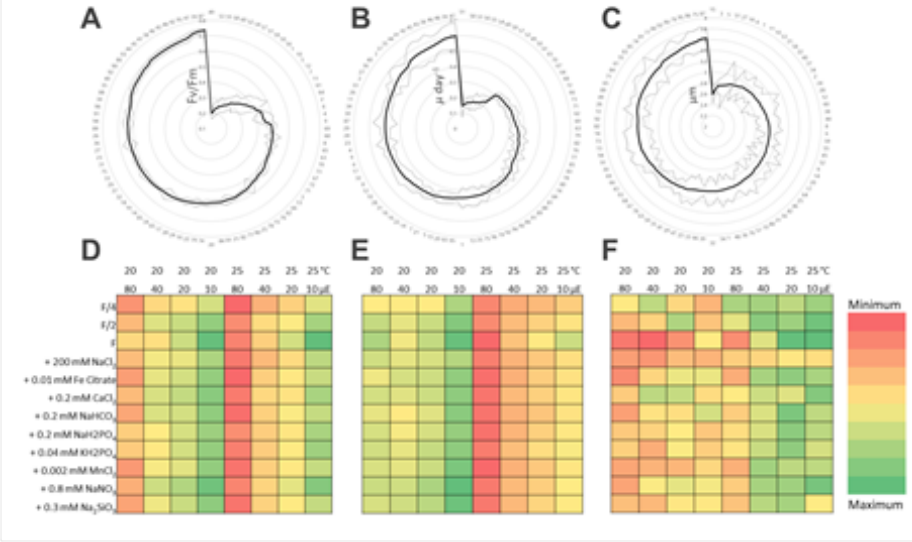
Unlock Innovation with Advanced Algal Services

Datasets and results generated from the UTS Algae Phenomics Facility in collaboration with CSIRO ANAC



High-throughput phenotyping generates rich, multidimensional datasets that reveal how microalgae respond to changing environments. For *Phaeodactylum* sp., we measured three cornerstone traits— photosynthetic efficiency (Fv/Fm; A, E), growth rate (μ day-1; B, F), and cell size (μm; C, G)— across a matrix of light and nutrient conditions. These data are visualized as:

- **Ranked nautilus plots**, which show each trait on a common radial scale to highlight trade-offs and absolute performance (A, B, C).
- **Heatmaps**, which map trait values across environmental gradients, revealing "hot" (optimal) and "cold" (sub-optimal) zones (E, F, G).

Together, these visualizations empower partners to rapidly compare strains, identify robust strains or species, and tailor selection to their operational priorities.

Case Study: Industrial Partner Benefit

The below is an example workflow utilising the UTS Algae Phenomics Facility PhenoGrow Robotic Platform:

Partner: "BlueTech Biofuels*", a photobioreactor manufacturer

Challenge: Outdoor *Phaeodactylum* cultivation suffers from unpredictable light regimes and temperature swings, causing variable yields.

Solution Workflow:

- **Pre-screening:** BlueTech uses our nautilus plots to eliminate strains with poor baseline growth or photosynthetic capacity.
- **Environment tuning:** They overlay our heatmaps onto their local irradiance and nutrient profiles to set daily dosing schedules, ensuring operations run in the "green" zones for all three traits.
- **Robustness check:** By comparing convex-hull volumes, they select a strain with balanced plasticity—small enough hull to guarantee consistency, but large enough to tolerate occasional spikes in light or nutrient shifts.

Outcome: In a 100 L pilot trial, BlueTech achieved a 25 % reduction in culture crash events and a 15 % increase in biomass yield, directly translating phenotyping insights into process resilience and cost savings.

**Fictional; for example purposes only*

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How we Analyse Algae - PhenoSelect Platform

This dataset demonstrates results from testing algae under three standard parameters: growth rate, photosynthetic efficiency (Fv/Fm), and cell size. Experiments are conducted under defined (standard) conditions (outlined in the tables below), which can be customized to meet specific research objectives.

While this example focuses on identifying optimal growth conditions, the platform also supports testing multiple algal strains or strain combinations under fixed conditions to assess comparative performance.

Following growth tests, optional destructive analyses can be performed to measure macronutrient content and other compounds of interest.

Up to 5,000 strains or condition sets can be screened simultaneously using multi-well plate formats. Standard screening takes 1–2 weeks, after which top-performing conditions undergo validation to confirm scalability and performance consistency.

How to Read the Figures

These figures are generated via our robotic “Pheno-Select” platform, and are indicative of standard testing on the platform.

Nautilus Plots: Treatments are ordered by overall performance, with larger radial areas indicating stronger absolute metrics.

Heatmaps: Rows correspond to light intensities, columns to nutrient levels, and composition. Colour intensity reflects trait magnitude—bright reds mark conditions yielding peak performance. A plateau of high Fv/Fm under low light, for example, pinpoints strains suited to shaded cultivators.

Convex Hull: The 2D projection of trait-space shows the hull area encapsulating all measured points. A large hull indicates high plasticity (broad tolerance), while a tight hull signals consistent performance across treatments.

Practical Applications

Culture condition selection: Use the nautilus plots to shortlist candidates that meet minimum absolute requirements (e.g., growth ≥0.4 day^{-1}, Fv/Fm ≥0.5).

Process optimization: Reference heatmaps to identify cultivation “sweet spots” (e.g., medium light + high nutrients for maximal Fv/Fm), then validate at pilot scale.

Risk assessment: Leverage convex-hull volumes to gauge robustness—strains with small hulls maintain stable traits, reducing the risk of batch failures under fluctuating outdoor conditions.

Standard test conditions in plate

Treatment	Final concentration	Treatment	Final concentration
MLA Base (*C. sorokiniana*, *H. pluvialis*)		F/2 Base (*H. tapeticola*, *N. australis*, *P. Tricornutum*)	
*$MgSO_4*7H_2O$	0.4 mM	**Na_2SiO_3	0.3 mM
*$NaNO_3$	4 mM	**$NaNO_3$	0.8 mM
*K_2HPO_4	0.4 mM	**$MnCl_2$	0.002 mM
*KH_2PO_4	0.4 mM	**KH2PO_4	0.04 mM
*NaH_2PO_4	0.2 mM	**NaH_2PO_4	0.2 mM
*$NaHCO_3$	0.04 mM	**$NaHCO_3$	0.2 mM
*$CaCl_2*2H_2O$	0.04 mM	**$CaCl_2*2H_2O$	0.2 mM
*$FeCl_3$	0.01 mM	**Fe Citrate	0.01 mM
10% MLA	Standard	**$NaCl_2$	200 mM
50% MLA	Standard	F/4	Standard
100% MLA	Standard	F/2	Standard
150% MLA	Standard	F	Standard
* in 100% MLA		**in F/2	

Standard test conditions in Robot

Temperature (°C)	Light intensity (µmol photons m^{-2} s^{-1})
20	80
	40
	20
	10
25	80
	40
	20
	10

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Chlorella sorokiniana CS-903 – Growth rate day-1 (via OD 750 nm); n=5-10

a

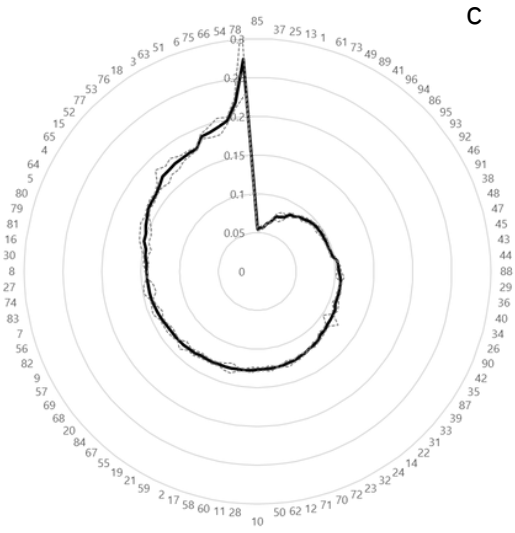
	20 °C 80 µE	20 °C 40 µE	20 °C 20 µE	20 °C 10 µE	25 °C 80 µE	25 °C 40 µE	25 °C 20 µE	25 °C 10 µE
10% MLA	1	13	25	37	49	61	73	85
50% MLA	2	14	26	38	50	62	74	86
100% MLA	3	15	27	39	51	63	75	87
150% MLA	4	16	28	40	52	64	76	88
+ 0.4 mM $MgSO_4$	5	17	29	41	53	65	77	89
+ 4 mM $NaNO_3$	6	18	30	42	54	66	78	90
+ 0.4 mM K_2HPO_4	7	19	31	43	55	67	79	91
+ 0.4 mM KH_2PO_4	8	20	32	44	56	68	80	92
+ 0.2 mM Na_2HPO_4	9	21	33	45	57	69	81	93
+ 0.04 mM $NaHCO_3$	10	22	34	46	58	70	82	94
+ 0.04 mM $CaCl_2$	11	23	35	47	59	71	83	95
+ 0.01 mM $FeCl_3$	12	24	36	48	60	72	84	96

b

µ day-1

	20 °C 80 µE	20 °C 40 µE	20 °C 20 µE	20 °C 10 µE	25 °C 80 µE	25 °C 40 µE	25 °C 20 µE	25 °C 10 µE
10% MLA	0.066 ± 0	0.064 ± 0	0.057 ± 0	0.056 ± 0.01	0.078 ± 0.01	0.075 ± 0.01	0.076 ± 0.01	0.055 ± 0.01
50% MLA	0.13 ± 0	0.119 ± 0.01	0.108 ± 0	0.096 ± 0	0.126 ± 0	0.126 ± 0.01	0.141 ± 0.01	0.093 ± 0.01
100% MLA	0.176 ± 0.01	0.164 ± 0	0.142 ± 0	0.113 ± 0	0.188 ± 0.01	0.177 ± 0	0.193 ± 0.02	0.113 ± 0.02
150% MLA	0.162 ± 0	0.145 ± 0	0.128 ± 0.01	0.108 ± 0	0.168 ± 0.01	0.158 ± 0.01	0.175 ± 0.02	0.105 ± 0.01
+ 0.4 mM MgSO4	0.155 ± 0.01	0.129 ± 0.01	0.106 ± 0.01	0.085 ± 0	0.173 ± 0.01	0.163 ± 0.01	0.173 ± 0.02	0.085 ± 0.01
+ 4 mM NaNO3	0.19 ± 0.01	0.175 ± 0.01	0.143 ± 0.01	0.111 ± 0.01	0.219 ± 0.01	0.199 ± 0.01	0.275 ± 0.09	0.109 ± 0.01
+ 0.4 mM K2HPO4	0.141 ± 0	0.131 ± 0.01	0.115 ± 0.01	0.103 ± 0	0.133 ± 0.01	0.133 ± 0	0.151 ± 0.01	0.096 ± 0.01
+ 0.4 mM KH2PO4	0.143 ± 0	0.135 ± 0	0.122 ± 0	0.105 ± 0	0.14 ± 0.01	0.135 ± 0.01	0.152 ± 0.01	0.095 ± 0.01
+ 0.2 mM Na2HPO4	0.138 ± 0	0.131 ± 0	0.115 ± 0	0.099 ± 0.01	0.137 ± 0.01	0.135 ± 0.01	0.146 ± 0.01	0.095 ± 0.01
+ 0.04 mM NaHCO3	0.127 ± 0	0.119 ± 0	0.108 ± 0.01	0.096 ± 0.01	0.129 ± 0.01	0.125 ± 0.01	0.139 ± 0.01	0.09 ± 0.01
+ 0.04 mM CaCl2	0.128 ± 0	0.123 ± 0.01	0.112 ± 0	0.097 ± 0	0.13 ± 0	0.126 ± 0	0.141 ± 0.02	0.094 ± 0
+ 0.01 mM FeCl3	0.126 ± 0	0.12 ± 0	0.108 ± 0	0.096 ± 0	0.129 ± 0	0.124 ± 0	0.135 ± 0.01	0.088 ± 0

c



Highest Growth Rate: Of the 96 conditions tested, table (a) demonstrates that condition 78 (corresponding to ranked condition 78 in (c) nautilus plot, via peak) resulted in the highest growth rate day-1; conditions and growth rate demonstrated in table (b) heatmap, corresponding with the green conditions (0.275 uday-1; 25C, 20uE, media consisting of MLA + 4mM NaNO3).
Lowest Growth Rate: Of the 96 conditions tested, the lowest growth rate is seen as condition 85 (a), in the innermost spiral via the nautilus plot (c), corresponding with the red conditions (table b heatmap) of 0.055 u day-1 (25C, 10uE, media consisting of 10% MLA).

Chlorella sorokiniana CS-903 – Fv/Fm; n=5-10

a

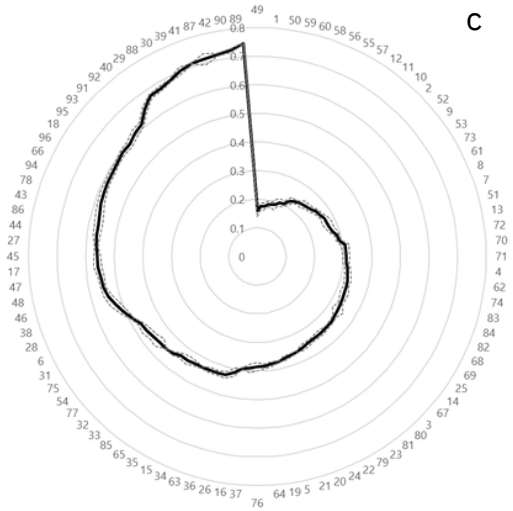
	20 °C 80 µE	20 °C 40 µE	20 °C 20 µE	20 °C 10 µE	25 °C 80 µE	25 °C 40 µE	25 °C 20 µE	25 °C 10 µE
10% MLA	1	13	25	37	49	61	73	85
50% MLA	2	14	26	38	50	62	74	86
100% MLA	3	15	27	39	51	63	75	87
150% MLA	4	16	28	40	52	64	76	88
+ 0.4 mM $MgSO_4$	5	17	29	41	53	65	77	89
+ 4 mM $NaNO_3$	6	18	30	42	54	66	78	90
+ 0.4 mM K_2HPO_4	7	19	31	43	55	67	79	91
+ 0.4 mM KH_2PO_4	8	20	32	44	56	68	80	92
+ 0.2 mM Na_2HPO_4	9	21	33	45	57	69	81	93
+ 0.04 mM $NaHCO_3$	10	22	34	46	58	70	82	94
+ 0.04 mM $CaCl_2$	11	23	35	47	59	71	83	95
+ 0.01 mM $FeCl_3$	12	24	36	48	60	72	84	96

b

Fv/Fm

	20 °C 80 µE	20 °C 40 µE	20 °C 20 µE	20 °C 10 µE	25 °C 80 µE	25 °C 40 µE	25 °C 20 µE	25 °C 10 µE
10% MLA	0.175 ± 0.03	0.29 ± 0.02	0.337 ± 0.04	0.391 ± 0.03	0.16 ± 0.04	0.27 ± 0.03	0.269 ± 0.02	0.437 ± 0.02
50% MLA	0.245 ± 0.02	0.341 ± 0.01	0.413 ± 0.03	0.524 ± 0.03	0.176 ± 0.03	0.317 ± 0.02	0.322 ± 0.02	0.567 ± 0.03
100% MLA	0.345 ± 0.01	0.433 ± 0.01	0.565 ± 0.01	0.704 ± 0.02	0.287 ± 0.02	0.429 ± 0.02	0.466 ± 0.03	0.714 ± 0.04
150% MLA	0.311 ± 0.02	0.395 ± 0.01	0.507 ± 0.03	0.648 ± 0.02	0.249 ± 0.02	0.385 ± 0.02	0.386 ± 0.03	0.677 ± 0.02
+ 0.4 mM MgSO4	0.376 ± 0.01	0.559 ± 0.03	0.673 ± 0.02	0.712 ± 0.01	0.261 ± 0.02	0.437 ± 0.03	0.455 ± 0.04	0.745 ± 0.01
+ 4 mM NaNO3	0.488 ± 0.01	0.589 ± 0.02	0.687 ± 0.01	0.719 ± 0.01	0.459 ± 0.03	0.585 ± 0.02	0.578 ± 0.03	0.726 ± 0.01
+ 0.4 mM K2HPO4	0.277 ± 0.03	0.379 ± 0.02	0.47 ± 0.02	0.571 ± 0.03	0.204 ± 0.02	0.345 ± 0.01	0.351 ± 0.02	0.607 ± 0.03
+ 0.4 mM KH2PO4	0.271 ± 0.03	0.365 ± 0.01	0.453 ± 0	0.566 ± 0.02	0.203 ± 0.03	0.331 ± 0.02	0.346 ± 0.02	0.614 ± 0.02
+ 0.2 mM Na2HPO4	0.258 ± 0.02	0.368 ± 0.02	0.449 ± 0.01	0.56 ± 0.03	0.222 ± 0.03	0.335 ± 0.02	0.347 ± 0.02	0.594 ± 0.02
+ 0.04 mM NaHCO3	0.24 ± 0.03	0.355 ± 0.02	0.43 ± 0.02	0.541 ± 0.03	0.192 ± 0.04	0.31 ± 0.02	0.329 ± 0.03	0.582 ± 0.02
+ 0.04 mM CaCl2	0.238 ± 0.01	0.348 ± 0.02	0.434 ± 0.02	0.551 ± 0.02	0.186 ± 0.02	0.311 ± 0.02	0.326 ± 0.03	0.594 ± 0.02
+ 0.01 mM FeCl3	0.23 ± 0.02	0.36 ± 0.01	0.428 ± 0.03	0.55 ± 0.02	0.188 ± 0.02	0.309 ± 0.03	0.327 ± 0.02	0.586 ± 0.02

c



Highest Photosynthetic Rate: Of the 96 conditions tested, table (a) demonstrates that condition 89 (corresponding to ranked condition 89 in (c) nautilus plot, via peak) resulted in the highest fv/fm; conditions and fv/fm demonstrated in table (b) heatmap, corresponding with the green conditions (0.726 fv/fm; 25C, 10uE, media consisting of MLA + 4mM NaNO3).
Lowest Photosynthetic Rate: Of the 96 conditions tested, the lowest fv/fmis seen as condition 49(a), in the innermost spiral via the nautilus plot (c), corresponding with the red conditions (table b heatmap) of 0.16 fv/fm; (25C, 80uE, media consisting of 10% MLA).

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Chlorella sorokiniana CS-903 – Cell size (µm); n=5

a

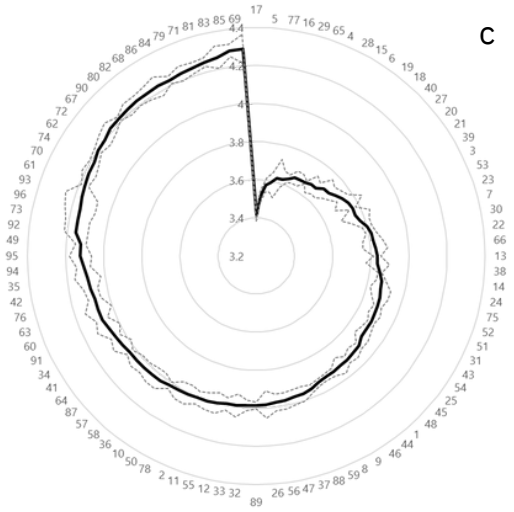
	20 °C 80 µE	20 °C 40 µE	20 °C 20 µE	20 °C 10 µE	25 °C 80 µE	25 °C 40 µE	25 °C 20 µE	25 °C 10 µE
10% MLA	1	13	25	37	49	61	73	85
50% MLA	2	14	26	38	50	62	74	86
100% MLA	3	15	27	39	51	63	75	87
150% MLA	4	16	28	40	52	64	76	88
+ 0.4 mM $MgSO_4$	5	17	29	41	53	65	77	89
+ 4 mM $NaNO_3$	6	18	30	42	54	66	78	90
+ 0.4 mM K_2HPO_4	7	19	31	43	55	67	79	91
+ 0.4 mM KH_2PO_4	8	20	32	44	56	68	80	92
+ 0.2 mM Na_2HPO_4	9	21	33	45	57	69	81	93
+ 0.04 mM $NaHCO_3$	10	22	34	46	58	70	82	94
+ 0.04 mM $CaCl_2$	11	23	35	47	59	71	83	95
+ 0.01 mM $FeCl_3$	12	24	36	48	60	72	84	96

µm

b

	20 °C 80 µE	20 °C 40 µE	20 °C 20 µE	20 °C 10 µE	25 °C 80 µE	25 °C 40 µE	25 °C 20 µE	25 °C 10 µE
10% MLA	3.924 ± 0.05	3.834 ± 0.04	3.896 ± 0.09	3.967 ± 0.08	4.123 ± 0.05	4.171 ± 0.04	4.154 ± 0.13	4.288 ± 0.07
50% MLA	4.005 ± 0.07	3.854 ± 0.03	3.982 ± 0.14	3.838 ± 0.12	4.013 ± 0.1	4.197 ± 0.04	4.181 ± 0.06	4.229 ± 0.11
100% MLA	3.762 ± 0.03	3.66 ± 0.07	3.703 ± 0.09	3.757 ± 0.16	3.889 ± 0.04	4.076 ± 0.14	3.874 ± 0.11	4.034 ± 0.09
150% MLA	3.639 ± 0.04	3.593 ± 0.1	3.659 ± 0.07	3.699 ± 0.13	3.883 ± 0.09	4.034 ± 0.04	4.077 ± 0.07	3.965 ± 0.08
+ 0.4 mM MgSO4	3.51 ± 0.07	3.415 ± 0.06	3.622 ± 0.21	4.044 ± 0.11	3.762 ± 0.16	3.625 ± 0.09	3.576 ± 0.08	3.986 ± 0.03
+ 4 mM NaNO3	3.663 ± 0.02	3.673 ± 0.08	3.815 ± 0.06	4.085 ± 0.08	3.895 ± 0.06	3.826 ± 0.13	4.012 ± 0.11	4.219 ± 0.03
+ 0.4 mM K2HPO4	3.802 ± 0.05	3.672 ± 0.11	3.89 ± 0.07	3.894 ± 0.03	4.001 ± 0.11	4.218 ± 0.08	4.237 ± 0.08	4.061 ± 0.13
+ 0.4 mM KH2PO4	3.939 ± 0.04	3.721 ± 0.08	3.988 ± 0.05	3.925 ± 0.1	3.976 ± 0.09	4.228 ± 0.08	4.224 ± 0.08	4.154 ± 0.12
+ 0.2 mM Na2HPO4	3.933 ± 0.04	3.744 ± 0.07	3.992 ± 0.12	3.915 ± 0.04	4.03 ± 0.07	4.289 ± 0.15	4.252 ± 0.05	4.166 ± 0.18
+ 0.04 mM NaHCO3	4.018 ± 0.04	3.816 ± 0.1	4.051 ± 0.05	3.932 ± 0.05	4.029 ± 0.1	4.178 ± 0.08	4.227 ± 0.06	4.108 ± 0.07
+ 0.04 mM CaCl2	4.004 ± 0.09	3.775 ± 0.1	4.091 ± 0.14	3.975 ± 0.08	3.955 ± 0.05	4.241 ± 0.06	4.263 ± 0.12	4.123 ± 0.12
+ 0.01 mM FeCl3	3.992 ± 0.07	3.869 ± 0.05	4.027 ± 0.11	3.918 ± 0.07	4.075 ± 0.06	4.201 ± 0.08	4.23 ± 0.04	4.157 ± 0.16

c



Largest Cell Size: Of the 96 conditions tested, table (a) demonstrates that condition 69 (corresponding to ranked condition 69 in (c) nautilus plot, via peak) resulted in the largest cell size day-1; conditions and cell size demonstrated in table (b) heatmap, corresponding with the green conditions (4.289 um; 25C, 20uE, media consisting of MLA + 0.2mM Na2HPO4).
Smallest Cell Size: Of the 96 conditions tested, the smallest cell size is seen as condition 17 (a), in the innermost spiral via the nautilus plot (c), corresponding with the red conditions (table b heatmap) of 3.415 um (20C, 40uE, media consisting of MLA + 0.4 mM MgSO4).

Nannochloropsis australis CS-416 – Growth rate day-1 (via OD 750 nm); n=10

a

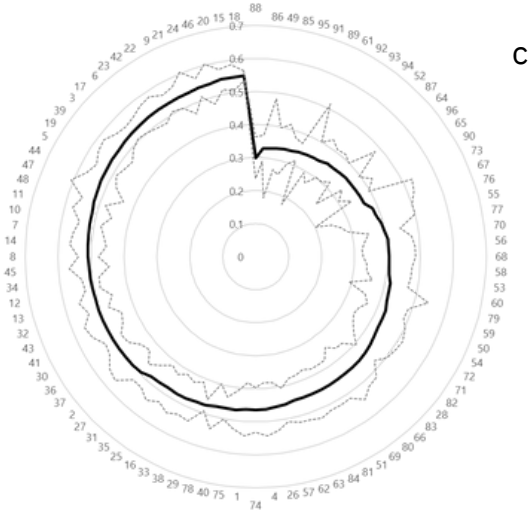
	20 °C 80 µE	20 °C 40 µE	20 °C 20 µE	20 °C 10 µE	25 °C 80 µE	25 °C 40 µE	25 °C 20 µE	25 °C 10 µE
F/4	1	13	25	37	49	61	73	85
F/2	2	14	26	38	50	62	74	86
F	3	15	27	39	51	63	75	87
+ 200 mM $NaCl_2$	4	16	28	40	52	64	76	88
+ 0.01 mM Fe Citrate	5	17	29	41	53	65	77	89
+ 0.2 mM $CaCl_2$	6	18	30	42	54	66	78	90
+ 0.2 mM $NaHCO_3$	7	19	31	43	55	67	79	91
+ 0.2 mM $NaH2PO_4$	8	20	32	44	56	68	80	92
+ 0.04 mM $KH2PO_4$	9	21	33	45	57	69	81	93
+ 0.002 mM $MnCl_2$	10	22	34	46	58	70	82	94
+ 0.8 mM $NaNO_3$	11	23	35	47	59	71	83	95
+ 0.3 mM Na_2SiO_3	12	24	36	48	60	72	84	96

µ day^{-1}

b

	20 °C 80 µE	20 °C 40 µE	20 °C 20 µE	20 °C 10 µE	25 °C 80 µE	25 °C 40 µE	25 °C 20 µE	25 °C 10 µE
F/4	0.464 ± -0.16	0.504 ± -0.1	0.479 ± -0.1	0.498 ± -0.12	0.33 ± -0.3	0.346 ± -0.34	0.366 ± -0.33	0.333 ± -0.13
F/2	0.498 ± -0.14	0.51 ± -0.11	0.458 ± -0.15	0.475 ± -0.13	0.427 ± -0.12	0.45 ± -0.14	0.464 ± -0.14	0.329 ± -0.08
F	0.529 ± -0.07	0.547 ± -0.08	0.494 ± -0.07	0.527 ± -0.11	0.448 ± -0.14	0.45 ± -0.14	0.468 ± -0.12	0.36 ± -0.08
+ 200 mM $NaCl_2$	0.464 ± -0.16	0.479 ± -0.13	0.442 ± -0.07	0.468 ± -0.07	0.357 ± -0.11	0.363 ± -0.24	0.387 ± -0.23	0.299 ± -0.13
+ 0.01 mM Fe Citrate	0.524 ± -0.07	0.531 ± -0.05	0.474 ± -0.04	0.501 ± -0.1	0.408 ± -0.14	0.364 ± -0.12	0.398 ± -0.1	0.342 ± -0.06
+ 0.2 mM $CaCl_2$	0.531 ± -0.06	0.549 ± -0.03	0.5 ± -0.05	0.535 ± -0.1	0.428 ± -0.16	0.445 ± -0.15	0.468 ± -0.14	0.365 ± -0.06
+ 0.2 mM $NaHCO_3$	0.512 ± -0.09	0.527 ± -0.1	0.483 ± -0.09	0.502 ± -0.12	0.395 ± -0.21	0.384 ± -0.27	0.417 ± -0.25	0.338 ± -0.08
+ 0.2 mM $NaH2PO_4$	0.509 ± -0.06	0.547 ± -0.06	0.503 ± -0.06	0.523 ± -0.1	0.405 ± -0.16	0.406 ± -0.16	0.446 ± -0.2	0.347 ± -0.11
+ 0.04 mM $KH2PO_4$	0.537 ± -0.07	0.537 ± -0.14	0.478 ± -0.11	0.507 ± -0.12	0.457 ± -0.1	0.447 ± -0.14	0.449 ± -0.14	0.347 ± -0.16
+ 0.002 mM $MnCl_2$	0.514 ± -0.07	0.536 ± -0.06	0.506 ± -0.05	0.542 ± -0.13	0.407 ± -0.14	0.404 ± -0.14	0.438 ± -0.13	0.355 ± -0.11
+ 0.8 mM $NaNO_3$	0.514 ± -0.12	0.534 ± -0.09	0.481 ± -0.13	0.521 ± -0.17	0.42 ± -0.14	0.432 ± -0.15	0.444 ± -0.15	0.336 ± -0.16
+ 0.3 mM Na_2SiO_3	0.504 ± -0.05	0.54 ± -0.06	0.499 ± -0.07	0.519 ± -0.07	0.416 ± -0.11	0.429 ± -0.17	0.45 ± -0.16	0.363 ± -0.07

c



Highest Growth Rate: Of the 96 conditions tested, table (a) demonstrates that condition 18 (corresponding to ranked condition 18 in (c) nautilus plot, via peak) resulted in the highest growth rate; conditions and growth rate demonstrated in table (b) heatmap, corresponding with the green conditions (0.549 u day-1; 20C, 40uE, media consisting of F/2 + 0.2 mM CaCl2).
Lowest Photosynthetic Rate: Of the 88 conditions tested, the lowest growth rate is seen as condition 88 (a), in the innermost spiral via the nautilus plot (c), corresponding with the red conditions (table b heatmap) of 0.299 u day-1; (25C, 10uE, media consisting of F/2 + 200 mM Na Cl2).

Datasets and results generated from the UTS Algae Phenomics Facility in collaboration with CSIRO ANAC

Nannochloropsis australis CS-416 – Fv/Fm; n=10

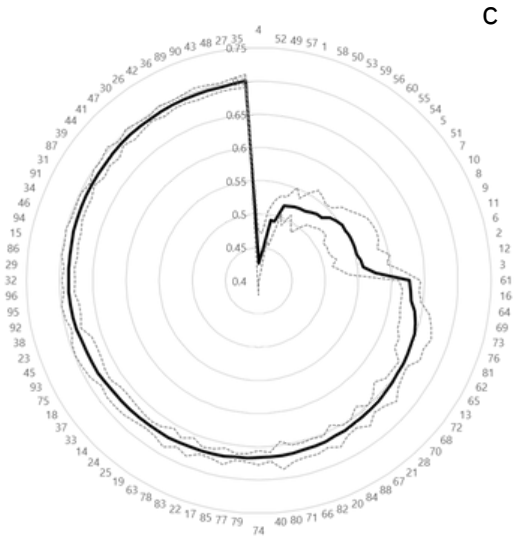
a

	20 °C 80 µE	20 °C 40 µE	20 °C 20 µE	20 °C 10 µE	25 °C 80 µE	25 °C 40 µE	25 °C 20 µE	25 °C 10 µE
F/4	1	13	25	37	49	61	73	85
F/2	2	14	26	38	50	62	74	86
F	3	15	27	39	51	63	75	87
+ 200 mM $NaCl_2$	4	16	28	40	52	64	76	88
+ 0.01 mM Fe Citrate	5	17	29	41	53	65	77	89
+ 0.2 mM $CaCl_2$	6	18	30	42	54	66	78	90
+ 0.2 mM $NaHCO_3$	7	19	31	43	55	67	79	91
+ 0.2 mM $NaH2PO_4$	8	20	32	44	56	68	80	92
+ 0.04 mM $KH2PO_4$	9	21	33	45	57	69	81	93
+ 0.002 mM $MnCl_2$	10	22	34	46	58	70	82	94
+ 0.8 mM $NaNO_3$	11	23	35	47	59	71	83	95
+ 0.3 mM Na_2SiO_3	12	24	36	48	60	72	84	96

b

Fv/Fm	20 °C 80 µE	20 °C 40 µE	20 °C 20 µE	20 °C 10 µE	25 °C 80 µE	25 °C 40 µE	25 °C 20 µE	25 °C 10 µE
F/4	0.493 ± 0.04	0.652 ± 0.01	0.673 ± 0.01	0.675 ± 0.01	0.448 ± 0.06	0.627 ± 0.02	0.645 ± 0.02	0.669 ± 0.01
F/2	0.557 ± 0.04	0.675 ± 0.01	0.693 ± 0	0.684 ± 0.01	0.521 ± 0.03	0.65 ± 0.02	0.666 ± 0.01	0.687 ± 0.01
F	0.576 ± 0.04	0.688 ± 0.01	0.699 ± 0.01	0.691 ± 0.01	0.547 ± 0.03	0.673 ± 0.02	0.68 ± 0.01	0.69 ± 0.01
+ 200 mM $NaCl_2$	0.426 ± 0.05	0.63 ± 0.01	0.657 ± 0.01	0.666 ± 0.01	0.433 ± 0.04	0.631 ± 0.01	0.648 ± 0.03	0.66 ± 0.01
+ 0.01 mM Fe Citrate	0.543 ± 0.02	0.67 ± 0.01	0.687 ± 0.01	0.692 ± 0	0.524 ± 0.01	0.651 ± 0.01	0.668 ± 0	0.695 ± 0.01
+ 0.2 mM $CaCl_2$	0.553 ± 0.03	0.677 ± 0.01	0.693 ± 0.01	0.694 ± 0.01	0.534 ± 0.02	0.664 ± 0.01	0.671 ± 0.01	0.696 ± 0.01
+ 0.2 mM $NaHCO_3$	0.551 ± 0.03	0.673 ± 0.01	0.69 ± 0	0.696 ± 0.01	0.532 ± 0.02	0.658 ± 0.01	0.667 ± 0.01	0.69 ± 0.01
+ 0.2 mM $NaH2PO_4$	0.553 ± 0.04	0.663 ± 0.01	0.687 ± 0.01	0.691 ± 0.01	0.525 ± 0.04	0.654 ± 0.02	0.665 ± 0.02	0.685 ± 0.01
+ 0.04 mM $KH2PO_4$	0.553 ± 0.04	0.657 ± 0.02	0.675 ± 0.01	0.681 ± 0.02	0.492 ± 0.03	0.64 ± 0.02	0.649 ± 0.02	0.68 ± 0.02
+ 0.002 mM $MnCl_2$	0.551 ± 0.04	0.67 ± 0.01	0.689 ± 0.01	0.689 ± 0.01	0.519 ± 0.01	0.656 ± 0.01	0.663 ± 0.01	0.689 ± 0.01
+ 0.8 mM $NaNO_3$	0.553 ± 0.04	0.681 ± 0.02	0.701 ± 0.01	0.693 ± 0.01	0.524 ± 0.03	0.665 ± 0.01	0.671 ± 0.01	0.686 ± 0.01
+ 0.3 mM Na_2SiO_3	0.559 ± 0.04	0.674 ± 0.01	0.694 ± 0.01	0.696 ± 0.01	0.529 ± 0.03	0.653 ± 0.01	0.661 ± 0.02	0.686 ± 0.01

c



Highest Photosynthetic Rate: Of the 96 conditions tested, table (a) demonstrates that condition 35 (corresponding to ranked condition 35 in (c) nautilus plot, via peak) resulted in the highest fv/fm; conditions and fv/fm demonstrated in table (b) heatmap, corresponding with the green conditions (0.695 fv/fm; 20C, 10uE, media consisting of F/2 + 0.4mM KH2PO4).
Lowest Photosynthetic Rate: Of the 96 conditions tested, the lowest fv/fm is seen as condition 4 (a), in the innermost spiral via the nautilus plot (c), corresponding with the red conditions (table b heatmap) of 0.426 fv/fm (20C, 80uE, media consisting of F/2+ 200 mM NaCl2).

Nannochloropsis australis CS-416 – Cell size (µm); n=5

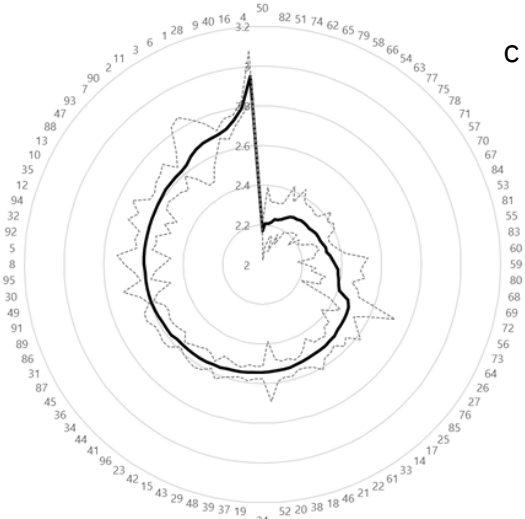
a

	20 °C 80 µE	20 °C 40 µE	20 °C 20 µE	20 °C 10 µE	25 °C 80 µE	25 °C 40 µE	25 °C 20 µE	25 °C 10 µE
F/4	1	13	25	37	49	61	73	85
F/2	2	14	26	38	50	62	74	86
F	3	15	27	39	51	63	75	87
+ 200 mM $NaCl_2$	4	16	28	40	52	64	76	88
+ 0.01 mM Fe Citrate	5	17	29	41	53	65	77	89
+ 0.2 mM $CaCl_2$	6	18	30	42	54	66	78	90
+ 0.2 mM $NaHCO_3$	7	19	31	43	55	67	79	91
+ 0.2 mM $NaH2PO_4$	8	20	32	44	56	68	80	92
+ 0.04 mM $KH2PO_4$	9	21	33	45	57	69	81	93
+ 0.002 mM $MnCl_2$	10	22	34	46	58	70	82	94
+ 0.8 mM $NaNO_3$	11	23	35	47	59	71	83	95
+ 0.3 mM Na_2SiO_3	12	24	36	48	60	72	84	96

b

µm	20 °C 80 µE	20 °C 40 µE	20 °C 20 µE	20 °C 10 µE	25 °C 80 µE	25 °C 40 µE	25 °C 20 µE	25 °C 10 µE
F/4	2.685 ± 0.08	2.607 ± 0.05	2.511 ± 0.07	2.55 ± 0.04	2.594 ± 0.12	2.521 ± 0.09	2.465 ± 0.26	2.501 ± 0.06
F/2	2.629 ± 0.09	2.518 ± 0.05	2.492 ± 0.04	2.537 ± 0.04	2.168 ± 0.05	2.234 ± 0.08	2.216 ± 0.11	2.59 ± 0.05
F	2.67 ± 0.19	2.563 ± 0.02	2.495 ± 0.08	2.552 ± 0.03	2.208 ± 0.11	2.287 ± 0.09	2.296 ± 0.07	2.582 ± 0.04
+ 200 mM $NaCl_2$	2.952 ± 0.12	2.797 ± 0.03	2.692 ± 0.02	2.739 ± 0.03	2.54 ± 0.15	2.485 ± 0.11	2.498 ± 0.12	2.611 ± 0.04
+ 0.01 mM Fe Citrate	2.599 ± 0.13	2.512 ± 0.03	2.555 ± 0.04	2.57 ± 0.03	2.322 ± 0.03	2.236 ± 0.09	2.295 ± 0.08	2.592 ± 0.01
+ 0.2 mM $CaCl_2$	2.681 ± 0.13	2.537 ± 0.05	2.594 ± 0.03	2.566 ± 0.05	2.287 ± 0.09	2.277 ± 0.16	2.298 ± 0.07	2.622 ± 0.03
+ 0.2 mM $NaHCO_3$	2.621 ± 0.09	2.546 ± 0.03	2.588 ± 0.06	2.562 ± 0.06	2.33 ± 0.06	2.313 ± 0.09	2.247 ± 0.18	2.594 ± 0.05
+ 0.2 mM $NaH2PO_4$	2.597 ± 0.1	2.537 ± 0.06	2.6 ± 0.05	2.571 ± 0.02	2.41 ± 0.1	2.384 ± 0.14	2.381 ± 0.11	2.6 ± 0.04
+ 0.04 mM $KH2PO_4$	2.709 ± 0.05	2.529 ± 0.03	2.519 ± 0.05	2.582 ± 0.04	2.306 ± 0.08	2.391 ± 0.07	2.33 ± 0.04	2.619 ± 0.07
+ 0.002 mM $MnCl_2$	2.606 ± 0.12	2.523 ± 0.05	2.572 ± 0.06	2.533 ± 0.03	2.26 ± 0.09	2.31 ± 0.1	2.207 ± 0.18	2.6 ± 0.04
+ 0.8 mM $NaNO_3$	2.655 ± 0.18	2.566 ± 0.05	2.605 ± 0.07	2.616 ± 0.06	2.364 ± 0.15	2.298 ± 0.14	2.344 ± 0.08	2.594 ± 0.05
+ 0.3 mM Na_2SiO_3	2.603 ± 0.11	2.543 ± 0.03	2.581 ± 0.05	2.554 ± 0.03	2.355 ± 0.18	2.399 ± 0.1	2.314 ± 0.04	2.57 ± 0.04

c



Largest Cell Size: Of the 96 conditions tested, table (a) demonstrates that condition 4 (corresponding to ranked condition 4 in (c) nautilus plot, via peak) resulted in the largest cell size; conditions and cell size demonstrated in table (b) heatmap, corresponding with the green conditions (2.952 um; 20C, 80uE, media consisting of F/2 + 200mM NaCl2).
Smallest Cell Size: Of the 96 conditions tested, the lowest growth rate is seen as condition 50 (a), in the innermost spiral via the nautilus plot (c), corresponding with the red conditions (table b heatmap) of 2.168 um (25C, 80uE, media consisting of F/2).