



## Metadata Standards

Fundamentals of Scientific Metadata: Why Context Matters

# Schema or standard?



A well established metadata schema can become a standard.

# The Dublin Core



**Researchers, librarians and web technologists drafted the Dublin Core** – a set of library-card-catalog-like metadata elements for the web – in 1995 at a meeting in Dublin, Ohio (USA). [1]

Creator  
Contributor  
Publisher  
Title  
Date  
Language  
Format  
Subject  
Description  
Identifier  
Relation  
Source  
Type  
Coverage  
Rights

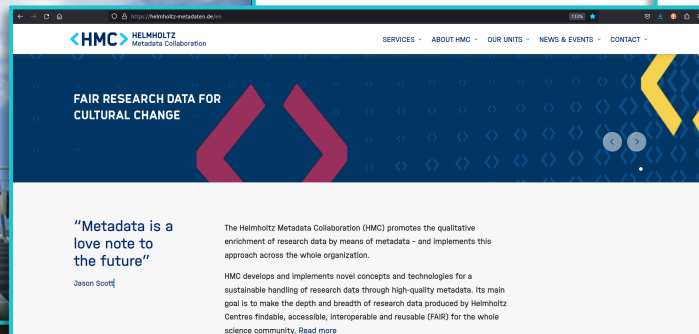
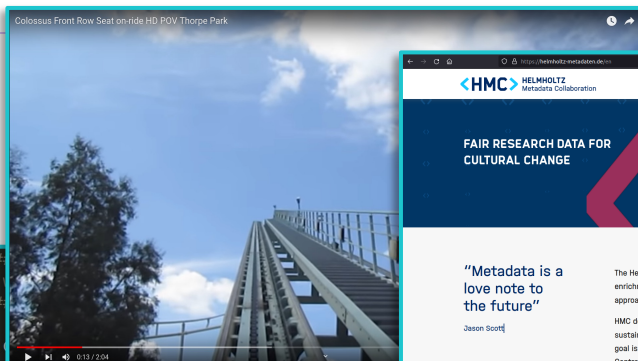
[1] <https://www.dublincore.org/resources/metadata-basics/>

[2] <https://www.dublincore.org/specifications/dublin-core/dcmi-terms/#section-3>

[3] <https://www.dublincore.org/about/>

[4] <https://www.iso.org/standard/71339.html>

# Web resources



## Sulfate Metabolism in *C. Flaveria* Species Is Controlled by the Root and Connected to Serine Biosynthesis<sup>11OPEN</sup>

Sebastian Gerlich,<sup>1,2</sup> Berkley J. Walker,<sup>3</sup> Stephan Krueger,<sup>2</sup> and Stanislav Kopriva<sup>1,2,3</sup>  
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<sup>2</sup>Cluster of Excellence on Plant Sciences, University of Cologne, 50674 Cologne, Germany  
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evolution of *C. photosynthesis* led to an increase in carbon assimilation rates and plant growth compared to *C. photosynthesis* plants. This enhanced plant growth, in turn, affects the requirement for soil-derived mineral nutrients. However, mineral nutrition has scarcely been considered in connection with *C. photosynthesis*. Sulfur is crucial for plant growth and development, and preliminary studies in the genus *Flaveria* suggested metabolic differences in sulfate assimilation along the *C. glutathione* (GSH) pathway. Here, we show that in controlled conditions, sulfur accumulation of the reduced sulfur compounds Cys and glutathione (GSH) increased with progressing establishment of the *C. photosynthesis* cycle in different *Flaveria* species. An increased demand for reduced sulfur in *C. Flaveria* species is reflected in high rates of [<sup>35</sup>S]sulfate incorporation into GSH upon sulfate deprivation and increased GSH turnover as a reaction to the inhibition of GSH synthesis. Expression analyses indicate that the  $\gamma$ -glutamyl cycle is crucial for the recycling of GSH in *C. species*. Sulfate reduction and GSH synthesis seems to be preferentially localized in the roots of *C. species*, which might be linked to the co-localization with the phosphorylated pathway of biosynthesis. Interspecific grafting experiments of *F. robusta* (C) and *F. hirsuta* (C<sub>2</sub>) revealed that the root system primarily controls sulfate acquisition, GSH synthesis, and sulfate and metabolite allocation in C<sub>2</sub> and C<sub>1</sub> plants. This study thus shows that the function of *C. photosynthesis* resulted in a wide range of adaptations of sulfur metabolism and points out the need for broader studies on importance of mineral nutrition for C<sub>2</sub> plants.

Sulfur (S) possesses a wide variety of essential functions for cell structure and metabolism. Incorporated in the amino acids Cys and Met, S is an important component of proteins. Cys is further a constituent of the tripeptide glutathione (GSH), which maintains cellular redox balance and is involved in signaling and xenobiotic and heavy metal detoxification (Rouhier et al., 2008). Further, GSH is a component of prosthetic groups of various enzymes, clusters, lipids, and coenzymes.

Sulfate uptake and distribution within the organism is facilitated by sulfate transporters. For assimilation, the inert and stable sulfate is activated by ATP sulfurylase (ATPS) by transferring it onto an  $\alpha$ -phosphate residue of ATP and yielding in adenosine-5-phosphosulfate (APS).



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"format": "text/csv",  
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 "creatorAffiliation": "Institute for Vigilance"

{  
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 "creatorAffiliation": "Institute for Vigilance"

"experimentalParameters": {  
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},  
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 "testDevice": "iPhone X",  
 "testDeviceFixture": "left upper arm",  
 "testApp": "Physics Toolbox Suite by Veyra Software"



https://orcid.org/  
0000-0003-3043-5657

Keywords  
Plant Science, Research Data Management, Data Science, Molecular Biology, Metadata

Countries  
Germany

to this you? Sign in to start

None  
Silke Christine Gerlich

Activities  
Employment (3)

Forschungszentrum Jülich GmbH, Jülich, Nordrhein-Westfalen, DE

2021-06-01 to present | Post Doc (IAS-9 | Helmholtz Metadata Collaboration (HMC))  
Employment

Source: Silke Christine Gerlich

StudienStiftung des deutschen Volkes eV, Bonn, Nordrhein-Westfalen, DE

2018-01-01 to 2020-09-30 | Coordinator  
Employment

Source: Silke Christine Gerlich

Universität zu Köln, Köln, Nordrhein-Westfalen, DE

2015-01-01 to 2018-12-31 | PhD student (Botanical Institute)  
Employment

Source: Silke Christine Gerlich

```
#####  
##### CREATE  
#####  
pathDict = {a:  
#####  
### assign template path for specific "Course Title"  
if pathDict.get("Course Title") == "Fundamentals of sci  
pathDict.update({"Template Path" : "/local/home/s.g.  
#####  
### UPDATE THIS PART IF NECESSARY ###  
#elif pathDict.get("Course Title") == "Metadata for data  
# pathDict.update({"Template Path" : "another/File/Path"  
#elif pathDict.get("Course Title") == "Introduction to l  
# pathDict.up  
#####  
pathDict = {key:  
#####  
### convert cou  
pathJsonOut = js  
#####  
### save metaJsc  
jsonFile = open  
jsonFile.write(p
```

	ax	ay	az	scr
0	0.3931848	-0.1593144	-0.41780789999999999	0
0.01000000000000019	0.3957354	-0.15696	-0.4242825	0
0.04000000000000021	0.4138839	-0.1547037	-0.42967800000000001	0
0.05000000000000011	0.4415481	-0.1512702	-0.4325229	0
0.06000000000000002	0.4741173	-0.1488177	-0.434583	0
0.08000000000000013	0.5021739	-0.1521531	-0.42850079999999999	0
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0.31000000000000002	0.6465771	-0.2317122	-0.39083040000000001	0
0.32000000000000022	0.6583491	-0.2291616	-0.3950487	0
0.34000000000000003	0.6725736	-0.2220984	-0.4050549	0
0.36000000000000014	0.6905259	-0.2168001	-0.41378580000000001	0
0.37000000000000005	0.7047504	-0.2139561	-0.4142763	0



**Dublin Core** and its extensions are widely used and referenced today. The Dublin Core Metadata Initiative (DCMI) states to work openly, with a paid-membership model. [3] The 15 Dublin Core metadata elements have been formally standardized for cross-domain resource description as e. g. **ISO 15836-1:2017**. [4]

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[4] <https://www.iso.org/standard/71339.html>








<https://www.science.org/>




 Inspector  Console  Debugger  Network 

 Search HTML  

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ring:Publication Websites;pageGroup:string:Publication Pages">
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<meta name="citation_journal_title" content="Science">
<meta name="dc.Title" content="USB1 is a miRNA deadenylase that regulates hematopo
<meta name="dc.Creator" content="Ho-Chang Jeong">
<meta name="dc.Creator" content="Siddharth Shukla">
<meta name="dc.Creator" content="Wilson Chun Fok">
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<meta name="dc.Creator" content="Luis Francisco Zirnberger Batista">
<meta name="dc.Creator" content="Roy Parker">
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U6 small nuclear RNA maturation, the molecular m...">
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small nuclear RNA maturation, the molecular m...">
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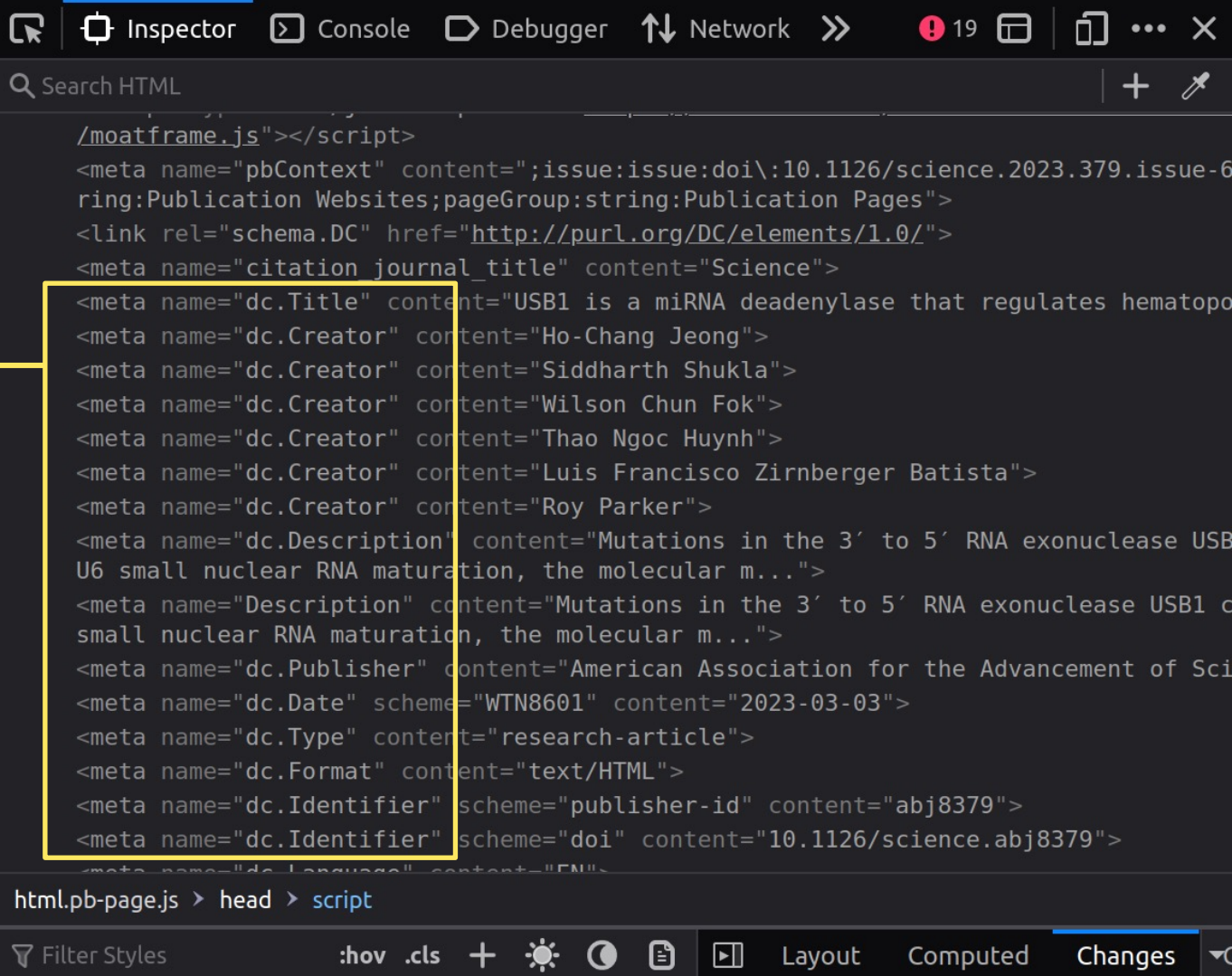
html.pb-page.js > head > script

 Filter Styles  :hov  .cls    

 Layout  Computed  Changes

<https://www.science.org/>

## Dublin Core Elements



Inspector Console Debugger Network

Search HTML

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<meta name="pbContext" content=";issue:issue:doi\10.1126/science.2023.379.issue-6
ring:Publication Websites;pageGroup:string:Publication Pages">
<link rel="schema.DC" href="http://purl.org/DC/elements/1.0/">
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U6 small nuclear RNA maturation, the molecular m...">
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<meta name="dc.Date" scheme="WTN8601" content="2023-03-03">
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html.pb-page.js > head > script

Filter Styles :hov .cls + [Icons] Layout Computed Changes



<https://www.theguardian.com>



Open Graph Protocol

**schema.org**

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<script type="application/ld+json">...</script>
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