

8. CELL DIVISION FREQUENCY: MICROORGANISMS

Part I. Protozoa

Type of Cultivation: Defined = axenic medium, in which all constituents are known chemical compounds; Axenic = sterile medium containing no living organisms except the one being cultivated; Agnotobiotic = medium containing biota of unknown composition; Monoxenic = medium con-

taining one living species in addition to the organism being cultivated; Dixenic = medium containing two living species in addition to the organism being cultivated. **Culture Medium:** Only organic constituents of media are listed.

Species	Type of Cultivation	Culture Medium	Temp °C	Genera- tion Time hr	Refer- ence	
Ciliatea						
1	<i>Blepharisma americanum</i>	Monoxenic	Lettuce + <i>Pseudomonas</i>	30	15	10
2	<i>Euplotes eurystomus</i>	Dixenic	Lettuce + <i>Aerobacter</i> + <i>Tetrahymena</i>	25	10-12	15
3	<i>Paramecium aurelia</i>	Monoxenic	Cerophyl + <i>Aerobacter</i>	27	5	16
4	Even syngens	Axenic	Peptone + trypticase + supplements	27	12	18
5	<i>Stentor coeruleus</i>	Agnotobiotic	Skim milk + rice + unknown + flora + fauna	<22	<48	11
6	<i>Tetrahymena pyriformis</i>	Axenic	Peptone + liver extract	29	2.7	3
7		Defined	Elliott defined medium	29	14.5	3
Rhizopodea						
8	<i>Acanthamoeba</i> sp.	Axenic	Peptone + glucose	28	17	14
9		Defined	10 amino acids + thiamine + B ₁₂ + biotin + glucose	25	46	1
10	<i>Amoeba proteus</i>	Agnotobiotic	Bacteria + <i>Tetrahymena</i>	24	<24	15
11	<i>Entamoeba histolytica</i>	Agnotobiotic	Bacteria + supplements	37	5	9
12		Axenic	Casamino acid medium	36	48	21
13	<i>Naegleria gruberi</i>	Monoxenic	<i>Aerobacter aerogenes</i>	30	2	8
14		Axenic	Peptone + yeast extract + liver extract + serum + glucose	30	6-12	8
Zoomastigophorea						
15	<i>Crithidia fasciculata</i>	Axenic	Yeast extract + hemin + sucrose	25	6	7
16	<i>Trichomonas vaginalis</i>	Axenic	Trypticase + serum + maltose + cystine-agar	37	5-6	12
17	<i>Trypanosoma mega</i>	Axenic	Tryptose + liver extract + hemin + glucose	23	19	19
Phytomastigophorea						
18	<i>Chilomonas paramecium</i>	Thiamine + acetate	23	12	6
19	<i>Chlamydomonas rein-</i>	Defined	Inorganic medium + CO ₂ ^{1/}	25	9.5	17
20	<i>hardi</i>		Inorganic medium + acetate ^{2/}	25	18	17
21	<i>Euglena gracilis</i>	Defined	Thiamine + B ₁₂ + CO ₂ ^{1/}	25	10.5	4
22			Thiamine + B ₁₂ + acetate ^{2/}	25	13	5
23	<i>E. gracilis</i> var. <i>bacillaris</i>	Defined	Thiamine + B ₁₂ + acetate ^{2/}	25	22.5	2
24	<i>Gonyaulax polyedra</i>	Axenic	Seawater-soil extract ^{1/}	25	25.4	20
25	<i>Ochromonas malhamensis</i>	Defined	Thiamine + B ₁₂ + biotin + glucose ^{3/}	25	14	13

^{1/} In light. ^{2/} In dark. ^{3/} In light or dark.

Contributor: Frankel, Joseph

References

- [1] Adam, K. G., 1964. J. Protozool. 11:98.
 [2] Buetow, D. E. 1962. Exp. Cell Res. 27:137.
 [3] Cameron, I. L., and D. S. Nachtwey. 1967. Ibid. 46: 385.
 [4] Cook, J. R. 1963. J. Protozool. 10:436.
 [5] Cook, J. R. 1968. In D. E. Buetow, ed. The Biology of *Euglena*. Academic Press, New York. v. 1, p. 243.
 [6] Cosgrove, W. C. 1950. Physiol. Zool. 23:73.

continued

8. CELL DIVISION FREQUENCY: MICROORGANISMS

Part I. Protozoa

- | | |
|--|--|
| <p>[7] Cosgrove, W. C., and M. J. Skeen. 1970. <i>J. Protozool.</i> 17:172.</p> <p>[8] Fulton, C. M. 1970. <i>Methods Cell Physiol.</i> 4:341.</p> <p>[9] Geiman, D. M., and C. E. Becker. 1953. <i>Ann. N.Y. Acad. Sci.</i> 56:1033.</p> <p>[10] Geise, A. C., and B. McCaw. 1963. <i>J. Protozool.</i> 10:173.</p> <p>[11] James, E. A. 1967. <i>Develop. Biol.</i> 16:577.</p> <p>[12] Kupferberg, A. B., et al. 1953. <i>Ann. N.Y. Acad. Sci.</i> 56:1006.</p> <p>[13] Myers, J., and J. R. Graham. 1956. <i>J. Cell. Comp. Physiol.</i> 47:397.</p> | <p>[14] Neff, R. J., et al. 1958. <i>Physiol. Zool.</i> 31:73.</p> <p>[15] Prescott, D. M., and R. F. Carrier. 1964. <i>Methods Cell Physiol.</i> 1:85.</p> <p>[16] Rasmussen, L. 1967. <i>Exp. Cell Res.</i> 48:132.</p> <p>[17] Sager, R., and S. Granick. 1953. <i>Ann. N.Y. Acad. Sci.</i> 56:831.</p> <p>[18] Soldo, A. T., et al. 1966. <i>J. Protozool.</i> 13:492.</p> <p>[19] Steinert, M., and G. Steinert. 1962. <i>Ibid.</i> 9:203.</p> <p>[20] Sweeney, B. M., and J. W. Hastings. 1958. <i>Ibid.</i> 5:217.</p> <p>[21] Wittner, M. 1968. <i>Ibid.</i> 15:403.</p> |
|--|--|

Part II. Viruses and Bacteria

Generation Time for viruses is the period required for infected cells to release a new virus; for bacteria, the average interval between cell divisions.

Species	Culture Medium	Temp °C	Generation Time min	Reference	
Vira					
1	Influenza A, PR-8	Allantoic membrane, chick embryo	37	330-510	12
2	Influenza A, 5 strains	Allantoic membrane, chick embryo	37	300-360	16
3	Influenza B, 3 strains	Allantoic membrane, chick embryo	37	480-600	16
4	Swine influenza	Allantoic membrane, chick embryo	37	360	16
Bacteriophyta					
5	<i>Aerobacter aerogenes</i>	Broth or milk	37	18	19
6		Glucose + peptone	37	17.2-17.4	19
7		Peptone	37	22-30	19
8		Synthetic medium	37	29-44	9
9	<i>Azotobacter chroococcum</i>	Glucose broth	27-39	19
10		Mineral salts + sugar	25-30	240-348	19
11		Sugar + urea	28	74	4
12	<i>Bacillus subtilis</i>	Complex medium	36	35	10
13	<i>Clostridium botulinum</i>	Glucose broth	37	35	26
14	<i>Corynebacterium diphtheriae</i>	Serum + glucose broth	37	34	19
15	<i>Diplococcus pneumoniae</i> type I	Broth	37	24.5	2
16		Serum	37	29	1
17		Serum + broth	37	20.5	6
18	<i>D. pneumoniae</i> type II	Broth	37	33	6
19		Glucose broth	37	30	18
20		Serum + broth	37	23	2
21	<i>Erwinia carotovora</i>	Broth	37	57	19
22		Glucose broth	37	42	19
23	<i>Escherichia coli</i>	Broth	37	16.5-17.0	25
24		Lactose broth	37	16	23
25		Milk	37	12.5	13
26	<i>Lactobacillus acidophilus</i>	Milk	37	66-87	19

continued

8. CELL DIVISION FREQUENCY: MICROORGANISMS

Part II. Viruses and Bacteria

	Species	Culture Medium	Temp °C	Generation Time min	Reference
27	<i>Mycobacterium tuberculosis</i> H37	Synthetic medium	37	792-932	28
28	<i>Proteus morganii</i>	Tryptic meat broth	30	30	13
29	<i>P. vulgaris</i>	Broth	37	21.5	19
30		Peptone + phosphate	37	40	7
31		Trypticase soy broth	37	43-46	11
32	<i>Pseudomonas aeruginosa</i>	Broth	37	34	19
33		Glucose broth	37	31	19
34		Lactose broth	37	34	19
35		Tryptic meat broth	35	32	11
36	<i>P. fluorescens</i>	Nutrient broth	0	2100	17
37		Nutrient broth	20	92	17
38	<i>Rhizobium leguminosarum</i>	Mineral salts + yeast + mannitol	25	79-187	5
39	<i>Salmonella typhimurium</i>	Trypticase soy broth	37	24-35	24
40	<i>S. typhosa</i>	Broth	37	23.5	20
41		Glucose broth	37	29	8
42		Glucose + peptone	37	33	21
43	<i>Serratia marcescens</i>	Tryptic meat broth	35	28	11
44	<i>Shigella dysenteriae</i>	Milk	37	23	15
45		Peptone + phosphate	37	37	7
46	<i>Staphylococcus aureus</i>	Broth	37	27	14
47		Glucose broth	37	32	19
48	<i>Streptococcus lactis</i>	Lactose broth	30	48	19
49		Glucose milk	37	26	19
50		Peptone milk	37	37	19
51		Milk	37	26	22
52	<i>Vibrio comma</i>	Broth	37	21.2-38.0	3
53	<i>Xanthomonas campestris</i>	Broth	23-25	165	27
54		Glucose broth	25	74	19

Contributor: Sinclair, Norval A.

References

- [1] Barber, M. A. 1919. J. Exp. Med. 30:569.
 [2] Blake, G. F. 1917. Ibid. 26:563.
 [3] Buchner, H., et al. 1887. Zentralbl. Bakteriol. Parasitenk. Infektionskr. 2:1.
 [4] Burk, D., and H. Lineweaver. 1930. J. Bacteriol. 19:389.
 [5] Cameron, G. M., and J. M. Sherman. 1935. Ibid. 30:647.
 [6] Chesney, M. M. 1916. J. Exp. Med. 24:387.
 [7] Cohen, B., and W. M. Clark. 1917. J. Bacteriol. 4:409.
 [8] Coulter, C. B., and M. L. Isaacs. 1929. J. Exp. Med. 49:711.
 [9] Dean, A. C. R., and C. Hinshelwood. 1951. J. Chem. Soc. London, p. 1157.
 [10] Dowben, R. M., and R. Weidenmuller. 1968. Biochim. Biophys. Acta 158:255.
 [11] Errington, F. P., et al. 1965. J. Gen. Microbiol. 39:109.
 [12] Fazekas de St. Groth, S., and H. J. F. Cairns. 1952. J. Immunol. 69:173.
 [13] Frazier, W. C., and E. O. Whittier. 1931. J. Bacteriol. 21:239.
 [14] Graham-Smith, C. S. 1920. J. Hyg. 19:133.
 [15] Heinemann, D. G., and T. H. Glenn. 1908. J. Infec. Dis. 5:534.
 [16] Henle, W., and E. S. Rosenberg. 1949. J. Exp. Med. 89:279.
 [17] Ingraham, J. L. 1958. J. Bacteriol. 76:75.
 [18] Lord, F. T., and R. N. Nye. 1919. Ibid. 30:389.
 [19] Mason, M. M. 1935. Ibid. 29:103.
 [20] Muller, M. 1895. Z. Hyg. Infektionskr. 20:245.
 [21] Penfold, W. J., and D. Norris. 1912. J. Hyg. 12:527.
 [22] Rogers, L. A., and G. L. Greenbank. 1930. J. Bacteriol. 19:181.

continued

8. CELL DIVISION FREQUENCY: MICROORGANISMS

Part II. Viruses and Bacteria

- [23] Saito, K. 1907. Arch. Hyg. Bakteriolog. 63:215.
- [24] Schaechter, M., et al. 1962. J. Gen. Microbiol. 29: 421.
- [25] Sherman, J. M., and J. E. Holm. 1922. J. Bacteriol. 7:465.
- [26] Wagner, E., et al. 1925. Ibid. 10:321.
- [27] Wolf, F. A., and A. C. Foster. 1921. N.C. Agr. Exp. Sta. Tech. Bull. 20.
- [28] Youmans, G. P., and A. S. Youmans. 1950. J. Bacteriol. 60:569.



Biology Data Book

Second Edition

VOLUME I

COMPILED AND EDITED BY

Philip L. Altman and Dorothy S. Dittmer

Federation of American Societies for Experimental Biology

BETHESDA, MARYLAND