INTRODUCTION TO XQUERY

XQUERYINSTITUTE.ORG

Jonathan.Robie @ ibiblio.org / @jonathan_robie

MARKUP

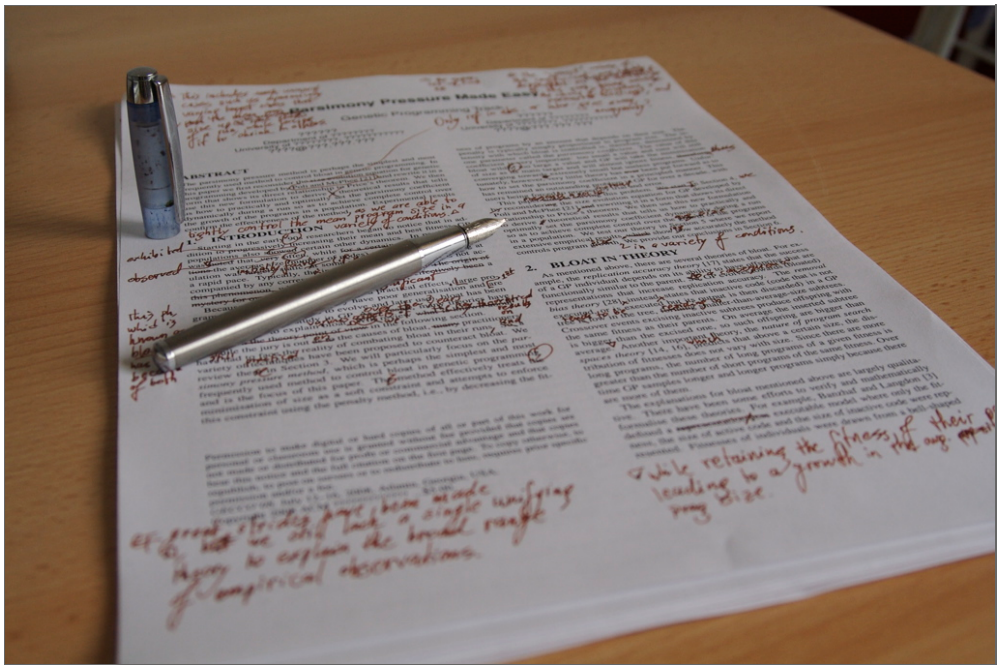
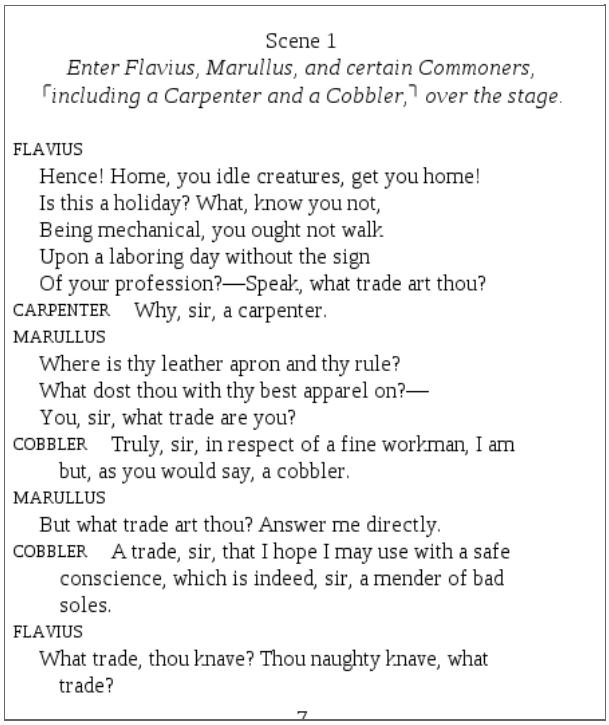


Photo by Nick McPhee, **(CC BY-SA 2.0)**

TEXT WITHOUT MARKUP (FOLGER EDITION)



Scene 1

Enter Flavius, Marullus, and certain Commoners, ⌜including a Carpenter and a Cobbler,⌝ over the stage.

FLAVIUS
Hence! Home, you idle creatures, get you home!
Is this a holiday? What, know you not,
Being mechanical, you ought not walk
Upon a laboring day without the sign
Of your profession?—Speak, what trade art thou?

CARPENTER Why, sir, a carpenter.

MARULLUS
Where is thy leather apron and thy rule?
What dost thou with thy best apparel on?—
You, sir, what trade are you?

COBBLER Truly, sir, in respect of a fine workman, I am but, as you would say, a cobbler.

MARULLUS
But what trade art thou? Answer me directly.

COBBLER A trade, sir, that I hope I may use with a safe conscience, which is indeed, sir, a mender of bad soles.

FLAVIUS
What trade, thou knave? Thou naughty knave, what trade?

TEXT WITH MARKUP (JON BOSAK)

```
<ACT><TITLE>ACT I</TITLE>

<SCENE><TITLE>SCENE I.  Rome. A street.</TITLE>
<STAGEDIR>Enter FLAVIUS, MARULLUS, and certain Commoners</STAGEDIR>

<SPEECH>
<SPEAKER>FLAVIUS</SPEAKER>
<LINE>Hence! home, you idle creatures get you home:</LINE>
<LINE>Is this a holiday? what! know you not,</LINE>
<LINE>Being mechanical, you ought not walk</LINE>
<LINE>Upon a labouring day without the sign</LINE>
<LINE>Of your profession? Speak, what trade art thou?</LINE>
</SPEECH>
```

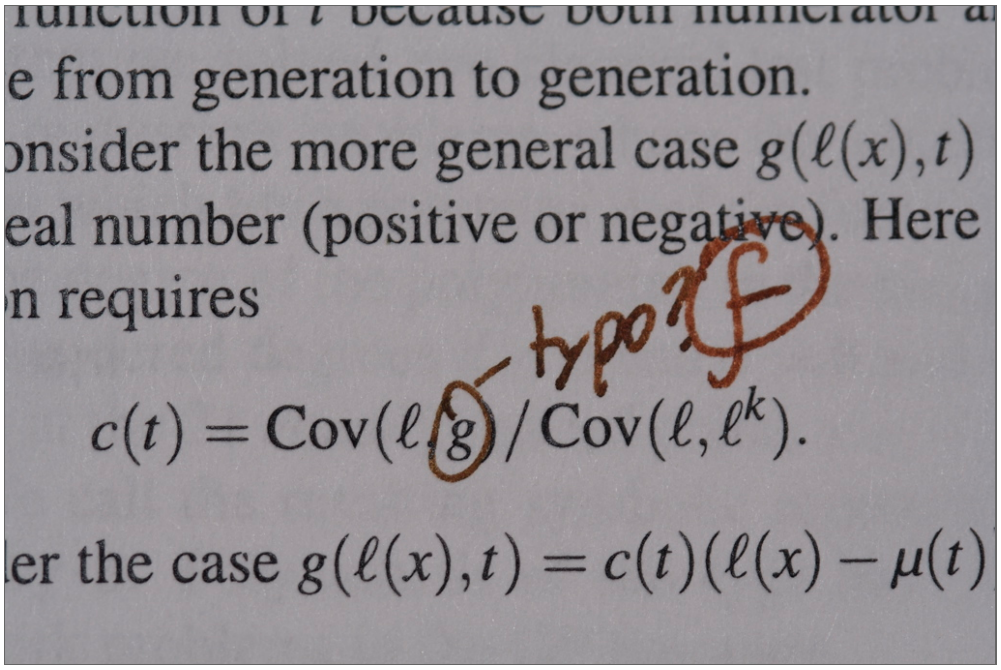
TEXT WITH MARKUP (FOLGER EDITION)

```
<sp xml:id="sp-0001" who="#Flavius_JC">
  <speaker xml:id="spk-0001">
    <w xml:id="w0000400">FLAVIUS</w>
  </speaker>
  <ab xml:id="ab-0001">
    <lb xml:id="lb-00008"/>
    <milestone unit="ftln" xml:id="ftln-0001" n="1.1.1" ana="#verse"
      corresp="#w0000410 #p0000420 #c0000430 #w0000440 #p0000450 #c0000460 #w0000470 #c0
    <w xml:id="w0000410" n="1.1.1">Hence</w>
    <pc xml:id="p0000420" n="1.1.1">!</pc>
    <c xml:id="c0000430" n="1.1.1"> </c>
    <w xml:id="w0000440" n="1.1.1">Home</w>
    <pc xml:id="p0000450" n="1.1.1">,</pc>
    <c xml:id="c0000460" n="1.1.1"> </c>
    <w xml:id="w0000470" n="1.1.1">you</w>
    <c xml:id="c0000480" n="1.1.1"> </c>
    <w xml:id="w0000490" n="1.1.1">idle</w>
    <c xml:id="c0000500" n="1.1.1"> </c>
    <w xml:id="w0000510" n="1.1.1">creatures</w>
    <pc xml:id="p0000520" n="1.1.1">,</pc>
    <c xml:id="c0000530" n="1.1.1"> </c>
    <w xml:id="w0000540" n="1.1.1">get</w>
    <c xml:id="c0000550" n="1.1.1"> </c>
    <w xml:id="w0000560" n="1.1.1">you</w>
    <c xml:id="c0000570" n="1.1.1"> </c>
    <w xml:id="w0000580" n="1.1.1">home</w>
    <pc xml:id="p0000590" n="1.1.1">!</pc>
    <lb xml:id="lb-00010"/>
    <milestone unit="ftln" xml:id="ftln-0002" n="1.1.2" ana="#verse"
```

TEXT WITH MARKUP (HTML)

```
<br/>
<span class="speaker">FLAVIUS</span>
<span class="indentInline"> </span>
<br/>
<a name="ftln-0001"> </a>
<span class="ftln" name="ftln_0001">FTLN 0001</span>
<span class="alignment indentVerse"> </span>
<span id="line-1.1.1" title="1.1.1">Hence! Home, you idle creatures, get you home!</span>
<br/>
<a name="ftln-0002"> </a>
<span class="ftln" name="ftln_0002">FTLN 0002</span>
<span class="alignment indentVerse"> </span>
<span id="line-1.1.2" title="1.1.2">Is this a holiday? What, know you not,</span>
<br/>
```

EDITORIAL MARKUP



EDITORIAL MARKUP - DIFF MARKUP

```
<item diff="add" at="2014-04-02">
  <p>The following comparison is <code>true</code> because atomization
     converts an array to its member sequence:</p>
  <eg role="parse-test">[ "Kennedy" ] = "Kennedy"</eg>
</item>
```

LINGUISTIC MARKUP

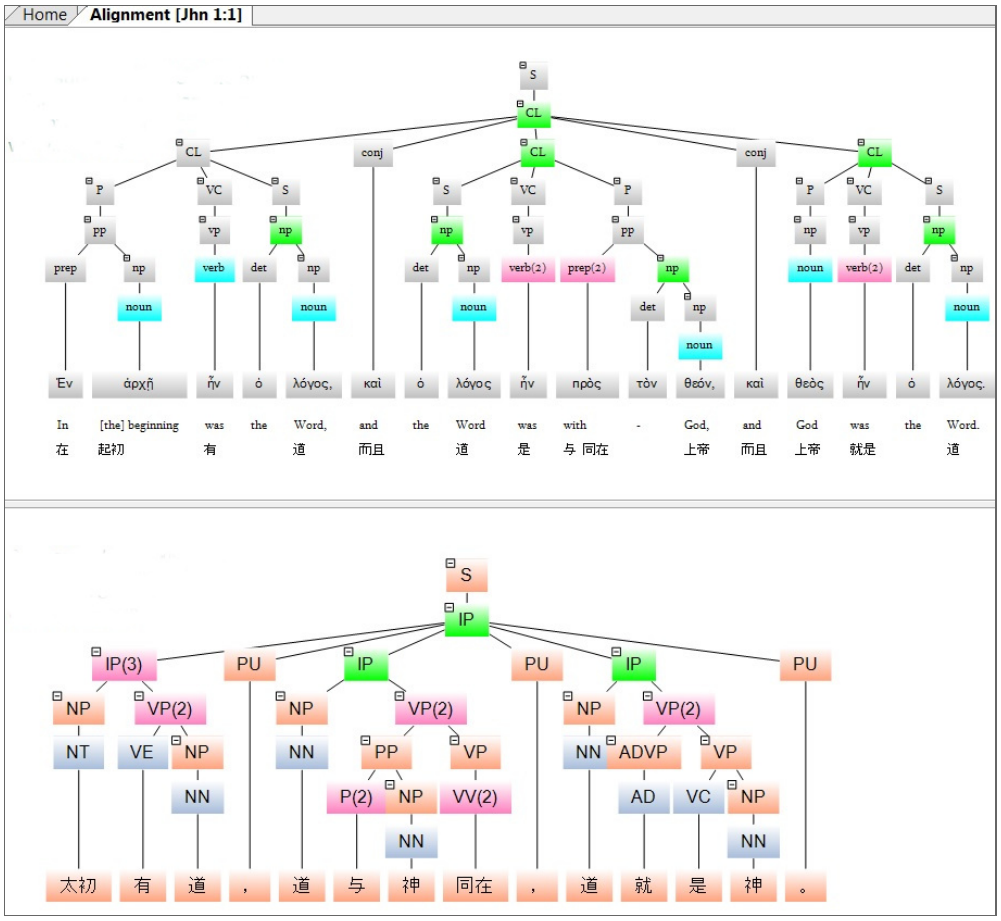


Image provided by **Global Bible Initiative**

LINGUISTIC MARKUP

```
<Tree>
<Node Cat="S" Head="0" nodeId="430010010010171">
  <Node Cat="CL" Start="0" End="16" Rule="Conj3CL" Head="0" nodeId="430010010010170">
    <Node Cat="CL" Start="0" End="4" Rule="P-VC-S" Head="0" nodeId="430010010010050">
      <Node Cat="P" Start="0" End="1" Rule="pp2P" Head="0" nodeId="430010010010021">
        <Node Cat="pp" Start="0" End="1" Rule="PrepNP" Head="1" nodeId="430010010010020">
          <Node Cat="prep" Start="0" End="0" StrongNumber="1722" UnicodeLemma="ἐν" FunctionalTag="PREP"
          <Node Cat="np" Start="1" End="1" Rule="N2NP" Head="0" nodeId="430010010020011">
            <Node Cat="noun" Start="1" End="1" StrongNumber="746" UnicodeLemma="ἀρχή" Gender="Feminine"
          </Node>
        </Node>
      </Node>
      <Node Cat="VC" Start="2" End="2" Rule="vp2VC" Head="0" nodeId="430010010030012">
        <Node Cat="vp" Start="2" End="2" Rule="V2VP" Head="0" nodeId="430010010030011">
          <Node Cat="verb" Start="2" End="2" StrongNumber="1510" UnicodeLemma="εἰμί" Person="Third" Mood
        </Node>
      </Node>
      <Node Cat="S" Start="3" End="4" Rule="np2S" Head="0" HasDet="True" nodeId="430010010040021">
        <Node Cat="np" Start="3" End="4" Rule="DetNP" Head="1" HasDet="True" nodeId="4300100100400020">
          <Node Cat="det" Start="3" End="3" StrongNumber="3588" UnicodeLemma="ὁ" Gender="Masculine" Numb
          <Node Cat="np" Start="4" End="4" Rule="N2NP" Head="0" nodeId="430010010050011">
            <Node Cat="noun" Start="4" End="4" StrongNumber="3056" UnicodeLemma="λόγος" Gender="Masculin
          </Node>
        </Node>
      </Node>
    </Node>
```

XML available at **biblicalhumanities github**

PRESENTATIONAL MARKUP (HTML)

XQueryInstitute.org

This presentation's source ...

PRESENTATIONAL MARKUP (WIKI MARKUP)

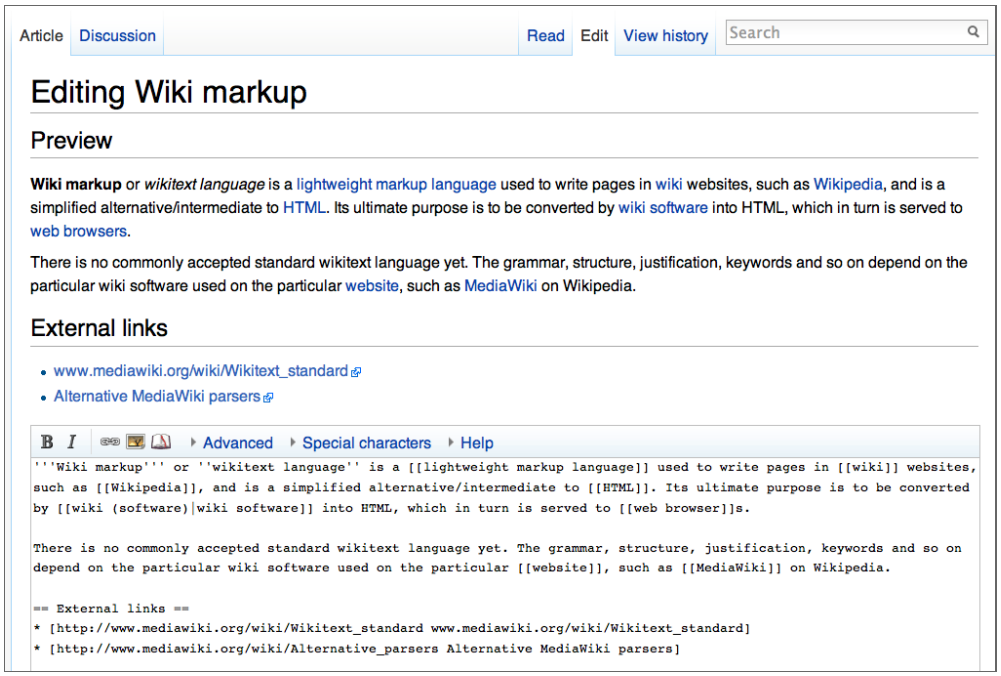
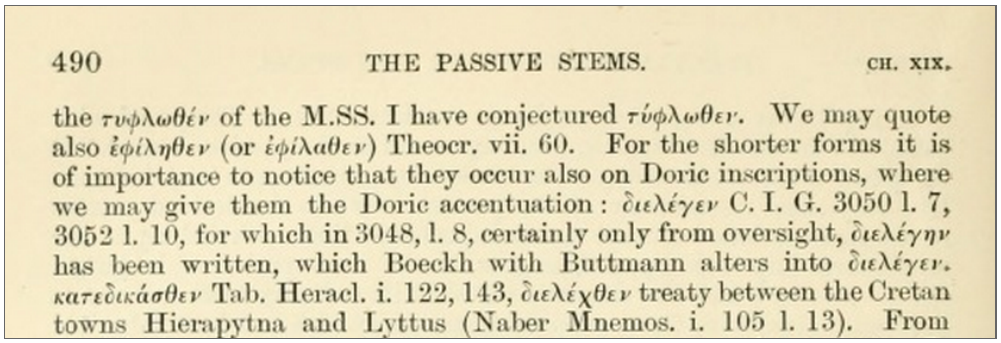


Image from Wikimedia **(CC BY-SA 3.0)**

OCR OUTPUT (HOCR)



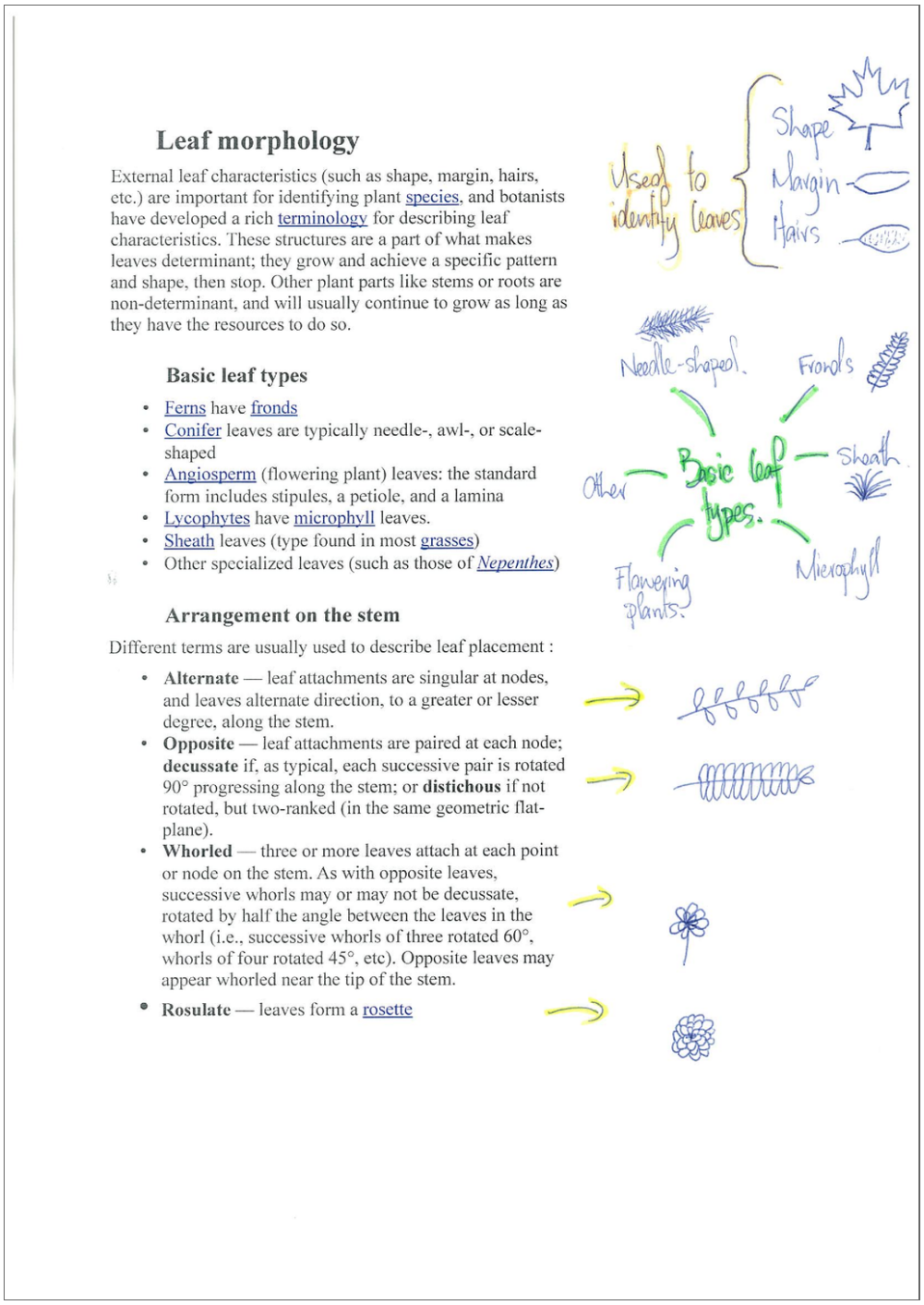
490 THE PASSIVE STEMS. CH. XIX.

the τυφλωθέν of the M.SS. I have conjectured τύφλωθεν. We may quote also ἐφίληθεν (or ἐφίλαθεν) Theocr. vii. 60. For the shorter forms it is of importance to notice that they occur also on Doric inscriptions, where we may give them the Doric accentuation: διελέγεν C. I. G. 3050 l. 7, 3052 l. 10, for which in 3048, l. 8, certainly only from oversight, διελέγην has been written, which Boeckh with Buttmann alters into διελέγεν. κατεδικάσθεν Tab. Heracl. i. 122, 143, διελέχθεν treaty between the Cretan towns Hierapytna and Lyttus (Naber Mnemos. i. 105 l. 13). From

```
<div class="ocr_page" title="file /tmp/tmp.1KyOjfDG21/0001.bin.png">
<span class="ocr_line" title="bbox 227 3046 315 3086">490</span> <br />
<span class="ocr_line" title="bbox 787 3045 1285 3079">THE PASSIVE STEMS.</span> <br />
<span class="ocr_line" title="bbox 1680 3037 1832 3067">CH. Ix.</span> <br />
<p></p>
<span class="ocr_line" title="bbox 228 2934 1830 2989">the τυφλωθέν of the M.SS. I have conjectured τύφλωθεν. We may quote</span> <br />
<span class="ocr_line" title="bbox 228 2883 1831 2937">also ἐφίληθεν (or ἐφίλαθεν) Theocr. vii. 60. For the shorter forms it ia</span> <br />
<span class="ocr_line" title="bbox 229 2832 1832 2883">of importance to notice that they occur also on Doric inscriptions, where</span> <br />
<span class="ocr_line" title="bbox 228 2780 1827 2831">we may give them the Doric accentuation: διελέγεν C. I. G. 3050 l. 1,</span> <br />
<span class="ocr_line" title="bbox 231 2728 1827 2778">3052 l. 10, for which in 3048, l. 8, certainly only from oversight, διελέγην</span> <br />
<span class="ocr_line" title="bbox 229 2678 1828 2726">has been written, which Boeckh with Buttmann alters into διελέγεν.</span> <br />
<span class="ocr_line" title="bbox 230 2623 1828 2674">κατεδικάσθεν Tab. Heracl. i. 122, 143, διελέχθεν treaty between the Cretan</span> <br />
<span class="ocr_line" title="bbox 229 2565 1824 2621">towns Hierapytna and Lyttus (Naber Mnemos. i. 105 l. 13). From</span> <br />
```

Ocropus OCR output from **Lace** project, Bruce Robertson, Federico Boschetti

ANNOTATING TEXTS



Leaf morphology

External leaf characteristics (such as shape, margin, hairs, etc.) are important for identifying plant species, and botanists have developed a rich terminology for describing leaf characteristics. These structures are a part of what makes leaves determinant; they grow and achieve a specific pattern and shape, then stop. Other plant parts like stems or roots are non-determinant, and will usually continue to grow as long as they have the resources to do so.

Basic leaf types

- Ferns have fronds
- Conifer leaves are typically needle-, awl-, or scale-shaped
- Angiosperm (flowering plant) leaves: the standard form includes stipules, a petiole, and a lamina
- Lycophytes have microphyll leaves.
- Sheath leaves (type found in most grasses)
- Other specialized leaves (such as those of *Nepenthes*)

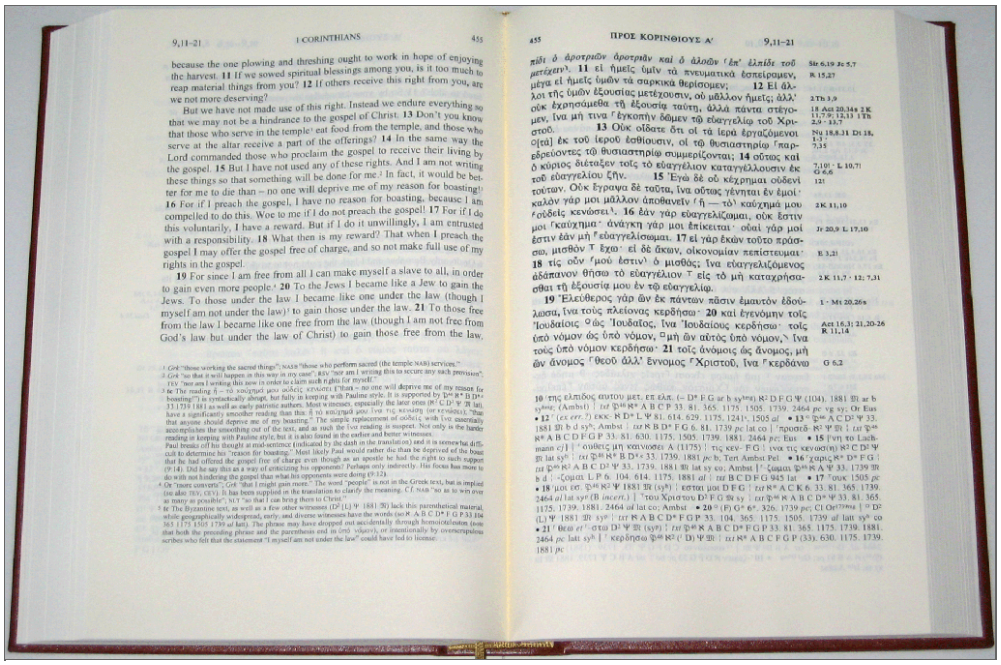
Arrangement on the stem

Different terms are usually used to describe leaf placement :

- **Alternate** — leaf attachments are singular at nodes, and leaves alternate direction, to a greater or lesser degree, along the stem.
- **Opposite** — leaf attachments are paired at each node; **decussate** if, as typical, each successive pair is rotated 90° progressing along the stem; or **distichous** if not rotated, but two-ranked (in the same geometric flat-plane).
- **Whorled** — three or more leaves attach at each point or node on the stem. As with opposite leaves, successive whorls may or may not be decussate, rotated by half the angle between the leaves in the whorl (i.e., successive whorls of three rotated 60°, whorls of four rotated 45°, etc). Opposite leaves may appear whorled near the tip of the stem.
- **Rosulate** — leaves form a rosette

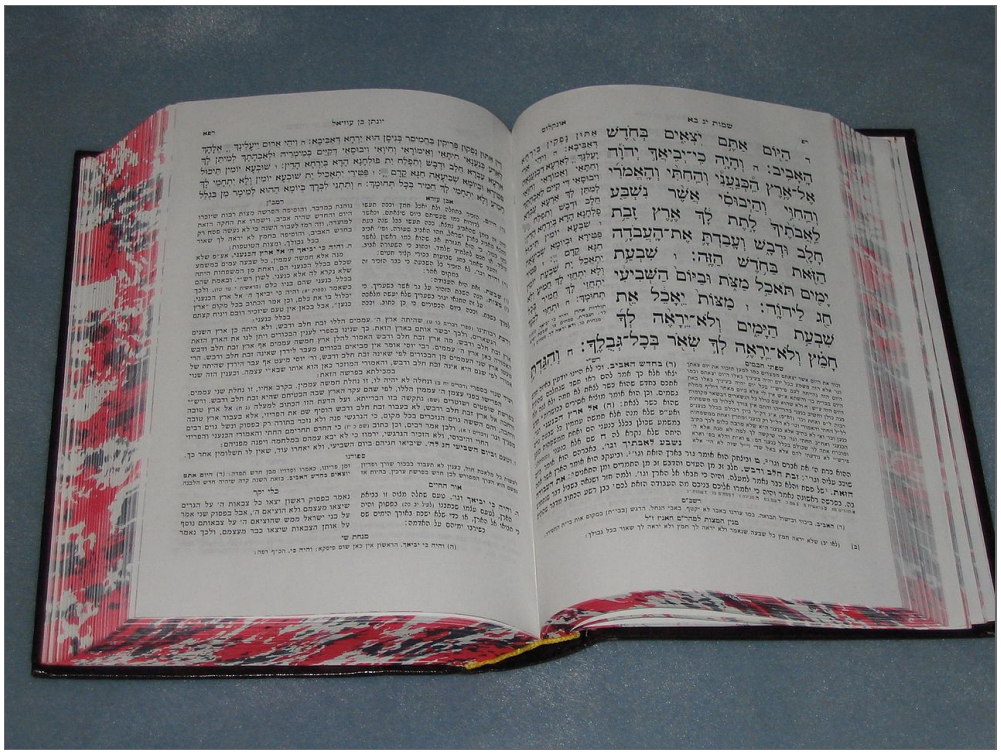
Image from Wikimedia **(CC BY-SA 3.0)**

ANNOTATING TEXTS



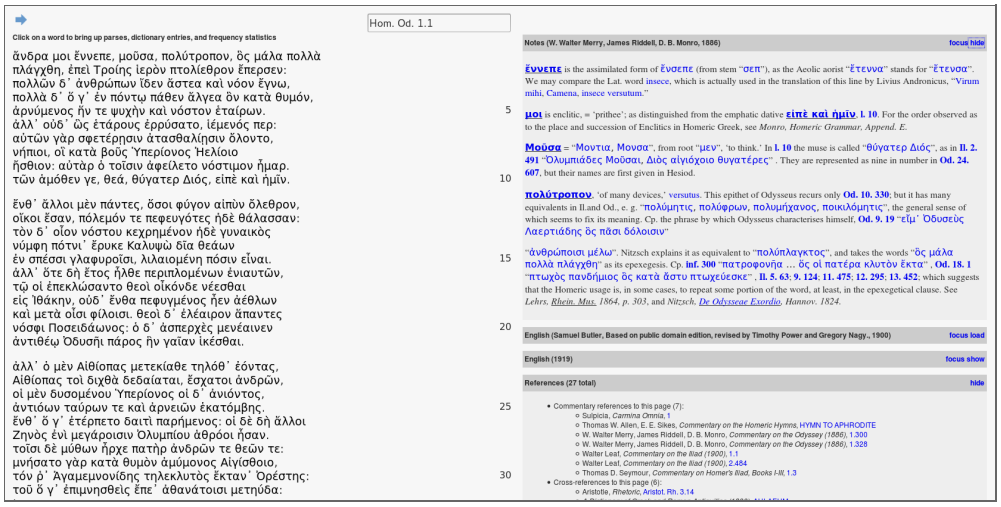
NET Diglot Greek New Testament

ANNOTATING TEXTS



Mikaot Gedolot, image from **Wikipedia**

ANNOTATING TEXTS



Homer's Odyssey, from the **Perseus Project**

ANNOTATING TEXTS

```
<publicationStmt>
  <idno>JC</idno>
  <publisher>Folger Shakespeare Library</publisher>
  <address>
    <addrLine>201 East Capitol Street, SE</addrLine>
    <addrLine>Washington, DC 20003</addrLine>
    <addrLine>http://www.folgerdigitaltexts.org</addrLine>
    <addrLine>folgertexts@folger.edu</addrLine>
  </address>
  <availability>
    <licence target="http://creativecommons.org/licenses/by-nc/3.0/deed.en_US">Distributed
      under a Creative Commons Attribution-NonCommercial 3.0 Unported License</licence>
  </availability>
  <date>April, 2014</date>
</publicationStmt>
```

WHY XQUERY?

Abstract

XML is a versatile markup language, capable of labeling the information content of diverse data sources including structured and semi-structured documents, relational databases, and object repositories. A query language that uses the structure of XML intelligently can express queries across all these kinds of data, whether physically stored in XML or viewed as XML via middleware. This specification describes a query language called XQuery, which is designed to be broadly applicable across many types of XML data sources.

XQuery 1.0: An XML Query Language

WHAT CAN XQUERY QUERY?

- XML in documents or XML databases (e.g. eXist, BaseX, Marklogic, xDB)
- HTML (normalized using HTML Tidy, etc.)
- Word / Open Office documents (saved as XML)
- XML serialization of database data or programming objects
- XML views of relational data
- Coming soon - JSON Documents (XQuery 3.1)

PATH EXPRESSIONS

FIND THINGS IN XML DOCUMENTS

- `/TEI/teiHeader`
- `//person`
- `//person[persName]`
- `//tagUsage`
- `//tagUsage[@gi="stage"]`
- `//sp[@who = '#Caesar_JC`

FLWOR EXPRESSIONS

- Acronym: For / Let / Where / Return
- Iteration
- Binding variables to intermediate results
- Identifying related data ("joins")
- Restructuring

EXAMPLE: FLWOR EXPRESSIONS

"SUMMARIZE THE SPEECHES FOR EACH PERSON"

```
declare default element namespace "http://www.tei-c.org/ns/1.0";

for $person in //person[persName]
let $id := $person/@xml:id
let $idref := concat('#',$id)  (: bad Folger convention :)
let $speeches := //sp[@who=$idref]/ab
let $words := $speeches//w
let $nspeeches := count($speeches)
let $nwords := count($words)
order by $nwords descending, $nspeeches descending
return
     <person xml:id="{$id}"
             speeches="{$nspeeches}"
             words="{$nwords}"/>
```

XML CONSTRUCTORS

- Create any XML instance
- Literal syntax: same as XML

```
<person
  xml:id="Brutus_JC"
  speeches="193"
  words="5475">
Farewell, good Strato. Brutus runs on his swor
Caesar, now be still. I killed not thee with h
so good a will.
</person>
```

- {} lets you add expressions

```
<person xml:id="{$id}"
        speeches="{$nspeeches}"
        words="{$nwords}">
 {
   normalize-space(string($speeches[last()]))
 }
</person>
```

EXAMPLE: SPEAKERS AND THEIR LINES

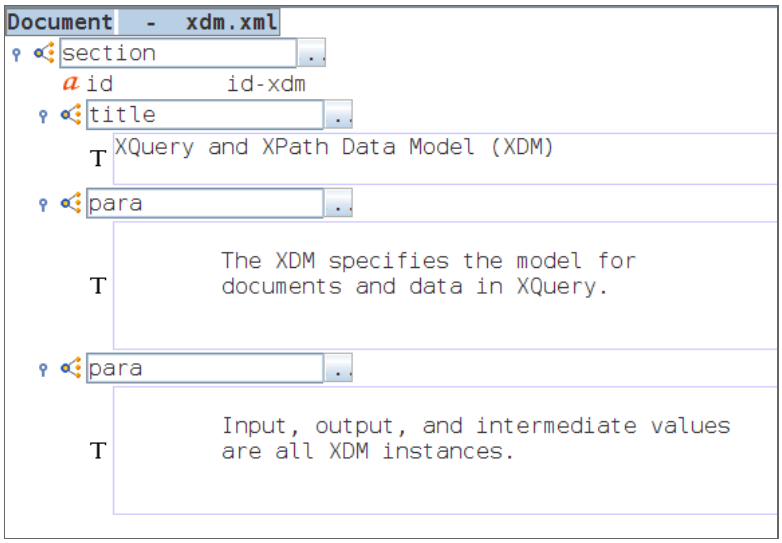
```
declare default element namespace "http://www.tei-c.org/ns/1.0";

<personae>
 {
  for $person in //person[persName]
  let $name := $person/persName/name
  let $id := $person/@xml:id
  let $idref := concat('#',$id)  (: bad Folger convention :)
  let $speeches := //sp[@who=$idref]/ab
  let $lines := //sp[@who=$idref]/ab//lb
  let $words := $speeches//w
  let $nspeeches := count($speeches)
  let $nlines := count($lines)
  let $nwords := count($words)
  order by $nwords descending, $nlines, $nspeeches descending
  return
          <person xml:id="{$id}"
                  speeches="{$nspeeches}"
                  lines="{$nlines}"
                  words="{$nwords}">
           {
            $name
           }
          </person>
  }
</personae>
```

WHY XQUERY?

- Find things in marked up data
- Explore relationships among marked up data
- Find related resources
- Create new markup that explores new representations and relationships
- Support close reading by answering questions as you read
- **Distant reading?**
- Convert to HTML and other formats
  (XSLT is very good at this)

XML AND XPATH DATA MODEL (XDM)

```
<section id="id-xdm">
    <title>XQuery and XPath Data Model (XDM)</title>
    <para>
        The XDM specifies the model for
        documents and data in XQuery.
    </para>
    <para>
        Input, output, and intermediate values
        are all XDM instances.
    </para>
</section>
```



PATH EXPRESSIONS

XQUERYINSTITUTE.ORG

Jonathan.Robie @ ibiblio.org / @jonathan_robie

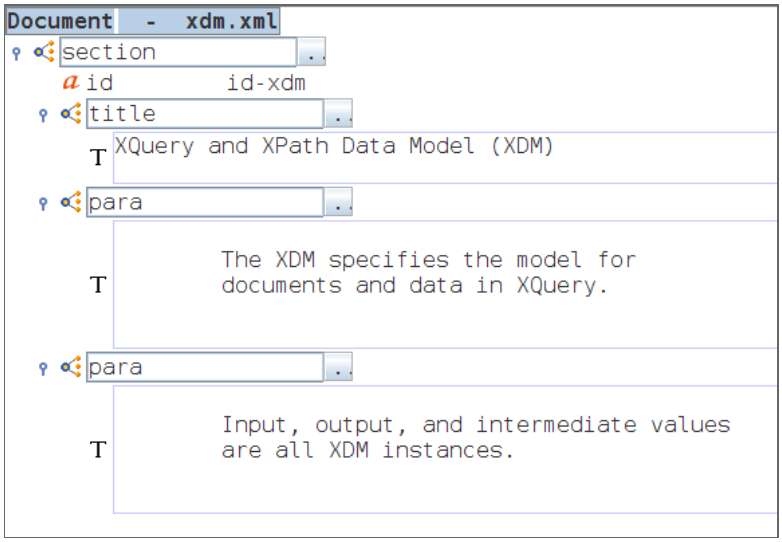
PATH EXPRESSIONS

FIND THINGS IN XML DOCUMENTS

- `/TEI/teiHeader`
- `//person`
- `//sp[@who = '#Caesar_JC']`

XML AND XPATH DATA MODEL (XDM)

```
<section id="id-xdm">
    <title>XQuery and XPath Data Model (XDM)</title>
    <para>
        The XDM specifies the model for
        documents and data in XQuery.
    </para>
    <para>
        Input, output, and intermediate values
        are all XDM instances.
    </para>
</section>
```



KINDS OF NODES

- Document Nodes
- Element Nodes
- Attribute Nodes
- Text Nodes
- Comment Nodes
- Namespace Nodes
- Processing Instruction Nodes (rarely used today ...)

KINDS OF NODES

```
<?xml version="1.0" encoding="utf-8"?>
<!-- The xml-stylesheet is a processing instruction. -->
<?xml-stylesheet type="text/xsl" href="fdt.xsl"?>
<TEI xmlns="http://www.tei-c.org/ns/1.0">
    <teiHeader>
        <fileDesc>
            <titleStmt>
                <title>Julius Caesar</title>
                <author>William Shakespeare</author>
                <editor xml:id="BAM">Barbara A. Mowat</editor>
                <editor xml:id="PW">Paul Werstine</editor>
                <respStmt>
                    <resp>Edited for XML and encoded by</resp>
                    <persName xml:id="MSP">Michael Poston</persName>
                    <persName xml:id="RLN">Rebecca Niles</persName>
                </respStmt>
            </titleStmt>
            <editionStmt>
                <edition n="0.9.0">Text released without textual notes</edition>
            </editionStmt>
            <publicationStmt>
                <idno>JC</idno>
                <publisher>Folger Shakespeare Library</publisher>
                <address>
                    <addrLine>201 East Capitol Street, SE</addrLine>
```

PATH EXPRESSION BASICS

LOCATING NODES IN TREES

- Paths may start with "/" or "//" (or any other expression)

  Leading "/" selects document root

  Leading "//" selects document root and all descendants
- Name Tests

  Elements by name: `/TEI`, `//speaker`

  Any element: `/*`, `//*`

  Attributes by name: `//@who`

  Any attribute: `//@*`
- Steps are separated by "/" or "//"

  Example: `//sp/@who`

  Example: `/TEI//speaker/w`

EXPLORING A DOCUMENT WITH XPATH

- Select the root node
- Select the author
- Select all elements, at any level
- Select all attributes, at any level
- Find the "tagsDecl" element - what is it for?
- Find the elements that describe what the "lb" and "ab" elements are for
- Find all the "lb" elements, all the "ab" elements

NODE TESTS (KIND OF NODE)

- `document-node()`
- `element()`
- `element(stage)`
- `attribute()`
- `attribute(who)`
- `text()`
- `comment()`
- `namespace-node()`
- `processing-instruction()`

HEADS UP! DOCUMENT NODES!

What's the difference between this query ...

```
tei-doc.xml:

<TEI xmlns="http://www.tei-c.org/ns/1.0">
  <teiHeader/>
</TEI>;

query:

document("tei-doc.xml")/*
```

... and this one?

```
declare variable $tei :=
  <TEI xmlns="http://www.tei-c.org/ns/1.0">
    <teiHeader/>
  </TEI>;

$tei/*
```

HEADS UP! DOCUMENT NODES!

hint ...

```
declare variable $tei :=
  document {
    <TEI xmlns="http://www.tei-c.org/ns/1.0">
      <teiHeader/>
    </TEI>
};

$tei/*
```

HEADS UP! NAMESPACES!

What's the difference between this query ...

```
tei-doc.xml:

<TEI xmlns="http://www.tei-c.org/ns/1.0">
  <teiHeader/>
</TEI>;

query:

document("tei-doc.xml")/TEI
```

... and this one?

```
query:

declare default element namespace "http://www.tei-c.org/ns/1.0";
document("tei-doc.xml")/TEI
```

FILTER EXPRESSIONS - SPEECHES

```
//sp[@who="#Caesar_JC"]

//sp[@who="#Caesar_JC" or @who="#Brutus_JC"]

//sp[@who="#Caesar_JC" and .//ab//w="Brutus"]

//sp[@who="#Brutus_JC" and .//ab//w="Caesar"]

//sp[@who="#Caesar_JC" and  .//ab//w="Caesar"]

//sp[@who="#Brutus_JC" and  .//ab//w="Brutus"]

//sp[@who="#Brutus_JC" and (.//ab//w="Brutus" or .//ab//w="Caesar")]

//sp[@who="#Brutus_JC" and (.//ab//w="Brutus" and .//ab//w="Caesar")]

//sp[@who="#Brutus_JC" and (.//ab//w="Caesar" and not(.//ab//w="Brutus"))]
```

FILTER EXPRESSIONS - STAGE DIRECTIONS

```
//stage[@type="entrance"]

//stage[empty(@who)]

//stage[@type="entrance" and empty(@who)]

//stage[@type="entrance" and  empty(*)]

//stage[@type="entrance"]/*

//stage[empty(*)]

distinct-values(//stage/@type)

//stage[@type="delivery"]
```

FILTER EXPRESSIONS - POSITION

```
//sp[1]

(//sp)[1]

//sp[last()]

(//sp)[last()]

//sp[position() = 1 to 3]

(//sp)[position() = 1 to 3]

(25 to 29)[3]

(//sp[@who="#Caesar_JC"])[1]

//sp[@who="#Caesar_JC"][1]

(//sp[@who="#Caesar_JC"])[last()]

//sp[@who="#Caesar_JC"][last()]
```

GENERAL COMPARISONS

- `5 = (1, 3, 5, 7, 9)`
- `(1, 3, 5, 7, 9) = 5`
- `(1, 2, 3) = (1, 3, 5)`
- `//sp[@who = "#Caesar_JC"]`
- `//sp[@who != "#Caesar_JC"]`
- `//ab//w[position() < 5]`
- `//ab//w[position() <= 5]`
- `//ab//w[position() = 1 to 5]`
- `//ab//w[position() = (1, 3, 5)]`
- `//ab//w[position() >= 5]`

PRECEDENCE AND COMPARISONS

- Puzzle: why is this an error?

```
//stage[@type="entrance", "exit"]
```

- Ask XQuery what this means:

```
"entrance" = "entrance", "exit"
```

- How can we correct the first expression?
- Ask XQuery what this means:

```
boolean("entrance" = "entrance", "exit")
```

EFFECTIVE BOOLEAN VALUE

- Many expressions test if a condition is `true` or `false`. These are "Boolean Values".

  Effective Boolean Value of expression E = boolean(E)
- `boolean(true())`
- `boolean(false())`
- `boolean(0)`
- `boolean(1)`
- `boolean( one or more nodes )`
- `boolean ( () )`
- `boolean("non-empty string")`
- `boolean("")`

VALUE COMPARISONS

COMPARING SINGLE VALUES

- `//sp[@who eq "#Caesar_JC"]`
- `//sp[@who ne "#Caesar_JC"]`
- `//ab//w[position() lt 5]`
- `//ab//w[position() le 5]`
- `//ab//w[position() gt 5]`
- `//ab//w[position() ge 5]`

AGGREGATE FUNCTIONS

- `count()`
- `avg()`
- `min()`
- `max()`
- `sum()`
- `//ab[count(.//w) > 100]`
- `max(//ab/count(.//w))`
- `sum(//ab/count(.//w))`
- `//ab[count(.//w) eq max(//ab/count(.//w))]`

AXES: UP AND DOWN

- `self::*`
- `attribute::*`
- `child::*`
- `descendant::*`
- `parent::*`
- `ancestor::*`

AXES: FORWARD AND BACK

- `following::*`
- `following-sibling::*`
- `preceding::*`
- `preceding-sibling::*`

AXES: UP AND DOWN

```
(//stage)[1]

(//stage)[1]/.

(//stage)[1]/self::*

(//stage)[1]/child::*

(//stage)[1]/child::node()

(//stage)[1]/attribute::*

(//stage)[1]/descendant::*

(//stage)[1]/descendant::*[4]

(//stage)[1]/descendant::*[position() = 2 to 5]

//ab//w[.="Greek"]/ancestor::sp

//ab//w[.="Greek"]/parent::*
```

AXES: FORWARD AND BACK

```
(//stage)[1]

(//stage)[1]/.

(//stage)[1]/self::node()

(//stage)[1]/child::node()

(//stage)[1]/attribute::*

(//stage)[1]/descendant::node()

//ab//w[.="Greek"]/ancestor::sp

//ab//w[.="Greek"]/parent::*
```

ALL FORWARD AXES

- `self::*`
- `child::*`
- `attribute::*`
- `descendant::*`
- `descendant-or-self::*`
- `following-sibling::*`
- `following::*`
- `following-sibling::*`

ALL REVERSE AXES

- `parent::*`
- `ancestor::*`
- `ancestor-or-self::*`
- `preceding::*`
- `preceding-sibling::*`
- `descendant::*`
- `descendant-or-self::*`
- `following::*`
- `following-sibling::*`

FLWOR EXPRESSIONS

XQUERYINSTITUTE.ORG

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WHAT ARE FLWOR EXPRESSIONS FOR?

- Swiss army knife for manipulating XML structures
- Iterate over sequences
- Join sequences (e.g. "Speeches by each character")
- Grouping
- Windowing

FOR CLAUSES - ITERATION

```
declare default element namespace "http://www.tei-c.org/ns/1.0";

for $sp in //sp
return $sp
```

USING ITERATION TO RESTRUCTURE

```
declare default element namespace "http://www.tei-c.org/ns/1.0";

for $sp in //sp
return
  <speech>
    <speaker>{ $sp/@who }</speaker>
     {
      for $ab in $sp/ab
      return
          <line>{ normalize-space(string($ab))}</line>
     }
    </speech>
```

USING ITERATION TO RESTRUCTURE

```
declare default element namespace "http://www.tei-c.org/ns/1.0";

for $person in //person[persName]
let $id := $person/@xml:id
let $idref := concat('#',$id)  (: bad Folger convention :)
let $speeches := //sp[@who=$idref]/ab
let $words := $speeches//w
let $nspeeches := count($speeches)
let $nwords := count($words)
order by $nwords descending, $nspeeches descending
return
     <person xml:id="{$id}"
             speeches="{$nspeeches}"
             words="{$nwords}">
        {
           normalize-space(string($speeches[last()]))
        }
      </person>
```

TUPLES

A tuple is like a row in a table

A tuple stream:

```
($x = 1003, $y = "Fred", $z = <age>21</age>)
($x = 1017, $y = "Mary", $z = <age>35</age>)
($x = 1020, $y = "Bill", $z = <age>18</age>)
($x = 1024, $y = "John", $z = <age>29</age>)
```

TUPLES

Each clause (before return) generates a tuple stream

for clauses

```
for $i in (1, 2, 3)
return <tuple>{ $i }</tuple>
```

```
for $i in (1, 2, 3)
for $j in (3, 4, 5)
return <tuple>{ $i, $j }</tuple>
```

where clause

```
for $i in (1, 2, 3)
for $j in (3, 4, 5)
where $i eq $j
return <tuple>{ $i, $j }</tuple>
```

TUPLES

Each clause (before return) generates a tuple stream

let clauses

```
let $i := (1, 2, 3)
return <tuple>{ $i }</tuple>
```

```
for $i in (1, 2, 3)
let $j := (3, 4, 5)
return <tuple>{ $i, $j }</tuple>
```

```
let $i := (1, 2, 3)
let $j := (3, 4, 5)
return <tuple>{ $i, $j }</tuple>
```

TUPLES

Each clause (before return) generates a tuple stream

order by clauses

```
for $i in (1, 2, 3)
let $j := (3, 4, 5)
order by $i descending
return <tuple>{ $i, $j }</tuple>
```

TUPLES

The return clause creates a result, using variable bindings from the tuple stream

return clause

```
declare default element namespace "http://www.tei-c.org/ns/1.0";

for $person in //person[persName]
let $id := $person/@xml:id
let $idref := concat('#',$id)  (: bad Folger convention :)
let $speeches := //sp[@who=$idref]/ab
let $words := $speeches//w
let $nspeeches := count($speeches)
let $nwords := count($words)
order by $nwords descending, $nspeeches descending
return
     <person xml:id="{$id}"
             speeches="{$nspeeches}"
             words="{$nwords}">
        {
           normalize-space(string($speeches[last()]))
        }
      </person>
```

COUNT CLAUSE

```
for $speech in //sp
for $speaker in $speech/speaker
count $c
return
  <speech>
    <speaker>
     {
       $speech/@who,
       $speaker/w/text()
     }
    </speaker>
    {
      for $block in $speech/ab
      return
        <line xml:id="line-{$c}">{ normalize-space(string($block))}</line>
    }
  </speech>
```

GROUPING

```
for $speech in //sp
let $who := $speech/@who
group by $who
order by $who
return
  <person who="{$who}">
   <speeches>
   {
    for $s in $speech
    return
        <speech>{ $s/@xml:id }</speech>
   }
   </speeches>
  </person>
```

PRE-GROUPING TUPLES

```
declare default element namespace "http://www.tei-c.org/ns/1.0";

for $speech in //sp
let $who := $speech/@who
return
   <tuple><speech>{ $speech }</speech><who>{ $who }</who></tuple>
```

POST-GROUPING TUPLES

```
declare default element namespace "http://www.tei-c.org/ns/1.0";

for $speech in //sp
let $who := $speech/@who
group by $who
return
   <tuple><who>{ $who }</who><speech>{ $speech }</speech></tuple>
```

- Each grouping variable has a single value
- Each group corresponds to a unique set of values for the grouping variables
- Each non-grouping variable is bound to all instances assigned to the group

POST-GROUPING TUPLES

```
declare default element namespace "http://www.tei-c.org/ns/1.0";

for $speech in //sp
let $who := $speech/@who
count $pregroup-count
group by $who
order by $who
count $postgroup-count
return
  <person who="{$who}" count="{$postgroup-count}" pre="{$pregroup-count}">
   <speeches>
   {
    for $s in $speech
    return
        <speech>{ $s/@xml:id }</speech>
   }
   </speeches>
  </person>
```

A SIMPLE CONCORDANCE

```
declare default element namespace "http://www.tei-c.org/ns/1.0";

for $w in //sp//ab//w/lower-case(.)
group by $w
order by $w
return
  <word w="{$w}"/>
```

CONCORDANCE IN WELL-FORMED XML

```
declare default element namespace "http://www.tei-c.org/ns/1.0";

<lexicon>
 {
   for $w in //sp//ab//w/lower-case(.)
   group by $w
   order by $w
   return
     <word w="{$w}"/>
 }
</lexicon>
```

CONCORDANCE WITH FREQUENCY

```
declare default element namespace "http://www.tei-c.org/ns/1.0";

<lexicon>
{
  for $w in //sp//ab//w/lower-case(.)
  count $occurrence
  group by $w
  order by $w
  count $word-number
  return
    <word n="{$word-number}" w="{$w}" freq="{count($occurrence)}"/>
}
</lexicon>
```

WHO USES WHAT WORDS? (FLAT)

```
declare default element namespace "http://www.tei-c.org/ns/1.0";

<lexicon>
{
  for $sp in //sp
  for $who in $sp/@who
  for $w in $sp//ab//w/lower-case(.)
  count $occurrence
  group by $who, $w
  order by $w, $who
  return
    <word who="{$who}" w="{$w}" freq="{count($occurrence)}"/>
}
</lexicon>
```

WHO USES WHAT WORDS? (NESTED)

```
declare default element namespace "http://www.tei-c.org/ns/1.0";

<lexicon>
{
  for $sp in //sp
  for $who in $sp/@who
  for $w in $sp//ab//w/lower-case(.)
  count $occurrence
  group by $w
  order by $w
  return
    <word w="{$w}" freq="{count($occurrence)}">
     {
       for $gwho in $who
       group by $gwho
       order by $gwho
       return
         <who name="{$gwho}"/>
     }
    </word>
}
</lexicon>
```

FUNCTIONS

```
declare function local:lexicon($folger-play) as element(le
{
 <lexicon>
 {
  for $sp in $folger-play//sp
  for $w in $sp//ab//w/lower-case(.)
  count $occurrence
  group by $w
  order by $w
  return
    <word w="{$w}" freq="{fn:count($occurrence)}"/>
 }
 </lexicon>
};

local:lexicon(/)
```