



Product Information

Medium 199

Many early tissue culture media were predominantly formulated from animal products and/or tissue extracts. In 1950, Morgan and his coworkers reported their efforts to produce a totally defined nutritional source for cell cultures. Their experiments, conducted with various combinations of vitamins, amino acids and other factors revealed that growth of explanted tissue could be measured in what has become known as Medium 199. However, it was found that long-term cultivation of cells required addition of a serum supplement to the culture fluid. When properly supplemented, Medium 199 has broad species applicability, particularly for cultivation of non-transformed cells. It is widely used in virology, vaccine production and in vitro cultivation of primary explants of mouse pancreatic epithelial and rat lens tissues.

| COMPONENT | M 5017 g/L | M 0393 g/L | M 3769 g/L | M 2520 g/L | M 3274 g/L |
|--|---------------|---------------|---------------|---------------|---------------|
| INORGANIC SALTS | | | | | |
| CaCl ₂ •2H ₂ O | 0.265 | 0.185 | 0.265 | 0.265 | 0.185 |
| Fe(NO ₃) ₃ •9H ₂ O | 0.00072 | 0.00072 | 0.00072 | 0.00072 | 0.00072 |
| MgSO ₄ (anhyd) | 0.09767 | 0.09767 | 0.09767 | 0.09767 | 0.09767 |
| KCl | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| KH ₂ PO ₄ | — | 0.06 | — | — | 0.06 |
| Na•Acetate (anhyd) | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| NaHCO ₃ | — | — | — | — | — |
| NaCl | 6.8 | 8.0 | 6.8 | 6.0 | 8.0 |
| Na ₂ HPO ₄ (anhyd) | — | 0.04788 | — | — | 0.04788 |
| NaH ₂ PO ₄ (anhyd) | 0.122 | — | 0.122 | 0.122 | — |
| AMINO ACIDS | | | | | |
| DL-Alanine | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| L-Arginine•HCl | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 |
| DL-Aspartic Acid | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 |
| L-Cysteine•HCl•H ₂ O | 0.00011 | 0.00011 | 0.00011 | 0.00011 | 0.00011 |
| L-Cystine•2HCl | 0.026 | 0.026 | 0.026 | 0.026 | 0.026 |
| DL-Glutamic Acid | 0.1336 | 0.1336 | 0.1336 | 0.1336 | 0.1336 |
| L-Glutamine | 0.1 | 0.1 | — | 0.1 | — |
| Glycine | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| L-Histidine•HCl•H ₂ O | 0.02188 | 0.02188 | 0.02188 | 0.02188 | 0.02188 |
| Hydroxy-L-Proline | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| DL-Isoleucine | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| DL-Leucine | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 |
| L-Lysine•HCl | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 |
| DL-Methionine | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| DL-Phenylalanine | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| L-Proline | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| DL-Serine | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| DL-Threonine | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 |
| DL-Tryptophan | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| L-Tyrosine•2Na•2H ₂ O | 0.05766 | 0.05766 | 0.05766 | 0.05766 | 0.05766 |
| DL-Valine | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| VITAMINS | | | | | |
| Ascorbic Acid•Na | 0.0000566 | 0.0000566 | 0.0000566 | 0.0000566 | 0.0000566 |
| D-Biotin | 0.00001 | 0.00001 | 0.00001 | 0.00001 | 0.00001 |
| Calciferol | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 |
| Choline Chloride | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 |
| Folic Acid | 0.00001 | 0.00001 | 0.00001 | 0.00001 | 0.00001 |
| Menadione (sodium bisulfite) | 0.000016 | 0.000016 | 0.000016 | 0.000016 | 0.000016 |
| myo-Inositol | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 |
| Niacinamide | 0.000025 | 0.000025 | 0.000025 | 0.000025 | 0.000025 |
| Nicotinic Acid | 0.000025 | 0.000025 | 0.000025 | 0.000025 | 0.000025 |
| p-Amino Benzoic Acid | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 |
| D-Pantothenic Acid •½Ca | 0.00001 | 0.00001 | 0.00001 | 0.00001 | 0.00001 |
| Pyridoxal•HCl | 0.000025 | 0.000025 | 0.000025 | 0.000025 | 0.000025 |
| Pyridoxine•HCl | 0.000025 | 0.000025 | 0.000025 | 0.000025 | 0.000025 |
| Retinol Acetate | 0.00014 | 0.00014 | 0.00014 | 0.00014 | 0.00014 |
| Riboflavin | 0.00001 | 0.00001 | 0.00001 | 0.00001 | 0.00001 |
| DL-α -Tocopherol Phosphate•Na | 0.00001 | 0.00001 | 0.00001 | 0.00001 | 0.00001 |
| Thiamine•HCl | 0.00001 | 0.00001 | 0.00001 | 0.00001 | 0.00001 |

Formulas continued on next page

Medium 199 continued

| COMPONENT | M 5017 g/L | M 0393 g/L | M 3769 g/L | M 2520 g/L | M 3274 g/L |
|---|---------------|---------------|---------------|---------------|---------------|
| OTHER | | | | | |
| Adenine Sulfate | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Adenosine Triphosphate•2Na | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| Adenosine Monophosphate•Na | 0.0002385 | 0.0002385 | 0.0002385 | 0.0002385 | 0.0002385 |
| Cholesterol | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 |
| Deoxyribose | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 |
| Glucose | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Glutathione (reduced) | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 |
| Guanine•HCl | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 |
| HEPES | — | — | — | 5.958 | — |
| Hypoxanthine | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 |
| Phenol Red•Na | 0.0213 | 0.0213 | — | 0.0213 | — |
| Tween 80 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| Ribose | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 |
| Thymine | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 |
| Uracil | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 |
| Xanthine•Na | 0.000344 | 0.000344 | 0.000344 | 0.000344 | 0.000344 |
| ADD | | | | | |
| L-Glutamine | — | — | 0.1 | — | 0.1 |
| NaHCO ₃ | 2.2 | 0.35 | 2.2 | 2.2 | 0.35 |
| Grams of powder required to prepare 1 L | 9.9 | 11.0 | 9.8 | 15.1 | 10.9 |

Medium 199 continued

| COMPONENT | M 4530 [1X] g/L | M 2154 [1X] g/L | M 7528 [1X] g/L | M 7653 [1X] g/L | M 0650 [10X] g/L | M 9163 [10X] g/L | M 7417 [1X] g/L |
|--|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|------------------------|-----------------------|
| INORGANIC SALTS | | | | | | | |
| CaCl ₂ •2H ₂ O | 0.265 | 0.265 | 0.265 | 0.185 | 2.65 | 1.85 | 0.265 |
| Fe(NO ₃) ₃ •9H ₂ O | 0.00072 | 0.00072 | 0.00072 | 0.00072 | 0.0072 | 0.0072 | 0.00072 |
| MgSO ₄ (anhyd) | 0.09767 | 0.09767 | 0.09767 | 0.09767 | 0.9767 | 0.9767 | 0.09767 |
| KCl | 0.4 | 0.4 | 0.4 | 0.4 | 4.0 | 4.0 | 0.4 |
| KH ₂ PO ₄ | — | — | — | 0.06 | — | 0.6 | — |
| Na•Acetate (anhyd) | 0.05 | 0.05 | 0.05 | 0.05 | 0.5 | 0.5 | 0.05 |
| NaHCO ₃ | 2.2 | 2.2 | 2.2 | 0.35 | — | — | 2.2 |
| NaCl | 6.8 | 6.8 | 6.0 | 8.0 | 68.0 | 80.0 | 6.8 |
| Na ₂ HPO ₄ (anhyd) | — | — | — | 0.04788 | — | 0.4788 | — |
| NaH ₂ PO ₄ (anhyd) | 0.122 | 0.122 | 0.172 | — | 1.22 | — | 0.122 |
| AMINO ACIDS | | | | | | | |
| DL-Alanine | 0.05 | 0.05 | 0.05 | 0.05 | 0.5 | 0.5 | 0.05 |
| L-Arginine•HCl | 0.07 | 0.07 | 0.07 | 0.07 | 0.7 | 0.7 | 0.07 |
| DL-Aspartic Acid | 0.06 | 0.06 | 0.06 | 0.06 | 0.6 | 0.6 | 0.06 |
| L-Cysteine•HCl•H ₂ O | 0.00011 | 0.00011 | 0.00011 | 0.00011 | 0.0011 | 0.0011 | 0.00011 |
| L-Cystine•2HCl | 0.026 | 0.026 | 0.026 | 0.026 | 0.26 | 0.26 | 0.026 |
| DL-Glutamic Acid | 0.1336 | 0.1336 | 0.1336 | 0.1336 | 1.336 | 1.336 | 0.1336 |
| L-Glutamine | 0.1 | — | — | — | — | — | — |
| Glycine | 0.05 | 0.05 | 0.05 | 0.05 | 0.5 | 0.5 | 0.05 |
| L-Histidine•HCl•H ₂ O | 0.02188 | 0.02188 | 0.02188 | 0.02188 | 0.2188 | 0.2188 | 0.02188 |
| Hydroxy-L-Proline | 0.01 | 0.01 | 0.01 | 0.01 | 0.1 | 0.1 | 0.01 |
| DL-Isoleucine | 0.04 | 0.04 | 0.04 | 0.04 | 0.4 | 0.4 | 0.04 |
| DL-Leucine | 0.12 | 0.12 | 0.12 | 0.12 | 1.2 | 1.2 | 0.12 |
| L-Lysine•HCl | 0.07 | 0.07 | 0.07 | 0.07 | 0.7 | 0.7 | 0.07 |
| DL-Methionine | 0.03 | 0.03 | 0.03 | 0.03 | 0.3 | 0.3 | 0.03 |
| DL-Phenylalanine | 0.05 | 0.05 | 0.05 | 0.05 | 0.5 | 0.5 | 0.05 |
| L-Proline | 0.04 | 0.04 | 0.04 | 0.04 | 0.4 | 0.4 | 0.04 |
| DL-Serine | 0.05 | 0.05 | 0.05 | 0.05 | 0.5 | 0.5 | 0.05 |
| DL-Threonine | 0.06 | 0.06 | 0.06 | 0.06 | 0.6 | 0.6 | 0.06 |
| DL-Tryptophan | 0.02 | 0.02 | 0.02 | 0.02 | 0.2 | 0.2 | 0.02 |
| L-Tyrosine 2Na•2H ₂ O | 0.05766 | 0.05766 | 0.05766 | 0.05766 | 0.5766 | 0.5766 | 0.05766 |
| DL-Valine | 0.05 | 0.05 | 0.05 | 0.05 | 0.5 | 0.5 | 0.05 |
| VITAMINS | | | | | | | |
| Ascorbic Acid•Na | 0.000056 | 0.000056 | 0.000056 | 0.000056 | 0.000562 | 0.00056 | 0.000056 |
| D-Biotin | 0.00001 | 0.00001 | 0.00001 | 0.00001 | 0.0001 | 0.001 | 0.00001 |
| Calciferol | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.001 | 0.001 | 0.0001 |
| Choline Chloride | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.005 | 0.005 | 0.0005 |
| Folic Acid | 0.00001 | 0.00001 | 0.00001 | 0.00001 | 0.0001 | 0.0001 | — |
| Menadione (sodium bisulfite) | 0.000016 | 0.000016 | 0.000016 | 0.000016 | 0.00016 | 0.00016 | 0.000016 |
| myo-Inositol | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.0005 | 0.0005 | 0.00005 |
| Niacinamide | 0.000025 | 0.000025 | 0.000025 | 0.000025 | 0.00025 | 0.00025 | 0.000025 |
| Nicotinic Acid | 0.000025 | 0.000025 | 0.000025 | 0.000025 | 0.00025 | 0.00025 | 0.000025 |
| p-Amino Benzoic Acid | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.0005 | 0.0005 | 0.00005 |
| D-Pantothenic Acid •½Ca | 0.00001 | 0.00001 | 0.00001 | 0.00001 | 0.0001 | 0.0001 | 0.00001 |
| Pyridoxal•HCl | 0.000025 | 0.000025 | 0.000025 | 0.000025 | 0.00025 | 0.00025 | 0.000025 |
| Pyridoxine•HCl | 0.000025 | 0.000025 | 0.000025 | 0.000025 | 0.00025 | 0.00025 | 0.000025 |
| Retinol Acetate | 0.00014 | 0.00014 | 0.00014 | 0.00014 | 0.0014 | 0.0014 | 0.00014 |
| Riboflavin | 0.00001 | 0.00001 | 0.00001 | 0.00001 | 0.0001 | 0.0001 | 0.00001 |
| DL-α -Tocopherol Phosphate•Na | 0.00001 | 0.00001 | 0.00001 | 0.00001 | 0.0001 | 0.0001 | 0.00001 |
| Thiamine•HCl | 0.00001 | 0.00001 | 0.00001 | 0.00001 | 0.0001 | 0.0001 | 0.00001 |

Formulas continued on next page

Medium 199 continued

| COMPONENT | M 4530 | M 2154 | M 7528 | M 7653 | M 0650 | M 9163 | M 7417 |
|----------------------------|-------------|-------------|-------------|-------------|--------------|--------------|-------------|
| | [1X] g/L | [1X] g/L | [1X] g/L | [1X] g/L | [10X] g/L | [10X] g/L | [1X] g/L |
| OTHER | | | | | | | |
| Adenine Sulfate | 0.01 | 0.01 | 0.01 | 0.01 | 0.1 | 0.1 | 0.01 |
| Adenosine Triphosphate•2Na | 0.001 | 0.001 | 0.001 | 0.001 | 0.01 | 0.01 | 0.001 |
| Adenosine Monophosphate•Na | 0.000238 | 0.000238 | 0.000238 | 0.000238 | 0.00238 | 0.00238 | 0.000238 |
| Cholesterol | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.002 | 0.002 | 0.0002 |
| Deoxyribose | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.005 | 0.005 | 0.0005 |
| Glucose | 1.0 | 1.0 | 1.0 | 1.0 | 10.0 | 10.0 | 1.0 |
| Glutathione (reduced) | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.0005 | 0.0005 | 0.00005 |
| Guanine•HCl | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.003 | 0.003 | 0.0003 |
| HEPES | — | — | 5.958 | — | — | — | — |
| Hypoxanthine | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.003 | 0.003 | 0.0003 |
| Phenol Red•Na | 0.0213 | 0.0213 | 0.0213 | 0.0213 | 0.213 | 0.213 | 0.0213 |
| Tween 80 | 0.02 | 0.02 | 0.02 | 0.02 | 0.2 | 0.2 | 0.02 |
| Ribose | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.005 | 0.005 | 0.0005 |
| Thymine | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.003 | 0.003 | 0.0003 |
| Uracil | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.003 | — | 0.0003 |
| Xanthine•Na | 0.000344 | 0.000344 | 0.000344 | 0.000344 | 0.00344 | — | 0.000344 |
| ADD | | | | | | | |
| L-Glutamine | — | 0.1 | 0.1 | 0.1 | 0.1 at 1X | 0.1 at 1X | 0.1 |
| NaHCO ₃ | — | — | — | — | 2.2 at 1X | 0.35 at 1X | — |

Medium 199 continued

| COMPONENT | M 7042 | M 7667 | M 7542 |
|--|-------------|-------------|-------------|
| | [1X] g/L | [1X] g/L | [1X] g/L |
| INORGANIC SALTS | | | |
| CaCl ₂ •2H ₂ O | 0.265 | 0.265 | 0.265 |
| Fe(NO ₃) ₃ •9H ₂ O | 0.00072 | 0.00072 | 0.00072 |
| MgSO ₄ (anhyd) | 0.09767 | 0.09767 | 0.09767 |
| KCl | 0.4 | 0.4 | 0.4 |
| KH ₂ PO ₄ | — | — | — |
| Na•Acetate (anhyd) | 0.05 | 0.05 | 0.05 |
| NaHCO ₃ | 2.2 | 2.2 | 2.2 |
| NaCl | 6.8 | 6.8 | 6.0 |
| Na ₂ HPO ₄ (anhyd) | — | — | — |
| NaH ₂ PO ₄ (anhyd) | 0.122 | 0.122 | — |
| AMINO ACIDS | | | |
| L-Alanine | 0.05 | 0.05 | 0.05 |
| L-Arginine•HCl | 0.07 | 0.07 | 0.07 |
| L-Aspartic Acid | 0.06 | 0.06 | 0.06 |
| L-Cysteine•HCl•H ₂ O | 0.00011 | 0.00011 | 0.00011 |
| L-Cystine•2HCl | 0.026 | 0.026 | 0.026 |
| L-Glutamic Acid | 0.1336 | 0.1336 | 0.1336 |
| L-Glutamine | — | 0.1 | — |
| Glycine | 0.05 | 0.05 | 0.05 |
| L-Histidine•HCl•H ₂ O | 0.02188 | 0.02188 | 0.02188 |
| Hydroxy-L-Proline | 0.01 | 0.01 | 0.01 |
| L-Isoleucine | 0.04 | 0.04 | 0.04 |
| L-Leucine | 0.12 | 0.12 | 0.12 |
| L-Lysine•HCl | 0.07 | 0.07 | 0.07 |
| L-Methionine | 0.03 | 0.03 | 0.03 |
| L-Phenylalanine | 0.05 | 0.05 | 0.05 |
| L-Proline | 0.04 | 0.04 | 0.04 |
| L-Serine | 0.05 | 0.05 | 0.05 |
| L-Threonine | 0.06 | 0.06 | 0.06 |
| L-Tryptophan | 0.02 | 0.02 | 0.02 |
| L-Tyrosine 2Na•2H ₂ O | 0.05766 | 0.05766 | 0.05766 |
| L-Valine | 0.05 | 0.05 | 0.05 |
| VITAMINS | | | |
| Ascorbic Acid•Na | 0.0000566 | 0.0000566 | 0.0000566 |
| D-Biotin | 0.00001 | 0.00001 | 0.00001 |
| Calciferol | 0.0001 | 0.0001 | 0.0001 |
| Choline Chloride | 0.0005 | 0.0005 | 0.0005 |
| Folic Acid | 0.00001 | 0.00001 | 0.00001 |
| Menadione (sodium bisulfite) | 0.000016 | 0.000016 | 0.000016 |
| myo-Inositol | 0.00005 | 0.00005 | 0.00005 |
| Niacinamide | 0.000025 | 0.000025 | 0.000025 |
| Nicotinic Acid | 0.000025 | 0.000025 | 0.000025 |
| p-Amino Benzoic Acid | 0.00005 | 0.00005 | 0.00005 |
| D-Pantothenic Acid •½Ca | 0.00001 | 0.00001 | 0.00001 |
| Pyridoxal•HCl | 0.000025 | 0.000025 | 0.000025 |
| Pyridoxine•HCl | 0.000025 | 0.000025 | 0.000025 |
| Retinol Acetate | 0.00014 | 0.00014 | 0.00014 |
| Riboflavin | 0.00001 | 0.00001 | 0.00001 |
| DL-α -Tocopherol Phosphate•Na | 0.00001 | 0.00001 | 0.00001 |
| Thiamine•HCl | 0.00001 | 0.00001 | 0.00001 |

Formulas continued on next page

Medium 199 continued

| COMPONENT | M 7042 [1X] g/L | M 7667 [1X] g/L | M 7542 [1X] g/L |
|----------------------------|-----------------------|-----------------------|-----------------------|
| OTHER | | | |
| Adenine Sulfate | 0.01 | 0.01 | 0.01 |
| Adenosine Triphosphate•2Na | 0.001 | 0.001 | 0.001 |
| Adenosine Monophosphate•Na | 0.0002385 | 0.0002385 | 0.0002385 |
| Cholesterol | 0.0002 | 0.0002 | 0.0002 |
| Deoxyribose | 0.0005 | 0.0005 | 0.0005 |
| Glucose | 1.0 | 1.0 | 1.0 |
| Glutathione (reduced) | 0.00005 | 0.00005 | 0.00005 |
| Guanine•HCl | 0.0003 | 0.0003 | 0.0003 |
| HEPES | — | — | 5.958 |
| Hypoxanthine | 0.0003 | 0.0003 | 0.0003 |
| Phenol Red•Na | 0.0213 | 0.0213 | 0.0213 |
| Tween 80 | 0.02 | 0.02 | 0.02 |
| Ribose | 0.0005 | 0.0005 | 0.0005 |
| Thymine | 0.0003 | 0.0003 | 0.0003 |
| Uracil | 0.0003 | 0.0003 | 0.0003 |
| Xanthine•Na | 0.000344 | 0.000344 | 0.000344 |
| ADD | | | |
| L-Glutamine | — | 0.1 | 0.1 |
| NaHCO ₃ | — | — | — |

REFERENCES

1. Morgan, J.F., Morton, H.J. and Parker, R.C. (1950) The Nutrition of Animal Cells in Tissue Culture. I. Initial Studies on a Synthetic Medium. Proc. Soc. Exp. Biol. Med. 73, 1-8.
2. Morgan, J.F., Campbell, E. and Morton, H.J. (1955) The Nutrition of Animal Tissues Cultivated In Vitro. I. A Survey of Natural Materials as Supplements to Synthetic Medium. J.N.C.I. 16:2, 557-567.