Implementation of Web Technology as a Means of Improving Medical Basic Sciences Education

J. Matthew Velkey, Ph.D
Duke University School of Medicine
Durham, NC
The challenge:

Teaching basic biomedical sciences in a highly compressed curriculum

Not unique to Duke, but our curriculum is even more compressed than most:

- The entire body, in health AND disease, in about 44 weeks.
- The “normal” body in 12.5 weeks.

In this setting, standard anatomy, histology, physiology, and embryology resources are less than ideal and the need to maximize asynchronous learning is utmost.
The impact on students, faculty, and curricula are very real

Data from Normal Body course evaluations at Duke from 2006-2010 asking students to rate:

- the value of using a commercial dissector in the anatomy lab experience (scale of 1 to 5)
- the overall value of dissection (scale of 1 to 5)
- whether goals were clearly stated for each session (1=no, 2=somewhat, 3=yes)
- the overall quality of laboratory instruction
Organization vs. filtration
The solution (or part of it)

The Duke Anatomy Resources Website (www.duke.edu/web/anatomy)
Features of the Duke anatomy site

• Dissection instructions SPECIFIC to our curriculum with objectives listed and links to atlas images, videos, etc.
• Easily edited (encourages faculty and student engagement).
• Directs students to additional resources in a FOCUSED manner – an organizing center for synchronous and asynchronous learning.
If you build it, they will come: 

anatomy website use during fall term

[7,351 visits] x [00:03:20/visit] = 408 hrs of total use
subtract 72 hrs of in-lab use → 336 hrs of use outside of class
The results?

2011 evaluations of Anatomy showed improvements in each measure:

- **the value of using the dissector** in the anatomy lab experience (scale of 1 to 5)
- **the overall value of dissection** (scale of 1 to 5)
- **whether goals were clearly stated** for each session (1=no, 2=somewhat, 3=yes)
- **the overall quality of laboratory instruction**

![Graph showing improvements over years]
The web is not just for anatomy...

www.duke.edu/web/anatomy/embryology/embryology.html

– **Rated highest** (4.44 out of 5) of ALL anatomy resources surveyed

![Online Resources](chart.png)

Also of note: Acland videos ([http://www.aclandanatomy.com](http://www.aclandanatomy.com)) were highly rated – obtained via a site license agreement with Wolters-Kluwer (~$3000 US, 150 concurrent users on campus or via VPN)
The web is not just for anatomy...

www.duke.edu/web/histology

- Online version of lab manual with links to Bacus & Aperio virtual microscopy slides
- Also an organizing center for asynchronous learning
- **Rated highest** (4.44 out of 5) out of **ALL** histology resources surveyed

### Histology Resources

- **Extremely useful**
- **Mostly useful**
- **Somewhat useful**
- **Minimally useful**
- **Not useful**
- **Did not use**

<table>
<thead>
<tr>
<th>Resource</th>
<th>Extremely useful</th>
<th>Mostly useful</th>
<th>Somewhat useful</th>
<th>Minimally useful</th>
<th>Not useful</th>
<th>Did not use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Website</td>
<td>56%</td>
<td>21%</td>
<td>6%</td>
<td>4%</td>
<td>17%</td>
<td>19%</td>
</tr>
<tr>
<td>Lecture files</td>
<td>34%</td>
<td>31%</td>
<td>19%</td>
<td>19%</td>
<td>6%</td>
<td>9%</td>
</tr>
<tr>
<td>VM labs</td>
<td>48%</td>
<td>23%</td>
<td>7%</td>
<td>3%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Review materials</td>
<td>39%</td>
<td>33%</td>
<td>18%</td>
<td>5%</td>
<td>11%</td>
<td>1%</td>
</tr>
<tr>
<td>Lecture notes</td>
<td>28%</td>
<td>31%</td>
<td>21%</td>
<td>6%</td>
<td>5%</td>
<td>6%</td>
</tr>
<tr>
<td>Fresh tissue</td>
<td>30%</td>
<td>21%</td>
<td>10%</td>
<td>5%</td>
<td>13%</td>
<td>14%</td>
</tr>
<tr>
<td>Textbook</td>
<td>47%</td>
<td>23%</td>
<td>14%</td>
<td>11%</td>
<td>12%</td>
<td>11%</td>
</tr>
<tr>
<td>Computer atlas</td>
<td>49%</td>
<td>21%</td>
<td>10%</td>
<td>6%</td>
<td>12%</td>
<td>10%</td>
</tr>
</tbody>
</table>
The web is not just for anatomy...

Even more discipline-specific websites at Duke University School of Medicine:

• [www.duke.edu/web/histology/DPT.html](http://www.duke.edu/web/histology/DPT.html)
  – Online histopathology lab manual with links to virtual microscopy slides (Aperio format)

• [www.duke.edu/web/brain](http://www.duke.edu/web/brain)
  – Online version of Cant & White’s Brain and Behavior laboratory manual
Site usage profiles

**Histology site (fall term)**
- 759 people visited this site
- 2,696 Visits
- 759 Unique Visitors
- 6,602 Pageviews
- 2.45 Pages/Visit
- 00:03:38 Avg. Time on Site
- 38.50% Bounce Rate
- 25.37% % New Visits

**Embryology site (fall term)**
- 257 people visited this site
- 699 Visits
- 257 Unique Visitors
- 1,434 Pageviews
- 2.05 Pages/Visit
- 00:01:01 Avg. Time on Site
- 35.77% Bounce Rate
- 25.37% % New Visitors

**Neuro site (1 Jan - present)**
- 136 people visited this site
- 227 Visits
- 136 Unique Visitors
- 701 Pageviews
- 3.09 Pages/Visit
- 00:04:11 Avg. Time on Site
- 47.58% Bounce Rate
- 44.49% % New Visits

**DPT site (fall term)**
- 1,404 people visited this site
- 5,352 Visits
- 1,404 Unique Visitors
- 7,205 Pageviews
- 1.35 Pages/Visit
- 00:01:36 Avg. Time on Site
- 81.18% Bounce Rate
- 25.02% % New Visitors

~165 hrs total

11 hrs total*

*some pages not tracked due to coding error

~16 hrs total

~145 hrs total
What to expect over the long term:
consider the UMich Histology site (www.med.umich.edu/histology)

Visitors Overview
100.00% of total visits

Overview

243,499 people visited this site

- 385,770 Visits
- 243,499 Unique Visitors
- 648,291 Pageviews
- 1.68 Pages/Visit
- 00:02:03 Avg. Time on Site
- 71.76% Bounce Rate
- 63.09% % New Visits

13,180 hours (~1.5 years)
total contact time

- 63.13% New Visitor
  243,549 Vists
- 36.87% Returning Visitor
  142,221 Vists
Beyond these walls...

it’s a world wide web

<20% of visitors to the UMich site are in Michigan
Summary

• Development of discipline-specific websites has positively impacted biomedical sciences education at Duke

• Websites can be tailored to the needs of any curriculum and its students (and faculty!)

• Course-specific websites can serve as organizing centers for synchronous and asynchronous learning and improve the student and faculty experience

• Open websites can give a course and its school a “public face” useful for:
  – attracting future students
  – attracting future collaborators
Acknowledgements

• Anatomy online dissector
  Based on the anatomy dissector first began development at Duke more than forty years ago and has been in use much of the time since. The original ideas and writing come from, among others, Drs. Matt Cartmill, Bill Hylander, Rich Kay, and Kathleen Smith.
  Dr. Marianne Bouvier was responsible for generating new text and images as well as much of the editing of the and images in the 1990s.
  The current version relies on the original version(s) but is being edited and revised by the GROSS ANATOMY COURSE FACULTY: Drs. Daniel Schmitt, Kirk Johnson, Rick Madden, Sara Doyle, Carrie Carreno, Siobhan Cooke, and Jennifer Hotzman

• Histology online laboratory manual
  Edited and revised by Drs. Jennifer Carbrey, Tom McIntosh, and Mimi Jakoi with additional assistance from the HISTOLOGY COURSE FACULTY: Drs. Steve Vigna, RJ Perz-Edwards, and Joe Coreless

• Brain and Behavior online laboratory manual
  Edited and revised by Drs. Nell Cant and Len White, with illustrations by Dr. S. Mark Williams

• Support from the Duke Office of Curriculum and OIT
  IT: Bryan Andregg, Clinton Miller, and Russell Borland
  Assessment: Dr. Deborah Engle and Joe Cawley

• Collaboration from the University of Michigan
  UMICH Medical Information Services (MSIS), Learning Resource Center (LRC) development staff, Anatomy teaching faculty, Department of Cell & Developmental Biology, Department of Pathology