The effect of nutrients on carbon and nitrogen fixation by the UCYN-A-haptophyte symbiosis

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Running title: Nutrient effects on UCYN–A–haptophyte symbiosis

Subject category: Microbe–microbe and microbe–host interactions
Supplementary Fig. 1: Summary of AT% $^{13}$C and $^{15}$N isotopic signal for (A,C) UCYN-A and (B,D) haptophyte cells correlating to the respective cell diameters across nutrient treatments as described in the Material and Methods.

Supplementary Fig. 2: Summary of nanoSIMS measurements showing the $^{13}$C and $^{15}$N isotopic signal in AT% for association between (A) UCYN-A and (B) haptophyte according to different nutrient treatments as described in the Material and Methods.

Supplementary Fig. 3: Summary of nanoSIMS measurements showing the $^{13}$C and $^{15}$N isotopic signal (AT%) within individual UCYN-A cells and their corresponding partner cell (haptophyte) according to various nutrient treatments as described in the Material and Methods. Circles (open and filled) represent UCYN-A cells and squares (open and filled) represent haptophyte cells. The color-coding refers to the respective partner cells.

Supplementary Table 1: Summary of nanoSIMS analysis for the UCYN-A-haptophyte association from nutrient incubation experiments conducted on surface seawater samples collected from Cape Verde May 2009. The range, mean and standard deviation (SD) are listed for $^{13}$C atom % and $^{15}$N atom % (AT %) measured in individual cells. Corresponding CO$_2$ and N$_2$ fixation rates and C and N transfer rates for individual UCYN-A and partner haptophyte cells are calculated based on the nanoSIMS and cell dimension analysis.
Supplementary Fig. 1
Supplementary Fig. 2

A

UCYN-A

Isotopic enrichment AT% $^{15}$N

B

Haptophyte

Isotopic enrichment AT% $^{15}$N

Isotopic enrichment AT% $^{13}$C
Supplementary Fig. 3

The figure shows a series of scatter plots comparing isotopic enrichment AT% 15N and AT% 13C for different treatments and conditions. Each plot is labeled with different conditions or treatments, such as UCYN-A, Haptophyte, and Fe, among others. The data points are color-coded to represent different categories or groups within each condition.
Supplementary Table 1

<table>
<thead>
<tr>
<th>Experiment</th>
<th>n\textsuperscript{a}</th>
<th>AT% \textsuperscript{13}C range (mean±SD)</th>
<th>CO\textsubscript{2} fixation or C transfer rate (fmol C cell\textsuperscript{-1} h\textsuperscript{-1})</th>
<th>AT% \textsuperscript{15}N range (mean±SD)</th>
<th>N\textsubscript{2} fixation or N transfer rate (fmol N cell\textsuperscript{-1} h\textsuperscript{-1})</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>UCYN-A Haptophyte</td>
<td>UCYN-A Haptophyte</td>
<td>UCYN-A Haptophyte</td>
<td>UCYN-A Haptophyte</td>
</tr>
<tr>
<td>Ctr</td>
<td>8</td>
<td>1.18–3.08 (2.40±0.20)</td>
<td>1.68–4.37 (3.49±0.28)</td>
<td>0.0038–0.1016</td>
<td>0.1254–0.4796*</td>
</tr>
<tr>
<td>N</td>
<td>8</td>
<td>1.58–3.88 (2.75±0.31)</td>
<td>2.75–4.31 (3.57±0.24)</td>
<td>0.0225–0.2220</td>
<td>0.3011–0.8454*</td>
</tr>
<tr>
<td>Fe</td>
<td>5</td>
<td>3.30–4.49 (3.78±4.55)</td>
<td>3.78–4.55 (4.12±0.16)</td>
<td>0.0575–0.2106</td>
<td>0.3330–0.5937*</td>
</tr>
<tr>
<td>NP</td>
<td>5</td>
<td>1.38–3.74 (2.71–4.86)</td>
<td>2.71–4.86 (4.21±0.28)</td>
<td>0.0398–0.2938</td>
<td>0.5760–1.0974*</td>
</tr>
<tr>
<td>NFe</td>
<td>4</td>
<td>2.70–3.87 (3.64–4.72)</td>
<td>3.64–4.72 (4.14±0.50)</td>
<td>0.0022–0.1407</td>
<td>0.3480–1.1036*</td>
</tr>
<tr>
<td>NPFe</td>
<td>5</td>
<td>3.32±0.38\textsuperscript{*}</td>
<td>4.21±0.28 (4.12±0.16)</td>
<td>0.0940–0.1900\textsuperscript{*}</td>
<td>0.5878–0.8321\textsuperscript{*}</td>
</tr>
<tr>
<td>PFe</td>
<td>1</td>
<td>3.83 (na**)</td>
<td>4.90 (na**)</td>
<td>0.1594</td>
<td>0.8850</td>
</tr>
<tr>
<td>DI</td>
<td>4</td>
<td>2.03–4.08 (2.30–4.74)</td>
<td>2.30–4.74 (4.09±0.34)</td>
<td>0.0108–0.2012</td>
<td>0.5496–0.6490\textsuperscript{*}</td>
</tr>
<tr>
<td>DII</td>
<td>4</td>
<td>2.59–3.94 (2.70–4.57)</td>
<td>2.70–4.57 (4.09±0.34)</td>
<td>0.0703–0.2520</td>
<td>0.1879–0.6447 (2.97–0.44)*</td>
</tr>
</tbody>
</table>

\*significantly different from control measurements

\**not applicable

\textsuperscript{a} Number of cells measured in each treatment