
      - ▼ Sulfolobales 18 media
        - ▼ Sulfolobaceae 18 media
          - Acidianus 10 media
          - Metallosphaera 6 media
          - Saccharolobus 5 media
          - Stygiolobus 2 media
          - Sulfodiicoccus 1 media
        - ▼ Sulfolobus 2 media
          - Sulfuracidifex 2 media
          - Sulfurisphaera 2 media
      - Thermoproteales 24 media

**Media shown for *Sulfolobus acidocaldarius* (species)**

Media ID	Medium Name
88	SULFOLOBUS MEDIUM
J165	SULFOLOBUS MEDIUM



# Standardization leads to new possibilities

- Search & find cultivation media
  - by medium name and number
  - by ingredients & concentrations
  - by strains & taxonomy
- Modify
  - Volume
  - Strain-specific media

 \* Modified for *Thiofractor thiocaminus* DSM 22050

Supplement medium with 1.00 g/l NaNO<sub>3</sub> and omit pyruvate, lactate and yeast extract. Upon autoclaving add 3.00 g/l sterile sulfur powder (sterilized by steaming for 3 hours on each of 3 successive days) and adjust pH to 6.0 - 6.5.



# Standardization leads to new possibilities

- Search & find cultivation media
  - by medium name and number
  - by ingredients & concentrations
  - by strains & taxonomy
- Modify
  - Volume
  - Strain-specific media

## \* Modified for *Thiofractor thiocaminus* DSM 22050

Supplement medium with 1.00 g/l NaNO<sub>3</sub> and omit pyruvate, lactate and yeast extract. Upon autoclaving add 3.00 g/l sterile sulfur powder (sterilized by steaming for 3 hours on each of 3 successive days) and adjust pH to 6.0 - 6.5.

Main sol. 1011c #					1020 ml
Compound	Amount	Unit	Conc. [g/L]	Conc. [mM]	
NaCl	30.00	g	29.412	503.281	
...	...	...	...	...	...
CaCl <sub>2</sub> × 2 H <sub>2</sub> O	0.14	g	0.137	0.934	
Na-pyruvate*	0.50	g	0.49	4.455	
Na-lactate*	0.50	g	0.49	4.374	
Yeast extract*	0.10	g	0.098		
Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> × 5 H <sub>2</sub> O	1.50	g	1.471	5.925	
Wolin's vitamin solution	10.00	ml	-	-	
Sulfur powder*	3.00	g	-	-	
NaNO <sub>3</sub> *	1.00	g	-	-	
Distilled water	1000.00	ml	-	-	



# Standardization leads to new possibilities



- Search & find cultivation media
  - by medium name and number
  - by ingredients & concentrations
  - by strains & taxonomy
- Modify
  - Volume
  - Strain-specific media
- Export
  - Download tables as CSV
  - Download media and solutions as PDF recipes

**JCM**

**2: XYLOSE-YP BROTH**

Xylose	10.00	g
Yeast extract (BD-Difco)	5.00	g
Polypeptone (Nihon Pharm. Co.)	10.00	g
Sodium acetate	5.00	g
MgSO <sub>4</sub> x 7 H <sub>2</sub> O	0.20	g
MnSO <sub>4</sub> x n H <sub>2</sub> O	10.00	mg
FeSO <sub>4</sub> x 7 H <sub>2</sub> O	10.00	mg
NaCl	10.00	mg
Distilled water	1000.00	ml

Adjust pH to 6.8.

Dissolve ingredients (except carbonate, pyruvate, lactate, yeast extract, thiosulfate and vitamins), then dispense medium with 80% H<sub>2</sub> and 20% CO<sub>2</sub> gas mixture for 30 - 45 min to make it anoxic. Dispense medium under same gas atmosphere into anoxic Hungate-type tubes or serum vials up to a volume of 20% and autoclave. Add pyruvate, lactate, yeast extract, thiosulfate and vitamin to the autoclaved medium from sterile anoxic stock solutions prepared under 100% N<sub>2</sub> gas and carbonate from a sterile anoxic stock solution prepared under 80% N<sub>2</sub> and 20% CO<sub>2</sub> gas mixture. Solutions of vitamins and thiosulfate may be sterilized. Adjust pH of the complete medium to 6.7. Prior to inoculation reduce medium with 10 - 20 mg/l sodium dithionite, added from a 5% (w/v) solution freshly prepared under N<sub>2</sub> and filter sterilized. After inoculation pressurize vessels to 2 bar overpressure with sterile 80% H<sub>2</sub> and 20% CO<sub>2</sub> gas mixture.

**Modified Wölin's mineral solution (from medium 141)**

Nitrosoacetic acid	1.50	g
MgSO <sub>4</sub> x 7 H <sub>2</sub> O	5.00	g
MnSO <sub>4</sub> x 4 H <sub>2</sub> O	0.50	g
NaCl	1.00	g
FeSO <sub>4</sub> x 7 H <sub>2</sub> O	0.10	g
CoSO <sub>4</sub> x 7 H <sub>2</sub> O	0.18	g
CaCl <sub>2</sub> x 2 H <sub>2</sub> O	0.10	g
ZnSO <sub>4</sub> x 7 H <sub>2</sub> O	0.18	g
CuSO <sub>4</sub> x 5 H <sub>2</sub> O	0.01	g
AlK(SO <sub>4</sub> ) <sub>2</sub> x 12 H <sub>2</sub> O	0.02	g
H <sub>2</sub> BO <sub>3</sub>	0.01	g
Na <sub>2</sub> MoO <sub>4</sub> x 2 H <sub>2</sub> O	0.01	g

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**1011c: DESULFOTHERMUS MJ MEDIUM (H<sub>2</sub>/CO<sub>2</sub>)**

NaCl	30.00	g
K <sub>2</sub> HPO <sub>4</sub>	0.14	g
CaCl <sub>2</sub> x 2 H <sub>2</sub> O	0.14	g
MgSO <sub>4</sub> x 7 H <sub>2</sub> O	3.40	g
MgCl <sub>2</sub> x 6 H <sub>2</sub> O	4.18	g
KCl	0.33	g
NH <sub>4</sub> Cl	0.25	g
Fe(NH <sub>4</sub> ) <sub>2</sub> (SO <sub>4</sub> ) <sub>2</sub> x 6 H <sub>2</sub> O	0.01	g
Modified Wölin's mineral solution	10.00	ml
Na <sub>2</sub> CO <sub>3</sub>	1.50	g
Na-pyruvate	0.50	g
Na-lactate	0.50	g
Yeast extract	0.10	g
Yeast extract	1.50	g
Wölin's vitamin solution	10.00	ml
Distilled water	1000.00	ml

Dissolve ingredients (except carbonate, pyruvate, lactate, yeast extract, thiosulfate and vitamins), then dispense medium with 80% H<sub>2</sub> and 20% CO<sub>2</sub> gas mixture for 30 - 45 min to make it anoxic. Dispense medium under same gas atmosphere into anoxic Hungate-type tubes or serum vials up to a volume of 20% and autoclave. Add pyruvate, lactate, yeast extract, thiosulfate and vitamin to the autoclaved medium from sterile anoxic stock solutions prepared under 100% N<sub>2</sub> gas and carbonate from a sterile anoxic stock solution prepared under 80% N<sub>2</sub> and 20% CO<sub>2</sub> gas mixture. Solutions of vitamins and thiosulfate may be sterilized. Adjust pH of the complete medium to 6.7. Prior to inoculation reduce medium with 10 - 20 mg/l sodium dithionite, added from a 5% (w/v) solution freshly prepared under N<sub>2</sub> and filter sterilized. After inoculation pressurize vessels to 2 bar overpressure with sterile 80% H<sub>2</sub> and 20% CO<sub>2</sub> gas mixture.

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# Standardization leads to new possibilities



- Search & find cultivation media
  - by medium name and number
  - by ingredients & concentrations
  - by strains & taxonomy
- Modify
  - Volume
  - Strain-specific media
- Export
  - Download tables as CSV
  - Download media and solutions as PDF recipes
- Connect
  - Strains and ingredients are linked to other resources

**JCM**

**2: XYLOSE-YP BROTH**

	10.00	g
Xylose	5.00	g
Yeast extract (BD-Difco)	10.00	g
Polypeptone (Nihon Pharm. Co.)	5.00	g
Sodium acetate	0.20	g
MgSO <sub>4</sub> x 7 H <sub>2</sub> O	10.00	mg
MnSO <sub>4</sub> x n H <sub>2</sub> O	10.00	mg
FeSO <sub>4</sub> x 7 H <sub>2</sub> O	10.00	mg
NaCl	10.00	mg
Distilled water	1000.00	ml

Adjust pH to 6.8.

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**DSMZ**

**Microorganisms**

**1011c: DESULFOTHERMUS MJ MEDIUM (H<sub>2</sub>/CO<sub>2</sub>)**

This recipe contains strain-specific modifications for Thiotractor thiocamminus DSM 22050 \*

	30.00	g
NaCl	0.14	g
K <sub>2</sub> HPO <sub>4</sub>	0.14	g
CaCl <sub>2</sub> x 2 H <sub>2</sub> O	3.40	g
MgSO <sub>4</sub> x 7 H <sub>2</sub> O	4.18	g
MgCl <sub>2</sub> x 6 H <sub>2</sub> O	0.33	g
KCl	0.25	g
NH <sub>4</sub> Cl	0.01	g
Fe(NH <sub>4</sub> ) <sub>2</sub> (SO <sub>4</sub> ) <sub>2</sub> x 6 H <sub>2</sub> O	10.00	ml
Modified Wölin's mineral solution	1.50	g
Na <sub>2</sub> CO <sub>3</sub>	0.60	g
No-lactate	0.60	g
No-yeast	0.10	g
Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> x 5 H <sub>2</sub> O	1.50	g
Wölin's vitamin solution	10.00	ml
Sulfur powder	3.00	g
NaNO <sub>3</sub>	1.00	g
Distilled water	1000.00	ml

Dissolve ingredients (except carbonate, pyruvate, lactate, yeast extract, thiosulfate and vitamins), then sparge medium with 80% H<sub>2</sub> and 20% CO<sub>2</sub> gas mixture for 30 - 45 min to make it anoxic. Dispense medium under same gas atmosphere into anoxic Hungate-type tubes or serum vials up to a volume of 20% and autoclave. Add pyruvate, lactate, yeast extract, thiosulfate and vitamins to the autoclaved medium from sterile anoxic stock solutions prepared under 100% N<sub>2</sub> gas and carbonate from a sterile anoxic stock solution prepared under 80% N<sub>2</sub> and 20% CO<sub>2</sub> gas mixture. Solutions of vitamins and thiosulfate are sterilized by filtration. Adjust pH of the complete medium to 6.7. Prior to inoculation reduce medium with 10 - 20 mg/l sodium dithionite, added a 5% (w/v) solution freshly prepared under N<sub>2</sub> and filter sterilized. After inoculation pressurize vessels to 2 bar overpressure with sterile 80% H<sub>2</sub> and 20% CO<sub>2</sub> mixture.

\* Supplement medium with 1.00 g/l NaNO<sub>3</sub> and omit pyruvate, lactate and yeast extract. Upon autoclaving add 3.00 g/l sterile sulfur powder (sterilized by steaming for 3 hours on each of 3 successive days) and adjust pH to 6.0 - 6.5.

Modified Wölin's mineral solution (from medium 141)

	1.50	g
Nitritotriacetic acid	3.00	g
MgSO <sub>4</sub> x 7 H <sub>2</sub> O	0.50	g
MnSO <sub>4</sub> x H <sub>2</sub> O	1.00	g
NaCl	0.10	g
FeSO <sub>4</sub> x 7 H <sub>2</sub> O	0.18	g

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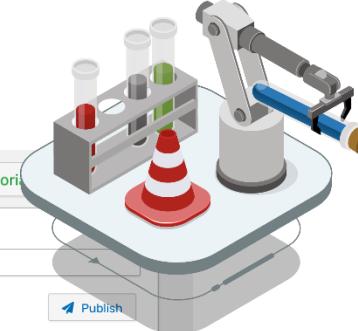
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# Community engagement

## Medium builder

- Design your own medium
- Add metadata, references and strains
- Publish under FAIR principles
- Get a unique & persistent medium number



The screenshot shows the MediaDive Medium builder interface. At the top, there's a header with a 'Medium builder' icon, a search bar containing 'HaHa agar', and buttons for 'Save', 'Load', 'View mode', 'Start over', and 'Publish'. Below this is a 'Main solution' section where users can enter compound names, amounts, and units. The current entry is 'Artificial sea water (ASW) 2x' at 350 ml. There are also notes: 'Add magnetic stir bar.' and 'pH should be between 6.5 and 7.0.'. To the right, there are sections for 'Your data' (Author(s) and ORCID), 'Medium metadata' (Reference DOI, Final pH, Defined medium, Description), 'Growth data', and 'Gas composition'. A large preview window at the bottom displays the medium recipe: P1: HaHa agar, Main solution: Artificial sea water (ASW) 2x (350.00 ml), 1. Add magnetic stir bar., HEPES (50 mM, pH 7.5) (9.92 g), MilleQ water, fill up to (650.00 ml).



# Community engagement

## Medium builder

- Design your own medium
- Add metadata, references and strains
- Publish under FAIR principles
- Get a unique & persistent medium number

## Get in touch

- Tailored transformation process for a large number of cultivation media

The screenshot displays the MediaDive Medium builder interface. At the top, there's a header with a 'Medium builder' icon, 'Tour' and 'Tutorial' buttons, and a 'Publish' button. Below the header, the 'Medium name' is set to 'HaHa agar'. The 'Main solution' section lists the following ingredients:

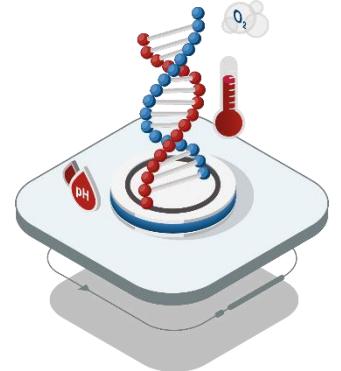
Compound	Amount	Unit
Artificial sea water (ASW) 2x	350	ml
HEPES (50 mM, pH 7.5)	9.92	g
MilleQ water , fill up to	650	ml
Bacto agar	19	g/l

Instructions and notes are provided: 'Add magnetic stir bar.' and 'pH should be between 6.5 and 7.0.' On the right, the 'Your data' section shows authors 'Richard L. Hahnke and Jens Harder' and an ORCID field. The 'Medium metadata' section includes a DOI ('https://doi.org/10.1016/j.syapm.2013.06.00'), final pH ('7.5'), and a 'Defined medium' checkbox. The 'Growth data' and 'Gas composition' sections are currently empty.



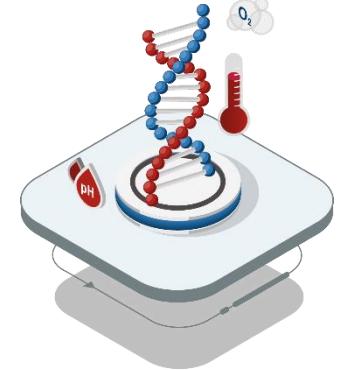
# Cultivation media prediction

- Prototype currently in alpha test phase

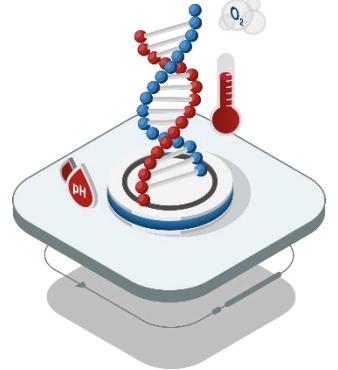


# Cultivation media prediction

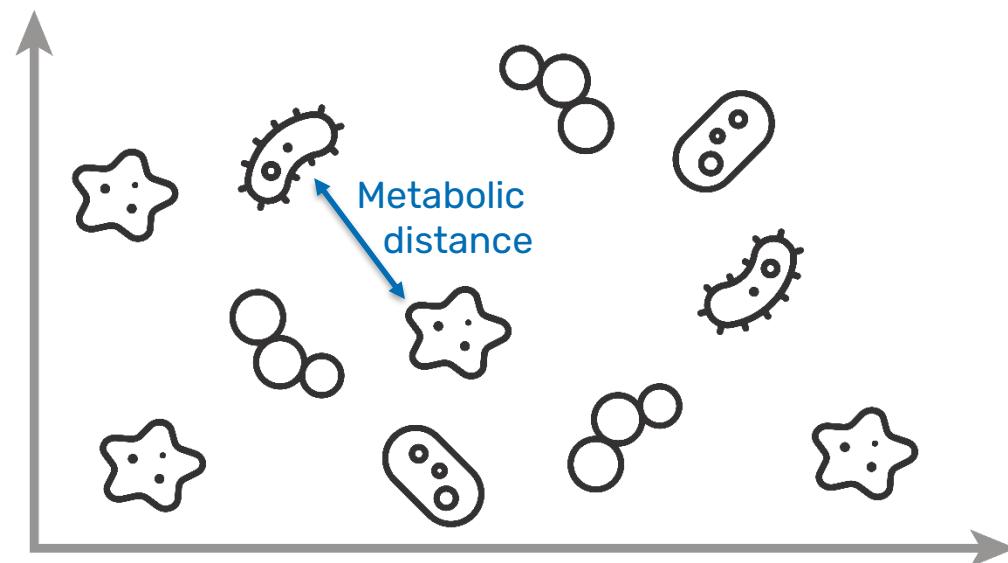
- Prototype currently in alpha test phase
- Find metabolic neighbors with  $k$ -nearest neighbor (KNN) and *Pfam* profiles



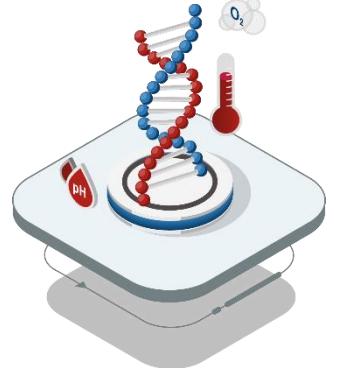
# Cultivation media prediction



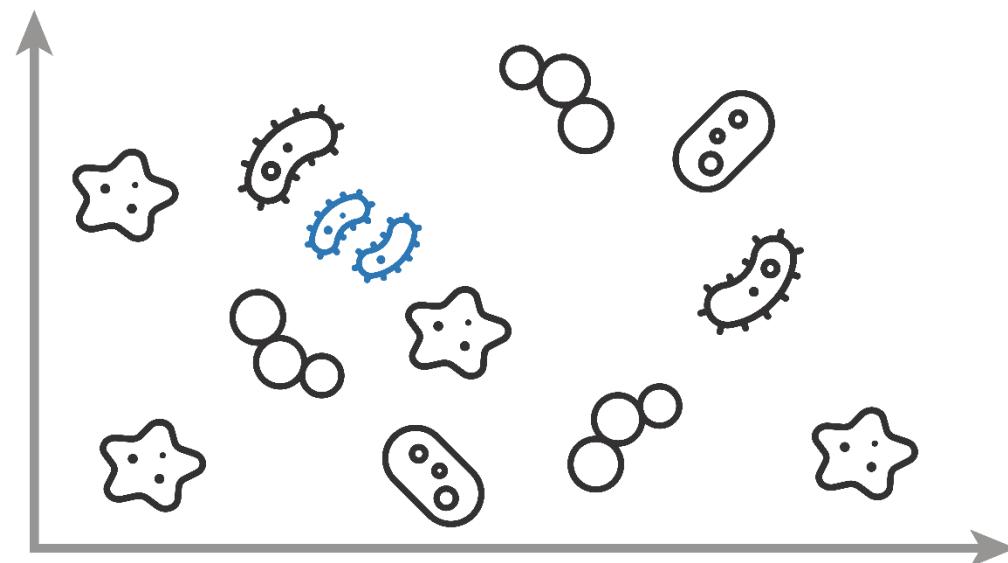
- Strains are arranged using their metabolic distance
- Find metabolic neighbors with  $k$ -nearest neighbor (KNN) and Pfam profiles



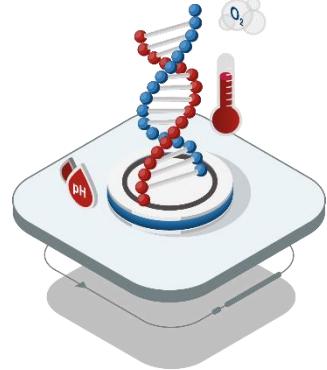
# Cultivation media prediction



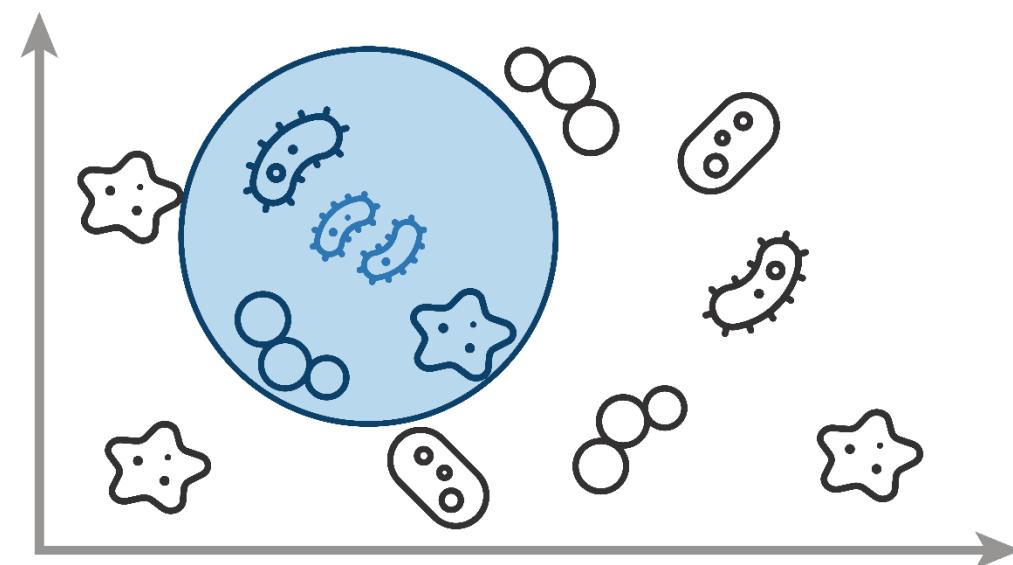
- Strains are arranged using their metabolic distance
- Find metabolic neighbors with  $k$ -nearest neighbor (KNN) and Pfam profiles



# Cultivation media prediction

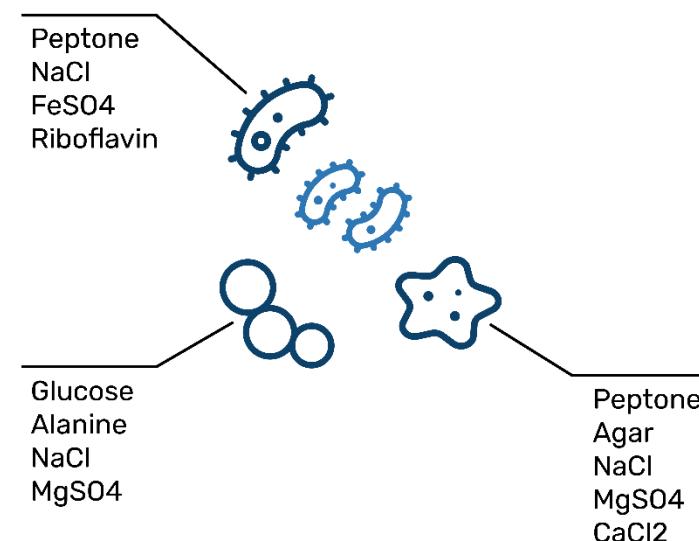
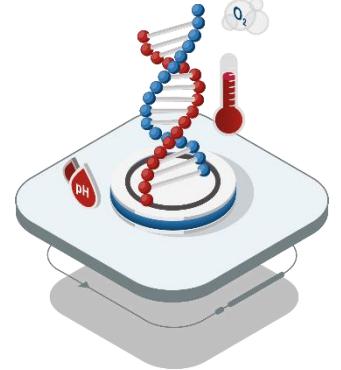


- $k$ -Nearest-Neighbor
- Find *Metabolic neighbors* and calculate metabolic distances

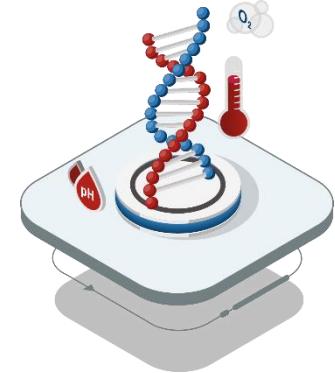


# Cultivation media prediction

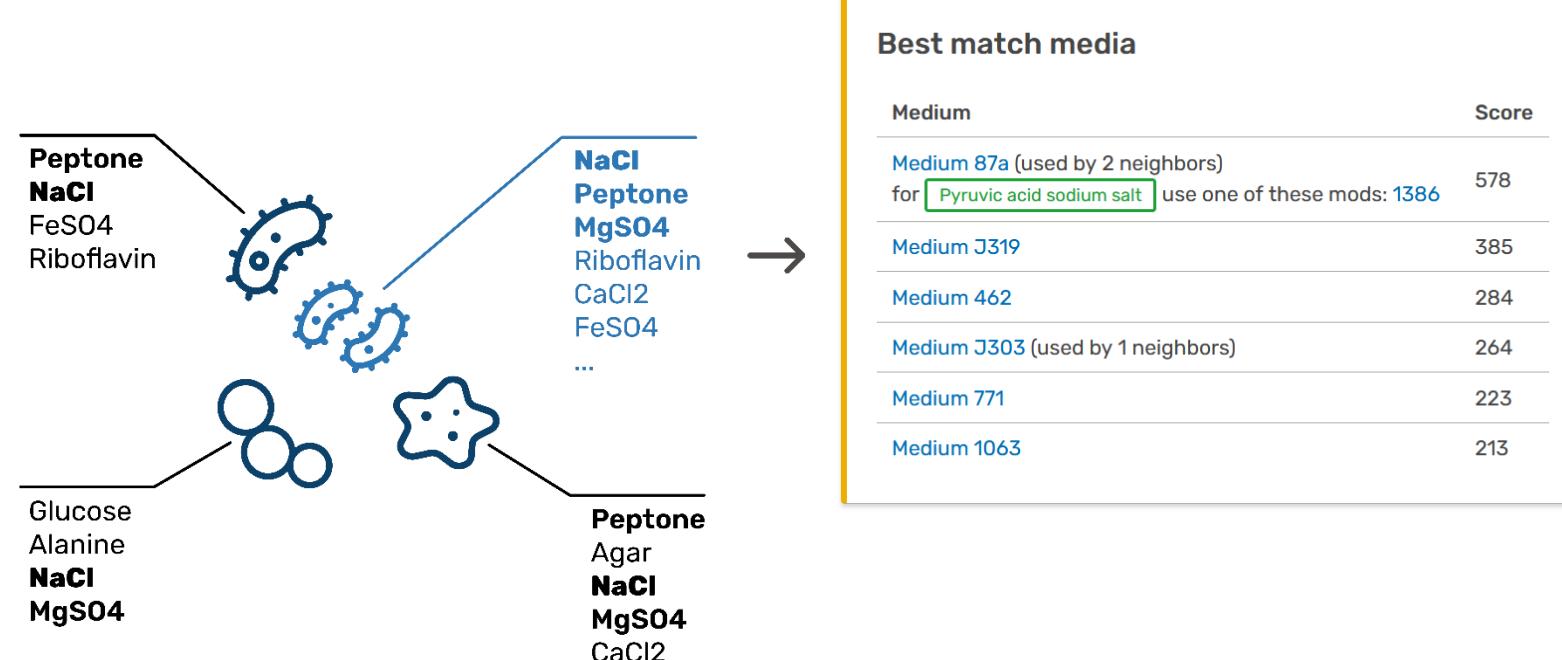
- Medium composition of metabolic neighbors



# Cultivation media prediction



- Propose new medium composition
- Find matching media



# Plans for the near future

- Integrate the media prediction tool



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# Plans for the near future

- Integrate the media prediction tool
- Expand the taxonomy search for fungi
- Include cultivation media for cell cultures



# Plans for the near future

- Integrate the media prediction tool
- Expand the taxonomy search for fungi
- Include cultivation media for cell cultures
- Add a „source search“ based on the BacDive isolation source ontology

**Isolation Source:** Soil from a rice paddy in Deok-So,  
by enrichment with corn oil as the sole carbon



#Condition	#Anoxic (anaerobic)	
#Host	#Plants	#Herbaceous plants (Grass,Crops)
#Environmental	#Terrestrial	#Soil
#Engineered	#Agriculture	#Field



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Dr. Vera Thiel

Dr. Richard Hahnke

Dr. Christiane Baschien

**The BacDive Team**

## Get in touch!

Feedback?



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MediaDive: the expert-curated cultivation media database

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