Supplementary Information for:

Taxis Toward Hydrogen Gas by *Methanococcus maripaludis*

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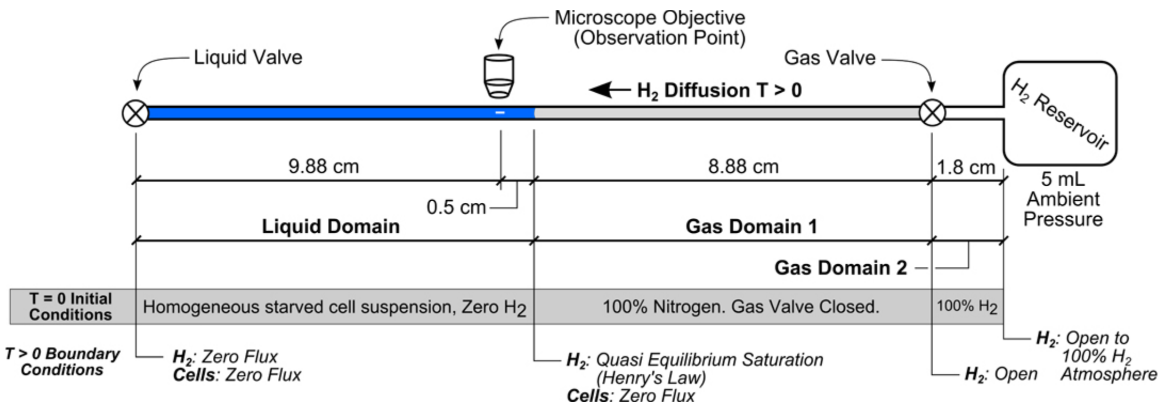
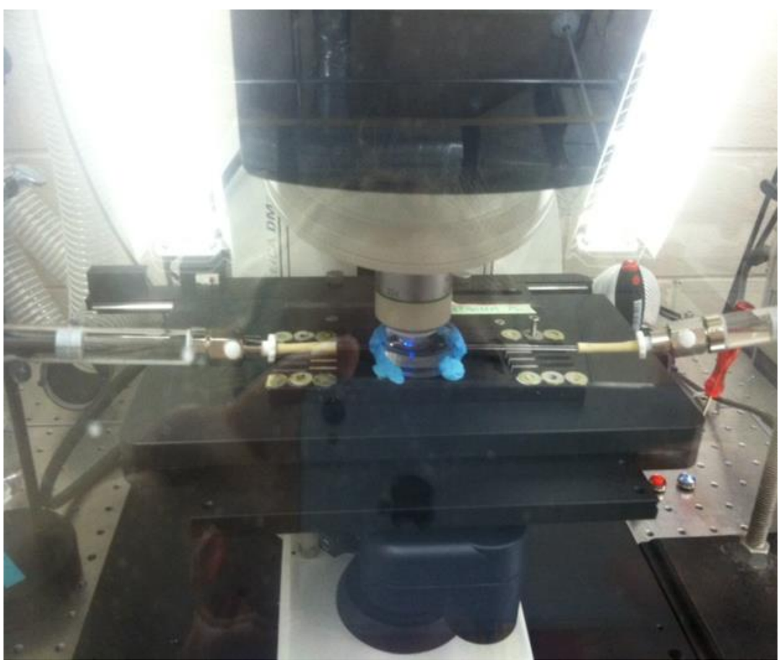
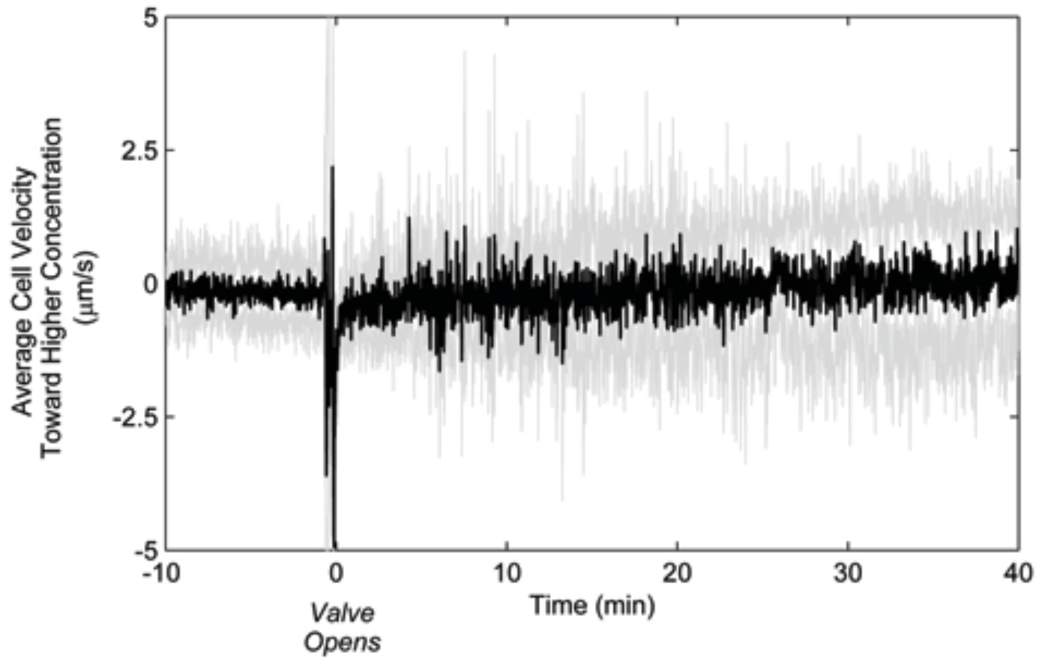


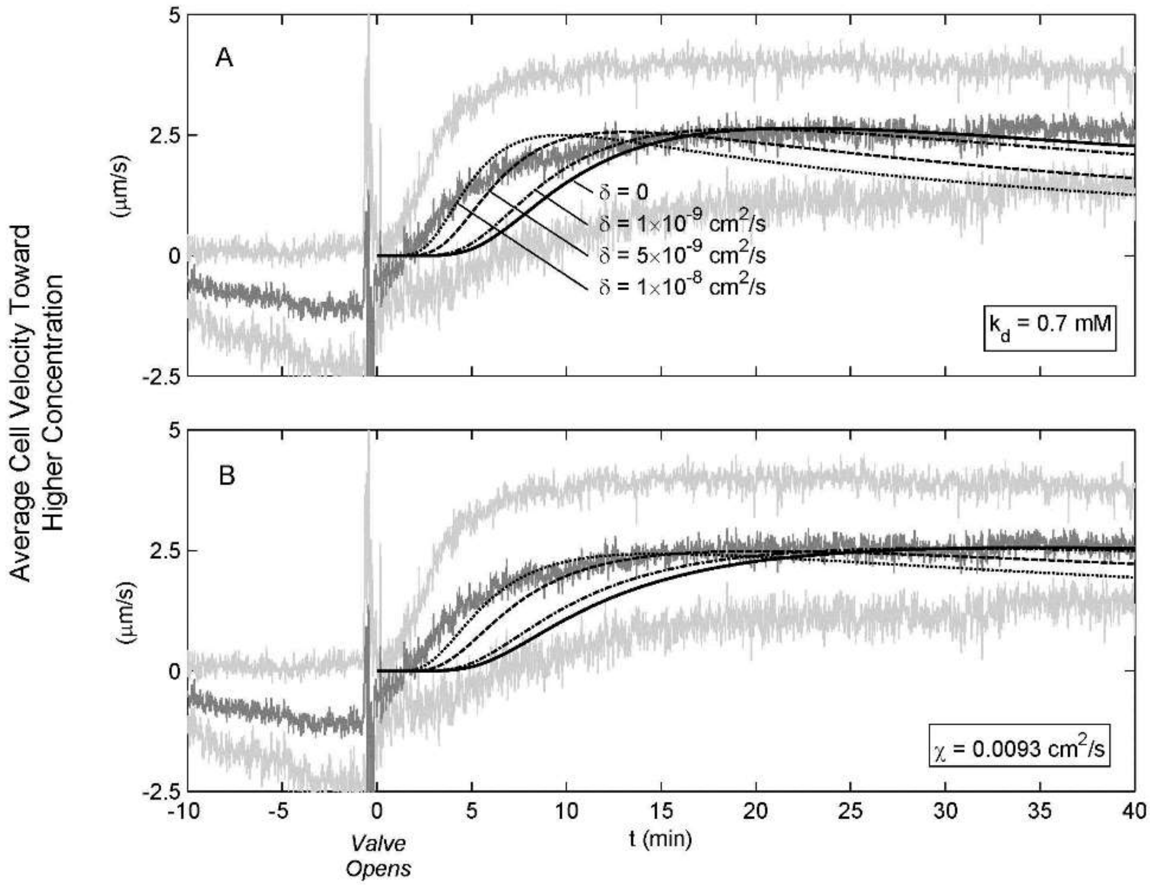
Supplementary Figure S1. Model boundary conditions



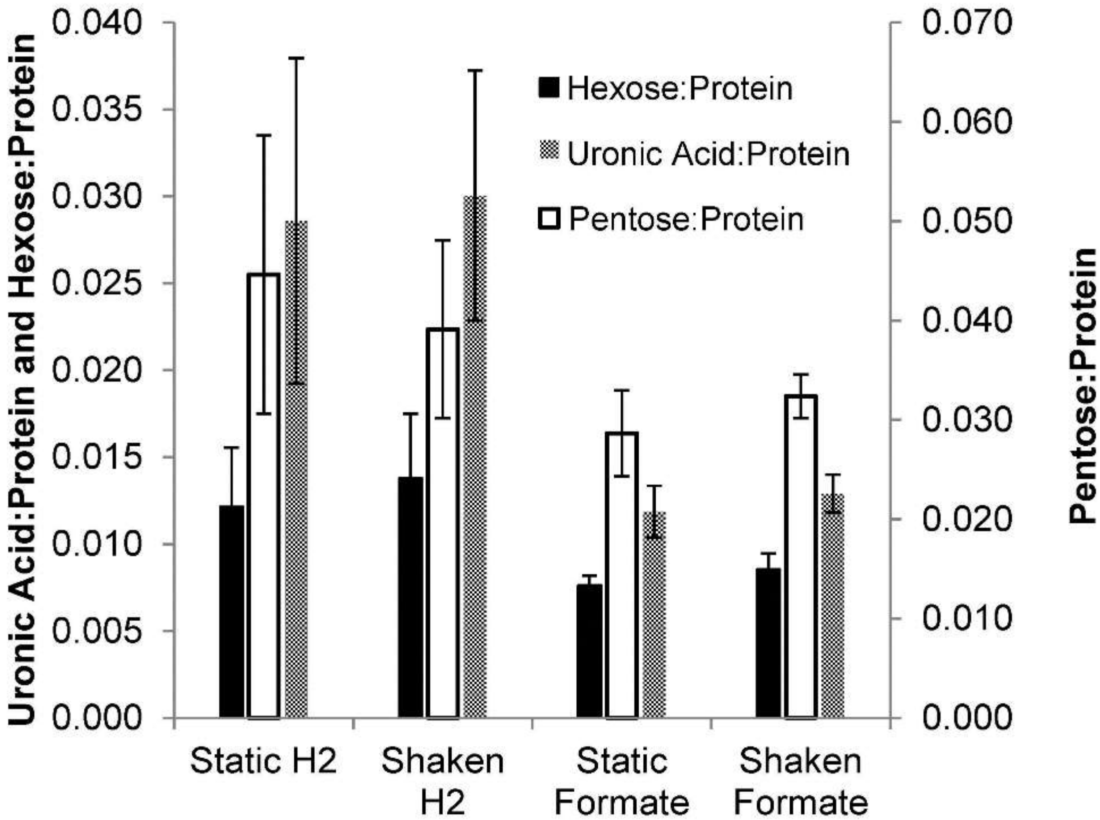
Supplementary Figure S2. Capillary assay setup on microscope stage. The petri dish water bath allowed the capillary to be maintained at a constant temperature and maintained a reliable water column for the water-dipping objective without the need to add water, for the duration of data collection.



Supplementary Figure S3. Average cell velocity toward hydrogen concentration gradient (positive y-axis) and away (negative y-axis) when M. maripaludis cells were not subjected to starvation prior to capillary assay. Black is average with n=3 and gray 95% confidence interval.



Supplementary Figure S4. The effect of a mass transport correction term, δ, on the predicted chemotactic response. A shifted response is demonstrated for a range of correction values when the model is fit using (a) the receptor-ligand dissociation constant, k_d, and (b) the constant chemotactic coefficient, χ.



Supplementary Figure S5. Comparison of cell-associated carbohydrate concentration including Hexose, Uronic Acid (both primary axis), and Pentose (secondary axis), each normalized to biomass protein. Four culturing conditions include static and shaken for each electron donor, H_2 gas and formate. Error bars represent standard deviation.

Supplementary Table S1. Physical parameters used in the finite element model. A literature search was performed for μ, χ and k_d and all values found were averaged for this study. The high and low values reported for flagellated, chemotactic bacteria are listed here as well as the calculated averages. No values from any archaeum exist in the literature to the best of the authors' knowledge.

Parameter	Value	Unit	Comments	Reference
P	84.3	kPa	Atmospheric pressure at experimental elevation of 1525 m.	Calculated
D_{Haq}	5.32×10^{-5}	$cm^2\ s^{-1}$	Diffusion coefficient of H_2 in water with a salinity of 2.65% and T=30º C	[41]
D_{Hgas}	0.779	$cm^2\ s^{-1}$	Diffusion coefficient of H_2 in N_2 at T=297.2 K and P=1 atm	[42]
k_{satH}	7.64×10^{-4}	$mol\ L^{-1}\ atm^{-1}$	Henry's law saturation constant for H_2 in pure water at 30º C	[43]
r_{max}	7.13×10^{-14}	min^{-1}	Michaelis–Menten maximum hydrogen consumption rate.	[44]
k_m	4.1×10^{-6}	M	Michaelis–Menten half saturation constant for hydrogen consumption rate.	[44]
b_o	1.157×10^{10}	$cell\ m^{-3}$	Initial cell population density	Measured
μ	7.20×10^{-5} 2.09×10^{-5} 3.20×10^{-7}	$cm^2\ s^{-1}$	Cell diffusion coefficient	High: [23] Low: [45]
χ	1.24×10^{-3} 4.16×10^{-4} 7.20×10^{-5}	$cm^2\ s^{-1}$	Constant chemotactic coefficient	High: [29] Low: [45]
k_d	170 24.38 1.5×10^{-3}	mM	Receptor-ligand binding dissociation constant	High: [46] Low: [30]

Caption for Supplementary Movie S1. *M. maripaludis* swimming in a capillary after a five hour starvation period. Gas phase is oriented at the top. There is no hydrogen available initially, then the valve is opened after 10 minutes and hydrogen diffuses into the liquid phase. A fifty-five minute video was minimized by including only every third frame at 10 x speed. The video was compressed by 81% to minimize file size.

Caption for Supplementary Movie S2. *M. maripaludis* swimming in a capillary after a five hour starvation period. Gas phase is oriented at the top. The valve is opened after 16 minutes and argon diffuses into the liquid phase. A fifty-five minute video was minimized by including only every third frame at 10 x speed. The video was compressed by 81% to minimize file size.

References

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