

# Stable HTTP URIs For Specimens

Royal Botanic Garden Edinburgh  
4th & 5th June 2013

# Please Interrupt

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- My job here is to steer us through the issues around setting up HTTP URIs for specimens

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- Prescriptive set of tightly scoped stages

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- Prescriptive set of tightly scoped stages
- Please interrupt, disagree & complain
- So long as it is on topic

# Please Interrupt

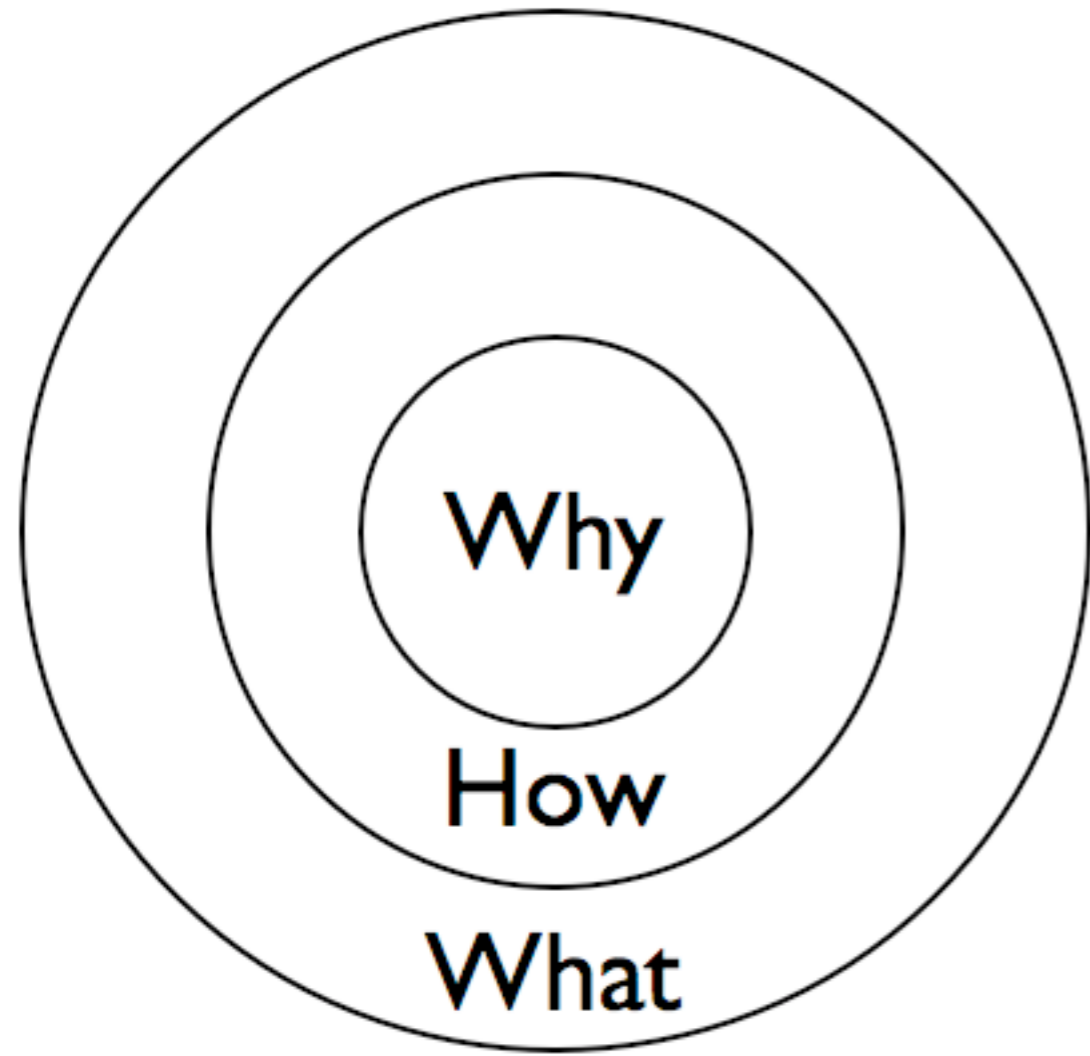
- My job here is to steer us through the issues around setting up HTTP URIs for specimens
- Prescriptive set of tightly scoped stages
- Please interrupt, disagree & complain
- So long as it is on topic
- Also help yourselves to refreshments

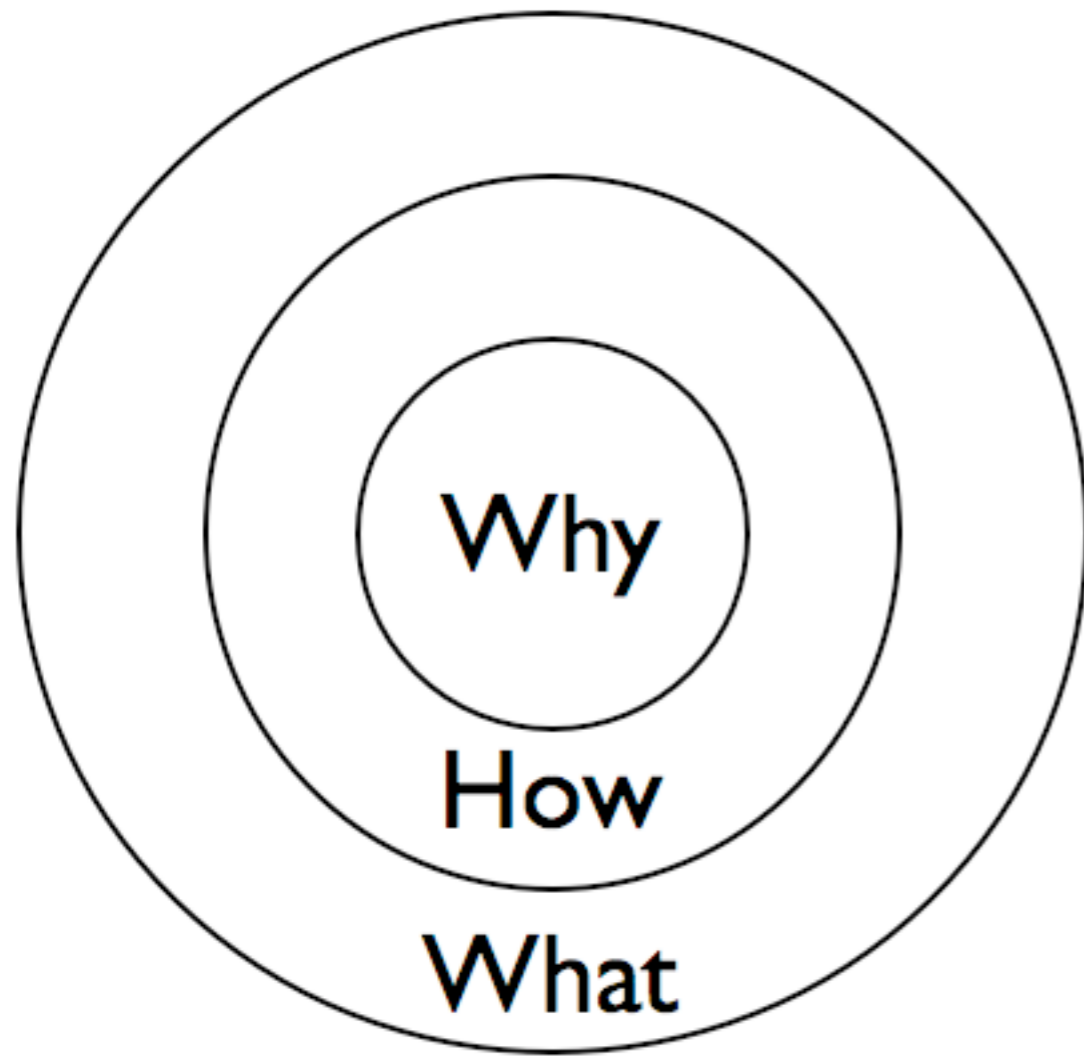
# Start With Why?

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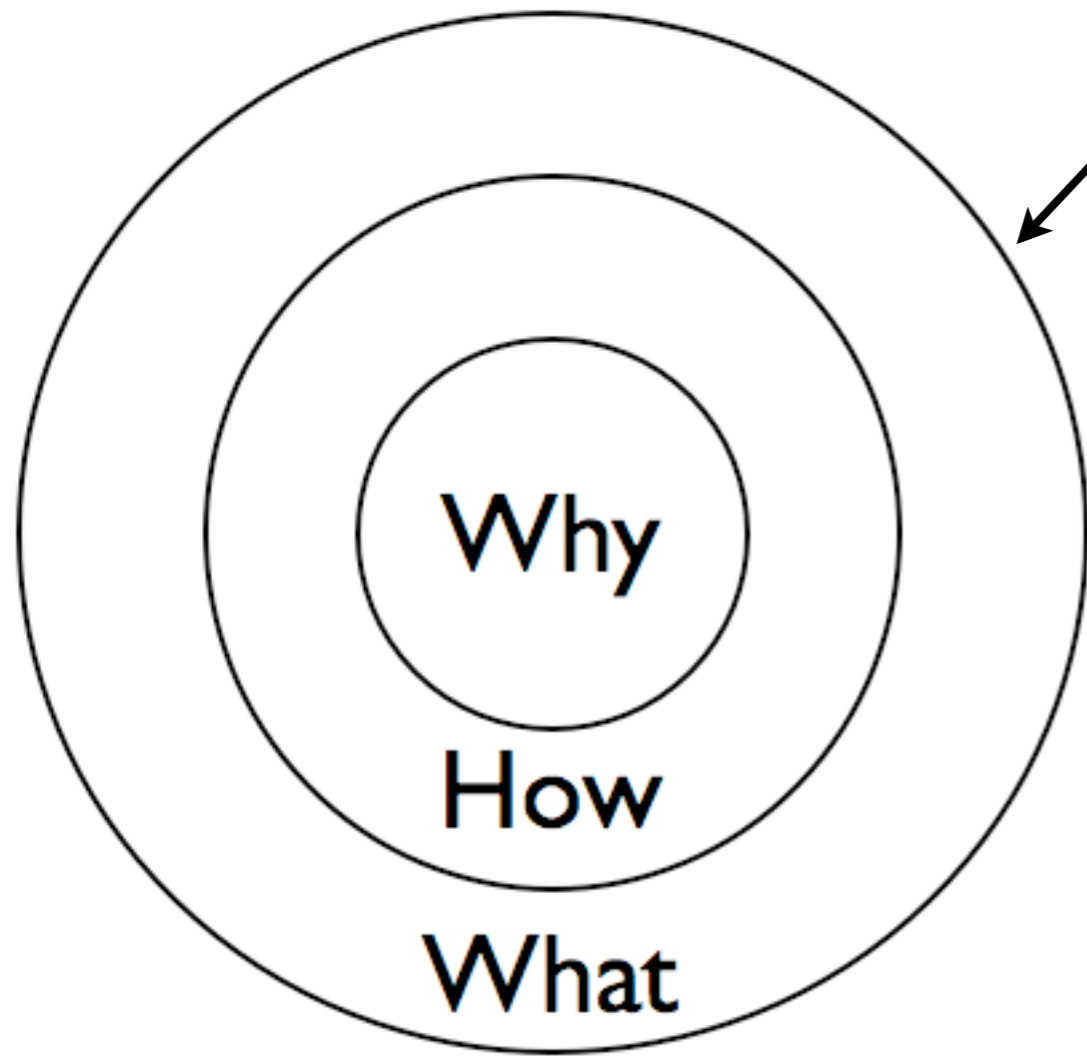
Oh, the vision thing!



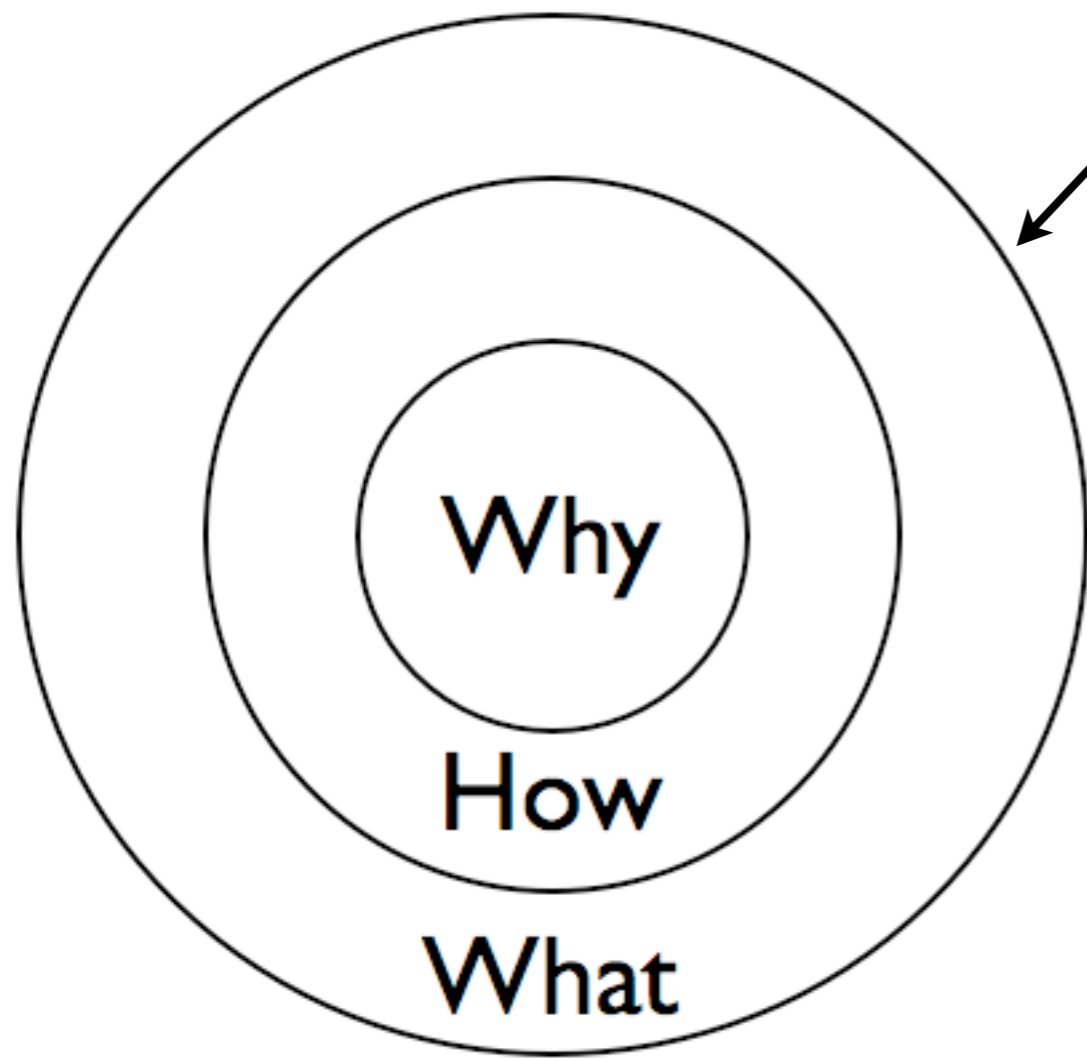


**Stolen from 2009 TED Talk by Simon Sinek: How great leaders inspire action**

This workshop is about  
**What** we do

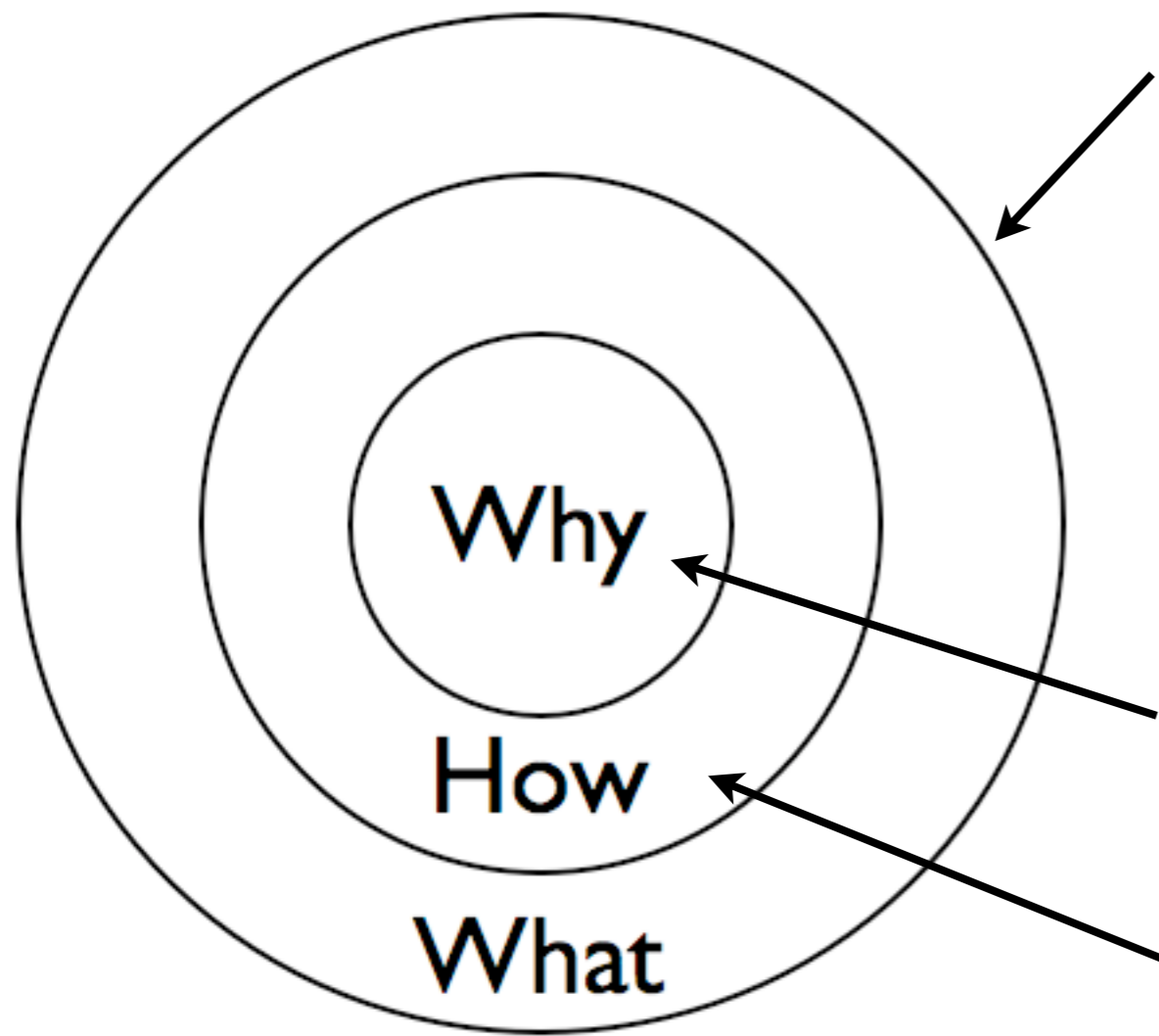


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This workshop is about  
**What** we do

But on what basis will  
we make decisions?

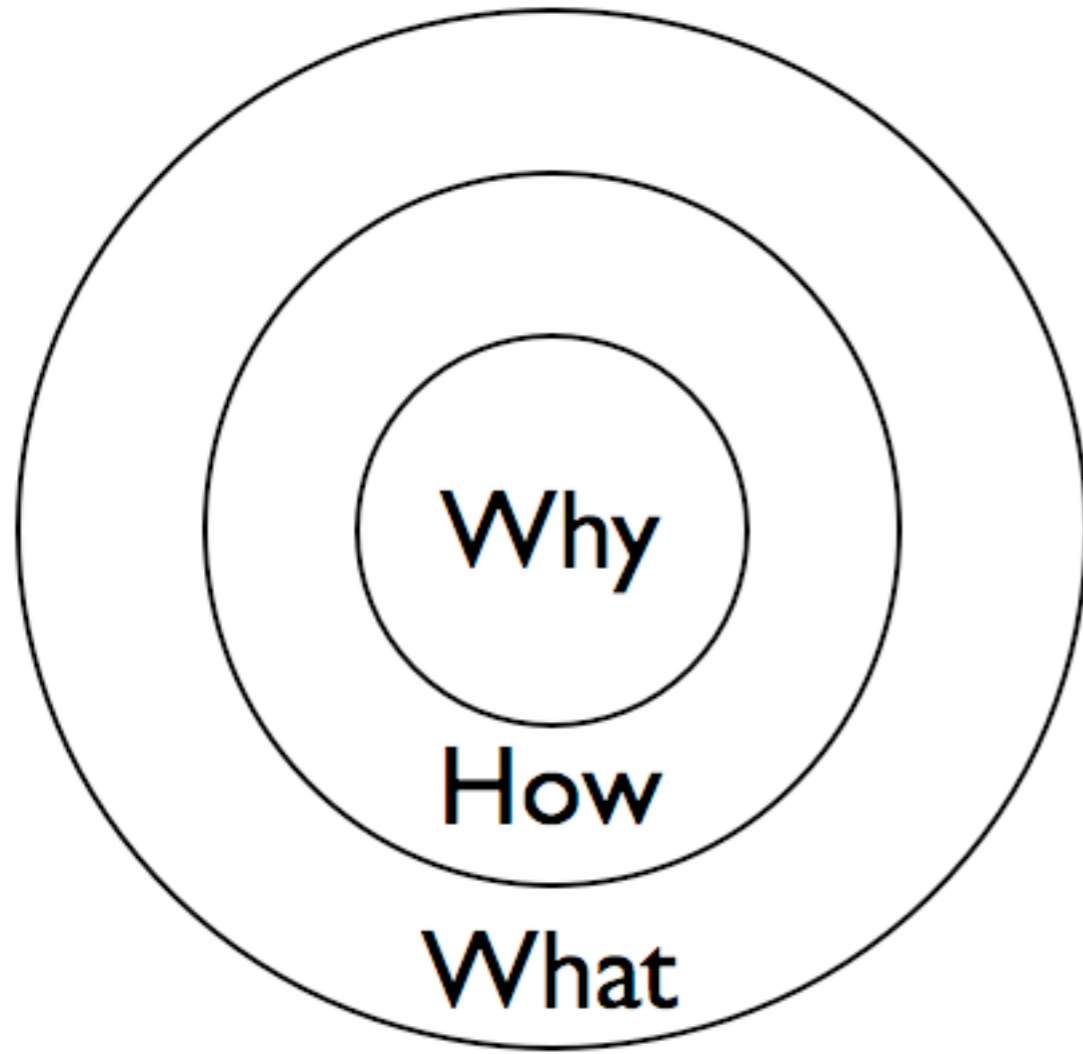


This workshop is about  
**What** we do

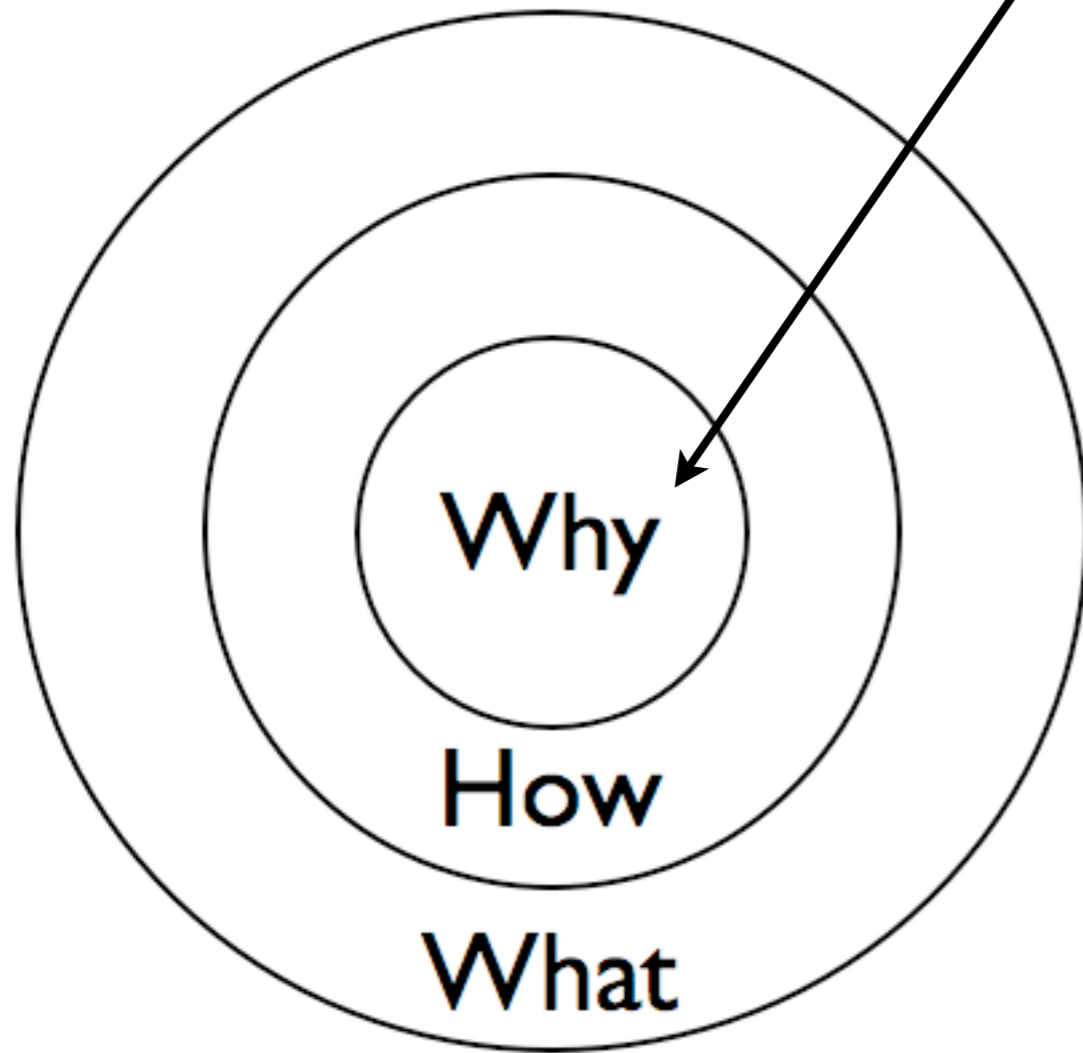
But on what basis will  
we make decisions?

A shared understanding of  
**Why**  
and  
**How** we are doing it

**Why do we have Natural History Museums & Herbaria?**

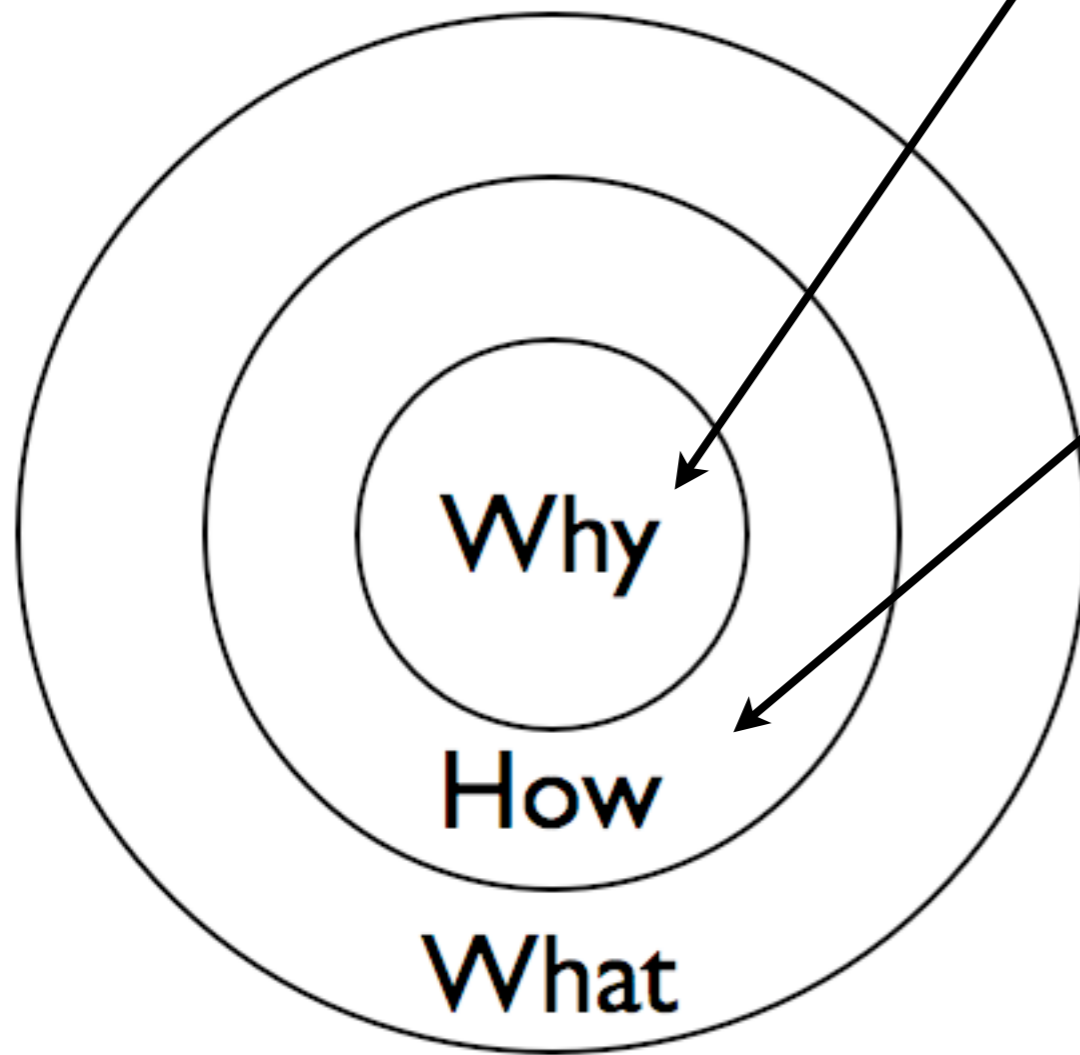


# “Ground Truth” Life Sciences Research - Vouchering



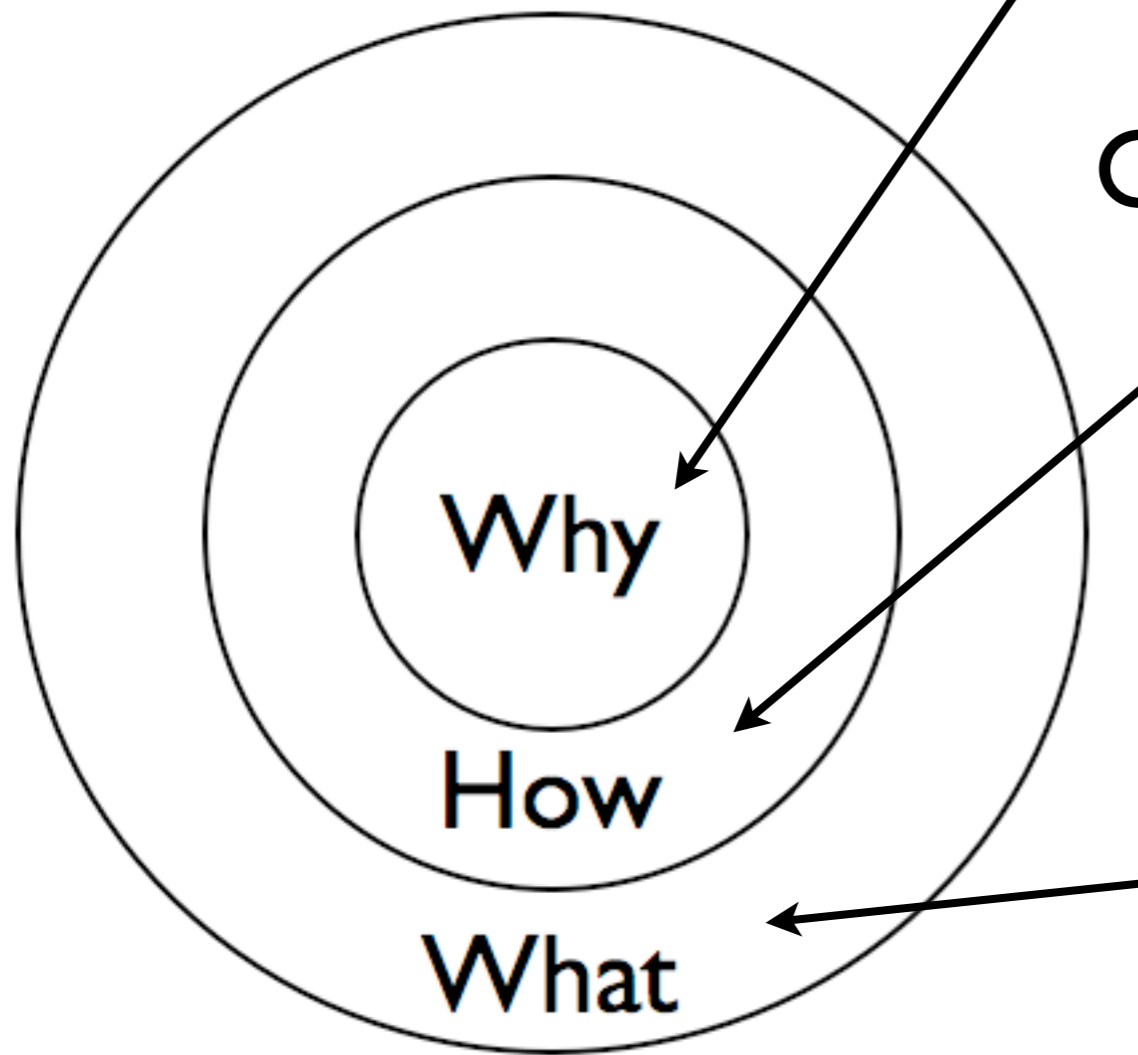
“Ground Truth” Life Sciences  
Research - Vouchering

Curate Collections of Objects  
both physical and digital



“Ground Truth” Life Sciences  
Research - Vouchering

Curate Collections of Objects  
both physical and digital



- \* Select
- \* Describe
- \* Preserve
- \* Track Provenance
- \* Publish on the web
- \* **Make it linkable/citable**



- **Why:** If we are facilitating vouchering we must enable people to cite the vouchers

- **Why:** If we are facilitating vouchering we must enable people to cite the vouchers
- **How:** If we are holding the collections of vouchers then all requests will end up at our door eventually

- **Why:** If we are facilitating vouchering we must enable people to cite the vouchers
- **How:** If we are holding the collections of vouchers then all requests will end up at our door eventually
- **What:** We will implement HTTP URIs for our specimens as a simple way to express our “why”

“It seems reasonable that the reader of a taxonomic publication should expect to click on a reference to a specimen and see an image of that specimen immediately just as they do with references to written works.”

# Examples of Linking

- From PDF - our paper
- From GBIF - Browser
- From EoL - Browser - wrong!
- From GenBank - Elspeth
- From JSTOR - Elspeth





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## Article

### **Stable citations for herbarium specimens on the internet: an illustration from a taxonomic revision of *Duboscia* (Malvaceae)**

ROGER HYAM<sup>1</sup>, ROBYN E. DRINKWATER<sup>1</sup> & DAVID J. HARRIS<sup>1,2</sup>

<sup>1</sup>*Royal Botanic Garden Edinburgh, 20a Inverleith Row, Edinburgh EH3 5LR, UK*

<sup>2</sup>*Email [d.harris@rbge.org.uk](mailto:d.harris@rbge.org.uk)*

#### **Abstract**

A taxonomic revision of *Duboscia* (Malvaceae) with two species, *D. macrocarpa* and *D. viridiflora*, is presented and used to demonstrate a mechanism for linking from revisions to specimens held in herbaria using HTTP URIs. The implementation of this mechanism at the Royal Botanic Garden Edinburgh (E) is used as an example. Advantages of this approach include near universal support amongst web-connected devices. Hindrances to widespread adoption of such an



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### Stable citations for herbarium specimens on the internet: an illustration from a taxon

ROGER

<sup>1</sup>Royal Botanic

<sup>2</sup>Email d.

#### Abstract

A taxon  
 used to  
 impleme  
 approach

**TABLE 1.** HTTP URIs of cited specimens held at Edinburgh (E)

Species	Collector Name and No.	HTTP URI
<i>D. macrocarpa</i>	Goldsmith, M. 207	<a href="http://data.rbge.org.uk/herb/E00435912">http://data.rbge.org.uk/herb/E00435912</a>
<i>D. macrocarpa</i>	Harris, D.J. 5093	<a href="http://data.rbge.org.uk/herb/E00435914">http://data.rbge.org.uk/herb/E00435914</a>
<i>D. macrocarpa</i>	Harris, D.J. 5488	<a href="http://data.rbge.org.uk/herb/E00435922">http://data.rbge.org.uk/herb/E00435922</a>
<i>D. macrocarpa</i>	Harris, D.J. & Fay, J.M. 829	<a href="http://data.rbge.org.uk/herb/E00435918">http://data.rbge.org.uk/herb/E00435918</a>
<i>D. macrocarpa</i>	Harris, D.J. & Fay, J.M. 848	<a href="http://data.rbge.org.uk/herb/E00435917">http://data.rbge.org.uk/herb/E00435917</a>
<i>D. macrocarpa</i>	Harris, D.J. & Fay, J.M. 1540	<a href="http://data.rbge.org.uk/herb/E00435913">http://data.rbge.org.uk/herb/E00435913</a>
<i>D. viridiflora</i>	Fangounda, J. 506	<a href="http://data.rbge.org.uk/herb/E00435920">http://data.rbge.org.uk/herb/E00435920</a>
<i>D. viridiflora</i>	Fay, J.M. & Harris, D.J. 8548	<a href="http://data.rbge.org.uk/herb/E00435911">http://data.rbge.org.uk/herb/E00435911</a>
<i>D. viridiflora</i>	Harris, D.J. 4960	<a href="http://data.rbge.org.uk/herb/E00435923">http://data.rbge.org.uk/herb/E00435923</a>
<i>D. viridiflora</i>	Harris, D.J. 6016	<a href="http://data.rbge.org.uk/herb/E00435919">http://data.rbge.org.uk/herb/E00435919</a>



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<i>D. viridiflora</i>	Fangounda, J. 506	<a href="http://data.rbge.org.uk/herb/E00435920">http://data.rbge.org.uk/herb/E00435920</a>
<i>D. viridiflora</i>	Fay, J.M. & Harris, D.J. 8548	<a href="http://data.rbge.org.uk/herb/E00435911">http://data.rbge.org.uk/herb/E00435911</a>

Kénnié confluence on the East bank of the Sangha River. Riparian forest with *Uapaca heudelotii*, *Irvingia smithii* and *Trichilia retusa*. Precp. 1400 m, 2°21' N, 16°09' E Alt: 350m, 30 July 1988, *D.J. Harris, J.M. Fay* 848 (E, WAG); Dzanga-Sangha Reserve. 45 km South of Lidjombo, East bank of Sangha River from NDAKAN. Riparian forest with *Uapaca heudelotii* and *Irvingia smithii*. Precp. 1400 m, 2°21' N, 16°09' E Alt: 350m, 4 November 1988, *D.J. Harris, J.M. Fay* 1540 (E); Ca. 10 km from Kongana on the road to Bayanga, 20 km SE of Bayanga, 2°47' N, 16°23' E, 7 June 1994, *D.J. Harris* 5093 (E); Sangha-Mbaere, Kongana camp, 22 km SE of Bayanga, 2°47' N, 16°26' E, 7 March 1996, *D.J. Harris* 5488 (E); Sangha-Mbaere, Bai Hoku Camp, 25 km ESE of Bayanga, 2°52' N, 16°28' E, 15 May 1996, *D.J. Harris* 5529 (E); Safari camp at mouth of Babongo stream, 2°59' N, 16°13' E, 2 January 1998, *D.J. Harris* 5736 (E); Boukoko, 3°54' N, 17°56' E, 1949, *C. Tisserant (Équipe)* 1595 (WAG); *C. Tisserant* 16 (K, WAG); *C. Tisserant* 1595 (K, WAG); Boukoko, 3°54' N, 17°56' E, *C. Tisserant* 1708 (K); Bayanga, 2°54' N, 16°16' E, 5 March 1976, *Wraber* 101



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### Occurrence Details: E E E00421509

*Duboscia viridiflora* (K.Schum.) Mildbr.

#### Actions

- Find:** [Records of \*Duboscia viridiflora\* \(K.Schum.\) Mildbr. from RBGE Herbarium \(E 3.083333°N\)](#) [All records of any species at 3.083333, 10.416667](#)
- Retrieve:** [Retrieve original record from data publisher](#) [Download Google Earth \(KML\)](#)
- View:** [View information for \*Duboscia viridiflora\* \(K.Schum.\) Mildbr.](#) [Classification of](#)
- Send:** [!\[\]\(4d9c6fd0f6d4550c5067cf48debcceaa\_img.jpg\) Feedback about this occurrence record to Royal Botanic Garden Edinburgh](#)

#### Dataset


Data Publisher:	<a href="#">Royal Botanic Garden Edinburgh</a>
Dataset:	<a href="#">RBGE Herbarium (E)</a>
Dataset Rights:	Copyright Royal Botanic Garden Edinburgh. Contact us for rights
Institution code:	E
Collection code:	E
Catalogue number:	E00421509
Basis of record:	PreservedSpecimen (interpreted as Specimen)
Collector name:	Zenker, Georg August
Other catalogue number:	BGBASE:469051
Alternative identifier:	<a href="http://data.rbge.org.uk/herb/E00421509">http://data.rbge.org.uk/herb/E00421509</a>
Collector number:	4165
Date collected:	1911 (interpreted value)



### Occurrence Details: E E E00421509

*Duboscia viridiflora* (K.Schum.) Mildbr.

#### Actions

- Find:** [Records of \*Duboscia viridiflora\* \(K.Schum.\) Mildbr. from RBGE Herbarium \(E 3.083333°N\)](#) [All records of any species at 3.083333, 10.416667](#)
- Retrieve:** [Retrieve original record from data publisher](#) [Download Google Earth \(KML\)](#)
- View:** [View information for \*Duboscia viridiflora\* \(K.Schum.\) Mildbr.](#) [Classification of](#)
- Send:**  [Feedback about this occurrence record to Royal Botanic Garden Edinburgh](#)

#### Dataset

Data Publisher: [Royal Botanic Garden Edinburgh](#)

Dataset: [RBGE Herbarium \(E\)](#)

Dataset Rights: Copyright Royal Botanic Garden Edinburgh. Contact us for rights

Institution code: E

Collection code: E

Catalogue number: E00421509

Basis of record: PreservedSpecimen (interpreted as Specimen)

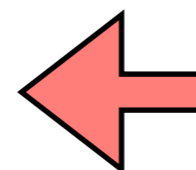
Collector name: Zenker, Georg August

Other catalogue number: BGBASE:469051

Alternative identifier: <http://data.rbge.org.uk/herb/E00421509>

Collector number: 4165

Date collected: 1911 (interpreted value)



## Herbarium Specimen Image

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[Duboscia viridiflora \(K. Schum.\) Mildbr.](#)

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Royal Botanic Garden Edinburgh Herbarium (E)

Location Created: Tropical Africa

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## Herbarium Specimen Image

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Location Created: Tropical Africa

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4 stars	<input type="text"/>	0
3 stars	<input type="text"/>	0
2 stars	<input type="text"/>	0
1 star	<input type="text"/>	0

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Royal Botanic Garden Edinburgh Herbarium Catalogue

Hits matching Barcode=E00279483

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New query Edit query

Download selection options: You have 0 items selected for download

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Family: LEGUMINOSAE Select this record for download

***Lathyrus satdagghensis* P.H.Davis** Name details >>

Collector/Expedition: Davis, Peter Hadland Collector details >>

Collection number: 45642

Collection date: 26 June 1966

Filing region: West Asia and Egypt

Country of origin: Turkey

holotype of *Lathyrus satdagghensis* P.H.Davis

Barcode: E00279483

Cite as: <http://data.rbge.org.uk/herb/E00279483>

Label data completely captured Full specimen details

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Global Plants



NCBI

All Databases PubMed Nucleotide

Search CoreNucleotide for U41319.1

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Found 1 nucleotide sequence. CoreNucleotide [1]

Summary Show

All: 1 Bacteria: 0 RefSeq: 0 mRNA: 0

1: [U41319](#) Reports

Putative dinosaur genomic DNA, partial sequence  
gil1171159|gb|U41319.1|XXU41319[1171159]

# LinkOuts

- Can be added to existing GenBank records by registered third parties allowing backlog of links to be created
- Links appear on the right hand side of the window and not within the record flatfile itself

**Distichochlamys sp. AS18 chloroplast matK gene for maturase K, complete cds**  
GenBank: AB553309.1

[FASTA](#) [Graphics](#)

Go to:

LOCUS	AB553309	1542 bp	DNA	linear	PLN 02-OCT-2010
DEFINITION	Distichochlamys sp. AS18 chloroplast matK gene for maturase K, complete cds.				
ACCESSION	AB553309				
VERSION	AB553309.1 GI:308072161				
KEYWORDS	.				
SOURCE	chloroplast Distichochlamys sp. AS18				
ORGANISM	Distichochlamys sp. AS18 Eukaryota; Viridiplantae; Streptophyta; Embryophyta; Tracheophyta; Spermatophyta; Magnoliophyta; Liliopsida; Zingiberales; Zingiberaceae; Distichochlamys.				
REFERENCE	1				
AUTHORS	Takano, A. and Nagamasu, H.				
TITLE	Monophyly of Myxochlamys (Zingiberaceae) is confirmed: Molecular phylogenetic analysis				
JOURNAL	Unpublished				
REFERENCE	2 (bases 1 to 1542)				
AUTHORS	Takano, A. and Nagamasu, H.				
TITLE	Direct Submission				
JOURNAL	Submitted (01-APR-2010) Contact: Atsuko Takano Museum of Nature and Human Activities, Hyogo; 6 chome, Yayoigaoka, Sanda, Hyogo 669-1546, Japan				
FEATURES	Location/Qualifiers				
source	1..1542 /organism="Distichochlamys sp. AS18" /organelle="plastid:chloroplast" /mol_type="genomic DNA" /specimen_voucher="E: Adele Smith 18" /db_xref="taxon:749680" /collected_by="Adele Smith" /note="This individual is cultivated as acc. No. 20021433 at Royal Botanic Garden Edinburgh"				
gene	1..1542				

Customize view

**Analyze this sequence**

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Find in this Sequence

**LinkOut to external resources**

RBGE Herbarium Catalogue E00198079  
[Royal Botanic Garden Edinburgh]

RBGE Living Collection 20021433  
[Royal Botanic Garden Edinburgh]

**Related information**

Related Sequences

Protein

Taxonomy

**Recent activity**

[Turn Off](#) [Clear](#)

Distichochlamys sp. AS18 chloroplast matK gene for maturase K, complete cds Nucleotide

Bupleurum fruticosum chloroplast rps16 gene-trnK gene intergenic spacer, Nucleotide

Bupleurum fruticosum chloroplast partial tRNA-Gln gene-rps16 gene intergenic spacer, Nucleotide

Friesodielsia enghiana voucher E:8708 Nucleotide

**LinkOut to external resources**

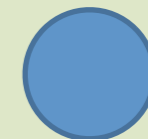
RBGE Herbarium Catalogue E00198079  
[Royal Botanic Garden Edinburgh]

RBGE Living Collection 20021433  
[Royal Botanic Garden Edinburgh]

**Related information**

Related Sequences

Protein



## Specimen\_vouchers

- Provided by submitters only, not by third parties
- Links appear within the record flatfile
- Structured voucher qualifiers (Darwin triplets) are then hotlinked by GenBank

### Ochotona collaris voucher UAM:Mamm:88534 cytochrome b (cytb) gene, complete cds; mitochondrial

GenBank: JQ624577.1

[FASTA](#) [Graphics](#) [PopSet](#)

[Go to:](#) ☐

LOCUS JQ624577 1140 bp DNA linear MAM 05-MAR-2013  
 DEFINITION Ochotona collaris voucher UAM:Mamm:88534 cytochrome b (cytb) gene, complete cds; mitochondrial.  
 ACCESSION JQ624577  
 VERSION JQ624577.1 GI:404256360  
 KEYWORDS .  
 SOURCE mitochondrion Ochotona collaris  
 ORGANISM [Ochotona collaris](#)  
 Eukaryota; Metazoa; Chordata; Craniata; Vertebrata; Euteleostomi; Mammalia; Eutheria; Euarchontoglires; Glires; Lagomorpha; Ochotonidae; Ochotona.  
 REFERENCE 1 (bases 1 to 1140)  
 AUTHORS Lanier,H.C. and Olson,L.E.  
 TITLE Deep barriers, shallow divergences: reduced phylogeographical structure in the collared pika (Mammalia: Lagomorpha: Ochotona collaris)  
 JOURNAL J. Biogeogr. 40 (3), 466-478 (2013)  
 REFERENCE 2 (bases 1 to 1140)  
 AUTHORS Lanier,H.C.  
 TITLE Direct Submission  
 JOURNAL Submitted (04-FEB-2012) University of Alaska Museum, University of Alaska, 907 Yukon Drive, Fairbanks, AK 99775, USA  
 FEATURES  
 Location/Qualifiers  
 source 1..1140  
 /organism="Ochotona collaris"  
 /organelle="mitochondrion"  
 /mol\_type="genomic DNA"  
 /specimen\_voucher="UAM:Mamm:88534"  
 /db\_xref="taxon:134600"  
 gene 1..1140  
 /gene="cytb"

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 gene 1..1140  
 /gene="cytb"

## Db\_xrefs

- Provided by submitters only, not by third parties
- Links appear within the record flatfile
- Retain collector and collection number information in specimens\_voucher field
- Possible to have multiple db\_xrefs in one record allowing a link to the specimen record and one to the living accession record

### Sida rhombifolia ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit (rbcL) gene, partial cds; chloroplast

GenBank: JX110822.1

[FASTA](#) [Graphics](#)

[Go to:](#)

```
LOCUS       JX110822               572 bp    DNA        linear    PLN 25-MAY-2013
DEFINITION  Sida rhombifolia ribulose-1,5-bisphosphate carboxylase/oxygenase
            large subunit (rbcL) gene, partial cds; chloroplast.
ACCESSION   JX110822
VERSION     JX110822.1   GI:399934503
KEYWORDS    .
SOURCE      chloroplast Sida rhombifolia
  ORGANISM  Sida rhombifolia
            Eukaryota; Viridiplantae; Streptophyta; Embryophyta; Tracheophyta;
            Spermatophyta; Magnoliophyta; eudicotyledons; core eudicotyledons;
            rosids; malvids; Malvales; Malvaceae; Malvoideae; Sida.
REFERENCE   1  (bases 1 to 572)
  AUTHORS   Patil,U.B., Khobragade,C.N., Khedkar,G.D., Ughade,B.R.,
            Kalyanakar,V.B. and Karodpati,B.N.
  TITLE     Barcoding of Sida species
  JOURNAL    Unpublished
REFERENCE   2  (bases 1 to 572)
  AUTHORS   Patil,U.B., Khobragade,C.N., Khedkar,G.D., Ughade,B.R.,
            Kalyanakar,V.B. and Karodpati,B.N.
  TITLE     Direct Submission
  JOURNAL    Submitted (29-MAY-2012) School of Life Sciences, Swami Ramanand
            Tirth Marathwada University, Aurangabad, University, Nanded,
            Maharashtra 431606, India
FEATURES             Location/Qualifiers
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                     /organelle="plastid:chloroplast"
                     /mol_type="genomic DNA"
                     /specimen_voucher="SM04"
                     /db_xref="BOLD:MTSS003-12.rbcL"
                     /db_xref="taxon:108377"
                     /country="India: Maharashtra, Marathwada, Mirzapur"
```

**TITLE** Direct Submission

**JOURNAL** Submitted (29-MAY-2012) School of Life Sciences,  
Tirth Marathwada University, Aurangabad, Univ  
Maharashtra 431606, India

**FEATURES**

**source**

Location/Qualifiers

1..572

/organism="Sida rhombifolia"

/organelle="plastid:chloroplast"

/mol\_type="genomic DNA"

/specimen\_voucher="SM04"

/db\_xref="BOLD:MTSS003-12.rbcL"

/db\_xref="taxon:108377"

/country="India: Maharashtra, Marathwada, Mirzapur"

/lat\_lon="18.52 N 77.64 E"

**specimen\_voucher:** Collector + number + (Herbarium)  
eg [specimen\_voucher= Harris 8708 (E)]

**db\_xref:** Institution\_collection + collection id  
eg [db\_xref=RBGE\_herbarium:E00217291]  
eg [db\_xref=RBGE\_garden:19920112]





“Please may I see specimen XYZ.”





“Please may I see specimen XYZ.”



“Yes. Here it is.”



# Implications

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- The user wants **data** not 'metadata'

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- We are responsible for hosting that data

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  - PDF, Desktop, Web, Kindle, ePub etc

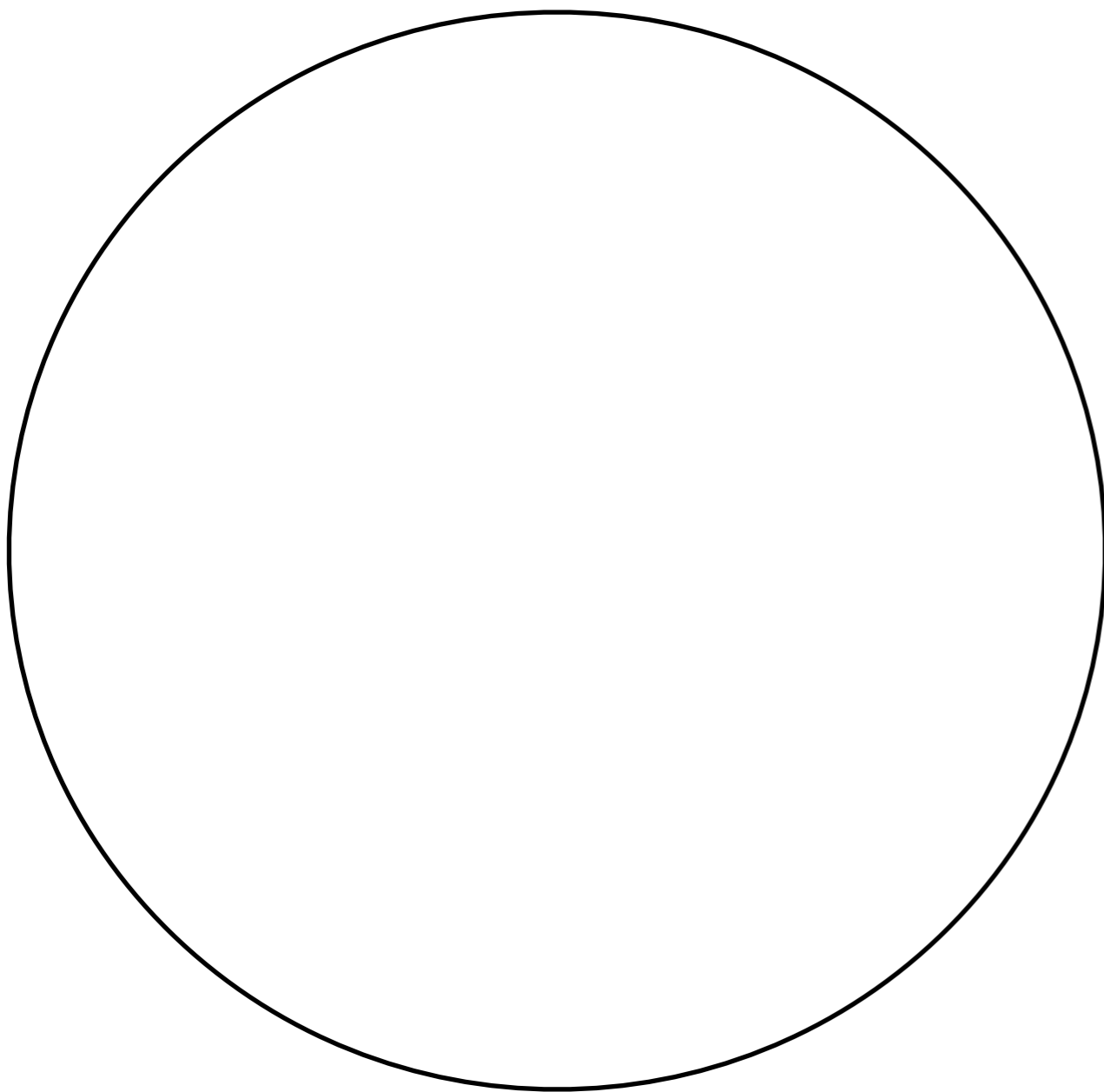
# Implications

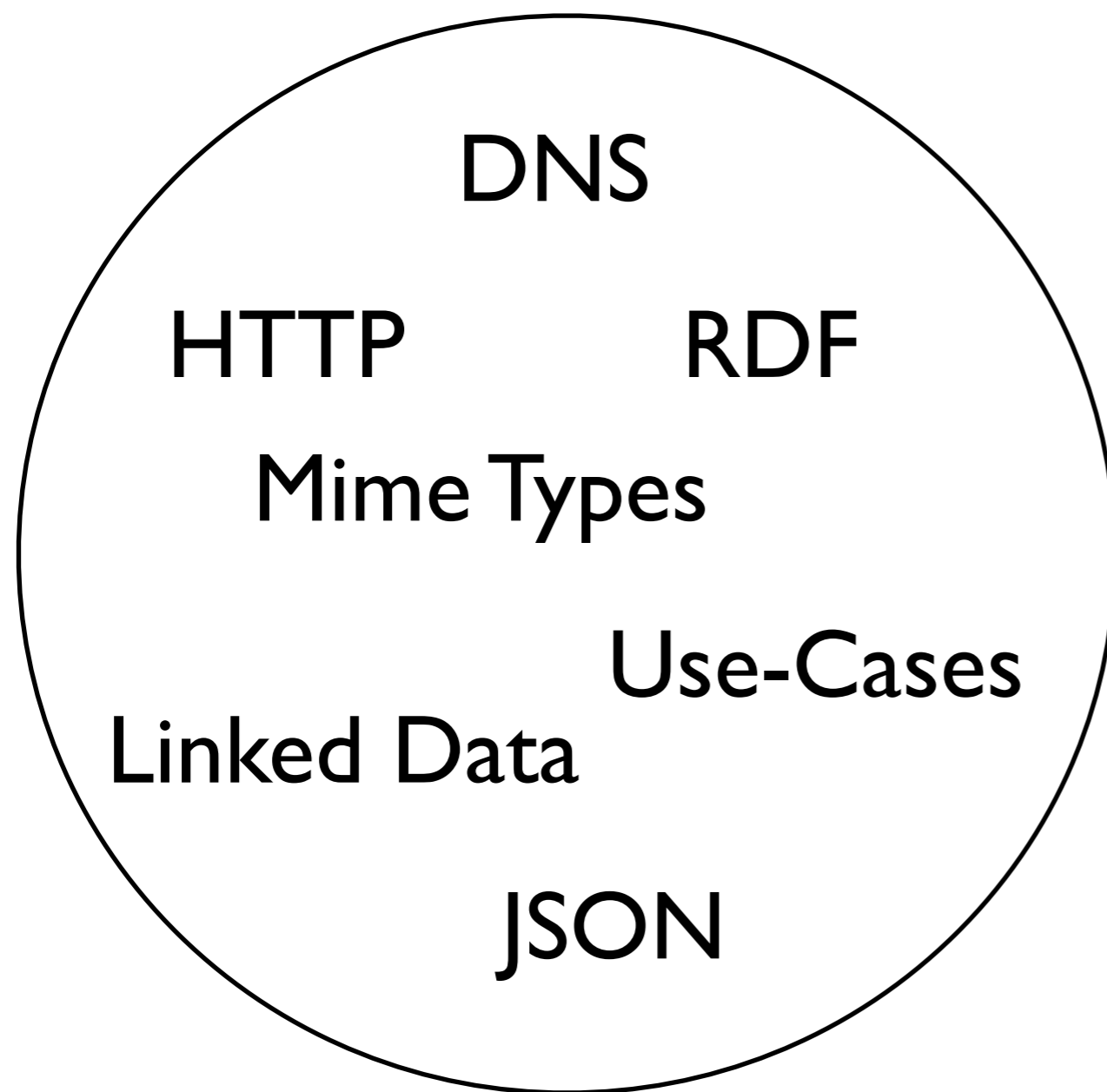
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- We are responsible for hosting that data
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- Links must work on multiple platforms now
  - PDF, Desktop, Web, Kindle, ePub etc
- Links must be 'stable'
  - They are embedded in documents we don't control

# Scoping





Philosophy

Metaphysics

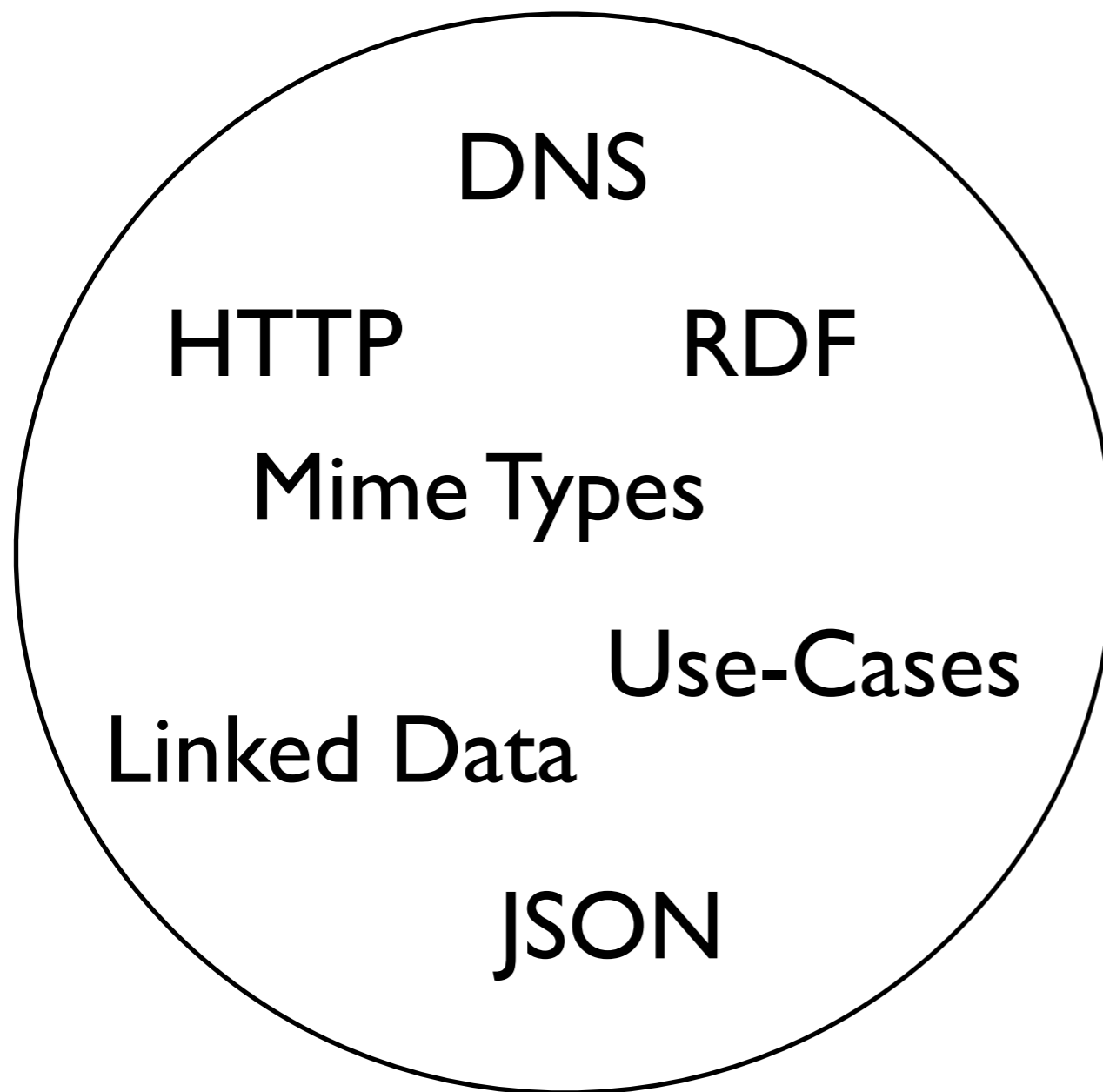
Religion

Hypothetical  
Edge Cases

LSID

DOI

Any Other Identifiers



Metadata\*



Layer I

Tuesday

Creating and Managing URIs

Layer 2

Wednesday

Content Negotiation & Linked Data

Layer 1

Tuesday

Creating and Managing URIs

Layer 3

Thursday!

Building Services - Data

Layer 2

Wednesday

Content Negotiation & Linked Data

Layer 1

Tuesday

Creating and Managing URIs

# Tim Berners-Lee List

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- \* data is available on the web (whatever format), but with an open license.

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- \*\*\*\* data is available according to all the above, **plus the use of open standards from the W3C to identify things**, so that people can link to it.
- \*\*\*\*\* data is available according to all the above, plus outgoing links to other people's data to provide context.

**Both lists are incremental**

A photograph of a large, gnarled tree trunk in the foreground, with a grassy field and other trees in the background. The tree trunk is thick and has a rough, textured bark. The background shows a green lawn and a line of trees under a bright sky.

# Presentations on Institutional Systems