



Roles of the Mathematical Sciences in Bioinformatics Education

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Who am I, and why am I here?

- Assoc. Prof. of Computational Biology in Biostatistics dept. at Harvard Sch. of Public Health
 - Ph.D. in Computer Science
 - B.S. in CS, Math, and Chemistry
- My teaching focuses on graduate level:
 - Survey courses in bioinformatics for biologists
 - Applied training in systems for research computing
 - Reproducibility and best practices for “computational experiments”





HSPH BIO508: Genomic Data Manipulation

Genomic Data Manipulation (2014)

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<http://huttenhower.sph.harvard.edu/bio508>

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27 January - 2 February

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Latest news

- 15 May, 16:10
Emma Schwager
[Problem Set 10 Grades Posted](#)
- 13 May, 16:34
Emma Schwager
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- 6 May, 16:37
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- 1 May, 15:20
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[FW: Bioinformatics Bruch Tomorrow Older topics ...](#)



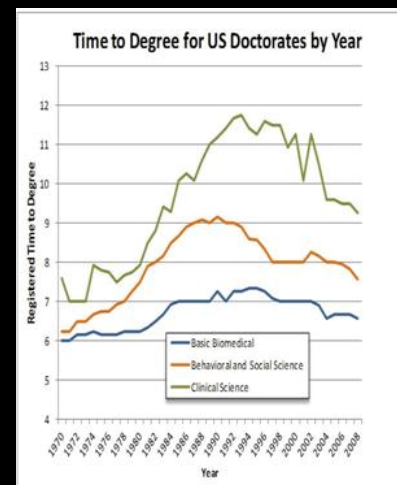
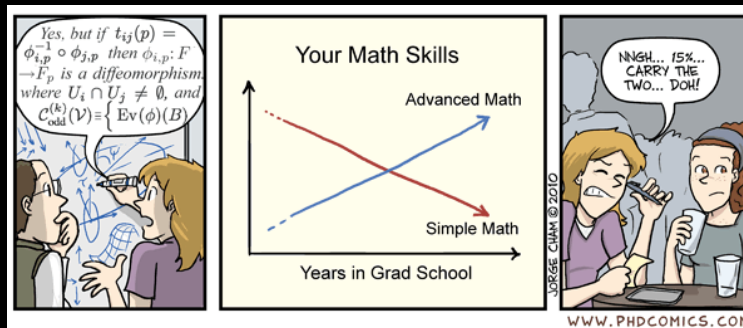
Teaching quantitative methods to biologists: challenges

- Biologists aren't interested in stats as taught to biostatisticians
 - And they're right!
 - Biostatisticians don't usually like biology, either
 - Two ramifications: excitement gap and pedagogy

$$\frac{\pi^2}{6} = \lim_{n \rightarrow \infty} \sum_{k=1}^n \frac{1}{k^2}$$

- Differences in research culture matter

- Hands-on vs. coursework
- Lab groups
- Rotations
- Length of Ph.D.
- ...

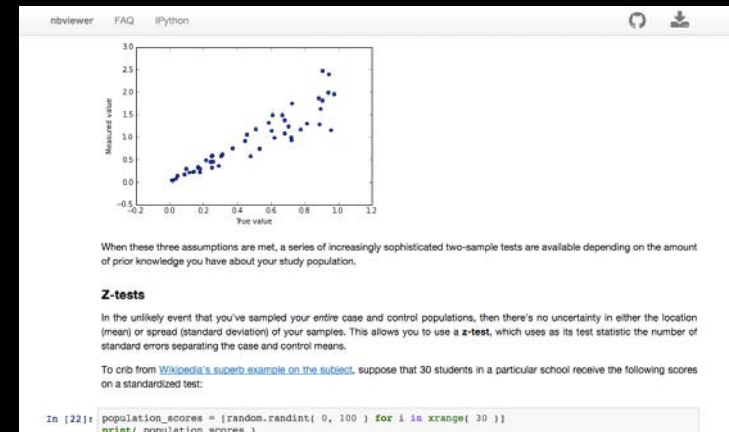


- There are few/no textbooks that are comprehensive, recent, and audience-appropriate
 - Choose any two of three



Teaching quantitative methods to biologists: (some of the) solutions

- Teach intuitions
 - Biologists will never need to prove anything about a t-distribution
 - They will benefit minimally from looking up when to use a t-test
 - They will benefit a lot from seeing when a t-test lies (or doesn't)
- Teach applications
 - Problems/projects must be interactive
 - IPython Notebook / RStudio / etc. are invaluable
- Teach writing
- Demonstrate reproducibility by example
 - Experience Pain is the best teacher





Quantitative biology for clinical and translational biologists

- Clinical/translational researchers do care about biostatistics
 - Good! Decades of successful pedagogy
- “Genomics” is more of a challenge
 - Recent and very broad field that applies in many areas
 - No early training, few established curricula
 - Little intuition for where there be dragons (or how to slay them)




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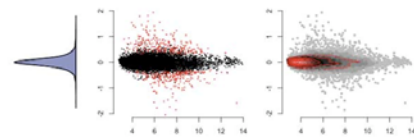
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Data Analysis for Genomics

- Huge demand for modern quantitative biology in the clinic
 - This is important – will be what gets ‘omics to the bedside
 - Be prepared to start even more from scratch



The HSPH Biostatistics S.M. in Computational Biology and Quantitative Genetics

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<http://www.hsph.harvard.edu/sm-computational-biology/>



Examples from HSPH Biostatistics

- 2003 Department initiative, hire John Quackenbush
- 2006 Bioinformatics Core founded
- 2007 Program in Quantitative Genomics (PQG)
- 2009 I joined, 6 comp. bio. Faculty
- 2010 Latest arrival (Franziska Michor), 10 faculty
- 2012 First tenured assistant professor (Shirley Liu)
- 2013 Ph.D. “area of interest”
- 2014 S.M. program
- 2016? Computational biology Ph.D. concentration?