

1                   **FISH-SIMS imaging of an autotrophic, nitrate-reducing,**  
2                   **Fe(II)-oxidizing enrichment culture provides insights into carbon**  
3                   **metabolism**

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17                   **SUPPLEMENTARY INFORMATION**  
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34 **Tab. S1:** Raw counts and calculated enrichments of *Gallionellaceae* sp. and *Bradyrhizobium* spp. cells under both autotrophic and heterotrophic growth conditions  
 35 measured by nanoSIMS.

Growth phase	<sup>12</sup> C	<sup>13</sup> C	<sup>14</sup> N	<sup>15</sup> N	<sup>56</sup> Fe <sup>16</sup> O	<sup>13</sup> C/ <sup>12</sup> C [% APE]	<sup>15</sup> N/ <sup>14</sup> N [% APE]	<sup>13</sup> C/ <sup>15</sup> N [% APE]	cell volume	<sup>13</sup> C/ <sup>15</sup> N normalized to cell volume [% APE]
<b><i>Gallionellaceae</i> sp. – autotrophic growth conditions</b>										
<b>exponential</b>	1.14E+10	3.68E+08	1.66E+11	4.61E+09	2.42E+10	3.23	2.78	7.99	0.35	22.82
	8.13E+10	7.64E+08	8.63E+11	1.85E+09	6.75E+09	0.94	0.21	41.20	0.35	117.73
	1.23E+10	1.81E+08	7.07E+10	9.43E+08	1.67E+10	1.47	1.33	19.20	0.35	54.85
	3.39E+09	5.90E+07	4.42E+10	6.93E+08	1.42E+10	1.74	1.57	8.52	0.35	24.34
	3.64E+09	6.70E+07	7.34E+10	1.31E+09	1.40E+10	1.84	1.79	5.11	0.35	14.59
	1.75E+10	2.54E+08	2.09E+11	2.38E+09	3.65E+10	1.46	1.14	10.68	0.35	30.51
	4.89E+09	5.10E+07	1.04E+11	3.13E+08	8.14E+09	1.04	0.30	16.28	0.35	46.53
	4.40E+09	9.20E+07	8.21E+10	1.33E+09	7.82E+09	2.09	1.62	6.92	0.35	19.76
	5.94E+09	1.30E+08	1.06E+11	1.60E+09	1.15E+10	2.19	1.50	8.15	0.35	23.27
2.90E+09	6.90E+07	6.14E+10	1.08E+09	1.33E+10	2.38	1.77	6.37	0.35	18.20	
<b>stationary</b>	1.49E+09	2.70E+07	1.89E+10	3.93E+08	3.91E+09	1.82	2.08	6.86	0.35	19.61
	7.12E+08	3.30E+07	1.23E+10	6.81E+08	4.48E+09	4.63	5.52	4.85	0.35	13.84
	1.49E+10	1.66E+08	4.28E+11	1.29E+09	2.73E+10	1.11	0.30	12.82	0.35	36.63
	9.26E+09	8.20E+07	1.49E+11	4.56E+08	7.34E+09	0.89	0.31	17.98	0.35	51.36
	1.03E+10	3.19E+08	2.61E+11	7.55E+09	3.59E+10	3.08	2.89	4.22	0.35	12.07
	8.06E+09	9.40E+07	2.15E+11	8.29E+08	3.27E+10	1.17	0.39	11.33	0.35	32.38
	7.12E+09	7.40E+07	1.46E+11	6.65E+08	1.79E+10	1.04	0.46	11.12	0.35	31.78
	7.35E+09	5.70E+07	1.51E+11	5.13E+08	2.82E+10	0.78	0.34	11.11	0.35	31.74
	1.15E+10	1.76E+08	2.58E+11	2.99E+09	2.63E+10	1.53	1.16	5.89	0.35	16.84
	1.59E+10	4.57E+08	1.83E+11	3.20E+09	2.56E+10	2.88	1.75	14.28	0.35	40.81
	2.89E+11	7.55E+09	9.41E+11	5.52E+10	1.26E+09	2.61	5.87	13.67	0.35	39.05
	4.38E+09	1.36E+08	7.76E+10	3.06E+09	1.71E+10	3.11	3.95	4.44	0.35	12.68

	3.86E+10	1.01E+09	1.92E+11	7.37E+09	9.30E+09	2.61	3.83	13.66	0.35	39.03
	8.32E+09	1.43E+08	7.68E+10	2.21E+09	1.06E+10	1.72	2.87	6.48	0.35	18.53
	9.92E+09	3.93E+08	8.18E+10	3.08E+09	4.49E+09	3.96	3.77	12.75	0.35	36.42
	3.36E+09	7.90E+07	9.87E+10	2.28E+09	1.35E+10	2.35	2.31	3.47	0.35	9.92
	4.13E+09	1.55E+08	8.20E+10	2.50E+09	1.25E+10	3.76	3.05	6.19	0.35	17.69
	2.09E+09	7.30E+07	5.87E+10	1.98E+09	7.88E+09	3.50	3.37	3.69	0.35	10.55
	7.65E+08	1.80E+07	1.90E+10	4.40E+08	3.96E+09	2.35	2.32	4.09	0.35	11.68
	4.09E+08	1.00E+07	1.15E+10	3.86E+08	3.45E+09	2.44	3.37	2.59	0.35	7.40
	5.79E+10	1.16E+09	6.43E+11	1.33E+10	1.25E+11	2.01	2.07	8.72	0.35	24.92
<b><i>Gallionellaceae</i> sp. – heterotrophic growth conditions</b>										
<b>exponential</b>	1.47E+11	6.68E+09	4.11E+11	2.59E+10	7.54E+08	4.53	6.29	25.80	0.35	73.71
	1.31E+12	4.79E+10	1.82E+12	9.89E+10	1.70E+07	3.66	5.43	48.46	0.35	138.47
	2.44E+11	1.26E+10	8.48E+11	4.60E+10	7.61E+08	5.17	5.42	27.39	0.35	78.27
	1.47E+11	7.92E+09	8.36E+11	4.37E+10	5.40E+08	5.40	5.22	18.14	0.35	51.82
	7.07E+10	3.50E+09	2.61E+11	1.79E+10	1.50E+07	4.95	6.88	19.50	0.35	55.71
	1.30E+10	6.77E+08	8.64E+10	5.59E+09	1.64E+08	5.21	6.47	12.11	0.35	34.60
	2.10E+11	8.23E+09	6.48E+11	3.35E+10	1.50E+07	3.92	5.16	24.61	0.35	70.30
<b>stationary</b>	1.67E+11	1.12E+10	4.64E+11	3.11E+10	5.40E+08	6.73	6.69	36.21	0.35	103.45
	7.18E+10	4.50E+09	2.87E+11	1.62E+10	8.78E+08	6.28	5.65	27.77	0.35	79.35
	8.05E+10	3.52E+09	3.45E+11	7.94E+09	3.05E+08	4.38	2.30	44.37	0.35	126.78
	2.47E+11	1.69E+10	1.09E+12	5.77E+10	1.53E+09	6.85	5.31	29.29	0.35	83.69
	5.44E+10	4.34E+09	2.88E+11	1.98E+10	3.07E+09	7.99	6.88	21.89	0.35	62.55
<b><i>Bradyrhizobium</i> spp. – autotrophic growth conditions</b>										
<b>Exponential (cells ≤1.8 μm)</b>	3.53E+10	3.78E+08	1.22E+11	1.40E+09	1.90E+07	1.07	1.15	27.06	1.41	19.19
<b>Exponential (cells &gt;1.8 μm)</b>	9.22E+11	8.64E+09	5.53E+12	1.39E+10	2.01E+10	0.94	0.25	62.18	4.71	13.20
	4.51E+10	4.33E+08	6.96E+10	3.32E+08	1.69E+09	0.96	0.48	130.45	4.71	27.70
	7.42E+11	7.13E+09	5.17E+12	1.46E+10	1.16E+10	0.96	0.28	48.81	4.71	10.36

<b>Stationary</b>	1.13E+11	1.08E+09	6.96E+11	2.02E+09	1.59E+10	0.95	0.29	53.37	1.41	37.85
<b>(cells ≤1.8 μm)</b>	1.30E+10	1.46E+08	3.46E+10	1.44E+08	1.80E+07	1.12	0.42	101.38	1.41	71.90
<b>Stationary</b>	2.63E+11	2.61E+09	1.53E+12	4.02E+09	2.69E+10	0.99	0.26	64.80	4.71	13.76
<b>(cells &gt;1.8 μm)</b>	3.32E+11	3.24E+09	7.89E+11	2.68E+09	3.56E+10	0.98	0.34	121.01	4.71	25.69
	2.85E+11	2.80E+09	2.34E+12	6.21E+09	8.22E+09	0.98	0.27	45.13	4.71	9.58
	1.15E+12	1.08E+10	1.90E+12	6.03E+09	8.69E+09	0.94	0.32	178.96	4.71	38.00
	2.07E+12	1.86E+10	4.03E+12	1.13E+10	4.44E+09	0.90	0.28	164.33	4.71	34.89
<b><i>Bradyrhizobium</i> spp. – heterotrophic growth conditions</b>										
<b>Exponential</b>	4.69E+10	2.36E+09	2.03E+11	1.17E+10	2.54E+08	5.04	5.77	20.12	1.41	14.27
<b>(cells ≤1.8 μm)</b>	4.54E+10	2.18E+09	1.67E+11	9.53E+09	1.00E+07	4.81	5.72	22.88	1.41	16.22
	2.76E+10	8.87E+08	4.37E+11	1.24E+10	3.73E+09	3.21	2.85	7.13	1.41	5.06
	1.23E+10	2.55E+08	4.29E+11	7.78E+09	2.62E+09	2.08	1.81	3.28	1.41	2.33
	8.19E+10	4.07E+09	1.82E+12	6.57E+10	9.20E+07	4.97	3.61	6.20	1.41	4.40
<b>Exponential</b>	1.52E+12	1.38E+10	4.37E+12	1.11E+10	2.76E+08	0.91	0.26	124.09	4.71	26.35
<b>(cells &gt;1.8 μm)</b>	4.28E+11	4.00E+09	2.72E+12	5.83E+09	8.90E+07	0.93	0.21	68.61	4.71	14.57
	1.89E+12	1.74E+10	7.07E+12	1.81E+10	8.28E+09	0.92	0.26	96.00	4.71	20.38
	5.12E+10	2.02E+09	9.81E+11	3.61E+10	1.00E+10	3.94	3.67	5.59	4.71	1.19
	2.98E+11	1.45E+10	5.01E+12	1.77E+11	5.95E+09	4.87	3.54	8.16	4.71	1.73
<b>Stationary</b>	1.17E+11	6.39E+09	3.90E+11	2.06E+10	2.12E+09	5.47	5.27	31.07	1.41	22.03
<b>(cells ≤1.8 μm)</b>	8.76E+10	3.97E+09	3.60E+11	1.45E+10	1.49E+09	4.54	4.02	27.46	1.41	19.47
	5.71E+10	3.19E+09	6.01E+11	2.05E+10	2.81E+09	5.58	3.42	15.53	1.41	11.01
	4.09E+10	1.64E+09	1.50E+11	5.73E+09	6.90E+07	4.02	3.83	28.70	1.41	20.36
	2.10E+11	1.03E+10	9.98E+11	3.58E+10	3.81E+08	4.91	3.59	28.71	1.41	20.36
	1.05E+11	4.71E+09	5.36E+11	2.23E+10	5.59E+09	4.50	4.16	21.11	1.41	14.97
	1.37E+11	6.73E+09	4.38E+11	2.15E+10	3.80E+07	4.90	4.91	31.30	1.41	22.20
	5.36E+10	3.10E+09	1.97E+11	1.33E+10	3.31E+08	5.78	6.75	23.35	1.41	16.56
	8.02E+10	4.17E+09	4.69E+11	2.62E+10	1.23E+09	5.20	5.58	15.94	1.41	11.30
	2.81E+10	1.44E+09	1.32E+11	8.15E+09	3.40E+08	5.10	6.16	17.62	1.41	12.50
	2.17E+10	1.18E+09	1.35E+11	8.96E+09	1.84E+09	5.41	6.63	13.13	1.41	9.31
	5.29E+10	2.96E+09	3.94E+11	2.06E+10	1.42E+08	5.60	5.22	14.43	1.41	10.23

	1.16E+11	6.02E+09	5.47E+11	2.65E+10	3.10E+07	5.18	4.85	22.70	1.41	16.10
	3.19E+10	1.77E+09	1.78E+11	1.02E+10	8.81E+09	5.55	5.72	17.46	1.41	12.39
	6.39E+10	4.38E+09	2.38E+11	1.36E+10	3.57E+08	6.86	5.71	32.23	1.41	22.86
	1.38E+11	6.87E+09	8.20E+11	3.59E+10	1.13E+10	4.96	4.38	19.14	1.41	13.57
	2.40E+11	1.30E+10	2.88E+11	1.71E+10	3.50E+09	5.41	5.94	75.95	1.41	53.86
	1.77E+11	9.82E+09	2.73E+11	1.61E+10	1.72E+08	5.56	5.89	61.09	1.41	43.33
	5.05E+10	2.47E+09	1.99E+11	1.02E+10	3.83E+09	4.89	5.13	24.21	1.41	17.17
	3.55E+10	1.96E+09	9.34E+10	5.33E+09	7.50E+07	5.52	5.71	36.77	1.41	26.08
	5.17E+10	2.54E+09	1.17E+11	6.93E+09	6.10E+07	4.90	5.93	36.60	1.41	25.95
	2.78E+11	1.44E+10	5.15E+11	2.95E+10	7.10E+08	5.20	5.73	49.00	1.41	34.75
	1.04E+11	5.63E+09	3.22E+11	1.91E+10	8.96E+08	5.43	5.94	29.48	1.41	20.91
<b>Stationary</b>	6.54E+10	3.68E+09	3.20E+11	1.94E+10	6.46E+08	5.62	6.05	18.99	4.71	4.03
<b>(cells &gt;1.8 μm)</b>	1.47E+11	8.14E+09	4.85E+11	2.78E+10	3.74E+09	5.55	5.72	29.30	4.71	6.22
	1.29E+11	8.27E+09	9.33E+10	6.40E+09	5.20E+07	6.42	6.87	129.18	4.71	27.43
	2.96E+11	1.56E+10	4.40E+11	2.43E+10	3.10E+07	5.27	5.53	64.07	4.71	13.60
	3.48E+11	1.94E+10	9.32E+11	4.70E+10	6.60E+07	5.58	5.04	41.37	4.71	8.78
	5.53E+11	3.09E+10	1.59E+12	8.15E+10	5.70E+07	5.59	5.12	37.89	4.71	8.04
	1.72E+11	9.29E+09	6.14E+11	2.87E+10	6.08E+09	5.39	4.67	32.43	4.71	6.88
	1.00E+11	6.46E+09	4.16E+11	2.32E+10	2.08E+10	6.46	5.59	27.78	4.71	5.90
	2.10E+11	1.30E+10	1.17E+12	5.93E+10	8.86E+09	6.18	5.08	21.86	4.71	4.64
	4.39E+11	2.78E+10	2.90E+12	1.35E+11	3.16E+10	6.32	4.66	20.58	4.71	4.37
	1.78E+11	1.01E+10	1.67E+12	5.94E+10	3.06E+09	5.68	3.56	17.05	4.71	3.62
	3.85E+11	1.57E+10	9.68E+11	4.00E+10	1.87E+09	4.08	4.13	39.29	4.71	8.34
	1.48E+11	7.88E+09	6.49E+11	3.26E+10	7.90E+07	5.34	5.02	24.21	4.71	5.14
	2.97E+11	1.55E+10	2.15E+12	7.10E+10	1.23E+09	5.23	3.31	21.88	4.71	4.65
	4.09E+11	2.12E+10	5.08E+11	2.58E+10	9.10E+07	5.19	5.08	82.22	4.71	17.46
	2.25E+11	1.09E+10	1.19E+12	4.48E+10	7.18E+08	4.86	3.76	24.42	4.71	5.18
	3.53E+11	1.93E+10	9.83E+11	4.38E+10	4.00E+07	5.45	4.46	43.96	4.71	9.33
	1.91E+11	8.87E+09	1.03E+12	4.10E+10	2.18E+08	4.64	3.98	21.61	4.71	4.59
	2.61E+11	1.74E+10	1.73E+12	1.04E+11	6.36E+08	6.69	6.02	16.78	4.71	3.56

3.43E+11	2.33E+10	1.64E+12	9.98E+10	5.99E+08	6.78	6.08	23.31	4.71	4.95
2.09E+11	1.23E+10	1.23E+12	6.85E+10	1.54E+09	5.89	5.55	17.96	4.71	3.81
4.36E+11	2.78E+10	2.31E+12	1.19E+11	1.82E+09	6.38	5.15	23.38	4.71	4.96
1.96E+11	1.23E+10	9.70E+11	5.67E+10	5.64E+09	6.27	5.84	21.68	4.71	4.60
2.09E+11	1.09E+10	8.60E+11	4.97E+10	1.15E+09	5.22	5.78	21.97	4.71	4.66
1.81E+11	1.21E+10	1.08E+12	5.97E+10	5.60E+08	6.70	5.53	20.32	4.71	4.32
2.26E+11	1.48E+10	1.18E+12	6.78E+10	2.58E+09	6.54	5.76	21.80	4.71	4.63
6.68E+11	2.89E+10	3.86E+12	1.56E+11	6.15E+09	4.33	4.04	18.56	4.71	3.94
4.19E+11	2.35E+10	1.27E+12	7.08E+10	4.71E+09	5.62	5.56	33.24	4.71	7.06
7.06E+11	4.43E+10	2.67E+12	1.29E+11	1.46E+09	6.28	4.83	34.29	4.71	7.28
3.05E+11	1.91E+10	1.48E+12	8.11E+10	1.25E+10	6.27	5.48	23.57	4.71	5.01
6.80E+11	3.88E+10	3.60E+12	1.58E+11	6.16E+09	5.71	4.38	24.61	4.71	5.23
6.91E+11	4.46E+10	2.44E+12	1.29E+11	1.45E+09	6.46	5.28	34.70	4.71	7.37
3.92E+11	2.48E+10	1.39E+12	7.69E+10	2.70E+09	6.34	5.54	32.29	4.71	6.86
3.20E+11	2.19E+10	1.24E+12	7.34E+10	3.48E+09	6.85	5.94	29.83	4.71	6.33
1.82E+11	9.51E+09	7.11E+11	3.34E+10	2.03E+08	5.24	4.71	28.45	4.71	6.04
4.37E+11	2.41E+10	4.47E+11	3.10E+10	2.90E+07	5.52	6.94	77.83	4.71	16.53
6.82E+11	3.93E+10	9.61E+11	5.74E+10	7.35E+09	5.76	5.98	68.38	4.71	14.52
1.04E+12	6.33E+10	1.58E+12	9.89E+10	6.99E+09	6.09	6.26	63.97	4.71	13.58
2.06E+11	1.32E+10	6.48E+11	3.86E+10	5.53E+08	6.37	5.95	34.10	4.71	7.24
9.58E+11	3.89E+10	1.96E+12	8.14E+10	4.52E+09	4.06	4.16	47.75	4.71	10.14
2.19E+11	1.07E+10	4.14E+11	2.14E+10	1.85E+08	4.87	5.16	49.97	4.71	10.61
6.30E+11	3.79E+10	1.75E+12	9.83E+10	8.27E+09	6.01	5.61	38.53	4.71	8.18
3.10E+11	1.94E+10	9.97E+11	5.50E+10	5.37E+09	6.25	5.51	35.28	4.71	7.49
2.55E+11	1.37E+10	5.79E+11	3.33E+10	3.20E+09	5.36	5.75	41.12	4.71	8.73

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***Gallionellaceae* sp. – natural enrichment under autotrophic growth conditions**

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8.98E+09	9.40E+07	6.39E+10	1.99E+08	4.95E+09	1.05	0.31	47.23	0.35	134.94
1.84E+09	1.60E+07	1.93E+10	6.80E+07	6.50E+09	0.87	0.35	23.53	0.35	67.22
2.04E+09	2.50E+07	5.34E+10	2.30E+08	1.19E+10	1.23	0.43	10.87	0.35	31.04
6.11E+09	5.90E+07	2.15E+11	6.87E+08	1.95E+10	0.97	0.32	8.58	0.35	24.52

8.09E+09	1.03E+08	3.29E+11	8.91E+08	6.54E+09	1.27	0.27	11.56	0.35	33.03
1.07E+10	1.08E+08	3.20E+11	8.48E+08	6.95E+09	1.01	0.27	12.74	0.35	36.39
4.28E+09	4.60E+07	2.00E+11	6.15E+08	1.06E+10	1.08	0.31	7.48	0.35	21.38
1.03E+10	1.19E+08	4.19E+11	1.08E+09	1.29E+10	1.15	0.26	11.05	0.35	31.57
1.48E+10	1.30E+08	6.88E+10	2.44E+08	2.77E+09	0.88	0.35	53.27	0.35	152.20
1.16E+10	1.14E+08	3.58E+11	8.86E+08	8.87E+09	0.98	0.25	12.87	0.35	36.76
2.06E+09	2.10E+07	7.12E+10	2.71E+08	4.46E+09	1.02	0.38	7.74	0.35	22.13
9.06E+09	8.40E+07	2.39E+11	6.76E+08	5.12E+09	0.93	0.28	12.43	0.35	35.52
3.74E+10	3.76E+08	2.43E+11	7.81E+08	1.12E+10	1.01	0.32	48.13	0.35	137.53
2.39E+10	2.48E+08	4.80E+11	1.41E+09	1.69E+10	1.04	0.29	17.60	0.35	50.29
1.09E+11	1.13E+09	2.18E+12	6.93E+09	2.34E+11	1.03	0.32	16.24	0.35	46.41
7.53E+10	7.76E+08	1.15E+12	3.67E+09	6.53E+10	1.03	0.32	21.16	0.35	60.45
1.15E+11	1.22E+09	2.06E+12	6.15E+09	1.18E+11	1.07	0.30	19.91	0.35	56.88
5.30E+10	5.64E+08	6.93E+11	2.13E+09	8.89E+10	1.06	0.31	26.52	0.35	75.78
1.07E+11	1.06E+09	2.46E+11	8.58E+08	1.15E+10	1.00	0.35	123.78	0.35	353.65

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***Bradyrhizobium* spp. – natural enrichment under heterotrophic growth conditions**

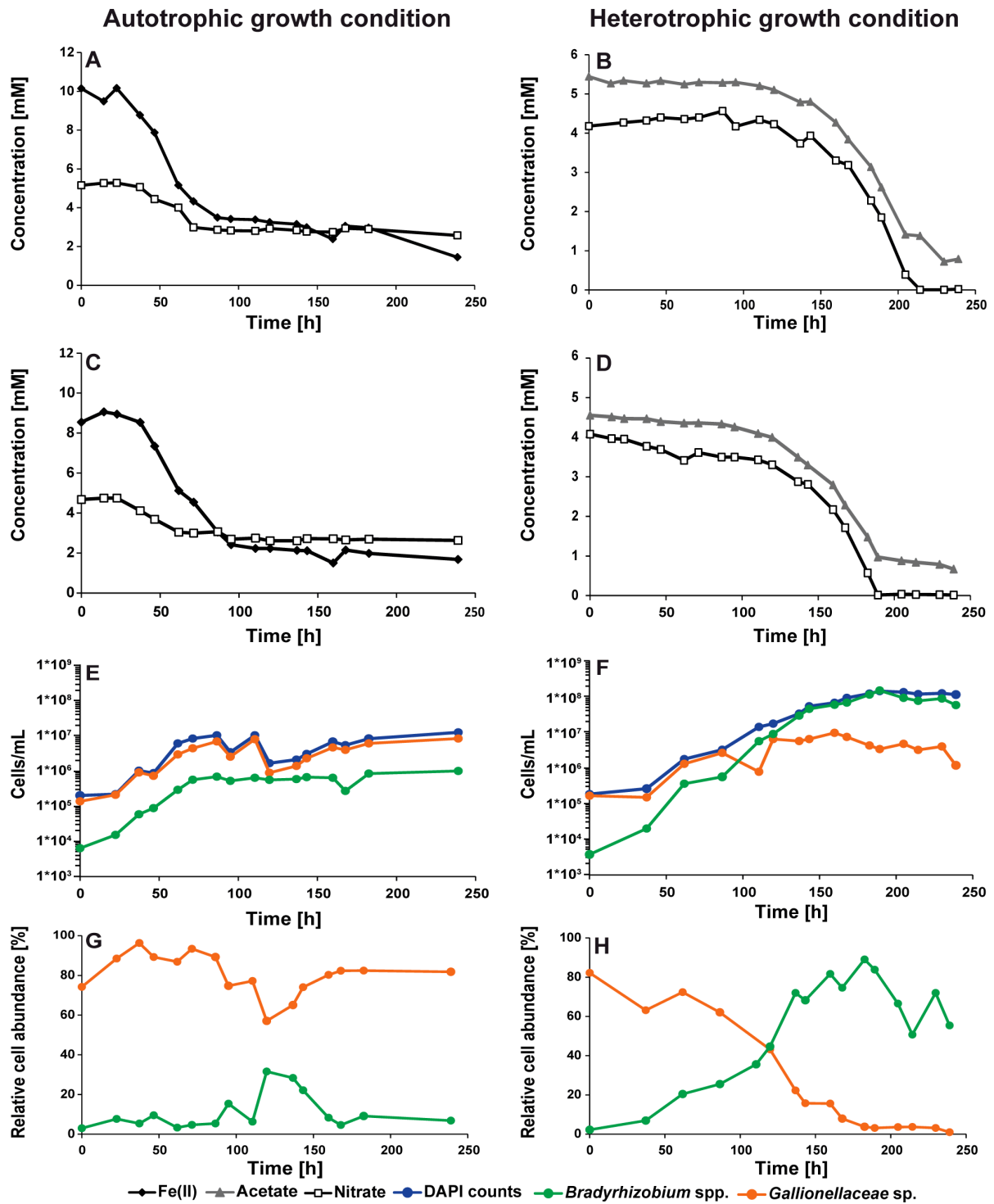
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6.48E+10	6.45E+08	3.36E+11	1.05E+09	2.70E+07	1.00	0.31	61.58	1.41	43.67
1.29E+11	1.22E+09	5.73E+11	1.78E+09	2.43E+08	0.94	0.31	98.71	1.41	70.01
1.32E+11	1.26E+09	7.42E+11	2.17E+09	1.07E+08	0.95	0.29	88.10	1.41	62.48
1.43E+11	1.37E+09	4.41E+11	1.39E+09	2.50E+07	0.96	0.31	117.58	1.41	83.39
3.34E+11	3.15E+09	1.98E+12	4.74E+09	8.10E+07	0.94	0.24	68.23	1.41	48.39
6.19E+10	6.15E+08	2.12E+11	6.98E+08	9.32E+08	0.99	0.33	85.55	1.41	60.67
5.04E+10	5.15E+08	2.07E+11	6.25E+08	2.36E+09	1.02	0.30	54.34	1.41	38.54
5.16E+10	5.42E+08	1.49E+11	4.61E+08	2.50E+07	1.05	0.31	136.81	1.41	97.03
4.44E+10	4.34E+08	2.14E+11	6.36E+08	3.40E+07	0.98	0.30	68.59	4.71	14.56
9.60E+10	9.60E+08	4.02E+11	1.16E+09	6.80E+09	1.00	0.29	57.92	4.71	12.30
4.00E+11	3.72E+09	1.74E+12	4.49E+09	1.81E+08	0.93	0.26	66.43	4.71	14.10
2.34E+10	2.31E+08	8.71E+10	2.70E+08	2.80E+07	0.99	0.31	82.39	4.71	17.49
4.72E+10	4.37E+08	2.01E+11	8.05E+08	7.00E+08	0.93	0.40	82.74	4.71	17.57
1.74E+10	1.71E+08	3.18E+10	1.25E+08	3.50E+07	0.98	0.39	82.87	4.71	17.59

1.67E+11	1.64E+09	1.35E+12	4.34E+09	1.08E+10	0.98	0.32	37.67	4.71	8.00
9.41E+09	1.01E+08	9.51E+09	3.50E+07	1.45E+08	1.07	0.37	288.59	4.71	61.27

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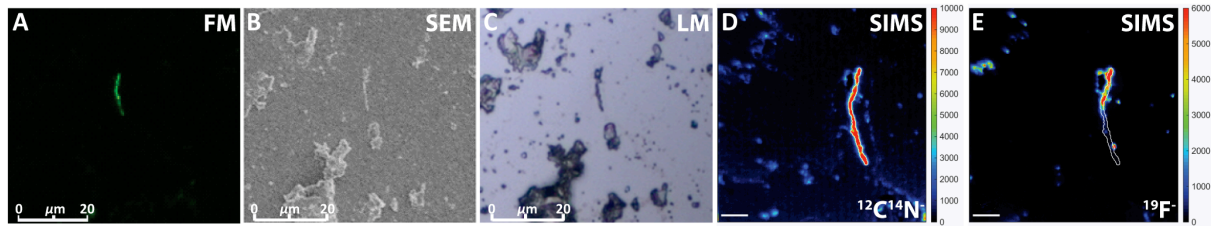




37

38 **Fig. S1:** Substrate consumption (A-D), cell growth (E-F), and relative cell abundances for the two culture  
39 KS strains *Gallionellaceae* sp. and *Bradyrhizobium* spp. (G-H) during cultivation under autotrophic (left  
40 panel) and heterotrophic (right panel) conditions. One set of data of experiments performed in  
41 duplicates is shown in C-H. The corresponding data for the second complete data set is provided in Fig.  
42 1 of the main manuscript. The third culture (A-B) was incubated without the labeled substrates and

43 used for the measurement of the natural enrichment of  $^{13}\text{C}$  and  $^{15}\text{N}$  in the cells. For this culture cell  
44 counts were not performed.



45

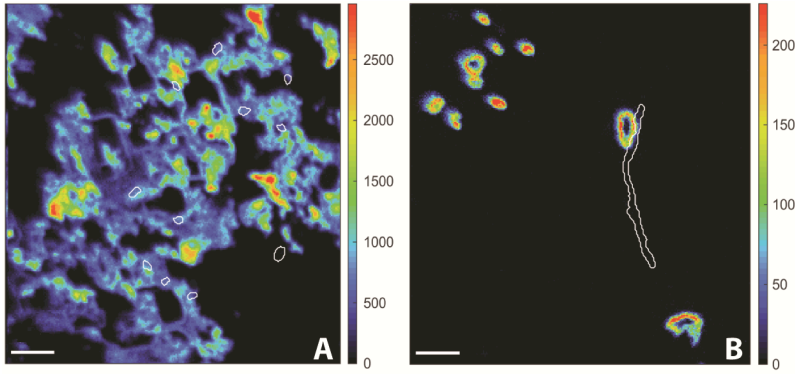
46 **Fig. S2:** Identification of regions of interests (ROIs). ROIs were identified based on CARD-FISH signals

47 (here: KS-Brady1249) using a fluorescence microscope (FM, A). Coordinates of these ROIs were

48 determined with light microscopy (LM, C) and Scanning Electron Microscopy (SEM) (B). CARD-FISH-

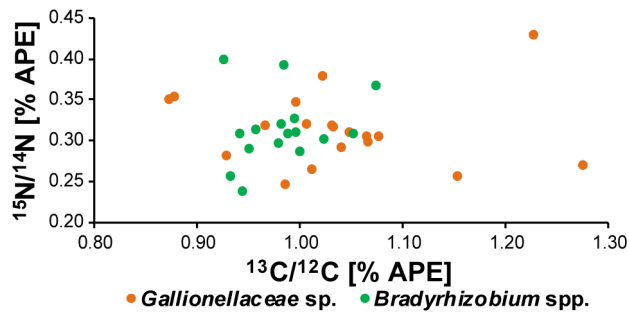
49 conferred  $^{19}\text{F}$  mass signals (E) helped to identify FISH positive cells of *Gallionellaceae* sp. and

50 *Bradyrhizobium* spp. in the mass spectrometer (D & E). Scale bars in D and E are 3  $\mu\text{m}$ .

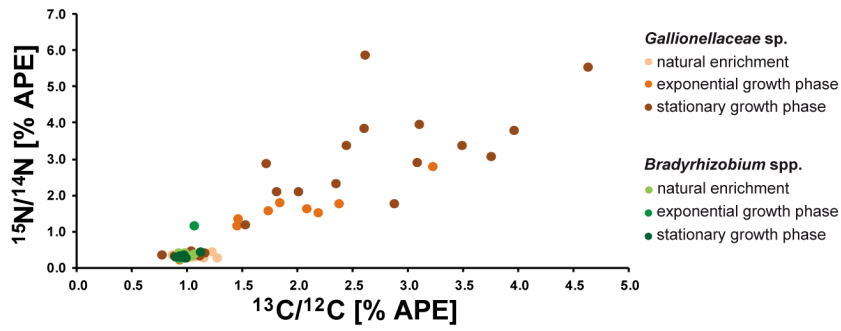


51

52 **Fig. S3:** NanoSIMS  $^{56}\text{Fe}^{16}\text{O}^-$  images of culture KS grown under autotrophic conditions with Fe(II) and  
53 nitrate (A) and heterotrophic growth conditions with acetate and nitrate (B). The white outlines  
54 indicate individual cells that have been identified and traced on the corresponding  $^{12}\text{C}^{14}\text{N}$  mass images.  
55 Scale bars are 3  $\mu\text{m}$ .

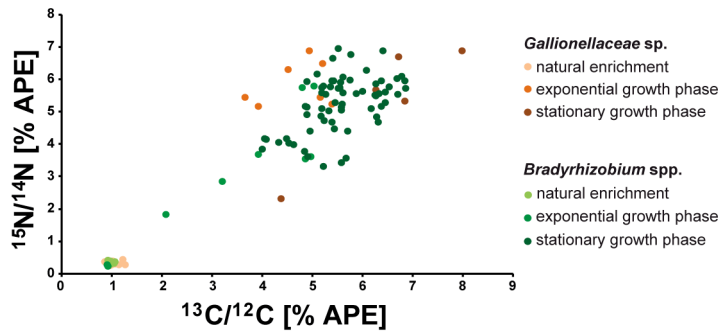


57 **Fig. S4:** Natural enrichments of  $^{13}\text{C}$  and  $^{15}\text{N}$  in *Gallionellaceae* sp. cells (orange) grown under  
 58 autotrophic conditions (Fe(II) and nitrate) and *Bradyrhizobium* spp. cells (green) grown under  
 59 heterotrophic conditions (acetate and nitrate). No isotopic-labeled substrates were added to the  
 60 medium. Measurements were done at the end of the stationary growth phase (183 h in Fig. S1A and  
 61 239 h in Fig. S1B).



62

63 **Fig. S5:** Enrichments of  $^{13}\text{C}$  and  $^{15}\text{N}$  in *Gallionellaceae* sp. cells (orange) and *Bradyrhizobium* spp. cells  
 64 (green) during growth of culture KS under autotrophic conditions (Fe(II) and nitrate). The  
 65 corresponding growth curve is shown in Fig. 1A, C, and E of the main manuscript. Samples for the  
 66 exponential growth phase were taken at 47 h and for the stationary growth phase on 183 h (see Fig.  
 67 1). The natural enrichments are the same as shown and described in Fig. S4.



68

69 **Fig. S6:** Enrichments of  $^{13}\text{C}$  and  $^{15}\text{N}$  in *Gallionellaceae* sp. cells (orange) and *Bradyrhizobium* spp. cells  
 70 (green) during growth of culture KS under heterotrophic conditions (acetate and nitrate). The  
 71 corresponding growth curve is shown in Fig. 1B, D, and F of the main manuscript. Samples for the  
 72 exponential growth phase were taken at 183 h and for the stationary growth phase on 239 h (see Fig.  
 73 1). The natural enrichments are the same as shown and described in Fig. S4.