

History of Science 555 (Capstone): Making Visible  
Spring 2014  
Prof. Lynn K. Nyhart, lknyhart@wisc.edu  
226 Bradley Memorial, office hrs. by appointment

Meets: Tuesdays 1:20-3:15 pm in 332 Bradley Memorial Building.

This seminar for majors in the history of science focuses on researching and writing history, not just reading what others have written about it. The main requirement will be to prepare and write a 15-20-page research paper (roughly 4,000-6,000 words, including footnotes but not including bibliography) using primary and secondary sources, along with an oral presentation of your argument. The theme for Spring 2014 is “Making Visible.” We will consider how scientists, physicians, and technologists over the past four centuries have sought to make visible phenomena that are not evident to the naked eye: the very small, the very large, the interiors of bodies and things, collective phenomena, and evanescent temporal processes. Your research paper will treat some aspect of “making visible” in science, technology, and/or medicine. The course’s secondary literature will provide models for research-based writing, and potential jumping-off points for your individual research papers.

**Expectations:** This is the capstone in the major, and I expect this to be your top priority course this semester. We meet for only two hours per week, but it’s a three-credit course. This means that you should be doing extra work outside class each week that makes up for that credit-hour. I have front-loaded the readings to give you a variety models and materials to work with; investing the time in the first third of the course will pay off as you move into more independent research and writing in the second third. Note that the **paper is due April 22**. That means you deliver a polished paper with full argument and notes. It is not a “draft;” it is a “first-final” version. Aim mentally for April 22 as your endpoint.

The course is organized around helping you achieve success in all aspects of writing a research paper in the history of science. The final paper will also be judged according to these criteria.

**Research** (expansiveness of primary [and secondary] source searching and examination)

**Argumentation** (relation between claim and evidence; logic; analysis)

**Historiography** (exploring something new; situating your topic in relation to existing literature)

**Writing quality**

- a) **style** (correct grammar and punctuation; style: graceful sentence structure, variety of word use)
- b) **structure** (organization, transitional sentences, signposting, clear thesis statement, good intro and conclusion)

**Course Readings:**

Stanley Chodorow, *Writing a Successful Research Paper: A Simple Approach*

(Indianapolis: Hackett, 2011). A Room of One’s Own has copies for sale. Please buy

them there.

All other readings are posted on Learn@UW.

### **Grading:**

40% class participation:

15% attendance and participation in discussion

15% on-time completion of exercises for class and postings on Learn@UW (generally due by 7 a.m. the day of the relevant class).

10% constructive critical discussion of others' oral presentations, and peer review of others' paper drafts.

60% research project, including timely progress on its stages:

10% Google doc running log of notes and ideas for a research paper (I will be monitoring this weekly for the first month of the course), plus ideas sheet, due Feb. 25.

10% prospectus with annotated bibliography, due March 4.

10% oral presentation on April 8 or April 15

10% first-final draft, due April 22

20% revised (final-final) draft, due May 13 by 1:30 pm.

### **Schedule Overview:**

1/21: Introduction to HS 555 and historical research methods

#### **Part 1: Finding and Developing a Research Topic and Question (READING/RESEARCH/HISTORIOGRAPHY)**

1/28: Kinds of invisibility, ways of making visible

2/4: Seeing inside the body (meet at Ebling Library 3<sup>rd</sup> floor reading room)

2/11: Charts, graphs, and maps

2/18: Making visible change over time (meet at Memorial Library Special Collections)

2/25: Individual meetings: ideas sheet due.

#### **Part 2: From Topic/Question to Argument (RESEARCH/ARGUMENT)**

3/4: The elements of argumentation. Proposal with preliminary annotated bibliography due.

3/11: Parts of the Argument: Evidence and its contextualization

3/18: No class: Spring Break

3/25: Troubleshooting

#### **Part 3: Refining, Deepening, Clarifying, Polishing (WRITING)**

4/1: Beautiful writing. Nuts and bolts of oral presentations and documentation.

4/8: Presentations I

4/15: Presentations II

4/22: **Papers Due**

#### **Part 4: Revising (WRITING/EDITING)**

4/29: Revisions/editing workshop

5/8: Wrap-Up

**FINAL VERSION DUE 5/13** in L@UW Dropbox.

## Detailed Schedule:

1/21: Introduction to HS 555 and historical research methods

Chodorow, chapter 3

## Part 1: Finding and Developing a Research Topic and Question (READING/RESEARCH/HISTORIOGRAPHY)

**1/28: Kinds of invisibility, ways of making visible**

### ***Required Readings:***

Chodorow, Introduction and chapters 1-2.

Stanley Joel Reiser, "The microscope and the revelation of a cellular universe," Chapter 4 in idem, *Medicine and the Reign of Technology*, (Cambridge, UK: Cambridge University Press, 1978), 69-90

Christoph Meinel, "Molecules and Croquet Balls," Chapter 9 in *Models: The Third Dimension of Science*, edited by Soraya de Chadarevian and Nick Hopwood (Stanford, CA: Stanford University Press, 2004), 242-275.

Courtenay Raia Grean, "Picturing the supernatural : spirit photography, radiant matter, and the spectacular science of Sir William Crookes," in *Visions of the industrial age, 1830-1914 : modernity and the anxiety of representation in Europe*, edited by Minsoo Kang and Amy Woodson-Boulton. (Aldershot: Ashgate, 2008), 55-79.

Robert Hooke, *Micrographia* (London: John Martyn, 1667), pp. 1-5, 213-215. For assignment #2 below: the entire text is available in several online editions. The most readily readable and useful one was produced here at the UW: <<http://digicoll.library.wisc.edu/cgi-bin/HistSciTech/HistSciTech-idx?type=header&id=HistSciTech.HookeMicro&isize=M>>

### ***Supplementary Readings:***

Courtenay Grean Raia, "From Ether Theory to Ether Theology: Oliver Lodge and the Physics of Immortality," *Journal of the History of the Behavioral Sciences*, 2007, 43(1), 19-43.

Alan MacFarlane and Gerry Martin, "Chapter 5: Glass and Later Science" in idem, *Glass: A World History* (Chicago: University of Chicago Press, 1992), 79-98, 204-213.

### ***Assignments:***

- 1) Read all the readings (of course!); and take notes on at least one secondary source reading (to be assigned in class) **using the method outlined in Chodorow**. (It may be useful to you to take notes like this on the other sources, too.) Deposit your notes on L@UW's dropbox, and bring 3 hard copies to class (2 for people in your group, one for me). The point of this exercise is to practice taking notes actively.
- 2) In addition to the specific readings from Hooke's *Micrographia*, scroll through the book to get a sense of the whole by skimming through its "Observations" headings and dipping into

places you find interesting. What is the range of things that Hooke thinks might be made visible by the microscope? The point of this exercise is to practice scanning a work as a whole and learning how to get both a big picture and some details.

- 3) Come to class prepared to discuss the following question: What is the nature of the invisibility expressed in the different readings? How did scientists propose to render this invisibility visible? What assumptions about nature and science are embedded in the different ways of making visible? Into what historical and historiographic contexts did the historians here situate their historical stories? You may want to write down notes on your answers to these questions.
- 4) Is there anything here that sparks your interest for a research paper—topic, approach, question, keywords? Even if you already have an idea in mind for a paper topic, some angle may be useful. Spend at least 5 minutes reflecting and make notes on your google doc.

#### **2/4: Seeing inside the body**

**[meet at Ebling Library Historical Reading Room, 3<sup>rd</sup> Floor, Ebling Library. Please be on time.** You can take the 80 bus, leaving Memorial Union as late as 12:54, 1:00, or 1:06 pm, with stops thereafter; or the faster but more crowded HSLC/CSC shuttle, which can be picked up only on Orchard outside WID/MIR at 1:05 pm; return shuttle at 3:35. Or, of course, you can walk or bike. It is about 2 miles along Observatory Drive or the lake.]

#### ***Required Readings:***

Review Chodorow, chapter 3.

Andrea Carlino (transl. Noga Arikha), Chapter 3, “The Birth of an Anatomical Icon,” from *Paper Bodies: A Catalogue of Anatomical Fugitive Sheets, 1538-1687*, 74-103

Etsuo Shirasugi, “Envisioning the inner body during the Edo period in Japan: Inshoku yojo kagami (Rules of Dietary Life) and Boji yojo kagami (Rules of Sexual Life),” *Anatomical Science International* (2007) 82: 46–52.

Tatjana Buklijas and Nick Hopwood, “Making Visible Embryos”

<http://www.hps.cam.ac.uk/visibleembryos/index.html>

Kelly Joyce, *Magnetic Appeal: MRI and the Myth of Transparency* (Ithaca: Cornell University Press, 2008), 1-46.

#### ***Supplementary Readings:***

Shigihisa Kuriyama, “Between Mind and Eye: Japanese Anatomy in the Eighteenth Century,” in *Paths to Asian Medical Knowledge*, ed. Charles Leslie and Allan Young (Berkeley: University of California Press, 1992), 21-43

Historical Anatomies on the Web: Johann Adam Kulmus: Kitai Shinsho:

[http://www.nlm.nih.gov/exhibition/historicalanatomies/kulmus\\_home.html](http://www.nlm.nih.gov/exhibition/historicalanatomies/kulmus_home.html)

[if available:] Stefani Engelstein, *Anxious Anatomy: The Conception of the Human Form in Literary and Naturalist Discourse* (SUNY Press, 2008)

Bettyann Kevles, *Naked to the Bone: Medical Imaging in the Twentieth Century* (New Brunswick, NJ: Rutgers University Press, 1997), Chapter 1: “The Discovery of X-Rays: Seeing is Believing,” and Chapter 8: “A Subtler Slice: Magnetic Resonance Imaging”  
José van Dijck, “Bodyworlds: The Art of Plastinated Cadavers,” *Configurations* (2001), 9: 99-126.

**Assignments:**

- 1) Complete the UW-Library Campus Library User Education (CLUE) online training program, <http://clue.library.wisc.edu/index.html>. Take a screen shot or print your results from the quizzes and hand it in.
- 2) As you read the required readings (including the website), generate a list of at least 5 *open ended research questions*, as described in Chodorow ch. 3, that you could imagine forming the basis of a research paper. After each question, say which class of questions you think it falls into, from the list on Chodorow p. 34. Make sure at least 3 of your questions are in Class 3. Post your questions on L@UW in the “Research Questions” exercise folder under “Assignments.” (This gives you practice in generating research questions; you are not committed to any of these in any way.)
- 3) Is there anything here that sparks your interest for a research paper topic for yourself, or that provides analytical tools you might want to make use of for that paper? Spend at least 5-10 minutes reflecting and make notes on your google doc.
- 4) Start mucking around in primary and secondary sources looking for a paper topic/question. Preview later course readings (required and supplementary), pursue titles found in footnotes of any readings you have found interesting thus far. Search keywords in the History of Science, Technology, and Medicine database in the library databases. Write down potential sources (or cut and paste them) in your google doc.
- 5) For discussion: What does it mean to see inside the body? What do different visualization technologies and techniques make visible?

**2/11: Charts, graphs, and maps**

**Required Readings:**

Thomas L. Hankins, “A ‘Large and Graceful Sinuosity’: John Herschel’s Graphical Method,” *Isis* (2006), 97: 605-633

Tom Koch, Chapter 3: Mapping and statistics: 1830-1849, in idem, *Cartographies of Disease: Maps, Mapping, and Medicine* (Redlands, CA: ESRI Press, 2005), 41-74.

Alice Hamilton, “The Fly as a Carrier of Typhoid” *Journal of the American Medical Association*, 28 February 1903, pp. 576-583

**Supplementary:**

Jane R. Camerini: "The Physical Atlas of Heinrich Berghaus: Distribution Maps as Scientific Knowledge." In R. Mazzolini, ed., *Non-Verbal Communication in Science before 1900* (Florence: L. Olschki, 1993) 481-512.

Martin Rudwick, "The emergence of a visual language for geological science, 1760-1840," *History of Science* (1976) 14: 149-195

Robert M. Brain, "Representation on the Line: Graphic Recording Instruments and Scientific Modernism," in *From Energy to Information: Representation in Science and Technology, Art, and Literature*, edited by Bruce Clarke and Linda Dalrymple Henderson. (Stanford, CA: Stanford University Press, 2002), 155-177, 398-404.

### **Assignments:**

1) Come to class prepared to discuss the following question:

- a) What features do mapping and graphing share? What sorts of phenomena do they make visible?
- b) The times and places discussed in the readings by Hankins and Koch overlap. What bigger picture might be derived from these readings together?

2) As you read the primary source by Alice Hamilton, ask yourself these questions:

- a) What did Hamilton make visible in her 1903 article with her maps?
- b) What broader features that Koch discusses are illustrated by the Hamilton article?
- c) What features are different between what Koch discusses and what Hamilton does? What questions would you need to answer to determine why they are different?

\*Please write a brief critical analysis (approximately 500 words) answering (c). This is an exercise in using primary and secondary sources together and thinking about what are researchable questions.

3) Is there anything topical or analytical in the readings for today that you can make use of for a research paper? Spend at least 5 minutes reflecting and make notes on your google doc.

4) Keep looking for secondary and primary-source material for your paper.

**2/18: Making visible change over time [meet at Memorial Library Special Collections, 9<sup>th</sup> Floor Memorial Library.** Take the elevator at the end of the lobby, the one separate from the rank of 3, up to the 9<sup>th</sup> floor. You will need to leave your coats, backpacks, and any food and drink in the coatroom and bring only pencils and note paper into the classroom.]

### **Required Readings:**

Daniel Rosenberg, "Joseph Priestley and the Graphic Invention of Modern Time," *Studies in 18<sup>th</sup> Century Culture* (2007) 36: 55-103

Stanley Joel Reiser, "The Technologies of Time Measurement: Implications at the Bedside and the Bench," *Annals of Internal Medicine* (2000), 132: 31-36

Angela Creager, "Pathways" (excerpts), in idem, *Life Atomic: A History of Radioisotopes in Science and Medicine* (Chicago: University of Chicago Press, 2013), 220-238.

Receive "ideas sheet" handout in class.

***Supplementary Reading:***

Volker Hess, Andrew Mendelsohn, "Case and Series: Medical Knowledge and Paper Technology, 1600-1900," *History of Science* (2010) 48: 287-314

***Assignments:***

- 1) Prepare for discussion: Through what techniques and technologies have scientists and physicians made visible change over time, as presented in each of these readings? How do these reading help you build on what you learned last week? What historian's analytical tools do these readings offer that might enhance your intellectual toolkit?
- 2) If you haven't already done so, now is the time to get serious about your paper topic; spend several hours rooting around online and in the library, more as needed. Come talk to me if you're at a loss for an idea. Write down ideas and potential sources on your google doc as you go. Start your annotated bibliography.

**2/25: Library session: Individual meetings (in Prof. Nyhart's office).**

Individual 25-minute meetings, to be held between 9 a.m. and 3:15 pm. (Sign up in advance.)

***Assignment:*** Ideas sheet due at meeting. This lists possible TOPICS, QUESTIONS, and WAYS IN (specific sources, research paths) to both topics and questions that you have found. (Bring hard copy to hand in; keep one for yourself.)

**Part 2: From Topic/Question to Argument (RESEARCH/ARGUMENT)**

**3/4: The Elements of Argumentation**

***Required Readings:***

Chodorow, chapters 4, 5, and 8.

David Sepkoski, "Towards a Natural History of Data: Evolving Practices and Epistemologies of Data in Paleontology, 1800-2000," *Journal of the History of Biology* (2013) 46:401-444

***Assignments:***

- 1) **Prospectus with preliminary annotated bibliography due.** Use the format for a prospectus in Chodorow, pp. 86-88. For bibliographical entries in annotated bibliography, use Chicago Manual of Style 16<sup>th</sup> edition, "Notes and Bibliography" style, not "Author-Date" style. Online access is available through the UW Library at [http://www.chicagomanualofstyle.org/16/ch14/ch14\\_toc.html](http://www.chicagomanualofstyle.org/16/ch14/ch14_toc.html). Include both primary and

secondary sources. Use only sources you have actually looked closely at, though you should also be keeping your own list of other items you still want to investigate. There should be at least a half-dozen items on your list, including more than one primary source. Annotations should be a couple of sentences, and should include how you plan to use this source. Deposit in L@UW Dropbox by 7 a.m.

- 2) Read Sepkoski's article with an eye toward the components and organization of his argument. What is his thesis? (Find it and mark it or write it down.) How does he set it up in the introduction? How does he follow through in the body? How does his conclusion work? How does he treat chronology and change over time? Can you find elements of Chodorow's "argument chart" (pp. 58-59) in it?

### **3/11: Evidence and the Web of Corroboration**

#### ***Required Reading:***

Chodorow, chapter 6

#### ***Assignments:***

- 1) Pick one reading from your annotated bibliography (or updated bibliography) and examine the role of evidence in the author's argument. What kind of evidence does s/he use, and to what end? How is the evidence deployed in the argument? By what means does the author try to get the reader (that is, you) to believe the relationship asserted between evidence and argument? Write down a proper citation for the source and your answers to these questions, using examples; hand them into the L@UW Dropbox by 7 a.m. 3/11.
- 2) Continue extending and deepening your research. Add to your annotated bibliography.

### **3/18: No class: Spring Break**

#### **3/25: Troubleshooting**

Collective check-in on how you're doing. Dead-ends on your research? A new lead has taken you in a different direction?

#### ***Assignments:***

- 1) Turn in a thesis statement and preliminary outline, in roughly the form used by Chodorow on pp. 54-55.

### **Part 3: Refining, Deepening, Clarifying, Polishing (WRITING)**

#### **4/1: Beautiful writing. Nuts and bolts of oral presentations and documentation.**

***Reading:*** Chodorow, chapters 7, 9, and 10.

#### ***Assignments:***

- 1) Go back through your readings from this course and identify a phrase, a sentence, or a paragraph that you consider to be an example of beautiful academic writing. What makes it so? Bring it in and prepare to read it aloud.
- 2) Research and write, write, write!

**4/8: Presentations I**

**4/15: Presentations II**

**4/22: Papers Due.** Deposit in L@UW Dropbox by 7 a.m. Bring hard copies to class for your workshop partners to work on for next week. Discussion on majoring in the history of science.

**Part 4: Revising (WRITING/EDITING)**

**4/29: Revisions/Editing workshop.** You will work in teams of 3 (or 4), following editing guidelines I hand out, to edit one another's papers.

**5/6: Wrap-Up**

**5/13: FINAL-FINAL VERSION DUE** in L@UW Dropbox by 1:30 pm; hard copy portfolio of final-final and first-final versions edited by others due in my Bradley mailbox.

### **Academic Performance and Accommodation:**

Extensions are only granted if requested before the due date, and only in case of illness or other serious emergency. All extensions will have a definite new due date established. Papers received after the new due date will be subject to late paper penalties.

Late paper policy: any piece of writing that you hand in late without an extension will have the following penalties assessed: a quarter of a grade for every working day late. For example, if the paper on its merits deserves a B, after one day it would receive a B/BC, after two days a BC, after three a BC/C, after four a C. NOTE: LATE FINAL PAPERS WILL NOT BE ACCEPTED.

Academic Credit and Plagiarism: Students may not copy sentences or ideas from others (including authors, websites, or other students) without giving credit to those sources; if someone else's words are so wonderful that you cannot substantially rephrase them, you must put them inside quotation marks, using the exact same words. If you omit the quotation marks or the credit, you are plagiarizing. Plagiarism is grounds for failure on the assignment plagiarized; repeated plagiarism is ground for failure in the course. If you use 3 or more words in a row from another source, they must be placed in quotation marks and footnoted. Otherwise, it is plagiarism. For more details on what plagiarism is and how to avoid it, consult a style manual or the Writing Lab. An excellent source of all the ways you can go wrong is: <<http://students.wisc.edu/doso/docs/Plagiarism.pdf>>

Appealing a Grade: If you have questions about a grade, come speak to me. If the problem is not resolved, speak with the Undergraduate Chair, Prof. Florence Hsia. She will attempt to resolve the issue informally and inform you of the Appeals Procedures if no resolution is reached informally.

Access and Accommodation: I will make every effort to honor requests for reasonable accommodations made by individuals with disabilities. (If you think you qualify for accommodation, please contact the McBurney Disability Resource Center [263-2741; [www.mcburney.wisc.edu](http://www.mcburney.wisc.edu)] to establish your eligibility for services.) Requests for accommodation can be responded to more effectively if I receive them as far in advance as possible, preferably at the beginning of the semester. Such requests are confidential.

Religious Observance: If religious holidays or observances conflict with your participation in this course, please come talk to me well in advance for us to work out alternative arrangements.

If any other problems arise, either academic or personal, which might jeopardize your performance in the course, you must try to inform me after class or by the soonest available office hour, by email ([lknyhart@wisc.edu](mailto:lknyhart@wisc.edu)), or by leaving a message with the History of Science department administrator (262-1406).

## **Grading Scale for Research Papers:**

I scrutinize five elements in a history of science research paper:

- argumentation (relation between claim and evidence; logic; analysis);
- historiography (situating your topic in relation to existing literature);
- research (expansiveness of primary [and secondary] source searching and examination);
- writing structure (organization, transitional sentences, signposting, clear thesis statement, good intro and conclusion); and
- writing style (correct grammar and punctuation; style: graceful sentence structure, variety of word use).

Different papers might balance these differently, but all should be part of your picture. For undergraduate papers, I place less weight on historiography than on the other elements, but you should recognize that it's an element.

A: For outstanding papers only. Thesis and argument are clear, thought-provoking, and based on correctly understood facts; material used to support the argument synthesizes ideas from different sources; relationships drawn between facts and ideas are sophisticated, subtle, and/or original; relationship to existing literature is addressed well. The argument flows from point to point, without any puffery or wasted words. Writing is grammatically correct and succinct.

AB: For very good papers that for some reason fall short of the criteria listed above. For example, the argument may be murky in one place; information may be presented that doesn't directly or clearly contribute to the argument; writing style may be awkward here and there, or flawed by one or two consistent (if minor) grammatical errors; there is recognition of a literature but not much attempt to engage it, or it is misunderstood.

B: For solid papers—the largest group typically fall into this range. The paper may pursue a straightforward but not especially deep or sophisticated argument; it is okay as far as it goes, but doesn't penetrate the material very far (or use very much material). It may have a flash of brilliance that is unfulfilled, counterbalanced by minor grammatical problems, a weakness in argumentation, and/or a significant misunderstanding of events or chronology.

BC: The paper shows some of the basics of the ideal, but is weakened by a lack of serious think-work or writing problems. It may make superficial connections without offering sufficient evidence to make the connections plausible or persuasive, or it may have what is in principle a good argument supported by incorrect facts or chronology. Alternatively, it may provide a fairly solid argument with minor flaws, from which the reader is repeatedly distracted by awkward or ungrammatical prose.

C: A grade signifying some serious problem. It may deliver facts without a recognizable thesis or argument; it may wander away from the point; or it may be a thoughtful attempt so weakened by writing problems (grammar, punctuation, word choice) that it is difficult for the reader to understand a crucial point you are trying to make.

D: A marginal grade. There may be enough in here to show you have paid some attention to the research and writing requirements, but the essay indicates no effort at synthesis or thinking on your own, or else shows a serious misunderstanding of the nature of the material and/or the assignment. Also used for papers that are just barely coherent.

F: For unacceptable papers. A paper may be judged unacceptable if it contains plagiarism (see above); if it consists primarily in content inappropriate to the question or the material for this course; if it shows a complete misunderstanding of the technical or historical topic; or if the writing fails to meet standard college-level requirements of basic communication in English.