



# The Carpentries Incubator

## Metadata Annotation in the Scientific Context

Fundamentals of Scientific Metadata: Why Context Matters



You should start  
your project with  
**repeating** your  
collaborator's  
results





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results



## The Publication

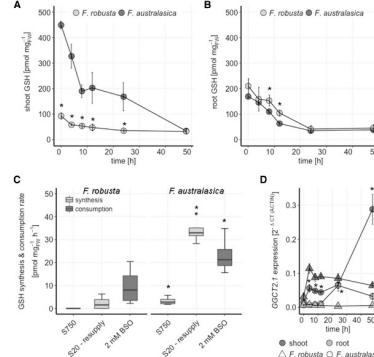


Figure 4. GSH turnover in *F. robusta* and *F. australasica*. GSH concentrations in shoots (A) and roots (B) of 2D-old seedlings are presented in a time course of 48 h after transfer to medium supplemented with 2 mM BSO. Data are presented as means and SEM,  $n = 4$ . C: GSH synthesis was analyzed in 2D-old seedlings exposed to low sulfate (20  $\mu$ M sulfate; S20) or adequate sulfate (750  $\mu$ M sulfate; S750) for 4 d by resupply with 0.2 mM [ $^{35}$ S]ulfate solution for 4 h. GSH consumption rate is calculated from A at 4 h after treatment with 2 mM BSO. Data are shown as box plot (25%-75%), the line represents the median, the whiskers represent the range, and the asterisks represent significant differences between *F. robusta* and *F. australasica* ( $P < 0.05$ , Student's *t*-test). D: GGT2 expression in shoots and roots of 2D-old seedlings in a time course of 48 h after transfer to medium supplemented with 2 mM BSO. Data are presented as means and SEM,  $n = 4$ . Asterisks represent significant differences between *F. robusta* and *F. australasica* at  $P < 0.05$  (Student's *t*-test).

at higher GSH synthesis are therefore likely to be involved in the adjustment of S supply and GSH homeostasis of  $C_4$  plants.

### Partitioning of S in Shoots and Roots of *Flaviera* Species

To test the significance of the root to S metabolism in the context of the evolution of  $C_4$  photosynthesis, the five species were grown under full nutrient and low S conditions. Total S, sulfate and low M, thiols were determined in shoots and roots (Supplemental Fig. S7). Whereas total S and sulfate did not show any clear patterns relative to photosynthetic type, Cys, and GSH

at full nutrition. To better understand the partitioning of S in the different species, the relative portions of total S in sulfate, Cys, and GSH were calculated (Fig. 5). In the shoots of fully nourished *Flaviera* species, the fraction of total S occupied by inorganic sulfate was relatively stable at 50%–70%. However, in the roots, the fraction of sulfate decreased in all species except the  $C_4$  species. Exposure to S deficiency reduced the sulfate pool in the shoots and roots of *F. robusta*, *F. linearis*, *F. anomala*, and *F. palmeri* to 3.5%–16%. The  $C_3$  species *F. australasica* suffered little loss of relative sulfate pool in shoots, but showed a strong decrease in roots. The increase in GSH fractions of total S in shoots and roots

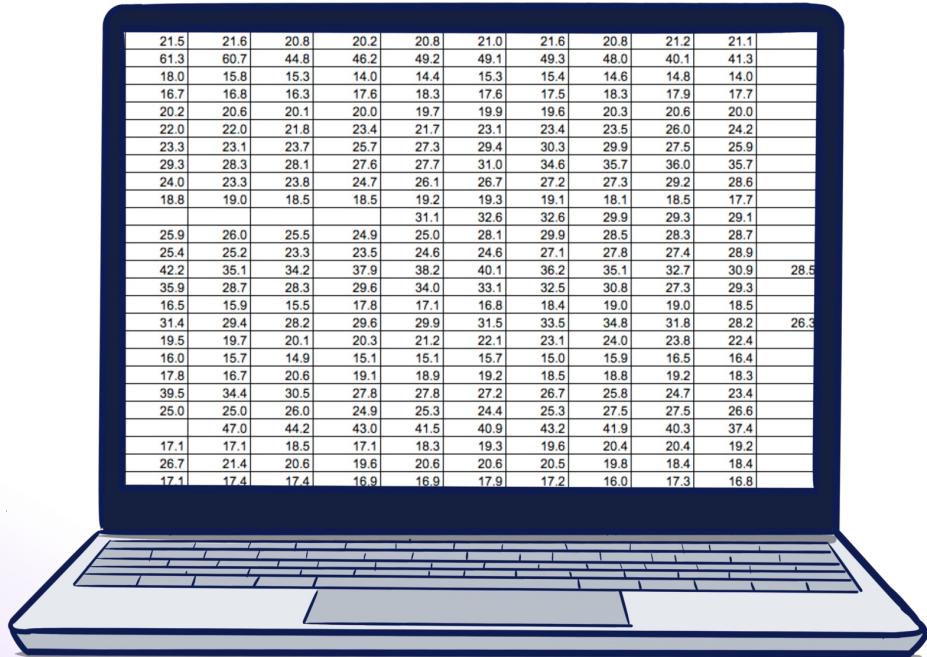


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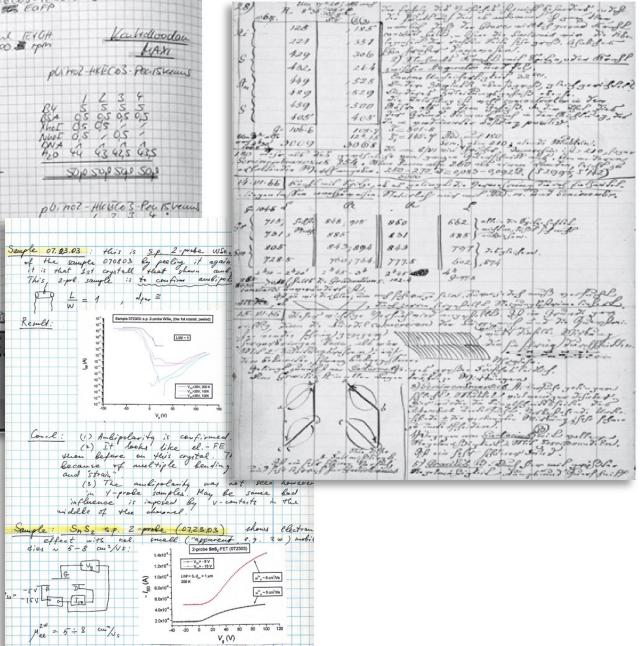
## The Data

21.5	21.6	20.8	20.2	20.8	21.0	21.6	20.8	21.2	21.1	
61.3	60.7	44.8	46.2	49.2	49.1	49.3	48.0	40.1	41.3	
18.0	15.8	15.3	14.0	14.4	15.3	15.4	14.6	14.8	14.0	
16.7	16.8	16.3	17.6	18.3	17.6	17.5	18.3	17.9	17.7	
20.2	20.6	20.1	20.0	19.7	19.9	19.6	20.3	20.6	20.0	
22.0	22.0	21.8	23.4	21.7	23.1	23.4	23.5	26.0	24.2	
23.3	23.1	23.7	25.7	27.3	29.4	30.3	29.9	27.5	25.9	
29.3	28.3	28.1	27.6	27.7	31.0	34.6	35.7	36.0	35.7	
24.0	23.3	23.8	24.7	26.1	26.7	27.2	27.3	29.2	28.6	
18.8	19.0	18.5	18.5	19.2	19.3	19.1	18.1	18.5	17.7	
					31.1	32.6	32.6	29.9	29.3	29.1
25.9	26.0	25.5	24.9	25.0	28.1	29.9	28.5	28.3	28.7	
25.4	25.2	23.3	23.5	24.6	24.6	27.1	27.8	27.4	28.9	
42.2	35.1	34.2	37.9	38.2	40.1	36.2	35.1	32.7	30.9	28.5
35.9	28.7	28.3	29.6	34.0	33.1	32.5	30.8	27.3	29.3	
16.5	15.9	15.5	17.8	17.1	16.8	18.4	19.0	19.0	18.5	
31.4	29.4	28.2	29.6	29.9	31.5	33.5	34.8	31.8	28.2	26.3
19.5	19.7	20.1	20.3	21.2	22.1	23.1	24.0	23.8	22.4	
16.0	15.7	14.9	15.1	15.1	15.7	15.0	15.9	16.5	16.4	
17.8	16.7	20.6	19.1	18.9	19.2	18.5	18.8	19.2	18.3	
39.5	34.4	30.5	27.8	27.8	27.2	26.7	25.8	24.7	23.4	
25.0	25.0	26.0	24.9	25.3	24.4	25.3	27.5	27.5	26.6	
47.0	44.2	43.0	41.5	40.9	43.2	41.9	40.3	37.4		
17.1	17.1	18.5	17.1	18.3	19.3	19.6	20.4	20.4	19.2	
28.7	21.4	20.6	19.6	20.6	20.6	20.5	19.8	18.4	18.4	
17.1	17.4	17.4	16.9	16.9	17.9	17.2	16.0	17.3	16.8	





# The Documentation



# Monya Baker

„More than 70 % of researchers have tried and failed to reproduce another scientist's experiments.

More than half have failed to reproduce their own experiments.“

Quote: Baker, M. 1,500 scientists lift the lid on reproducibility. *Nature* **533**, 452 – 454 (2016). <https://doi.org/10.1038/533452a>

Image: <https://www.booksmithe.com/event/bindery-launch-katie-burke-urban-playground-what-kids-say-about-living-san-francisco>



# Slightly better – lab notes

	A	B	C	D	E
1	t	ax	ay	az	scr
2	0	0.3931848	-0.1593144	-0.4178079	0
3	0.01	0.3957354	-0.15696	-0.4242825	0
4	0.04	0.4138839	-0.1547037	-0.429678	0
5	0.05	0.4415481	-0.1512702	-0.4325229	0
6	0.06	0.4741173	-0.1488177	-0.434583	0
7	0.08	0.5021739	-0.1521531	-0.4285008	0
8	0.1	0.5247369	-0.1669662	-0.420849	0
9	0.11	0.5421987	-0.1813869	-0.4160421	0
10	0.14	0.5506353	-0.1947285	-0.4094694	0
11	0.15	0.5538726	-0.203067	-0.4057416	0
12	0.16	0.5534802	-0.2035575	-0.4056435	0
13	0.17	0.5527935	-0.1961019	-0.4098618	0
14	0.2	0.558189	-0.1908045	-0.4121181	0
15	0.21	0.5764356	-0.1865862	-0.4162383	0
16	0.22	0.589581	-0.18639	-0.4258521	0
17	0.25	0.6049827	-0.1941399	-0.4243806	0
18	0.26	0.619992	-0.206991	-0.4192794	0
19	0.27	0.6320583	-0.2191554	-0.4092732	0
20	0.3	0.6392196	-0.2279844	-0.3975993	0
21	0.31	0.6465771	-0.2317122	-0.3908304	0
22	0.32	0.6583491	-0.2291616	-0.3950487	0
23	0.34	0.6725736	-0.2220984	-0.4050549	0



someRandomFileName.csv



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8	0.1	0.5247369	-0.1669662	-0.420849	0
9	0.11	0.5421987	-0.1813869	-0.4160421	0
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20220228\_recordingData.csv

2022-02-28

Gotham City, New Jersey, USA

Flight of the bat

weather: more clouds than sun, 11°C, 74% humidity,  
1023 mbars, 55W, 17 km/h

recording device strapped to upper arm



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7	0.08	0.5021739	-0.1521531	-0.4285008	0
8	0.1	0.5247369	-0.1669662	-0.420849	0
9	0.11	0.5421987	-0.1813869	-0.4160421	0
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20220228

recordingData.csv

LAB NOTES IV

LAB NOTES III

LAB NOTES II

LAB NOTES I

2022 - 02 - 28

Gotham City, New Jersey, USA

Flight of the bat

weather: more clouds than sun, 11°C, 74% humidity,  
1023 mbars, 55W, 17 km/h

recording device strapped to upper arm

# Slightly better – lab notes



- some kind of documentation

- unstructured
- hard to find
- separated from data
- hard to share / only in the possession of the experimentator
- frequently hard to read

2022-02-28

11°C, 74% humidity,

6

recording device strapped to upper arm

A	B
1 t	ax
2 0	0.3931
3 0.01	0.3957
4 0.04	0.4138639
5 0.05	0.4415481
6 0.06	0.4741173
7 0.08	0.5021
8 0.1	0.5247
9 0.11	0.5421
10 0.14	0.5506
11 0.15	0.5538726
12 0.16	0.5534802
13 0.17	0.5527935
14 0.2	0.558189
15 0.21	0.5764356
16 0.22	0.589581
17 0.25	0.6049827
18 0.26	0.619992
19 0.27	0.6320583
20 0.3	0.6392196
21 0.31	0.6465771
22 0.32	0.6583491
23 0.34	0.6725736



dingData.csv

LAB NOTES IV

LAB NOTES III



# Even better – Readme style metadata

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1	t	ax	ay	az	scr
2	0	0.3931848	-0.1593144	-0.4178079	0
3	0.01	0.3957354	-0.15696	-0.4242825	0
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20220228\_recordingData.csv



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20220228\_recordingData.csv



20220228\_recordingData\_Readme.txt

```
Open Save 20220228_trainingObject_Readme.txt ~ /Documents/IAS-9/HMC/HubInfo_Information-and-Materials/materiel 3  
4 The data describes the biomechanical acceleration and screams detected of a test person during  
5 the ride of the roller coaster "Flight of the Bat" in Gotham City.  
6 The data was collected by Bruce Wayne and Selina Kyle (Institute for Vigilance and Nightly Motion  
- Justice League) on 2022-02-28 in Gotham City, New Jersey.  
7 Weather conditions were optimal for the measurement, 11°C, more clouds than sun, 74% humidity,  
SSW wind with 17 km/h velocity.  
8  
9 Test person:  
10 The test person (male) is 5'11 tall and weighs 187 lbs.  
11  
12 Recording procedure:  
13 The test person strapped the recording device (iPhone X) with a running armband to the left upper  
arm and activated the biomechanical acceleration and scream detection of the application Physics  
Toolbox Suite by Vleyra Software.  
14 During the ride, the test person was instructed to grab the seat handles tightly to avoid  
excessive movement of the arm. The test person was seated in row 10 on the outer left (seat 37).  
15  
16 Recorded variables:  
17 "t" describes the ride time at which measurements were taken upon activating the recording.  
18 "ax" describes the biomechanical acceleration of the test person on the x axis in m/s2.  
19 "ay" describes the biomechanical acceleration of the test person on the y axis in m/s2.  
20 "az" describes the biomechanical acceleration of the test person on the z axis in m/s2.  
21 "scr" is a boolean indicating a detected scream of the test person.
```



# Even better – Readme style metadata

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20220228\_recordingData.csv



20220228\_recordingData\_Readme.txt

```
*Readme.md
-/Documents/AS-9/HMC/HubInfo_Training/train.../Fundamentals-of-scientific-Metadata/material
20220228_trainingObject_Readme.txt *Readme.md

1 This 20220228_BiomechAcccolosus_Readme.txt file was generated on 2022-02-28 by Bruce Wayne
2
3
4
5 GENERAL INFORMATION
6
7 1. Title of Dataset: Biomechanical acceleration - Flight of the Bat, Gotham City
8
9
10
11
12 2. Author Information
13
14 A. Principal Investigator Contact Information
15
16 Name: Bruce Wayne
17
18 Institution: Institute for Vigilance and Nightly Motion - Justice League
19
20 Address: Gotham City, New Jersey
21
22 Email: b.wayne@batman.com
23
24
25
26 B. Associate or Co-investigator Contact Information
27
28 Name: Selina Kyle
29
30 Institution: Institute for Vigilance and Nightly Motion - Justice League
31
32 Address: Gotham City, New Jersey
33
34 Email: s.kyle@catwoman.com
35
36
37 3. Date of data collection (single date, range, approximate date):
38 2022-02-28
39
40
```

# Even better – Readme style metadata



	A	B	C	D	E	
1	t	a				
2		0				
3	0.01					
4	0.04					
5	0.05					
6	0.06					
7	0.08					
8	0.1					
9	0.11					
10	0.14					
11	0.15					
12	0.16					
13	0.17					
14	0.2	0.558189	-0.1908045	-0.4121181	0	
15	0.21	0.5764356	-0.1865862	-0.4162383	0	
16	0.22	0.589581	-0.18639	-0.4258521	0	
17	0.25	0.6049827	-0.1941399	-0.4243806	0	
18	0.26	0.619992	-0.206991	-0.4192794	0	
19	0.27	0.6320583	-0.2191554	-0.4092732	0	
20	0.3	0.6392196	-0.2279844	-0.3975993	0	
21	0.31	0.6465771	-0.2317122	-0.3908304	0	
22	0.32	0.6583491	-0.2291616	-0.3950487	0	
23	0.34	0.6725736	-0.2220984	-0.4050549	0	



Flight of the bat

## Results



20220228\_recordingData\_Readme.txt

Institution: Institute For Vigilance and Nightly Motion - Justice League  
Address: Gotham City, New Jersey  
Email: b.wayne@batman.com

B. Associate or Co-Investigator Contact Information

Name: Selina Kyle  
Institution: Institute for Vigilance and Nightly Motion - Justice League  
Address: Gotham City, New Jersey  
Email: s.kyle@catwoman.com

3. Date of data collection (single date, range, approximate date):  
2022-02-28

# Even better – Readme style metadata



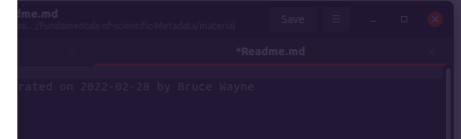
t	A	B	ax	ay	az
0	0	0.3931	-0.203067	-0.4057416	0
0.01	0.01	0.3957	-0.203575	-0.4056425	0
0.04	0.04	0.413833	-0.203067	-0.4057416	0
0.05	0.05	0.4415481	-0.195275	-0.4056425	0
0.06	0.06	0.4741173	-0.195275	-0.4056425	0
0.08	0.08	0.5021739	-0.195275	-0.4056425	0
0.1	0.1	0.5247369	-0.195275	-0.4056425	0
0.11	0.11	0.5421987	-0.195275	-0.4056425	0
0.14	0.14	0.5506353	-0.195275	-0.4056425	0
0.15	0.15	0.5538726	-0.203067	-0.4057416	0
0.16	0.16	0.5534003	-0.203575	-0.4056425	0
0.17	0.17	0.5527	-0.203067	-0.4057416	0
0.2	0.2	0.558	-0.203575	-0.4056425	0
0.21	0.21	0.5764	-0.203067	-0.4057416	0
0.22	0.22	0.589	-0.203575	-0.4056425	0
0.25	0.25	0.6049827	-0.195275	-0.4056425	0
0.26	0.26	0.619992	-0.195275	-0.4056425	0
0.27	0.27	0.6320583	-0.2191554	-0.4092732	0
0.3	0.3	0.6392196	-0.2279844	-0.3975993	0
0.31	0.31	0.6465771	-0.2317122	-0.3908304	0
0.32	0.32	0.6583491	-0.2291616	-0.3950487	0
0.34	0.34	0.6725736	-0.2220984	-0.4050549	0

- documentation linked to the data
- locally searchable
- Readme file can be shared with the data
- increased readability



dingData.csv

dingData\_Readme.txt



- unstructured
- subjective information
- only keyword search possible

1. Title of Dataset:	Biomechanical acceleration - Flight of the Bat, Gotham City
2. Date of data collection (single date, range, approximate date):	2022-02-28
3. Institutions:	Lance and Nightly Motion - Justice League
4. Address:	Gotham City, New Jersey
5. Email:	s.kyle@catwoman.com

# Even better – Readme style metadata



	A	B	C	D	E
1	t	ax	ay	az	scr
2	0	0.3931848	-0.1593144	-0.4178079	0
3	0.01	0.3957354	-0.15696	-0.4242825	0
4	0.04	0.4160000	0.1547007	0.4000700	0
5	0.05	0.4160000	0.1547007	0.4000700	0
6	0.06	0.4160000	0.1547007	0.4000700	0
7	0.08	0.4160000	0.1547007	0.4000700	0
8	0.1	0.524			
9	0.11	0.542			
10	0.14	0.550			
11	0.15	0.553			
12	0.16	0.5534802	-0.2035575	-0.4056435	0
13	0.17	0.5527935	-0.1961019	-0.4098618	0
14	0.2	0.558189	-0.1908045	-0.4121181	0
15	0.21	0.5764356	-0.1865862	-0.4162383	0
16	0.22	0.589581	-0.18639	-0.4258521	0
17	0.25	0.6049827	-0.1941399	-0.4243806	0
18	0.26	0.619992	-0.206991	-0.4192794	0
19	0.27	0.6320583	-0.2191554	-0.4092732	0
20	0.3	0.6392196	-0.2279844	-0.3975993	0
21	0.31	0.6465771	-0.2317122	-0.3908304	0
22	0.32	0.6583491	-0.2291616	-0.3950487	0
23	0.34	0.6725736	-0.2220984	-0.4050549	0



20220228\_recordingData.csv

readme.txt

```
Save Readme.md
```

Readme.md

```
1
2. Author Information
3
4. A. Principal Investigator Contact Information
5
6. Name: Bruce Wayne
7. Institution: Institute for Vigilance and Nightly Motion - Justice League
8. Address: Gotham City, New Jersey
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36
37. Date of data collection (single date, range, approximate date):
38. 2022-02-28
39
40
```

[https://ordo.open.ac.uk/articles/dataset/Template\\_for\\_a\\_REA\\_DME\\_file\\_for\\_data\\_uploads/13332743/1](https://ordo.open.ac.uk/articles/dataset/Template_for_a_REA_DME_file_for_data_uploads/13332743/1)

Link in Episode!

# Questions?



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Why Context Matters**

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The Carpentries Incubator.

You can find more information about this course on **Github**.

image:  
[https://c.pxhere.com/photos/35/f5/coffee\\_notebook\\_wooden\\_background\\_orange\\_work\\_table\\_office-1222115.jpg!d](https://c.pxhere.com/photos/35/f5/coffee_notebook_wooden_background_orange_work_table_office-1222115.jpg!d)

