Master of Science in Translational Research

Emma A. Meagher, MD
Program Director, MTR
Vice Dean, Clinical Research
Education for Heterogeneous Career Endpoints

Private Practice
- Clinician
- Administration

Academics
- Clinician
-Scientist
-Innovator
-Educator
-Leader/Administrator

Industry/For Profit Sector
- Pharma
-Biotechnology
-Finance/Business

Not For Profit Sector
- Health Policy
-Regulatory
-Advocacy
MD+ Programs

Research Dual Degrees

• PhD
• MSc in Clinical Epidemiology
• MSc Health Policy Research
• MSc Medical Ethics
• MSc Translational Research

Non Research Dual Degrees

• Master in Law and Health
• Master of Public Health
• Master of Bioethics
• MBA – Healthcare Administration
• JD

Fifth Year Fellowship-Research

2015 PERELMAN GRADUATES SELECTING INDIVIDUALIZED PROGRAMS

43% MD graduates
57% MD+ graduates
25% received certificates
17% received MS
15% received MD/PhD

165 GRADUATES
What does the Education Pathway look like?

- Medical School
- Residency & Subspecialty Training
- Research Training
  - Apprentice Model or Formalized Program
- Non-Research Training
  - MBA, JD, etc

In parallel or in sequence?
The Shifting Interface of Academia and Healthcare

Integrating the translation of discovery into medical education

The Learning Health Care System

- Large Data
- Academic Partnerships/Consortia
- Team Science
- Science of Healthcare Economics
- Science of healthcare operations on outcomes
The Evolution of the Research Landscape

Clinical Research

Basic Research

Proof of Concept
Animals

Basic Research

Proof of Concept
Humans

“Translational Research”
Innovation

Clinical Trials

Observational Studies

+ Pragmatic trials

**The Learning Health Care System**

Health Sciences Policy

+ Health Systems Research
Overall Goals of MTR Program

- Provide mentored training experience in translational research by combining didactic and experiential experiences in a structured degree granting program

- Prepare trainees to think critically to pose and answer research questions
General Information

• The program enrolls ~20 students per year
  • Includes a mix of MD Students, Residents, Fellows, Pre/Postdoctoral Scientists, and early stage Faculty

• There are ~10 funded (TL1) trainee slots for MD students per year

• MD students apply in the fall of their 3rd year (Sept - Oct)

• Selection occurs in December

• Students start program at the end of 3rd year (July)
Overview of Curriculum

• Full time student
  • Student complete a total of 12 credits

• Required Courses
  • 6 credits – each course equals one credit (see next slide)

• Elective Courses
  • 2 credits (a mix of one credit and/or half credit courses)

• Required ‘Lab’ Time
  • Students complete 2 dry or wet lab rotations to learn specific methods and are awarded 2 credits

• Thesis
  • Students are awarded 2 credits for completing their thesis successfully
Core Courses

• Introduction to Biostatistics (MTR 600)

• Review Writing (MTR 601)

• Proposal Development (MTR 602)

• Disease Measurement (MTR 603)

• Scientific & Ethical Conduct (MTR 604)

• Manuscript Writing (MTR 605)
## Integration of Curricula - Sample MTR Study Plan

<table>
<thead>
<tr>
<th>YEAR</th>
<th>FALL</th>
<th>SPRING</th>
<th>SUMMER</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Module 1</td>
<td>Module 2</td>
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<tr>
<td>2</td>
<td>Module 2</td>
<td>Module 4</td>
<td>Module 4</td>
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<tr>
<td>3</td>
<td>Module 4</td>
<td>Module 5 Step 1 USMLE</td>
<td>MTR 602 Research</td>
</tr>
<tr>
<td>4</td>
<td>MTR 600, 601, 603 Research</td>
<td>MTR 604, 605, Elective 1 Research</td>
<td>Research</td>
</tr>
<tr>
<td>5</td>
<td>2 x MTR 999, Elective 2 Research</td>
<td>Module 5 + MTR 607, 608 Research</td>
<td>Research</td>
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</tbody>
</table>
MTR Translational Therapeutics Track

• Focuses on discovery of new treatments in an academic setting and transfer of this technology to industry for implementation in clinical practice.

• Three main components:
  
  i. core didactic class in Translational Therapeutics (MTR 620)
  
  ii. an internship in industry
  
  iii. thesis project with a focus in translational therapeutics.
MTR Entrepreneurial Science Track

- Offers trainees the opportunity to translate biomedical research into innovative solutions and to develop approaches to commercialization

- Provides mentored training in translational research and entrepreneurship by combining didactic and experiential learning in a structured degree program.

- Key Components:
  i. Entrepreneurship Seminar
  ii. Building a Life Sciences Startup (MTR 642)
  iii. Leadership (MTR 641)
  iv. Elective options across campus (ie Healthcare Entrepreneurship (HCMG 867), Medical Devices (HCMG 853))
  v. Internships

Track Director: Nalaka Gooneratne, MD, MSCE
MTR Bioinformatics Track

• Medical informatics: how we compare and evaluate health/care data to both understand and introduce improvements to care

• Bioinformatics: the use of health/care data to conduct discovery-based investigation of biological systems

• MTR Track: To enable clinician scientists to utilize existing informatics tools and to collaborate effectively with informatics specialists

• Key Components:
  i. EPID 632 Introduction to Biomedical and Health Informatics
  ii. EPID 600 Data Science for Biomedical Informatics
     or MTR 535 Introduction to Bioinformatics
  iii. MTR 999 Lab with Bioinformatics Focus

In collaboration with the Penn Institute for Biomedical Informatics
Providing the Educational Environment

Ingredients for successful outcomes

- Train to a Competency
- Mentoring
- Advising
- Funding
- Resources
- Collaboration
- Professional Development Core
## Finances

<table>
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<th>SUMMER</th>
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<tbody>
<tr>
<td>1</td>
<td>Module 1 MD tuition</td>
<td>Module 2 MD tuition</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Module 2 MD tuition</td>
<td>Module 4 MD tuition</td>
<td>Module 4</td>
</tr>
<tr>
<td>3</td>
<td>Modules 4 MD tuition</td>
<td>Module 5 MD tuition</td>
<td>MTR tuition TL1 starts July 1&lt;sup&gt;st&lt;/sup&gt;</td>
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<tr>
<td>4</td>
<td>MTR tuition TL1 grant</td>
<td>MTR tuition TL1 grant</td>
<td>MTR TL1 ends June 30&lt;sup&gt;th&lt;/sup&gt;</td>
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<tr>
<td>5</td>
<td>MTR tuition</td>
<td>Module 5 + MTR MD tuition</td>
<td></td>
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Tuition Costs

- Cost of MTR (12 c.u.) is $59,172 in 2016
  - Subtract $29,405 (1 semester of MD tuition)
  - Subtract $20,500 (TL1 tuition benefit)
  - Subtract $9,630 (PSOM additional course policy for 2 courses)

- Cost Neutral: bottom line tuition cost for TL1 grant funded student is approximately -$363

- Cost of living stipend of $23,376 to offset delay to earning

- For students receiving merit scholarships the scholarship applies for 7 MD semesters only
<table>
<thead>
<tr>
<th>Student</th>
<th>Research Area</th>
<th>Research Project</th>
<th>Mentor</th>
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</thead>
<tbody>
<tr>
<td>Ian Danford, BS</td>
<td>Ophthalmology/Glaucoma</td>
<td>The role of mitochondrial genetics in contributing to associated optic neuropathy</td>
<td>Joan O’Brien, MD</td>
</tr>
<tr>
<td>George Fryhofer, BA</td>
<td>Orthopaedic Surgery</td>
<td>Defining the Achilles tendon response to controlled passive motion rehabilitation following acute tendon tear, in comparison to active motion rehabilitation</td>
<td>Louis Soslowsky, PhD</td>
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<tr>
<td>Harry Han, BS</td>
<td>Pediatric Neurology Oncology</td>
<td>The role of ACVR1 and Histone 3 mutations in pediatric diffuse infiltrative pontine gliomas</td>
<td>Adam Resnick, PhD</td>
</tr>
<tr>
<td>Eric Lin, BA</td>
<td>Gastroesophageal Cancer</td>
<td>Role of iNOS in Myeloid Derived Suppressor Cell-mediated Immune Suppression in Esophageal Cancer</td>
<td>Anil Rustgi, MD</td>
</tr>
<tr>
<td>Catherine Norise, BA</td>
<td>Neurology</td>
<td>Transcranial Direct Current Stimulation Elucidates Mechanisms of Recovery From Non-Fluent Aphasia</td>
<td>Roy Hamilton, MD, MS</td>
</tr>
<tr>
<td>Aeron Small, BA</td>
<td>Cardiology/Genetics</td>
<td>The pathophysiology and clinical progression of aortic valvular disease</td>
<td>Daniel Rader, MD</td>
</tr>
<tr>
<td>Wen Xu, BS</td>
<td>Pediatric Craniofacial Surgery</td>
<td>Diagnostic value of spectral domain optical coherence tomography for papilledema in patients with presumed increased intracranial pressure</td>
<td>Jesse Taylor, MD</td>
</tr>
<tr>
<td>Peter Hadar, BA</td>
<td>Neurology</td>
<td>Use of Novel GluCEST Imaging to Identify Epileptic Foci</td>
<td>Kathryn Davis, MD, MTR</td>
</tr>
<tr>
<td>Arka Mallela, BA, MS</td>
<td>Neurosurgery</td>
<td>Mapping the Evolution of Acute Mild TBI</td>
<td>Douglas Smith, MD</td>
</tr>
<tr>
<td>Nina Ran, BA</td>
<td>Dermatology</td>
<td>Defining B cell tolerance checkpoints in PV</td>
<td>Aimee Payne, MD, PhD</td>
</tr>
<tr>
<td>John Riley, BA</td>
<td>Pediatric Fetal Surgery</td>
<td>Augmenting Peripheral Tolerance in IUHCT</td>
<td>William Peranteau, MD</td>
</tr>
<tr>
<td>Ari Wes, BA</td>
<td>Pediatric Plastic Surgery</td>
<td>EntSci: Development of an internal, motorized, cranio-maxi</td>
<td>Jesse Taylor, MD</td>
</tr>
<tr>
<td>Alan Workman, BA</td>
<td>ENT: Head/Neck Surgery</td>
<td>Translating observations in the murine nose to the human nose</td>
<td>Noam Cohen, MD, PhD</td>
</tr>
</tbody>
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## 20 MD-MTR Graduates - Outcomes

### Residency programs
- Penn Neurosurgery
- Penn Radiation Oncology x 3
- Penn Internal Medicine X 2
- Penn Integrated Vascular Surgery
- Penn Integrated Plastic Surgery
- Penn Neurosurgery
- Penn Otorhinolaryngology
- Jefferson Dermatology
- Johns Hopkins Internal Medicine
- Mass General Surgery X 2
- Mass General Orthopaedic Surgery
- NYU Neurology
- Seattle Children’s Hospital, Pediatrics
- U of Michigan Anesthesiology
- UCLA Neurosurgery
- UCSF Radiation Oncology

### Over 50 first author pubs
- JAMA
- Ann Thorac Cardiovasc Surg
- J Am Acad Dermatol
- Blood
- Cancer Biol Ther
- Neurosurg Focus
- Neurocrit Care
- J Vasc Interv Radiol
- J Neurointerv Surg
- Eur J Cardiothorac Surg
- Oncology
- J Craniofac Surg.
- Acad Med
- JAMA Dermatol
MTR Contact Information

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