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A SURVEY OF COMMERCIALLY AVAILABLE TISSUE CULTURE MEDIA

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Synthetic media for in vitro studies on animal cells (to be used with or without various supplements) have been in use for more than 20 years. The earliest media (1, 2) were not produced commercially but, starting with medium 199 (3), many of these media have become available from a variety of commercial sources. During the ensuing years many modifications were made in the original formulae, sometimes as a result of further studies by the original author, and sometimes by other workers who modified a medium for a new or specialized use. It is now a major task to check the history of these modifications or, when starting with the original reference, to discover subsequent changes which may be beneficial. For this reason, the following survey has been prepared to act as a reference for those using a medium for the first time and to provide a standard for commercial firms so that all media sold under the same name will, in fact, be identical.

Before listing the media themselves, the sources and method of collection of information should be explained. The senior author of the original publication of each medium now commercially available, and in extensive use, was asked to supply all possible information on his medium. When the senior author was no longer active, the information was obtained from an associate still active in the same field. The sole exception to this procedure was Trowell's medium which, since the work has not been continued since his death, was copied from the FASEB Biological Handbook (4). All other data reprinted here are, thus, that of the original author or a close associate and the Editors take no responsibility for any changes.

All authors were asked to supply full details of changes in methods of preparation of stock solutions, optical rotation, salt forms, and water of crystallization where applicable. It is to be assumed therefore that the form of compound used is exactly as specified in these tables. The media are all presented as grams per liter or milligrams per liter for convenience and, where the author has supplied the information, also as millimolar concentrations. Beyond that, however, the amount of information varies greatly since it was reprinted as received.

Unfortunately, a few authors did not reply, but I would like to thank all those who participated and, most especially, those who provided extensive supplemental information.

Prepared by HELEN J. MORTON at the request of the Standards Committee of the Tissue Culture Association.

REFERENCES

1. White, P. R. 1946. Growth 10: 231–289.
2. White, P. R. 1949. J. Cell. Comp. Physiol. 34: 221–241.
3. Morgan, J. F., H. J. Morton, and R. C. Parker. 1950. Proc. Soc. Exp. Biol. Med. 73: 1–8.
4. Waymouth, C. 1968. *Metabolism.* FASEB *Biological Handbook,* pp. 180–187.

Index of Media

Original			Modifications		
Date	Medium name	Authors	Date	Medium name	Authors
1950	199	Morgan, Morton, Parker	1955	M150	Morgan, Campbell, Morton
1953	—*	Scherer, Syverton, Gey	1955	HeLa maintenance medium	Ginsberg, Gold, Jordan
1955	BME	Eagle	1959	MEM	Eagle
				2 modified Eagle media	Dulbecco
			1965	A39	Behbehani
1955	Monkey kidney media A and B	Melnick			
1956	NCTC 109	Evans, Bryant, Fioramonti, McQuilkin, Sanford, Earle	1964	NCTC 135	Evans, Bryant, Kerr, Schilling
1956	5A	McCoy, Maxwell, Kruse	See history of 5A, and also RPMI series of media		
1958	N15, N16	Puck, Cieciura, Robinson	1963	F10	Ham
			1965	F12	Ham
1959	MB 752/1	Waymouth			
1959	T8	Trowell			
1961	CMRL 1066	Parker	1966	CMRL 1415	Healy, Parker
1963	L15	Leibovitz			

* No reply received.

Medium 199 and Modifications

References

Original paper: Morgan, J. F., H. J. Morton, and R. C. Parker. 1950. Proc. Soc. Exp. Biol. Med. 73: 1.

Subsequent modifications: Morgan, J. F., M. E. Campbell, and H. J. Morton. 1955. J. Nat. Cancer Inst. 16: 557.

Constituents

Compound	*Concentration mg/liter*
L-Arginine·HCl	70.0
L-Histidine·HCl	20.0
L-Lysine·HCl	70.0
DL-Tryptophan	20.0
L-Tyrosine	40.0
DL-Phenylalanine	50.0
L-Cystine	20.0
DL-Methionine	30.0
DL-Serine	50.0
DL-Threonine	60.0
DL-Leucine	120.0
DL-Isoleucine	40.0
DL-Valine	50.0
DL-Glutamic acid H_2O	150.0
DL-Aspartic acid	60.0
DL-Alanine	50.0
L-Proline	40.0
Hydroxy-L-proline	10.0
Glycine	50.0
Cysteine·HCl	0.1
Adenine·SO_4	10.0
Guanine·HCl	0.3
Xanthine	0.3*
Hypoxanthine	0.3
Thymine	0.3
Uracil	0.3
Thiamine·HCl	0.010
Riboflavin	0.010
Pyridoxal·HCl	0.025
Pyridoxine·HCl	0.025
Niacin	0.025
Niacinamide	0.025
Pantothenate (Ca)	0.01
d-Biotin	0.01
Folic acid	0.01
Choline chloride	0.50
i-Inositol	0.05
p-Aminobenzoic acid	0.05
Vitamin A	0.10
Calciferol	0.10
Menadione	0.01
α-Tocopherol (PO_4)	0.01
Ascorbic acid	0.05
Glutathione	0.05
Tween 80	20.0*
Cholesterol	0.2
Sodium acetate	50.0*
L-Glutamine	100.0
ATP 2Na	10.0 or 1.0*
Adenylic acid	0.2
Ferric nitrate	0.1 or 0.72*
Ribose	0.5
Deoxyribose	0.5
Phenol red	15.0*
Salt solution	—*

* See notes on history of medium 199.