

Appendix I

1. PCA loadings plots showing the distribution of components for raw and complete datasets for different days of culture. In figures 1 to 4, X axis shows PC1 and Y axis shows PC2, where PC1 and PC2 are the first two PCA components. Orange dots represents raw dataset and blue dots represents complete dataset. Axes have no units. Plot number in each figure corresponds to the day of culture. Percentage variance explained by each component for each day is provided in table 1 at the end.

Parameters are assigned alphabets to enable visualisation. Culture Days - A; ECT - B; VCD - C; TCD - D; ACC - E; ACD - F; pH - G; [Glutamine] - H; [Glutamate] - I; EGN - J; ACV - K; [Lactate] - L; [NH₃] - M; Osmolality - N; [Glucose] - O; CPDL - P; [Na⁺] - Q; [K⁺] - R; [HCO₃⁻] - S; Temperature - T; pCO₂ - U; pO₂ - V.

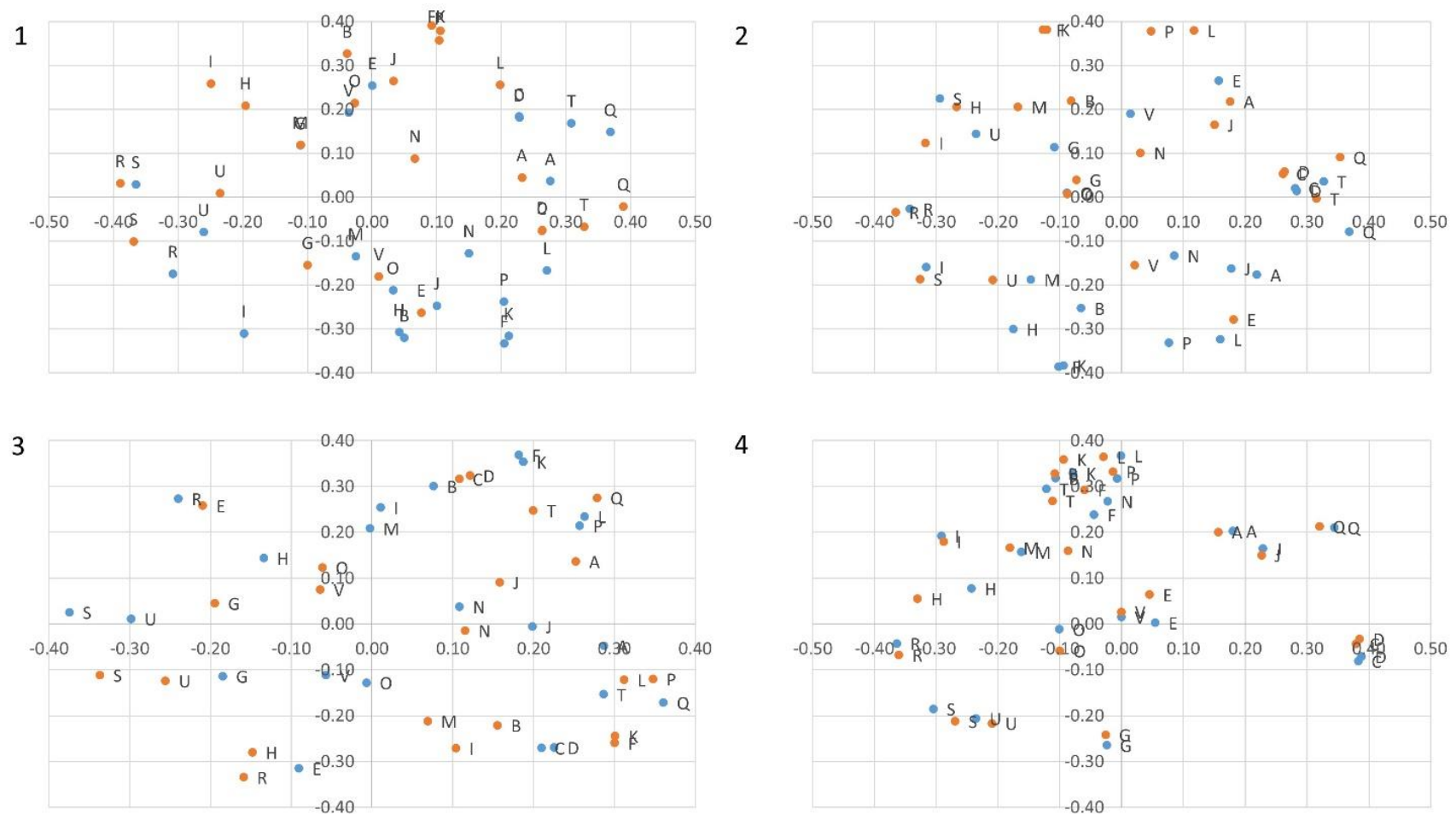


Figure 1: PCA loadings plot for Days 1, 2, 3 and 4 of the culture. Refer to the explanation above to interpret results.

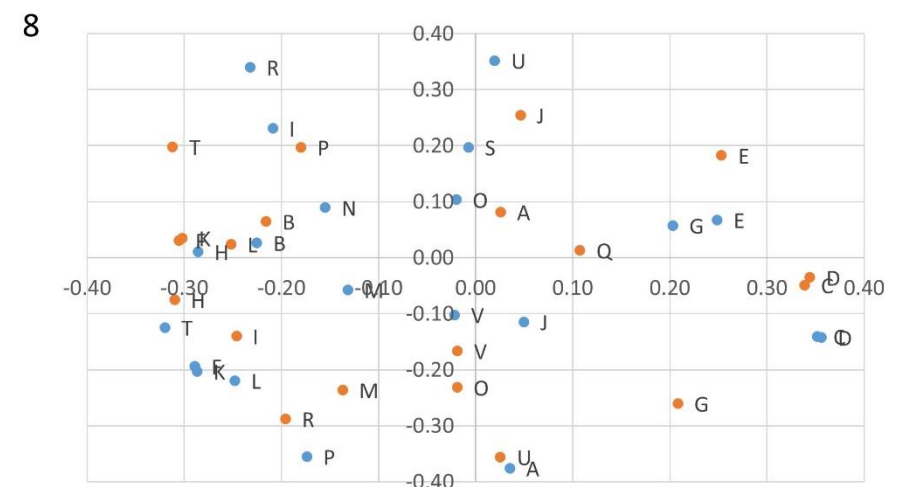
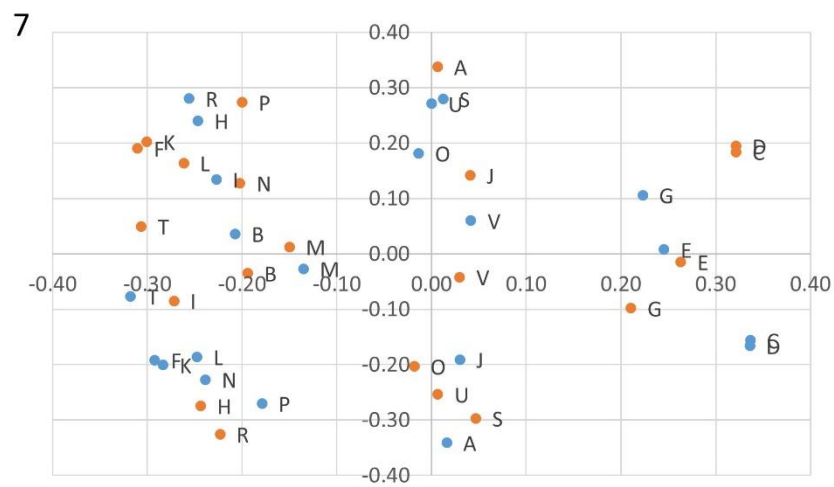
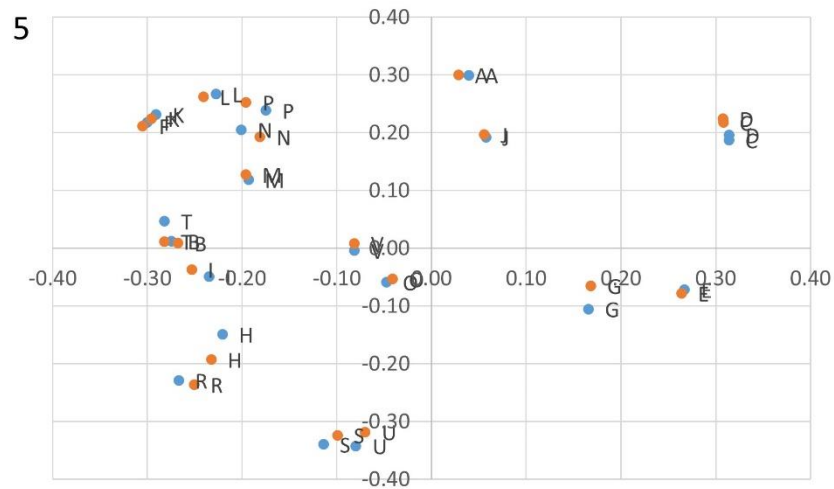


Figure 2: PCA loadings plot for Days 5, 6, 7 and 8 of the culture. Refer to the explanation above to interpret results.

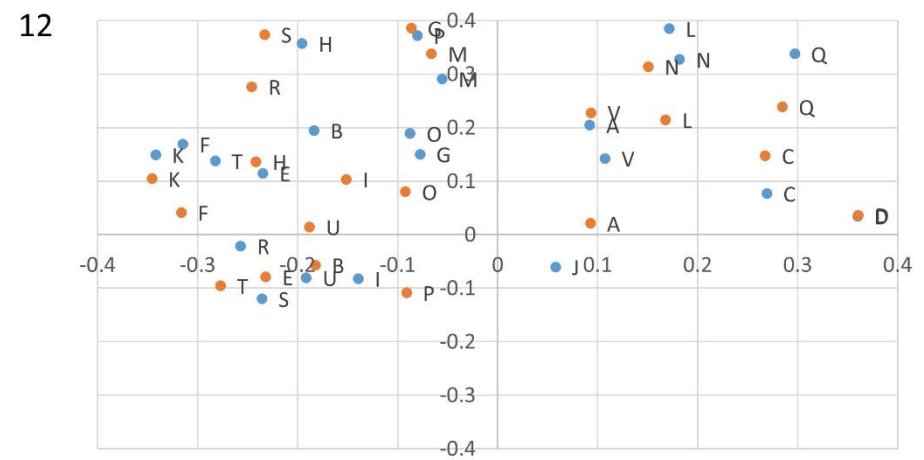
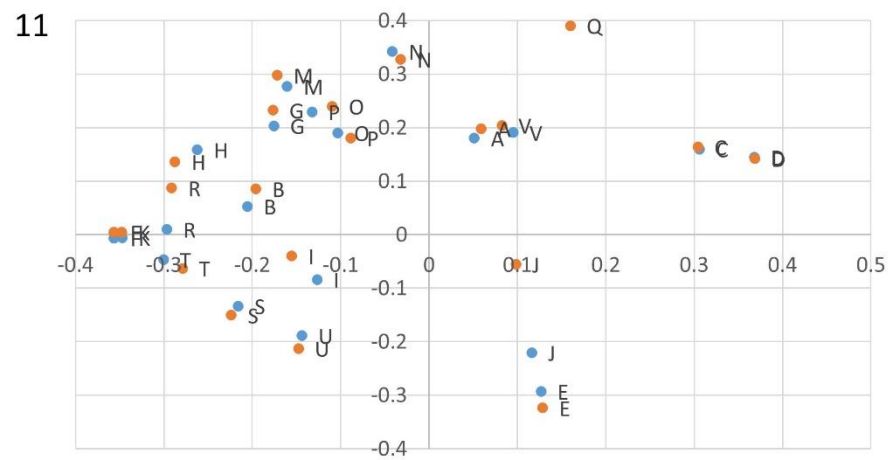
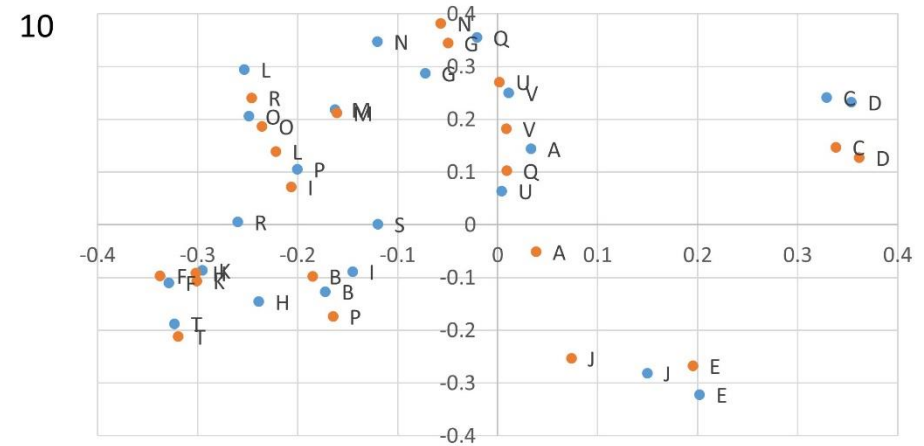
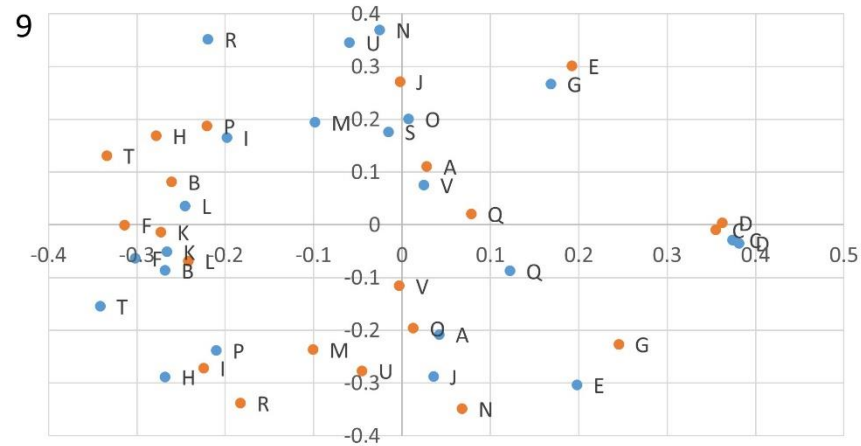


Figure 3: PCA loadings plot for Days 9, 10, 11 and 12 of the culture. Refer to the explanation above to interpret results.

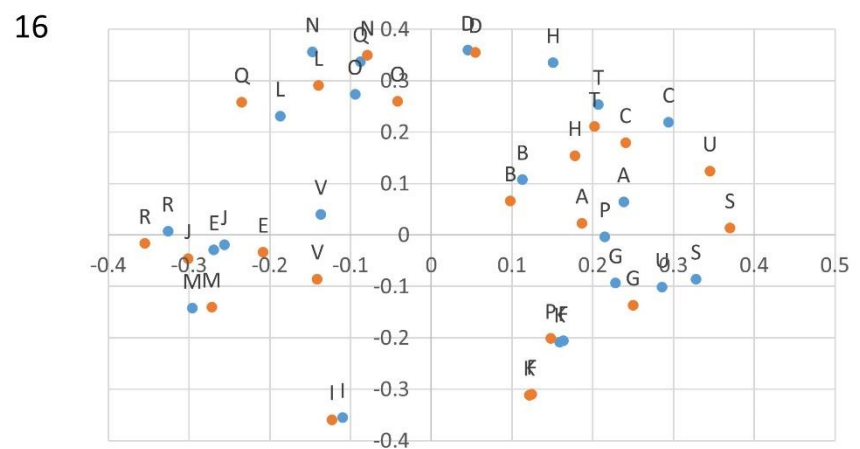
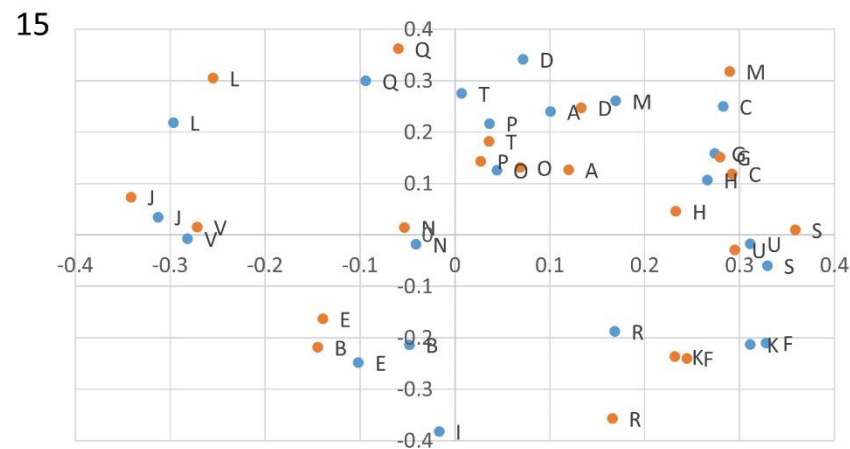
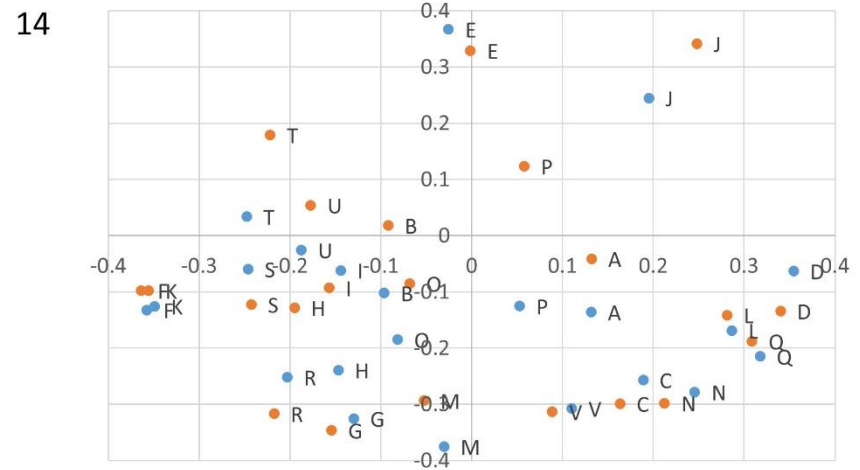
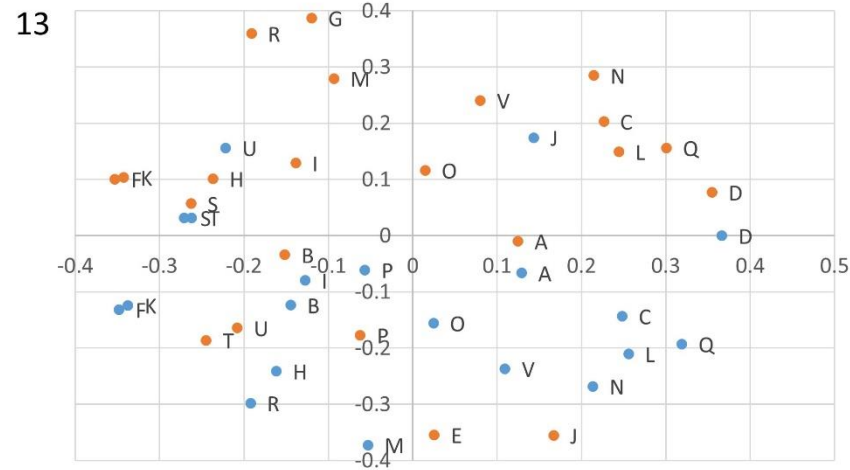


Figure 4: PCA loadings plot for Days 13, 14, 15 and 16 of the culture. Refer to the explanation above to interpret results.

Table 1: Table showing percentage variance explained by each component on each day of the culture.

Day	Percentage Variance Explained			
	Complete Dataset		Raw Dataset	
	PC1	PC2	PC1	PC2
1	23.600	21.700	26.200	22.700
2	27.800	20.200	30.100	19.900
3	24.200	20.600	25.700	23.400
4	22.900	20.200	23.500	20.900
5	27.800	17.700	29.400	18.400
6	29.100	14.900	30.800	15.600
7	30.000	14.800	30.900	15.500
8	28.600	14.000	30.200	15.600
9	26.000	15.100	27.800	18.100
10	25.500	17.200	26.300	19.200
11	25.400	18.400	26.300	17.200
12	25.500	15.400	26.200	13.700
13	27.000	15.000	28.700	16.700
14	27.100	15.700	28.500	16.900
15	27.300	17.400	30.200	20.300
16	35.600	23.000	36.800	19.700

2. Tables showing distance of each parameter from the origin for different days of culture. P1 and P2 represents the weights of parameter in the 1st and 2nd components respectively. Hypotenuse is the distance of the parameter from the origin on a Cartesian plane. The column 'Distance' is the distance between corresponding parameters in raw and complete datasets on a Cartesian plane.

Table 2: Table showing proximity in the distribution of values for raw and complete datasets for Day 0 of the culture. Refer to description above for interpreting the table.

Day 0	Complete			Raw			Raw - Complete
Parameters	P1	P2	Hypotenuse	P1	P2	Hypotenuse	Distance
Culture Days	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ECT	0.000	0.000	0.000	0.000	0.000	0.000	0.000
VCD	0.148	-0.027	0.150	0.137	-0.099	0.169	0.019
TCD	0.150	-0.027	0.152	0.139	-0.095	0.169	0.017
ACC	-0.109	0.460	0.473	-0.075	0.401	0.408	0.065
ACD	-0.079	0.517	0.523	-0.032	0.422	0.423	0.100
pH	-0.245	-0.055	0.251	-0.215	-0.141	0.257	0.006
[Glutamine]	-0.156	0.052	0.164	-0.187	0.027	0.189	0.026
[Glutamate]	-0.400	-0.071	0.406	-0.328	-0.013	0.328	0.078
EGN	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ACV	-0.020	0.425	0.425	0.028	0.328	0.329	0.097
[Lactate]	0.168	0.010	0.169	0.181	0.018	0.181	0.013
[NH ₃]	-0.185	-0.005	0.185	-0.139	-0.128	0.189	0.005
Osmolality	0.061	0.159	0.170	0.224	0.006	0.224	0.054
[Glucose]	-0.329	-0.048	0.332	-0.288	-0.119	0.311	0.022
CPDL	-0.034	0.500	0.501	0.214	-0.202	0.294	0.208
[Na ⁺]	0.409	0.050	0.412	0.366	-0.047	0.369	0.043
[K ⁺]	-0.389	-0.037	0.391	-0.392	-0.016	0.392	0.002
[HCO ₃ ⁻]	-0.225	-0.101	0.246	-0.367	0.023	0.367	0.121
Temperature	0.335	0.025	0.336	0.288	-0.033	0.290	0.046
pCO ₂	-0.106	0.176	0.205	-0.080	0.275	0.286	0.082
pO ₂	-0.171	-0.088	0.192	-0.165	-0.604	0.627	0.435
Minimum value			0.000			0.000	0.000
Maximum Value			0.523			0.627	0.435

Table 3: Table showing proximity in the distribution of values for raw and complete datasets for Day 1 of the culture. Refer to description above for interpreting the table.

Day 1	Complete			Raw			Raw - Complete
Parameters	P1	P2	Hypotenuse	P1	P2	Hypotenuse	Distance
Culture Days	0.276	0.037	0.279	0.232	0.045	0.237	0.043
ECT	0.051	-0.320	0.324	-0.039	0.327	0.329	0.006
VCD	0.228	0.184	0.293	0.264	-0.077	0.275	0.019
TCD	0.228	0.182	0.292	0.264	-0.075	0.274	0.018
ACC	0.001	0.255	0.255	0.077	-0.263	0.274	0.020
ACD	0.205	-0.334	0.391	0.093	0.392	0.402	0.011
pH	-0.111	0.119	0.162	-0.100	-0.155	0.184	0.022
[Glutamine]	0.042	-0.307	0.310	-0.196	0.209	0.286	0.024
[Glutamate]	-0.199	-0.311	0.369	-0.250	0.259	0.360	0.009
EGN	0.101	-0.248	0.267	0.034	0.265	0.267	0.001
ACV	0.212	-0.316	0.380	0.106	0.380	0.394	0.014
[Lactate]	0.271	-0.168	0.319	0.199	0.257	0.324	0.006
[NH ₃]	-0.025	-0.135	0.138	-0.111	0.120	0.163	0.026
Osmolality	0.150	-0.128	0.198	0.067	0.089	0.111	0.087
[Glucose]	0.033	-0.212	0.215	-0.027	0.215	0.217	0.002
CPDL	0.205	-0.238	0.314	0.104	0.358	0.372	0.059
[Na ⁺]	0.369	0.149	0.398	0.389	-0.022	0.390	0.008
[K ⁺]	-0.309	-0.175	0.354	-0.390	0.032	0.391	0.037
[HCO ₃ ⁻]	-0.366	0.030	0.367	-0.369	-0.101	0.383	0.016
Temperature	0.309	0.169	0.352	0.328	-0.068	0.335	0.017
pCO ₂	-0.261	-0.080	0.273	-0.236	0.010	0.236	0.038
pO ₂	-0.037	0.193	0.196	0.011	-0.181	0.182	0.015
Minimum value			0.138			0.111	0.001
Maximum Value			0.398			0.402	0.087

Table 4: Table showing proximity in the distribution of values for raw and complete datasets for Day 2 of the culture. Refer to description above for interpreting the table.

Day 2	Complete			Raw			Raw - Complete
Parameters	P1	P2	Hypotenuse	P1	P2	Hypotenuse	Distance
Culture Days	0.219	-0.177	0.282	0.176	0.218	0.280	0.002
ECT	-0.066	-0.253	0.262	-0.082	0.220	0.235	0.027
VCD	0.281	0.021	0.282	0.261	0.054	0.267	0.016
TCD	0.283	0.015	0.284	0.264	0.059	0.271	0.014
ACC	0.158	0.266	0.309	0.181	-0.279	0.333	0.024
ACD	-0.102	-0.386	0.400	-0.128	0.382	0.403	0.003
pH	-0.109	0.114	0.158	-0.074	0.040	0.084	0.075
[Glutamine]	-0.176	-0.301	0.348	-0.268	0.206	0.337	0.011
[Glutamate]	-0.317	-0.160	0.355	-0.318	0.124	0.341	0.014
EGN	0.178	-0.163	0.241	0.151	0.165	0.223	0.018
ACV	-0.094	-0.384	0.395	-0.121	0.382	0.401	0.006
[Lactate]	0.160	-0.324	0.361	0.117	0.380	0.398	0.037
[NH ₃]	-0.148	-0.188	0.239	-0.169	0.207	0.266	0.028
Osmolality	0.085	-0.133	0.158	0.031	0.101	0.106	0.053
[Glucose]	-0.089	0.010	0.090	-0.088	0.008	0.089	0.002
CPDL	0.077	-0.332	0.340	0.048	0.378	0.381	0.041
[Na ⁺]	0.369	-0.079	0.377	0.354	0.091	0.365	0.012
[K ⁺]	-0.344	-0.027	0.345	-0.366	-0.035	0.368	0.024
[HCO ₃ ⁻]	-0.295	0.225	0.371	-0.326	-0.187	0.376	0.006
Temperature	0.328	0.036	0.329	0.316	-0.004	0.316	0.014
pCO ₂	-0.236	0.145	0.277	-0.209	-0.189	0.282	0.005
pO ₂	0.015	0.191	0.191	0.022	-0.155	0.157	0.035
Minimum value			0.090			0.084	0.002
Maximum Value			0.400			0.403	0.075

Table 5: Table showing proximity in the distribution of values for raw and complete datasets for Day 3 of the culture. Refer to description above for interpreting the table.

Day 3	Complete			Raw			Raw - Complete
Parameters	P1	P2	Hypotenuse	P1	P2	Hypotenuse	Distance
Culture Days	0.288	-0.048	0.292	0.253	0.137	0.287	0.005
ECT	0.077	0.301	0.310	0.156	-0.221	0.271	0.040
VCD	0.210	-0.271	0.343	0.109	0.317	0.335	0.008
TCD	0.226	-0.270	0.352	0.122	0.324	0.346	0.006
ACC	-0.091	-0.316	0.328	-0.210	0.259	0.333	0.005
ACD	0.182	0.369	0.411	0.301	-0.260	0.398	0.014
pH	-0.185	-0.114	0.218	-0.195	0.045	0.200	0.018
[Glutamine]	-0.135	0.144	0.197	-0.149	-0.281	0.317	0.121
[Glutamate]	0.011	0.254	0.255	0.104	-0.271	0.291	0.036
EGN	0.199	-0.006	0.199	0.159	0.091	0.183	0.017
ACV	0.188	0.354	0.401	0.301	-0.245	0.388	0.013
[Lactate]	0.264	0.235	0.353	0.313	-0.122	0.336	0.018
[NH ₃]	-0.003	0.209	0.209	0.069	-0.213	0.223	0.015
Osmolality	0.108	0.038	0.115	0.115	-0.015	0.116	0.002
[Glucose]	-0.007	-0.128	0.129	-0.062	0.124	0.138	0.010
CPDL	0.257	0.215	0.335	0.348	-0.120	0.368	0.034
[Na ⁺]	0.361	-0.172	0.400	0.279	0.276	0.392	0.008
[K ⁺]	-0.240	0.274	0.364	-0.159	-0.335	0.371	0.007
[HCO ₃ ⁻]	-0.375	0.026	0.376	-0.337	-0.112	0.355	0.021
Temperature	0.287	-0.154	0.325	0.200	0.248	0.319	0.007
pCO ₂	-0.299	0.012	0.299	-0.257	-0.124	0.285	0.015
pO ₂	-0.058	-0.112	0.126	-0.065	0.075	0.099	0.028
Minimum value			0.115			0.099	0.002
Maximum Value			0.411			0.398	0.121

Table 6: Table showing proximity in the distribution of values for raw and complete datasets for Day 4 of the culture. Refer to description above for interpreting the table.

Day 4	Complete			Raw			Raw - Complete
Parameters	P1	P2	Hypotenuse	P1	P2	Hypotenuse	Distance
Culture Days	0.180	0.203	0.271	0.157	0.201	0.255	0.017
ECT	-0.108	0.318	0.336	-0.109	0.329	0.346	0.011
VCD	0.383	-0.082	0.392	0.380	-0.044	0.382	0.010
TCD	0.389	-0.072	0.395	0.385	-0.033	0.387	0.009
ACC	0.055	0.003	0.055	0.046	0.065	0.079	0.024
ACD	-0.045	0.239	0.243	-0.061	0.293	0.299	0.057
pH	-0.025	-0.265	0.266	-0.026	-0.242	0.243	0.023
[Glutamine]	-0.244	0.078	0.256	-0.331	0.056	0.335	0.080
[Glutamate]	-0.292	0.193	0.350	-0.289	0.180	0.340	0.010
EGN	0.229	0.165	0.282	0.227	0.150	0.272	0.011
ACV	-0.079	0.329	0.338	-0.094	0.360	0.372	0.034
[Lactate]	-0.002	0.368	0.368	-0.030	0.365	0.366	0.002
[NH ₃]	-0.163	0.157	0.226	-0.181	0.167	0.246	0.020
Osmolality	-0.023	0.268	0.269	-0.087	0.160	0.182	0.087
[Glucose]	-0.101	-0.012	0.102	-0.100	-0.059	0.116	0.015
CPDL	-0.008	0.318	0.318	-0.015	0.333	0.333	0.016
[Na ⁺]	0.345	0.211	0.404	0.321	0.213	0.385	0.019
[K ⁺]	-0.364	-0.043	0.367	-0.361	-0.068	0.367	0.001
[HCO ₃ ⁻]	-0.305	-0.186	0.357	-0.270	-0.213	0.343	0.014
Temperature	-0.123	0.295	0.320	-0.113	0.269	0.291	0.029
pCO ₂	-0.236	-0.207	0.313	-0.210	-0.217	0.302	0.012
pO ₂	-0.001	0.016	0.016	-0.001	0.027	0.027	0.012
Minimum value			0.016			0.027	0.001
Maximum Value			0.404			0.387	0.087

Table 7: Table showing proximity in the distribution of values for raw and complete datasets for Day 5 of the culture. Refer to description above for interpreting the table.

Day 5	Complete			Raw			Raw - Complete
Parameters	P1	P2	Hypotenuse	P1	P2	Hypotenuse	Distance
Culture Days	0.040	0.300	0.302	0.029	0.300	0.302	0.001
ECT	-0.275	0.012	0.275	-0.268	0.009	0.268	0.008
VCD	0.314	0.187	0.366	0.308	0.218	0.377	0.012
TCD	0.315	0.196	0.371	0.308	0.224	0.381	0.011
ACC	0.267	-0.073	0.277	0.264	-0.079	0.276	0.002
ACD	-0.300	0.218	0.371	-0.305	0.212	0.372	0.001
pH	0.166	-0.106	0.197	0.169	-0.066	0.181	0.016
[Glutamine]	-0.221	-0.150	0.267	-0.233	-0.193	0.303	0.036
[Glutamate]	-0.235	-0.050	0.240	-0.254	-0.037	0.256	0.016
EGN	0.058	0.192	0.201	0.056	0.197	0.205	0.005
ACV	-0.291	0.232	0.372	-0.296	0.225	0.372	0.001
[Lactate]	-0.228	0.267	0.351	-0.241	0.263	0.356	0.006
[NH ₃]	-0.194	0.119	0.227	-0.196	0.128	0.234	0.008
Osmolality	-0.202	0.206	0.288	-0.182	0.193	0.265	0.023
[Glucose]	-0.048	-0.059	0.076	-0.042	-0.054	0.068	0.009
CPDL	-0.176	0.239	0.296	-0.196	0.253	0.320	0.024
[Na ⁺]	0.080	0.429	0.436	0.072	0.424	0.430	0.007
[K ⁺]	-0.267	-0.230	0.352	-0.251	-0.237	0.345	0.008
[HCO ₃ ⁻]	-0.114	-0.340	0.359	-0.100	-0.324	0.339	0.020
Temperature	-0.282	0.047	0.286	-0.283	0.012	0.283	0.004
pCO ₂	-0.080	-0.343	0.352	-0.071	-0.319	0.327	0.026
pO ₂	-0.082	-0.005	0.082	-0.082	0.008	0.083	0.001
Minimum value			0.076			0.068	0.001
Maximum Value			0.436			0.430	0.036

Table 8: Table showing proximity in the distribution of values for raw and complete datasets for Day 6 of the culture. Refer to description above for interpreting the table.

Day 6	Complete			Raw			Raw - Complete
Parameters	P1	P2	Hypotenuse	P1	P2	Hypotenuse	Distance
Culture Days	0.042	-0.282	0.285	0.030	0.285	0.286	0.001
ECT	-0.185	-0.008	0.185	-0.180	0.023	0.182	0.004
VCD	0.337	-0.159	0.372	0.317	0.187	0.367	0.005
TCD	0.338	-0.164	0.375	0.317	0.193	0.371	0.005
ACC	0.258	0.051	0.263	0.259	-0.055	0.265	0.003
ACD	-0.291	-0.182	0.343	-0.302	0.189	0.356	0.014
pH	0.195	0.156	0.249	0.190	-0.173	0.257	0.009
[Glutamine]	-0.292	0.203	0.356	-0.301	-0.184	0.353	0.003
[Glutamate]	-0.242	0.048	0.246	-0.266	-0.041	0.269	0.023
EGN	0.081	-0.209	0.224	0.077	0.201	0.215	0.009
ACV	-0.285	-0.190	0.343	-0.295	0.201	0.357	0.015
[Lactate]	-0.258	-0.228	0.344	-0.262	0.172	0.313	0.031
[NH ₃]	-0.160	-0.103	0.190	-0.172	0.052	0.179	0.011
Osmolality	-0.172	-0.109	0.203	-0.206	-0.006	0.206	0.003
[Glucose]	0.014	0.046	0.048	0.008	-0.082	0.083	0.036
CPDL	-0.147	-0.322	0.354	-0.158	0.357	0.390	0.036
[Na ⁺]	0.110	-0.438	0.451	0.094	0.413	0.424	0.028
[K ⁺]	-0.254	0.311	0.401	-0.230	-0.348	0.417	0.017
[HCO ₃ ⁻]	-0.010	0.313	0.314	0.023	-0.317	0.317	0.004
Temperature	-0.312	-0.125	0.336	-0.298	0.112	0.318	0.018
pCO ₂	0.023	0.324	0.325	0.028	-0.305	0.306	0.019
pO ₂	-0.047	0.028	0.054	-0.051	-0.031	0.059	0.005
Minimum value			0.048			0.059	0.001
Maximum Value			0.451			0.424	0.036

Table 9: Table showing proximity in the distribution of values for raw and complete datasets for Day 7 of the culture. Refer to description above for interpreting the table.

Day 7	Complete			Raw			Raw - Complete
Parameters	P1	P2	Hypotenuse	P1	P2	Hypotenuse	Distance
Culture Days	0.017	-0.342	0.342	0.007	0.338	0.338	0.005
ECT	-0.208	0.037	0.211	-0.194	-0.036	0.198	0.014
VCD	0.337	-0.157	0.372	0.322	0.185	0.371	0.001
TCD	0.336	-0.167	0.375	0.322	0.195	0.376	0.001
ACC	0.246	0.008	0.246	0.263	-0.015	0.264	0.018
ACD	-0.293	-0.192	0.350	-0.311	0.191	0.365	0.015
pH	0.223	0.106	0.247	0.211	-0.099	0.233	0.015
[Glutamine]	-0.247	0.240	0.345	-0.244	-0.275	0.367	0.023
[Glutamate]	-0.228	0.135	0.264	-0.272	-0.085	0.285	0.022
EGN	0.030	-0.191	0.194	0.042	0.142	0.148	0.046
ACV	-0.284	-0.201	0.348	-0.301	0.203	0.363	0.016
[Lactate]	-0.248	-0.187	0.310	-0.262	0.164	0.309	0.002
[NH ₃]	-0.136	-0.028	0.138	-0.150	0.013	0.151	0.013
Osmolality	-0.239	-0.227	0.330	-0.203	0.128	0.240	0.091
[Glucose]	-0.014	0.182	0.182	-0.019	-0.204	0.205	0.023
CPDL	-0.180	-0.271	0.325	-0.200	0.274	0.339	0.015
[Na ⁺]	0.068	-0.445	0.450	0.043	0.449	0.451	0.002
[K ⁺]	-0.256	0.281	0.380	-0.224	-0.326	0.395	0.016
[HCO ₃ ⁻]	0.013	0.280	0.280	0.047	-0.297	0.301	0.021
Temperature	-0.318	-0.077	0.327	-0.307	0.050	0.311	0.017
pCO ₂	0.001	0.271	0.271	0.007	-0.254	0.254	0.017
pO ₂	0.042	0.060	0.073	0.030	-0.043	0.052	0.022
Minimum value			0.073			0.052	0.001
Maximum Value			0.450			0.451	0.091

Table 10: Table showing proximity in the distribution of values for raw and complete datasets for Day 8 of the culture. Refer to description above for interpreting the table.

Day 8	Complete			Raw			Raw - Complete
Parameters	P1	P2	Hypotenuse	P1	P2	Hypotenuse	Distance
Culture Days	0.036	-0.376	0.378	0.026	0.082	0.086	0.292
ECT	-0.226	0.027	0.227	-0.216	0.065	0.226	0.002
VCD	0.352	-0.141	0.379	0.339	-0.049	0.343	0.037
TCD	0.356	-0.143	0.384	0.345	-0.036	0.346	0.038
ACC	0.249	0.068	0.258	0.254	0.183	0.313	0.055
ACD	-0.289	-0.194	0.348	-0.306	0.031	0.307	0.042
pH	0.204	0.058	0.212	0.209	-0.261	0.334	0.123
[Glutamine]	-0.286	0.011	0.286	-0.310	-0.076	0.319	0.033
[Glutamate]	-0.209	0.231	0.312	-0.247	-0.140	0.284	0.029
EGN	0.050	-0.115	0.126	0.047	0.255	0.259	0.134
ACV	-0.287	-0.203	0.352	-0.302	0.035	0.304	0.048
[Lactate]	-0.248	-0.220	0.331	-0.252	0.024	0.253	0.079
[NH ₃]	-0.132	-0.058	0.144	-0.137	-0.237	0.273	0.130
Osmolality	-0.156	0.090	0.180	-0.078	-0.408	0.416	0.237
[Glucose]	-0.020	0.104	0.106	-0.019	-0.232	0.233	0.127
CPDL	-0.174	-0.356	0.396	-0.180	0.198	0.267	0.129
[Na ⁺]	0.106	-0.406	0.420	0.108	0.014	0.109	0.312
[K ⁺]	-0.233	0.341	0.412	-0.196	-0.288	0.348	0.064
[HCO ₃ ⁻]	-0.008	0.198	0.198	-0.021	-0.449	0.449	0.252
Temperature	-0.320	-0.125	0.344	-0.312	0.199	0.370	0.027
pCO ₂	0.020	0.352	0.353	0.026	-0.356	0.357	0.005
pO ₂	-0.022	-0.102	0.105	-0.019	-0.167	0.168	0.064
Minimum value			0.105			0.086	0.002
Maximum Value			0.420			0.449	0.312

Table 11: Table showing proximity in the distribution of values for raw and complete datasets for Day 9 of the culture. Refer to description above for interpreting the table.

Day 9	Complete			Raw			Raw - Complete
Parameters	P1	P2	Hypotenuse	P1	P2	Hypotenuse	Distance
Culture Days	0.042	-0.208	0.212	0.029	0.111	0.115	0.098
ECT	-0.269	-0.087	0.283	-0.261	0.082	0.274	0.009
VCD	0.375	-0.029	0.376	0.355	-0.010	0.355	0.021
TCD	0.382	-0.035	0.383	0.363	0.004	0.363	0.021
ACC	0.198	-0.304	0.363	0.192	0.302	0.358	0.005
ACD	-0.302	-0.064	0.309	-0.314	-0.001	0.314	0.006
pH	0.169	0.268	0.316	0.246	-0.227	0.334	0.018
[Glutamine]	-0.269	-0.289	0.394	-0.279	0.169	0.326	0.069
[Glutamate]	-0.199	0.166	0.259	-0.225	-0.272	0.353	0.095
EGN	0.036	-0.288	0.291	-0.003	0.272	0.272	0.019
ACV	-0.266	-0.052	0.271	-0.273	-0.014	0.274	0.003
[Lactate]	-0.246	0.036	0.249	-0.242	-0.069	0.252	0.004
[NH ₃]	-0.099	0.195	0.218	-0.101	-0.237	0.258	0.040
Osmolality	-0.026	0.370	0.371	0.068	-0.349	0.356	0.016
[Glucose]	0.008	0.201	0.201	0.013	-0.197	0.197	0.005
CPDL	-0.211	-0.239	0.318	-0.221	0.188	0.290	0.029
[Na ⁺]	0.123	-0.088	0.151	0.079	0.022	0.082	0.069
[K ⁺]	-0.220	0.352	0.415	-0.183	-0.338	0.385	0.031
[HCO ₃ ⁻]	-0.016	0.177	0.178	0.033	-0.431	0.432	0.255
Temperature	-0.342	-0.155	0.375	-0.334	0.132	0.359	0.016
pCO ₂	-0.060	0.346	0.351	-0.046	-0.277	0.281	0.071
pO ₂	0.025	0.076	0.080	-0.004	-0.116	0.116	0.037
Minimum value			0.080			0.082	0.003
Maximum Value			0.415			0.432	0.255

Table 12: Table showing proximity in the distribution of values for raw and complete datasets for Day 10 of the culture. Refer to description above for interpreting the table.

Day 10	Complete			Raw			Raw - Complete
Parameters	P1	P2	Hypotenuse	P1	P2	Hypotenuse	Distance
Culture Days	0.034	0.145	0.148	0.039	-0.052	0.064	0.084
ECT	-0.173	-0.127	0.214	-0.186	-0.098	0.210	0.005
VCD	0.330	0.242	0.409	0.339	0.148	0.369	0.040
TCD	0.354	0.233	0.424	0.362	0.128	0.384	0.040
ACC	0.202	-0.322	0.380	0.196	-0.268	0.331	0.050
ACD	-0.329	-0.110	0.347	-0.338	-0.097	0.352	0.005
pH	-0.073	0.288	0.297	-0.050	0.345	0.349	0.052
[Glutamine]	-0.239	-0.146	0.280	-0.302	-0.092	0.316	0.036
[Glutamate]	-0.146	-0.089	0.171	-0.207	0.072	0.219	0.049
EGN	0.150	-0.282	0.319	0.074	-0.254	0.264	0.055
ACV	-0.296	-0.087	0.308	-0.301	-0.107	0.320	0.012
[Lactate]	-0.254	0.295	0.389	-0.222	0.140	0.262	0.127
[NH ₃]	-0.163	0.219	0.273	-0.161	0.213	0.267	0.007
Osmolality	-0.121	0.348	0.368	-0.057	0.382	0.387	0.019
[Glucose]	-0.249	0.206	0.323	-0.236	0.187	0.301	0.023
CPDL	-0.201	0.106	0.227	-0.165	-0.174	0.240	0.013
[Na ⁺]	-0.021	0.356	0.356	0.010	0.103	0.103	0.253
[K ⁺]	-0.260	0.006	0.260	-0.247	0.241	0.345	0.085
[HCO ₃ ⁻]	-0.120	0.002	0.120	-0.105	0.408	0.422	0.302
Temperature	-0.324	-0.188	0.374	-0.320	-0.212	0.384	0.010
pCO ₂	0.005	0.065	0.065	0.002	0.271	0.272	0.207
pO ₂	0.012	0.251	0.251	0.009	0.183	0.183	0.069
Minimum value			0.065			0.064	0.005
Maximum Value			0.424			0.422	0.302

Table 13: Table showing proximity in the distribution of values for raw and complete datasets for Day 11 of the culture. Refer to description above for interpreting the table.

Day 11	Complete			Raw			Raw - Complete
Parameters	P1	P2	Hypotenuse	P1	P2	Hypotenuse	Distance
Culture Days	0.052	0.181	0.188	0.059	0.198	0.207	0.019
ECT	-0.206	0.053	0.213	-0.197	0.086	0.215	0.002
VCD	0.307	0.160	0.346	0.305	0.164	0.346	0.001
TCD	0.368	0.145	0.396	0.369	0.142	0.395	0.001
ACC	0.127	-0.293	0.319	0.129	-0.324	0.349	0.030
ACD	-0.357	-0.007	0.357	-0.357	0.005	0.357	0.001
pH	-0.176	0.204	0.269	-0.177	0.233	0.292	0.024
[Glutamine]	-0.263	0.159	0.307	-0.288	0.137	0.319	0.012
[Glutamate]	-0.127	-0.084	0.152	-0.156	-0.040	0.161	0.009
EGN	0.117	-0.221	0.250	0.099	-0.056	0.114	0.137
ACV	-0.348	-0.006	0.348	-0.348	0.005	0.348	0.001
[Lactate]	-0.029	0.410	0.411	-0.006	0.406	0.406	0.005
[NH ₃]	-0.161	0.277	0.321	-0.172	0.298	0.344	0.024
Osmolality	-0.042	0.343	0.345	-0.033	0.328	0.330	0.016
[Glucose]	-0.104	0.191	0.217	-0.110	0.240	0.264	0.048
CPDL	-0.133	0.230	0.266	-0.089	0.181	0.202	0.064
[Na ⁺]	0.148	0.410	0.436	0.160	0.391	0.423	0.014
[K ⁺]	-0.297	0.010	0.297	-0.292	0.088	0.304	0.008
[HCO ₃ ⁻]	-0.217	-0.134	0.254	-0.224	-0.151	0.270	0.016
Temperature	-0.301	-0.047	0.305	-0.279	-0.063	0.286	0.019
pCO ₂	-0.144	-0.189	0.238	-0.148	-0.213	0.260	0.022
pO ₂	0.095	0.191	0.213	0.083	0.205	0.221	0.008
Minimum value			0.152			0.114	0.001
Maximum Value			0.436			0.423	0.137

Table 14: Table showing proximity in the distribution of values for raw and complete datasets for Day 12 of the culture. Refer to description above for interpreting the table.

Day 12	Complete			Raw			Raw - Complete
Parameters	P1	P2	Hypotenuse	P1	P2	Hypotenuse	Distance
Culture Days	0.092	0.205	0.225	0.093	0.022	0.096	0.130
ECT	-0.184	0.195	0.268	-0.183	-0.057	0.192	0.077
VCD	0.270	0.077	0.280	0.268	0.148	0.306	0.026
TCD	0.360	0.035	0.362	0.361	0.037	0.363	0.001
ACC	-0.235	0.115	0.262	-0.232	-0.080	0.246	0.017
ACD	-0.315	0.170	0.358	-0.317	0.042	0.320	0.039
pH	-0.078	0.151	0.170	-0.087	0.386	0.396	0.226
[Glutamine]	-0.196	0.358	0.408	-0.242	0.137	0.278	0.130
[Glutamate]	-0.140	-0.082	0.162	-0.152	0.104	0.184	0.022
EGN	0.059	-0.061	0.084	0.075	-0.406	0.413	0.329
ACV	-0.342	0.150	0.374	-0.346	0.105	0.362	0.012
[Lactate]	0.172	0.385	0.422	0.168	0.215	0.273	0.149
[NH ₃]	-0.056	0.292	0.297	-0.067	0.339	0.345	0.049
Osmolality	0.182	0.328	0.375	0.151	0.315	0.349	0.027
[Glucose]	-0.088	0.189	0.209	-0.093	0.081	0.123	0.087
CPDL	-0.081	0.372	0.381	-0.092	-0.109	0.142	0.239
[Na ⁺]	0.298	0.338	0.450	0.285	0.239	0.372	0.079
[K ⁺]	-0.258	-0.022	0.259	-0.246	0.277	0.370	0.112
[HCO ₃ ⁻]	-0.236	-0.120	0.265	-0.234	0.375	0.441	0.177
Temperature	-0.283	0.138	0.315	-0.278	-0.096	0.294	0.022
pCO ₂	-0.192	-0.081	0.208	-0.189	0.015	0.189	0.020
pO ₂	0.108	0.143	0.179	0.094	0.228	0.247	0.068
Minimum value			0.084			0.096	0.001
Maximum Value			0.450			0.441	0.329

Table 15: Table showing proximity in the distribution of values for raw and complete datasets for Day 13 of the culture. Refer to description above for interpreting the table.

Day 13	Complete			Raw			Raw - Complete
Parameters	P1	P2	Hypotenuse	P1	P2	Hypotenuse	Distance
Culture Days	0.130	-0.067	0.146	0.125	-0.010	0.126	0.021
ECT	-0.145	-0.124	0.191	-0.152	-0.035	0.156	0.036
VCD	0.249	-0.144	0.287	0.227	0.204	0.305	0.018
TCD	0.367	-0.001	0.367	0.355	0.078	0.364	0.004
ACC	-0.002	0.409	0.409	0.026	-0.355	0.356	0.054
ACD	-0.349	-0.132	0.373	-0.354	0.101	0.368	0.005
pH	-0.092	-0.418	0.428	-0.120	0.387	0.406	0.023
[Glutamine]	-0.162	-0.242	0.291	-0.237	0.102	0.258	0.033
[Glutamate]	-0.128	-0.080	0.151	-0.139	0.129	0.190	0.040
EGN	0.144	0.175	0.226	0.168	-0.356	0.393	0.167
ACV	-0.338	-0.125	0.36	-0.343	0.104	0.358	0.003
[Lactate]	0.256	-0.211	0.332	0.245	0.149	0.287	0.046
[NH ₃]	-0.053	-0.373	0.377	-0.094	0.280	0.295	0.082
Osmolality	0.214	-0.269	0.343	0.215	0.285	0.357	0.014
[Glucose]	0.025	-0.156	0.158	0.015	0.117	0.118	0.041
CPDL	-0.057	-0.061	0.084	-0.063	-0.178	0.188	0.105
[Na ⁺]	0.320	-0.193	0.373	0.301	0.156	0.339	0.035
[K ⁺]	-0.193	-0.298	0.355	-0.192	0.360	0.407	0.053
[HCO ₃ ⁻]	-0.272	0.032	0.273	-0.263	0.057	0.269	0.005
Temperature	-0.262	0.032	0.264	-0.245	-0.187	0.308	0.044
pCO ₂	-0.222	0.156	0.272	-0.209	-0.165	0.266	0.006
pO ₂	0.110	-0.237	0.261	0.080	0.241	0.254	0.008
Minimum value			0.084			0.118	0.003
Maximum Value			0.428			0.407	0.167

Table 16: Table showing proximity in the distribution of values for raw and complete datasets for Day 14 of the culture. Refer to description above for interpreting the table.

Day 14	Complete			Raw			Raw - Complete
Parameters	P1	P2	Hypotenuse	P1	P2	Hypotenuse	Distance
Culture Days	0.132	-0.137	0.190	0.133	-0.042	0.139	0.052
ECT	-0.097	-0.103	0.141	-0.092	0.019	0.094	0.047
VCD	0.189	-0.257	0.319	0.164	-0.299	0.341	0.023
TCD	0.355	-0.064	0.361	0.341	-0.135	0.366	0.006
ACC	-0.026	0.367	0.368	-0.002	0.330	0.330	0.039
ACD	-0.358	-0.133	0.382	-0.364	-0.098	0.377	0.005
pH	-0.130	-0.326	0.351	-0.155	-0.347	0.380	0.029
[Glutamine]	-0.147	-0.240	0.281	-0.195	-0.129	0.234	0.048
[Glutamate]	-0.144	-0.062	0.157	-0.157	-0.094	0.183	0.026
EGN	0.196	0.245	0.313	0.249	0.342	0.422	0.110
ACV	-0.350	-0.126	0.372	-0.356	-0.099	0.369	0.003
[Lactate]	0.287	-0.169	0.333	0.282	-0.142	0.315	0.018
[NH ₃]	-0.031	-0.376	0.377	-0.053	-0.294	0.299	0.079
Osmolality	0.246	-0.279	0.372	0.213	-0.299	0.366	0.006
[Glucose]	-0.082	-0.186	0.203	-0.069	-0.086	0.110	0.094
CPDL	0.053	-0.126	0.137	0.058	0.124	0.137	0.001
[Na ⁺]	0.318	-0.215	0.384	0.309	-0.188	0.362	0.022
[K ⁺]	-0.203	-0.252	0.324	-0.218	-0.317	0.385	0.061
[HCO ₃ ⁻]	-0.247	-0.060	0.254	-0.243	-0.123	0.272	0.019
Temperature	-0.248	0.034	0.251	-0.222	0.179	0.285	0.035
pCO ₂	-0.188	-0.026	0.190	-0.178	0.055	0.186	0.005
pO ₂	0.111	-0.308	0.327	0.089	-0.314	0.326	0.001
Minimum value			0.137			0.094	0.001
Maximum Value			0.384			0.422	0.110

Table 17: Table showing proximity in the distribution of values for raw and complete datasets for Day 15 of the culture. Refer to description above for interpreting the table.

Day 15	Complete			Raw			Raw - Complete
Parameters	P1	P2	Hypotenuse	P1	P2	Hypotenuse	Distance
Culture Days	0.101	0.240	0.261	0.120	0.127	0.175	0.086
ECT	-0.049	-0.214	0.219	-0.145	-0.219	0.263	0.044
VCD	0.283	0.250	0.378	0.293	0.120	0.316	0.062
TCD	0.072	0.342	0.349	0.134	0.248	0.282	0.068
ACC	-0.102	-0.248	0.269	-0.140	-0.164	0.215	0.054
ACD	0.328	-0.210	0.390	0.245	-0.240	0.343	0.048
pH	0.275	0.159	0.317	0.280	0.152	0.318	0.001
[Glutamine]	0.266	0.107	0.287	0.233	0.046	0.238	0.050
[Glutamate]	-0.017	-0.383	0.383	-0.038	-0.407	0.409	0.026
EGN	-0.313	0.035	0.315	-0.342	0.074	0.350	0.035
ACV	0.312	-0.213	0.377	0.232	-0.237	0.332	0.046
[Lactate]	-0.297	0.219	0.369	-0.255	0.306	0.398	0.030
[NH ₃]	0.170	0.261	0.311	0.290	0.319	0.431	0.120
Osmolality	-0.041	-0.019	0.045	-0.054	0.015	0.056	0.011
[Glucose]	0.045	0.126	0.134	0.070	0.132	0.149	0.015
CPDL	0.037	0.217	0.220	0.027	0.144	0.146	0.075
[Na ⁺]	-0.095	0.300	0.314	-0.060	0.362	0.367	0.053
[K ⁺]	0.169	-0.188	0.253	0.166	-0.358	0.394	0.142
[HCO ₃ ⁻]	0.330	-0.060	0.335	0.359	0.010	0.359	0.025
Temperature	0.008	0.276	0.276	0.036	0.183	0.186	0.090
pCO ₂	0.312	-0.018	0.312	0.296	-0.030	0.297	0.016
pO ₂	-0.282	-0.008	0.282	-0.272	0.016	0.273	0.010
Minimum value			0.045			0.056	0.001
Maximum Value			0.390			0.431	0.142

Table 18: Table showing proximity in the distribution of values for raw and complete datasets for Day 16 of the culture. Refer to description above for interpreting the table.

Day 16	Complete			Raw			Raw - Complete
Parameters	P1	P2	Hypotenuse	P1	P2	Hypotenuse	Distance
Culture Days	0.239	0.065	0.247	0.187	0.023	0.189	0.059
ECT	0.114	0.108	0.157	0.099	0.067	0.119	0.038
VCD	0.295	0.220	0.367	0.241	0.180	0.301	0.067
TCD	0.046	0.360	0.363	0.055	0.355	0.359	0.004
ACC	-0.270	-0.030	0.271	-0.209	-0.034	0.212	0.060
ACD	0.164	-0.206	0.263	0.125	-0.310	0.334	0.072
pH	0.229	-0.094	0.247	0.250	-0.137	0.285	0.038
[Glutamine]	0.152	0.335	0.368	0.179	0.155	0.236	0.132
[Glutamate]	-0.110	-0.355	0.372	-0.123	-0.360	0.380	0.009
EGN	-0.257	-0.019	0.257	-0.302	-0.046	0.305	0.048
ACV	0.159	-0.209	0.262	0.122	-0.312	0.335	0.073
[Lactate]	-0.188	0.232	0.298	-0.140	0.291	0.323	0.025
[NH ₃]	-0.296	-0.143	0.329	-0.272	-0.141	0.307	0.023
Osmolality	-0.148	0.357	0.386	-0.080	0.350	0.359	0.027
[Glucose]	-0.095	0.274	0.290	-0.042	0.261	0.264	0.026
CPDL	0.216	-0.004	0.216	0.148	-0.202	0.250	0.035
[Na ⁺]	-0.088	0.338	0.349	-0.235	0.259	0.350	0.001
[K ⁺]	-0.327	0.008	0.327	-0.355	-0.017	0.356	0.029
[HCO ₃ ⁻]	0.328	-0.086	0.340	0.371	0.014	0.371	0.032
Temperature	0.207	0.254	0.328	0.202	0.211	0.293	0.036
pCO ₂	0.287	-0.102	0.304	0.346	0.125	0.367	0.064
pO ₂	-0.137	0.041	0.143	-0.142	-0.086	0.166	0.023
Minimum value			0.143			0.119	0.001
Maximum Value			0.386			0.380	0.132

3. Table showing bandwidth calculation of the spread of parameter values on a Cartesian plane as identified from PCA loadings. 'Range of Loadings' columns describes the spread of values of all the parameters for each day in the culture for raw and complete datasets. Distances are measured from the origin. The row 'Range' is calculated as the difference between overall maximum and minimum, and explains the width of upper and lower bounds. The row 'midpoint' attempts to find a midpoint in the upper and lower bounds by taking the average of the overall minimum and maximum values. Bandwidth is calculated as the difference between the midpoints of overall maximum and minimum values.

Table 19: Table showing the spread of parameters on a Cartesian plane for complete and raw datasets.

	Range of Loadings			
	Complete Data		Raw Data	
Days	Min	Max	Min	Max
0	0.000	0.523	0.000	0.627
1	0.138	0.398	0.111	0.402
2	0.090	0.400	0.084	0.403
3	0.115	0.411	0.099	0.398
4	0.016	0.404	0.027	0.387
5	0.076	0.436	0.068	0.430
6	0.048	0.451	0.059	0.424
7	0.073	0.450	0.052	0.451
8	0.105	0.420	0.086	0.449
9	0.080	0.415	0.082	0.432
10	0.065	0.424	0.064	0.422
11	0.152	0.436	0.114	0.423
12	0.084	0.450	0.096	0.441
13	0.084	0.428	0.118	0.407
14	0.137	0.384	0.094	0.422
15	0.045	0.390	0.056	0.431
16	0.143	0.386	0.119	0.380
Overall Minimum	0.000	0.384	0.000	0.380
Overall Maximum	0.152	0.523	0.119	0.627
Range	0.152	0.139	0.119	0.247
Midpoint	0.076	0.453	0.06	0.503
Band width	0.377		0.444	

Appendix II

1. Heat maps from 'mvtsplot' function in R showing different parameter behaviour at different time points across 106 cultures. Purple depicts low values, grey - medium, and green - high values. Colours are not comparable across cultures. Right hand side panel has box plots of the data in each time-series and on the bottom panel are the median values across all time-series for each time point.

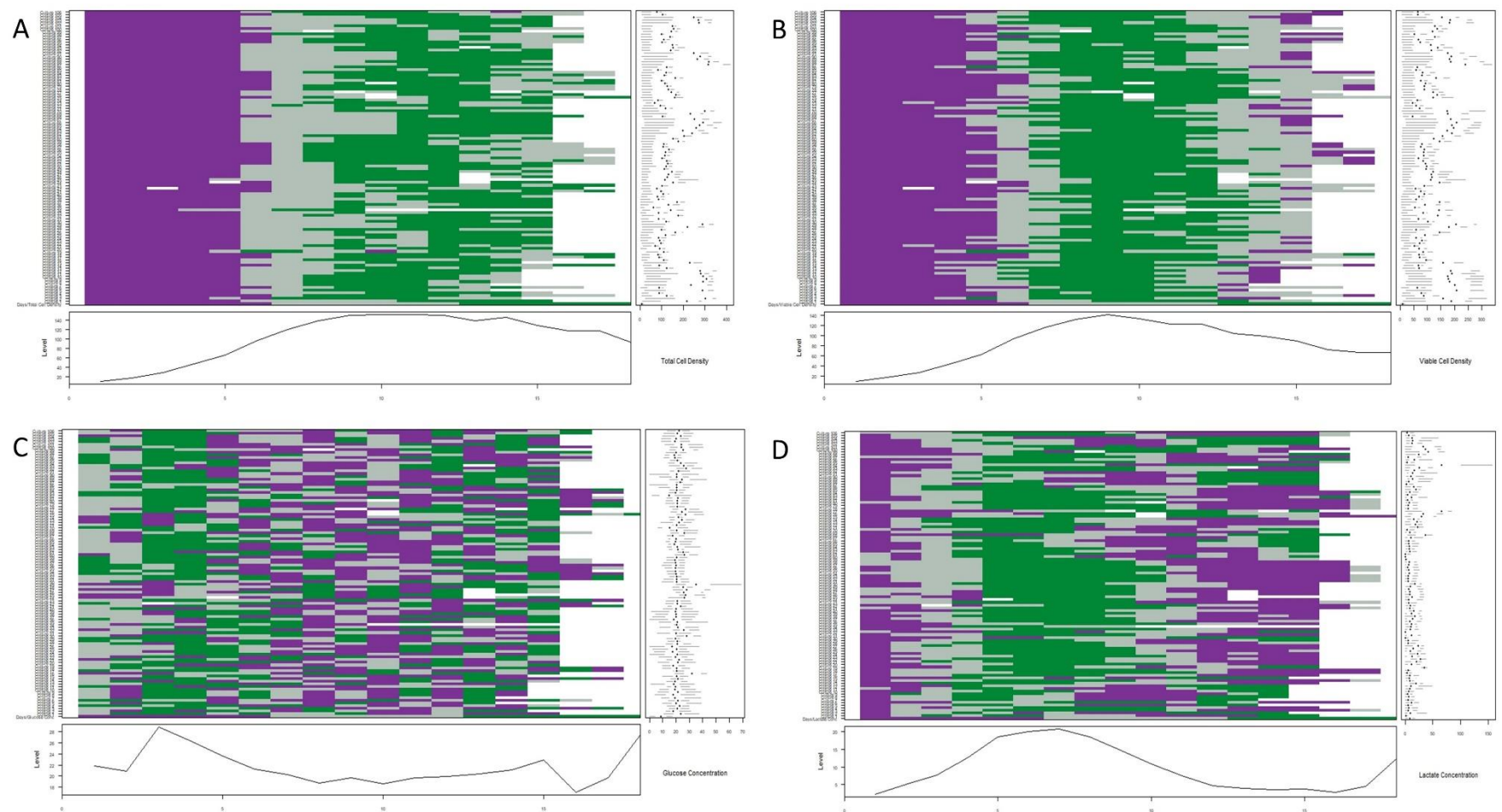


Figure 1: Heat maps of (A) TCD (B) VCD (C) [Glucose] (D) [Lactate]. Refer to the explanation above for interpretation.

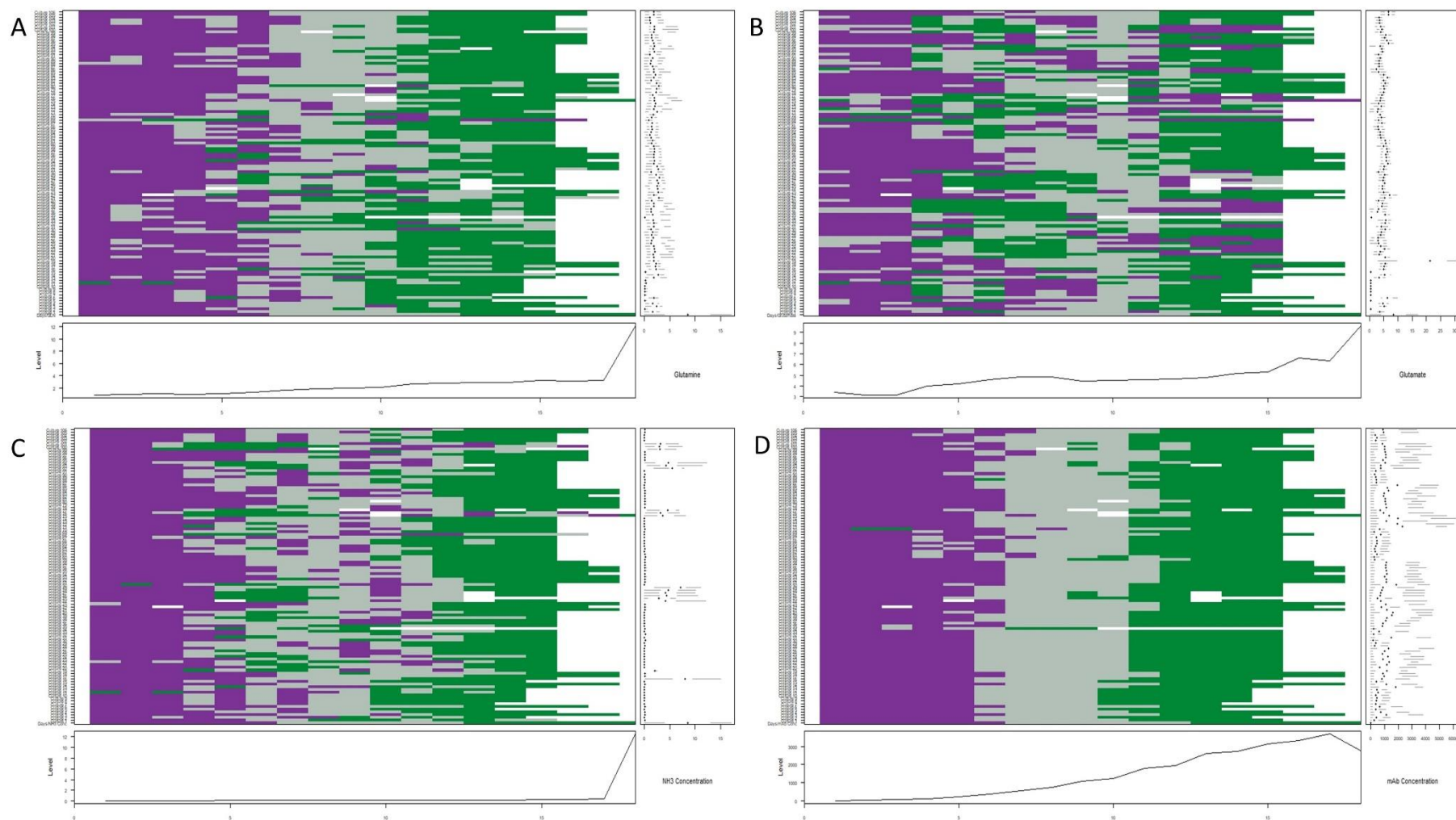


Figure 2: Heat maps of (A) [Glutamine] (B) [Glutamate] (C) [NH₃] (D) [mAb]. Refer to the explanation above for interpretation.

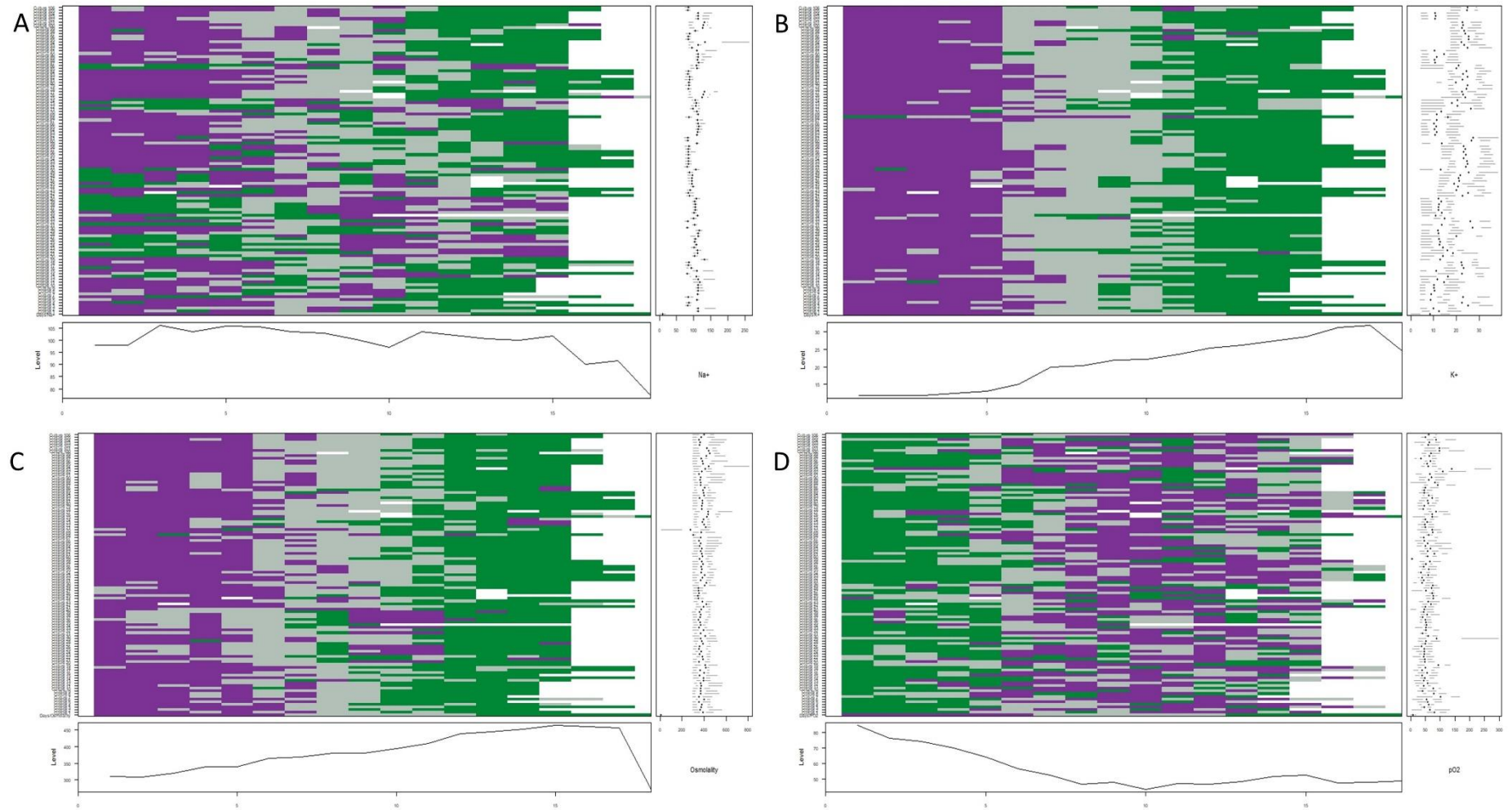


Figure 3: Heat maps of (A) [Na⁺] (B) [K⁺] (C) Osmolality (D) [pO₂]. Refer to the explanation above for interpretation.

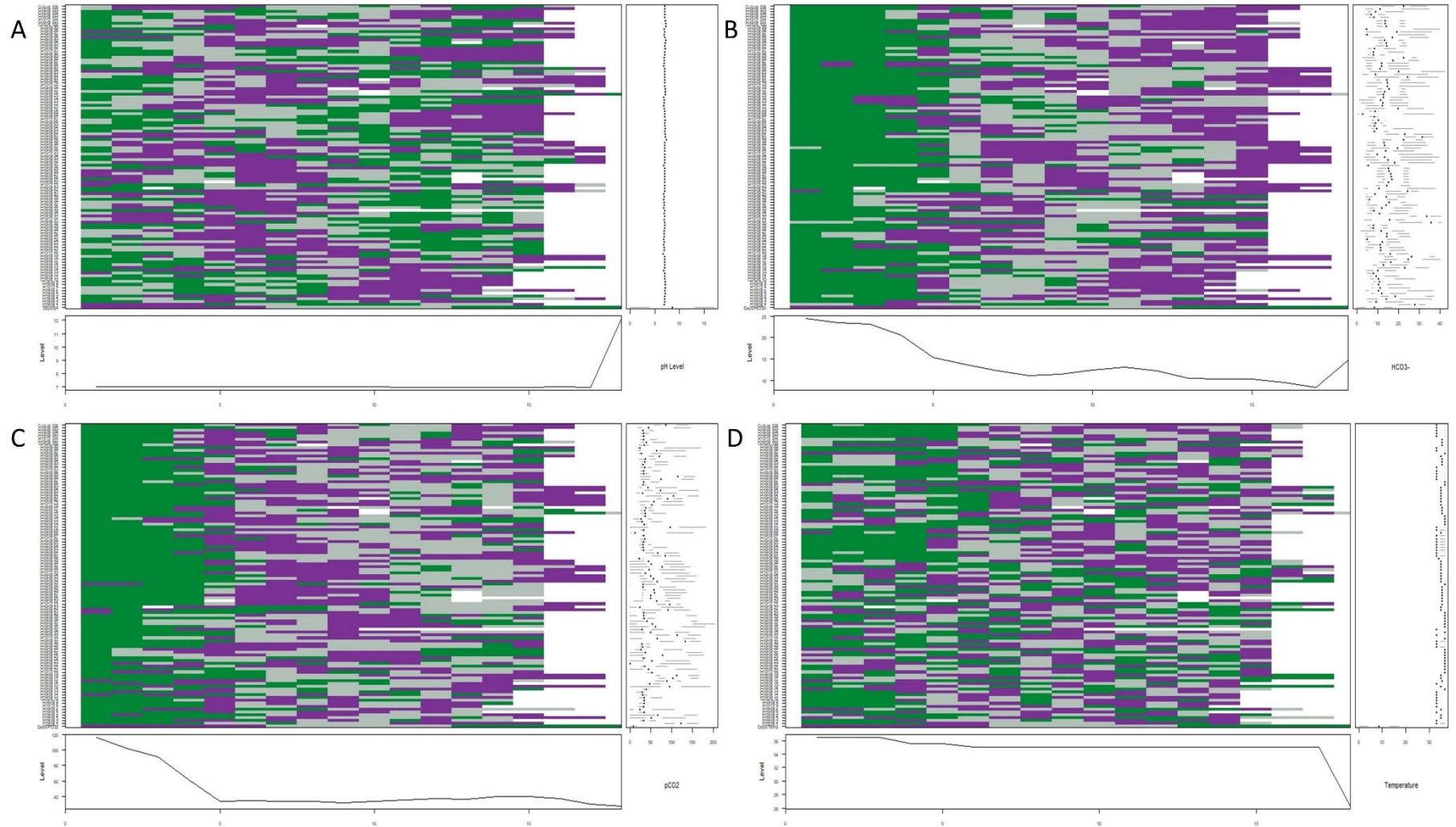


Figure 4: Heat maps of (A) pH (B) $[HCO_3^-]$ (C) $[pCO_2]$ (D) Temperature. Refer to the explanation above for interpretation.

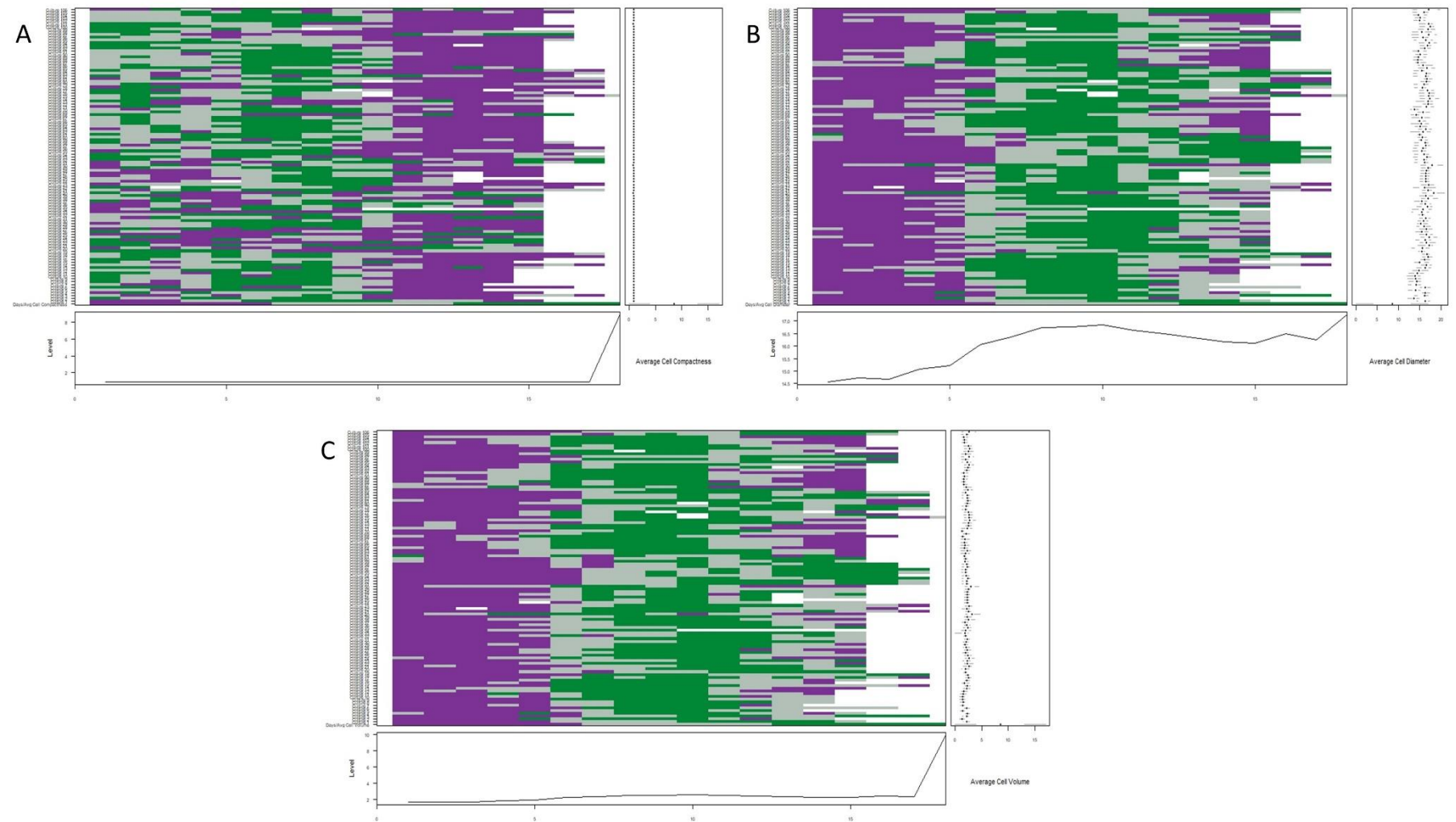


Figure 5: Heat maps of (A) ACC (B) ACD (C) ACV. Refer to the explanation above for interpretation.

Appendix III

1. Outputs from different stages of clustering for different days of culture. In figures 1 to 15 (A) Dendrogram showing parameter clustering. Scale on the left hand side shows the number of clusters formed at different heights of the dendrogram. Number of parameters in each cluster increases, moving from bottom to top of the dendrogram. (B) Plot showing aggregation level at different heights of dendrogram. X axis shows the number of clusters and Y axis shows the height of dendrogram in centimetres. More parameters cluster moving from bottom to top on Y axis. (C) Plot showing stability of partition while cutting the dendrogram into different clusters. Moving from left to right on X axis, stability increases. Adjusted RAND index has no units. (D) Plot showing dispersion of adjusted RAND index. X axis shows number of clusters and Y axis shows adjusted RAND index. Axes have no units. (E) Dendrogram showing parameters of the same cluster in same colour. These are the most stable clusters from the analyses. Scale on the left hand side shows the number of clusters formed at different heights of the dendrogram.

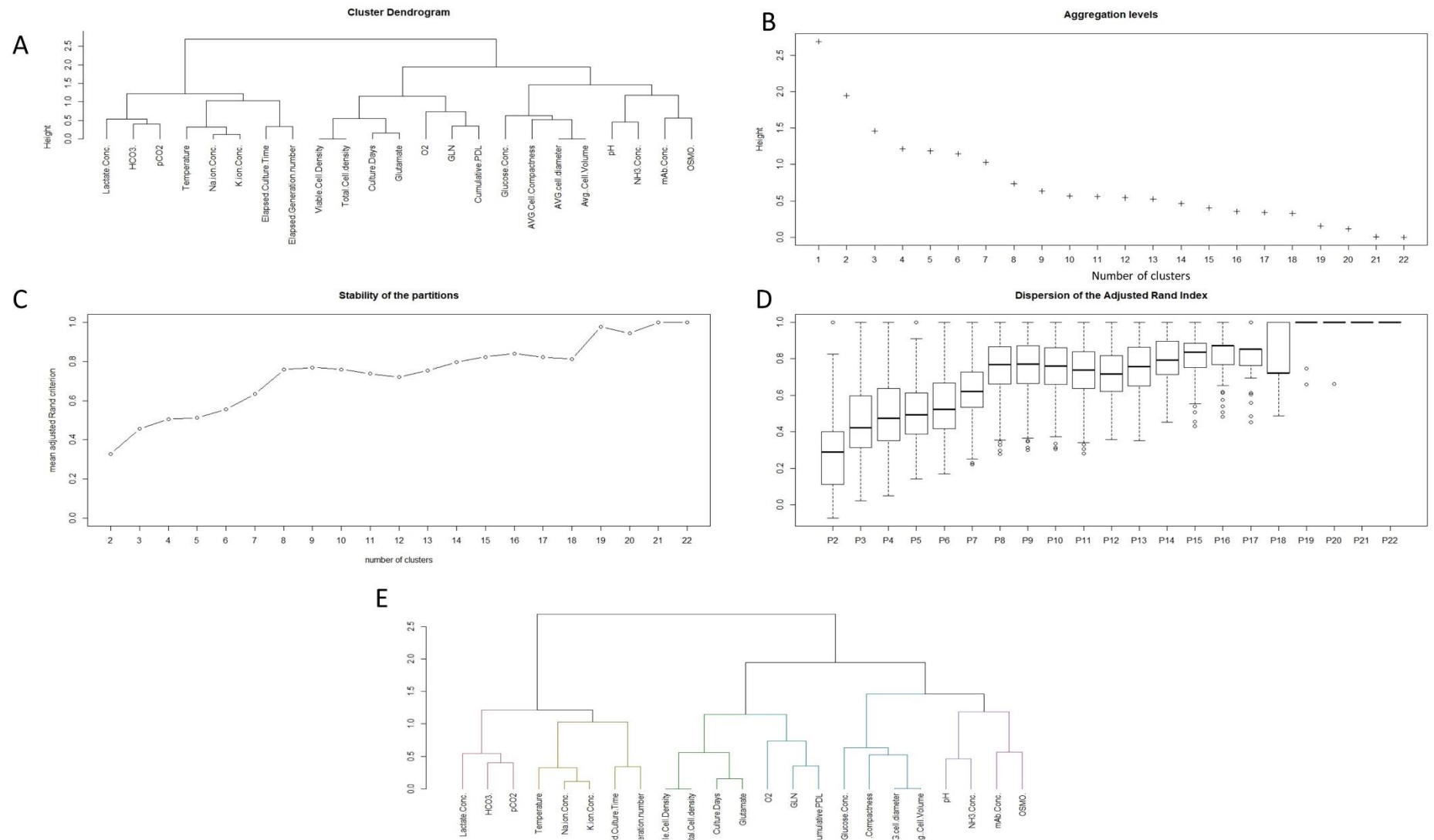


Figure 1: Clustering results for Day 1. Refer to the explanation above for interpretation.

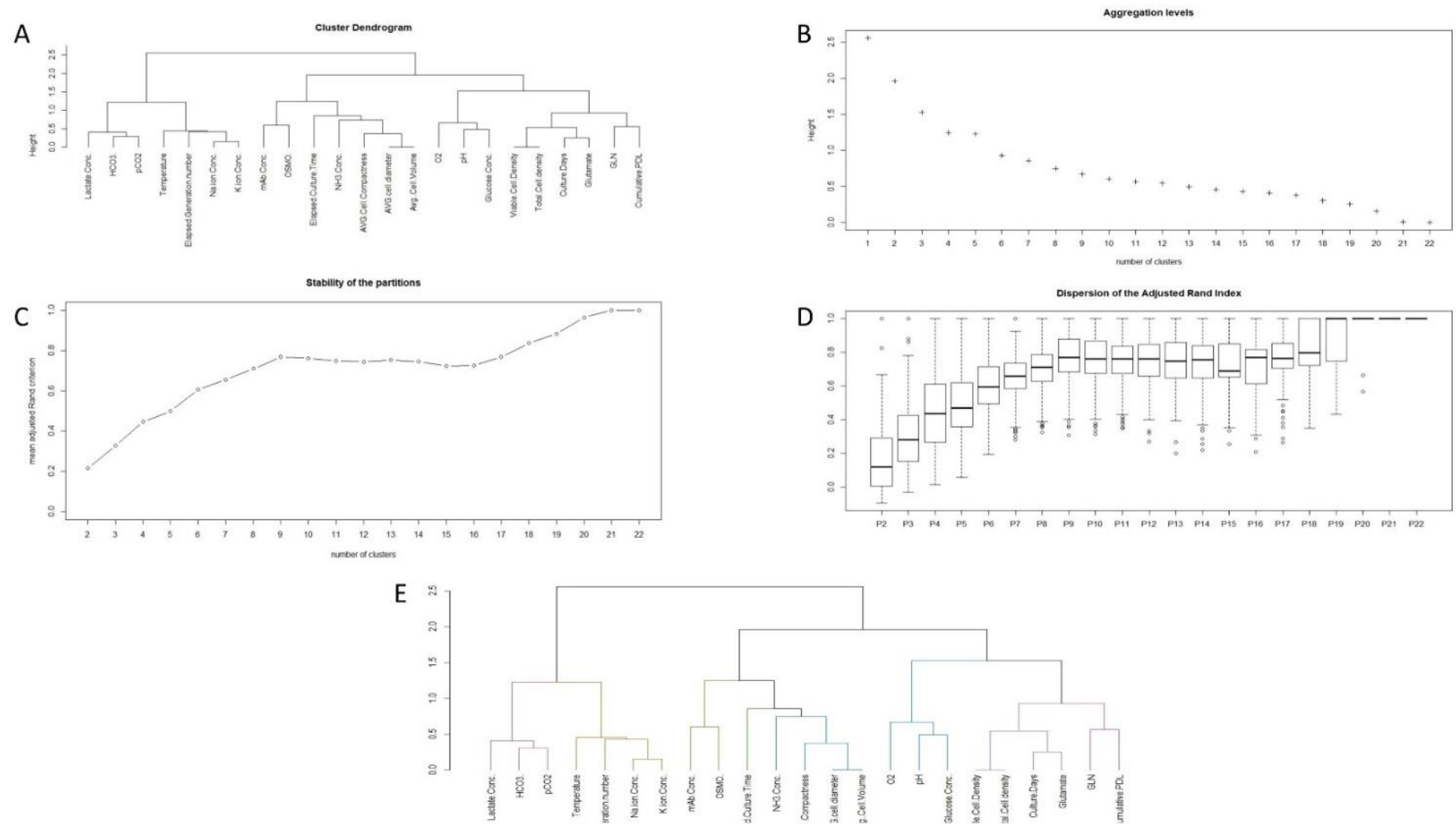


Figure 2: Clustering results for Day 2. Refer to the explanation above for interpretation.

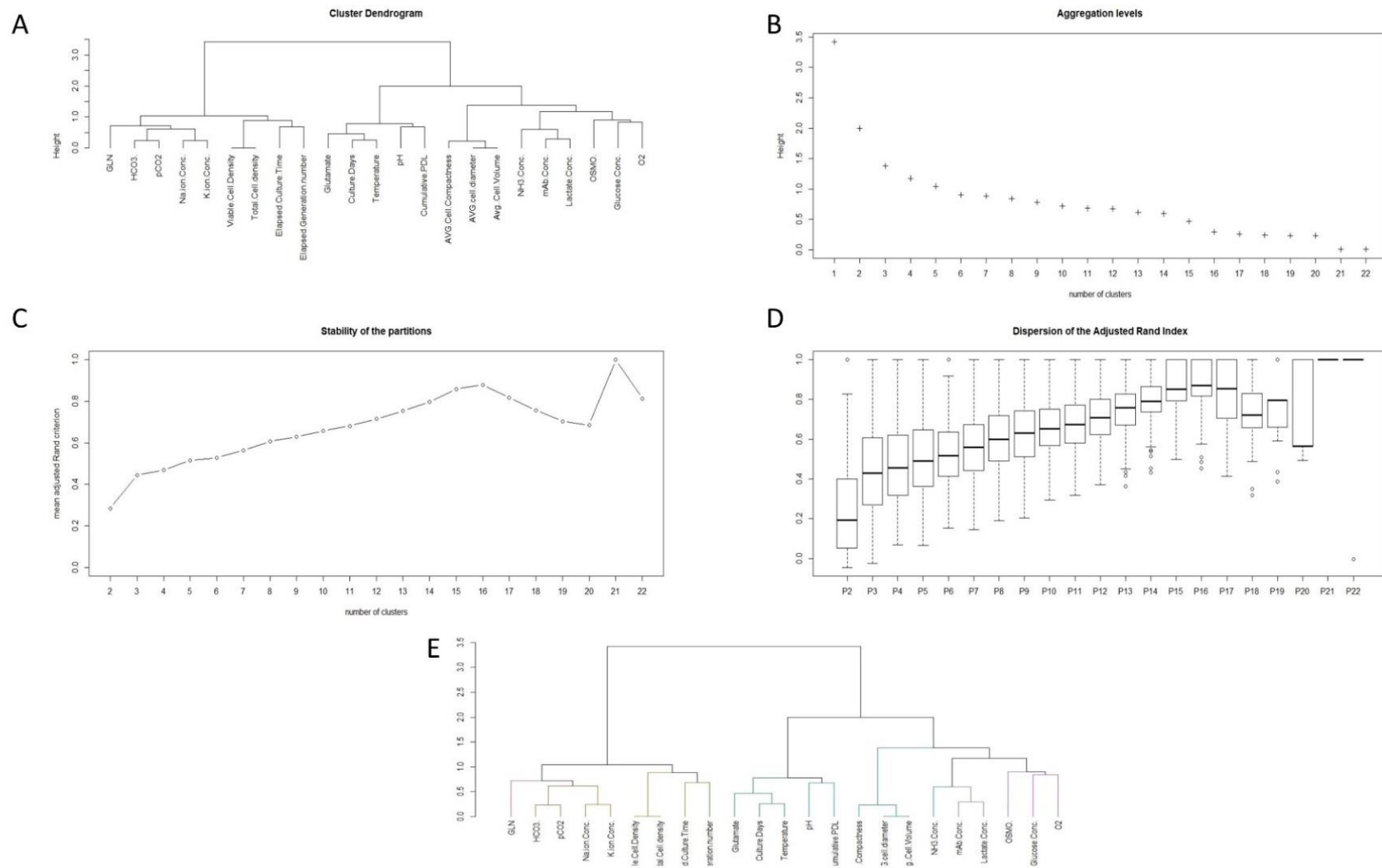


Figure 3: Clustering results for Day 3. Refer to the explanation above for interpretation.

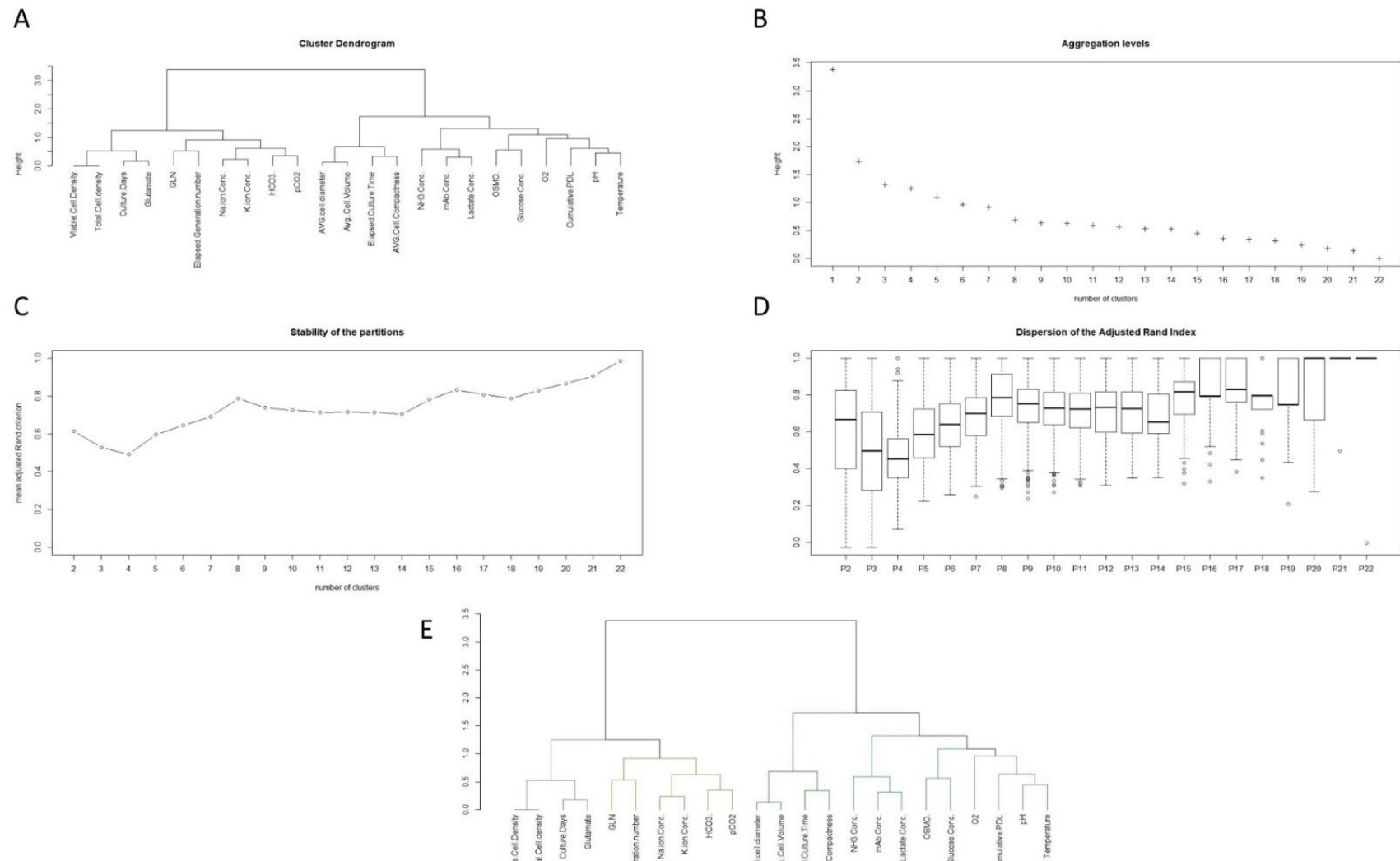


Figure 4: Clustering results for Day 4. Refer to the explanation above for interpretation.

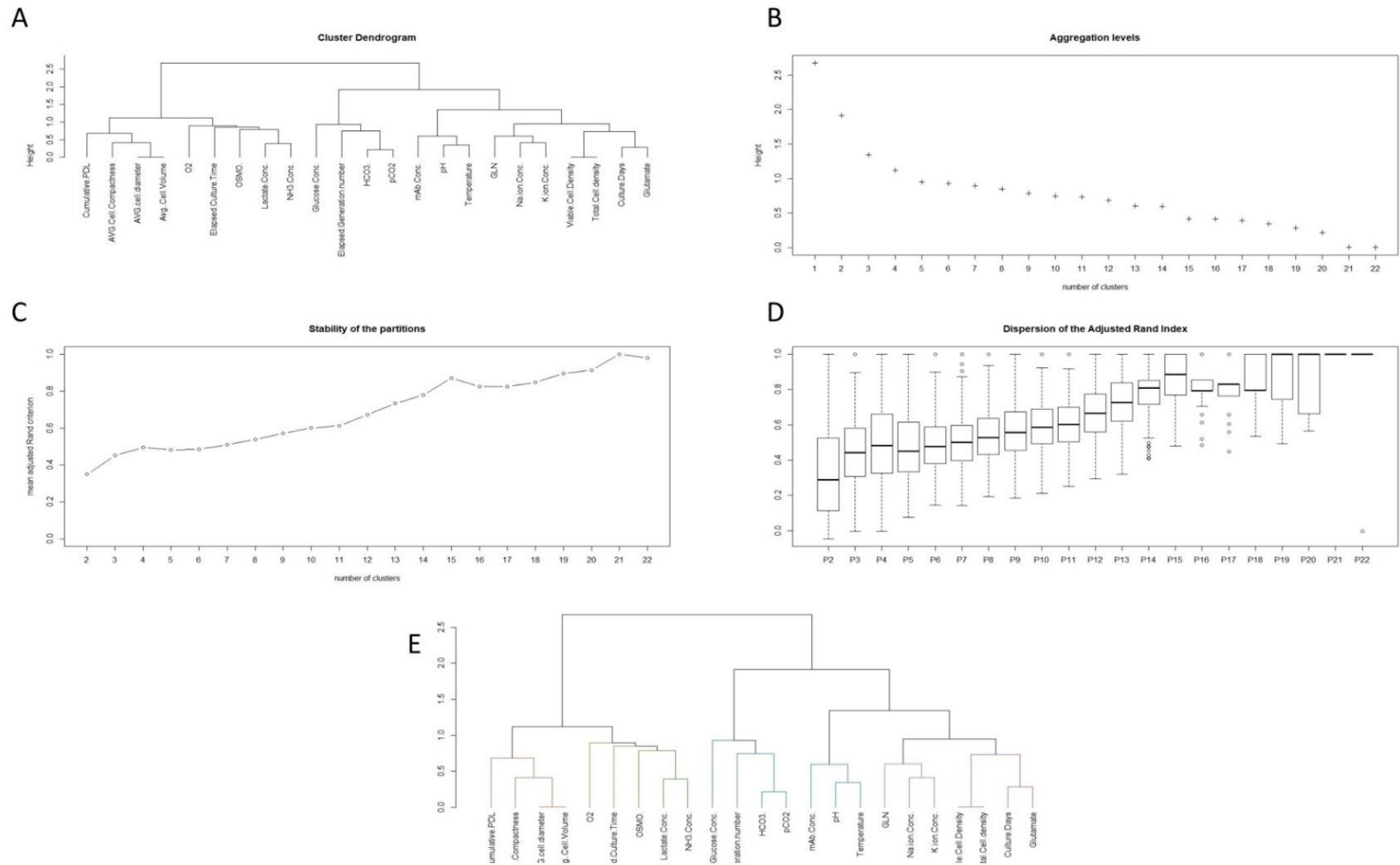


Figure 5: Clustering results for Day 5. Refer to the explanation above for interpretation.

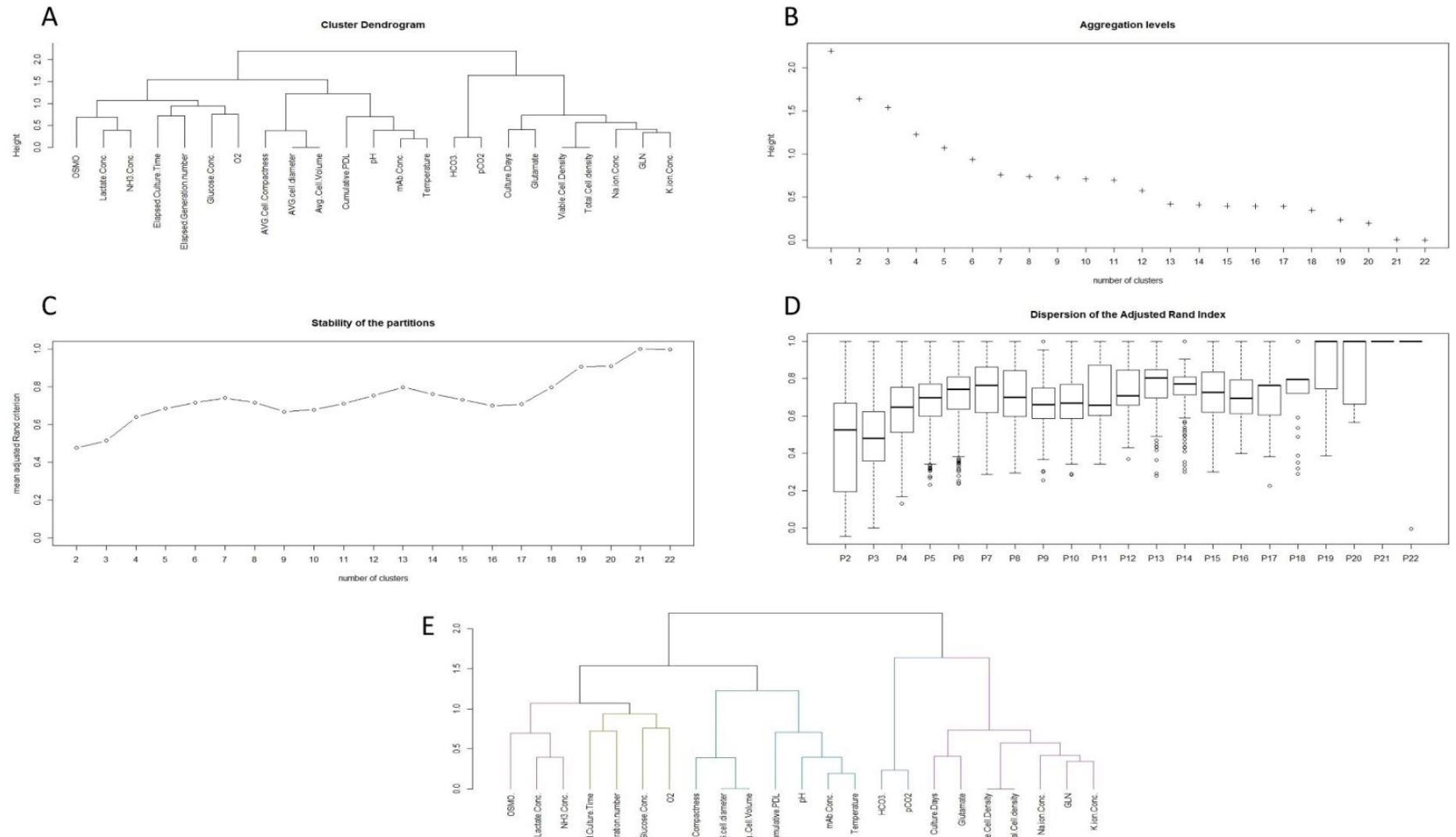


Figure 6: Clustering results for Day 6. Refer to the explanation above for interpretation.

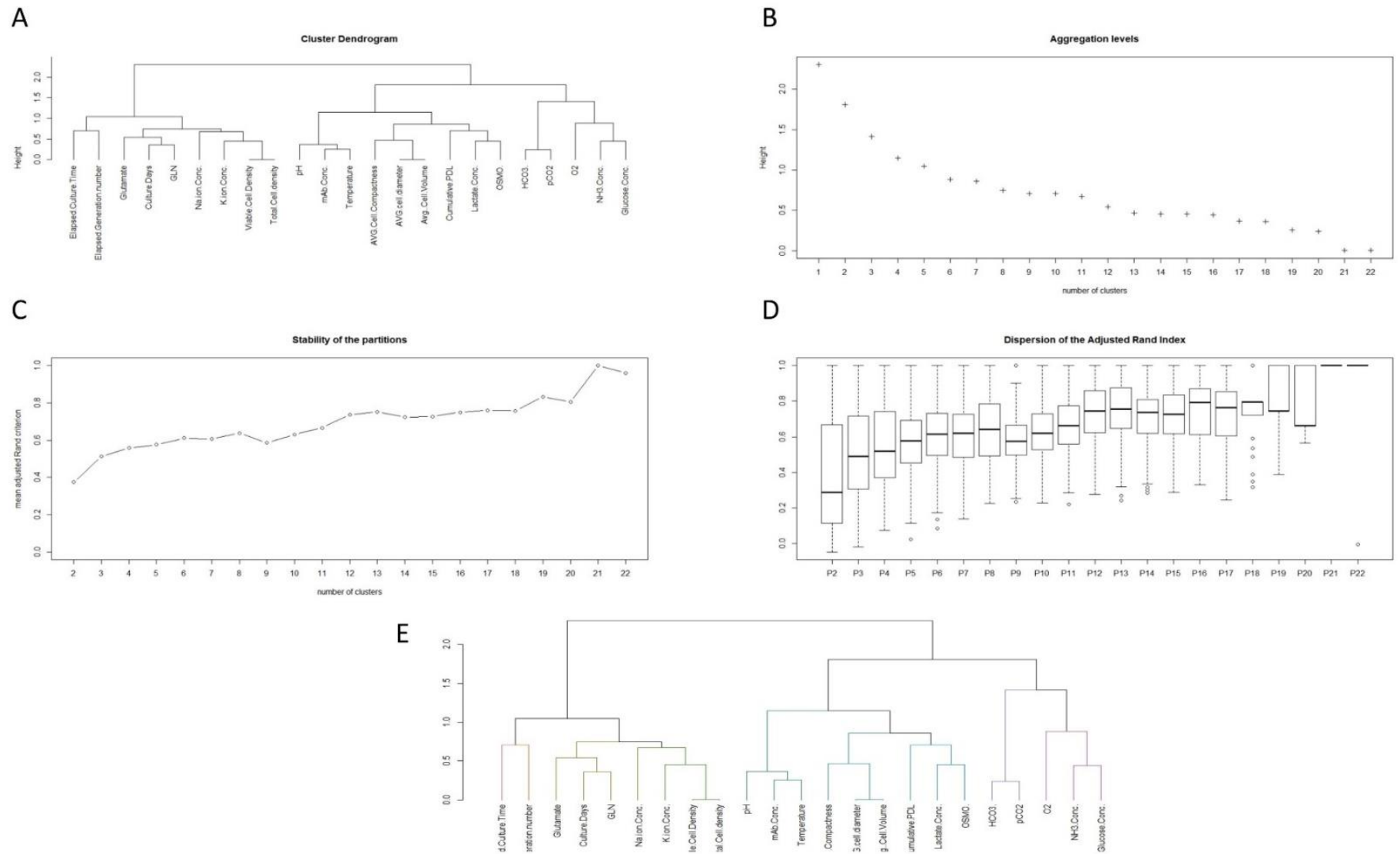


Figure 7: Clustering results for Day 7. Refer to the explanation above for interpretation.

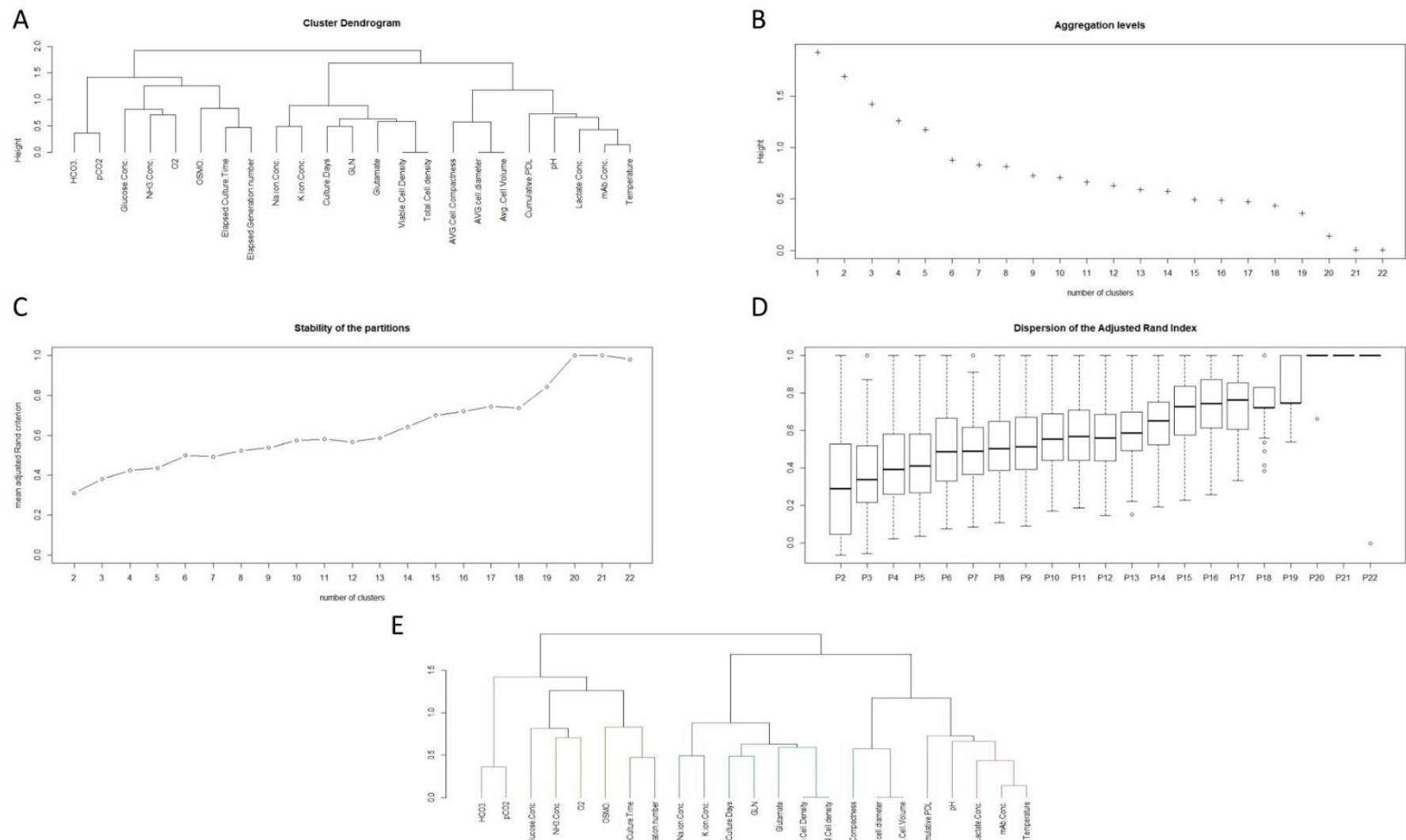


Figure 8: Clustering results for Day 8. Refer to the explanation above for interpretation.

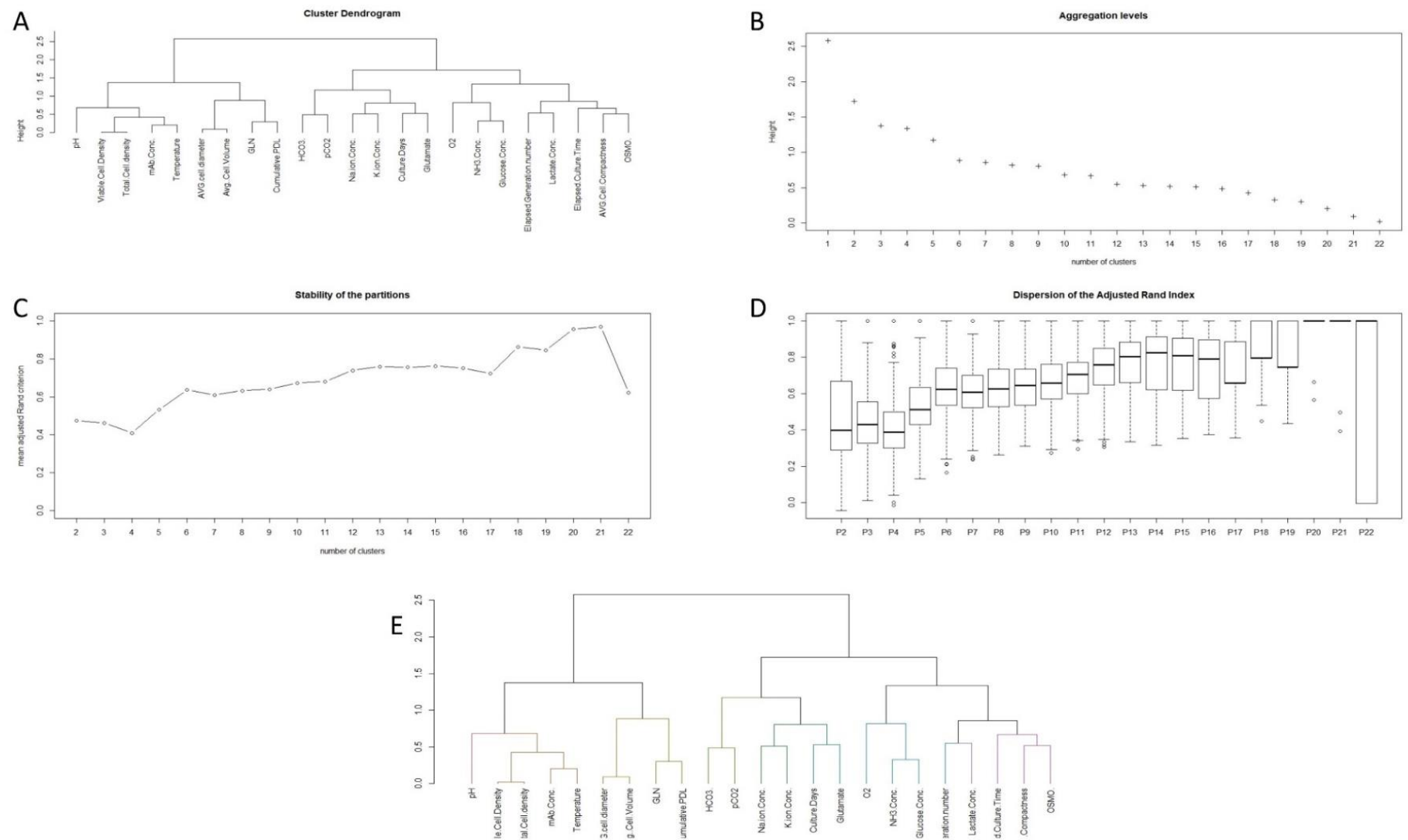


Figure 9: Clustering results for Day 9. Refer to the explanation above for interpretation.

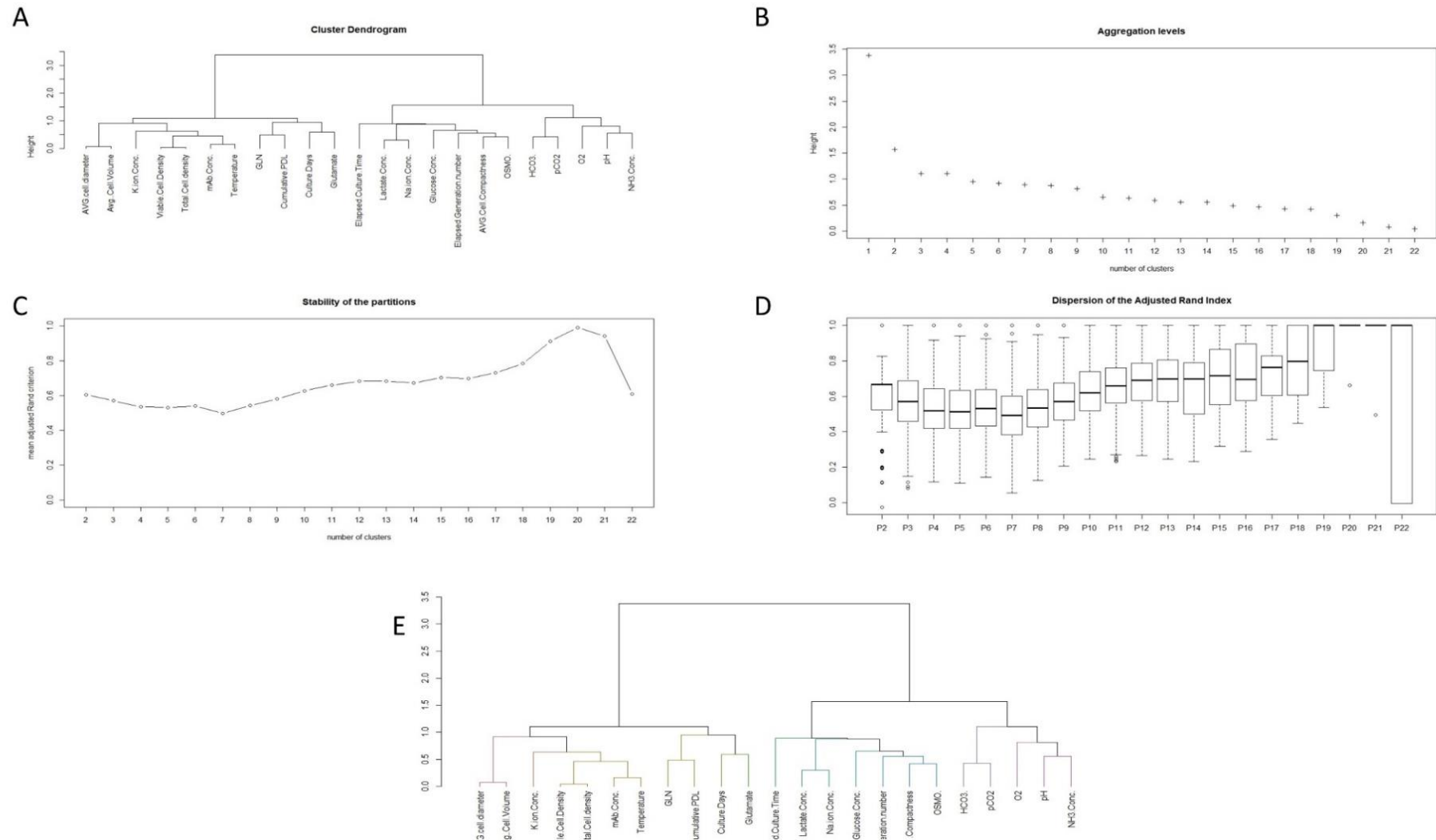


Figure 10: Clustering results for Day 10. Refer to the explanation above for interpretation.

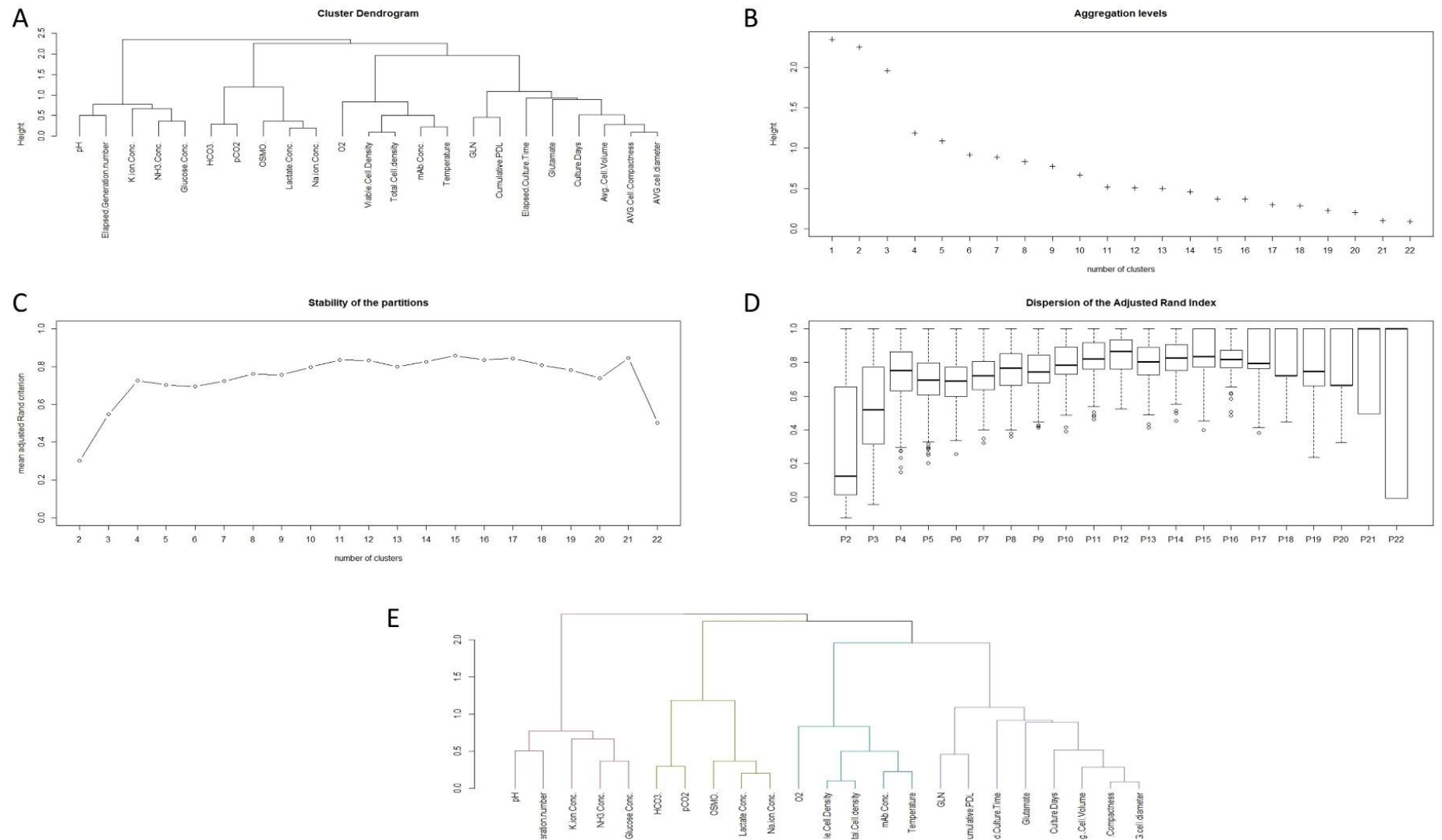


Figure 11: Clustering results for Day 11. Refer to the explanation above for interpretation.

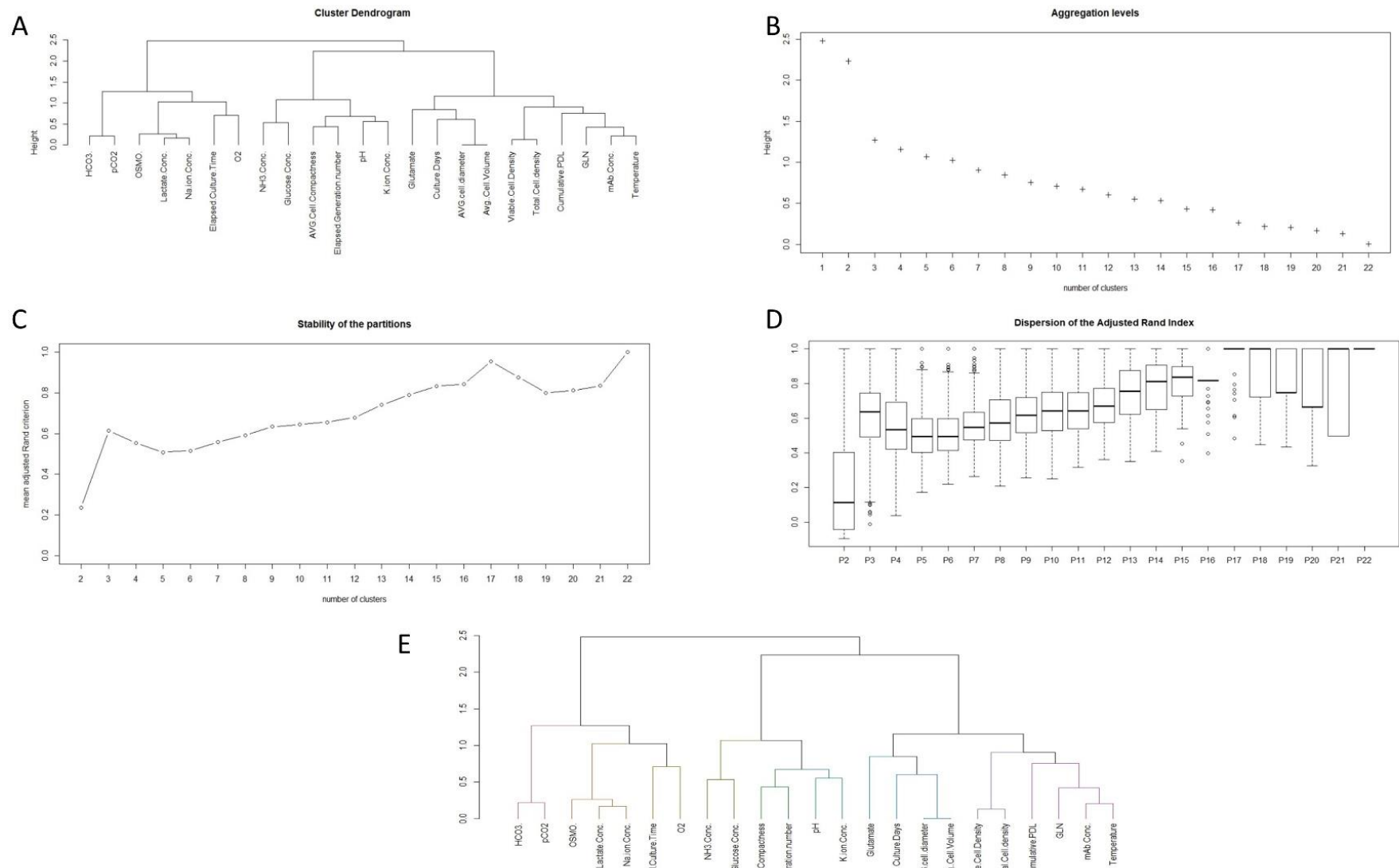


Figure 12: Clustering results for Day 12. Refer to the explanation above for interpretation.

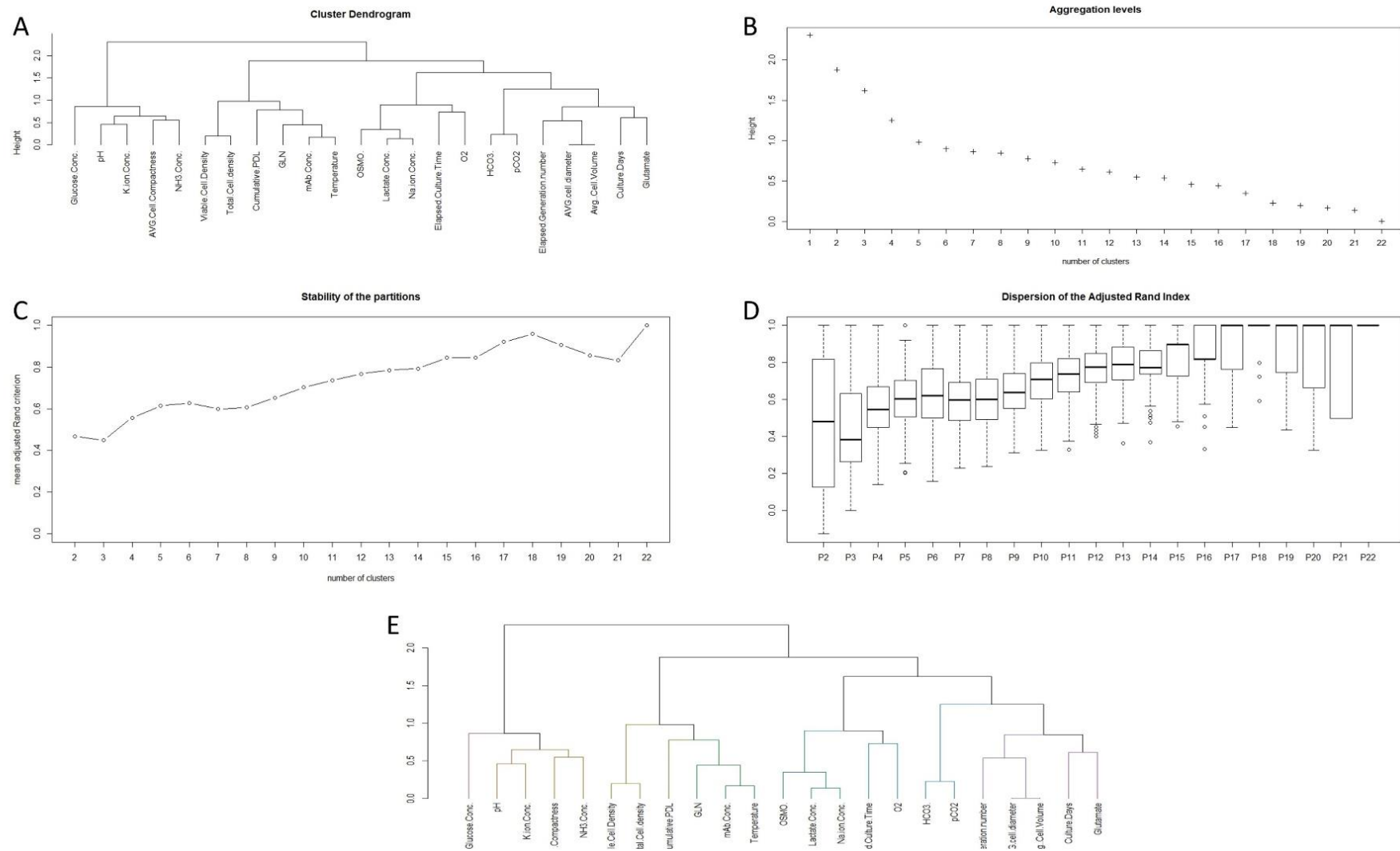


Figure 13: Clustering results for Day 13. Refer to the explanation above for interpretation.

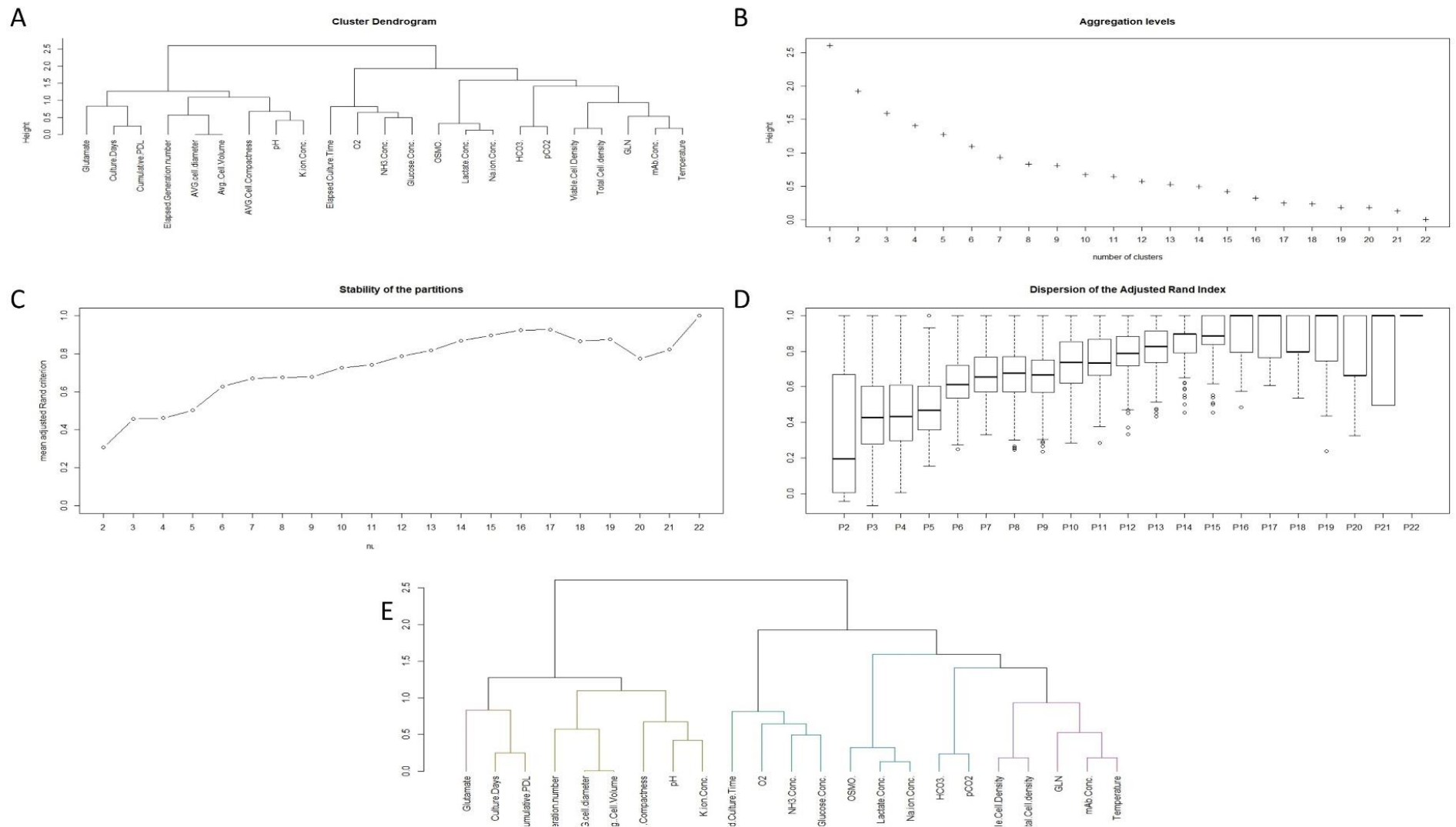


Figure 14: Clustering results for Day 14. Refer to the explanation above for interpretation.

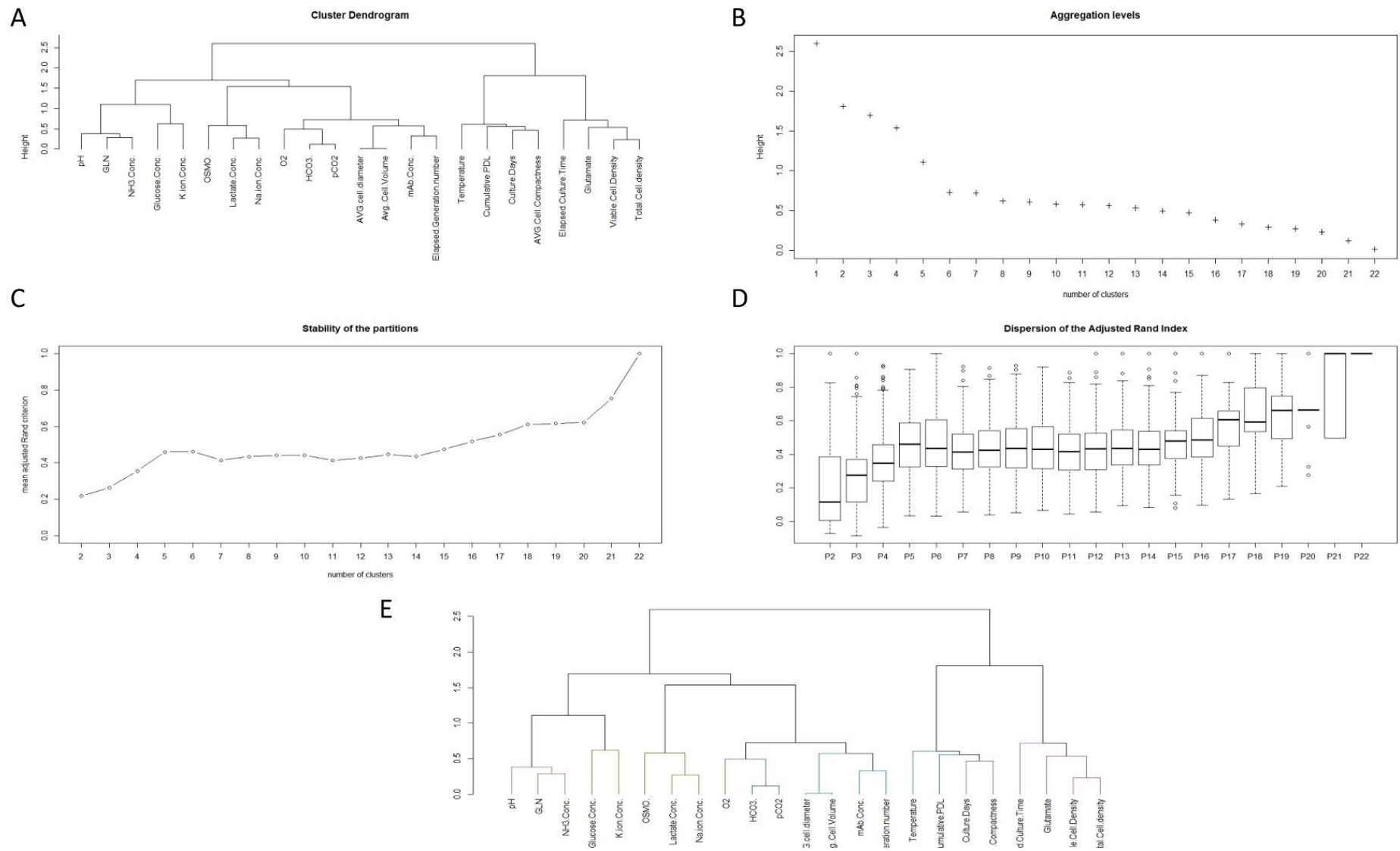


Figure 15: Clustering results for Day 15. Refer to the explanation above for interpretation.

- Tables showing squared loadings of all the parameters in different clusters and its correlation with the central synthetic variable for each day of culture.

Table 1: Table showing parameters in different clusters on Day 1 of the culture. Refer to the explanation above to interpret.

Cluster	Parameter	[Loading] ²	Correlation
cluster1	VCD	0.871	0.933
	TCD	0.867	0.931
	Culture Days	0.782	0.884
	[Glutamate]	0.766	-0.875
cluster2	ECT	0.831	0.911
	EGN	0.831	0.911
cluster3	ACD	0.916	-0.957
	ACV	0.909	-0.953
	AVG Cell Compactness	0.536	0.732
	[Glucose]	0.472	-0.687
cluster4	[mAb]	0.716	0.846
	Osmolality	0.716	-0.846
cluster5	pH	0.769	0.876
	[NH ₃]	0.769	0.876
cluster6	[Glutamine]	0.785	0.886
	CPDL	0.695	0.833
	pO ₂	0.432	-0.657
cluster7	pCO ₂	0.724	-0.851
	[HCO ₃ ⁻]	0.712	-0.844
	[Lactate]	0.622	0.789
cluster8	[Na ⁺]	0.926	-0.963
	[K ⁺]	0.857	0.925
	Temperature	0.772	-0.879

Table 2: Table showing parameters in different clusters on Day 2 of the culture. Refer to the explanation above to interpret.

Cluster	Parameter	[Loading] ²	Correlation
Cluster 1	TCD	0.879	0.938
	VCD	0.876	0.936
	[Glutamate]	0.732	-0.856
	Culture Days	0.720	0.849
Cluster 2	ECT	1.000	1.000
Cluster 3	ACV	0.947	-0.973
	ACD	0.945	-0.972
	ACC	0.730	0.855
Cluster 4	[mAb]	0.698	0.836
	Osmolality	0.698	-0.836
Cluster 5	[Glucose]	0.727	0.853
	pH	0.591	0.769

	pO ₂	0.527	0.726
Cluster 6	[Glutamine]	0.719	0.848
	CPDL	0.719	0.848
Cluster 7	[Na ⁺]	0.835	-0.914
	[K ⁺]	0.817	0.904
	EGN	0.672	-0.820
	Temperature	0.647	-0.804
Cluster 8	[HCO ₃ ⁻]	0.797	-0.893
	pCO ₂	0.776	-0.881
	[Lactate]	0.721	0.849
Cluster 9	[NH ₃]	1.000	1.000

Table 3: Table showing parameters in different clusters on Day 3 of the culture. Refer to the explanation above to interpret.

Cluster	Parameter	[Loading] ²	Correlation
Cluster 1	Culture Days	0.840	0.917
	Temperature	0.763	-0.874
	[Glutamate]	0.672	-0.820
Cluster 2	ECT	1.000	1.000
Cluster 3	VCD	0.998	-0.999
	TCD	0.998	-0.999
Cluster 4	ACD	0.964	0.982
	Average Cell Volume	0.959	0.980
	ACC	0.839	-0.916
Cluster 5	[mAb]	0.854	0.924
	[Lactate]	0.854	0.924
Cluster 6	pH	1.000	1.000
Cluster 7	[Glutamine]	1.000	1.000
Cluster 8	EGN	1.000	1.000
Cluster 9	[NH ₃]	1.000	1.000
Cluster 10	Osmolality	1.000	1.000
Cluster 11	[Glucose]	1.000	1.000
Cluster 12	CPDL	1.000	1.000
Cluster 13	[K ⁺]	0.878	0.937
	[Na ⁺]	0.878	-0.937
Cluster 14	[HCO ₃ ⁻]	0.884	-0.940
	pCO ₂	0.884	-0.940
Cluster 15	pO ₂	1.000	1.000

Table 4: Table showing parameters in different clusters on Day 4 of the culture. Refer to the explanation above to interpret.

Cluster	Parameter	[Loading] ²	Correlation
Cluster 1	TCD	0.884	0.940
	VCD	0.872	0.934
	[Glutamate]	0.808	-0.899

	Culture Days	0.735	0.858
Cluster 2	ACD	0.934	0.967
	ECT	0.709	0.842
	Average Cell Volume	0.609	0.780
	ACC	0.593	0.770
Cluster 3	[Lactate]	0.841	0.917
	[mAb]	0.682	0.826
	[NH ₃]	0.572	0.757
Cluster 4	Temperature	0.718	0.848
	pH	0.652	-0.807
	CPDL	0.549	0.741
Cluster 5	EGN	0.737	-0.859
	[Glutamine]	0.737	0.859
Cluster 6	Osmolality	0.719	-0.848
	[Glucose]	0.719	-0.848
Cluster 7	[Na ⁺]	0.792	-0.890
	[HCO ₃ ⁻]	0.723	0.851
	[K ⁺]	0.673	0.820
	pCO ₂	0.596	0.772
Cluster 8	pO ₂	1.000	1.000

Table 5: Table showing parameters in different clusters on Day 5 of the culture. Refer to the explanation above to interpret.

Cluster	Parameter	[Loading] ²	Correlation
Cluster 1	Culture Days	0.860	0.927
	[Glutamate]	0.860	-0.927
Cluster 2	ECT	1.000	1.000
Cluster 3	VCD	0.999	-1.000
	TCD	0.999	-1.000
Cluster 4	Average Cell Volume	0.948	0.974
	ACD	0.935	0.967
	ACC	0.697	-0.835
Cluster 5	[mAb]	1.000	1.000
Cluster 6	Temperature	0.828	-0.910
	pH	0.828	0.910
Cluster 7	[Glutamine]	1.000	1.000
Cluster 8	EGN	1.000	1.000
Cluster 9	[NH ₃]	0.804	0.897
	[Lactate]	0.804	0.897
Cluster 10	Osmolality	1.000	1.000
Cluster 11	[Glucose]	1.000	1.000
Cluster 12	CPDL	1.000	1.000
Cluster 13	[Na ⁺]	0.793	-0.891
	[K ⁺]	0.793	0.891

Cluster 14	[HCO ₃ ⁻]	0.892	-0.945
	pCO ₂	0.892	-0.945
Cluster 15	pO ₂	1.000	1.000

Table 6: Table showing parameters in different clusters on Day 6 of the culture. Refer to the explanation above to interpret.

Cluster	Parameter	[Loading] ²	Correlation
Cluster 1	TCD	0.855	0.925
	VCD	0.845	0.919
	[Glutamine]	0.708	-0.842
	[K ⁺]	0.658	-0.811
	Culture Days	0.561	0.749
	[Glutamate]	0.464	-0.681
	[Na ⁺]	0.430	0.656
Cluster 2	EGN	0.638	-0.799
	ECT	0.638	-0.799
Cluster 3	ACV	0.952	0.976
	ACD	0.936	0.968
	ACC	0.720	-0.849
Cluster 4	Temperature	0.861	0.928
	[mAb]	0.751	0.867
	pH	0.691	-0.832
	CPDL	0.399	0.632
Cluster 5	[Lactate]	0.840	0.917
	[NH ₃]	0.583	0.763
	Osmolality	0.491	0.701
Cluster 6	pO ₂	0.621	-0.789
	[Glucose]	0.621	-0.789
Cluster 7	pCO ₂	0.883	-0.940
	[HCO ₃ ⁻]	0.883	-0.940

Table 7: Table showing parameters in different clusters on Day 7 of the culture. Refer to the explanation above to interpret.

Cluster	Parameter	[Loading] ²	Correlation
Cluster 1	Culture Days	0.801	0.895
	[Glutamine]	0.678	-0.824
	[Glutamate]	0.618	-0.786
Cluster 2	ECT	1.000	1.000
Cluster 3	TCD	0.941	-0.970
	VCD	0.939	-0.969
	[K ⁺]	0.666	0.816
Cluster 4	ACV	0.940	0.970
	ACD	0.934	0.967
	ACC	0.655	-0.809

Cluster 5	Temperature	0.844	0.919
	[mAb]	0.786	0.887
	pH	0.749	-0.866
Cluster 6	EGN	1.000	1.000
Cluster 7	[Lactate]	0.774	0.880
	Osmolality	0.774	0.880
Cluster 8	[NH ₃]	0.778	0.882
	[Glucose]	0.778	0.882
Cluster 9	CPDL	1.000	1.000
Cluster 10	[Na ⁺]	1.000	1.000
Cluster 11	pCO ₂	0.882	-0.939
	[HCO ₃ ⁻]	0.882	-0.939
Cluster 12	pO ₂	1.000	1.000

Table 8: Table showing parameters in different clusters on Day 8 of the culture. Refer to the explanation above to interpret.

Cluster	Parameter	[Loading] ²	Correlation
Cluster 1	[Glutamine]	0.758	-0.871
	Culture Days	0.758	0.871
Cluster 2	ECT	0.763	0.874
	EGN	0.763	0.874
Cluster 3	TCD	0.997	-0.999
	VCD	0.997	-0.999
Cluster 4	ACC	1.000	1.000
Cluster 5	Average Cell Volume	0.999	1.000
	ACD	0.999	1.000
Cluster 6	[mAb]	0.876	0.936
	Temperature	0.860	0.928
	[Lactate]	0.689	0.830
Cluster 7	pH	1.000	1.000
Cluster 8	[Glutamate]	1.000	1.000
Cluster 9	[NH ₃]	1.000	1.000
Cluster 10	Osmolality	1.000	1.000
Cluster 11	[Glucose]	1.000	1.000
Cluster 12	CPDL	1.000	1.000
Cluster 13	[Na ⁺]	0.754	-0.869
	[K ⁺]	0.754	0.869
Cluster 14	pCO ₂	0.820	-0.906
	[HCO ₃ ⁻]	0.820	-0.906
Cluster 15	pO ₂	1.000	1.000

Table 9: Table showing parameters in different clusters on Day 9 of the culture. Refer to the explanation above to interpret.

Cluster	Parameter	[Loading] ²	Correlation
Cluster 1	Culture Days	0.735	0.858
	[Glutamate]	0.735	-0.858
Cluster 2	ECT	1.000	1.000
Cluster 3	VCD	0.895	-0.946
	TCD	0.887	-0.942
	Temperature	0.827	0.91
	[mAb]	0.742	0.861
Cluster 4	ACC	0.742	-0.861
	Osmolality	0.742	0.861
Cluster 5	ACD	0.955	-0.977
	Average Cell Volume	0.955	-0.977
Cluster 6	pH	1.000	1.000
Cluster 7	[Glutamine]	0.851	0.923
	CPDL	0.851	0.923
Cluster 8	[Lactate]	1.000	1.000
Cluster 9	EGN	1.000	1.000
Cluster 10	[NH ₃]	0.838	0.915
	[Glucose]	0.838	0.915
Cluster 11	[K ⁺]	0.745	0.863
	[Na ⁺]	0.745	-0.863
Cluster 12	[HCO ₃ ⁻]	0.757	-0.870
	pCO ₂	0.757	-0.870
Cluster 13	pO ₂	1.000	1.000

Table 10: Table showing parameters in different clusters on Day 10 of the culture. Refer to the explanation above to interpret.

Cluster	Parameter	[Loading] ²	Correlation
Cluster 1	Culture Days	1.000	1.000
Cluster 2	ECT	1.000	1.000
Cluster 3	TCD	0.875	-0.936
	VCD	0.866	-0.931
	Temperature	0.844	0.919
	[mAb]	0.757	0.87
Cluster 4	ACC	0.792	-0.89
	Osmolality	0.792	0.89
Cluster 5	ACV	0.961	-0.98
	ACD	0.961	-0.98
Cluster 6	pH	1.000	1.000
Cluster 7	CPDL	0.758	-0.871
	[Glutamine]	0.758	-0.871
Cluster 8	[Glutamate]	1.000	1.000
Cluster 9	EGN	1.000	1.000

Cluster 10	[Na ⁺]	0.851	0.923
	[Lactate]	0.851	0.923
Cluster 11	[NH ₃]	1.000	1.000
Cluster 12	[Glucose]	1.000	1.000
Cluster 13	[K ⁺]	1.000	1.000
Cluster 14	[HCO ₃ ⁻]	0.786	-0.887
	pCO ₂	0.786	-0.887
Cluster 15	pO ₂	1.000	1.000

Table 11: Table showing parameters in different clusters on Day 11 of the culture. Refer to the explanation above to interpret.

Cluster	Parameter	[Loading] ²	Correlation
Cluster 1	ACD	0.878	-0.937
	Average Cell Volume	0.764	-0.874
	ACC	0.658	-0.811
	Culture Days	0.639	0.799
	[Glutamine]	0.442	-0.665
	CPDL	0.194	-0.441
	[Glutamate]	0.095	-0.308
	ECT	0.089	0.297
Cluster 2	TCD	0.838	-0.916
	VCD	0.814	-0.902
	Temperature	0.748	0.865
	[mAb]	0.722	0.850
	pO ₂	0.226	-0.475
Cluster 3	[NH ₃]	0.653	0.808
	pH	0.624	0.790
	[Glucose]	0.569	0.755
	[K ⁺]	0.463	0.681
	EGN	0.383	-0.619
Cluster 4	[Na ⁺]	0.790	0.889
	[Lactate]	0.749	0.865
	Osmolality	0.540	0.735
	[HCO ₃ ⁻]	0.447	-0.669
	pCO ₂	0.421	-0.649

Table 12: Table showing parameters in different clusters on Day 12 of the culture. Refer to the explanation above to interpret.

Cluster	Parameter	[Loading] ²	Correlation
Cluster 1	Culture Days	1.000	1.000
Cluster 2	ECT	1.000	1.000
Cluster 3	TCD	0.936	-0.968
	VCD	0.936	-0.968

Cluster 4	ACC	0.785	-0.886
	EGN	0.785	-0.886
Cluster 5	ACV	0.998	-0.999
	ACD	0.998	-0.999
Cluster 6	[mAb]	0.843	0.918
	Temperature	0.825	0.908
	[Glutamine]	0.706	0.840
Cluster 7	[K+]	0.725	0.851
	pH	0.725	0.851
Cluster 8	[Glutamate]	1.000	1.000
Cluster 9	[Na+]	0.878	0.937
	[Lactate]	0.871	0.934
	Osmolality	0.820	0.906
Cluster 10	[NH ₃]	0.734	0.857
	[Glucose]	0.734	0.857
Cluster 11	CPDL	1.000	1.000
Cluster 12	pCO ₂	0.892	-0.945
	[HCO ₃ ⁻]	0.892	-0.945
Cluster 13	pO ₂	1.000	1.000

Table 13: Table showing parameters in different clusters on Day 13 of the culture. Refer to the explanation above to interpret.

Cluster	Parameter	[Loading] ²	Correlation
Cluster 1	Culture Days	1.000	1.000
Cluster 2	ECT	1.000	1.000
Cluster 3	VCD	0.902	-0.950
	TCD	0.902	-0.950
Cluster 4	[NH ₃]	0.726	0.852
	ACC	0.726	-0.852
Cluster 5	ACD	0.938	-0.969
	ACV	0.927	-0.963
	EGN	0.590	0.768
Cluster 6	[mAb]	0.884	0.940
	Temperature	0.820	0.906
	[Glutamine]	0.683	0.827
Cluster 7	pH	0.771	0.878
	[K+]	0.771	0.878
Cluster 8	[Glutamate]	1.000	1.000
Cluster 9	[Na+]	0.895	0.946
	[Lactate]	0.862	0.929
	Osmolality	0.758	0.871
Cluster 10	[Glucose]	1.000	1.000
Cluster 11	CPDL	1.000	1.000
Cluster 12	pCO ₂	0.886	0.941
	[HCO ₃ ⁻]	0.886	0.941
Cluster 13	pO ₂	1.000	1.000

Table 14: Table showing parameters in different clusters on Day 14 of the culture. Refer to the explanation above to interpret.

Cluster	Parameter	[Loading] ²	Correlation
Cluster 1	Culture Days	0.877	-0.937
	CPDL	0.877	-0.937
Cluster 2	ECT	1.000	1.000
Cluster 3	TCD	0.908	-0.953
	VCD	0.908	-0.953
Cluster 4	pH	0.747	0.865
	[K ⁺]	0.652	0.807
	ACC	0.507	-0.712
Cluster 5	ACD	0.938	-0.969
	ACV	0.924	-0.961
	EGN	0.559	0.748
Cluster 6	[mAb]	0.881	0.939
	Temperature	0.793	0.891
	[Glutamine]	0.612	0.783
Cluster 7	[Glutamate]	1.000	1.000
Cluster 8	[Na ⁺]	0.885	0.941
	[Lactate]	0.883	0.94
	Osmolality	0.776	0.881
Cluster 9	[NH ₃]	0.724	0.851
	[Glucose]	0.589	0.768
	pO ₂	0.544	0.737
Cluster 10	pCO ₂	0.883	0.940
	[HCO ₃ ⁻]	0.883	0.940

Table 15: Table showing parameters in different clusters on Day 15 of the culture. Refer to the explanation above to interpret.

Cluster	Parameter	[Loading] ²	Correlation
Cluster 1	Culture Days	1.000	1.000
Cluster 2	ECT	1.000	1.000
Cluster 3	VCD	0.885	-0.941
	TCD	0.885	-0.941
Cluster 4	ACC	1.000	1.000
Cluster 5	ACD	0.995	-0.998
	ACV	0.995	-0.998
Cluster 6	[mAb]	1.000	1.000
Cluster 7	pH	1.000	1.000
Cluster 8	[NH ₃]	0.857	-0.926
	[Glutamine]	0.857	-0.926
Cluster 9	[Glutamate]	1.000	1.000
Cluster 10	EGN	1.000	1.000

Cluster 11	[Na ⁺]	0.865	0.930
	[Lactate]	0.865	0.930
Cluster 12	Osmolality	1.000	1.000
Cluster 13	[Glucose]	1.000	1.000
Cluster 14	CPDL	1.000	1.000
Cluster 15	[K ⁺]	1.000	1.000
Cluster 16	[HCO ₃ ⁻]	0.941	0.970
	pCO ₂	0.941	0.970
Cluster 17	Temperature	1.000	1.000
Cluster 18	pO ₂	1.000	1.000

- Heat maps showing similarity of parameters in different clusters on different days of the culture. Clusters with only one parameter has been removed from the figures as their similarity with themselves is always unity. Panel on the right hand side provides the similarity measures. (Abbreviations for figures 16 to 30 : ACC – Average Cell Compactness, ACD – Average Cell Density, ACV – Average Cell Volume, EGN – Elapsed Generation Number, ECT – Elapsed Culture Time)

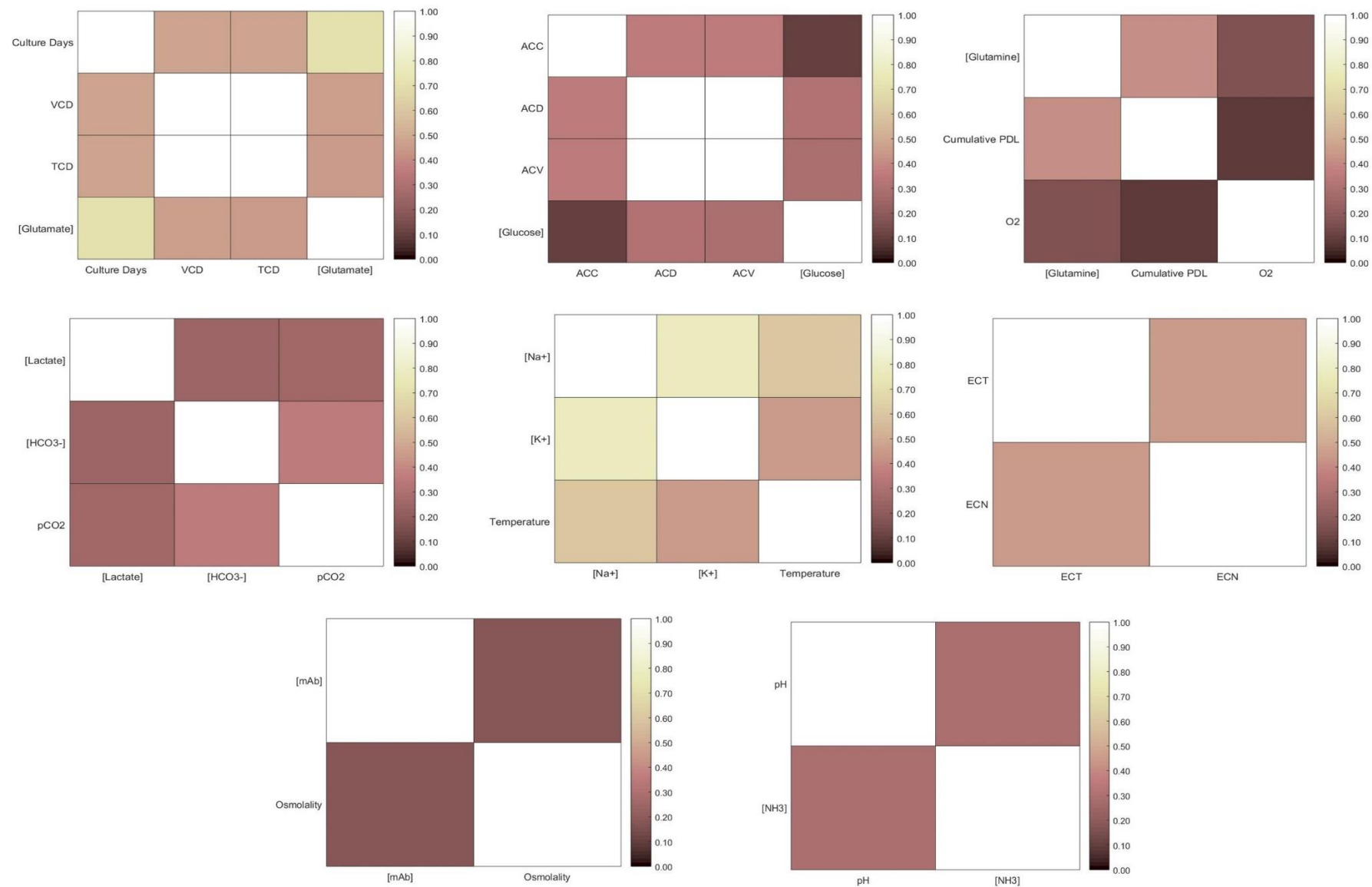


Figure 16: Similarity heat maps of parameters in the same cluster for Day 1 of the culture. Refer to the explanation above to interpret results.

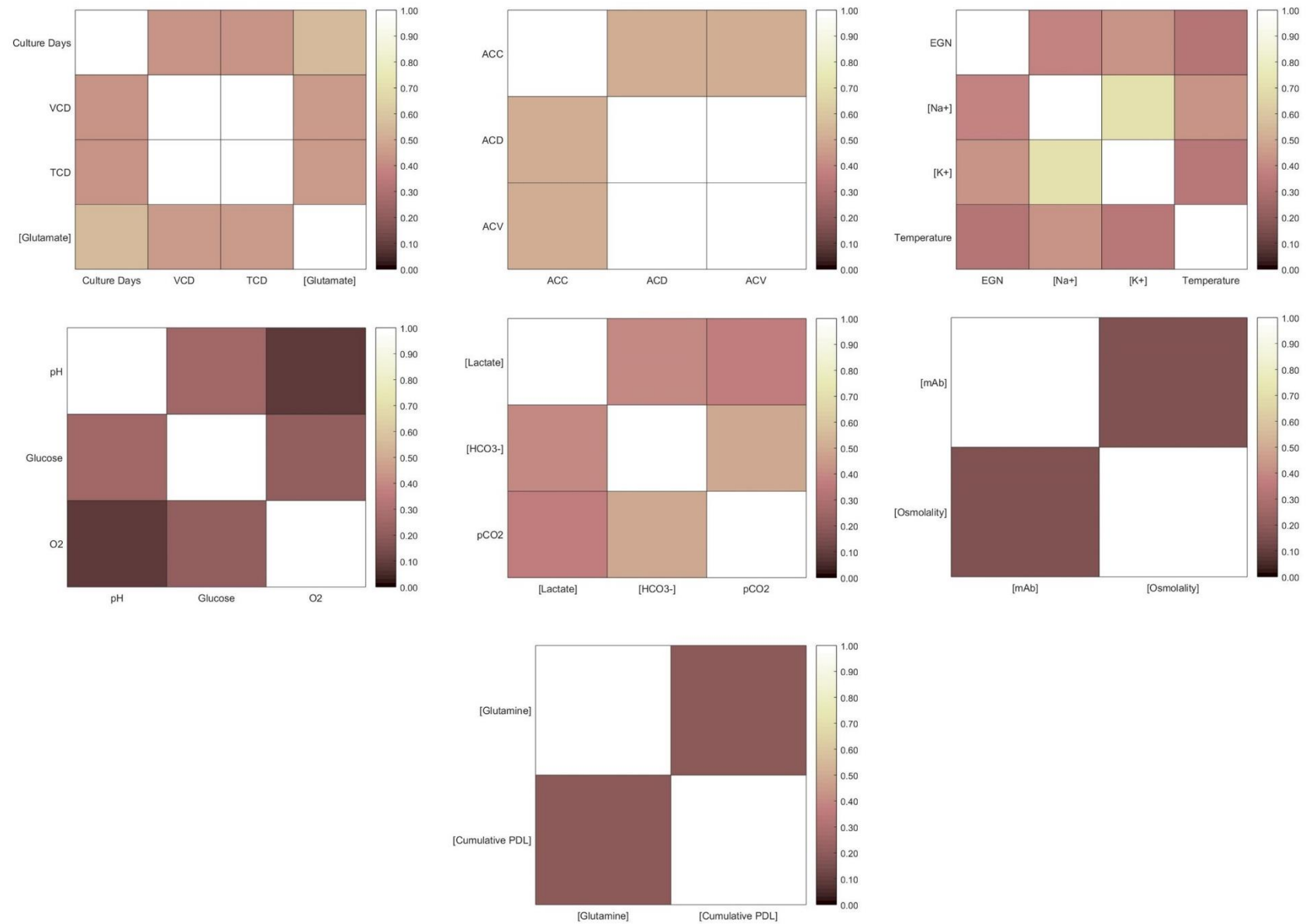


Figure 17: Similarity heat maps of parameters in the same cluster for Day 2 of the culture. Refer to the explanation above to interpret results.

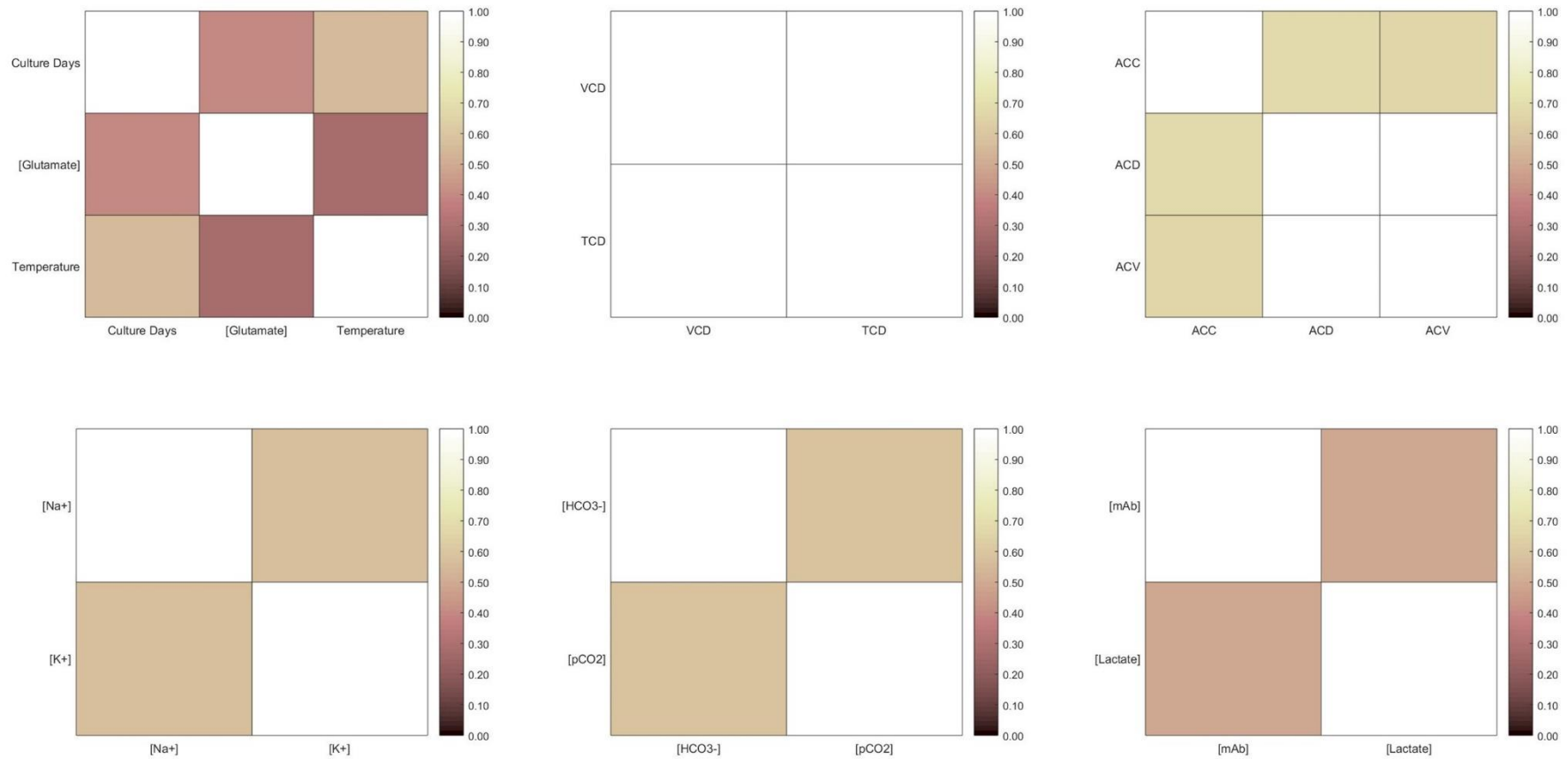


Figure 18: Similarity heat maps of parameters in the same cluster for Day 3 of the culture. Refer to the explanation above to interpret results.

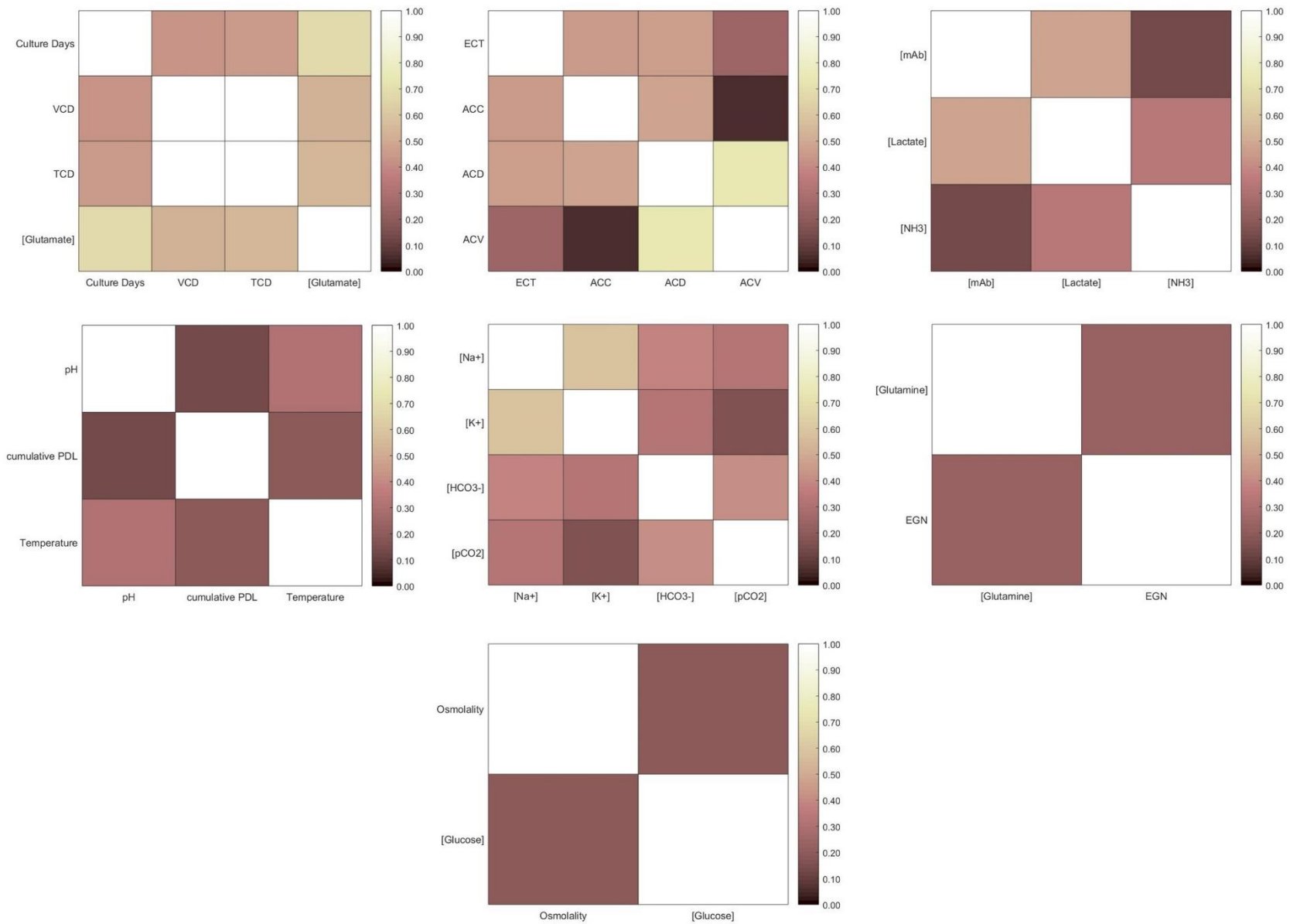


Figure 19: Similarity heat maps of parameters in the same cluster for Day 4 of the culture. Refer to the explanation above to interpret results.

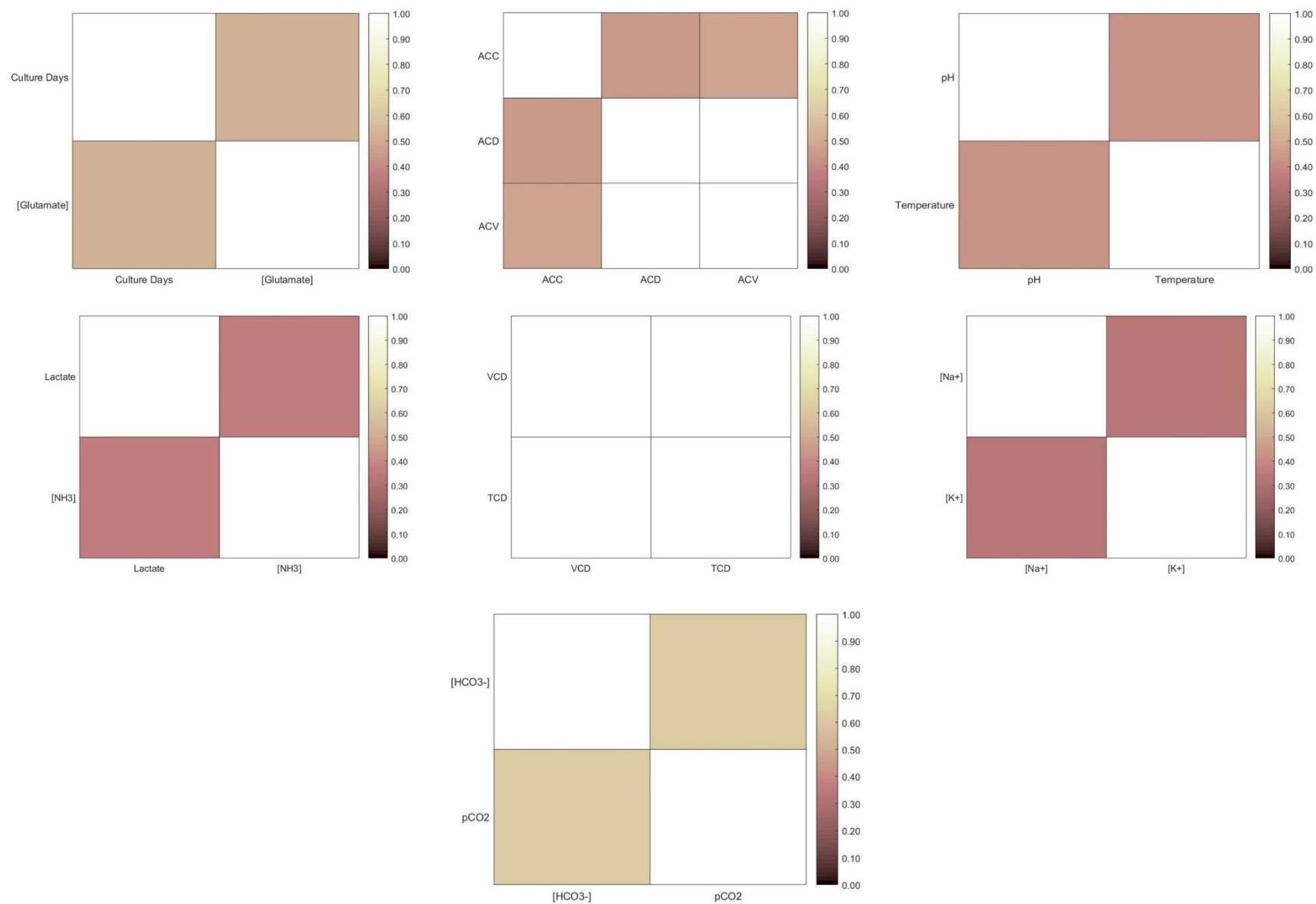


Figure 20: Similarity heat maps of parameters in the same cluster for Day 5 of the culture. Refer to the explanation above to interpret results.

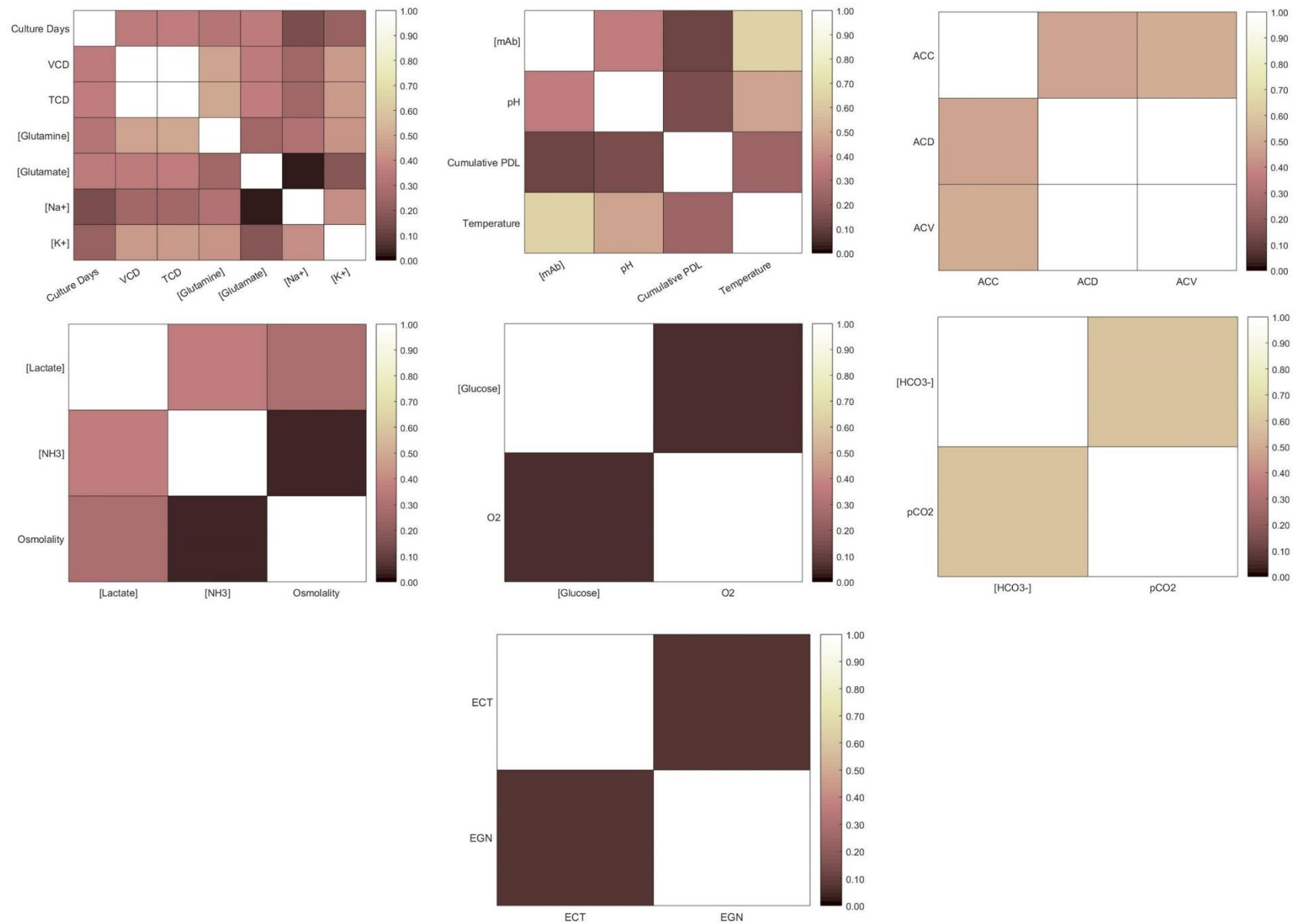


Figure 21: Similarity heat maps of parameters in the same cluster for Day 6 of the culture. Refer to the explanation above to interpret results.

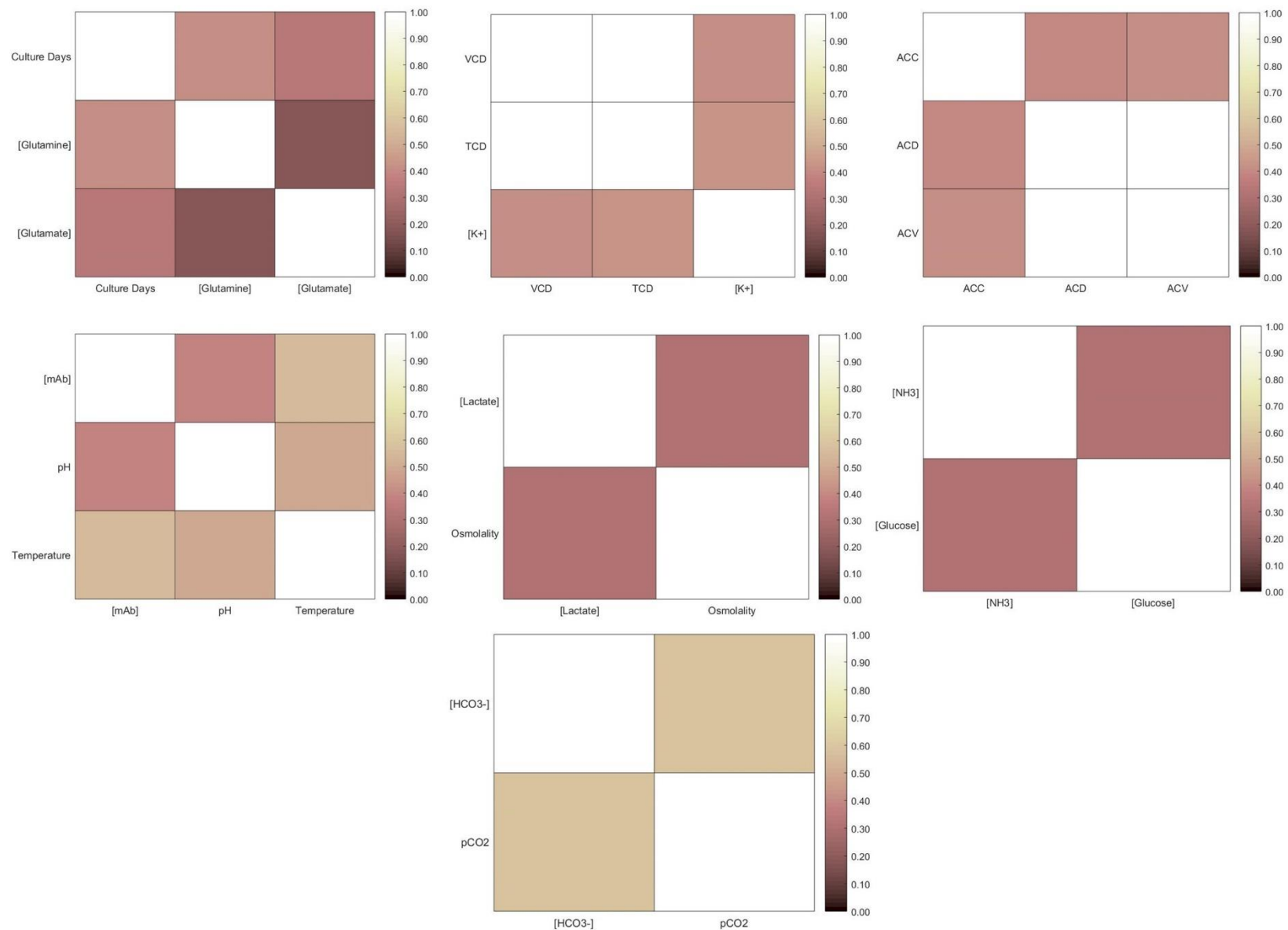


Figure 22: Similarity heat maps of parameters in the same cluster for Day 7 of the culture. Refer to the explanation above to interpret results.

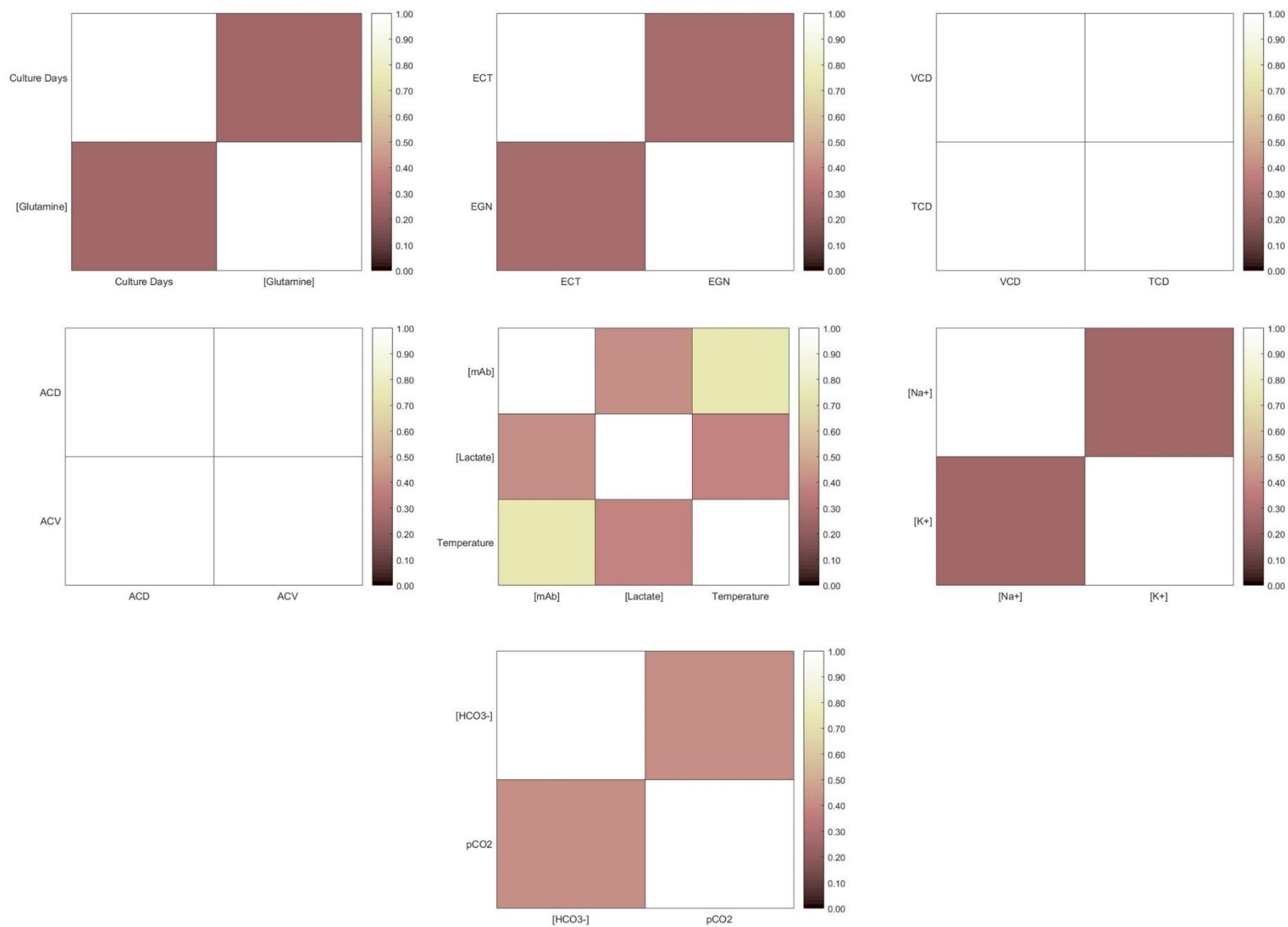


Figure 23: Similarity heat maps of parameters in the same cluster for Day 8 of the culture. Refer to the explanation above to interpret results.

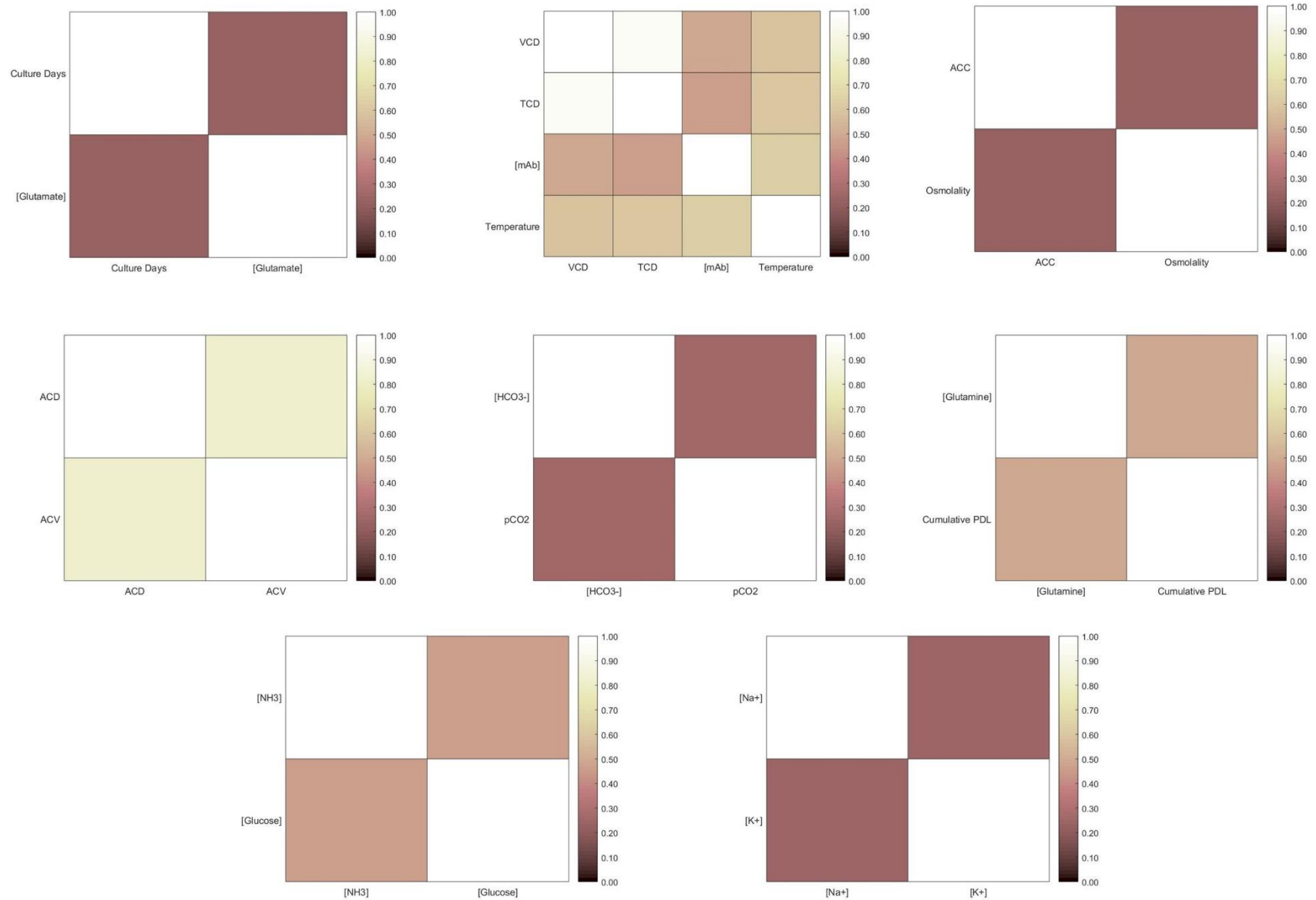


Figure 24: Similarity heat maps of parameters in the same cluster for Day 9 of the culture. Refer to the explanation above to interpret results.

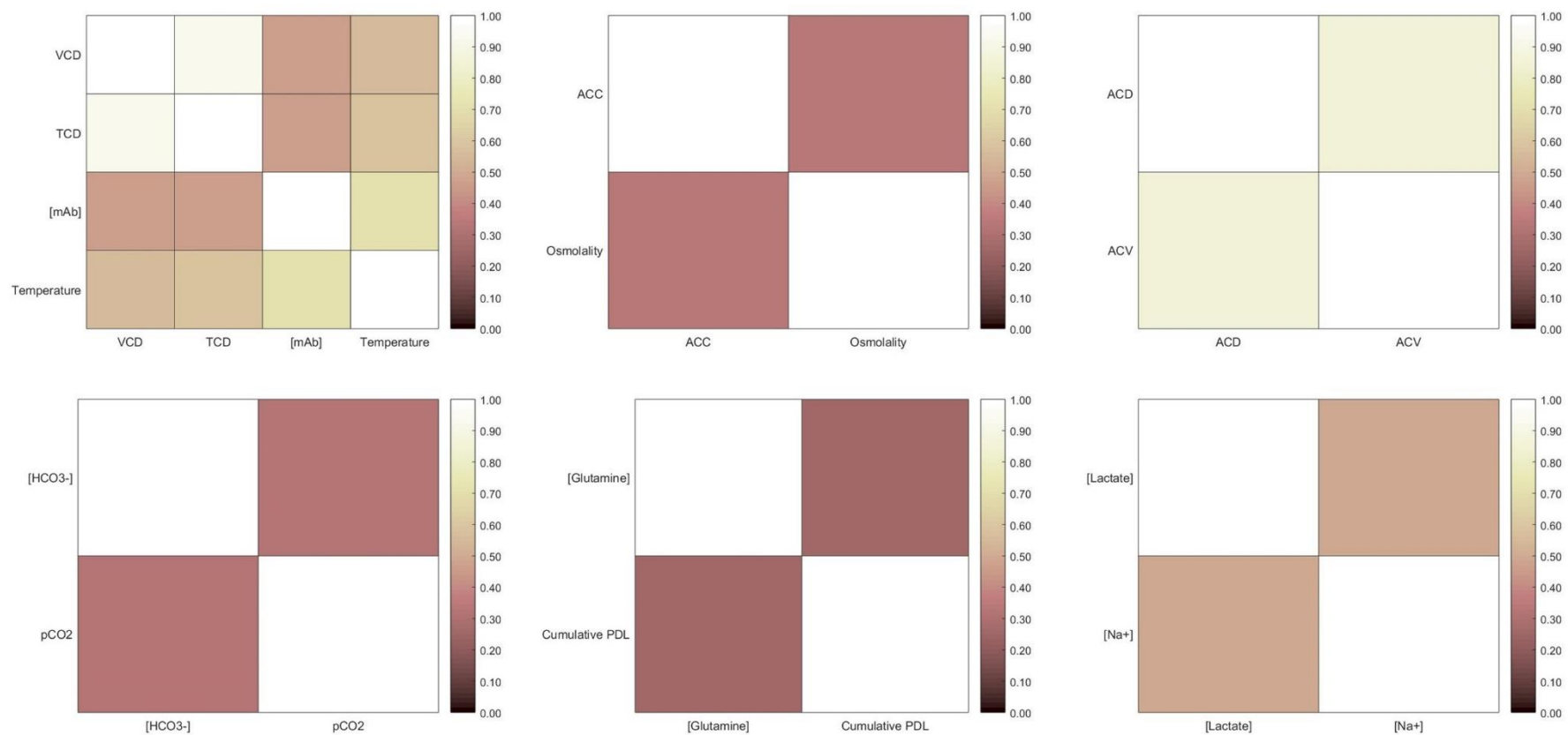


Figure 25: Similarity heat maps of parameters in the same cluster for Day 10 of the culture. Refer to the explanation above to interpret results.

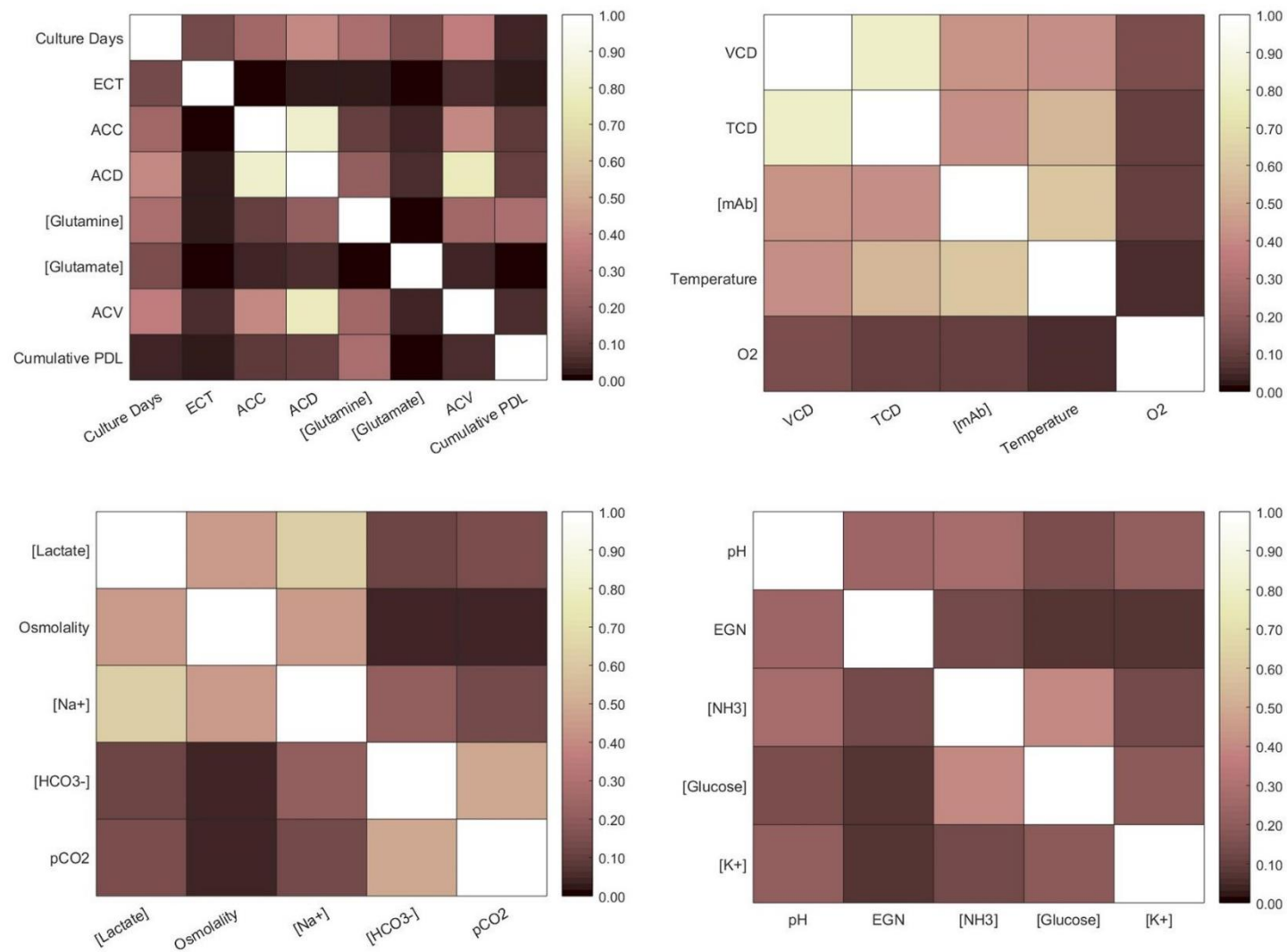


Figure 26: Similarity heat maps of parameters in the same cluster for Day 11 of the culture. Refer to the explanation above to interpret results.

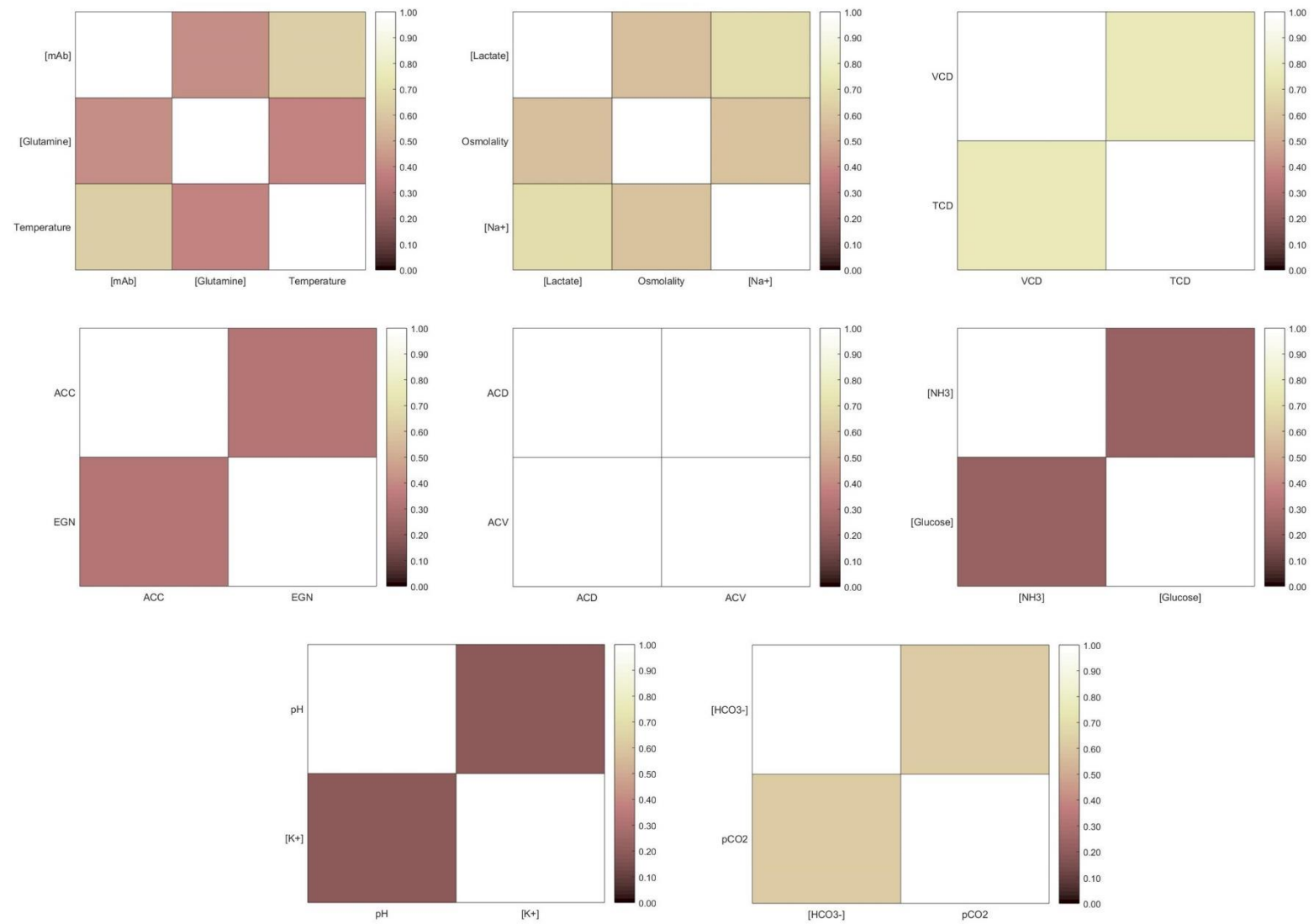


Figure 27: Similarity heat maps of parameters in the same cluster for Day 12 of the culture. Refer to the explanation above to interpret results.

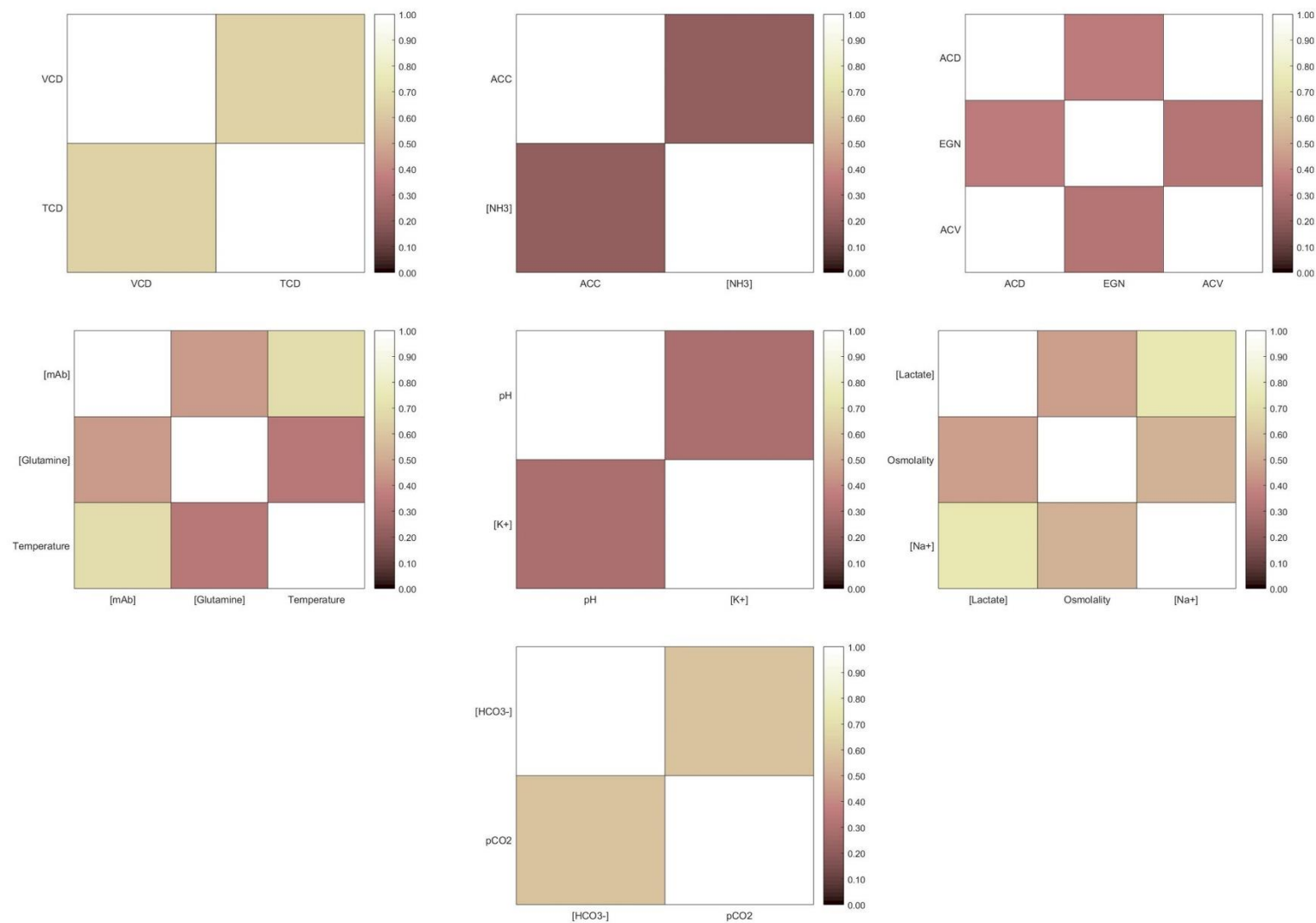


Figure 28: Similarity heat maps of parameters in the same cluster for Day 13 of the culture. Refer to the explanation above to interpret results.

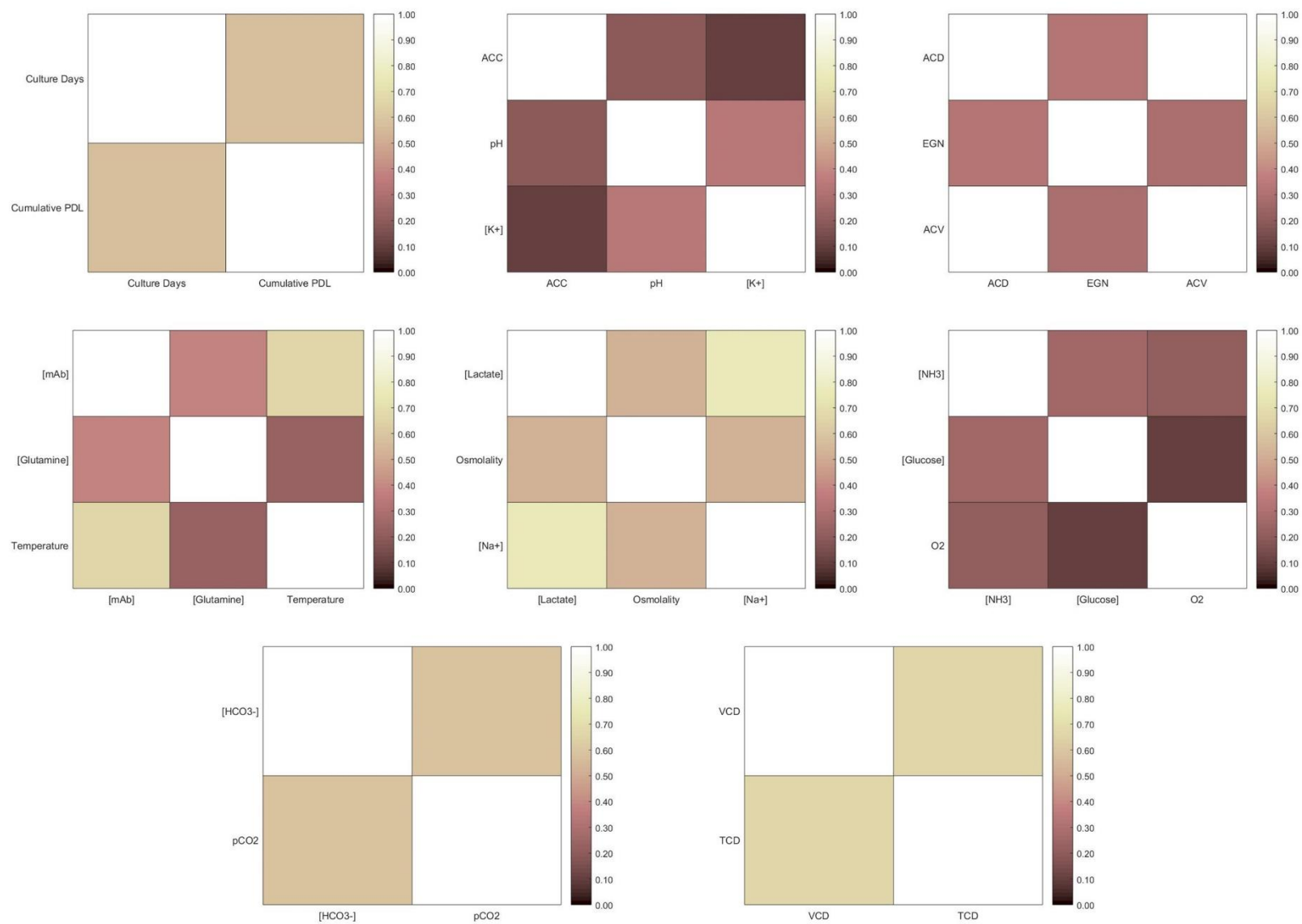


Figure 29: Similarity heat maps of parameters in the same cluster for Day 14 of the culture. Refer to the explanation above to interpret results.

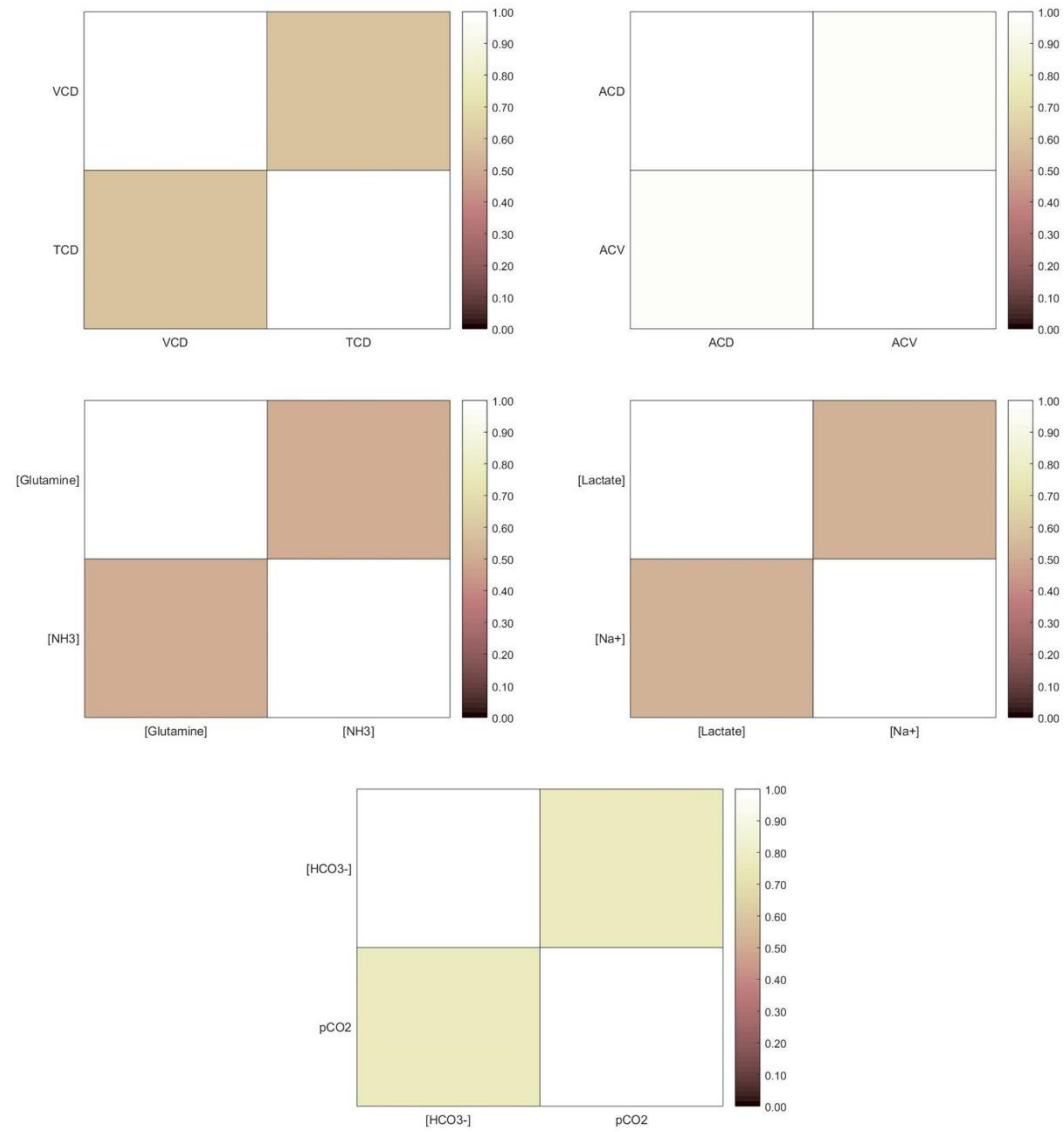


Figure 30: Similarity heat maps of parameters in the same cluster for Day 15 of the culture. Refer to the explanation above to interpret results.

4. Tanglegrams showing comparison of dendrogram of each day of the culture with remaining days. Lines of the same colour depicts parameters clustered together on both the days being compared. Scale at the bottom shows the height at which the parameters cluster.

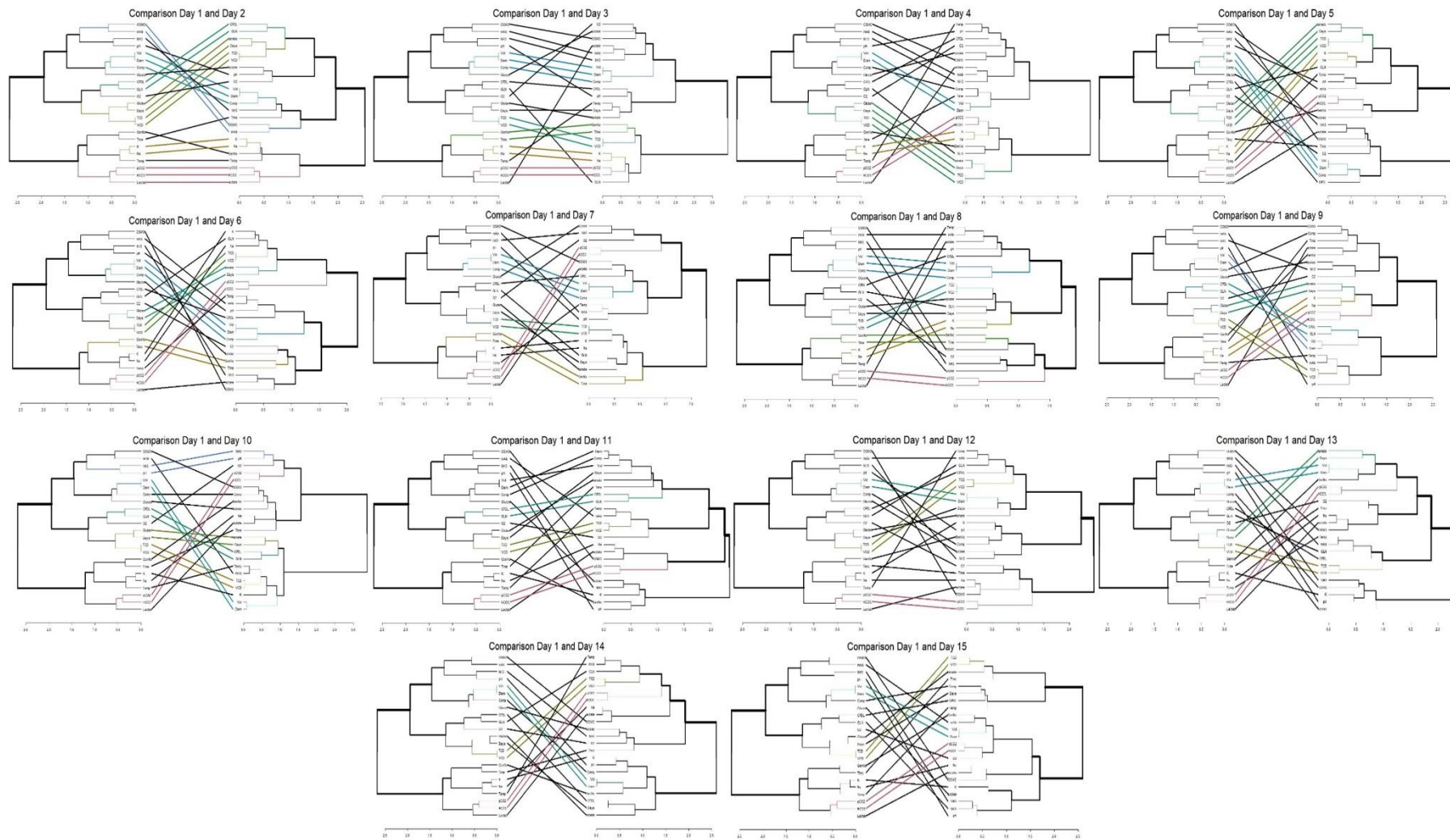


Figure 31: Tanglegrams for comparison of parameter clustering on Day 1 with the remaining days of culture. Refer to the explanation above.

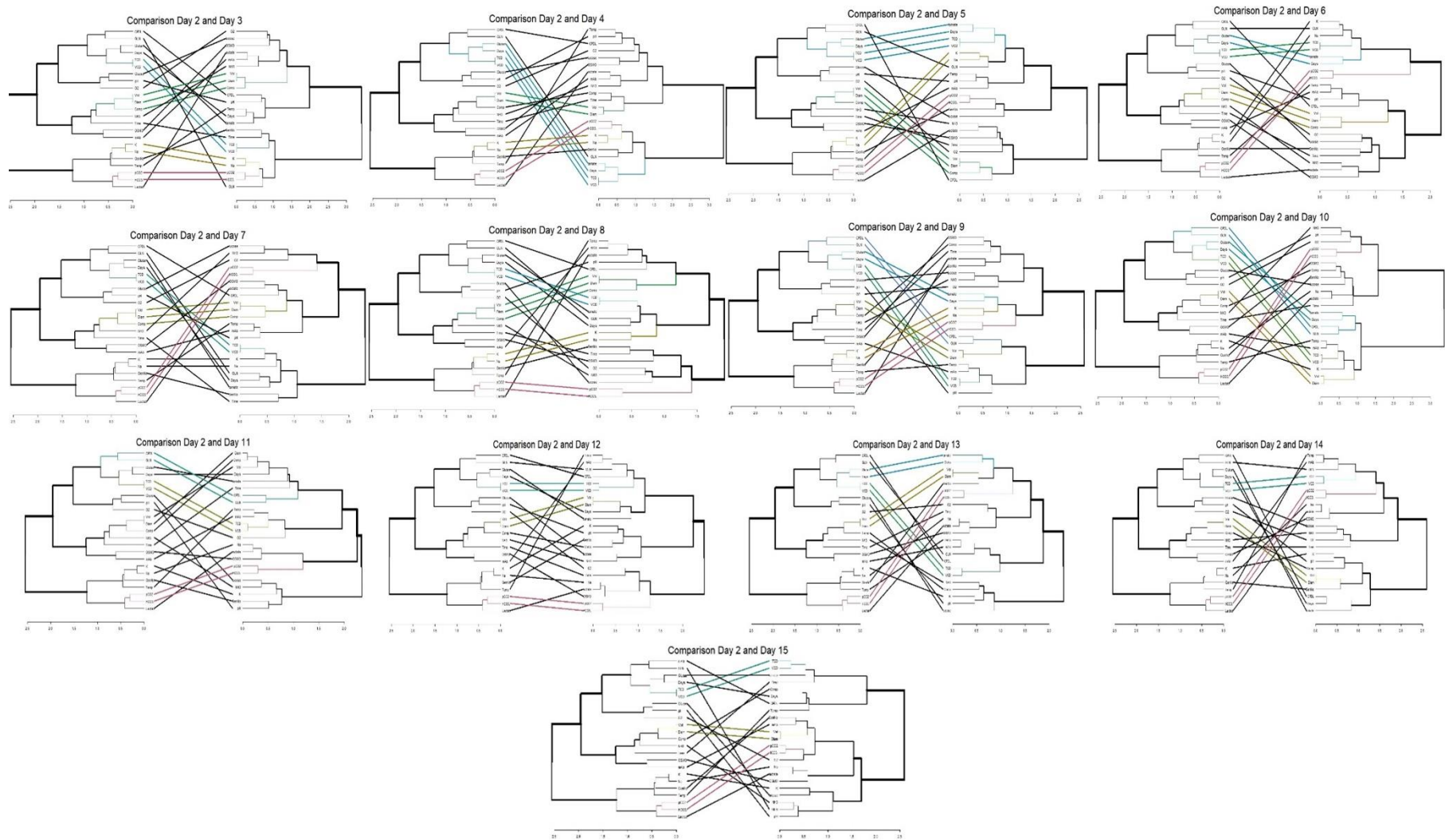


Figure 32: Tanglegrams for comparison of parameter clustering on Day 2 with the remaining days of culture. Refer to the explanation above.

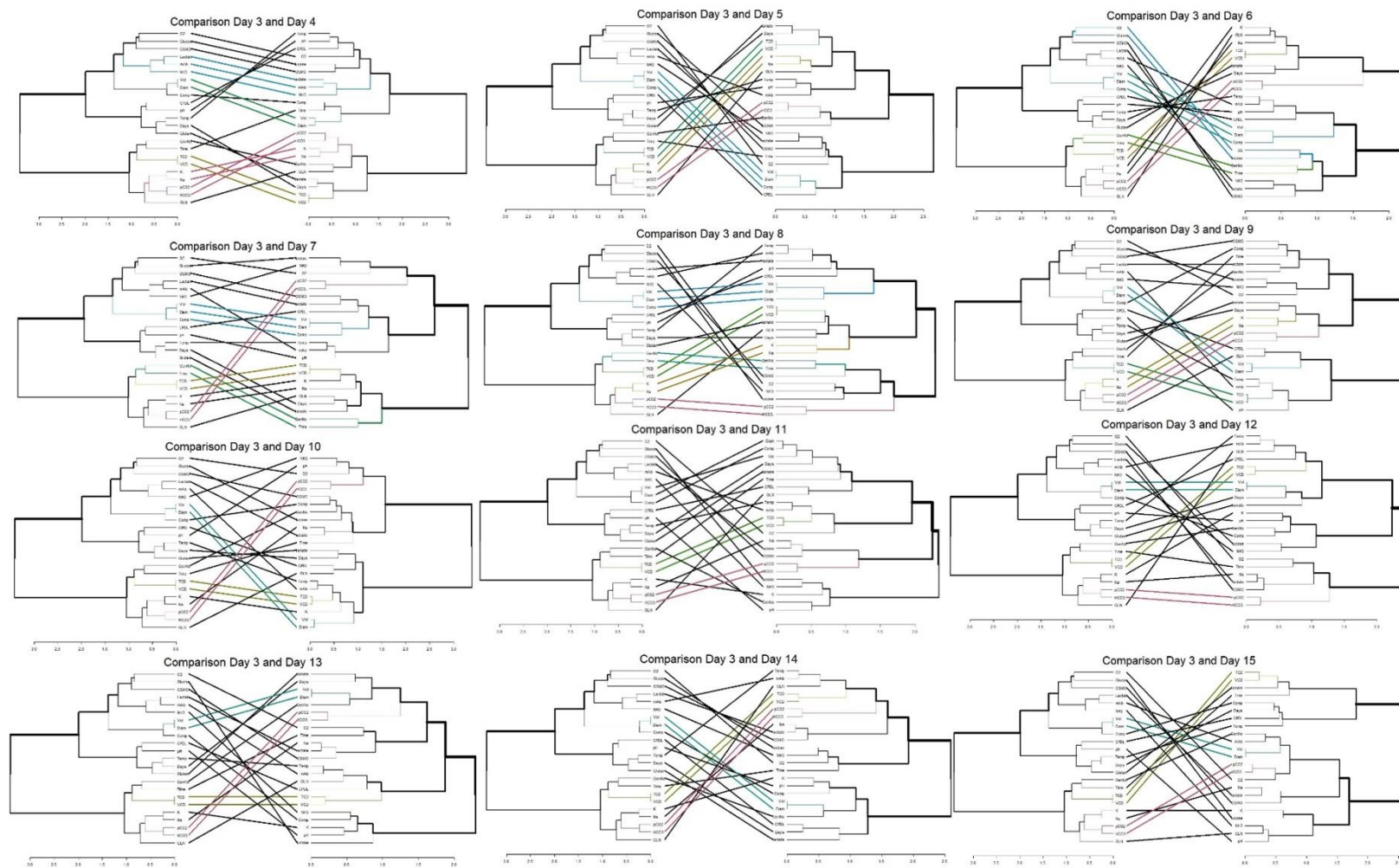


Figure 33: Tanglegrams for comparison of parameter clustering on Day 3 with the remaining days of culture. Refer to the explanation above.

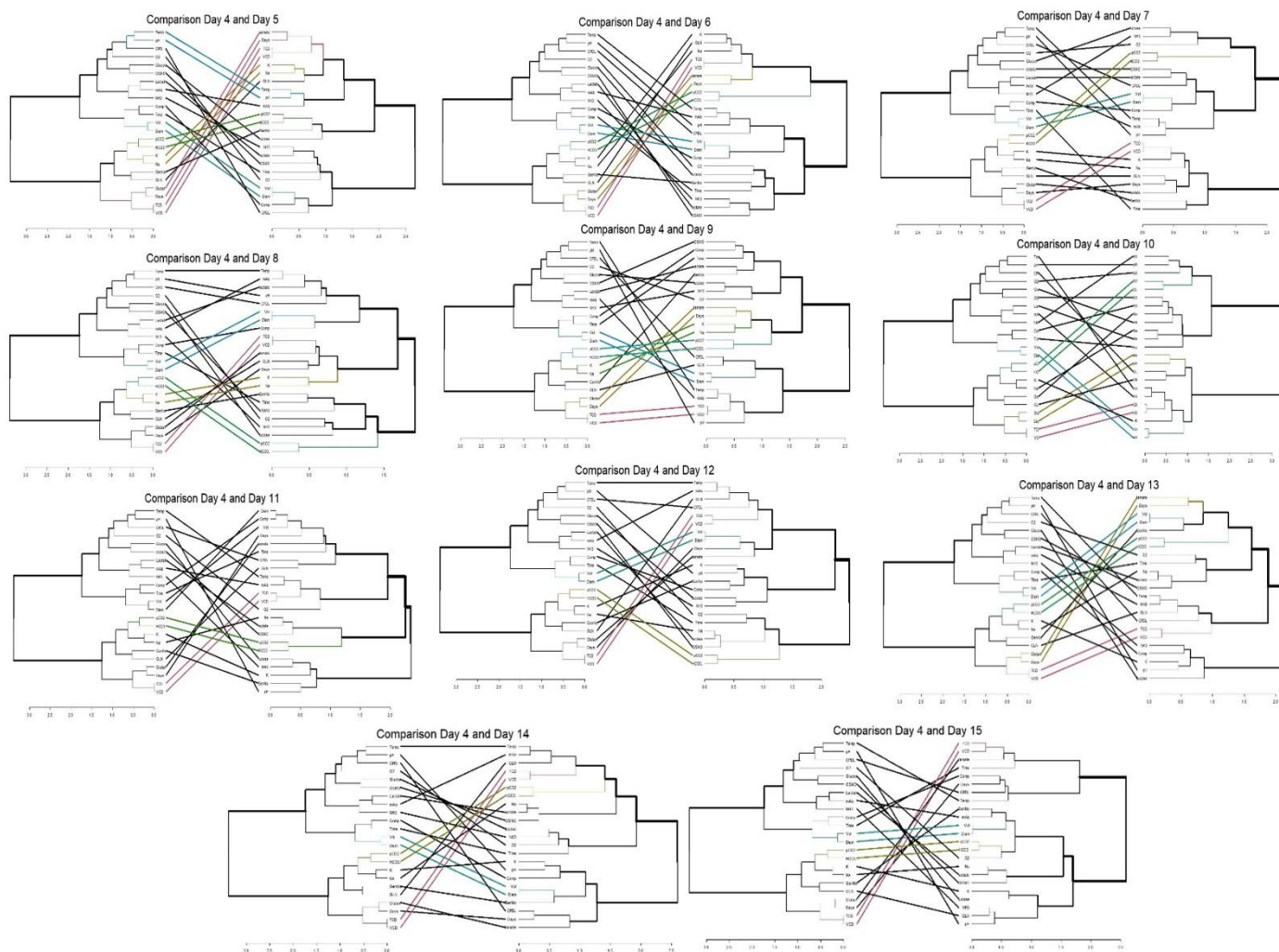


Figure 34: Tanglegrams for comparison of parameter clustering on Day 4 with the remaining days of culture. Refer to the explanation above.

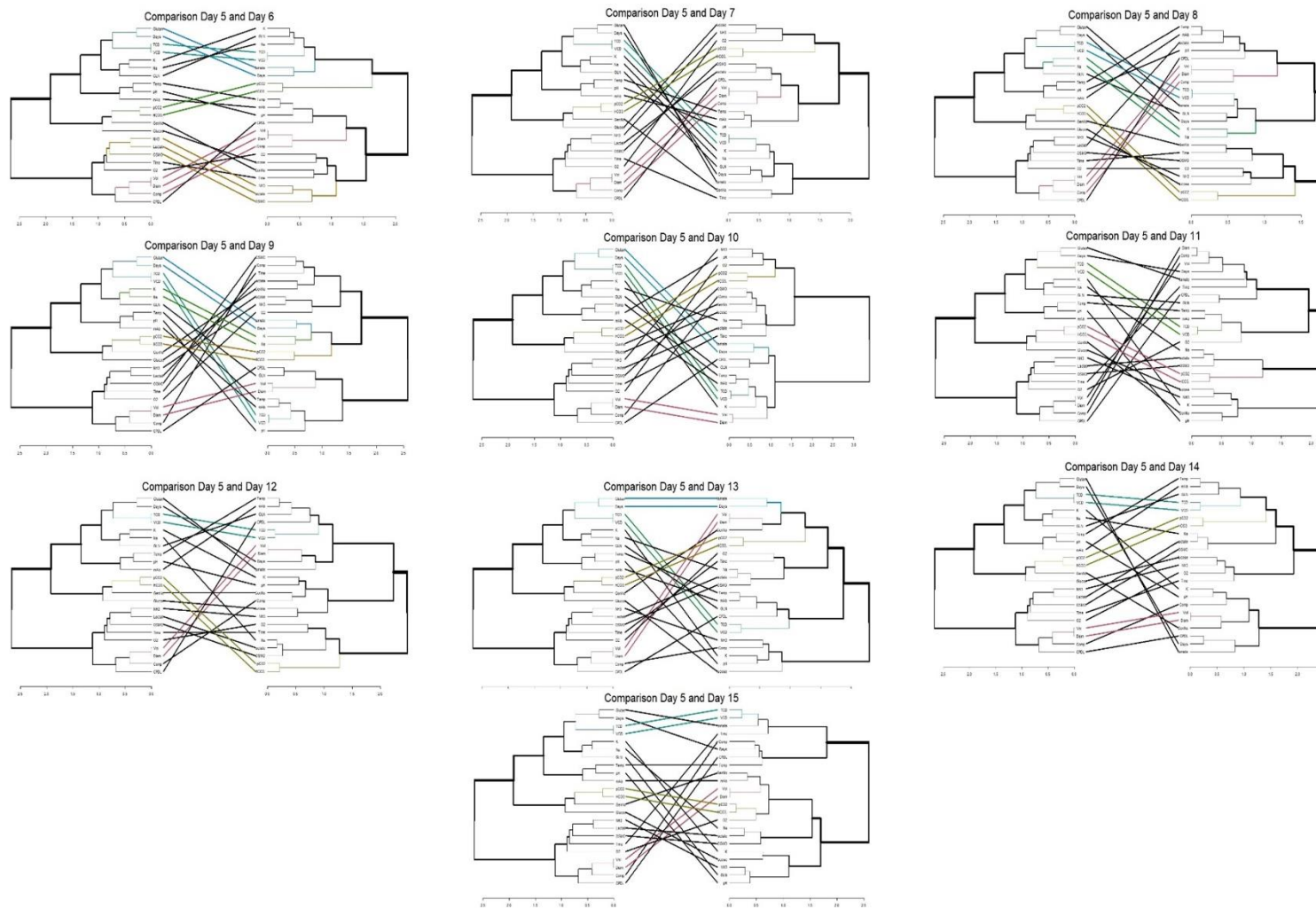


Figure 35: Tanglegrams for comparison of parameter clustering on Day 5 with the remaining days of culture. Refer to the explanation above.

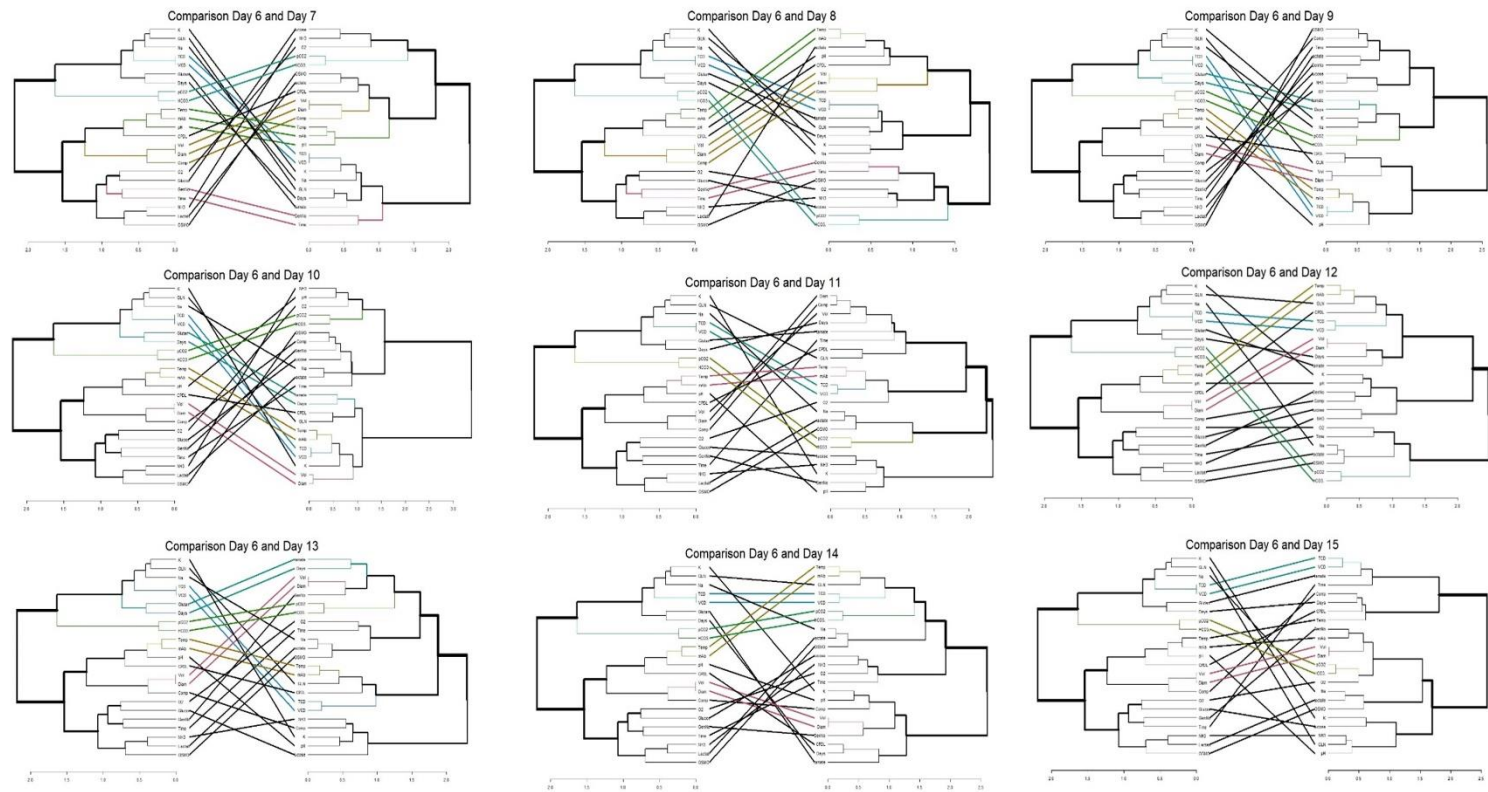


Figure 36: Tanglegrams for comparison of parameter clustering on Day 6 with the remaining days of culture. Refer to the explanation above.

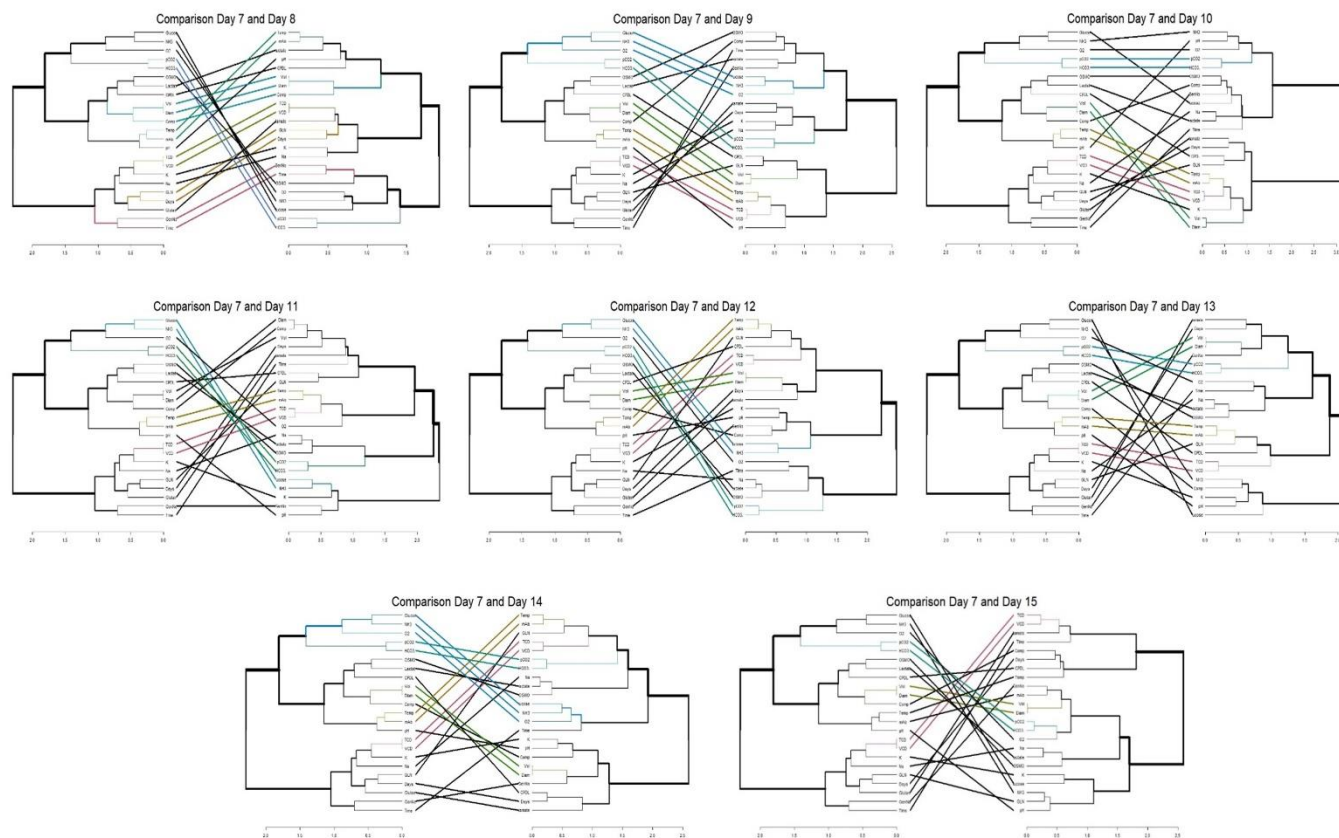


Figure 37: Tanglegrams for comparison of parameter clustering on Day 7 with the remaining days of culture. Refer to the explanation above.

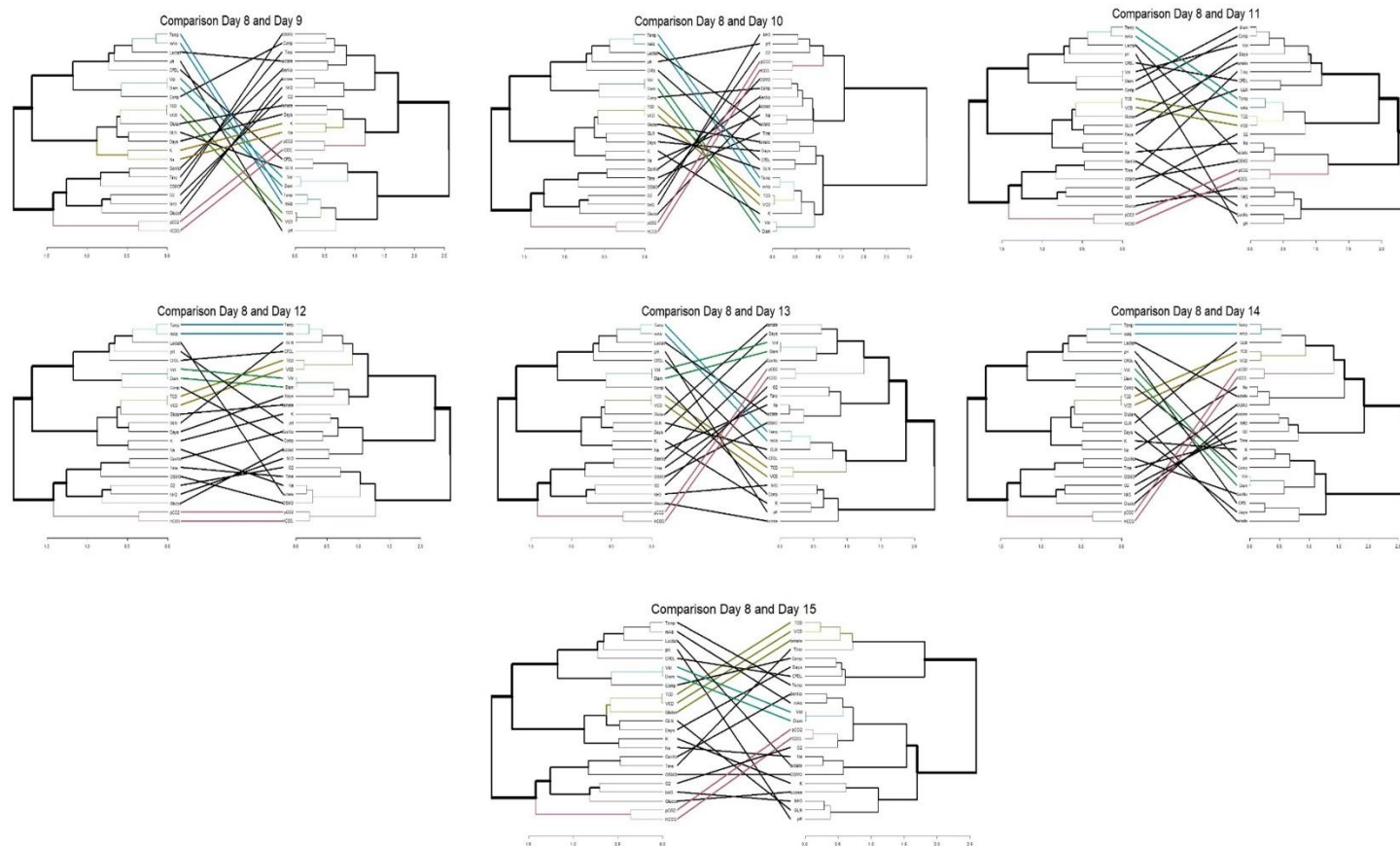


Figure 38: Tanglegrams for comparison of parameter clustering on Day 8 with the remaining days of culture. Refer to the explanation above.

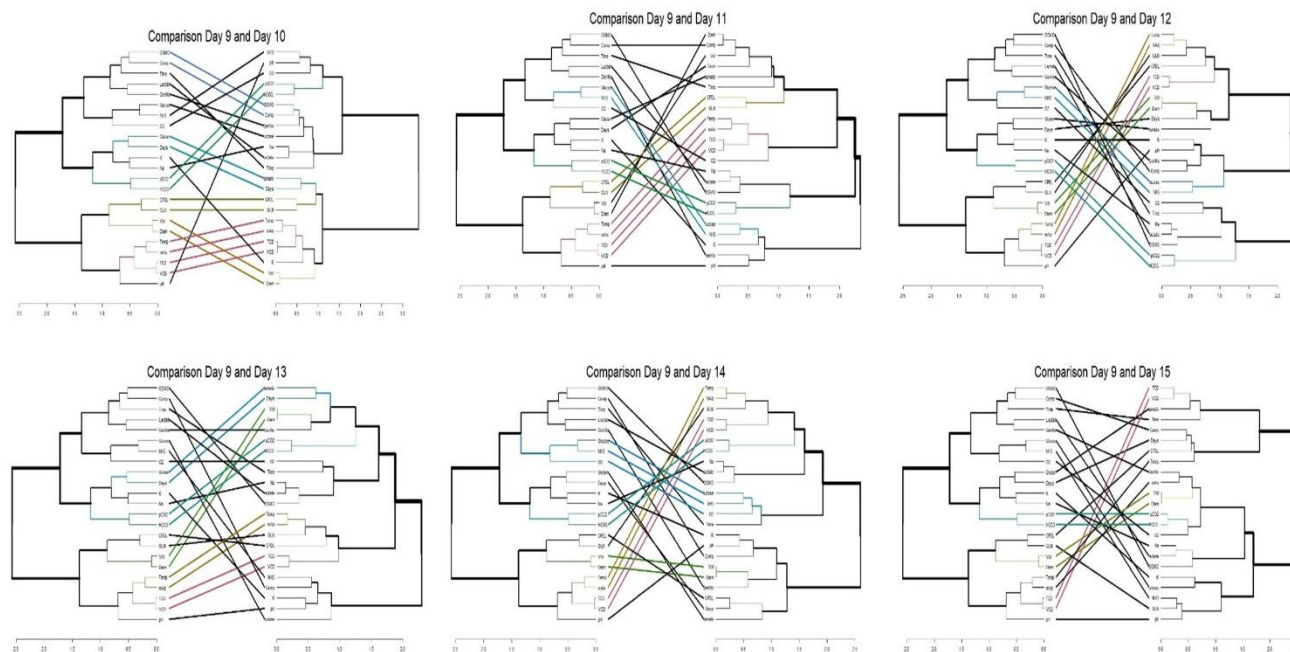


Figure 39: Tanglegrams for comparison of parameter clustering on Day 9 with the remaining days of culture. Refer to the explanation above.

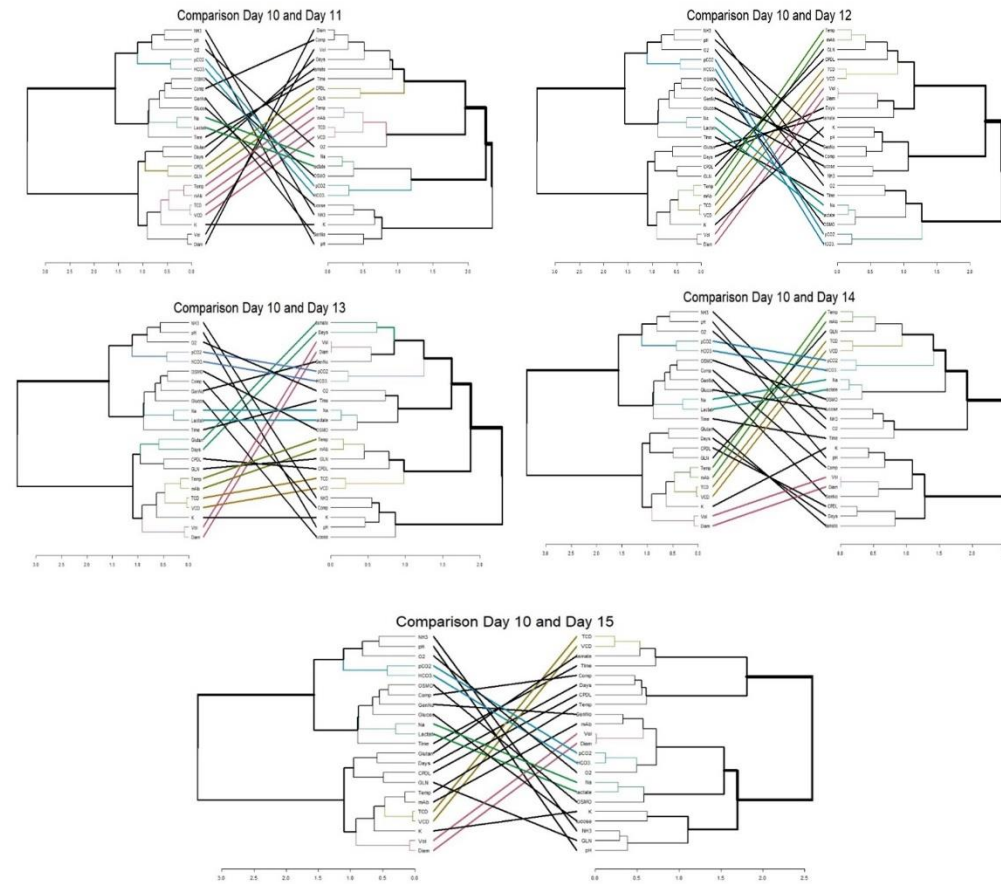


Figure 40: Tanglegrams for comparison of parameter clustering on Day 10 with the remaining days of culture. Refer to the explanation above.

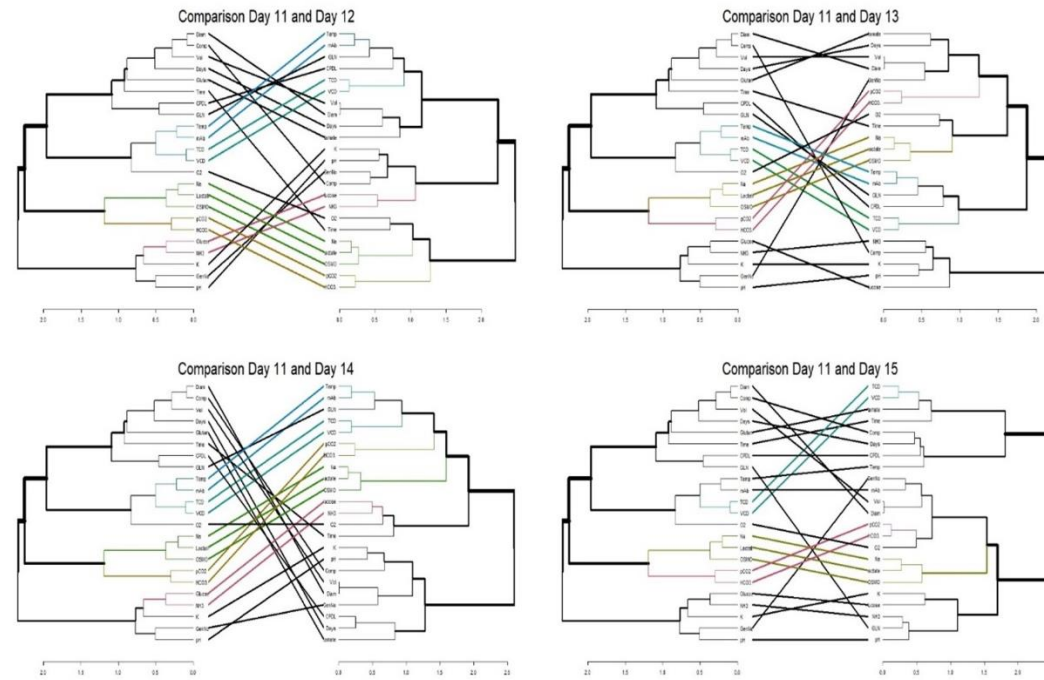


Figure 41: Tanglegrams for comparison of parameter clustering on Day 11 with the remaining days of culture. Refer to the explanation above.

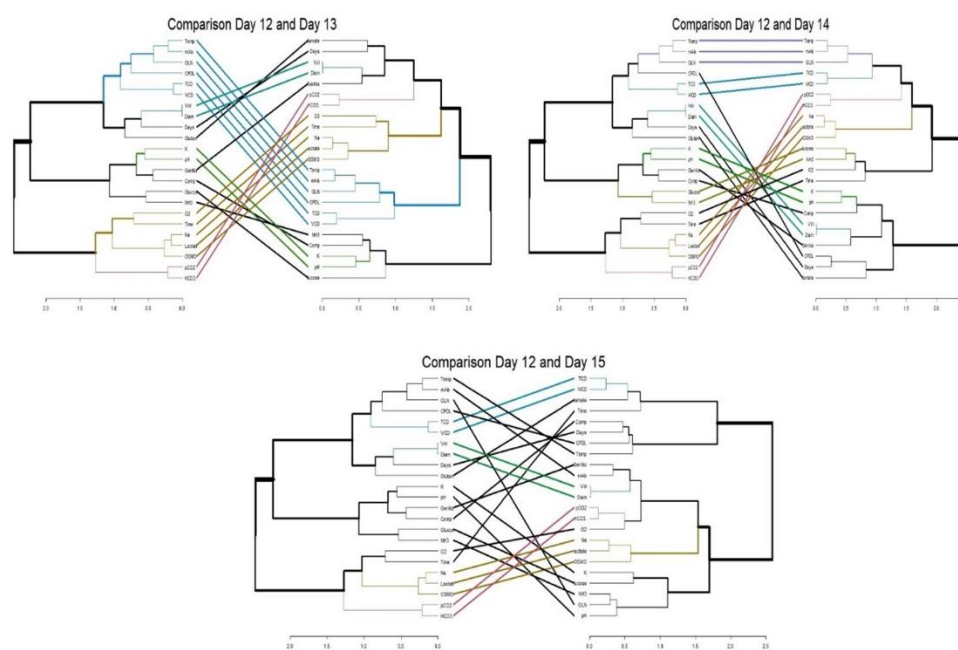


Figure 42: Tanglegrams for comparison of parameter clustering on Day 12 with the remaining days of culture. Refer to the explanation above.

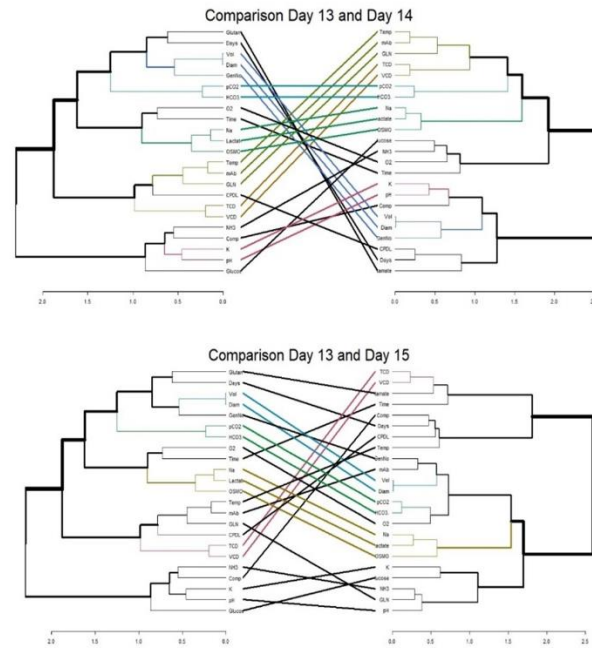


Figure 43: Tanglegrams for comparison of parameter clustering on Day 13 with the remaining days of culture. Refer to the explanation above.

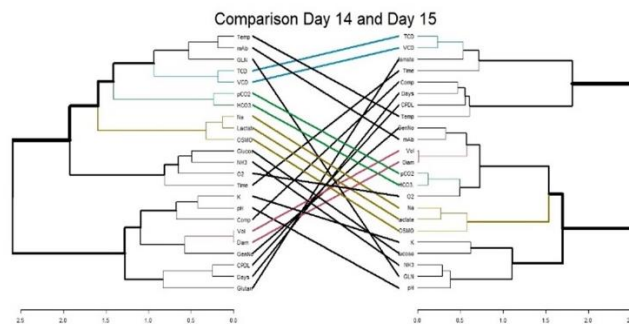


Figure 44: Tanglegrams for comparison of parameter clustering on Day 14 with the remaining days of culture. Refer to the explanation above.

Appendix IV

1. Plots generated by different algorithms used for feature selection.

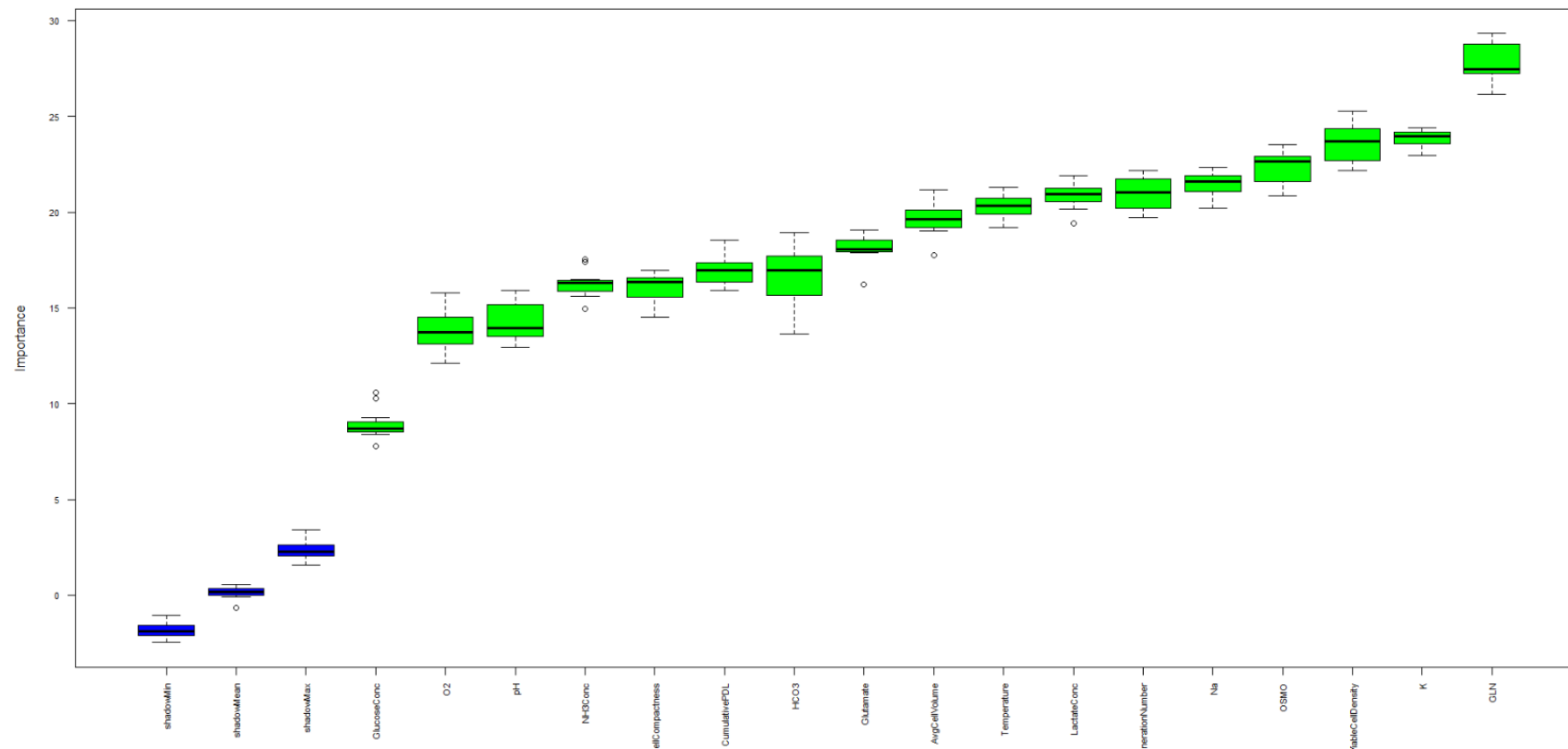


Figure 1: Parameter importance as calculated by Boruta algorithm. X axis shows the parameters and Y axis shows their importance. Importance is measured by mean decrease in accuracy of prediction using a model with the parameter incorporated. Axes have no units. Blue boxplots correspond to minimal, average and maximum Z score of a shadow attribute. Green boxplots represent Z scores of confirmed attributes.

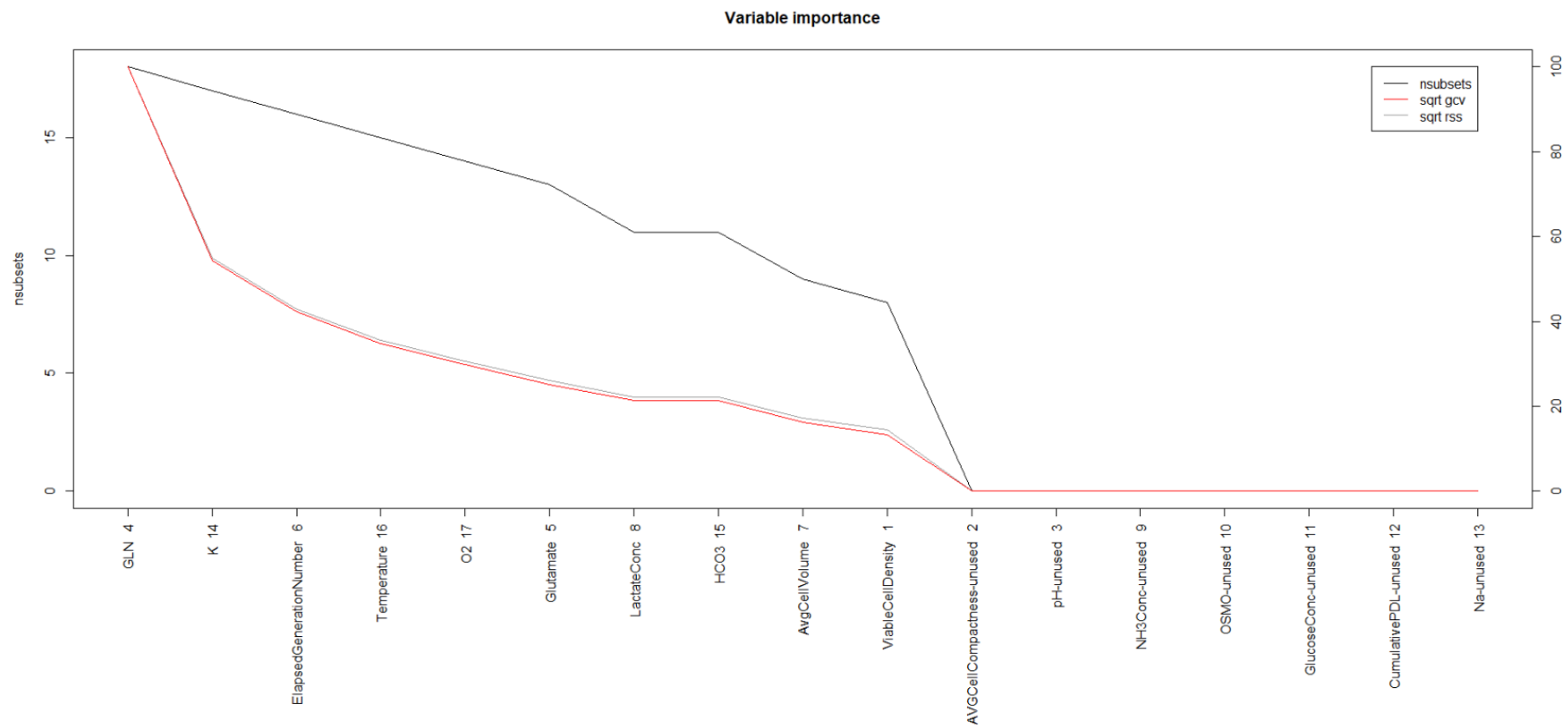


Figure 2: Parameter importance as predicted by MARS. X axis shows the different parameters, Y axis on the left shows nsubsets, which is the number of subset models in which the parameter occurs, and Y axis on the right shows GCV and RSS values. Moving from top to bottom on the left Y axis, the number of subset models in which the parameter occurred decreases, and hence the parameter importance decreases. Red line represents Generalised Cross Validation (GCV), Grey line represents Residual Sum of Squares (RSS) and Blue line represents value of nsubsets for each parameter. Axes have no units.

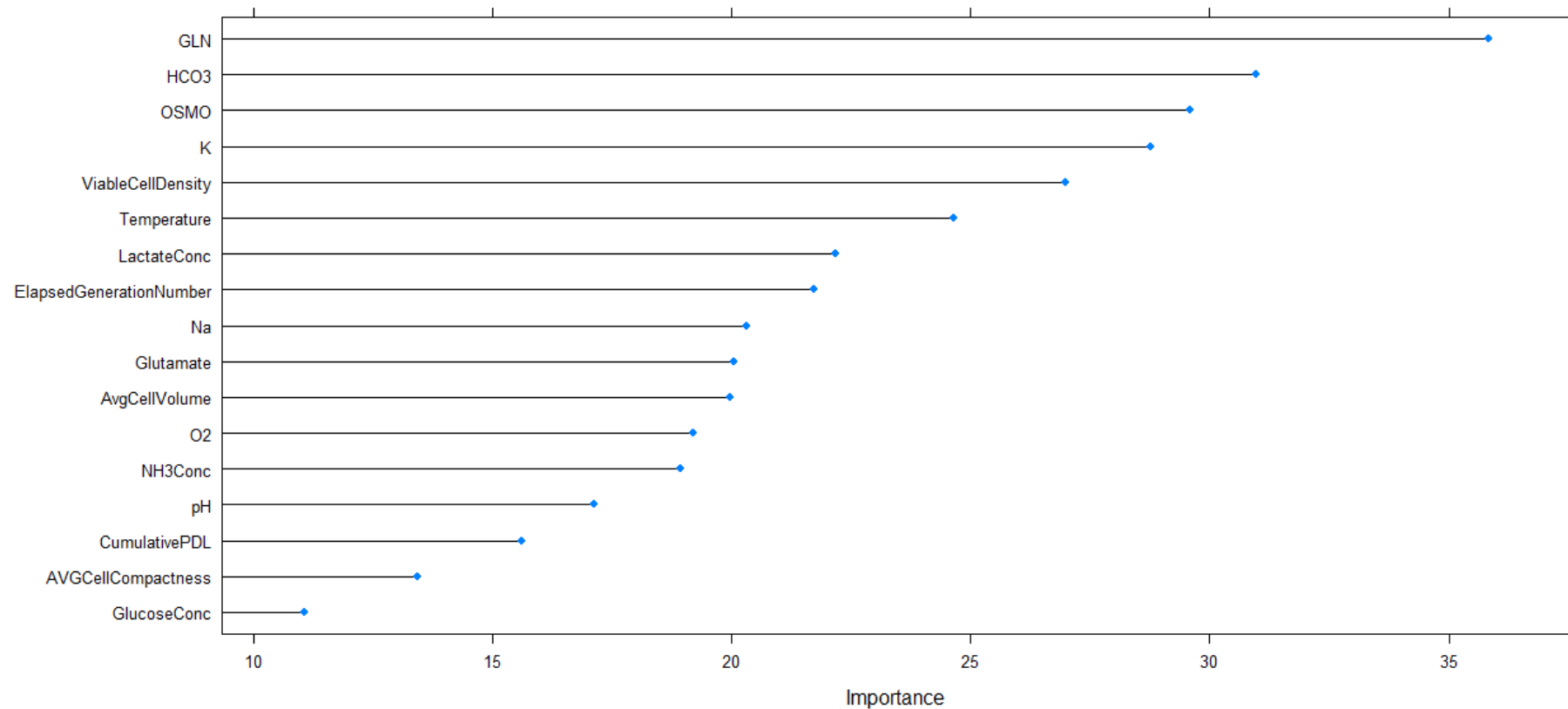


Figure 3: Parameter importance as predicted by parRF. X axis shows the importance and Y axis shows the different parameters. Moving from left to right on X axis the importance increases. Importance scores are aggregate measures that quantify the impact of the predictor (All importance measures are set to have a maximum value of 100 in R). Axes have no units.

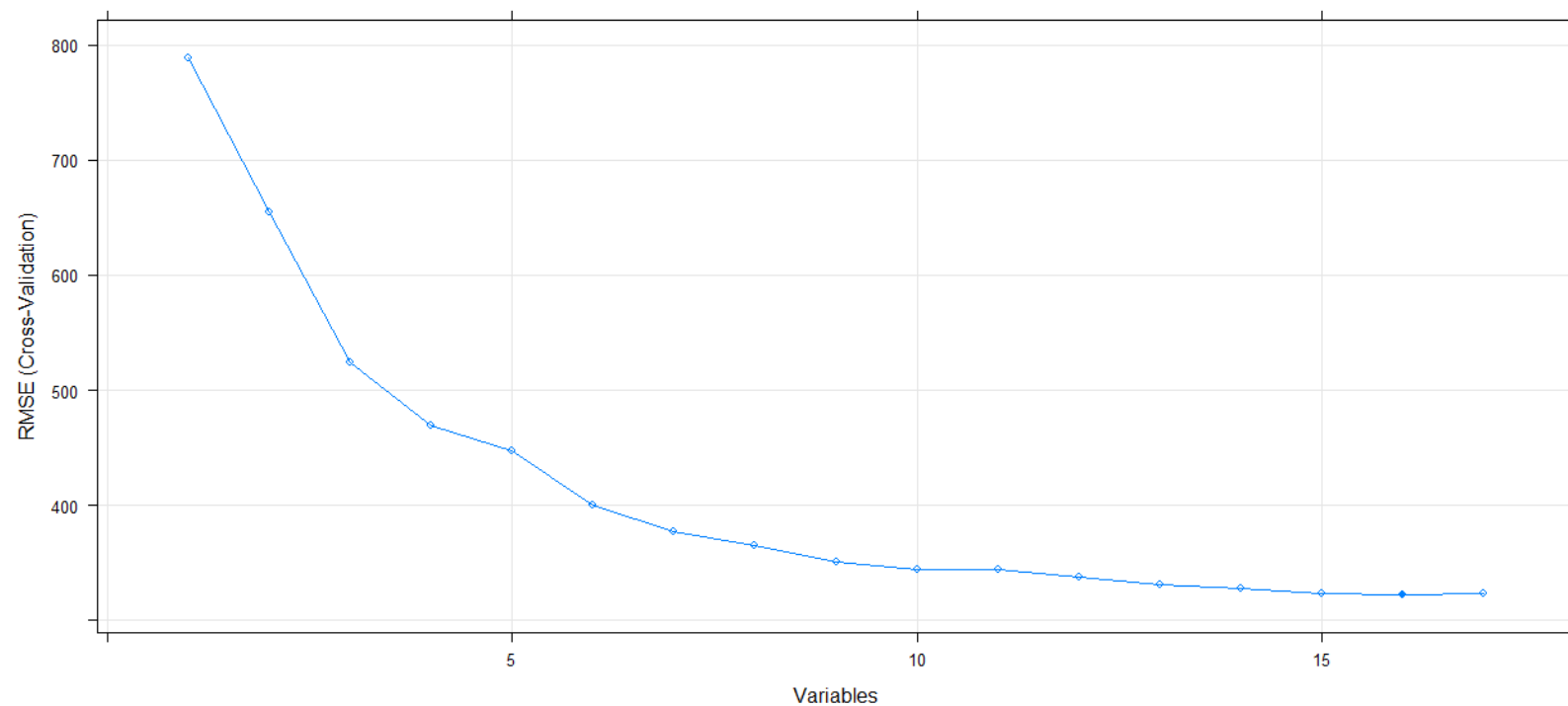


Figure 4: Decrease in cross validation RMSE with increasing number of parameters employed in prediction using RFE. X axis shows the number of parameters and Y axis shows the RMSE of prediction. RMSE has the same value as response variable. In this case mAb concentration (mg/L). Moving from top to bottom on Y axis RMSE value decreases.

Appendix V

1. Table showing prediction RMSE for the first dimension models, using a training set comprised of randomly selected 70% of the complete dataset, and a test set, which corresponded to the remaining 30% of the complete data. Alphabets in the table corresponds to parameters : [Glutamine]-A, [K⁺]-B, Osmolality-C, VCD-D, Temperature-E, EGN-F, [Lactate]-G, [Glutamate]-H, ACV-I, [HCO₃⁻]-J, [Na⁺]-K, CPDL-L, ACC-M, pH-N, [NH₃]-O, pO₂-P, [Glucose]-Q, [mAb]-R. Values in red indicate the earliest days on which prediction RMSE is low. Values in blue represent RMSEs lower than red, but are far ahead on culture days.

Table 1: Prediction RMSE for the first dimension models

Para meter	Day0 to 1	Day0 to 2	Day0 to 3	Day0 to 4	Day0 to 5	Day0 to 6	Day0 to 7	Day0 to 8	Day0 to 9	Day0 to 10	Day0 to 11	Day0 to 12	Day0 to 13
A	1.267	1.261	1.234	1.248	1.093	1.231	1.110	1.114	1.097	1.444	1.320	0.920	0.478
B	3.883	4.190	3.492	4.277	4.235	4.090	3.584	3.420	3.619	3.324	5.250	4.314	3.705
C	93.819	97.328	92.330	107.755	108.813	110.495	111.975	140.188	113.260	114.689	108.879	63.704	42.554
D	35.894	34.243	30.363	30.747	26.028	26.280	24.111	22.214	18.992	15.611	14.484	20.958	10.538
E	2.312	2.309	2.309	2.309	1.682	0.837	0.746	0.181	0.180	0.178	0.173	0.177	0.198
F	1.405	1.201	1.172	1.165	1.150	1.148	1.193	1.175	1.082	0.743	0.386	0.201	0.140
G	37.378	36.987	37.927	38.490	38.639	38.303	30.495	59.086	51.286	46.123	36.110	32.997	7.989
H	2.270	2.220	2.003	1.772	1.982	10.142	2.041	1.778	1.852	1.535	1.246	1.169	0.956
I	0.610	0.631	0.647	0.612	0.616	0.603	0.594	0.639	0.628	0.509	0.493	0.447	0.466
J	5.039	5.437	4.871	4.793	5.047	4.939	4.932	4.904	5.298	5.196	3.639	3.043	2.152
K	46.082	46.341	43.773	42.117	41.645	41.281	131.816	72.718	74.798	24.435	19.396	13.764	10.219
L	1.512	2.161	8.544	1.424	1.408	1.429	1.420	1.479	1.663	1.539	1.407	3.196	0.562
M	0.022	0.020	0.018	0.018	0.017	0.018	0.017	0.017	0.018	0.016	0.012	0.013	0.012
N	0.111	0.112	0.109	0.159	0.125	0.204	0.169	0.125	0.117	0.092	0.059	0.066	0.054
O	2.949	4.526	4.792	4.467	4.900	4.768	4.895	3.152	3.242	2.685	2.584	1.785	1.603
P	22.936	24.213	24.023	23.951	24.159	23.604	23.507	20.933	20.993	21.128	21.349	19.994	20.512
Q	7.663	7.047	7.295	6.985	6.850	6.552	6.860	7.608	7.000	6.842	6.851	6.614	6.994
R	1128.168	661.554	638.014	700.972	1359.879	875.620	1388.953	622.319	691.145	489.628	778.742	586.623	345.768