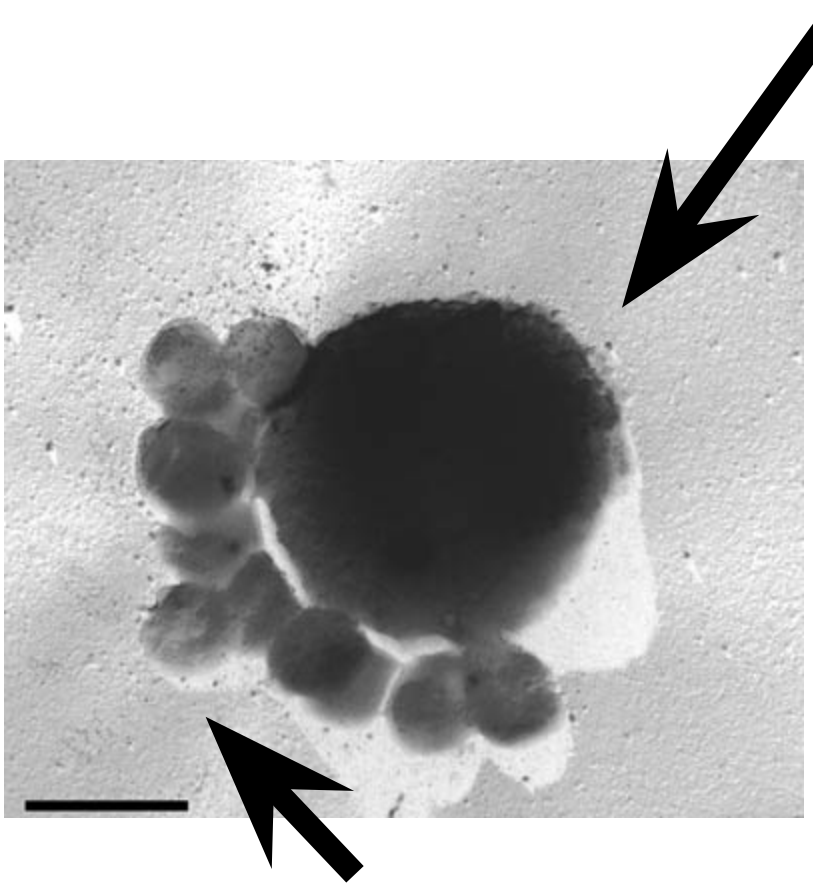
An Open Laboratory for Microbial Ecology

Russell Neches @ryneches
Meg Pirrung @megalodonatron

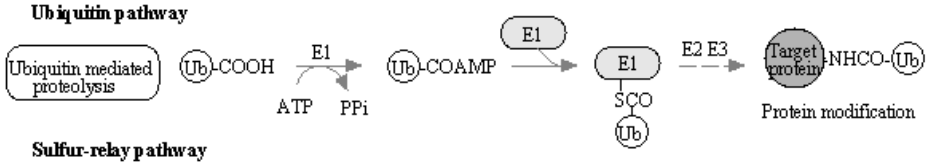
rebels

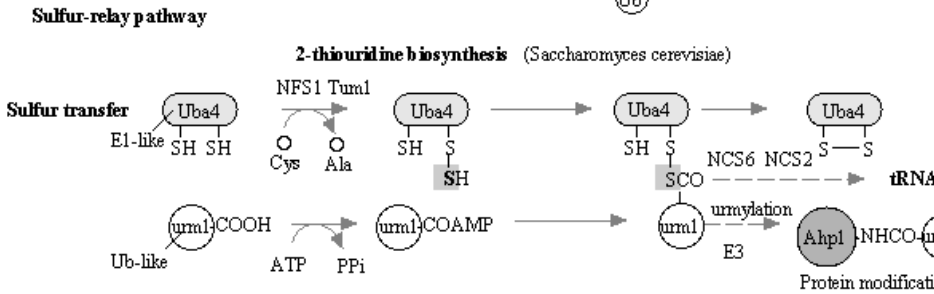
Ignicoccus hospitalis

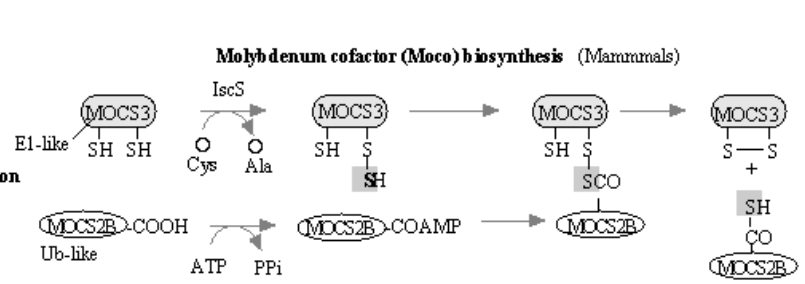


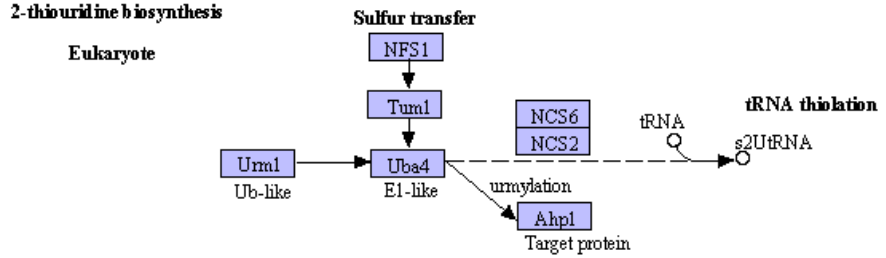
Nanoarchaeum equitans

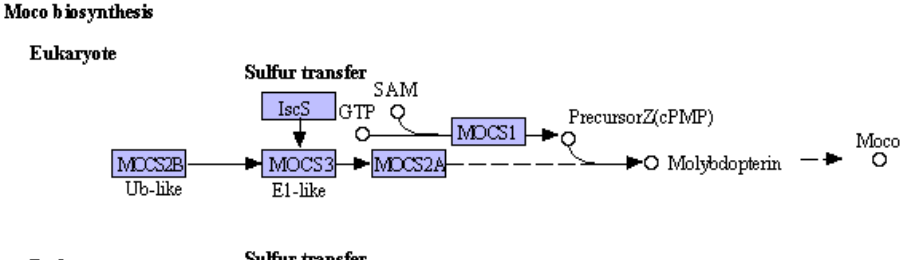
SULFUR RELAY SYSTEM

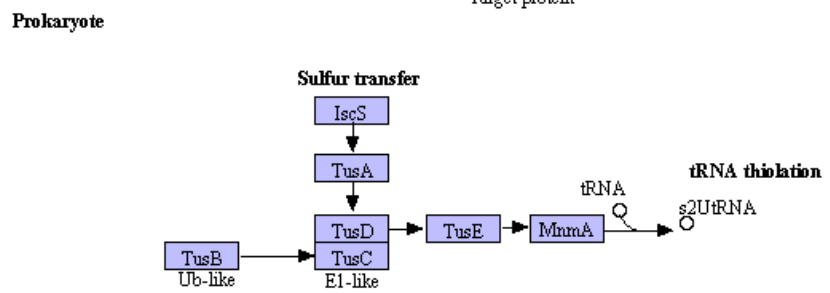


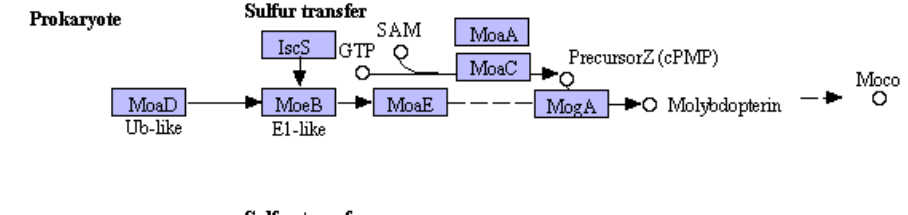


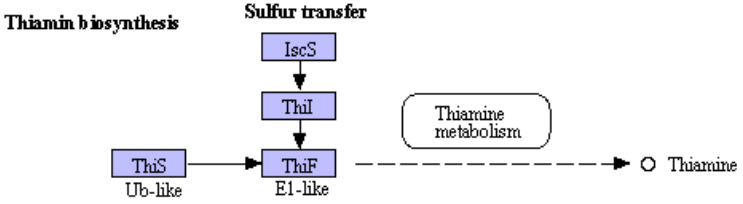












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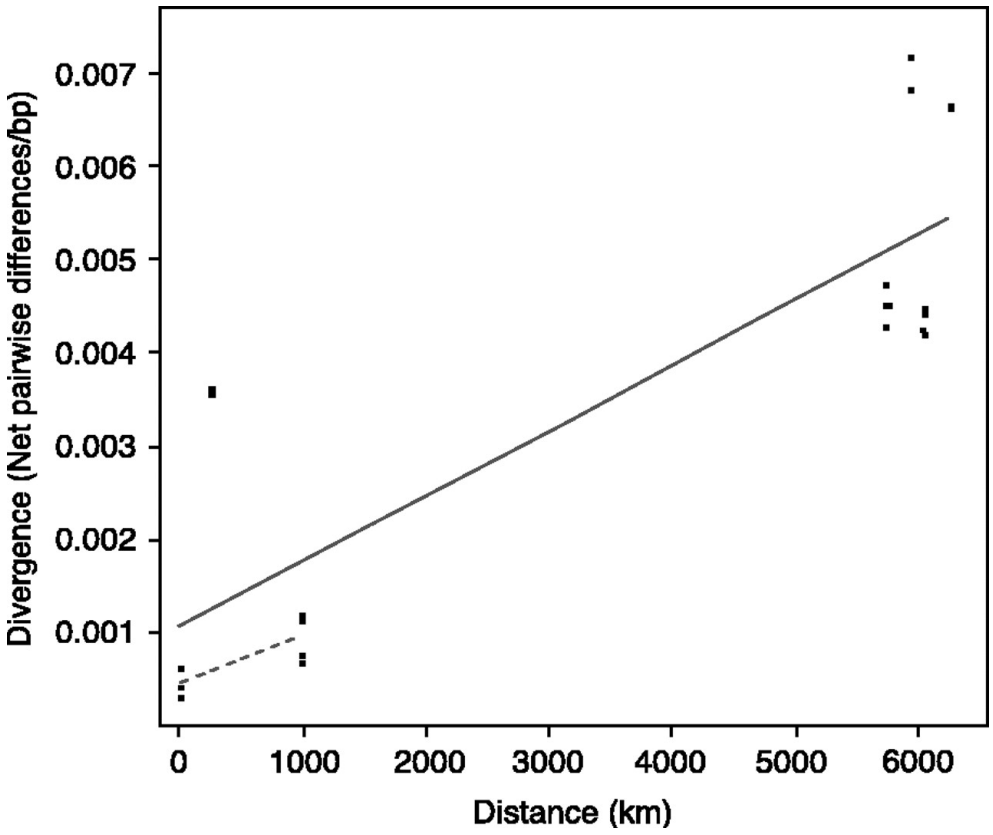

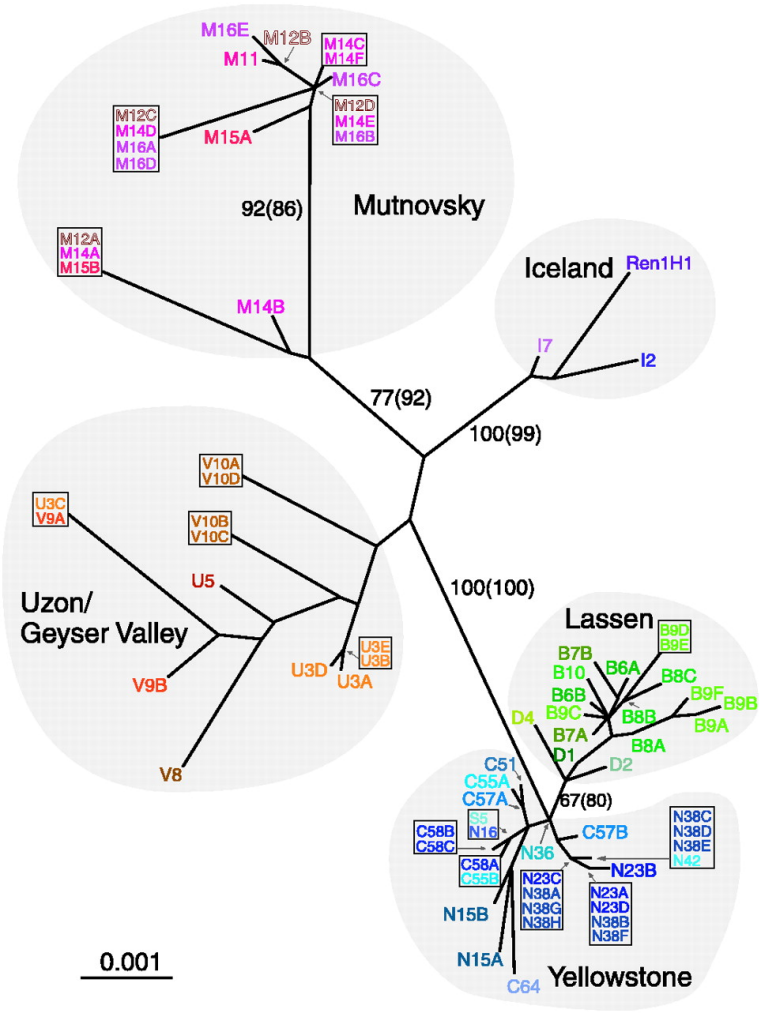

Whitaker, R. J., Grogan, D. W. & Taylor, J. W. Geographic barriers isolate endemic populations of hyperthermophilic archaea. *Science* **301**, 976-978 (2003). http://dx.doi.org/10.1126/science.1086909.

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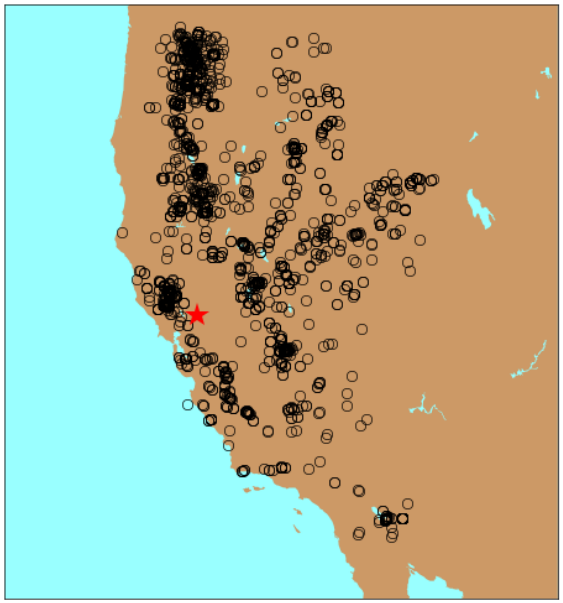
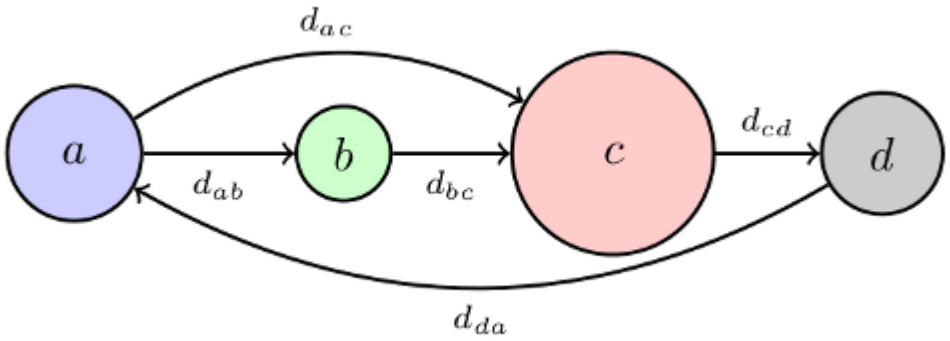
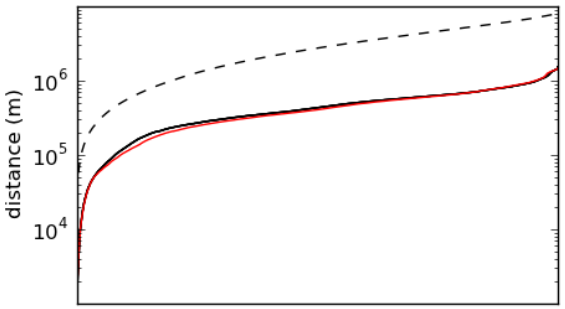


$$Q = \begin{bmatrix} & [\mathrm{A}] & [\mathrm{T}] & [\mathrm{G}] & [\mathrm{C}] \\ [\mathrm{A}] & - & \pi_{\mathrm{T}} r_{\mathrm{AT}} & \pi_{\mathrm{G}} r_{\mathrm{AG}} & \pi_{\mathrm{C}} r_{\mathrm{AC}} \\ [\mathrm{T}] & \pi_{\mathrm{A}} r_{\mathrm{TA}} & - & \pi_{\mathrm{G}} r_{\mathrm{TG}} & \pi_{\mathrm{C}} r_{\mathrm{TC}} \\ [\mathrm{G}] & \pi_{\mathrm{A}} r_{\mathrm{GA}} & \pi_{\mathrm{T}} r_{\mathrm{GT}} & - & \pi_{\mathrm{C}} r_{\mathrm{GC}} \\ [\mathrm{C}] & \pi_{\mathrm{A}} r_{\mathrm{CA}} & \pi_{\mathrm{T}} r_{\mathrm{CT}} & \pi_{\mathrm{G}} r_{\mathrm{CG}} & - \end{bmatrix}$$

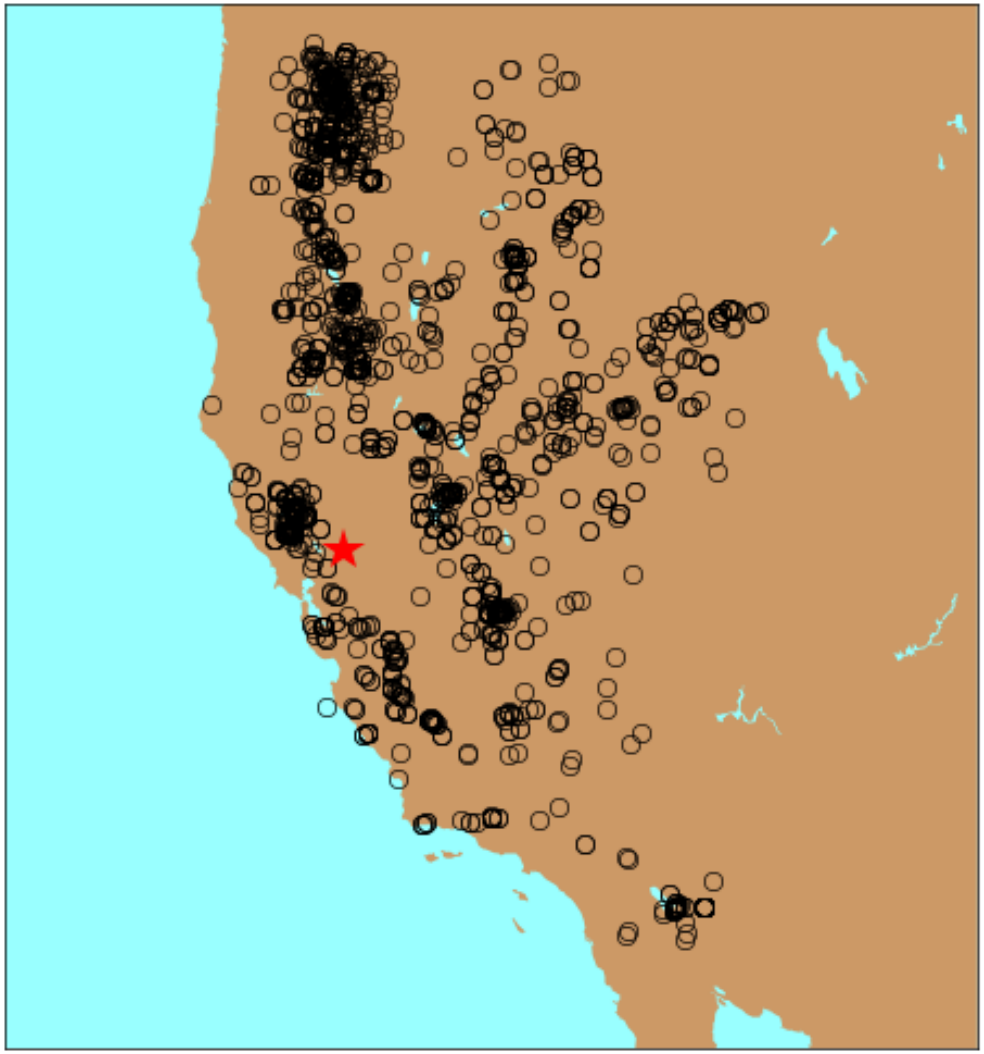




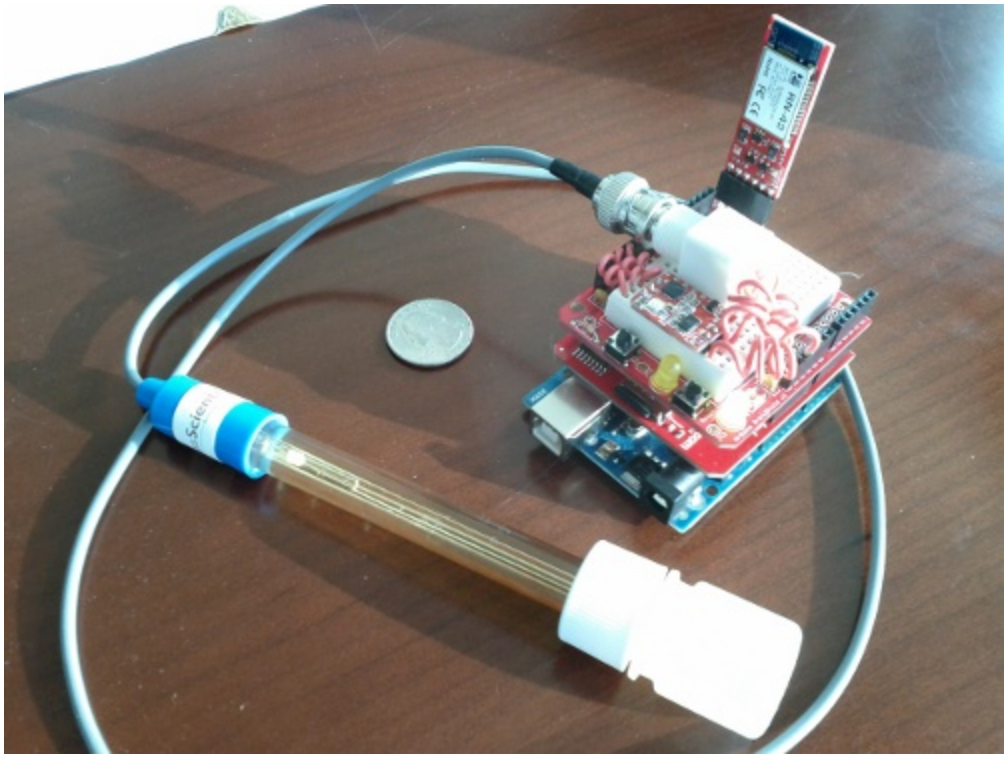
$$Q = \begin{bmatrix} & [\mathrm{A}] & [\mathrm{B}] & [\mathrm{C}] & [\mathrm{D}] \\ [\mathrm{A}] & - & \pi_{\mathrm{B}} r_{\mathrm{AB}} & \pi_{\mathrm{C}} r_{\mathrm{AC}} & \pi_{\mathrm{D}} r_{\mathrm{AD}} \\ [\mathrm{B}] & \pi_{\mathrm{A}} r_{\mathrm{BA}} & - & \pi_{\mathrm{C}} r_{\mathrm{BC}} & \pi_{\mathrm{D}} r_{\mathrm{BD}} \\ [\mathrm{C}] & \pi_{\mathrm{A}} r_{\mathrm{CA}} & \pi_{\mathrm{B}} r_{\mathrm{CB}} & - & \pi_{\mathrm{D}} r_{\mathrm{CD}} \\ [\mathrm{D}] & \pi_{\mathrm{A}} r_{\mathrm{DA}} & \pi_{\mathrm{B}} r_{\mathrm{DB}} & \pi_{\mathrm{C}} r_{\mathrm{DG}} & - \end{bmatrix}$$

$6500

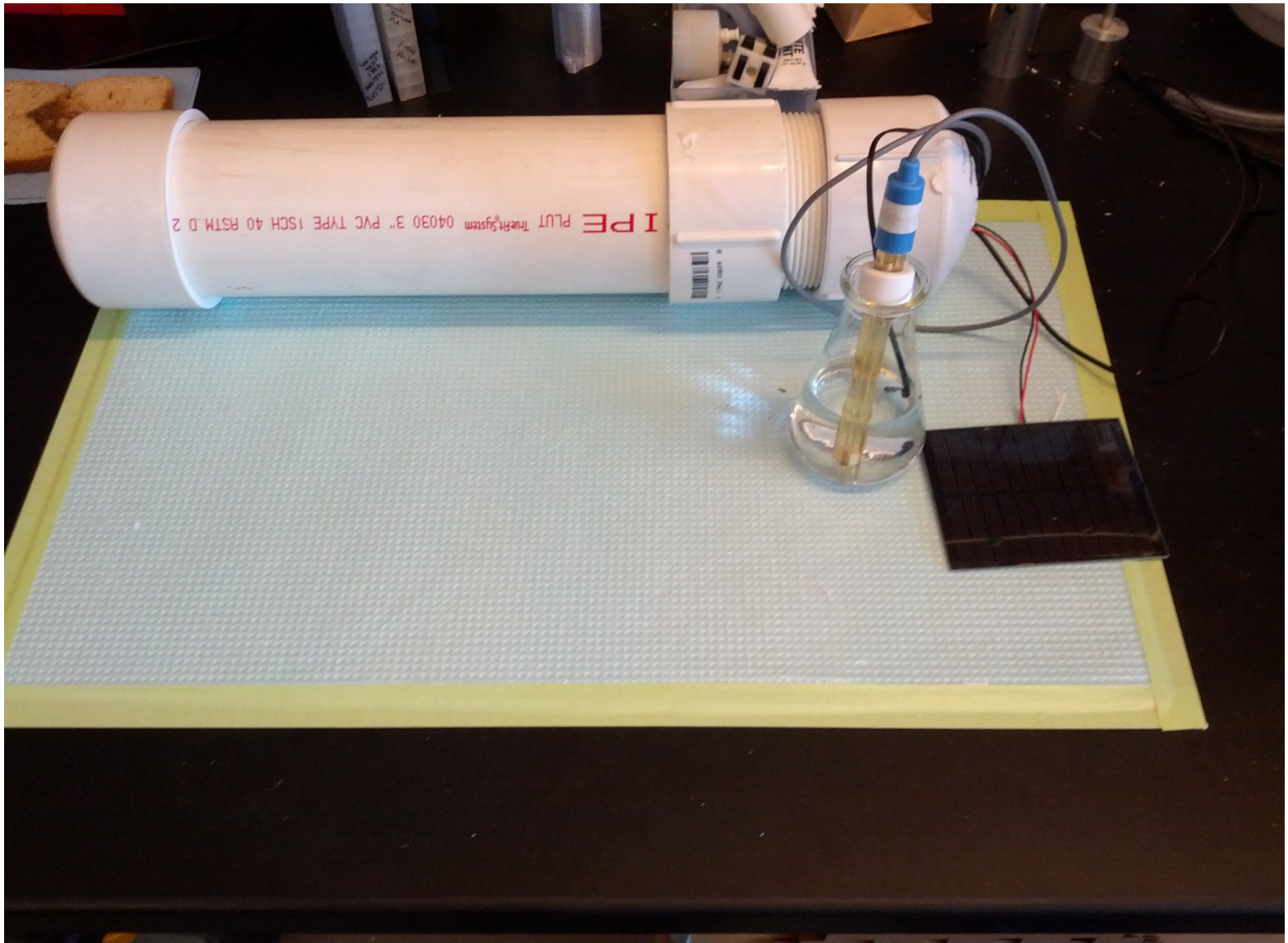
YSI CastAway
http://www.ysi.com/productsdetail.php?CastAway-CTD-49

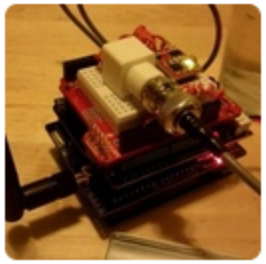


First prototype...



Second prototype...





Russell's pH Meter

@RussellspHMeter FOLLOWS YOU

I am an Open Hardware prototype device for collecting and transmitting water chemistry data from the field. I am part of @rynecheses's dissertation project.

Davis, CA · http://vort.org/

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1,067 TWEETS

2 FOLLOWING

15 FOLLOWERS

Tweet to Russell's pH Meter

@RussellspHMeter

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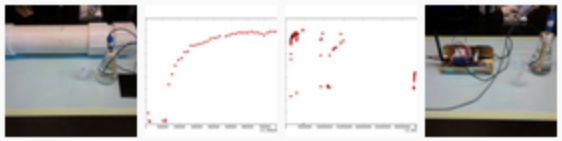

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Tweets

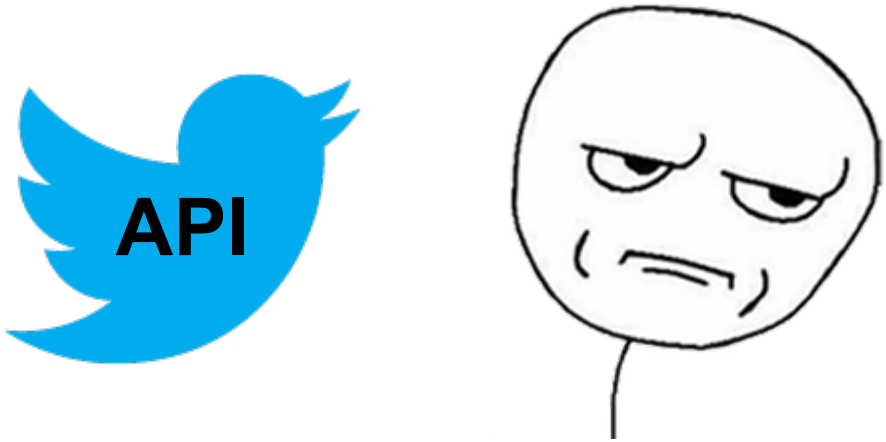
Russell's pH Meter @RussellspHMeter 48m
The latest pH measurement is 6.85, battery voltage 3.00, temp 22.53C
Expand

Russell's pH Meter @RussellspHMeter 1h
The latest pH measurement is 6.85, battery voltage 3.00, temp 22.56C
Expand

Russell's pH Meter @RussellspHMeter 2h
The latest pH measurement is 6.85, battery voltage 3.00, temp 22.58C
Expand

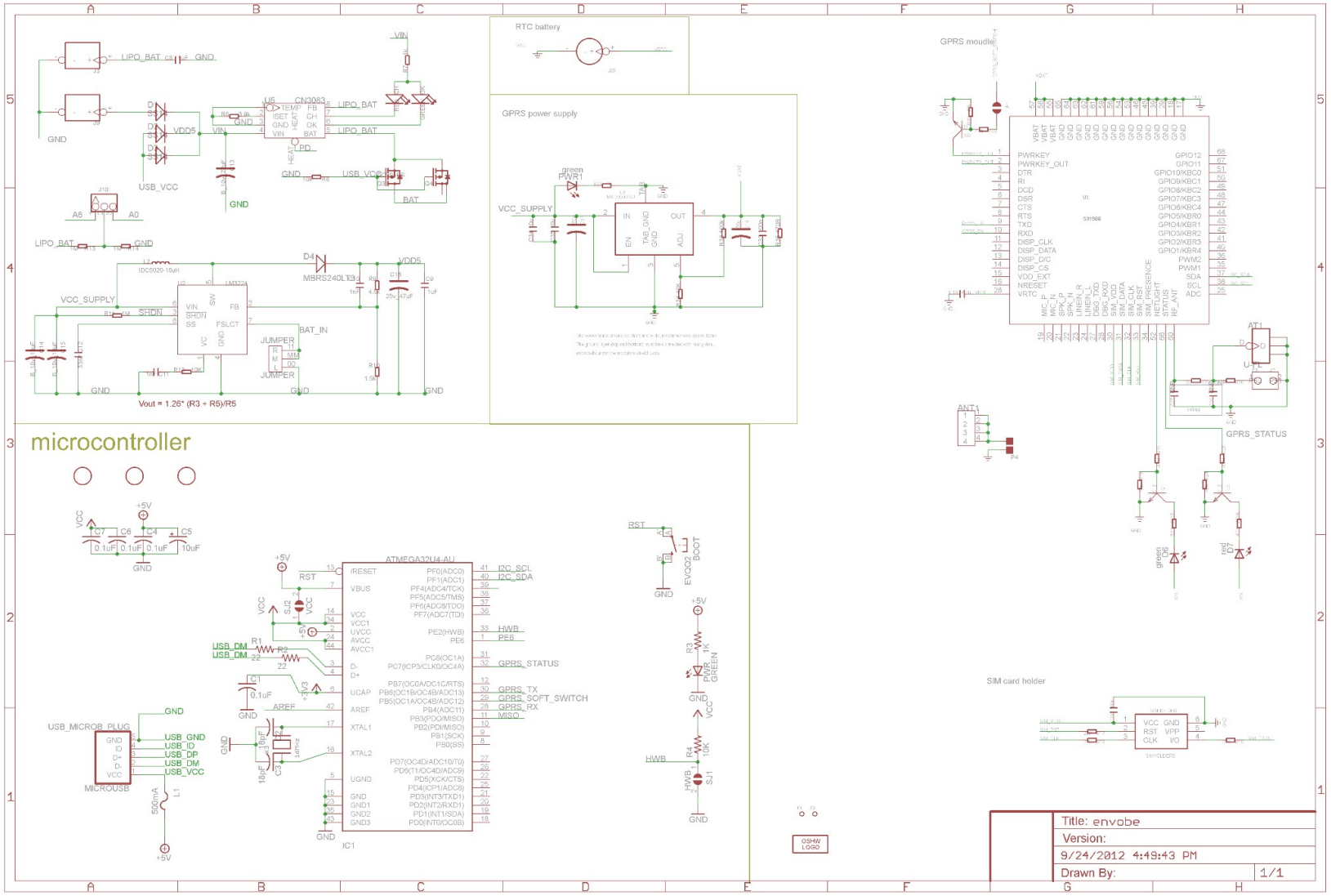
Russell's pH Meter @RussellspHMeter 2h
The latest pH measurement is 6.85, battery voltage 3.00, temp 22.51C
Expand

(...although that may have to change)



Software...

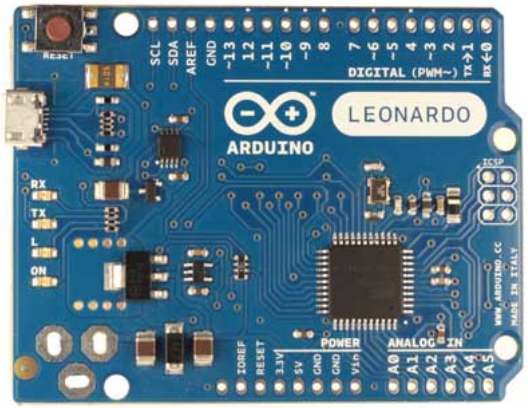
First production model...



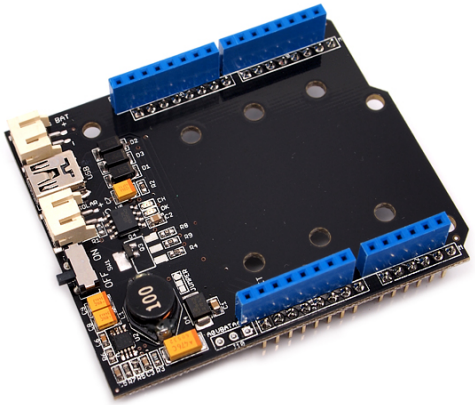
Wait a second.

I am not an engineer.

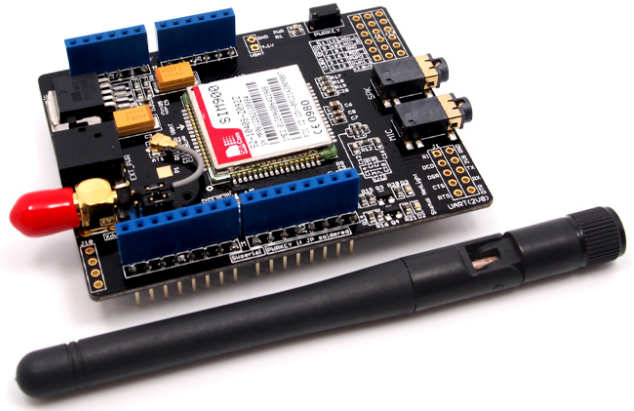
Building blocks



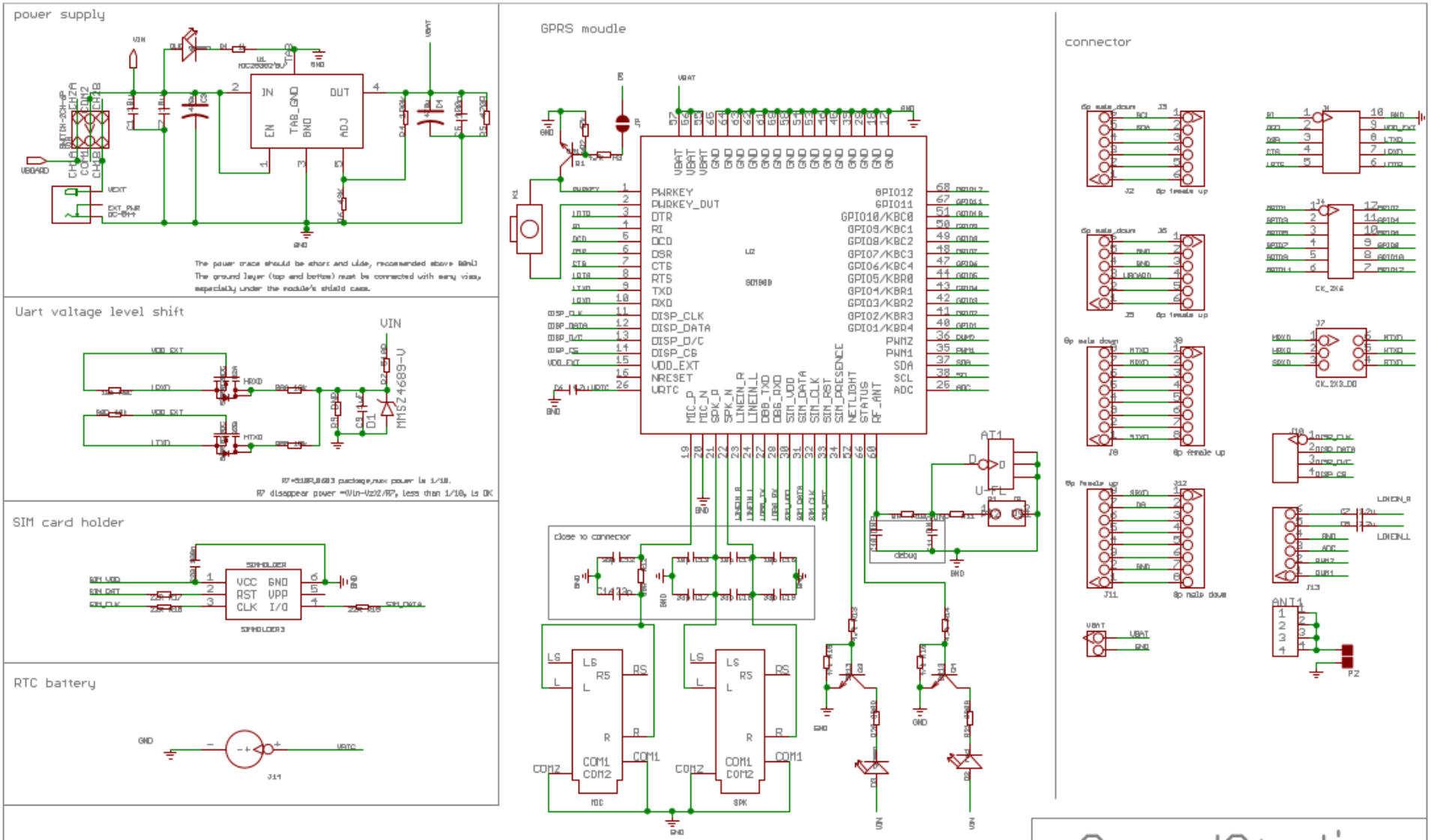
Arduino Leonardo



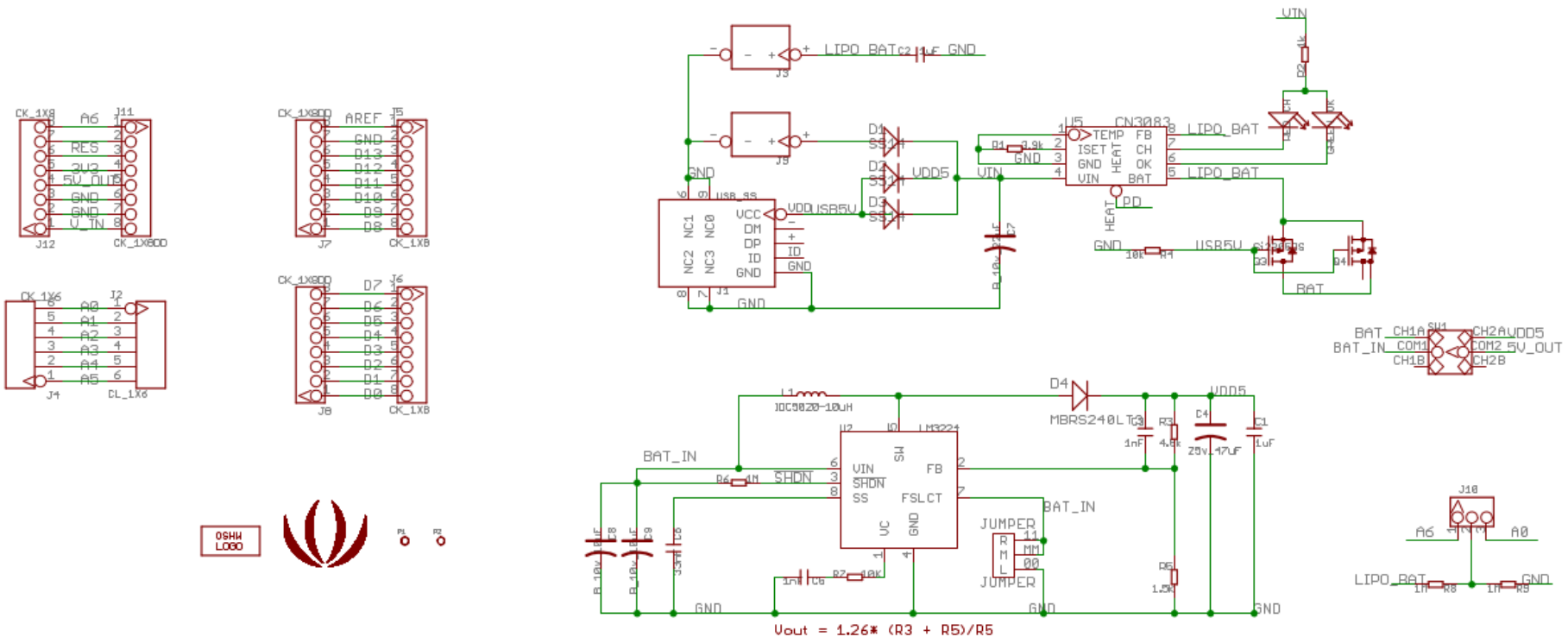
Seeed Studio Solar Shield



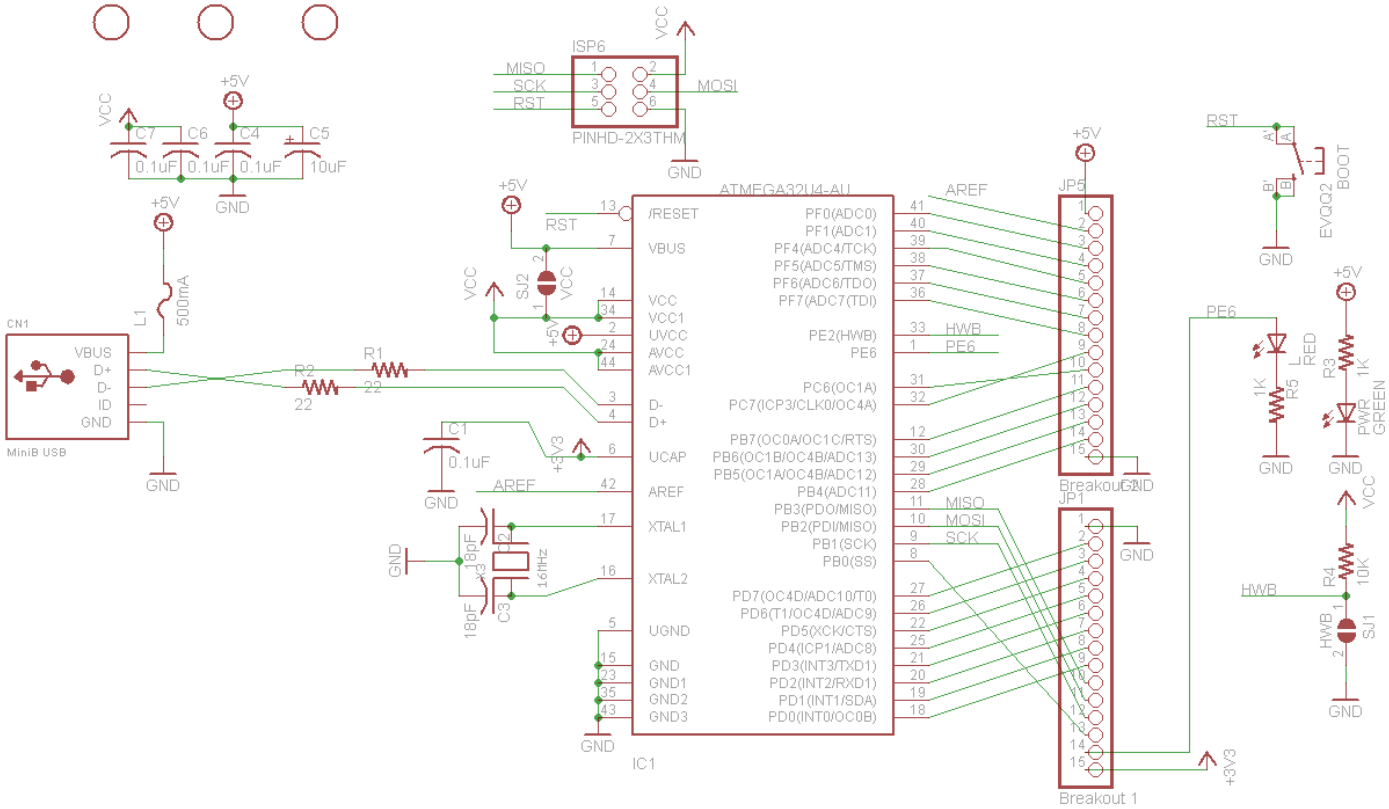
Seeed Studio GPRS Shield



Thanks Seeed Studio!



Thanks Seeed Studio!

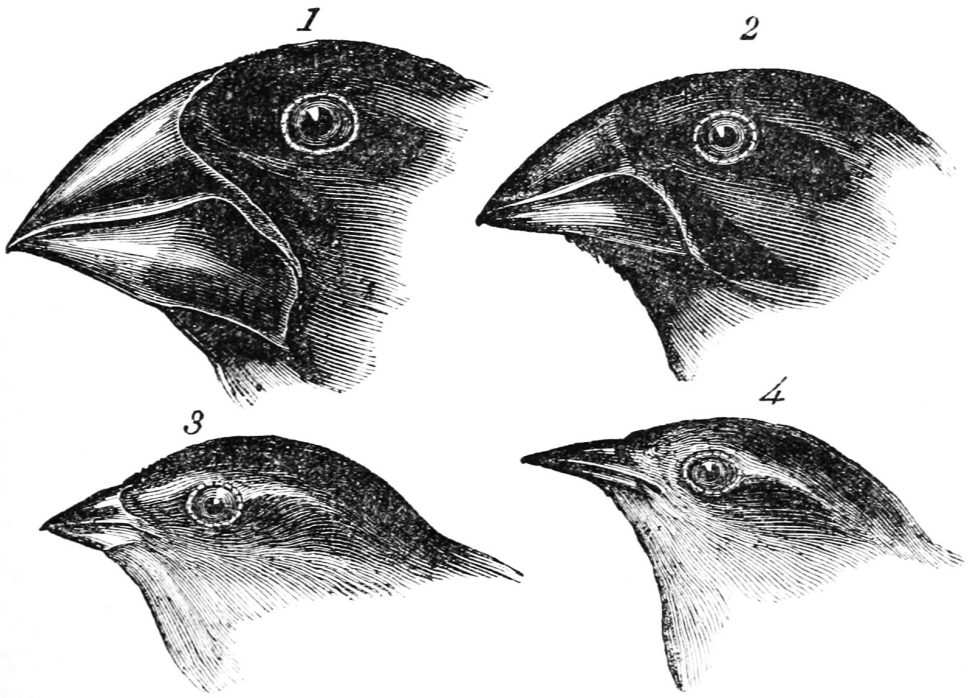


Thanks Limor!

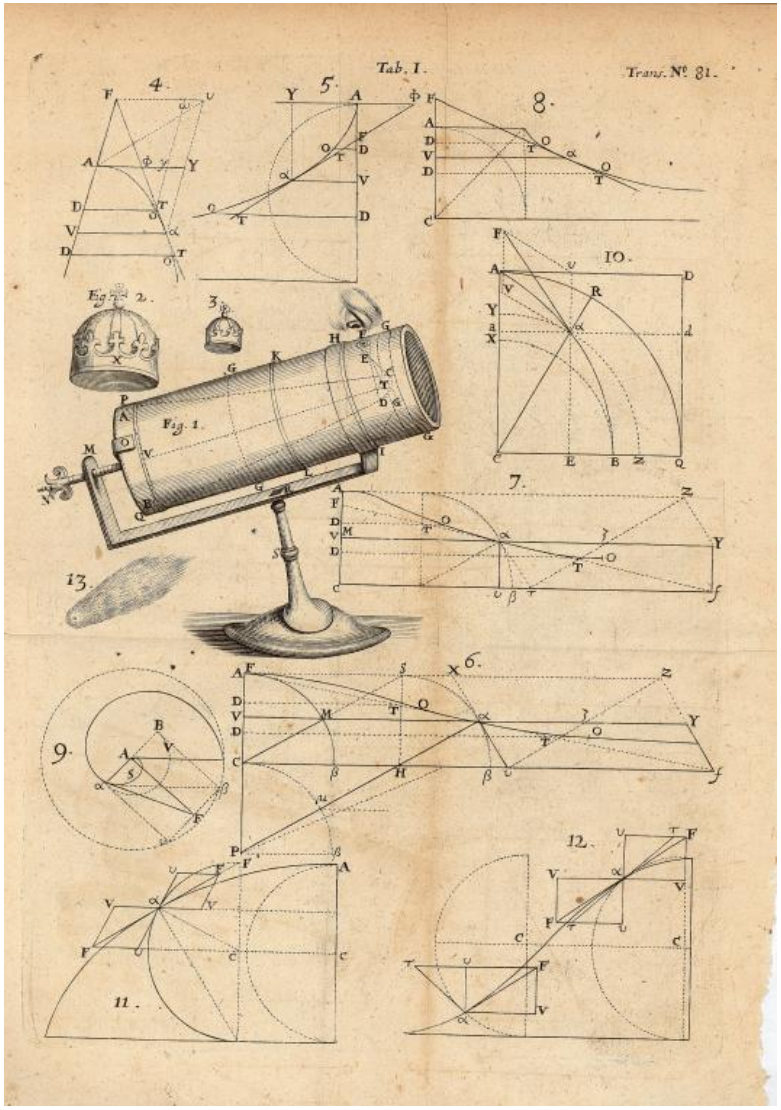
Atmega32u4 Breakout Board+	CC 2.5 BY-SA
http://ladyada.net/products/atmega32u4breakout/	
TITLE: atmega32u4bb	
Document Number:	REV:
Date: 11/5/2010 1:05:24 PM	Sheet: 1/1

We depend on these machines...

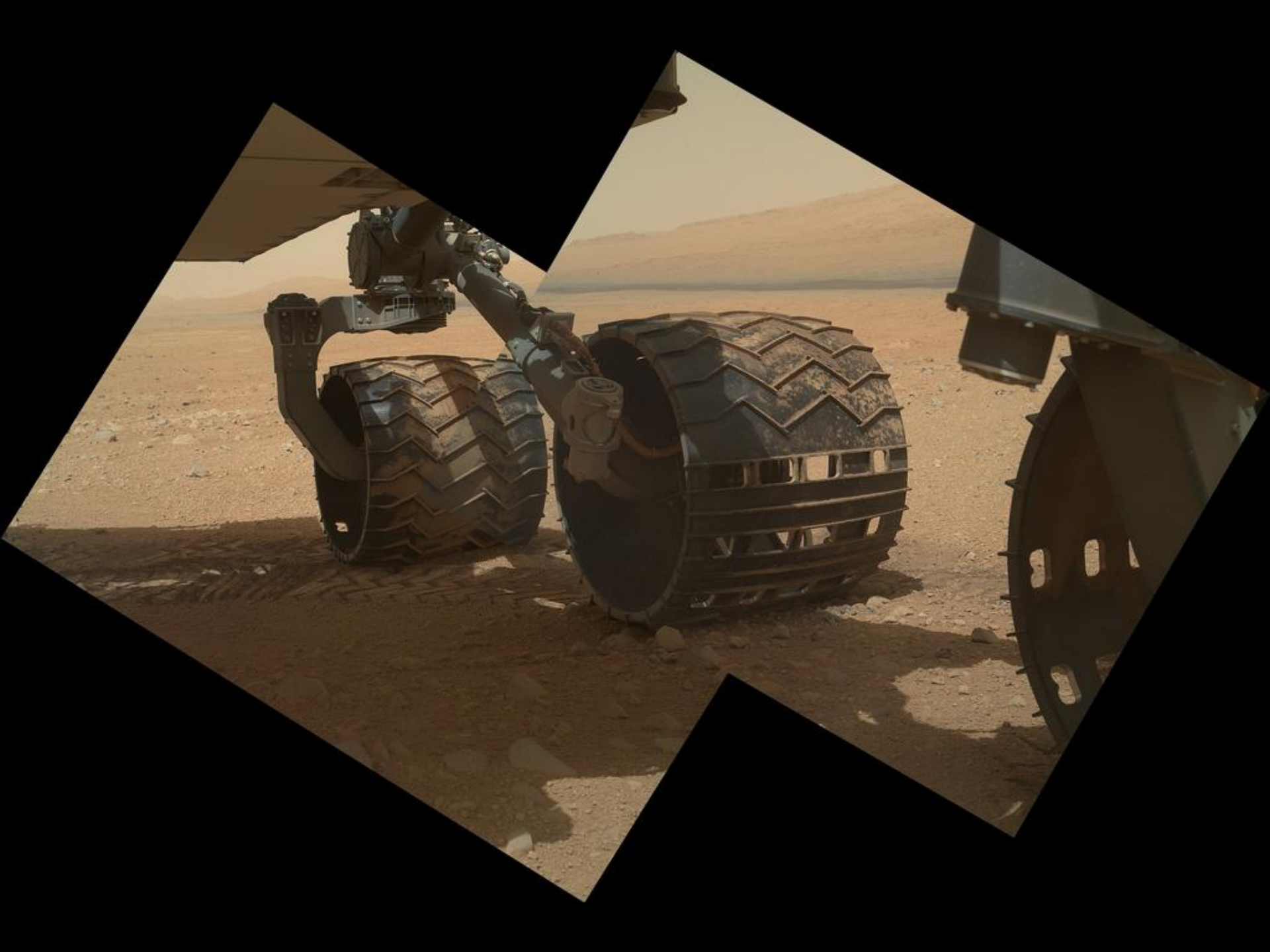
Science
was born
when
researchers
stopped
keeping
secrets.



1. Geospiza magnirostris.
2. Geospiza fortis.
3. Geospiza parvula.
4. Certhidea olivasea.



H. COCK EXCVD CVM PRIVILEGIO



Der Doctor Schna-
-bel von Rom

Science Needs *You*

...to design open instrumentation