Supplemental Material

Efficient metabolic exchange and electron transfer within a syntrophic TCE degrading co-culture of *Dehalococcoides mccartyi* 195 and *Syntrophomonas. wolfei*

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Supplemental material. Part 1.

Effect of TCE on *S. wolfei* growth.

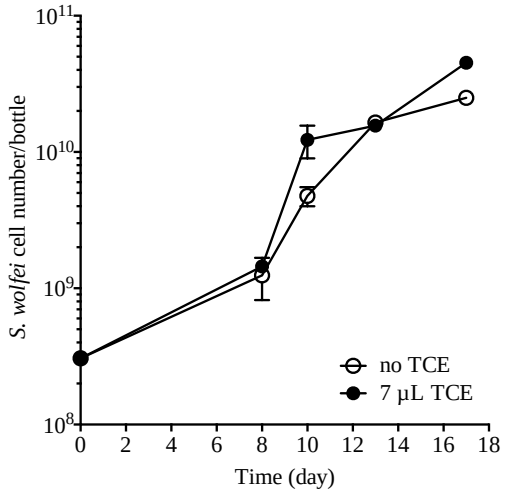

Fig. S1. Increase in the cell numbers of *S. wolfei* growing in pure culture with 10 mM crotonate with or without TCE amendment.

Time course of TCE degradation and cell growth in strain 195 and *S. wolfei* co-culture growing on crotonate as the sole electron donor. The experiment was carried out after 80 transfers (5% vol/vol inoculation, around 1,600 generations) of the original set-up co-culture.

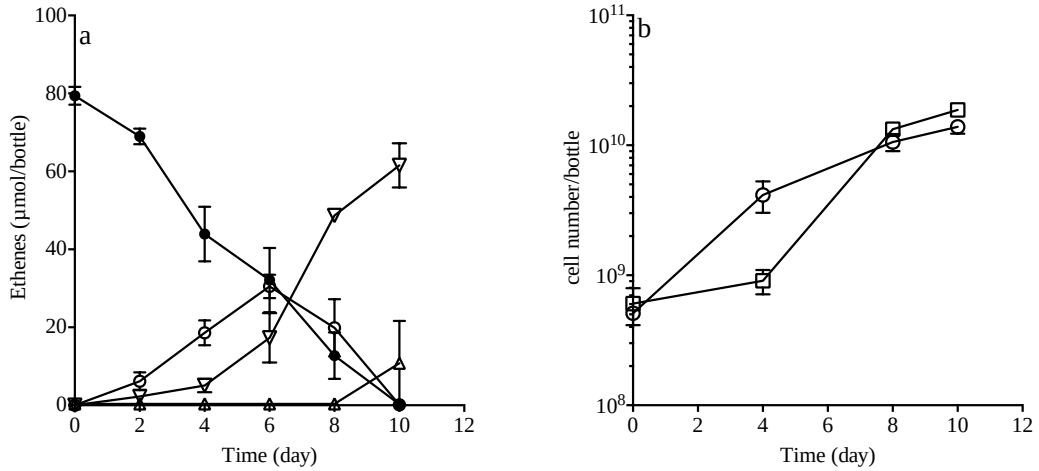

Fig. S2. a) Time course of TCE removal and production of TCE-reduced metabolites in strain 195 and *S. wolfei* co-culture growing on 5 mM crotonate (TCE, *cis*-DCE, VC, ETH), and b) Cell growth of *S. wolfei* and strain 195 growing on 5 mM crotonate. The cell numbers were normalized to 16S rRNA gene copy numbers. The symbols indicate the averages based on biological triplicate determinations. The error bars indicate standard deviation.

Supplemental material. Part 2.

Calculation of (i) standard Gibbs free energy and entropy changes of acetogenic butyrate fermentation catalyzed by *S. wolfei* and (ii) Gibbs free energy of acetogenic fermentative degradation of butyrate in the course of TCE dechlorination by the strain 195 and *S. wolfei* co-culture.

$$C_4H_7O_2^- + 2H_2O \rightarrow 2C_2H_3O_2^- + H^+ + 2H_2$$

$$\Delta G = \Delta G^\circ + RT\, lnK = \Delta G^\circ + RT\, ln\frac{[\text{Acetate}]^2\,[H^+]\,p_{H_2}^2}{[\text{Butyrate}]} = \Delta G^\circ_{\text{pH}} + RT\, ln\frac{[\text{Acetate}]^2\,p_{H_2}^2}{[\text{Butyrate}]}$$

$$\Delta G^\circ_{\text{pH,298.15K}} = \Delta G° + nRT\ln[H^+] = \Delta G° - 2.3026nRT \times pH = \Delta G° - 5.708n \times pH$$

R =0.00831451 kJ mol^{-1} K^{-1}=0.083451 L bar mol^{-1} K^{-1}.

$n =$ number of protons.

ΔG° = Standard Gibbs free energy change of reaction when all reactants and products are present at unit activity at a specified standard state (i.e., 298.15 K, 100 kPa = 1bar).

p_{H_2} = Hydrogen partial pressure (bar); $[H_{2(aq)}] = \frac{p_{H_{2(g)}}}{k_H}$.

k_H (H_2, 298.15K) =1.299038× 10^3 bar L mol^{-1} (1.236747 × 10^3 bar L mol^{-1} at 307.15 K) (1).

The pH during syntrophic butyrate fermentation and TCE dechlorination was maintained at 7.3 by a dual buffer bacterial growth medium ($NaHCO_3^-$ and TES) (i.e., $[H^+]= 5 \times 10^{-8}$ mol L^{-1}).

The standard Gibbs free energy change of reaction (ΔG_r°) for acetogenic butyrate fermentation $C_4H_7O_2^- + 2H_2O \rightarrow 2C_2H_3O_2^- + H^+ + 2H_2$ is calculated using the Hess's law and the standard molar Gibbs energy of formation (Table S1).

Table S1. Standard molar Gibbs energy of formation ($\Delta_f G_i^\circ$), standard molar enthalpy of formation ($\Delta_f H_i^\circ$) and standard molar entropy (S_i°) values (at 298.15 K, unit activity) used for the calculation of $\Delta G_r^\circ, \Delta H_r^\circ$ and ΔS_r° of butyrate fermentation reaction.

Reactant/product	$\Delta_f \boldsymbol{G_i^\circ}$ (kJ mol^{-1})	$\Delta_f \boldsymbol{H_i^\circ}$ (kJ mol^{-1})	$\boldsymbol{S_i^\circ}$ (kJ mol^{-1} K^{-1})[a]
Butyric acid (ionized form), pK_a = 4.821	-352.6[b]	-536[c]	0.1358[d]
Acetic acid (ionized form), pK_a = 4.757	-369.4[b]	-486.0	0.0866
$\mathbf{H^+}$ (pH = 0)	0	0	0
$\mathbf{H_2O}$	-237.17	-285.8	0.070
$\mathbf{H_2}$ (g)	0	0	0.1307
$\mathbf{H_2}$ (aq)	17.8[e]	-4.16[f]	0.0577[f]

(a) Data obtained from reference (2) and (3); (b) Thermodynamic values for ionized forms of butyric acid and acetic acid from reference (4); (c) Calculated from reference (5); (d) reference (6); (e) Calculated from $\Delta_f G^\circ_{i(\mathrm{aq})} = \Delta_f G^\circ_{i(\mathrm{g})} + RT\, ln k_{\mathrm{H},i}$, as described in reference (7); (f) values are from reference (4).

$$\Delta G_r^\circ = \left(2 \times \Delta_f G^\circ_{\mathrm{CH_3COO^-\,(aq)}}\right) + \left(\Delta_f G^\circ_{\mathrm{H^+(aq)}}\right) + \left(2 \times \Delta_f G^\circ_{\mathrm{H_{2(g)}}}\right) - \left[\left(2 \times \Delta_f G^\circ_{\mathrm{H_2O\,(aq)}}\right) + \left(\Delta_f G^\circ_{\mathrm{C_4H_7O_2^-\,(aq)}}\right)\right]$$

= [2×(-369.4 kJ mol^{-1})+(0 kJ mol^{-1})+ 2×(0 kJ mol^{-1})]-[2× (-237.17 kJ mol^{-1})+(-352.63 kJ mol^{-1})]=88.17 kJ mol^{-1}

For the calculation of the standard Gibbs free energy of reaction using the standard Gibbs free energy of formation of hydrogen in the aqueous phase (i.e., all reactants and products are in dissolved or liquid state, $\Delta G^\circ_{r,(\mathrm{aq})}$),

$\Delta G^\circ_{r,(\mathrm{aq})}$= [2×(-369.4kJ mol^{-1})+(0 kJ mol^{-1})+2×(17.8 kJ mol^{-1})]-[2×(-237.17kJ mol^{-1})+(-352.63 kJ mol^{-1})]=123.7 kJ mol^{-1}

Because the experiments are carried out at 307.15 K, the standard Gibbs free energy change of reaction is corrected for the desired incubation temperature using the Gibbs-Helmholtz equation.

$$\left(\frac{\partial(\Delta G/T)}{\partial T}\right)_p = -\frac{\Delta H}{T^2}$$

ΔH_r°=[2×(-486kJ mol^{-1})+(0kJ mol^{-1})+2×(0 kJ mol^{-1})]-[2×(-285.8kJ mol^{-1})+(-536kJ mol^{-1})]

=135.6 kJ mol^{-1}

$\Delta H^{\circ}_{r(aq)}$=[2×(-486kJ mol^{-1})+(0 kJ mol^{-1})+2×(-4.16 kJ mol^{-1})]-[2×(-285.8 kJ mol^{-1})+(-536 kJ mol^{-1})]=127.28kJ mol^{-1}

ΔS°_{r} =[2×(0.0867 kJ mol^{-1} K^{-1})+(0 kJ mol^{-1} K^{-1})+ 2×(0.1307 kJ mol^{-1} K^{-1})]-[2×(0.07 kJ mol^{-1} K^{-1})+(0.1358 kJ mol^{-1} K^{-1})]= 0.159 kJ mol^{-1} K^{-1}

$\Delta S^{\circ}_{r(aq)}$ =[2×(0.0867 kJ mol^{-1} K^{-1})+(0 kJ mol^{-1} K^{-1})+2×(0.0577 kJ mol^{-1} K^{-1})]-[2×(0.07 kJ mol^{-1} K^{-1})+(0.1358 kJ mol^{-1} K^{-1})]= 0.013 kJ mol^{-1} K^{-1}

Using the Gibbs-Helmholtz equation,

$$\Delta G^{\circ}_{307.15} = 307.15\left(\frac{\Delta G^{\circ}_{298.15}}{298.15}\right) + \left(\frac{\Delta H^{\circ}\,(298.15-307.15)}{298.15}\right) = 86.74 \text{ kJ mol}^{-1}$$

Using another form of the Gibbs-Helmholtz equation,

$$\Delta G^{\circ}_{307.15} = \Delta G^{\circ}_{298.15} - \Delta S^{\circ}\,(307.15 - 298.15)$$

=88.17 kJ mol^{-1}- [0.159 kJ mol^{-1} K^{-1}×9 K]= 86.74 kJ mol^{-1}

When all reactants and products are in dissolved or liquid state,

$$\Delta G^{\circ}_{307.15(aq)} = 307.15\left(\frac{\Delta G^{\circ}_{298.15(aq)}}{298.15}\right) + \left(\frac{\Delta H^{\circ}_{(aq)}\,(298.15-307.15)}{298.15}\right) = 123.59 \text{ kJ mol}^{-1}$$

A minimum of free energy about -20 kJ mol^{-1} is required by a bacterium to exploit the free energy change in a reaction and support growth (8). Therefore, each data point of Gibbs free energy change of reaction was calculated based on the measurement of each compound concentration at specific time (9). Table S2 presents an example of calculation of Gibbs free energy available for *S. wolfei* during syntrophic growth with strain 195 in the presence of butyrate as the sole electron donor.

Table S2. Sample calculation for free Gibbs energy available for *S. wolfei*[(a)]

Time (day)	H_2 partial pressure ($\times 10^{-5}$ bar)	$H_{2(aq)}$ (nM)[(b)]	Acetate concentration (M)	H^+ (M)	Butyrate Concentration (M)	$\Delta G^\circ_{307.15K}$ (kJ mol^{-1})	Final delta G (kJ mol^{-1})
0	2.7	21.8	9.0×10^{-5}	5×10^{-8}	4.3×10^{-3}	86.7	-43.6[(c)]
2	5.9	47.5	1.5×10^{-4}	5×10^{-8}	4.6×10^{-3}	86.7	-37.1
4	15.3	123.8	3.1×10^{-4}	5×10^{-8}	4.5×10^{-3}	86.7	-28.5
6	21.9	177.0	7.5×10^{-4}	5×10^{-8}	4.2×10^{-3}	86.7	-22.0
8	42.9	347.0	1.7×10^{-3}	5×10^{-8}	3.7×10^{-3}	86.7	-13.9
10	126.6	1023.7	2.0×10^{-3}	5×10^{-8}	3.4×10^{-3}	86.7	-7.5
12	118.2	955.5	2.3×10^{-3}	5×10^{-8}	3.5×10^{-3}	86.7	-7.2
14	152.4	1232.4	2.54×10^{-3}	5×10^{-8}	3.5×10^{-3}	86.7	-5.4
16	160.8	1300.1	2.61×10^{-3}	5×10^{-8}	3.5×10^{-3}	86.7	-5.0
18	192.4	1555.5	2.32×10^{-3}	5×10^{-8}	3.2×10^{-3}	86.7	-4.5

(a) The calculation summarized in the table is for one biological replicate in the feeding cycle, (b) Henry's law constant of hydrogen gas at 307.15 K = 1.236747×10^3 bar L mol^{-1}, (c) If we use aqueous concentration of H_2, $\Delta G = \Delta G^\circ_{(aq)} + RT\, ln \frac{[\text{Acetate}]^2\,[H^+]\,[H_2]^2}{[\text{Butyrate}]}$ =123.59 kJ mol^{-1} + (0.00831451 kJ mol^{-1} K^{-1}×307.15K) $ln \frac{\left((9\times10^{-5}\ \text{M})^2\,(5\times10^{-8}\ \text{M})\,(21.8\times10^{-9}\ \text{M})^2\right)}{(4.3\times10^{-3}\ \text{M})}$ = -43.1 kJ mol^{-1}

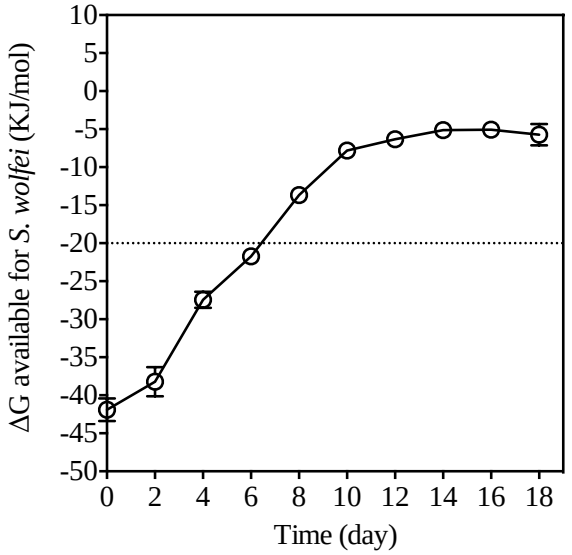

Fig. S3. Gibbs free energy available for *S. wolfei* during syntrophic fermentation of butyrate with strain 195.

Supplemental material. Part 3.

The method used to determine H_2 threshold in the co-culture was based on the method described by Löffler (10). Briefly, triplicate 100-mL co-cultures were inoculated (2%, vol/vol) from active dechlorinating cultures that had completely reduced all of the TCE present to ethene. One set of the triplicate cultures were amended with 7 µL neat TCE (~ 78 µmol), and 25 µL 1M butyrate stock solution (0.25 mM butyrate) while the other set did not receive an electron acceptor. The concentrations of chlorinated compounds were determined weekly, and the H_2 concentration was measured accordingly. Values for H_2 threshold were assessed when the H_2 concentration remained stable.

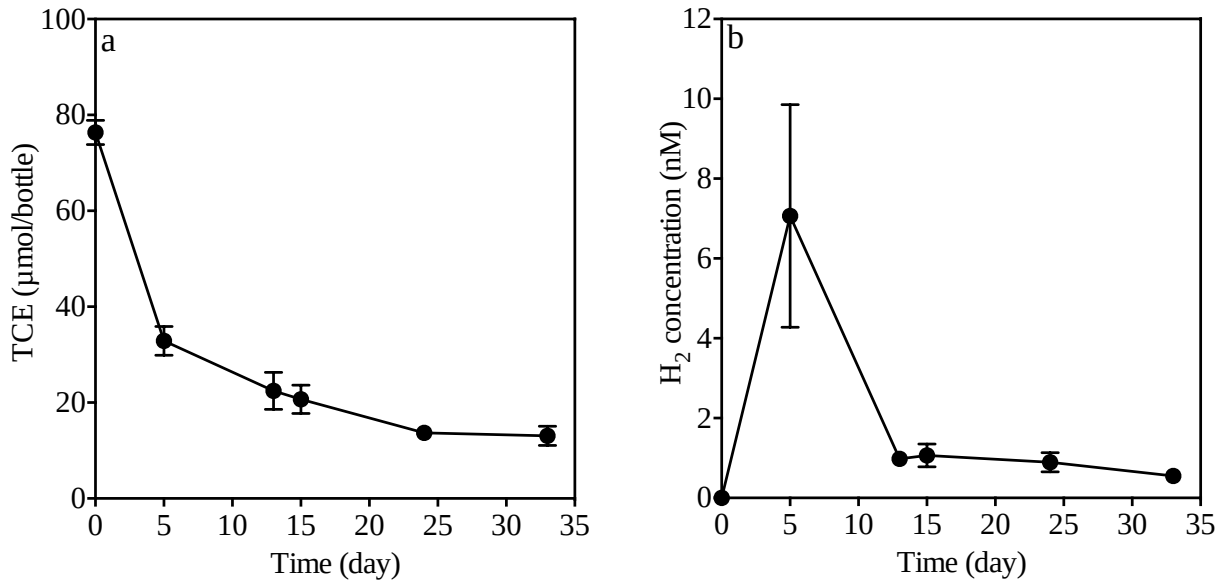

Fig. S4. a) Time course of TCE removal and b) Aqueous H_2 concentration in the bottle while co-culture strain 195 and *S. wolfei* was fed with 0.25 mM butyrate and 78 µmol TCE. 5µL butyrate (0.05 mM) was re-spiked to the bottle (on day 15) when TCE removal significantly decreased (no peak of H_2 was observed because of the long delay of sampling). The measured values correspond to the averages based on biological triplicate determinations. The error bars indicate standard deviation.

Supplemental material. Part 4.

5.1 Calculation of allowed interspecies distance for butyrate fermentation in strain 195 and *S. wolfei* co-culture by using Fick's diffusion law.

$$J_{H_2} = D_{H_2} \times \frac{\Delta C_{H_2}}{d_{sw-195}}$$

$$d_{sw-195} = D_{H_2} \times \frac{\Delta C_{H_2}}{J_{H_2}}$$

1. J_{H2} = H_2 flux (pmol μm^{-2}_{cell} d^{-1}) across the total surface area ($A_{S,tot}$) of H_2-producing *S. wolfei*.

The hydrogen flux J_{H2} in the co-culture experiment was calculated on the basis of the oxidation rate of butyrate by *S. wolfei* at a specific interval time and the hydrogen consumption rate of strain 195.

2. $A_{S,tot}$: total surface area over which hydrogen diffuses (total surface area of H_2-producing *S. wolfei*) (μm^2).

   Surface area of *S. wolfei*: assume diameter= 0.25μm, length= 2.5 μm

$$A_S = \pi dl + \frac{1}{2}\pi d^2 = 2.1\ \mu m^2\ cell^{-1}$$

$$A_{S,tot} = A_S \times \text{cell number}$$

3. D_{H2}= molecular diffusion coefficient in water for hydrogen at 35 °C, 6.31×10^{-5} cm^2 s^{-1} = 6.31×10^{-9} m^2 s^{-1} (2).

4. ΔC_{H2} is the maximum difference of hydrogen concentration at the outside cell surface between the H_2-producing *S. wolfei* and H_2-consuming strain 195, taking into account the highest H_2 level at which *S. wolfei* can ferment butyrate and the lowest H_2 level at which strain 195 can dechlorinate TCE (H_2 threshold for strain 195).
   $\Delta C_{H2} = C_{H2\text{-}sw} - C_{H2\text{-}195} = 3.494 \times 10^{-1}\mu M$
   $C_{H2\text{-}sw} = 0.35 \pm 0.1\mu M$
   $C_{H2\text{-}195} = 0.6 \times 10^{-3}\mu M$

Calculated from Fig. 1b-c of the manuscript.

* Incubation period: $t_{day2\text{-}day4}$= 2 days

* H_2 produced in the defined time interval by *S. wolfei* (day4-day2) was 3.4×10^7 pmol. The number was calculated from theoretical hydrogen production by butyrate fermentation using Equation 2 in Table 1 of the manuscript. Because hydrogen production (from butyrate fermentation) is directly linked to generation of energy in *S. wolfei* cells, hydrogen will be formed during bacterial growth. The theoretical yield of hydrogen from biomass $Y_{H2/X}$ can be calculated from the measured amount of hydrogen produced during the incubation time Δt per unit of biomass formed.

Biomass formation during incubation period (day2 and day4) = 2.7×10^8 cells.

Cell number of *S.wolfei* on day 2 = 7.4×10^7 cells.
Cell number of *S.wolfei* on day 4 = 3.4×10^8 cells.

$$Y_{H_2/X} = \frac{3.4 \times 10^7 \text{ pmol}}{2.7 \times 10^8 \text{ cells}} = 0.1259 \text{ pmol cell}^{-1}$$

* H_2 consumed in the defined time interval by strain 195 (day4-day2) was 2.8×10^7 pmol. Hydrogen consumption during the targeted incubation time is mainly due to TCE dechlorination activity of strain 195.The number was calculated from the Cl^- production rate based on direct GC measurements using Equations 3-5 in Table 1 of the manuscript. This number is slightly lower than the H_2 produced, due to part of the electrons went to biosynthesis.

The hydrogen flux is calculated using the following equation:

$$J_{H_2} = \frac{H_2 \text{produced (pmol) in the defined time interval } \Delta t \text{ by } S.wolfei}{\text{total surface area of growing } S.wolfei \text{ in } \Delta t \times \Delta t}$$

$$J_{H_2} = \frac{3.4 \times 10^7 \text{ pmol}}{2.7 \times 10^8 \text{ cell} \times 2.1 \times 10^{-12} \frac{\text{m}^2}{\text{cell}} \times 1.728 \times 10^5 \text{ s}} = 3.47 \times 10^5 \text{ pmol m}^{-2} \text{ s}^{-1}$$

$$d_{sw-\text{strain 195}} = D_{H_2} \times \frac{C_{H_2-sw} - C_{H_2-\text{strain 195}}}{J_{H_2}}$$

$$d_{sw-\text{strain 195}} = \frac{6.31 \times 10^{-9} \frac{\text{m}^2}{\text{s}} \times \frac{3.494 \times 10^5 \text{ pmol}}{10^{-3} \text{ m}^3}}{3.47 \times 10^5 \frac{\text{pmol}}{\text{m}^2 \times \text{s}}} = 6.3 \text{ µm}$$

On day 4, *S.wolfei* cell number was 3.4×10^8 per bottle and strain195 cell number was 4.7×10^9 per bottle (i.e. 5.04×10^9 total cells / bottle containing 100-mL culture medium). In a previous study, the calculation showed *S. wolfei* (H_2 producer) could only exert an influence on local H_2 concentrations within 10µm of its surface (13).

There are two scenarios of cell distribution in the bottle:

Scenario 1: Cell aggregation between strain 195 and *S. wolfei*

Cell-cell distances in cell aggregates <1 μm. Previous studies calculated the cell-cell distance of aggregated cells to be 0.08~2 μm in propionate degrading co-cultures (14,15).

Scenario 2: Equal distribution of cells growing in planktonic state:

Assuming the cells were evenly dispersed in the bottle, the average cell-cell distance will be 27.1 μm.

$$d_{cell-cell} = \frac{1cm}{\sqrt[3]{5.04\times10^7}} \times \frac{10^4\ \mu m}{1cm} = 27.1\ \mu m$$

This distance is larger than the predicted distance (6.3 μm) that can support interspecies hydrogen transfer at the measured butyrate oxidation rate (calculated above).

Therefore, in order to accomplish syntrophic butyrate oxidation at the rate observed, the average interspecies distance should be much less than the distance between randomly dispersed cells.

5.2. Allowed interpecies distance in another syntrophic co-culture *Desulfovibiro vulgaris* Hildenborough (DvH) with strain195 growing on lactate.

A comparison of the allowed interspecies distances is summarized below:

Table S3 Parameters in Fick's equation and allowed interspecies distance calculation.[a]

	S. wolfei with strain 195 on butyrate	DvH with strain 195 on lactate
As (μm^2)	2.1	1.3[b]
$\Delta Cell_{syn}$ (day4-day2)[c]	2.7×10^8	1.1×10^9
$C_{H2\text{-}syn}$ μM	0.35±0.1	38.9[d]
J_{H2} (pmol m^{-2} s^{-1})	3.5×10^5	3.2×10^5
$d_{syn\text{-}strain195}$ (μm)	6.3	755

(a) The values were calculated in a time interval from day 2 to day 4, at 307.15 K, (b) Surface area of DvH: assume diameter= 0.25 μm, length= 1.5 μm, (c) Syntroph cell number increase from day 2 to day4. DvH cell number increase was calculated from unpublished data, (d) The highest H_2 level at which DvH can ferment lactate was calculated from Figure 3a. reference (16).

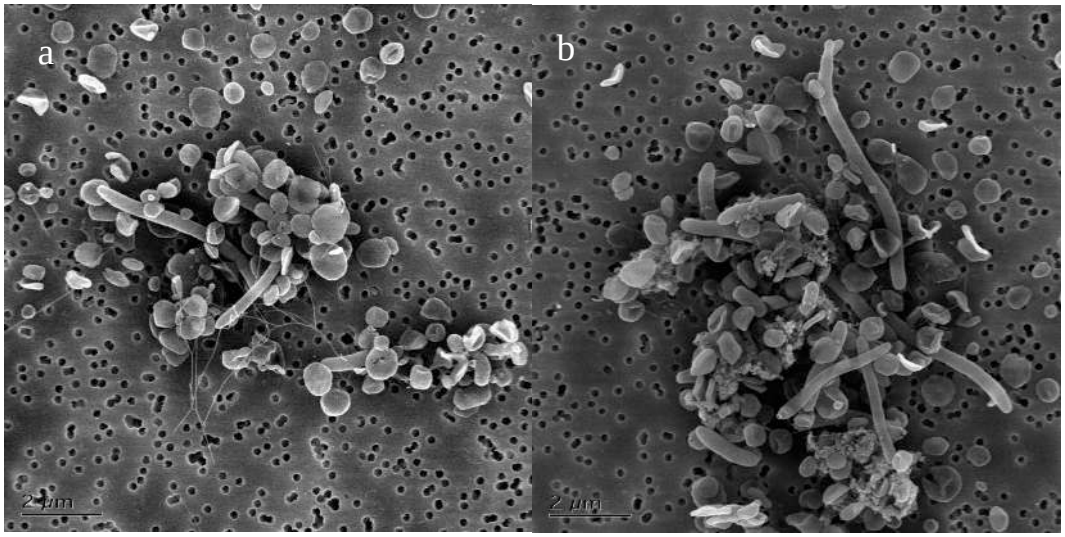

Fig. S5. Cell aggregates observed on a) day 4 and b) day 6 in co-culture *S.wolfei*/strain 195 growing on butyrate during exponential growth phase.

Supplemental material. Part 5.

The Gibbs free energy available for strain 195 to dechlorinate TCE to *cis*-DCE has been calculated at different H_2 concentrations.

$TCE + H_2 \rightarrow$ *cis*-DCE $+ Cl^- + H^+$

The standard free energy of reductive dechlorination of TCE to *cis*-DCE is calculated using the Hess's law and the standard molar Gibbs energy of formation (Table S3).

Table S4. Standard free energy of formation of reactants and products.

Compound	$\Delta_f \boldsymbol{G_i^\circ}$ (**g**) (kJ mol^{-1})	$\Delta_f \boldsymbol{G_i^\circ}$ (**aq**) (kJ mol^{-1})	$\Delta_f \boldsymbol{H_i^\circ}$ (kJ mol^{-1})[(c)]
TCE	19.9[(a)]	25.53[(b)]	-32.2
H_2	0	17.8	0
cis-DCE	24.3[(a)]	27.82[(b)]	-26.9
Cl^-	N.A.	-131.3	0
H^+	N.A.	0	0

(a) reference (11), (b) Using $\Delta_f G^\circ_{i(\mathrm{aq})} = \Delta_f G^\circ_{i(\mathrm{g})} + RT\ lnk_{\mathrm{i,H}}$, k_H (TCE, 298.15K)= 9.706935 bar L mol^{-1}and k_H (TCE, 298.15K)=4.134060 bar L mol^{-1} (12), (c) reference (2)

$\Delta G_r^\circ = -\Delta_f G^\circ_{\mathrm{TCE,aq}} - \Delta_f G^\circ_{\mathrm{H_2}} + \Delta_f G^\circ_{cis-\mathrm{DCE,aq}} + \Delta_f G^\circ_{\mathrm{H^+}} + \Delta_f G^\circ_{\mathrm{Cl^-}}$= -128.9 kJ mol^{-1}

ΔH_r°=[(-26.9 kJ mol^{-1})+ (0 kJ mol^{-1}) + (0 kJ mol^{-1})]-[(-32 kJ mol^{-1})+(0 kJ mol^{-1})]= 5.3 kJ mol^{-1}

Using the Gibbs-Helmholtz equation,

$\Delta G^\circ_{307.15} = 307.15 \left(\frac{\Delta G^\circ_{298.15}}{298.15}\right) + \left(\frac{\Delta H^\circ\ (298.15-307.15)}{298.15}\right)$ = -132.95 kJ mol^{-1}

The Gibbs free energy available for strain 195 to dechlorinate TCE to *cis*-DCE is calculated using the following equation:

$$\Delta G = \Delta G^\circ + RT\ lnK = \Delta G^\circ + RT\ ln \frac{[c\mathrm{DCE}]\ [\mathrm{H^+}]\ [\mathrm{Cl^-}]}{[\mathrm{TCE}]\ p_{\mathrm{H_2}}}$$

Table S5. Calculation of Gibbs free energy of reductive dechlorination of TCE to *cis*-DCE in the presence of H_2[(a)].

H_2 ($\times 10^{-5}$ bar)	$H_{2(aq)}$[(b)] (M)	Cl^- (M)	H^+ (M)	TCE (M)	*cis*-DCE (M)	$\Delta G^{\circ}_{r,\mathrm{TCE-cDCE}}$ (kJ mol^{-1})	ΔG (kJ mol^{-1})
7.4×10^{-2}	6.0×10^{-10}	0.025	5×10^{-8}	9.6×10^{-5}	4.3×10^{-4}	-133.0	-145.5
7.4×10^{-10}	6.0×10^{-18}	0.025	5×10^{-8}	9.6×10^{-5}	4.3×10^{-4}	-133.0	-98.4
7.4×10^{-18}	6.0×10^{-26}	0.025	5×10^{-8}	9.6×10^{-5}	4.3×10^{-4}	-133.0	-51.4
7.4×10^{-24}	6.0×10^{-32}	0.025	5×10^{-8}	9.6×10^{-5}	4.3×10^{-4}	-133.0	-16.1
7.4×10^{-28}	6.0×10^{-36}	0.025	5×10^{-8}	9.6×10^{-5}	4.3×10^{-4}	-133.0	7.4

(a) TCE and *cis*-DCE concentrations were measured on day 33 under electron donor-limited condition (Fig. S4). Gas-liquid equilibrium was assumed for calculation. H_2 concentration on day 33 was 0.6 nM (Fig. S4). Henry's law constants used for calculation at 307.15 K are 15.309744 bar L mol^{-1} (dimensionless value: 0.591) and 7.65337 bar L mol^{-1} (dimensionless value: 0.216) for TCE and *cis*-DCE, respectively (12).

(b) Henry's law constant of H_2 at 307.15 K = 1.236747×10^3 bar L mol^{-1}.

Reference

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