Graduate Mathematics Training at Illinois
Richard Laugesen, Dept. of Mathematics
Director of Graduate Studies

TPSE
Chicago
Sept 2015
U. of Illinois, Urbana-Champaign: mathematics at scale

- 72 faculty, 25 postdocs, 15 lecturers/instructors
- 24,000 undergrad student-courses per year
- 160 PhD students = 100 men + 60 women
- 16 URM (=20% of domestic total)
- 20-27 PhD graduates per year in Mathematics
PhD production: huge increase

Doctoral Degrees Awarded to US Citizens

From AMS Survey of New Doctorates, 2014
PhD Training Goals

GUIDING PRINCIPLE
PhD study is a personal, intellectual journey – not job training

OUR RESPONSIBILITY
To honor students’ desire to engage deeply with Mathematics, while preparing them for career impact
Transformations at Illinois

- Simplified quals and prelim, no language exam
- Intensive recruiting of URM students, Sloan Center of Exemplary Mentoring
- Summer program for early year students (NSF & Dept funding)
- Early transition to research and publication
- Computational math training targeting ALL interested students (summer, and in-semester)
- Progress monitoring each semester
Academic career development

- TA training: pre-semester, some in-semester, peer mentors, university teaching center
- Mentoring of undergrad research
- Systematic fellowship nominations
- Travel funding for PhD students ($20k)
- Networking lunches w/ visiting speakers ($2k)
- Panelists from liberal arts colleges, public 4-years, research intensive institutions, …
Nonacademic career development

- Career panels and round-tables
- Advice and résumé critiquing (career center)
- Careers listserv
- Career fair
- Networking with scientists on campus
- Networking with national labs
- NSF workforce grant (precursor to EDT)
- Computational Mathematics Bootcamp

===> INTERNSHIPS
Interns from Mathematics

<table>
<thead>
<tr>
<th>Host type</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
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<tbody>
<tr>
<td>On-campus corporate</td>
<td>2</td>
<td>6</td>
<td>9</td>
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<tr>
<td>Off-campus corporate</td>
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<tr>
<td>Government</td>
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<td>3</td>
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<tr>
<td>On-campus scientific labs</td>
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<td>6</td>
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Case studies - pure math interns

- Combinatorist - modeling infectious disease in sheep, in veterinary medicine lab
- Number theorist - modeling ant colonies, in entomology department
- Functional analyst - e-commerce analytics firm
- Graph theorist - financial trading firm
- Differential eq. - agricultural data analytics
Future transformations?

• More computational training
• More students researching with faculty in other disciplines
• More off-campus corporate internships
• More interesting Masters program
• More URM recruiting (become self-sustaining?)
• More women (role for undergrad programs?)
NSF grant: Program for Interdisciplinary and Industrial Internships at Illinois (PI4)

*Academic year:* topics courses like

“Top 10 Algorithms of Today”

*Summer:* Computational Mathematics Bootcamp (2 wks) on Python, Matlab, Fenics. Then 6 wks:

• Exploratory mathematics group for 0th and 1st year students (12 funded students); and

• BIG internship (5 funded industrial interns, 7 funded scientific interns)

PI4 catalyzes BIG activity
PI4 program features

• Place “pure math” students first into scientific internships, later to corporate or national labs
• Place interns in pairs
• Incentivize corporate hosts through cost-share (“buy one, get one free”)
• PI4 stipends topped up by the corporate hosts (they want interns to be employees)
• Stipend for exploratory math group leader and for program organizers
Corporate intern hosts: case studies

• Regional utility company (data analytics)
• Boutique agricultural data analytics firm
• Energy multinational (biofuels research)
• Agricultural/chemicals multinational
• Image recognition start-up
• Agricultural machinery multinational (modeling and data analytics)

Non-PI4 interns find their own hosts through our links or by themselves.
For more information on PI4:

https://pi4.math.illinois.edu

Principal Investigators are

Yuliy Baryshnikov (Mathematics and ECE)
R. Lee DeVille (Mathematics)
Richard Laugesen (Mathematics)
Well under half of PhD graduates get postdoctoral positions

From AMS Survey of New Doctorates, 2014
### Growth in BIG internships

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<th>Intern demographics</th>
<th>2013</th>
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<tr>
<td>Women/Men</td>
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<td>12/14</td>
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<td>Early/Middle/Late/Masters</td>
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<td>9/3/5/0</td>
<td>8/9/5/4</td>
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<td>Applied/Pure</td>
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<td>8/9</td>
<td>8/18</td>
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