

Mathematics 4W03 Reading Course, Winter 2025

Student: Sarah Leong

Instructor: David Earn

Course Information

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Course Dates: 2025-01-06 – 2025-04-08

Units: 3.00

Course Delivery Mode: Research

Course Description: Directed reading in areas of mathematics of interest to the student and the instructor. This course includes a scientific communication component. Prerequisite(s): GPA of at least 7.0 and permission of the Chair of the Department. MATH 4W03 may be repeated if on a different topic.

Course Evaluation

Table 1: Course Evaluation Breakdown

Component	Weight
Research Notebook	15%
Discussions / Meetings	25%
Final Presentation	10%
Final Report	50%

Note: Weights may shift between components depending on the research needs and questions that develop.

Course Evaluation Details

Research Notebook

- Diary of thoughts, questions, and progress in relation to this course.
- Updated and pushed to GitHub every week before and after meetings with the instructor. The notebook will be a markdown file on the private GitHub repository shared by the student and the instructor.
- Marked based on the quality of the diary and keeping it up to date.

Readings

- Explore multiple papers and other sources to address the research question: “*Could smallpox have been eradicated using variolation rather than vaccination?*”
- Plans, including the list of readings and the structure of the final paper, will be revised as the term progresses. Relevant sources include: [1, 2, 3, 4, 5, 6, 7, 8].

Discussions / Meetings

- Based on the plans indicated in the research notebook, the student will come prepared, having read sources, written documents (such as draft sections for the final paper or supplementary material associated with it), and/or completion of other tasks (e.g., coding in R, mathematical modeling/analysis, library or online searches, etc.).
- The student will be prepared to lead discussion on the agreed-upon topics for the week and will raise any other important issues that arise.
- The student will also attend the weekend Mac-TheoBio lab meetings whenever possible.

Final Report

- The primary deliverable for the course will be a draft manuscript, in the style of a paper suitable for submission to a refereed journal.
- The manuscript will be written in \LaTeX , with supplementary material written in either \LaTeX or knitr (to be discussed with the instructor). The student will use a \LaTeX template provided by the instructor.

Tentative Course Schedule

Until the mid-term recess: Readings, discussions, exciting research, updating research notebook, ...

3 March 2025: First draft of final report.

Sometime in April 2025: Oral presentation to the Mac-TheoBio lab.

Sometime in April 2025: Submission of final report.

References

- [1] Duncan SR, Scott S, Duncan CJ. The dynamics of smallpox epidemics in Britain, 1550–1800. *Demography*. 1993;30(3):405-23. Available from: <https://doi.org/10.2307/2061648>.
- [2] Earn DJD, Ma J, Poinar H, Dushoff J, Bolker BM. Acceleration of plague outbreaks in the second pandemic. *PNAS – Proceedings of the National Academy of Sciences of the USA*. 2020;117(44):27703-11. Available from: <https://doi.org/10.1073/pnas.2004904117>.
- [3] Fenner F, Henderson DA, Arita I, Jezek Z, Ladnyi ID. Smallpox and its eradication. vol. 6. World Health Organization Geneva; 1988.
- [4] Hopkins DR. The greatest killer: smallpox in history. vol. 793. University of Chicago Press; 2002.

- [5] Krylova O, Earn DJD. Patterns of smallpox mortality in London, England, over three centuries. PLoS Biology. 2020;18(12):e3000506. Available from: <https://doi.org/10.1371/journal.pbio.3000506>.
- [6] Levine Z, Earn DJD. Face Masking and COVID-19: Potential effects of variolation on transmission dynamics. Journal of the Royal Society of London, Interface. 2022;19:20210781. Available from: <https://dx.doi.org/10.1098/rsif.2021.0781>.
- [7] McNeill WH, McNeill W. Plagues and peoples. Anchor; 1998.
- [8] Razzell P. The conquest of smallpox: the impact of inoculation on smallpox mortality in eighteenth century Britain. Caliban Books, 13 The Dock, Firle, Sussex BN8 6NY; 1977.