Chapter 3: Physiology

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# Results

#### (A) Coral host and algal endosymbiont physiology

Coral host total tissue energy reserves (mg cm-2) was calculated as the sum of each protein, lipid, and carbohydrate value per coral host. Total host energy reserves of *P. astreoides* at T0 were clearly greater than the total energy reserves quantified in coral hosts maintained under at control treatment at T90 (**Figure 1A**). There was not statistically clear difference in total energy reserves between T0 and T90 control coral hosts in both *S. siderea* and *P. strigosa*. Elevated temperature (31°C) resulted in a statistically clear reduction in total coral host energy reserves in only *P. strigosa* across all pCO2 treatments (**Figure 1A**). No overall effect of *p*CO2 was quantified in any of the four species examined.

Algal endosymbiont cell density (106 cells cm-2) in *S. siderea* fragments at T0 was lower than densities measured in fragments under the control treatment at T90, while *P. astreoides* T0 densities were clearly lower than those measured under the control treatment at T90 (**Figure 1B**). Algal endosymbiont cell densities did not exhibit a statistically clear difference between T0 fragments and T90 fragments maintained at the control treatment in *P. strigosa*. Neither *p*CO2 nor temperature exhibited a statistically clear overall effect on algal endosymbiont cell densities quantified at T90 in any of the four coral species (**Figure 1B**). Algal endosymbiont chlorophyll a content (ug cm-2) of *S. siderea* and *P. strigosa* at T0 was lower than the measured chlorophyll a in fragments maintained in the control treatment at T90 (**Figure 1C**). Conversely, chlorophyll a measured at T0 was not clearly different than in fragments reared in the control treatment at T90 for *P. astreoides*. All species have algal endosymbionts with statistically clear reductions in chlorophyll a content with increasing *p*CO2, while elevated temperature (31°C) only clearly reduces chlorophyll a in the algal endosymbionts associated with *P. strigosa* (**Figure 1C**).

#### (B) Host transcriptomic responses

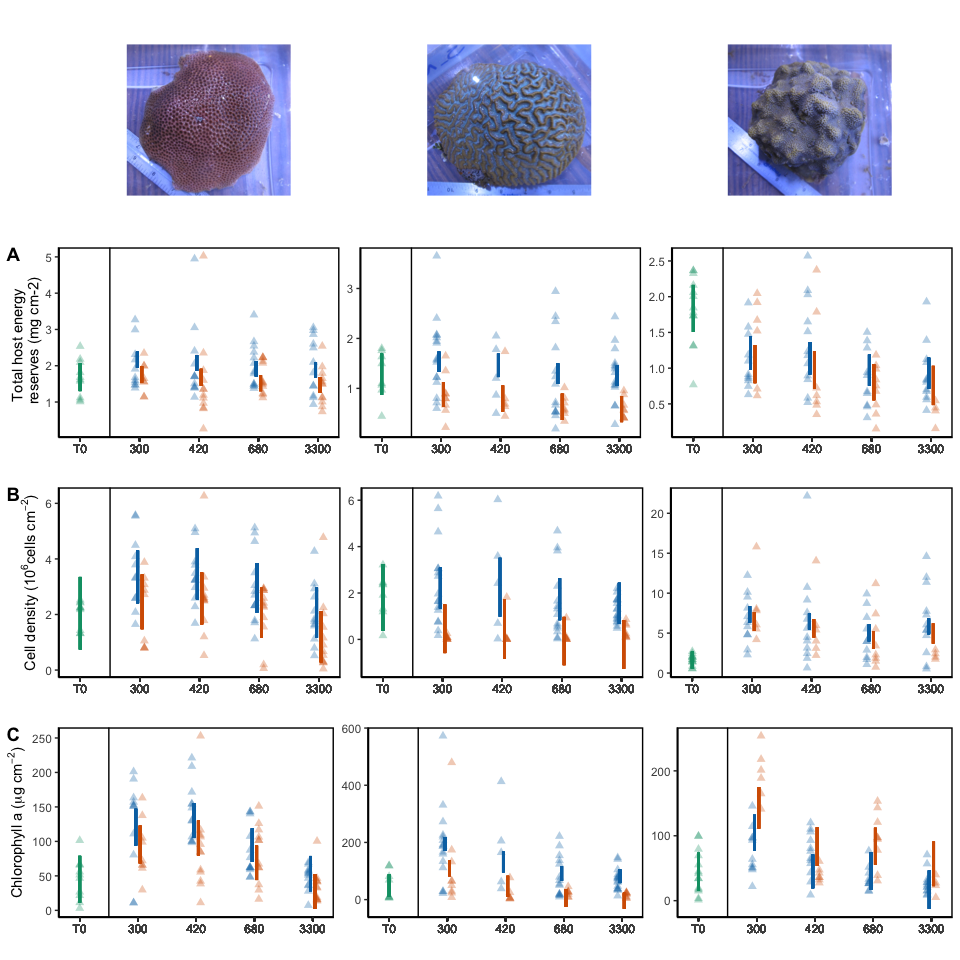
I will talk about HOST trends/findings about gene expression here.

#### (C) Algal endosymbiont transcriptomic responses

I will talk about symbiont trends/findings about gene expression here.

#### (D) Overall physiological response

This will discuss overall responses and the WGCNA here.

 **Figure 1.** Modeled 95% confidence interval of (**A**) total host energy reserves (mg cm-2), (**B**) cell density (106 cells cm-2), and (**C**) Chlorophyll a (ug cm-2) for *S. siderea*, *P. strigosa*, and *P. astreoides* at T0 (green) or T90 (red/blue), with individual coral fragment physiology denoted by points. Blue denotes 28°C and red denotes 31°C, with *p*CO2 treatment along the x axis.

sessionInfo()

## R version 3.5.1 (2018-07-02)  
## Platform: x86\_64-apple-darwin15.6.0 (64-bit)  
## Running under: macOS High Sierra 10.13.6  
##   
## Matrix products: default  
## BLAS: /Library/Frameworks/R.framework/Versions/3.5/Resources/lib/libRblas.0.dylib  
## LAPACK: /Library/Frameworks/R.framework/Versions/3.5/Resources/lib/libRlapack.dylib  
##   
## locale:  
## [1] en\_US.UTF-8/en\_US.UTF-8/en\_US.UTF-8/C/en\_US.UTF-8/en\_US.UTF-8  
##   
## attached base packages:  
## [1] stats graphics grDevices utils datasets methods base   
##   
## other attached packages:  
## [1] magick\_2.2 lme4\_1.1-21 Matrix\_1.2-17 kableExtra\_1.1.0  
## [5] ggfortify\_0.4.7 cowplot\_1.0.0 Rmisc\_1.5 plyr\_1.8.4   
## [9] lattice\_0.20-38 shiny\_1.4.0 forcats\_0.4.0 stringr\_1.4.0   
## [13] purrr\_0.3.2 tibble\_2.1.3 tidyverse\_1.2.1 plotly\_4.9.0   
## [17] openxlsx\_4.1.2 tidyr\_0.8.3 dplyr\_0.8.3 ggplot2\_3.2.1   
## [21] readr\_1.3.1 knitr\_1.25   
##   
## loaded via a namespace (and not attached):  
## [1] httr\_1.4.0 jsonlite\_1.6 viridisLite\_0.3.0  
## [4] splines\_3.5.1 modelr\_0.1.4 assertthat\_0.2.1   
## [7] highr\_0.8 cellranger\_1.1.0 yaml\_2.2.0   
## [10] pillar\_1.4.2 backports\_1.1.4 glue\_1.3.1   
## [13] digest\_0.6.20 promises\_1.1.0 rvest\_0.3.4   
## [16] minqa\_1.2.4 colorspace\_1.4-1 htmltools\_0.4.0   
## [19] httpuv\_1.5.2 pkgconfig\_2.0.2 broom\_0.5.2   
## [22] haven\_2.1.1 xtable\_1.8-4 scales\_1.0.0   
## [25] webshot\_0.5.1 later\_1.0.0 generics\_0.0.2   
## [28] withr\_2.1.2 lazyeval\_0.2.2 cli\_1.1.0   
## [31] magrittr\_1.5 crayon\_1.3.4 readxl\_1.3.1   
## [34] mime\_0.7 evaluate\_0.14 nlme\_3.1-140   
## [37] MASS\_7.3-51.4 xml2\_1.2.0 tools\_3.5.1   
## [40] data.table\_1.12.2 hms\_0.5.0 munsell\_0.5.0   
## [43] zip\_2.0.3 compiler\_3.5.1 rlang\_0.4.0   
## [46] grid\_3.5.1 nloptr\_1.2.1 rstudioapi\_0.10   
## [49] htmlwidgets\_1.3 labeling\_0.3 rmarkdown\_1.16   
## [52] boot\_1.3-23 gtable\_0.3.0 R6\_2.4.0   
## [55] gridExtra\_2.3 lubridate\_1.7.4 fastmap\_1.0.1   
## [58] zeallot\_0.1.0 stringi\_1.4.3 Rcpp\_1.0.1   
## [61] vctrs\_0.2.0 tidyselect\_0.2.5 xfun\_0.8